

# Rack to Mini Pressurized Logistics Module Interface Control Document (ICD) Part 1

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## International Space Station Program

Revision F

May 18, 2001



**NASDA**

National Space Development  
Agency of Japan



**esa**

European Space Agency



agenzia spaziale italiana  
(Italian Space Agency)

National Aeronautics and Space Administration  
International Space Station Program  
Johnson Space Center  
Houston, Texas  
Contract No. NAS15-10000 (DR VE05)



## REVISION AND HISTORY PAGE

REV.	DESCRIPTION	PUB. DATE																								
-	<p>Initial Release (Reference per SSCBD 000293, EFF. 05/10/96)</p> <p>The Following PIRNs were agreed to and incorporated into this Initial Release;</p> <p>41017-AS-0001A 41017-AS-0005B 41017-NA-0001E 41017-NA-0002D 41017-NA-0007</p>	06/12/96																								
A	Revision A (REFERENCE PIRN ES-0006A, NA-0008B, NA-0014, NA-0016A, NA-0018, ND-0003B, NA-0010A, AS-0011B) (Reference per SSCD 000403, EFF. 10/04/96)	04/16/98																								
B	Revision B (REFERENCE PIRN, AS-0013B, AS-0014D, AS-0015C, NA-0021E, NA-0023D) (Reference per SSCD 000607, EFF. 01/08/98)	08/19/98																								
C	Revision C (REFERENCE SSCD 000988, EFF. 07/26/00 ) (Reference per PIRNs AS-0016, AS-0017C, NA-0026A, NA-0027, NA-0028B, NA-0030B)	04/06/01																								
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D	<p>Revision D (REFERENCE SSCD 001809, EFF. 08/01/00)</p> <p>Incorporates the following PIRNs associated with the appropriate SSCNs.</p> <table border="0" data-bbox="337 1108 993 1346"> <tr> <td>PIRN 41017-ES-0007F</td> <td>IRN N/A</td> <td>SSCN 001809</td> </tr> <tr> <td>PIRN 41017-NA-0024H</td> <td>IRN N/A</td> <td>SSCN 001809</td> </tr> <tr> <td>PIRN 41017-NA-0032B</td> <td>IRN N/A</td> <td>SSCN 001809</td> </tr> <tr> <td>PIRN 41017-NA-0037B</td> <td>IRN N/A</td> <td>SSCN 001809</td> </tr> <tr> <td>PIRN 41017-NA-0038A</td> <td>IRN N/A</td> <td>SSCN 001809</td> </tr> <tr> <td>PIRN 41017-NA-0039A</td> <td>IRN N/A</td> <td>SSCN 001809</td> </tr> <tr> <td>PIRN 41017-NA-0041</td> <td>IRN N/A</td> <td>SSCN 001809</td> </tr> <tr> <td>PIRN 41017-ND-0005C</td> <td>IRN N/A</td> <td>SSCN 001809</td> </tr> </table> <p>Revision D accounts for impacts identified in the following SSCNs: 000845, 000591, 000583, 000773, 001004, 000832, 000440, 000671, 000877, 000915, 000844, 001029, 001051, 001052, 001026, 000470, 000823, 000673, 000585, 000588, 000600, 000567 001127, and 000554.</p> <p>Revision D also closes IRN 0346 for SSCN 000346 as the PIRN 41017-NA-0017 was withdrawn and IRN 0074 for SSCN 000074 as the PIRN 41017-NA-0009A was withdrawn.</p>	PIRN 41017-ES-0007F	IRN N/A	SSCN 001809	PIRN 41017-NA-0024H	IRN N/A	SSCN 001809	PIRN 41017-NA-0032B	IRN N/A	SSCN 001809	PIRN 41017-NA-0037B	IRN N/A	SSCN 001809	PIRN 41017-NA-0038A	IRN N/A	SSCN 001809	PIRN 41017-NA-0039A	IRN N/A	SSCN 001809	PIRN 41017-NA-0041	IRN N/A	SSCN 001809	PIRN 41017-ND-0005C	IRN N/A	SSCN 001809	04/10/01
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**REVISION AND HISTORY PAGE**

<b>REV.</b>	<b>DESCRIPTION</b>	<b>PUB. DATE</b>																					
E	<p>Revision E (Reference SSCD 003760, EFF. 06/30/00)</p> <p>Incorporates the following PIRNs associated with the appropriate SSCNs</p> <table data-bbox="337 478 993 655"> <tr><td>PIRN 41017-NA-0036A</td><td>IRN N/A</td><td>SSCN 003760</td></tr> <tr><td>PIRN 41017-NA-0043B</td><td>IRN N/A</td><td>SSCN 003760</td></tr> <tr><td>PIRN 41017-NA-0051C</td><td>IRN N/A</td><td>SSCN 003760</td></tr> <tr><td>PIRN 41017-NA-0052</td><td>IRN N/A</td><td>SSCN 003760</td></tr> <tr><td>PIRN 41017-NA-0053C</td><td>IRN N/A</td><td>SSCN 003760</td></tr> <tr><td>PIRN 41017-NA-0055A</td><td>IRN N/A</td><td>SSCN 003760</td></tr> </table> <p>Incorporate the following PIRNs with the appropriate SSCNs</p> <table data-bbox="337 730 993 764"> <tr><td>PIRN 41017-NA-0044G</td><td>IRN 0006</td><td>SSCN 001959</td></tr> </table>	PIRN 41017-NA-0036A	IRN N/A	SSCN 003760	PIRN 41017-NA-0043B	IRN N/A	SSCN 003760	PIRN 41017-NA-0051C	IRN N/A	SSCN 003760	PIRN 41017-NA-0052	IRN N/A	SSCN 003760	PIRN 41017-NA-0053C	IRN N/A	SSCN 003760	PIRN 41017-NA-0055A	IRN N/A	SSCN 003760	PIRN 41017-NA-0044G	IRN 0006	SSCN 001959	TBD
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PIRN 41017-NA-0054	IRN 0011	SSCN 003011																					

## **PREFACE**

The contents of this document are intended to be consistent with the tasks and products to be prepared by Program participants. The SSP 41017 Rack to Mini Pressurized Logistics Module Interface Control Document Part 1, Revision A shall be implemented on all new ISSA contractual and internal activities and shall be included in any existing contracts through contract changes. This document is under the control of the Space Station Control Board, and any changes or revisions will be approved by the Program Manager (or statement to indicate the delegated authority, i.e., SSAIT, VAIT).

**INTERNATIONAL SPACE STATION PROGRAM**  
**RACK TO MINI PRESSURIZED LOGISTICS MODULE**  
**INTERFACE CONTROL DOCUMENT PART 1, REVISION E**

**LIST OF CHANGES**

**MAY 18, 2001**

All changes to paragraphs, tables, and figures in this document are shown below:

<b>SSCBD</b>	<b>ENTRY DATE</b>	<b>CHANGE</b>	<b>PARAGRAPH(S)</b>
000403		AS-0011B	3.2.1.4.4
		ES-0006A	<b>PARAGRAPH(S)</b> 2.0 3.2.1.2 3.2.2.2 3.2.2.3.5 <b>APPENDIX</b> A1
		NA-0008B	<b>FIGURES</b> 3.2.1.1.1-1 3.2.1.1.1-2
		NA-0010A	<b>PARAGRAPHS</b> 3.2.1.4.2
		NA-0014	<b>PARAGRAPHS</b> 4.0
		NA-0016A	<b>PARAGRAPHS</b> 2.0
		NA-0018	<b>PARAGRAPHS</b> Delete Issue Sheets
		ND-0003B	<b>PARAGRAPHS</b> 3.2.1.1.2 <b>FIGURES</b> 3.2.1.1.2-1 3.2.1.1.2-2 3.2.1.1.2-3

<b>SSCBD</b>	<b>ENTRY DATE</b>	<b>CHANGE</b>	<b>PARAGRAPH(S)</b>
000607		AS-0013B	3.2.1.3.4 3.2.2.3.5
		AS-0014D	<b>PARAGRAPH(S)</b> 3.2.1.4.2 3.2.1.4.3 3.2.2.4.3 <b>TABLE(S)</b> 3.2.1.4.2-1 3.2.1.4.2-2 3.2.1.4.3-1
		AS-0015C	<b>PARAGRAPH(S)</b> 4.0 <b>TABLE(S)</b> 4.0-1 (add)
		NA-0021E	<b>FIGURE(S)</b> 3.2.1.1.2-1 3.2.1.1.2-2
		NA-0023D	<b>FIGURE(S)</b> 3.2.1.1.2-4 3.2.1.1.2-5 3.2.1.1.2-6
000988		AS-0016	<b>PARAGRAPH(S)</b> 3.2.1.4.4
		AS-0017C	<b>TABLE(S)</b> 3.2.1.4.1.1-1 3.2.2.4.1.1-1 <b>PARAGRAPH(S)</b> 3.2.1.4.1.1 3.2.2.4.1.1
		NA-0026A	<b>PARAGRAPH(S)</b> 2.0 2.1

<b>SSCBD</b>	<b>ENTRY DATE</b>	<b>CHANGE</b>	<b>PARAGRAPH(S)</b>
		NA-0027	Add to Concurrence Sheet
		NA-0028B	<b>FIGURE(S)</b> 3.2.1.1.2-1 3.2.1.1.2-2
		NA-0030B	<b>PARAGRAPH(S)</b> 3.2.1.3.3
000343		NA-0015A	<b>PARAGRAPH(S)</b> 3.2.1.1.1 3.2.1.1.2 3.2.2.1.1 3.2.2.1.2 <b>FIGURE(S)</b> 3.2.1.1.1-4 3.2.1.1.1-5 3.2.1.1.1-6 3.2.1.1.2-3 3.2.1.1.2-4 3.2.1.1.2-5
001809		ES-0007F	<b>PARAGRAPH(S)</b> 3.2.1.1.1 <b>FIGURE(S)</b> 3.2.1.1.1-6 3.2.1.1.1-7 3.2.1.1.1-8
		NA-0024H	<b>PARAGRAPH(S)</b> 3.2.1.1.2 <b>FIGURE(S)</b> 3.2.1.1.2-7 3.2.1.1.2-8 3.2.1.1.2-9
		NA-0032	<b>FIGURE(S)</b> 3.2.1.1.2-2
		NA-0037B	<b>PARAGRAPH(S)</b> 3.2.2.3.6

<b>SSCBD</b>	<b>ENTRY DATE</b>	<b>CHANGE</b>	<b>FIGURE(S)</b>
		NA-0038A	3.2.1.1.1-1
		NA-0039A	<b>FIGURE(S)</b> 3.2.1.1.2-7 3.2.1.1.2-10
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		ND-0005C	<b>PARAGRAPH(S)</b> 3.2.1.4.2 3.2.1.4.3 <b>TABLE(S)</b> 3.2.1.4.2-1 3.2.1.4.2-2 3.2.1.4.2-3 3.2.1.4.3-1 3.2.1.4.3-2 3.2.1.4.3-3
003760		NA-0036A	<b>TABLE(S)</b> 3.2.1.4.1.2-1
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		NA-0051C	<b>FIGURE(S)</b> 3.2.1.1.2-7
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		NA-0053C	<b>PARAGRAPH(S)</b> 3.2.1.2 3.2.1.2.1 (ADD) 3.2.1.2.2 (ADD) 3.2.2.2

<b>SSCBD</b>	<b>ENTRY DATE</b>	<b>CHANGE</b>	<b>TABLE(S)</b>
		NA-0055A	3.2.1.4.2-1
001959		NA-0044G	<b>TABLE(S)</b> 3.2.1.4.3-1
005508		AS-0018F	<b>TABLE(S)</b> 3.2.1.4.2-1 3.2.1.4.3-1
		NA-0050H	<b>FIGURE(S)</b> 3.2.1.1.2-1 3.2.1.1.2-2
		ND-0008B	<b>PARAGRAPH(S)</b> 3.2.1.1.2
			<b>FIGURE(S)</b> 3.2.1.1.2-11 (Page 1 of 5) (ADD) 3.2.1.1.2-11 (Page 2 of 5) (ADD) 3.2.1.1.2-11 (Page 3 of 5) (ADD) 3.2.1.1.2-11 (Page 4 of 5) (ADD) 3.2.1.1.2-11 (Page 5 of 5) (ADD) 3.2.1.1.2-12 (Page 1 of 4) (ADD) 3.2.1.1.2-12 (Page 2 of 4) (ADD) 3.2.1.1.2-12 (Page 3 of 4) (ADD) 3.2.1.1.2-12 (Page 4 of 4) (ADD)
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SSP 41017, Part 1  
Revision F

May 18, 2001

**NASA/NASDA/ESA/ASI APPROVAL**

**INTERNATIONAL SPACE STATION PROGRAM  
RACK TO MINI PRESSURIZED LOGISTICS MODULE  
INTERFACE CONTROL DOCUMENT**

**MAY 18, 2001**

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**CONCURRENCE****INTERNATIONAL SPACE STATION PROGRAM  
RACK TO MINI PRESSURIZED LOGISTICS MODULE  
INTERFACE CONTROL DOCUMENT****MAY 18, 2001**

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Alenia ICWG Chairman Representative for Concurrence	/s/Alessandro Bellomo Alessandro Bellomo	<u>3/26/96</u> DATE

(S) Document has been signed by representative

## Node 2 Project Concurrence

### INTERNATIONAL SPACE STATION PROGRAM RACK TO MINI PRESSURIZED LOGISTICS MODULE

#### INTERFACE CONTROL DOCUMENT, PART 1

May 18, 2001

Alenia	<u>/s/ Walter Cugno</u> Walter Cugno	<u>11/21/97</u> Date
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NASA-MSFC	<u>/s/ Robert Crumbley</u> Robert Crumbley	<u>11/21/97</u> Date



**INTERNATIONAL SPACE STATION PROGRAM**  
**RACK TO MINI PRESSURIZED LOGISTICS MODULE**  
**INTERFACE CONTROL DOCUMENT, PART 1**

**MAY 18, 2001**

**CONCURRENCE**

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## **1.0 INTRODUCTION**

### **1.1 PURPOSE AND SCOPE**

The purpose of this document is to provide definition of the physical, functional, and environmental requirements between the Mini Pressurized Logistics Module (MPLM) and racks which conform to the interfaces of the International Standard Payload Rack (ISPR), and between the Ground Support Equipment (GSE) and racks which conform to the interfaces of the ISPR. The scope of this document is limited to the structural/mechanical interfaces between the MPLM and the ISPR that support the launch/landing/on-orbit event, and between the GSE and the ISPR that support the ground handling event.

### **1.2 PRECEDENCE**

In the event of conflict between SSP 41000, Space Station System Specification, and the contents of this ICD, only the requirements of SSP 41000 applicable to each International Partner and to the National Aeronautics and Space Administration (NASA) shall take precedence.

### **1.3 RESPONSIBILITY AND CHANGE AUTHORITY**

This document is prepared and maintained in accordance with SSP 30459, International Space Station Interface Control Plan. The Prime Contractor shall delegate the responsibility for preparation and maintenance of this ICD.

## 2.0 APPLICABLE DOCUMENTS

The following documents of the exact issue form a part of this document to the extent specified herein.

SSP 30245 Rev. B, 3 Jun, 1994 Reference	Space Station Electrical Bonding Requirements  Paragraph 3.2.1.3.5; 3.2.2.3.5
ASTM E380 Rev. A, 1993 Reference	Standard Practice for Use of the International System of Units (SI) (the Modernized Metric System)  Paragraph 3.1.3.2
COL-RQ-ESA-014  Issue 2, Rev., B 15. Dec 95 Reference	Columbus Electromagnetic Compatibility Requirements (Applicable to APM only)  Paragraph 3.2.2.3.5
SSP 30459 Rev. F, 23 March, 1994 Reference	International Space Station Interface Control Plan  Paragraph 1.3

## 2.1 REFERENCE DOCUMENTS

The following documents are referenced in this ICD for context and user convenience:

SSP 41000 Reference	Space Station System Specification Paragraph 1.2
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## **3.0 INTERFACES**

### **3.1 GENERAL**

#### **3.1.1 INTERFACE DESCRIPTION**

##### **3.1.1.1 ISPR DESCRIPTION**

The International Standard Payload Rack (ISPR) interfaces to the Mini Pressurized Logistics Module (MPLM) and to the Ground Support Equipment (GSE) will be physically identical and functionally compatible without the use of hardware adapters. The ISPR interfaces to the MPLM consist of structural/mechanical attachment for the launch/landing/on-orbit event. The ISPR interfaces to the GSE consist of structural/mechanical attachment for the ground handling event.

##### **3.1.1.2 MODULE DESCRIPTION**

Regardless of ISPR provider and without the use of hardware adapters the MPLM will support ISPR structural/mechanical attachment for the launch/landing/on-orbit event.

##### **3.1.1.3 ISPR INTERFACE FUNCTIONS**

The ISPR will support the following function at the interface with the MPLM and the GSE:

- A. Structural/Mechanical Attachment

##### **3.1.1.4 MODULE INTERFACE FUNCTIONS**

The MPLM will support the following function at the interface to ISPRs:

- A. Launch/landing/on-orbit Structural/Mechanical Attachment

#### **3.1.2 INTERFACE RESPONSIBILITIES**

##### **3.1.2.1 RESPONSIBILITY FOR ISPR**

The ISPR designer will ensure that the ISPR conforms to the interface requirements contained within this document.

##### **3.1.2.2 RESPONSIBILITY FOR MODULE**

Agenzia Spaziale Italiana (Italian Space Agency) (ASI) will ensure that dedicated ISPR locations within the MPLM conform to the interface requirements contained within this document.

### **3.1.3 ENGINEERING UNITS, TOLERANCES, AND CONVERSIONS**

#### **3.1.3.1 ENGINEERING UNITS**

All dimensions will be defined in the English system of units followed by the parenthetical SI metric equivalent.

#### **3.1.3.2 TOLERANCES AND CONVERSIONS**

All tolerances and conversions will be in accordance with ASTM E380, Standard Practice For Use Of The International System Of Units (SI).

