Decision and Solutions Guide

May 2005

Smarter power delivery

IBM

IBM Distributed Power Interconnect products

NEW! *Featuring the NEW DPI Enterprise power distribution products*

Contents

Help enhance system and data availability with modular, space-efficient power distribution solutions from IBM

With the changes brought on by the new generation of Intel®-based servers, power distribution and power delivery are becoming critical issues. Only a few years ago, the quest was on to find ways to easily place 42 outlets in a rack for what was then an amazingly dense configuration of 1U servers. Today, there are more factors to consider than counting the power line cords and matching them to the number of outlets. The quest for outlet count has now been joined by the quest for delivering current adequate to feed the substantial power draw of today's servers. This trend toward higher current (amperage) draw in servers is making it more difficult to design a fault-tolerant system.

IBM offers Distributed Power Interconnect (DPI) products, a family of modular "zero-U" power distribution units (PDUs) designed to be capable of supporting solutions from a handful of servers to an array of large enterprise servers—all without consuming valuable rack space. These units can be configured to provide redundant power distribution, thus helping to eliminate a point of failure and assure higher levels of data availability.

IBM® DP Interconnect (DPI) products were developed specifically for use with sensitive electronic equipment in the rack environment. Unlike many third-party products which were designed for the desktop or industrial environments, the DPI products are sized and protected with servers in mind.

There are compelling reasons why one should include IBM DPI PDUs in a rack-based IBM @server® xSeries® solution:

- Even in simple configurations, the combined power-line requirement of devices in the rack can easily exceed the capacity of existing wall outlets. A PDU can help customers efficiently use the available power and the available outlets.
- A properly configured PDU solution may help customers increase availability and protect their system investments at a very affordable price. IBM PDUs can be used to help provide an advanced fault-tolerant power distribution system.
- IBM's modular approach provides the flexibility to mix and match components as needed to configure a wide range of power distribution solutions. Universal voltage support, plus single- and three-phase models, provide solutions that can be used in virtually any facility or location to meet almost any rack power requirement.
- These PDUs assume a three-year onsite limited warranty[1] when they are installed in an IBM rack, which means they include award-winning IBM service and support. A fully configured, all-IBM rack solution—including PDUs, uninterruptible power supply (UPS), console switches and cables—may help customers speed implementation with one-stop shopping and simplify installation with the assurance that the pieces will work together out of the box.

About this Guide

Choosing a properly designed and properly protected PDU is more important than ever. This guide will provide an introduction to the IBM DPI family of PDUs and explain:

- The design philosophy driving the development of these products
- How to use, size and install PDUs
- Trends in power requirements for Intel-based servers and data center power architecture
- Factors to be considered when designing the layout of your power system.

Products and solutions

The IBM DPI family of PDUs can help satisfy customer business needs for reliable, redundant power at a competitive price point. Key features of these PDUs include:

Ease of use

DP Interconnect products are quick and easy to install. They come standard with the necessary brackets and hardware for your installation, plus the appropriate line cord for connecting to a wall power source and the appropriate jumper cord for connection to a front-end PDU. One reason to choose IBM DPI PDUs is that they are built using customer-attachable line cords and connectors. This design approach helps eliminate terminal blocks and the expensive electrician visits required for their installation. This means that virtually anywhere in the world you are located, IBM DPI PDUs come ready to deploy.

Zero-space design

DPI products are designed to mount in the sidewall compartment, preserving valuable "U" rack real estate for servers, storage devices and other rack options. Customers can mount several PDUs in an IBM rack's sidewall compartments.

High-availability solutions

Units can be configured to provide redundant power distribution for servers and other critical components.

Outstanding scalability and flexibility

Modular design allows you to mix and match components, adjusting configurations to accommodate growing power distribution needs, from total wattage to a sufficient number of outlets for rack-mounted equipment. Plus, by combining multiple units you can support rack-dense, power-hungry configurations such as:

- Up to 42 1U servers in a single rack
- High-density, power intensive blade servers
- A large array of multiple rack-optimized servers
- Clustered eight-way enterprise servers
- Large-scale redundant storage systems

Cord consolidation and cable management

Using short, easy-to-manage jumper cables to connect multiple rack devices to a single PDU, you may significantly reduce the number of individual power cords going from the rack to the wall. Plus, you can mount PDUs in sidewall pockets close to the equipment they support, helping to further reduce cable clutter.

Protection

Internal fuses and/or breakers in DPI PDUs help protect equipment from catastrophic faults in connected devices.

IBM DPI product family

Design philosophy

The design philosophy of the entire DPI line is twofold. First, make it easy to install and access outlets within the rack. Second, minimize the number of line cords leaving the rack, thus helping to decrease power infrastructure requirements without sacrificing scalable growth. IBM @server® xSeries® offerings pioneered the scalable modular approach to power distribution, our NetBAY Modular PDUs have been making it easy for customers to support rack-dense environments for years.

No matter the version that you choose, the IBM PDU products can help you meet demanding power requirements in the rack environment while saving space, consolidating line cords and providing easy access to outlets for scaling up and for cable management.

DPI Universal Rack PDU

This PDU provides an economical, basic power distribution capability for rack-based systems, helping to enable you to satisfy the power requirements of each device without overtaxing your power source. It has one universal-voltage power input and supports up to seven devices with a combined power requirement of 1500W at 100Vac to 3600W at 240Vac (based on AC input volts). Features include:
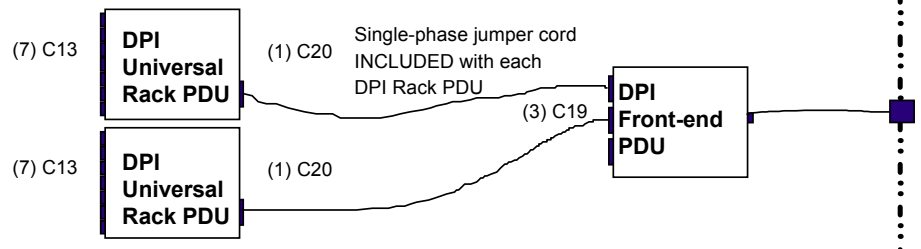
- Universal voltage (100-240Vac, 50-60Hz)
- Mount in rack side walls, or on the EIA space. PDU is half-rack width, so you can mount two in a single 1U space
- Two-pole 15-amp circuit breaker with time-delay protection
- Seven IEC 320-C13 power outlets (for connection to devices)
- One IEC 320-C20 power inlet (for connection to wall or to front-end PDU)
- Single LED power on indicator
- Cable management brackets included with PDU to help neatly and securely run cabling

This unit is designed to be used one of two ways: plugged into an appropriate wall outlet or, more commonly, used in conjunction with the innovative DPI Front-end PDU. Below is a graphical overview of the two ways to use the DPI Rack PDUs:

PDU plugged directly into wall

(7) C13 | **DPI Universal Rack PDU** | (1) Country-specific line cord INCLUDED with DPI Rack PDU — Wall

Multiple PDUs in combination with DPI Front-end PDU

(7) C13 | **DPI Universal Rack PDU** | (1) C20 — Single-phase jumper cord INCLUDED with each DPI Rack PDU

(3) C19 | **DPI Front-end PDU**

(7) C13 | **DPI Universal Rack PDU** | (1) C20

DPI Front-end PDU

DPI Single-phase Front-end PDU
One unit supports both 30/32amp and 60/63amp power supply

DPI Single-phase Front-end PDUs provide a front-end wiring box to allow connection of multiple DPI Universal Rack models to higher-current single-phase circuits. These modular, front-end PDUs provide three single-phase output circuits from one single-phase (100V-240V at 30amp or 200V-240V at 60amp) input circuit. Features include:

- Adapts to high-current circuits (three-wire, single-phase)
  - 100V-240V at 30/32amp, supports up to 3000W at 100V or up to 7200W at 240V
  - 200V-240V at 60/63amp, supports up to 9000W at 200V or up to 10,800W at 240V
- Three single-phase output circuits with three IEC 320-C19 receptacles (for connection to PDUs and blades)
- Non-replaceable fuse for protection
- Brackets for vertical (sidewall) rack mounting only
- Power on LED indicator on each load segment
- Mount in rack side walls, or on the EIA space. PDU is half-rack width, so you can mount two in a single 1U space

Front view of DPI Front-end PDU

A DPI Front-end PDU with 60(63)amp line cord is an ideal choice for servers like x346, x336, x445, x455 and IBM @server BladeCenter™. This high- amperage product offering is designed to make it easier for customers to support large installations of virtually any server, helping to reduce the number of line cords and helping reduce electrical power infrastructure needed to feed the rack.

One of the hot new features of the DPI family is the scalability of power support. The same DPI Front-end PDU unit can be used at 30amps to 63amps, depending on the line cord you choose. This provides an excellent way to grow your solution as needs change or to size the right solution for even the most power-hungry setups.
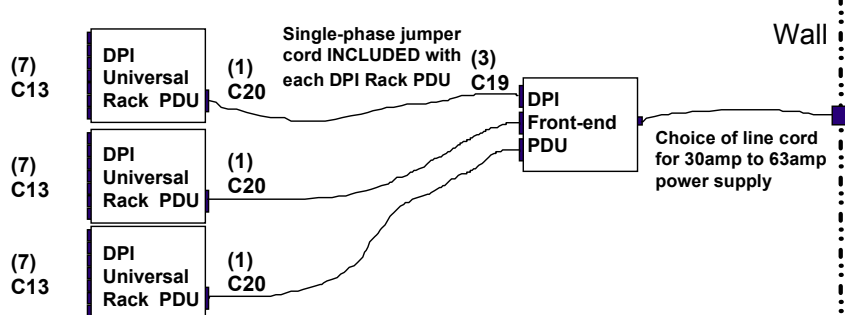
How do the line cords work?
The photograph (left) shows the rear of the PDU equipped with a special pin-out connector. This connector enables you to attach one of several different line cords to the unit. Depending on the line cord, the DPI Front-end PDU can be either 30(32)amp or 60(63)amp, which may offer enhanced investment protection to help prepare the way for future growth.

