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System Requirements Document
Human Research Facility (HRF)
Surface, Water, and Air Biocharacterization (SWAB) Experiment System

CCB Controlled

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APPROVED:	EB/James LeBlanc Division Chief, Biomedical Systems Division	Original Signature on File	09/15/03

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Human Research Facility (HRF)
Surface, Water, and Air Biocharacterization (SWAB) Experiment System

Prepared by: Original Signature on File 07/14/03
M. Johnson Date
Experiment Project Engineer

Approved: Original Signature on File 07/14/03
L. Walters Date
System Engineer

Approved: Original Signature on File 08/07/03
D. Kilbourn Date
Manager, S&PA Department

Approved: Original Signature on File 08/13/03
J. McDonald Date
Manager, Technical Work Plan
HRF Hardware Development Section

Prepared by:

Lockheed Martin Space Operations
Houston, Texas
for
National Aeronautics and Space Administration
Johnson Space Center

REVISION/CHANGE APPROVALS

Date	Change Number	Prepared by	Approved by:		
			Unit Manager	SR&QA Manager	Projects Manager

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Altered pages must be typed and distributed for insertion.

CONTENTS

CONTENTS (Cont'd)

CONTENTS (Cont'd)

CONTENTS (Cont'd)

CONTENTS (Cont'd)

LIST OF TABLES

LIST OF FIGURES

ACRONYMS AND ABBREVIATIONS

A	Amperes
AC	Alternating Current
ADP	Acceptance Data Package
APM	Attached Pressurized Module
ARIS	Active Rack Isolation System
ASD	Air Sampling Device
ºC	Degrees Celsius
CAM	Centrifuge Accommodation Module
CCB	Configuration Control Board
CFU	Colony Forming Units
CHeCS	Crew Health Care System
cm	Centimeters
COTS	Commercial-Off-the-Shelf
dB	Decibels
dBA	Acoustic Decibel Level
dBmicroV/m	Decibels Micro volts/meter
dBpT	Decibels picotesla
DC	Direct Current
DGGE	Denaturing Gradient Gel Electrophoresis
DRD	Data Requirements Document
DRL	Data Requirements List
EEE	Electrical, Electronic, and Electromechanical
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EPCE	Electrical Power Consuming Equipment
ESD	Electrostatic Discharge
ESEM	Environmental Scanning Electron Microscope
EUE	Experiment Unique Equipment
EVA	Extravehicular Activity
ºF	Degrees Fahrenheit
fc	foot candle
ft	foot
g	gravity
GFCI	Ground Fault Circuit Interrupter
GFE	Government Furnished Equipment
GHz	GigaHertz
GIDEP	Government and Industry Data Exchange Program
g rms	gravity root mean square
GSE	Ground Support Equipment

ACRONYMS AND ABBREVIATIONS (Cont'd)

HRF	Human Research Facility
Hz	Hertz
ICD	Interface Control Document
IDD	Interface Definition Document
IMS	Inventory Management System
in.	inch
ISIS	International Subrack Interface Standard
ISPR	International Standard Payload Rack
ISS	International Space Station
IVA	Intravehicular Activity
JEM	Japanese Experiment Module
JSC	Johnson Space Center
kHz	Kilohertz
kPa	KiloPascal
LAL	Limulus Amebocyte Lysate
lb	pound
lbf	pounds force
lg	log (base 10)
Lux	Luminous flux
max	maximum
MHz E QP	Megahertz Energy quality product
min	minimum
MIL-ER	Military Established Reliability
mm	millimeter
MPLM	Multi-Purpose Logistics Module
MSFC	Marshall Space Flight Center
MUA	Material Usage Agreement
N	Newton (metric force measurement)
N_2	Nitrogen
NASA	National Aeronautics and Space Administration
Nm	Newton-meter
O_2	Oxygen
ORU	Orbital Replacement Unit
oz	ounce
Pa	Pascal
PCR	Polymerase Chain Reaction
PDA	Pre-Delivery Acceptance
PFE	Portable Fire Extinguisher

ACRONYMS AND ABBREVIATIONS (Cont'd)

PHTR	Packaging, Handling, and Transportation Records
PI	Principal Investigator
P/L	Payload
PRACA	Problem Reporting and Corrective Action
PRD	Program Requirements Document
psi	pounds per square inch
psia	pounds per square inch absolute
PSRP	Payload Safety Review Panel
QAVT	Qualification for Acceptance Vibration Testing
QEPM&L	Qualified Electrical, Electronic, Electromechanical (EEE) Parts, Manufacturers, and Laboratories
QPCR	Quantitative Polymerase Chain Reaction
Rad	Radiation Absorbed Dose
RMS	Root Mean Square
RPC	Remote Power Controller
RSS	root-summed squared
SD	Standard Deviation
SEE	Single Event Effect
sec	second
SIR	Standard Interface Rack
SOW	Statement of Work
SPL	Sound Pressure Level
SRD	System Requirements Document
SRV-K	Condensate Recovery System (Russian translation)
SRV-K	sistema regeneratsii vody iz kondensata
SVO-ZV	Water Supply System, Potable (Russian translation)
SVO-ZV	sistema vodoobespecheniya na ziapasakh vody
SWAB	Surface, Water, and Air Biocharacterization
TBR	To Be Reviewed
TM	Technical Memo
TPS	Task Performance Sheet
V rms	Volts root mean square
UOP	Utility Outlet Panel
UPVP	Unique Payload Verification Plan
USL	United States Lab
V	Volts
VC-S	Visibly Clean-Sensitive
VDS	Verification Data Sheet
VOC	Volatile Organic Compounds
WSTF	White Sands Test Facility

1.0 SCOPE

This specification defines the Human Research Facility (HRF) Program requirements for 99E049 Surface, Water, and Air Biocharacterization (SWAB) Experiment. The 99E049 SWAB Experiment consists of Criticality 3 Experiment Unique Equipment (EUE) hardware that will be used to support the HRF. The term "Experiment Unique Equipment," as used in this document, is defined as hardware designed to support an HRF Program experiment and not intended for general use.

The primary governing document for the requirements levied in this document is LS-71000, Program Requirements Document for the Human Research Facility. Other requirements are derived from the experiment-unique Interface Definition Documents (IDDs) for the various items of HRF equipment.

The requirements in Sections 3.0, 4.0 and 5.0 of this document consist of a minimum set of constraints for Criticality 3 EUE hardware and software. Criticality 3 items are defined in the table in Section 3.2 of LS-71000.

The HRF Project Office is the controlling authority for this document. The HRF Configuration Control Board (CCB) or a delegated authority must approve any deviations from the requirements of this document. Any change in EUE functionality that requires equipment designated as Criticality 3 to be used in a manner that is not consistent with the requirements specified herein and in LS-71000 will require a reassessment of the item or items for criticality level as well as a re-evaluation of applicability to this document.

2.0 APPLICABLE DOCUMENTS

The following applicable documents of the exact issue shown herein form a part of this specification to the extent specified herein. If a revision level or date is not cited, the latest version of the document should be used.

All specifications, standards, exhibits, drawings or other documents referenced in this specification are hereby incorporated as cited in the text of this document.

Any updated revisions to documents specified herein shall be reviewed to determine the impact to the design. Changes to the design or this document shall only be made upon the direction of the HRF CCB.

2.1 DOCUMENTS

Document Number	Revision	Document Title
FED-STD-595	Rev. B 12/89	Colors Used in Government Procurement
JPD 5335.1	Rev. E	JSC Quality Management System Quality Policy
LS-71000	Rev. B	Program Requirements Document for the Human Research Facility
LS-71011	Rev. A 10/01	Acoustic Noise Control and Analysis Plan for Human Research Facility Payloads and Racks
MIL-STD-1686	Rev. C 10/95	Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices)
NASA TM 102179	6/91	Selection of Wires and Circuit Protective Devices for STS Orbiter Vehicle Payload Electrical Circuits
NSTS/ISS 13830	Rev. C, Ch. 5 3/03	Payload Safety Review and Data Submittal Requirements for Payloads Using the Space Shuttle and International Space Shuttle
NSTS/ISS 18798	Rev. B, Ch. 7 2/00	Interpretations of NSTS/ISS Payload Safety Requirements

Document Number	Revision	Document Title
NSTS-1700.7	Rev. B, Ch. 14 3/03	Safety Policy and Requirements for Payloads Using the Space Transportation System
NSTS-1700.7B ISS Addendum	Basic, Ch. 6 3/03	Safety Policy and Requirements for Payloads Using the International Space Station
NSTS-21000-IDD-MDK	Rev. B, Ch. 15 10/02	Shuttle/Payload Interface Definition Document for Middeck Accommodations
SN-C-0005	Rev. D, Chg 8 1/03	Space Shuttle Contamination Control Requirements
SSP 30237	Rev. F, Chg 20 03/02	Space Station Electromagnetic Emission and Susceptibility Requirements
SSP 30243	Rev. G, Ch. 13 5/03	Space Station Requirements for Electromagnetic Compatibility
SSP 30512	Rev. C 9/94	Space Station Ionizing Radiation Design Environment
SSP 41017	Rev. F 1/02	Rack to Mini Pressurized Logistics Module Interface Control Document (ICD) Part 1
	Rev. G 1/01	Rack to Mini Pressurized Logistics Module Interface Control Document (ICD) Part 2
SSP 50005	Rev. C, Ch. 8 9/01	International Space Station Flight Crew Integration Standard (NASA-STD-3000/T)
SSP 57000	Rev. E 4/00	Pressurized Payloads Interface Requirements Document
SSP 57001	Rev. C 10/00	Pressurized Payloads Hardware Interface Control Document Template

2.2 ORDER OF PRECEDENCE

In the event of a conflict between the text of this specification and references cited herein, the text of this specification takes precedence. Nothing in this specification, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3.0 SYSTEM REQUIREMENTS

3.1 ITEM DEFINITION

The SWAB Experiment system includes hardware designed by the HRF, which include the SWAB Air Sampling Device (ASD), ASD Battery Pack and ASD Filter Unit. This equipment will be designed and certified under this requirements document for use on the International Space Station (ISS) as a part of the HRF program.

The ASD is one part of the entire experiment cadre of hardware; however, the other remaining portions of this experiment will utilize modified Government Furnished Equipment (GFE) hardware developed and certified by the Crew Health Care System (CHeCS). This document does not levy any new requirements into the CHeCS GFE hardware but does have functional requirements specific for the SWAB experiment system related to the functional use of the CHeCS designed equipment. Any other HRF hardware used with this experiment is certified under separate documentation, which is maintained by the appropriate program(s).

Table 3.1-1 lists the equipment items covered by this document, including the stowage kits that will be used to transport the items and contain the items on-orbit.

TABLE 3.1-1. SWAB EXPERIMENT UNIQUE EQUIPMENT

Item Name	Notes
SWAB ASD Kit	The kit will contain the HRF ASD and ASD Battery Packs for this experiment.
SWAB ASD Pouch	This is the pouch that will hold the ASD and ASD Battery Pack.
HRF ASD	Modified Commercial-Off-the-Shelf (COTS) Unit used to acquire air samples for the SWAB Experiment.
HRF ASD Battery Pack	Modified COTS Battery Pack specifically designed by ASD manufacturer for the ASD.
SWAB Sample Kit	This kit will contain all the sample media to collect the SWAB experiment samples. Includes equipment below.
SWAB Sample Kit Pouch	This is the pouch that will hold the SWAB Transfer Kit Pouch, Water Sampler Assembly, Adapter Probe Assembly, Sample Bag, (SWAB) Buffer Tube, and HRF ASD Filter Unit.
SWAB Transfer Kit Pouch	This pouch, which is empty when launched, will hold the experiment samples that will be returned to the ground.
Water Sampler Assembly, Potable, Sterile	This device is a CHeCS developed item that will be used to collect water from the SRV-K potable water port on the ISS. This part has been certified for flight per GCAR# G3628.
Adapter Probe Assembly, SVO-ZV Port	This device is a CHeCS developed item that will be used to collect water from the SVO-ZV potable water port on the ISS. This part has been certified for flight per GCAR# G3628.
Sample Bag, Chemical, Post-Flight Analysis (1L)	This device is a CHeCS developed item that will be used to collect and store the water samples. This part has been certified for flight per GCAR# G3304.
(SWAB) Buffer Tube	This device is a CHeCS developed item that will be used to collect and store the surface samples. This part has been certified for flight per GCAR# G3723.
HRF ASD Filter Unit	These filter units are modified COTS equipment that interface to the HRF ASD to acquire the air samples.

3.1.1 Experiment Description

During protocol and hardware development, **surface, water**, and **air samples** from the Johnson Space Center (JSC) environment as well as samples of known cultures will be evaluated. To serve as reference, the results of these ground-based studies will be compared to culture-based results. In-flight samples will be collected.

Surface samples will be collected using the swab tube used for in-flight sample collection on board the ISS. Specifically, a 25 cm^2 surface area is wiped with a pre-moistened Dacron swab.

Potable water samples will be collected directly into 1-liter Teflon bags that are currently approved for in-flight use. In-flight ISS water sampling sites will include the Russian humidity Condensate Recovery System (SRV-K) that regenerates water for potable use as well as the SVO-ZV system. If available, free condensate, which accumulates during extended missions, will be collected using a surface sampling swab.

Collection of in-flight **air samples** will be performed using existing gelatin filter technology and a modified COTS ASD. The special filters should prevent sample desiccation during return to Earth and dissolve in water to facilitate processing.

Once the samples are returned to Earth, they will be analyzed by a combination of methods to enumerate and identify all bacterial species in each sample type. These methods will include Polymerase Chain Reaction (PCR), Quantitative Polymerase Chain Reaction (QPCR), Denaturing Gradient Gel Electrophoresis (DGGE), and 16S ribosomal analysis. In addition, the samples will be analyzed for endotoxin levels using the *Limulus* Amebocyte Lysate (LAL) endotoxin assay. Direct imaging for allergens will be performed using the Environmental Scanning Electron Microscope (ESEM) and immunogold labeling. Initial analyses of all bacterial protocols will be compared to results using standard culture-based methodologies currently performed in the Microbiology Laboratory at JSC. Additional data analyses will be performed that compare in-flight microbial contamination to Volatile Organic Compounds (VOC) detected during flight.

3.1.1.1 Experiment Overview

All previous microbial analysis of spacecraft utilized culture-based methodology, omitting greater than 90% of all micro-organisms including pathogens, such as *Legionella* and *Cryptosporidium*. Culture bacteria and fungi have been the only allergens studied; the more potent allergens, such as dust mites, have never been analyzed in spacecraft environments. No attempt to monitor microbial toxins has been made as well. This experiment will utilize modern molecular biology, advanced microscopy, and immunochemical techniques to study air, surface, and water samples from spacecraft. These samples will be analyzed for bacteria and fungi (total composition and specific pathogens), pathogenic protozoa, specific

allergens, and microbial toxins. After the development of collection and processing technologies for flight, this study will provide a comprehensive analysis of the ISS by:

- Monitoring the ISS modules prior to launch to develop a baseline of contamination.
- Monitoring launch vehicles to evaluate sources of new contamination.
- Direct sampling of the ISS.

During protocol and hardware development, surface, water, and air samples from the JSC, and samples of known cultures will be evaluated. The results of these ground-based studies will be compared to culture-based results to use as a reference.

Surface samples will be collected using the damp swab and liquid vial currently designed as the contingency method for the National Aeronautics and Space Administration (NASA) Surface Sample Kit, approved for inflight use. Specifically, a 25 cm^2 surface area is wiped with a pre-moistened cotton swab and then returned to a vial containing a known amount buffer solution.

Potable water samples will be collected directly into 1 liter Teflon bags currently approved for in-flight use. ISS water sampling sites will include SRV-K that regenerates water for potable use as well as the SVO-ZV dispensing ports. If available, free-floating condensate, which accumulates during extended missions, will be collected using a surface sampling swab.

Collection of air samples will be collected via a COTS ASD by Sartorius Co. The ASD will draw air through a gelatin membrane filter, which will capture any airborne microbes. The membrane filters and Adapters will be returned to the kit for stowage and returned to ground for analysis.

Once the samples are returned to Earth, they will be analyzed by a combination of PCR, QPCR, DGGE, and 16S ribosomal analysis to enumerate and identify all bacterial species in every sample. In addition, the samples will be analyzed for endotoxin levels using the LAL endotoxin assay, and direct imaging for allergens will be performed using the ESEM and immunogold labeling. Initial analyses of all bacterial protocols will be compared to results using the standard culture-based methodologies of the Microbiology Laboratory at JSC.

Finally, data analyses will be performed that compare inflight microbial contamination to VOC detected during flight. The Toxicology Laboratory currently monitors VOC at JSC, but no previous association with microbial flora has been investigated.

3.1.1.2 Operational Overview

This experiment will utilize three different sampling methods as described in the following:

Surface samples will be taken at a variety of locations, including locations such as air supply surfaces, food locker surfaces, and water dispenser surfaces. Essentially, a surface sampling tube from the SWAB Kit will be removed, and the Dacron swab contained within the tube will be used to "swab" approximately 25-cm^2 area. Once completed, the Dacron swab is returned to the tube, and the tube will be marked with the date and location where the sample was collected using a Sharpie marker. The swab tube will then be returned to the SWAB Stowage Kit.

Water sampling will take place from three sources, the ISS potable water – supply including the SRV-K Hot water, SRV-K "cold" Water and the SVO-ZV potable water. Any 'free' condensate (if available) will also be acquired. When collecting ISS potable water samples, a Potable Water Sampler (interface adapter) is connected to a potable water source, and then a 1-liter collection bag is connected to the Sampler.

In the event that 'free' condensate that has accumulated on ISS surfaces is found, a contingency syringe will be used to extract the condensate and then placed back inside a contingency stowage bag. For smaller volumes of 'free' condensate, dry Dacron swabs will be available for collection.

The Air Sampling protocol will utilize the HRF ASD Equipment to take air samples from strategic locations of both the orbiter and the ISS. Once the hardware is unstowed from the SWAB Stowage Kit, a gelatin membrane filter will be attached to the membrane filter adapter, and the crewmember will turn the device on and select a sample rate and volume to be taken by the ASD. Since the device is hand held, it can be used in any ISS module.

Once operating, air is drawn through a membrane filter attached to a filter adapter via an internal impeller wheel. The crewmember is free to move to specified locations for sample collection. After the sampling protocol is completed, the air sampler filter adapter is removed from the ASD, and the membrane filter is then removed from the adapter and placed into a sealed bag, which is returned to the SWAB Stowage Kit. After all sample collection has been complete, the ASD is returned to the SWAB Stowage Kit and the kit is returned to its stowed location.

3.2 CHARACTERISTICS

3.2.1 Performance Characteristics

3.2.1.1 Functional Performance Characteristics

A. The HRF ASD Equipment shall be functional in a 1-G environment as well as the microgravity environment.

B. The HRF ASD Equipment shall be capable of displaying the flow rate in L/min.

C. The HRF ASD Equipment shall be capable of displaying the volume of air to be sampled in liters.

D. The HRF ASD Equipment shall be compatible with COTS 80 mm diameter gelatin membrane filter discs.

E. The HRF ASD Equipment shall be capable of sampling at least 1 cubic meter (m3) (1000 liters) of air.

F. The HRF ASD Equipment shall be portable in design.

G. Replaceable batteries shall power the HRF ASD Equipment.

H. The SWAB experiment system shall provide a means to acquire and store water samples from the ISS water supplies in support of the water sample portion of the experiment.

I. The SWAB experiment system shall provide a means to acquire and store surface samples from the ISS and launch vehicles

3.2.2 Physical Characteristics

3.2.2.1 Mass Properties

Not applicable to the SWAB ASD Equipment and stowage pouches. This equipment has no defined mass property requirements.

3.2.2.2 Envelope

3.2.2.2.1 Stowed Envelope

Not applicable to the SWAB ASD Equipment and stowage pouches. This equipment has no defined stowage requirements.

3.2.2.2.2 Deployed Envelope

3.2.2.2.2.1 On-Orbit Payload Protrusions

Definitions for on-orbit permanent protrusions, on-orbit semi-permanent protrusions, on-orbit temporary protrusions, on-orbit momentary protrusions, and protrusions for on-orbit keep-alive payloads can be found in Section 6.1, Definitions. The requirements in Section 3.2.2.2.2.1 apply to installation and operation activities but not to maintenance activities. (LS-71000, Section 6.3.1.5)

NOTE: The on-orbit protrusions requirements in this section are applicable when the payload (P/L) is on-orbit and do not apply to other phases of the transportation of the P/L [e.g., launch, landing, Multi-Purpose Logistics Module (MPLM), installation]. (LS-71000, Section 6.3.1.5)

A. Not Applicable to the HRF ASD Equipment.

B. Not Applicable to the HRF ASD Equipment.

3.2.2.2.2.1.1 On-Orbit Permanent Protrusions

Not Applicable to the HRF ASD Equipment.

3.2.2.2.2.1.2 On-Orbit Semi-Permanent Protrusions

A. Not Applicable to the HRF ASD Equipment.

B. Not Applicable to the HRF ASD Equipment.

3.2.2.2.2.1.3 On-Orbit Temporary Protrusions

A. Not Applicable to the HRF ASD Equipment.

B. The combination of all on-orbit temporary protrusions for the integrated rack shall be designed such that they can be eliminated or returned to their stowed configuration by the crew with hand operations and/or standard Intravehicular Activity (IVA) tools within 10 minutes. (LS-71000, Section 6.3.1.5.3B)

3.2.2.2.2.1.4 On-Orbit Momentary Protrusions

Not Applicable to the HRF ASD Equipment.

3.2.2.2.2.1.5 Deleted

3.2.2.2.2.2 Deployed Envelope Dimensions

NOTE: The Stowed and deployed envelope dimensions of the HRF ASD Equipment will be the same.

