

M/T 9176 Single Frame  
System Cabling Best Practices Guide



## Safety Notices



**DANGER:** To prevent a possible shock from touching two surfaces with different protective ground (earth), use one hand, when possible, to connect or disconnect signal cables. (D001)



**DANGER:** Overloading a branch circuit is potentially a fire hazard and a shock hazard under certain conditions. To avoid these hazards, ensure that your system electrical requirements do not exceed branch circuit protection requirements. Refer to the information that is provided with your device or the power rating label for electrical specifications. (D002)



**DANGER:** If the receptacle has a metal shell, do not touch the shell until you have completed the voltage and grounding checks. Improper wiring or grounding could place dangerous voltage on the metal shell. If any of the conditions are not as described, *STOP*. Ensure the improper voltage or impedance conditions are corrected before proceeding. (D003)



**DANGER:** An electrical outlet that is not correctly wired could place hazardous voltage on the metal parts of the system or the devices that attach to the system. It is the responsibility of the customer to ensure that the outlet is correctly wired and grounded to prevent an electrical shock. (D004)



**DANGER:** When working on or around the system, observe the following precautions:

Electrical voltage and current from power, telephone, and communication cables are hazardous. To avoid a shock hazard: If IBM supplied the power cord(s), connect power to this unit only with the IBM provided power cord. Do not use the IBM provided power cord for any other product. Do not open or service any power supply assembly. Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.



- The product might be equipped with multiple power cords. To remove all hazardous voltages, disconnect all power cords from their power source.
- When connecting power to the product ensure all power cables are properly connected. This includes connecting all power cords to a properly wired and grounded electrical outlet. Ensure that the outlet supplies proper voltage and phase rotation according to the system rating plate.
- Connect any equipment that will be attached to this product to properly wired outlets.
- When possible, use one hand only to connect or disconnect signal cables.
- Never turn on any equipment when there is evidence of fire, water, or structural damage.
- Do not attempt to switch on power to the machine until all possible unsafe conditions are corrected.
- When performing a machine inspection: Assume that an electrical safety hazard is present. Perform all continuity, grounding, and power checks specified during the subsystem installation procedures to ensure that the machine meets safety requirements. Do not attempt to switch power to the machine until all possible unsafe conditions are corrected. Before you open the device covers, unless instructed otherwise in the installation and configuration procedures: Disconnect the attached power cords, turn off the applicable circuit breakers located in the rack power distribution panel (PDP), and disconnect any telecommunications systems, networks, and modems.
- Connect and disconnect cables as described in the following procedures when installing, moving, or opening covers on this product or attached devices.

To Disconnect: 1) Turn off everything (unless instructed otherwise). 2) Remove the power cords from the outlets. 3) Remove the signal cables from the connectors. 4) Remove all cables from the devices.

To Connect: 1) Turn off everything (unless instructed otherwise). 2) Attach all cables to the devices. 3) Attach the signal cables to the connectors. 4) Attach the power cords to the outlets. 5) Turn on the devices.



- Sharp edges, corners and joints may be present in and around the system. Use care when handling equipment to avoid cuts, scrapes and pinching. (D005)



**DANGER:** Observe the following precautions when working on or around your IT rack system:

- Heavy equipment—personal injury or equipment damage might result if mishandled.
- Always lower the leveling pads on the rack cabinet.
- Always install stabilizer brackets on the rack cabinet if provided, unless the earthquake option is to be installed.
- To avoid hazardous conditions due to uneven mechanical loading, always install the heaviest devices in the bottom of the rack cabinet. Always install servers and optional devices starting from the bottom of the rack cabinet.
- Rack-mounted devices are not to be used as shelves or work spaces. Do not place objects on top of rack-mounted devices. In addition, do not lean on rack-mounted devices and do not use them to stabilize your body position (for example, when working from a ladder).



- Stability hazard:
  - The rack may tip over causing serious personal injury.
  - Before extending the rack to the installation position, read the installation instructions.
  - Do not put any load on the slide-rail mounted equipment mounted in the installation position.
  - Do not leave the slide-rail mounted equipment in the installation position.
- Each rack cabinet might have more than one power cord.
  - Be sure to disconnect all power cords in the rack cabinet when directed to disconnect power during servicing.
- Connect all devices installed in a rack cabinet to power devices installed in the same rack cabinet. Do not plug a power cord from a device installed in one rack cabinet into a power device installed in a different rack cabinet.
- An electrical outlet that is not correctly wired could place hazardous voltage on the metal parts of the system or the devices that attach to the system. It is the responsibility of the customer to ensure that the outlet is correctly wired and grounded to prevent an electrical shock. (R001 part 1 of 3)



**WARNING:** Not all parts are effectively grounded. (C057)



**CAUTION:** This product is equipped with a 4-wire (three-phase and ground) power cable. Use this power cable with a properly grounded electrical outlet to avoid electrical shock. (C019)



**CAUTION:** This product might be equipped with a 5-wire (three-phase, neutral ground) power cable. Use this power cable with a properly grounded electrical outlet to avoid electrical shock. (C020)



**CAUTION:** The power distribution outlets provide 200 to 240 V ac. Use these outlets only for devices that operate within this voltage range. (C021)



**CAUTION:** The product might be equipped with a hard-wired power cable. Ensure that a licensed electrician performs the installation per the national electrical code. (C022)



**CAUTION:** Ensure the building power circuit breakers are turned off BEFORE you connect the power cord or cords to the building power. (C023)



**CAUTION:** Data processing environments can contain equipment transmitting on system links with laser modules that operate at greater than Class 1 power levels. For this reason, never look into the end of an optical fiber cable or open receptacle. Although shining light into one end and looking into the other end of a disconnected optical fiber to verify the continuity of optic fibers may not injure the eye, this procedure is potentially dangerous. Therefore, verifying the continuity of optical fibers by shining light into one end and looking at the other end is not recommended. To verify continuity of a fiber optic cable, use an optical light source and power meter. (C027)



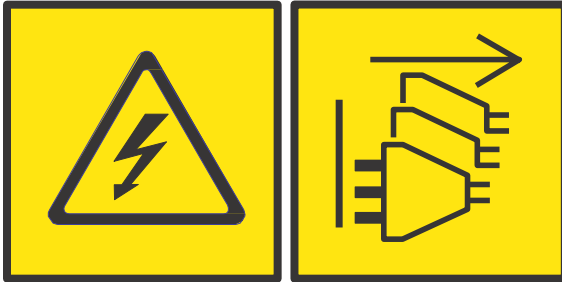
**CAUTION:** This product contains a Class 1M laser. Do not view directly with optical instruments. (C028)



