CRITCAL ITEMS LIST

REFERENCE DESIGNATOR	TBA-1	PROJECT	HST	SUBSYSTEM	TOOL BOX
NAME / QUANTITY	PFR SOCKET (1)	LRU NAME / QUANTITY	QUAD POD ASSY (1)	EFFECTIVTY	ALL ORBITERS
DRAWING REFERENCE:	[illegible]	LRU PART NUMBER:	[illegible]		

FAILURE MODE NUMBER: HST-TBA-1-1

CRITICALITY: 1R/2

FUNCTION

The portable foot restraint (PFR) socket is used to retrain the PFR so that the crew will have a work platform at the tool box.

FAILURE MODE AND CAUSE

MODE

Cannot remove the PFR from the PFR socket for landing.

CAUSE(S)

1.) Pip pin is jammed in the socket, cannot remove PFR.
2.) Galling between socket and PFR.
3.) Contamination.

REDUNDANCY SCREENS

A - Pass
B - N/A
C - Pass

REMAINING PATHS

1.) Use contingency release handle at the pivot point.

MISSION PHASE	CORRECTIVE ACTION TIMES: TIME TO EFFECT	TIME TO CORRECT
EVA	Hours	Minutes

FAILURE EFFECT

END ITEM

Cannot remove the PFR from the PFR socket. The quad pod cannot support the PFR loads during landing.

MISSION

Mission objectives are complete.

CREW / VEHICLE

Possible damage to the orbiter if the PFR becomes loose in the payload bay.

INTERFACE

PFR is stuck in the socket and cannot be removed.

RETENTION RATIONALE

DESIGN

I. Design Feature to Minimize the Chance of the Failure Mode

A. Design
All tool box components were designed to a structural safety factor of 2.0.

B. Tolerances
Sufficient tolerances will be used in the socket design to prevent jamming by expansion and contraction of material due to temperature extremes or on-orbit use.

C. Materials - Major Components

1. Pip Pin - MS17990C621

2. Socket - CRES 15-5 PH-H1050

II. Testing and Analysis

A. Acceptance Testing

1. PDA

A full pre delivery acceptance (PDA) test will be performed on the tool box assembly before it is delivered to JSC for the beginning of the certification process. The PDA will verify that the pip pin and contingency handle are operating correctly and that the assembly is clean.

2. Vibration

The flight tool box will be exposed to acceptance vibration loads while it is in flight configuration. The test will verify that the pip pin will withstand the vibration loads.

PREPARED BY J. F. PARK REVISION BASIC SUPERSEDING DATE: NONE DATE [illegible]

CRITCAL ITEMS LIST

REFERENCE DESIGNATOR: TBA-1
NAME / QUANTITY: PFR SOCKET (1)
DRAWING REFERENCE: 10100-20178

PROJECT HST
LRU NAME / QUANTITY: QUAD POD ASSY (1)
LRU PART NUMBER: 10101-3001-01

SUBSYSTEM TOOL BOX
EFFECTIVITY: ALL ORBITERS

FAILURE MODE NUMBER	CRITICALITY
HST-TBA-1-1	1R/2

FUNCTION

The portable foot restraint (PFR) socket is used to retain the PFR so that the crew will have a work platform at the tool box.

FAILURE MODE AND CAUSE

MODE

Cannot remove the PFR from the PFR socket for landing.

CAUSE(S)

1.) Pip pin (MS17980C621) is jammed in the socket, cannot remove PFR.
2.) Galling between socket and PFR.
3.) Contamination.

REDUNDANCY SCREENS	REMAINING PATHS
A - Pass B - N/A C - Pass	1.) Use contingency release handle at the pivot point.

MISSION PHASE	CORRECTIVE ACTION TIMES	
	TIME TO EFFECT	TIME TO CORRECT
EVA	Hours	Minutes

FAILURE EFFECT

END ITEM
Cannot remove the PFR from the PFR socket. The quad pod cannot support the PFR loads during landing.

MISSION
Mission objectives are complete.

CREW / VEHICLE
Possible damage to the orbiter if the PFR becomes loose in the payload bay.

INTERFACE
PFR is stuck in the socket and cannot be removed

RETENTION RATIONALE

DESIGN

A. Acceptance Testing (continued):

The following vibration levels are per SMD memo ES42-92-434:

Frequency (Hz)	Slope (dB/oct.)	Constant Level G^2/Hz	Overal Grms
20-60	+3.0		6.1
60-350		.04	
350-2000	-3.0		
20-45	+10.0		7.7
45-600		.08	
600-2000	-6.6		
20-70	+4.0		7.0
70-600		.05	
600-2000	-6.0		

3. Pip Pin Program

All Pip Pins used in the HST hardware will be exposed to a separate dedicated acceptance test program to assure the project that the pip pins are at acceptable conditions which will help prevent a failure on-orbit.

a. Cleaning
All pip pins will be cleaned with freon to remove any lubricant from the pin which could be the cause of binding in the internal pin mechanism due to cold temperature.

b. Thermal
An ambient pressure cold cycle temperature test will be performed to verify that the actuation of the pip pin is possible at the missions cold temperature.