### **3.2 INTERFACE REQUIREMENTS**

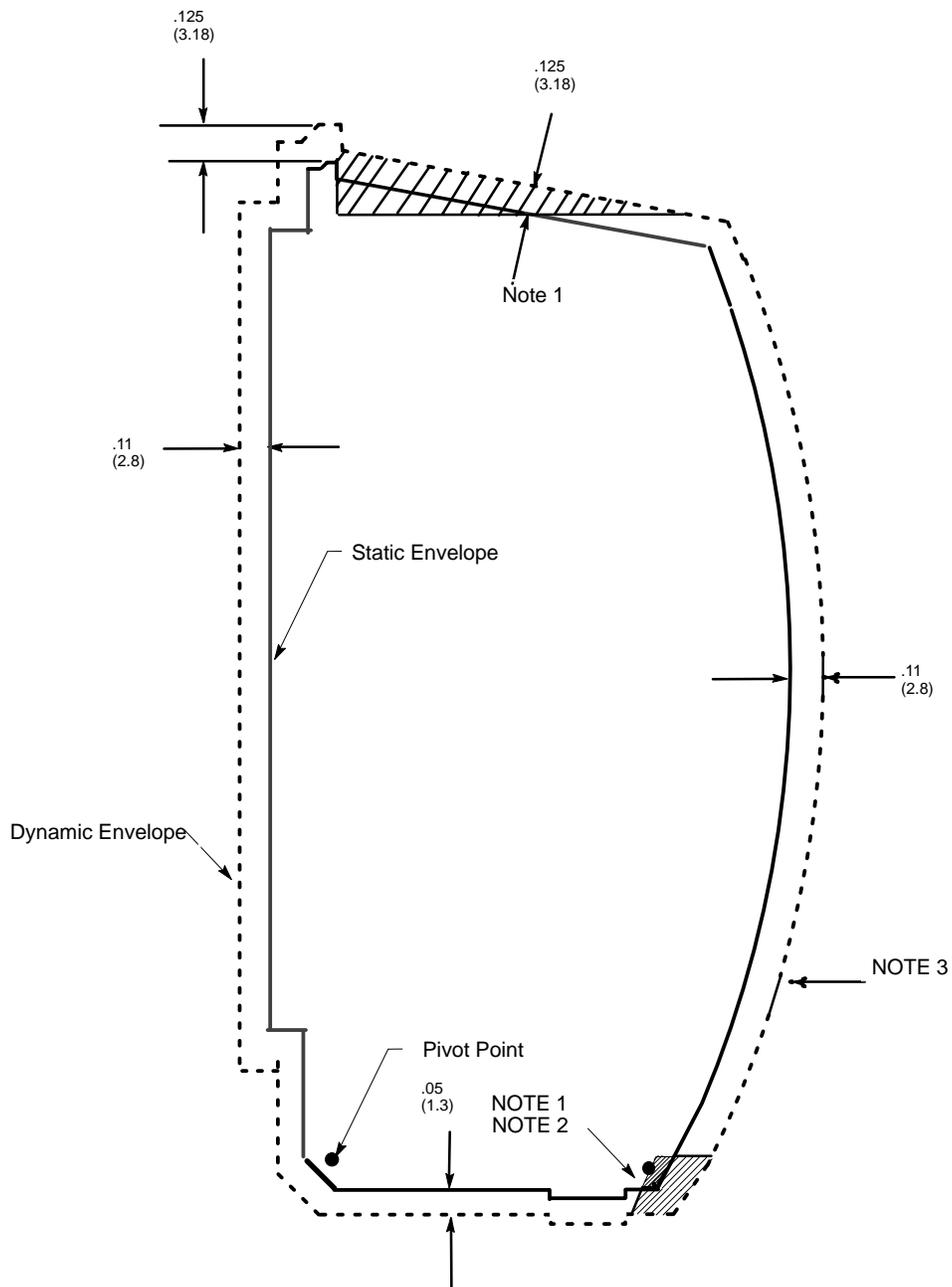
#### **3.2.1 ISPR INTERFACE REQUIREMENTS**

##### **3.2.1.1 ENVELOPE REQUIREMENTS**

###### **3.2.1.1.1 DYNAMIC ENVELOPE**

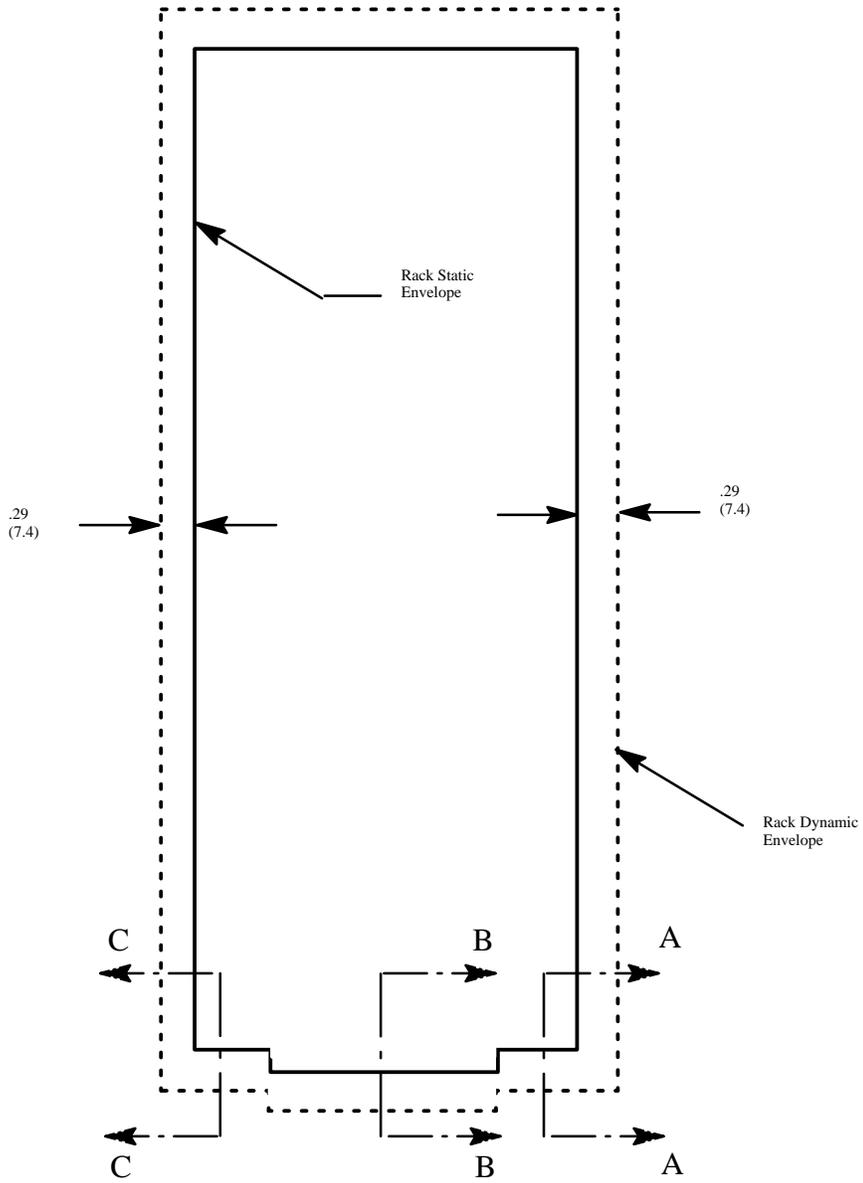
The rack shall not exceed the dynamic envelope shown in Figures 3.2.1.1.1-1 and 3.2.1.1.1-2, Rack Dynamic Envelope, when the attachment points A, B, C and D defined in Figure 3.2.1.1.1-3, Rack Attach Point Descriptions, are constrained to an infinitely stiff and massive boundary, and using the accelerations of paragraph 3.2.1.4.2.

Racks which utilize the Active Rack Isolation System (ARIS) shall not exceed the launch / landing dynamic envelope shown in Figures 3.2.1.1.1-4, 3.2.1.1.1-5, and 3.2.1.1.1-6, ARIS Rack launch / landing Dynamic Envelope, when the attachment points A, B, C and D defined in Figure 3.2.1.1.1-3, Rack Attach Point Descriptions, are constrained to an infinitely stiff and massive boundary, and using the accelerations of paragraph 3.2.1.4.2.

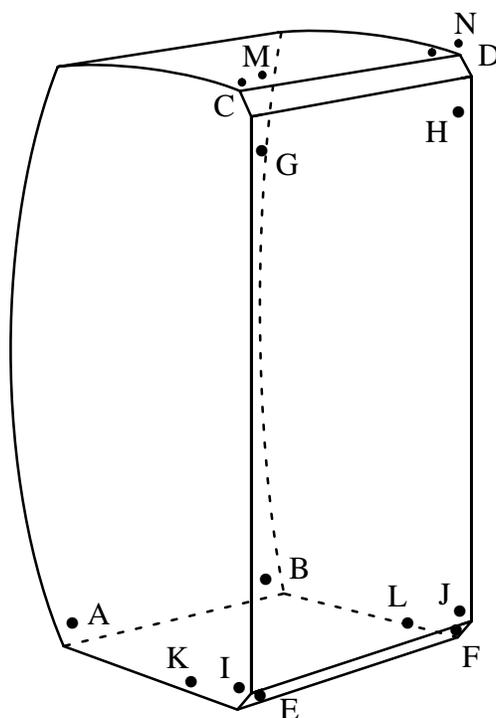


- Note 1: MPLM intrusion of this area can be calculated from the static envelope defined in Figure 3.2.1.1.2-1
- Note 2: Detail dimensions of shaded area per section views as indicated on Figure 3.2.1.1.1-2 for racks in US Lab
- Note 3: Racks may protrude into the dynamic envelope of US Lab on orbit

**FIGURE 3.2.1.1.1-1 RACK DYNAMIC ENVELOPE (SIDE VIEW)**

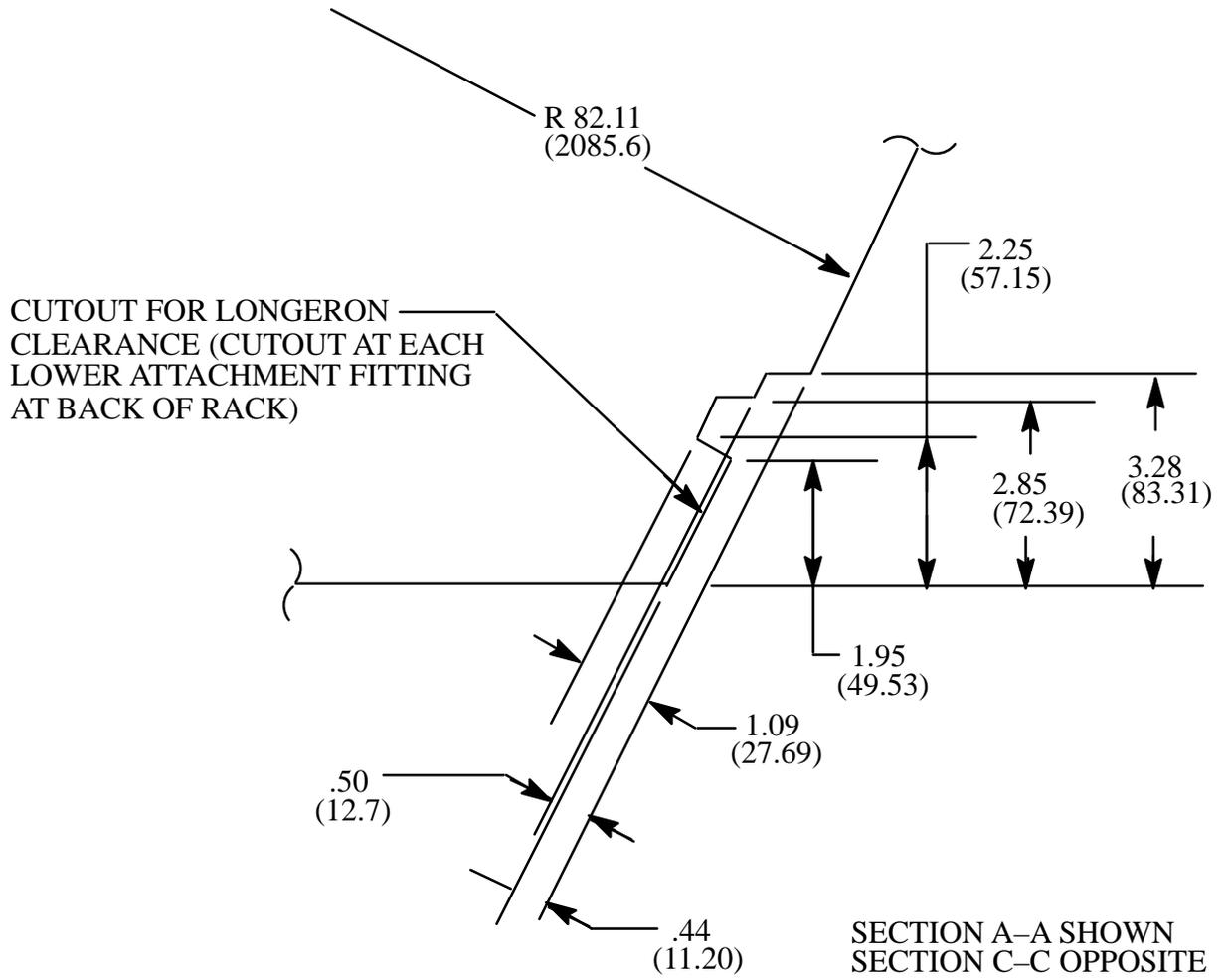


**FIGURE 3.2.1.1.1-2 RACK DYNAMIC ENVELOPE (FRONT VIEW)**



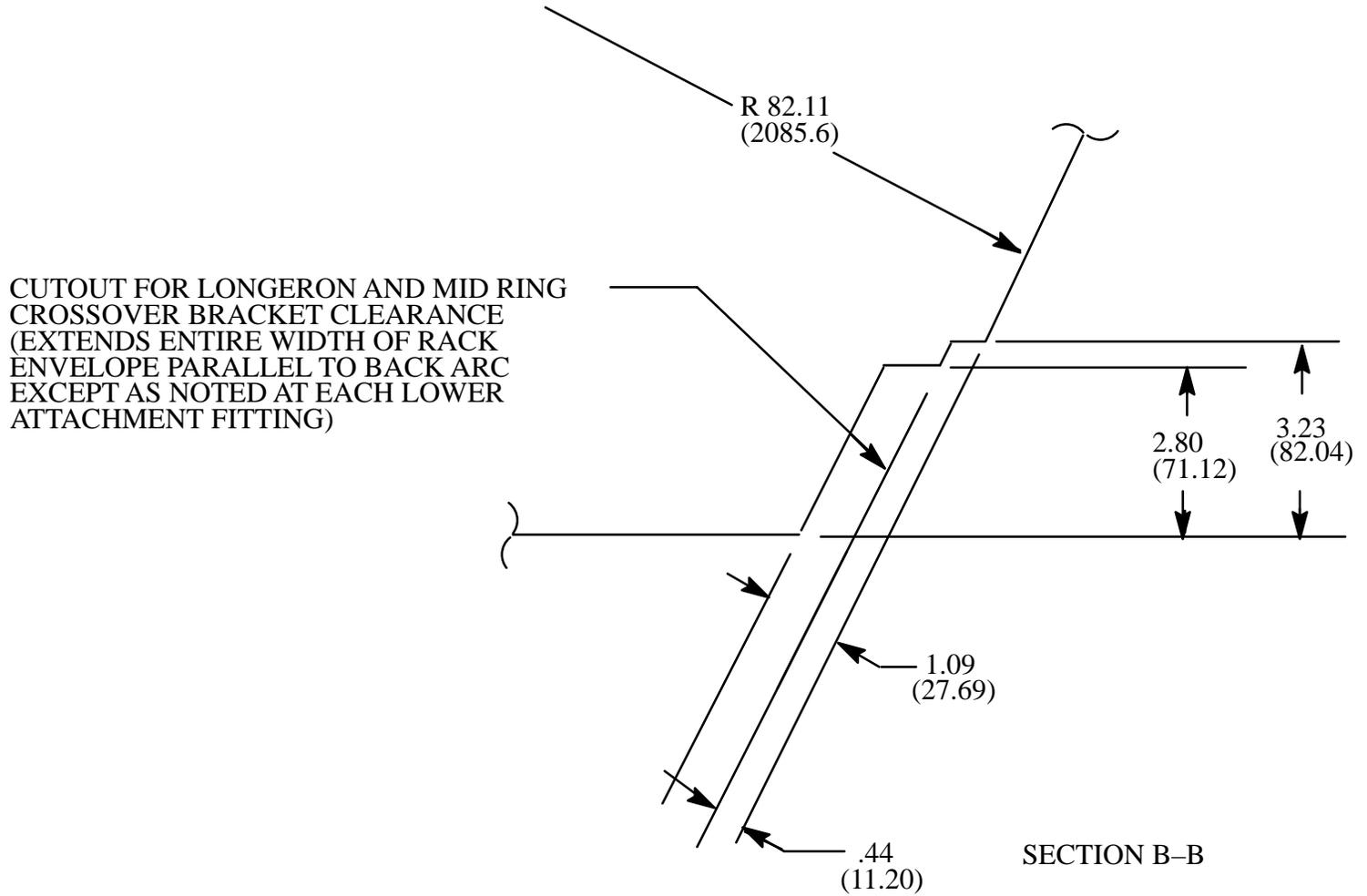
<u>POINT</u>	<u>NAME</u>	<u>PHASE</u>
A	Rack Lower Rear Attachment	Launch/Landing
B	Rack Lower Rear Attachment	Launch/Landing
C	Rack Upper Attachment	Launch/Landing/On-orbit
D	Rack Upper Attachment	Launch/Landing/On-orbit
E	Rack Lower GSE Attachment	Ground Handling
F	Rack Lower GSE Attachment	Ground Handling
G	Rack Upper GSE Attachment	Ground Handling
H	Rack Upper GSE Attachment	Ground Handling
I	Rack Pivot Attachment	On-orbit
J	Rack Pivot Attachment	On-orbit
K	Rack Bonding Interface (SSP 41002, Fig. 3.3.1.2.3-3)	Launch/Landing/On-orbit
L	Rack Bonding Interface (SSP 41002, Fig. 3.3.1.2.3-3)	Launch/Landing/On-orbit
M	Rack Upper KBAR Attachment	On-orbit (N/A to MPLM)
N	Rack Upper KBAR Attachment	On-orbit (N/A to MPLM)

**FIGURE 3.2.1.1.1-3 RACK ATTACH POINT DESCRIPTIONS**



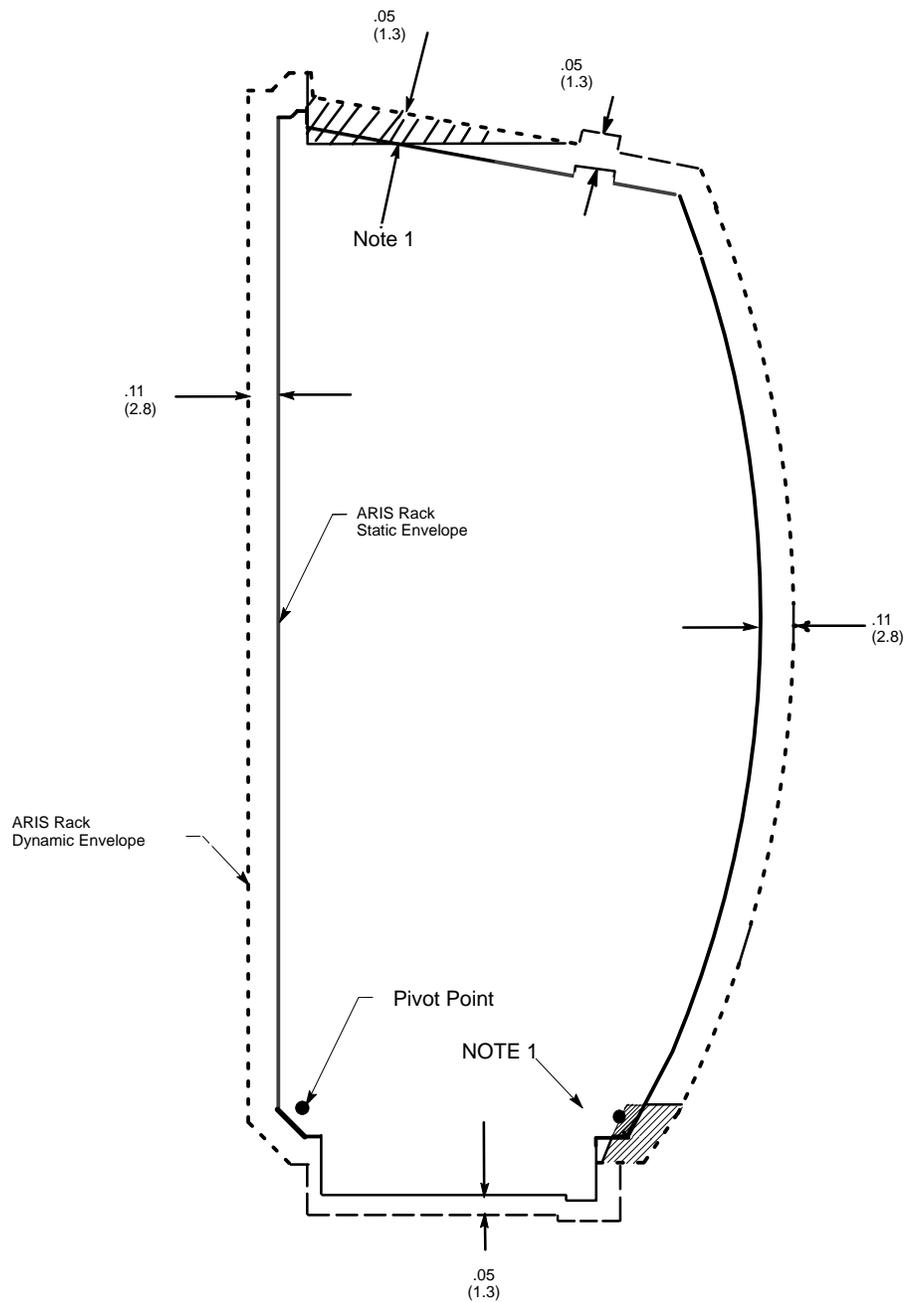
Note: Racks may protrude into the dynamic envelope of US Lab on orbit

