



Server Rack Cabinet Compatibility Guide

Revision 2.4

September 2005

*A Guide to the Selection and Evaluation of Server Rack
Cabinets for Compatibility and Use with Intel® Server Chassis*

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Revision History

Orig./Rev.	Description	Date
1.0	First release	April 2002
2.0	Updated legal text; updated testing information; updated Figure 1 graphic; updated IHV product and contact information; added dimension "F" information.	5/20/2002
2.1	Added SC5300, SR1325 & SR1350	12/21/04
2.3	Modified Intel® Server Chassis List	April 2005
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1 Purpose

The Intel *Server Rack Cabinet Compatibility Guide* is intended to provide guidance and clarification to both customers and Independent Hardware Vendors (IHVs) who seek compatibility with Intel® server chassis. This document provides a checklist and explanation of the critical IHV server rack cabinet attributes that are required for full compatibility with Intel® server chassis and related accessory kits.

2 Conceptual Overview

This specification was created to address the following major areas:

1. Introduction to the EIA-310-D enclosure specification
2. Critical rack cabinet dimensions and features
3. Thermal cooling considerations
4. Provide a list of Intel server chassis and IHV racks that have successfully passed a form/fit evaluation.

3 Terminology:

Table 1: Definitions, Terms, and Acronyms (listed alphabetically)

<i>Term:</i>	<i>Definition:</i>
Bezel	Aesthetic plastic or metal front-facing cover of a typical computer server.
Cabinet	A freestanding and self-supporting 4-post enclosure for housing electrical and/or electronic equipment. It is usually fitted with access doors and/or side panels, which may or may not be removable. Also typical of the telecommunications industry in EMEA.
CFM	Cubic Feet per Minute. Measure of Volumetric Airflow.
Chassis	A mechanical structure designed specifically to support associated electrical and electronic components.
EIA 310-D Mounting Flange	The front internal mounting surface within a Cabinet Enclosure or Rack that provides a mounting surface for Computer Servers, electrical equipment, chassis guides, slide rails, and/or panels.
PCI Card Bulkhead	The mounting surface, within a computer server, to which the PCI Expansion card Brackets mate.
Rack	An open-air structure for mounting electrical or electronic equipment. A Rack is an open Cabinet. There are 2 basic types of Racks, 2-post & 4-post. 2-post racks are typical of the telecommunications industry in the USA.
Rear Mounting Flange	The rear internal mounting surface within a Cabinet Enclosure or Rack which provides a mounting surface for computer servers, electrical equipment, chassis guides, and/or slide rails.
Slide Rails	Devices to Support Retractable (Telescopic) Sub-racks and Chassis in the Extended Position.
U	Equal to 1.75 inches (44.45 millimeters)

4 General

This guide intends to clarify the critical compatibility issues between Intel® server chassis and IHV server rack cabinets. All system design considerations in this document are based upon a 19-inch rack configuration only as defined in the Electronic Industries Association, EIA, 310-D Standard. The predominate dimensional unit of length for this guide is noted in millimeters followed by inches: 25.4mm [1.00 inches].

