Active Common Berthing Mechanism to Passive Common Berthing Mechanism Interface Control Document, Part 1

International Space Station Program

Revision D

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D	Revision D released per SSCN 001665. Incorporates the following PIRNs associated with the appropriate SSCNs. PIRN 41148–0014 IRN N/A SSCN 001665	10–09–98

PREFACE

The contents of this document are intended to be consistent with the tasks and products to be prepared by Program participants. The Active Common Berthing Mechanism to Passive Common Berthing Mechanism Interface Control Document (ICD) shall be implemented on all new International Space Station contractual and internal activities and shall be included in any existing contracts through contract changes. This document is under the control of the Prime Contractor Interface Control Working Group (ICWG), and any changes or revisions will be approved by the Prime ICWG Chairman or have a statement to indicate the delegated authority.

/s/ Craig Aman	09/30/98
Boeing Prime ICWG Chairman, International Space Station	Date

INTERNATIONAL SPACE STATION PROGRAM

ACTIVE COMMON BERTHING MECHANISM TO PASSIVE COMMON BERTHING MECHANISM INTERFACE CONTROL DOCUMENT, PART 1

30 SEPTEMBER 1998

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1.0 INTRODUCTION

The Space Station Common Berthing Mechanism (CBM) will be used on the European Space Agency (ESA) Element, the Italian Space Agency (ASI) element, the National Space Development Agency of Japan (NASDA) Elements, and the National Aeronautics and Space Administration (NASA) Elements.

There are two types of CBMs used on the Space Station. These are referred to as the Active CBM (ACBM) and the Passive CBM (PCBM).

1.1 PURPOSE

The purpose of this document is to provide definition of the structural/mechanical, interface functional requirements between the ACBM and the PCBM.

1.2 SCOPE

The scope of this document is limited to interfaces between the ACBM and the PCBM.

1.3 PRECEDENCE

In the event of conflict between SSP 41162, Segment Specification for the United States On–orbit Segment and the contents of this Interface Control Document (ICD), the requirements of SSP 41162 shall take precedence.

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2.0 APPLICABLE DOCUMENTS

The following applicable documents of the exact issue shown form a part of this specification to the extent specified herein. Inclusion of applicable documents herein does not in any way supersede the order of precedence identified in 1.3. The references show where each applicable document is cited in this document.

DOCUMENT NO.	TITLE
SSP 30240 Revision C September 30, 1998	Space Station Grounding Requirements Paragraph: 3.2.1.8.1.1, 3.2.2.8.1.1
SSP 30245 Revision D, DCN 004, 005 June 4, 1998	Space Station Electrical Bonding Requirements Paragraph: 3.2.1.8.1.2, 3.2.2.8.1.2
SSP 41004 Revision F IRN 41004-1465, 1594, 1481, 1555 April 30, 1998	Common Berthing Mechanism to Pressurized Elements Interface Control Document, Part 1 Paragraph: 3.2.1.1.1, 3.2.1.2.1, 3.2.2.1.1, 3.2.2.2.1
SSP 50023 Revision Basic April 15, 1994	Thermal Control Plan Paragraph: 3.2.1.8.4, 3.2.2.8.4

3.0 ACTIVE COMMON BERTHING MECHANISM TO PASSIVE COMMON BERTHING MECHANISM INTERFACES

3.1 GENERAL

This section defines the functional interface requirements between the ACBM and the PCBM.

3.1.1 INTERFACE DESCRIPTION

The ACBM to PCBM interface consists of the structural/mechanical attachment, capture, rigidization, alignment, and proximity detection. A functional interface diagram is shown in Figure 3.1.1–1.

