CRITICAL ITEMS LIST (CIL)

SYSTEM:	Propulsion/Mechanical	FUNCTIONAL CRIT:	1
SUBSYSTEM:	GH2 Vent/Relief	PHASE(S):	b
REV & DATE:	J, 12-19-97	HAZARD REF:	S.06
DCN & DATE:	005, 6-30-00		
ANALYSTS:	J. White/H. Claybrook		

FAILURE MODE: Internal Leakage

FAILURE EFFECT: b) Loss of mission and vehicle and crew due to fire/explosion.

TIME TO EFFECT: Seconds

FAILURE CAUSE(S):
- A: Main Shaft Seal Leakage
- B: Primary Pilot Seat Leakage
- C: Secondary Pilot Poppet Seat Leakage
- D: Main Poppet Seat Leakage
- E: Primary Pilot Seat Gasket Leakage

REDUNDANCY SCREENS: Not Applicable

FUNCTIONAL DESCRIPTION: The vent/relief valve limits maximum tank pressure through relief operation and provides a manual venting capability during prelaunch operation.

FMEA ITEM CODE(S)	PART NO.	PART NAME	QTY	EFFECTIVITY
2.8.14.7	PD4700189-029	GH2 Vent/Relief Valve	1	LWT-54 thru 84, 89-93
	-039		1	LWT-85 thru 88, 94 thru 114
	-040		1	LWT-115 & Up

REMARKS:

SYSTEM:	Propulsion/Mechanical	REV & DATE:	J, 12-19-97
SUBSYSTEM:	GH2 Vent/Relief	DCN & DATE:	005, 6-30-00
FMEA ITEM CODE(S):	2.8.14.7		

RATIONALE FOR RETENTION

DESIGN:

The GH2 Vent/Relief (V/R) valve assembly design is based on the Saturn S-II configuration. Poppet flow control, actuation and relief sensing system concepts have been incorporated. The ET GH2 valve was designed to meet the required ultimate factor of safety of 1.4 (ET Stress Report 826-2188 and Calmec Stress Report TR-4-1). Material selection in accordance with MMC-ET-SE16 and controlled per MMMA Approved Vendor Product Assurance Plan assures conformance of composition, material compatibility and properties.

A: The main shaft seal is composed of armalon and teflon sheets, all sandwiched and clamped together by bushing and valve body. This multiple seal arrangement pressing against a smooth 304 CRES main shaft assures minimum leakage.

B: The primary pilot seat is 440C CRES. The sealing surface is flat within 2 light bands. Surface finish is 4 micro inches. The poppet is 17-4 PH CRES. It is also flat within 2 light bands with a surface finish of 4 microinches.

C: Secondary pilot poppet is made from 18-8/301 CRES. The poppet presses against a sheet of KEL-F to effect a seal.

D: Valve flange sealing surface is specified to be free of nicks, scratches or other imperfections that could impair sealing function. The seal is sheet KEL-F. The main poppet presses the KEL-F sheet against the outlet flange to provide a seal.

E: The primary poppet seat gasket is FEP teflon sheet. It seals the poppet seat from the primary pilot body. Sealing surface finish is 16 microinches.

TEST:

The GH2 V/R Valve Assembly is qualified. Reference COQ MMC-ET-TM06-065.

The PD4700189-040 (Ketema) GH2 V/R Valve will be qualified by test and similarity. Test criteria is specified in the Procurement Drawing (PD4700189). Ketema will have all testing responsibility. Applicable test reports will be identified in this section at the conclusion of all testing.

Development: Two development valves, GO2 and GH2, were fabricated and tested to develop the relief mechanism and provide confidence to proceed with qualification test. Cryogenic and ambient functional checks were run which included vent mode response and relief mode response, life cycle and leakage test (MMC-T-77-18-2). Development vibration testing was accomplished on the GH2 valve using a composite of the two required vibration spectra for the GO2 and GH2 valves (MMC-T-77-18-1).

Qualification: Two GH2 qualification valves were fabricated and tested. Both valves were given relief mode response tests at various temperature and pressure (altitude simulation). Also, functional and leak tests, minimum vent actuation pressure tests, vent mode response, life cycle tests (500 relief and 500 vent), vibration, post vibration cryogenic functional and leak test, and burst pressure tests were run. All test requirements were met; relief and reseat pressures were within the required limits (MMC-ET-RA09-61 and MMC-ET-RA09-84).

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RATIONALE FOR RETENTION

TEST: (cont)

The GH2 valve was later qualified by similarity for 5000 vent mode cycles (MMC-ET-RA09-60 addendum). It was also qualified by similarity to new and higher vibration levels (MMC-ET-RA09-91).

MPTA Firings/Tankings: One flight configuration valve assembly installed on MPTA has accumulated 60.9 minutes of firing time, 17 cryogenic cycles and 33 pressurization cycles.

Acceptance:

Vendor:

B: Perform primary pilot pressure versus stroke and primary pilot seat leakage during build cycle (PS-413, CCC LWT-54 thru 84, 89-93, 88691 AP1 LWT-85 thru 88, 94 thru 114, AIS-K210-502 for LWT-115 & Up).

Vendor - (Total Assembly):

A-E: Perform proof pressure test, internal leak test, functional test (T-290, CCC LWT-54 thru 84, 89-93, 88690 ATP1 LWT-85 thru 88, 94 thru 114, 8-480798 for LWT-115 & Up).

MAF:

A-E: Perform V/R valve operation test (MMC-ET-TM04k).

Launch Site:

A-E: Perform V/R valve operation test (OMRSD File II).

INSPECTION:

Vendor Inspection - Lockheed Martin Surveillance:

A, C, D, E: Verify materials selection and verification controls (MMC-ET-SE16 and drawings 1419-83, 1419-85, 1419-84, 1419-255, 1419-250, 1419-50, 1419-48, 1419-331, Consolidated Controls, LWT-54 thru 114), (K210-66, K210-68, K210-67, K210-103, K210-115, K210-31, K210-30, K210-142 for LWT-115 & Up).

A-E: Witness valve assembly (PS-413, CCC for LWT-54 thru 84, 89-93; 88691 AP1 for LWT-85 thru 88, 94 thru 114; AIS-K210-502 for LWT-115 & Up).

B: Inspect surface flatness, finish and dimensions (drawings 1419-293 and 1419-285, Consolidated Controls for LWT-54 thru 114; K210-81 and K210-82 for LWT-115 & Up).

Lockheed Martin Procurement Quality Representative:

A-E: Witness proof pressure, internal leakage and functional tests (T-290, CCC for LWT-54 thru 84, 89-93; 88690 ATP1 for LWT-85 thru 88, 94 thru 114; 8-480798 for LWT-115 & Up).

B: Verify primary pilot pressure versus stroke and primary pilot seat leakage tests (PS413, CCC for LWT-54 thru 84, 89-93; 88691 AP1 for LWT-85 thru 88, 94 thru 114; AIS-K210-502 for LWT-115 & Up).

MAF Quality Inspection:

A-E: Witness V/R valve operation test (MMC-ET-TM04K).

Launch Site:

A-E: Witness V/R valve operation test (OMRSD File II).

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.