3.2.3 Reliability, Quality and Non-Conformance Reporting

A. Not Applicable to the HRF ASD Equipment.

B. Quality Assurance for the HRF ASD Equipment shall be implemented in accordance with JPD 5335.1, "JSC Quality Management System Quality Policy." (LS-71000, Section 7.3.1)

C. Non-Conformance Reporting

1. For flight hardware produced under a contract or subcontract at a site other than JSC, non-conformance reporting requirements shall be specified in the Statement of Work (SOW) Data Requirements List (DRL), and Data Requirements Documents (DRDs) shall be used to identify the submittal and data requirements. [LS-71000, Section 7.3.2(1)]

2. For flight hardware developed at JSC, non-conformance reporting shall be in accordance with JPD 5335.1, and the applicable technical division plan. [LS-71000, Section 7.3.2(2)]

3. Non-conformances, which meet the Level 1 Problem Reporting and Corrective Action (PRACA) criteria for payloads as defined in SSP 30223, shall be reported in accordance with SSP 30223. [LS-71000, Section 7.3.2(3)]

4. Not Applicable to the HRF ASD Equipment. The ASD Equipment has no software.

3.2.3.1 Failure Propagation

The design shall preclude propagation of failures from the P/L to the environment outside the P/L. (NSTS 1700.7B, Section 206)

3.2.3.2 Useful Life

The HRF ASD Equipment shall be designed for a 10-year utilization with ground refurbishment. (LS-71000, Section 7.2.1) This useful life can be obtained by replacing limited life items (e.g., batteries) with Orbital Replacement Units (ORUs) and/or allowing for ground refurbishment. (LS-71000, Section 7.2.1)

3.2.4 Maintainability

A. Not Applicable to the HRF ASD Equipment.

B. Not Applicable to the HRF ASD Equipment.

C. Not Applicable to the HRF ASD Equipment.

D. Not Applicable to the HRF ASD Equipment.

E. Not Applicable to the HRF ASD Equipment.

F. Not Applicable to the HRF ASD Equipment.

G. The capture elements, including grids, screens, or filter surfaces shall be accessible for replacement or cleaning without dispersion of the trapped materials. (LS-71000, Section 6.4.3.1.2B)

3.2.4.1 Logistics and Maintenance

3.2.4.1.1 Payload In-Flight Maintenance

Payloads shall be designed to be maintainable using Space Station-provided on-board tools. Available tools on-orbit are defined in the Payloads Accommodations Handbook, SSP 57020. (LS-71000, Section 6.4.10)

3.2.4.1.2 Maintenance

The HRF ASD Equipment inflight cleanliness/maintenance will be controlled through an on-orbit operations procedure. No unscheduled on-orbit maintenance activities will be performed. The following scheduled maintenance activities will be performed:

Battery replacement will be performed as necessary.

3.2.5 Environmental Conditions

3.2.5.1 On-Orbit Environmental Conditions

3.2.5.1.1 On-Orbit Internal Environments

3.2.5.1.1.1 Pressure

The HRF ASD Equipment shall be safe when exposed to pressures of 0 to 104.8 kPa (0 to 15.2 psia). (LS-71000, Section 6.3.7.1.1)

3.2.5.1.1.2 Temperature

The HRF ASD Equipment shall be safe when exposed to temperatures of 10° to 46 °C (50 to 115 °F). (LS-71000, Section 6.3.7.1.2)

3.2.5.1.1.3 Humidity

Not applicable to the HRF ASD Equipment. The HRF ASD Equipment has no cold sources and will not generate humidity.

3.2.5.1.2 Use of Cabin Atmosphere

3.2.5.1.2.1 Active Air Exchange

Not Applicable to the HRF ASD Equipment.

3.2.5.1.2.2 Oxygen Consumption

Not applicable to the HRF ASD Equipment.

3.2.5.1.2.3 Chemical Releases

Chemical releases to the cabin air shall be in accordance with paragraphs 209.1a and 209.1b in NSTS 1700.7, ISS Addendum. (LS-71000, Section 6.3.7.2.3)

3.2.5.1.2.4 Cabin Air Heat Leak

Cabin air heat rejection is defined by the ISS program in terms of ISS modules only. No sub-allocation has been made for integrated racks or EUE. HRF ASD Equipment maximum cabin air heat rejection must be documented in the HRF ASD Equipment Interface Control Document (ICD). (LS-71000, Section 6.3.4.2)

3.2.5.1.3 Ionizing Radiation Requirements

3.2.5.1.3.1 Instrument Contained or Generated Ionizing Radiation

EUE containing or using radioactive materials or that generate ionizing radiation shall comply with NSTS 1700.7, ISS Addendum, paragraph 212.1. (LS-71000, Section 6.3.7.3.1)

3.2.5.1.3.2 Ionizing Radiation Dose

EUE should expect a total dose (including trapped protons and electrons) of 30 Rads (Si) per year of ionizing radiation. A review of the dose estimates in the ISS (SAIC-TN-9550) may show ionizing radiation exposure to be different than 30 Rads (Si) per year, if the intended location of the rack in the ISS is known. (LS-71000, Section 6.3.7.3.2)

NOTE: This is a testing guideline and is not a verifiable requirement.

3.2.5.1.3.3 Single Event Effect Ionizing Radiation

The HRF ASD Equipment shall be designed not to produce an unsafe condition or one that could cause damage to equipment external to the ASD as a result of exposure to Single Event Effect (SEE) ionizing radiation, assuming exposure levels specified in SSP 30512, paragraph 3.2.1, with a shielding thickness of 25.4 mm (1000 mils). (LS-71000, Section 6.3.7.3.3)

3.2.5.1.3.4 Lab Window Rack Location Radiation Requirements

Not applicable to the HRF ASD Equipment.

3.2.5.1.4 Additional Environmental Conditions

The environmental information provided in Table 3.2.5.1.4-1, Environmental Conditions on ISS, and Figure 3.2.5.1.4-1, Operating Limits of the ISS Atmospheric Total Pressure, Nitrogen and Oxygen Partial Pressures, is for design and analysis purposes. (LS-71000, Section 6.3.7.3.5)

3.2.5.1.4.1 Microgravity

A. For frequencies below 0.01 Hz, integrated racks and non-rack payloads shall limit unbalanced transitional average impulse to generate less than 10 lb-s (44.8 N-s) within any 10 to 500 second period, along any ISS coordinate system vector.

B. Between 0.01 and 300 Hz, integrated rack payloads without Active Rack Isolation System (ARIS) and inactive ARIS racks shall limit vibration so that the limits of Figure 3.2.5.1.4.1-1 are not exceeded using the force method, or the limits of Table 3.2.5.1.4.1-1 are not exceeded using the acceleration method. Non-rack payloads shall limit vibration so that one-fourth of the limits of Figure 3.2.5.1.4.1-1 are not exceeded using the force method, or one-fourth the limits of Table 3.2.5.1.4.1-1 are not exceeded using the acceleration method.

C. Integrated racks shall limit force applied to the ISS over any 10-second period to an impulse of no greater than 10 lb-s (44.5 N-s). Non-rack payloads shall limit force applied to the ISS over any 10-second period to an impulse of no greater than 2.5 lb-s (11.1 N-s).

D. Integrated racks and non-rack payloads shall limit their peak force applied to the ISS to less than 1000 lb (4448 N) for any duration.

TABLE 3.2.5.1.4-1. ENVIRONMENTAL CONDITIONS

Environmental Conditions	Value	
Atmospheric Conditions on ISS		
Pressure Extremes	0 to 104.8 kPa (0 to 15.2 psia)	
Normal operating pressure	See Figure 3.2.5.1.4-1	
Oxygen partial pressure	See Figure 3.2.5.1.4-1	
Nitrogen partial pressure	See Figure 3.2.5.1.4-1	
Dewpoint	4.4 to 15.6 °C (40 to 60 °F) ref. Figure 3.2.5.1.1.3-1	
Percent relative humidity	25 to 75 % ref. Figure 3.2.5.1.1.3-1	
Carbon dioxide partial pressure during normal operations with six crewmembers plus animals	24-hr average exposure 5.3 mm Hg Peak exposure 7.6 mm Hg	
Carbon dioxide partial pressure during crew changeout with 11 crewmembers plus animals	24-hr average exposure 7.6 mm Hg Peak exposure 10 mm Hg	
Cabin air temperature in United States Lab (USL), Japanese Experiment Module (JEM), Attached Pressurized Module (APM) and CAM	17 to 28 °C (63 to 82 °F)	
Cabin air temperature in Node 1	17 to 31 °C (63 to 87 °F)	
Air velocity (nominal)	0.051 to 0.203 m/s (10 to 40 ft/min)	
Airborne microbes	Less than 1000 CFU/m3	
Atmosphere particulate level	Average less than 100,000 particles/ft^3 for particles less than 0.5 microns in size	
MPLM Air Temperatures	**Passive Flights**	**Active Flights**
Pre-Launch	15 to 24 °C (59 to 75.2 °F)	14 to 30 °C (57.2 to 86 °F)
Launch/Ascent	14 to 24 °C (57.2 to 75.2 °F)	20 to 30 °C (68 to 86 °F)
On-Orbit (Cargo Bay + Deployment)	24 to 44 °C (75.2 to 111.2 °F)	16 to 46 °C (60.8 to 114.8 °F)
On-Orbit (On-Station)	23 to 45 °C (73.4 to 113 °F)	16 to 43 °C (60.8 to 109.4 °F)
On-Orbit (Retrieval + Cargo Bay)	17 to 44 °C (62.6 to 111.2 °F)	11 to 45 °C (51.8 to 113 °F)
Descent/Landing	13 to 43 °C (55.4 to 109.4 °F)	10 to 42 °C (50 to 107.6 °F)
Post-Landing	13 to 43 °C (55.4 to 109.4 °F)	10 to 42 °C (50 to 107.6 °F)
Ferry Flight	15.5 to 30 °C (59.9 to 86°F)	15.5 to 30 °C (59.9 to 86 °F)
MPLM Maximum Dewpoint Temperatures		
Pre-Launch	13.8 °C (56.8 °F)	12.5 °C (54.5 °F)
Launch/Ascent	13.8 °C (56.8 °F)	12.5 °C (54.5 °F)
On-Orbit (Cargo Bay +Deployment)	13.8 °C (56.8 °F)	12.5 °C (54.5 °F)
On-Orbit (On Station)	15.5 °C (60 °F)	15.5 °C (60 °F)
On-Orbit (Retrieval + Cargo Bay)	10 °C (50 °F)	10 °C (50 °F)
Descent/Landing	10 °C (50 °F)	10 °C (50 °F)
Post Landing	10 °C (50 °F)	10 °C (50 °F)
Ferry Flight	15.5 °C (60 °F)	15.5 °C (60 °F)
Thermal Conditions		
USL module wall temperature	13 °C to 43 °C (55 °F to 109 °F)	
JEM module wall temperature	13 °C to 45 °C (55 °F to 113 °F) **(TBR)**	
APM module wall temperature	13 °C to 43 °C (55 °F to 109 °F) **(TBR)**	
CAM module wall temperature	13 °C to 43 °C (55 °F to 109 °F) **(TBR)**	
Other integrated payload racks	Front surface less than 37 °C (98.6 °F)	
***Microgravity**		
Quasi-Steady State Environment	See SSP 57000 Figures 3.9.4-2, 3.9.4-3 and Table 3.9.4-2	
Vibro-acoustic Environment	See SSP 57000 Figure 3.9.4-4	
General Illumination	108 Lux (10 fc) measured 30 inches from the floor in the center of the aisle	

*NOTE: Data reflects best available information as of May 1997. The data does not include effects of Centrifuge Accommodation Module (CAM).

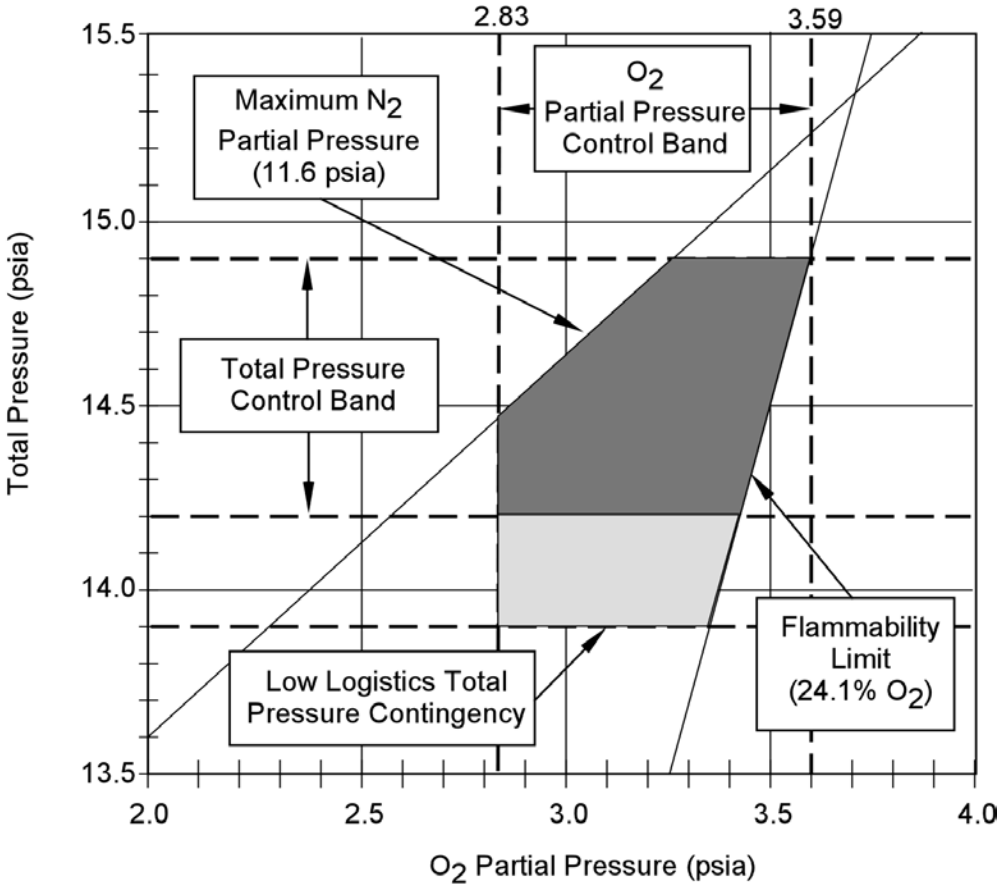


Figure 3.2.5.1.4-1. Operating Limits of the ISS Atmospheric Total Pressure, Nitrogen and Oxygen Partial Pressures

TABLE 3.2.5.1.4.1-1. ALLOWABLE INTEGRATED RACK NARROW BAND ENVELOPE AND WIDEBAND INTERFACE FORCE VALUES FOR ISPRS, 0.5% DAMPING FACTOR

Freq (Hz)	NB lb f	WB Lb f
0.008913	0.06261	0.089635
0.01122	0.06261	0.089635
0.01122	0.06261	0.073218
0.01413	0.06261	0.073218
0.01413	0.068172	0.084667
0.01778	0.068172	0.084667
0.01778	0.079202	0.097495
0.02239	0.079202	0.097495
0.02239	0.091377	0.112968
0.02818	0.091377	0.112968
0.02818	0.105641	0.133067
0.03548	0.105641	0.133067
0.03548	0.123739	0.161094
0.04467	0.123739	0.161094
0.04467	0.134457	0.205508
0.05623	0.134457	0.205508
0.05623	0.042699	0.22137
0.07079	0.042699	0.22137
0.07079	0.042699	0.158917
0.08913	0.042699	0.158917
0.08913	0.042699	0.2093
0.1122	0.042699	0.2093
0.1122	0.030213	0.373089
0.1413	0.030213	0.373089
0.1413	0.017289	0.146008
0.1778	0.017289	0.146008
0.1778	0.021755	0.083429
0.2239	0.021755	0.083429
0.2239	0.027396	0.24715
0.2818	0.027396	0.24715
0.2818	0.061482	0.224779
0.3548	0.061482	0.224779
0.3548	0.030924	0.378806
0.4467	0.030924	0.378806
0.4467	0.038934	0.138909
0.5623	0.038934	0.138909
0.5623	0.04901	0.274588
0.7079	0.04901	0.274588
0.7079	0.06922	0.222568
0.8913	0.06922	0.222568
0.8913	0.087153	0.404688
1.122	0.087153	0.404688
1.122	0.154561	1.337042
1.413	0.154561	1.337042
1.413	0.976353	4.322593
1.778	0.976353	4.322593
1.778	1.953413	8.01995
2.239	1.953413	8.01995
2.239	0.915835	7.567684
2.818	0.915835	7.567684
2.818	0.818034	3.504552
3.548	0.818034	3.504552
3.548	1.029953	3.531682
4.467	1.029953	3.531682
4.467	0.460611	2.979207
5.623	0.460611	2.979207
5.623	0.579824	2.330438
7.079	0.579824	2.330438
7.079	0.315606	1.16448
8.913	0.315606	1.16448
8.913	0.39737	4.848007
11.22	0.39737	4.848007
11.22	0.817148	3.451307
14.13	0.817148	3.451307
14.13	0.579786	3.358266
17.78	0.579786	3.358266
17.78	0.516921	2.048448
22.39	0.516921	2.048448
22.39	0.57451	2.091627
28.18	0.57451	2.091627
28.18	0.168996	1.443748
35.48	0.168996	1.443748
35.48	0.212776	0.50643
44.67	0.212776	0.50643
44.67	0.267886	1.498072
56.23	0.267886	1.498072
56.231	0.10793	0.431721
70.79	0.10793	0.431721
70.791	0.122491	0.489965
89.13	0.122491	0.489965
89.131	0.143827	0.575309
100	0.143827	0.575309
112.2	0.143827	0.575309
112.2	0.135367	0.541469
141.3	0.135367	0.541469
141.3	0.115819	0.463274
177.8	0.115819	0.463274
177.8	0.116941	0.467763
223.9	0.116941	0.467763
223.9	0.104363	0.417452
281.8	0.104363	0.417452
281.8	0.097688	0.390751
354.8	0.097688	0.390751

Note: Non–rack payloads are limited to one–fourth of these values

PAYLOAD INTERFACE FORCE METHOD

The total force will be calculated as the RMS average of the forces at all interface points for inactive (latched) ARIS P/L configurations, or the root-summed squared (RSS) of the forces at all interface points for non-ARIS payloads and non-rack payloads. The force at each interface point will be calculated to be the RSS in all axis, within each third octave band, during the worst-case 100 second interval.

The forces within each 1/3-octave band will be classified as either wide-band or narrow-band. Forces will be classified as wide-band if the peak-to-average ratio is less than or equal to five, otherwise they will be classified as narrow-band. The peak to average ratio will be determined by dividing the peak power spectrum magnitude of the one-third-octave band by the average magnitude within the band for the axis in which the peak occurs. The forces so classified will then be compared to the appropriate limit (wide or narrow band) in Figure 3.2.5.1.4.1-1.

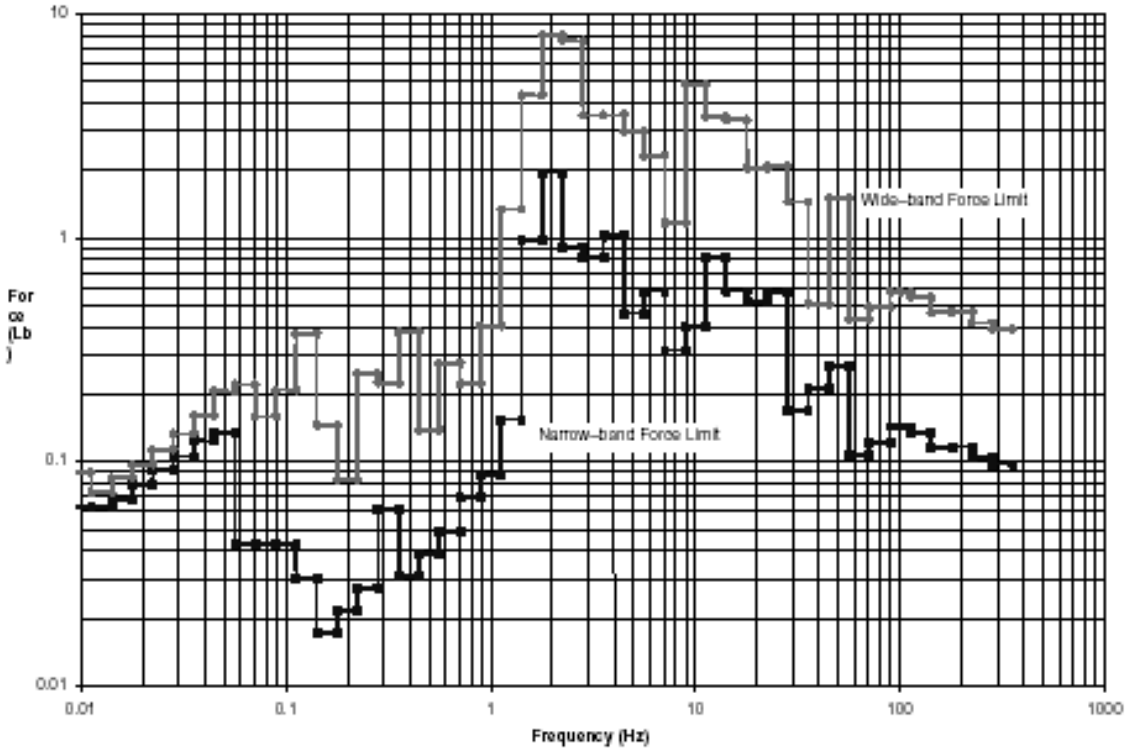


Figure 3.2.5.1.4.1-1. Allowable 1/3rd Octave Interface Forces for Integrated Racks and Non-Rack Payloads, 0.5% Damping Factor

3.2.5.1.5 Pressure Rate of Change

A. The HRF ASD Equipment shall maintain positive margins of safety for the on-orbit depress/repress rates in Table 3.2.5.1.5-1. (LS-71000, Section 6.3.1.2B)

TABLE 3.2.5.1.5-1. ISS PRESSURE RATE OF CHANGE

Depressurization	878 Pa/sec (7.64 psi/minute)
Repressurization	230 Pa/sec (2.0 psi/minute)

B. Deleted

C. HRF ASD Equipment shall maintain positive margins of safety for maximum depressurization and repressurization rates for the carrier(s) in which it will be transported. (LS-71000, Section 6.3.1.2A)

1. HRF ASD Equipment shall maintain positive margins of safety for maximum depressurization and repressurization rates for the MPLM documented in Table 3.2.5.1.5-2. (Derived from LS-71000, Section 6.3.1.2A)

TABLE 3.2.5.1.5-2. MPLM PRESSURE RATE OF CHANGE

Depressurization	890 Pa/sec (7.75 psi/minute)
Repressurization	800 Pa/sec (6.96 psi/minute)

2. HRF ASD Equipment shall maintain positive margins of safety for maximum depressurization and repressurization rates for the Orbiter Middeck documented in Table 3.2.5.1.5-3. (Derived from LS-71000, Section 6.3.1.2A)

TABLE 3.2.5.1.5-3. ORBITER MIDDECK PRESSURE RATE OF CHANGE

Depressurization/Repressurization	1031 Pa/sec (9.0 psi/minute)

D. Not applicable to the HRF ASD Equipment.

3.2.5.2 Acoustic Emission Limits

3.2.5.2.1 Continuous Noise Limits

Not Applicable to the HRF ASD Equipment. The ASD is not a continuous noise source.