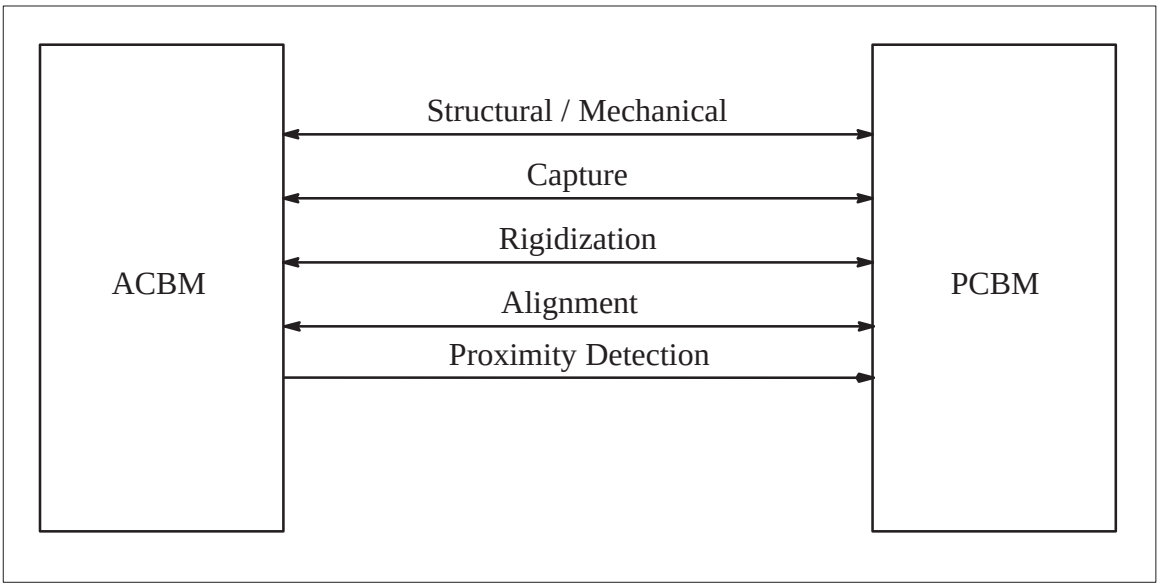


FIGURE 3.1.1–1 FUNCTIONAL INTERFACE DIAGRAM

3.1.1.1 ACTIVE COMMON BERTHING MECHANISM DESCRIPTION

The ACBM is a mechanism which berths with a PCBM on orbit to provide a common interface between pressurized elements. The ACBM contains active components to accomplish the berthing operation.