For example, a customer in the US can migrate from low voltage 30amp to high voltage 30amp to high voltage 60amp via only a line cord change. Or, a customer in the UK could migrate from 32amp 250V to a 63amp 250V. The intended result is great investment protection and solution flexibility.

Rear view of DPI Front-end PDU, showing pin-out connector on the PDU and line cord. Customers can easily detach or attach the high amperage line cord.

DPI Front-end PDU configuration

Provides 21 outlets (1 line cord to the source)

Wall

(7) C13	DPI Universal Rack PDU	(1) C20	Single-phase jumper cord INCLUDED with each DPI Rack PDU	(3) C19	DPI Front-end PDU	Choice of line cord for 30amp to 63amp power supply
(7) C13	DPI Universal Rack PDU	(1) C20				
(7) C13	DPI Universal Rack PDU	(1) C20				

DPI NEMA 100-127V Rack PDU

This PDU provides an economical, basic power distribution capability for rack-based systems, helping to enable you to satisfy the power requirements of your devices. It has one low-voltage power input and supports up to six devices with a combined power requirement of up to 1200W at 100v through 1524W at 127V. This 1U PDU is half-rack width, so you can mount two in a single 1U space for a total of 12 outlets.

This PDU is primarily used in North America, Japan, Taiwan, the Philippines and various other nations that have power systems that work at 100V-127V. Features include:

- Low voltage (100V-127V)
- Brackets for vertical (sidewall) and horizontal (EIA space) rack mounting
- Two-pole 15-amp circuit breaker with time-delay protection
- Six NEMA 5-15 power outlets
- Fixed L5-15 line cord
- Cable retention aids

Although very similar to the IEC-based DPI Universal Rack PDU, this NEMA model does not provide the same flexibility and scalability of configurations. Unlike the rest of the IBM PDU product line, this unit is designed to be used on its own, not in combination with front-end PDU units. Simply plug it into the wall and power up as many as six devices. Because this PDU shares the same form factor as the DPI Universal Rack PDU, it can be mounted on the same hardware—a great benefit for customers who require both NEMA and IEC outlets in the same rack.

DPI High Density PDUs

DPI High Density PDU

Twelve C19 outlet PDU available in 32A/60A 3-phase or 60/63A 1-phase models

- Built with twelve (12) IEC C19 outlets (same as the Front End PDUs)
- Each outlet is rated to support up to 16A
- Fixed 4.3M line cords
- Hardware allows mounting in EIA space or in side pockets
- Push button breaker on each outlet for protection
- Brackets for vertical and sidewall rack mounting
- Cable retention aids
- 1U full rack width

Front view

Three phase units
- Available in North American version as a 60A unit with IEC309 3P+G style connector
- North American version can deliver up to 27A per phase (derated)

- Available in World Trade (International) as a 32A unit with IEC 3P+N+G style connector
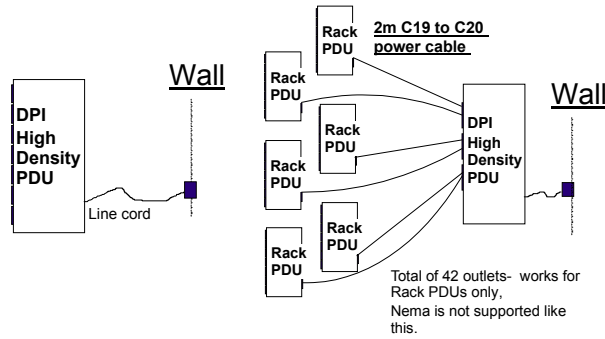- World Trade version can deliver up to 32A per phase

Rear view

Single phase units
- Available in North American version as a 60A unit with IEC309 2P+G style connector
- North American version can deliver up to 48A (derated)

- Available in World Trade (International) as a 63A unit with IEC P+N+G style connector
- World Trade version can deliver up to 63A

Note: This PDU can be used directly attached to servers or as a front end to the DPI Universal Rack PDUs. See diagram below.

Rack PDU

2m C19 to C20 power cable

Rack PDU

<u>Wall</u>

DPI High Density PDU

Line cord

Rack PDU

Rack PDU

Rack PDU

DPI High Density PDU

<u>Wall</u>

Total of 42 outlets- works for Rack PDUs only, Nema is not supported like this.

DPI Enterprise PDUs

DPI Enterprise PDU
Two Models Available: Twelve C13 or Six C19 Outlets

Features common to both models:
- Power cord connection, breakers and outlets all on the same side of PDU for easy access

- 1U full rack width

- Includes hardware to mount in either EIA space of sidepocket of rack

- Available in single or three phase models

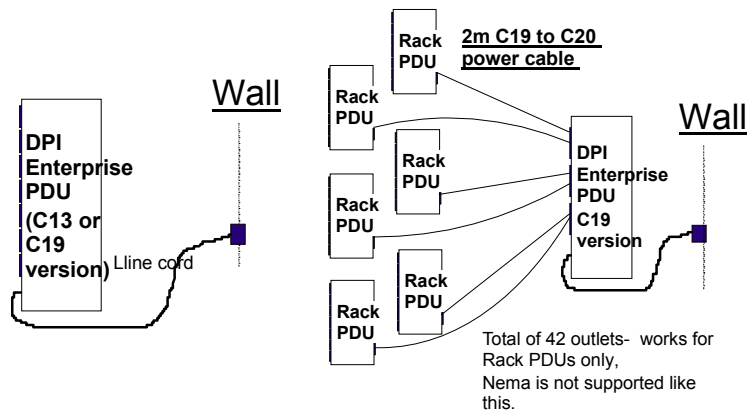- Available in either 30/32A or 60/63A versions

Twelve C13 Models
- Built with twelve C13 outlets rated at 10A each

- Push button breaker for each pair of outlets

Six C19 Models

- Built with six C19 outlets rated at 16A each

- Push button breaker for each outlet

- Can be used as either a front End PDU or directly connected to servers

Rack PDU

2m C19 to C20 power cable

Rack PDU

<u>Wall</u>

DPI Enterprise PDU (C13 or C19 version)

Lline cord

Rack PDU

Rack PDU

Rack PDU

DPI Enterprise PDU C19 version

<u>Wall</u>

Total of 42 outlets- works for Rack PDUs only, Nema is not supported like this.

IEC versus NEMA standard

Why we believe IEC is the best outlet choice for your rack systems

For many customers, there is no choice: IEC 320 C13-based PDUs are the accepted standard for internal rack power outlets for the vast majority of the countries around the world. But for customers in North America, Japan, Taiwan, the Philippines, Saudi Arabia and various other nations, the NEMA standard is an available alternative.

The NEMA outlets on our DPI 100-127V Rack PDU are the same size and shape as many wall outlets where 100-127V power systems are used (NEMA 5-15R). The larger size of the NEMA outlet means that fewer outlets can be incorporated into the same "real estate" on a piece of electronic

equipment. As a result, products with NEMA outlets typically are less dense and not as flexible as products designed with IEC outlets.

The C13 outlet has been adopted throughout the world as the choice for internal rack power. Unlike country-specific outlets, the IEC C13 outlet extends beyond country borders and across various types of power distribution, from 100V all the way to 240V. Many of the benefits engineered into the IBM line of modular PDU products originate from the higher-density, smaller-sized IEC outlets. These benefits, which we believe make IEC-based PDU products the best choice for internal-rack power distribution, include:

- Universal support for both low voltage (100V-127V) and high voltage (200V-240V) input in a single product, helping to provide enhanced flexibility and investment protection
- Optimizing device support in a small space, helping to conserve valuable rack real estate.

Going forward, IEC is the platform that IBM intends to support for innovation because it enables us to focus resources on a product line that can virtually be used worldwide.

	Rack PDU (IEC)	100-127V PDU (NEMA)
Can be used with DPI Front-end PDUs to reduce cord clutter?	YES	NO
Maximum number of outlets in full 1U rack width	14 (2 PDUs)	12 (2 PDUs)
Able to adapt to high voltage inputs?	YES	NO
Accepted virtually worldwide for internal rack distribution systems?	YES	NO
Rating of the PDU	15amp	12amp

The benefits of IBM DPI PDUs

Customer requirements

Keeping today's enterprise up and running is a top priority for IT managers. Server downtime originates from many sources but often it is due to unexpected power problems stemming from natural disasters, faulty electrical systems, poor quality power or an accidental cutting of electrical lines. At the same time, the power requirements of ever more powerful computing equipment continues to grow. With rack-dense solutions allowing companies to fit an old data center's worth of computing horsepower into the space of a small wiring closet IT managers can find it difficult to keep the electricity flowing.

To meet new high-availability requirements, a fault-tolerant system design must address power management. Desired solution components include:

- PDUs to help assure that the combined line-cord requirement of all rack-mounted equipment is met
- Redundant configurations that provide power from separate sources to enable fail over capability
- In unprotected data center environments, combining PDUs with uninterruptible power supply (UPS) products for even greater levels of reliability in the event of a power failure.

In addition, power fault tolerance solutions should address requirements for:

- Preserving valuable "U" space in a rack that quickly fills up with network-critical equipment
- Easy serviceability, high reliability, and high availability
- Scalable and flexible systems that can grow with changing network demands.

The use of IBM DP Interconnect PDUs alone may not solve all the issues with power that customers are facing today. Many problems such as power surges, brownouts, under-voltage and the like can only be protected against by the use of the right UPS products. IBM offers a complete suite of power-protecting UPS products. For detailed information on these products and how to choose the right one for your application, download the *IBM Decision Maker's Guide to Selecting the Right UPS* from: http://www-1.ibm.com/servers/eserver/xseries/storage/rack.html. This guide includes information on the IBM UPS solutions- an ideal addition to any midrange solution of xSeries servers and storage.