3.2.5.2.2 Intermittent Noise Limits

A. The HRF ASD Equipment (See Section 6.1, Definitions for Intermittent Noise Source) shall not exceed the Total Rack A-weighted Sound Pressure Level (SPL) limits during the Maximum Rack Noise Duration as specified in Table 3.2.5.2.2-1, Intermittent Noise Limits, when the equipment is operating in the loudest expected configuration and mode of operation that can occur on-orbit under any planned operations. (LS-71000, Section 6.4.3.3.2A)

   NOTE: These acoustic requirements do not apply during failure or maintenance operations. (LS-71000, Section 6.4.3.3.2)

B. The Rack Noise Duration is the total time that the rack produces intermittent noise above the NC-40 limit during a 24-hour time period. This duration is the governing factor in determining the allowable Intermittent Noise Limits. Regardless of the number of separate sources and varying durations within a rack, this cumulative duration shall be used to determine the A-weighted SPL limit in column B. (LS-71000, Section 6.4.3.3.2B)

TABLE 3.2.5.2.2-1. INTERMITTENT NOISE LIMITS

Rack Noise Limits Measured At 0.6 Meters Distance From The Test Article	
Maximum Rack Noise Duration	Total Rack A - Weighted SPL (dBA)
8 Hours	49
7 Hours	50
6 Hours	51
5 Hours	52
4 Hours	54
3 Hours	57
2 Hours	60
1 Hour	65
30 Minutes	69
15 Minutes	72
5 Minutes	76
2 Minutes	78
1 Minute	79
Not Allowed	80

3.2.5.3 Deleted

3.2.6 Transportability

3.2.6.1 Launch and Landing

The HRF ASD Equipment shall be transportable to and from orbit contained within the SWAB Stowage Kit. Equipment carried in the Shuttle middeck lockers shall be transportable in the Shuttle middeck locker to and from orbit, as specified in NSTS-21000-IDD-MDK. (LS-71000, Section 6.3.1.3)

3.2.7 Operational Interface Requirements

There are no planned operational interfaces for the HRF ASD Equipment. It will be a hand-held device intended to be used as such. However, the possibility to place the device using Velcro will be possible.

3.2.7.1 Mechanical Interface Requirements

3.2.7.1.1 Connector Physical Mate

Not Applicable to the HRF ASD Equipment. The ASD Equipment has no physical mating via connector to any other object.

3.2.7.2 Electrical Interface Requirements

3.2.7.2.1 Electromagnetic Radiation

3.2.7.2.1.1 Electromagnetic Compatibility

The HRF ASD Equipment shall meet the P/L provider applicable requirements of SSP 30243, paragraphs 3.1 and 3.6.2. (LS-71000, Section 6.3.2.4)

EXCEPTION: The HRF ASD Equipment shall only test to Radiated Emission Requirements RE-02. HRF ASD Equipment will not perform any of the Electromagnetic Interference (EMI) Susceptibility tests or conducted emissions tests (CS-01, CS-02, CS-06, CRS-02, RS-03, CE-01, CE-03, and CE-07).

3.2.7.2.1.1.1 Electrical Grounding

Not Applicable to the HRF ASD Equipment.

3.2.7.2.1.1.2 Electrical Bonding

Not Applicable to the HRF ASD Equipment

3.2.7.2.1.2 Electromagnetic Interference

The HRF ASD Equipment shall meet all EMI requirements of SSP 30237. (LS-71000, Section 6.3.2.4.4)

EXCEPTION: The HRF ASD Equipment shall only test to Radiated Emission Requirements RE-02. HRF ASD Equipment will not perform any of the EMI Susceptibility tests or conducted emissions tests (CS-01, CS-02, CS-06, CRS-02, RS-03, CE-01, CE-03, and CE-07).

3.2.7.2.2 Electrostatic Discharge

A. Unpowered HRF ASD Equipment shall not be damaged by Electrostatic Discharge (ESD) equal to or less than 4000 V to the case or any pin on external connectors.(LS-71000, Section 6.3.2.5)

B. If the HRF ASD Equipment is damaged by ESD between 4000 V and 15,000 V, it shall have a label affixed to the case in a location clearly visible in the installed position. (LS-71000, Section 6.3.2.5)

C. Labeling of the HRF ASD Equipment susceptible to ESD up to 15,000 V shall be in accordance with MIL-STD-1686. (LS-71000, Section 6.3.2.5)

NOTE: These voltages are the result of charges that may be accumulated and discharged from ground personnel or crewmembers during equipment installation or removal. (LS-71000, Section 6.3.2.5)

3.2.7.2.3 Corona

Not applicable to the HRF ASD Equipment.

3.2.7.2.4 Cable/Wire Design and Control Requirements

Not applicable to the HRF ASD Equipment.

3.2.7.2.4.1 Wire Derating

A. Deleted

B. Derating criteria for rack independent instrument circuit elements below the first level of instrument provided circuit protection shall be per NASA Technical Memo (TM) 102179, as interpreted by NSTS 18798, TA-92-038. (LS-71000, Section 6.3.2.1B)

3.2.7.2.4.2 Exclusive Power Feeds

Not applicable to the HRF ASD Equipment.

3.2.7.2.5 Loss of Power

Not Applicable to the HRF ASD Equipment.

3.2.7.2.6 Alternating Current Magnetic Fields

The generated Alternating Current (AC) magnetic fields, measured at a distance of 7 centimeters (cm) from the HRF ASD Equipment, shall not exceed 140 dB above 1 picotesla for a frequency at 30 Hz, then falling 26.5 dB per decade to 3.5 kHz, and 85 dB for frequencies ranging from 3.5 kHz to 50 kHz. (LS-71000, Section 6.3.2.6)

3.2.7.2.7 Direct Current Magnetic Fields

The generated Direct Current (DC) magnetic fields shall not exceed 170 dB picotesla at a distance of 7 cm from the HRF ASD Equipment. This applies to electromagnetic and permanent magnetic devices. (LS-71000, Section 6.3.2.7)

3.2.7.2.8 Utility Outlet Panel (UOP) Interface Requirements

Not Applicable to the HRF ASD Equipment.

3.2.7.3 Command and Data Handling Interface Requirements

Not Applicable to the HRF ASD Equipment.

3.2.7.4 Fire Protection Interface Requirements

Fire detection requirements for instruments operated outside of rack volumes have not been defined by ISS. The Payload Safety Review Panel (PSRP) must approve fire detection methodology for instruments operated outside of rack volumes. Fire protection requirements in this section apply to all instruments. Fire suppression requirements in this section apply for instruments operated outside of the rack volume that have forced airflow. (LS-71000, Section 6.3.8)

3.2.7.4.1 Fire Prevention

The HRF ASD Equipment shall meet the fire prevention requirements specified in NSTS 1700.7B, ISS Addendum, paragraph 220.10a. (LS-71000, Section 6.3.8.1)

3.2.7.4.2 Fire Suppression

NOTE: Each separate HRF rack and subrack equipment volume, which contains a potential fire source, will require fire suppression capabilities. Determination of potential fire sources will be presented to and approved by the PSRP during the phased safety reviews. Safety fire suppression requirements are specified in NSTS 1700.7B, ISS Addendum, paragraph 220.10c. [SSP 57000E, paragraph 3.10.3]

Not Applicable for the HRF ASD Equipment. No Portable Fire Extinguisher (PFE) access port required. The ASD Equipment meets NSTS 22648 containment requirements from using the cabin smoke detector.

3.2.7.4.3 Labeling

Not Applicable to the HRF ASD Equipment.

3.2.7.5 Other Interface Requirements

3.2.7.5.1 Intravehicular Activity Transfer Pathway

The HRF ASD Equipment shall fit within the following dimensions: 18.125 in. by 21.88 in. by 21.062, in as indicated in the Middeck Interface Definition Document (IDD). (NSTS-21000-IDD-MDK Section 3.0)

3.2.7.5.2 Launch and Landing Loads

The HRF ASD Equipment shall maintain positive margins of safety for the limit load factors specified in Table 3.2.7.5.2-1.

TABLE 3.2.7.5.2-1. MIDDECK PAYLOAD DESIGN LOAD FACTORS

	Nx Limit Load Factor (g)	Ny Limit Load Factor (g)	Nz Limit Load Factor (g)
Lift-off	+/-6.00	+/-3.40	+/-6.30
Landing	+/-6.25	+/-2.50	+/-12.50

3.2.7.5.3 Kick Loads

The HRF ASD Equipment shall provide positive margins of safety when exposed to a 125-pound limit load distributed over a 4-inch x 4-inch area.

3.2.7.5.4 Factors of Safety for Structural Design

A. The HRF ASD Equipment shall use an ultimate factor of safety = 1.4 for structural design.

B. Not Applicable for the HRF ASD Equipment.

C. Not Applicable for the HRF ASD Equipment.

D. Not Applicable for the HRF ASD Equipment.

3.2.7.5.5 Fracture Control

HRF ASD Equipment structural components, including all pressure vessels, the failure of which would cause damage to the Orbiter or injury to personnel, shall be analyzed to preclude failures caused by propagation of pre-existing flaws. Fracture control of critical structural components shall be verified in accordance with NSTS 1700.7B and NHB 8071.1 during the P/L safety review process.

3.2.7.5.6 Acoustic Noise

The HRF ASD Equipment shall meet the acoustic noise limits shown in Table 3.2.7.5.6-1 as measured 1 foot from the noise radiating surfaces(s).

TABLE 3.2.7.5.6-1. INTERMITTENT NOISE LIMITS

A-Weighted SPL* (BA)	Maximum Allowable Duration**
55-60	8 Hours
61-65	4 Hours
66-70	2 Hours
71-75	1 Hour
76-80	5 Minutes
81-85	1 Minute
86 and Above	Not Allowed

* A-Weighted SPL, Decibels (dB) re 20 micropascals. Measured at 0.3 meters distance from noisiest surface with equipment operating in the mode or condition that produces the maximum acoustic noise. Round Acoustic Decibel Level (dBA) to nearest whole number.

** Per 24-hour period.

3.2.7.5.7 Payload Element Cleanliness

A. HRF ASD Equipment external surfaces shall conform to the visibly clean level as specified in SN-C-0005 prior to installation into the Orbiter.

B. Cleaning fluids used to clean the HRF ASD Equipment shall comply with the requirements specified in NSTS 08242.

3.2.7.5.8 Payload Effluents

A. The HRF ASD Equipment shall provide for safe containment of any by-product of P/L experiment-gaseous, liquid or solid.

B. The HRF ASD Equipment shall not discharge any gases into the Orbiter.

3.2.7.5.9 Nuclear Radiation

The HRF ASD Equipment shall not use materials containing natural or man-made radioisotopes (in any quantity, including trace amounts).

3.2.7.5.10 Environmental Conditions

The HRF ASD Equipment shall be certified safe for the following environments:

• Dew Point	+61 ºF to +39 ºF
• Cabin Pressure	14.7 + 0.2 psia (Normal Operation)
	8.0 + 0.2 psia (Abort Operations - to be considered for Structural Design Purposes. P/L required to be powered off.)
	16.0 psia Maximum On-Orbit (Relief valve Operation)
	18.1 psia maximum (Ground Pressurization Test)
	Reduced cabin pressure Extravehicular Activity (EVA) procedure: 10.2 ± 0.5 psia (+ 0.2 psia dynamic operating range, ± 0.3 psia sensor bias error)
• Cabin Rate of Pressure Change	2.0 psi/min Repressurization/ Depressurization
• Nominal Operations	
• Contingency (other than Bailout)	9.0 psi/min Depressurization/ Repressurization

• Particulate Level	Cabin air
• Cabin O_2 Concentration	25.9 percent at 14.7 + 0.2 psia 30.0 percent maximum at 10.2 psia
• Contingency hold in Cabin (P/L required)	32.0 percent at 8 psia to be powered off
• Temperature (Cabin Air)	65 - 80 ºF Nominal on-orbit operations
	80 ºF Peak launch/ascent
	75 ºF Peak entry/landing
	95 ºF Peak contingency operations
	32 - 120 ºF Ferry flight
• Temperature (Structure)	120 ºF Max (All Mission Phases)

3.2.7.5.11 Payload Waste Heat Dissipation

A. HRF ASD Equipment waste heat shall be dissipated to middeck cabin air.

B. HRF ASD Equipment shall design cooling based on 10.2 psia cabin pressure.

3.2.7.5.12 Passive Cooling

HRF ASD Equipment shall generate less than 60 W continuous heat load unless HRF ASD Equipment is designed with an active means of rejecting heat to the cabin (i.e., P/L fan).

The SP design value for the convective heat transfer coefficient is 0.25 Btu/hr ºF ft^2 for 14.7 psia or 0.17 Btu/hr ºF ft^2 for 10.2 psia cabin pressure.

3.2.7.5.13 Non-Ducted Air Cooling

HRF ASD Equipment non-ducted cooling outlet temperature shall not exceed 120 ºF.

3.2.7.5.14 Non-Ducted Payload Contamination Protection

A. HRF ASD Equipment active cooling design shall be compatible with ingestion of up to 1 gram of lint-like contamination from the cabin and/or 1.0 square inch material blockage or provide protection from that contamination.

B. HRF ASD Equipment active cooling system design shall not contribute to further contamination of the cabin or avionics bays.

3.2.7.5.15 External Surface Temperatures

HRF ASD Equipment external surfaces accessible and inaccessible to the crew shall not exceed 120 °F.

3.2.7.5.16 Payload Element Activation/Deactivation and Isolation

HRF ASD Equipment shall provide means for its power activation/deactivation via crew control.

3.2.7.5.17 Payload Produced Radiated Fields

HRF ASD Equipment radiated field shall be limited as follows:

A. The unintentional radiated electric fields shall not exceed the levels defined in Figure 3.2.7.5.17-1.

B. The generated AC magnetic fields (applies at a distance of 1 meter from any P/L equipment) shall not exceed 130 dB above 1 picotesla (30 Hz to 2 kHz) falling 40 dB per decade to 50 kHz.

C. The generated DC magnetic fields shall not exceed 170 dBpT at the P/L envelope. This limit applies to electromagnetic and permanent magnetic devices.

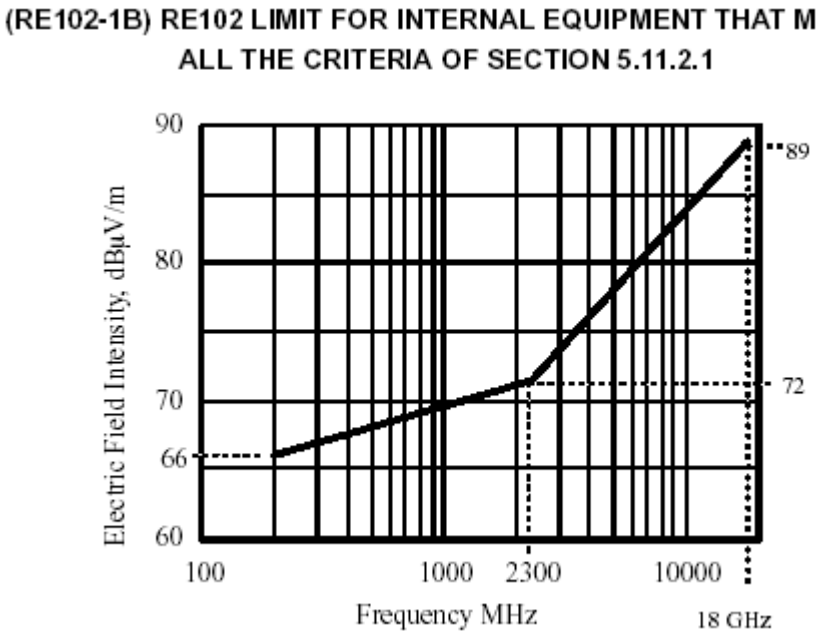


Figure 3.2.7.5.17-1. Payload Allowable Unintentional Radiated Emissions

3.2.7.5.18 Electrical Bonding

A. HRF ASD Equipment to Orbiter electrical bonding interfaces shall be securely bonded to structure in compliance with NSTS 37330 Class S bond requirements.

B. Not Applicable to the HRF ASD Equipment.

C. HRF ASD Equipment conducting items subject to triboelectric (frictional) or any other charging mechanism shall have a mechanically secure electrical connection to the cargo element structure. The resistance of this connection shall be less than 1 ohm.

EXCEPTION: The HRF ASD Equipment cannot be bonded to the cargo element structure. The unit must be portable in design per its functional requirements.

3.2.7.5.19 Static Electricity Protection

HRF ASD Equipment shall be designed to preclude the accumulation of an electrostatic charge on its external surfaces.

3.2.7.5.20 Russian Segment EMI

Equipment installed in the Russian segment shall not produce interference in excess of the limits given in Figure 3.2.7.5.20-1. Above 30 MHz, adherence to the limits must be ensured for both horizontally and vertically polarized waves. Measurements should be taken with the detector in quasi-peak (or peak) mode. The distance between the measuring antenna and equipment must be 1m.

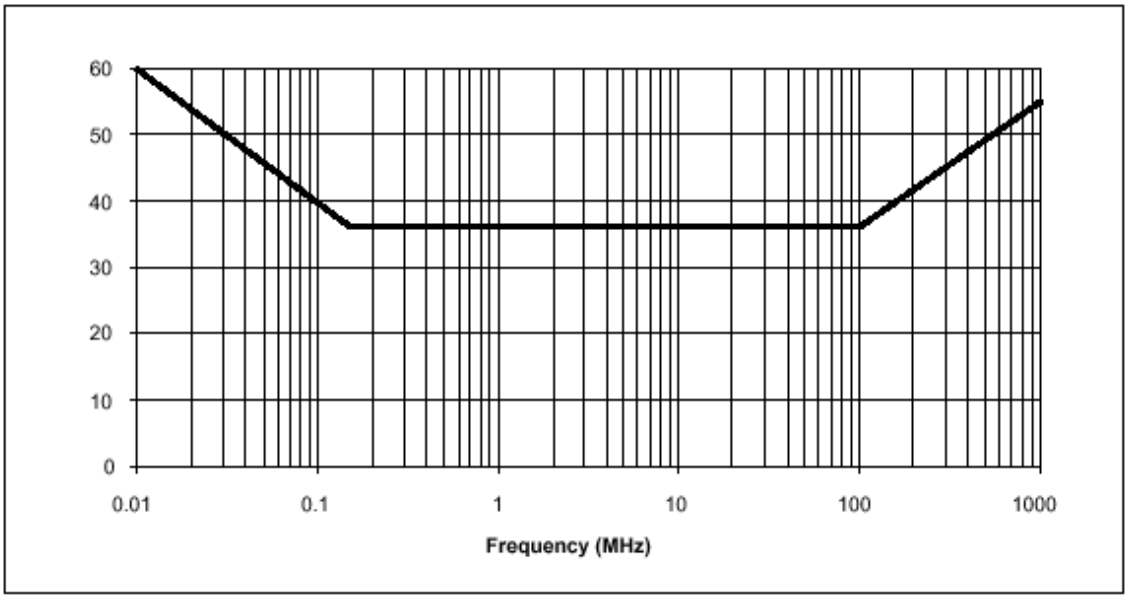


Figure 3.2.7.5.20-1. Russian Segment EMI Radiated Emissions

The values given in Figure 3.2.7.5.20-1 are calculated according to the following formula:

- In the frequency band from 0.01 through 0.15 MHz E QP = 60 - 20.4 lg(f/0.01) [dBmicroV/m]
- In the frequency band from 0.15 through 100 MHz E QP = 36 [dBmicroV/m]
- In the frequency band from 100 through 1000 MHz E QP = 36 + 19 lg(f/100) [dBmicroV/m], where f is the frequency in [MHz].