**CAUTION:** Servicing of this product or unit is to be performed by trained service personnel only. (C032)



**CAUTION:** The power control button or switch, if present on the device, does not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from the device or from the power source. (C047)



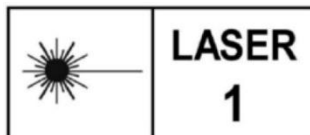
**CAUTION:** Protective conductor current may exceed 10 mA. Risk of shock. Ensure connection to earth is made before supply connection. (C053)



**CAUTION:** A mismatch in the wiring configuration (delta versus wye) between the IBM product and your facility AC voltage supply can cause significant product damage. Ensure that the PDUs of the product match the supply voltage and wiring configuration of your facility. If the number of wires in the power cord does not match the wiring configuration in your facility, or if the rated voltage on the product does not match the supply voltage in your facility, or if you have any questions about the connection method, do not connect the product to the supply voltage. Contact a certified electrician familiar with your installation, and IBM, for guidance. (C054)



**CAUTION:**



The system might contain separately approved low-power optical devices for communication through closed fiber links. Unless otherwise noted, these inherent eye-safe component options each have an Accessible Emission Limit (AEL) that comply as a:

CLASS 1 LASER PRODUCT

IEC 60825-1 : 2014 (or latest accepted published version)

China standard GB/T 7247.1 - 2024 (or latest accepted published version) (C056)

**CAUTION:**

- Do not install a unit in a rack where the internal rack ambient temperatures will exceed the manufacturer's recommended ambient temperature for all your rack-mounted devices.
- Do not install a unit in a rack where the air flow is compromised. Ensure that air flow is not blocked or reduced on any side, front, or back of a unit used for air flow through the unit.
- Consideration should be given to the connection of the equipment to the supply circuit so that overloading of the circuits does not compromise the supply wiring or overcurrent protection. To provide the correct power connection to a rack, refer to the rating labels located on the equipment in the rack to determine the total power requirement of the supply circuit.
- (For sliding drawers.) Do not pull out or install any drawer or feature if the rack stabilizer brackets are not attached to the rack or if the rack is not bolted to the floor. Do not pull out more than one drawer at a time. The rack might become unstable if you pull out more than one drawer at a time.



(For fixed drawers.) This drawer is a fixed drawer and must not be moved for servicing unless specified by the manufacturer. Attempting to move the drawer partially or completely out of the rack might cause the rack to become unstable or cause the drawer to fall out of the rack.  
(R001 part 2 of 3)

*Cabling information inside the rack is provided to customers for reference only. Only IBM Service may plug and route cables within the rack.*

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### References:

- 1) [Installation and Maintenance Physical Planning \(IMPP\) Guide](#)
- 2) [Planning for Fiber Optic Links Guide](#)

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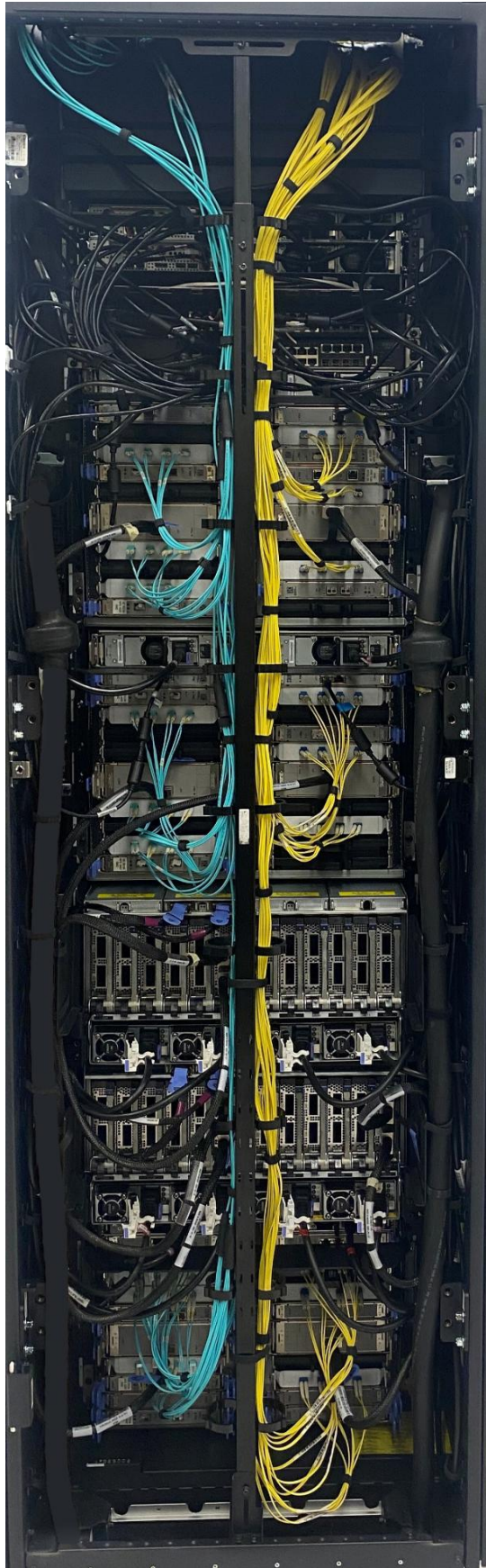
## Chapter 1. Introduction



**CAUTION:** Servicing of this product or unit is to be performed by trained service personnel only.  
(C032)

This cabling best practices document was created to help the reader plan, install and retain cables for the 9176 Single Frame system mainframe. This document includes information for both internal and external cables to assist in both the initial system installation, system upgrades as well as external connections. In this context, internal cables are those pre-installed and provided within the system while external cables are considered either those cables provided with the system (i.e., power line cord, external communications network attach, etc.) or by the client (i.e., I/O, coupling, and storage network attach) and that egress from the system.

To ensure system reliability and serviceability, it is critical that the system be ordered with the necessary Feature Codes (FC) (reference Table 1 below) and the installation completed following the contents of this document. It serves as a supplement for the Installation Manual for Physical Planning (IMPP). For essential information including, but not limited to, safety notices, specifications, power requirements, and hardware management, refer to the [IMPP](#). For visual help, 9176 Single Frame Visio® files are available online through IBM documents.