3.1.1.2 PASSIVE COMMON BERTHING MECHANISM DESCRIPTION

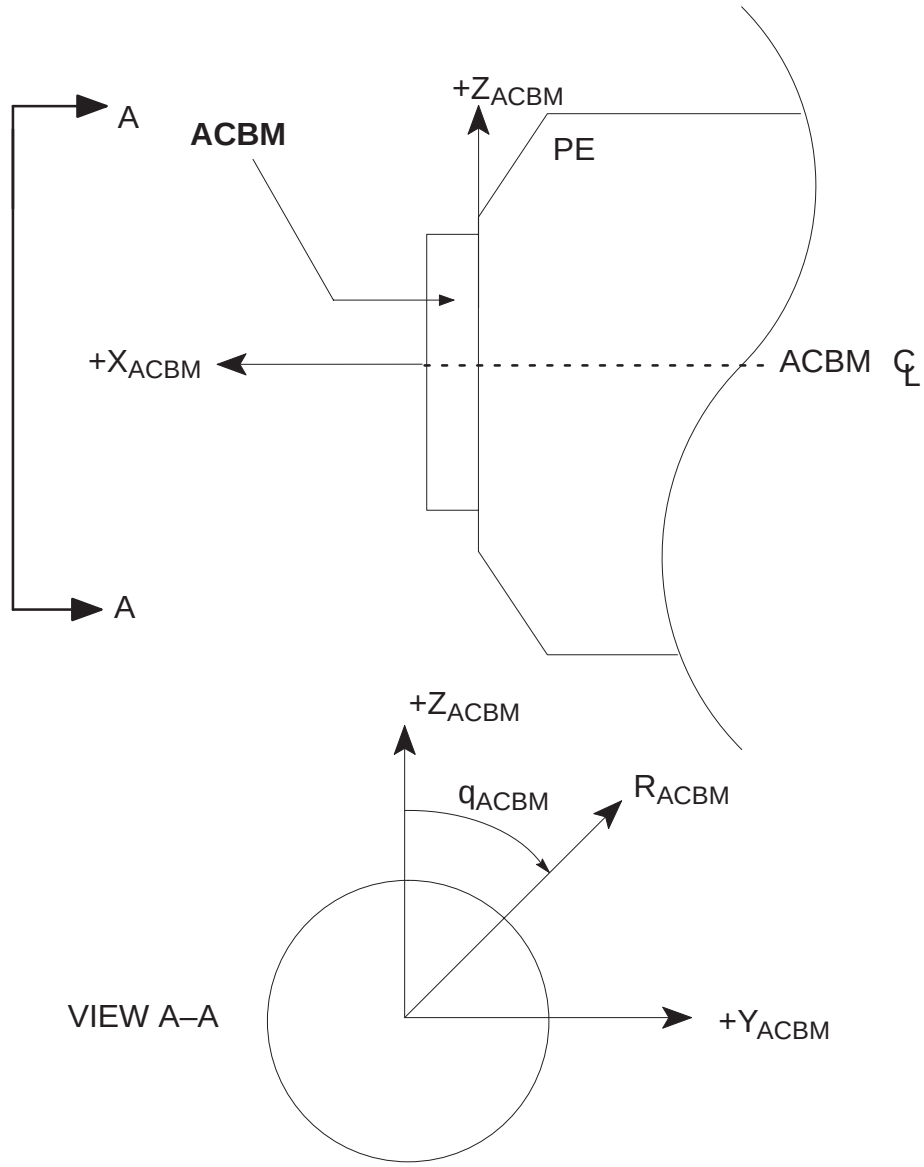
The PCBM is a mechanism which berths with an ACBM on orbit to provide a common interface between pressurized elements. The PCBM contains passive components to accomplish the berthing operation.

3.1.1.3 INTERFACE PLANE DESCRIPTION

The ACBM to PCBM interface plane is between the ACBM and PCBM sealing surfaces.

3.1.1.4 COORDINATE SYSTEM

The ACBM coordinate system is shown in Figure 3.1.1.4–1. The PCBM coordinate system is shown in Figure 3.1.1.4–2.

