INDEPENDENT ORBITER ASSESSMENT

ASSESSMENT OF THE ELECTRICAL POWER GENERATION/POWER REACTANT STORAGE AND DISTRIBUTION SUBSYSTEM

26 FEBRUARY 1988

MCDONNELL DOUGLAS ASTRONAUTICS COMPANY
HOUSTON DIVISION

SPACE TRANSPORTATION SYSTEM ENGINEERING AND OPERATIONS SUPPORT

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INDEPENDENT ORBITER ASSESSMENT ASSESSMENT OF THE ELECTRICAL POWER GENERATION/POWER REACTANT STORAGE AND DISTRIBUTION SUBSYSTEM FMEA/CIL

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1.0 EXECUTIVE SUMMARY

The McDonnell Douglas Astronautics Company (MDAC) was selected in June 1986 to perform an Independent Orbiter Assessment (IOA) of the Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL). Direction was given by the STS Orbiter and GFE Projects Office to perform the hardware analysis using the instructions and ground rules defined in NSTS 22206, Instructions for Preparation of FMEA and CIL, 10 October 1986.

The IOA effort first completed an analysis of the Electrical Power Generation/Power Reactant Storage and Distribution (EPG/PRSD) subsystem hardware, generating draft failure modes and potential critical items. To preserve independence, this analysis was accomplished without reliance upon the results contained within the NASA FMEA/CIL documentation. The IOA results were then compared to the NASA FMEA/CIL baselines with proposed Post 51-L updates included. A resolution of each discrepancy from the comparison is provided through additional analysis as required. This report documents the results of that comparison for the Orbiter EPG/PRSD hardware.

In the analysis report, the PRSD hardware was divided into seven sections. However, in the assessment report, the PRSD has been divided into eight sections for the hardware divisions and the FMEA/CIL count comparison. Some of the components in the sections were moved to other sections to facilitate the comparison.

The IOA product for the EPG/PRSD analysis consisted of one hundred sixty-two failure mode "worksheets" that resulted in eighty-two potential critical items being identified. Comparison was made to the NASA baseline (as of 23 July 1986) which consisted of ninety-two FMEAs and fifty-eight CIL items. An additional comparison was conducted to an updated FMEA/CIL list (as of 18 March 1987) which consisted of sixty-six FMEAs and thirty-nine CIL items. The comparison caused the IOA to generate four additional failure modes to match the NASA FMEAs, but four others were considered non-credible, and deleted. The final comparison was conducted with a revised FMEA/CIL list (as of 7 January 1988). This revision consists of two, three, and four tank configurations, instead of the earlier baseline of just two tanks. The baselines are broken down as follows: 2-Tank) sixty-four FMEAs and thirty-nine CIL items, 3-Tank) sixty-seven FMEAs and forty-two CIL items, and 4-Tank) sixty-seven FMEAS and forty-two CIL items. The comparisons and the discussion with the NASA subsystem manager reduced the EPG/PRSD analysis to seventy-seven failure mode worksheets and thirty-two critical items.

Figure 1 presents a comparison of the proposed post 51-L NASA three or four tank baseline, with IOA recommended baseline, and issues. The IOA column is the number of FMEA and CILs after they were mapped (grouped) together so a direct comparison could be made with NASA's failure modes (IOA was more likely to produce a report for each item, while NASA, where possible, group similar items under the same failure mode).

The comparison determined if there were any results which had been found by the IOA but were not in the NASA baseline. This comparison produced agreement on all but twenty-seven FMEAs and nine CIL items. The discrepancy between the number of IOA findings and NASA FMEAs can be partially explained by the different approaches used by IOA and NASA to group failure modes together to form one FMEA. Also, several IOA items represented inner tank components and ground operations failure modes which were not in the NASA baseline. The remaining issues arose due to differences between the NASA and IOA FMEA/CIL preparation instructions. NASA had used an older ground rules document which has since been superseded by the NSTS 22206 used by the IOA.

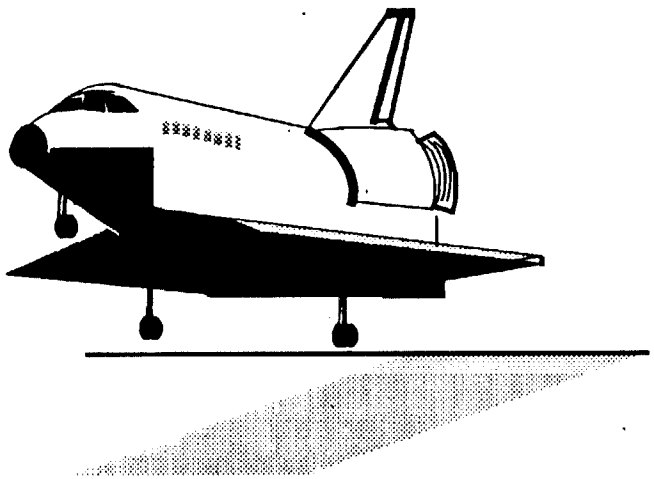
EPG/PRSD ASSESSMENT OVERVIEW

EPG/PRSD ASSESSMENT SUMMARY			
	IOA	NASA	ISSUES
FMEA	77	67	27
CIL	32	42	9

H_2 TANK			
	IOA	NASA	ISSUES
FMEA	8	4	6
CIL	3	2	1

HRVFP			
	IOA	NASA	ISSUES
FMEA	9	9	3
CIL	3	8	1

HVM			
	IOA	NASA	ISSUES
FMEA	14	14	3
CIL	4	6	2



O_2 TANK			
	IOA	NASA	ISSUES
FMEA	8	4	6
CIL	3	2	1

ORVFP			
	IOA	NASA	ISSUES
FMEA	8	8	3
CIL	3	7	1

OVM			
	IOA	NASA	ISSUES
FMEA	18	18	4
CIL	6	7	3

HOLCF			
	IOA	NASA	ISSUES
FMEA	2	2	0
CIL	2	2	0

QDCAP			
	IOA	NASA	ISSUES
FMEA	10	8	2
CIL	8	8	0

HOLCF - H2 & O2 Lines, Components, and Fittings
HRVFP - Hydrogen Relief Valve/Filter Package
HVM - Hydrogen Valve Module
ORVFP - Oxygen Relief Valve/Filter Package
OVM - Oxygen Valve Module
QDCAP - H2 & O2 Fill and Vent ODs, Horizontal Drain QDs, GSE Fill T-O QDs and their Caps

Figure 1 - EPG/PRSD FMEA/CIL ASSESSMENT

IOA PRA 024 February 24, 1988 10:51 AM AMES

2.0 INTRODUCTION

2.1 Purpose

The 51-L Challenger accident prompted the NASA to readdress safety policies, concepts, and rationale being used in the National Space Transportation System (NSTS). The NSTS Office has undertaken the task of re-evaluating the FMEA/CIL for the Space Shuttle design. The MDAC is providing an independent assessment of the proposed Post 51-L Orbiter FMEA/CIL for completeness and technical accuracy.

2.2 Scope

The scope of the independent FMEA/CIL assessment activity encompasses those Shuttle Orbiter subsystems and GFE hardware identified in the Space Shuttle Independent FMEA/CIL Assessment Contractor Statement of Work. Each subsystem analysis addresses hardware, functions, internal and external interfaces, and operational requirements for all mission phases.

2.3 Analysis Approach

The independent analysis approach is a top-down analysis utilizing as-built drawings to breakdown the respective subsystem into components and low-level hardware items. Each hardware item is evaluated for failure mode, effects, and criticality. These data are documented in the respective subsystem analysis report, and are used to assess the proposed Post 51-L NASA and Prime Contractor FMEA/CIL. The IOA analysis approach is summarized in the following Steps 1.0 through 3.0. Step 4.0 summarizes the assessment of the NASA and Prime Contractor FMEA/CIL which is documented in this report.

Step 1.0 Subsystem Familiarization
- 1.1 Define subsystem functions
- 1.2 Define subsystem components
- 1.3 Define subsystem specific ground rules and assumptions

Step 2.0 Define subsystem analysis diagram
- 2.1 Define subsystem
- 2.2 Define major assemblies
- 2.3 Develop detailed subsystem representations

Step 3.0 Failure events definition
- 3.1 Construct matrix of failure modes
- 3.2 Document IOA analysis results

Step 4.0 Compare IOA analysis data to NASA FMEA/CIL
- 4.1 Resolve differences
- 4.2 Review in-house
- 4.3 Document assessment issues
- 4.4 Forward findings to Project Manager

2.4 Ground Rules and Assumptions

The ground rules and assumptions used in the IOA are defined in Appendix B.

3.0 SUBSYSTEM DESCRIPTION

3.1 Design and Function

The EPG/PRSD consists of hardware that is required for cryogenic hydrogen and oxygen storage and distribution to the Fuel Cell Powerplants (FCP) and Atmospheric Revitalization Pressure Control Subsystem (ARPCS). Reference Figures 2 and 3. The grouping of the EPG/PRSD components has changed slightly from the analysis report, in order to facilitate the FMEA, CIL, and issues count comparison. The check valves, tank relief valves, and relief ports were relocated to the relief valve/filter packages. The EPG/PRSD consists of the following divisions:

1. The Hydrogen (H2) tanks can number from 2 to 5 (each tank having a 1:1 correspondence to an oxygen tank). The H2 reactant is stored in the tank at an initial temperature of -424 degrees F. Each tank consists of an A and B heater, heater controller pressure sensor, tank pressure sensor, fluid temperature sensor, quantity sensor, heater assembly temperature sensor, and fill and vent Quick Disconnects (QD) with caps. The reactant flow to the fuel cells is regulated by the heater controller. Reference Figure 4.

2. There is a H2 Relief Valve/Filter Package (HRVFP) for each H2 tank. All HRVFPs have a filter, and tank relief valve and the ones for tanks 1 and 2 contain a manifold relief valve, while those for tanks 1 through 4 contain a check valve. Packages 1, 2, and 4 share relief port 1, and packages 3 and 5 share relief port 2. The filters extract reactant impurities which could degrade fuel cell performance. The manifold relief valves relieve excess manifold pressure by allowing reactants to flow into tanks 1 or 2. The check valves prevent reactants from flowing back into the tank in the event it is at a low pressure. Tanks 4 and 5 share a check valve. Reference Figure 5.

3. There are 2 H2 Valve Modules (HVM). Both HVMs contain a manifold shutoff valve and its position indicator, and a manifold pressure sensor. HVM 1 contains a horizontal drain QD and cap. HVM 1 also contains one fuel cell reactant supply valve and its position sensor, while HVM 2 contains two of each. HVM 2 also contains a Ground Support Equipment (GSE) valve and its position indicator and a GSE Time Zero (T-0) fill QD. The manifold valves can be used to isolate manifold 1 from 2. The GSE valve and fill QD allow the fuel cells to run on ground reactants before launch. Reference Figure 6.

4. The Oxygen (O2) tanks flown on a mission can number from 2 to 5. The O2 reactant is stored in the tank at an initial temperature of -300 degrees F. Each tank contains heaters labeled A1, A2, B1 and B2, with one heater assembly consisting of A1 and B1 and the other containing A2 and B2. The tanks also consist of a temperature sensor for each heater assembly, fluid temperature sensor, quantity sensor, pressure sensor, heater controller pressure sensor, fill QD and cap, and vent QD and cap. In a five tank configuration, the B heater in tanks 4 and 5 are not operational. Reference Figure 7.

5. There is an O2 Relief Valve/Filter Package (ORVFP) for each O2 tank. All ORVFPs have a filter and tank relief valve, plus the ones for tanks 1 and 2 contain a manifold relief valve, while those for tanks 1 through 4 contain a check valve. All packages share a relief port. Reference Figure 8.

6. There are two O2 Valve Modules (OVM). Both OVMs contain a manifold shutoff valve and its position indicator, a manifold pressure sensor, and an Environmental Control and Life Support System (ECLSS) system supply valve and its position sensor. OVM 1 contains one fuel cell reactant supply valve and its position sensor, while OVM 2 contains two of each. OVM 1 contains a GSE valve and its position indicator, and a GSE fill T-O QD. OVM 2 contains a horizontal drain QD and cap. Reference Figure 9.

7. The H2 and O2 lines, components, and fittings (HOLCF) made up two separate hardware categories outside of the six major divisions, but were grouped together into one category for the FMEA and CIL issue count comparison.

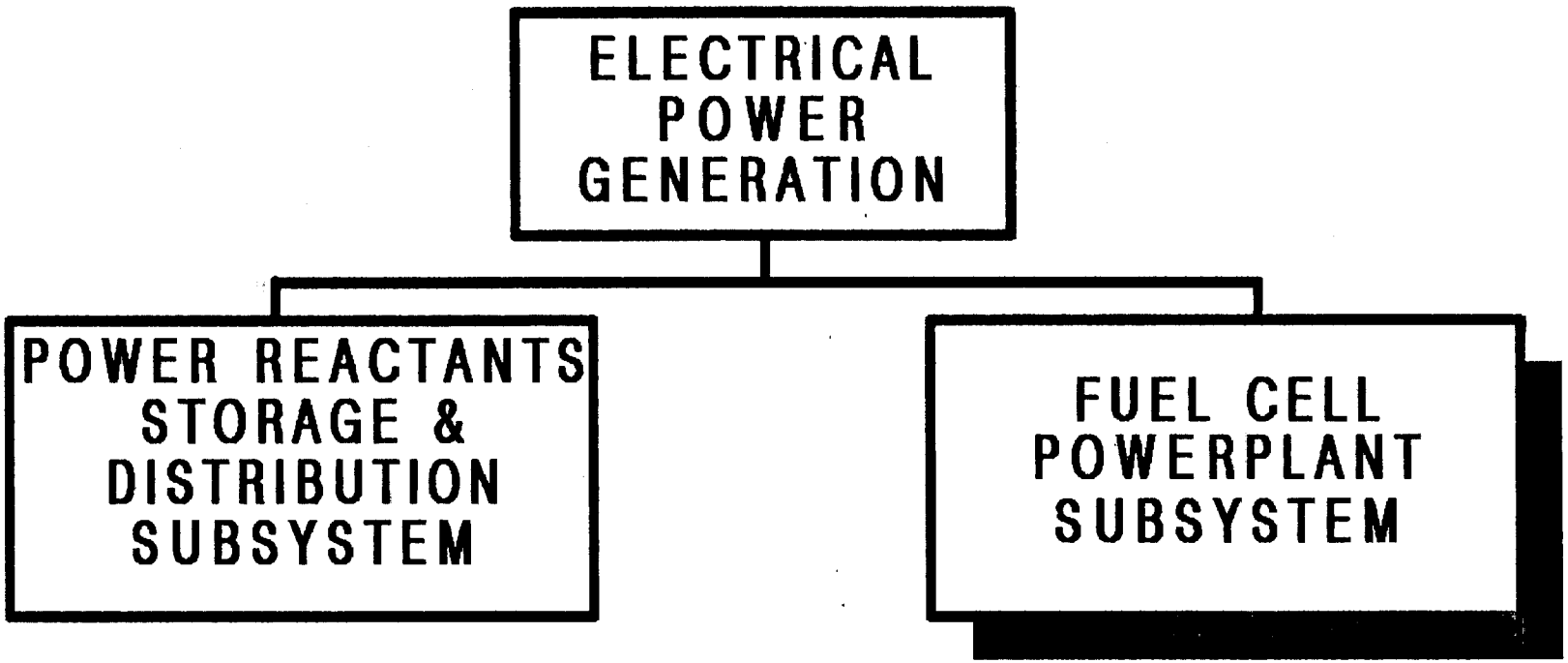
8. The H2 and O2 fill and vent QDs, horizontal drain QDs, GSE fill T-O QDs and their caps (QDCAP) were grouped together as a category only for the FMEA and CIL issue count comparison.

3.2 Interfaces and Locations

The EPG/PRSD interfaces directly with the FCP and ARPCS. Hydrogen and Oxygen are supplied to the FCPs while oxygen is supplied to the ARPCS. The PRSD subsystem components are installed in the mid-fuselage of the Orbiter beneath the payload bay liner. The H2 and O2 tanks are arranged on both sides of the mid-fuselage in a random type of order. Reference Figure 10. The O2 and H2 relief and drain ports are located on both sides of the Orbiter fuselage. Reference Figures 11 and 12.

3.3 Hierarchy

Figures 2 and 3 illustrate the hierarchy of the EPG and PRSD systems hardware, respectively, and the corresponding subcomponents. The PRSD subsystems are depicted in Figures 4 through 9.



EPG INTERFACE BUT NOT CONSIDERED IN THIS ANALYSIS.

