

### CRITICAL ITEMS LIST

PAGE 1 OF 5  
SUBSYSTEM N/A  
EFFECTIVITY ALL ORBITERS

REFERENCE DESIGNATOR: HPA-1  
NAME / QUANTITY: MFR Latches  
DRAWING REFERENCE: OMS-106,107,108

PROJECT: HST  
LRU NAME / QUANTITY: HST PFR/APC Assembly  
LRU PART NUMBER: SED 30110226-001/503

FAILURE MODE NUMBER HST-HPA-1-1	CRITICALITY 1R/2	FAILURE EFFECT	RETENTION RATIONALE
<b>FUNCTION</b> MFR latches provide a latching mechanism for stowing the HST PFR on APC for launch/landing and on-orbit.		<b>END ITEM</b> HST PFR loses connection to APC and is free in the payload bay.	I. <b>Design Feature to Minimize the Chance of the Failure Mode</b> A. <u>Design</u> All MFR latches were designed to an ultimate structural safety factor of 1.4 B. <u>Tolerances</u> Sufficient tolerances were used in the MFR latches design to prevent inadvertent movement by contraction of material due to temperature extremes. C. <u>Materials - Major Components</u> See material list (Table B-2). II. <b>Testing and Analysis</b> A. <u>Acceptance Testing</u> 1. PIA A full pre-installation acceptance (PIA) test was performed on each MFR latch before it is delivered to GSFC or KSC to support flight. The PIA is verify that the MFR latch is functioning within tolerances and that the assembly is clean.
<b>FAILURE MODE AND CAUSE MODE</b> Latch inadvertently opens during launch or landing.		<b>MISSION</b> Unable to perform HST repairs if HST PFR is damaged.	
<b>CAUSE(S)</b> 1) Relaxation of hook spring. 2) Latch mechanism vibrates apart.		<b>CREW / VEHICLE</b> Loss of crew and vehicle damage due to impact from PFR.	
<b>REDUNDANCY SCREENS</b> A - Pass B - Pass C - Pass	<b>REPAIRING PATHS</b> 1.) Latch Handle Lock Lever.	<b>INTERFACE</b> HST PFR.	
<b>MISSION PHASE</b>	<b>CORRECTIVE ACTION TIMES</b> TIME TO EFFECT      TIME TO CORRECT		
EVA	Minutes	Seconds	

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### CRITICAL ITEMS LIST

PAGE 2 OF 5  
SUBSYSTEM: N/A  
EFFECTIVITY: ALL ORBITERS

REFERENCE DESIGNATOR: MPA-1  
NAME / QUANTITY: MFR Latches  
DRAWING REFERENCE: C86-108, 107, 109

PROJECT: HST  
LRU NAME / QUANTITY: HST PFR/APC Assembly  
LRU PART NUMBER: SED 30110205-001/503

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FAILURE MODE NUMBER HST-HPA-1-1	CRITICALITY 1R/2	FAILURE EFFECT	RETENTION RATIONALE			
<b>FUNCTION</b> MFR latches provide a latching mechanism for stowing the HST PFR on APC for launch/landing and on-orbit.		<b>END ITEM</b> HST PFR loses connection to APC and is free in the payload bay.	<b>B. Certification Testing</b> 1. Thermal Vacuum The MFR Latches were exposed to a cold (-132°F) and hot (+224°F) temperatures at a vacuum (1x10 <sup>-5</sup> torr) environment. This test was used to check the tolerances of the linkages. The operational requirement was -80°F (Ref. JSC-23550 for cold test and MTV test at JSC on 7/29/84 for hot)  2. Functionals The HST PFR was functionally operated prior to and immediately after all acceptance/certification tests to verify that the test environment did not degrade the hardware performance. (reference Grumman test procedure 380-94 01)  2. Vibration The MFR latches were exposed to qualification level vibration loads during their initial development. The test verified that the MFR latches were free of manufacturing defects and tolerance problems. (Reference Grumman Document number 380-98-01 (7/7/83)).			
<b>FAILURE MODE AND CAUSE</b> <b>MODE</b> Latch inadvertently opens during launch or landing.		<b>MISSION</b> Unable to perform HST repairs if HST PFR is damaged.				
<b>CAUSE(S)</b> 1) Relaxation of hook spring. 2) Latch mechanism vibrates apart.		<b>CREW / VEHICLE</b> Loss of crew and vehicle damage due to impact from PFR.				
<b>REDUNDANCY SCREENS</b> A - Pass B - Pass C - Pass	<b>REMAINING PARTS</b> 1.) Latch Handle Lock Lever.	<b>INTERFACE</b> HST PFR.				
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### CRITICAL ITEMS LIST