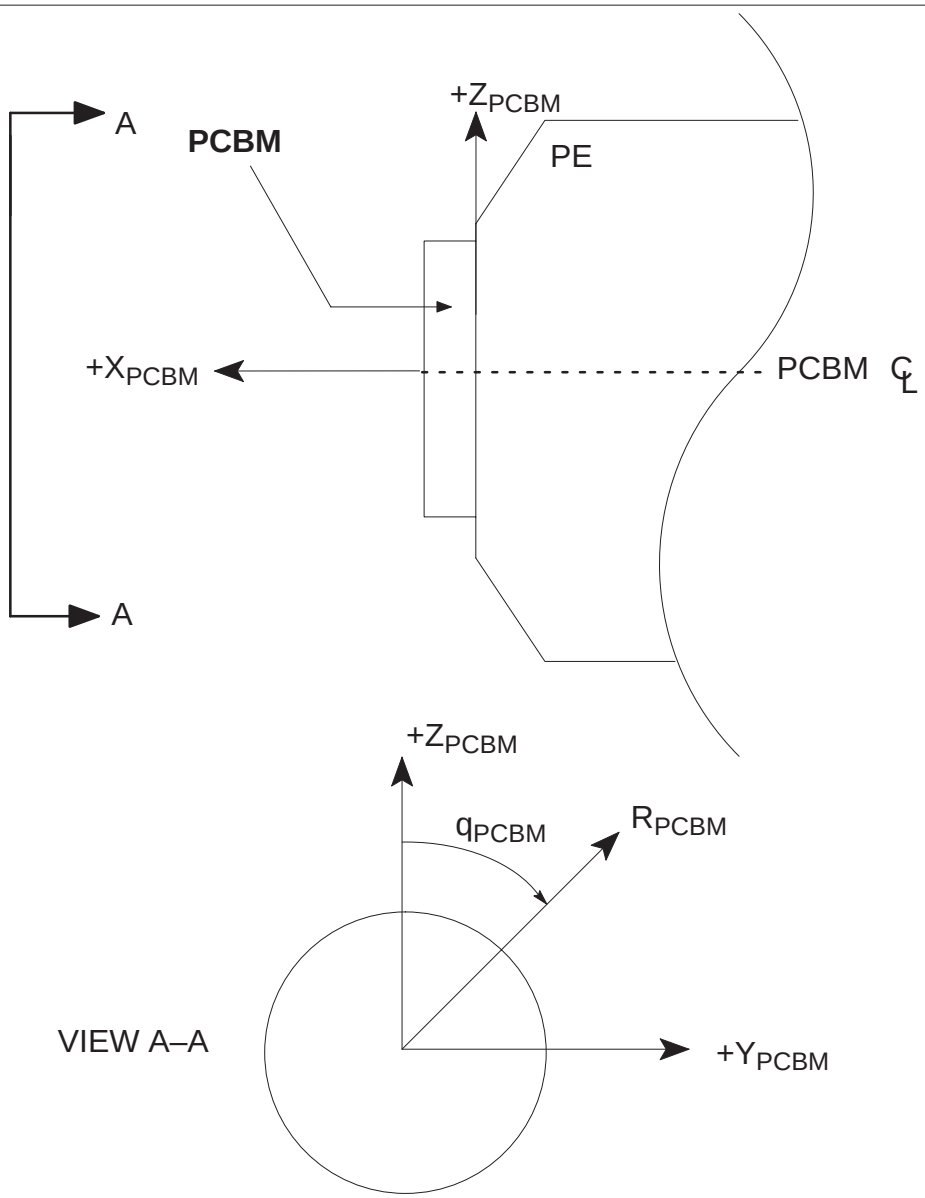


NOTE 1) R_{ACBM} and q_{ACBM} define a radial coordinate system.

FIGURE 3.1.1.4–1 ACTIVE COMMON BERTHING MECHANISM COORDINATE SYSTEM

3.1.1.5 ENGINEERING UNITS AND TOLERANCES

Dimensions in this document are shown primarily in the English (inch, pound, second) system of units.



NOTE 1) R_{PCBM} and q_{PCBM} define a radial coordinate system.

FIGURE 3.1.1.4–2 PASSIVE COMMON BERTHING MECHANISM COORDINATE SYSTEM

3.1.1.5.1 TOLERANCE

Linear tolerances on dimensions are as indicated in Table 3.1.1.5.1–1. Angular tolerances are +/– 0.1 degrees on all angles unless otherwise stated.

TABLE 3.1.1.5.1–1 LINEAR TOLERANCES

English dimension	Implied tolerance (inches)
X.XX	+/– 0.03
X.XXX	+/– 0.010

3.1.1.6 ACBM INTERFACE FUNCTIONS

The ACBM shall support the following functions at the interface to the PCBM:

A. Structural/mechanical attachment

B. Alignment

C. Capture

D. Rigidization

E. Proximity detection

3.1.1.7 PCBM INTERFACE FUNCTIONS

The PCBM shall support the following functions at the interface to the ACBM:

A. Structural/mechanical attachment

B. Alignment

C. Capture

D. Rigidization

E. Support proximity detection

3.1.2 INTERFACE RESPONSIBILITIES

3.1.2.1 RESPONSIBILITY FOR THE ACBM

Boeing Defense & Space Group (BD&SG) carries the responsibility for designing the ACBM to the requirements herein.

3.1.2.2 RESPONSIBILITY FOR THE PCBM

BD&SG carries the responsibility for designing the PCBM to the requirements herein.