4.1 Status Table Acronyms

STATUS
Information

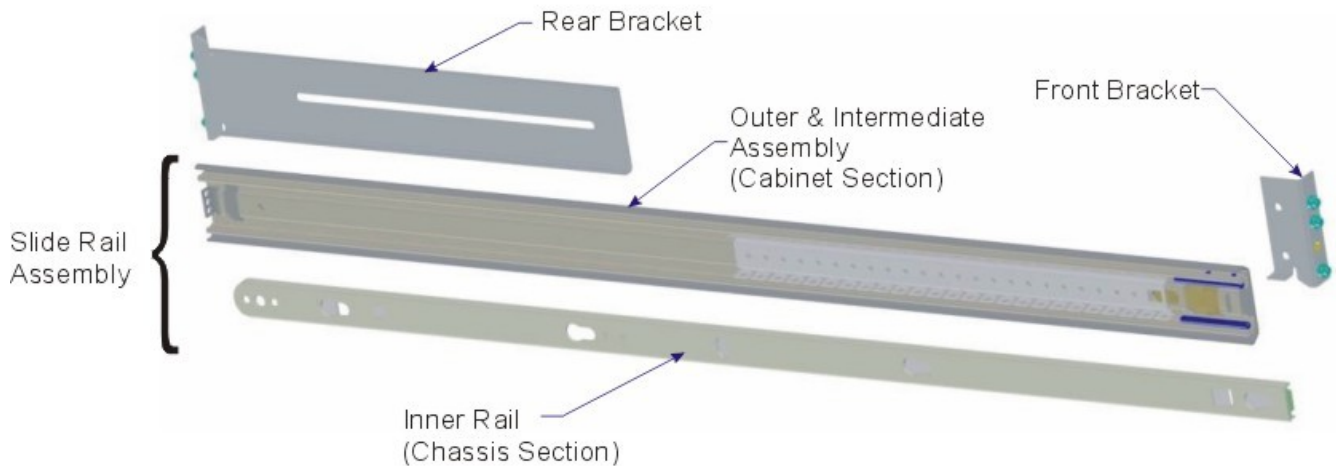
Each of the following sections begins with a “Status” table that makes a distinction between concepts or technologies that are critical and those that are not critical but rather are open to differentiation.

- Required** An essential element; must follow exactly.
- Recommended** Section is recommended but not required for compatibility.
- Optional** This section is optional and open to user discretion.
- Information** This section is provided for general information only.

4.2 Slide Rail Terminology

STATUS
Information

Figure 1: Slide Rail Terminology



4.3 Types of Rack Cabinets

STATUS
Information

Figure 2: 4-POST “Enclosed” rack (shown without front or rear doors)

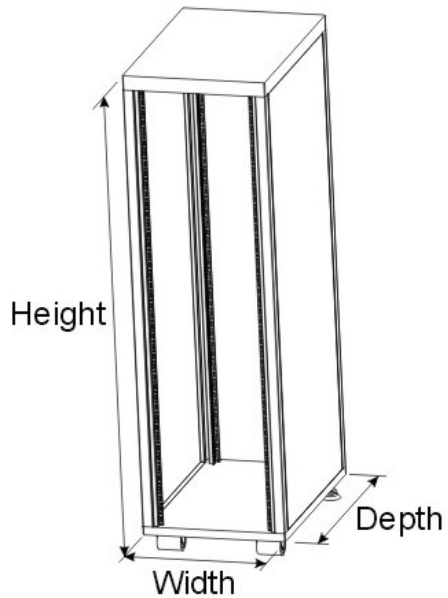
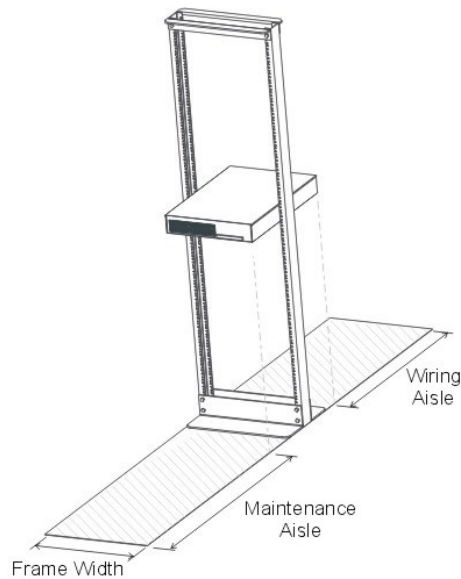


Figure 3: 2-POST “open air” rack



5 Compatibility Checklist

5.1 The Rack is Compliant with the EIA-310-D Standard

STATUS
Required

The Electronic Industries Association (EIA) created the EIA-310-D standard in 1992 for cabinets, racks, panels, and associated equipment. Intel designs server chassis to be compatible with racks that are designed to the EIA-310-D specifications.