Figure 2 - EPG SUBSYSTEM OVERVIEW

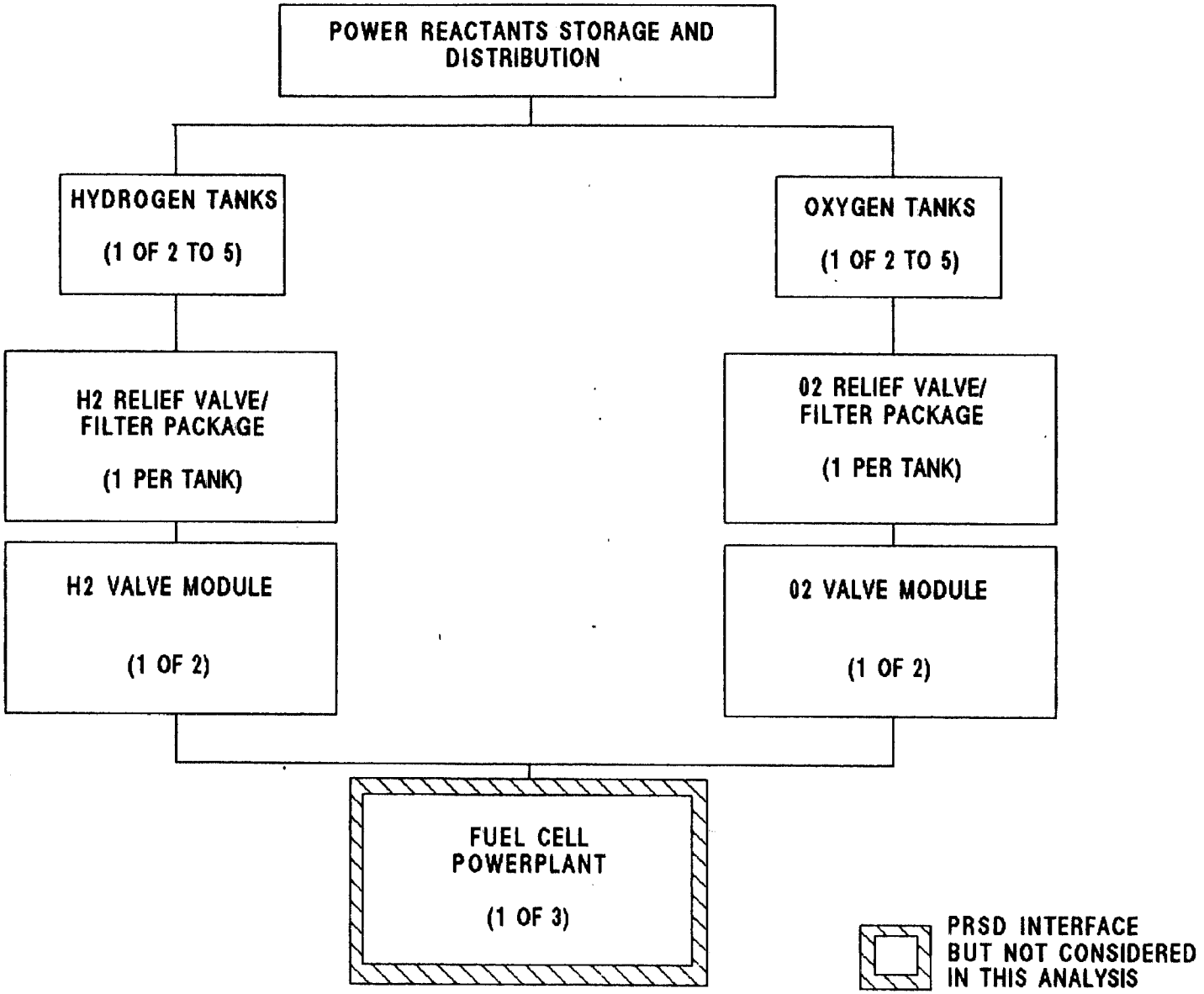


Figure 3 - PRSD SUBSYSTEM OVERVIEW

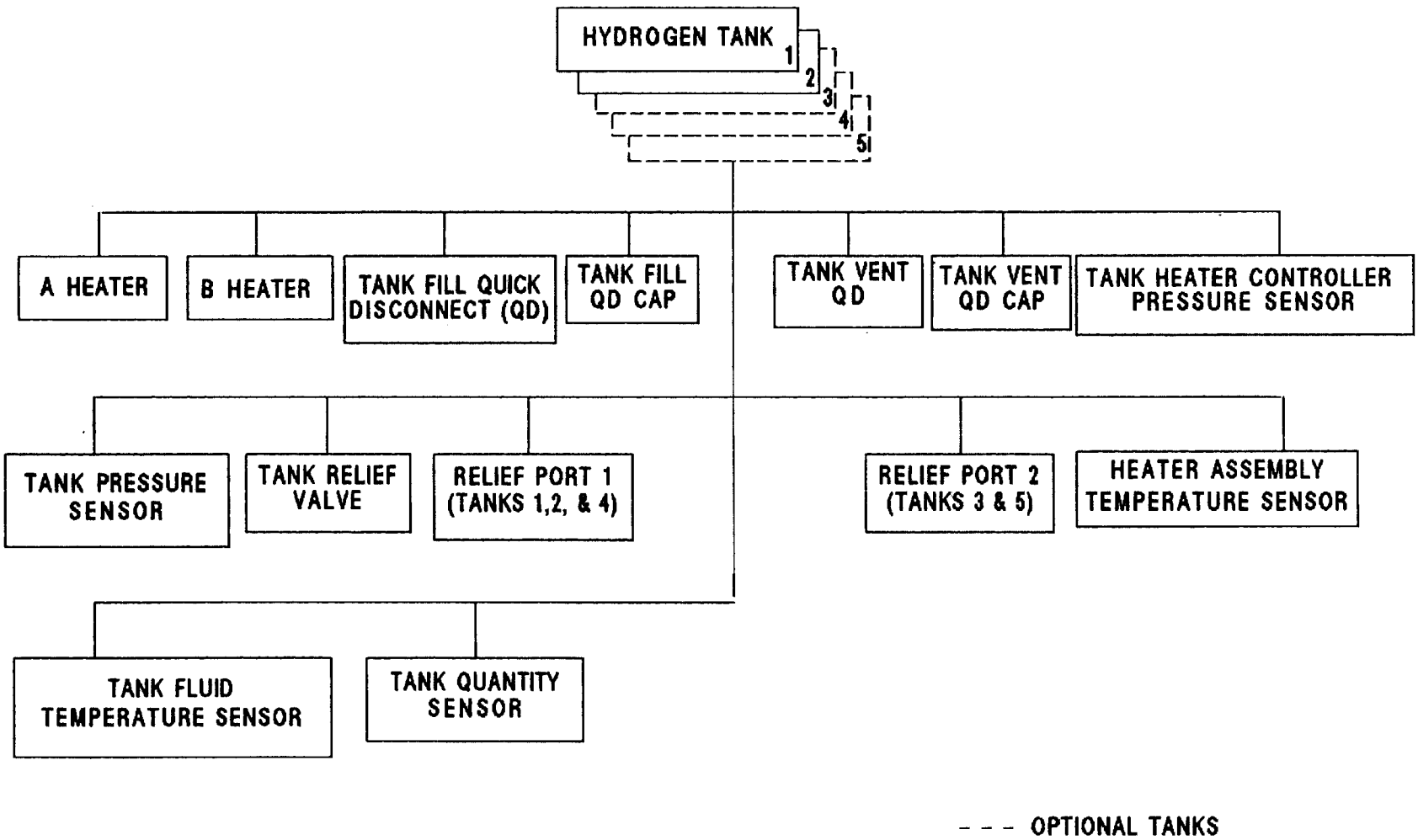


Figure 4 - PRSD HYDROGEN TANKS

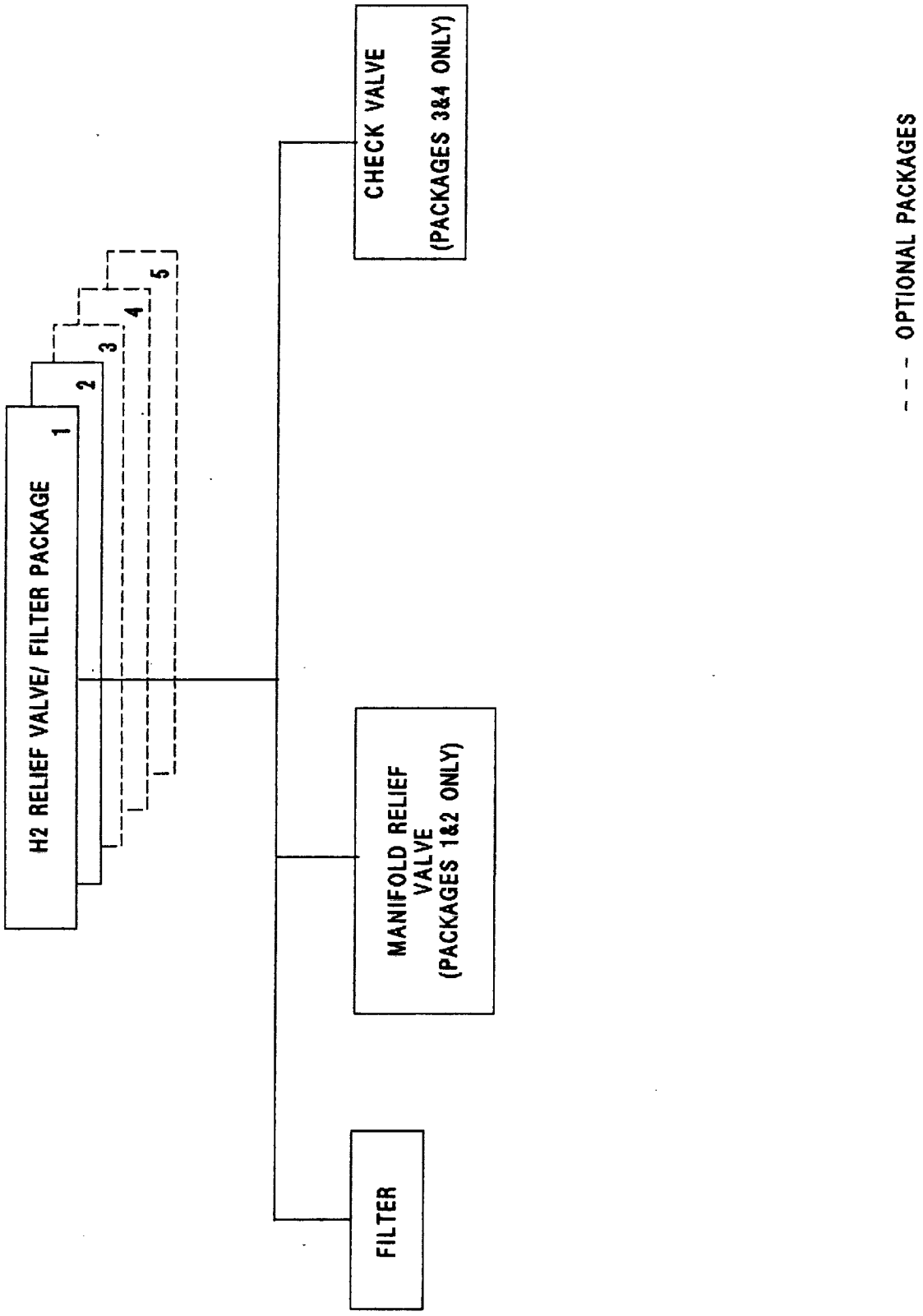


Figure 5 - PRSD H2 RELIEF VALVE/FILTER PACKAGES

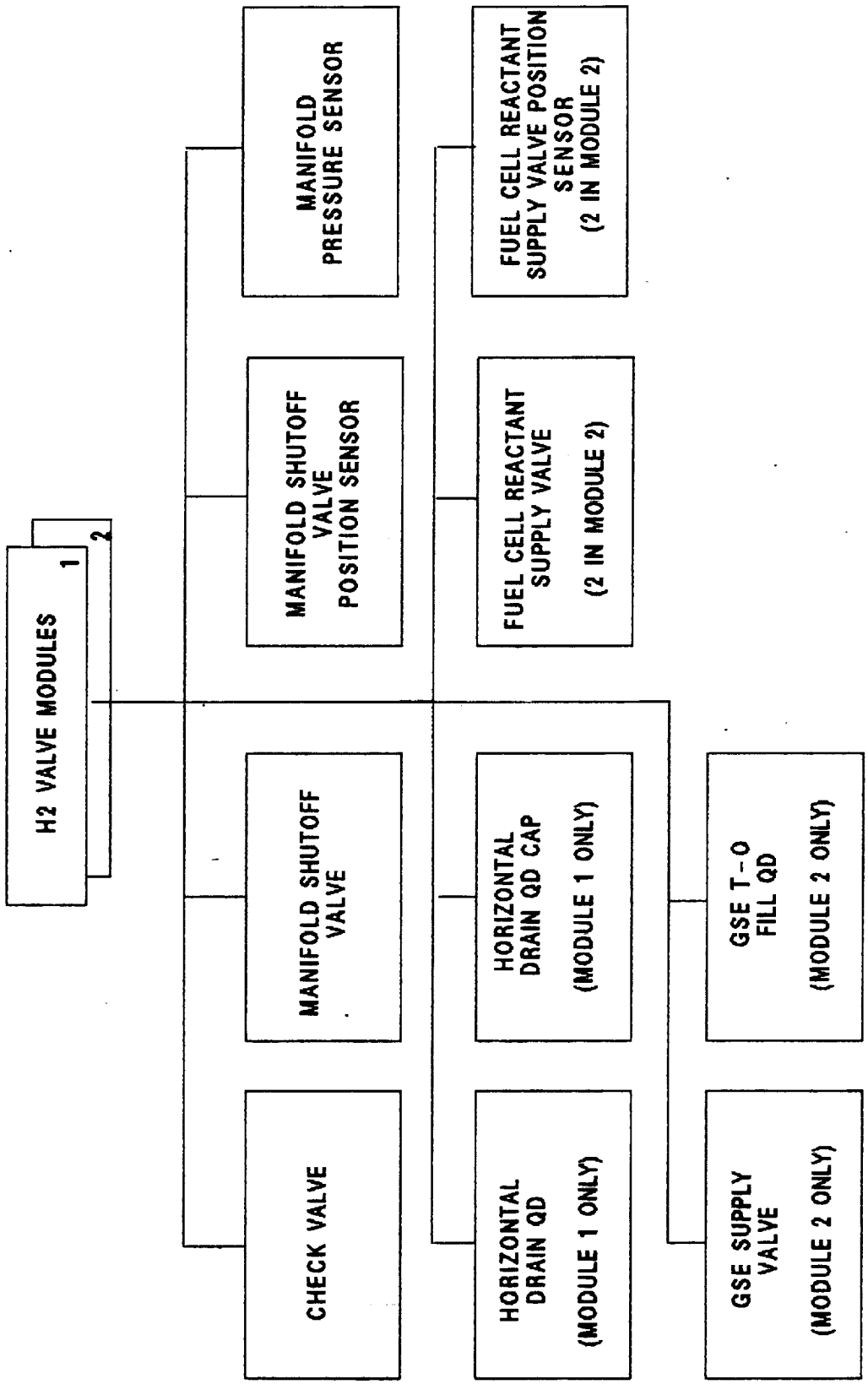


Figure 6 - PRSD H2 VALVE MODULES

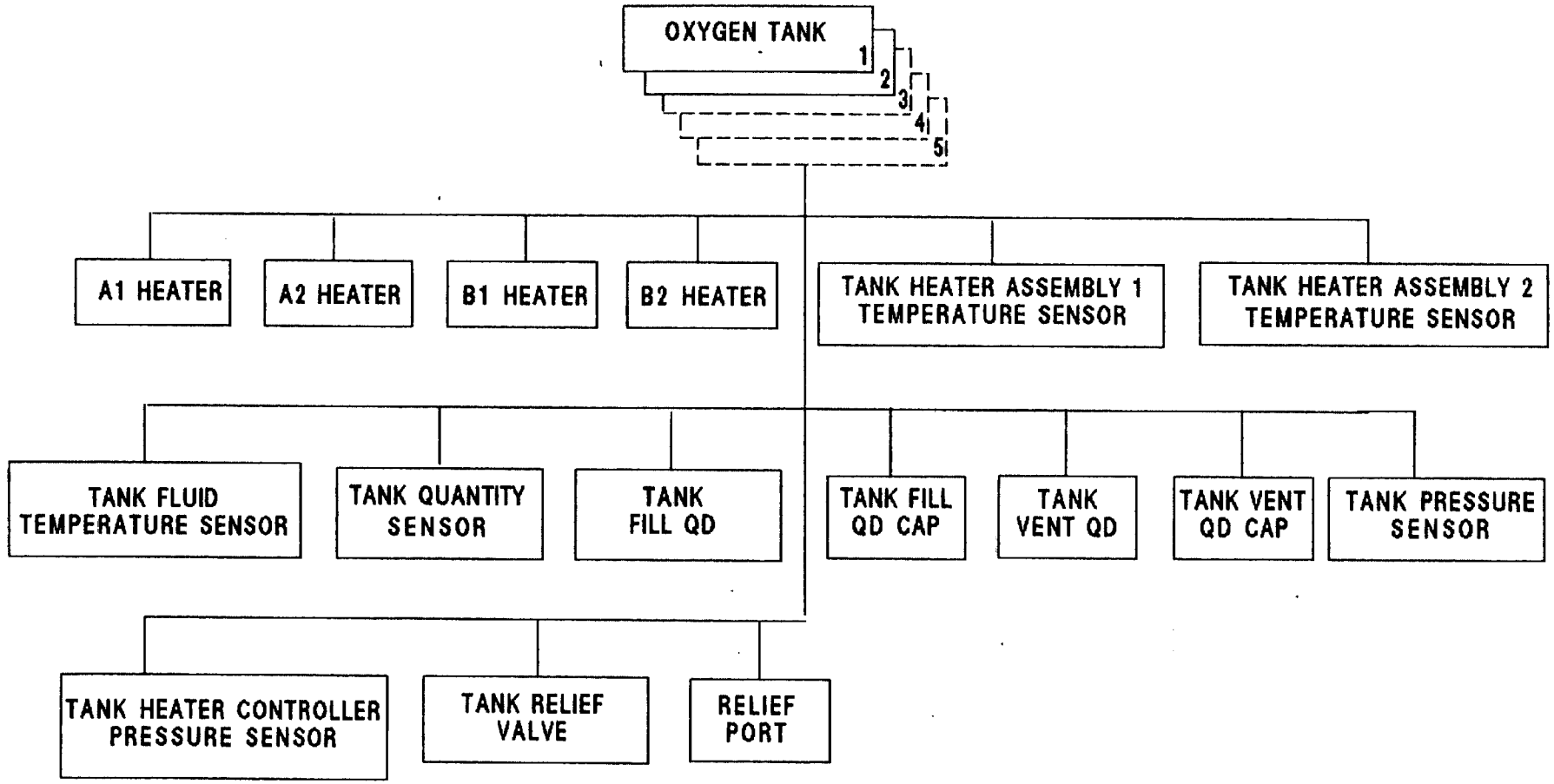


Figure 7 - PRSD OXYGEN TANKS

Figure 8 - PRSD O2 RELIEF VALVE/FILTER PACKAGES

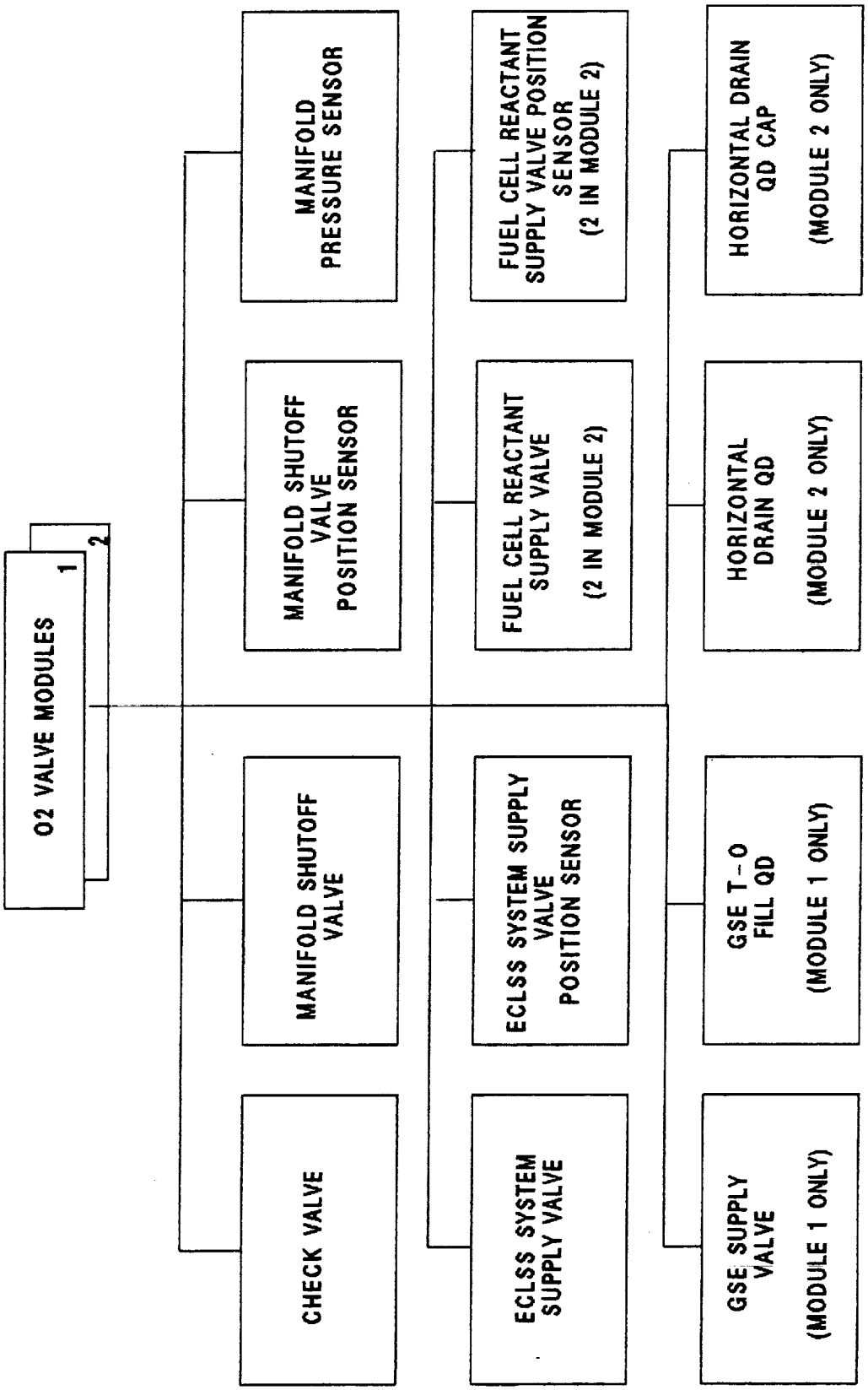


Figure 9 - PRSD 02 VALVE MODULES

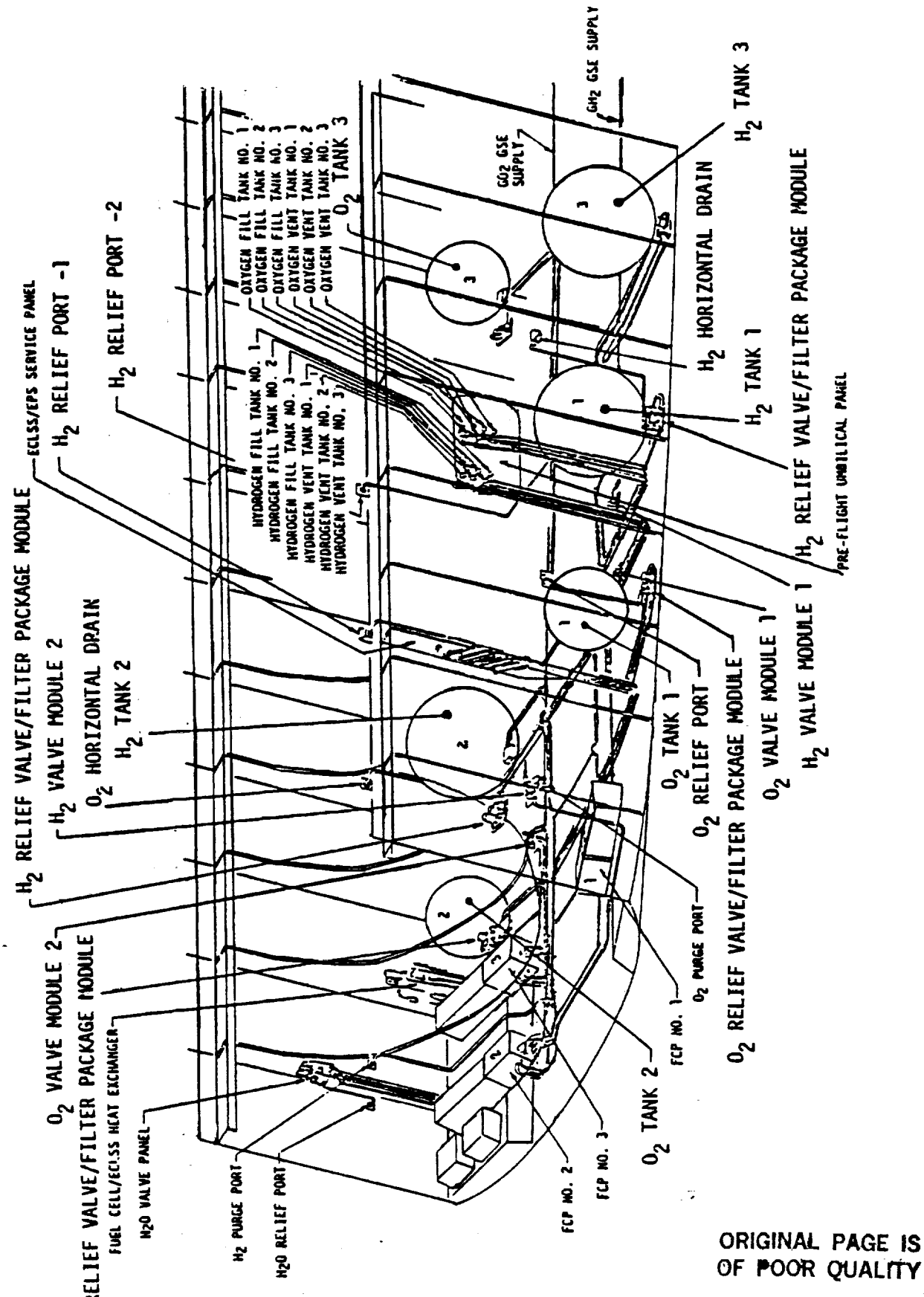


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Figure 10 - PRSD COMPONENT LOCATIONS

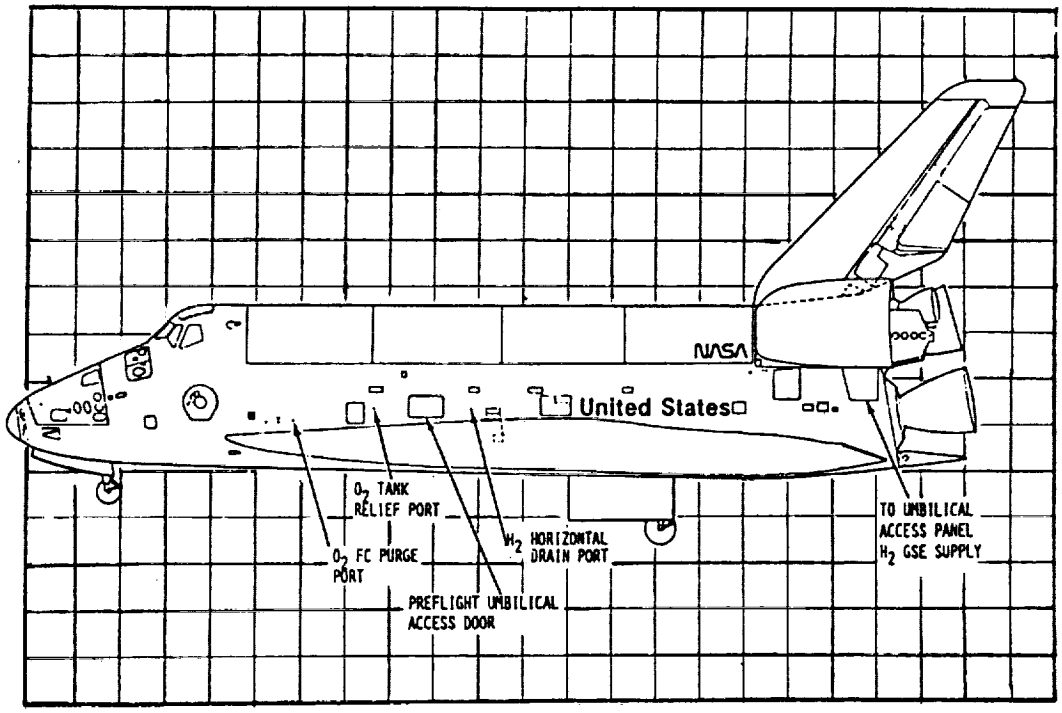

Figure 11 - PRSD PORTS - LEFT SIDE

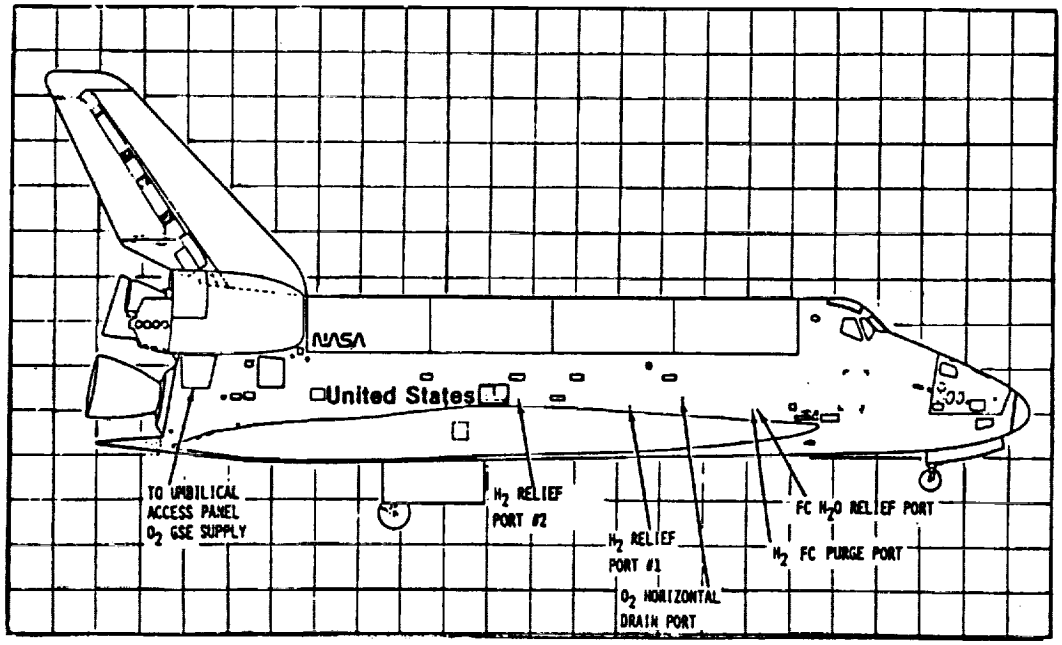

Figure 12 - PRSD PORTS - RIGHT SIDE

4.0 ASSESSMENT RESULTS

The IOA analysis of the EPG/PRSD hardware initially generated one hundred sixty two failure mode worksheets and identified eighty-two Potential Critical Items (PCIs) before starting the assessment process. In order to facilitate comparison, four additional failure mode analysis worksheets were generated. These analysis results were first compared to the proposed NASA Post 51-L baseline of ninety-two FMEAs and fifty-eight CIL items, and then to the updated version of sixty-six FMEAs and thirty-nine CIL items, and finally to three different baseline configurations: 2-Tank) Sixty-four FMEAs and thirty-nine CIL items, 3&4-Tank) Sixty-seven FMEAs and forty-two CIL items. The discrepancy between the number of IOA and NASA FMEAs can be explained by four different reasons:

1) Eight issues arose from inner tank component FMEAs that had not been covered by NASA, but which may have been covered by the tank manufacturer, Beech Aircraft.

2) Two issues were due to FMEAs the NASA subsystem manager thought should be covered under the ground operations FMEAs.

3) Thirteen issues were caused by the differences between the Rockwell International reliability desk instructions No. 100-2G and the NSTS 22206.

4) Four issues can be explained by the different approach used by NASA and IOA to group failure modes.

Upon completion of the assessment, and after discussions with the NASA subsystem manager, nineteen of the seventy-seven recommended FMEAs were in agreement. Of the fifty-eight that remained, twenty-seven had minor discrepancies that did not affect criticality.

In the analysis report, the PRSD was divided into seven sections according to hardware and location. However, in the assessment report the PRSD has been divided into eight sections to facilitate comparison to the NASA FMEAs. Some of the components in the sections were moved to other sections while the QDs and caps were grouped into a new section called QDCAP.

In the tabulation below, the various failure mode and FMEA counts are compared. The unmapped IOA column is the raw number of IOA failure mode worksheets. The mapped IOA column is the number of IOA failure modes after they have been mapped into the NASA FMEAs for comparison. The NASA column is the number of FMEAs for the three or four tank baseline.

EPG/PRSD Sections	Unmapped IOA	Mapped IOA	NASA	Issues
H2 Tank	20	8	4	6
HRVFP	15	9	9	3
HVM	21	14	14	3
O2 Tank	23	8	4	6
ORVFP	14	8	8	3
OVM	27	18	18	4
HOLCF	30	2	2	0
QDCAP	16	10	8	2
TOTAL	166	77	67	27

A summary of the quantity of NASA FMEAs three or four tank baseline assessed, versus the IOA five tank configuration baseline, and identified issues is presented in Table I.

Table I Summary of IOA FMEA Assessment

Component	NASA	IOA	Issues
H2 Tank	4	8	6
HRVFP	9	9	3
HVM	14	14	3
O2 Tank	4	8	6
ORVFP	8	8	3
OVM	18	18	4
HOLCF	2	2	0
QDCAP	8	10	2
TOTAL	67	77	27

The IOA FMEA total is ten greater than the NASA FMEA total, because IOA, for completeness, recommends the addition of ten new FMEAs. Unmapped there are 26 assessment worksheets of criticality flight HDW/FUNC: 3/3, and three assessment worksheets of criticality flight HDW/FUNC: 3/1R that NASA may want to consider adding.

A summary of the quantity of NASA CIL items for three or four tank baseline assessed, versus IOA five tank baseline, any issues identified is presented in Table II.

Table II Summary of IOA CIL Assessment

Component	NASA	IOA	Issues
H2 Tank	2	3	1
HRVFP	8	3	1
HVM	6	4	2
O2 Tank	2	3	1
ORVFP	7	3	1
OVM	7	6	3
HOLCF	2	2	0
QDCAP	8	8	0
TOTAL	42	32	9

Starting at section 4.1 the FMEA and CIL issues are discussed for the above component divisions. Appendix C presents the detailed assessment worksheets for each failure mode identified and assessed. Appendix D highlights the NASA Critical Items and corresponding IOA worksheet ID. Appendix E contains IOA analysis worksheets supplementing previous analysis results reported in Space Transportation System Engineering and Operations Support (STSEOS) Working Paper No. 1.0-WP-VA86001-11, Analysis of the EPG/PRSD, 12 December 1986. Appendix F provides a cross reference between the NASA FMEA and corresponding IOA worksheet(s). IOA recommendations are also summarized.

Table III presents a summary of the IOA recommended failure criticalities for the three or four tank Post 51-L FMEA baseline. Further discussion of each of these subdivisions and the applicable failure modes is provided in subsequent paragraphs.

TABLE III Summary of IOA Recommended Failure Criticalities

Criticality:	1/1	2/1R	2/2	3/1R	3/2R	3/3	TOTAL
H2 Tank	2	-	-	4	-	2	8
HRVFP	-	3	-	6	-	-	9
HVM	-	4	-	1	1	8	14
O2 Tank	2	-	-	2	-	4	8
ORVFP	-	3	-	5	-	-	8
OVM	-	6	-	1	1	10	18
HOLCF	2	-	-	-	-	-	2
QDCAP	-	6	-	2	-	2	10
TOTAL	6	22	-	21	2	26	77

Of the failure modes analyzed, thirty-two were determined to be critical items. A summary of the IOA recommended critical items is presented in Table IV.

TABLE IV Summary of IOA Recommended Critical Items

Criticality:	1/1	2/1R	2/2	3/1R	3/2R	3/3	TOTAL
H2 Tank	2	-	-	1	-	-	3
HRVFP	-	3	-	-	-	-	3
HVM	-	4	-	-	-	-	4
O2 Tank	2	-	-	1	-	-	3
ORVFP	-	3	-	-	-	-	3
OVM	-	6	-	-	-	-	6
HOLCF	2	-	-	-	-	-	2
QDCAP	-	6	-	2	-	-	8
TOTAL	6	22	-	4	-	-	32

The scheme for assigning IOA assessment (Appendix C) and analysis (Appendix E) worksheet numbers is shown in Table V.

Table V IOA Worksheet Numbers	
Component	IOA ID Number
H2 Tank	PRSD-203 to 210, 216 to 227
HRVFP	PRSD-211, 212, 214, 215, 230 to 232, 234, 235, 237, 238, 240, 241, 243, 244
HVM	PRSD-249 to 253, 255, 256, 258, 259, 261, 262, 264, 265, 267, 268, 350, 351, 356, 357, 362X, 363X
O2 Tank	PRSD-318 to 332, 337 to 344
ORVFP	PRSD-272, 273, 307, 308, 310, 311, 313, 314, 333 to 335, 358 to 360
OVM	PRSD-275, 276, 278, 279, 281, 282, 286 to 290, 292, 293, 295, 296, 301, 302, 304, 305, 348, 349, 352 to 355, 364X, 365X
HOLCF	PRSD-213, 228, 229, 233, 236, 239, 242, 245, 254, 257, 260, 263, 266, 269, 274, 277, 280, 283, 291, 294, 297, 303, 306, 309, 312, 315 to 317, 336, 361
QDCAP	PRSD-200 to 202, 246 to 248, 270, 271, 284, 285, 298, 299, 300, 345 to 347

To facilitate comparison with the NASA FMEAs, several IOA failure modes were moved to other sections, a new section was created, and four new worksheets were written. This combined effect causes comparison of the before and after unmapped worksheet counts to be difficult. This effect can be seen on the next page.

Component	Analysis Report Worksheets	Assessment Report Worksheets
H2 Tank	28	20
HRVFP	10	15
HVM	36	21
O2 Tank	30	23
ORVFP	10	14
OVM	44	27
HOLCF	4	30
QDCAP	-	16
TOTAL	162	166

The previous tables have dealt with comparing IOA's five tank baseline to NASA's three or four tank baseline. The main difference between these tank configurations is the number of items to consider - this has not effected the criticality. The two tank configuration have differences when compared to the other baselines that does effect criticality, and in eight cases the failure mode does not occur in the two tank baseline. These differences in FMEA/CIL are listed in Table VI.

TABLE VI Baseline Comparisons						
			NASA		IOA	
Component	NASA ID #	IOA ID #	FMEA	CI	FMEA	PCI
HRVFP	CV030-1 (3&4)	237	2/1R	X	2/1R	X
	CV030-2 (3&4)	238	2/1R	X	3/1R	
	VP045-1 (3&4)	215	2/1R	X	3/1R	
HVM	LV031-2 (2)	253	2/1R	X	2/2R	
	(3&4)		3/1R	X	3/2R	
	(2)	265	2/1R	X	2/2R	
	(3&4)		3/1R	X	3/2R	
	LV044-2 (3&4)	262	1/1	X	2/1R	X
ORVFP	CV010-1 (3&4)	313	2/1R	X	2/1R	X
	CV010-2 (3&4)	314	2/1R	X	3/1R	
OVM	LV011-2 (2)	293	2/1R	X	2/2R	
	(3&4)		3/1R	X	3/2R	
	(2)	296	2/1R	X	2/2R	
	(3&4)		3/1R	X	3/2R	
	LV024-2 (3&4)	302	1/1	X	2/1R	X
HOLCF	AOIFSH-1 (3&4)	239	1/1	X	1/1	X
	AO1FSO-1 (3&4)	315	1/1	X	1/1	X

Prefixes for NASA ID #s are: (2) = 04-1B-
(3) = M4-1B1-
(4) = M4-1B2-

Prefix for IOA ID #s is: PRSD-

Table VI shows the issues that have been resolved since NASA has adopted three baseline configurations versus the former two tank baseline. In the remarks section of the assessment worksheets in appendix C, the differences between baseline configurations are listed.

