

# DELL™

## BEST PRACTICES GUIDE FOR RACK ENCLOSURES

A Dell Technical White Paper

### PE2420 & PE4220

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## Executive Summary

The Dell™ PowerEdge™ Rack Enclosures are offered in two sizes, 24U (2420) and 42U (4220). The Dell 2420 and 4220 Rack Enclosures are designed to hold and protect server, network, and data storage equipment. The Dell Rack Enclosure is a sturdy, practical design that is solidly built and delivered with Dell quality service, support, and reliability. The Dell 2420 and 4220 Rack Enclosure feature an array of enhancements over traditional cabinets to address critical power, cooling, and cabling issues of the datacenter. Dell 2420 and 4220 Rack Enclosures are designed to be used in any environment: a data center, a remote office, a wiring closet, or even a factory floor.

The Dell 2420 and 4220 Rack Enclosures are UL certified and adhere to the CEA-310-E standards for 19" rackmount equipment. Dell PowerEdge servers fit into these racks as do other important networking equipment including Dell PowerVault™, Dell EqualLogic and Dell EMC storage, PowerConnect™ or other networking equipment like routers, switches, and etc.

This document is intended only as a guide to some best practices when installing and using a Dell 2420 or 4220 Rack Enclosure. While not all deployment scenarios can be covered here, this document looks to provide guidance for some of the more common environments where Dell Rack Enclosures are used.

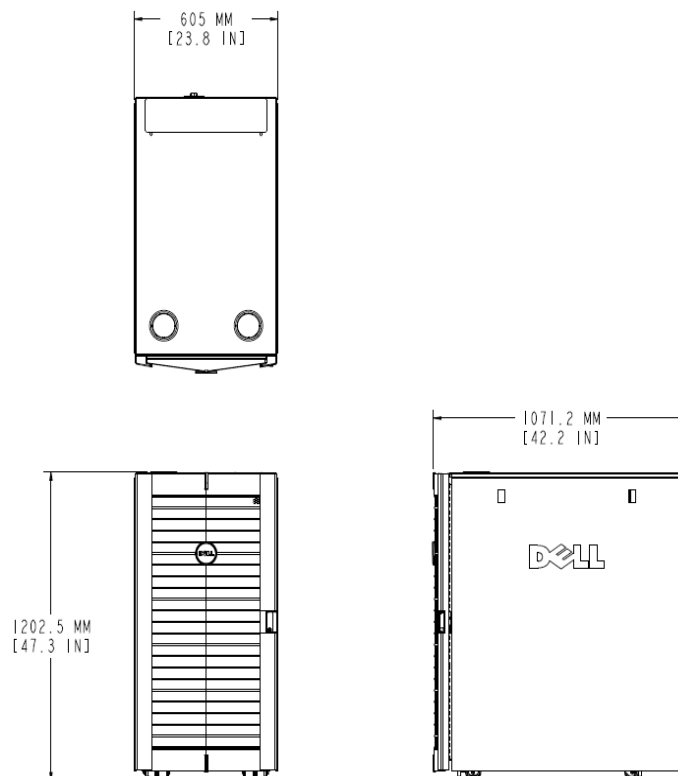
## Key Attributes

### Size

Dell 2420 and 4220 Rack Enclosures come in two key sizes to accommodate server mounting needs at both small office environments and in large scale data center installations.

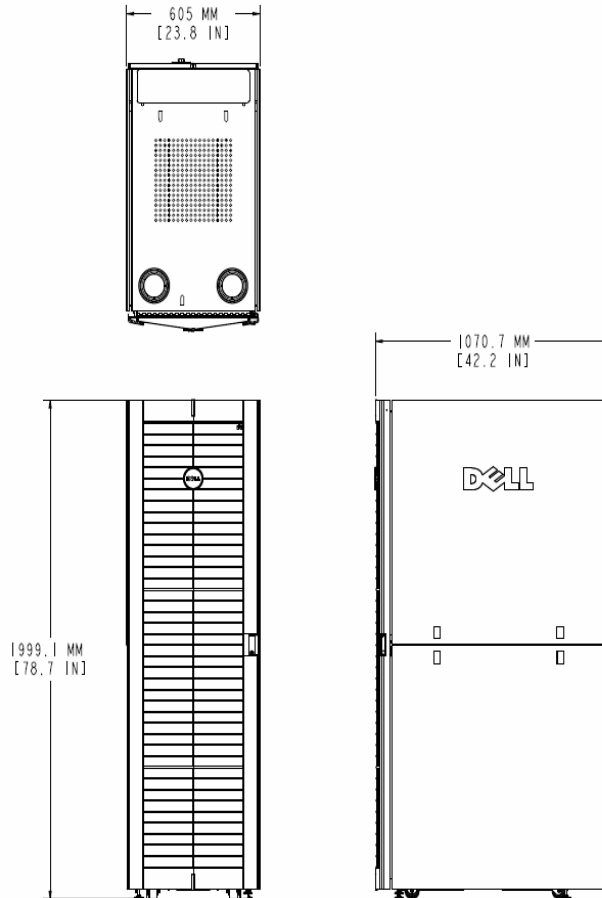
The 2420 Rack Enclosure is a 24U rack that has the following dimensions shown in Figure 1.