NOTE

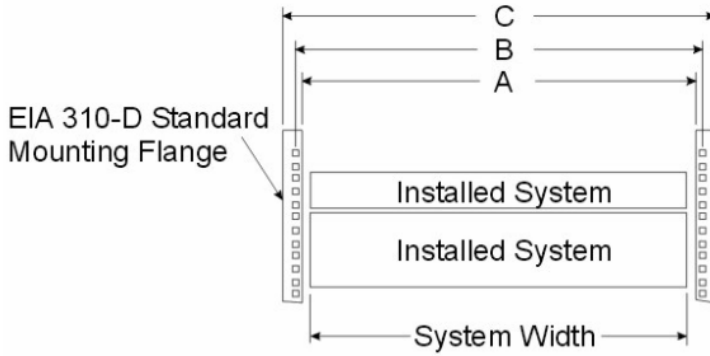
Not all IHV server rack cabinets are built to EIA-310-D specifications, so be sure and ask. Your Intel® server chassis and associated accessory railkit may not install successfully in a server rack cabinet that is not EIA-310-D compliant.

5.1.1 Mounting Flange Dimensions:

STATUS
Information

The EIA-310-D specification addresses form, fit, and function for system spacing, mounting, and bezel clearance (see Figure 4):

Figure 4: Critical Mounting Flange Dimensions



Notable Dimensions:

- Dimension A = 450mm [17.717"] min.
- Dimension B = 465mm [18.307"] nominal
- Dimension C = 483.4mm [19.031"] min.

5.1.2 Mounting Flange Holes:

STATUS
Recommended

The EIA-310-D standard also specifies the placement of the mounting holes in the mounting flange.

Figure 5: Square mounting holes

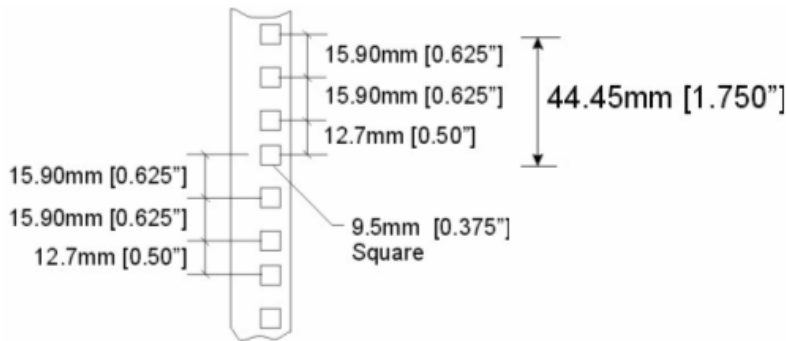
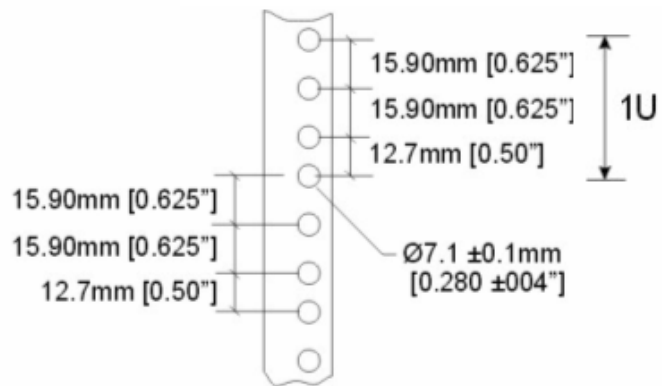


Figure 6: Round mounting holes



NOTE

While EIA-310-D allows the mounting flange holes to be round, square, or tapped (threaded), Intel railkit hardware is only designed to work with round or square holes, but not tapped holes. [Intel mounting brackets work best with square holes.](#)

5.1.3 Mounting Flange Clearance

STATUS
Required

The EIA-310-D standard does not address the issue of “rack angle clearance”. Figure 7 shows a top view of a 4-post server rack cabinet. Detail B shows the top-view of an L-shaped EIA Mounting Flange (this is the part of the rack that has the round or square holes in the front). What is important to note on this drawing is the 16.77mm minimum clearance between the two edges of the mounting flange. **This area is absolutely critical for proper mounting of Intel slide rails.** Many IHV racks ship with an EIA Mounting Flange that is U-Shaped (see Figure 9).