4.1 H2 Tank Assessment Results

The assessment between the IOA recommended failure modes and the latest NASA FMEA baseline produced six FMEA issues and one CIL issue. Four issues are due to inner tank components that NASA had not covered. These are the failure modes of the tank heater elements failing off (PRSD-210), tank heater assembly temperature sensors (PRSD-219 to 221),tank fluid temperature sensors (PRSD-222 to 224), and tank quantity sensors (PRSD-225 to 227). Two issues are created by a difference in mapping. For the tank subassemblies, the IOA recommends that the failure mode of external leakage (PRSD-216) be separate from FMEA 04-1-TK030-1, which also covers rupture. For the tank heater controller pressure transducers, the IOA recommends that the failure mode of zero output (PRSD-207) be separate from FMEA 04-1-MT039-1, because it has a vastly different effect on PRSD operation than does full output. PRSD-216 is also a CIL issue because it is a criticality 1/1. The failure mode of the tank heater elements failing on (PRSD-209) was deleted because it is covered by the EPD&C/PRSD analysis. The component changes from the analysis report were the moving of the tank relief valves and relief ports 1 and 2 into the HRVFP section.

4.2 HRVFP Assessment Results

The assessment produced three FMEA issues and one CIL issues. The three FMEA issues are the failure modes of the tank relief valves failing open (PRSD-211), relief port 1 having restricted flow (PRSD-214), and manifold relief valves failing open (PRSD-231 and 234). These are caused by NSTS 22206 stating that screen B should be NA because these components are standby redundant. The CIL issue is PRSD-231 and 234 because changing screen B to NA allows it to be deleted from the CIL. The component changes from the analysis report were the additions of the tank relief valves and relief ports 1 and 2, and the combining of the check valves.

4.3 HVM Assessment Results

The assessment produced three FMEA issues and two CIL issues. All three FMEA issues involved passing screen B due to NSTS 22206 because there is a valve position indicator. These are the failure modes of the fuel cell reactant supply valves failing open (PRSD-255,258, and 261), manifold cross-over valves failing open (PRSD-252 and 264) and GSE supply valve failing closed (PRSD-267). The IOA also recommended that the hardware criticality for PRSD-252 and 264 be changed from a 2 to a 3. If the manifold crossover valves failed open, all reactant could be depleted out failed open tank and manifold relief valves. The latter two FMEA issues also are CIL issues because the IOA recommended changes cause them to no longer qualify as CILs. During the IOA

assessment, two failure modes were developed to cover the GSE valve position indicator failure modes of reading open when the valve is closed (PRSD-362X) and reading closed when the valve is open (PRSD-363X). The component changes from the analysis report were the deletion of a check valve and the addition of a GSE supply valve position indicator.

4.4 O2 Tank Assessment Results

The assessment produced six FMEA issues and one CIL issue. Four issues are due to inner tank components that NASA had not covered. These are the failure modes of the tank quantity sensors (PRSD-318 to 320), tank fluid temperature sensors (PRSD-321 to 323), tank heater assembly temperature sensors (PRSD-324 to 329), and tank heater elements failing off (PRSD-338). Two issues are created by a difference in mapping. For the tank subassemblies, the IOA recommends that the failure mode of external leakage (PRSD-330) be separate from FMEA 04-1-TK010-1, which also covers rupture. For the tank heater controller pressure transducers, the IOA recommends that the failure mode of zero output (PRSD-340) be separate from FMEA 04-1-MT018-1 because it has a vastly different effect on PRSD operation than does full output. PRSD-330 is also a CIL issue because it is a criticality 1/1. The failure mode of the tank heater elements failing on (PRSD-337) was deleted because it is covered by the EPD&C/PRSD analysis. The component changes from the analysis report were the moving of the tank relief valves and relief port into the ORVFP section.

4.5 ORVFP Assessment Results

The assessment produced three FMEA issues and one CIL issues. The three FMEA issues are the failure modes of the relief port (PRSD-333), tank relief valves failing open (PRSD-334), and manifold relief valves failing open (PRSD-307 and 310). These are caused by NSTS 22206 stating that screen B should be NA because these components are standby redundant. The CIL issue is represented by PRSD-307 and 310. This should be deleted from the CIL because screen B is NA. The component changes from the analysis report were the additions of the tank relief valves, relief port, and the combining of the check valves.

4.6 OVM Assessment Results

The assessment produced four FMEA issues and three CIL issues. All four FMEA issues involved passing screen B due to NSTS 22206 because there is a valve position indicator. These are the failure modes of the GSE supply valve failing open (PRSD-275), ECLSS system supply valves failing open (PRSD-278 and 281), manifold crossover valves failing open (PRSD-292 and 295), and fuel cell reactant supply valves failing open (PRSD-289,301, and 304). The IOA also recommends that the hardware criticality for PRSD-292 and

295 be changed from a 2 to a 3. If the manifold crossover valves failed open, all reactant could be depleted out failed open tank and manifold relief valves. The first three FMEA issues listed above are also CIL issues because passing screen B allows them to be deleted from the CIL. During the IOA assessment , two failure modes were developed to cover the GSE supply valve position indicator failure modes of reading open when the valve is closed (PRSD-364X) and reading closed when the valve is open (PRSD-365X). The component changes from the analysis report were the deletion of a check valve and the addition of a GSE supply valve position indicator.

4.7 HOLCF Assessment Results

The assessment produced zero FMEA issues and zero CIL issues. This section has two FMEAs dealing with external leakage for all the lines, fittings, and most components. The only components with separate FMEAs for external leakage were QDs and caps. The failure modes for the H2 (PRSD-229) and O2 (PRSD-317) lines, components, and fittings having restricted flow were deleted because this was considered non-credible.

4.8 QDCAP Assessment Results

The assessment produced two FMEA issues and zero CIL issues. The failure modes on the inability of the H2 (PRSD-201,247, and 271), and O2 (PRSD-285,299, and 347) fill and vent, horizontal drain, and GSE fill T-O QDs to mate/demate were not covered by the NASA subsystem manager because it was thought these were covered under ground operations. The IOA recommends they be included in the PRSD category. This section is entirely new and was created for ease of comparison between the IOA and NASA FMEAs. All of the QD and cap failure modes were grouped into this section because they were in a couple analysis section groupings.

5.0 REFERENCES

Reference documentation available from NASA and Rockwell was used in the analysis. The documentation used included the following:

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2. Space Shuttle Operations and Maintenance Requirements and Specification Document (OMRSD), V. 45 File III, Orbiter OMRSD - Electrical Power Generation/Power Reactant Storage and Distribution, 5-29-86.

3. VS70-945099, Integrated System Schematic, Electrical Power System (EPS), Orbiter Vehicles - 099, 103 & 104, Rev. A08, 7-18-85.

4. VS70-945102, Integrated System Schematic, Orbiter OV-102, EPS, Rev. G04, 6-19-84.

5. Mission Operations Directorate, Systems Analysis Section, Training Guide, Space Shuttle Electrical Power System, Basic, 6-28-85.

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20. JSC-18537, Flight Data File, Ascent Pocket Checklist, All Vehicle, Basic, Rev. A, 5-24-85.

21. JSC-18539, Flight Data File, Entry Pocket Checklist, All Vehicle, Basic, Rev. A, 5-24-85.

22. JSC-18547, Flight Data File, Ascent Checklist, Basic, Rev. A, 5-28-85.

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    b. MC276-0012, Disconnect, Gas Supply, Rev. C. 3-24-77.
    c. MC282-0063, Storage Assembly, Power Reactant - Orbiter, Rev. H, 6-4-82.
    d. MC284-0429, Valve, Shutoff, Unidirectional and Bi-directional O2 and H2, Rev. B. 10-30-75.
    e. MC284-0440, Valve, Pressure Relief, Cryogenic, Rev. C, 5-14-79.
    f. MC286-0054, Filter, Cryogenic, Rev. A, 9-17-75.
    g. MC449-0185, Sensor, Control Pressure, Rev. E, 2-01-79.
    h. MC999-0097, Metallic Pressure Vessel, Space Shuttle Orbiter, Requirements for, Rev. C, 11-10-75.
    i. ME273-0074, Coupling, Half, Quick Disconnect, Female Fitting, Rev. F, 7-21-75.
    j. ME273-0075, Coupling, Half, Quick Disconnect, Male Fitting, Rev. F, 7-10-75.
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c. VO70-454315, Panel-Oxygen Control, LH Side, Assy. of, Rev. A, 2-20-76.
d. VO70-454374, Panel - H2 Pressure Relief, PRSD, Electrical Power Subsystem, Assy. of, 4-14-75.
e. VO70-454377, Panel - O2 Pressure Relief, PRSD Electrical Power Subsystem, Assy. of, 4-14-75.
f. VO70-454388, Panel - H2 Pressure Relief, Electrical Power Subsystem, Assy. of, Rev. B. 1-14-82.
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h. VO70-454410, Panel - Oxygen Control, RH Side, Assy. of, 4-3-75.
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j. VO70-454710, Panel - Oxygen Control, LH Side, Assy. of, Rev. E, 3-12-82.
k. VO70-454712, Braze & Insulation - H2 Control Valves & Components, LH Side, Assy. of, Rev. C, 4-17-79.
l. VO70-454714, Panel - Oxygen Control, RH Side, Assy. of, Rev. F, 10-8-82.
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28. NASA-JSC FMEAs and CIL, 3-18-87.

APPENDIX A
ACRONYMS

AOA	-	Abort Once Around
ARPCS	-	Atmospheric Revitalization Pressure Control Subsystem
Assy	-	Assembly
ATO	-	Abort To Orbit
CI	-	Critical Item
CIL	-	Critical Items List
CRIT	-	Criticality
CRYO	-	Cryogenic
C&W	-	Caution and Warning System
ECLSS	-	Environmental Control and Life Support System
EGIL	-	Electrical, General Instrumentation, and Lighting Engineer
EPG	-	Electrical Power Generation
EPS	-	Electrical Power System
F	-	Functional
FCP	-	Fuel Cell Powerplant
FMEA	-	Failure Mode and Effect Analysis
GFE	-	Government Furnished Equipment
GSE	-	Ground Support Equipment
HOLCF	-	H2 & O2 Lines, Components, and Fittings
HR	-	Hour
HRVFP	-	Hydrogen Relief Valve/Filter Package
H2	-	Hydrogen
HVM	-	Hydrogen Valve Module
HW	-	Hardware
IOA	-	Independent Orbiter Assessment
JSC	-	Lyndon B. Johnson Space Center
LB	-	Pound
LH	-	Left Hand
MDAC	-	McDonnell Douglas Astronautics Company
MECO	-	Main Engine Cutoff
MPS	-	Main Propulsion Subsystem
NASA	-	National Aeronautics and Space Administration
NSTS	-	National Space Transportation System
NA	-	Not Applicable
OMRSD	-	Operations and Maintenance Requirements and Specification Document
OMS	-	Orbital Maneuvering Subsystem
ORVFP	-	Oxygen Relief Valve/Filter Package
O2	-	Oxygen
OVM	-	Oxygen Valve Module
PCI	-	Potential Critical Item
PLS	-	Primary Landing Site
PRCB	-	Program Requirements Control Board
PRSD	-	Power Reactant Storage and Distribution
psi	-	Pounds Per Square Inch
psig	-	Pounds Per Square Inch Gauge

ACRONYMS

QD	-	Quick Disconnect
QDCAP	-	H2 & O2 Fill and Vent QDs, Horizontal Drain QDs, GSE Fill T-O QDs and their caps
Rev	-	Revision
RH	-	Right Hand
RI	-	Rockwell International
RTLS	-	Return to Landing Site
STS	-	Space Transportation System
TAL	-	Transatlantic Abort Landing
T-O	-	Time Zero
Xo	-	X Axis of Orbiter

APPENDIX B

DEFINITIONS, GROUND RULES, AND ASSUMPTIONS

APPENDIX B
DEFINITIONS, GROUND RULES, AND ASSUMPTIONS

B.1 Definitions

Definitions contained in NSTS 22206, Instructions For Preparation of FMEA/CIL, 10 October 1986, were used with the following amplifications and additions.

INTACT ABORT DEFINITIONS:

RTLS - begins at transition to OPS 6 and ends at transition to OPS 9, post-flight

TAL - begins at declaration of the abort and ends at transition to OPS 9, post-flight

AOA - begins at declaration of the abort and ends at transition to OPS 9, post-flight

ATO - begins at declaration of the abort and ends at transition to OPS 9, post-flight

CREDIBLE (CAUSE) - an event that can be predicted or expected in anticipated operational environmental conditions. Excludes an event where multiple failures must first occur to result in environmental extremes

CONTINGENCY CREW PROCEDURES - procedures that are utilized beyond the standard malfunction procedures, pocket checklists, and cue cards

EARLY MISSION TERMINATION - termination of onorbit phase prior to planned end of mission

EFFECTS/RATIONALE - description of the case which generated the highest criticality

HIGHEST CRITICALITY - the highest functional criticality determined in the phase-by-phase analysis

MAJOR MODE (MM) - major sub-mode of software operational sequence (OPS)

MC - Memory Configuration of Primary Avionics Software System (PASS)

MISSION - assigned performance of a specific Orbiter flight with payload/objective accomplishments including orbit phasing and altitude (excludes secondary payloads such as GAS cans, middeck P/L, etc.)

MULTIPLE ORDER FAILURE - describes the failure due to a single cause or event of all units which perform a necessary (critical) function

OFF-NOMINAL CREW PROCEDURES - procedures that are utilized beyond the standard malfunction procedures, pocket checklists, and cue cards

OPS - software operational sequence

PRIMARY MISSION OBJECTIVES - worst case primary mission objectives are equal to mission objectives

PHASE DEFINITIONS:

PRELAUNCH PHASE - begins at launch count-down Orbiter power-up and ends at moding to OPS Major Mode 102 (liftoff)

LIFTOFF MISSION PHASE - begins at SRB ignition (MM 102) and ends at transition out of OPS 1 (Synonymous with ASCENT)

ONORBIT PHASE - begins at transition to OPS 2 or OPS 8 and ends at transition out of OPS 2 or OPS 8

DEORBIT PHASE - begins at transition to OPS Major Mode 301 and ends at first main landing gear touchdown

LANDING/SAFING PHASE - begins at first main gear touchdown and ends with the completion of post-landing safing operations

APPENDIX B
DEFINITIONS, GROUND RULES, AND ASSUMPTIONS

B.2 IOA Project Level Ground Rules and Assumptions

The philosophy embodied in NSTS 22206, Instructions for Preparation of FMEA/CIL, 10 October 1986, was employed with the following amplifications and additions.

1. The operational flight software is an accurate implementation of the Flight System Software Requirements (FSSRs).

   RATIONALE: Software verification is out-of-scope of this task.

2. After liftoff, any parameter which is monitored by system management (SM) or which drives any part of the Caution and Warning System (C&W) will support passage of Redundancy Screen B for its corresponding hardware item.

   RATIONALE: Analysis of on-board parameter availability and/or the actual monitoring by the crew is beyond the scope of this task.

3. Any data employed with flight software is assumed to be functional for the specific vehicle and specific mission being flown.

   RATIONALE: Mission data verification is out-of-scope of this task.

4. All hardware (including firmware) is manufactured and assembled to the design specifications/drawings.

   RATIONALE: Acceptance and verification testing is designed to detect and identify problems before the item is approved for use.

5. All Flight Data File crew procedures will be assumed performed as written, and will not include human error in their performance.

   RATIONALE: Failures caused by human operational error are out-of-scope of this task.

6. All hardware analyses will, as a minimum, be performed at the level of analysis existent within NASA/Prime Contractor Orbiter FMEA/CILs, and will be permitted to go to greater hardware detail levels but not lesser.

RATIONALE: Comparison of IOA analysis results with other analyses requires that both analyses be performed to a comparable level of detail.

7. Verification that a telemetry parameter is actually monitored during AOS by ground-based personnel is not required.

RATIONALE: Analysis of mission-dependent telemetry availability and/or the actual monitoring of applicable data by ground-based personnel is beyond the scope of this task.

8. The determination of criticalities per phase is based on the worst case effect of a failure for the phase being analyzed. The failure can occur in the phase being analyzed or in any previous phase, whichever produces the worst case effects for the phase of interest.

RATIONALE: Assigning phase criticalities ensures a thorough and complete analysis.

9. Analysis of wire harnesses, cables, and electrical connectors to determine if FMEAs are warranted will not be performed nor FMEAs assessed.

RATIONALE: Analysis was substantially complete prior to NSTS 22206 ground rule redirection.

10. Analysis of welds or brazed joints that cannot be inspected will not be performed nor FMEAs assessed.

RATIONALE: Analysis was substantially complete prior to NSTS 22206 ground rule redirection.

11. Emergency system or hardware will include burst discs and will exclude the EMU Secondary Oxygen Pack (SOP), pressure relief valves and the landing gear pyrotechnics.

RATIONALE: Clarify definition of emergency systems to ensure consistency throughout IOA project.

B.3 EPG/PRSD - Specific Ground Rules and Assumptions

1. Component age life will not be considered in the analysis.

   RATIONALE: Component age life analysis is beyond the scope of this task.

2. Cryogenic system pressure to the fuel cell will be assumed lost if unable to maintain minimum supply conditions of 100 PSI for H2 and/or O2 tanks.

   RATIONALE: Minimum requirements definition. Flight rule definition.

3. An O2 cryo tank will be assumed lost if both of its heaters fail to function (i.e., neither heater will function with the delta current sensors enabled).

   RATIONALE: Systems failure definition. Flight rule definition.

4. An H2 cryo tank will be assumed lost if neither of its heaters will function.

   RATIONALE: Systems failure definition. Flight rule definition.

5. An impending loss of all cryo O2 or all cryo H2 tanks will be cause to exercise the highest-priority abort mode the loss/leak will allow.

   RATIONALE: Flight rule definition.

6. Continue nominal ascent if 2/3/4 O2 (H2) tanks fail when flying 3/4/5.

   Enter next PLS daily go/no-go if two O2 (H2) tanks fail during lift-off and on-orbit.

   RATIONALE: Flight rules go/no-go criteria.

7. Ascent abort decision will be needed for any EPG/PRSD/FCP problems that will not support four hours on-orbit plus entry time.

   RATIONALE: Flight operations rules.

8. A fuel cell will be considered failed if the following conditions exist.

   a. An abnormal or unexplained voltage versus current performance loss of $\geq$0.5 volts for a single FC based on predicted performance data.

   b. Coolant pump or H2 pump/H2O separator is lost.

   c. Fuel cell stack-coolant temperature >255 degrees (242.5) degrees F or <175 degrees (182.5) degrees F.

   d. Coolant pressure >75 (71.4) PSIA and increasing.

   e. Fuel cell unable to discharge water to the ECLSS H2O storage tanks or overboard via the fuel cell H2O relief system.

   f. Local KOH concentration >48 percent (45 percent) dry or <24 percent (29 percent) wet as indicated by fuel cell stack-coolant temperature, condenser exit temperature, and current relationship.

   g. Fuel cell reactant valve fails closed.

   h. Cannot be connected to a main bus.

   i. Fuel cell H2O pH high confirmed.

   j. Fuel cell O2 reaction chambers cannot be purged.

   k. Fuel cell end-cell heater failing on.

   l. Fuel cell substack delta volts >150 millivolts and increasing.

   RATIONALE: Systems failure definition.

9. Loss of one fuel cell is considered cause for priority flight and abort decision.

   RATIONALE: Mission flight rule definition.

10. Loss of two fuel cells is considered cause for abort mission.

    RATIONALE: Contingency action summary. Flight Rule definition.

11. Loss of three fuel cells is considered loss of life/vehicle in all mission phases.

    RATIONALE: Flight rule definition.

12. Loss of two fuel cells in the first stage of ascent is considered loss of life/vehicle.

    RATIONALE: SRB loads are too high for one fuel cell to support. Voltage may go <25v which will shut down the GPCs.

13. Although the ECLSS product-water storage is a separate system from EPG, it will be considered as a failable redundant product-water relief line for purposes of the EPG functional criticality scenarios.

    RATIONALE: This assumption violates general ground rule 3.1.1.6 but is essential for evaluating failures associated with the water relief line.

14. Filter failure will only be considered in the case of total flow blockage. Cases of improper/insufficient filtering will not be considered except where obvious.

    RATIONALE: The effect of `poor' filter performance on downstream components is beyond the scope of our efforts.

15. The start/sustaining heater on the left-hand FCP (FCP #1) is assumed to be disconnected. Thus, this FCP cannot be maintained operational at no-load, and will be considered shutdown if the load cannot be maintained at greater than 2 KW.

    RATIONALE: Load needed to maintain operating temperature. RH FCP uses sustaining heater to maintain temperatures at no-load.

16. For all "failed open" failure modes for valves which are normally open, redundancy screen B will be assumed failed.

    RATIONALE: The failure is not detectable until the valve is required to be closed.

17. Five 02 and H2 tanks are being used as the baseline configuration under study.

    RATIONALE: The configuration for all redundant components is being considered for this analysis.

18. Inadvertent Fuel Cell shutdown during RTLS and TAL abort is considered loss of crew/vehicle.

    RATIONALE: Loss of FCP 1/Bus A is loss of OMS Engine Purge Capability (required for TAL) and Aft Compartment MPS Helium Purge Capability (required for RTLS and TAL).

19. Inadvertent Fuel Cell shutdown during RTLS and TAL abort is considered loss of crew/vehicle.

RATIONALE: Loss of FCP 1/Bus A is loss of OMS Engine Purge Capability (required for TAL) and Aft Compartment MPS Helium Purge Capability (required for RTLS and TAL).

APPENDIX C
DETAILED ASSESSMENT

This section contains the IOA assessment worksheets generated during the assessment of this subsystem. The information on these worksheets facilitates the comparison of the NASA FMEA/CIL (Pre and Post 51-L) to the IOA detailed analysis worksheets included in Appendix E. Each of these worksheets identifies the NASA FMEA being assessed, corresponding MDAC Analysis Worksheet ID (Appendix E), hardware item, criticality, redundancy screens, and recommendations. For each failure mode, the highest assessed hardware and functional criticality is compared and discrepancies noted as "N" in the compare row under the column where the discrepancy occurred.

LEGEND FOR IOA ASSESSMENT WORKSHEETS

Hardware Criticalities:
- 1 = Loss of life or vehicle
- 2 = Loss of mission or next failure of any redundant item (like or unlike) could cause loss of life/vehicle
- 3 = All others

Functional Criticalities:
- 1R = Redundant hardware items (like or unlike) all of which, if failed, could cause loss of life or vehicle
- 2R = Redundant hardware items (like or unlike) all of which, if failed, could cause loss of mission

Redundancy Screens A, B and C:
- P = Passed Screen
- F = Failed Screen
- NA = Not Applicable

NASA Data :
- Baseline = NASA FMEA/CIL
- New = Baseline with Proposed Post 51-L Changes

CIL Item :
- X = Included in CIL

Compare Row :
- N = Non compare for that column (deviation)

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-200 BASELINE [ ]
NASA FMEA #: M4-182-PD030-1 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 200
ITEM: H2 (PRE-FLIGHT) FILL QUICK DISCONNECT (4) & VENT QD'S (5)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[F]	[P]	[X] *
IOA	[3 /1R]	[P]	[F]	[P]	[X]
COMPARE	[N /]	[ ]	[ ]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [ ]
INADEQUATE [X]

REMARKS:
ALSO NASA FMEA'S 04-1B-PD030-1 AND M4-1B1-PD030-1.
THE FAILURE MODE IS FAILS OPEN OR EXTERNAL LEAKAGE. THE RETENTION RATIONALE IS NOT AVAILABLE. IF THE CAP ALSO LEAKED, H2 COULD ACCUMULATE IN THE MID FUSELAGE AND POSSIBLY RESULT IN AN EXPLOSION.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-201
NASA FMEA #:

NASA DATA:
BASELINE [ ]
NEW [ ]

SUBSYSTEM: EPG
MDAC ID: 201
ITEM: H2 (PRE-FLIGHT) FILL QUICK DISCONNECT (4) & VENT QD'S (5)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[/]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[N /N]	[N]	[N]	[N]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[3 /3]	[NA]	[NA]	[NA]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
THE FMEAs DID NOT INCLUDE THIS FAILURE MODE (INABILITY TO MATE/DEMATE). FOR COMPLETENESS, NASA MAY WANT TO CONSIDER WRITING A FMEA FOR THIS FAILURE MODE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-202 BASELINE [ ]
NASA FMEA #: M4-1B2-PC030-1 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 202
ITEM: H2 (PRE-FLIGHT) FILL AND VENT QD CAPS (9)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[3 /1R]	[P]	[F]	[P]	[X]
COMPARE	[N /N]	[N]	[N]	[N]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [ ]
INADEQUATE [X]

REMARKS:
ALSO NASA FMEA'S 04-1B-PC030-1 AND M4-1B1-PC030-1.
THE FAILURE MODE IS EXTERNAL LEAKAGE. BECAUSE THE QD HAS AN ALLOWABLE LEAK RATE, THIS FAILURE COULD RESULT IN THE ACCUMULATION OF H2 IN THE ORBITER MID FUSELAGE AND A POSSIBLE EXPLOSION. THE RETENTION RATIONALE IS NOT AVAILABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-203
NASA FMEA #: M4-1B2-MT030-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 203
ITEM: H2 TANK PRESSURE SENSOR (5)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[NA]	[NA]	[NA]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-MT030-1 AND M4-1B1-MT030-1.
THE FAILURE MODE IS FULL OUTPUT.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-204
NASA FMEA #: M4-1B2-MT030-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 204
ITEM: H2 TANK PRESSURE SENSOR (5)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[NA]	[NA]	[NA]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-MT030-1 AND M4-1B1-MT030-1.
THE FAILURE MODE IS FULL OUTPUT.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-205
NASA FMEA #: M4-1B2-MT030-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 205
ITEM: H2 TANK PRESSURE SENSOR (5)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[NA]	[NA]	[NA]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-MT030-1 AND M4-1B1-MT030-1.
THE FAILURE MODE IS FULL OUTPUT.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-206
NASA FMEA #: M4-1B2-MT039-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 206
ITEM: H2 TANK HEATER CONTROLLER PRESSURE SENSOR/TRANSDUCER (4)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /1R]	[P]	[P]	[P]	[ ] *
IOA	[3 /1R]	[P]	[P]	[P]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-MT039-1 AND M4-1B1-MT039-1.
THE FAILURE MODE IS FULL OUTPUT. THIS NASA FAILURE MODE IS LOSS OF OUTPUT INCLUDING ERRONEOUS SIGNAL. THIS FAILURE WOULD CAUSE INADEQUATE H2 SUPPLY PRESSURE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-207 BASELINE [ ]
NASA FMEA #: M4-1B2-MT039-1 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 207
ITEM: H2 TANK HEATER CONTROLLER PRESSURE SENSOR/TRANSDUCER (4)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /1R]	[P]	[P]	[P]	[ ] *
IOA	[1 /1]	[P]	[P]	[P]	[X]
COMPARE	[N /N]	[ ]	[ ]	[ ]	[N]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-MT039-1 AND M4-1B1-MT039-1.
THE IOA FAILURE MODE IS ZERO OUTPUT. THE NASA FMEA FAILURE MODE IS LOSS OF OUTPUT INCLUDING ERRONEOUS SIGNAL. THE TANK COULD RUPTURE STARTING 35 HOURS AFTER TANK RESIDUAL LEVEL IS REACHED. THE OFF POSITION OF THE SWITCH IS A REDUNDANCY. IF THE HEATERS OF BOTH TANKS 1 AND 2 OR 3 AND 4 ARE SELECTED TO THE AUTOMATIC MODE, THE CRITICALITY WOULD BE 3/1R, BECAUSE THEIR TANK SENSOR LOGIC WOULD BE CONNECTED, AND BOTH TANK PAIR'S SENSORS WOULD HAVE TO FAIL. IT IS RECOMMENDED THAT A SEPARATE FMEA BE WRITTEN FOR THIS FAILURE MODE BECAUSE ITS EFFECT IS VASTLY DIFFERENT FROM A FAILURE OF FULL OUTPUT.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-208
NASA FMEA #: M4-1B2-MT039-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 208
ITEM: H2 TANK HEATER CONTROLLER PRESSURE SENSOR/TRANSDUCER (4)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /1R]	[P]	[P]	[P]	[ ] *
IOA	[1 /1]	[P]	[P]	[P]	[X]
COMPARE	[N /N]	[ ]	[ ]	[ ]	[N]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-MT039-1 AND M4-1B1-MT039-1.
THE IOA FAILURE MODE IS OUT OF TOLERANCE. THE NASA FMEA FAILURE MODE IS LOSS OF OUTPUT INCLUDING ERRONEOUS SIGNAL. THIS COULD CAUSE A RANGE OF RESULTS FROM REACTANT PRESSURE BEING TOO LOW TO REACTANT DEPLETION AND A TANK RUPTURE STARTING 35 HOURS RESIDUAL LEVEL IS REACHED. SENSOR READINGS NEAR ZERO COULD CAUSE THE TANK HEATERS TO BE ON IF THE HEATERS OF BOTH TANKS 1 AND 2, OR 3 AND 4 ARE SELECTED TO THE AUTOMATIC MODE. THE REDUNDANT PATH IS PUTTING THE HEATER SWITCH IN THE OFF POSITION.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-209
NASA FMEA #:

NASA DATA:
BASELINE [ ]
NEW [ ]

SUBSYSTEM: EPG
MDAC ID: 209
ITEM: H2 TANK HEATER ELEMENT A (5), H2 TANK HEATER ELEMENT B (5)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[/]	[ ]	[ ]	[ ]	[ ] *
IOA	[1 /1]	[P]	[P]	[P]	[X]
COMPARE	[N /N]	[N]	[N]	[N]	[N]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
NASA DOES NOT HAVE A FMEA FOR THIS COMPONENT. THE FAILURE MODE IS FAILS ON. IT IS RECOMMENDED THAT THE MDAC FMEA BE DELETED SINCE THIS FAILURE MODE IS REALLY ONLY AN EFFECT THAT IS THE RESULT OF THE HEATER SWITCH FAILING ON. THIS FAILURE IS COVERED IN THE MDAC EPD&C/PRSD ANALYSIS.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-210
NASA FMEA #:

NASA DATA:
BASELINE [ ]
NEW [ ]

SUBSYSTEM: EPG
MDAC ID: 210
ITEM: H2 TANK HEATER ELEMENT A (5), H2 TANK HEATER ELEMENT B (5)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[/]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /1R]	[P]	[P]	[P]	[ ]
COMPARE	[N /N]	[N]	[N]	[N]	[ ]

RECOMMENDATIONS: (If different from NASA)

[3 /1R] [P] [P] [P] [ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
NASA DOES NOT HAVE A FMEA FOR THIS COMPONENT. THE FAILURE MODE IS FAILS OFF. INOPERATIVE HEATERS WILL CAUSE LOSS OF H2 PRESSURE TO THE FUEL CELLS.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-211 BASELINE [ ]
NASA FMEA #: M4-1B2-RV030-1 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 211
ITEM: H2 TANK RELIEF VALVE (4)-RV030,RV040,RV500,RV560

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[2 /1R]	[P]	[F]	[P]	[X]
COMPARE	[N /N]	[N]	[N]	[N]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[NA]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S: 04-1B-RV030-1 FOR H2 TANK RELIEF VALVE (2) - RV030, RV040 AND M4-1B1-RV030-1 FOR H2 TANK RELIEF VALVE (3) - RV030, RV040, RV500. THE FAILURE MODE IS FAILED OPEN OR INTERNAL LEAKAGE. SCREEN B SHOULD BE NA PER NSTS 22206 SECTION 2.3.4.b.2.a. BECAUSE THE RELIEF VALVE IS STANDBY REDUNDANT. THE HARDWARE CRITICALITY
SHOULD BE A 3 FOR GREATER THAN TWO TANK SETS. CHANGING THIS WOULD ALLOW DELETION OF THIS FAILURE MODE FROM THE CIL.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-212
NASA FMEA #: M4-1B2-RV030-2

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 212
ITEM: H2 TANK RELIEF VALVE (4)-RV030,RV040,RV500,RV560

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[NA]	[P]	[X] *
IOA	[3 /1R]	[P]	[P]	[P]	[ ]
COMPARE	[N /]	[ ]	[N]	[ ]	[N]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S: 04-1B-RV030-2 FOR H2 TANK RELIEF VALVE (2) - RV030, RV040 AND M4-1B1-RV030-2 FOR H2 TANK RELIEF VALVE (3) - RV030, RV040, RV500. THE FAILURE MODE IS FAILED CLOSED. IF THE SAME TANK'S CHECK VALVE ALSO FAILED CLOSED, AN EXPLOSION COULD OCCUR DUE TO CONDUCTIVE HEAT TRANSFER INTO THE TANK. SCREEN B IS NA PER NSTS 22206 SECTION 2.3.4.b.2.a. BECAUSE THE RELIEF VALVE IS STANDBY REDUNDANT.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-213 BASELINE [ ]
NASA FMEA #: M4-1B2-A01FSH-1 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 213
ITEM: H2 TANK RELIEF VALVE (4)-RV030,RV040,RV500,RV560

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[1 /1]	[NA]	[NA]	[NA]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S: 04-1B-A01FSH-1 FOR H2 TANK RELIEF VALVE (2) - RV030, RV040 AND M4-1B1-A01FSH-1R FOR H2 TANK RELIEF VALVE (3) - RV030, RV040, RV500. THE FAILURE MODE IS EXTERNAL LEAKAGE. NASA COVERED THE EXTERNAL LEAKAGE OF MOST COMPONENTS IN ONE FMEA, AND SINCE THE EFFECT IS THE SAME, IT IS AGREEABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-214
NASA FMEA #: M4-1B2-VP035-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 214
ITEM: H2 RELIEF PORT 1 (1)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[F]	[P]	[X] *
IOA	[3 /1R]	[P]	[P]	[P]	[ ]
COMPARE	[N /]	[ ]	[N]	[ ]	[N]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[NA]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-VP035-1 AND M4-1B1-VP035-1.
THE FAILURE MODE IS RESTRICTED FLOW. IF A CHECK VALVE FOR TANK 1, 2, OR 4 ALSO FAILED CLOSED, AN EXPLOSION COULD OCCUR DUE TO CONDUCTIVE HEAT TRANSFER INTO THE TANK. SCREEN B SHOULD BE NA PER NSTS 22206 SECTION 2.3.4.b.2.a. BECAUSE THE RELIEF PORT IS STANDBY REDUNDANT.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-215
NASA FMEA #: M4-1B2-VP045-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 215
ITEM: H2 RELIEF PORT 2 (1)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[NA]	[P]	[X] *
IOA	[3 /1R]	[P]	[P]	[P]	[ ]
COMPARE	[N /]	[ ]	[N]	[ ]	[N]

RECOMMENDATIONS: (If different from NASA)

[2 /1R]	[P]	[NA]	[P]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA # M4-1B1-VP045-1. THE FAILURE MODE IS RESTRICTED FLOW. SCREEN B SHOULD BE NA PER NSTS 22206 SECTION 2.3.4.b.2.a. BECAUSE THE RELIEF PORT IS STANDBY REDUNDANT. THE HARDWARE CRITICALITY SHOULD BE A 2. IF A CHECK VALVE FOR TANK 3 OR 5 ALSO FAILED CLOSED, AN EXPLOSION COULD OCCUR DUE TO CONDUCTIVE HEAT TRANSFER INTO THE TANK.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-216
NASA FMEA #: M4-1B2-TK030-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 216
ITEM: H2 TANK SUBASSEMBLY (4), (3), OR (2)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[1 /1]	[NA]	[NA]	[NA]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-TK030-1 AND M4-1B1-TK030-1.
THE FAILURE MODE IS EXTERNAL LEAKAGE. PER NSTS 22206 SECTION 2.3.3.h., A SINGLE FAILURE RESULTING IN LEAKAGE OF H2 IS A CRITICALITY 1/1. THE NEW FMEA REVIEW COMBINED THE FAILURE MODES OF EXTERNAL LEAKAGE AND RUPTURE INTO ONE FMEA. IT IS RECOMMENDED THAT A SEPARATE FMEA BE WRITTEN ON THIS FAILURE MODE AND ITEM PER NSTS 22206 SECTION 2.3.1.A.1.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-217
NASA FMEA #: M4-1B2-TK030-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 217
ITEM: H2 TANK SUBASSEMBLY (4), (3), OR (2)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[1 /1]	[NA]	[NA]	[NA]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-TK030-1 AND M4-1B1-TK030-1.
THE FAILURE MODE IS RUPTURE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-218 BASELINE [ ]
NASA FMEA #: M4-1B2-TK030-2 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 218
ITEM: H2 TANK SUBASSEMBLY (4), (3), OR (2)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[3 /1R]	[P]	[F]	[P]	[X]
COMPARE	[N /N]	[N]	[N]	[N]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO FMEA NASA'S 04-1B-TK030-2 AND M4-1B1-TK030-2.
THE FAILURE MODE IS LOSS OF ANNULUS VACUUM. THE REACTANT COULD BE DEPLETED DURING RE-ENTRY DUE TO EXCESSIVE HEATING, AND THIS COULD LOSE THE ORBITER.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-219
NASA FMEA #:

NASA DATA:
BASELINE [ ]
NEW [ ]

SUBSYSTEM: EPG
MDAC ID: 219
ITEM: H2 TANK HEATER ASSEMBLY TEMPERATURE SENSOR (5)
V45T21(-5)07A

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[/]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[N /N]	[N]	[N]	[N]	[ ]

RECOMMENDATIONS: (If different from NASA)

[3 /3]	[NA]	[NA]	[NA]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
THE FMEAs DID NOT INCLUDE THIS FAILURE MODE (FULL OUTPUT) OR COMPONENT. FOR COMPLETENESS, NASA MAY WANT TO CONSIDER WRITING A FMEA FOR THIS FAILURE MODE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-220
NASA FMEA #:

NASA DATA:
BASELINE [ ]
NEW [ ]

SUBSYSTEM: EPG
MDAC ID: 220
ITEM: H2 TANK HEATER ASSEMBLY TEMPERATURE SENSOR (5)
V45T21(-5)07A

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[/]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[N /N]	[N]	[N]	[N]	[ ]

RECOMMENDATIONS: (If different from NASA)

[3 /3]	[NA]	[NA]	[NA]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
THE FMEAs DID NOT INCLUDE THIS FAILURE MODE (ZERO OUTPUT) OR [illegible] COMPONENT. FOR COMPLETENESS, NASA MAY WANT TO CONSIDER WRITING A FMEA FOR THIS FAILURE MODE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-221
NASA FMEA #:

NASA DATA:
BASELINE [ ]
NEW [ ]

SUBSYSTEM: EPG
MDAC ID: 221
ITEM: H2 TANK HEATER ASSEMBLY TEMPERATURE SENSOR (5)
V45T21(-5)07A

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[/]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[N /N]	[N]	[N]	[N]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[3 /3]	[NA]	[NA]	[NA]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
THERE IS NO FMEA FOR THIS FAILURE MODE (OUT OF TOLERANCE) OR COMPONENT. FOR COMPLETENESS, NASA MAY WANT TO CONSIDER WRITING A FMEA FOR THIS FAILURE MODE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-222
NASA FMEA #:

NASA DATA:
BASELINE [ ]
NEW [ ]

SUBSYSTEM: EPG
MDAC ID: 222
ITEM: H2 TANK FLUID TEMPERATURE SENSOR (5) V45T21(-4)01A

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[/]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[N /N]	[N]	[N]	[N]	[ ]

RECOMMENDATIONS: (If different from NASA)

	[3 /3]	[NA]	[NA]	[NA]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
THERE IS NO FMEA FOR THIS FAILURE MODE (FULL OUTPUT) OR COMPONENT. FOR COMPLETENESS, NASA MAY WANT TO CONSIDER WRITING A FMEA FOR THIS FAILURE MODE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-223
NASA FMEA #:

NASA DATA:
BASELINE [ ]
NEW [ ]

SUBSYSTEM: EPG
MDAC ID: 223
ITEM: H2 TANK FLUID TEMPERATURE SENSOR (5) V45T21(-4)01A

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[/]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[N /N]	[N]	[N]	[N]	[ ]

RECOMMENDATIONS: (If different from NASA)

	[3 /3]	[NA]	[NA]	[NA]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
THERE IS NO FMEA FOR THIS FAILURE MODE (ZERO OUTPUT) OR COMPONENT. FOR COMPLETENESS, NASA MAY WANT TO CONSIDER WRITING A FMEA FOR THIS FAILURE MODE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-224
NASA FMEA #:

NASA DATA:
BASELINE [ ]
NEW [ ]

SUBSYSTEM: EPG
MDAC ID: 224
ITEM: H2 TANK FLUID TEMPERATURE SENSOR (5) V45T21(-4)01A

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[/]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[N /N]	[N]	[N]	[N]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[3 /3]	[NA]	[NA]	[NA]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
THERE IS NO FMEA FOR THIS FAILURE MODE (OUT OF TOLERANCE) OR COMPONENT. FOR COMPLETENESS, NASA MAY WANT TO CONSIDER WRITING A FMEA FOR THIS FAILURE MODE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-225
NASA FMEA #:

NASA DATA:
BASELINE [ ]
NEW [ ]

SUBSYSTEM: EPG
MDAC ID: 225
ITEM: H2 TANK QUANTITY SENSOR (5) V45Q21(-5)05A

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[/]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[N /N]	[N]	[N]	[N]	[ ]

RECOMMENDATIONS: (If different from NASA)

[3 /3]	[NA]	[NA]	[NA]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
THERE IS NO FMEA FOR THIS FAILURE MODE (FULL OUTPUT) OR COMPONENT. FOR COMPLETENESS, NASA MAY WANT TO CONSIDER WRITING A FMEA FOR THIS FAILURE MODE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-226
NASA FMEA #:

NASA DATA:
BASELINE [ ]
NEW [ ]

SUBSYSTEM: EPG
MDAC ID: 226
ITEM: H2 TANK QUANTITY SENSOR (5) V45Q21(-5)05A

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[/]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[N /N]	[N]	[N]	[N]	[ ]

RECOMMENDATIONS: (If different from NASA)

[3 /3]	[NA]	[NA]	[NA]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
THERE IS NO FMEA FOR THIS FAILURE MODE (ZERO OUTPUT) OR COMPONENT. FOR COMPLETENESS, NASA MAY WANT TO CONSIDER WRITING A FMEA FOR THIS FAILURE MODE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-227
NASA FMEA #:

NASA DATA:
BASELINE [ ]
NEW [ ]

SUBSYSTEM: EPG
MDAC ID: 227
ITEM: H2 TANK QUANTITY SENSOR (5) V45Q21(-5)05A

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[/]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[N /N]	[N]	[N]	[N]	[ ]

RECOMMENDATIONS: (If different from NASA)

[3 /3]	[NA]	[NA]	[NA]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
THERE IS NO FMEA FOR THIS FAILURE MODE (OUT OF TOLERANCE) OR COMPONENT. FOR COMPLETENESS, NASA MAY WANT TO CONSIDER WRITING A FMEA FOR THIS FAILURE MODE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-228
NASA FMEA #: M4-1B2-A01FSH-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 228
ITEM: H2 LINES, COMPONENTS, & FITTINGS

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[1 /1]	[NA]	[NA]	[NA]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ]
(ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-A01FSH-1 AND M4-1B1-A01FSH-1.
THE FAILURE MODE IS EXTERNAL LEAKAGE. IT IS RECOMMENDED THAT ALL THE COMPONENTS COVERED BY THIS FMEA BE LISTED IN IT.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-229
NASA FMEA #:

NASA DATA:
BASELINE [ ]
NEW [ ]

SUBSYSTEM: EPG
MDAC ID: 229
ITEM: H2 LINES, COMPONENTS, & FITTINGS

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[/]	[ ]	[ ]	[ ]	[ ] *
IOA	[2 /1R]	[P]	[P]	[P]	[X]
COMPARE	[N /N]	[N]	[N]	[N]	[N]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
THERE IS NO FMEA FOR THIS FAILURE MODE (RESTRICTED FLOW). THIS FAILURE COULD RESULT IN SHUTTING DOWN THE FUEL CELLS DUE TO LACK OF H2. IT IS RECOMMENDED THAT THE MDAC FMEA BE DELETED SINCE THIS FAILURE MODE IS NON-CREDIBLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-230 BASELINE [ ]
NASA FMEA #: M4-1B2-FL030-1 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 230
ITEM: H2 FILTER (4) FL030,FL040,FL500,FL560

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[P]	[P]	[X] *
IOA	[3 /1R]	[P]	[P]	[P]	[ ]
COMPARE	[N /]	[ ]	[ ]	[ ]	[N]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S: 04-1-FL030-1 FOR H2 FILTER (2) - FL030, FL040 AND M4-1B-FL030-1 FOR H2 FILTER (3) - FL030, FL040, FL040. THE FAILURE MODE IS RESTRICTED FLOW. THE HARDWARE CRITICALITY IS A 2 BECAUSE IF THE SAME TANK'S RELIEF VALVE ALSO FAILED CLOSED, AN EXPLOSION COULD OCCUR DUE TO CONDUCTIVE HEAT TRANSFER INTO THE TANK.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-231
NASA FMEA #: M4-1B2-RV031-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 231
ITEM: H2 MANIFOLD 1 RELIEF VALVE (1) RV031

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[F]	[P]	[X] *
IOA	[2 /1R]	[P]	[F]	[P]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [NA] [ ] [D] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [X]

REMARKS:
ALSO NASA FMEA'S 04-1B-RV031-1 AND M4-1B1-RV031-1.
THE FAILURE MODE IS FAILED OPEN OR INTERNAL LEAKAGE. THE CIL RETENTION RATIONALE IS NOT AVAILABLE. THE HARDWARE CRITICALITY SHOULD BE A 3. SCREEN B SHOULD BE NA PER NSTS 22206 SECTION 2.3.4.b.2.a. BECAUSE THE RELIEF VALVE IS STANDBY REDUNDANT. NOT FAILING SCREEN B WOULD ALLOW THIS TO BE DELETED FROM THE CIL.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-232 BASELINE [ ]
NASA FMEA #: M4-1B2-RV031-2 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 232
ITEM: H2 MANIFOLD 1 RELIEF VALVE (1) RV031

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /1R]	[P]	[NA]	[P]	[ ] *
IOA	[3 /1R]	[P]	[P]	[P]	[ ]
COMPARE	[/]	[ ]	[N]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-RV031-2 AND M4-1B1-RV031-2.
THE FAILURE MODE IS FAILS CLOSED. SCREEN B IS NA PER NSTS 22206 SECTION 2.3.4.b.2.a. BECAUSE THE RELIEF VALVE IS STANDBY REDUNDANT.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-233
NASA FMEA #: M4-1B2-A01FSH-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 233
ITEM: H2 MANIFOLD 1 RELIEF VALVE (1) RV031

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[1 /1]	[NA]	[NA]	[NA]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-A01FSH-1 AND M4-1B1-A01FSH-1.
THE FAILURE MODE IS EXTERNAL LEAKAGE. NASA COVERED THE EXTERNAL LEAKAGE OF MOST COMPONENTS IN ONE FMEA, AND SINCE THE EFFECT IS THE SAME, IT IS AGREEABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-234 BASELINE [ ]
NASA FMEA #: M4-1B2-RV031-1 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 234
ITEM: H2 MANIFOLD 2 RELIEF VALVE (1) RV041

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[F]	[P]	[X] *
IOA	[2 /1R]	[P]	[F]	[P]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [NA] [ ] [D] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [X]

REMARKS:
ALSO NASA FMEA'S 04-1B-RV031-1 AND M4-1B1-RV031-1. THE FAILURE MODE IS FAILED OPEN OR INTERNAL LEAKAGE. THE CIL RETENTION RATIONALE IS NOT AVAILABLE. THE HARDWARE CRITICALITY SHOULD BE A 3. SCREEN B SHOULD BE NA PER NSTS 22206 SECTION 2.3.4.B.2.A. BECAUSE THE RELIEF VALVE IS STANDBY REDUNDANT. FAILING SCREEN B WOULD ALLOW THIS TO BE DELETED FROM THE CIL.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-235 BASELINE [ ]
NASA FMEA #: M4-1B2-RV031-2 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 235
ITEM: H2 MANIFOLD 2 RELIEF VALVE (1) RV041

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /1R]	[P]	[NA]	[P]	[ ] *
IOA	[3 /1R]	[P]	[P]	[P]	[ ]
COMPARE	[/]	[ ]	[N]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-RV031-2 AND M4-1B1-RV031-2.
THE FAILURE MODE IS FAILS CLOSED. SCREEN B IS NA PER NSTS 22206 SECTION 2.3.4.b.2.a. BECAUSE THE RELIEF VALVE IS STANDBY REDUNDANT.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-236 BASELINE [ ]
NASA FMEA #: M4-1B2-A01FSH-1 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 236
ITEM: H2 MANIFOLD 2 RELIEF VALVE (1) RV041

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[1 /1]	[NA]	[NA]	[NA]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-A01FSH-1 AND M4-1B1-A01FSH-1.
THE FAILURE MODE IS EXTERNAL LEAKAGE. NASA COVERED THE EXTERNAL LEAKAGE OF MOST COMPONENTS IN ONE FMEA, AND SINCE THE EFFECT IS THE SAME, IT IS AGREEABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-237
NASA FMEA #: M4-1B2-CV030-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 237
ITEM: H2 CHECK VALVE (2) CV031,CV041

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[F]	[P]	[X] *
IOA	[2 /1R]	[P]	[F]	[P]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[3 /1R]	[P]	[P]	[P]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA # M4-1B1-CV030-1 FOR H2 CHECK VALVE CV031.
THE FAILURE MODE IS FAILED OPEN OR INTERNAL LEAKAGE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-238
NASA FMEA #: M4-1B2-CV030-2

NASA DATA:
BASELINE [ ]
NEW [ ]

SUBSYSTEM: EPG
MDAC ID: 238
ITEM: H2 CHECK VALVE (2) CV031,CV041

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[P]	[P]	[X] *
IOA	[3 /1R]	[P]	[P]	[P]	[ ]
COMPARE	[N /]	[ ]	[ ]	[ ]	[N]

RECOMMENDATIONS: (If different from NASA)

[2 /1R] [P] [P] [P] [ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA # M4-1B1-CV030-2 FOR H2 CHECK VALVE CV031. THE FAILURE MODE IS FAILS CLOSED OR RESTRICTED FLOW. THE HARDWARE CRITICALITY SHOULD BE A 2 BECAUSE IF THE SAME TANK'S RELIEF VALVE ALSO FAILED CLOSED, AN EXPLOSION COULD OCCUR DUE TO CONDUCTIVE HEAT TRANSFER INTO THE TANK. THE ASSESSMENT WORKSHEET COVERING THE OTHER H2 CHECK VALVE FOR THIS FAILURE MODE IS PRSD-241.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-239 BASELINE [ ]
NASA FMEA #: M4-1B2-A01FSH-1 NEW [ ]

SUBSYSTEM: EPG
MDAC ID: 239
ITEM: H2 CHECK VALVE (2) CV031,CV041

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[1 /1]	[NA]	[NA]	[NA]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA # M4-1B1-A01FSH-1 FOR H2 CHECK VALVE CV031.
THE FAILURE MODE IS EXTERNAL LEAKAGE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-240
NASA FMEA #: M4-1B2-CV030-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 240
ITEM: H2 CHECK VALVE (1) CV030

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[F]	[P]	[X] *
IOA	[2 /1R]	[P]	[F]	[P]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-CV030-1 AND M4-1B1-CV030-1.
THE FAILURE MODE IS FAILED OPEN OR INTERNAL LEAKAGE. THE HARDWARE CRITICALITY SHOULD BE A 3.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-241
NASA FMEA #: M4-1B2-CV030-2

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 241
ITEM: H2 CHECK VALVE (1) CV030

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[P]	[P]	[X] *
IOA	[3 /1R]	[P]	[P]	[P]	[ ]
COMPARE	[N /]	[ ]	[ ]	[ ]	[N]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [X]

REMARKS:
ALSO NASA FMEA'S 04-1B-CV030-2 AND M4-1B1-CV030-2.
THE FAILURE MODE IS FAILED CLOSED OR RESTRICTED FLOW. THE HARDWARE CRITICALITY IS A 2 BECAUSE IF THE SAME TANK'S RELIEF VALVE ALSO FAILED CLOSED, AN EXPLOSION COULD OCCUR DUE TO CONDUCTIVE HEAT TRANSFER INTO THE TANK. THE RETENTION RATIONALE IS NOT AVAILABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-242
NASA FMEA #: M4-1B2-A01FSH-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 242
ITEM: H2 CHECK VALVE (1) CV030

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[1 /1]	[NA]	[NA]	[NA]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-A01FSH-1 AND M4-1B1-A01FSH-1. THE FAILURE MODE IS EXTERNAL LEAKAGE. NASA COVERED THE EXTERNAL LEAKAGE OF MOST COMPONENTS IN ONE FMEA, AND SINCE THE EFFECT IS THE SAME, IT IS AGREEABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-243
NASA FMEA #: M4-1B2-CV030-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 243
ITEM: H2 CHECK VALVE (1) CV040

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[F]	[P]	[X] *
IOA	[2 /1R]	[P]	[F]	[P]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-CV030-1 AND M4-1B1-CV030-1.
THE FAILURE MODE IS FAILED OPEN OR INTERNAL LEAKAGE. THE HARDWARE CRITICALITY SHOULD BE A 3.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-244
NASA FMEA #: M4-1B2-CV030-2

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 244
ITEM: H2 CHECK VALVE (1) CV040

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[P]	[P]	[X] *
IOA	[3 /1R]	[P]	[P]	[P]	[ ]
COMPARE	[N /]	[ ]	[ ]	[ ]	[N]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [X]

REMARKS:
ALSO NASA FMEA'S 04-1B-CV030-2 AND M4-1B1-CV030-2.
THE FAILURE MODE IS FAILS CLOSED OR RESTRICTED FLOW. THE HARDWARE CRITICALITY IS A 2 BECAUSE IF THE SAME TANK'S RELIEF VALVE ALSO FAILED CLOSED, AN EXPLOSION COULD OCCUR DUE TO CONDUCTIVE HEAT TRANSFER INTO THE TANK. THE RETENTION RATIONALE IS NOT AVAILABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-245
NASA FMEA #: M4-1B1-A01FSH-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 245
ITEM: H2 CHECK VALVE (1) CV040

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[1 /1]	[NA]	[NA]	[NA]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-A01FSH-1 AND M4-1B1-A01FSH-1.
THE FAILURE MODE IS EXTERNAL LEAKAGE. NASA COVERED THE EXTERNAL LEAKAGE OF MOST COMPONENTS IN ONE FMEA, AND SINCE THE EFFECT IS THE SAME, IT IS AGREEABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-246 BASELINE [ ]
NASA FMEA #: M4-1B2-PD032-1 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 246
ITEM: H2 HORIZONTAL DRAIN QD (1) TYPE II, CLASS 8

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[F]	[P]	[X] *
IOA	[2 /1R]	[P]	[F]	[P]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [X]

REMARKS:
ALSO NASA FMEA'S 04-1B-PD032-1 AND M4-1B1-PD032-1.
THE FAILURE MODE IS EXTERNAL LEAKAGE. THE CIL RETENTION RATIONALE IS NOT AVAILABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-247
NASA FMEA #:

NASA DATA:
BASELINE [ ]
NEW [ ]

SUBSYSTEM: EPG
MDAC ID: 247
ITEM: H2 HORIZONTAL DRAIN QD (1) TYPE II, CLASS 8

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[/]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[N /N]	[N]	[N]	[N]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[3 /3]	[NA]	[NA]	[NA]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
NASA DOES NOT HAVE A FMEA ON THIS FAILURE MODE (INABILITY TO MATE/DEMATE) FOR THIS COMPONENT. FOR COMPLETENESS, NASA MAY WANT TO CONSIDER WRITING A FMEA FOR THIS FAILURE MODE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-248 BASELINE [ ]
NASA FMEA #: M4-1B2-PC030-1 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 248
ITEM: H2 HORIZONTAL DRAIN CAP (1)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[2 /1R]	[P]	[F]	[P]	[X]
COMPARE	[N /N]	[N]	[N]	[N]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [ ]
INADEQUATE [X]