**Figure 1: Dell 2420 Rack Enclosure**



The 4220 Rack Enclosure is a 42U rack that has the following dimensions shown in Figure 2.

**Figure 2: Dell 4220 Rack Enclosure**



## Strength

The new Dell Rack Enclosures have increased static load capacity versus the previous generation of Dell Rack Enclosures. They have been upgraded with redesigned frame base members, stronger corner weld joints, better reinforced leveling feet, and new castor wheels made of nylon with higher impact strength over the previous version of castor wheels.

**Table 1. Rack Enclosure Load Capacities**

Rack Model	Static Load Capacity (Lbs)
2420	1500
4220	2500

## Cooling

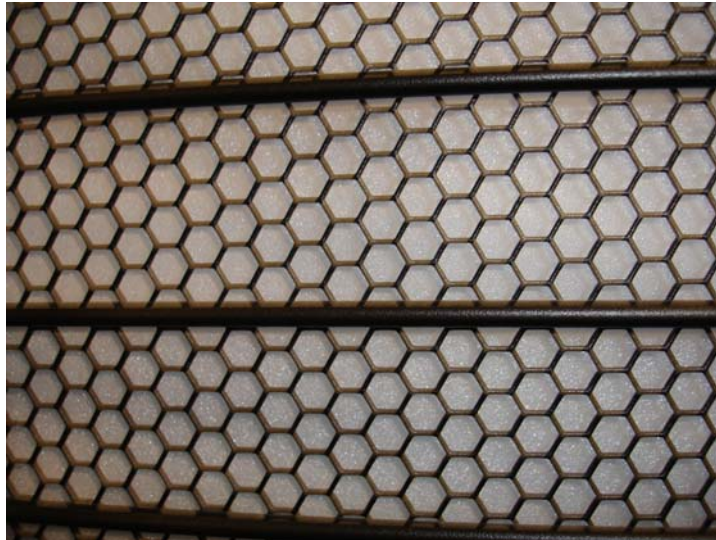
The Dell 2420 and 4220 Rack Enclosures have been designed to provide the necessary thermal environment to help reduce inefficiency at the rack level in cooling your rack mount equipment in the data center environment.

When it comes to cooling in the rack environment, the two key areas that need to be addressed are airflow into the rack and management of the hot air exhaust inside the rack.

The air intake into the rack enclosure is a function of how much cool air is presented to the rack and the amount of cool air that can make it through the perforations in the rack enclosure front door as well as how much hot air can be expelled through the perforations in the rear doors of the rack enclosure.

The door perforation design of the 2420 and 4220 Rack Enclosure front and rear doors provide 80% open area for greater airflow capability than many other comparable racks.

Figure 3: 80% Open Perforation on Front & Rear Doors



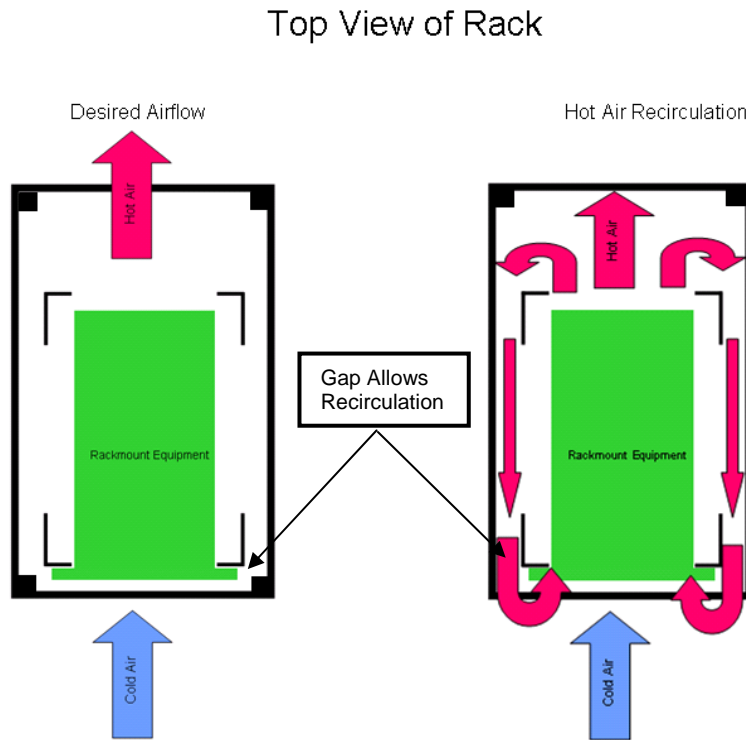
Although the size of perforations in the rack doors are not usually a key contributor to overheating in the rack and data center environment, a more open door perforation design ensures adequate airflow at the rack level.

Incorrect airflow management inside the rack enclosure can cause inefficiencies in cooling your rack mount equipment. In standard data center environments, IT equipment pulls cool air in through the front door of the rack enclosure and expels hot air through the rear of the system, and then through the rear doors of the rack. This cycle of air flow should be consistent and continuous.