*Figure 1: Reference Example of Full-System Cable Routing*

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## Chapter 2. Line Cords



**DANGER:** To prevent a possible shock from touching two surfaces with different protective ground (earth), use one hand, when possible, to connect or disconnect signal cables. (D001)



**DANGER:** Overloading a branch circuit is potentially a fire hazard and a shock hazard under certain conditions. To avoid these hazards, ensure that your system electrical requirements do not exceed branch circuit protection requirements. Refer to the information that is provided with your device or the power rating label for electrical specifications. (D002)



**DANGER:** If the receptacle has a metal shell, do not touch the shell until you have completed the voltage and grounding checks. Improper wiring or grounding could place dangerous voltage on the metal shell. If any of the conditions are not as described, *STOP*. Ensure the improper voltage or impedance conditions are corrected before proceeding. (D003)



**DANGER:** An electrical outlet that is not correctly wired could place hazardous voltage on the metal parts of the system or the devices that attach to the system. It is the responsibility of the customer to ensure that the outlet is correctly wired and grounded to prevent an electrical shock. (D004)



**DANGER:** When working on or around the system, observe the following precautions:

Electrical voltage and current from power, telephone, and communication cables are hazardous. To avoid a shock hazard: If IBM supplied the power cord(s), connect power to this unit only with the IBM provided power cord. Do not use the IBM provided power cord for any other product. Do not open or service any power supply assembly. Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.



- The product might be equipped with multiple power cords. To remove all hazardous voltages, disconnect all power cords from their power source.
- When connecting power to the product ensure all power cables are properly connected. This includes connecting all power cords to a properly wired and grounded electrical outlet. Ensure that the outlet supplies proper voltage and phase rotation according to the system rating plate.
- Connect any equipment that will be attached to this product to properly wired outlets.
- When possible, use one hand only to connect or disconnect signal cables.
- Never turn on any equipment when there is evidence of fire, water, or structural damage.
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To Connect: 1) Turn off everything (unless instructed otherwise). 2) Attach all cables to the devices. 3) Attach the signal cables to the connectors. 4) Attach the power cords to the outlets. 5) Turn on the devices.



- Sharp edges, corners and joints may be present in and around the system. Use care when handling equipment to avoid cuts, scrapes and pinching. (D005)



**CAUTION:** This product is equipped with a 4-wire (three-phase and ground) power cable. Use this power cable with a properly grounded electrical outlet to avoid electrical shock. (C019)



**CAUTION:** This product might be equipped with a 5-wire (three-phase, neutral ground) power cable. Use this power cable with a properly grounded electrical outlet to avoid electrical shock. (C020)



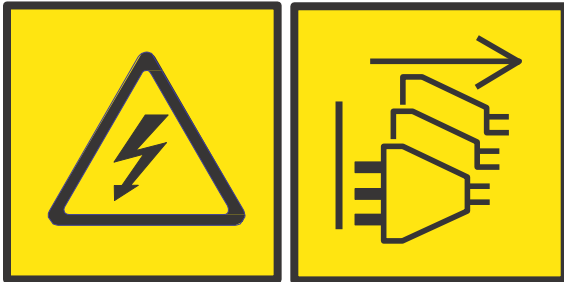
**CAUTION:** The product might be equipped with a hard-wired power cable. Ensure that a licensed electrician performs the installation per the national electrical code. (C022)



**CAUTION:** Ensure the building power circuit breakers are turned off BEFORE you connect the power cord or cords to the building power. (C023)



**CAUTION:** The power control button or switch, if present on the device, does not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from the device or from the power source. (C047)



**CAUTION:** Protective conductor current may exceed 10 mA. Risk of shock. Ensure connection to earth is made before supply connection. (C053)

The line cords are used to power the system. The only type of internal power sub-system available is the intelligent Power Distribution Unit (iPDU).

IBM offers multiple line cord options to suit varying installation needs. Only the line cords provided with the system may be used. The line cords must not be modified (cut to length, connectors changed, etc.). Any request for line cord modifications must be approved by IBM. Note, only connectorized line cord FCs are available starting with 9176. If there is a specific issue regarding this change and a cut-end cord is needed, please contact your IBM sales representative for assistance.

**IMPORTANT: Line cords should be installed after all internal system cables have been routed and plugged.** This ensures maximum accessibility for routing the other cables.

The line cord is designed to exit straight out of the connector then bend with a given minimum bend radius towards the top or bottom of the frame depending on the desired system frame exiting orientation. Cables can exit through the top of the frame using one of the following feature codes:

- Top Exit Cabling feature with enclosure (**FC 5823**) or Top Exit Cabling feature without enclosure (**FC 7803**)
- Cables that leave the frame through the bottom would use Bottom Exit Cabling feature (**FC 7804**)

If the line cords are top exiting, the bottom PDU line cord should route in front of the top PDU line cord as they are routed upwards. The opposite will hold for bottom exiting cables. Please note the warning provided in Figure 2 when line cords are running through the top exit.

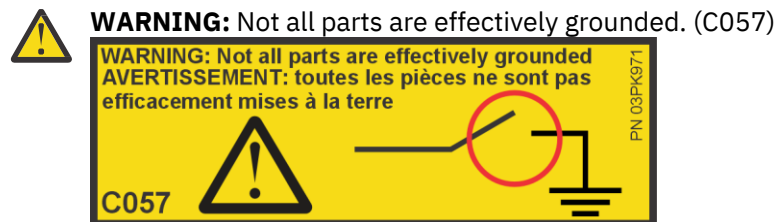


Figure 2: Top Exit Enclosure Grounding Warning

For top exit systems without an enclosure, the space above the system should be clear with sufficient physical space for the line cords to exit the system (Figure 3). In this case, the line cords would be routed directly out the top corners of the frame then plugged to the data center power supply side connector. Top exit systems with an enclosure (**FC 5823**) support both line cords and external system cables exit. The line cords similarly go through the top of the frame, but in this case, are routed within the enclosure using provided cable management features (Figure 4). All cables exit the enclosure through brush elements.

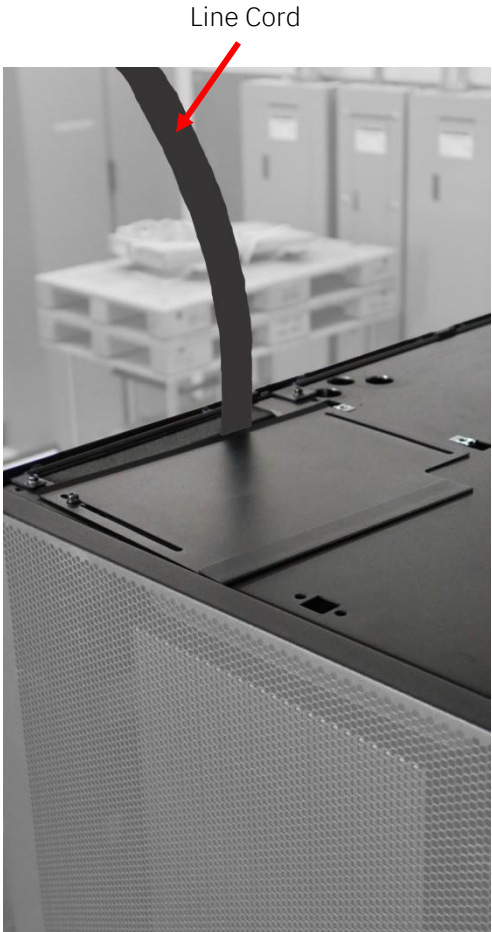


Figure 3: Top Exiting Line Cord without an Enclosure (FC 7803)