NOTES:

1. The measurement band should be no narrower than:
   - 0.2 kHz in the 0.01 - 0.15 MHz range
   - 9.0 kHz in the 0.15 - 30.0 MHz range
   - 120 kHz in the 30 - 100 MHz range.
2. The given requirements do not apply to radio frequency interference produced by emissions of radio transmitter output channels.
3. The following requirements will be verified with U.S. provided hardware:
   - In the frequency band from 1 GHz through 10 GHz E QP = 55 + 17 lg(f) [dBmicroV/m] where f is the frequency in GHz
   - In the frequency band from 13.5-15.5 GHz E QP = 76 dBmicroV/m.

3.2.7.5.21 Lighting Design

The general illumination of the space station in the aisle will be a minimum of 108 lux [10 foot candles (fcs)] of white light. This illumination will be sufficient for ordinary P/L operations performed in the aisle (e.g., examining dials or panels, reading procedures, transcription, tabulation, etc.). Payloads will meet the following requirements:

A. P/L work surface specularity shall not exceed 20 percent. Paints listed in Table 3.12.3.4-1 meet this requirement.

B. Not applicable to the HRF ASD Equipment.

TABLE 3.12.3.4-1. SURFACE INTERIOR COLORS AND PAINTS

Hardware Description	Color	Finish	Paint Specification Per FED-STD-595
Equipment Rack Utility Panel Recess	White	Semigloss	27925
Equipment Rack Utility Panel Text Characters	Black	Lusterless	37038
International Standard Payload Rack (ISPR) Utility Panel Recess	White	Semigloss	27925
ISPR Utility Panel Recess Text Characters	Black	Lusterless	37038
Functional Unit Utility Panel Recess (as applicable)	White	Semigloss	27925
Functional Unit Utility Panel Recess Text Characters	Black	Lusterless	37038
Rack Front Aisle Extensions	Off-White	Semigloss	27722
Overhead Rack Face Plates	Off-White	Semigloss	27722
Port Rack Face Plates	Off-White	Semigloss	27722
Starboard Rack Face Plates	Off-White	Semigloss	27722
Deck Rack Face Plates	Off-White	Semigloss	27722
Overhead Rack Utility Panel Closeouts	Off-White	Semigloss	27722
Port Rack Utility Panel Closeouts	Off-White	Semigloss	27722
Starboard Rack Utility Panel Closeouts	Off-White	Semigloss	27722
Deck Rack Utility Panel Closeouts	Off-White	Semigloss	27722
Stowage Trays	Off-White	Semigloss	27722
Stowage Tray Handle Straps (any location)	Blue material	Semigloss	25102 or equiv.
Common Seat Track Interface	Clear (Anodized)	Semigloss	none
Glovebox (Aluminum or Plastic)	Medium Gray	Gloss	16329 or 16373
Glovebox (Aluminum)	White	Gloss	17925
Glovebox (Aluminum or Plastic)	Off-White	Gloss	17722
Glovebox (Aluminum)	Tan	Gloss	10475
EXPRESS Program Rack Utility Panels	Off-White	Gloss	17875

3.3 DESIGN AND CONSTRUCTION

3.3.1 Materials, Processes, and Parts

3.3.1.1 Materials and Processes

A. The HRF ASD Equipment shall use materials and parts that meet the materials requirements specified in NSTS 1700.7, ISS Addendum, Section 209. (LS-71000, Section 6.3.9.1)

B. COTS parts used in the HRF ASD Equipment shall meet the materials requirements specified in NSTS 1700.7, ISS Addendum, Section 209. (LS-71000, Section 6.3.9.2)

C. The HRF ASD Equipment shall conform to Visibly Clean-Sensitive (VC-S) requirements as specified in SN-C-0005. (LS-71000, Section 6.3.9.3)

D. Deleted

E. HRF EUE instruments that are intended to remain on-orbit for more than 1 year shall use fungus resistant materials according to the requirements specified in SSP 30233, paragraph 4.2.10. (LS-71000, Section 6.3.9.4)

F. Materials shall comply with the "Agreement on the Safe Utilization of Materials in Cargos to be Delivered to ISS by Any Vehicle and Transferred to ISS for Stowage and/or Operation - 6/22/2000." (LS-71000, Section 6.3.9.1.1)

G. Fiberglass cloth tape shall not be used in HRF payloads that may be carried into the ISS Russian segment. (Materials and Processes Technology Branch)

3.3.1.2 Sharp Edges and Corner Protection

The HRF ASD Equipment design within a pressurized module shall protect crewmembers from sharp edges and corners during all crew operations in accordance with NSTS 1700.7, ISS Addendum, paragraph 222.1. (LS-71000, Section 6.4.9.2)

3.3.1.3 Holes

Holes that are round or slotted in the range of 10.0 to 25.0 mm (0.4 to 1.0 in) shall be covered. (LS-71000, Section 6.4.9.3)

3.3.1.4 Latches

Latches that pivot, retract, or flex so that a gap of less than 35 mm (1.4 in) exists shall be designed to prevent entrapment of a crewmember's appendage. (LS-71000, Section 6.4.9.4)

3.3.1.5 Screws and Bolts

Threaded ends of screws and bolts accessible by the crew and extending more than 3.0 mm (0.12 in) shall be capped to protect against sharp threads. (LS-71000, Section 6.4.9.5)

3.3.1.6 Securing Pins

Securing pins shall be designed to prevent their inadvertently backing out above the handhold surface. (LS-71000, Section 6.4.9.6)

3.3.1.7 Levers, Cranks, Hooks and Controls

Levers, cranks, hooks and controls shall not be located where they can pinch, snag, or cut the crewmembers or their clothing. (LS-71000, Section 6.4.9.7)

3.3.1.8 Burrs

Exposed surfaces shall be free of burrs. (LS-71000, Section 6.4.9.8)

3.3.1.9 Locking Wires

A. Safety wires shall not be used on fasteners, which must be unfastened for on-orbit removal or replacement. (LS-71000, Section 6.4.9.9A)

B. All fracture-critical fasteners as defined in SSP 52005 (paragraph 5.6, Fastener Requirements, and Appendix B, Glossary of Terms), which must be unfastened for on-orbit removal or replacement, shall be safety cabled or cotter pinned. (LS-71000, Section 6.4.9.9B)

C. Safety wire shall not be used on any on-orbit fastener.

3.3.2 Nameplates and Product Marking

3.3.2.1 Equipment Identification

Integrated racks, all (installed in the rack or separately) sub-rack elements, loose equipment, stowage trays, consumables, ORUs, crew accessible connectors and cables, switches, indicators, and controls shall be labeled. Labels are markings of any form, such as decals, placards and Inventory Management System (IMS) labels, which can be adhered, “silk screened,” engraved, or otherwise applied directly onto the hardware. Appendix C of SSP 57000E provides instructions for label and decal design and approval. (LS-71000, Section 6.4.7)

3.3.3 Workmanship

Workmanship shall be in accordance with approved NASA and industry recognized standards. (LS-71000, Section 7.3.1)

3.3.4 Interchangeability

Interchangeability requirements are not applicable to detail parts of permanent assemblies such as welded assemblies or matched detailed parts, such as lapped components. Interchangeability requirements do not apply to custom-fitted or custom sized items.

All replaceable parts for the HRF ASD Equipment having the same part number shall be directly and completely interchangeable with each other, with respect to form, fit and function.

3.3.5 Safety Requirements

3.3.5.1 Electrical Safety

3.3.5.1.1 Mating/Demating of Powered Connectors

A. Not applicable to the HRF ASD Equipment.

B. Not applicable to the HRF ASD Equipment.

3.3.5.1.2 Power Switches/Controls

Not applicable to the HRF ASD Equipment.

3.3.5.1.3 Ground Fault Circuit Interrupters (GFCIs)/Portable Equipment DC Sourcing Voltage

Not Applicable to the HRF ASD Equipment.

3.3.5.1.4 Portable Equipment/Power Cords

Not Applicable to the HRF ASD Equipment.

3.3.6 Human Engineering

3.3.6.1 Closures or Covers Design Requirements

Closures or covers shall be provided for any area of the P/L that is not designed for routine cleaning. (LS-71000, Section 6.4.3.1.1)

NOTE: SSP 50005, Section 11.4.3, may be used as a guideline for the design of closures and covers on equipment housing.

3.3.6.2 Interior Color

3.3.6.2.1 Rack Mounted Equipment

Not Applicable to the HRF ASD Equipment.

3.3.6.2.2 Stowed/Deployable Equipment

The colors and finishes for stowed and deployable equipment, even if it is normally attached to the rack during use, shall be as specified below:

A. COTS equipment that is not repackaged by HRF engineers shall be finished as delivered by the manufacturer. (LS-71000, Section 6.4.3.5.2A)

B. Items that are repackaged by HRF engineers shall be finished using anodic film per MIL-A-8625, Type II, Class 2, Dyed Turquoise. Reference FED-STD-595, Color Specification 15187. (LS-71000, Section 6.4.3.5.2B)

3.3.6.2.3 Colors for Soft Goods

Human factors engineering will provide guidance in the appropriate colors for soft goods, in cooperation with the lead engineers, who will provide data on the available color choices for the specified materials.

3.3.6.3 Full Size Range Accommodation

A. All P/L workstations and hardware having crew nominal operations and planned maintenance shall be sized to meet the functional reach limits for the 5th percentile Japanese female and yet shall not constrict or confine the body envelope for the 95th percentile American male as specified in SSP 50005, Section 3. (LS-71000, Section 6.4.2.3)

B. COTS equipment shall be as delivered by the manufacturer and is exempted from this requirement.

3.3.6.4 Operation and Control of Payload Equipment

A. Grip Strength

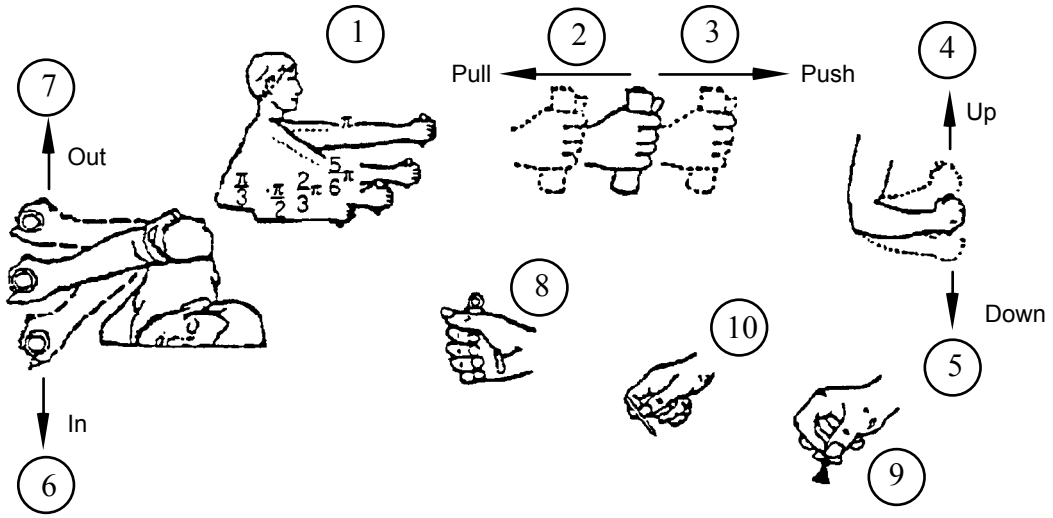
To remove, replace and operate P/L hardware, grip strength required shall be less than 254 N (57 lbf). (LS-71000, Section 6.4.1.1A)

B. Linear Forces

Linear forces required to operate or control P/L hardware or equipment shall be less than the strength values for the 5th percentile female, defined as 50% of the strength values shown in Figure 3.3.6.4-1, and 60% of the strength values shown in Figure 3.3.6.4-2. (LS-71000, Section 6.4.1.1B)

C. Torque

Torque required to operate or control P/L hardware or equipment shall be less than the strength values for the 5th percentile female, defined as 60% of the calculated 5th percentile male capability shown in Figure 3.3.6.4-3. (LS-71000, Section 6.4.1.1C)



Arm Strength (N)												
(1)	(2)		(3)		(4)		(5)		(6)		(7)	
Degree of elbow flexion (rad)	Pull		Push		Up		Down		In		Out	
	L**	R**	L	R	L	R	L	R	L	R	L	R
π	222	231	187	222	40	62	58	76	58	89	36	62
5/6 π	187	249	133	187	67	80	80	89	67	89	36	67
2/3 π	151	187	116	160	76	107	93	116	89	98	45	67
1/2 π	142	165	98	160	76	89	93	116	71	80	45	71
1/3 π	116	107	96	151	67	89	80	89	76	89	53	76
Hand and thumb-finger strength (N)												
	(8)				(9)				(10)			
	Hand Grip											
	L		R		Thumb-finger grip (Palmer)				Thumb-finger grip (tips)			
Momentary hold	250		260		60				60			
Sustained hold	145		155		35				35			
*Elbow angle shown in radians **L = Left, R = Right												
Arm strength (lb)												
(1)	(2)		(3)		(4)		(5)		(6)		(7)	
Degree of elbow flexion (deg)	Pull		Push		Up		Down		In		Out	
	L	R*	L	R	L	R	L	R	L	R	L	R
180	50	52	42	50	9	14	13	17	13	20	8	14
150	42	56	30	42	15	18	18	20	15	20	8	15
120	34	42	26	36	17	24	21	26	20	22	10	15
90	32	37	22	36	17	20	21	26	16	18	10	16
60	26	24	22	34	15	20	18	20	17	20	12	17
Hand and thumb-finger strength (lb)												
	(8)				(9)				(10)			
	Hand Grip											
	L		R		Thumb-finger grip (Palmer)				Thumb-finger grip (tips)			
Momentary hold	56		59		13				13			
Sustained hold	33		35		8				8			
*Left; R = Right												

Figure 3.3.6.4-1. Arm, Hand and Thumb/Finger Strength (5th Percentile Male Data)

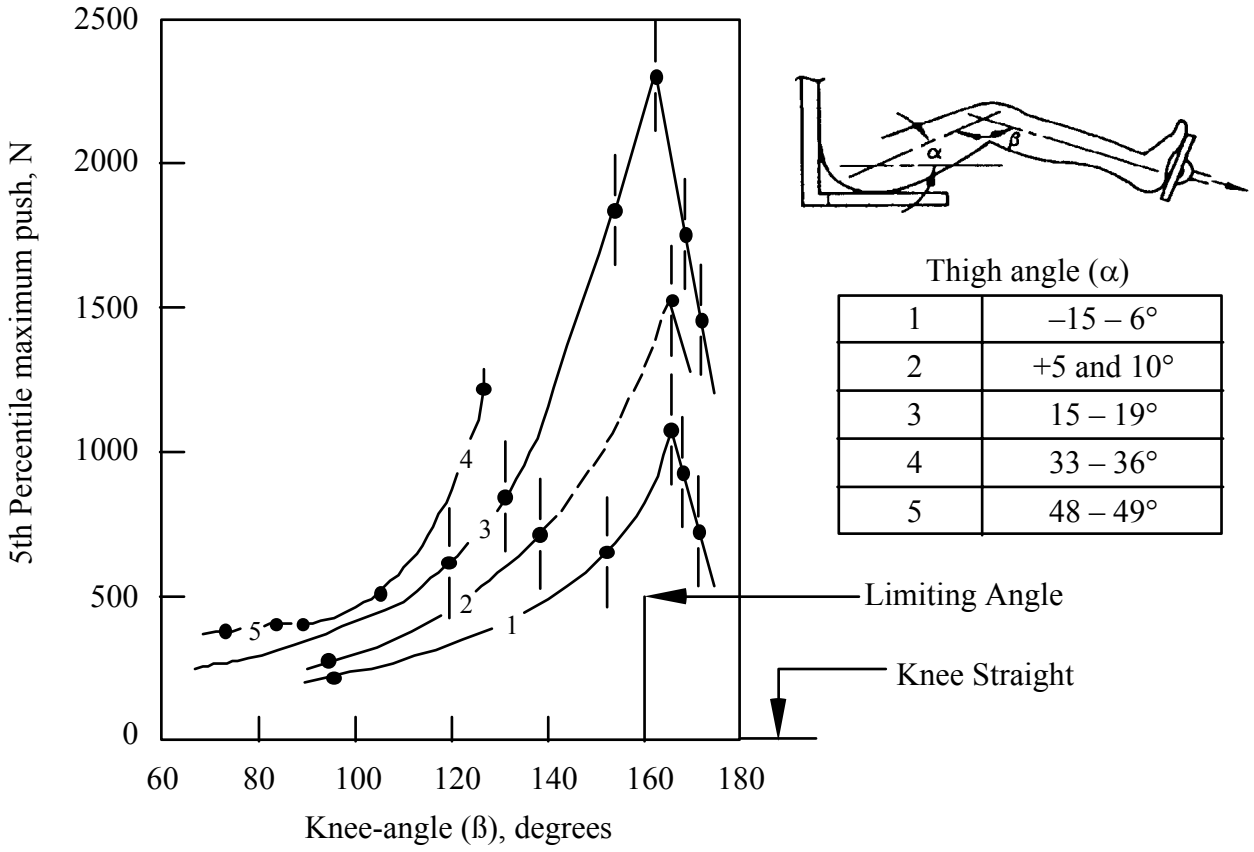


Figure 3.3.6.4-2. Leg Strength at Various Knee and Thigh Angles (5th Percentile Male Data)

	Unpressurized suit, bare handed	
	Mean	SD
Maximum torque: Suppination, Nm (lb-in.)	13.73 (121.5)	3.41 (30.1)
Maximum torque: Pronation, Nm (lb-in.)	17.39 (153.9)	5.08 (45.0)

Figure 3.3.6.4-3. Torque Strength

3.3.6.5 Maintenance Operations

Not Applicable to the HRF ASD Equipment.

3.3.6.6 Adequate Clearance

Not Applicable to the HRF ASD Equipment.

3.3.6.7 Accessibility

A. P/L hardware shall be geometrically arranged to provide physical and visual access for all P/L installation, operations, and maintenance tasks. P/L ORUs should be removable along a straight path until they have cleared the surrounding structure. (LS-71000, Section 6.4.2.2A)

B. IVA clearances for finger access shall be provided as given in Figure 3.3.6.7-1. (LS-71000, Section 6.4.2.2B)

3.3.6.8 One-Handed Operation

Cleaning equipment and supplies shall be designed for one-handed operation or use. (LS-71000, Section 6.4.3.1.3)

3.3.6.9 Continuous/Incidental Contact - High Temperature

When P/L surfaces whose temperature exceeds 49 °C (120 °F), which are subject to continuous or incidental contact, are exposed to crewmember's bare skin contact, protective equipment shall be provided to the crew, and warning labels shall be provided at the surface site. This also applies to surfaces not normally exposed to the cabin in accordance with the NASA IVA Touch Temperature Safety interpretation letter JSC, MA2-95-048. (LS-71000, Section 6.4.3.2.1)

3.3.6.10 Continuous/Incidental Contact - Low Temperature

Not Applicable to the HRF ASD Equipment.

3.3.6.11 Equipment Mounting

Equipment items used during nominal operations, and planned maintenance shall be designed, labeled, or marked to protect against improper installation. (LS-71000, Section 6.4.4.2.1)

3.3.6.12 Drawers and Hinged Panels

Not Applicable to the HRF ASD Equipment.

3.3.6.13 Alignment

Not Applicable to the HRF ASD Equipment.

3.3.6.14 Push-Pull Force

Not Applicable to the HRF ASD Equipment.

3.3.6.15 Covers

Where physical access is required, one of the following practices shall be followed, with the order of preference given.

A. Provide a sliding or hinged cap or door where debris, moisture, or other foreign materials might otherwise create a problem. (LS-71000, Section 6.4.4.2.6.1A)

B. Provide a quick-opening cover plate if a cap will not meet stress requirements. (LS-71000, Section 6.4.4.2.6.1B)

3.3.6.16 Self-Supporting Covers

All access covers that are not completely removable shall be self-supporting in the open position. (LS-71000, Section 6.4.4.2.6.2)

3.3.6.17 Accessibility

Not Applicable to the HRF ASD Equipment.

3.3.6.18 Ease of Disconnect

A. Not Applicable to the HRF ASD Equipment.

B. Not Applicable to the HRF ASD Equipment.

3.3.6.19 Self Locking

Not Applicable to the HRF ASD Equipment.

3.3.6.20 Connector Arrangement

Not Applicable to the HRF ASD Equipment.

3.3.6.21 Arc Containment

Not Applicable to the HRF ASD Equipment.

3.3.6.22 Connector Protection

Not Applicable to the HRF ASD Equipment.

3.3.6.23 Connector Shape

Not Applicable to the HRF ASD Equipment.

3.3.6.24 Alignment Marks or Guide Pins

Mating parts shall have alignment marks in a visible location during mating or guide pins (or their equivalent). (LS-71000, Section 6.4.4.3.11A)

3.3.6.25 Coding

Not Applicable to the HRF ASD Equipment.

3.3.6.26 Pin Identification

Not Applicable to the HRF ASD Equipment.

3.3.6.27 Orientation

Not Applicable to the HRF ASD Equipment.

3.3.6.28 Hose/Cable Restraints

Not Applicable to the HRF ASD Equipment.

