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**Critical Item:** 8 Channel Relay Closure Card

**Find Number:** 78K00474 8 ea.

**Criticality Category:** 1S & 2

| SYSTEM | AREA | CRIT | TOTAL LRU'S |
|---|---|---|---|
| Hypergol Vapor Detection Sys | LOA | 1S | 6 |
| MPS L02 Control System for LOA & VAA | Pad | 2 | 1 |
| | MLP | 1S | 1 |

| | | | |
|---|---|---|---|
| **SAA No:** | 09IT09-001 | **System/Area:** | LPS/CCMS/FR1/FR2/CR3/CR4 |
| **NASA Part No:** | 78K00474 | **PMN/ Name:** | L72-0400-01, -03, -04 HIM |
| **Mfg/ Part No:** | 78K00474 | **Drawing/ Sheet No:** | MCR7656 VOL III 4.2 (REV CY) |

**Function:** This HIM Critical Item is used in support of a critical user system. It provides 8 unique channels utilized to command (on - off) ground support equipment.

**Critical Failure Mode/Failure Mode No:** * Failure Mode - Fails to Switch/09IT09-001.484; * Failure Mode - Unsolicited Change/09IT09-001.485

* 8 channel relay closure card failures could cause unsolicited commands or affect normal HIM I/O bus communications resulting in loss of the data for the critical system being monitored/controlled.

**Failure Cause:** Electrical/Electronic failure of LRU piece part

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**Failure Effect:**

| SYSTEM | FAILURE EFFECT | CRIT |
|---|---|---|
| Hypergol Vapor Detection System (LOA) | Loss of output signal will fail to provide the console operator with an input that would indicate a leak in the hypergol propellant servicing system. Loss of the capability to detect a leak during hazardous operations could result in loss of life and/or vehicle. Time to effect: Immediate. Detection method: Software detects loss of HIM functions. | 1S |
| MPS L02 Control System for LOA/VAA | Loss of GN2 purge for ORB/ET disconnect carrier plate could allow a hazardous condition to exist and possibly allow loss of life and/or vehicle. Time to effect: Immediate. Detection method: Software detects unsolicited changes. | 1S |
| | Loss of pneumatic control of redundant GN2 shut-off valve, and loss of heated GN2 to ET nose cone and lighting rod could cause possible damage to Orbiter TPS. Time to effect: Immediate. Detection method: Software detects unsolicited changes. | 2 |

## ACCEPTANCE RATIONALE

**Design:** The 8 Channel Relay Closure Card was designed per the requirements of the following documents.

1. CP09IT0910: General design requirements specification for LPS/CCMS.
2. CP09IT0916: Contract end item assembly specifications for HIM for LPS/CCMS.

These specifications support the Shuttle design and procurement philosophy procurement of hardware that is not undergoing development, but to procure "off-the-shelf hardware" and to maximum extent possible parts previously qualified through proven design.

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**Test:** Rigorous sets of acceptance tests were performed to verify performance and design requirements of the LPS/CCMS. This process occurred on each end item from "In Process Assembly" phase to "Site Acceptance". Master control procedures (MCPs) 78K-M401 and 78K-M701 were utilized for acceptance testing by MMC. Following this acceptance testing IBM performed integrated testing of each set. Test procedures KSC-LPS-IB-086, Book 3 and KSC-LPS-IB-105, Book 5 were utilized.

Hypergol Vapor Detection Sys

- OMRSD File VI Volume 1 requires a sensor functional test prior to each flow. OMI V3542 "Hypergol Vapor Detection System Operations Support (LPS)" provides this end-to-end verification of the system (LPS/HVDS).
- During loading operations, personnel are stationed on the RSS to provide visual monitor..

MPS L02 Control System for LOA and VAA

- OMRSD File VI Volume 1 requires verification of MPS pneumatic/solenoid valves prior to each flow. OMI G2340 "LH2/LOX Auto Component Functional Test and Hardware Checkout" sequence 7 provides for the cycling of all remotely operated valves using LPS.

**Inspection:** LPS system integrity is continuously monitored by on-line software programs. These programs provide health and status to system operators. OMRSD, File VI requires verification of backup power to be performed every 360 days on the hardware interface module which contains this LRU. OMI C6040 "HIM Preventive Maintenance" satisfies this requirement. Proper HIM operation is verified by each user system as part of the end-to-end verification of their integrated system.

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**Failure History:**

The PRACA Data Base was used for this analyses (timeframe APR. 88 to Sep. 90). There were 63 Problem Reports initiated on 8 Channel Relay Closure Cards that relate to failure modes depicted on this CIL sheet. There is a total population of 1735 8 Channel Relay Closure Cards installed in various CCMS Station Sets. In the basic SAA the timeframe of Jan. 84 to Mar. 88 was used with 92 Problem Reports identified from a total population of 1478 cards installed. Operation use varies from 7 days a week, 24 hours a day to as required.

**Operational Use:**

- Correcting Action:

  Troubleshooting required to isolate and replace failed unit.

- Timeframe:

  Varies, troubleshooting required.