Figure 7: Enclosure Top View

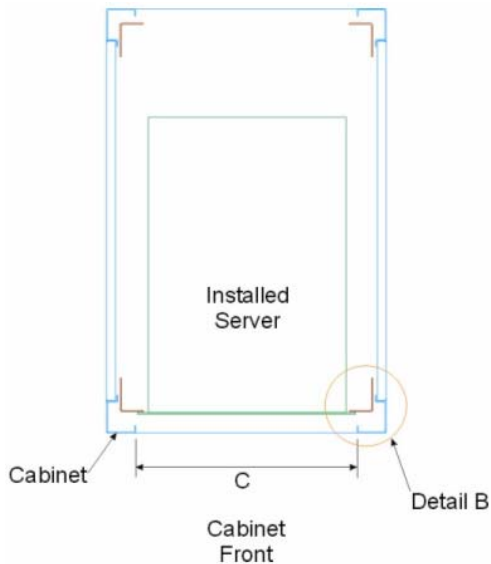


Figure 8: Mounting flange detail

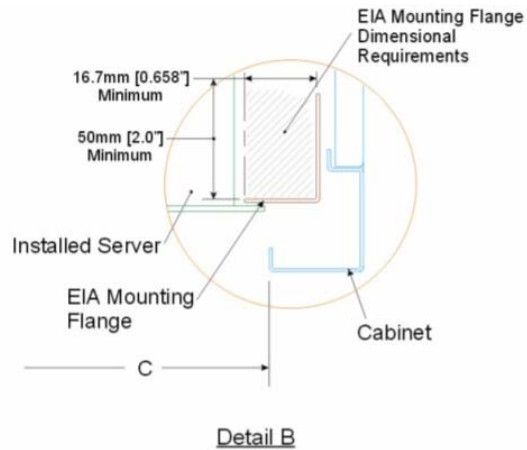
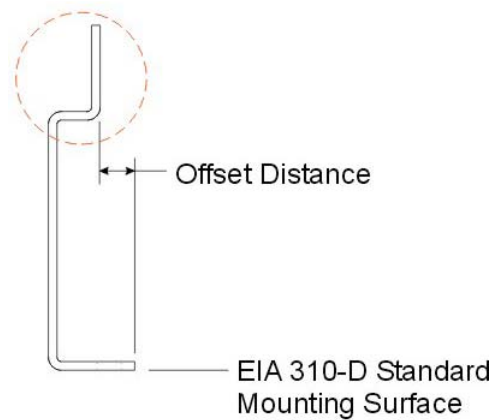


Figure 9: U-shaped mounting flange



NOTE

Figure 9 shows a U-shaped EIA Mounting Flange. Often, the “offset distance” is less than 16.77mm (15mm is typical). If there is any doubt about the offset distance, order a rack cabinet with L-shaped EIA Mounting Flanges as these typically provide 22mm worth of space for the slide rail assembly.



5.2 Rack Depth

STATUS
Recommended

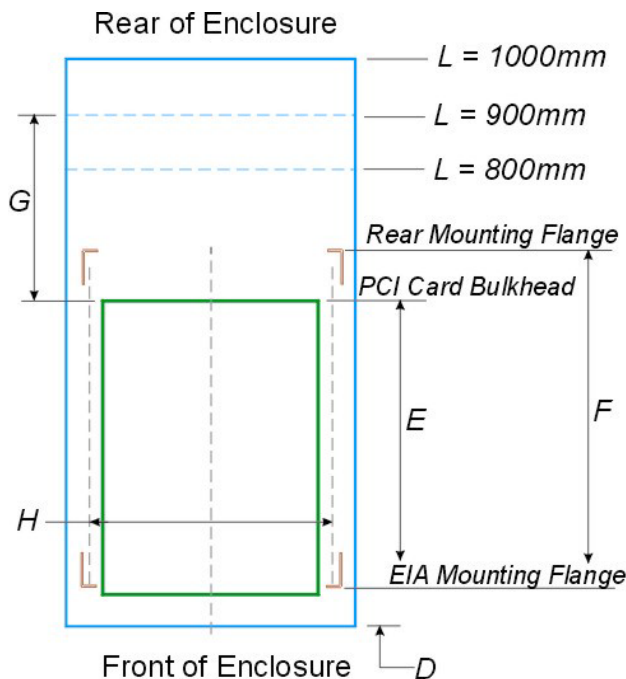
Selecting a server rack cabinet with the proper depth is essential. It's important to consider the length of the server chassis as well as additional room in the rear for cable management and clearance in the front for the chassis bezel and handles/pulls. Intel chassis are designed to fit into racks that are 900mm – 1000mm deep. While some chassis may be mountable in 800mm cabinets, they may extend out the back of the cabinet and prevent the enclosure doors from closing properly.