Key to maintaining this airflow cycle is proper rack enclosure design and the use of best practices in configuring your rackmount equipment. The design of the rack should be such that the airflow path inside the rack does not allow hot air exhausting from the rear of systems to travel to the front of the equipment through the sides of the rack. When hot air exhaust travels to the front of the rack, it can enter rackmount equipment and disrupt the cooling cycle by introducing hot air into the systems, thereby decreasing the systems' efficiency. See Figure 4.

It should be noted that the rack fan kit available from Dell for legacy rack enclosures will also install into the 4220 Rack Enclosure.

**Figure 4: Rack Airflow**



The 2420 and 4220 are designed to prevent the return path for hot air exhaust from traveling to the front of the rack. The sides are sealed with side closeout panels. These panels overlap the front mounting rails such that even if you choose to move the front mounting rails back up to 2-1/4", the seal between the front mounting rail and the side closeout panels can still be maintained.

Another key best practice in managing rack level airflow is the usage of closeout panels to seal off all empty U-spaces. Any openings in the rack provide a path for hot air to travel through the rack to the front of systems. Ask your Dell TSR for assistance in purchasing closeout panels from Dell.

## Rack Installation

### Removal from Pallet

Before beginning the removal process, be sure there are roughly 2.7 meters (9 feet) of free space in front of the pallet to allow the rack to be rolled off the pallet.

It is important to minimize the distance that the rack has to be rolled to its final destination whenever possible. It's recommended that the rack be transported on its pallet as close as possible to its final location.

Also, it is important to survey the path the rack will be rolled across to make sure that any obstacles to a smooth transport have been identified and either avoided or addressed to minimize the impact. As an example, doorways shorter than 2.0 meters are too low to allow the 4220 Rack Enclosure to pass through. Plan for an alternate route, or make provisions for dealing with getting the rack through any short doorway in a suitable manner prior to moving the rack. Never tilt a rack with equipment installed.

When you're ready to remove the rack from the pallet, check the leveling feet inside the rack and be sure they are in the fully-retracted or upward position and not down towards the pallet before unbolting the rack from the pallet.

The 2420 and 4220 Rack Enclosures are secured to their shipping pallet with L-brackets in the front and Z-brackets in the rear. In order to remove the rack from the pallet: follow the steps listed below.

- Open the front door and pull out the ramps from under the rack frame. Put these aside in a readily accessible area as they will be used to take the rack off of the pallet.
- Using a 13mm wrench or socket set, remove the bolts attaching the front L-brackets to the rack frame.
- Using a 17mm wrench or socket set, remove the bolts attaching the front L-brackets to the pallet. Set these parts aside. See Figure 5.
- Still using the 17mm wrench, loosen the bolts attaching the rear Z-brackets to the pallet. It is not necessary to fully remove the bolts and the rear Z-brackets from the pallet.
- Attach the wooden ramps provided to the front of the pallet utilizing the Velcro strips to hold the ramps in place.
- Close the front door.
- With the assistance of at least one other person, slowly roll the rack off the pallet and down the ramps.

**Figure 5: Pallet Brackets**

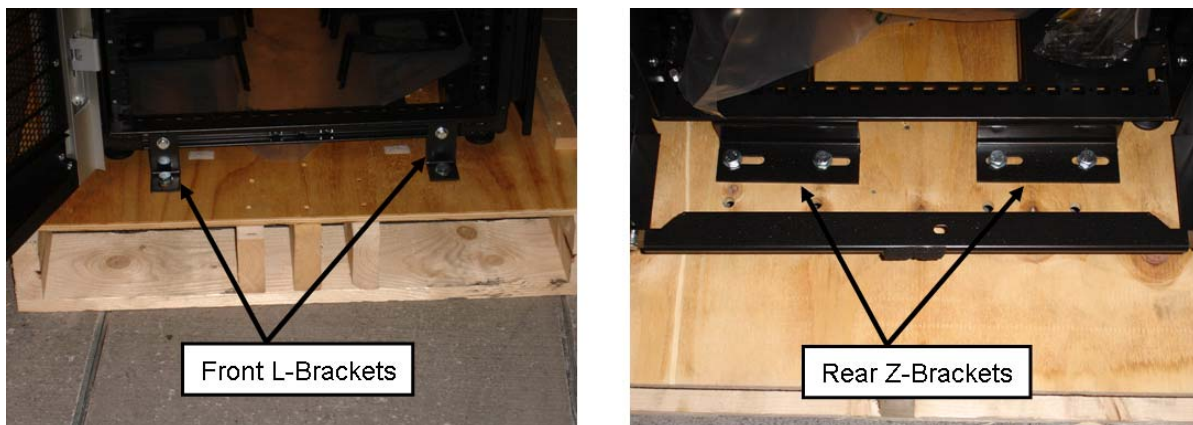


Figure 5. Pallet Brackets

## Moving into Place

Prior to moving a rack, verify that the leveling feet are in the fully-raised position. Do not attempt to move the rack alone. Always move the rack with assistance to help guide and position the rack as it is rolled into place. Try to avoid uneven surfaces, and make sure to keep checking for debris on the floor that can catch the rack castors and cause the rack to stop abruptly. Uneven and/or rough surfaces such as door jams, elevator gaps, asphalt, etc. cause undue stress on the rack castor wheels and can create an unstable environment for rolling the rack. Also, make sure to use appropriate care whenever going up or down any ramps.