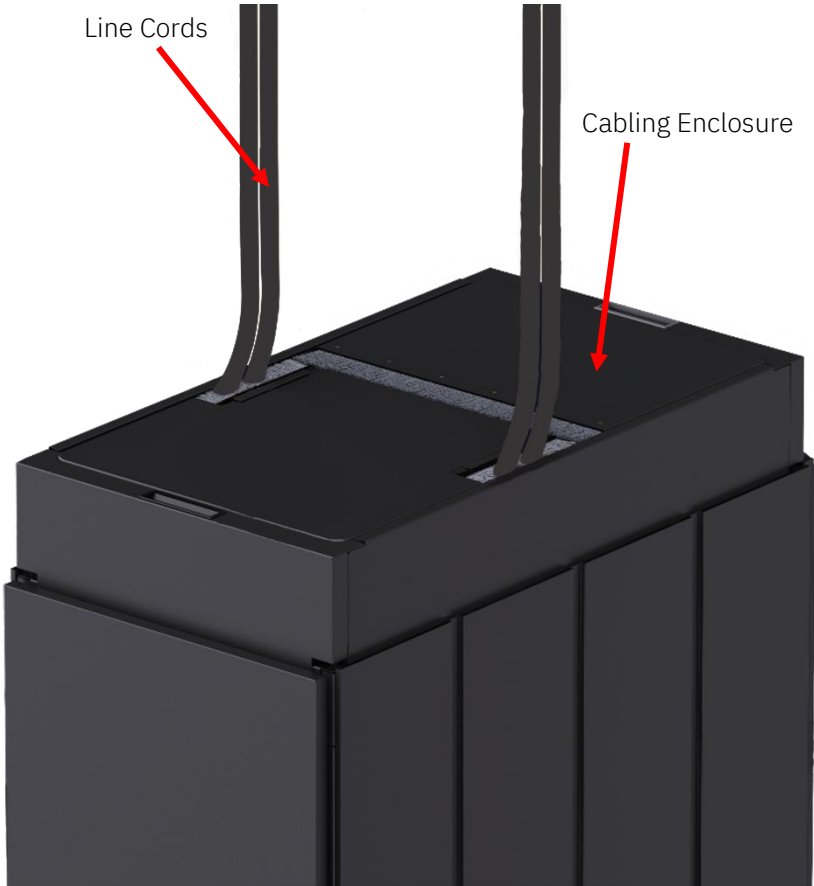
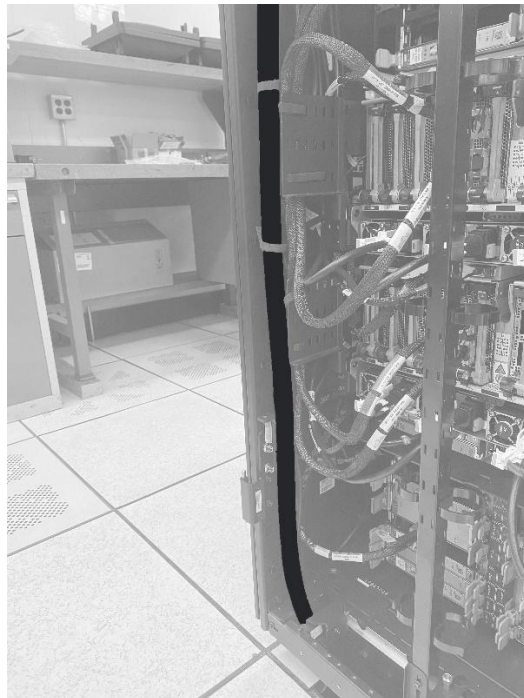


Figure 4: Line Cords in a Top Exit Cabling Enclosure (FC 5823)

For bottom exit systems (**FC 7804**), the line cord is routed directly to the bottom corners of the system and plugged at customer end. Line cords should be affixed and strain relieved to the tailgate using the provided bracket(s) (Figure 5). As required and specified by the IMPP, a floor tile cut-out must be present to accommodate this FC. **Note:** To ensure maneuverability, cable slack must be left to allow for a service loop under the floor.



*Figure 5: Bottom Exiting Line Cords (FC 7804)*

There is a line cord actuation tool available to assist in plugging line cords. This tool was developed to cam the line cord in for ease of installation, as the area to plug a line cord into an iPDU may be congested. For more information, see the Install Manual. **Note:** the square key element enables a ¼" drive extension to be used as a tool assist.



Square Key  
Element

*Figure 6: iPDU Cable Actuation Tool*

Line cords that are routed directly behind the frame's rear door latch plate may interfere with the operation of the door latch. To prevent this, the line cord should be strapped to the A14 CPC bracket if present (Figure 7).



*Figure 7: Use Hook-and-Loop to Retain Line Cord and Keep Away from Latch*

If the above strap location is not available, use any available hook-and-loop tie-down point on the frame's side wall to retain the line cord away from the door latch plate.

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## Chapter 3. Cable Retention and Strain Relief

### *CPC Bracket*

These brackets are used to manage and strain-relieve Peripheral Component Interconnect express+ (PCIe+) I/O cables that attach to the Central Processor Complex (CPC) drawer. The function and routing of this cable is discussed later in this document. These brackets hold the cables by using hook-and-loop straps.