REMARKS:
ALSO NASA FMEA'S 04-1B-PC030-1 AND M4-1B1-PC030-1.
THE FAILURE MODE IS EXTERNAL LEAKAGE. BECAUSE THE QD HAS AN ALLOWABLE LEAK RATE, THIS FAILURE COULD RESULT IN THE ACCUMULATION OF H2 IN THE ORBITER MID FUSELAGE AND A POSSIBLE EXPLOSION. THE RETENTION RATIONALE IS NOT AVAILABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-249 BASELINE [ ]
NASA FMEA #: M4-1B2-MT032-1 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 249
ITEM: H2 MANIFOLD PRESSURE SENSOR (2)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[NA]	[NA]	[NA]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-MT032-1 AND M4-1B1-MT032-1.
THE IOA FAILURE MODE IS FULL OUTPUT. THE NASA FAILURE MODE IS LOSS OF OUTPUT OR ERRONEOUS SIGNAL.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-250 BASELINE [ ]
NASA FMEA #: M4-1B2-MT032-1 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 250
ITEM: H2 MANIFOLD PRESSURE SENSOR (2)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[NA]	[NA]	[NA]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-MT032-1 AND M4-1B1-MT032-1.
THE IOA FAILURE MODE IS ZERO OUTPUT. THE NASA FAILURE MODE IS LOSS OF OUTPUT OR ERRONEOUS SIGNAL.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-251
NASA FMEA #: M4-1B2-MT032-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 251
ITEM: H2 MANIFOLD PRESSURE SENSOR (2)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[NA]	[NA]	[NA]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-MT032-1 AND M4-1B1-MT032-1.
THE IOA FAILURE MODE IS OUT OF TOLERANCE. THE NASA FAILURE MODE IS LOSS OF OUTPUT OR ERRONEOUS SIGNAL.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-252
NASA FMEA #: M4-1B2-LV031-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 252
ITEM: H2 MANIFOLD 1 SOLENOID CROSSOVER VALVE (1) LV031

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[F]	[P]	[X] *
IOA	[3 /1R]	[P]	[P]	[P]	[ ]
COMPARE	[N /]	[ ]	[N]	[ ]	[N]

RECOMMENDATIONS: (If different from NASA)

[3 /]	[ ]	[P]	[ ]	[D] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [X]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV031-1 AND M4-1B1-LV031-1.
THE FAILURE MODE IS FAILS OPEN OR INTERNAL LEAKAGE. IT IS RECOMMENDED THAT THE HARDWARE CRITICALITY BE CHANGED TO A 3. IF THE TANK 1 RELIEF VALVE AND MANIFOLD 1 RELIEF VALVE FAILED OPEN, ALL REACTANT COULD BE DEPLETED OUT THE RELIEF PORT. ISOLATING THE LEAK BY CLOSING LV041 COULD STILL SHUTDOWN FUEL CELLS 1 AND 3. EXTERNAL LEAKAGE OF LINES AND COMPONENTS IS NOT INCLUDED AS AN ADDITIONAL FAILURE BECAUSE NSTS 22206 SECTION 2.3.3.h. ALREADY DEFINES THIS AS A CRITICALITY 1/1. SCREEN B SHOULD BE PASSED PER NSTS 22206 SECTION 2.3.5.a. BECAUSE THE FAILURE IS DETECTABLE WITH THE VALVE POSITION INDICATOR. THIS WOULD ALLOW REMOVAL OF THIS FAILURE MODE FROM THE CIL. THE RETENTION RATIONALE IS NOT AVAILABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-253
NASA FMEA #: M4-1B2-LV031-2

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 253
ITEM: H2 MANIFOLD 1 SOLENOID CROSSOVER VALVE (1) LV031

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /1R]	[P]	[F]	[P]	[X] *
IOA	[3 /2R]	[P]	[P]	[P]	[ ]
COMPARE	[/N]	[ ]	[N]	[ ]	[N]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV031-2 AND M4-1B1-LV031-2. FOR 04-1B-LV031-2 NASA'S CRITICALITY FLIGHT HDW/FUNC: 2/1R. THE FAILURE MODE IS FAILS CLOSED. THE VALVE IS USED FOR LEAK ISOLATION AND AS A REDUNDANT PRESSURE RELIEF PATH. FOR A TWO TANK SET SYSTEM, THE HARDWARE CRITICALITY WOULD BE A 2 DURING ASCENT BECAUSE TWO FUEL CELLS COULD BE LOST IF THE TANK 2 RELIEF VALVE FAILED OPEN. THE HARDWARE CRITICALITY SHOULD BE A 3 FOR GREATER THAN TWO TANK SETS, BECAUSE AN EXPLOSION COULD OCCUR IF A TANK'S RELIEF VALVE FAILS CLOSED AND HEATERS FAIL ON. THIS DOES NOT MEET THE CRITERIA TO BE A CIL ITEM, AND SHOULD BE DELETED.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-254
NASA FMEA #: M4-1B2-A01FSH-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 254
ITEM: H2 MANIFOLD 1 SOLENOID CROSSOVER VALVE (1) LV031

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[1 /1]	[NA]	[NA]	[NA]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-A01FSH-1 AND M4-1B1-A01FSH-1.
THE FAILURE MODE IS EXTERNAL LEAKAGE. NASA COVERED THE EXTERNAL LEAKAGE OF MOST COMPONENTS IN ONE FMEA, AND SINCE THE EFFECT IS THE SAME, IT IS AGREEABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-255 BASELINE [ ]
NASA FMEA #: M4-1B2-LV033-1 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 255
ITEM: H2 FUEL CELL 1 SOLENOID REACTANT SUPPLY VALVE (1) LV033

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[F]	[P]	[X] *
IOA	[2 /1R]	[P]	[P]	[P]	[X]
COMPARE	[/]	[ ]	[N]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [P] [ ] [ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [X]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV033-1 AND M4-1B1-LV033-1.
THE FAILURE MODE IS FAILS OPEN OR INTERNAL LEAKAGE. THE HARDWARE CRITICALITY IS A 2 BECAUSE IT WILL ONLY TAKE A FUEL CELL FAILURE REQUIRING FUEL CELL SHUTDOWN, PLUS A FAILURE OF THE REACTANT SUPPLY VALVES TO CAUSE THE POSSIBLE LOSS OF THE ORBITER.
SCREEN B SHOULD BE PASSED PER NSTS 22206 SECTION 2.3.5.a. BECAUSE THERE IS A VALVE POSITION INDICATOR. THE CIL RETENTION RATIONALE IS NOT AVAILABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-256
NASA FMEA #: M4-1B2-LV033-2

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 256
ITEM: H2 FUEL CELL 1 SOLENOID REACTANT SUPPLY VALVE
(1) LV033

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[P]	[P]	[X] *
IOA	[2 /1R]	[P]	[P]	[P]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV033-2 AND M4-1B1-LV033-2.
THE FAILURE MODE IS FAILS CLOSED. THE CRITICALITY SHOULD BE 2/1R FOR THE ONORBIT PHASE ALSO BECAUSE LOSS OF A FUEL CELL CAUSES A PRIORITY FLIGHT DECISION.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-257
NASA FMEA #: M4-1B2-A01FSH-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 257
ITEM: H2 FUEL CELL 1 SOLENOID REACTANT SUPPLY VALVE
(1) LV033

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[1 /1]	[NA]	[NA]	[NA]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-A01FSH-1 AND M4-1B1-A01FSH-1.
THE FAILURE MODE IS EXTERNAL LEAKAGE. NASA COVERED THE EXTERNAL LEAKAGE OF MOST COMPONENTS IN ONE FMEA, AND SINCE THE EFFECT IS THE SAME, IT IS AGREEABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-258
NASA FMEA #: M4-1B2-LV033-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 258
ITEM: H2 FUEL CELL 2 SOLENOID REACTANT SUPPLY VALVE (1) LV043

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[F]	[P]	[X] *
IOA	[2 /1R]	[P]	[P]	[P]	[X]
COMPARE	[/]	[ ]	[N]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)	[/]	[ ]	[P]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [X]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV033-1 AND M4-1B1-LV033-1.
THE FAILURE MODE IS FAILS OPEN OR INTERNAL LEAKAGE. THE HARDWARE CRITICALITY IS A 2 BECAUSE IT WILL ONLY TAKE A FAILURE REQUIRING FUEL CELL SHUTDOWN, PLUS A FAILURE OF THE REACTANT SUPPLY VALVE TO CAUSE THE POSSIBLE LOSS OF THE ORBITER. SCREEN B SHOULD BE PASSED PER NSTS 22206 SECTION 2.3.5.a. BECAUSE THERE IS A VALVE POSITION INDICATOR. THE CIL RETENTION RATIONALE IS NOT AVAILABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-259
NASA FMEA #: M4-1B2-LV033-2

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 259
ITEM: H2 FUEL CELL 2 SOLENOID REACTANT SUPPLY VALVE (1) LV043

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[P]	[P]	[X] *
IOA	[2 /1R]	[P]	[P]	[P]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV033-2 AND M4-1B1-LV033-2.
THE FAILURE MODE IS FAILS CLOSED. THE CRITICALITY SHOULD BE 2/1R FOR THE ONORBIT PHASE ALSO, BECAUSE LOSS OF A FUEL CELL CAUSES A PRIORITY FLIGHT DECISION.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-260
NASA FMEA #: M4-1B2-A01FSH-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 260
ITEM: H2 FUEL CELL 2 SOLENOID REACTANT SUPPLY VALVE (1) LV043

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[1 /1]	[NA]	[NA]	[NA]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-A01FSH-1 AND M4-1B1-A01FSH-1.
THE FAILURE MODE IS EXTERNAL LEAKAGE. NASA COVERS THE EXTERNAL LEAKAGE OF MOST COMPONENTS IN ONE FMEA, AND SINCE THE EFFECT IS THE SAME, IT IS AGREEABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-261
NASA FMEA #: M4-1B2-LV033-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 261
ITEM: H2 FUEL CELL 3 SOLENOID REACTANT SUPPLY VALVE (1) LV044

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[F]	[P]	[X] *
IOA	[2 /1R]	[P]	[P]	[P]	[X]
COMPARE	[/]	[ ]	[N]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)	[/]	[ ]	[P]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [X]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV033-1 AND M4-1B1-LV033-1.
THE FAILURE MODE IS FAILS OPEN OR INTERNAL LEAKAGE. THE HARDWARE CRITICALITY IS A 2 BECAUSE IT WILL ONLY TAKE A FAILURE REQUIRING FUEL CELL SHUTDOWN, PLUS A FAILURE OF THE REACTANT SUPPLY VALVES TO CAUSE POSSIBLE LOSS OF THE ORBITER. SCREEN B SHOULD BE PASSED PER NSTS 22206 SECTION 2.3.5.a. BECAUSE THERE IS A VALVE POSITION INDICATOR. THE CIL RETENTION RATIONALE IS NOT AVAILABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-262 BASELINE [ ]
NASA FMEA #: M4-1B2-LV044-2 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 262
ITEM: H2 FUEL CELL 3 SOLENOID REACTANT SUPPLY VALVE (1) LV044

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[2 /1R]	[P]	[P]	[P]	[X]
COMPARE	[N /N]	[N]	[N]	[N]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA # M4-1B1-LV044-2.
THE FAILURE MODE IS FAILS CLOSED. THE CRITICALITY SHOULD BE 2/1R FOR THE ONORBIT PHASE ALSO, BECAUSE LOSS OF A FUEL CELL CAUSES A PRIORITY FLIGHT DECISION.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-263 BASELINE [ ]
NASA FMEA #: M4-1B2-A01FSH-1 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 263
ITEM: H2 FUEL CELL 3 SOLENOID REACTANT SUPPLY VALVE
(1) LV044

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[1 /1]	[NA]	[NA]	[NA]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ]
(ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-A01FSH-1 AND M4-1B1-A01FSH-1.
THE FAILURE MODE IS EXTERNAL LEAKAGE. NASA COVERED THE EXTERNAL LEAKAGE OF MOST COMPONENTS IN ONE FMEA, AND SINCE THE EFFECT IS THE SAME, IT IS AGREEABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-264
NASA FMEA #: M4-1B2-LV031-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 264
ITEM: H2 MANIFOLD 2 SOLENOID CROSSOVER VALVE (1) LV041

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[F]	[P]	[X] *
IOA	[3 /1R]	[P]	[P]	[P]	[ ]
COMPARE	[N /]	[ ]	[N]	[ ]	[N]
RECOMMENDATIONS: (If different from NASA)					
	[3 /]	[ ]	[P]	[ ]	[D] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [X]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV031-1 AND M4-1B1-LV031-1.
THE FAILURE MODE IS FAILS OPEN OR INTERNAL LEAKAGE. IT IS RECOMMENDED THAT THE HARDWARE CRITICALITY BE CHANGED TO A 3. IF THE TANK 2 RELIEF VALVE AND MANIFOLD 2 RELIEF VALVE FAILED OPEN, ALL REACTANT COULD BE DEPLETED OUT THE RELIEF PORT. ISOLATING THE LEAK BY CLOSING LV031 WOULD STILL SHUTDOWN FUEL CELLS 2 AND 3. EXTERNAL LEAKAGE OF LINES AND COMPONENTS IS NOT INCLUDED AS AN ADDITIONAL FAILURE BECAUSE NSTS 22206 SECTION 2.3.3.h. ALREADY DEFINES THIS AS A CRITICALITY 1/1. SCREEN B SHOULD BE PASSED PER NSTS 22206 SECTION 2.3.5.a. BECAUSE THE FAILURE IS DETECTABLE WITH THE VALVE POSITION INDICATOR. THIS WOULD ALLOW REMOVAL OF THIS FAILURE MODE FROM THE CIL. THE RETENTION RATIONALE IS NOT AVAILABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-265
NASA FMEA #: M4-1B2-LV031-2

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 265
ITEM: H2 MANIFOLD 2 SOLENOID CROSSOVER VALVE (1) LV041

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /1R]	[P]	[P]	[P]	[X] *
IOA	[3 /2R]	[P]	[P]	[P]	[ ]
COMPARE	[/N]	[ ]	[ ]	[ ]	[N]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV031-2 AND M4-1B1-LV031-2. FOR 04-1B-LV031-2 NASA'S CRITICALITY FLIGHT HDW/FUNC: 2/1R. THE FAILURE MODE IS FAILS CLOSED. THE VALVE IS USED FOR LEAK ISOLATION AND AS A REDUNDANT PRESSURE RELIEF PATH. FOR A TWO TANK SET SYSTEM, THE HARDWARE CRITICALITY WOULD BE A 2 DURING ASCENT BECAUSE TWO FUEL CELLS COULD BE LOST IF THE TANK 1 RELIEF VALVE FAILED OPEN. THE HARDWARE CRITICALITY SHOULD BE A 3 FOR GREATER THAN TWO TANK SETS, BECAUSE AN EXPLOSION COULD OCCUR IF A TANK'S RELIEF VALVE FAILS CLOSED AND HEATERS FAIL ON. THIS DOES NOT MEET THE CRITERIA TO BE A CIL ITEM, AND SHOULD BE DELETED.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-266 BASELINE [ ]
NASA FMEA #: M4-1B2-A01FSH-1 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 266
ITEM: H2 MANIFOLD 2 SOLENOID CROSSOVER VALVE (1) LV041

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[1 /1]	[NA]	[NA]	[NA]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ]
(ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-A01FSH-1 AND M4-1B1-A01FSH-1.
THE FAILURE MODE IS EXTERNAL LEAKAGE. NASA COVERED THE EXTERNAL LEAKAGE OF MOST COMPONENTS IN ONE FMEA, AND SINCE THE EFFECT IS THE SAME, IT IS AGREEABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-267
NASA FMEA #: M4-1B2-LV045-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 267
ITEM: H2 SOLENOID GSE SUPPLY VALVE (1) LV045

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[F]	[P]	[X] *
IOA	[2 /1R]	[P]	[F]	[P]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[P]	[ ]	[D] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [X]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV045-1 AND M4-1B1-LV045-1.
THE FAILURE MODE IS FAILS OPEN OR INTERNAL LEAKAGE. THE HARDWARE CRITICALITY SHOULD BE A 3. THE RETENTION RATIONALE IS NOT AVAILABLE. SCREEN B SHOULD BE PASSED PER NSTS 22206 SECTION 2.3.5.a. BECAUSE THERE IS A VALVE POSITION INDICATOR. PASSING SCREEN B WOULD ALLOW THIS TO BE DELETED FROM THE CIL.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-268 BASELINE [ ]
NASA FMEA #: M4-1B2-LV045-2 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 268
ITEM: H2 SOLENOID GSE SUPPLY VALVE (1) LV045

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[NA]	[NA]	[NA]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV045-2 AND M4-1B1-LV045-2.
THE FAILURE MODE IS FAILS CLOSED.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-269 BASELINE [ ]
NASA FMEA #: M4-1B2-A01FSH-1 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 269
ITEM: H2 SOLENOID GSE SUPPLY VALVE (1) LV045

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[1 /1]	[NA]	[NA]	[NA]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-A01FSH-1 AND M4-1B1-A01FSH-1.
THE FAILURE MODE IS EXTERNAL LEAKAGE. NASA COVERED THE EXTERNAL LEAKAGE OF MOST COMPONENTS IN ONE FMEA, AND SINCE THE EFFECT IS THE SAME, IT IS AGREEABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-270
NASA FMEA #: M4-1B2-PD035-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 270
ITEM: H2 FILL GSE SUPPLY T-0 QUICK DISCONNECT (1)
PD035

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[F]	[P]	[X] *
IOA	[2 /1R]	[P]	[F]	[P]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [X]

REMARKS:
ALSO NASA FMEA'S 04-1B-PD035-1 AND M4-1B1-PD035-1.
THE FAILURE MODE IS EXTERNAL LEAKAGE. THE NASA FMEA FAILURE MODE IS FAILS OPEN. THE HARDWARE CRITICALITY SHOULD BE A 3. THE RETENTION RATIONALE IS NOT AVAILABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-271
NASA FMEA #:

NASA DATA:
BASELINE [ ]
NEW [ ]

SUBSYSTEM: EPG
MDAC ID: 271
ITEM: H2 FILL GSE SUPPLY T-0 QUICK DISCONNECT (1)
PD035

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[/]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[N /N]	[N]	[N]	[N]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[3 /3]	[NA]	[NA]	[NA]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
NASA DOES NOT HAVE A FMEA ON THIS FAILURE MODE (INABILITY TO MATE/DEMATE) FOR THIS COMPONENT. FOR COMPLETENESS, NASA MAY WANT TO CONSIDER WRITING A FMEA FOR THIS FAILURE MODE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-272 BASELINE [ ]
NASA FMEA #: M4-1B2-CV010-1 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 272
ITEM: 02 CHECK VALVE (1) CV010

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[P]	[P]	[ ] *
IOA	[2 /1R]	[P]	[F]	[P]	[X]
COMPARE	[/]	[ ]	[N]	[ ]	[N]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-CV010-1 AND M4-1B1-CV010-1.
THE FAILURE MODE IS FAILS OPEN OR INTERNAL LEAKAGE. THE HARDWARE CRITICALITY SHOULD BE A 3.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-273
NASA FMEA #: M4-1B2-CV010-2

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 273
ITEM: O2 CHECK VALVE (1) CV010

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[P]	[P]	[X] *
IOA	[3 /1R]	[P]	[P]	[P]	[ ]
COMPARE	[N /]	[ ]	[ ]	[ ]	[N]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [X]

REMARKS:
ALSO NASA FMEA'S 04-1B-CV010-2 AND M4-1B1-CV010-2.
THE FAILURE MODE IS FAILS CLOSED OR RESTRICTED FLOW. THE HARDWARE CRITICALITY IS A 2 BECAUSE IF THE SAME TANK'S RELIEF VALVE ALSO FAILED CLOSED, AN EXPLOSION COULD OCCUR DUE TO CONDUCTIVE HEAT TRANSFER INTO THE TANK. THE RETENTION RATIONALE IS NOT AVAILABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-274
NASA FMEA #: M4-1B2-A01FSO-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 274
ITEM: O2 CHECK VALVE (1) CV010

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[1 /1]	[NA]	[NA]	[NA]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-A01FSO-1 AND M4-1B1-A01FSO-1.
THE FAILURE MODE IS EXTERNAL LEAKAGE. NASA COVERED THE EXTERNAL LEAKAGE OF MOST COMPONENTS IN ONE FMEA, AND SINCE THE EFFECT IS THE SAME, IT IS AGREEABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-275
NASA FMEA #: M4-1B2-LV015-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 275
ITEM: 02 SOLENOID GSE SUPPLY VALVE (1) LV015

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[F]	[P]	[X] *
IOA	[2 /1R]	[P]	[F]	[P]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[P]	[ ]	[D] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [X]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV015-1 AND M4-1B1-LV015-1.
THE FAILURE MODE IS FAILS OPEN OR INTERNAL LEAKAGE. THE HARDWARE CRITICALITY SHOULD BE A 3. THE RETENTION RATIONALE IS NOT AVAILABLE SCREEN B SHOULD BE PASSED PER NSTS 22206 SECTION 2.3.5.a. BECAUSE THERE IS A VALVE POSITION INDICATOR. PASSING SCREEN B WOULD ALLOW THIS TO BE DELETED FROM THE CIL.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-276 BASELINE [ ]
NASA FMEA #: M4-1B2-LV015-2 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 276
ITEM: 02 SOLENOID GSE SUPPLY VALVE (1) LV015

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[NA]	[NA]	[NA]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ]
(ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV015-2 AND M4-1B1-LV015-2.
THE FAILURE MODE IS FAILS CLOSED.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-277 BASELINE [ ]
NASA FMEA #: M4-1B2-A01FSO-1 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 277
ITEM: 02 SOLENOID GSE SUPPLY VALVE (1) LV015

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[1 /1]	[NA]	[NA]	[NA]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-A01FSO-1 AND M4-1B1-A01FSO-1.
THE FAILURE MODE IS EXTERNAL LEAKAGE. NASA COVERED THE EXTERNAL LEAKAGE OF MOST COMPONENTS IN ONE FMEA, AND SINCE THE EFFECT IS THE SAME, IT IS AGREEABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-278
NASA FMEA #: M4-1B2-LV012-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 278
ITEM: 02 SOLENOID ECLSS SYSTEM 1 SUPPLY VALVE (1)
LV012

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /1R]	[P]	[F]	[P]	[X] *
IOA	[2 /1R]	[P]	[P]	[P]	[X]
COMPARE	[N /]	[ ]	[N]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[P]	[ ]	[D] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [X]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV012-1 AND M4-1B1-LV012-1.
THE FAILURE MODE IS FAILS OPEN OR INTERNAL LEAKAGE. THE HARDWARE CRITICALITY SHOULD BE A 3. SCREEN B SHOULD BE PASSED PER NSTS 22206 SECTION 2.3.5.a. BECAUSE THERE IS A VALVE POSITION INDICATOR. THE RETENTION RATIONALE IS NOT AVAILABLE.
PASSING SCREEN B WOULD ALLOW THIS TO BE DELETED FROM THE CIL.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-279 BASELINE [ ]
NASA FMEA #: M4-1B2-LV012-2 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 279
ITEM: 02 SOLENOID ECLSS SYSTEM 1 SUPPLY VALVE (1) LV012

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /1R]	[P]	[P]	[P]	[ ] *
IOA	[2 /1R]	[P]	[P]	[P]	[X]
COMPARE	[N /]	[ ]	[ ]	[ ]	[N]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV012-2 AND M4-1B1-LV012-2.
THE FAILURE MODE IS FAILS CLOSED. THE IOA AGREES THAT THE HARDWARE CRITICALITY IS A 3. THE CREW HAS ENOUGH OXYGEN IN THE CABIN FOR THEM TO SURVIVE A DEORBIT.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-280
NASA FMEA #: M4-1B2-A01FSO-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 280
ITEM: 02 SOLENOID ECLSS SYSTEM 1 SUPPLY VALVE (1)
LV012

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[1 /1]	[NA]	[NA]	[NA]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-A01FSO-1 AND M4-1B1-A01FSO-1.
THE FAILURE MODE IS EXTERNAL LEAKAGE. NASA COVERED THE EXTERNAL LEAKAGE OF MOST COMPONENTS IN ONE FMEA, AND SINCE THE EFFECT IS THE SAME, IT IS AGREEABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-281 BASELINE [ ]
NASA FMEA #: M4-1B2-LV012-1 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 281
ITEM: 02 SOLENOID ECLSS SYSTEM 2 SUPPLY VALVE (1) LV022

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /1R]	[P]	[F]	[P]	[X] *
IOA	[2 /1R]	[P]	[P]	[P]	[X]
COMPARE	[N /]	[ ]	[N]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[P]	[ ]	[D] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [ ]
INADEQUATE [X]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV012-1 AND M4-1B1-LV012.
THE FAILURE MODE IS FAILS OPEN OR INTERNAL LEAKAGE. THE HARDWARE CRITICALITY SHOULD BE A 3. SCREEN B SHOULD BE PASSED PER NSTS 22206 SECTION 2.3.5.a. BECAUSE THERE IS A VALVE POSITION INDICATOR. THE RETENTION RATIONALE IS NOT AVAILABLE.
PASSING SCREEN B WOULD ALLOW THIS TO BE DELETED FROM THE CIL.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-282
NASA FMEA #: M4-1B2-LV012-2

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 282
ITEM: 02 SOLENOID ECLSS SYSTEM 2 SUPPLY VALVE (1)
LV022

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /1R]	[P]	[P]	[P]	[ ] *
IOA	[2 /1R]	[P]	[P]	[P]	[X]
COMPARE	[N /]	[ ]	[ ]	[ ]	[N]
RECOMMENDATIONS: (If different from NASA).					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV012-2 AND M4-1B1-LV012-2.
THE FAILURE MODE IS FAILS CLOSED. THE IOA AGREES THAT THE HARDWARE CRITICALITY IS A 3. THE CREW HAS ENOUGH OXYGEN IN THE CABIN FOR THEM TO SURVIVE A DEORBIT.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-283
NASA FMEA #: M4-1B2-A01FSO-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 283
ITEM: 02 SOLENOID ECLSS SYSTEM 2 SUPPLY VALVE (1)
LV022

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[1 /1]	[NA]	[NA]	[NA]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-A01FSO-1 AND M4-1B1-A01FSO-1.
THE FAILURE MODE IS EXTERNAL LEAKAGE. NASA COVERED THE EXTERNAL LEAKAGE OF MOST COMPONENTS IN ONE FMEA, AND SINCE THE EFFECT IS THE SAME, IT IS AGREEABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-284
NASA FMEA #: M4-1B2-PD015-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 284
ITEM: 02 FILL GSE SUPPLY T-0 QUICK DISCONNECT (1)
PD015

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[F]	[P]	[X] *
IOA	[2 /1R]	[P]	[F]	[P]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [X]

REMARKS:
ALSO NASA FMEA'S 04-1B-PD015-1 AND M4-1B1-PD015-1.
THE FAILURE MODE IS EXTERNAL LEAKAGE. THE HARDWARE CRITICALITY SHOULD BE A 3. THE RETENTION RATIONALE IS NOT AVAILABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-285
NASA FMEA #:

NASA DATA:
BASELINE [ ]
NEW [ ]

SUBSYSTEM: EPG
MDAC ID: 285
ITEM: 02 FILL GSE SUPPLY T-0 QUICK DISCONNECT (1)
PD015

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[/]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[N /N]	[N]	[N]	[N]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[3 /3]	[NA]	[NA]	[NA]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
NASA DOES NOT HAVE A FMEA ON THIS FAILURE MODE (INABILITY TO MATE/DEMATE). FOR COMPLETENESS, NASA MAY WANT TO CONSIDER WRITING A FMEA FOR THIS FAILURE MODE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-286 BASELINE [ ]
NASA FMEA #: M4-1B2-MT012-1 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 286
ITEM: 02 MANIFOLD PRESSURE SENSOR (2)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[NA]	[NA]	[NA]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ]
(ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-MT012-1 AND M4-1B1-MT012-1.
THE IOA FAILURE MODE IS FULL OUTPUT. THE NASA FMEA FAILURE MODE IS LOSS OF OUTPUT OR ERRONEOUS SIGNAL.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-287 BASELINE [ ]
NASA FMEA #: M4-1B2-MT012-1 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 287
ITEM: 02 MANIFOLD PRESSURE SENSOR (2)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[NA]	[NA]	[NA]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ]
(ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-MT012-1 AND M4-1B1-MT012-1.
THE IOA FAILURE MODE IS ZERO OUTPUT. THE NASA FMEA FAILURE MODE IS LOSS OF OUTPUT OR ERRONEOUS SIGNAL.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-288
NASA FMEA #: M4-1B2-MT012-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 288
ITEM: 02 MANIFOLD PRESSURE SENSOR (2)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[NA]	[NA]	[NA]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-MT012-1 AND M4-1B1-MT012-1.
THE IOA FAILURE MODE IS OUT OF TOLERANCE. THE NASA FMEA FAILURE MODE IS LOSS OF OUTPUT OR ERRONEOUS SIGNAL.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-289 BASELINE [ ]
NASA FMEA #: M4-1B2-LV013-1 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 289
ITEM: 02 FUEL CELL 1 SOLENOID REACTANT SUPPLY VALVE (1) LV013