Note that the rear castor wheels are 360-degree swiveling castor wheels, while the front wheels are fixed. This should be taken into account when steering the rack around corners and into place in your datacenter. Avoid pushing the rack from the sides near the front where the wheels are fixed. Steering should be done at the rear of the rack.

It's recommended that the rack be rolled into its final location by backing it into place while pushing on the front of the rack. Once in place, the leveling feet should then be lowered to the ground so that the rack can no longer roll and so that the rack is level. The leveling feet can be lowered and adjusted from inside the rack with a flat head screwdriver, or from outside the rack with a 12mm wrench. See Figure 6.

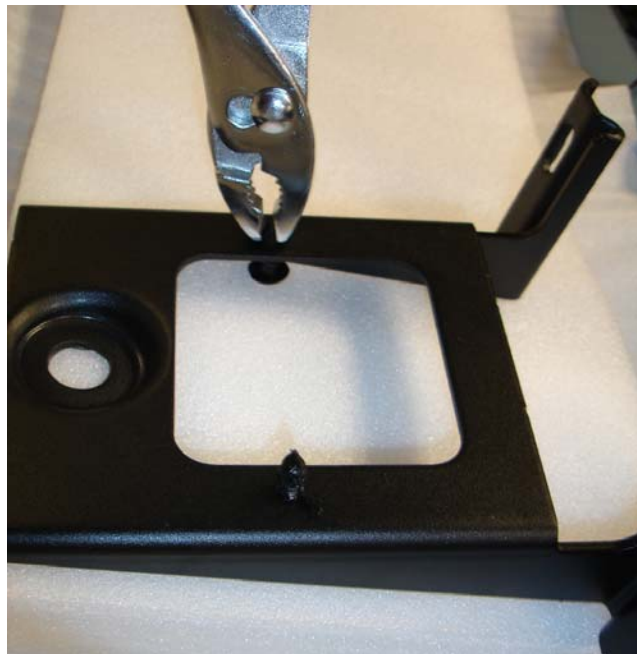


**Figure 6: Leveling Feet Deployment**



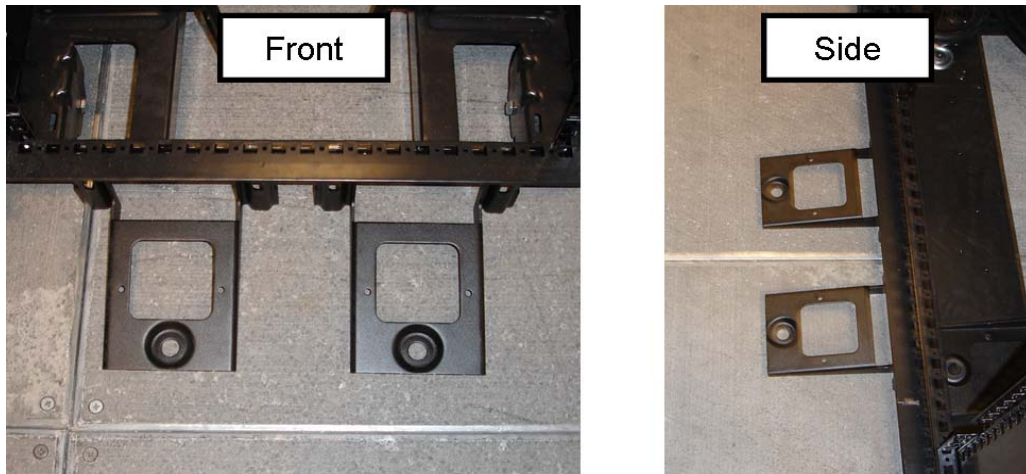
Installing rack level stabilizers should be done next. The 4220 rack comes with a set of brackets in the rack that are used to provide stability when equipment is being loaded, unloaded, or serviced in the rack. Reach into the rack, grab a stabilizer bracket firmly with both hands, and pull straight up. Once the stabilizer has been removed, use pliers to push the plastic fastener through the hole in the stabilizer and discard these plastic pieces. See Figure 7.

**Figure 7: Stabilizer Plastic Fastener Removal**



As shown in the installation guide included in the hardware kit, line up the stabilizers in front of the rack, then secure the stabilizers to the rack using the hardware provided in the kit. See Figure 8.