Key messages

- **LINE CORD CONSOLIDATION**: Innovative, modular design is designed to reduce the number of line cords leaving the rack, while increasing the possible total outlet count possible in the rack.
- **CUSTOMER-FRIENDLY DESIGN**: Equipped with customer-attachable rather than hardwired line cords, IBM DPI PDUs may help you save money. This design approach helps eliminate terminal blocks and the expensive electrician visits required for their installation. Instead, to power up these PDUs you just plug them into an appropriate outlet.
- **SERVER-LEVEL PROTECTION**: Designed for IBM servers. Unlike the PDUs one might find at local retailers or available from third parties, IBM PDUs are designed for protecting expensive and sensitive IT equipment. DPI PDUs helpprovide protection against overload and surge for the large loads required on today's servers.
- **DESIGNED FOR THE RACK ENVIRONMENT:** These products are designed to be used in the space-constrained environment of a server rack. Unlike many other PDU products that support higher power levels, our 1U designs allow placement of multiple PDUs in the rack side panels, helping to preserve the maximum amount of "U" space.
- **GREATER AVAILABILITY**: DPI products can be configured to provide redundant power distribution, thus eliminating a single point of failure and helping to increase data availability.
- **FASTER INSTALLATION**: Now, you may significantly speed solution setup by deploying IBM PDUs in combination with IBM racks. We design our PDUs with IBM racks in mind. When you combine IBM racks and IBM power, you get simple, quick, stable and thoughtful solutions. Add these benefits to the ability to prewire a location for these "connectorized" PDUs and you can help eliminate the waiting period that is so common after your equipment arrives, but before the electricians finish their work.
- **SUPERIOR SCALABILITY:** The modularity of the IBM PDUs make it easy to support virtually any configuration, from a handful of servers to an entire rack. For example, you can place up to 84 outlets in a single IBM Enterprise Rack—without sacrificing a single "U" of space.
- **CUSTOMER CHOICE:** No matter the type of input power DPI PDUs have versions that are designed to accommodate 20A, 30A, 32A, 60A, or 63A single phase , three phase-
- **SERVICE BENEFITS:** Buying DPI products and placing them in an IBM rack may mean enhanced protection and service benefits to the customer. An IBM PDU placed in an IBM rack receives the same level of service as the rack itself. The standard protection for IBM racks is a three-year on-site limited warranty**. Add a service pack or warranty uplift to the rack, and you gain the same extended coverage for your PDUs as well. This is a great way to consolidate services and help protect your investment.

Selection questions: Helping ensure that you get the right product

Selection questions	Rationale for asking
Do you currently have the infrastructure in place to run multiple line cords to the rack?	If not, the modular design of IBM DP Interconnect PDUs may help you avoid having to run new lines, which could be a huge cost savings for customers adding a new rack or adding to their existing solution.
Are you paying an electrician to hardwire your current PDUs?	This can be one of the most substantial expenses involved with server set up. DPI products with customer- friendly line cords and connectors may help you do away with much of this cost.
Do you anticipate adding new servers to your environment?	IBM DPI solutions scale easily to accommodate growing rack configurations. Customers can start with a single Universal Rack PDU, and add more Universal Rack PDUs, Front-end PDUs or Enterprise PDUs as needs grow. The DPI family's scalability of power support also helps growing customers quickly modify their power systems to add newer, more powerful servers with very little effort.
Is your business-critical data adequately protected in the event of a power outage? How much downtime can your business tolerate until systems can be brought back online?	DPI PDUs can be configured to provide redundant power distribution. Plus, these units can be used in combination with select rack-mountable UPS products from IBM to provide an advanced fault-tolerant power distribution system.
If you are considering third-party PDUs, are you sure they will provide protection against catastrophic faults?	Many third-party PDUs were not designed for the IT environment. Rather, they are intended to protect motors or other industrial equipment, which may not be as sensitive as the electronics equipment that IBM PDUs are designed to safeguard.
Is your solution likely to be shipped configured in the rack?	DP Interconnect PDUs have been designed and tested to withstand the rigors of configured shipment in the rack. Many alternative products have plastic components that may not survive transit outside their carefully packaged boxes.

Product specifications

This section details the PDU models used in the North Americas marketplace. Countries where this standard is common are: United States, Canada, Japan, Saudi Arabia, Taiwan, Philippines. It is common in these countries to see power rated at 100-127V or 200-208V.

Americas Rack PDU models

Model	DPI 100-127V Rack PDU	DPI Universal Rack PDU
Part number(s)	32P1761 with fixed NEMA L5-15 line	32P1736 - US line cords (NEMA L5-20 and L6-20) 32P1745 - Brazilian line cord (NBR 6147) 32P1747 - Argentinian line cord (IRAM 2073)
Form factor	Units are 1U high, half-rack width, and can be mounted alone or in combination.	
Description	Six-outlet, low-voltage-only (100-127V) PDU with NEMA 5-15 outlets	Seven-outlet 100-240V PDU with IEC320 C13 outlets.
Capacity Low voltage High voltage	Up to 1524W @ 127V N/A	Up to 1905W @ 127V Up to 3120W @ 208V
Support	ServerProven support for Netfinity™ and xSeries® servers and options	
Input	Fixed line cord, NEMA L5-15 connector (2.5m)	IEC 320 C20 input connector along with 4.3m country-specific line cord (see above)
Power source	100-127Vac, 50/60Hz	100-240Vac, 50/60Hz
Mounting option	Hardware included for both EIA mounting and side pocket mounting; both installations are approved for reconfigured shipment in an IBM rack	
Protection	15amp dual pole circuit breaker	15amp dual pole circuit breaker
Dimensions	41.50x222.5x114.5mm 1.63x8.76x4.51"	41.50x222.5x114.5mm 1.63x8.76x4.51"
Warranty[1]	Three-year limited onsite warranty when installed in an IBM Rack	

Americas Front-end PDU models

Model	DPI 30amp/125V Front-end PDU with NEMA L5-30 line	DPI 30amp/250V Front-end PDU with NEMA L6-30 line	DPI 60amp/250V Front-end PDU with IEC 309 2P+G
Part number	32P1751	32P1766	32P1767
Form factor	Units are 1U high, half-rack width, and can be mounted alone or in combination.		
Description	Single-phase, low-voltage 30amp front-end PDU with three IEC 320 C19 outlets	Single-phase, high-voltage 30amp front-end PDU with three IEC 320 C19 outlets	Single-phase, high-voltage 60amp front -end PDU with three IEC 320 C19 outlets
Capacity Low voltage High voltage	Up to 3048W @ 127V N/A	N/A Up to 4992W @ 208V	N/A Up to 9360W @ 208V
Support	ServerProven support for Netfinity and xSeries® servers and options		
Line cord	NEMA L5-30 (2.5m)	NEMA L6-30 (2.5m)	IEC 309 60amp 2P+G (2.5m)
Power source	100-127Vac, 50/60 Hz	200-208Vac, 50/60 Hz	200-208Vac, 50/60 Hz
Mounting option	Units come with side wall mounting hardware only; however, FE PDUs can be mounted in the EIA space using the rack PDU hardware. Front-end PDUs only support reconfigured shipment in side panel.		
Protection	Non-replaceable fuse included with each outlet circuit for protection		
Dimensions	41.5x225.5x222.5mm 1.63x8.76x8.76"	41.5x225.5x222.5mm 1.63x8.76x8.76"	41.5x225.5x222.5mm 1.63x8.76x8.76"
Warranty[1]	Three-year limited onsite warranty when installed in an IBM Rack		

Americas High Density PDU models

Model	DPI High Density 60A Single Phase	DPI High Density 60A Three Phase
Part number(s)	73P5855	73P5847
Form factor	Units are 1U high, full-rack width, and can be mounted in EIA space of side panel	
Description	Twelve-outlet 200-208V PDU with IEC C19 outlets	Twelve-outlet 200-208V PDU with IEC320 C19 outlets.
Capacity	Up to 9984W @208V	Up to 17097W @ 208V
Support	ServerProven support for Netfinity™ and xSeries® servers and options	
Input	Fixed line cord, IEC 309 2P+G connector (4.3m)	Fixed line cord, IEC 309 3P+G connector (4.3m)
Power source	200-208Vac, 50/60Hz	200-208Vac, 50/60Hz
Mounting option	Hardware included for both EIA mounting and side pocket mounting; both installations are approved for reconfigured shipment in an IBM rack	
Protection	15amp push button circuit breaker/outlet	15amp push button circuit breaker/outlet
Dimensions	41.5x450x213mm 1.70x17.7x8.4"	41.5x450x213mm 1.70x17.7x8.4"
Warranty[1]	Three-year limited onsite warranty when installed in an IBM Rack	

Americas Enterprise PDU models

Model	DPI 30amp/208V Enterprise PDU with NEMA L6-30 line	DPI 60amp/208V Enterprise PDU with IEC 309 2P+G line	DPI 60amp/208V Enterprise PDU with IEC 309 3P+G
Part number	26K4246	26K4242	26K4244
Form factor	Units are 1U high, full-rack width, and can be mounted in EIA space of side panel		
Description	Single-phase, high-voltage 30amp enterprise PDU with twelve IEC 320 C13 outlets	Single-phase, high-voltage 60amp enterprise PDU with twelve IEC 320 C13 outlets	Three-phase, high-voltage 60amp enterprise PDU with twelve IEC 320 C13 outlets
Capacity Low voltage High voltage	N/A Up to 4992W @ 208V	N/A Up to 9984W @ 208V	N/A Up to 17313W @ 208V
Support	ServerProven support for Netfinity and xSeries® servers and options		
Line cord	NEMA L6-30 (2.5m)	IEC 309 60amp 2P+G (2.5m)	Fixed line cord IEC 309 60amp 3P+G (2.5m)
Power source	200-208Vac, 50/60 Hz	200-208Vac, 50/60 Hz	200-208Vac, 50/60 Hz
Mounting option	Hardware included for both EIA mounting and side pocket mounting; both installations are approved for reconfigured shipment in an IBM rack		
Protection	20amp switch breaker/ pair of outlet		
Dimensions	41.5x450.5x213mm 1.70x17.7x8.4"	41.5x450.5x213mm 1.70x17.7x8.4"	41.5x450.5x213mm 1.70x17.7x8.4"
Warranty[1]	Three-year limited onsite warranty when installed in an IBM Rack		

Model	DPI 60amp/208V Enterprise PDU with IEC 309 2P+G line cord	DPI 60amp/208V Enterprise PDU with IEC 309 3P+G line cord
Part number(s)	26K4256	26K4258
Form factor	Units are 1U high, full-rack width, and can be mounted in EIA space of side panel	
Description	Single-phase, high voltage 60amp enterprise PDU with six IEC 320 C19 outlets	Three-phase, high voltage 60amp enterprise PDU with six IEC 320 C19 outlets
Capacity Low voltage High voltage	N/A Up to 9984W @ 208V	N/A Up to 17313W @ 208V
Support	ServerProven support for Netfinity™ and xSeries® servers and options	
Input	IEC 309 60amp 2P+G (2.5m)	IEC 309 60amp 3P+G (2.5m)
Power source	200-208Vac, 50/60Hz	200-208Vac, 50/60Hz
Mounting option	Hardware included for both EIA mounting and side pocket mounting; both installations are approved for reconfigured shipment in an IBM Rack	
Protection	20amp switch breaker/ outlet	20amp switch breaker/ outlet
Dimensions	41.50x450.5x213mm 1.70x17.7x8.4"	41.50x450.5x213mm 1.70x17.7x8.4"

Smarter power delivery

Warranty[1]	Three-year limited onsite warranty when installed in an IBM Rack

This section details the PDU models used in the World Trade marketplace. This standard covers most of the rest of the world. It is common in these environments to see power listed as 220-240V.