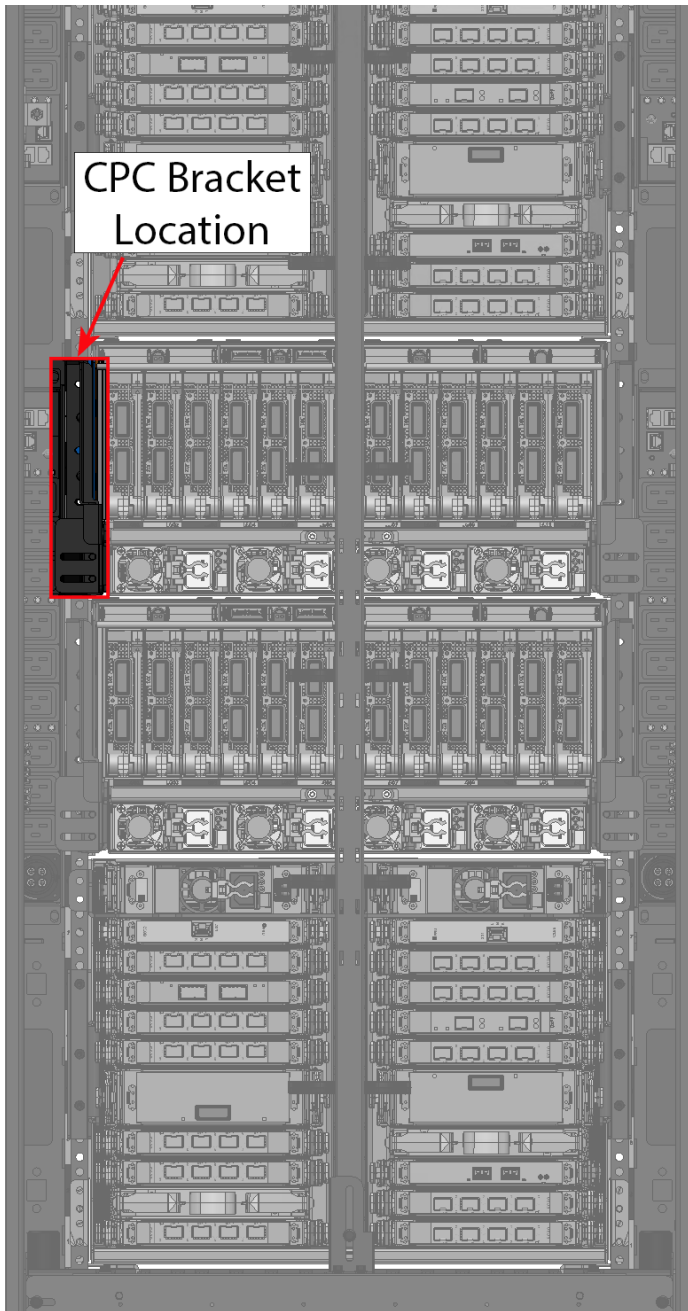


Figure 8: 3D Rendering of CPC Bracket Location

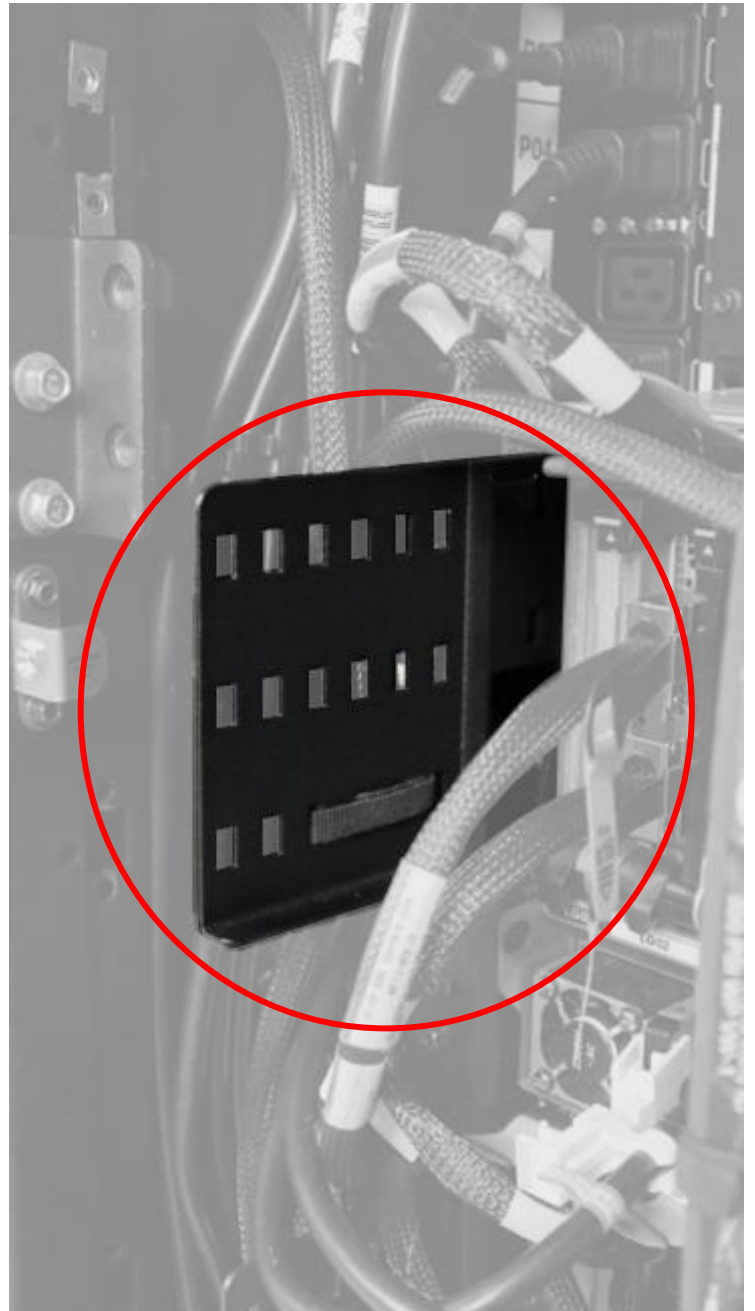
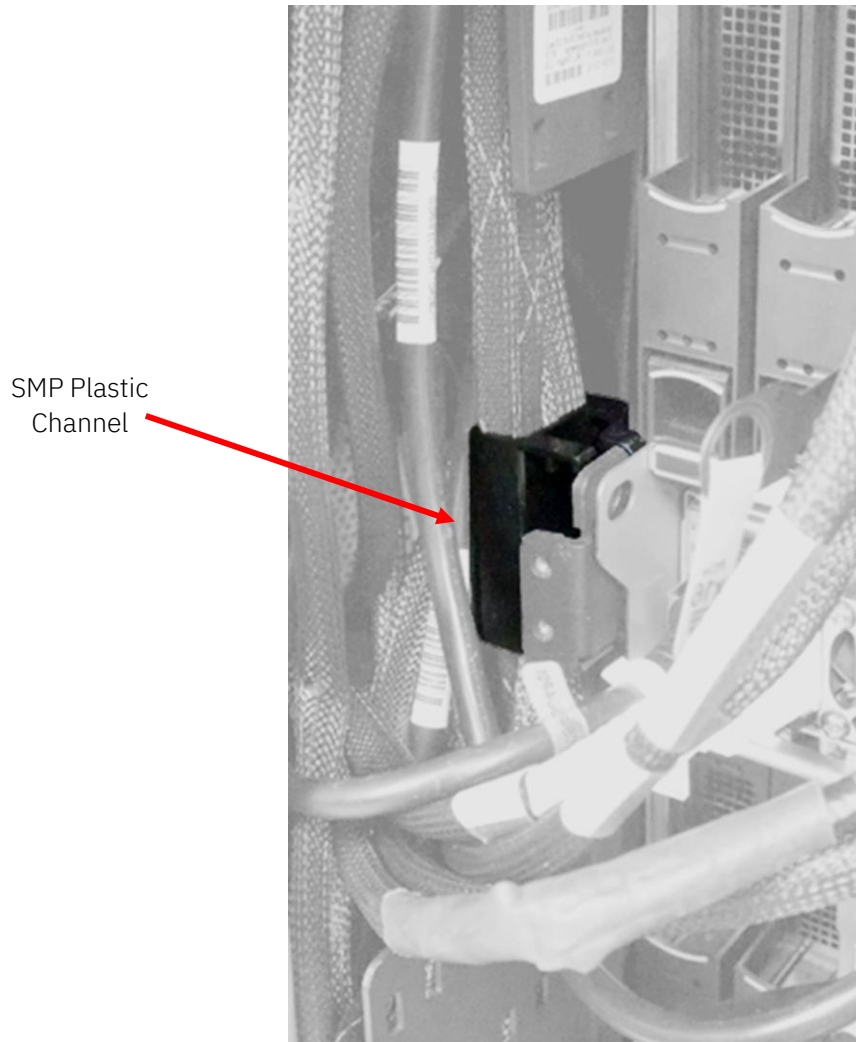