FIGURE 3.2.1.1-1-4 RACK DYNAMIC ENVELOPE (Detail at Attach Points A and B).  
APPLICABLE ONLY TO RACKS LAUNCHED IN THE US LAB



Note: Racks may protrude into the dynamic envelope of US Lab on orbit

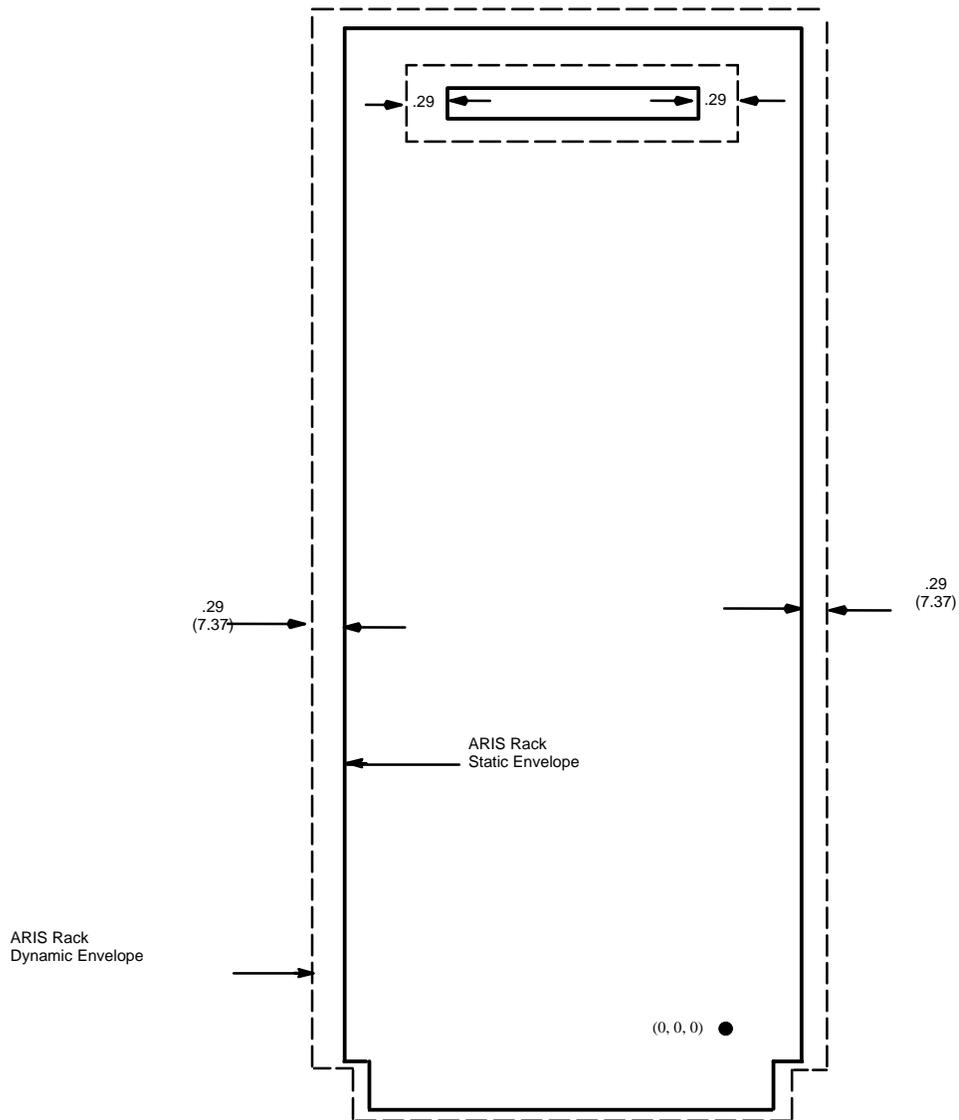
FIGURE 3.2.1.1.1-5 RACK DYNAMIC ENVELOPE (BACK VIEW DETAIL)  
APPLICABLE ONLY TO RACKS LAUNCHED IN U.S. LAB



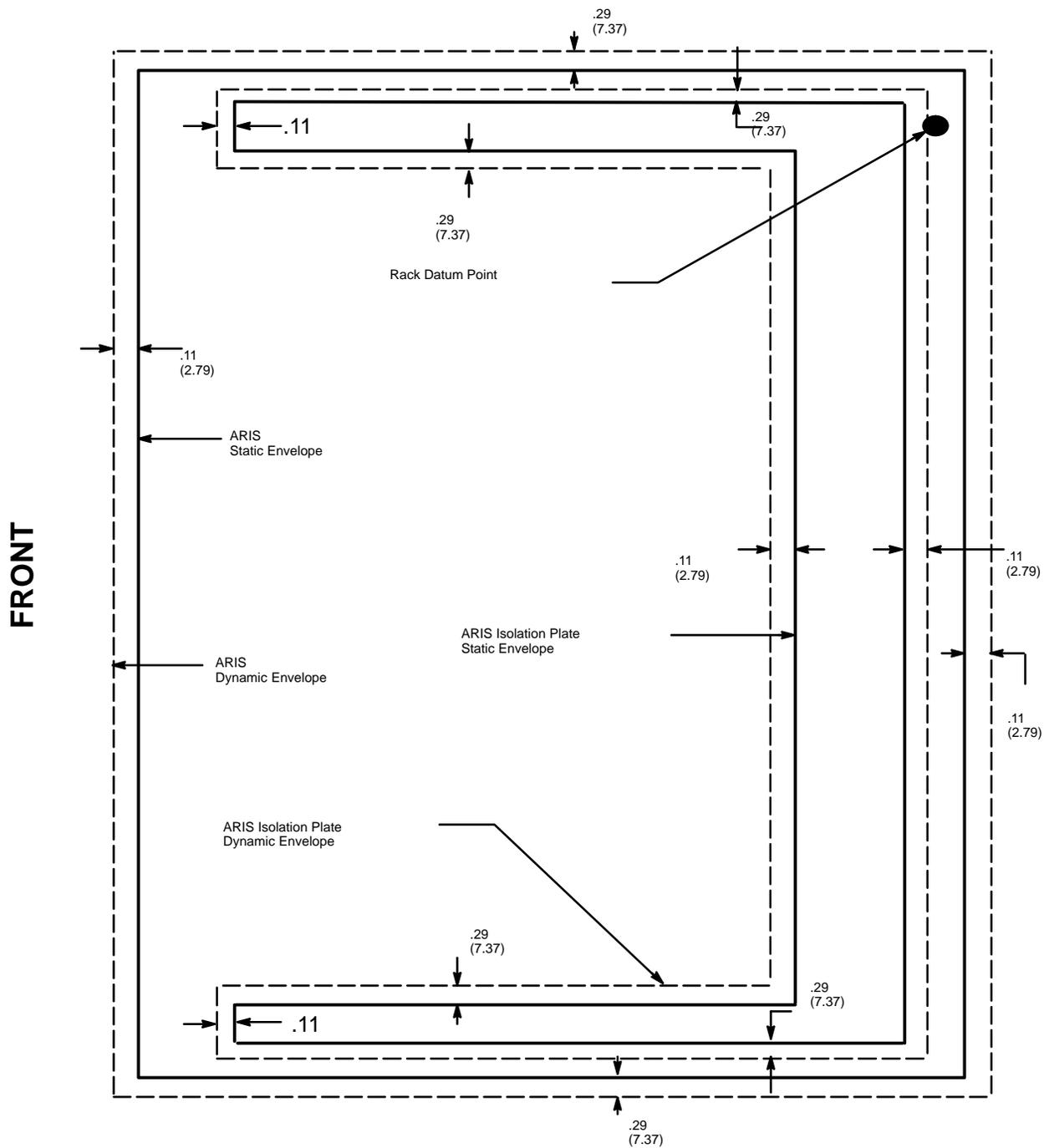
Note 1: MPLM intrusion of this area can be calculated from the static envelope defined in Figure 3.2.1.1.2-1

**FIGURE 3.2.1.1.1-6 ARIS RACK LAUNCH/LANDING DYNAMIC ENVELOPE (SIDE VIEW)**

ARIS



**FIGURE 3.2.1.1.1-7 ARIS RACK LAUNCH/LANDING DYNAMIC ENVELOPE (BACK VIEW)**



**FIGURE 3.2.1.1.1-8 ARIS RACK LAUNCH/LANDING DYNAMIC ENVELOPE (BOTTOM VIEW)**

### **3.2.1.1.2 RACK STATIC ENVELOPE**

The rack shall not exceed the static envelope as shown in Figures 3.2.1.1.2–1 Rack Static Envelope (Side View), 3.2.1.1.2–2, Rack Static Envelope (Front View), and 3.2.1.1.2–3 Rack Static Envelope (Top View).

Racks which utilize the ARIS shall not exceed the launch configuration static envelope as shown in Figures 3.2.1.1.2–7, 3.2.1.1.2–8, ARIS Rack Static Envelope, and 3.2.1.1.2–9, ARIS Rack Launch/Landing Static Envelope Detail.

Racks in the JEM–PM location A5, F5, F6 shall not exceed the static envelope as shown in Figure 3.2.1.1.2–11 Rack Static Envelope (Applicable only to racks in JEM–PM). Racks in all locations of ELM–PS shall not exceed the static envelope as shown in Figure 3.2.1.1.2–12 Rack Static Envelope (Applicable only to racks in ELM–PS).

### **3.2.1.2 MASS PROPERTIES**

#### **3.2.1.2.1 LAUNCH/LANDING/GROUND HANDLING MASS**

The mass of an integrated ISPR for launch/landing/ground handling shall be less than or equal to 1773 lbs (804.2 Kg).

#### **3.2.1.2.2 ON ORBIT MASS**

The mass of an integrated ISPR on orbit shall be less than or equal to 2200 lbs (997.9 Kg).

Note: All Modules will support the maximum integrated ISPR on orbit mass up to 1773 lbs (804.2 Kg) without operational restrictions, see paragraph 3.2.2.2.

### **3.2.1.3 STRUCTURAL/MECHANICAL**

#### **3.2.1.3.1 LAUNCH/LANDING/ON–ORBIT ATTACHMENT**

ISPRs shall incorporate structural/mechanical provisions for attachment to the MPLM during the launch/landing/on–orbit event.

#### **3.2.1.3.2 GROUND HANDLING ATTACHMENT**

ISPRs shall incorporate structural/mechanical provisions for attachment to GSE during the ground handling event.

#### **3.2.1.3.3 ISPR MINIMUM RESONANT FREQUENCY**

ISPRs shall have a minimum natural frequency greater than 28 Hz when constrained without knee braces to infinitely heavy and stiff boundaries or greater than 25 Hz when constrained including the knee braces to infinitely heavy and stiff boundaries.

**3.2.1.3.4 BONDING**

Active ISPR's shall incorporate structural/mechanical provisions for class R bonding to the MPLM in accordance with SSP 30245, Space Station Electrical Bonding Requirements.

**3.2.1.4 INDUCED ENVIRONMENTS**

ISPR interfaces to the MPLM shall be capable of operation during and after exposure to any feasible combination of the following environments.

**3.2.1.4.1 VIBRATION****3.2.1.4.1.1 LAUNCH ACOUSTICS**

Racks launched in the MPLM shall be capable of operation after exposure to the launch minimum acoustic environment defined in Table 3.2.1.4.1.1-1, MPLM Internal Acoustic Noise Spectra.

**TABLE 3.2.1.4.1.1-1 MPLM ACOUSTIC NOISE SPECTRA**

1/3 Octave Band Center Frequency (Hz)	Sound Pressure Level (dB) ref. $2 \times 10^{-5}$ N/m <sup>2</sup>	
	Liftoff (1)	Aeronoise (2)
31.5	111.5	96.0
40.0	93.5	99.5
50.0	98.0	102.0
63.0	102.5	105.0
80.0	114.0	108.0
100.0	124.0	110.0
125.0	122.0	112.0
160.0	121.0	113.5
200.0	124.5	115.0
250.0	123.0	116.0
315.0	121.5	116.5
400.0	121.5	114.5
500.0	117.0	111.0
630.0	115.5	107.5
800.0	114.5	104.5
1000.0	113.0	101.5
1250.0	109.0	97.5
1600.0	108.5	94.0
2000.0	106.0	90.0
2500.0	102.0	86.5
Overall	131.5	123.5

Notes:

- 1) 5 seconds per mission (time per flight does not include a scatter factor)
- 2) 10 seconds per mission (time per flight does not include a scatter factor)

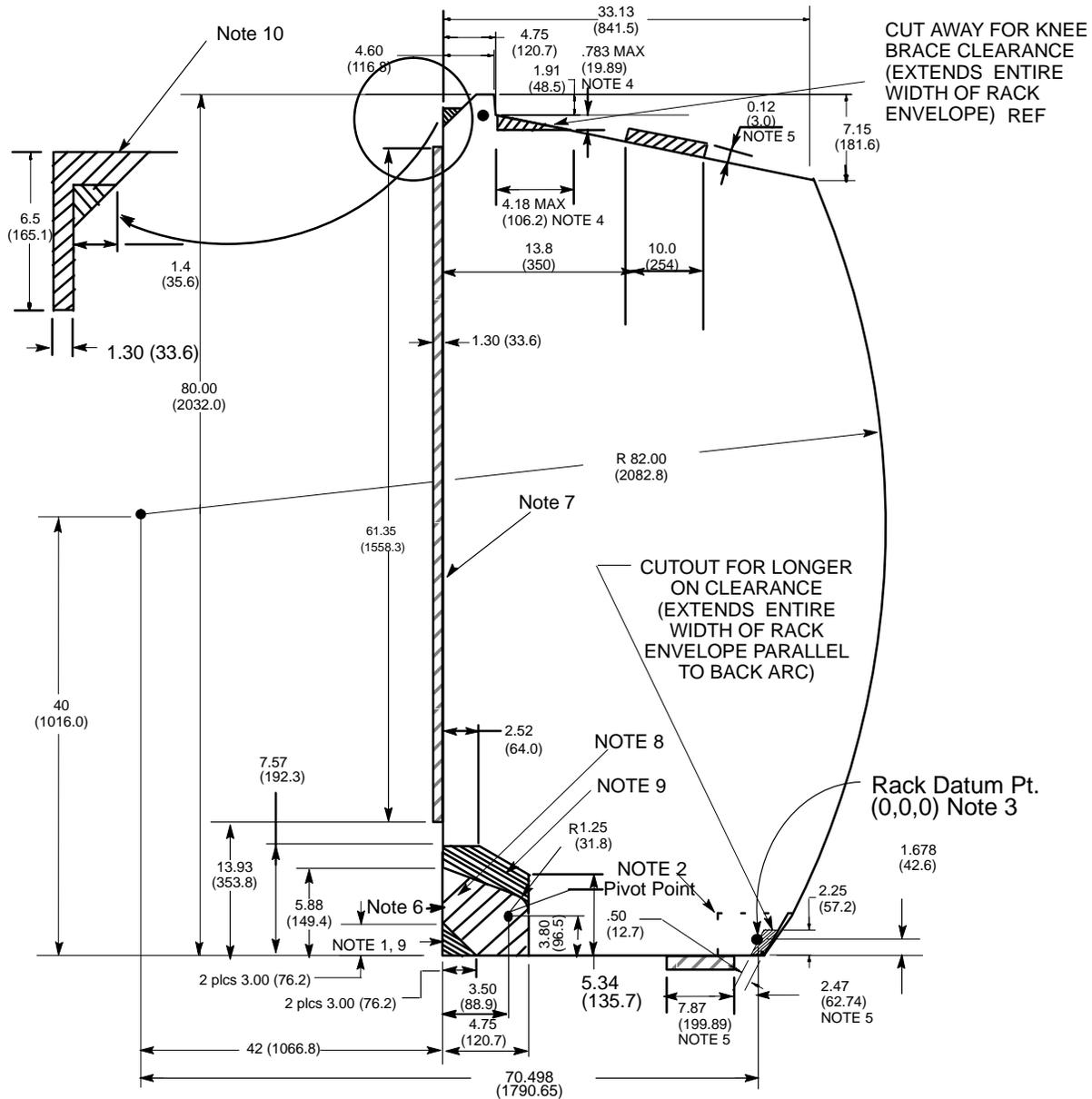
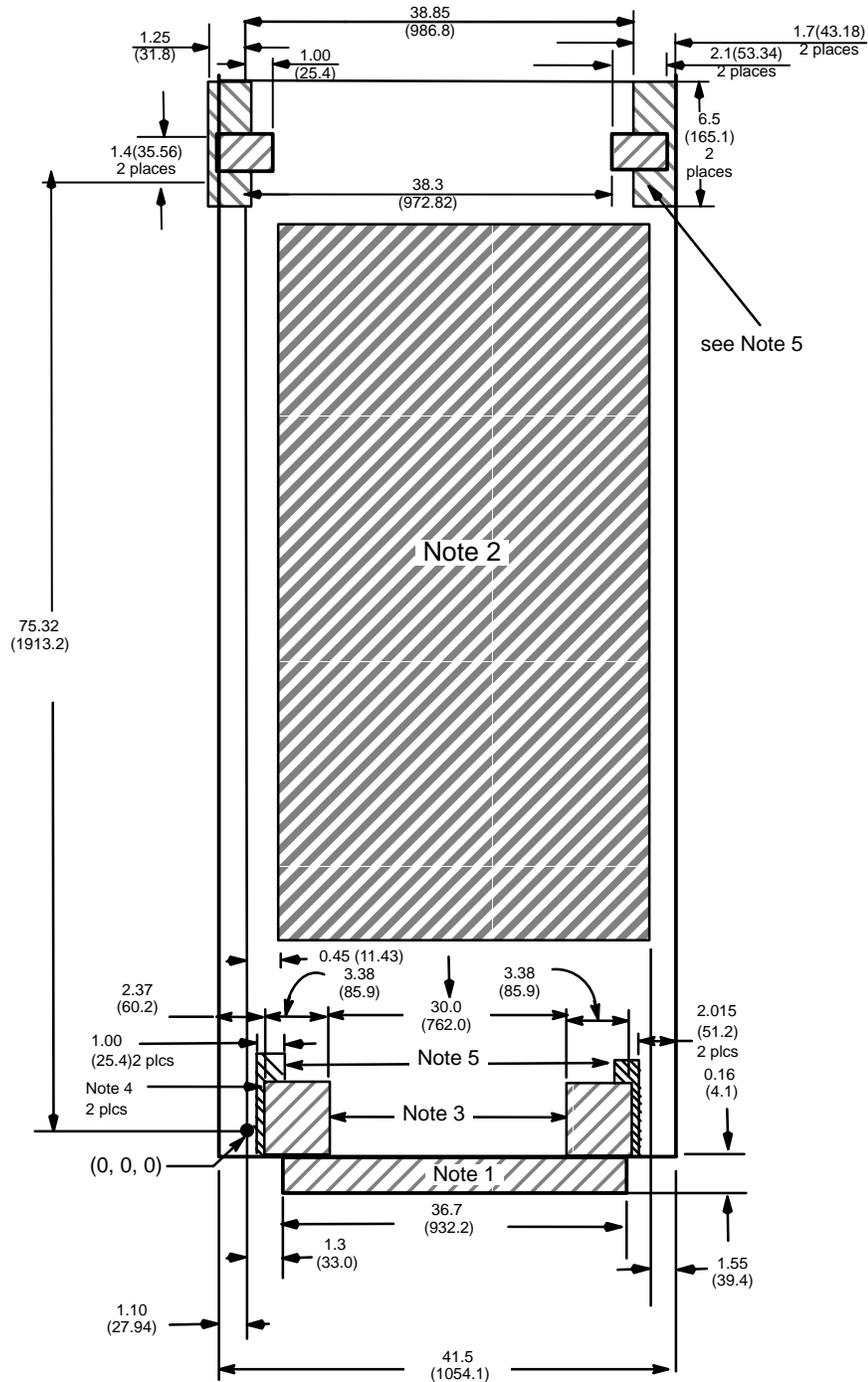


FIGURE 3.2.1.1.2-1 RACK STATIC ENVELOPE (SIDE VIEW)



Origin (0,0,0) = Rack Datum Point, see Figure 3.3.3-1 for Reference System definition

Note 1: NASDA Rack only volume occupied by seat tracks.