EMEA and AP Rack and Front-end PDU models

Model	DPI Universal Rack PDU	DPI 32amp/250V Front-end PDU with IEC 309 P+N+G	DPI 63amp/250V Front-end PDU with IEC 309 P+N+G
Part number	32P1736-US style (NEMA L5-20P and L6-20P) 32P1737 - Europe (CEE7-VII) 32P1738 - Denmark (IEC309 2P+Gnd) 32P1739 - Israel (SI 32) 32P1740 - Italy (CEI 23-16) 32P1741 - S. Africa (SABS 164) 32P1742 - UK (BS 1363/A) 32P1743 - Australia/ N. Zealand (AS/NZ 3112) 32P1744 - China (BG 2099.1) 32P1746 - India (IS6538)	32P1752	32P1754
Form factor	Units are 1U high, half-rack width, and can be mounted alone or in combination.		
Description	Seven-outlet 100-240V PDU with IEC320 C13 outlets	Single-phase, 32amp front-end PDU with three IEC 320 C19 outlets	Single-phase, 63amp front-end PDU with three IEC 320 C19 outlets
Capacity 220V 240V	Up to 3,300W Up to 3,600W	Up to 7,040W Up to 7,680W	Up to 9,900W Up to 10,800W
Support	ServerProven support for Netfinity™ and xSeries® servers and options		
Line cord	IEC 309 C20 input connector along with 2.5m country-specific line cord (see above)	IEC 309 32amp P+N+G (2.5m)	IEC 309 63amp P+N+G (2.5m)
Power Source	220-240Vac, 50/60Hz	220-240Vac, 50/60Hz	220-240Vac, 50/60Hz
Mounting option	Included hardware supports EIA and side pocket mounting. Supports configured shipment in an IBM Rack.	Included hardware supports side wall mounting. Units can also be mounted on EIA mounting bracket included with Rack PDU. Configured shipment supported in rack side panel only.	
Protection	15amp dual pole circuit breaker	Non-replaceable fuse included with each outlet circuit for protection	Non-replaceable fuse included with each outlet circuit for protection
Dimensions	41.50x225.5x114.5mm 1.63x8.76x4.51"	41.50x225.5x225mm 1.63x8.76x8.76"	41.50x225.5x225.5mm 1.63x 8.76x 8.76"
Warranty[1]	Three-year limited onsite warranty when installed in an IBM Rack		

EMEA and AP High Density PDUs

Model	DPI High Density 63A Single Phase	DPI High Density 32A Three Phase
Part number(s)	73P5856	73P5844
Form factor	Units are 1U high, full-rack width, and can be mounted in EIA space or side panel	
Description	Twelve-outlet 220-240V PDU with IEC C19 outlets	Twelve-outlet 220-240V PDU with IEC320 C19 outlets.
Capacity	Up to 14490W @230V	Up to 22080W @ 230V
Support	ServerProven support for Netfinity™ and xSeries® servers and options	
Input	Fixed line cord, IEC 309 P+N+G connector (4.3m)	Fixed line cord, IEC 309 3P+N+G connector (4.3m)
Power source	220-240Vac, 50/60Hz input	380-415Vac, 50/60Hz input; 220-240V output

Mounting option	Hardware included for both EIA mounting and side pocket mounting; both installations are approved for reconfigured shipment in an IBM rack	
Protection	15amp push button circuit breaker/outlet	15amp push button circuit breaker/outlet
Dimensions	41.5x450x213mm 1.70x17.7x8.4"	41.5x450x213mm 1.70x17.7x8.4"
Warranty[1]	Three-year limited onsite warranty when installed in an IBM Rack	

EMEA, AP and LA Enterprise PDU models

Model	DPI 32amp/250V Enterprise PDU with IEC309 P+N+G line	DPI 63amp/250V Enterprise PDU with IEC 309 P+N+G line	DPI 32amp/250V Enterprise PDU with IEC 309 3P+N+G
Part number	26K4241	26K4243	26K4245
Form factor	Units are 1U high, full-rack width, and can be mounted in EIA space of side panel		
Description	Single-phase, high-voltage 32amp enterprise PDU with twelve IEC 320 C13 outlets	Single-phase, high-voltage 63amp enterprise PDU with twelve IEC 320 C13 outlets	Three-phase, high-voltage 32amp enterprise PDU with twelve IEC 320 C13 outlets
Capacity 220V 230V 240V	7040W 7360W 7680W	13860W 14490W 15120W	21120W 22080W 23040W
Support	ServerProven support for Netfinity and xSeries® servers and options		
Line cord	IEC 309 32amp P+N+G (2.5m)	IEC 309 63amp P+N+G (2.5m)	IEC 309 32amp 3P+N+G (2.5m)
Power source	220-240Vac, 50/60 Hz	220-240Vac, 50/60 Hz	220-240Vac, 50/60 Hz
Mounting option	Hardware included for both EIA mounting and side pocket mounting; both installations are approved for reconfigured shipment in an IBM rack		
Protection	20amp switch breaker/ pair of outlet		
Dimensions	41.5x450.5x213mm 1.70x17.7x8.4"	41.5x450.5x213mm 1.70x17.7x8.4"	41.5x450.5x213mm 1.70x17.7x8.4"
Warranty[1]	Three-year limited onsite warranty when installed in an IBM Rack		

Model	DPI Enterprise 63A Single Phase	DPI Enterprise 32A Three Phase
Part number(s)	26K4257	26K4259
Form factor	Units are 1U high, full-rack width, and can be mounted in EIA space or side panel	
Description	220-240V PDU with six IEC C19 outlets	220-240V PDU with six IEC320 C19 outlets.
Capacity 220V 230V 240V	9900W 10350W 10800W	21120W 22080W 23040W
Support	ServerProven support for Netfinity™ and xSeries® servers and options	
Input	IEC 309 63amp P+N+G connector (4.3m)	IEC 309 32amp 3P+N+G wye connector (4.3m)
Power source	220-240Vac, 50/60Hz input	380-415Vac, 50/60Hz input; 220-240V output
Mounting option	Hardware included for both EIA mounting and side pocket mounting; both installations are approved for reconfigured shipment in an IBM rack	
Protection	20amp switch breaker/ outlet	15amp push button circuit breaker/outlet
Dimensions	41.5x450x213mm 1.70x17.7x8.4"	41.5x450x213mm 1.70x17.7x8.4"
Warranty[1]	Three-year limited onsite warranty when installed in an IBM Rack	

Line cord description reference

Model	Part number	Description	Line cord	Availability by country
DPI NEMA Rack PDU	32P1761	DPI 100-127V Rack PDU with Fixed NEMA L5-15P line cord	Fixed-line NEMA L5-15P	US, Canada, Mexico, Japan, Taiwan, Philippines
DPI Universal	32P1736	DPI Universal Rack PDU with NEMA L5-20P & L6-20P US line cords	IEC C19 to NEMA L5-20 and IEC C19 to L6-20	US, Canada, Mexico, Japan,

Smarter power delivery

Model	Part number	Description	Line cord	Availability by country
Rack PDU				Taiwan, Philippines, Saudi
	32P1737	DPI Universal Rack PDU with CEE7-VII Europe line cord	IEC C19 to CEE7-VII	Europe
	32P1738	DPI Universal Rack PDU with IEC 309 16A P+N+G Denmark line cord	IEC C19 to IEC 309 16amp P+N+G	Denmark, Switzerland
	32P1739	DPI Universal Rack PDU with SI 32 Israel line cord	IEC C19 to SI 32	Israel
	32P1740	DPI Universal Rack PDU with CEI 23-16 Italy line cord	IEC C19 to CEI 23-16	Italy
	32P1741	DPI Universal Rack PDU with SABS 164 South Africa line cord	IEC C19 to SABS 164	South Africa
	32P1742	DPI Universal Rack PDU with BS 1363/A UK line cord	IEC C19 to BS 1363/A	UK, Hong Kong
	32P1743	DPI Universal Rack PDU with AS/NZ 3112 Australia/NZ line cord	IEC C19 to AS/NZ 3112	Australia, New Zealand,
	32P1744	DPI Universal Rack PDU with GB 2099.1 China line cord	IEC C19 to GB 2099.1	China
	32P1745	DPI Universal Rack PDU with NBR 6147 Brazil line cord	IEC C19 to NBR 6147	Brazil
	32P1746	DPI Universal Rack PDU with IS6538 India line cord	IEC C19 to IS6538	India
	32P1747	DPI Universal Rack PDU with IRAM 2073 Argentina line cord	IEC C19 to IRAM 2073	Argentina, Uruguay, Paraguay