REFERENCE DESIGNATOR: HPA-1  
 NAME / QUANTITY: MFR Latches  
 DRAWING REFERENCE: CMC-108, 107, 106

PROJECT: HST  
 LRU NAME / QUANTITY: HST PFR/APC Assembly  
 LRU PART NUMBER: SED 99110205-601502

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 SUBSYSTEM: N/A  
 EFFECTIVITY: ALL ORBITERS

FAILURE MODE NUMBER HST-HPA-1-1	CRITICALITY 1R/2	FAILURE EFFECT	RETENTION RATIONALE																																								
<b>FUNCTION</b> MFR latches provide a latching mechanism for posing the HST PFR on APC for launch/landing and on-orbit.		<b>END ITEM</b> HST PFR loses connection to APC and is free in the payload bay.  <b>MISSION</b> Unable to perform HST repairs if HST PFR is damaged.  <b>CREW / VEHICLE</b> Loss of crew and vehicle damage due to impact from PFR.  <b>INTERFACE</b> HST PFR.	<b>C. Certification Analysis</b> All MFR Latch components were analyzed to the following induced environments to verify that the assembly can withstand the environment levels.  <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">1. Requirements</td> <td style="width: 30%;">Source</td> <td style="width: 40%;">Data</td> </tr> <tr> <td colspan="3">a. <u>Shock</u></td> </tr> <tr> <td>- Functional</td> <td>NSTS-07700 VOL. XIV</td> <td>20g's 11ms saw tooth</td> </tr> <tr> <td colspan="3">b. <u>Vibration</u></td> </tr> <tr> <td>- Random</td> <td>NSTS-07700 VOL. XIV</td> <td>(ref. 380-98.01 Vib. Report)</td> </tr> <tr> <td colspan="3">c. <u>Structures</u></td> </tr> <tr> <td>- UR (fs = 2.0)</td> <td>NSTS-07700 VOL. XIV</td> <td>(OK for STS-61 Bay 10 Port input loads from Rockwell International)</td> </tr> <tr> <td colspan="3"> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;"><b>Loads:</b></td> <td style="width: 30%;"><b>Translation</b></td> <td style="width: 40%;"><b>Rotational</b></td> </tr> <tr> <td>x = 8.8</td> <td>y = 14.4</td> <td>Mx = 225.1</td> </tr> <tr> <td>y = 14.4</td> <td>z = 10.3</td> <td>My = 71.6</td> </tr> <tr> <td>z = 10.3</td> <td></td> <td>Mz = 73.8</td> </tr> </table> </td> </tr> <tr> <td colspan="3">- Fracture</td> <td>NSTS-07700 VOL. XIV OK per Mail-93-079</td> </tr> </table>	1. Requirements	Source	Data	a. <u>Shock</u>			- Functional	NSTS-07700 VOL. XIV	20g's 11ms saw tooth	b. <u>Vibration</u>			- Random	NSTS-07700 VOL. XIV	(ref. 380-98.01 Vib. Report)	c. <u>Structures</u>			- UR (fs = 2.0)	NSTS-07700 VOL. XIV	(OK for STS-61 Bay 10 Port input loads from Rockwell International)	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;"><b>Loads:</b></td> <td style="width: 30%;"><b>Translation</b></td> <td style="width: 40%;"><b>Rotational</b></td> </tr> <tr> <td>x = 8.8</td> <td>y = 14.4</td> <td>Mx = 225.1</td> </tr> <tr> <td>y = 14.4</td> <td>z = 10.3</td> <td>My = 71.6</td> </tr> <tr> <td>z = 10.3</td> <td></td> <td>Mz = 73.8</td> </tr> </table>			<b>Loads:</b>	<b>Translation</b>	<b>Rotational</b>	x = 8.8	y = 14.4	Mx = 225.1	y = 14.4	z = 10.3	My = 71.6	z = 10.3		Mz = 73.8	- Fracture			NSTS-07700 VOL. XIV OK per Mail-93-079
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### CRITICAL ITEMS LIST