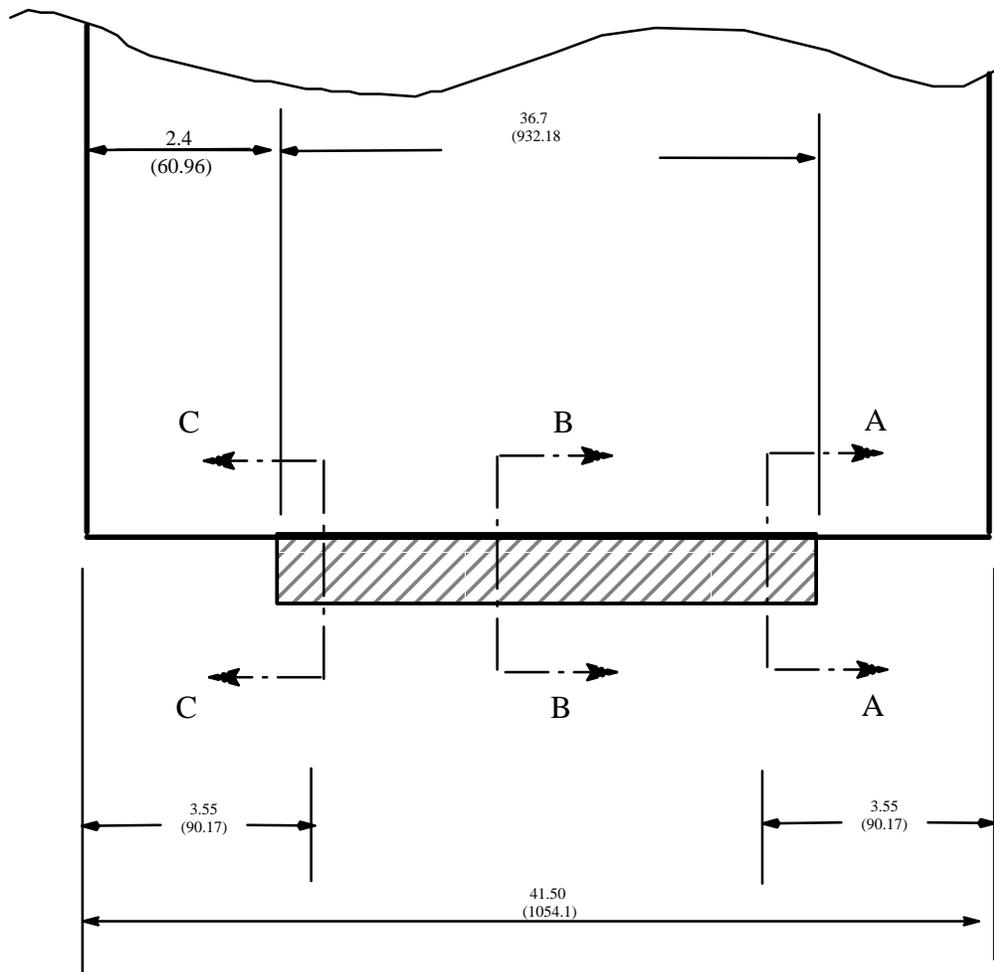
Note 2: Payload SIR Drawer Handles may extend beyond the static envelope into the shaded area. Other permanent payload protrusions into the shaded area must be reviewed by the Operations Community and approved as exceedances to SSP 57000 by the Payload Control Board and documented in the Payload Unique Hardware ICDs. (Not applicable for racks in the JEM Logistics Module) Rack installation with this protrusion is only allowed with NASA GSE through the MPLM aft end cone.

Note 3: Equipment within the shaded area shall be designated removable or relocatable during rack installation/removal.

Note 4: Equipment within the shaded area shall be designated removable or relocatable during on-orbit operations. Pivot may protrude into this area.

Note 5: This stay out zone only applies to Boeing rack structures (TBD for NASDA racks).

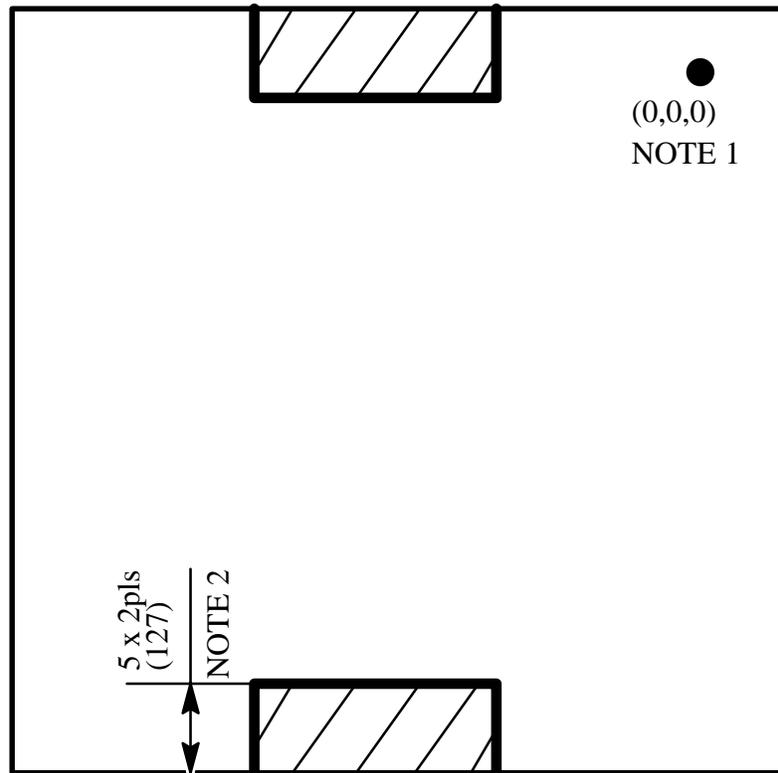
**FIGURE 3.2.1.1.2-2 RACK STATIC ENVELOPE (FRONT VIEW)**



DETAIL BOX A

Note 1: NASDA racks only volume occupied by seat tracks

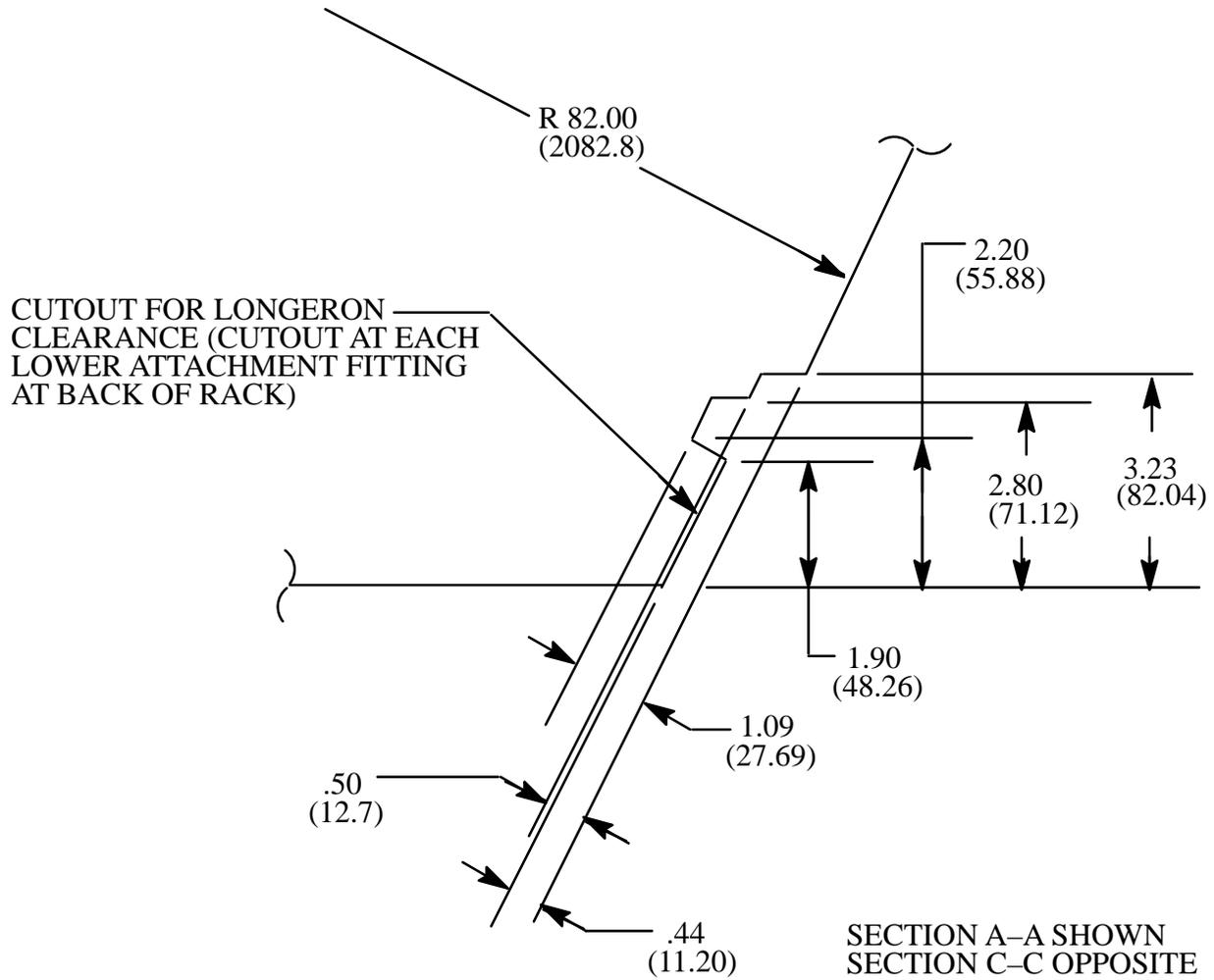
**FIGURE 3.2.1.1.2-2 RACK STATIC ENVELOPE (FRONT VIEW) (PAGE 2 OF 2)  
APPLICABLE ONLY TO RACKS FLOWN IN US LAB**



NOTE 1 : Origin  $(0,0,0)$  = Rack Datum Point. See FIGURE 3.1.3-1, SSP41017 Part 2 for reference system definition.

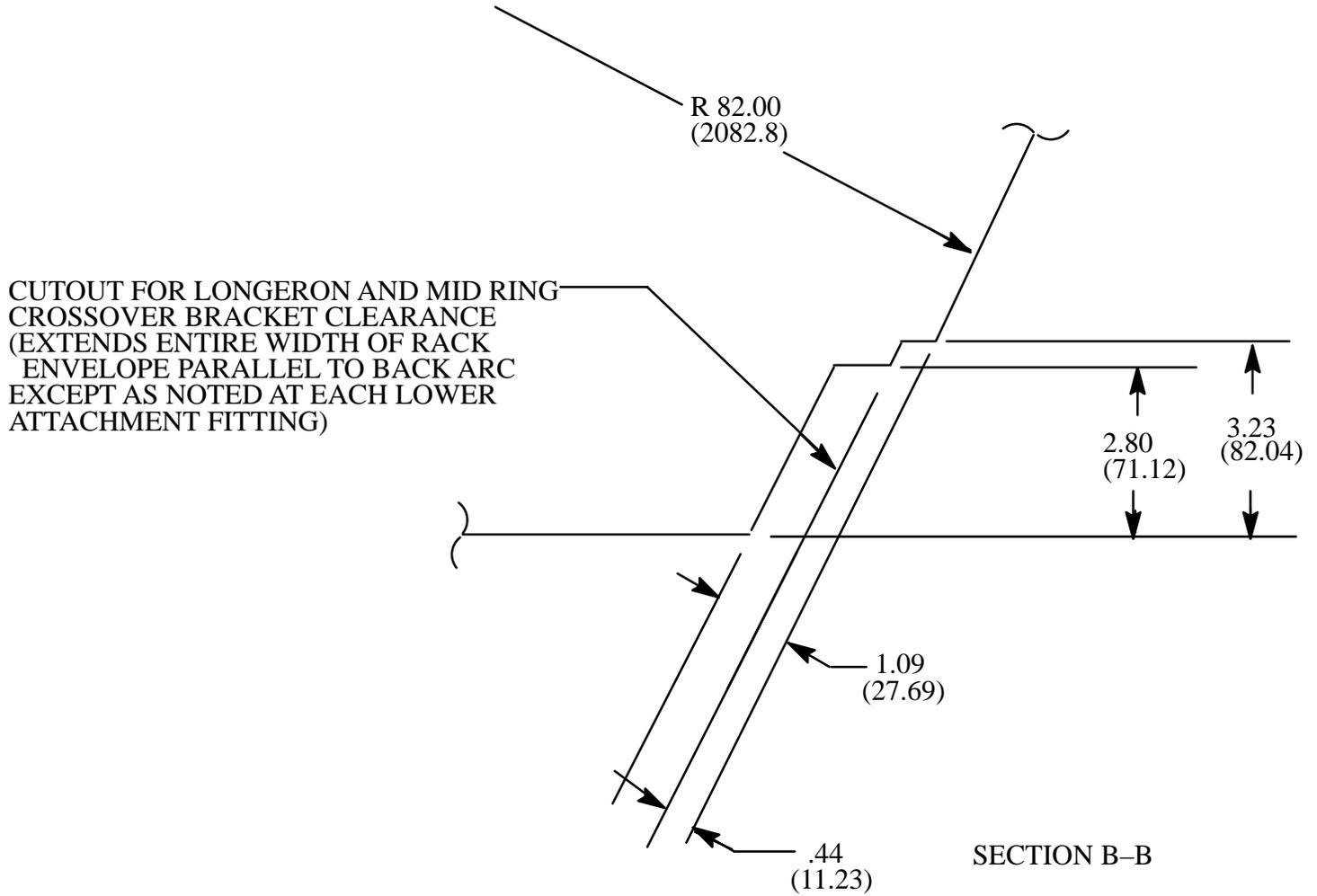
NOTE 2 : NASDA Rack only, Volume occupied by seat tracks.

**FIGURE 3.2.1.1.2-3 RACK STATIC ENVELOPE (TOP VIEW)**



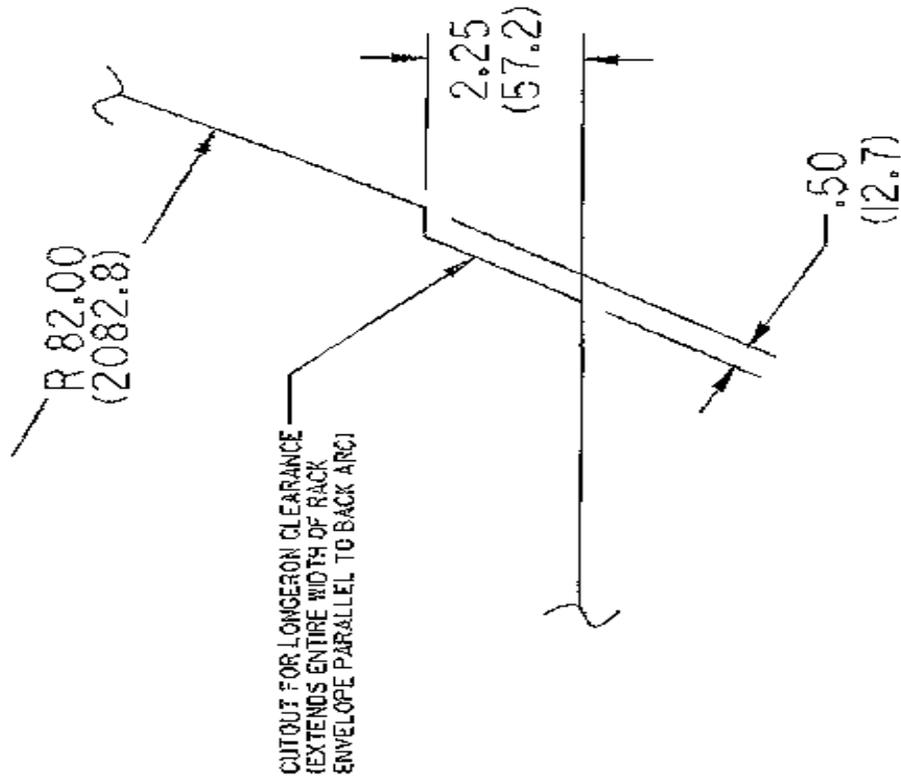
Note: Racks may protrude into the dynamic envelope of US Lab on orbit (See Figures 3.2.1.1.1-4 and 3.2.1.1.1-5)