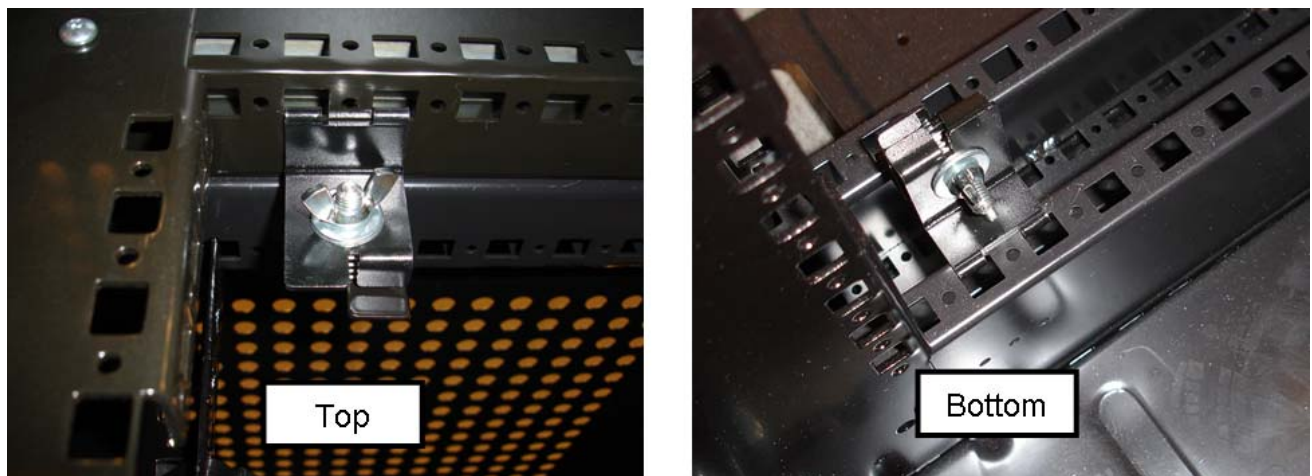
**Figure 8: Stabilizer Installation**



## Coupling Racks

4220 Rack Enclosures can be coupled using an interconnect accessory kit that can be purchased with the Dell Rack Enclosure. This kit can be used to couple the 4220 to another 4220 or to a previous generation Dell 4210 Rack Enclosure. Follow the steps in the instruction manuals to seal and spaces between racks with the foam provided. Then use the brackets to complete a tool-less coupling of the two racks. For maximum stability, use all four coupling brackets to secure mated racks at top and bottom in the front and rear of the racks. See Figure 9.

**Figure 9: Coupling Locations**



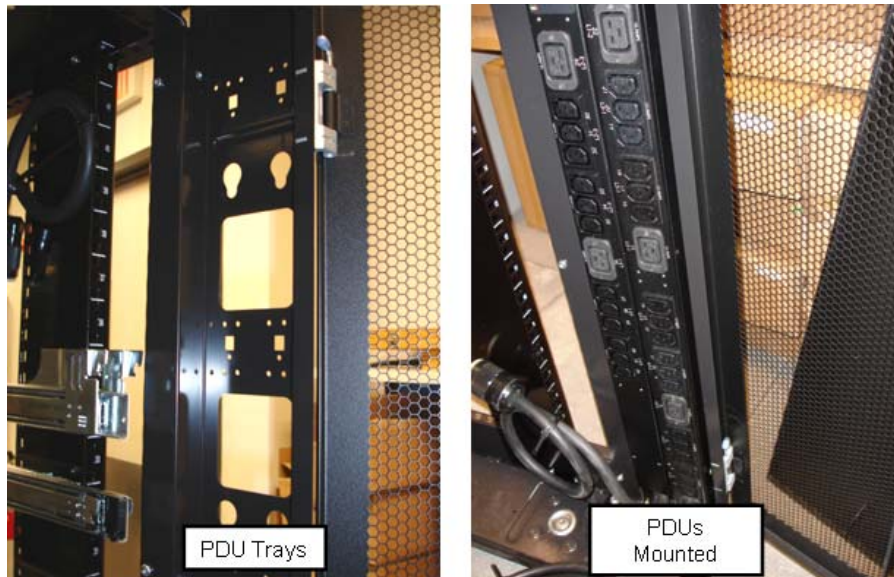
# Power Distribution Unit (PDU) Installation

## Rear Mount PDUs

The Dell 4220 and 2420 Rack Enclosures have provisions to mount a larger variety of Power Distribution Units (PDUs) than the legacy rack enclosures. The biggest change is the addition of the PDU trays in the rear of the rack enclosure. These are designed to mount different varieties of rear mount, full-height, and half-height PDUs from various suppliers. PDUs with the button mounting design are now readily accepted. Simply line up the buttons with the teardrop holes in the PDU tray and let the PDU slide down while holding it against the PDU tray. In addition, the large holes in the PDU trays allow you to route cables between racks. See Figure 10.