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[F]	[P]	[X] *
IOA	[2 /1R]	[P]	[P]	[P]	[X]
COMPARE	[/]	[ ]	[N]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [P] [ ] [ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [X]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV013-1 AND M4-1B1-LV013-1.
THE FAILURE MODE IS FAILS OPEN OR INTERNAL LEAKAGE. SCREEN B SHOULD BE PASSED PER NSTS 22206 SECTION 2.3.5.a. BECAUSE THERE IS A VALVE POSITION INDICATOR. THE CIL RETENTION RATIONALE IS NOT AVAILABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-290
NASA FMEA #: M4-1B2-LV013-2

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 290
ITEM: 02 FUEL CELL 1 SOLENOID REACTANT SUPPLY VALVE
(1) LV013

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[P]	[P]	[X] *
IOA	[2 /1R]	[P]	[P]	[P]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV013-2 AND M4-1B1-LV013-2.
THE FAILURE MODE IS FAILS CLOSED. THE CRITICALITY SHOULD BE A 2/1R FOR THE ONORBIT PHASE ALSO BECAUSE LOSS OF A FUEL CELL CAUSES A PRIORITY FLIGHT DECISION.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-291
NASA FMEA #: M4-1B2-A01FSO-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 291
ITEM: 02 FUEL CELL 1 SOLENOID REACTANT SUPPLY VALVE (1) LV013

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[1 /1]	[NA]	[NA]	[NA]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-A01FSO-1 AND M4-1B1-A01FSO-1
THE FAILURE MODE IS EXTERNAL LEAKAGE. NASA COVERED THE EXTERNAL LEAKAGE OF MOST COMPONENTS IN ONE FMEA, AND SINCE THE EFFECT IS THE SAME, IT IS AGREEABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-292
NASA FMEA #: M4-1B2-LV011-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 292
ITEM: 02 MANIFOLD 1 SOLENOID CROSSOVER VALVE (1) LV011

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[F]	[P]	[X] *
IOA	[3 /1R]	[P]	[P]	[P]	[ ]
COMPARE	[N /]	[ ]	[N]	[ ]	[N]

RECOMMENDATIONS: (If different from NASA)

[3 /]	[ ]	[P]	[ ]	[D] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [X]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV011-1 AND M4-1B1-LV011-1.
THE FAILURE MODE IS FAILS OPEN OR INTERNAL LEAKAGE. IT IS RECOMMENDED THAT THE HARDWARE CRITICALITY BE CHANGED TO A 3. IF THE TANK 1 RELIEF VALVE AND MANIFOLD 1 RELIEF VALVE FAILED OPEN, ALL REACTANT COULD BE DEPLETED OUT THE RELIEF PORT. ISOLATING THE LEAK BY CLOSING LV021 WOULD STILL SHUTDOWN FUEL CELLS 1 AND 3, AND ECLSS SYSTEM 1. EXTERNAL LEAKAGE OF LINES AND COMPONENTS IS NOT INCLUDED AS AN ADDITIONAL FAILURE BECAUSE NSTS 22206 SECTION 2.3.3.h ALREADY DEFINES THIS AS A CRITICALITY 1/1. SCREEN B SHOULD BE PASSED PER NSTS 22206 SECTION 2.3.5.a. BECAUSE THE FAILURE IS DETECTABLE WITH THE VALVE POSITION INDICATOR. THIS WOULD ALLOW REMOVAL OF THIS FAILURE MODE FROM THE CIL. THE RETENTION RATIONALE IS NOT AVAILABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-293 BASELINE [ ]
NASA FMEA #: M4-1B2-LV011-2 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 293
ITEM: 02 MANIFOLD 1 SOLENOID CROSSOVER VALVE (1) LV011

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /1R]	[P]	[P]	[P]	[X] *
IOA	[3 /2R]	[P]	[P]	[P]	[ ]
COMPARE	[/N]	[ ]	[ ]	[ ]	[N]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV011-2 AND M4-1B1-LV011-2. FOR 04-1B-LV031-2 NASA'S CRITICALITY FLIGHT HDW/FUNC: 2/1R. THE FAILURE MODE IS FAILS CLOSED. THE VALVE IS USED FOR LEAK ISOLATION AND AS A REDUNDANT PRESSURE RELIEF PATH. FOR A TWO TANK SET SYSTEM, THE HARDWARE CRITICALITY WOULD BE A 2 DURING ASCENT BECAUSE TWO FUEL CELLS COULD BE LOST IF THE TANK 2 RELIEF VALVE FAILED OPEN. THE HARDWARE CRITICALITY SHOULD BE A 3 FOR GREATER THAN TWO TANK SETS, BECAUSE AN EXPLOSION COULD OCCUR IF A TANK'S RELIEF VALVE FAILS CLOSED AND HEATERS FAIL ON. THIS DOES NOT MEET THE CRITERIA TO BE A CIL ITEM, AND SHOULD BE DELETED.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-294
NASA FMEA #: M4-1B2-A01FSO-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 294
ITEM: O2 MANIFOLD 1 SOLENOID CROSSOVER VALVE (1) LV011

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[1 /1]	[NA]	[NA]	[NA]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-A01FSO-1 AND M4-1B1-A01FSO-1.
THE FAILURE MODE IS EXTERNAL LEAKAGE. NASA COVERED THE EXTERNAL LEAKAGE OF MOST COMPONENTS IN ONE FMEA, AND SINCE THE EFFECT IS THE SAME, IT IS AGREEABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-295 BASELINE [ ]
NASA FMEA #: M4-1B2-LV011-1 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 295
ITEM: 02 MANIFOLD 2 SOLENOID CROSSOVER VALVE (1) LV021

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[F]	[P]	[X] *
IOA	[3 /1R]	[P]	[P]	[P]	[ ]
COMPARE	[N /]	[ ]	[N]	[ ]	[N]
RECOMMENDATIONS: (If different from NASA)					
	[3 /]	[ ]	[P]	[ ]	[D] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [ ]
INADEQUATE [X]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV011-1 AND M4-1B1-LV011-1.
THE FAILURE MODE IS FAILS OPEN OR INTERNAL LEAKAGE. IT IS RECOMMENDED THAT THE HARDWARE CRITICALITY BE CHANGED TO A 3. IF THE TANK 2 RELIEF VALVE AND MANIFOLD 2 RELIEF VALVE FAILED OPEN, ALL REACTANT COULD BE DEPLETED OUT THE RELIEF PORT. ISOLATING THE LEAK BY CLOSING LV011 WOULD STILL SHUTDOWN FUEL CELLS 2 AND 3, AND ECLSS SYSTEM 2. EXTERNAL LEAKAGE OF LINES AND COMPONENTS IS NOT INCLUDED AS AN ADDITIONAL FAILURE BECAUSE NSTS 22206 SECTION 2.3.3.h. ALREADY DEFINES THIS AS A CRITICALITY 1/1. SCREEN B SHOULD BE PASSED PER NSTS 22206 SECTION 2.3.5.a. BECAUSE THE FAILURE IS DETECTABLE WITH THE VALVE POSITION INDICATOR. THIS WOULD ALLOW REMOVAL OF THIS FAILURE MODE FROM THE CIL. THE RETENTION RATIONALE IS NOT AVAILABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-296
NASA FMEA #: M4-1B2-LV011-2

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 296
ITEM: 02 MANIFOLD 2 SOLENOID CROSSOVER VALVE (1) LV021

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /1R]	[P]	[P]	[P]	[X] *
IOA	[3 /2R]	[P]	[P]	[P]	[ ]
COMPARE	[/N]	[ ]	[ ]	[ ]	[N]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV011-2 AND M4-1B1-LV011-2. FOR 04-1B-LV031-2 NASA'S CRITICALITY FLIGHT HDW/FUNC: 2/1R. THE THE FAILURE MODE IS FAILS CLOSED. THE VALVE IS USED FOR LEAK ISOLATION AND AS A REDUNDANT PRESSURE RELIEF PATH. FOR A TWO TANK SET SYSTEM, THE HARDWARE CRITICALITY WOULD BE A 2 DURING ASCENT BECAUSE TWO FUEL CELLS COULD BE LOST IF THE TANK 1 RELIEF VALVE FAILED OPEN. THE HARDWARE CRITICALITY SHOULD BE A 3 FOR GREATER THAN TWO TANK SETS, BECAUSE AN EXPLOSION COULD OCCUR IF A TANK'S RELIEF VALVE FAILS CLOSED AND HEATERS FAIL ON. THIS DOES NOT MEET THE CRITERIA TO BE A CIL ITEM, AND SHOULD BE DELETED.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-297
NASA FMEA #: M4-1B2-A01FSO-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 297
ITEM: 02 MANIFOLD 2 SOLENOID CROSSOVER VALVE (1) LV021

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[1 /1]	[NA]	[NA]	[NA]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-A01FSO-1 AND M4-1B1-A01FSO-1.
THE FAILURE MODE IS EXTERNAL LEAKAGE. NASA COVERED THE EXTERNAL LEAKAGE OF MOST COMPONENTS IN ONE FMEA, AND SINCE THE EFFECT IS THE SAME, IT IS AGREEABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-298
NASA FMEA #: M4-1B2-PD025-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 298
ITEM: 02 HORIZONTAL DRAIN QD (1)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[F]	[P]	[X] *
IOA	[2 /1R]	[P]	[F]	[P]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [X]

REMARKS:
ALSO NASA FMEA'S 04-1B-PD025-1 AND M4-1B1-PD025-1.
THE FAILURE MODE IS EXTERNAL LEAKAGE. THE RETENTION RATIONALE IS NOT AVAILABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-299
NASA FMEA #:

NASA DATA:
BASELINE [ ]
NEW [ ]

SUBSYSTEM: EPG
MDAC ID: 299
ITEM: 02 HORIZONTAL DRAIN QD (1)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[/]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[N /N]	[N]	[N]	[N]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[3 /3]	[NA]	[NA]	[NA]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
NASA DOES NOT HAVE A FMEA ON THIS FAILURE MODE (INABILITY TO MATE/DEMATE) FOR THIS COMPONENT. FOR COMPLETENESS, NASA MAY WANT TO CONSIDER WRITING A FMEA FOR THIS FAILURE MODE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-300
NASA FMEA #: M4-1B2-PC010-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 300
ITEM: 02 HORIZONTAL DRAIN CAP (1)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[F]	[P]	[X] *
IOA	[2 /1R]	[P]	[F]	[P]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [X]

REMARKS:
ALSO NASA FMEA'S 04-1B-PC010-1 AND M4-1B1-PC010-1.
THE FAILURE MODE IS EXTERNAL LEAKAGE. BECAUSE THE QD HAS AN ALLOWABLE LEAK RATE, THIS FAILURE COULD RESULT IN THE ACCUMULATION OF O2 IN THE ORBITER MID FUSELAGE AND A POSSIBLE EXPLOSION. THE RETENTION RATIONALE IS NOT AVAILABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-301
NASA FMEA #: M4-1B2-LV013-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 301
ITEM: 02 FUEL CELL 3 SOLENOID REACTANT SUPPLY VALVE (1) LV024

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[F]	[P]	[X] *
IOA	[2 /1R]	[P]	[P]	[P]	[X]
COMPARE	[/]	[ ]	[N]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [P] [ ] [ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [X]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV013-1 AND M4-1B1-LV013-1.
THE FAILURE MODE IS FAILS OPEN OR INTERNAL LEAKAGE. SCREEN B SHOULD BE PASSED PER NSTS 22206 SECTION 2.3.5.a. BECAUSE THERE IS A VALVE POSITION INDICATOR. THE CIL RETENTION RATIONALE IS NOT AVAILABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-302
NASA FMEA #: M4-1B2-LV024-2

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 302
ITEM: 02 FUEL CELL 3 SOLENOID REACTANT SUPPLY VALVE
(1) LV024

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[2 /1R]	[P]	[P]	[P]	[X]
COMPARE	[N /N]	[N]	[N]	[N]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA # M4-1B-LV024-2.
THE FAILURE MODE IS FAILS CLOSED. THE CRITICALITY SHOULD BE A 2/1R FOR THE ONORBIT PHASE ALSO, BECAUSE LOSS OF A FUEL CELL CAUSES A PRIORITY FLIGHT DECISION.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-303 BASELINE [ ]
NASA FMEA #: M4-1B2-A01FSO-1 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 303
ITEM: 02 FUEL CELL 3 SOLENOID REACTANT SUPPLY VALVE
(1) LV024

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[1 /1]	[NA]	[NA]	[NA]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-A01FSO-1 AND M4-1B1-A01FSO-1.
THE FAILURE MODE IS EXTERNAL LEAKAGE. NASA COVERED THE EXTERNAL LEAKAGE OF MOST COMPONENTS IN ONE FMEA, AND SINCE THE EFFECT IS THE SAME, IT IS AGREEABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-304
NASA FMEA #: M4-1B2-LV013-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 304
ITEM: 02 FUEL CELL 2 SOLENOID REACTANT SUPPLY VALVE (1) LV023

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[F]	[P]	[X] *
IOA	[2 /1R]	[P]	[P]	[P]	[X]
COMPARE	[/]	[ ]	[N]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)	[/]	[ ]	[P]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [X]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV013-1 AND M4-1B1-LV013-1. THE FAILURE MODE IS FAILS OPEN OR INTERNAL LEAKAGE. SCREEN B SHOULD BE PASSED PER NSTS 22206 SECTION 2.3.5.a. BECAUSE THERE IS A VALVE POSITION INDICATOR. THE CIL RETENTION RATIONALE IS NOT AVAILABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-305
NASA FMEA #: M4-1B2-LV013-2

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 305
ITEM: 02 FUEL CELL 2 SOLENOID REACTANT SUPPLY VALVE (1) LV023

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[P]	[P]	[X] *
IOA	[2 /1R]	[P]	[P]	[P]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV013-2 AND M4-1B1-LV013-2.
THE FAILURE MODE IS FAILS CLOSED. THE CRITICALITY SHOULD BE A 2/1R FOR THE ONORBIT PHASE ALSO BECAUSE LOSS OF A FUEL CELL CAUSES A PRIORITY FLIGHT DECISION.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-306
NASA FMEA #: M4-1B2-A01FSO-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 306
ITEM: 02 FUEL CELL 2 SOLENOID REACTANT SUPPLY VALVE
(1) LV023

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[1 /1]	[NA]	[NA]	[NA]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-A01FSO-1 AND M4-1B1-A01FSO-1.
THE FAILURE MODE IS EXTERNAL LEAKAGE. NASA COVERED THE EXTERNAL LEAKAGE OF MOST COMPONENTS IN ONE FMEA, AND SINCE THE EFFECT IS THE SAME, IT IS AGREEABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-307 BASELINE [ ]
NASA FMEA #: M4-1B2-RV011-1 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 307
ITEM: O2 MANIFOLD 1 RELIEF VALVE (1) RV011

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[F]	[P]	[X] *
IOA	[2 /1R]	[P]	[F]	[P]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [NA] [ ] [D] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [X]

REMARKS:
ALSO NASA FMEA'S 04-1B-RV011-1 AND M4-1B1-RV011-1.
THE FAILURE MODE IS FAILED OPEN OR INTERNAL LEAKAGE. THE CIL RETENTION RATIONALE IS NOT AVAILABLE. THE HARDWARE CRITICALITY SHOULD BE A 3 SCREEN B SHOULD BE NA PER NSTS 22206 SECTION 2.3.4.b.2.a. BECAUSE THE RELIEF VALVE IS STANDBY REDUNDANT. NOT FAILING SCREEN B WOULD ALLOW THIS TO BE DELETED FROM THE CIL.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-308
NASA FMEA #: M4-1B2-RV011-2

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 308
ITEM: O2 MANIFOLD 1 RELIEF VALVE (1) RV011

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /1R]	[P]	[NA]	[P]	[ ] *
IOA	[3 /1R]	[P]	[P]	[P]	[ ]
COMPARE	[/]	[ ]	[N]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-RV011-2 AND M4-1B1-RV011-2.
THE FAILURE MODE IS FAILS CLOSED. A FUNCTIONAL CRITICALITY OF 1R WOULD RESULT IF BOTH MANIFOLD RELIEF VALVES FAIL CLOSED, ALONG WITH A TANK RELIEF VALVE FAILED CLOSED, AND THAT SAME TANK'S HEATERS FAILED ON. THE LINES COULD BE OVERPRESSURIZED AND BURST. SCREEN B IS NA PER NSTS 22206 SECTION 2.3.4.b.2.a. BECAUSE THE RELIEF VALVE IS STANDBY REDUNDANT.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-309 BASELINE [ ]
NASA FMEA #: M4-1B2-A01FSO-1 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 309
ITEM: O2 MANIFOLD 1 RELIEF VALVE (1) RV011

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[1 /1]	[NA]	[NA]	[NA]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-A01FSO-1 AND M4-1B1-A01FSO-1.
THE FAILURE MODE IS EXTERNAL LEAKAGE. NASA COVERED THE EXTERNAL LEAKAGE OF MOST COMPONENTS IN ONE FMEA, AND SINCE THE EFFECT IS THE SAME, IT IS AGREEABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-310
NASA FMEA #: M4-1B2-RV011-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 310
ITEM: O2 MANIFOLD 2 RELIEF VALVE (1) RV021

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[F]	[P]	[X] *
IOA	[2 /1R]	[P]	[F]	[P]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[NA]	[ ]	[D] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [X]

REMARKS:
ALSO NASA FMEA'S 04-1B-RV011-1 AND M4-1B1-RV011-1.
THE FAILURE MODE IS FAILED OPEN OR INTERNAL LEAKAGE. THE RETENTION RATIONALE IS NOT AVAILABLE. THE HARDWARE CRITICALITY SHOULD BE A 3. SCREEN B SHOULD BE NA PER NSTS 22206 SECTION 2.3.4.b.2.a. BECAUSE THE RELIEF VALVE IS STANDBY REDUNDANT. NOT FAILING SCREEN B WOULD ALLOW THIS TO BE DELETED FROM THE CIL.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-311 BASELINE [ ]
NASA FMEA #: M4-1B2-RV011-2 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 311
ITEM: O2 MANIFOLD 2 RELIEF VALVE (1) RV021

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /1R]	[P]	[NA]	[P]	[ ] *
IOA	[3 /1R]	[P]	[P]	[P]	[ ]
COMPARE	[/]	[ ]	[N]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-RV011-2 AND M4-1B1-RV011-2.
THE FAILURE MODE IS FAILS CLOSED. A FUNCTIONAL CRITICALITY OF 1R WOULD RESULT IF BOTH MANIFOLD RELIEF VALVES FAIL CLOSED, ALONG WITH A TANK RELIEF VALVE FAILED CLOSED, AND THAT SAME TANK'S HEATERS FAILED ON. THE LINES COULD BE OVERPRESSURIZED AND BURST. SCREEN B IS NA PER NSTS 22206 SECTION 2.3.4.b.2.a BECAUSE THE RELIEF VALVE IS STANDBY REDUNDANT.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-312
NASA FMEA #: M4-1B1-A01FSO-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 312
ITEM: O2 MANIFOLD 2 RELIEF VALVE (1) RV021

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[1 /1]	[NA]	[NA]	[NA]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-A01FSO-1 AND M4-1B1-A01FSO-1.
THE FAILURE MODE IS EXTERNAL LEAKAGE. NASA COVERS THE EXTERNAL LEAKAGE OF MOST COMPONENTS IN ONE FMEA, AND SINCE THE EFFECT IS THE SAME, IT IS AGREEABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-313 BASELINE [ ]
NASA FMEA #: M4-1B2-CV010-1 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 313
ITEM: 02 CHECK VALVE (2) CV021

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[F]	[P]	[ ] *
IOA	[2 /1R]	[P]	[F]	[P]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[N]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ]
(ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA # M4-1B1-CV010-1.
THE FAILURE MODE IS FAILS OPEN OR INTERNAL LEAKAGE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-314 BASELINE [ ]
NASA FMEA #: M4-1B2-CV010-2 NEW [ ]

SUBSYSTEM: EPG
MDAC ID: 314
ITEM: 02 CHECK VALVE (2) CV021

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[P]	[P]	[X] *
IOA	[3 /1R]	[P]	[P]	[P]	[ ]
COMPARE	[N /]	[ ]	[ ]	[ ]	[N]

RECOMMENDATIONS: (If different from NASA)

[2 /1R]	[P]	[P]	[P]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA # M4-1B1-CV010-2.
THE HARDWARE CRITICALITY SHOULD BE A 2 BECAUSE IF THE SAME TANK'S RELIEF VALVE ALSO FAILED CLOSED, AN EXPLOSION COULD OCCUR DUE TO CONDUCTIVE HEAT TRANSFER INTO THE TANK.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-315
NASA FMEA #: M4-1B2-A01FSO-1

NASA DATA:
BASELINE [ ]
NEW [ ]

SUBSYSTEM: EPG
MDAC ID: 315
ITEM: 02 CHECK VALVE (2) CV021

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[1 /1]	[NA]	[NA]	[NA]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA # M4-1B1-A01FSO-1. THE FAILURE MODE IS EXTERNAL LEAKAGE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-316
NASA FMEA #: M4-1B2-A01FSO-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 316
ITEM: 02 LINES, COMPONENTS, & FITTINGS

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[1 /1]	[NA]	[NA]	[NA]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-A01FSO-1 AND M4-1B1-A01FSO-1.
THE FAILURE MODE IS EXTERNAL LEAKAGE. IT IS RECOMMENDED THAT ALL THE COMPONENTS COVERED BY THIS FMEA BE LISTED IN IT.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-317
NASA FMEA #:

NASA DATA:
BASELINE [ ]
NEW [ ]

SUBSYSTEM: EPG
MDAC ID: 317
ITEM: 02 LINES, COMPONENTS, & FITTINGS

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[/]	[ ]	[ ]	[ ]	[ ] *
IOA	[2 /1R]	[P]	[P]	[P]	[X]
COMPARE	[N /N]	[N]	[N]	[N]	[N]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
NASA DOES NOT HAVE A FMEA ON THIS FAILURE MODE (RESTRICTED FLOW). THIS FAILURE COULD RESULT IN SHUTTING DOWN THE FUEL CELLS DUE TO LACK OF 02. IT IS RECOMMENDED THAT THE MDAC FMEA BE DELETED SINCE THIS FAILURE MODE IS NON-CREDIBLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-318
NASA FMEA #:

NASA DATA:
BASELINE [ ]
NEW [ ]

SUBSYSTEM: EPG
MDAC ID: 318
ITEM: 02 TANK QUANTITY SENSOR (5) V45Q11(-5)05A

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[/]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[N /N]	[N]	[N]	[N]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[3 /3]	[NA]	[NA]	[NA]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
NASA DOES NOT HAVE A FMEA ON THIS FAILURE MODE (FULL OUTPUT) OR COMPONENT. FOR COMPLETENESS, NASA MAY WANT TO CONSIDER WRITING A FMEA FOR THIS FAILURE MODE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-319
NASA FMEA #:

NASA DATA:
BASELINE [ ]
NEW [ ]

SUBSYSTEM: EPG
MDAC ID: 319
ITEM: 02 TANK QUANTITY SENSOR (5) V45Q11(-5)05A

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[/]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[N /N]	[N]	[N]	[N]	[ ]

RECOMMENDATIONS: (If different from NASA)

	[3 /3]	[NA]	[NA]	[NA]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
NASA DOES NOT HAVE A FMEA ON THIS FAILURE MODE (ZERO OUTPUT) OR COMPONENT. FOR COMPLETENESS, NASA MAY WANT TO CONSIDER WRITING A FMEA FOR THIS FAILURE MODE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-320
NASA FMEA #:

NASA DATA:
BASELINE [ ]
NEW [ ]

SUBSYSTEM: EPG
MDAC ID: 320
ITEM: 02 TANK QUANTITY SENSOR (5) V45Q11(-5)05A

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[/]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[N /N]	[N]	[N]	[N]	[ ]

RECOMMENDATIONS: (If different from NASA)

[3 /3]	[NA]	[NA]	[NA]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
NASA DOES NOT HAVE A FMEA ON THIS FAILURE MODE (OUT OF TOLERANCE) OR COMPONENT. FOR COMPLETENESS, NASA MAY WANT TO CONSIDER WRITING A FMEA FOR THIS FAILURE MODE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-321
NASA FMEA #:

NASA DATA:
BASELINE [ ]
NEW [ ]

SUBSYSTEM: EPG
MDAC ID: 321
ITEM: 02 TANK FLUID TEMPERATURE SENSORS (5) V45T11(-5)01A

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[/]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[N /N]	[N]	[N]	[N]	[ ]
RECOMMENDATIONS: (If different from NASA)	[3 /3]	[NA]	[NA]	[NA]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
NASA DOES NOT HAVE A FMEA ON THIS FAILURE MODE (FULL OUTPUT) OR COMPONENT. FOR COMPLETENESS, NASA MAY WANT TO CONSIDER WRITING A FMEA FOR THIS FAILURE MODE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-322
NASA FMEA #:

NASA DATA:
BASELINE [ ]
NEW [ ]

SUBSYSTEM: EPG
MDAC ID: 322
ITEM: 02 TANK FLUID TEMPERATURE SENSORS (5) V45T11(-5)01A

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[/]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[N /N]	[N]	[N]	[N]	[ ]

RECOMMENDATIONS: (If different from NASA)

[3 /3]	[NA]	[NA]	[NA]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
NASA DOES NOT HAVE A FMEA ON THIS FAILURE MODE (ZERO OUTPUT) OR COMPONENT. FOR COMPLETENESS, NASA MAY WANT TO CONSIDER WRITING A FMEA FOR THIS FAILURE MODE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-323
NASA FMEA #:

NASA DATA:
BASELINE [ ]
NEW [ ]

SUBSYSTEM: EPG
MDAC ID: 323
ITEM: 02 TANK FLUID TEMPERATURE SENSORS (5) V45T11(-5)01A

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[/]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[N /N]	[N]	[N]	[N]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[3 /3]	[NA]	[NA]	[NA]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
NASA DOES NOT HAVE A FMEA ON THIS FAILURE MODE (OUT OF TOLERANCE) OR COMPONENT. FOR COMPLETENESS, NASA MAY WANT TO CONSIDER WRITING A FMEA FOR THIS FAILURE MODE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-324
NASA FMEA #:

NASA DATA:
BASELINE [ ]
NEW [ ]

SUBSYSTEM: EPG
MDAC ID: 324
ITEM: O2 TANK HEATER ASSEMBLY 1 TEMPERATURE SENSOR (5)
V45T11(-5)07A

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[/]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[N /N]	[N]	[N]	[N]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[3 /3]	[NA]	[NA]	[NA]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
NASA DOES NOT HAVE A FMEA ON THIS FAILURE MODE (FULL OUTPUT) OR COMPONENT. FOR COMPLETENESS, NASA MAY WANT TO CONSIDER WRITING A FMEA FOR THIS FAILURE MODE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-325
NASA FMEA #:

NASA DATA:
BASELINE [ ]
NEW [ ]

SUBSYSTEM: EPG
MDAC ID: 325
ITEM: O2 TANK HEATER ASSEMBLY 1 TEMPERATURE SENSOR (5)
V45T11(-5)07A

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[/]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[N /N]	[N]	[N]	[N]	[ ]

RECOMMENDATIONS: (If different from NASA)

[3 /3]	[NA]	[NA]	[NA]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
NASA DOES NOT HAVE A FMEA ON THIS FAILURE MODE (ZERO OUTPUT) OR COMPONENT. FOR COMPLETENESS, NASA MAY WANT TO CONSIDER WRITING A FMEA FOR THIS FAILURE MODE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-326
NASA FMEA #:

NASA DATA:
BASELINE [ ]
NEW [ ]

SUBSYSTEM: EPG
MDAC ID: 326
ITEM: O2 TANK HEATER ASSEMBLY 1 TEMPERATURE SENSOR (5)
V45T11(-5)07A

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[/]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[N /N]	[N]	[N]	[N]	[ ]

RECOMMENDATIONS: (If different from NASA)

[3 /3]	[NA]	[NA]	[NA]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
NASA DOES NOT HAVE A FMEA ON THIS FAILURE MODE (OUT OF TOLERANCE) OR COMPONENT. FOR COMPLETENESS, NASA MAY WANT TO CONSIDER WRITING A FMEA FOR THIS FAILURE MODE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-327
NASA FMEA #:

NASA DATA:
BASELINE [ ]
NEW [ ]

SUBSYSTEM: EPG
MDAC ID: 327
ITEM: O2 TANK HEATER ASSEMBLY 2 TEMPERATURE SENSOR (5) V45T11(-5)09A

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[/]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[N /N]	[N]	[N]	[N]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[3 /3]	[NA]	[NA]	[NA]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
NASA DOES NOT HAVE A FMEA ON THIS FAILURE MODE (FULL OUTPUT) OR COMPONENT. FOR COMPLETENESS, NASA MAY WANT TO CONSIDER WRITING A FMEA FOR THIS FAILURE MODE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-328
NASA FMEA #:

NASA DATA:
BASELINE [ ]
NEW [ ]

SUBSYSTEM: EPG
MDAC ID: 328
ITEM: O2 TANK HEATER ASSEMBLY 2 TEMPERATURE SENSOR (5)
V45T11(-5)09A

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[/]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[N /N]	[N]	[N]	[N]	[ ]

RECOMMENDATIONS: (If different from NASA)

[3 /3]	[NA]	[NA]	[NA]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
NASA DOES NOT HAVE A FMEA ON THIS FAILURE MODE (ZERO OUTPUT) OR COMPONENT. FOR COMPLETENESS, NASA MAY WANT TO CONSIDER WRITING A FMEA FOR THIS FAILURE MODE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-329
NASA FMEA #:

NASA DATA:
BASELINE [ ]
NEW [ ]

SUBSYSTEM: EPG
MDAC ID: 329
ITEM: O2 TANK HEATER ASSEMBLY 2 TEMPERATURE SENSOR (5)
V45T11(-5)09A

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[/]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[N /N]	[N]	[N]	[N]	[ ]

RECOMMENDATIONS: (If different from NASA)

[3 /3]	[NA]	[NA]	[NA]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
NASA DOES NOT HAVE A FMEA ON THIS FAILURE MODE (OUT OF TOLERANCE) OR COMPONENT. FOR COMPLETENESS, NASA MAY WANT TO CONSIDER WRITING A FMEA FOR THIS FAILURE MODE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-330 BASELINE [ ]
NASA FMEA #: M4-1B2-TK010-1 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 330
ITEM: O2 TANK SUBASSEMBLY (4), (3), OR (2)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[1 /1]	[NA]	[NA]	[NA]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ]
(ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-TK010-1 AND M4-1B1-TK010-1.
THE FAILURE MODE IS EXTERNAL LEAKAGE. THE NASA FMEA REVIEW COMBINED THE FAILURE MODES OF EXTERNAL LEAKAGE AND RUPTURE INTO ONE FMEA. IT IS RECOMMENDED THAT A SEPARATE FMEA BE WRITTEN ON THIS FAILURE MODE AND ITEM PER NSTS 22206 SECTION 2.3.1.a.1.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-331 BASELINE [ ]
NASA FMEA #: M4-1B2-TK010-1 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 331
ITEM: O2 TANK SUBASSEMBLY (4), (3), OR (2)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[1 /1]	[NA]	[NA]	[NA]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-TK010-1 AND M4-1B1-TK010-1. THE FAILURE MODE IS RUPTURE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-332
NASA FMEA #: M4-1B2-TK010-2

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 332
ITEM: O2 TANK SUBASSEMBLY (4), (3), OR (2)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[F]	[P]	[X] *
IOA	[3 /1R]	[P]	[F]	[P]	[X]
COMPARE	[N /]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-TK010-2 AND M4-1B1-TK010-2.
THE FAILURE MODE IS LOSS OF ANNULUS VACUUM. ALL THE REACTANT COULD BE DEPLETED DURING RE-ENTRY DUE TO EXCESSIVE HEATING, AND THIS COULD LOSE THE ORBITER.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-333
NASA FMEA #: M4-1B2-VP015-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 333
ITEM: O2 RELIEF PORT (1)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[F]	[P]	[X] *
IOA	[3 /1R]	[P]	[P]	[P]	[ ]
COMPARE	[N /]	[ ]	[N]	[ ]	[N]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[NA]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-VP015-1 AND M4-1B1-VP015-1.
THE FAILURE MODE IS RESTRICTED FLOW. IF A TANK CHECK VALVE ALSO FAILED CLOSED, AN EXPLOSION COULD OCCUR DUE TO CONDUCTIVE HEAT TRANSFER INTO THE TANK. SCREEN B SHOULD BE NA PER NSTS 22206 SECTION 2.3.4.b.2.a. BECAUSE THE RELIEF PORT IS STANDBY REDUNDANT.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-334 BASELINE [ ]
NASA FMEA #: M4-1B2-RV010-1 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 334
ITEM: O2 TANK RELIEF VALVE (4) RV010,RV020,RV410,RV460

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[P]	[P]	[X] *
IOA	[2 /1R]	[P]	[F]	[P]	[X]
COMPARE	[/]	[ ]	[N]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)	[/]	[ ]	[NA]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S: 04-1B-RV010-1 FOR O2 TANK RELIEF VALVE (2) - RV010, RV020 AND M4-1B1-RV010-1 FOR O2 TANK RELIEF VALVE (3) - RV010, RV020, RV410. THE FAILURE MODE IS FAILED OPEN OR INTERNAL LEAKAGE. THE NEW NASA FMEA MENTIONS THIS FAILURE IS NOT DETECTABLE IN FLIGHT, YET
IT STILL PASSES THEIR SCREEN B. THE RELIEF VALVE IS A STANDBY REDUNDANT SYSTEM AND THEREFORE THE B SCREEN SHOULD BE NA PER NSTS 22206 SECTION 2.3.4.b.2.a. THE
HARDWARE CRITICALITY SHOULD BE A 3 FOR GREATER THAN TWO TANK SETS. CHANGING THIS WOULD ALLOW DELETION OF THIS FAILURE MODE FROM THE CIL.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-335 BASELINE [ ]
NASA FMEA #: M4-1B2-RV010-2 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 335
ITEM: O2 TANK RELIEF VALVE (4) RV010,RV020,RV410,RV460

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[NA]	[P]	[X] *
IOA	[3 /1R]	[P]	[P]	[P]	[ ]
COMPARE	[N /]	[ ]	[N]	[ ]	[N]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S: 04-1B-RV010-2 FOR O2 TANK RELIEF VALVE (2) - RV010, RV020 AND M4-1B1-RV010-2 FOR O2 TANK RELIEF VALVE (3) - RV010, RV020, RV410. THE FAILURE MODE IS FAILS CLOSED. IF THE SAME TANK'S CHECK VALVE ALSO FAILED CLOSED, AN EXPLOSION COULD OCCUR DUE TO CONDUCTIVE HEAT TRANSFER INTO THE TANK. SCREEN B IS NA PER NSTS 22206 SECTION 2.3.4.b.2.a. BECAUSE THE RELIEF VALVE IS STANDBY REDUNDANT.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-336
NASA FMEA #: M4-1B2-A01FSO-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 336
ITEM: O2 TANK RELIEF VALVE (5) RV010,RV020,RV410,RV460

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[1 /1]	[NA]	[NA]	[NA]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-A01FSO-1 AND M4-1B1-A01FSO-1.
THE FAILURE MODE IS EXTERNAL LEAKAGE. NASA COVERED THE EXTERNAL LEAKAGE OF MOST COMPONENTS IN ONE FMEA, AND SINCE THE EFFECT IS THE SAME, IT IS AGREEABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-337 BASELINE [ ]
NASA FMEA #: NEW [ ]

SUBSYSTEM: EPG
MDAC ID: 337
ITEM: O2 TANK HEATER ELEMENT A1(5), A2(5), B1(4 OR 3), B2(4 OR 3)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[/]	[ ]	[ ]	[ ]	[ ] *
IOA	[1 /1]	[P]	[P]	[P]	[X]
COMPARE	[N /N]	[N]	[N]	[N]	[N]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
NASA DOES NOT HAVE A FMEA FOR THIS COMPONENT. THE FAILURE MODE IS FAILS ON. IT IS RECOMMENDED THAT THE MDAC FMEA BE DELETED SINCE THIS FAILURE MODE IS REALLY ONLY AN EFFECT THAT IS THE RESULT OF THE HEATER SWITCH FAILING ON. THIS FAILURE MODE IS COVERED IN THE MDAC EPD&C/PRSD ANALYSIS.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-338
NASA FMEA #:

NASA DATA:
BASELINE [ ]
NEW [ ]

SUBSYSTEM: EPG
MDAC ID: 338
ITEM: O2 TANK HEATER ELEMENT A1(5), A2(5), B1(4 OR 3), B2(4 OR 3)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[/]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /1R]	[P]	[P]	[P]	[ ]
COMPARE	[N /N]	[N]	[N]	[N]	[ ]

RECOMMENDATIONS: (If different from NASA)

[3 /1R]	[P]	[P]	[P]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
NASA DOES NOT HAVE A FMEA FOR THIS COMPONENT. THE FAILURE MODE IS FAILS OFF. INOPERATIVE HEATERS WILL CAUSE LOSS OF O2 PRESSURE TO THE FUEL CELLS.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-339 BASELINE [ ]
NASA FMEA #: M4-1B2-MT018-1 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 339
ITEM: O2 TANK HEATER CONTROLLER PRESSURE SENSOR/TRANSDUCER (4)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /1R]	[P]	[P]	[P]	[ ] *
IOA	[3 /1R]	[P]	[P]	[P]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-MT018-1 AND M4-1B1-MT018-1.
THE ICA FAILURE MODE IS FULL OUTPUT. THE NASA FMEA FAILURE MODE IS LOSS OF OUTPUT INCLUDING ERRONEOUS SIGNAL. THIS FAILURE WOULD CAUSE INADEQUATE O2 SUPPLY PRESSURE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-340
NASA FMEA #: M4-1B2-MT018-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 340
ITEM: O2 TANK HEATER CONTROLLER PRESSURE SENSOR/TRANSDUCER (4)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /1R]	[P]	[P]	[P]	[ ] *
IOA	[1 /1]	[P]	[P]	[P]	[X]
COMPARE	[N /N]	[ ]	[ ]	[ ]	[N]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-MT018-1 AND M4-1B1-MT018-1.
THE IOA FAILURE MODE IS ZERO OUTPUT. THE NASA FMEA FAILURE MODE IS LOSS OF OUTPUT INCLUDING ERRONEOUS SIGNAL. THE TANK COULD RUPTURE STARTING 9 HOURS AFTER TANK RESIDUAL LEVEL IS REACHED. THE OFF POSITION OF THE SWITCH IS A REDUNDANCY. IF THE HEATERS OF BOTH TANKS 1 AND 2 OR 3 AND 4 ARE SELECTED TO THE AUTOMATIC MODE, THE CRITICALITY WOULD BE A 3/1R, BECAUSE THEIR TANK SENSOR LOGIC WOULD BE CONNECTED, AND BOTH TANK PAIR'S SENSORS WOULD HAVE TO FAIL. IT IS RECOMMENDED THAT A SEPARATE FMEA BE WRITTEN FOR THIS FAILURE MODE BECAUSE ITS EFFECT IS VASTLY DIFFERENT FROM A FAILURE OF FULL OUTPUT.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-341
NASA FMEA #: M4-1B2-MT018-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 341
ITEM: O2 TANK HEATER CONTROLLER PRESSURE SENSOR/TRANSDUCER (4)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /1R]	[P]	[P]	[P]	[ ] *
IOA	[1 /1]	[P]	[P]	[P]	[X]
COMPARE	[N /N]	[ ]	[ ]	[ ]	[N]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-MT018-1 AND M4-1B1-MT018-1.
THE IOA FAILURE MODE IS OUT OF TOLERANCE. THE NASA FMEA FAILURE MODE IS LOSS OF OUTPUT INCLUDING ERRONEOUS SIGNAL. THIS COULD CAUSE A RANGE OF RESULTS, FROM REACTANT PRESSURE BEING TOO LOW TO REACTANT DEPLETION AND A TANK RUPTURE STARTING 9 HOURS AFTER THE TANK RESIDUAL LEVEL IS REACHED. SENSOR READINGS NEAR ZERO COULD CAUSE THE TANK HEATERS TO BE ON IF THE HEATERS OF BOTH TANKS 1 AND 2, OR 3 AND 4 ARE SELECTED TO THE AUTOMATIC MODE. THE REDUNDANT PATH IS PUTTING THE HEATER SWITCH IN THE OFF POSITION.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-342
NASA FMEA #: M4-1B2-MT010-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 342
ITEM: O2 TANK PRESSURE SENSOR (5)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[NA]	[NA]	[NA]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-MT010-1 AND M4-1B1-MT010-1.
THE FAILURE MODE IS FULL OUTPUT.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-343
NASA FMEA #: M4-1B2-MT010-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 343
ITEM: O2 TANK PRESSURE SENSOR (5)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[NA]	[NA]	[NA]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-MT010-1 AND M4-1B1-MT010-1.
THE FAILURE MODE IS ZERO OUTPUT.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-344 BASELINE [ ]
NASA FMEA #: M4-1B2-MT010-1 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 344
ITEM: O2 TANK PRESSURE SENSOR (5)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[NA]	[NA]	[NA]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ]
(ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-MT010-1 AND M4-1B1-MT010-1.
THE FAILURE MODE IS OUT OF TOLERANCE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-345 BASELINE [ ]
NASA FMEA #: M4-1B2-PC010-1 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 345
ITEM: O2 (PRE-FLIGHT) FILL AND VENT QD CAPS M4-1B2-(9), M4-1B1-(7), 04-1B-(5)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[F]	[P]	[X] *
IOA	[3 /1R]	[P]	[F]	[P]	[X]
COMPARE	[N /]	[ ]	[ ]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [ ]
INADEQUATE [X]

REMARKS:
ALSO NASA FMEA'S 04-1B-MT010-1 AND M4-1B1-MT010-1.
THE FAILURE MODE IS EXTERNAL LEAKAGE. BECAUSE THE QD HAS AN ALLOWABLE LEAK RATE, THIS FAILURE COULD RESULT IN THE ACCUMULATION OF O2 IN THE ORBITER MID FUSELAGE AND A POSSIBLE EXPLOSION. SCREEN B SHOULD BE NA PER NSTS 22206 SECTION 2.3.4.b.2.a. BECAUSE THE CAP IS A STANDBY REDUNDANT ITEM TO THE QD.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-346
NASA FMEA #: M4-1B2-PD010-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 346
ITEM: O2 (PRE-FLIGHT) FILL QUICK DISCONNECTS (4) AND VENT QD'S (5)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[F]	[P]	[X] *
IOA	[3 /1R]	[P]	[F]	[P]	[X]
COMPARE	[N /]	[ ]	[ ]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [X]

REMARKS:
ALSO NASA FMEA'S 04-1B-PD010-1 AND M4-1B1-PD010-1.
THE FAILURE MODE IS FAILS OPEN OR EXTERNAL LEAKAGE. THE RETENTION RATIONALE IS NOT AVAILABLE. IF THE CAP ALSO LEAKED, O2 COULD ACCUMULATE IN THE MID FUSELAGE AND POSSIBLY RESULT IN AN EXPLOSION.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-347 BASELINE [ ]
NASA FMEA #: NEW [ ]

SUBSYSTEM: EPG
MDAC ID: 347
ITEM: O2 (PRE-FLIGHT) FILL QUICK DISCONNECTS (4) AND VENT QD'S (5)

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[/]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[N /N]	[N]	[N]	[N]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[3 /3]	[NA]	[NA]	[NA]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
THE FMEA DID NOT INCLUDE THIS FAILURE MODE (INABILITY TO MATE/DEMATE). FOR COMPLETENESS, NASA MAY WANT TO CONSIDER WRITING A FMEA FOR THIS FAILURE MODE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-348
NASA FMEA #: M4-1B2-LV013-3

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 348
ITEM: O2 FUEL CELL REACTANT VALVE POSITION INDICATORS (3) V45X1150E, V45X1155E, V45X1160E

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[NA]	[NA]	[NA]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV013-3 AND M4-1B1-LV013-3.
THE FAILURE MODE IS READS OPEN WHEN THE VALVE IS CLOSED. THE NASA FMEA INCLUDES ANALYSIS ON THE O2 FUEL CELL VALVES WITH THE FAILURE MODE BEING SWITCH POSITION INDICATOR FAILS OPEN. IT IS RECOMMENDED THAT THE NASA FMEA ITEM BE CHANGED TO THE POSITION INDICATOR RATHER THAN THE VALVE ITSELF, SINCE THE VALVE COULD BE OPERATING PERFECTLY. THE NASA FMEA IS INCONSISTENT IN THE FAILURE DETECTABLE IN FLIGHT SECTION; THE FMEA MENTIONS THAT THE INDICATOR READS CLOSED, BUT THE VALVE IS OPEN.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-349 BASELINE [ ]
NASA FMEA #: M4-1B2-LV013-4 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 349
ITEM: O2 FUEL CELL REACTANT VALVE POSITION INDICATORS (3) V45X1150E, V45X1155E, V45X1160E

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[NA]	[NA]	[NA]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV013-4 AND M4-1B1-LV013-4.
THE FAILURE MODE IS READS OPEN WHEN THE VALVE IS CLOSED. THE NASA FMEA INCLUDES ANALYSIS ON THE O2 FUEL CELL VALVES WITH THE FAILURE MODE BEING SWITCH POSITION INDICATOR FAILS OPEN. THESE SHOULD READ FAILS CLOSED, NOT OPEN. IT IS RECOMMENDED THAT THE NASA FMEA ITEM BE CHANGED TO THE POSITION INDICATOR RATHER THAN THE VALVE ITSELF, SINCE THE VALVE COULD BE OPERATING PERFECTLY.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-350
NASA FMEA #: M4-1B2-LV033-3

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 350
ITEM: H2 FUEL CELL REACTANT VALVE POSITION INDICATORS (3) V45X2150E, V45X2155E, V45X2160E

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[NA]	[NA]	[NA]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV033-3 AND M4-1B1-LV033-3.
THE FAILURE MODE IS READS CLOSED WHEN THE VALVE IS OPEN. THE NASA FMEA INCLUDES ANALYSIS ON THE O2 FUEL CELL VALVES WITH THE FAILURE MODE BEING SWITCH POSITION INDICATOR FAILS OPEN. THESE SHOULD READ FAILS CLOSED, NOT OPEN. IT IS RECOMMENDED POSITION INDICATOR RATHER THAN THE VALVE ITSELF, SINCE THE VALVE COULD BE OPERATING PERFECTLY. THE NASA FMEA IS INCONSISTENT IN THE FAILURE DETECTABLE IN FLIGHT SECTION; THE FMEA MENTIONS THAT THE INDICTOR READS CLOSED, BUT THE VALVE IS OPEN.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-351
NASA FMEA #: M4-1B2-LV033-4

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 351
ITEM: H2 FUEL CELL REACTANT VALVE POSITION INDICATORS (3) V45X2150E, V45X2155E, V45X2160E

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[NA]	[NA]	[NA]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV033-4 AND M4-1B1-LV033-4.
THE FAILURE MODE IS READS CLOSED WHEN THE VALVE IS OPEN. THE NASA FMEA INCLUDES ANALYSIS ON THE H2 FUEL CELL VALVES WITH THE FAILURE MODE BEING SWITCH POSITION INDICATOR FAILS OPEN. THESE SHOULD READ FAILS CLOSED, NOT OPEN. IT IS RECOMMENDED THAT THE FMEA ITEM BE CHANGED TO THE POSITION INDICATOR RATHER THAN THE VALVE ITSELF, SINCE THE VALVE COULD BE OPERATING PERFECTLY.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-352 BASELINE [ ]
NASA FMEA #: M4-1B2-LV012-3 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 352
ITEM: O2 ECLSS SYSTEM SUPPLY VALVE POSITION INDICATOR (2) V45X1080E, V45X1083E

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[NA]	[NA]	[NA]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV012-3 AND M4-1B1-LV012-3.
THE FAILURE MODE IS READS OPEN WHEN THE VALVE IS CLOSED. THE NASA FMEA INCLUDES ANALYSIS ON THE ECLSS VALVES WITH THE FAILURE MODE BEING SWITCH POSITION INDICATOR FAILS OPEN. IT IS RECOMMENDED THAT THE NASA FMEA ITEM BE CHANGED TO THE POSITION INDICATOR RATHER THAN THE VALVE ITSELF, SINCE THE VALVE COULD BE OPERATING PERFECTLY. THE NASA FMEA IS INCONSISTENT IN THE FAILURE DETECTABLE IN FLIGHT SECTION; THE FMEA MENTIONS THAT THE INDICATOR READS CLOSED, BUT THE VALVE IS OPEN.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-353
NASA FMEA #: M4-1B2-LV012-4

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 353
ITEM: O2 ECLSS SYSTEM SUPPLY VALVE POSITION INDICATOR (2) V45X1080E, V45X1083E

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[NA]	[NA]	[NA]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV012-4 AND M4-1B1-LV012-4.
THE FAILURE MODE IS READS CLOSED WHEN THE VALVE IS OPEN. THE NASA FMEA INCLUDES ANALYSIS ON THE ECLSS VALVES WITH THE FAILURE MODE BEING SWITCH POSITION INDICATOR FAILS OPEN. THESE SHOULD READ FAILS CLOSED, NOT OPEN. IT IS RECOMMENDED THAT THE NASA FMEA ITEM BE CHANGED TO THE POSITION INDICATOR RATHER THAN THE VALVE ITSELF, SINCE THE VALVE COULD BE OPERATING PERFECTLY.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-354
NASA FMEA #: M4-1B2-LV011-3

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 354
ITEM: O2 MANIFOLD VALVE POSITION INDICATORS (2)
V45X1141E, V45X1146E

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[NA]	[NA]	[NA]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV011-3 AND M4-1B1-LV011-3.
THE FAILURE MODE IS READS OPEN WHEN THE VALVE IS CLOSED. THE NASA FMEA INCLUDES ANALYSIS ON BOTH 02 MANIFOLD VALVES WITH THE FAILURE MODE BEING SWITCH POSITION INDICATOR FAILS OPEN. IT IS RECOMMENDED THAT THE NASA FMEA ITEM BE CHANGED TO THE POSITION INDICATOR RATHER THAN THE VALVE ITSELF, SINCE THE VALVE COULD BE OPERATING PERFECTLY. THE NASA FMEA IS INCONSISTENT IN THE FAILURE DETECTABLE IN FLIGHT SECTION; THE FMEA MENTIONS THAT THE INDICATOR READS CLOSED, BUT THE VALVE IS OPEN.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-355 BASELINE [ ]
NASA FMEA #: M4-1B2-LV011-4 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 355
ITEM: O2 MANIFOLD VALVE POSITION INDICATORS (2)
V45X1141E, V45X1146E

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[NA]	[NA]	[NA]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV011-4 AND M4-1B1-LV011-4.
THE FAILURE MODE IS READS CLOSED WHEN THE VALVE IS OPEN. THE NASA FMEA INCLUDES ANALYSIS ON BOTH O2 MANIFOLD VALVES WITH THE FAILURE MODE BEING SWITCH POSITION INDICATORS FAILS CLOSED. IT IS RECOMMENDED THAT THE NASA FMEA ITEM BE CHANGED TO THE POSITION INDICATOR RATHER THAN THE VALVE ITSELF, SINCE THE VALVE COULD BE OPERATING PERFECTLY.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-356 BASELINE [ ]
NASA FMEA #: M4-1B2-LV031-3 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 356
ITEM: H2 MANIFOLD VALVE POSITION INDICATORS (2)
V45X2141E, V45X2146E

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[NA]	[NA]	[NA]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV031-3 AND M4-1B1-LV031-3.
THE FAILURE MODE IS READS OPEN WHEN THE VALVE IS CLOSED. THE NASA FMEA INCLUDES ANALYSIS ON BOTH H2 MANIFOLD VALVES WITH THE FAILURE MODE BEING SWITCH POSITION INDICATOR FAILS OPEN. IT IS RECOMMENDED THAT THE NASA FMEA ITEM BE CHANGED TO THE POSITION INDICATOR RATHER THAN THE VALVE ITSELF, SINCE THE VALVE COULD BE OPERATING PERFECTLY. THE NASA FMEA IS INCONSISTENT IN THE FAILURE DETECTABLE IN FLIGHT SECTION; THE FMEA MENTIONS THAT THE INDICATOR READS CLOSED, BUT THE VALVE IS OPEN.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-357 BASELINE [ ]
NASA FMEA #: M4-1B2-LV031-4 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 357
ITEM: H2 MANIFOLD VALVE POSITION INDICATORS (2)
V45X2141E, V45X2146E

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[NA]	[NA]	[NA]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ]
(ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV031-4 AND M4-1B1-LV031-4.
THE FAILURE MODE IS READS CLOSED WHEN THE VALVE IS OPEN. THE NASA FMEA INCLUDES ANALYSIS ON BOTH H2 MANIFOLD VALVES WITH THE FAILURE MODE BEING SWITCH POSITION INDICATOR FAILS CLOSED. IT IS RECOMMENDED THAT THE NASA FMEA ITEM BE CHANGED TO THE POSITION INDICATOR RATHER THAN THE VALVE ITSELF, SINCE THE VALVE COULD BE OPERATING PERFECTLY.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-358 BASELINE [ ]
NASA FMEA #: M4-1B2-FL010-1 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 358
ITEM: 02 FILTER (4) FL010,FL020,FL410,FL460

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[P]	[P]	[X] *
IOA	[3 /1R]	[P]	[P]	[P]	[ ]
COMPARE	[N /]	[ ]	[ ]	[ ]	[N]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S: 04-1B-FL010-1 FOR O2 FILTER (2) - FL010, FL020 AND M4-1B1-FL010-1 FOR O2 FILTER (3) - FL010, FL020, FL410.. THE FAILURE MODE IS RESTRICTED FLOW. THE HARDWARE CRITICALITY IS A 2 BECAUSE IF THE SAME TANK'S RELIEF VALVE ALSO FAILED CLOSED, AN EXPLOSION COULD OCCUR DUE TO CONDUCTIVE HEAT TRANSFER INTO THE TANK.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-359
NASA FMEA #: M4-1B2-CV010-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 359
ITEM: 02 CHECK VALVE (1) CV020

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[F]	[P]	[ ] *
IOA	[2 /1R]	[P]	[F]	[P]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[N]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-CV010-1 AND M4-1B1-CV010-1.
THE FAILURE MODE IS FAILS OPEN OR INTERNAL LEAKAGE. THE HARDWARE CRITICALITY SHOULD BE A 3.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-360
NASA FMEA #: M4-1B2-CV010-2

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 360
ITEM: 02 CHECK VALVE (1) CV020

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[P]	[P]	[X] *
IOA	[3 /1R]	[P]	[P]	[P]	[ ]
COMPARE	[N /]	[ ]	[ ]	[ ]	[N]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [X]

REMARKS:
ALSO NASA FMEA'S 04-1B-CV010-2 AND M4-1B1-CV010-2.
THE FAILURE MODE IS FAILS CLOSED OR RESTRICTED FLOW. THE HARDWARE CRITICALITY IS A 2 BECAUSE IF THE SAME TANK'S RELIEF VALVE ALSO FAILED CLOSED, AN EXPLOSION COULD OCCUR DUE TO CONDUCTIVE HEAT TRANSFER INTO THE TANK. THE RETENTION RATIONALE IS NOT AVAILABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-361
NASA FMEA #: M4-1B2-A01FSO-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 361
ITEM: 02 CHECK VALVE (1) CV020

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[NA]	[NA]	[NA]	[X] *
IOA	[1 /1]	[NA]	[NA]	[NA]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-A01FSO-1 AND M4-1B1-A01FSO-1.
THE FAILURE MODE IS EXTERNAL LEAKAGE. THE NASA FMEA COVERS THE EXTERNAL LEAKAGE OF MOST COMPONENTS IN ONE FMEA, AND SINCE THE EFFECT IS THE SAME, IT IS AGREEABLE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-362X
NASA FMEA #: M4-1B2-LV045-4

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 362
ITEM: H2 GSE SUPPLY VALVE POSITION INDICATOR (1)
V45X2195E

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[NA]	[NA]	[NA]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV045-4 AND M4-1B1-LV045-4.
THE FAILURE MODE IS READS OPEN WHEN THE VALVE IS CLOSED. THE NASA FMEA INCLUDES ANALYSIS OF THE H2 GSE SUPPLY VALVE, WITH THE FAILURE MODE BEING SWITCH POSITION INDICATOR FAILS OPEN. IT IS RECOMMENDED THAT THE NASA FMEA ITEM BE CHANGED TO THE POSITION INDICATOR RATHER THAN THE VALVE ITSELF, SINCE THE VALVE COULD BE OPERATING PERFECTLY.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-363X BASELINE [ ]
NASA FMEA #: M4-1B2-LV045-3 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 363
ITEM: H2 GSE SUPPLY VALVE POSITION INDICATOR (1)
V45X2195E

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[NA]	[NA]	[NA]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV045-3 AND M4-1B1-LV045-3.
THE FAILURE MODE IS READS CLOSED WHEN THE VALVE IS OPEN. THE NASA FMEA INCLUDES ANALYSIS OF THE H2 GSE SUPPLY VALVE, WITH THE FAILURE MODE BEING SWITCH POSITION INDICATOR FAILS CLOSED. IT IS RECOMMENDED THAT THE NASA FMEA ITEM BE CHANGED TO THE POSITION INDICATOR RATHER THAN THE VALVE ITSELF, SINCE THE VALVE COULD BE OPERATING PERFECTLY.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88
ASSESSMENT ID: PRSD-364X
NASA FMEA #: M4-1B2-LV015-4

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: EPG
MDAC ID: 364
ITEM: O2 GSE SUPPLY VALVE POSITION INDICATOR (1)
V45X1195E

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[NA]	[NA]	[NA]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]
RECOMMENDATIONS: (If different from NASA)					
	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV015-4 AND M4-1B1-LV015-4.
THE FAILURE MODE IS READS OPEN WHEN THE VALVE IS CLOSED. THE NASA FMEA INCLUDES ANALYSIS OF THE O2 GSE SUPPLY VALVE, WITH THE FAILURE MODE BEING SWITCH POSITION INDICATOR FAILS OPEN. IT IS RECOMMENDED THAT THE NASA FMEA ITEM BE CHANGED TO THE POSITION INDICATOR RATHER THAN THE VALVE ITSELF, SINCE THE VALVE COULD BE OPERATING PERFECTLY.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 2/17/88 NASA DATA:
ASSESSMENT ID: PRSD-365X BASELINE [ ]
NASA FMEA #: M4-1B2-LV015-3 NEW [X]

SUBSYSTEM: EPG
MDAC ID: 365
ITEM: O2 GSE SUPPLY VALVE POSITION INDICATOR (1)
V45X1195E

LEAD ANALYST: B. E. AMES

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[NA]	[NA]	[NA]	[ ] *
IOA	[3 /3]	[NA]	[NA]	[NA]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/] [ ] [ ] [ ] [ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
ALSO NASA FMEA'S 04-1B-LV015-3 AND M4-1B1-LV015-3.
THE FAILURE MODE IS READS CLOSED WHEN THE VALVE IS OPEN. THE NASA FMEA INCLUDES ANALYSIS OF THE O2 GSE SUPPLY VALVE, WITH THE FAILURE MODE BEING SWITCH POSITION INDICATOR FAILS CLOSED. IT IS RECOMMENDED THAT THE NASA FMEA ITEM BE CHANGED TO THE POSITION INDICATOR RATHER THAN THE VALVE ITSELF, SINCE THE VALVE COULD BE OPERATING PERFECTLY.