FIGURE 3.2.1.1.2-4 RACK STATIC ENVELOPE (DETAIL AT ATTACH POINTS A AND B)  
APPLICABLE ONLY TO RACKS FLOWN IN US LAB

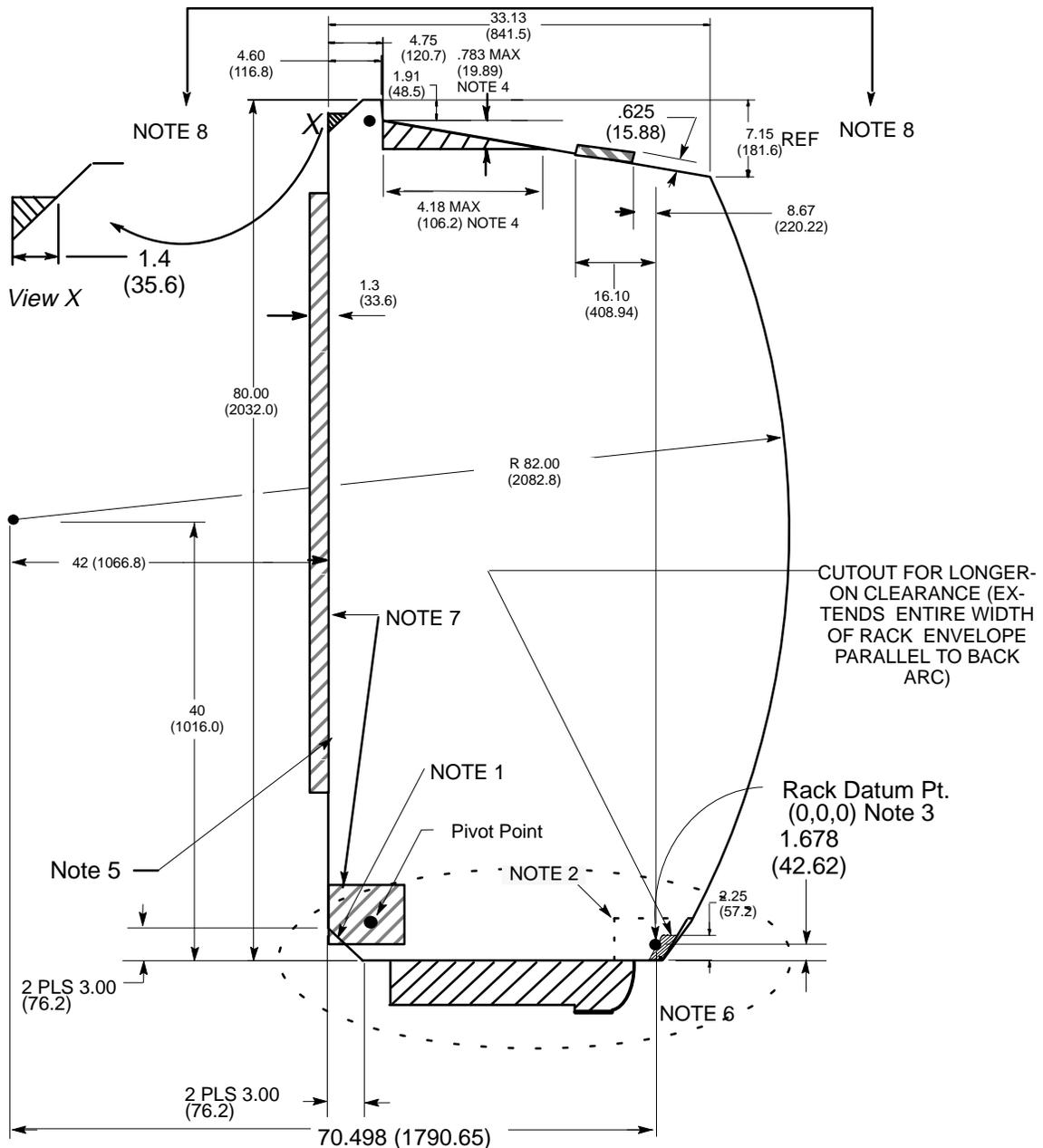


Note: Racks may protrude into the dynamic envelope of US Lab on orbit (See Figures 3.2.1.1.1-4 and 3.2.1.1.1-5)

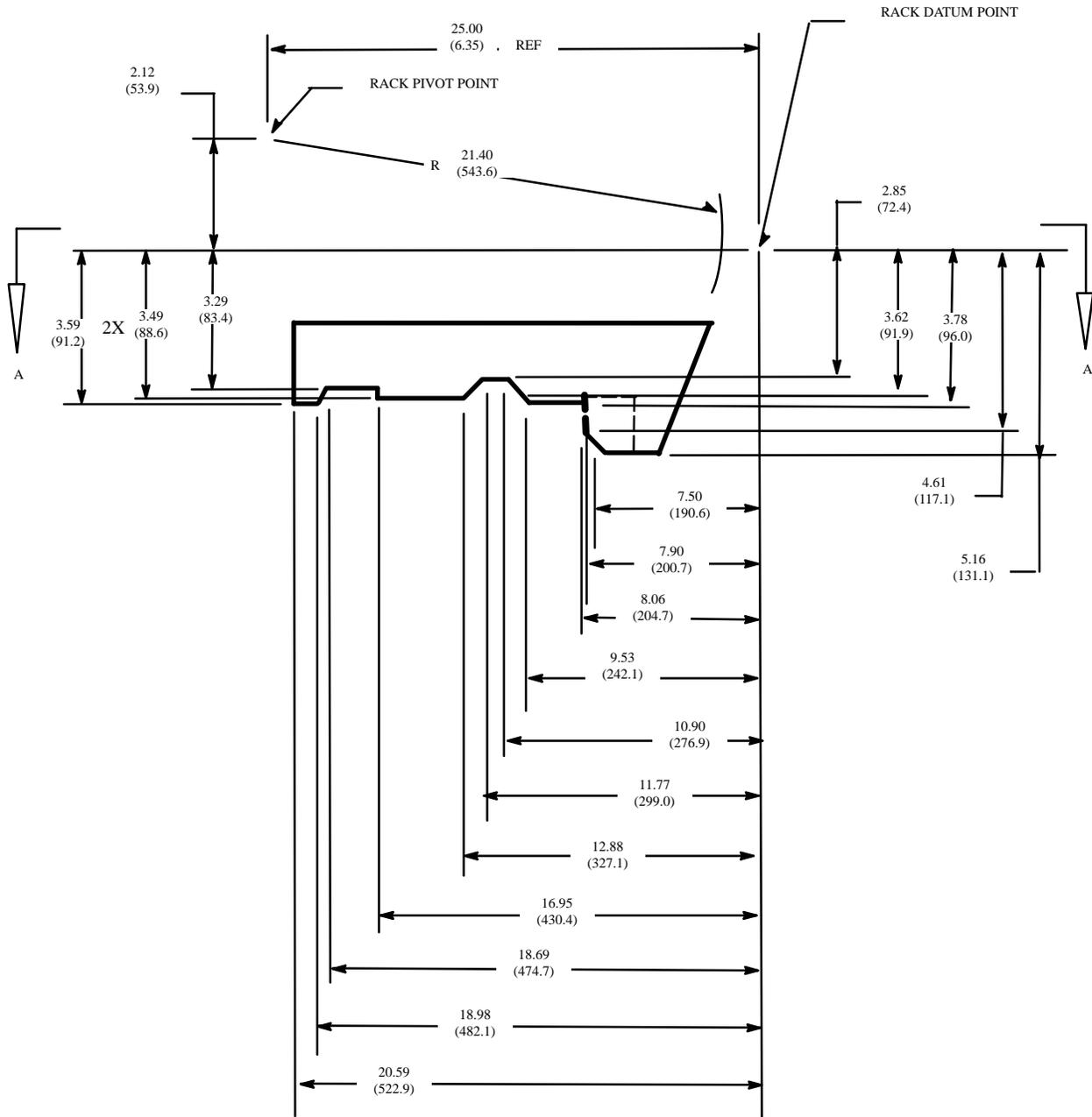
FIGURE 3.2.1.1.2-5 RACK STATIC ENVELOPE (SIDE VIEW DETAIL)  
APPLICABLE TO RACKS FLOWN IN US LAB ONLY



**FIGURE 3.2.1.1.2-6 RACK STATIC ENVELOPE (SIDE VIEW DETAIL)  
APPLICABLE TO RACKS FLOWN IN ALL MODULES EXCEPT US LAB**

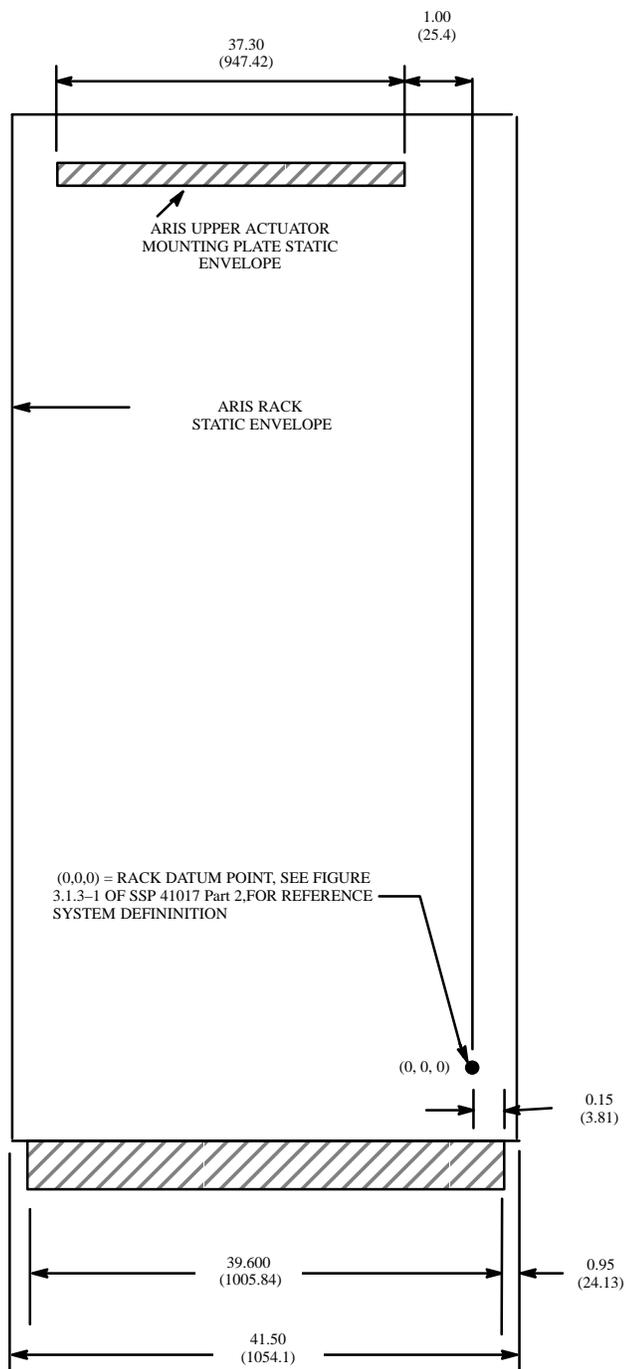


**FIGURE 3.2.1.1.2-7 ARIS RACK LAUNCH/LANDING STATIC ENVELOPE (SIDE VIEW)  
(PAGE 1 OF 2)**



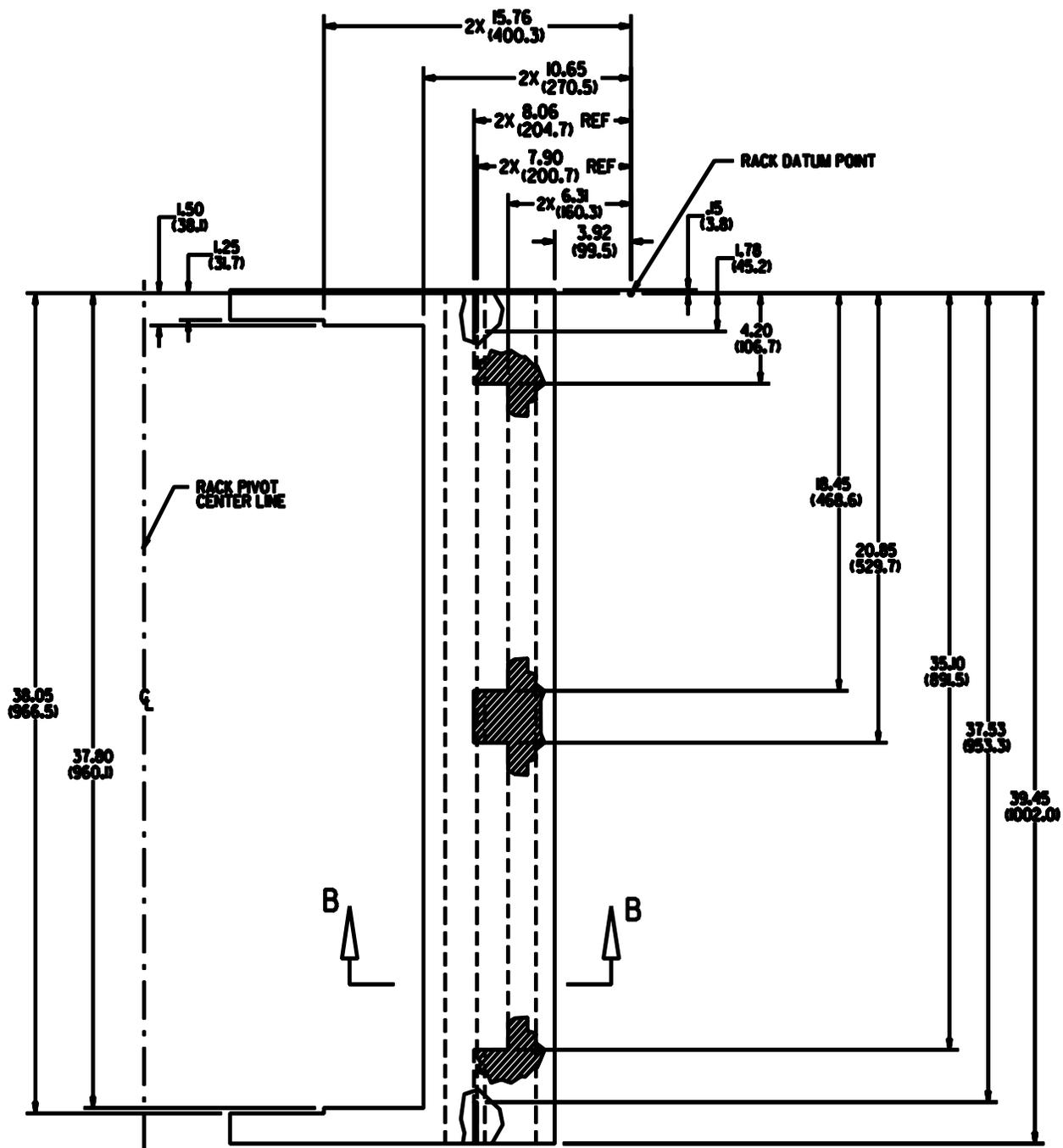
NOTE 1 - ISPR BOTTOM STATIC ENVELOPE

**FIGURE 3.2.1.1.2-7 ARIS RACK LAUNCH/LANDING STATIC ENVELOPE (SIDE VIEW)  
(PAGE 2 OF 2)**



NOTE: For SIR Drawer exceptions and GSE Stayout Areas see Figure 3.2.1.1.2-2.

**FIGURE 3.2.1.1.2-8 ARIS RACK LAUNCH/LANDING STATIC ENVELOPE (BACK VIEW)**



VIEW A-A

FIGURE 3.2.1.1.2-9 ARIS LAUNCH/LANDING RACK STATIC ENVELOPE DETAIL  
(BOTTOM VIEW) PAGE 1 OF 2

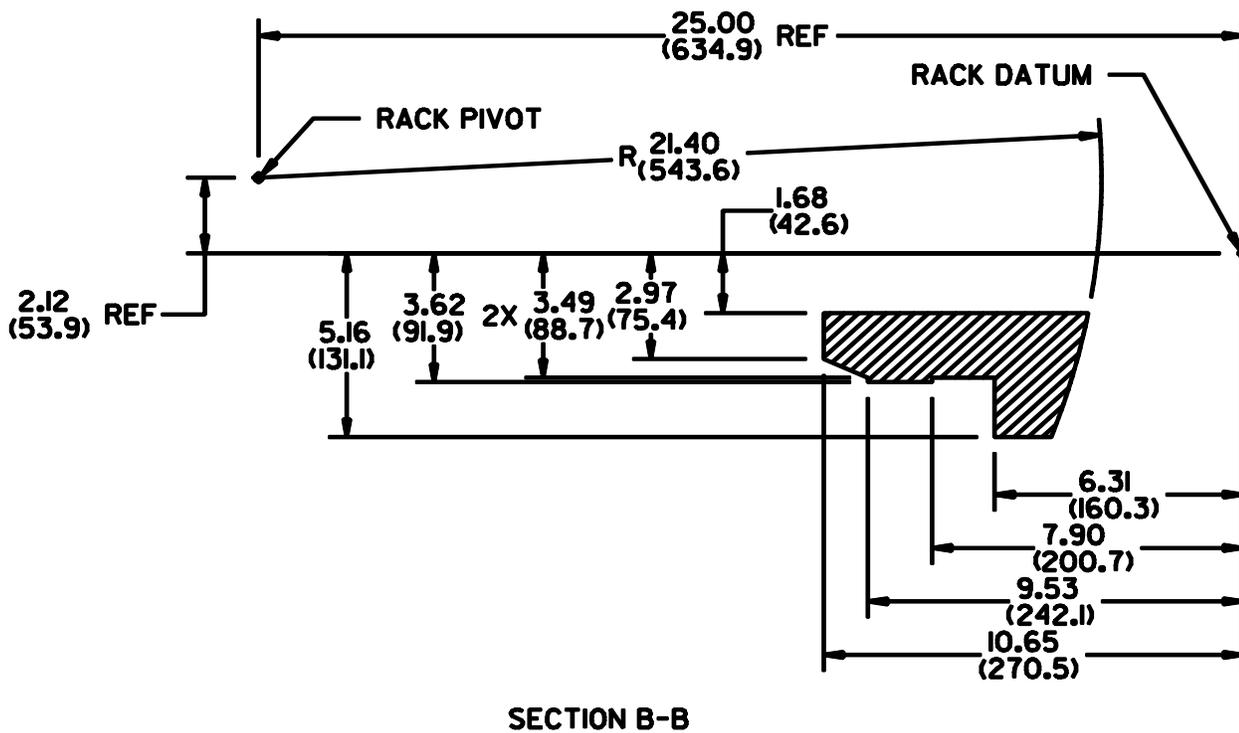
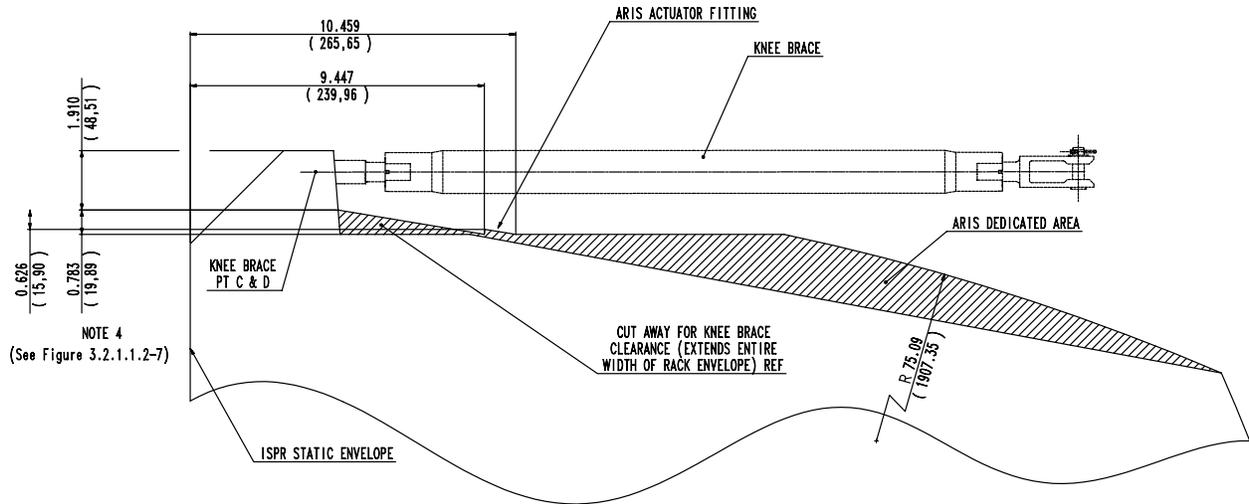
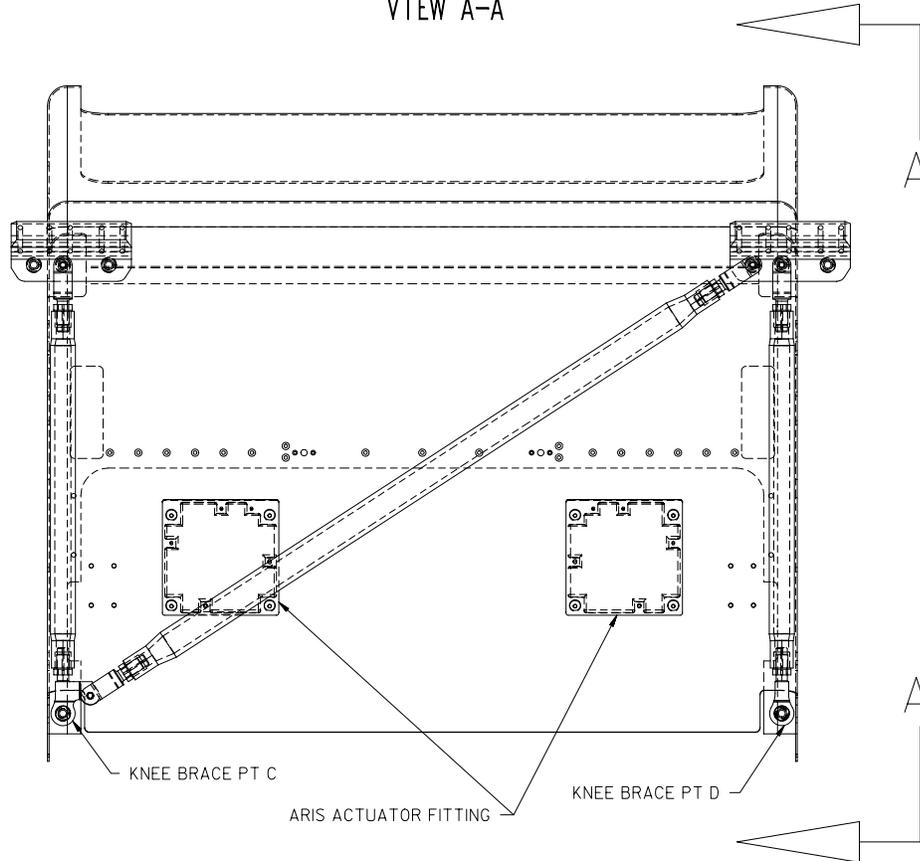


