CRITIC[illegible] ITEMS LIST

REFERENCE DES[illegible]/OR DS - 1
NAME / QUANTITY: Pip pin, Double Socket
DRAWING REFERENCE: 58769R26-21NL6C4

PROJECT: DTO 671
LRU NAME / QUANTITY: Double PFR Socket/1
LRU PART NUMBER: SED39122648

SUBSYSTEM EVA
EFFECTIVITY: ALL ORBITERS

FAILURE MODE NUMBER	CRITICALITY
DS-1-1	1R/2

FUNCTION

Secures articulating socket and/or PFR to double PFR socket during launch/landing and on-orbit use (articulating socket and PFR not in series for launch/landing).

FAILURE MODE AND CAUSE

MODE
A double socket pip pin releases during launch or landing and allows the articulating socket or PFR to become free.

CAUSE(S)

1) Piece part(s) failure of pip pin
2) Vibration

REDUNDANCY SCREENS	REMAINING PATHS
A - Pass B - Pass C - Pass	1) Hitch pin on pip pin

MISSION PHASE	CORRECTIVE ACTION TIMES	
	TIME TO EFFECT	TIME TO CORRECT
Launch/Landing	Seconds	None

FAILURE EFFECT

END ITEM

On hitch pin failure the articulating socket or PFR could become free in the payload bay.

MISSION

None

CREW / VEHICLE

Possible damage to orbiter

INTERFACES

Articulating sockets:
SED39105422-301 (LESC)
-303,-305
SED39124666-302 (OSS)
PFRs:
SED39105308-301
SED39105708-301, -303

RETENTION RATIONALE

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

A. Design
The double PFR socket was designed to an ultimate structural safety factor of 1.4 by test and 1.4 by analysis.

B. Tolerances
Sufficient tolerances were used in the double socket design to prevent pip pin release by expansion and contraction of material due to temperature extremes or on-orbit use, as documented during each mission's thermal analysis.

C. Materials - Major Components

1) Pip pin 58769R26-21NL6C4; Stainless Steel Shank and Balls with hitch pin.
or 2) Pip pin MS17990C621; Stainless Steel Shank and Balls.

II. Testing and Analysis

A. Acceptance Testing

1. PIA

A full pre-installation acceptance (PIA) test shall be performed on the double PFR socket per the requirements found in HRD #JSC-38153 before it is delivered to KSC to support any STS flight. The PIA will verify that the socket is functioning within tolerances and that the assembly is clean.

2. Vibration

The PFR socket assembly shall be exposed to acceptance level vibration loads per HRD #JSC-38153. The test shall verify that the socket assembly is free of manufacturing defects and tolerance problems

PREPARED BY M. M. GIETZEL REVISION BASIC SUPERSEDING DATE: NONE DATE: 7/26/94

CRITIC. . ITEMS LIST

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DRAWING REFERENCE: 56789R26-21NLSC4

PROJECT: DTO 671
LRU NAME / QUANTITY: Double PFR Socket/1
LRU PART NUMBER: SED39122648

SUBSYSTEM: EVA
EFFECTIVITY: ALL ORBITERS

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MISSION

None

CREW / VEHICLE

Possible damage to orbiter

INTERFACES

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SED33105422-301 (LESC)
-303,-305
SED39124666-302 (OSS)
PFRs:
SED33105306-301
SED33105706-301,-303

RETENTION RATIONALE

A. Acceptance Testing (continued)

3. Pip Pin Program

All Pip Pins used in the double socket shall 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. Reference: 'Hardware Requirements Document (HRD) #JSC-38153.

a. Cleaning
All pip pins shall 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
All of the flight and flight back-up pip pins shall be exposed to a cold chamber test to a range of -100°F to -130°F and must operate properly at that temperature.

c. Vibration
All flight and back-up pip pins shall be exposed to an AVT/QAVT vibration level derived from SP-T-0023B as described in JSC-38153. The duration shall be three minutes per axis. The vibration levels are:

Frequency (Hz)	Slope (dB/oct.)	Constant Level G^2/Hz	Overall Grms
20		0.01	6.06
80		0.04	
200		0.04	
350		0.04	
2000		0.007	