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CRITCAL ITEMS LIST

REFERENCE DESIGNATOR: T8A-1
NAME / QUANTITY: PFR SOCKET (1)
DRAWING REFERENCE: 10184-30179

PROJECT: HST
LRU NAME / QUANTITY: QUAD POD ASSY (1)
LRU PART NUMBER: 10181-30214-01

SUBSYSTEM: TOOL BOX
EFFECTIVITY: ALL ORBITERS

FAILURE MODE NUMBER	CRITICALITY
HST-T8A-1-1	1R/2

FUNCTION

The portable tool restraint (PFR) socket is used to retrain the PFR so that the crew will have a work platform at the tool box.

FAILURE MODE AND CAUSE

MODE

Cannot remove the PFR from the PFR socket for landing.

CAUSE(S)

1.) Pip pin (MS17990C621) is jammed in the socket, cannot remove PFR.
2.) Galling between socket and PFR.
3.) Contamination.

REDUNDACY SCREENS	REMARKS / NOTES
A - Pass B - N/A C - Pass	1.) Use contingency release handle at the pivot point.

MISSION PHASE	CORRECTIVE ACTION TIMES	
	TIME TO EFFECT	TIME TO CORRECT
EVA	Hours	Minutes

FAILURE EFFECT

END ITEM
Cannot remove the PFR from the PFR socket. The quad pod cannot support the PFR loads during landing.

MISSION
Mission objectives are complete.

CREW / VEHICLE
Possible damage to the orbiter if the PFR becomes loose in the payload bay.

INTERFACE
PFR is stuck in the socket and cannot be removed.

RETENTION RATIONALE

DESIGN

A. Acceptance Testing (continued)

3. Pip Pin Program (continued)

c. Vibration
All pip pins will be vibration tested to standard acceptance level vibration loads to screen for any workmanship defects.

d. Functional
All pip pins will be functionally operated and operation loads recorded prior to and immediately after all acceptance level testing to determine if there has been any adverse effects due to the test environment.

B. Certification Testing

1. Thermal Vacuum

The Tool Box will be exposed to the following thermal vacuum environment. Pip pin actuation, PFR interface with socket, and contingency handle operation will be a part of the test plan.

a. Temperature
- Cold Side Only (amb. to -90°F)

b. Pressure
- ATM to 1x10-5 torrs

PREPARED BY: J. F. PARK | REVISION: BASIC | SUPERSEDING DATE: NONE | DATE: 11/30/92

HST-T8A - 3

CRITCAL ITEMS LIST

REFERENCE DESIGNATOR: TBA-1
NAME / QUANTITY: PFR SOCKET (1)
DRAWING REFERENCE: M196-30173

PROJECT: HST
LRU NAME / QUANTITY: QUAD POD ASSY (1)
LRU PART NUMBER: 10181-30216-01

SUBSYSTEM: TOOL BOX
EFFECTIVITY: ALL ORBITERS

FAILURE MODE NUMBER	CRITICALITY
HST-TBA-1-1	1R/2

FUNCTION

The portable foot restraint (PFR) socket is used to retrain the PFR so that the crew will have a work platform at the tool box.

FAILURE MODE AND CAUSE

MODE

Cannot remove the PFR from the PFR socket for landing.

CAUSE(S)

1.) Pip pin (MS17990C821) is jammed in the socket, cannot remove PFR.
2.) Galling between socket and PFR.
3.) Contamination.

REDUNDACY SCREENS	REMARKS RATIONALE
A - Pass B - N/A C - Pass	1.) Use contingency release handle at the pivot point.

MISSION PHASE	CORRECTIVE ACTION TIMES	
	TIME TO EFFECT	TIME TO CORRECT
EVA	Hours	Minutes

FAILURE EFFECT

END ITEM
Cannot remove the PFR from the PFR socket. The quad pod cannot support the PFR loads during landing.

MISSION
Mission objectives are complete.

CREW / VEHICLE
Possible damage to the orbiter if the PFR becomes loose in the payload bay

INTERFACE
PFR is stuck in the socket and cannot be removed.

RETENTION RATIONALE

DESIGN
B. Certification Testing (continued)

2. Functionals

The tool box components like the PFR socket pip pin and contingency handle will be functionally operated prior to and immediately after all certification test to verify that the test environment does not degrade the hardware performance.