FIGURE 3.2.1.1.2-9 ARIS RACK LAUNCH/LANDING STATIC ENVELOPE DETAIL  
PAGE 2 OF 2



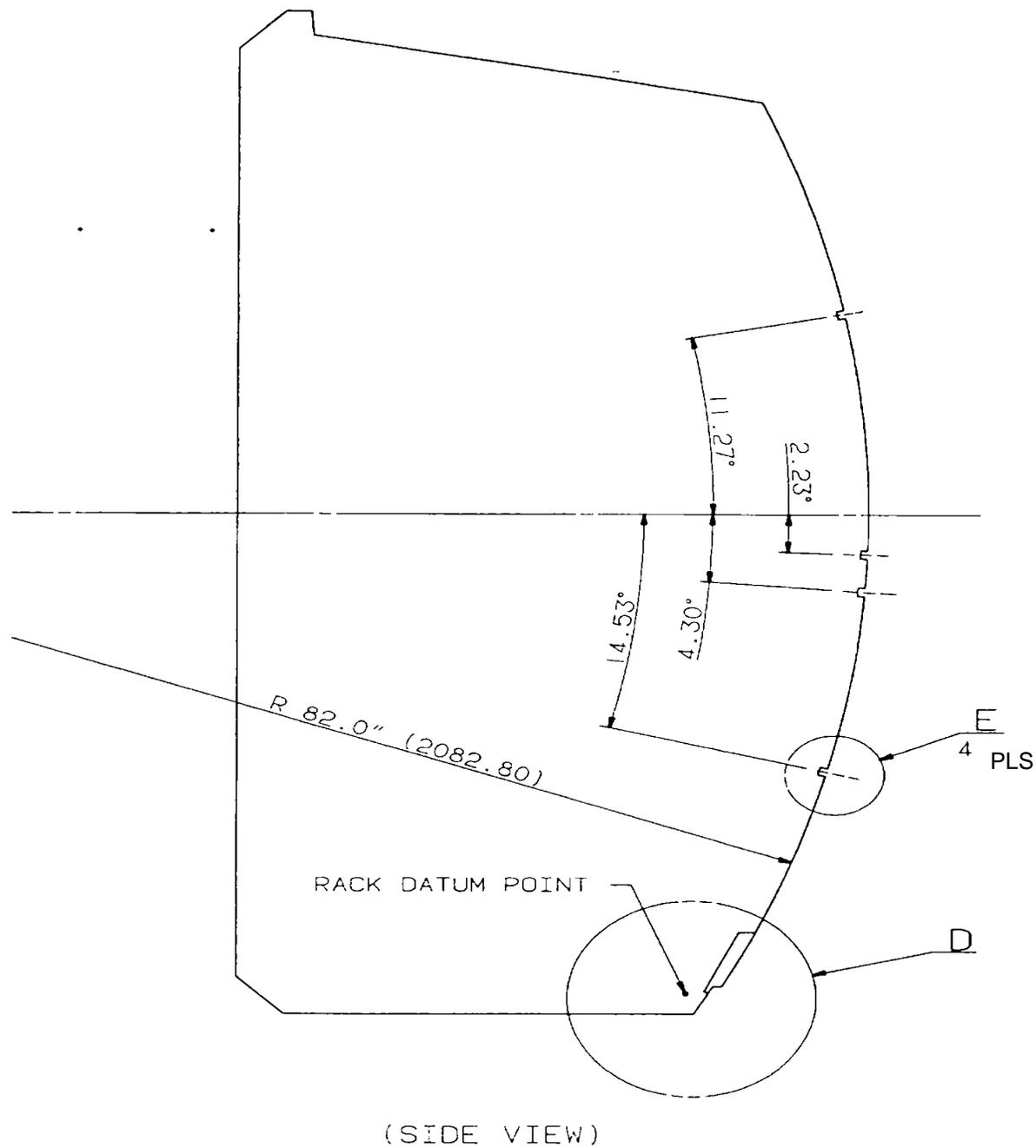
NOTE 4  
(See Figure 3.2.1.1.2-7)

VIEW A-A



ARIS RACK TOP VIEW

FIGURE 3.2.1.1.2-10 ARIS RACK STATIC ENVELOPE KNEE BRACE INTRUSION DETAILS (TOP VIEW) (NASA-ASI ONLY)

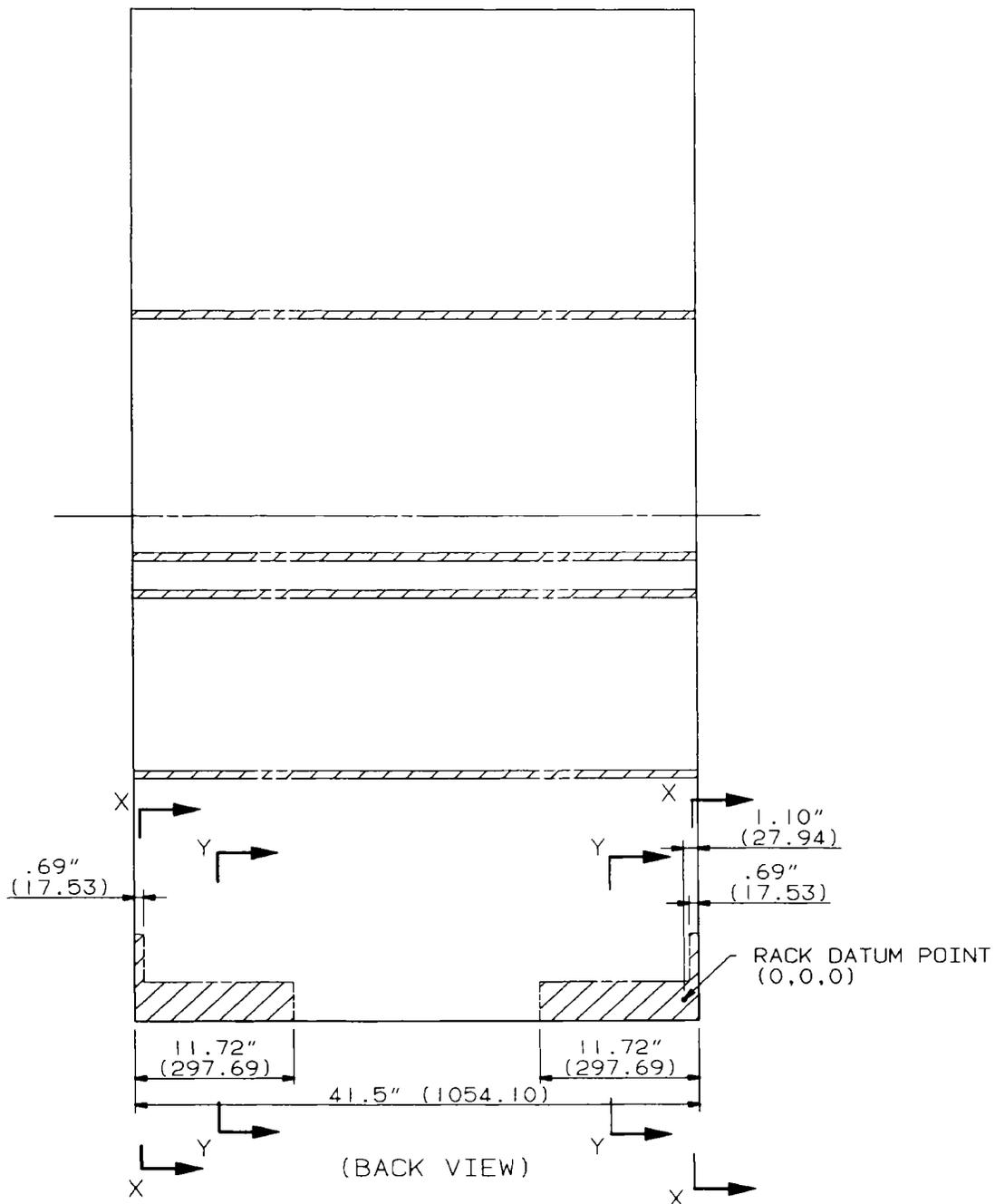


Note 1: This figure is applicable only to the racks in the JEM-PM location A5, F5, F6.

Note 2: Figure 3.2.1.1.2-1 and Figure 3.2.1.1.2-2 are applicable to other envelope except as shown in this figure.

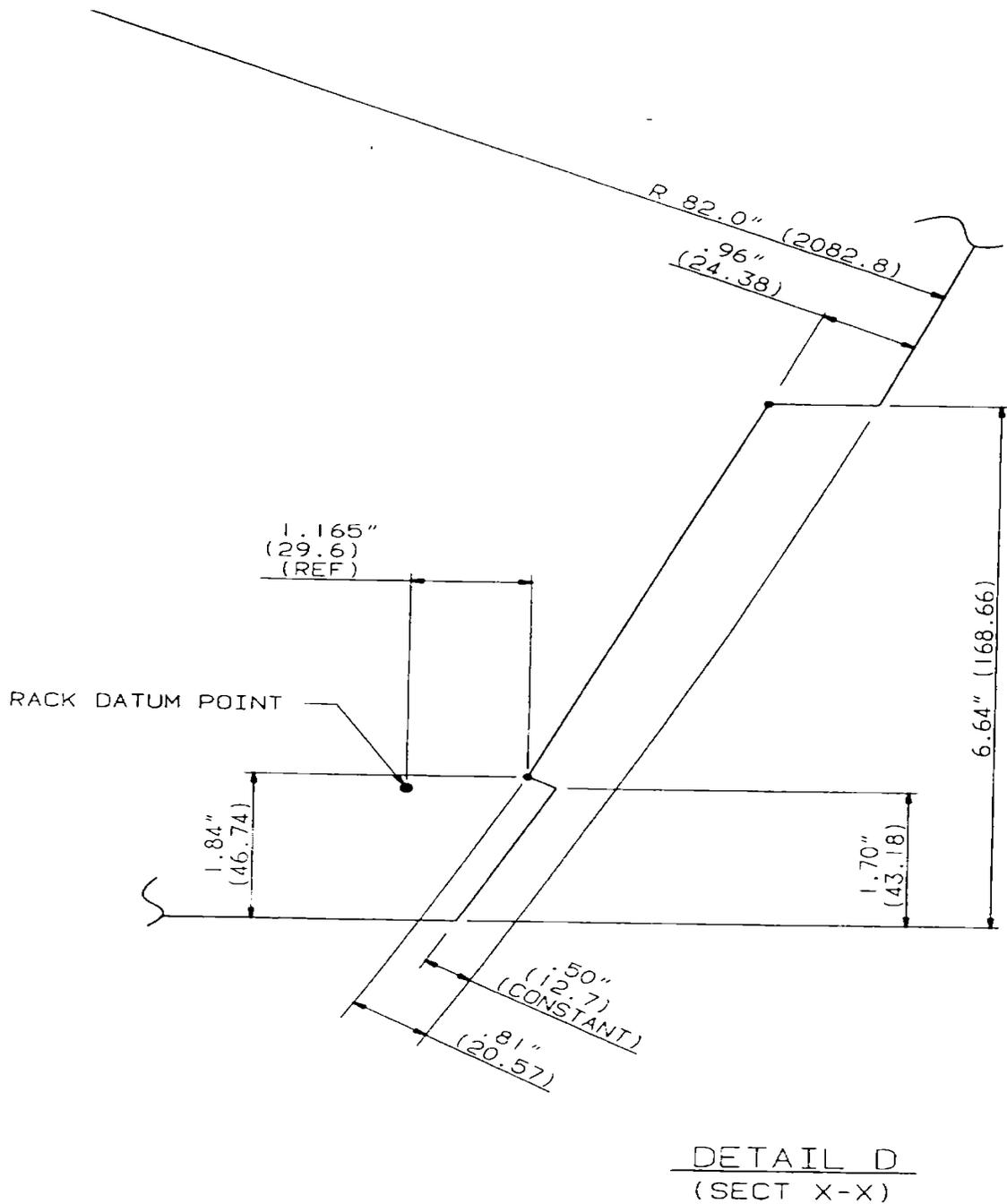
Note 3: Detail E(4PLS) is applicable only to the rack in the JEM-PM location F6.

**FIGURE 3.2.1.1.2-11 RACK STATIC ENVELOPE (APPLICABLE ONLY TO RACKS IN JEM -PM) (SIDE VIEW) (PAGE 1 OF 5)**



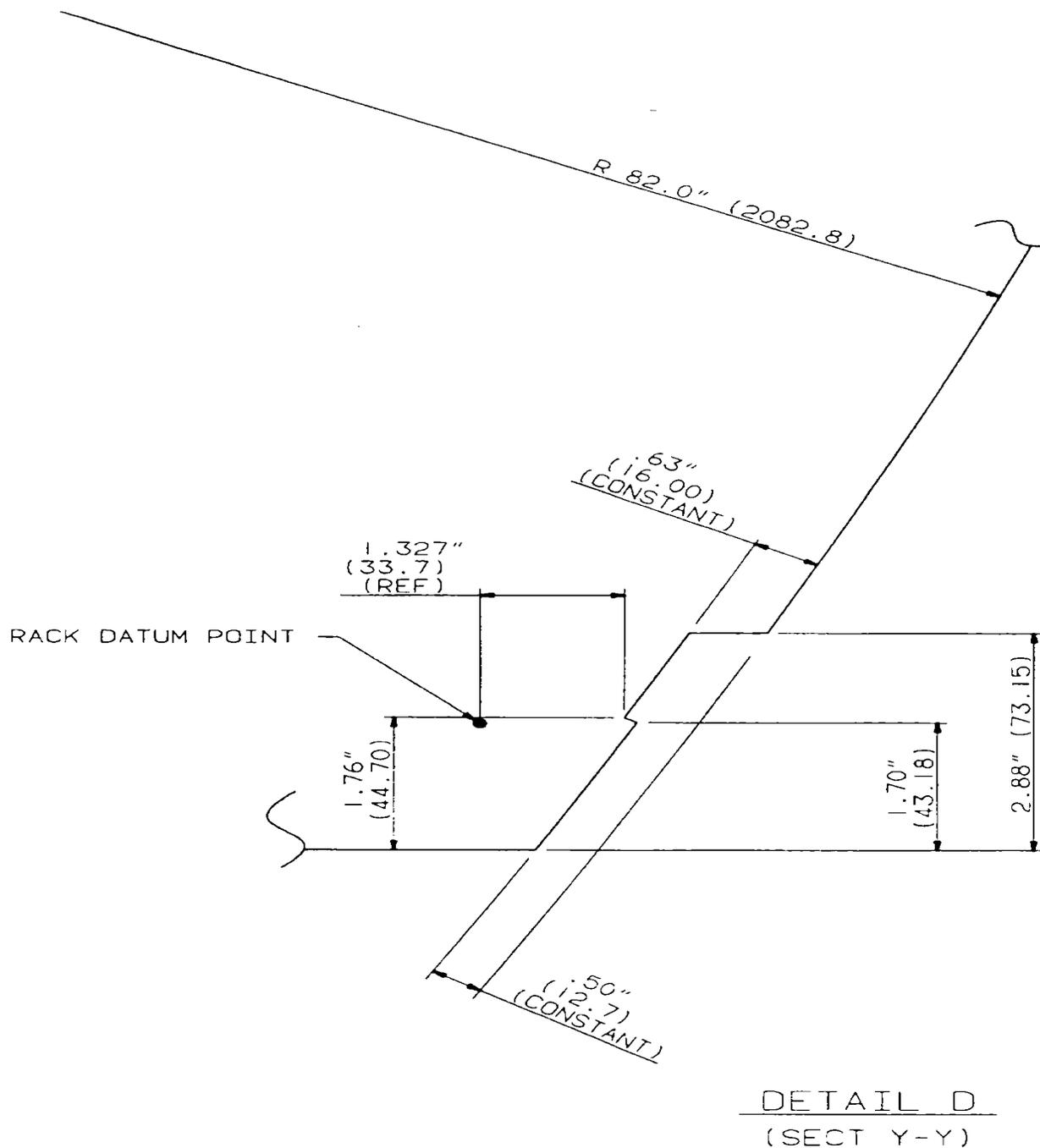
Note 1: This figure is applicable only to the racks in the JEM-PM location A5, F5, F6.

**FIGURE 3.2.1.1.2-11 RACK STATIC ENVELOPE (APPLICABLE ONLY TO RACKS IN JEM -PM) (BACK VIEW) (PAGE 2 OF 5)**



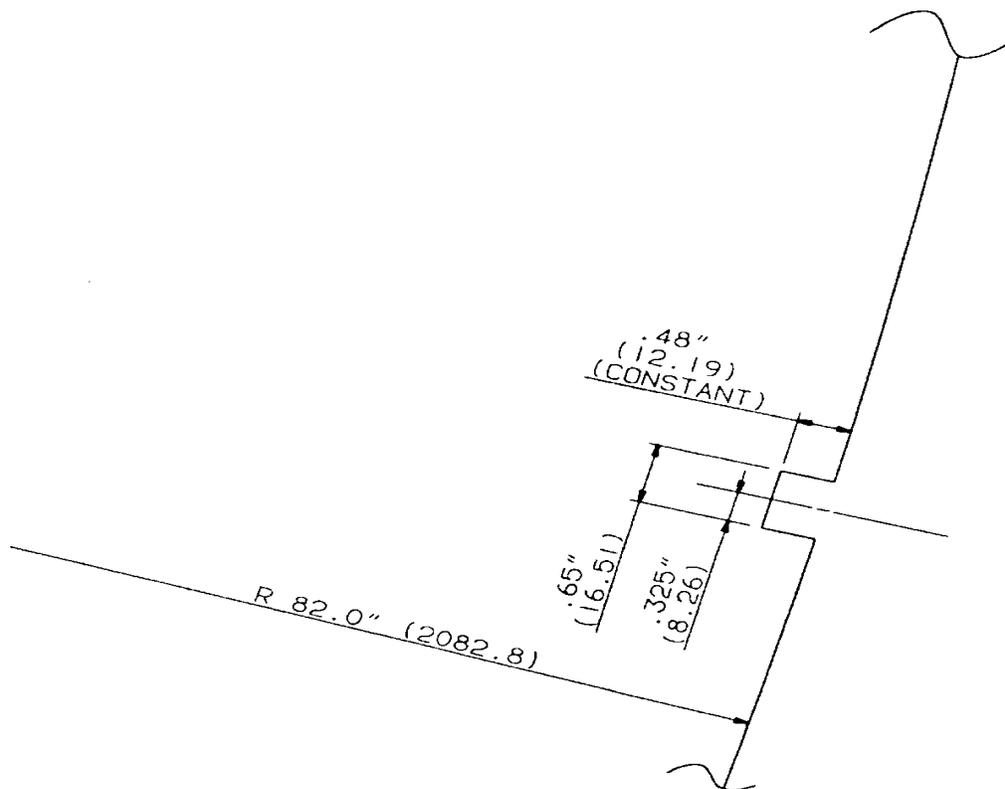
Note 1: This figure is applicable only to the racks in the JEM-PM location A5, F5, F6.