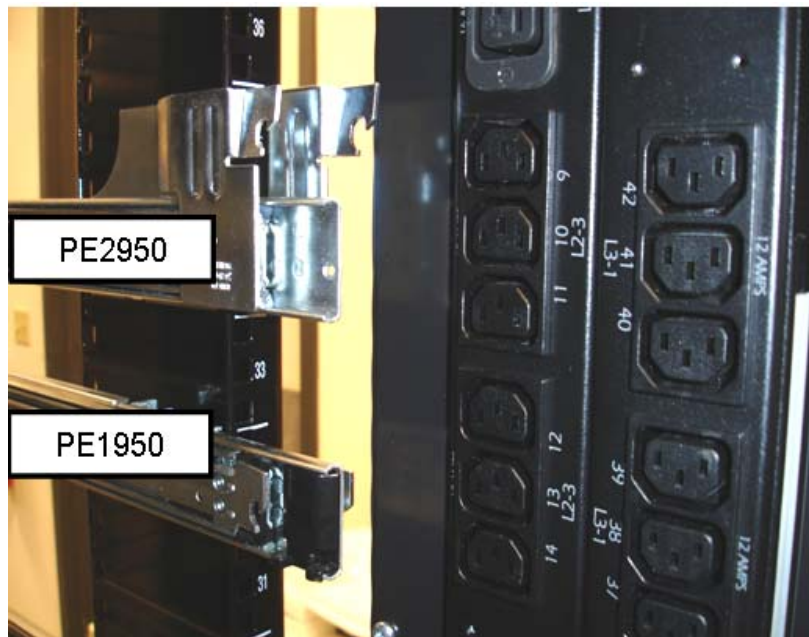
A larger array of PDUs from a variety of suppliers can mount into the Dell 4220 and 2420 Rack Enclosures than are available to mount in comparable rack enclosures. PDU trays designed to accommodate rear-mount, full-height, and half-height PDUs have been added. Button-mounting designs are now readily accepted and easy to use: simply line up the buttons with the teardrop holes in the PDU tray and, bracing the PDU against the tray, let the PDU slide into place. For further ease of use, large holes in the PDU trays allow cable-routing between racks. See Figure 10.

**Figure 10: Rear Mount PDUs**



Another benefit of the PDU trays in the Dell 2420 and 4220 Rack Enclosures is that the rear-mount PDUs are placed further back and away from the server equipment than is the case for other rear-mount PDU racks in the same 1070mm depth class. Mounting very deep server rails such as the Dell PE1950 and PE2950/PE2970 rails onto other racks results in rail interference with the inner PDU, whereas the user avoids this interference without sacrificing floor space by mounting these rails onto the Dell 2420 and 4220 Rack Enclosures. See Figure 11.

**Figure 11: Rail Clearance to PDUs**



## **Zero U Mount PDUs**

The 2420 and 4220 racks still support the Dell zero U mount PDUs that mount in the sides of the rack. For PDUs with detachable input cables, simply mount the PDU from the side of the rack and then plug the cable in and route it back into the rack through the opening between the rear mounting rail and the PDU tray. Plugging cables into PDUs of this design is easiest when the user has ready access to the sides of the rack. See Figure 12.

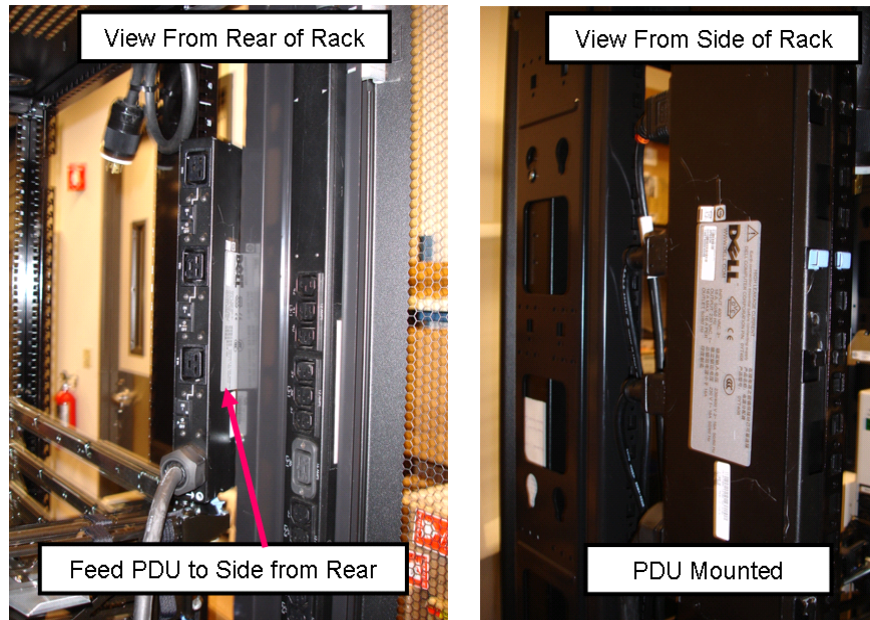
**Figure 12: Zero U Mount PDUs**



In order to install Zero U mount PDUs with hardwired cables and connectors that are too large to fit through the gap between the rear mounting rail and the PDU trays, follow these steps for mounting:

1. Insert the PDU through the gap between the rear mounting rail and the PDU tray. Installation should be from the inside of the rack.
2. From the side of the rack, snap the PDU tray into the mounting rail. Ensure that the cable is tucked back into the rack so that there's no interference between either a side panel or with any part of an adjacent rack. See Figure 13.
3. Once PDUs are installed, connect equipment power cords and dress them to assure that they are not under stress.

**Figure 13: Installing Hardwired Zero U PDUs**



## Cabling

The Dell 2420 and 4220 Rack Enclosures have been designed with improved internal and external cable management features.