3.3.6.29 Non-Threaded Fasteners Status Indication

An indication of correct engagement (hooking, latch fastening, or proper positioning of interfacing parts) of non-threaded fasteners shall be provided. (LS-71000, Section 6.4.4.4.1)

3.3.6.30 Mounting Bolt/Fastener Spacing

Clearance around fasteners to permit fastener hand threading (if necessary) shall be a minimum of 0.5 inches for the entire circumference of the bolt head, and a minimum of 1.5 inches over 180 degrees of the bolt head and provide the tool handle sweep as seen in Figure 3.3.6.30-1. Excepted are NSTS standard middeck lockers or P/L-provided hardware with the static envelope dimensions (cross-section) as specified in Figures 3.4.2.1-1, 3.4.2.2-1 and 3.4.2.3-1 of NSTS-21000-IDD-MDK and other similar captive fastener arrangements. (LS-71000, Section 6.4.4.4.2)

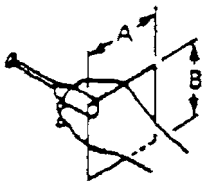
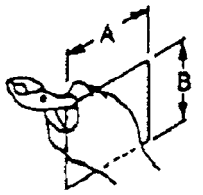
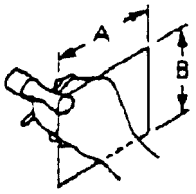
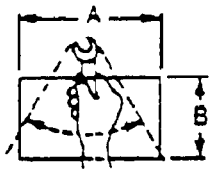
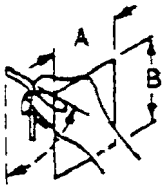
Opening dimensions		Task
	A 117 mm (4.6 in) B 107 mm (4.2 in)	Using common screwdriver with freedom to turn hand through 180°
	A 133 mm (5.2 in) B 115 mm (4.5 in)	Using pliers and similar tools
	A 155 mm (6.1 in) B 135 mm (5.3 in)	Using T-handle wrench with freedom to turn wrench through 180°
	A 203 mm (8.0 in) B 135 mm (5.3 in)	Using open-end wrench with freedom to turn wrench through 62°
	A 122 mm (4.8 in) B 155 mm (6.1 in)	Using Allen-type wrench with freedom to turn wrench through 62°

Figure 3.3.6.30-1. Minimal Clearance for Tool-Operated Fasteners

3.3.6.31 Multiple Fasteners

When several fasteners are used on one item they shall be of identical type. (LS-71000, Section 6.4.4.4.3)

NOTE: Phillips or Torque-Set fasteners may be used where fastener installation is permanent relative to planned on-orbit operations or maintenance, or where tool-fastener interface failure can be corrected by replacement of the unit containing the affected fastener with a spare unit. (LS-71000, Section 6.4.4.4.3)

3.3.6.32 Captive Fasteners

All fasteners planned to be installed and/or removed on-orbit shall be captive when disengaged. (LS-71000, Section 6.4.4.4.4)

3.3.6.33 Quick Release Fasteners

A. Quick release fasteners shall require a maximum of one complete turn to operate (quarter - turn fasteners are preferred). (LS-71000, Section 6.4.4.4.5A)

B. Quick release fasteners shall be positive locking in open and closed positions. (LS-71000, Section 6.4.4.4.5B)

3.3.6.34 Threaded Fasteners

Only right-handed threads shall be used. (LS-71000, Section 6.4.4.4.6)

3.3.6.35 Over Center Latches

Not Applicable to the HRF ASD Equipment.

3.3.6.36 Winghead Fasteners

Not Applicable to the HRF ASD Equipment.

3.3.6.37 Fastener Head Type

A. Hex type external or internal grip or combination head fasteners shall be used where on-orbit crew actuation is planned (e.g., ORU replacement). (LS-71000, Section 6.4.4.4.9A)

B. If a smooth surface is required, flush or oval head internal hex grip fasteners shall be used for fastening. (LS-71000, Section 6.4.4.4.9B)

C. Not Applicable to the HRF ASD Equipment.

3.3.6.38 One-Handed Actuation

Fasteners planned to be removed or installed on-orbit shall be designed and placed so they can be mated/demated using either hand. (LS-71000, Section 6.4.4.4.10)

3.3.6.39 Deleted

3.3.6.40 Access Holes

Covers or shields through which mounting fasteners must pass for attachment to the basic chassis of the unit shall have holes for passage of the fastener without

precise alignment (and hand or necessary tool if either is required to replace). (LS-71000, Section 6.4.4.4.12)

3.3.6.41 Controls Spacing Design Requirements

All spacing between controls and adjacent obstructions shall meet the minimum requirements as shown in Figure 3.3.6.41-1, Control Spacing Requirements for Ungloved Operation. (LS-71000, Section 6.4.5.1)

3.3.6.42 Protective Methods

Payloads shall provide protection against accidental control actuation using one or more of the protective methods listed in sub-paragraphs A through G below. Infrequently used controls (i.e., those used for calibration) should be separated from frequently used controls. Leverlock switches or switch covers are strongly recommended for switches related to mission success. Switch guards may not be sufficient to prevent accidental actuation. (LS-71000, Section 6.4.5.1)

A. Locate and orient the controls so that the operator is not likely to strike or move them accidentally in the normal sequence of control movements. (LS-71000, Section 6.4.5.2.1A)

B. Recess, shield, or otherwise surround the controls by physical barriers. The control shall be entirely contained within the envelope described by the recess or barrier. (LS-71000, Section 6.4.5.2.1B)

C. Cover or guard the controls. Safety or lock wire shall not be used. (LS-71000, Section 6.4.5.2.1C)

D. Cover guards when open shall not cover or obscure the protected control or adjacent controls. (LS-71000, Section 6.4.5.2.1D)

E. Provide the controls with interlocks so that extra movement (e.g., lifting switch out of a locked detent position) or the prior operation of a related or locking control is required. (LS-71000, Section 6.4.5.2.1E)

F. Provide the controls with resistance (i.e., viscous or coulomb friction, spring-loading, or inertia) so that definite or sustained effort is required for actuation. (LS-71000, Section 6.4.5.2.1F)

G. Provide the controls with a lock to prevent the control from passing through a position without delay when strict sequential actuation is necessary (i.e., the control moved only to the next position, then delayed). (LS-71000, Section 6.4.5.2.1G)

3.3.6.43 Noninterference

P/L provided protective devices shall not cover or obscure other displays or controls. (LS-71000, Section 6.4.5.2.2)

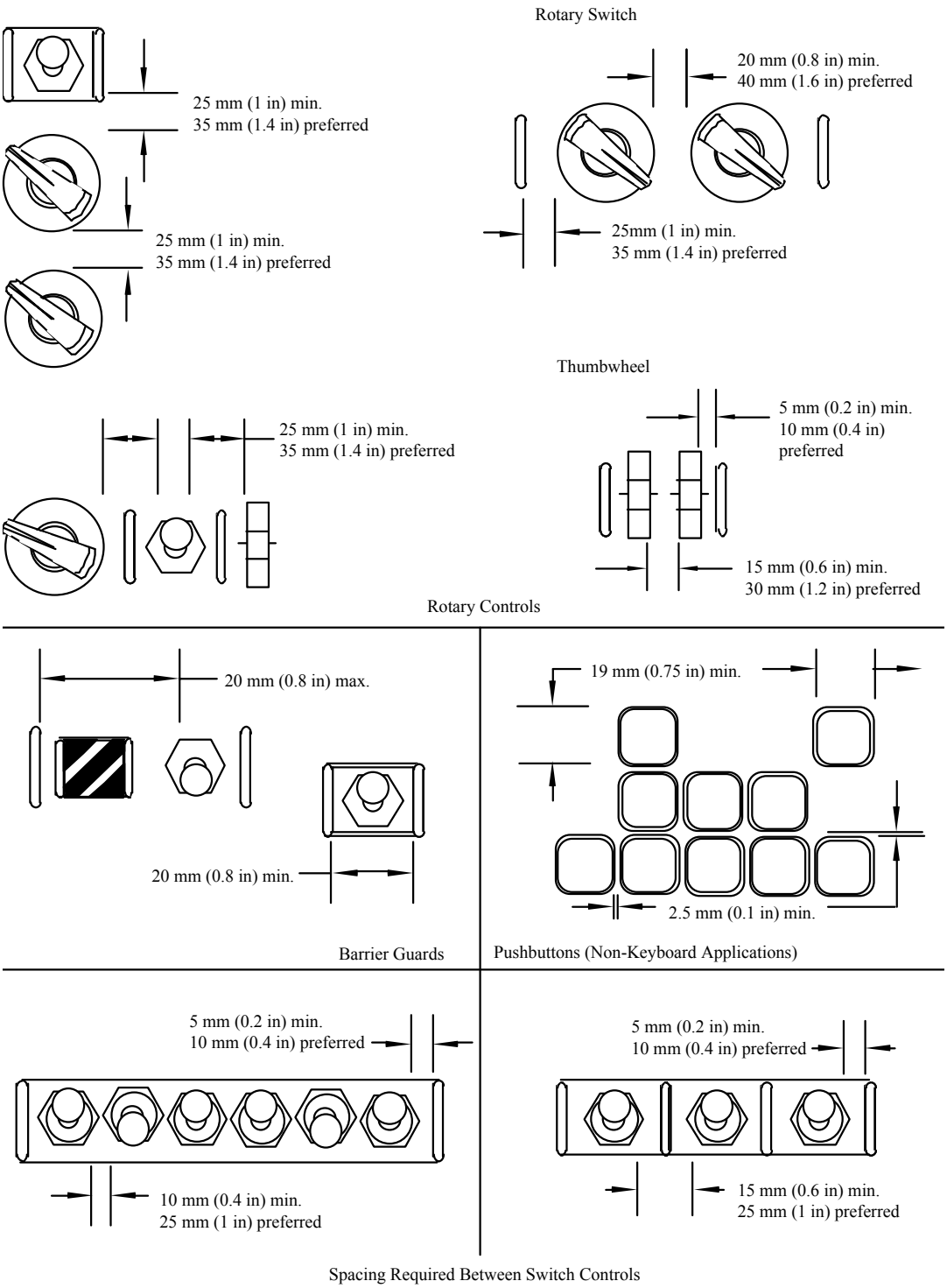


Figure 3.3.6.41-1. Control Spacing Requirements for Ungloved Operation

NOTE: Displays and controls used only for maintenance and adjustments, which could disrupt normal operations if activated, should be protected during normal operations (e.g., by being located separately or guarded/covered).

3.3.6.44 Dead-Man Controls

Not Applicable to the HRF ASD Equipment.

3.3.6.45 Barrier Guards

Barrier guard spacing shall adhere to the requirements for use with the toggle switches, rotary switches, and thumbwheels as shown in Figures 3.3.6.41-1, Control Spacing Requirements for Ungloved Operation, and 3.3.6.45-1, Rotary Switch Guard. (LS-71000, Section 6.4.5.2.4)

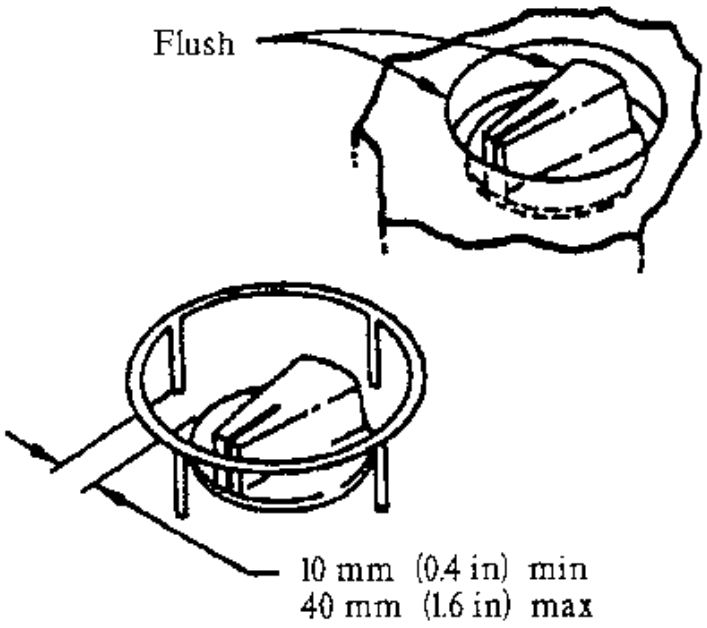


Figure 3.3.6.45-1. Rotary Switch Guard

3.3.6.46 Recessed Switch Protection

Not Applicable to the HRF ASD Equipment.

3.3.6.47 Position Indication

When P/L switch protective covers are used, control position shall be evident without requiring cover removal. (LS-71000, Section 6.4.5.2.7)

3.3.6.48 Hidden Controls

Not Applicable to the HRF ASD Equipment.

3.3.6.49 Hand Controllers

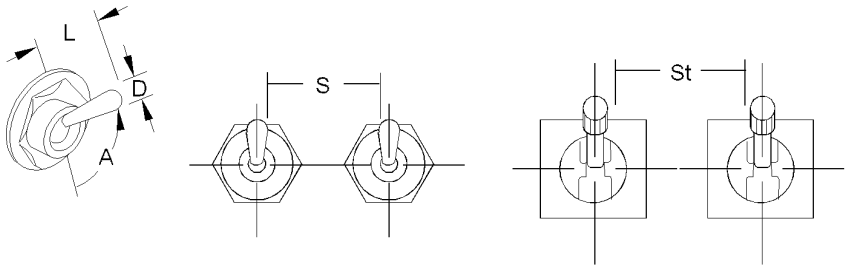
Not Applicable to the HRF ASD Equipment.

3.3.6.50 Valve Controls

Not Applicable to the HRF ASD Equipment.

3.3.6.51 Toggle Switches

Dimensions for a standard toggle switch shall conform to the values presented in Figure 3.3.6.51-1, Toggle Switches. (LS-71000, Section 6.4.5.4)



	Dimensions		Resistance	
	L Arm Length	D Control Tip	Small Switch	Large Switch
Minimum	13 mm (1/2 in.)	3 mm (1/8 in.)	2.8 N (10 oz)	2.8 N (10 oz.)
Maximum	50 mm (2 in.)	25 mm (1 in.)	4.5 N (16 oz.)	11 N (40 oz.)

	Displacement between positions	
	A	
	2 position	3 position
Minimum	30°	17°
Maximum	80°	40°
Desired		25°

	Separation			
	Single finger operation	†	S Single finger sequential operation	Simultaneous operation by different fingers
Minimum	19 mm (3/4 in.)	25 mm (1 in.)	13 mm (1/2 in.)	16 mm (5/8 in.)
Optimum	50 mm (2 in.)	50 mm (2 in.)	25 mm (1 in.)	19 mm (3/4 in.)

† Using a lever lock toggle switch

Figure 3.3.6.51-1. Toggle Switches

3.3.6.52 Restraints and Mobility Aids

Payloads shall be designed such that all installation, operation, and maintenance can be performed using standard crew restraints, mobility aids, and interfaces as defined in SSP 30257:004. (LS-71000, Section 6.4.6)

3.3.6.53 Deleted

3.3.6.54 Captive Parts

The HRF ASD Equipment shall be designed in such a manner to ensure that all unrestrained parts (e.g., locking pins, knobs, handles, lens covers, access plates, or similar devices) that may be temporarily removed on-orbit will be tethered or otherwise held captive. (LS-71000, Section 6.4.6.3)

3.3.6.55 Handles and Restraints

All removable or portable items, which cannot be grasped with one hand, shall be provided with handles or other suitable means of grasping, tethering, carrying and restraining. (LS-71000, Section 6.4.6.4.1)

3.3.6.56 Handle Location/Front Access

Handles and grasp areas shall be placed on the accessible surface of a P/L item consistent with the removal direction. (LS-71000, Section 6.4.6.4.2)

3.3.6.57 Handle Dimensions

IVA handles for movable or portable units shall be designed in accordance with the minimum applicable dimensions in Figure 3.3.6.57-1. (LS-71000, Section 6.4.6.4.3)

3.3.6.58 Non-Fixed Handles Design Requirements

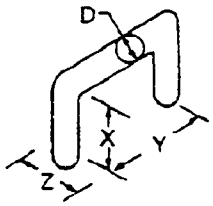
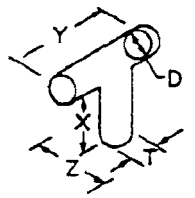
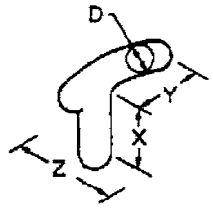
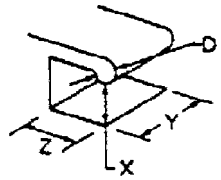
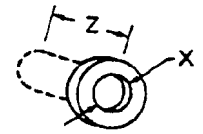
Not Applicable to the HRF ASD Equipment.

3.3.6.59 Electrical Hazards

Not Applicable to the HRF ASD Equipment.

Electrical equipment other than bioinstrumentation equipment will incorporate the following controls as specified below:

A. If the exposure condition is below the threshold for shock (i.e., below maximum leakage current and voltage requirements as defined within this section), no controls are required. Non-patient equipment with internal voltages not exceeding 30 V rms or DC nominal (32 V rms or DC maximum) will contain potentials below the threshold for electrical shock. (LS-71000, Section 6.4.9.1A)

Illustration	Type of handle	Dimensions in mm (in inches) (Bare hand)		
		X	Y	Z
	Two-finger bar One-hand bar Two-hand bar	32 (1-1/4) 48 (1-7/8) 48 (1-7/8)	65 (2-1/2) 111 (4-3/8) 215 (8-1/2)	75 (3) 75 (3) 75 (3)
	T-bar	38 (1-1/2)	100 (4)	75 (3)
	J-bar	50 (2)	100 (4)	75 (3)
	Two-finger recess One-hand recess	32 (1-1/4) 50 (2)	65 (2-1/2) 110 (4-1/4)	75 (3) 90 (3-1/2)
	Finger-tip recess On-finger recess	19 (3/4) 32 (1-1/4)	— —	13 (1/2) 50 (2)

Curvature of handle or edge	Weight of item	Minimum Diameter	
(DOES NOT PRECLUDE USE OF OVAL HANDLES)	Up to 6.8 kg (up to 15 lbs)	D = 6 mm (1/4 in)	Gripping efficiency is best if finger can curl around handle or edge to any angle of 2/3 π rad (120°) or more
	6.8 to 9.0 kg (15 to 20 lbs)	D = 13 mm (1/2 in)	
	9.0 to 18 kg (20 to 40 lbs)	D = 19 mm (3/4 in)	
	Over 18 kg (over 40 lbs)	D = 25 mm (1 in)	
	T-bar post	T = 13 mm (1/2 in)	

Figure 3.3.6.57-1. Minimum IVA Handle Dimensions for IVA Applications

B. Not Applicable to the HRF ASD Equipment.

C. Not Applicable to the HRF ASD Equipment.

TABLE 3.3.6.59-1. LET-GO CURRENT PROFILE, THRESHOLD VERSUS FREQUENCY

Frequency (Hertz)	Maximum Total Peak Current (AC + DC components combined) milliamperes
DC	40.0
15	8.5
2000	8.5
3000	13.5
4000	15.0
5000	16.5
6000	17.9
7000	19.4
8000	20.9
9000	22.5
10000	24.3
50000	24.3
(Based on 99.5 Percentile Rank of Adults)	

D. Not Applicable to the HRF ASD Equipment.

E. Not Applicable to the HRF ASD Equipment.

3.3.6.60 Mismatched

Not Applicable to the HRF ASD Equipment.

3.3.6.61 Device Accessibility

An overload protective device shall not be accessible without opening a door or cover, except that an operating handle or operating button of a circuit breaker, the cap of an extractor-type fuse holder, and similar parts may project outside the enclosure. (LS-71000, Section 6.4.9.1.2.1)

3.3.6.62 Extractor -Type Fuse Holder

The design of the extractor-type fuse holder shall be such that the fuse is extracted when the cap is removed. (LS-71000, Section 6.4.9.1.2.2)

3.3.6.63 Overload Protection Location

Not Applicable to the HRF ASD Equipment. There are no fuses or circuit breakers that are intended to be replaced on orbit.

3.3.6.64 Overload Protection Identification

Not applicable to the HRF ASD Equipment. There are no fuses or circuit breakers that are intended to be replaced on orbit.

3.3.6.65 Automatic Restart Protection

Controls shall be employed that prevent automatic restarting after an overload-initiated shutdown. (LS-71000, Section 6.4.9.1.2.5)

3.3.6.66 Audio Devices (Displays)

Not Applicable to the HRF ASD Equipment.

3.3.6.67 Egress

All P/L egress requirements shall be in accordance with NSTS 1700.7B, ISS Addendum, paragraph 205. (LS-71000, Section 6.4.9.11)

3.3.7 System Security

Not Applicable to the HRF ASD Equipment.

3.3.8 Design Requirements

3.3.8.1 Structural Design Requirements

A. EUE shall maintain positive margins of safety for launch and landing loading conditions for the carrier(s) in which it will be transported:

   1. Not Applicable to the HRF ASD Equipment.

   2. Orbiter Middeck Launch and Landing Loading - based upon acceleration environment as defined in NSTS-21000-IDD-MDK, Table 4.1-1. (LS-71000, Section 6.3.1.3A)

B. EUE shall provide positive margins of safety for on-orbit loads of 0.2 Gs acting in any direction. (LS-71000, Section 6.3.1.3B)

3.3.8.1.1 Crew Induced Load Requirements

EUE shall provide positive margins of safety when exposed to the crew induced loads defined in Table 3.3.8.1.1-1, Crew-Induced Loads. (LS-71000, Section 6.3.1.3C)

TABLE 3.3.8.1.1-1. CREW-INDUCED LOADS

Crew System Or Structure	Type of Load	Load	Direction of Load
Levers, Handles, Operating Wheels, Controls	Push or Pull concentrated on most extreme edge	222.6 N (50 lbf), limit	Any direction
Small Knobs	Twist (torsion)	14.9 N-m (11 ft-lbf), limit	Either direction
Exposed Utility Lines (Gas, Fluid, and Vacuum)	Push or Pull	222.6 N (50 lbf)	Any direction
Rack front panels and any other normally exposed equipment	Load distributed over a 4 inch by 4 inch area	556.4 N (125 lbf), limit	Any direction

Legend:
ft = feet, m = meter, N = Newton, lbf = pounds force

3.3.8.1.2 Safety Critical Structures Requirements

Not applicable to the HRF ASD Equipment and stowage pouches. The HRF ASD Equipment and stowage pouches are not safety critical structures. Any device failure is not critical and is contained to the device. The ASD and pouches are crit level three.