**FIGURE 3.2.1.1.2-11 RACK STATIC ENVELOPE (APPLICABLE ONLY TO RACKS IN JEM -PM) (DETAIL D FOR SECTION X-X) (PAGE 3 OF 5)**



1: This figure is applicable only to the racks in the JEM-PM location A5, F5, F6.

**FIGURE 3.2.1.1.2-11 RACK STATIC ENVELOPE (APPLICABLE ONLY TO RACKS IN JEM -PM) (DETAIL D FOR SECTION Y-Y) (PAGE 4 OF 5)**

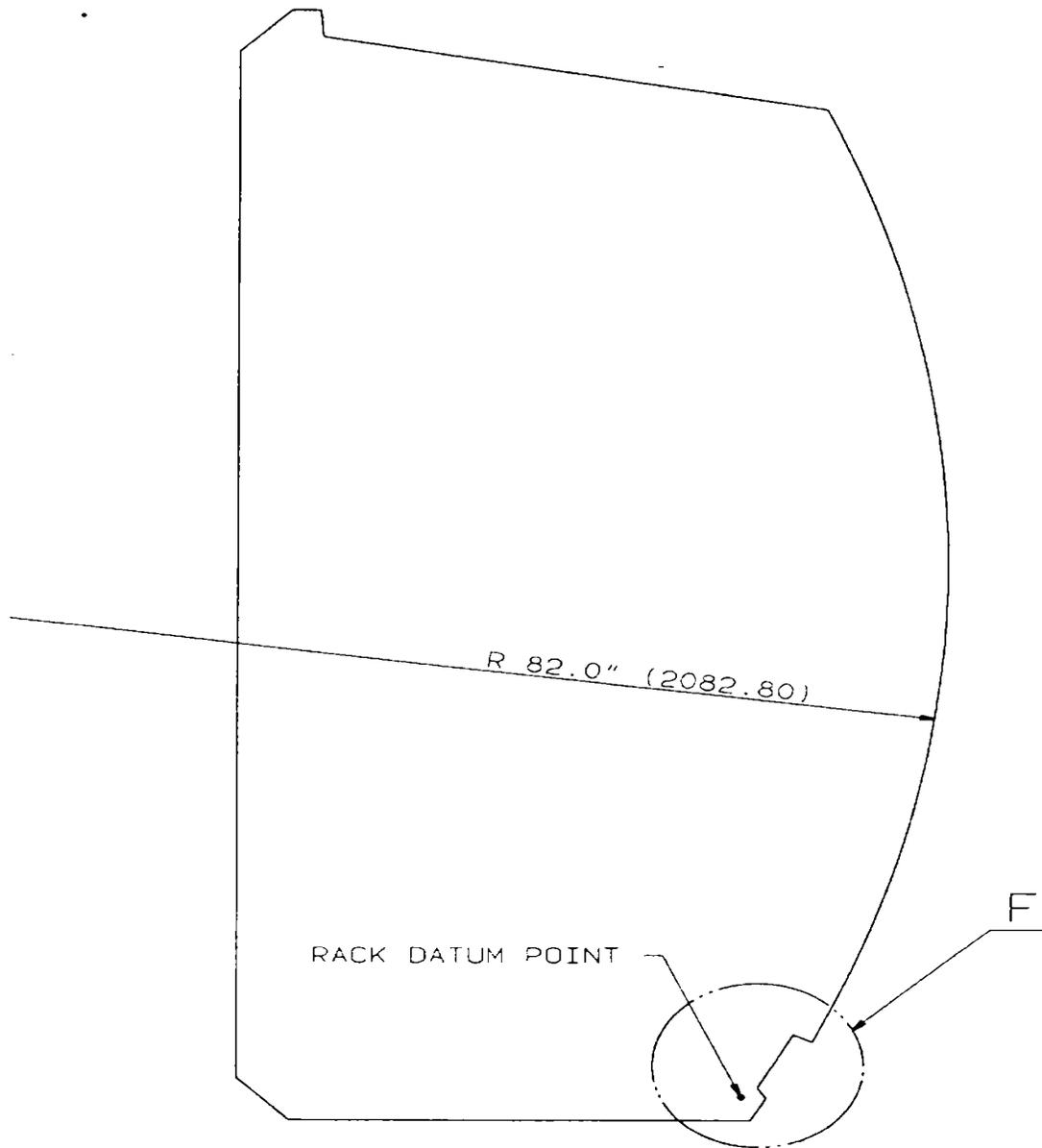


DETAIL E

EXTENDS ENTIRE WIDTH OF RACK ENVELOPE  
4PLS

Note 1: This figure is applicable only to the racks in the JEM-PM location F6.

**FIGURE 3.2.1.1.2-11 RACK STATIC ENVELOPE (APPLICABLE ONLY TO RACKS IN  
JEM -PM) (DETAIL E) (PAGE 5 OF 5)**

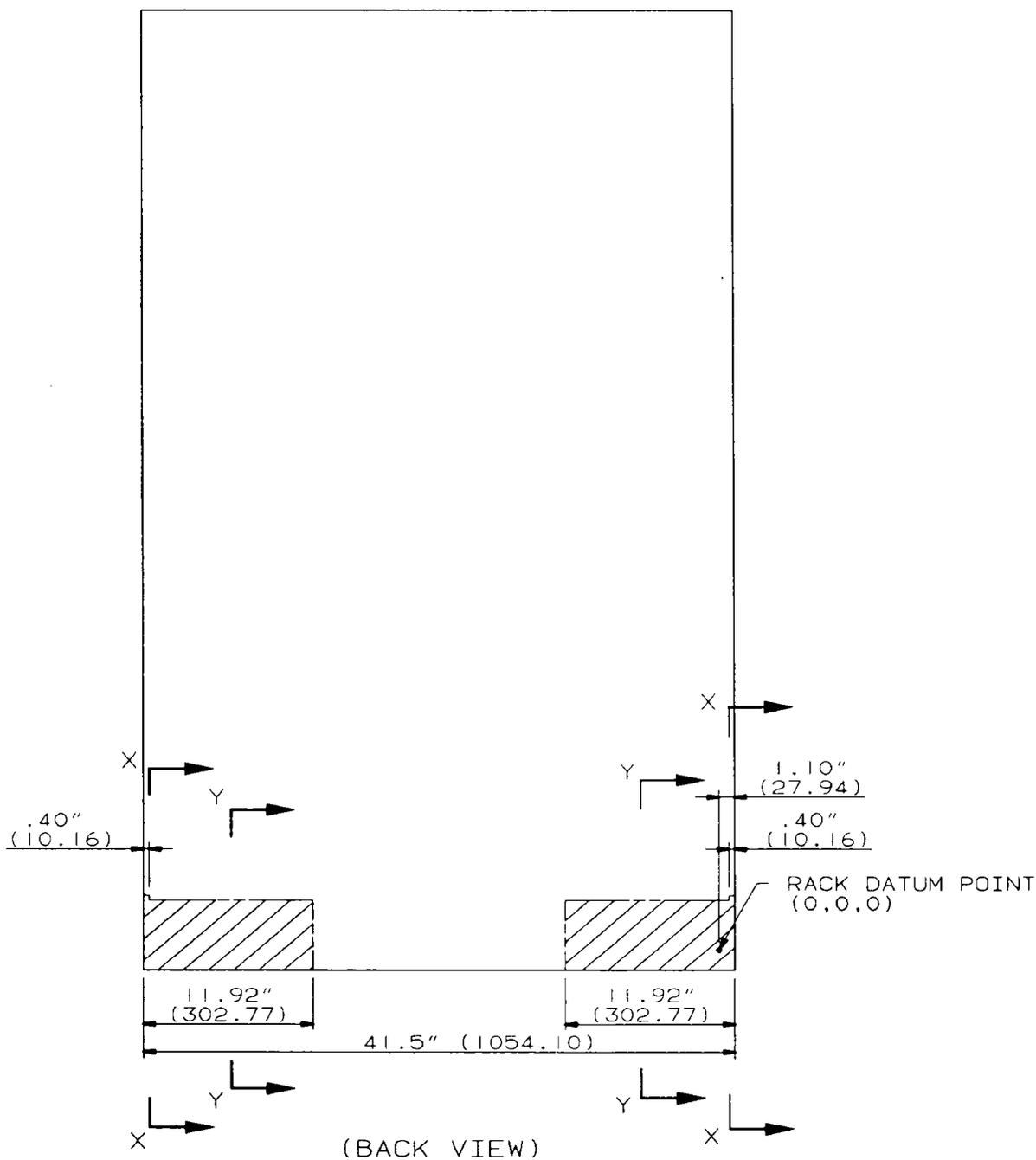


(SIDE VIEW)

Note 1: This figure is applicable only to the racks in the ELM-PS.

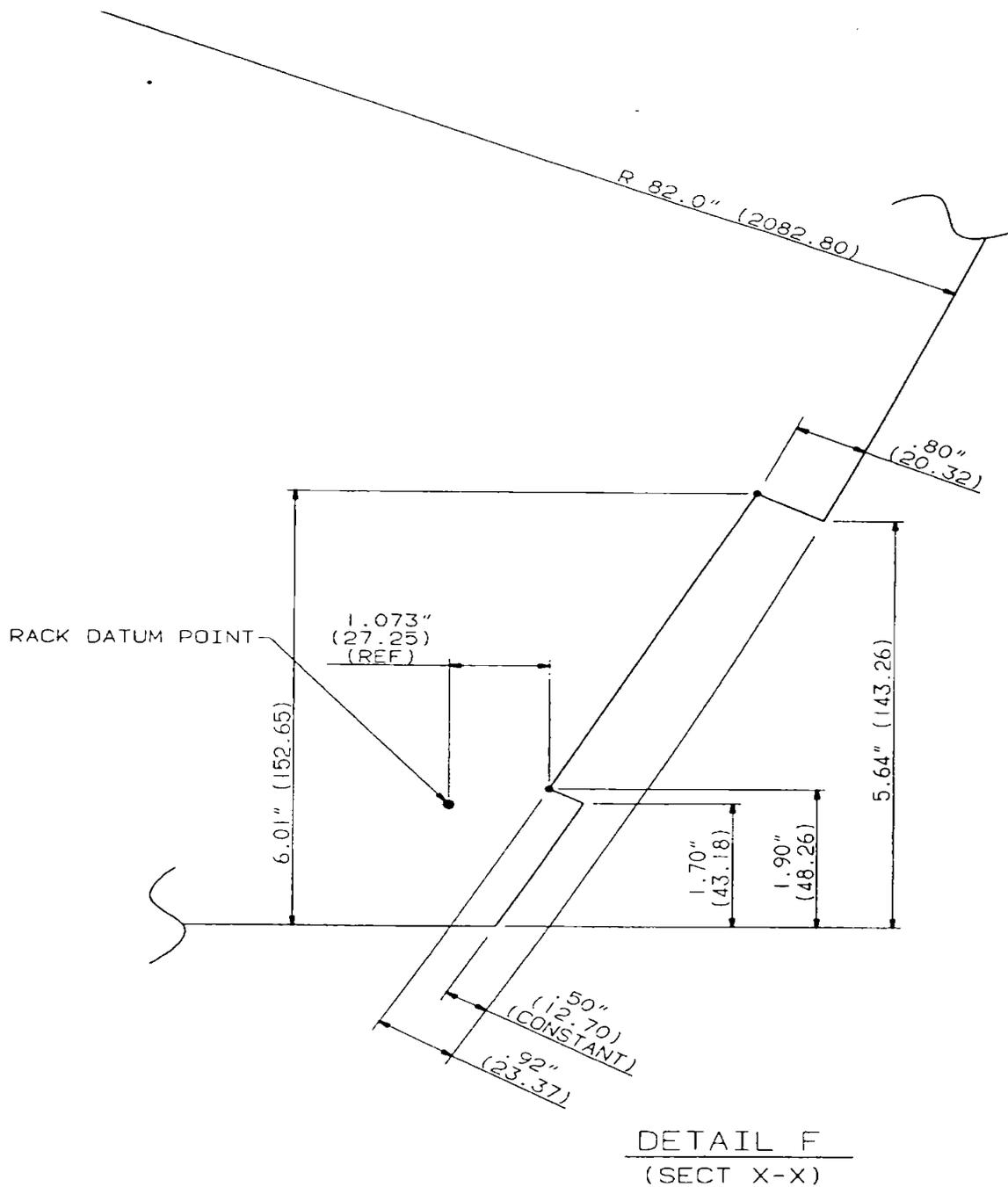
Note 2: Figure 3.2.1.1.2-1 and Figure 3.2.1.1.2-2 are applicable to other envelope except as shown in this figure.

**FIGURE 3.2.1.1.2-12 RACK STATIC ENVELOPE APPLICABLE ONLY TO RACKS IN ELM-PS (SIDE VIEW) (PAGE 1 OF 4)**



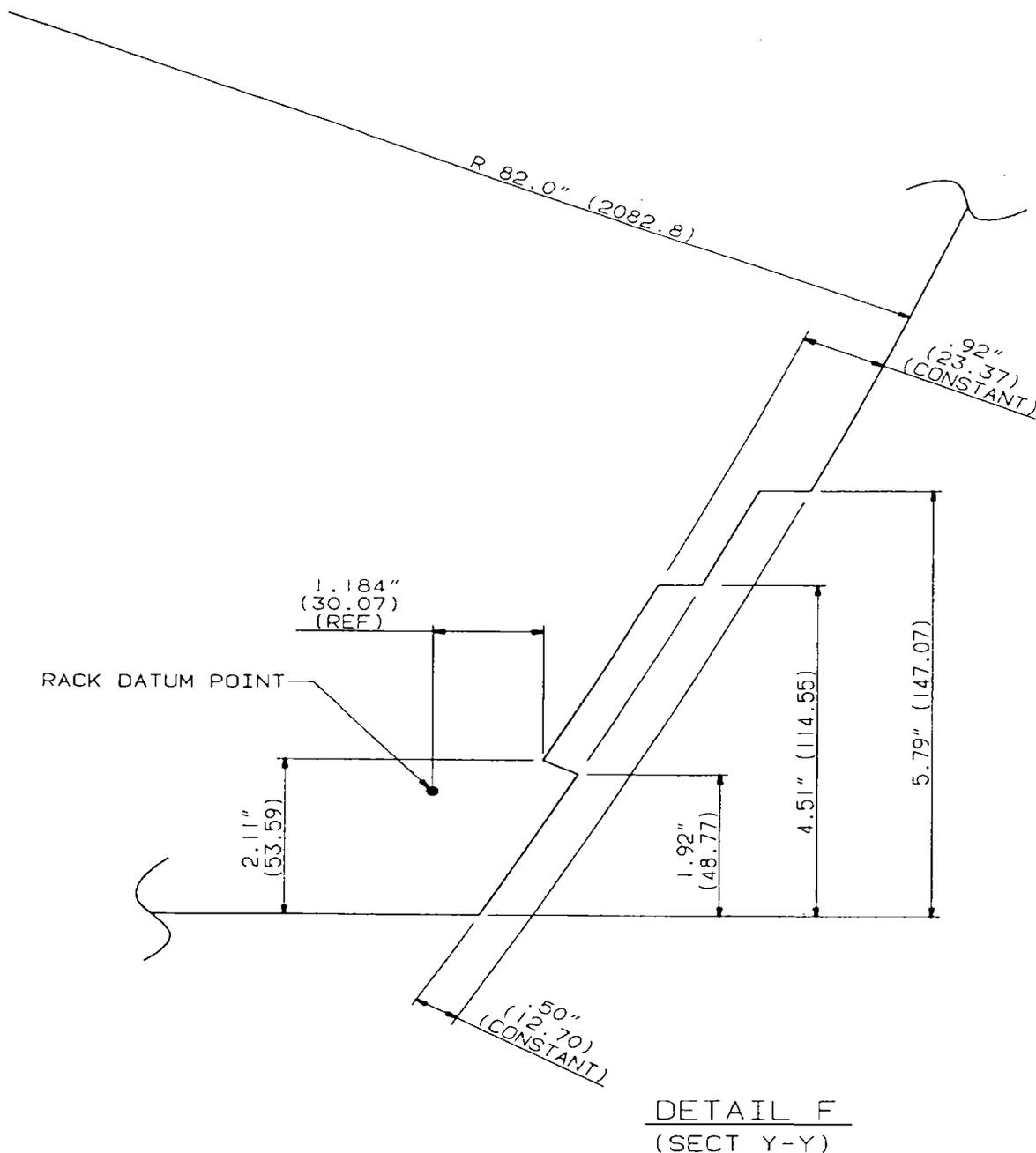
Note 1: This figure is applicable only to the racks in the ELM-PS.

**FIGURE 3.2.1.1.2-12 RACK STATIC ENVELOPE APPLICABLE ONLY TO RACKS IN ELM-PS (BACK VIEW) (PAGE 2 OF 4)**



Note 1: This figure is applicable only to the racks in the ELM-PS.

**FIGURE 3.2.1.1.2-12 RACK STATIC ENVELOPE APPLICABLE ONLY TO RACKS IN ELM-PS (DETAIL F FOR SECTION X-X) (PAGE 3 OF 4)**



Note 1: This figure is applicable only to the racks in the ELM-PS.

**FIGURE 3.2.1.1.2-12 RACK STATIC ENVELOPE APPLICABLE ONLY TO RACKS IN ELM-PS (DETAIL F FOR SECTION Y-Y) (PAGE 4 OF 4)**

**3.2.1.4.1.2 RANDOM VIBRATION**

ISPR interfaces to the MPLM shall be capable of operation during and after exposure to the random vibration environment defined in Table 3.2.1.4.1.2-1, MPLM Random Vibration Environment.

**TABLE 3.2.1.4.1.2-1 MPLM RANDOM VIBRATION ENVIRONMENT**

LOCATION	FREQUENCY	LEVEL
Input to rack at rack interfaces	20 Hz	0.0001 $g^2/Hz$
	20-80 HZ	+11.5 dB/Oct
Any direction independent of mass	80 - 150 Hz	.02 $g^2/Hz$
	150-2000 Hz	-4.9 dB/Oct
	2000 Hz	0.0003 $g^2/Hz$
	Composite	2.4 $g_{rms}$

**3.2.1.4.2 ACCELERATION**

Rack accelerations are defined in Table 3.2.1.4.2-1, NASA Rack Accelerations (Maximum Predicted Level), Table 3.2.1.4.2-2, NASDA Payload Rack Accelerations (Maximum Predicted Level), Table 3.2.1.4.2-3, NASDA System Rack Accelerations (Maximum Predicted Level) respectively.

Racks to be flown in MPLM will be designed to withstand the applicable acceleration environment for each kind of racks reported in these tables, when constrained to an infinitely massive and stiff boundary.

These acceleration environment values may be superseded by results from flight specific coupled loads analyses (CLA) of the MPLM with racks.

For on-orbit conditions, the acceleration environment will be 0.2g in any direction when the attach points A, B, C and D or C, D, I and J are employed.