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SUBSYSTEM: N/A  
EFFECTIVITY: ALL ORBITERS

REFERENCE DESIGNATOR: HPA-1  
NAME / QUANTITY: MFR Latches  
DRAWING REFERENCE: OHS-100,107,108

PROJECT: HST  
LRU NAME / QUANTITY: HST PFR/APC Assembly  
LRU PART NUMBER: SED 3011226-01/503

FAILURE MODE NUMBER	CRITICALITY	FAILURE EFFECT	RETENTION RATIONALE
HST-HPA-1-1	1R/2		
<b>FUNCTION</b> MFR latches provide a latching mechanism for stowing the HST PFR on APC for launch/landing and on-orbit.		<b>END ITEM</b> HST PFR loses connection to APC and is free in the payload bay.	III. <u>Inspection</u> A. <u>Manufacturing</u> 1. The MFR Latch components were inspected at final assembly completion for conformance to their applicable drawings. B. <u>Assembly</u> 1. MFR Latches were cleaned and inspected to the levels described in JSC 5322B. Once cleaned, the MFR Latches were bagged to prevent any contamination from entering the unit. C. <u>Testing</u> 1. The hardware was fully inspected for any signs of loose parts as a part of the pre/post functional tests performed prior to and immediately after all certification and acceptance tests (reference Grumman test procedure 390-94.01).
<b>FAILURE MODE AND CAUSE MODE</b> Latch inadvertently opens during launch or landing.		<b>MISSION</b> Unable to perform HST repairs if HST PFR is damaged.	
<b>CAUSE(S)</b> 1) Relaxation of hook spring. 2) Latch mechanism vibrates apart.		<b>CREW / VEHICLE</b> Loss of crew and vehicle damage due to impact from PFR.	
<b>REDUNDANCY SCREENS</b> A - Pass B - Pass C - Pass	<b>REMAINING PATHS</b> 1.) Latch Handle Lock Lever.	<b>INTERFACE</b> HST PFR.	
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EVA	Minutes	Seconds	

### CRITICAL ITEMS LIST

REFERENCE DESIGNATOR: HPA-1  
 NAME / QUANTITY: MFR Latches  
 DRAWING REFERENCE: C88-106, 107, 108

PROJECT: HST  
 LRU NAME / QUANTITY: HST PFR/APC Assembly  
 LRU PART NUMBER: BED 30119295-501/503

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 SUBSYSTEM: N/A  
 EFFECTIVITY: ALL ORBITERS

FAILURE MODE NUMBER HST-HPA-1-1	CRITICALITY 1R/2	FAILURE EFFECT	RETENTION RATIONALE
<b>FUNCTION</b> MFR latches provide a latching mechanism for slowing the HST PFR on APC for launch/landing and on-orbit.		<b>END ITEM</b> HST PFR loses connection to APC and is free in the payload bay.	IV. Failure History A. None, HST PFR/APC flew on STS-31 and 51, but was only used during STS-51 and all operations were nominal. V. Operations A. <u>Effects of Failure</u> HST PFR loses connection to the APC and is free to move within the payload bay. B. <u>Crew Actions</u> None. C. <u>Training</u> None. D. <u>Mission Constraints</u> Possible damage to cargo within payload bay if the HST PFR does come loose. E. <u>In-Flight Check-Outs</u> None
<b>FAILURE MODE AND CAUSE</b> <b>MODE</b> Latch inadvertently opens during launch or landing.		<b>MISSION</b> Unable to perform HST repairs if HST PFR is damaged.	
<b>CAUSE(S)</b> 1) Relaxation of hook spring. 2) Latch mechanism vibrates apart.		<b>CREW / VEHICLE</b> Loss of crew and vehicle damage due to impact from PFR.	
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EVA	Minutes	Seconds	

PREPARED BY: J. F. PARK

REVISION: Rev. A

SUPERSEDING DATE: March 1994

DATE: 10/21/93

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