Table 2: Cabinet Depth Required for System Length

EIA Flange To PCI Bulkhead	Total System Depth	Installed Depth	Cabinet Depth
mm [inch]	mm [inch]	mm [inch]	mm
E	D+E	D+E+G	L
597 [23.5]	648 [25.5]	800.2 [31.5]	800
697 [27.4]	748 [29.4]	900.2 [35.4]	900
797 [31.4]	848 [33.4]	1000.2 [39.4]	1000

It's important to remember that you will need space behind the server for cables (Dimension "G"). Fiber optic cables require ~152mm (6") while standard ethernet and power cables may get by with only 112mm (4") of clearance.

Figure 10: Top view of critical cabinet dimensions



Intel chassis do not ship with cable management arms or other adapters. The major rack cabinet IHVs sell cable management systems and you should consult with them directly regarding your particular requirements.

Also note that dimension "D" specifies 51mm (2") of free space between the EIA Mounting Flange and **inside** of the enclosure door. This space is required for clearance on the bezel and pull handles on the front of the chassis.



NOTE

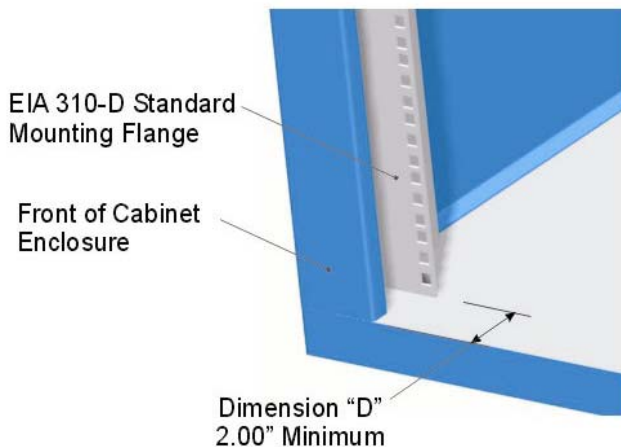
See Appendix A for a definition and explanation of the "PCI Card Bulkhead".

5.2.1 Clearance for chassis pull handles

STATUS
Required

Intel® server chassis require a minimum of 51mm (2 inches) between the front of the EIA Mounting Flange and the *inside* of the front enclosure door. This clearance allows room for the chassis pull handles and bezel as well as air circulation through the cabinet.

Figure 11: Clearance for chassis pull handles



5.2.2 Slide rail range of motion distance

STATUS
Required

The distance between the front and back EIA mounting flanges is noted in Figure 10, dimension "F". In most server rack cabinets, the front mounting flanges are fixed in one position while the rear mounting flanges may be repositioned. The distance between the mounting flanges varies according to the range of motion distance supported by the telescoping rail assembly. Table 3 details the range of motion distance for various Intel slide rail assemblies. Dimension "F" is often a limiting factor when attempting to mount an Intel server chassis in a server rack cabinet that is less than 900mm deep.