Figure 9: CPC Bracket

## *SMP Plastic Channel*

The intention of this plastic channel is to retain the Symmetric Multi-Processing (SMP) cables and protect them as the machine is being serviced. Figure 10 depicts the SMP plastic channel. It allows the cables to be neatly routed behind the CPC drawer bracket.



*Figure 10: SMP10 Plastic Channel (CPC Bracket Not Shown for Clarity)*

## Clips

There are seven (7) types of cable retention clips:

- Spine Hardware Clip for Customer Fiber only (Figure 11)
- Frame Side Clip for Power Jumpers (Figure 12)
- Frame Side Clip for PCIe+ (CDFP) Cables (Figure 13)
- Frame Edge Clip for Ethernet Cables (Figure 14)
- Hook-and-Loop Fastener Clip for Power Jumpers and Ethernets (Figure 15 and 16)
- Large Power Supply 2-Piece Clip for Power Jumper Plug Retention (Figure 17 and 18)
- Small Power Supply 2-Piece Clip for Power Jumper Plug Retention (Figure 19)

Spine Clip

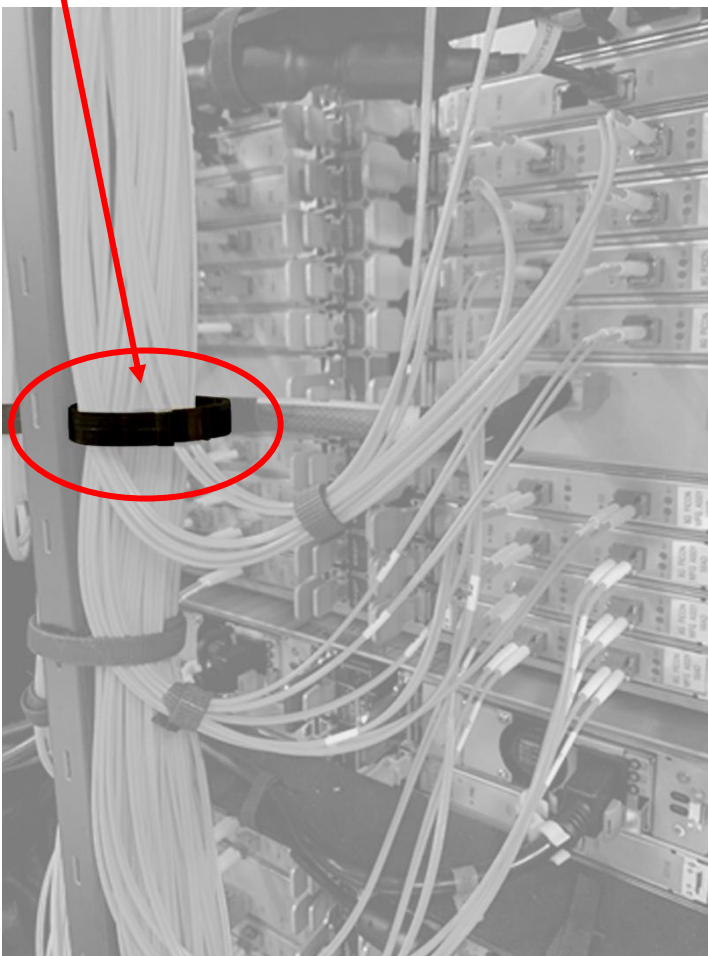


Figure 11: Spine Clips for Customer Fiber

Frame Side Clip for Power Jumpers

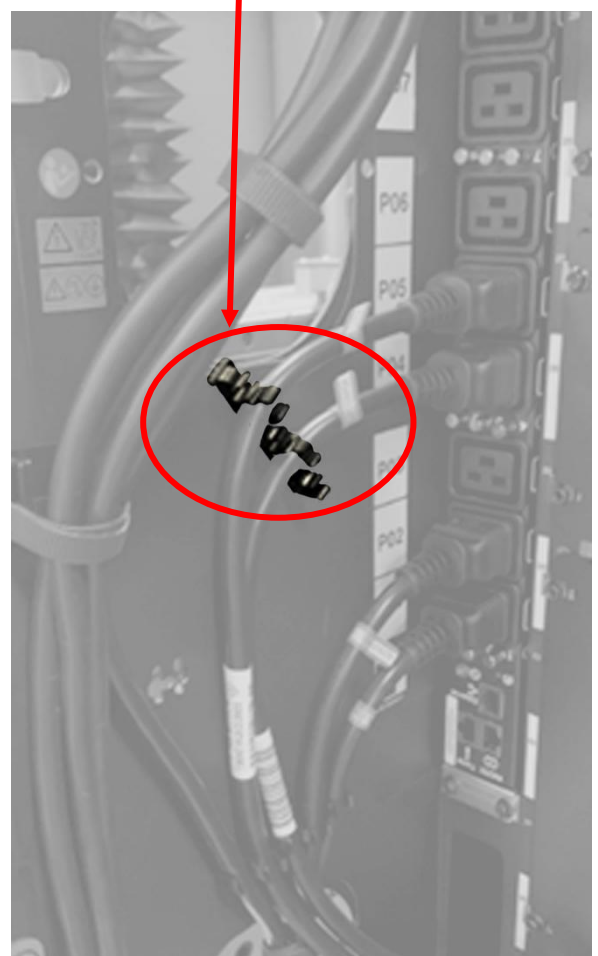


Figure 12: Frame Side Clip for Power Jumpers

Frame Side Clip for PCIe+ Cables

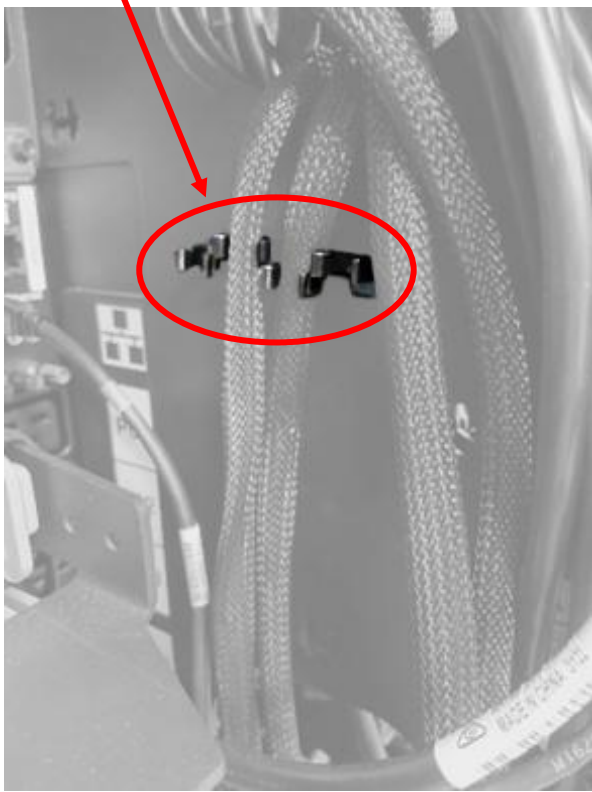


Figure 13: Frame Side Clip for PCIe+ Cables

Frame Edge Clip for Ethernet Cables

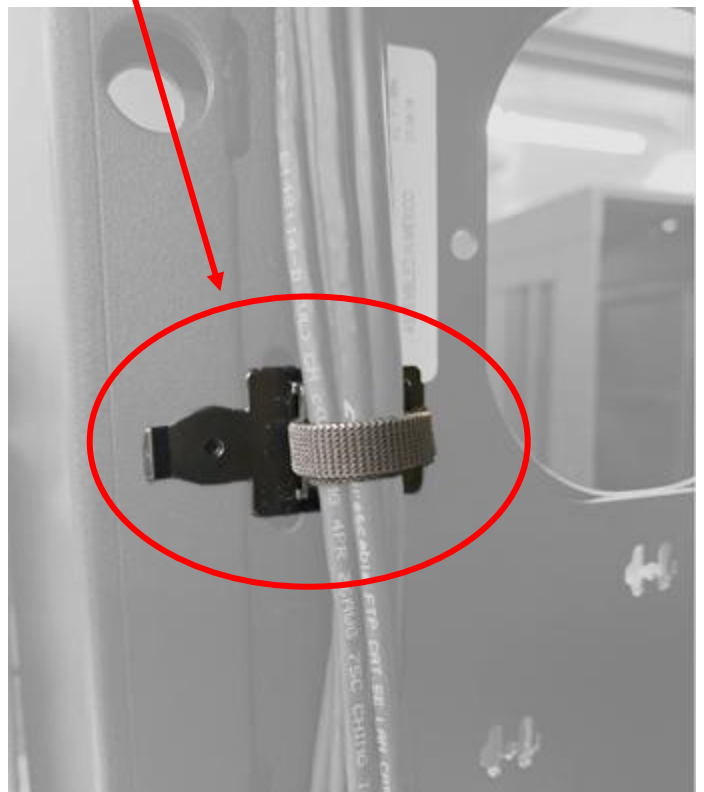


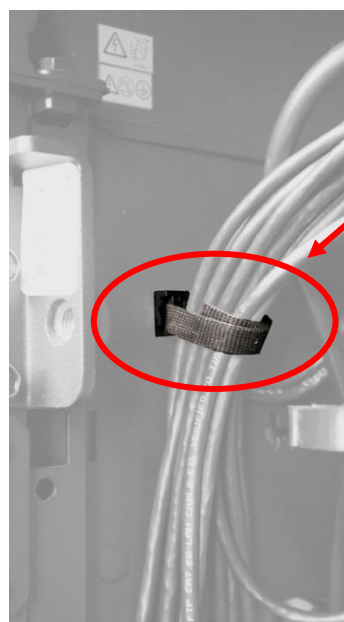
Figure 14: Frame Edge Clip for Ethernet Cables

Hook-and-loop fasteners are used to properly route and retain cables, while maintaining bend radii and providing strain relief. Figure 16 shows an example of the application of a hook-and-loop fastener clip.



Figure 15: Hook-and-Loop Fastener Clip

Hook-and-Loop Fastener Clip



Hook-and-Loop Fastener

Figure 16: Hook-and-Loop Fastener Application

During system service, plugged power jumpers are at risk of being accidentally snagged or bumped, which could result in system interruption. Retention clip assemblies are factory-installed to address this risk by retaining jumpers in their plugged state.

These two-piece clip assemblies are adjustable on a slide “zip-track” to accommodate a range of cable plug over-mold sizes. The trigger part of the assembly enables this adjustment, and this part is universal throughout the Z system. The grip part of the assembly affixes onto the PSU or frame bracket, and this part has two variations:

1. Large Grip – used on CPC Drawer PSUs. These ship fully installed in the system.
2. Small Grip – used on I/O Drawer PSU’s, Support Element PSUs, and Ethernet Switches. These ship fully installed in the system for Ethernet Switches, and they ship partially installed for I/O Drawer PSUs and SE PSUs since these PSUs are undocked for shipping.

Before system start-up at install, all retention clips should be checked to verify they are fully in place with the trigger part snug against the jumper plug over-mold. After service, any disturbed retention clip must be restored to its retaining state. Further details are available to IBM service personnel in the Install Manual and Repair & Verify service procedures.