For a tilted rack position, the rack will be subjected to the interface loads in Table 3.2.1.4.3-1, Mini Pressurized Logistics Module and Mechanical Ground Support Equipment Local Rack Attach Point Design Limit Loads (Launch, Landing, On-Orbit and Ground Handling), at attach points I and J.

**TABLE 3.2.1.4.2-1 NASA RACK ACCELERATION  
(MAXIMUM PREDICTED LEVEL)**

	Nx(g)	Ny(g)	Nz(g)	Rx * (rad/sec <sup>2</sup> )	Ry* (rad/sec <sup>2</sup> )	Rz* (rad/sec <sup>2</sup> )
<b>Launch</b>	+/-7.0	+/-8.0	+/-7.8	+/-70.8	+/-21.7	+/-34.8
<b>Landing</b>	+/-5.3	+/-7.2	+/-9.0	+/-37.1	+/-23.0	+/-28.3
<b>Ground Handling</b>	+/-0.5	+/-1.0	+/-2.0	+/-0.0	0.0	0.0
<b>KSC Ground Handling (Alt Attach/Bosses)</b>	+/-0.3	+/-1.08	+/-1.08	+/-0.0	+/-0.0	+/-0.0
<b>Nodes 2 &amp; 3 Ground Handling(Alt. Attach/ Bosses)</b>	±0.3	±1.5	±1.5	±0.0	±0.0	±0.0

\* Rotation taken about Rack center of mass.

**TABLE 3.2.1.4.2-2 NASDA PAYLOAD RACK ACCELERATIONS  
(MAXIMUM PREDICTED LEVEL)**

	Nx(g)	Ny(g)	Nz(g)	Rx * (rad/sec <sup>2</sup> )	Ry * (rad/sec <sup>2</sup> )	Rz * (rad/sec <sup>2</sup> )
<b>Launch**</b>	+6.54 -6.15	+5.16 -5.40	+7.66 -7.91	+43.4 -42.3	+16.0 -15.5	+36.8 -34.1
<b>Landing**</b>	+4.04 -4.92	+8.12 -7.75	+8.50 -4.46	+19.2 -18.9	+16.2 -18.0	+32.2 -33.0

\* Rotation taken about Rack center of mass.

\*\*The values in the table include uncertainty factor: 1.25

**TABLE 3.2.1.4.2-3 NASDA SYSTEM RACK ACCELERATIONS  
(MAXIMUM PREDICTED LEVEL)**

	Nx(g)	Ny(g)	Nz(g)	Rx * (rad/sec <sup>2</sup> )	Ry * (rad/sec <sup>2</sup> )	Rz * (rad/sec <sup>2</sup> )
<b>Launch**</b>	+4.06 -4.47	+4.55 -4.67	+5.49 -5.71	+27.4 -27.1	+12.9 -11.5	+15.9 -17.4
<b>Landing**</b>	+3.34 -3.76	+6.61 -6.46	+6.81 -3.74	+12.3 -11.9	+12.8 -13.5	+16.4 -15.6

\* Rotation taken about Rack center of mass.

\*\*The values in the table include uncertainty factor: 1.25

### **3.2.1.4.3 INTERFACE LOADS**

Interface loads for launch and landing are the static, dynamic, and pressure loads exchanged between the rack and the module through the attach points A, B, C and D. Interface loads for ground handling are the static and dynamic loads exchanged between the rack and GSE through the attach points E, F, G, and H. On-orbit interface loads are static, dynamic and pressure loads exchanged between the rack and the module through the attach points A, B, C and D or C, D, I and J or I and J (for a tilted rack). For all flight and ground events, the racks shall not exceed the interface loads defined in Table 3.2.1.4.3-1, MPLM and Mechanical Ground Support Equipment Local Rack Attach Point Design Limit Loads (Launch, Landing, On-Orbit and Ground Handling) based on coupled dynamic, static, and pressure analyses or additional structural analysis shall be required. Table 3.2.1.4.3-2 defines the loads on NASA racks due to differential pressure. Table 3.2.1.4.3-3 defines the loads on NASDA racks due to differential pressure. Design load table is for individual rack/cargo assessment. Verification coupled loads analysis may require MPLM manifest modification.

**TABLE 3.2.1.4.3–1 MINI PRESSURIZED LOGISTICS MODULE AND MECHANICAL GROUND SUPPORT EQUIPMENT LOCAL RACK ATTACH POINT DESIGN LIMIT LOADS (LAUNCH, LANDING, ON–ORBIT AND GROUND HANDLING) (PAGE 1 OF 2)**

EVENT	Limit Load lbf (N)	ATTACH POINT LOCATIONS											
		A	B	C	D	E	F	G	H	I <sup>*3</sup>	J <sup>*3</sup>	M <sup>*3</sup>	N <sup>*3</sup>
Launch	Fx	*1+7132/–6856 (31730) *2+6856/–6856 (30500)	0	±5927 (26367)	±23 (100)	N/A	N/A	N/A	N/A	333	333	167	167
	Fy	±6250 (27800)	±6630 (29500)	±5867 (26100)	±5305 (23600)	N/A	N/A	N/A	N/A	94	94	94	94
	Fz	±8340 (37100)	*1+9231/–8565 (41069) *2+8565/–8565 (38100)	±90 (400)	±83 (370)	N/A	N/A	N/A	N/A	383	383	0	0
Landing	Fx	±7613 (33863)	0	±5852 (26030)	±26 (116)	N/A	N/A	N/A	N/A	195	195	98	98
	Fy	±5524 (24571)	±5951 (26470)	±4987 (22182)	±5012 (22293)	N/A	N/A	N/A	N/A	173	173	173	173
	Fz	*1+13530/–12839 (60205) *2+12839/–12839 (57108)	±12861 (57206)	±87 (387)	±77 (343)	N/A	N/A	N/A	N/A	195	195	0	0
On–Orbit	Fx	Do not exceed launch and landing interface limit loads (see above)				N/A	N/A	N/A	N/A	+250 (1112)	–250 (1112)	±125 (556)	±125 (556)
	Fy					N/A	N/A	N/A	N/A	±125 (556)	±125 (556)	±125 (556)	±125 (556)
	Fz					N/A	N/A	N/A	N/A	±250 (1112)	±250 (1112)	0	0

**TABLE 3.2.1.4.3-1 MINI PRESSURIZED LOGISTICS MODULE AND MECHANICAL GROUND SUPPORT EQUIPMENT LOCAL RACK ATTACH POINT DESIGN LIMIT LOADS (LAUNCH, LANDING, ON-ORBIT AND GROUND HANDLING) (PAGE 2 OF 2)**

EVENT	Limit Load lbf (N)	ATTACH POINT LOCATIONS											
		A	B	C	D	E	F	G	H	I <sup>*3</sup>	J <sup>*3</sup>	M <sup>*3</sup>	N <sup>*3</sup>
Ground Handling (Launch Attached)	Fx	±4330 (19261)	0	±2370 (10542)	±2370 (10542)	N/A							
	Fy	±4620 (20551)	±4620 (20551)	±5140 (22864)	±5140 (22864)	N/A							
	Fz	±4940 (21974)	±4940 (21974)	0	0	N/A							
Ground Handling (Alt Attach)	Fx	N/A	N/A	N/A	N/A	±170 (756)	±170 (756)	±170 (756)	±170 (756)	N/A	N/A	N/A	N/A
	Fy	N/A	N/A	N/A	N/A	±560 (2491)	±560 (2491)	±560 (2491)	±560 (2491)	N/A	N/A	N/A	N/A
	Fz	N/A	N/A	N/A	N/A	±480 (2135)	±480 (2135)	±480 (2135)	±480 (2135)	N/A	N/A	N/A	N/A
Ground Handling (Alt Attach/Bosses) Nodes 2 & 3	Fx	N/A	N/A	N/A	N/A	±300 (1335)	±300 (1335)	±300 (1335)	±300 (1335)	N/A	N/A	N/A	N/A
	Fy	N/A	N/A	N/A	N/A	+ 3000 (13,345)	+ 3000 (13,345)	+ 3000 (13,345)	+ 3000 (13,345)	N/A	N/A	N/A	N/A
	Fz	N/A	N/A	N/A	N/A	- 2000 (- 8900)	- 2000 (- 8900)	- 2000 (- 8900)	- 2000 (- 8900)	N/A	N/A	N/A	N/A
Ground Handling (Alt Attach/Bosses) For U.S. ISPR'S in MPLM only (*4)	Fx	N/A	N/A	N/A	N/A	±300 (1335)	±300 (1335)	±300 (1335)	±300 (1335)	N/A	N/A	N/A	N/A
	Fy	N/A	N/A	N/A	N/A	±1000 (4450)	±1000 (4450)	±1000 (4450)	±1000 (4450)	N/A	N/A	N/A	N/A
	Fz	N/A	N/A	N/A	N/A	±1000 (4450)	±1000 (4450)	±1000 (4450)	±1000 (4450)	N/A	N/A	N/A	N/A

Notes: N/A = Not applicable - Rack is not attached at this location

On-orbit loads apply for the range of rack positions for normal to fully tilted

Landing loads include the pressure induced loads contained in Table 3.2.1.4.3-2 for NASA racks and Table 3.2.1.4.3-3 for NASDA racks.

Launch and landing loads are applicable for any rack mounted position (one rack at a time) as noted below:

\*1. Use the higher load value for the following MPLM locations: all starboard locations, portside locations for the 2 most forward bay locations, and the NADIR location for the 3rd bay from forward.

\*2. Use the lower load value for all other locations not defined in note \*1.

\*3. Launch and landing loads apply only to ZSR racks in Node 2.

On-orbit for ARIS Pivot Fx loads are opposite sign.

\*4. This row defines MPLM (KSC) GSE ground handling design limit loads.

**TABLE 3.2.1.4.3-2 MPLM RACK INTERFACE LOADS ON NASA RACKS DUE TO DIFFERENTIAL PRESSURE (APPLICABLE FOR LANDING ONLY)**

<b>Load Lbf (N)</b>	<b>ATTACH POINT LOCATION</b>			
<b>Load Lbf (N)</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
<b>FX</b>	± 959 (4266)	± 0 (0)	± 962 (4281)	± 0 (0)
<b>FY</b>	± 286 (1271)	± 286 (1271)	± 491 (2185)	± 601 (2674)
<b>FZ</b>	± 1892 (8416)	± 1892 (8416)	± 0 (0)	± 0 (0)

**TABLE 3.2.1.4.3-3 MPLM RACK INTERFACE LOADS ON NASDA RACKS DUE TO DIFFERENTIAL PRESSURE (APPLICABLE FOR LANDING ONLY)**

<b>Load Lbf (N)</b>	<b>ATTACH POINT LOCATION</b>			
<b>Load Lbf (N)</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
<b>FX</b>	± 1060 (4715)	± 0 (0)	± 1060 (4715)	± 0 (0)
<b>FY</b>	± 315 (1401)	± 315 (1401)	± 330 (1468)	± 330 (1468)
<b>FZ</b>	± 2090 (9296)	± 2090 (9296)	± 6 (27)	± 6 (27)

**3.2.1.4.4 RACK DIFFERENTIAL PRESSURE**

The rack structure shall not permanently deform when exposed to a maximum repressurization rate of 6.96 psi/min (800 Pa/s).

The rack structure shall not permanently deform when exposed to a maximum depressurization rate of 7.74 psi/min (890 Pa/s).

**3.2.2 MPLM INTERFACE REQUIREMENTS****3.2.2.1 ENVELOPE REQUIREMENTS**

### **3.2.2.1.1 DYNAMIC ENVELOPE**

Each rack location within the MPLM shall reserve volume for the dynamic envelope shown in Figure 3.2.1.1.1-1 and 3.2.1.1.1-2, Rack Dynamic Envelope, when the attachment points A, B, C and D defined in Figure 3.2.1.1.1-3 are for launch and landing.

(NASA ASI ONLY) Racks within the MPLM which utilize the ARIS shall reserve volume for the dynamic envelope shown in Figures 3.2.1.1.1-4, 3.2.1.1.1-5, and 3.2.1.1.1-6, ARIS Rack Dynamic Envelope, when the attachment points A, B, C and D defined in Figure 3.2.1.1.1-3, are for launch and landing

### **3.2.2.1.2 MPLM ACCOMMODATION OF RACK**

The MPLM shall accommodate racks designed in accordance with the rack static envelope as defined in Figure 3.2.1.1.2-1 side view and 3.2.1.1.2-2, Rack Static Envelope (Front View) for the launch/landing and on-orbit conditions.

(NASA ASI ONLY) The MPLM shall accommodate racks which utilize the ARIS in accordance with the static envelope as shown in Figures 3.2.1.1.2-3, 3.2.1.1.2-4, and 3.2.1.1.2-5, ARIS Rack Static Envelope for the launch/landing and on-orbit conditions.

### **3.2.2.2 MASS PROPERTIES**

Each ISPR location within the MPLM shall accommodate the maximum integrated ISPR mass of 1773 lbs (804.2 kg).

All Modules shall accommodate Racks with an On Orbit mass of 1773 lbs (804.2 Kg) without operational restrictions.

Each ISPR location within the USL, APM, JEM and CAM shall accommodate the maximum integrated on orbit mass of 2200 lbs (997.9 Kg) with restrictions as noted below.

The JEM shall only accommodate an On Orbit mass of 2200 lbs (997.9 Kg) with operational restrictions.

The APM shall accommodate one 2200 lbs (997.9 Kg) ISPR per stand off train, and no two such racks shall share the stand off in one bay. Each stand off train ISPR mass shall not exceed 7092 lbs (3217 Kg) in the APM.

### **3.2.2.3 STRUCTURAL/MECHANICAL**

#### **3.2.2.3.1 LAUNCH/LANDING/ON-ORBIT ATTACHMENT**

The MPLM shall incorporate structural/mechanical provisions for attachment of the ISPR for the launch/landing/on-orbit event.

##### **3.2.2.3.1.1 ON-ORBIT MODULAR ATTACHMENT**

On-Orbit modules shall provide the ARIS standoff link interface and the Capture Mechanism as the module to rack interface at specified locations (excluding MPLM).

**3.2.2.3.1.2 RACK TO MODULE INTERFACE**

On-Orbit racks shall provide the KBAR as the rack to module interface.

**3.2.2.3.2 GROUND HANDLING ATTACHMENT**

Not Applicable

**3.2.2.3.3 MINIMUM RESONANT FREQUENCY**

Not Applicable

**3.2.2.3.4 DELETED****3.2.2.3.5 BONDING (MPLM ONLY)**

For Each R/F location, the MPLM shall provide a bonding strap for class R bonding in accordance with SSP 30245, space Station Electrical Bonding Requirements.

**3.2.2.3.6 ARIS RACK COMPATIBILITY**

The MPLM shall accommodate ARIS in the launch configuration in up to 6 locations.

**3.2.2.4 INDUCED ENVIRONMENTS**

MPLM interfaces to the ISPR shall be capable of operation during and after exposure to any feasible combination of the following environments.

**3.2.2.4.1 VIBRATION****3.2.2.4.1.1 LAUNCH ACOUSTICS**

The MPLM shall impart an acoustic environment no greater than defined in Table 3.2.1.4.1.1-1, MPLM Internal Acoustic Noise Spectra.

**3.2.2.4.1.2 RANDOM VIBRATION**

MPLM interfaces to the ISPR shall be capable of operation during and after exposure to the random vibration environment defined in Table 3.2.1.4.1.2-1, MPLM Random Vibration Environment.

**3.2.2.4.2 ACCELERATION**

N/A

### **3.2.2.4.3 INTERFACE LOADS**

Interface loads for launch and landing are the static, dynamic, and pressure loads exchanged between the module and the rack through the attach points A, B, C and D. Interface loads for ground handling are the static and dynamic loads transmitted from the rack to the GSE through attach points E, F, G and H. On-orbit interface loads are the static, dynamic and pressure loads exchanged between the module and the rack through the attach points A, B, C and D or C, D, I and J or I and J for a tilted rack. The MPLM shall be capable of accommodating the interface loads defined in Table 3.2.1.4.3-1, MPLM and Mechanical Ground Support Equipment Local Rack Attach Point Design Limit Loads (launch, landing, on-orbit and ground handling). NASDA Rack loads are TBC by using NASDA Racks.

#### **4.0 INTERFACE VERIFICATION**

There will be no requirements that require joint verification for this interface. Verification of requirements will be performed separately by the rack provider, and the element provider, according with the verification responsibility matrix reported in Table 4.0-1.

**TABLE 4.0-1 INTERFACE VERIFICATION**

PARAGRAPH NUMBER	VERIFICATION RESPONSIBILITY		
	RACK PROVIDER	ELEMENT PROVIDER	No VERIFICATION REQUIRED
1.0			X
1.1			X
1.2			X
1.3			X
2.0			X
3.0			X
3.1			X
3.1.1			X
3.1.1.1			X
3.1.1.2			X
3.1.1.3			X
3.1.1.4			X
3.1.2			X
3.1.2.1			X
3.1.2.2			X
3.1.3			X
3.1.3.1			X
3.1.3.2			X
3.2			X
3.2.1			X
3.2.1.1			X
3.2.1.1.1	X		X
3.2.1.1.2	X		
3.2.1.2	X		
3.2.1.3			
3.2.1.3.1	X		
3.2.1.3.2	X		
3.2.1.3.3	X		
3.2.1.3.4	X		
3.2.1.4			
3.2.1.4.1			X
3.2.1.4.1.1	X		
3.2.1.4.1.2	X		
3.2.1.4.2	X		
3.2.1.4.3	X		
3.2.1.4.4	X		
3.2.2			X
3.2.2.1			X
3.2.2.1.1		X (I) *	
3.2.2.1.2		X (I) *	
3.2.2.2		X	
3.2.2.3			X

PARAGRAPH NUMBER	VERIFICATION RESPONSIBILITY		
	RACK PROVIDER	ELEMENT PROVIDER	No VERIFICATION REQUIRED
3.2.2.3.1		x (I) *	
3.2.2.3.2			x
3.2.2.3.3			x
3.2.2.3.4			x
3.2.2.3.5		x (T) *	
3.2.2.4			x
3.2.2.4.1			x
3.2.2.4.1.1		x	
3.2.2.4.1.2		x	
3.2.2.4.2			x
3.2.2.4.3		x	
4.0			x
<b>LEGEND:</b> (I) = INSPECTION (A) = ANALYSIS (T) = TEST * = Only ESA to verify these requirements for APM. Verification method applicable to ESA only.			

**APPENDIX A ABBREVIATIONS AND ACRONYMS****A.1 ABBREVIATIONS AND ACRONYMS**

ASI	Agenzia Spaziale Italiana (Italian Space Agency)
dB	Decibel
g	acceleration due to gravity
g <sub>rms</sub>	root mean squared acceleration
GSE	Ground Support Equipment
Hz	Hertz
ICD	Interface Control Document
ISPR	International Standard Payload Rack
kg	Kilogram
MPLM	Mini Pressurized Logistics Module
mm	millimeters
N/A	Not Applicable
N/m <sup>2</sup>	Newton per square meter
Oct	Octave
SI	International System
RAD	radians
ref.	reference
sec	second

**APPENDIX B INDEX OF TBDS AND TBCs**

<u>TBD No.</u>	<u>Page No.</u>	<u>Current Paragraph/Figure/ Table</u>	<u>Status</u>
1	3-12	Paragraph 3.2.1.4.4	Closed
3	3-12	Paragraph 3.2.1.4.4	Closed
6	4-16	Paragraph 4.0	Closed
TBC #1	3-17	Paragraph 3.2.1.4.2	Closed
TBC #2	3-18	Paragraph 3.2.1.4.3	Closed
TBC #3	3-29	Table 3.2.1.4.3-1	Closed
TBC #4	3-29	Table 3.2.1.4.3-1	Closed