3.3.8.1.3 Loads Requirements

Payloads shall provide positive margins of safety for launch and landing loading conditions in the MPLM based on an acceleration environment as defined in SSP 41017 Part 1, paragraph 3.2.1.4.2, with a full complement of generic 4 panel unit Standard Interface Rack (SIR) drawer payloads. Loads should be applied consistent with the rack coordinate system defined in SSP 41017, Part 2, paragraph 3.1.3. (LS-71000, Section 6.1.1.3.A)

3.3.8.2 Electrical Power Consuming Equipment (EPCE) Design

3.3.8.2.1 Batteries

All battery systems shall meet the requirements of NSTS 1700.7, ISS addendum, Section 213.2. (Derived from LS-71000, Section 6.3.2.10)

3.3.8.3 Pressurized Gas Bottle Design

Not Applicable to the HRF ASD Equipment.

3.4 ACCEPTANCE AND QUALIFICATION REQUIREMENTS

3.4.1 Thermal Environment Compatibility

A. The HRF ASD Equipment shall operate nominally during exposure to 17 ^{o}C to 31 ^{o}C (63 ^{o}F to 87 ^{o}F).

B. SWAB ASD shall operate nominally following exposure to -50 °C to 50 °C (-58 °F to 122 °F).

EXCEPTION: The HRF ASD Equipment is a COTS device that can be only operated for short durations due to battery life and functional characteristics of the device. Thermal cycle testing will be documented in a Thermal Cycle Test plan for both Qualification and Acceptance level testing.

3.4.2 Workmanship Vibration

The HRF ASD Equipment shall operate nominally [complete a functional test as outlined in a Task Performance Sheet (TPS) or functional test plan] following vibration at workmanship (Acceptance) levels.

3.4.3 Functional Performance

The HRF ASD Equipment shall complete a functional test as outlined in a TPS or functional test plan.

3.4.4 Electrical, Electronic, and Electromechanical Parts Control, Selection, and Burn-In

A. Parts control shall be in accordance with SSP 30312, "Electrical, Electronic and Electromechanical (EEE) and Mechanical Parts Management and Implementation Plan for Space Station Program."

B. Parts selection for equipment shall be in accordance with:

1. SSP-30423, "Space Station Approved Electrical, Electronic and Electromechanical (EEE) Parts List."

2. SSQ-25002, "Supplemental List of Qualified Electrical, Electronic, Electromechanical (EEE) Parts, Manufacturers, and Laboratories (QEPM&L)."

3. Semiconductors shall be JANTXV in accordance with MIL-PRF-19500, "Performance Specification Semiconductor Devices, General Specification for." Diodes shall have a metallurgical bond. Passive parts shall be at least the second highest level of appropriate Military Established Reliability (MIL-ER).

4. SSP-30512C, "Space Station Ionizing Radiation Design Environment."

Where no alternative is available, nonmilitary parts, components, and subassemblies may be used, but burn-in screening of these items shall be performed per 3.4.4C.

C. Burn-in screening shall be completed (100%) on all flight hardware (units).

3.4.5 Flammability

The HRF ASD Equipment shall meet the flammability test requirements as described in Section 4.3.5.

3.4.6 Offgassing

The HRF ASD Equipment located in inhabitable areas shall meet the Offgassing test requirements as described in Section 4.3.6.

3.4.7 Bench Handling

The HRF ASD Equipment shall meet the requirements as described in Section 4.3.7.

3.4.8 Payload Mass

Not Applicable to the HRF ASD Equipment.

For P/L mass requirements, refer to Section 3.2.2.1, Mass Properties.

3.4.9 Electromagnetic Compatibility

The HRF ASD Equipment shall meet the Electromagnetic Compatibility (EMC) control requirements as described in Section 4.3.9.

EXCEPTION: The HRF ASD Equipment shall only test to Radiated Emission Requirements RE-02. HRF ASD Equipment will not perform any of the EMI Susceptibility tests or conducted emissions tests (CS-01, CS-02, CS-06, CRS-02, RS-03, CE-01, CE-03, and CE-07).

3.4.10 Acoustic Noise

The HRF ASD Equipment shall meet the acoustic noise control requirements as described in Section 4.3.10.

3.4.11 Software Acceptance

Not Applicable to the HRF ASD Equipment.

3.4.12 Pre-Delivery Acceptance

The HRF ASD Equipment shall meet the Pre-Delivery Acceptance (PDA) requirements as described in Section 4.3.12. (LS-71000, Section 5.4.1.3.2)

3.4.13 Humidity Environment Compatibility

HRF ASD Equipment shall operate nominally during exposure to a relative humidity of 95 percent. (Russian П32928-103 document).

3.5 Human Research Program Requirements

3.5.1 Safety

The HRF ASD Equipment shall meet the applicable requirements of NSTS 1700.7, NSTS 1700.7 ISS Addendum, NSTS/ISS 18798, NSTS/ISS 13830 and KHB 1700.7.

3.5.2 Documentation Requirements

Documentation requirements for the HRF ASD Equipment are specified in Appendix A of the Program Requirements Document (PRD) for HRF, LS-71000.

3.5.2.1 Acceptance Data Package

The contents of the Acceptance Data Package (ADP) shall be based upon SSP 30695, Acceptance Data Package Requirements Specification.

3.5.2.1.1 Acceptance Data Package Statement in Statement of Work

Not Applicable to the HRF ASD Equipment.

4.0 VERIFICATION PROVISIONS

This section contains the required verification methods for ISS interface certification, science functional acceptance, and program qualification and acceptance. Section 4.1 addresses definitions for terms used herein.

Appendix B contains the applicability matrix for ISS Pressurized Payload Interface Requirements Document requirements. The Verification Data Sheet (VDS) addressing the appropriate method for ISS interface verification is also contained in Appendix B. If an alternate verification method is desired, the new verification method must be negotiated in the Unique Payload Verification Plan (UPVP).

Section 4.2 contains the verification methods for science functional acceptance. Appendix C contains the applicability matrix for science functional requirements.

Section 4.3 contains the verification methods for program qualification and acceptance requirements. Appendix D contains the applicability matrices for acceptance and qualification requirements.

The responsibility for the performance of all verification activities is as specified in Appendices B, C and D. All testing described in Appendices B, C and D shall be documented via TPS (JSC Form 1225) per JSC Work Instruction NT1-CWI-001. Except as otherwise specified in the contract, the provider may use their own or any other facility suitable for the performance of the verification requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the verifications set forth in this specification.

4.1 GENERAL

Equipment verification methods are defined as follows:

A. Inspection is a method that determines conformance to requirements by the review of drawings, data or by visual examination of the item using standard quality control methods, without the use of special laboratory procedures.

B. Analysis is a process used in lieu of, or in addition to, other methods to ensure compliance to specification requirements. The selected techniques may include, but not be limited to, engineering analysis, statistics and qualitative analysis, computer and hardware simulations, and analog modeling. Analysis may also include assessing the results of lower level qualification activity. Analysis may be used when it can be determined that (1) rigorous and accurate analysis is possible, (2) test is not cost effective and (3) verification by inspection is not adequate.

   Verification by similarity is the process of analyzing the specification criteria for hardware configuration and application for an article to determine if it is

similar or identical in design, manufacturing process and quality control to an existing article that has previously been qualified to equivalent or more stringent specification criteria. Special effort will be made to avoid duplication of previous tests from this or similar programs. If the previous application is considered to be similar, but not equal to or greater in severity, additional qualification tests shall concentrate on the areas of new or increased requirements.

C. Demonstration consists of a qualitative determination of the properties of a test article. This qualitative determination is made through observation, with or without special test equipment or instrumentation, which verifies characteristics, such as human engineering features, services, access features and transportability. Demonstration requirements are normally implemented within a test plan, operations plan, or test procedure.

D. Test is a method in which technical means, such as the use of special equipment, instrumentation, simulation techniques, and the application of established principles and procedures, are used for the evaluation of components, subsystems and systems to determine compliance with requirements. Test shall be selected as the primary method when analytical techniques do not produce adequate results; failure modes exist which could compromise personnel safety, adversely affect flight systems or P/L operation, or result in a loss of mission objectives; or for any components directly associated with Space Station and orbiter interfaces. The analysis of data derived from tests is an integral part of the test program and should not be confused with analysis as defined above.

4.2 FUNCTIONAL PERFORMANCE ACCEPTANCE TESTING

The requirements herein describe specific test requirements for functional performance acceptance. The Principal Investigator (PI) will evaluate the data resulting from the science-related functional performance acceptance tests for confirmation of proper functionality.

The functional performance requirements specified in Section 3.2.1.1 shall be verified by one or more of the following methods: demonstration, test, analysis and inspection.

4.3 ACCEPTANCE AND QUALIFICATION VERIFICATION METHODS

The requirements herein describe specific test requirements for the HRF ASD Equipment acceptance and qualification. Qualification testing shall only be performed if qualification articles exist for the hardware. If no qualification articles exist for the hardware, analysis may be used to qualify the hardware.

4.3.1 Thermal Cycle Tests

The HRF ASD equipment undergoing thermal cycle testing shall be defined in a test plan or test procedure. The pass-fail criteria for the functional test and the definition of the functional test will be equipment unique and also defined in the test plan or test procedure. Functional tests shall be conducted on end items prior to, during and after environmental exposure.

4.3.2 Vibration Tests

Qualification for Acceptance Vibration Test levels are as described in Section 4.3.2.1. Acceptance Vibration Test levels is as described in Section 4.3.2.2.

4.3.2.1 Qualification for Acceptance Vibration Test

Qualification for Acceptance Vibration Testing (QAVT) is not applicable to the HRF ASD Equipment.

4.3.2.2 Acceptance Vibration Test

AVT is used to screen defects in workmanship that cannot be detected by inspection. AVT for HRF ASD Equipment shall be performed at a 6.1 g rms composite level over the frequency range and minimum AVT levels defined in Table 4.3.2.2-1. Vibration duration shall be a minimum of 60 seconds in each of three axes. Functional/continuity tests shall be conducted on components before, during, and after the AVT. (LS-71000 Section 5.4.1.1.3.3)

TABLE 4.3.2.2-1. ACCEPTANCE VIBRATION TEST LEVELS

Frequency Range (Hz)	Minimum Power Spectral Density (g^2/Hz)
20	0.01
20 - 80	+3 dB/Octave - Slope
80 - 350	0.04
350 - 2000	-3 dB/Octave - Slope
2000	0.007
Composite	6.1 g rms

4.3.3 Functional Testing

The scope and method of functional testing shall be negotiated between the hardware developer, and the quality organization responsible for accepting the hardware and software. (LS-71000, Section 5.4.1.3.4)

4.3.4 Electrical, Electronic and Electromechanical Parts Control, Selection, and Burn-In

A. Compliance with 3.4.4A is considered successful when it can be shown via analysis that the parts control process is compliant with 3.4.4A.

B. Compliance with 3.4.4B is considered successful when an analysis is provided that includes a risk assessment, electrical stress analysis, and data delivery on information such as designed/as-built EEE parts, list, construction history, Government and Industry Data Exchange Program (GIDEP) Alerts, part obsolescence, radiation susceptibility and/or prior history.

C. The HRF ASD equipment undergoing burn-in testing shall be defined in a test plan or test procedure. The pass-fail criteria for the functional test, and the definition of the functional test will be equipment-unique and defined in the test plan or test procedure. Functional tests shall be conducted on end items prior to, during and after environmental exposure

4.3.5 Flammability

P/L materials shall be non-flammable or self-extinguishing per the test criteria of NASA-STD-6001, Test 1, Flammability, Odor, Offgassing and Compatibility Requirements and Test Procedures for Materials in Environments that Support Combustion. The material shall be evaluated in the worst-case use environment at the worst-case use configuration. When the use of a nonflammable material is not possible, a Material Usage Agreement (MUA) or equivalent shall be submitted to the cognizant NASA center for disposition. If test data does not exist for a material, the experimenter may be asked to provide samples (see NASA-STD-6001, Chapter 4) to a NASA-certified test facility, such as Marshall Space Flight Center (MSFC) or White Sands Test Facility (WSTF) for flammability testing.

Materials transported or operated in the orbiter cabin or operated in the ISS air lock during EVA preparations, shall be tested and evaluated for flammability in the worst-case use environment of 30% oxygen and 10.2 psia. Materials used in all other habitable areas shall be tested and evaluated in the worst-case use environment of 24.1% oxygen and 15.2 psia. (LS-71000, Section 5.4.1.1.8)

4.3.6 Offgassing

All flight hardware located in habitable areas shall be subjected to test and meet the toxicity Offgassing acceptance requirements of NASA-STD-6001, Test 7. (LS-71000, Section 5.4.1.1.9)

4.3.7 Bench Handling

A bench-handling test shall be performed on the qualification unit for all stowed hardware. The bench handling test shall be conducted in accordance with MIL-STD-810, Section 516.4, I-3.8, Procedure VI with the following

modifications: Number of actual drops depends upon hardware configuration and will be negotiated with JSC/NT prior to testing. Surfaces, corners, and edges shall be identified in the test procedure. (LS-71000, Section 5.4.1.1.5)

4.3.8 Payload Mass

Not Applicable to the HRF ASD Equipment.

For P/L mass requirements, refer to Section 3.2.2.1, Mass Properties.

4.3.9 Electromagnetic Compatibility

The HRF ASD Equipment shall comply with LS-71016, Electromagnetic Compatibility Control Plan for the Human Research Facility. (LS-71000, Section 5.4.1.2.1)

EXCEPTION: The HRF ASD Equipment shall only test to Radiated Emission Requirements RE-02. HRF ASD Equipment will not perform any of the EMI Susceptibility tests or conducted emissions tests (CS-01, CS-02, CS-06, CRS-02, RS-03, CE-01, CE-03, and CE-07).

4.3.10 Acoustic Noise

The HRF ASD Equipment shall comply with LS-71011, Acoustic Noise Control and Analysis Plan for Human Research Facility Payloads and Racks. (LS-71000, Section 5.4.1.1.7)

4.3.11 Software Acceptance

Not Applicable to the HRF ASD Equipment.

4.3.12 Pre-Delivery Acceptance

The responsible manufacturing parties shall perform a PDA after the complete fabrication and assembly has been conducted for all Class I deliverable assemblies. This test shall include verification of software interface and operation. The PDA must be completed before hardware certification testing begins. It is a full functional test and inspection that validates that the hardware operates per the design requirements and that it is constructed per released engineering drawings. All PDA tests shall be approved by the hardware's JSC technical monitor and JSC/NT3, as well as the contractor quality engineering (if applicable). The following are standard steps that each PDA test shall contain: (LS-71000, Section 5.4.1.3.2)

A. Conformance to Drawing. Verify that the hardware conforms to released engineering drawings.

B. No Sharp Edges. Inspect the hardware to verify that there are no sharp edges or corners present.

C. Proper Identifying Markings. Verify that the hardware has the proper part number and serial number (if applicable) on it.

D. Cleanliness. All PDA tests shall include verification that all surfaces (external, internal, etc.) are to the cleanliness level of Section 3.3.1.1C of this document.

4.3.13 Humidity Environment Compatibility

HRF ASD Equipment shall be inspected to ensure that electrical conductors within the payload housing are not exposed to humidity.

5.0 PREPARATION FOR SHIPMENT

5.1 General

A. The methods of preservation, packaging, and packing used for shipment, together with necessary special control during transportation, shall adequately protect the article(s) from damage or degradation in reliability or performance as a result of the natural and induced environments encountered during transportation and subsequent indoor storage. (LS-71000, Section 9.1A)

B. To reduce program cost, prior to developing a newly designed container, every effort will be made by project participants to use container designs and/or containers available commercially or from Government inventories. If reusable containers are not available, a screening process should be initiated for container availability in the following priority: existing containers, COTS containers, and modified COTS containers. Shipping containers and protective devices will be designed for effective and economical manufacture, procurement, and transportability. (LS-71000, Section 9.1B)

5.2 Packing, Handling and Transportation

A. Packaging, handling and transportation shall be in accordance with applicable requirements of NHB 6000.1C, and referenced documents therein. (LS-71000, Section 9.2A)

B. Documented procedures and physical controls shall be established to ensure that the HRF rack and individual items of equipment will not be subjected to temperature, shock and humidity outside the non-operational limits during shipment. (LS-71000, Section 9.2C)

C. The HRF ASD Equipment shall be cleaned to the "Visibly Clean Level 1 (Sensitive)" as determined in SN-C-0005, Specification Contamination Control Requirements for the Shuttle Program. (LS-71000, Section 9.2D)

5.3 Preservation and Packing

Preservation and packing shall be in accordance with approved Packaging, Handling, and Transportation Records (PHTRs). (LS-71000, Section 9.3)

5.4 Marking for Shipment

Interior and exterior containers shall be marked and labeled in accordance with NHB 6000.1C, including precautionary markings necessary to ensure safety of personnel and facilities, and to ensure safe handling, transport and storage. Should the individual items of equipment contain any hazardous materials, markings shall also comply with applicable requirements governing packaging and labeling of hazard materials. Packages with reuse capability shall be

identified with the words “Reusable Container - Do Not Destroy - Retain for Reuse.” NASA Critical Item Labels (Form 1368 series) shall be applied in accordance with NHB 6000.1C. (LS-71000, Section 9.4)

5.5 NASA Critical Space Item Label

The NASA Critical Space Item Labels Form 1368 shall be affixed to exterior and interior shipping containers in accordance with NHB 6000.1C. (LS-71000, Section 9.5A)

6.0 NOTES

This section contains information of a general or explanatory nature that may be helpful but is not mandatory.

6.1 Definitions

Qualification Test	Test conducted as part of the certification program to demonstrate that the design and performance requirements can be realized under specified conditions.
Acceptance Test	Formal tests conducted to assure that the end item meets specified requirements. Acceptance tests include performance demonstrations and environmental exposures to screen out manufacturing defects, workmanship errors, incipient failures, and other performance anomalies not readily detectable by normal inspection techniques or through ambient functional tests.
Active Air Exchange	Forced convection between two volumes. For example, forced convection between a subrack P/L and the internal volume of an integrated rack, or forced convection between a subrack P/L and cabin air.
Continuous Noise Source	A significant noise source, which exists for a cumulative total of eight hours or more in any 24-hour period is considered to be a continuous noise source.
Intermittent Noise Source	A significant noise source, which exists for a cumulative total of less than eight hours in a 24-hour period is considered to be an intermittent noise source.
On-Orbit Momentary Protrusions	P/L obstructions that typically would protrude for a very short time or could be readily eliminated by the crew at any time. Momentary protrusions include only the following: drawers/door/cover replacements or closures.)
On-Orbit Permanent Protrusions	A P/L hardware item that is not ever intended to be removed.

On-Orbit Semi-Permanent Protrusions	A P/L hardware item that is typically left in place, but can be removed by the crew with hand operations or standard IVA tools. Example: SIR and International Subrack Interface Standard (ISIS) drawer handles, other equipment that does not interfere with crew restraints and mobility aids.
On-Orbit Temporary Protrusions	A P/L item that is typically located in the aisle for experiment purposes only. These items should be returned to their stowed configuration when not being used. Example: Front panel mounted equipment.