### Internal Cable Management

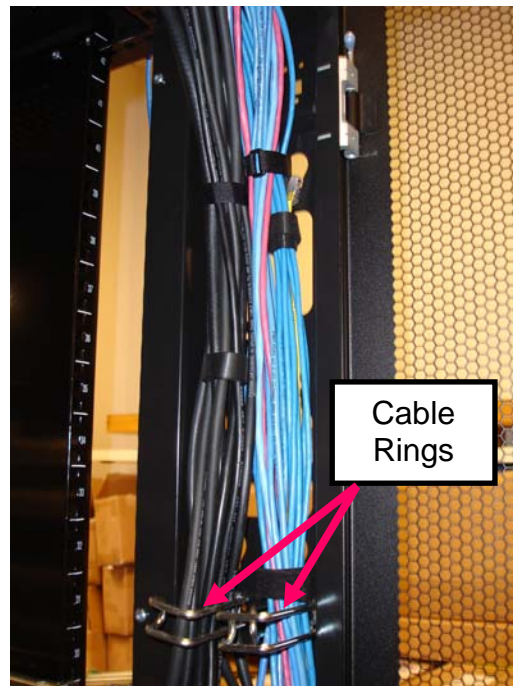
The Dell 2420 and 4220 Rack Enclosures are 2.7” (70mm) deeper than the older Dell 4210 Rack Enclosures. This extra room allows the user more space for cabling inside the rack. There are a few different cabling scenarios with the 2420/4220 racks depending on where PDUs are mounted.

In the event that you have zero-U mount PDUs installed in the sides of the rack, it is recommended that the PDU trays be used to route all cables either up or down.

The power cable from rackmount equipment can be routed to the sides of the rack and into the zero-U mount PDUs. Any excess cable length should be rolled up and attached or cinched to the rack’s vertical frame members.

Data cables can then be routed to the PDU trays and secured with either the cable rings provided in the hardware kit, or with Velcro straps or cable ties. See Figure 14.

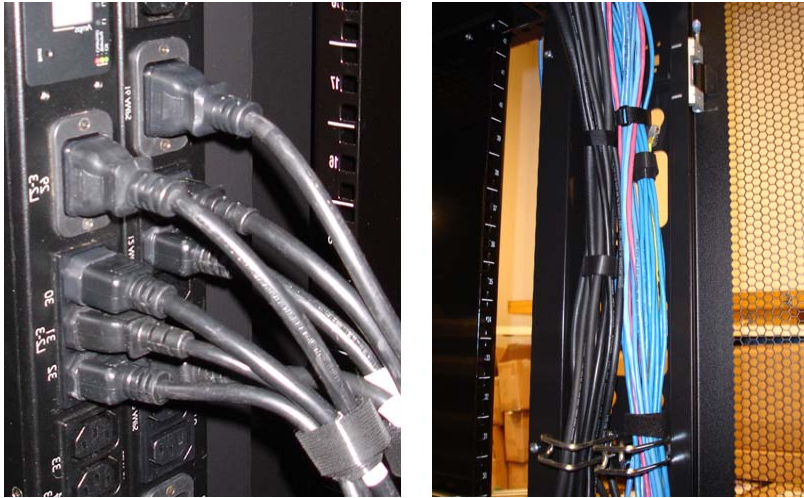
**Figure 14: Internal Cable Management**



Cabling is different when using rear-mount PDUs placed in PDU trays. If the user plans to separate power and data on opposite sides of the rack, then PDUs would be mounted in one PDU tray and the data cables can be routed into the PDU tray on the opposite side. When using Dell Cable Management Arms (CMAs), all cables will exit the CMA on one side. Dell CMAs can mount on either side of the system giving the user an option of which side he wants the cables to exit. If the cables exit the CMA on the opposite side as PDUs, then data cables can be routed right into the PDU trays and cinched with Velcro or cable ties, and tied off to the PDU tray.

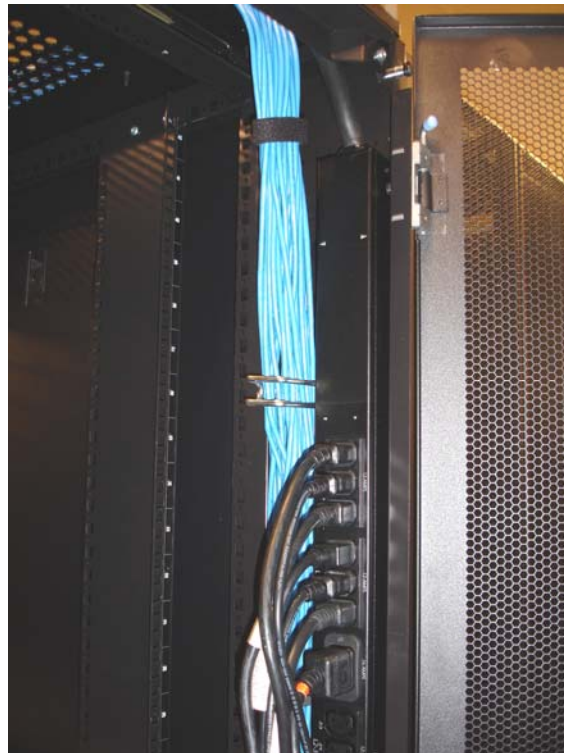
Power cables should then be grouped and routed together to a common “crossover point” in the rack. This is usually done at the top, bottom, or middle of the rack. Depending on the size of the bundle of power cables, this can be an empty 1U or 2U size area in the rear of the rack. Power cables can then be routed to the PDUs on the opposite side. See Figure 15.