3.2 INTERFACE REQUIREMENTS

3.2.1 ACBM INTERFACE REQUIREMENTS

3.2.1.1 ENVELOPE REQUIREMENTS

3.2.1.1.1 ENVELOPE

The unberthed ACBM envelope is defined in SSP 41004. The ACBM/PCBM berthed envelope shall be in accordance with Figure 3.2.1.1.1–1.

3.2.1.1.2 RESERVED VOLUMES

3.2.1.1.2.1 PCBM HARDWARE

The ACBM hardware mounting or operation shall not interfere with PCBM hardware.

3.2.1.2 STRUCTURAL/MECHANICAL ATTACHMENT

The ACBM shall supply structural and mechanical provisions for mechanical attachment to the PCBM.

3.2.1.2.1 VESTIBULE CLEARANCES

The ACBM to PCBM interface shall provide vestibule clearances at the interface plane in accordance with SSP 41004.

3.2.1.2.2 ATMOSPHERIC CONTAINMENT

Total atmospheric leakage for the PCBM/ACBM hardware following berthing shall not exceed 0.084 sccs air at 14.7 psia.

3.2.1.3 ALIGNMENT

The ACBM shall provide and receive alignment to and from the PCBM during on–orbit assembly. When fully berthed the alignment of the ACBM to PCBM interface shall allow clear passage and ACBM and PCBM hardware envelopes in accordance with Figure 3.2.1.1.1–1.

3.2.1.4 CAPTURE

The ACBM shall provide the active components necessary to capture the PCBM during on–orbit assembly.

3.2.1.5 RIGIDIZATION

The ACBM shall provide the active mechanism to rigidize the ACBM to PCBM interface during on–orbit assembly.