Table 3: Slide rail range of motion distance for dimension "F"

Intel® Server Chassis	Intel rail kit	Minimum Dimension "F"	Maximum Dimension "F"
		mm [inch]	mm [inch]
SC5000	AHDRACK	689.0 [27.13]	805.0 [31.69]
SC5100	AHD2RACK	721.0 [28.39]	849.5 [33.44]
SC5200	AHD3RACK	721.0 [28.39]	849.5 [33.44]
SC5300	ARIGRACK	610.0 [24.00]	762.0 [30.00]
SR1325	AXX1U2URAIL	660.0 [26.00]	812.0 [31.95]
SR1350	AXX1U2URAIL	660.0 [26.00]	812.0 [31.95]



NOTE

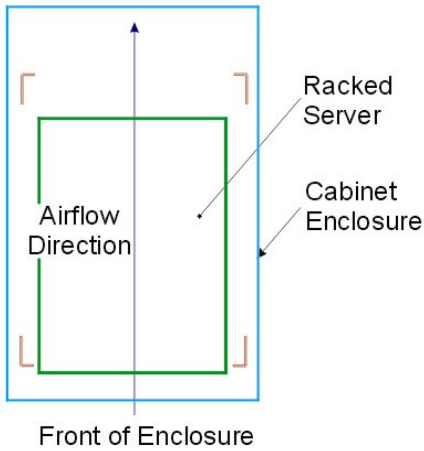
The Intel rail kits AH2RACK and AHD3RACK use identical telescoping rail assemblies (inner rails, outer rails, mounting brackets, and associated hardware).

5.3 Thermals

STATUS
Recommended

Most rack-ready servers today require front-to-back cooling. It is required, therefore, that enclosed cabinets provide front-to-back cooling as well. As the server thermal loads increase due to new technology, the cooling capability of the enclosed cabinet needs to scale as well.

Figure 12: Airflow
Rear of Enclosure



Fan packs, which force ambient air from the front of the cabinet through the back of the cabinet enclosure, aid the internal computer system fans in removing heat from the cabinet enclosure.

5.3.1 Enclosure Front and Rear Doors

STATUS
Recommended

The absence of access doors maximizes the volume of airflow into the cabinet. The need for secure enclosures, however, makes this unrealistic in some cases. Therefore, access doors need to be able to provide security and maximum allowable airflow at the same time.

For maximum system cooling, the actual airflow CFM per “U” should be maximized. Recommended airflow ranges are listed below.

Table 4: Maximum system volumetric airflow requirements

Total System Volumetric Airflow per “U”	
1U	32 – 36 CFM / U
2U	39 – 45 CFM / U
4U	38 – 40 CFM / U
5U	45 – 50 CFM / U
7U	25 – 43 CFM / U
<i>Values based on Historical Intel Product Data</i>	

In order to achieve these rates of CFM, both the front and rear doors need approximately 63% open-area perforations (holes). This percentage refers to the ratio of open space, by way of holes or slots, to un-open area within an airflow inlet or outlet. This is commonly referred to as the Free Area Ratio, or FAR.

A quick way to check the free area ratio is to count the number of holes in an area that is 25mm square (1 square inch). 63% FAR translates into approximately 33 holes in an area that is 25mm square.

While some racks have fans mounted on the top of the enclosure, it’s better to have them mounted directly to the rear door so the air is pulled through the chassis from front to back.



NOTE

Intel® servers and chassis are designed to operate within a range of 10C - 35 C room ambient temperatures. In general, cooler is better, so 25 C - 30 C is suggested. The ideal method for cooling servers is to control the room ambient temperature and use rack cabinet doors that have a 63% or higher Free Air Ratio. Under these conditions, additional fan packs on the rack cabinet are usually not necessary.

6 Server Rack Compatibility Matrix

STATUS
Information

Intel tested the following IHV server rack cabinets successfully for form/fit compatibility with the indicated Intel® server chassis. IHV server rack cabinets can usually be customized with a variety of different hardware, therefore it is important that you discuss your intended use and requirements with the IHV *before* selecting a server rack cabinet.