Model	Part number	Description	Line cord	Availability by country
DPI Front-end PDU	32P1751	DPI 30amp Front-end PDU with NEMA L5-30P (127V) Americas line cord	Burndy to NEMA 30A L5-30P (127V)	US, Canada, Mexico, Japan, Taiwan, Philippines
	32P1752	DPI 32amp Front-end PDU with IEC 309 32A P+N+G (250V) EMEA line cord	Burndy to IEC 309 32A P+N+G (250V)	All of EMEA, all HV AP
	32P1754	DPI 63amp Front-end PDU with IEC 309 63A P+N+G (250V) EMEA line cord	Burndy to IEC 309 63A P+N+G (250V)	All of EMEA, all HV AP
	32P1766	DPI 30amp Front-end PDU with NEMA 30A L6-30P (208V) line cord	Burndy to NEMA 30A L6-30P (208V)	US, Canada, Mexico, Japan, Taiwan, Philippines
	32P1767	DPI 60amp Front-end PDU with IEC 309 60A 2P+Gnd (250V) line cord	Burndy to IEC 309 60A 2P+Gnd (250V)	US, Canada, Mexico, Japan, Taiwan, Philippines
DPI High Density PDU	73P5844	DPI High Density 32A three phase PDU with IEC320 C19 outlets	Fixed line cord. IEC309 32A 3P+N+G	All of EMEA, all HV AP
	73P5856	DPI High Density 63A single phase PDU with IEC320 C19 outlets	Fixed line cord. IEC309 63A P+N+G	All of EMEA, all HV AP
	73P5847	DPI High Density 60A three phase PDU with IEC320 C19 outlets	Fixed line cord. IEC309 3P+G	US, Canada, Mexico, Japan, Taiwan, Philippines
	73P5855	DPI High Density 60A single phase PDU with IEC320 C19 outlets	Fixed line cord. IEC309 2P+G	US, Canada, Mexico, Japan, Taiwan, Philippines

Enterprise PDU	26K4241	DPI 32A 1Phase C13 Enterprise PDU	Burndy to IEC309 P+N+G (250V)	Used in EMEA and most of AP
	26K4243	DPI 63A1Phase C13 Enterprise PDU	Burndy to IEC309 P+N+G (250V)	Used in EMEA and most of AP
	26K4245	DPI 32A 3Phase C13 Enterprise PDU	Burndy to IEC309 3P+N+G (250V)	Used in EMEA and most of AP
	26K4257	DPI 63A 1Phase C19 Enterprise PDU	Burndy to IEC309 P+N+G (250V)	Used in EMEA and most of AP
	26K4259	DPI 32A 3Phase C19 Enterprise PDU	Burndy to IEC309 3P+N+G (250V)	Used in EMEA and most of AP
	26K4242	DPI 60A 1Phase C13 Enterprise PDU	Burndy to IEC309 2P+G (208V)	Used mainly in Americas an APJ
	26K4244	DPI 60A 3Phase C13 Enterprise PDU	Burndy to IEC309 3P+G (208V)	Used mainly in Americas an APJ
	26K4246	DPI 30A 1Phase C13 Enterprise PDU	Burndy to Nema L6-30P (208V)	Used mainly in Americas an APJ
	26K4256	DPI 60A 1Phase C19 Enterprise PDU	Burndy to IEC309 2P+G (208V)	Used mainly in Americas an APJ
	26K4258	DPI 60A 3Phase C19 Enterprise PDU	Burndy to IEC309 3P+G (208V)	Used mainly in Americas an APJ

Sizing and configuring PDU solutions

Step 1:
Identify the devices contained in the rack configuration

Step 2:
Sum the total load (watts) and total outlet requirements of all devices in the configuration.

Step 3:
Begin adding servers to the chosen PDU until you reach the total load of the PDU. It is critical that you not exceed the amperage of the breaker or fuse on the PDU or the outlet.

Server	# Power Cords (Std/Max)	Watt Load (Typ/Max)[1]
xSeries 206	1/1	340/485
xSeries 226 (single power supply)	1/1	495/707
xSeries 226 (redundant power supplies)	2/2	480/685
xSeries 236	1/2	625/893
xSeries 255 (two power supplies)	2/2	370/530
xSeries 255 (four power supplies)	2/2	530/1000
xSeries 306	1/1	340/430
xSeries 336	1/2	385/550
xSeries 346	1/2	581/830
xSeries 365	1/2	770/1100
xSeries 445	2/2	800/950
xSeries 455	1/2	800/950
xSeries 326	1/1	400/587
BladeCenter™ (two 2000W power supplies)	2/4	1855/2650
BladeCenter (four 2000W power supplies)	4/4	3710/5300
Other Devices		
RXE-100 (8684-1RX)	2/2	260/370
EXP400 Storage Expansion Unit (17331RU)	2/2	310/440
DS4100 Disk System (1724100)	2/2	275/390
DS4300 Disk System (172260U)	2/2	390/557
DS4400 Disk System (17421RU)	2/2	275/390
DS4500 Disk System (174290U)	2/2	275/390
DS4000 EXP100 Storage Expansion Unit (171010U)	2/2	245/350
SAN Fibre Channel Switch, 8-port (2109S08)	1/2	n/a /200
SAN Fibre Channel Switch, 16-port (2109S16, 2109F16)	1/2	n/a /200
TotalStorage SAN Switch F08, 8-port (3534F08)	1/1	n/a /50
SAN Data Gateway Router UltraSCSI LVD Port (2108R3L)	1/1	n/a /90
DLT Tape Autoloader and Library (3502)	1/1	n/a /135
Magstar® MP 3570 Tape Subsystem (C2x)	1/1	140/200
NetMEDIA Storage Expansion Unit EL (3551)	2/2	130/185
3600 Series Tape Autoloader and Library (3600xxx)	1/1	500/700
NetBAY Tape Enclosure (003B0X)	1/1	320/457
SDLT/LTO Modular Tape Library (4560SLX)	1/1	300/430

Installation and use of IBM PDUs

Customers must connect the plug on the power cord that comes with the Front-end PDU to a properly wired and grounded outlet. Below is a quick guide to the plug types you might encounter while installing the IBM PDUs. The chart below details the plug style on each PDU along with it's mating receptacle.

Electrical information: Guidelines for mating plugs and receptacles

More details are provided below for the 32A three phase and the 60amp products to assist you in choosing the right connector type.

Front-end PDU	Plug	Outlet
30amp/125V Front-end PDU with NEMA L5-30P connector		
30amp/250V Front-end PDU with NEMA L6-30P connector		
32amp/250V Front-end PDU with IEC 309 P+N+G connector		

Application for 63A single phase product
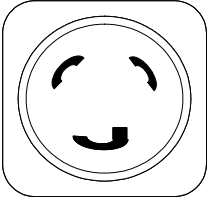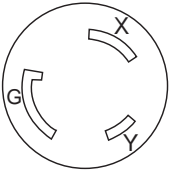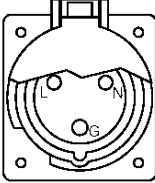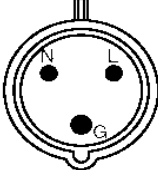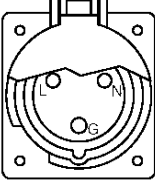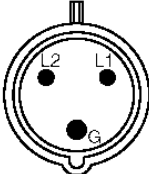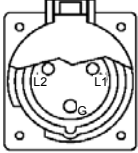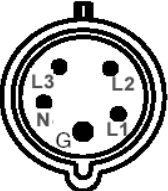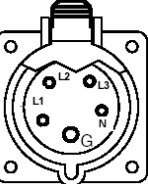
Part number: 32P1754, 73P5856, 26K4243, 26K4257

Part number: 32P1767, 73P5855, 26K4242, 26K4256
Note: North America customers plug is rated at 63A. UL rated for use at 60A as well.

Application for 32A three phase

Part number: 73P5844, 26K4245, 26K4259

Application for 60A three phase

|	Plug	Outlet
63amp single phase, IEC309, 250V, 2 Pole, 3 Wire Grounding Receptacle listing 363R6W IP-67 Hubbell Receptacle P/N HBL363R6W		
60amp single phase, IEC309, 250V, 2P+Gnd connector Receptacle listing 360R6W IP-67 Hubbell Receptacle P/N HBL360R6W		
32amp three phase, IEC309, 380-415V, 4pole, 5wire Grounding Receptacle listing 532R6W IP-67 Receptacle listing HBL532R6W		

Smarter power delivery

| Part number: 73P5847, 26K4244, 26K4258 | 60amp three phase, IEC309, 250V, 3pole, 4wire Grounding

Receptacle listing 460C9W IP-67

HUBBELL Receptacle P/N HBL460C9W | |
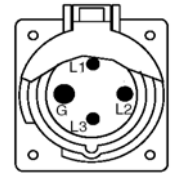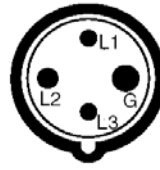
Installation options in IBM rack models

IBM DPI PDUs are part of the IBM family of rack-based products. They are designed to easily install and work within IBM rack offerings. To gain a better understanding of the NetBAY rack family of products and the benefits they offer, please see the "Decision makers' guide to IBM Rack/Stack/Power Solutions" , available on the IBM @server xSeries rack and rack solutions Web page at http://www-1.ibm.com/servers/eserver/xseries/storage/rack.html

DPI PDUs are designed to be mounted in any EIA-standard rack offering, but given the diversity of rack designs, many of the benefits for flexible mounting do not apply to non-IBM racks. For even more detailed information on the installation and maintenance of the IBM family of PDUs, consult the Installation and Maintenance Guides for these products available on the ibm.com site.