APPENDIX A

RESERVED

APPENDIX B

ISS PRESSURIZED PAYLOAD INTERFACE REQUIREMENTS DOCUMENT VERIFICATION MATRIX

APPENDIX B

ISS PRESSURIZED PAYLOAD INTERFACE REQUIREMENTS DOCUMENT VERIFICATION MATRIX

{If a request for deviation or waiver from the requirement stated in this System Requirements Document (SRD) is anticipated or if the type of documentation supplied or method of verification is anticipated to not be as stated in this matrix, this information should be noted in the Comments column.}

SRD Section	LS-71000 Section	SSP 57000 Section	Requirement	Applicable	Verification Method	Responsibility	Comments
3.2.2.2.2.1A	6.3.1.5A	3.1.1.7A	On-Orbit Payload Protrusions - lateral protrusions	N/A	See ICD		Temporary aisle hardware
3.2.2.2.2.1B	6.3.1.5B	3.1.1.7B	On-Orbit Payload Protrusions - seat track obstruction	N/A	See ICD		Temporary aisle hardware
3.2.2.2.2.1.1	6.3.1.5.1	3.1.1.7.1.1	On-Orbit Permanent Protrusions	N/A	See ICD		Temporary aisle hardware
3.2.2.2.2.1.2A	6.3.1.5.2B	3.1.1.7.2B	On-Orbit Semi-Permanent Protrusions - envelope	N/A	See ICD		Temporary aisle hardware
3.2.2.2.2.1.2B	6.3.1.5.2C	3.1.1.7.2C	On-Orbit Semi-Permanent Protrusions - easily removable	N/A	See ICD		Temporary aisle hardware
3.2.2.2.2.1.3A	6.3.1.5.3A	3.1.1.7.3A	On-Orbit Temporary Protrusions - envelope	N/A	See ICD		Temporary aisle hardware
3.2.2.2.2.1.3B	6.3.1.5.3B	3.1.1.7.3B	On-Orbit Temporary Protrusions - stow time	✓	See ICD		
3.2.2.2.2.1.4	6.3.1.5.4	3.1.1.7.4	On-Orbit Momentary Protrusions	N/A	See ICD		No momentary protrusions
3.2.4A	6.4.4.2.6.3	3.12.4.2.8.4	Maintainability - Unique Tools	N/A	See ICD		No unique tools
3.2.4B	6.4.4.3.1	3.12.4.3.1	Maintainability - One-handed Operation	N/A	See ICD		No planned maintenance
3.2.4C	6.4.4.3.2B	3.12.4.3.2A2	Maintainability - Connector Mate/Demate	N/A	See ICD		No connectors
3.2.4D	6.4.4.3.2C	3.12.4.3.2B	Maintainability - No Damage to Wiring Connectors	N/A	See ICD		No connectors
3.2.4E	6.4.4.2.6	3.12.4.2.8	Maintainability - Access to Hardware Items	N/A	See ICD		No planned maintenance
3.2.4F	6.4.3.1.2A	3.12.3.1.2A	Maintainability - Built-in Control	N/A	See ICD		No liquids or particulate matter

✓ - Requirement is applicable E - Exception N/A - Requirement is not applicable

APPENDIX B

ISS PRESSURIZED PAYLOAD INTERFACE REQUIREMENTS DOCUMENT VERIFICATION MATRIX (Cont'd)

SRD Section	LS-71000 Section	SSP 57000 Section	Requirement	Applicable	Verification Method	Responsibility	Comments
3.2.4G	6.4.3.1.2B	3.12.3.1.2B	Maintainability - Access to Filters for Replacement/Cleaning	✓	See ICD		
3.2.4.1.1	6.4.10	3.12.10	Payload In-flight Maintenance	✓	See ICD		
3.2.5.1.1.1	6.3.7.1.1	3.9.1.1	Pressure	✓	See ICD		
3.2.5.1.1.2	6.3.7.1.2	3.9.1.2	Temperature	✓	See ICD		
3.2.5.1.1.3	6.3.7.1.3	3.9.1.3	Humidity	N/A	See ICD		No cold sources
3.2.5.1.2.1	6.3.7.2.1	3.9.2.1A	Active Air Exchange	N/A	See ICD		Not a rack or subrack
3.2.5.1.2.2	6.3.7.2.2	3.9.2.2	Oxygen Exchange	N/A	See ICD		No oxygen consumption
3.2.5.1.2.3	6.3.7.2.3	3.9.2.3	Chemical Releases	✓	See ICD		
3.2.5.1.3.1	6.3.7.3.1	3.9.3.1	Instrument Contained or Generated Ionizing Radiation	✓	See ICD		
3.2.5.1.3.3	6.3.7.3.3	3.9.3.3	Single Event Effect (SEE) Ionizing Radiation	✓	See ICD		
3.2.5.1.3.4	6.3.7.3.4	3.9.3.4	Lab Window Rack Location Radiation Requirements	N/A	See ICD		Not window mounted
3.2.5.1.3.4.1	6.3.7.3.4.1	3.9.3.4.1	Window Rack Infrared Radiation Requirements	N/A	See ICD		Not window mounted
3.2.5.1.3.4.2	6.3.7.3.4.2	3.9.3.4.2	Window Rack Ultraviolet Radiation Requirements	N/A	See ICD		Not window mounted
3.2.5.1.4.1.A		3.1.2.1	Quasi-Steady State	✓	See ICD		
3.2.5.1.4.1.B		3.1.2.2	Vibroacoustic disturbances	✓	See ICD		
3.2.5.1.4.1.C		3.1.2.3.A	Transient Requirements	✓	See ICD		
3.2.5.1.4.1.D		3.1.2.3.B	Transient Requirements	✓	See ICD		
3.2.5.1.5A	6.3.1.2B	3.1.1.4B	Pressure Rate of Change - On-orbit	✓	See ICD		

✓ - Requirement is applicable E - Exception N/A - Requirement is not applicable

APPENDIX B

ISS PRESSURIZED PAYLOAD INTERFACE REQUIREMENTS DOCUMENT VERIFICATION MATRIX (Cont'd)

SRD Section	LS-71000 Section	SSP 57000 Section	Requirement	Applicable	Verification Method	Responsibility	Comments
3.2.5.1.5C1	6.3.1.2A	3.1.1.2B	Pressure Rate of Change - MPLM	✓	See ICD		
3.2.5.1.5D	6.3.1.2C	3.1.1.4K	Pressure Rate of Change - PFE	N/A	See ICD		No PFE access port required
3.2.5.2.1	6.4.3.3.1C	3.12.3.3.1C	Continuous Noise Limits	N/A	See ICD		Will not be operated for > 8 hours in any given 24 hour period
3.2.5.2.2A	6.4.3.3.2A	3.12.3.3.2A	Intermittent Noise Limits - A-weighted SPL Limits	✓	See ICD		
3.2.5.2.2B	6.4.3.3.2	3.12.3.3.2B	Intermittent Noise Limits - Cumulative Duration	✓	See ICD		
3.2.7.1.1	6.3.1.6.1	3.1.1.6.1	Connector Physical Mate	N/A	See ICD		Battery powered
3.2.7.2.1.1	6.3.2.4	3.2.4	Electromagnetic Compatibility (EMC)	✓	See ICD		
3.2.7.2.1.1.1	6.3.2.4.1	3.2.4.1	Electrical Grounding	N/A	See ICD		Battery powered
3.2.7.2.1.1.2	6.3.2.4.2	3.2.4.2	Electrical Bonding	N/A	See ICD		Battery powered
3.2.7.2.1.2A	6.3.2.4.4	3.2.4.4	Electromagnetic Interference	✓	See ICD		**EXCEPTION: The HRF ASD Equipment shall only test to Radiated Emission Requirements RE-02. HRF ASD Equipment will not perform any of the EMI Susceptibility tests or conducted emissions tests (CS-01, CS-02, CS-06, CRS-02, RS-03, CE-01, CE-03, and CE-07).**
3.2.7.2.1.2B	6.3.2.4.4	3.2.4.4	Electromagnetic Interference - Alternative Use of RS03PL	N/A	See ICD		Radiated emissions only
3.2.7.2.2A	6.3.2.5	3.2.4.5	ESD ≤ 4000V	✓	See ICD		
3.2.7.2.2B	6.3.2.5	3.2.4.5	ESD between 4000V and 15000V - Labeling EPCE	✓	See ICD		

✓ - Requirement is applicable E - Exception N/A - Requirement is not applicable

APPENDIX B

ISS PRESSURIZED PAYLOAD INTERFACE REQUIREMENTS DOCUMENT VERIFICATION MATRIX (Cont'd)

SRD Section	LS-71000 Section	SSP 57000 Section	Requirement	Applicable	Verification Method	Responsibility	Comments
3.2.7.2.2C	6.3.2.5	3.2.4.5	ESD Labeling	✓	See ICD		
3.2.7.2.3	6.3.2.8	3.2.4.8	Corona	N/A	See ICD		No internal voltages above 190 Vdc
3.2.7.2.4	6.3.2.4.3	3.2.4.3	Cable/Wire Design and Control Requirements	N/A	See ICD		Battery powered
3.2.7.2.4.1B	6.3.2.1B	3.2.3.1B	Wire Derating	✓	See ICD		
3.2.7.2.4.2	6.3.2.2	3.2.3.2B	Exclusive Power Feeds	N/A	See ICD		Battery powered
3.2.7.2.5	6.3.2.3	3.2.3.3	Loss of Power	N/A	See ICD		Battery powered
3.2.7.2.6	6.3.2.6	3.2.4.6	AC Magnetic Fields	✓	See ICD		
3.2.7.2.7	6.3.2.7	3.2.4.7	DC Magnetic Fields	✓	See ICD		
3.2.7.2.8.1	6.3.2.11.1	3.2.1.1.2	Steady State Voltage	N/A	See ICD		Battery powered
3.2.7.2.8.2	6.3.2.11.2	3.2.1.2.1	Ripple Voltage and Noise	N/A	See ICD		Battery powered
3.2.7.2.8.3	6.3.2.11.3	3.2.1.2.2	Ripple Voltage Spectrum	N/A	See ICD		Battery powered
3.2.7.2.8.4	6.3.2.11.4	3.2.1.3.2	Transient Voltages	N/A	See ICD		Battery powered
3.2.7.2.8.5	6.3.2.11.5	3.2.1.3.3	Fault Clearing and Protection	N/A	See ICD		Battery powered
3.2.7.2.8.6A	6.3.2.11.6A	3.2.1.3.4A	Non-Normal Voltage Range	N/A	See ICD		Battery powered
3.2.7.2.8.6B	6.3.2.11.6B	3.2.1.3.4B	Non-Normal Voltage Range	N/A	See ICD		Battery powered
3.2.7.2.8.7A	6.3.2.11.7A	3.2.2.1E	UOP Connectors and Pin Assignments	N/A	See ICD		Battery powered
3.2.7.2.8.7B	6.3.2.11.7B	3.2.2.1E	UOP Connectors and Pin Assignments	N/A	See ICD		Battery powered
3.2.7.2.8.7C	6.3.2.11.7C	3.2.2.1F	UOP Connectors and Pin Assignments	N/A	See ICD		Battery powered
3.2.7.2.8.7D	6.3.2.11.7D	3.2.2.1F	UOP Connectors and Pin Assignments	N/A	See ICD		Battery powered
3.2.7.2.8.8	6.3.2.11.8	3.2.2.3	Compatibility with Soft Start/Stop RPC	N/A	See ICD		Battery powered
3.2.7.2.8.9	6.3.2.11.9	3.2.2.4	Surge Current	N/A	See ICD		Battery powered

✓ - Requirement is applicable E - Exception N/A - Requirement is not applicable

APPENDIX B

ISS PRESSURIZED PAYLOAD INTERFACE REQUIREMENTS DOCUMENT VERIFICATION MATRIX (Cont'd)

SRD Section	LS-71000 Section	SSP 57000 Section	Requirement	Applicable	Verification Method	Responsibility	Comments
3.2.7.2.8.10	6.3.2.11.10	3.2.2.5	Reverse Energy/Current	N/A	See ICD		Battery powered
3.2.7.2.8.11A	6.3.2.11.11A	3.2.2.6.1.1C	Remote Power Controllers	N/A	See ICD		Battery powered
3.2.7.2.8.11B	6.3.2.11.11B	3.2.2.6.1.1D	Remote Power Controllers	N/A	See ICD		Battery powered
3.2.7.2.8.12A	6.3.2.11.12	3.2.2.8	Large Signal Stability	N/A	See ICD		Battery powered
3.2.7.2.8.12B	6.3.2.11.12	3.2.2.8	Large Signal Stability	N/A	See ICD		Battery powered
3.2.7.2.8.13	6.3.2.11.13	3.2.2.9	Maximum Ripple Voltage Emissions	N/A	See ICD		Battery powered
3.2.7.2.8.14A	6.3.2.11.14A	3.2.2.10A	Electrical Load Stand Alone Stability	N/A	See ICD		Battery powered
3.2.7.2.8.14B	6.3.2.11.14B	3.2.2.10B	Electrical Load Stand Alone Stability	N/A	See ICD		Battery powered
3.2.7.2.8.14C	6.3.2.11.14C	3.2.2.10C	Electrical Load Stand Alone Stability	N/A	See ICD		Battery powered
3.2.7.4.1	6.3.8.1	3.10.1	Fire Prevention	✓	See ICD		
3.2.7.4.2.1A	6.3.8.2.1A	3.10.3.1A	PFE - Small Access Port	N/A	See ICD		No PFE access port required
3.2.7.4.2.1B	6.3.8.2.1B	3.10.3.1B	PFE - Large Access Port	N/A	See ICD		No PFE access port required
3.2.7.4.2.2	6.3.8.2.2	3.10.3.2	Fire Suppression Access Port Accessibility	N/A	See ICD		No PFE access port required
3.2.7.4.2.3	6.3.8.2.3	3.10.3.3	Fire Suppressant Distribution	N/A	See ICD		No PFE access port required
3.2.7.4.3	6.3.8.3	3.10.4A	Labeling	N/A	See ICD		No PFE access port required
3.2.7.5.21.A		3.12.3.4.A	Specularity	✓	See ICD		
3.2.7.5.21.B		3.12.3.4.B	Lighting Design	N/A	See ICD		No fine tasks. No medium tasks. Not in aisle. Not a glovebox.
3.3.1.1A	6.3.9.1	3.11.1	Materials and Processes	✓	See ICD		
3.3.1.1B	6.3.9.2	3.11.1.1	Materials and Processes - Commercial Parts	✓	See ICD		

✓ - Requirement is applicable E - Exception N/A - Requirement is not applicable

APPENDIX B

ISS PRESSURIZED PAYLOAD INTERFACE REQUIREMENTS DOCUMENT VERIFICATION MATRIX (Cont'd)

SRD Section	LS-71000 Section	SSP 57000 Section	Requirement	Applicable	Verification Method	Responsibility	Comments
3.3.1.1C	6.3.9.3	3.11.3	Materials and Processes - Cleanliness	✓	See ICD		
3.3.1.1E	6.3.9.4	3.11.4	Materials and Processes - Fungus Resistant Materials	✓	See ICD		
3.3.1.2	6.4.9.2	3.12.9.2	Sharp Edges and Corner Protection	✓	See ICD		
3.3.1.3	6.4.9.3	3.12.9.3	Holes	✓	See ICD		
3.3.1.4	6.4.9.4	3.12.9.4	Latches	✓	See ICD		
3.3.1.5	6.4.9.5	3.12.9.5	Screws and Bolts	✓	See ICD		
3.3.1.6	6.4.9.6	3.12.9.6	Securing Pins	✓	See ICD		
3.3.1.7	6.4.9.7	3.12.9.7	Levers, Cranks, Hooks, and Controls	✓	See ICD		
3.3.1.8	6.4.9.8	3.12.9.8	Burrs	✓	See ICD		
3.3.1.9A	6.4.9.9A	3.12.9.9A	Locking Wires	✓	See ICD		
3.3.1.9B	6.4.9.9B	3.12.9.9B	Locking Wires - Safety Cabling or Cotter Pinning	✓	See ICD		
3.3.2.1	6.4.7	3.12.7	Equipment Identification	✓	See ICD		
3.3.5.1.1B	6.3.2.10.1	3.2.5.1.1	Mating/Demating of Powered Connectors	N/A	See ICD		The ASD Equipment has no powered interface with station.
3.3.5.1.2A	6.3.2.10.3A	3.2.5.3A	Power Switches/Controls -Open Supply Circuit Conductors	N/A	See ICD		Battery powered
3.3.5.1.2B	6.3.2.10.3B	3.2.5.3B	Power Switches/Controls -Power-off Markings/Indications	N/A	See ICD		Battery powered
3.3.5.1.2C	6.3.2.10.3C	3.2.5.3C	Power Switches/Controls -Supply Circuit not Completely Disconnected	N/A	See ICD		No standby mode
3.3.5.1.3A	6.3.2.10.4A	3.2.5.4A	GFCI - Output Voltages > 30 V rms	N/A	See ICD		No portable outlet above 32 Vdc

✓ - Requirement is applicable E - Exception N/A - Requirement is not applicable

APPENDIX B

ISS PRESSURIZED PAYLOAD INTERFACE REQUIREMENTS DOCUMENT VERIFICATION MATRIX (Cont'd)

SRD Section	LS-71000 Section	SSP 57000 Section	Requirement	Applicable	Verification Method	Responsibility	Comments
3.3.5.1.3B	6.3.2.10.4B	3.2.5.4B	GFCI - DC Detection Independent of Safety Wire	N/A	See ICD		No GFCI required in 3.2.5.4.A & D
3.3.5.1.3C	6.3.2.10.4C	3.2.5.4C	GFCI - AC Detection Dependent on Safety Wire	N/A	See ICD		No GFCI required in 3.2.5.4.A & D
3.3.5.1.3D	6.3.2.10.4D	3.2.5.4D	GFCI - EUE Generating Internal Voltages > 30 V rms	N/A	See ICD		No GFCI required in 3.2.5.4.A&D
3.3.5.1.3E	6.3.2.10.4E	3.2.5.4E	GFCI - Trip Current	N/A	See ICD		No GFCI required in 3.2.5.4.A&D
3.3.5.1.3F	6.3.2.10.4F	3.2.5.4F	GFCI - Power Removal Time	N/A	See ICD		No GFCI required in 3.2.5.4.A&D
3.3.5.1.3G	6.3.2.10.4G	3.2.5.4G	GFCI - On-Orbit Testing	N/A	See ICD		No GFCI required in 3.2.5.4.A&D
3.3.5.1.4A	6.3.2.10.5A	3.2.5.5A	Portable Equipment/Power Cords - Non-battery Powered Portable EUE	N/A	See ICD		Battery powered
3.3.5.1.4B	6.3.2.10.5B	3.2.5.5B	Portable Equipment/Power Cords - Fault Currents	N/A	See ICD		Battery powered
3.3.6.1	6.4.3.1.1	3.12.3.1.1	Closures or Covers Design Requirements	✓	See ICD		
3.3.6.3A	6.4.2.3	3.12.2.3	Full Size Range Accommodation	✓	See ICD		
3.3.6.4A	6.4.1.1A	3.12.1A1	Grip Strength	✓	See ICD		
3.3.6.4B	6.4.1.1B	3.12.1A2	Linear Forces	✓	See ICD		
3.3.6.4C	6.4.1.1C	3.12.1A3	Torque	✓	See ICD		
3.3.6.5	6.4.1.2	3.12.1B	Maintenance Operations	N/A	See ICD		No planned maintenance
3.3.6.6	6.4.2.1	3.12.2.1	Adequate Clearance	N/A	See ICD		No connectors
3.3.6.7A	6.4.2.2A	3.12.2.2A	Accessibility - Geometric Arrangement	✓	See ICD		

✓ - Requirement is applicable E - Exception N/A - Requirement is not applicable

APPENDIX B

ISS PRESSURIZED PAYLOAD INTERFACE REQUIREMENTS DOCUMENT VERIFICATION MATRIX (Cont'd)

SRD Section	LS-71000 Section	SSP 57000 Section	Requirement	Applicable	Verification Method	Responsibility	Comments
3.3.6.7B	6.4.2.2B	3.12.2.2B	Accessibility - Access Openings for Fingers	✓	See ICD		
3.3.6.8	6.4.3.1.3	3.12.3.1.5	One-Handed Operation	✓	See ICD		
3.3.6.9	6.4.3.2.1	3.12.3.2.1	Continuous/Incidental Contact - High Temperature	✓	See ICD		
3.3.6.10	6.4.3.2.2	3.12.3.2.2	Continuous/Incidental Contact - Low Temperature	N/A	See ICD		No cooling functions
3.3.6.11	6.4.4.2.1	3.12.4.2.1	Equipment Mounting	✓	See ICD		
3.3.6.12A	6.4.4.2.2A	3.12.4.2.2	Drawers and Hinged Panels - for routine checkout of P/L ORUs	N/A	See ICD		No planned maintenance
3.3.6.12B	6.4.4.2.2B	3.12.4.2.2	Drawers and Hinged Panels - remain open without manual support	N/A	See ICD		No planned maintenance
3.3.6.13	6.4.4.2.3	3.12.4.2.5	Alignment	N/A	See ICD		No blind mate connectors
3.3.6.14	6.4.4.2.5	3.12.4.2.7	Push-Pull Force	N/A	See ICD		No connectors
3.3.6.15A	6.4.4.2.6.1A	3.12.4.2.8.1A	Covers - sliding or hinged cap or door	✓	See ICD		
3.3.6.15B	6.4.4.2.6.1B	3.12.4.2.8.1B	Covers - quick-opening cover plate	✓	See ICD		
3.3.6.16	6.4.4.2.6.2	3.12.4.2.8.2	Self-Supporting Covers	✓	See ICD		
3.3.6.17	6.4.4.3.2A	3.12.4.3.2A1	Accessibility	N/A	See ICD		No connectors
3.3.6.18A	6.4.4.3.3A	3.12.4.3.3A	Ease of Disconnect - nominal operations	N/A	See ICD		No connectors
3.3.6.18B	6.4.4.3.3B	3.12.4.3.3B	Ease of Disconnect - ORU replacement operations	N/A	See ICD		No connectors
3.3.6.19	6.4.4.3.5	3.12.4.3.5	Self Locking	N/A	See ICD		No connectors
3.3.6.20A	6.4.4.3.6A	3.12.4.3.6A	Connector Arrangement - Space between Connectors and Adjacent Obstructions	N/A	See ICD		No connectors

✓ - Requirement is applicable E - Exception N/A - Requirement is not applicable

APPENDIX B

ISS PRESSURIZED PAYLOAD INTERFACE REQUIREMENTS DOCUMENT VERIFICATION MATRIX (Cont'd)