Table 5: Server Rack Compatibility Matrix

IHV	Model	Depth
Wrightline	Vantage series (ordering code "Intel 1")	900mm
Pentair/Schroff	Proline Server Cabinet (order# 12192-297)	900mm
Rittal	PS Server Cabinet	900mm

Intel® Server Chassis Covered By this Document
Intel® Server Chassis SC5100
Intel® Server Chassis SC5200
Intel® Server Chassis SC5300
Intel® Server Chassis SR1200
Intel® Server Chassis SR1300
Intel® Server Chassis SR1325
Intel® Server Chassis SR1350
Intel® Server Chassis SR2200
Intel® Server Chassis SR2300
Intel® Server Platform SPSH4
Intel® Server Platform SRSH4

NOTE

IHV server rack cabinets can be ordered with a variety of custom options and accessories. Consult your IHV rack manufacturer prior to purchase to be sure you get the hardware and accessories that are best suited to your particular rack installation.

The information contained in the matrix above does not constitute an endorsement, representation or opinion by Intel regarding the companies or products listed and is provided for your convenience only. The

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list may not be comprehensive. Please check with the vendors listed for availability of and specifications for their products. You remain solely responsible for the design, sale and functionality of your product. Intel Capital may be an investor in some of the companies listed. View a list of companies that Intel Capital is invested in at <http://www.intel.com/capital/portfolio/alpha.htm>.

6.1 Additional IHV Contact Information

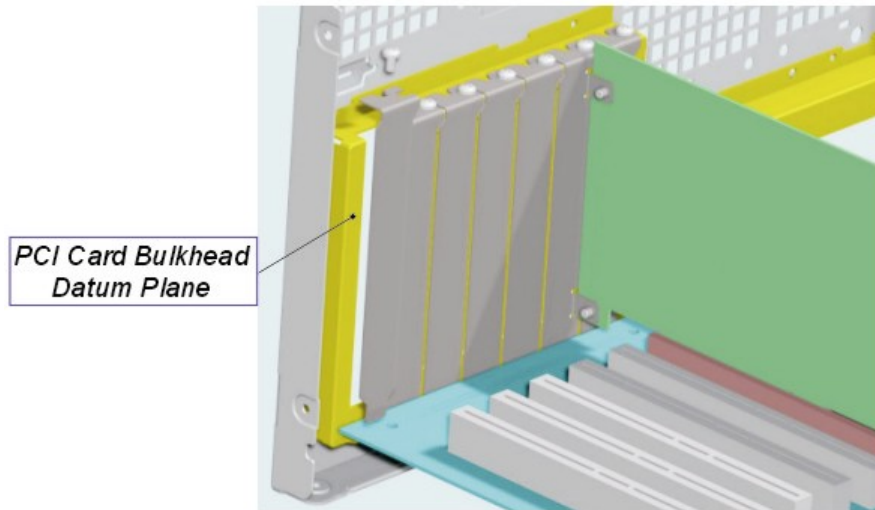
STATUS
Information

Table 6: Additional IHV Contact Information

IHV	Website
Wright Line	http://www.wrightline.com
Pentair/Schroff	http://www.pentair-ep.com/servercabinet
Rittal	http://www.rittal-corp.com

Appendix A : Definition of the PCI Card Bulkhead

Figure 13: The PCI Card Bulkhead Datum Defined



The PCI Card Bulkhead is defined as the interface between an installed PCI Expansion Card and the chassis mounting surface.

Appendix B: Related Documents

(listed alphabetically)

ATX Specification, <http://www.formfactors.org/>

Electronic Industries Association Standard, EIA, ANSI/EIA-310-D-1992, <http://www.eia.org/>

Entry-level Electronics-Bay Specification, a Server System Infrastructure (SSI) Specification for Entry Servers, <http://www.ssiforum.org/>

PCI Local Bus Specification, <http://www.pcisig.com/>

Server System Infrastructure, SSI, Web site: <http://www.ssiforum.org/>

The Uptime Institute, <http://www.uptime.com/TUIpages/tuihome.html>

Thin Server Power Supply, TPS, <http://www.ssiforum.org/>

Microsoft Windows NT Server Design Guide, <http://www.microsoft.com/hwdev/serverdg.htm>

IEC 917

For additional product compatibility information: <http://support.intel.com/support/motherboards/server>