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CRITICAL ITEMS LIST

REFERENCE DESIGNATOR: DS - 1
NAME / QUANTITY: Pip pin, Double Socket
DRAWING REFERENCE: 5878SP26-21MLSC4

PROJECT: OTO 671
LRU NAME / QUANTITY: Double PFR Socket/1
LRU PART NUMBER: SED39122648

SUBSYSTEM: EVA
EFFECTIVITY: ALL ORBITERS

FAILURE MODE NUMBER	CRITICALITY
DS-1-1	1R/2

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MISSION

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CREW / VEHICLE

Possible damage to orbiter

INTERFACES

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SED33105422-301 (LESC)
-303,-305
SED39124696-302 (OSS)
PFRs:
SED33105308-301
SED33105706-301,-303

RETENTION RATIONALE

A. Acceptance Testing (continued)

d. Functional

All pip pins shall 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. The double socket was tested to the EVA "general use" loads per HRD #JSC-38153 with a factor of safety of 1.4 (TPS #DW93200820).

2. Thermal Vacuum

The double socket was exposed to a cold temperature (-120°F) vacuum (1x10-5 torrs) environment per TPS # SB9320218 (HST MTV #3). This test was used to check the functionality of the pip pin with successful results Ref. JSC-38153.

3. Functionals

The double socket was functionally operated prior to and immediately after all acceptance and certification tests to verify that the test environment did not degrade the hardware performance.

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CRITICAL ITEMS LIST

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DRAWING REFERENCE: 5678SE26-21N18C4

PROJECT: DTO 671
LRU NAME / QUANTITY: Double PFR Socket/1
LRU PART NUMBER: SED39122048

SUBSYSTEM: EVA
EFFECTIVITY: ALL ORBITERS

FAILURE MODE NUMBER	CRITICALITY
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MISSION

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CREW / VEHICLE

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INTERFACES
Articulating sockets:
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-303,-305
SED39124866-302 (OSS)
PFRs:
SED39105308-301
SED39105706-301,-303

RETENTION RATIONALE

B. Certification Analysis (continued)

4. Qual Vibration Testing

The double socket was part of a successful QAVT/QVT PFR test, TPS FV9420042. The following levels are per HRD #JSC-38153.

Frequency (Hz)	G Level	Duration per axis x,y,z
20-2000	7.84	10 min
20-2000	7.80	33 min 20 sec

5. All double socket components were analyzed to the following induced environments to verify that the assembly can withstand the environment levels:

1. Requirements	Source
a. Structures	
- Lift	JSC-38153
- Fracture	JSC-38153

The double socket was designed to the following thermal environments:

b. Temperature	
- Hot (+250°F)	JSC-38153
- Cold (-120°F)	JSC-38153

III. Inspection

A. Manufacturing

1. The double socket is verified for conformance to the applicable drawings.
2. The pip pin is not fracture critical per drawings.
3. The pip pins are verified upon delivery.

PREPARED BY: M. M. GIETZEL REVISION: BASIC SUPERSEDING DATE: NONE DATE: 7/20/84

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DRAWING REFERENCE: 56789R26-21NL6C4

PROJECT: DTO 671
LRU NAME / QUANTITY: Double PFR Socket/1
LRU PART NUMBER: SED39122648

SUBSYSTEM: EVA
EFFECTIVITY: ALL ORBITERS

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INTERFACES

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-303,-305
SED39124686-302 (OSS)
PFRs:
SED39105308-301
SED39105706-301,-303

RETENTION RATIONALE

B. Assembly

1. The double socket shall be cleaned and verified to level VC per JSC 5322B. Once cleaned, the double socket shall be bagged to prevent any contamination from entering the unit.

C. Testing

1. The pip pins are fully inspected for any signs of loose parts as part of the pre/post functional tests performed prior to and immediately after all certification and acceptance tests.
2. After each flight, the assembly will be fully inspected. Prior to each flight, a PIA will be performed to verify that the hardware, especially the pip pin, is operating properly.

IV. Failure History
A. None

V. Operations

A. Effects of Failure
The PFR or articulating socket could become free in the payload bay during launch/landing.

B. Crew Actions
None.

C. Training
None.

D. Mission Constraints
None

E. In Flight Check-Outs
None

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