**Figure 15: Cabling with Rear-mount PDUs**



Another option is to mount one PDU on each side of the rack. This involves a similar routing schemes to the one used above. If there is no need for redundant power hookups, then this scenario is cleanest with no cable crossover point. The system CMAs can be balanced, half mounted on one side, and the other half mounted on the other side of the rack. All cables can then be routed up or down their respective sides. See Figure 16.

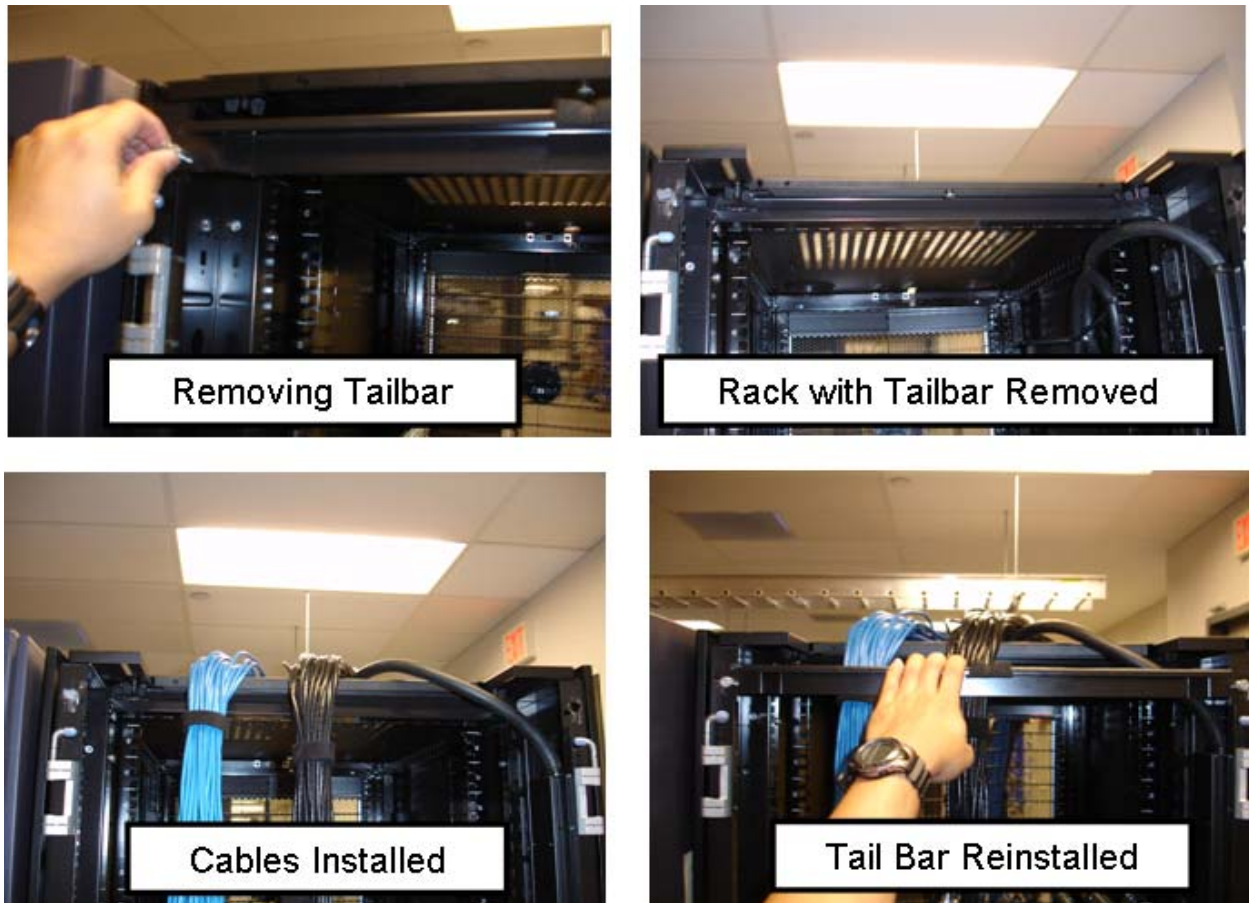
**Figure 16: Rear-Mount PDU with Adjacent Data Cables**





External cable management improvements include the enlarging and farthest-possible rear placement of top and bottom exits to accommodate a high density cable bundle. In addition, the removable tail bars at top and bottom make routing cables through the cable egress points much easier. These tail bars can be removed without the need for tools, the cables can be placed into the cable opening (top or bottom), and the tail bars can be reinstalled quickly for a substitute to routing cables through holes in the rack. It is recommended to remove the rear doors when removing and reinstalling the tail bars. See Figure 17.

**Figure 17: Tailbar Removal**



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