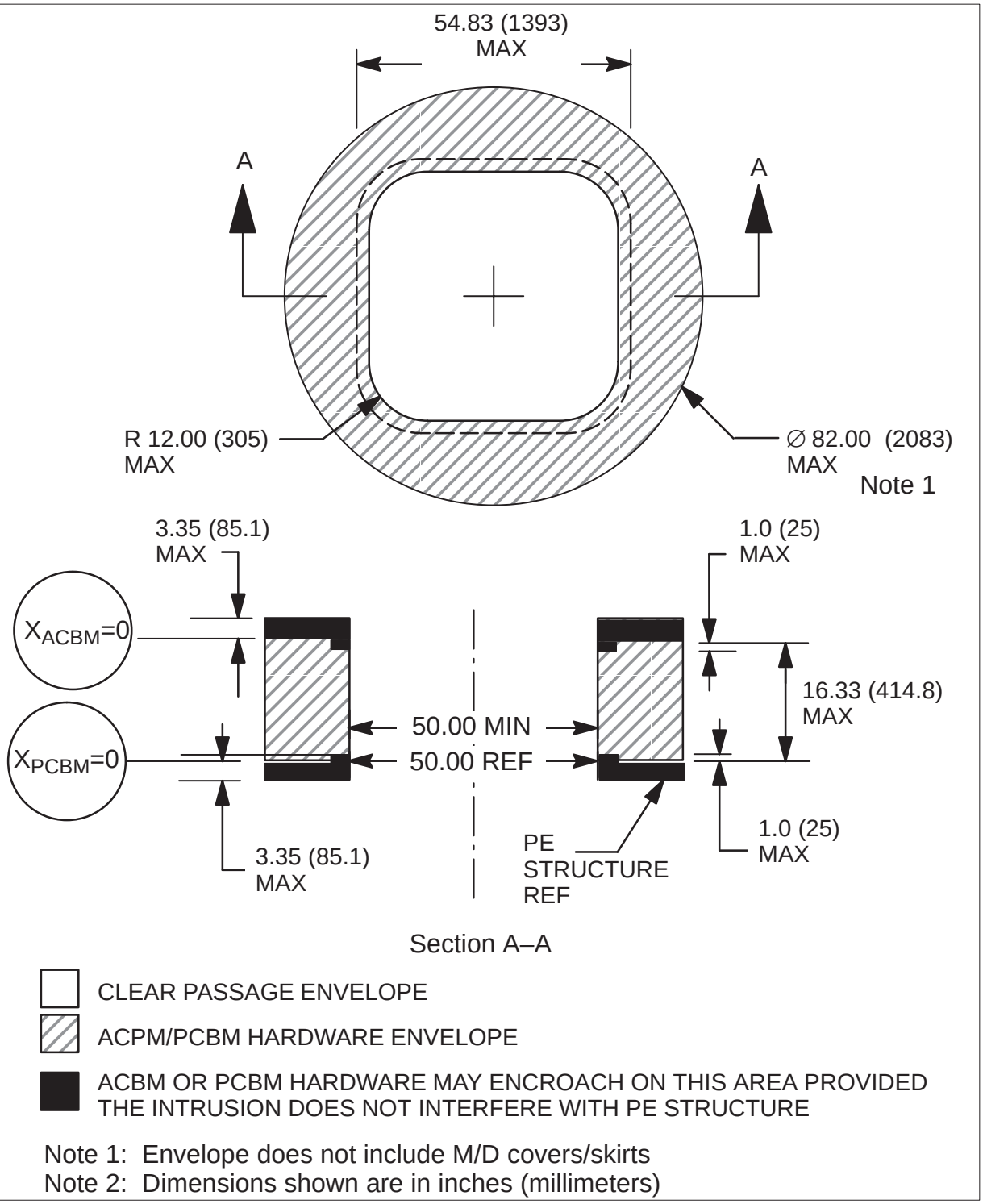


FIGURE 3.2.1.1.1–1 BERTHED ENVELOPE

3.2.1.6 DELETED

3.2.1.7 PROXIMITY DETECTION

The ACBM shall detect the proximity of the PCBM to indicate when ready to begin the capture process.

3.2.1.8 ENVIRONMENTS

3.2.1.8.1 ELECTROMAGNETIC EFFECTS

3.2.1.8.1.1 GROUNDING

The ACBM to PCBM interface shall meet the requirements of SSP 30240.

3.2.1.8.1.2 BONDING

The ACBM to PCBM structural/mechanical interface shall meet the requirements of SSP 30245.

3.2.1.8.2 STRUCTURAL LOADS

3.2.1.8.2.1 BERTHING AND ON–ORBIT

The ACBM to PCBM interface shall survive loads induced on the ACBM as specified in the applicable element–to–element interface control documents.

3.2.1.8.2.2 LAUNCH AND LANDING

ACBM to PCBM interfaces that are launched when mated shall survive launch and landing loads as specified in the applicable element–to–element interface control documents.

3.2.1.8.3 VIBROACOUSTICS

ACBM to PCBM interfaces that are launched when mated shall survive the launch vibroacoustics as specified in the applicable element–to–element interface control documents.

3.2.1.8.4 THERMAL

The ACBM to PCBM interface shall function as described herein when exposed to the thermal radiation environment as specified in SSP 50023. SSP 50023 specifies math models and thermal design analysis criteria for interface design.

3.2.1.8.5 CONTACT CONDUCTANCE

The ACBM to PCBM interface contact conductance will range between 10.8 and 62 BTU/hour degrees F.

3.2.1.9 DEPRESSURIZATION

The ACBM to PCBM interface shall survive a 0.76 psia/sec depressurization rate without loss of functionality as specified herein.

3.2.1.10 REPRESSURIZATION

The ACBM to PCBM interface shall survive a 0.76 psia/sec repressurization rate to 15.2 psia without loss of functionality as specified herein.

3.2.2 PCBM INTERFACE REQUIREMENTS

3.2.2.1 ENVELOPE REQUIREMENTS

3.2.2.1.1 ENVELOPE

The unberthed PCBM envelope is defined in SSP 41004. The PCBM/ACBM berthed envelope shall be in accordance with Figure 3.2.1.1.1–1.

