

CRITICAL ITEMS LIST (CIL)

SYSTEM:	Electrical	FUNCTIONAL CRIT:	1R
SUBSYSTEM:	GH2 Pressurization System	PHASE(S):	b
REV & DATE:	J, 12-19-97	HAZARD REF:	E.01, P.06, S.04
DCN & DATE:	001, 6-15-98		
ANALYSTS:	J. McCardle/T. McKeough/A. Oser		

FAILURE MODE: Fails with High Reading

FAILURE EFFECT: b) Loss of mission and vehicle/crew due to structural failure (tank buckling).
Loss of mission and vehicle/crew due to loss of NPSP prior to SRB separation.

TIME TO EFFECT: Minutes

FAILURE CAUSE(S):

- A: Winding Open Between Wiper Arm and Return
- B: Shorted Turns in Winding
- C: Wiper Arm Stuck in Incorrect Position
- D: Excitation Signal Wire and Wiper Arm Wire Shorted Together
- E: Sensitivity and Bias (Zero) Shifts

REDUNDANCY SCREENS:

- Screen A: PASS
- Screen B: FAIL - Not detectable in flight.
- Screen C: PASS

FUNCTIONAL DESCRIPTION: Tank ullage pressure measured by three sensors. Each sensor controls a flow control valve to open or close. (Measurement Number: T41P1700C, T41P1701C, T41P1702C, T41P1703C)

<u>FMEA ITEM CODE(S)</u>	<u>PART NO.</u>	<u>PART NAME</u>	<u>QTY</u>	<u>EFFECTIVITY</u>
3.4.1.1	PD7400098-089 (303A02, 303A03, 303A04, 303A05)	GH2 Pressure Transducers	4	LWT-54 & Up

REMARKS:

CRITICAL ITEMS LIST (CIL)
CONTINUATION SHEET

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RATIONALE FOR RETENTION

DESIGN:

The GH2 Transducer is a potentiometer type unit which operates as an absolute sensor in the range of the 12 to 52 PSIA. This transducer is completely sealed and the potentiometer is in a vacuum. The unit is enclosed in a stainless steel case and all seams are TIG welded. The unit is designed and fabricated to withstand all test conditions, checkout installation, pre-launch and launch without mechanical or electrical failure.

- A: The coil winding is a platinum commercial alloy wire Class H Alloy No. 479 (approved by MUA 146) with insulation of Isonel 200 Enamel. It is wound on a core of solid copper wire per J-W-1177 and insulated with a Heavy Coat Mil Enamel. The tension and consistency of wire lay are controlled. The wiper is made of Paliney #7 palladium alloy. The leads are soldered using Lockheed Martin approved vendor materials, drawings, and process instructions.
- B: The coil winding is processed through a soda honing operation per Gulton Process SSP-079-81 to remove enamel coating and provide a clean surface free from high/low points. The wiper is polished to a No. 4 finish per Gulton Process SSP-187-81. To provide a constant pressure on the coil and to eliminate wiper liftoff and chatter, the wiper tension on the coil is set per Gulton SPI-3031-13803. The processes and assembly are all validated and approved by Lockheed Martin.
- C: The smooth finish and a tension setting of the wiper per Gulton SPI-3031-13803 provides for firm contact of the wiper to the coil. The coil cleaning and manufacturing processes provide a contact surface that is clean and free from high/low points.
- D: The wires from the coil are cut to a minimum length and potted in place. The wiper wire is also a minimum length. The three wires are routed in areas that will prevent interference with the wiper and coil operations.
- E: Assembly techniques as defined on Gulton drawing 121-600 and Process Specification (SPI-3031-13803) provide the selection and matching of the detail parts for the sensing assembly. In process cycling provides a unit that will operate to PD7400098 requirements.

Redundancy Description

Four transducers are used in the LH2 tank to control ullage pressure. Of the four, only three are used in flight. The fourth transducer is a spare which can be substituted into the circuit by ground control in case of a failure prior to T-10 seconds.

In phase a (countdown) the loss of a second transducer (first redundancy) will result in a launch delay for failures occurring before T-10 seconds. Ref: Launch Commit Criteria.

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RATIONALE FOR RETENTION

DESIGN: (cont)

In phase b (flight), the effect of losing the first, second (first redundancy) and third transducers (second redundancy) is shown in the matrix below.

<u>FAILURE</u>	<u>EFFECT</u>
1 Xducer fails high output (1 FCV Closed)	No effect
2 Xducers fail high output (2 FCV Closed)	Failure effect described above
3 Xducers fail high output (3 FCV Closed)	Failure effect described above

FCV - Flow Control Valve

The transducers are not used in phase c.

TEST:

The GH2 ullage transducers are qualified. Reference COQ MMC-ET-TM06-037.

Vendor:

- A-E: Perform Functional Test (PD7400098).
- A, C, D: Perform Noise Test (PD7400098).
- B, C: Perform Hysteresis and Friction Test (PD7400098).
- A-E: Perform Calibration Test (PD7400098).

MAE:

- A-E: Perform Function Test (TM04k).
- A-E: Perform Calibration Test (TM04k).
- A: Perform DC Resistance Test (TM04k).

Launch Site:

- A-E: Perform Transducer Operation Test (QMRSD FILE II).
- A-E: Perform Functional Test (LCC).

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INSPECTION

Vendor Inspection - Lockheed Martin Surveillance:

- A, D: Inspect wire for freedom of nicks, scrapes, cuts or breaks prior to installation (Gulton Drawing 121-600).
- A, B: Inspect the soldering of wires for Electrical/Mechanical integrity (SSP-037-81).
- A, B: Verify certification of solder operator (SSP-037-81).
- A, B: Verify cure of potting material on wire connection (Gulton drawing 121-600).
- C: Inspect bearing for freedom of foreign matter (SSP-185-81).
- D: Inspect routing of wire to ensure full range movement of wiper arm (Gulton Drawing 121-600).
- D: Inspect length of wire to ensure it does not interfere with wiper movement (Gulton Drawing 121-600).
- C-E: Inspect movement of wiper arm prior to closure (Gulton Drawing 121-600).

Lockheed Martin Procurement Quality Representative:

- A-E: Witness Functional Test (PD7400098).
- A,C-E: Witness Noise Test (PD7400098).
- A-E: Witness Calibration Test (PD7400098).
- B, C: Witness Hysteresis and Friction Test (PD7400098).

MAF Quality Inspection:

- A-E: Witness Functional Operation Test (TM04k).
- A-E: Witness Calibration Test (TM04k).
- A: Witness DC Resistance from excitation to return (TM04k).

Launch Site:

- A-E: Witness Transducer Operation (OMRSD FILE II).
- A-E: Witness Transducer Operation at T-10 seconds (LCC - 3 of 3 mandatory).

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.