Basic installation ideas

The DPI PDUs can be mounted in a variety of methods. The simplest is to mount these in the EIA space of the rack as shown here. Two Rack PDUs can be installed like this to make accessing the devices very easy. Many customers choose to mount PDUs this way for the serviceability benefits.
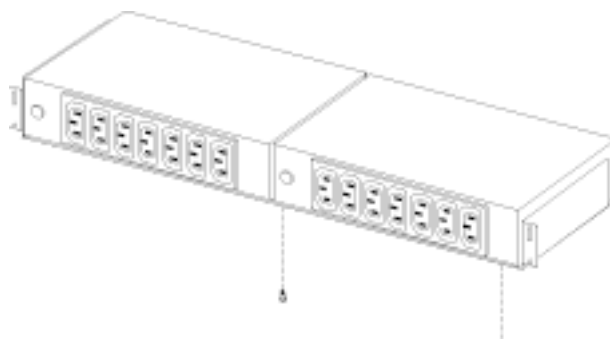
A more space-efficient method for mounting the PDUs is to install them in the side pockets of the rack. The following examples can be accomplished using the standard hardware provided with the PDUs. Each of these "nested" configurations can be placed in a variety of ways in the different NetBAY racks.
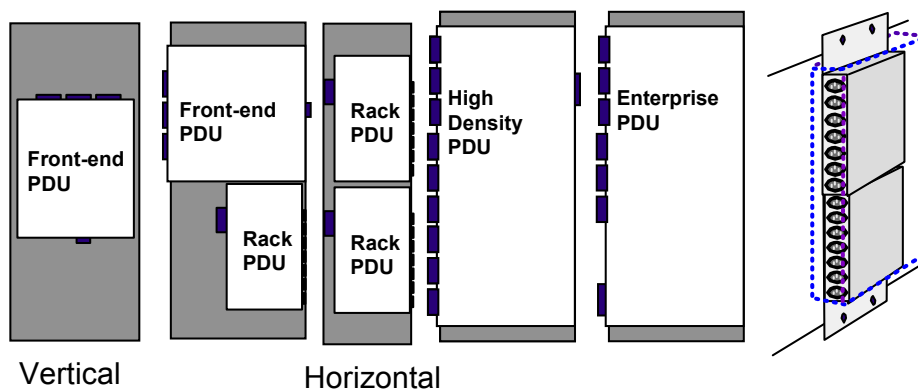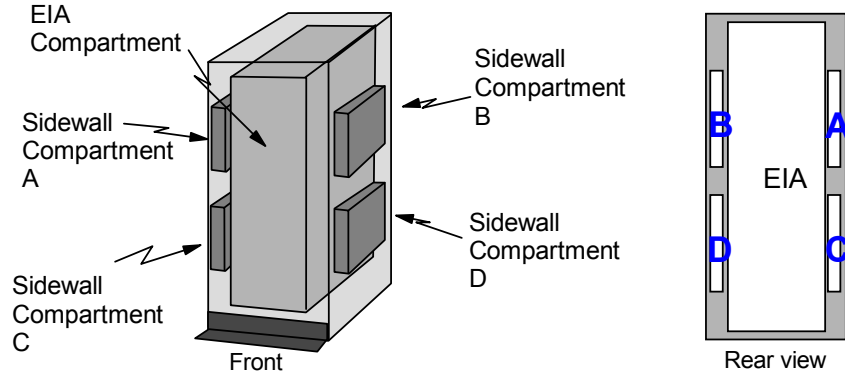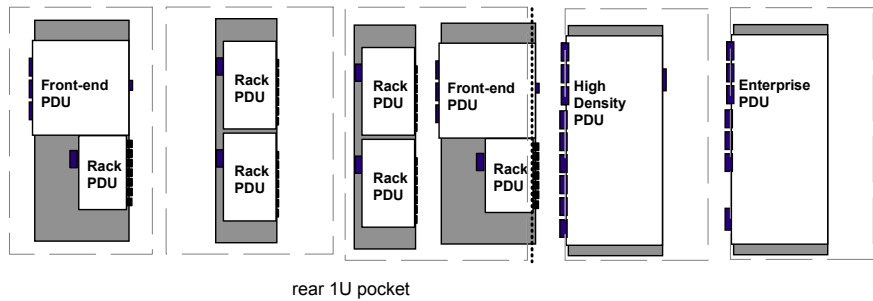

Vertical   Horizontal
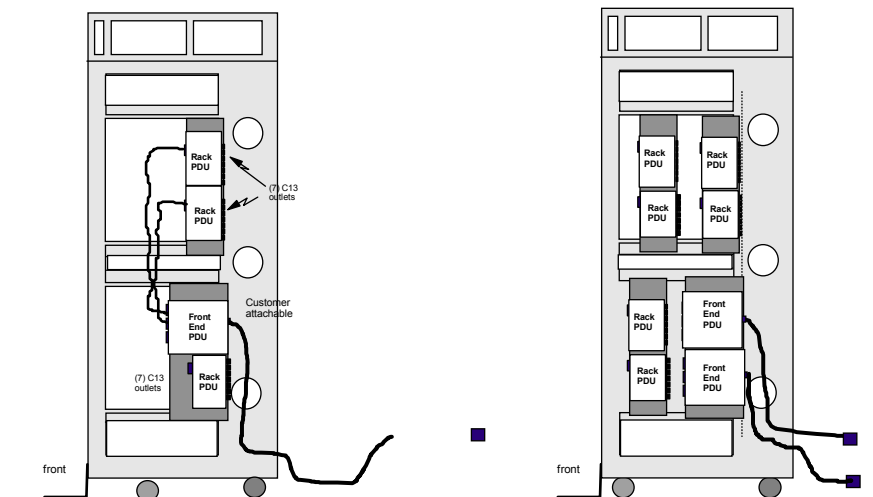
Enterprise Rack installation options

The IBM Enterprise Rack is the premier IBM rack, offering four deep side pockets that enable the greatest variety of side pocket mounting options. This flexibility is one of the major benefits of choosing this rack. Using all the available space in the side pockets of this rack enables customers to install up to 84 outlets in this rack without sacrificing any valuable "U" space. The picture below details these side pockets and provides a lettering guide to make explaining installation location easier.

EIA Compartment

Sidewall Compartment A

Sidewall Compartment C

Front

Sidewall Compartment B

Sidewall Compartment D

B   A

EIA

D   C

Rear view

The depth of these side pockets allows the PDUs to be nested side by side for support of large numbers of PDUs or KVM switches in the rack's pockets. Here are a few examples of the supported installations for the Enterprise Rack.

Front-end PDU

Rack PDU

Rack PDU

Rack PDU

Rack PDU

Rack PDU

Front-end PDU

Rack PDU

High Density PDU

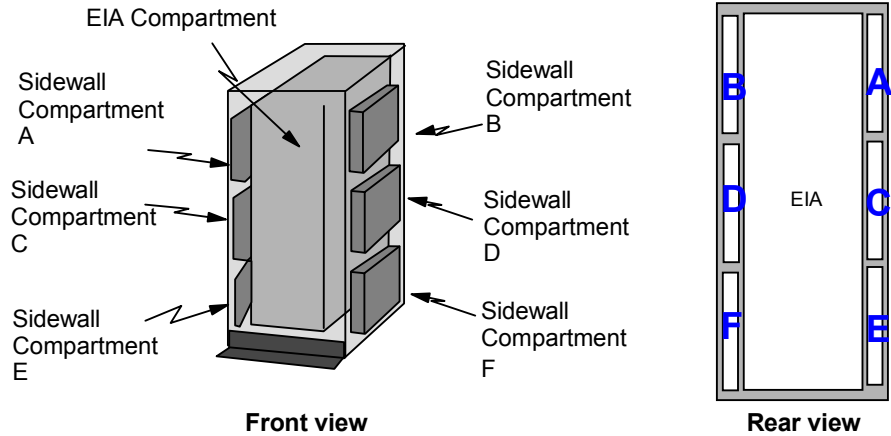Enterprise PDU

rear 1U pocket

The illustration below further clarifies how the rack looks once these PDUs are installed. These examples show how the pockets can be utilized in the Enterprise Rack. Notice the vertical placement option is not supported in this rack. One very nice feature of the Enterprise Rack is the fact that it has four 1U pockets that are accessible and visible from the rear of the rack. It is possible with the Enterprise Rack to install a pair of PDUs in these 1U pockets using the EIA mounting hardware- this yields easy access to the PDUs.
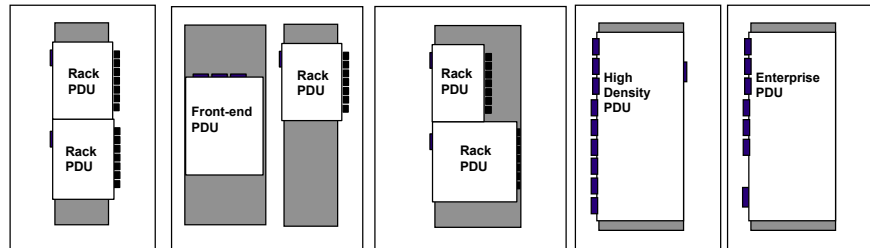
Rack PDU

Rack PDU

(7) C13 outlets

Customer attachable

Front End PDU

(7) C13 outlets

Rack PDU

front

Rack PDU

Rack PDU

Rack PDU

Rack PDU

Rack PDU

Rack PDU

Front End PDU

Front End PDU

front

IBM S2 Rack installation options

This entry rack offers six side panel pockets mounting locations. While it has more side pockets than the Enterprise Rack, the Standard Rack's pockets are much less deep and do not allow the variety of mounting options of the Enterprise Rack. Even so, customers can install up to 56 outlets in the Standard Rack without sacrificing any "U" space. Here is graphical depiction of the side pockets of the Standard Rack along with a lettering guide.

EIA Compartment

Sidewall Compartment A

Sidewall Compartment C

Sidewall Compartment E

Sidewall Compartment B

Sidewall Compartment D

Sidewall Compartment F

Front view

B **A**

D EIA **C**

F **E**

Rear view

Here are examples of accepted mounting configurations in a single IBM S2 Rack pocket. Up to four Front-end PDUs can be placed in the six pockets of the Standard rack.

Rack PDU

Rack PDU

Front-end PDU

Rack PDU

Rack PDU

Rack PDU

High Density PDU

Enterprise PDU

Sample configurations to help maximize uptime and availability

The pictures below detail ways to use PDUs to help maximize uptime and availability of your solution.

The first illustration shows the simplest configuration, with a Rack PDU plugged into a wall outlet or a Front-end PDU outlet. This simple topology provides non-protected, non-redundant power for up to seven devices.