APPENDIX D

CRITICAL ITEMS

APPENDIX D
CRITICAL ITEMS

MDAC ID	ITEM	FAILURE MODE
200	H2 (PRE-FLIGHT) FILL QUICK DISCONNECT (4) & VENT QD'S (5)	EXTERNAL LEAKAGE
202	H2 (PRE-FLIGHT) FILL AND VENT QD CAPS (9)	EXTERNAL LEAKAGE
211	H2 TANK RELIEF VALVE (5) - RV030,RV040,RV500,RV560	FAILED OPEN (ALSO INTERNAL LEAKAGE)
218	H2 TANK SUBASSEMBLY (5)	
229	H2 LINES, COMPONENTS, & FITTINGS	RESTRICTED FLOW
231	H2 MANIFOLD 1 RELIEF VALVE (1) RV031	FAILED OPEN (ALSO INTERNAL LEAKAGE)
234	H2 MANIFOLD 2 RELIEF VALVE (1) RV041	FAILED OPEN (ALSO INTERNAL LEAKAGE)
237	H2 CHECK VALVE (2) CV031,CV041	FAILS OPEN (ALSO INTERNAL LEAKAGE)
240	H2 CHECK VALVE (1) CV030	FAILS OPEN (ALSO INTERNAL LEAKAGE)
243	H2 CHECK VALVE (1) CV040	FAILS OPEN (ALSO INTERNAL LEAKAGE)
246	H2 HORIZONTAL DRAIN QD (1) TYPE II, CLASS 8	EXTERNAL LEAKAGE
248	H2 HORIZONTAL DRAIN CAP (1)	EXTERNAL LEAKAGE
255	H2 FUEL CELL 1 SOLENOID REACTANT SUPPLY VALVE (1) LV033	FAILS OPEN (INCLUDES INTERNAL LEAKAGE)
256	H2 FUEL CELL 1 SOLENOID REACTANT SUPPLY VALVE (1) LV033	FAILS CLOSED
258	H2 FUEL CELL 2 SOLENOID REACTANT SUPPLY VALVE (1) LV043	FAILS OPEN (INCLUDES INTERNAL LEAKAGE)
259	H2 FUEL CELL 2 SOLENOID REACTANT SUPPLY VALVE (1) LV043	FAILS CLOSED
261	H2 FUEL CELL 3 SOLENOID REACTANT SUPPLY VALVE (1) LV044	FAILS OPEN (INCLUDES INTERNAL LEAKAGE)
262	H2 FUEL CELL 3 SOLENOID REACTANT SUPPLY VALVE (1) LV044	FAILS CLOSED
267	H2 SOLENOID GSE SUPPLY VALVE (1) LV045	FAILS OPEN (INCLUDES INTERNAL LEAKAGE)
270	H2 FILL GSE SUPPLY T-0 QUICK DISCONNECT (1) PD035	EXTERNAL LEAKAGE
272	02 CHECK VALVE (1) CV010	FAILS OPEN (INTERNAL LEAKAGE ALSO)
275	02 SOLENOID GSE SUPPLY VALVE (1) LV015	FAILS OPEN (INTERNAL LEAKAGE ALSO)
278	02 SOLENOID ECLSS SYSTEM 1 SUPPLY VALVE (1) LV012	FAILS OPEN (INTERNAL LEAKAGE ALSO)

MDAC ID	ITEM	FAILURE MODE
279	02 SOLENOID ECLSS SYSTEM 1 SUPPLY VALVE (1) LV012	FAILS CLOSED
281	02 SOLENOID ECLSS SYSTEM 2 SUPPLY VALVE (1) LV022	FAILS OPEN (INTERNAL LEAKAGE ALSO)
282	02 SOLENOID ECLSS SYSTEM 2 SUPPLY VALVE (1) LV022	FAILS CLOSED
284	02 FILL GSE SUPPLY T-0 QUICK DISCONNECT (1) PD015	EXTERNAL LEAKAGE
289	02 FUEL CELL 1 SOLENOID REACTANT SUPPLY VALVE (1) LV013	FAILS OPEN (INCLUDES INTERNAL LEAKAGE)
290	02 FUEL CELL 1 SOLENOID REACTANT SUPPLY VALVE (1) LV013	FAILS CLOSED
298	02 HORIZONTAL DRAIN QD (1)	EXTERNAL LEAKAGE
300	02 HORIZONTAL DRAIN CAP (1)	EXTERNAL LEAKAGE
301	02 FUEL CELL 3 SOLENOID REACTANT SUPPLY VALVE (1) LV024	FAILS OPEN (INCLUDES INTERNAL LEAKAGE)
302	02 FUEL CELL 3 SOLENOID REACTANT SUPPLY VALVE (1) LV024	FAILS CLOSED
304	02 FUEL CELL 2 SOLENOID REACTANT SUPPLY VALVE (1) LV023	FAILS OPEN (INCLUDES INTERNAL LEAKAGE)
305	02 FUEL CELL 2 SOLENOID REACTANT SUPPLY VALVE (1) LV023	FAILS CLOSED
307	02 MANIFOLD 1 RELIEF VALVE (1) RV011	FAILED OPEN (ALSO INTERNAL LEAKAGE)
310	02 MANIFOLD 2 RELIEF VALVE (1) RV021	FAILED OPEN (ALSO INTERNAL LEAKAGE)
313	02 CHECK VALVE (2) CV021	FAILS OPEN (INTERNAL LEAKAGE ALSO)
317	02 LINES, COMPONENTS, & FITTINGS	RESTRICTED FLOW
332	02 TANK SUBASSEMBLY (5)	LOSS OF ANNULUS VACUUM
334	02 TANK RELIEF VALVE (5) RV010,RV020,RV410,RV460	FAILED OPEN (ALSO INTERNAL LEAKAGE)
345	02 (PRE-FLIGHT) FILL AND VENT QD CAPS (9)	EXTERNAL LEAKAGE
346	02 (PRE-FLIGHT) FILL QUICK DISCONNECTS (4) AND VENT QD'S (5)	EXTERNAL LEAKAGE
359	02 CHECK VALVE (1) CV020	FAILS OPEN (INTERNAL LEAKAGE ALSO)

APPENDIX E
DETAILED ANALYSIS

This appendix contains the IOA analysis worksheets supplementing previous results reported in STSEOS Working Paper 1.0-WP-VA86001-11, Analysis of the EPG/PRSD, (5 December 1986). Prior results were obtained independently and documented before starting the FMEA/CIL assessment activity. Supplemental analysis was performed to address failure modes not previously considered by the IOA. Each sheet identifies the hardware item being analyzed, parent assembly and function performed. For each failure mode possible causes are identified, and hardware and functional criticality for each mission phase are determined as described in NSTS 22206, Instructions for Preparation of FMEA and CIL, 10 October 1986. Failure mode effects are described at the bottom of each sheet and worst case criticality is identified at the top.

LEGEND FOR IOA ANALYSIS WORKSHEETS

Hardware Criticalities:

- 1 = Loss of life or vehicle
- 2 = Loss of mission or next failure of any redundant item (like or unlike) could cause loss of life/vehicle
- 3 = All others

Functional Criticalities:

- 1R = Redundant hardware items (like or unlike) all of which, if failed, could cause loss of life or vehicle.
- 2R = Redundant hardware items (like or unlike) all of which, if failed, could cause loss of mission.

Redundancy Screen A:

- 1 = Is Checked Out PreFlight
- 2 = Is Capable of Check Out PreFlight
- 3 = Not Capable of Check Out PreFlight
- NA = Not Applicable

Redundancy Screens B and C:

- P = Passed Screen
- F = Failed Screen
- NA = Not Applicable

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/31/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPG FLIGHT: 3/3
MDAC ID: 362 ABORT: 3/3

ITEM: H2 GSE SUPPLY VALVE POSITION INDICATOR (1)
V45X2195E
FAILURE MODE: READS OPEN WHEN VALVE CLOSED

LEAD ANALYST: S. GOTCH SUBSYS LEAD: M. HIOTT

BREAKDOWN HIERARCHY:
1) EPG
2) PRSD
3) HYDROGEN DISTRIBUTION
4) H2 VALVE MODULE 2
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/3	AOA:	3/3
DEORBIT:	3/3	ATO:	3/3
LANDING/SAFING:	3/3		

REDUNDANCY SCREENS: A [NA] B [NA] C [NA]

LOCATION: MID FUSELAGE
PART NUMBER:

CAUSES: ELECTRICAL FAILURE, CORROSION, VIBRATION, SHOCK

EFFECTS/RATIONALE:
THE SENSOR IS USED TO TELL THE CREW OF VALVE'S POSITION. NORMALLY THE VALVE IS CLOSED AFTER PRELAUNCH ACTIVITIES. THE FAILURE MAY NOT BE ABLE TO BE VERIFIED.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/31/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPG FLIGHT: 3/3
MDAC ID: 363 ABORT: 3/3

ITEM: H2 GSE SUPPLY VALVE POSITION INDICATOR (1)
V45X2195E
FAILURE MODE: READS CLOSED WHEN VALVE OPEN

LEAD ANALYST: S. GOTCH SUBSYS LEAD: M. HIOTT

BREAKDOWN HIERARCHY:
1) EPG
2) PRSD
3) HYDROGEN DISTRIBUTION
4) H2 VALVE MODULE 2
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/3	AOA:	3/3
DEORBIT:	3/3	ATO:	3/3
LANDING/SAFING:	3/3		

REDUNDANCY SCREENS: A [NA] B [NA] C [NA]

LOCATION: MID FUSELAGE
PART NUMBER:

CAUSES: ELECTRICAL FAILURE, CORROSION, VIBRATION, SHOCK

EFFECTS/RATIONALE:
THE SENSOR IS USED TO TELL THE CREW OF VALVE'S POSITION. NORMALLY THE VALVE IS CLOSED AFTER PRELAUNCH ACTIVITIES. THE FAILURE MAY NOT BE ABLE TO BE VERIFIED.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/31/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPG FLIGHT: 3/3
MDAC ID: 364 ABORT: 3/3

ITEM: O2 GSE SUPPLY VALVE POSITION INDICATOR (1)
V45X1195E
FAILURE MODE: READS OPEN WHEN VALVE CLOSED

LEAD ANALYST: S. GOTCH SUBSYS LEAD: M. HIOTT

BREAKDOWN HIERARCHY:
1) EPG
2) PRSD
3) OXYGEN DISTRIBUTION
4) O2 VALVE MODULE 1
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/3	AOA:	3/3
DEORBIT:	3/3	ATO:	3/3
LANDING/SAFING:	3/3		

REDUNDANCY SCREENS: A [NA] B [NA] C [NA]

LOCATION: MID FUSELAGE
PART NUMBER:

CAUSES: ELECTRICAL FAILURE, CORROSION, VIBRATION, SHOCK

EFFECTS/RATIONALE:
THE SENSOR IS USED TO TELL THE CREW OF VALVE'S POSITION. NORMALLY THE VALVE IS CLOSED AFTER PRELAUNCH ACTIVITIES. THE FAILURE MAY NOT BE ABLE TO BE VERIFIED.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/31/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPG FLIGHT: 3/3
MDAC ID: 365 ABORT: 3/3

ITEM: O2 GSE SUPPLY VALVE POSITION INDICATOR (1)
V45X1195E
FAILURE MODE: READS CLOSED WHEN VALVE OPEN

LEAD ANALYST: S. GOTCH SUBSYS LEAD: M. HIOTT

BREAKDOWN HIERARCHY:
1) EPG
2) PRSD
3) OXYGEN DISTRIBUTION
4) O2 VALVE MODULE 1
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/3	AOA:	3/3
DEORBIT:	3/3	ATO:	3/3
LANDING/SAFING:	3/3		

REDUNDANCY SCREENS: A [NA] B [NA] C [NA]

LOCATION: MID FUSELAGE
PART NUMBER:

CAUSES: ELECTRICAL FAILURE, CORROSION, VIBRATION, SHOCK

EFFECTS/RATIONALE:
THE SENSOR IS USED TO TELL THE CREW OF VALVE'S POSITION. NORMALLY THE VALVE IS CLOSED AFTER PRELAUNCH ACTIVITIES. THE FAILURE MAY NOT BE ABLE TO BE VERIFIED.

REFERENCES:

APPENDIX F
NASA FMEA TO IOA WORKSHEET CROSS REFERENCE/RECOMMENDATIONS

This section provides a cross reference between the NASA FMEA and corresponding IOA analysis worksheet(s) included in Appendix E. The Appendix F identifies: NASA FMEA Number, IOA Assessment Number, NASA criticality and redundancy screen data, and IOA recommendations.

Appendix F Legend

Code	Definition
1	IOA recommends that a FMEA for this failure mode be written.
2	IOA recommends maintaining all the components listed on this sheet in the NASA FMEA/CIL list to ensure visibility whenever more than two tank sets fly.
3	IOA concurs with NASA's re-evaluation.
4	IOA recommends changing the hardware criticality to a 3.
5	IOA recommends changing the hardware criticality to a 3 for greater than two tank sets.
6	IOA recommends that screen B be NA per NSTS 22206 section 2.3.4.b.2.a. because the component is standby redundant.
7	IOA recommends passing screen B per NSTS 22206 section 2.3.5.a. because the failure mode is detectable with a valve position indicator.
8	The CIL retention rationale was not available for review.
9	IOA recommends that the NASA FMEA item be changed from the valve to the valve position indicator.
10	IOA recommends that a separate FMEA be written for this failure mode.
11	IOA generated a non-credible failure mode.
12	IOA generated a failure mode covered by EPD&C.
13	IOA recommends that the NASA FMEA hardware criticality be a 2 for the onorbit phase also, because loss of a fuel cell impacts the mission.

APPENDIX F

NASA FMEA TO IOA WORKSHEET CROSS REFERENCE / RECOMMENDATIONS

IDENTIFIERS		NASA			IOA RECOMMENDATIONS #				
NASA FMEA NUMBER	IOA ASSESSMENT NUMBER	CRIT HW/F	SCREENS A	B C	CRIT HW/F	SCREENS A	B C	OTHER (SEE LEGEND CODE)	ISSUE
	PRSD-201	/			3/3	NA	NA NA	1	X
	PRSD-209	/			/			12	
	PRSD-210	/			3/1R	P	P P	1	X
	PRSD-219	/			3/3	NA	NA NA	1	X
	PRSD-220	/			3/3	NA	NA NA	1	X
	PRSD-221	/			3/3	NA	NA NA	1	X
	PRSD-222	/			3/3	NA	NA NA	1	X
	PRSD-223	/			3/3	NA	NA NA	1	X
	PRSD-224	/			3/3	NA	NA NA	1	X
	PRSD-225	/			3/3	NA	NA NA	1	X
	PRSD-226	/			3/3	NA	NA NA	1	X
	PRSD-227	/			3/3	NA	NA NA	1	X
	PRSD-229	/			/			11	
	PRSD-238	/			2/1R	P	P P	1	X
	PRSD-247	/			3/3	NA	NA NA	1	X
	PRSD-271	/			3/3	NA	NA NA	1	X
	PRSD-285	/			3/3	NA	NA NA	1	X
	PRSD-299	/			3/3	NA	NA NA	1	X
	PRSD-314	/			2/1R	P	P P	1	X
	PRSD-317	/			/			11	
	PRSD-318	/			3/3	NA	NA NA	1	X
	PRSD-319	/			3/3	NA	NA NA	1	X
	PRSD-320	/			3/3	NA	NA NA	1	X
	PRSD-321	/			3/3	NA	NA NA	1	X
	PRSD-322	/			3/3	NA	NA NA	1	X
	PRSD-323	/			3/3	NA	NA NA	1	X
	PRSD-324	/			3/3	NA	NA NA	1	X
	PRSD-325	/			3/3	NA	NA NA	1	X
	PRSD-326	/			3/3	NA	NA NA	1	X
	PRSD-327	/			3/3	NA	NA NA	1	X
	PRSD-328	/			3/3	NA	NA NA	1	X
	PRSD-329	/			3/3	NA	NA NA	1	X
	PRSD-337	/			/			12	
	PRSD-338	/			3/1R	P	P P	1	X
	PRSD-347	/			3/3	NA	NA NA	1	X
M4-182-PD030-1	PRSD-200	2/1R	P	F P	/			3, 8	
M4-1B1-A01FSH-1	PRSD-245	1/1	NA	NA NA	/			3	
M4-1B1-A01FSO-1	PRSD-312	1/1	NA	NA NA	/			3	
M4-1B2-A01FSO-1	PRSD-291	1/1	NA	NA NA	/			3	
M4-1B2-A01FSH-1	PRSD-213	1/1	NA	NA NA	/			2	
	PRSD-228	1/1	NA	NA NA	/			3	
	PRSD-233	1/1	NA	NA NA	/			3	
	PRSD-236	1/1	NA	NA NA	/			3	
	PRSD-239	1/1			/				X
	PRSD-242	1/1	NA	NA NA	/			3	

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M4-1B2-A01FSH-1	PRSD-254	1/1	NA	NA	NA	/				3	
	PRSD-257	1/1	NA	NA	NA	/				3	
	PRSD-260	1/1	NA	NA	NA	/				3	
	PRSD-263	1/1	NA	NA	NA	/				3	
	PRSD-266	1/1	NA	NA	NA	/				3	
	PRSD-269	1/1	NA	NA	NA	/				3	
M4-1B2-A01FSO-1	PRSD-274	1/1	NA	NA	NA	/				3	
	PRSD-277	1/1	NA	NA	NA	/				3	
	PRSD-280	1/1	NA	NA	NA	/				3	
	PRSD-283	1/1	NA	NA	NA	/				3	
	PRSD-294	1/1	NA	NA	NA	/				3	
	PRSD-297	1/1	NA	NA	NA	/				3	
	PRSD-303	1/1	NA	NA	NA	/				3	
	PRSD-306	1/1	NA	NA	NA	/				3	
	PRSD-309	1/1	NA	NA	NA	/				3	
	PRSD-315	1/1				/					X
	PRSD-316	1/1	NA	NA	NA	/				3	
	PRSD-336	1/1	NA	NA	NA	/				2	
	PRSD-361	1/1	NA	NA	NA	/				3	
M4-1B2-CV010-1	PRSD-272	2/1R	P	P	P	/				3	
	PRSD-313	2/1R				3/1R	P	P	P	1	X
	PRSD-359	2/1R	P	P	P	/				3	
M4-1B2-CV010-2	PRSD-273	2/1R	P	P	P	/				3, 8	
	PRSD-360	2/1R	P	P	P	/				3, 8	
M4-1B2-CV030-1	PRSD-237	2/1R				3/1R	P	P	P		X
	PRSD-240	2/1R	P	P	P	/				3	
	PRSD-243	2/1R	P	P	P	/				3	
M4-1B2-CV030-2	PRSD-241	2/1R	P	P	P	/				3, 8	
	PRSD-244	2/1R	P	P	P	/				3, 8	
M4-1B2-FL010-1	PRSD-358	2/1R	P	P	P	/				3	
M4-1B2-FL030-1	PRSD-230	2/1R	P	P	P	/				3	
M4-1B2-LV011-1	PRSD-292	2/1R	P	F	P	3/		P		4, 7, 8	X
	PRSD-295	2/1R	P	F	P	3/		P		4, 7, 8	X
M4-1B2-LV011-2	PRSD-293	3/1R	P	P	P	/					
	PRSD-296	3/1R	P	P	P	/				5	
M4-1B2-LV011-3	PRSD-354	3/3	NA	NA	NA	/				9	
M4-1B2-LV011-4	PRSD-355	3/3	NA	NA	NA	/				9	
M4-1B2-LV012-1	PRSD-278	3/1R	P	F	P	/		P		7, 8	X
	PRSD-281	3/1R	P	F	P	/		P		7, 8	X
M4-1B2-LV012-2	PRSD-279	3/1R	P	P	P	/				3	
	PRSD-282	3/1R	P	P	P	/				3	
M4-1B2-LV012-3	PRSD-352	3/3	NA	NA	NA	/				9	
M4-1B2-LV012-4	PRSD-353	3/3	NA	NA	NA	/				9	
M4-1B2-LV013-1	PRSD-289	2/1R	P	F	P	/		P		7, 8	X
	PRSD-301	2/1R	P	F	P	/		P		7, 8	X
	PRSD-304	2/1R	P	F	P	/		P		7, 8	X
M4-1B2-LV013-2	PRSD-290	2/1R	P	P	P	/				13	
	PRSD-305	2/1R	P	P	P	/				13	
M4-1B2-LV013-3	PRSD-348	3/3	NA	NA	NA	/				9	
M4-1B2-LV013-4	PRSD-349	3/3	NA	NA	NA	/				9	

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M4-1B2-LV015-1	PRSD-275	2/1R	P	F	P	/	P			7, 8	X
M4-1B2-LV015-2	PRSD-276	3/3	NA	NA	NA	/				3	
M4-1B2-LV015-3	PRSD-365X	3/3	NA	NA	NA	/				9	
M4-1B2-LV015-4	PRSD-364X	3/3	NA	NA	NA	/				9	
M4-1B2-LV024-2	PRSD-302	1/1	P	P	P	/				13	
M4-1B2-LV031-1	PRSD-252	2/1R	P	F	P	3/	P			4, 7, 8	X
	PRSD-264	2/1R	P	F	P	3/	P			4, 7, 8	X
M4-1B2-LV031-2	PRSD-253	3/1R	P	P	P	/					
	PRSD-265	3/1R	P	P	P	/					
M4-1B2-LV031-3	PRSD-356	3/3	NA	NA	NA	/				9	
M4-1B2-LV031-4	PRSD-357	3/3	NA	NA	NA	/				9	
M4-1B2-LV033-1	PRSD-255	2/1R	P	F	P	/	P			7, 8	X
	PRSD-258	2/1R	P	F	P	/	P			7, 8	X
	PRSD-261	2/1R	P	F	P	/	P			7, 8	X
M4-1B2-LV033-2	PRSD-256	2/1R	P	P	P	/				13	
	PRSD-259	2/1R	P	P	P	/				13	
M4-1B2-LV033-3	PRSD-350	3/3	NA	NA	NA	/				9	
M4-1B2-LV033-4	PRSD-351	3/3	NA	NA	NA	/				9	
M4-1B2-LV044-2	PRSD-262	1/1	P	P	P	/				13	
M4-1B2-LV045-1	PRSD-267	2/1R	P	F	P	/	P			7, 8	X
M4-1B2-LV045-2	PRSD-268	3/3	NA	NA	NA	/				3	
M4-1B2-LV045-3	PRSD-363X	3/3	NA	NA	NA	/				9	
M4-1B2-LV045-4	PRSD-362X	3/3	NA	NA	NA	/				9	
M4-1B2-MT010-1	PRSD-342	3/3	NA	NA	NA	/					
	PRSD-343	3/3	NA	NA	NA	/					
	PRSD-344	3/3	NA	NA	NA	/					
M4-1B2-MT012-1	PRSD-286	3/3	NA	NA	NA	/				3	
	PRSD-287	3/3	NA	NA	NA	/				3	
	PRSD-288	3/3	NA	NA	NA	/				3	
M4-1B2-MT018-1	PRSD-339	3/1R	P	P	P	/					
	PRSD-340	3/1R	P	P	P	/				10	X
	PRSD-341	3/1R	P	P	P	/				3	
M4-1B2-MT030-1	PRSD-203	3/3	NA	NA	NA	/					
	PRSD-204	3/3	NA	NA	NA	/					
	PRSD-205	3/3	NA	NA	NA	/					
M4-1B2-MT032-1	PRSD-249	3/3	NA	NA	NA	/				3	
	PRSD-250	3/3	NA	NA	NA	/				3	
	PRSD-251	3/3	NA	NA	NA	/				3	
M4-1B2-MT039-1	PRSD-206	3/1R	P	P	P	/					
	PRSD-207	3/1R	P	P	P	/				10	X
	PRSD-208	3/1R	P	P	P	/				3	
M4-1B2-PC010-1	PRSD-300	2/1R	NA	NA	NA	/				3, 8	
	PRSD-345	2/1R	NA	NA	NA	/				2, 3, 8	
M4-1B2-PC030-1	PRSD-202	1/1	NA	NA	NA	/				3, 8	
	PRSD-248	1/1	NA	NA	NA	/				3, 8	
M4-1B2-PD010-1	PRSD-346	2/1R	P	F	P	/				3, 8	
M4-1B2-PD015-1	PRSD-284	2/1R	P	F	P	/				3, 8	
M4-1B2-PD025-1	PRSD-298	2/1R	P	F	P	/				8	
M4-1B2-PD032-1	PRSD-246	2/1R	P	F	P	/				8	
M4-1B2-PD035-1	PRSD-270	2/1R	P	F	P	/				3, 8	

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M4-1B2-RV010-1	PRSD-334	2/1R	P	P	P	/		NA		6	X
M4-1B2-RV010-2	PRSD-335	2/1R	P	NA	P	/					
M4-1B2-RV011-1	PRSD-307	2/1R	P	F	P	/		NA		6, 8	X
	PRSD-310	2/1R	P	F	P	/		NA		6, 8	X
M4-1B2-RV011-2	PRSD-308	3/1R	P	NA	P	/				3	
	PRSD-311	3/1R	P	NA	P	/				3	
M4-1B2-RV030-2	PRSD-212	2/1R	P	NA	P	/					
M4-1B2-RV031-1	PRSD-231	2/1R	P	F	P	/		NA		6, 8	X
	PRSD-234	2/1R	P	F	P	/		NA		6, 8	X
M4-1B2-RV031-2	PRSD-232	3/1R	P	NA	P	/				3	
	PRSD-235	3/1R	P	NA	P	/				3	
M4-1B2-TK010-1	PRSD-330	1/1	NA	NA	NA	/				10	X
	PRSD-331	1/1	NA	NA	NA	/					
M4-1B2-TK010-2	PRSD-332	2/1R	P	F	P	/					
M4-1B2-TK030-1	PRSD-216	1/1	NA	NA	NA	/				10	X
	PRSD-217	1/1	NA	NA	NA	/					
M4-1B2-TK030-2	PRSD-218	1/1	P	F	P	/				2	
M4-1B2-VP015-1	PRSD-333	2/1R	P	F	P	/		NA		6	X
M4-1B2-VP035-1	PRSD-214	2/1R	P	F	P	/		NA		6	X
M4-1B2-VP045-1	PRSD-215	2/1R				2/1R	P	NA	P	1, 6	X
MR-1B2-RV030-1	PRSD-211	1/1	P	P	P	/		NA		6	X