C. Certification Analysis
The PFR socket assembly will be analyzed to the following induced environments to verify that the assembly can withstand the environment levels:

1. Requirements	Source
a. Shock	
- Functional	NSTS-07700 VOL. XIV
b. Vibration (Fl. Levels)	
- Acoustics	NSTS-07700 VOL. XIV
- Modal	JSC-14046
c. Structural	
- Ult. (fs = 2.0)	NSTS-07700 VOL. XIV
- Fracture	NSTS-07700 VOL. XIV
d. Acceleration	
- Flight	MF0004-014D
- Crash	MIL-STD-810D, Method 516, Procedure 1
e. Temperature	
- Hot (+250°F)	IST S/AD (10181-10081A)

PREPARED BY: J. F. PARK
REVISION: BASIC
SUPERSEDING DATE: NONE
DATE: 3/6/93

CRITCAL ITEMS LIST

REFERENCE DESIGNATOR: TBA-1
NAME / QUANTITY: PFR SOCKET (1)
DRAWING REFERENCE 10180-20079

PROJECT: HST
LEU NAME / QUANTITY QUAD POD ASSY (1)
LRU PART NUMBER 10181-20214-01

SUBSYSTEM TOOL BOX
EFFECTIVITY ALL ORBITERS

FAILURE MODE NUMBER	CRITICALITY
HST-TBA-1-1	1R/2

FUNCTION

The portable foot restraint (PFR) socket is used to retrain the PFR so that the crew will have a work platform at the tool box.

FAILURE MODE AND CAUSE

MODE

Cannot remove the PFR from the PFR socket for landing.

CAUSE(S)

1.) Pip pin (MS17990C621) is jammed in the socket, cannot remove PFR.
2.) Galling between socket and PFR.
3.) Contamination.

REDUNDANCY SCREENS	REMAINING PATHS
A - Pass B - N/A C - Pass	1.) Use contingency release handle at the pivot point.

MISSION PHASE	CORRECTIVE ACTION TIMES	
	TIME TO EFFECT	TIME TO CORRECT
EVA	Hours	Minutes

FAILURE EFFECT

FHD ITEM
Cannot remove the PFR from the PFR socket. The quad pod cannot support the PFR loads during landing.

MISSION
Mission objectives are complete.

CREW / VEHICLE
Possible damage to the orbiter if the PFR becomes loose in the payload bay.

INTERFACE
PFR is stuck in the socket and cannot be removed.

RETENTION RATIONALE

DESIGN

III. Inspection

A. Manufacturing

1. The PFR socket assembly components will be inspected prior to build-up for conformance to their applicable drawings.
2. All fracture critical piece parts will be inspected as described on their applicable drawings.
3. The pip pin will be inspected upon delivery.

B. Assembly

1. Exterior assemblies will be cleaned and inspected to the levels described in section 3.53.5 of the HST SAD (10181-10001A). Once cleaned, the tool box will be completely bagged to prevent any contamination from entering the PFR socket assembly.

C. Testing

1. The assembly will be fully inspected and functionally operated during PDAs and PIAs
2. The hardware will be fully inspected for any signs of galling as a part of the pre/post functional tests performed prior to and immediately after all major certification and acceptance testing.

PREPARED BY: J. F. PARK REVISION: BASIC SUPERSEDING DATE: NONE DATE 12/23/92

CRITCAL ITEMS LIST

REFERENCE DESIGNATOR: TBA-1
NAME / QUANTITY: PFR SOCKET (1)
DRAWING REFERENCE: 10160-30178

PROJECT: HST
LRU NAME / QUANTITY: QUAD POD ASSY (1)
LRU PART NUMBER: 10161-30014-01

SUBSYSTEM: TOOL BOX
EFFECTIVITY: ALL ORBITERS

FAILURE MODE NUMBER	CRITICALITY
HST-TBA-1-1	1R/2

FUNCTION

The portable foot restraint (PFR) socket is used to retrain the PFR so that the crew will have a work platform at the tool box.

FAILURE MODE AND CAUSE

MODE

Cannot remove the PFR from the PFR socket for landing.

CAUSE(S)

1.) Pip pin (MS17990C821) is jammed in the socket, cannot remove PFR.
2.) Galling between socket and PFR.
3.) Contamination.

REDUNDACY SCREENS	REMAINING PATHS
A - Pass B - N/A C - Pass	1.) Use contingency release handle at the pivot point.

MISSION PHASE	CORRECTIVE ACTION TIMES	
	TIME TO EFFECT	TIME TO CORRECT
EVA	Hours	Minutes

FAILURE EFFECT

END ITEM
Cannot remove the PFR from the PFR socket. The quad pod cannot support the PFR loads during landing.

MISSION
Mission objectives are complete.

CREW / VEHICLE
Possible damage to the orbiter if the PFR becomes loose in the payload bay.

INTERFACE
PFR is stuck in the socket and cannot be removed.

RETENTION RATIONALE

DESIGN

IV. Failure History

A. There have been no failures associated with the HST tool box quad pod PFR socket.

V. Operations

A. Effects of Failure
Cannot remove the PFR from the PFR socket. The quad pod cannot support the PFR loads during landing.

B. Crew Actions
To activate the redundant hardware, the crew will remove the contingency release handle by hand or with an EVA wrench. The handle actuation will release the central shaft at the pivot that will allow the PFR and socket to be removed from the quad pod.

C. Training
As part of the certification testing , crews will actuate the redundant systems during the thermal vacuum tests. Additional training will occur in the WETF.

D. Mission Constraints
The PFR must be removed prior to landing.

E. Inflight Check-Outs
None.

PREPARED BY: J.F. PARK

REVISION BASIC

SUPERSEDING DATE: NONE

DATE 11/30/92