Single Rack PDU

Rack PDU
7 outlets - C13
100-240Vac
15a

P D U

C13

(1)

Device / Unit
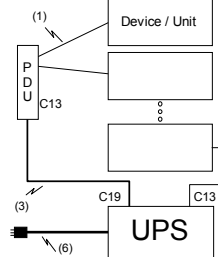
Power Supply

up to 7

(2)
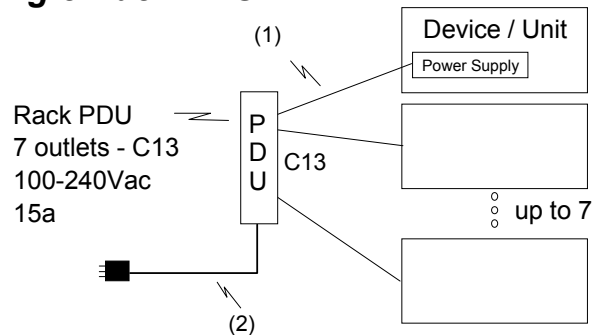
Addition of a second PDU to this yields redundancy back to the power source. With this topology, even if one power source is lost, the second power source and PDU are designed to power the load without bringing the solution down.

Redundant Power Distribution

(1)

P D U

Units with redundant p/s

o o o

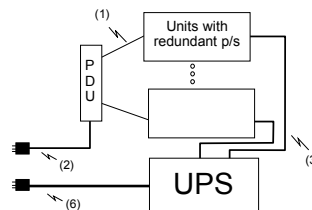Power Supply Power Supply

P D U

(2)
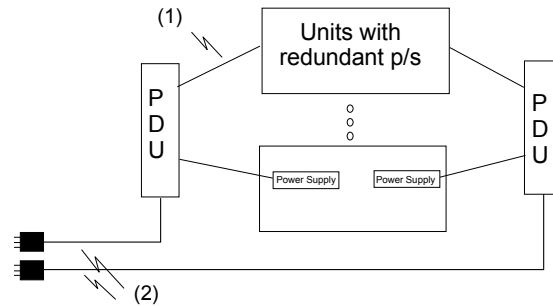
The last three topologies below go a long way in preventing the many types of power problems that effect equipment today. All these topologies involve the use of a UPS product to add power conditioning and battery backup in case of an outage. Notice how much better the load on these PDUs is protected when used in combination with the proper UPS.
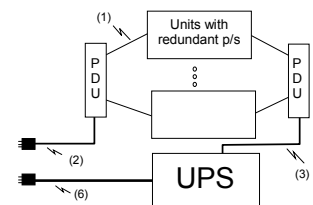
PDU used as UPS back-end

(1)

P D U

C13

Device / Unit

o o

(3)

C19   C13

UPS

(6)

Redundant Power Distribution with PDU and UPS

(1)

P D U

Units with redundant p/s

o o

(2)

(3)

(6)

UPS

Redundant Power Distribution with PDU and UPS with PDU

(1)

P D U

Units with redundant p/s

o o

P D U

(2)

(3)

(6)

UPS

xSeries Rack Configurator software

While this Guide provides a basic understanding of the way in which IBM DP Interconnect PDUs are used and installed, the complexity of today's power solutions and the variety of sizes, access options and cabling requirements of servers, accessories and storage components make configuring a complex networked system a challenge. A more detailed sizing tool is needed. The IBM @server xSeries Rack Configurator provides this functionality. It is an easy-to-use tool that helps you design the optimum layout. The configurator helps check, correct and report the following:

- Components by product number and position
- Infrastructure specifications, including weight, power, volt-amps (VA), heat (BTU/hr), bays, EIA, outlets and console ports
- Width and depth; front, rear and side clearances; total weight and top clearance
- Cables and connectors by component position

You can download the configurator software from http://www-1.ibm.com/servers/eserver/xseries/storage/rack.html. The configurator is a good source of accurate information on designing a redundant, reliable power distribution topology. Individual User and Installation Guides also provide detailed information on the use and mounting of for DPI PDU products. These are available from the IBM Web site above.

Country-specific considerations

To accommodate a wide variety of country-specific power systems, line cords and wiring rules, IBM offers a large number of PDU options. This section will provide basic detail of what each of these country-specific PDU options are and how they would be used. For more details, contact your local IBM representative.

North America, Japan, Taiwan, Philippines, Saudi Arabia

Power Cables:

(1) Device to Rack PDU power cable
IEC C13 to C14, 10/15a cable
typical: 36L8886 (2.8m)
requirement: C14 plug, long enough to reach
available option: 94G7448 (14ft)
(2) Rack PDU to wall line cord
IEC C19 to country-specific connector, 16/20a, 14ft (4.3m)
(3) Rack PDU to UPS power cable
IEC C19 to C20, 16/20a
00N7700 (2m)
provided with UPS and Rack PDUs
(4) Rack PDU to Front-end PDU power cable
IEC C19 to C20, 16/20a
00N7698 (1m) provided with the NetBAY Front-end PDUs
00N7700 (2m) provided with the DPI Rack
(5) Front-end PDU to wall line cord
special to country-specific connector, 30/32a, 60/63a, 8.2ft (2.5m)
(7) Device to High Density PDU power cable
IEC C19 to C20, 16/20a, 2.5m
(8) High Density PDU to wall line cord
hardwired to country-specific connector, 60a, 8.2ft (4.3m)
(9) Device to FE- or HD-PDU power cable
IEC C13 to C20, 10/15a cable
option: 23K4809 9ft (2.8m)

(2) Line Cords: Rack PDU

(5) Line Cords: Front-end PDU

(8) Line Cords:High Density PDU

(6) C19 or (12) C13 Line Cords:Enterprise PDU

DPI PDUs

Rack PDUs

Part Number	Plug Type	Source Circuit (single phase 50/60Hz)	PDU Output (single phase 50/60Hz)
32P1761	NEMA L5-15P	100-127Vac, 15a	six 100-127Vac, NEMA 5-15R receptacles, shared 12a
32P1736	NEMA L5-20P	100-127Vac, 20a	seven 100-127Vac, shared 15a
	NEMA L6-20P	200-240Vac, 20a	seven 200-240Vac, shared 15a

Front-end PDUs

Part Number	Plug Type	Source Circuit (50/60Hz)	PDU Output (single phase 50/60Hz)
32P1751	NEMA L5-30P	100-127Vac, 30a, single-phase	three 100-127Vac, 20a each, shared 24a
32P1766	NEMA L6-30P	200-240Vac, 30a, single-phase line-to-line with ground	three 200-240Vac, 20a each, shared 24a
32P1767	IEC 309-2P+G	200-240Vac, 60a, single-phase line-to-line with ground	three 200-240Vac, 20a each, shared 48a

High Density PDUs

Part Number	Plug Type	Source Circuit (50/60Hz)	PDU Output (single phase 50/60Hz)
73P5855	IEC 309 2P+G	208Vac, 60a, single-phase dedicated circuit	twelve 208Vac, 16a each, shared 60a
73P5847	IEC 309 3P+G	208Vac, 60a, three-phase delta dedicated circuit	twelve 208Vac, 16a each, shared 27a per four outlet phase group

Enterprise PDUs

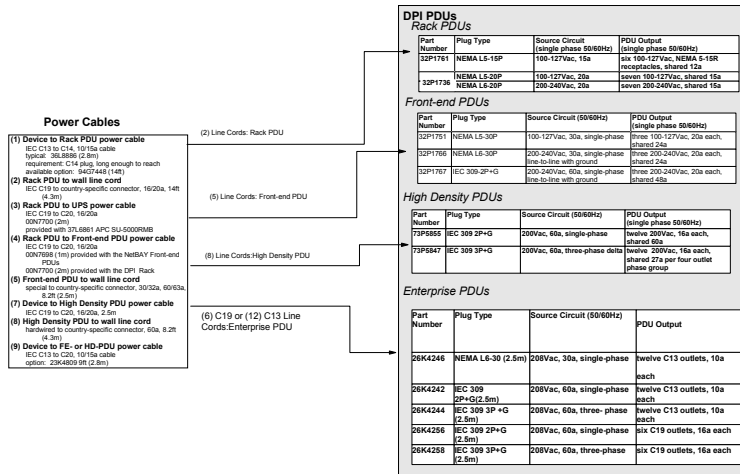| Part Number	Plug Type	Source Circuit (50/60Hz)	PDU Output
26K4246	NEMA L6-30 (2.5m)	208Vac, 30a, single-phase	twelve C13 outlets, 10a each
26K4242	IEC 309 2P+G(2.5m)	208Vac, 60a, single-phase	twelve C13 outlets, 10a each
26K4244	IEC 309 3P +G (2.5m)	208Vac, 60a, three- phase	twelve C13 outlets, 10a each
26K4256	IEC 309 2P+G (2.5m)	208Vac, 60a, single-phase	six C19 outlets, 16a each
26K4258	IEC 309 3P+G (2.5m)	208Vac, 60a, three-phase	six C19 outlets, 16a each

AP/EMEA and parts of Latin America

Power Cables:

(1) Device to Rack PDU power cable
IEC C13 to C14, 10/15a cable
typical: 36L8886 (2.8m)
requirement: C14 plug, long enough to reach
available option: 94G7448 (14ft)
(2) Rack PDU to wall line cord
IEC C19 to country-specific connector, 16/20a, 14ft (4.3m)
(3) Rack PDU to UPS power cable
IEC C19 to C20, 16/20a
00N7700 (2m)
provided with 37L6861 APC SU-5000RMB
(4) Rack PDU to Front-end PDU power cable
IEC C19 to C20, 16/20a
00N7698 (1m) provided with the NetBAY Front-end PDUs
00N7700 (2m) provided with the DPI Rack
(5) Front-end PDU to wall line cord
special to country-specific connector, 30/32a, 60/63a, 8.2ft (2.5m)
(7) Device to High Density PDU power cable
IEC C19 to C20, 16/20a, 2.5m
(8) High Density PDU to wall line cord
hardwired to country-specific connector, 60a, 8.2ft (4.3m)
(9) Device to FE- or HD-PDU power cable
IEC C13 to C20, 10/15a cable
option: 23K4809 9ft (2.8m)