3.2.2.1.2 RESERVED VOLUMES

3.2.2.1.2.1 ACBM INTERFACE HARDWARE

The PCBM shall not interfere with ACBM hardware mounting or operation.

3.2.2.2 STRUCTURAL/MECHANICAL ATTACHMENT

The PCBM shall supply structural and mechanical provisions for the mechanical attachment to the ACBM.

3.2.2.2.1 VESTIBULE CLEARANCES

The PCBM to ACBM interface shall provide vestibule clearances at the interface plane in accordance with SSP 41004.

3.2.2.2.2 ATMOSPHERIC CONTAINMENT

The ACBM to PCBM seal interface leakage shall not exceed 0.042 sccs air at 14.7 psi.

3.2.2.3 ALIGNMENT

The PCBM shall provide and receive alignment to and from the ACBM during on–orbit assembly. When fully berthed the alignment of the PCBM to ACBM interface shall allow clear passage and PCBM and ACBM hardware envelopes in accordance with Figure 3.2.1.1.1–1.

3.2.2.4 CAPTURE

The PCBM shall provide the passive components necessary to be captured by the ACBM during on–orbit assembly.

3.2.2.5 RIGIDIZATION

The PCBM shall provide the passive components necessary to rigidize the PCBM to ACBM interface during on–orbit assembly.

3.2.2.6 DELETED

3.2.2.7 PROXIMITY DETECTION

The PCBM shall support proximity detection by the ACBM.

3.2.2.8 ENVIRONMENTS

3.2.2.8.1 ELECTROMAGNETIC EFFECTS

3.2.2.8.1.1 GROUNDING

The PCBM to ACBM interface shall meet the requirements of SSP 30240.

3.2.2.8.1.2 BONDING

The PCBM to ACBM structural/mechanical interface shall meet the requirements of SSP 30245.

3.2.2.8.2 STRUCTURAL LOADS

3.2.2.8.2.1 BERTHING AND ON–ORBIT

The PCBM to ACBM interface shall survive the loads as specified in the applicable element–to–element interface control documents.

3.2.2.8.2.2 LAUNCH AND LANDING

PCBM to ACBM interfaces that are launched when mated shall survive launch and landing loads as specified in the applicable element–to–element interface control documents.

3.2.2.8.3 VIBROACOUSTICS

PCBM to ACBM interfaces that are launched when mated shall survive the launch vibroacoustics as specified in the applicable element–to–element interface control documents.

3.2.2.8.4 THERMAL

The PCBM to ACBM interface shall function as described herein when exposed to the thermal radiation environment per SSP 50023. SSP 50023 specifies math models and/or thermal design analysis criteria for interface design.

3.2.2.8.5 CONTACT CONDUCTANCE

The ACBM to PCBM interface contact conductance will range between 10.8 and 62 BTU/hour degrees F.

3.2.2.9 DEPRESSURIZATION

The PCBM to ACBM interface shall survive a 0.76 psia/sec depressurization rate without loss of functionality as specified herein.

3.2.2.10 REPRESSURIZATION

The PCBM to ACBM interface shall survive a 0.76 psia/sec repressurization rate to 15.2 psia without loss of functionality as specified herein.

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APPENDIX A ABBREVIATIONS AND ACRONYMS

A.1 ABBREVIATIONS AND ACRONYMS

ACBM	Active Common Berthing Mechanism
APM	Attached Pressurized Module
ASI	Italian Space Agency
BD&SG	Boeing Defense & Space Group
CBM	Common Berthing Mechanism
ESA	European Space Agency
ICD	Interface Requirements Document
IRD	Interface Control Document
lbm	Pound Mass
NASA	National Aeronautics and Space Administration
NASDA	The National Space Development Agency of Japan
PCBM	Passive Common Berthing Mechanism
PE	Pressurized Element
psi	pounds per square inch
psia	pounds per square inch absolute
sccs	Standard Cubic Centimeters per Second
sec	Second

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