SRD Section	LS-71000 Section	SSP 57000 Section	Requirement	Applicable	Verification Method	Responsibility	Comments
3.3.6.20B	6.4.4.3.6B	3.12.4.3.6B	Connector Arrangement - Space between Connectors in a Row	N/A	See ICD		No connectors
3.3.6.21	6.4.4.3.7	3.12.4.3.7	Arc Containment	N/A	See ICD		No connectors
3.3.6.22	6.4.4.3.8	3.12.4.3.8	Connector Protection	N/A	See ICD		No connectors
3.3.6.23	6.4.4.3.9	3.12.4.3.9	Connector Shape	N/A	See ICD		No connectors
3.3.6.24	6.4.4.3.11A	3.12.4.3.11A	Alignment Marks or Guide Pins	✓	See ICD		
3.3.6.25A	6.4.4.3.12A	3.12.4.3.12A	Coding - Unique to Connection	N/A	See ICD		No connectors
3.3.6.25B	6.4.4.3.12B	3.12.4.3.12B	Coding - Visible	N/A	See ICD		No connectors
3.3.6.26	6.4.4.3.13	3.12.4.3.13	Pin Identification	N/A	See ICD		No connectors
3.3.6.27	6.4.4.3.14	3.12.4.3.14	Orientation	N/A	See ICD		No connectors
3.3.6.28A	6.4.4.3.15A	3.12.4.3.15A	Hose/Cable Restraints - Loose Ends	N/A	See ICD		No hoses or cables
3.3.6.28B	6.4.4.3.15B	3.12.4.3.15B	Hose/Cable Restraints - Clamps	N/A	See ICD		No hoses or cables
3.3.6.28D	6.4.4.3.15D	3.12.4.3.15D	Hose/Cable Restraints - Lengths	N/A	See ICD		No hoses or cables
3.3.6.29	6.4.4.4.1	3.12.4.4.1	Non-Threaded Fasteners Status Indication	✓	See ICD		
3.3.6.30	6.4.4.4.2	3.12.4.4.2	Mounting Bolt/Fastener Spacing	✓	See ICD		
3.3.6.31	6.4.4.4.3	3.12.4.4.4A	Multiple Fasteners	✓	See ICD		
3.3.6.32	6.4.4.4.4	3.12.4.4.5	Captive Fasteners	✓	See ICD		
3.3.6.33A	6.4.4.4.5A	3.12.4.4.6A	Quick Release Fasteners - One turn max	✓	See ICD		
3.3.6.33B	6.4.4.4.5B	3.12.4.4.6B	Quick Release Fasteners - Positive Locking	✓	See ICD		
3.3.6.34	6.4.4.4.6	3.12.4.4.7	Threaded Fasteners	✓	See ICD		
3.3.6.35A	6.4.4.4.7A	3.12.4.4.8A	Over Center Latches - Nonself-latching	N/A	See ICD		No over the center latches
3.3.6.35B	6.4.4.4.7B	3.12.4.4.8B	Over Center Latches - Latch Lock	N/A	See ICD		No over the center latches

✓ - Requirement is applicable E - Exception N/A - Requirement is not applicable

APPENDIX B

ISS PRESSURIZED PAYLOAD INTERFACE REQUIREMENTS DOCUMENT VERIFICATION MATRIX (Cont'd)

SRD Section	LS-71000 Section	SSP 57000 Section	Requirement	Applicable	Verification Method	Responsibility	Comments
3.3.6.35C	6.4.4.4.7C	3.12.4.4.8C	Over Center Latches - Latch Handles	N/A	See ICD		No over the center latches
3.3.6.36	6.4.4.4.8	3.12.4.4.9	Winghead Fasteners	N/A	See ICD		No wing head fasteners
3.3.6.37A	6.4.4.4.9A	3.12.4.4.11A	Fastener Head Type - On-Orbit Crew Actuation	✓	See ICD		
3.3.6.37B	6.4.4.4.9B	3.12.4.4.11B	Fastener Head Type - Smooth Surface	✓	See ICD		
3.3.6.37C	6.4.4.4.9C	3.12.4.4.11C	Fastener Head Type - Slotted Fasteners	N/A	See ICD		No slotted fasteners used for critical structures
3.3.6.38	6.4.4.4.10	3.12.4.4.12	One-Handed Actuation	✓	See ICD		
3.3.6.40	6.4.4.4.12	3.12.4.4.14	Access Holes	✓	See ICD		
3.3.6.41	6.4.5.1	3.12.5.1	Controls Spacing Design Requirements	✓	See ICD		
3.3.6.42	6.4.5.2.1A-G	3.12.5.2.1	Protective Methods - Location/Orientation	✓	See ICD		
3.3.6.43	6.4.5.2.2	3.12.5.2.2	Noninterference	✓	See ICD		
3.3.6.44	6.4.5.2.3	3.12.5.2.3	Dead-Man Controls	N/A	See ICD		No dead man controls
3.3.6.45	6.4.5.2.4	3.12.5.2.4	Barrier Guards	✓	See ICD		
3.3.6.46	6.4.5.2.5	3.12.5.2.5	Recessed Switch Protection	N/A	See ICD		No recessed switches
3.3.6.47	6.4.5.2.7	3.12.5.2.7	Position Indication	✓	See ICD		
3.3.6.48	6.4.5.2.8	3.12.5.2.8	Hidden Controls	N/A	See ICD		No hidden controls
3.3.6.49	6.4.5.2.9	3.12.5.2.9	Hand Controllers	N/A	See ICD		No hidden controls
3.3.6.50A	6.4.5.3A	3.12.5.3A	Valve Controls - Low-Torque Valves	N/A	See ICD		No valves
3.3.6.50B	6.4.5.3B	3.12.5.3B	Valve Controls - Intermediate-Torque Valves	N/A	See ICD		No valves
3.3.6.50C	6.4.5.3C	3.12.5.3C	Valve Controls - High-Torque Valves	N/A	See ICD		No valves
3.3.6.50D	6.4.5.3D	3.12.5.3D	Valve Controls - Handle Dimensions	N/A	See ICD		No valves

✓ - Requirement is applicable E - Exception N/A - Requirement is not applicable

APPENDIX B

ISS PRESSURIZED PAYLOAD INTERFACE REQUIREMENTS DOCUMENT VERIFICATION MATRIX (Cont'd)

SRD Section	LS-71000 Section	SSP 57000 Section	Requirement	Applicable	Verification Method	Responsibility	Comments
3.3.6.50E	6.4.5.3E	3.12.5.3E	Valve Controls - Rotary Valve Controls	N/A	See ICD		No valves
3.3.6.51	6.4.5.4	3.12.5.4	Toggle Switches	✓	See ICD		
3.3.6.52	6.4.6	3.12.6	Restraints and Mobility Aids	✓	See ICD		
3.3.6.54	6.4.6.3	3.12.6.3	Captive Parts	✓	See ICD		
3.3.6.55	6.4.6.4.1	3.12.6.4.1	Handles and Restraints	✓	See ICD		
3.3.6.56	6.4.6.4.2	3.12.6.4.3	Handle Location/Front Access	✓	See ICD		
3.3.6.57	6.4.6.4.3	3.12.6.4.4	Handle Dimensions	✓	See ICD		
3.3.6.58A	6.4.6.4.4A	3.12.6.4.5A	Non-Fixed Handles Design Requirements - Stop Position	N/A	See ICD		No non-fixed handles
3.3.6.58B	6.4.6.4.4B	3.12.6.4.5B	Non-Fixed Handles Design Requirements - One Hand Use	N/A	See ICD		No non-fixed handles
3.3.6.58C	6.4.6.4.4C	3.12.6.4.5C	Non-Fixed Handles Design Requirements - Locked/Unlocked Indication	N/A	See ICD		No non-fixed handles
3.3.6.59B	6.4.9.1B	3.12.9.1B	Electrical Hazards - Exposure hazard exceeds threshold for shock	N/A	See ICD		Do not exceed 30 V threshold for shock. Meet requirement 3.12.9.1.A
3.3.6.59C	6.4.9.1C	3.12.9.1C	Electrical Hazards - Exposure hazard exceeds threshold for shock and threshold of let-go profile	N/A	See ICD		Do not exceed 30 V threshold for shock. Meet requirement 3.12.9.1.A
3.3.6.59D	6.4.9.1D	3.12.9.1D	Electrical Hazards -Two dependent controls provided	N/A	See ICD		Do not exceed 30 V threshold for shock. Meet requirement 3.12.9.1.A
3.3.6.59E	6.4.9.1E	3.12.9.1E	Electrical Hazards -Three independent hazard controls	N/A	See ICD		Do not exceed 30 V threshold for shock. Meet requirement 3.12.9.1.A
3.3.6.60A	6.4.9.1.1A	3.12.9.1.1	Mismatched - Reversed Connection	N/A	See ICD		No connectors or cables

✓ - Requirement is applicable E - Exception N/A - Requirement is not applicable

APPENDIX B

ISS PRESSURIZED PAYLOAD INTERFACE REQUIREMENTS DOCUMENT VERIFICATION MATRIX (Cont'd)

SRD Section	LS-71000 Section	SSP 57000 Section	Requirement	Applicable	Verification Method	Responsibility	Comments
3.3.6.60B	6.4.9.1.1B	3.12.9.1.1	Mismatched - Blind Connections	N/A	See ICD		No connectors or cables
3.3.6.60C	6.4.9.1.1C	3.12.9.1.1	Mismatched - Mismating	N/A	See ICD		No connectors or cables
3.3.6.60D	6.4.9.1.1D	3.12.9.1.1	Mismatched -Minimizing Equipment Risk	N/A	See ICD		No connectors or cables
3.3.6.61	6.4.9.1.2.1	3.12.9.1.4.1	Device Accessibility	✓	See ICD		
3.3.6.62	6.4.9.1.2.2	3.12.9.1.4.2	Extractor-Type Fuse Holder	✓	See ICD		
3.3.6.63	6.4.9.1.2.3	3.12.9.1.4.3	Overload Protection Location	N/A	See ICD		No overload protection devices
3.3.6.64	6.4.9.1.2.4	3.12.9.1.4.4	Overload Protection Identification	N/A	See ICD		There are no fuses or circuit breakers intended to be replaced
3.3.6.65	6.4.9.1.2.5	3.12.9.1.4.5	Automatic Restart Protection	✓	See ICD		
3.3.6.66A	6.4.9.10A	3.12.9.10A	Audio Displays - False Alarms	N/A	See ICD		No audio cues
3.3.6.66B	6.4.9.10C	3.12.9.10C	Audio Displays - Operability Testing	N/A	See ICD		No audio cues
3.3.6.66C	6.4.9.10D	3.12.9.10D	Audio Displays - Manual Disable	N/A	See ICD		No audio cues
3.3.6.67	6.4.9.11	3.12.9.12	Egress	✓	See ICD		
3.3.8.1A	6.3.1.3A	3.1.1.3A	Structural Design Requirements - Positive Margins of Safety for MPLM Launch and Landing	N/A	See ICD		Not a Rack
3.3.8.1B	6.3.1.3B	3.1.1.3B	Structural Design Requirements - Positive Safety Margins for On-orbit Loads	✓	See ICD		
3.3.8.1.1	6.3.1.3C	3.1.1.3D	Crew Induced Load Requirements	✓	See ICD		

✓ - Requirement is applicable E - Exception N/A - Requirement is not applicable

APPENDIX B

ISS PRESSURIZED PAYLOAD INTERFACE REQUIREMENTS DOCUMENT VERIFICATION MATRIX (Cont'd)

SRD Section	LS-71000 Section	SSP 57000 Section	Requirement	Applicable	Verification Method	Responsibility	Comments
3.3.8.1.2	6.3.1.1	3.1.1.5A	Safety Critical Structures Requirements	N/A	See ICD		The HRF ASD Equipment and stowage pouches are not safety critical structures. Any device failure is not critical and is contained to the device. The ASD and pouches are crit level three.
3.3.8.1.3	6.1.1.3.F	3.1.1.3.F	Loads Requirements	✓	See ICD		
3.3.8.3.1	6.2.7.2	3.7.5	Pressurized Gas Bottles	N/A	See ICD		No use of pressurized gas bottles
3.3.8.3.2	6.2.7.3	3.7.6	Manual Valves	N/A	See ICD		No pressure valves

✓ - Requirement is applicable E - Exception N/A - Requirement is not applicable

APPENDIX C

FUNCTIONAL PERFORMANCE VERIFICATION MATRIX

APPENDIX C

FUNCTIONAL PERFORMANCE VERIFICATION MATRIX

SRD Section	LS-71000 Section	Requirement	Applicable	Verification Method	Comments
3.2.1.1.A		Functional Performance Characteristics	✓	Demonstration, Test	
3.2.1.1.B		Functional Performance Characteristics	✓	Demonstration, Test	
3.2.1.1.C		Functional Performance Characteristics	✓	Demonstration, Test	
3.2.1.1.D		Functional Performance Characteristics	✓	Demonstration, Test	
3.2.1.1.E		Functional Performance Characteristics	✓	Demonstration, Test	
3.2.1.1.F		Functional Performance Characteristics	✓	Demonstration, Test	
3.2.1.1.G		Functional Performance Characteristics	✓	Analysis, Test	
3.2.2.2.2		Deployed Envelope	N/A		The Deployed envelope is identical to the Stowed Envelope
3.2.3A	7.2	Reliability, Quality, and Non-Conformance Reporting	N/A		Quality Assurance for the HRF Program shall be implemented in accordance with JPD 5335.1, "JSC Quality Manual."
3.2.3B	7.3.1	Reliability, Quality, and Non-Conformance Reporting	✓	Analysis	
3.2.3C1	7.3.2(1)	Reliability, Quality, and Non-Conformance Reporting	✓	Analysis	
3.2.3C2	7.3.2(2)	Reliability, Quality, and Non-Conformance Reporting	✓	Analysis	
3.2.3C3	7.3.2(3)	Reliability, Quality, and Non-Conformance Reporting	✓	Analysis	
3.2.3C4	7.3.2(4)	Reliability, Quality, and Non-Conformance Reporting	N/A		The HRF ASD Equipment does not utilize software
3.2.3.1		Failure Propagation	✓	Analysis	
3.2.3.2	3.1.1	Useful Life	✓	Analysis	
3.2.5.1.5C2	6.3.1.2A	Pressure Rate of Change - Carrier (Orbiter)	✓	Analysis	
3.2.6.1	6.3.1.3	Launch and Landing	✓	Analysis	

✓ - Requirement is applicable E - Exception N/A - Requirement is not applicable

APPENDIX C

FUNCTIONAL PERFORMANCE VERIFICATION MATRIX (Cont'd)

SRD Section	LS-71000 Section	Requirement	Applicable	Verification Method	Comments
3.3.1.1F		Materials and Processes	✓	Inspection	
3.3.1.1G		Materials and Processes	✓	Inspection	
3.3.1.9C		Locking Wires	✓	Inspection	
3.3.3	7.3.1	Workmanship	✓	Inspection	
3.3.5.1.1B		Mating/Demating of Powered Connectors	N/A	N/A	No powered connectors
3.3.6.2.1A	6.4.3.5.1	Rack Mounted Equipment - Color	N/A	N/A	The HRF ASD Equipment is not a rack mounted piece of equipment
3.3.6.2.1B	6.4.3.5.1	Rack Mounted Equipment - Finish	N/A	N/A	The HRF ASD Equipment is not a rack mounted piece of equipment
3.3.6.2.1C	6.4.3.5.1	Rack Mounted Equipment - SIR Drawer Panel Handle Latches - Finish	N/A	N/A	The HRF ASD Equipment is not a rack mounted piece of equipment
3.3.6.2.2A	6.4.3.5.2A	Stowed/Deployable Equipment - COTS Equipment Non-repackaged - Finish	✓	Inspection	
3.3.6.2.2B	6.4.3.5.2B	Stowed/Deployable Equipment - COTS Equipment Repackaged - Finish	✓	Inspection	
3.3.6.2.3	6.4.3.5.3	Colors for Soft Goods	✓	Inspection	
3.3.6.3B		Full Size Range Accommodation - COTS Equipment	✓	Analysis	
3.3.8.1A2	6.3.1.3A	Structural Design Requirements - Orbiter Loading Middeck Launch and Landing	✓	Analysis	
3.3.8.2.1	6.3.2.10	Batteries	✓	Analysis	

✓ - Requirement is applicable E - Exception N/A - Requirement is not applicable

APPENDIX D

ACCEPTANCE AND QUALIFICATION TEST APPLICABILITY MATRICES

APPENDIX D

TABLE D-1. ACCEPTANCE AND QUALIFICATION TEST APPLICABILITY MATRIX

SRD Section	LS-71000 Section	Requirement	Applicable	SRD Verification Section	Comments
3.4.1A		Thermal Environment Compatibility	✓	4.3.1	
3.4.1B		Thermal Environment Compatibility	✓	4.3.1	
3.4.2	5.4.1.1.3.2 and 5.4.1.1.3.3	Workmanship Vibration	✓	4.3.2.1, 4.3.2.2	
3.4.3	5.4.1.3.4	Functional Performance	✓	4.3.3	
3.4.4	5.4.1.1.10	EEE Parts Control, Selection, and Burn-in	✓	4.3.4	
3.4.5	5.4.1.1.8	Flammability	✓	4.3.5	
3.4.6	5.4.1.1.9	Offgassing	✓	4.3.6	
3.4.7	5.4.1.1.5	Bench Handling	✓	4.3.7	
3.4.8	5.4.1.1.1	Payload Mass	N/A	4.3.8	
3.4.9	5.4.1.2.1	Electromagnetic Compatibility	✓	4.3.9	
3.4.10	5.4.1.1.7	Acoustic Noise	✓	4.3.10	
3.4.11	5.4.1.3.1	Software Acceptance	N/A	4.3.11	
3.4.12	5.4.1.3.2	Pre-Delivery Acceptance	✓	4.3.12	
3.4.13		Humidity Environment Compatibility	✓	4.3.13	

TABLE D-2. NON-CRITICAL HARDWARE QUALIFICATION TEST REQUIREMENTS

Component / Type Test	HRF ASD Equipment	ASD Battery Pack	ASD Filter Unit
Thermal Cycling	✓	✓	**N/A**
Qualification for Acceptance Vibration	N/A	N/A	N/A
Flammability	✓	✓	✓
Offgassing	✓	✓	✓
Bench Handling	✓	✓	✓
Payload Mass Control Plan	N/A	N/A	N/A
EMI/EMC Control Plan	✓	N/A	N/A
Acoustic Noise Control Plan	✓	N/A	N/A
EEE Parts Screening	✓	✓	N/A
EEE Parts Control	✓	✓	N/A
Soyuz/Progress Humidity Environment	✓	✓	✓

TABLE D-3. NON-CRITICAL HARDWARE ACCEPTANCE TEST REQUIREMENTS

Component / Type Test	HRF ASD Equipment	ASD Battery Pack	ASD Filter Unit
Thermal Cycling	**E**	**E**	**N/A**
Acceptance Vibration	✓	✓	**N/A**
Functional	✓	✓	✓
Burn-in	✓	✓	N/A
Pre-Delivery Acceptance Functional	✓	✓	✓

APPENDIX E

ORBITER MIDDECK IDD VERIFICATION MATRIX

APPENDIX E

TABLE E-1. ORBITER MIDDECK IDD VERIFICATION MATRIX

SRD Section	Middeck IDD Section	Requirement	Applicable	Verification Method	Comments
3.2.7.5.1	3.9	IVA Transfer Pathway	✓	Inspection	
3.2.7.5.2	4.1	Launch and Landing Loads	✓	Analysis	
3.2.7.5.3	4.4	Kick Loads	✓	Analysis	
3.2.7.5.4.A	4.5	Factors of Safety for Structural Design	✓	Analysis	
3.2.7.5.5	4.6	Fracture Control	✓	Analysis	
3.2.7.5.6	4.7.4.3	Acoustic Noise	✓	Test	
3.2.7.5.7.A	5.1	Payload Element Cleanliness: External surfaces	✓	Inspection	
3.2.7.5.7.B	5.1	Payload Element Cleanliness: Cleaning Fluids	✓	Analysis	
3.2.7.5.8.A	5.2	Payload Effluents: Safe containment	✓	Analysis	
3.2.7.5.8.B	5.2	Payload Effluents: Gaseous venting	✓	Analysis	
3.2.7.5.9	5.4	Nuclear Radiation	✓	Analysis	
3.2.7.5.10	6.1	Environmental Conditions	✓	Analysis	
3.2.7.5.11.A	6.2.1	Payload Waste Heat Dissipation: Dissipated to Middeck cabin air	✓	Analysis	
3.2.7.5.11.B	6.2.1	Payload Waste Heat Dissipation: Cooling based on 10.2 psia cabin pressure	✓	Analysis	
3.2.7.5.12	6.2.1.2	Passive Cooling	✓	Analysis	
3.2.7.5.13	6.2.1.4	Non-Ducted Air Cooling	✓	Analysis	
3.2.7.5.14.A	6.2.1.4.1	Non-Ducted Payload Contamination Protection	✓	Analysis	
3.2.7.5.14.B	6.2.1.4.1	Non-Ducted Payload Contamination Protection	✓	Analysis	
3.2.7.5.15	6.2.2	External Surface Temperature	✓	Test	
3.2.7.5.16	7.4.4	Payload Element Activation/Deactivation and Isolation	✓	Inspection	

APPENDIX E

TABLE E-2. ORBITER MIDDECK IDD VERIFICATION MATRIX

SRD Section	Middeck IDD Section	Requirement	Applicable	Verification Method	Comments
3.2.7.5.17.A	Encompassed by SLE-0002 Book 3 Fig. 5-24	Unintentional radiated electric fields	✓	Test	
3.2.7.5.17.B	8.3.2.B	Generated AC magnetic fields	✓	Test	
3.2.7.5.17.C	8.3.2.B	Generated DC magnetic fields	✓	Test	
3.2.7.5.18.A	8.4.1	ASD to Orbiter electrical bonding	✓	Analysis	Reference Orbiter Middeck IDD Section 8.4.1.1.1 Battery Powered Payloads - For installation into the Orbiter, there is no testing for battery-powered payloads using Static Bond, Fault Bond or RF Bond.
3.2.7.5.18.B	8.4.1	Aluminum surfaces used for bonding	N/A	Analysis	The HRF ASD Equipment does not have an Aluminum housing
3.2.7.5.18.C	8.4.1.3	Turboelectric (frictional) charging mechanism Bonding	✓	Analysis	Reference Orbiter Middeck IDD Section 8.4.1.1.1 Battery Powered Payloads - For installation into the Orbiter, there is no testing for battery-powered payloads using Static Bond, Fault Bond or RF Bond.
3.2.7.5.19	8.4.1.2.3.1	Static Electricity Protection	✓	Analysis or Test	

APPENDIX F

ISS RUSSIAN SEGMENT APPLICABILITY MATRIX

APPENDIX F

TABLE F-1. ISS RUSSIAN APPLICABILITY MATRIX

SRD Section	SSP 50094	Requirement	Applicable	Verification Method	Comments
3.2.7.5.20	3.4.1.1.3	Russian Segment EMI	✓	Test	

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