(2) Line Cords: Rack PDUs

(5) Line Cords: Front-end PDUs

(8) Line Cords:High Density PDU

(12) C13 or (6) C19 Line Cords: Enterprise PDU

DPI PDUs

Rack PDUs

Part Number	Plug Type	Source Circuit (single phase 50/60Hz)	PDU Output (single phase 50/60Hz)
32P1761	NEMA L5-15P	100-127Vac, 15a	six 100-127Vac, NEMA 5-15R receptacles, shared 12a
32P1736	NEMA L5-20P	100-127Vac, 20a	seven 100-127Vac, shared 15a
	NEMA L6-20P	200-240Vac, 20a	
32P1737	CEE7-VII	220-240Vac, 16a	
32P1738	IEC 309-2P+Gnd	220-240Vac, 16a	
32P1739	SII 32	220-240Vac, 16a	seven 220-240Vac, shared 15a
32P1740	CEI 23-16	220-240Vac, 16a	
32P1741	SABS 164	220-240Vac, 16a	
32P1742	BS 1363/A	220-240Vac, 13a	seven 220-240Vac, shared 13a
32P1745	NBR 6147	100-127Vac, 15a	seven 100-127Vac, shared 15a
32P1747	IRAM 2073	220-240Vac, 15a	
32P1743	AS/NZ 3112	220-240Vac, 15a	
32P1744	GB 2099.1	220-240Vac, 15a	seven 220-240Vac, shared 15a
32P1746	IS6538	220-240Vac, 16a	

Front-end PDUs

Part Number	Plug Type	Source Circuit (50/60Hz)	PDU Output (single phase 50/60Hz)
32P1751	NEMA L5-30P	100-127Vac, 30a, single-phase	three 100-127Vac, 20a each, shared 24a
32P1766	NEMA L6-30P	200-240Vac, 30a, single-phase line-to-line with ground	three 200-240Vac, 20a each, shared 24a
32P1767	IEC 309-2P+G	200-240Vac, 60a, single-phase line-to-line with ground	three 200-240Vac, 20a each, shared 48a
32P1752	IEC 309-2P+G	220-240Vac, 32a, single-phase	three 220-240Vac, 16a each, shared 32a
32P1754	IEC 309-2P+G	220-240Vac, 63a, single-phase	three 220-240Vac, 16a each, shared 48a

High Density PDUs

Part Number	Plug Type	Source Circuit (50/60Hz)	PDU Output (single phase 50/60Hz)
73P5856	IEC 309 P+N+G	220-240Vac, 63a, single-phase	twelve 220-240Vac, 16a each, shared 63a
73P5844	IEC 309 3P+N+G	380-415Vac, 32a, three-phase wye	twelve 220-240Vac, 16a each, shared 32a per four outlet phase group

Enterprise PDUs

Part Number	Plug Type	Source Circuit	PDU Output
26K4241	IEC 309 P+N+G(2.5m)	220-240Vac, 32a, single-phase	twelve C13, 10a each
26K4243	IEC 309 P+N+G(2.5m)	220-240Vac, 63a, single-phase	twelve C13, 10a each
26K4245	IEC 309 3P+N+G (2.5m)	220-240Vac, 32a, three-phase	twelve C13, 10a each
26K4257	IEC 309 P+N+G (2.5m)	220-240Vac, 63a, single-phase	six C19 outlets, 16a each
26K4259	IEC 309 3P+N+G (2.5m)	380-415Vac,32a three-phase	six C19 outlets, 16a each

Japan

DPI PDUs
Rack PDUs

Part Number	Plug Type	Source Circuit (single phase 50/60Hz)	PDU Output (single phase 50/60Hz)
32P1761	NEMA L5-15P	100-127Vac, 15a	six 100-127Vac, NEMA 5-15R receptacles, shared 12a
	NEMA L5-20P	100-127Vac, 20a	seven 100-127Vac, shared 15a
32P1736	NEMA L6-20P	200-240Vac, 20a	seven 200-240Vac, shared 15a

Front-end PDUs

Part Number	Plug Type	Source Circuit (50/60Hz)	PDU Output (single phase 50/60Hz)
32P1751	NEMA L5-30P	100-127Vac, 30a, single-phase	three 100-127Vac, 20a each, shared 24a
32P1766	NEMA L6-30P	200-240Vac, 30a, single-phase line-to-line with ground	three 200-240Vac, 20a each, shared 24a
32P1767	IEC 309-2P+G	200-240Vac, 60a, single-phase line-to-line with ground	three 200-240Vac, 20a each, shared 48a

High Density PDUs

Part Number	Plug Type	Source Circuit (50/60Hz)	PDU Output (single phase 50/60Hz)
73P5855	IEC 309 2P+G	200Vac, 60a, single-phase	twelve 200Vac, 16a each, shared 60a
73P5847	IEC 309 3P+G	200Vac, 60a, three-phase delta	twelve 200Vac, 16a each, shared 27a per four outlet phase group

Enterprise PDUs

Part Number	Plug Type	Source Circuit (50/60Hz)	PDU Output
26K4246	NEMA L6-30 (2.5m)	208Vac, 30a, single-phase	twelve C13 outlets, 10a each
26K4242	IEC 309 2P+G(2.5m)	208Vac, 60a, single-phase	twelve C13 outlets, 10a each
26K4244	IEC 309 3P +G (2.5m)	208Vac, 60a, three- phase	twelve C13 outlets, 10a each
26K4256	IEC 309 2P+G (2.5m)	208Vac, 60a, single-phase	six C19 outlets, 16a each
26K4258	IEC 309 3P+G (2.5m)	208Vac, 60a, three-phase	six C19 outlets, 16a each

Power Cables

(1) **Device to Rack PDU power cable**
IEC C13 to C14, 10/15a cable
typical: 36L8886 (2.8m)
requirement: C14 plug long enough to reach
available option: 94G7448 (14ft)
(2) **Rack PDU to wall line cord**
IEC C19 to country-specific connector, 16/20a, 14ft
(4.3m)
(3) **Rack PDU to UPS power cable**
IEC C19 to C20, 16/20a
00N7700 (2m)
provided with 37L6861 APC SU-5000RMB
(4) **Rack PDU to Front-end PDU power cable**
IEC C19 to C20, 16/20a
00N7698 (1m) provided with the NetBAY Front-end PDUs
00N7700 (2m) provided with the DPI Rack PDUs
(5) **Front-end PDU to wall line cord**
special to country-specific connector, 30/32a, 60/63a,
8.2ft (2.5m)
(7) **Device to High Density PDU power cable**
IEC C19 to C20, 16/20a, 2.5m
(8) **High Density PDU to wall line cord**
hardwired to country-specific connector, 60a, 8.2ft
(4.3m)
(9) **Device to FE- or HD-PDU power cable**
IEC C13 to C20, 10/15a cable
option: 23K4809 9ft (2.8m)

(2) Line Cords: Rack PDU

(5) Line Cords: Front-end PDU

(8) Line Cords:High Density PDU

(6) C19 or (12) C13 Line Cords:Enterprise PDU

Preparing for the future

Road maps for Intel processors confirm that the trend of increasing power requirements and thermal output for servers is expected to continue in the short and long term. Therefore, it is critical that companies take this trend into consideration when making investments in data center infrastructure, including power service. Escalating power and thermal output requirements of Intel-based servers may soon approach levels traditionally seen in mainframes.

Here are a few points to consider moving forward:

- When designing new data centers, consider the addition of 60amp and 125amp service feeds in your plans. With continued growth in server power requirements, 60amp and even 125amp service feeds may become standard for data centers in the coming years. If 60amp is not currently needed, consider installing wiring that can handle a future upgrade to 60amp service.

- While not commonplace today, delta and wye power three-phase service may become much more widely used. A look into these power distribution systems now might be helpful. The IBM Three-phase Front-end PDU is a great way to help maximize power delivery to servers. IBM has plans for more three-phase products in the future to assist in this arena.

- The power requirements and thermal output of individual racks are rising and may be bumping the limits of today's cooling and power delivery. One must carefully consider how new equipment will be cooled and powered before introducing it into a data center.

- In the near future, traditional guidelines that state data center design should accommodate 50-75W per square foot may be inadequate. The requirement for 100-150W and greater per square foot may be on the horizon. Anyone considering a data center redesign should take this trend into consideration. For more information on thermal trends, consult the Uptime Institute's Web site at www.upsite.com/TUIpages/whitepapers/tuicooling.html.

- Customers in countries that can choose to use either a NEMA-style PDU or an IEC C13-based PDU may gain an advantage by making the move now to the IEC standard. The IBM IEC-based PDUs allow migration from low voltage to high, or single-phase to three-phase, simply by changing the front-end PDU used. This means you may have an easy way to scale up your power topology without completely replacing your investment in power distribution equipment.

- Customers who can choose between low voltage and high voltage should consider selecting high voltage whenever possible. Already, the amperage needed to run several of today's servers cannot be easily met with 100-127V power feeds. Many new servers may be high -voltage only or redundantly powered only at high voltage.

- When choosing PDUs, make sure you look to offerings that allow quick and easy scalability. The modular design of the IBM PDUs means that addition of outlets may be as simple as adding a single Rack PDU, eliminating the need for more wiring to the rack in many cases.

- Buying an all-IBM solution that includes IBM racks, rack options and PDUs may help ensure that your server investment is both easy to install and safe from power or thermal problems. As server installations grow in complexity, the decision of which rack products to buy becomes critical. Will a non-IBM rack handle the thermal loads you will require in the future? IBM rack products are tested to work with IBM servers and the cooling methodologies that they employ. Non-IBM racks may not meet these requirements. Will a non-IBM PDU be capable of both protecting and powering the servers of tomorrow? A lot of thought goes into how our PDUs fit into our server road map.

Additional resources

IBM @server xSeries Racks and rack options
http://www-1.ibm.com/servers/eserver/xseries/storage/rack.html

IBM @server xSeries Options
http://www-1.ibm.com/servers/eserver/xseries/already.html

IBM @server xSeries Rack Configurator
http://www-1.ibm.com/servers/eserver/xseries/library/configtools.html

IBM @server xSeries Configuration and Options Guide
http://www-1.ibm.com/servers/eserver/xseries/library/configtools/cog.html

Important notes and trademarks

Smarter power delivery