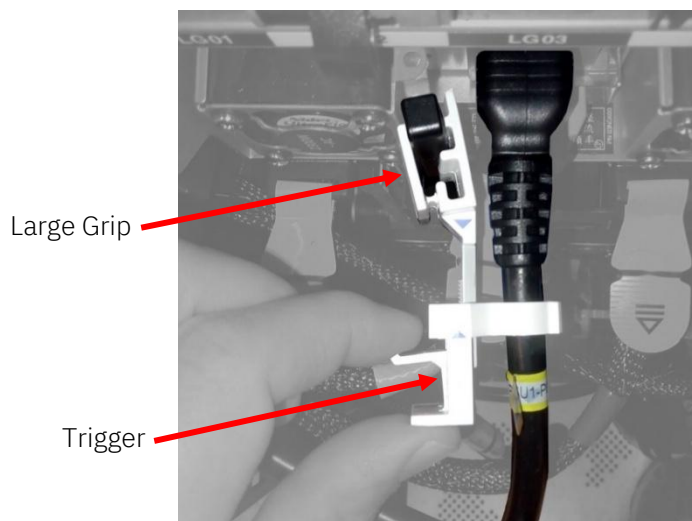


Figure 17: Large PSU Clip Being Adjusted



Figure 18: Large PSU Clip Fully Installed

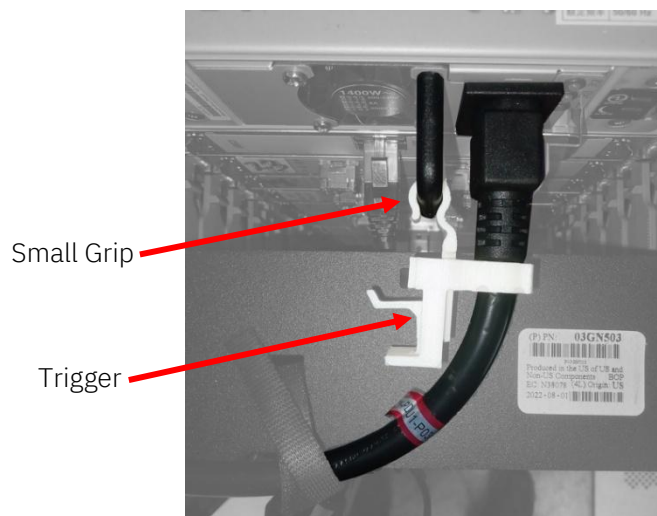


Figure 19: Small PSU Clip Fully Installed



Large Grip Small Grip

Figure 20: Large and Small Grips

## Center Spine

The center spine is used to route external customer-provided cables vertically in the frame. For 9176, the spine and clips are preinstalled. The clips may be relocated if needed. When the bottom exit FQC bracket feature code (**FC 5827**) is selected, there are optional FICON cable length management hoops that can be installed on the spine.

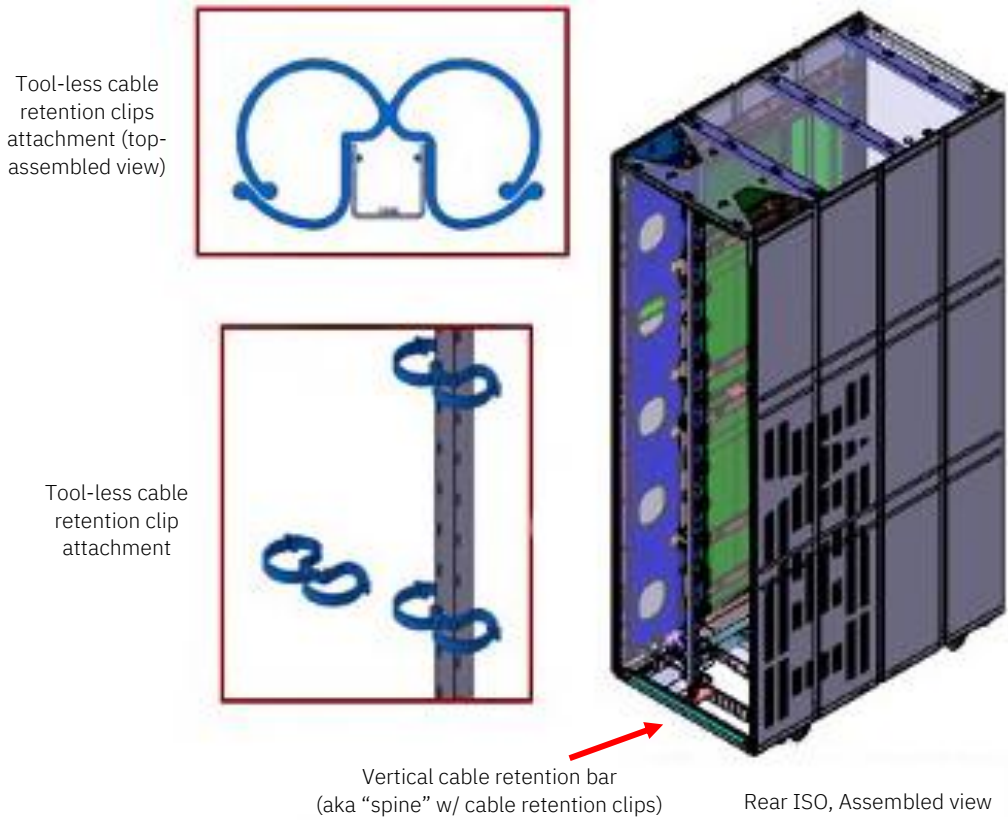
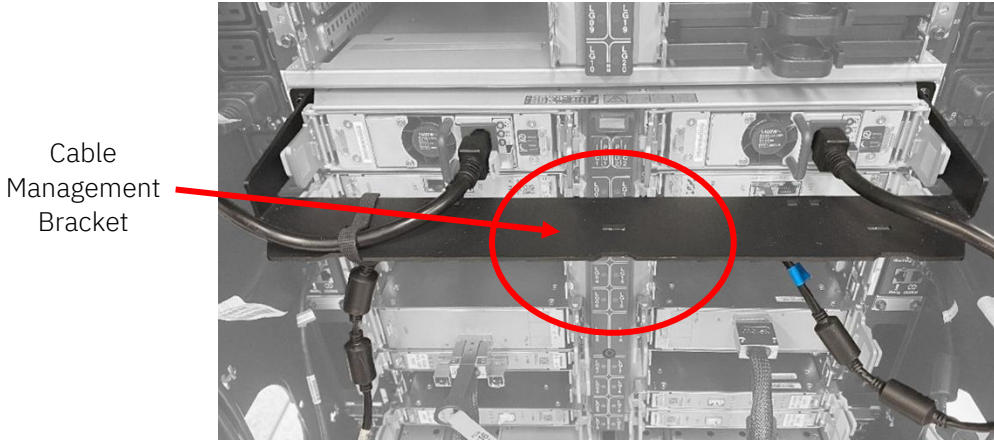


Figure 21: Center Spine and Clips

## Cable Management Brackets

Cables going across the frame should be routed along a cable management bracket for support. This bracket is designed to secure the power cords and ethernet cables exclusively, providing necessary clearance for servicing units both above and below these cables, thereby enhancing serviceability. There is a cable management bracket associated with each PCIe+ I/O drawer.



*Figure 22: PCIe+ I/O Drawer Cable Management Bracket*

In the maximum configuration only (4 PDUs, 2 CPC drawers, and 3 PCIe+ I/O drawers), at I/O cage #3 there are left and right vertical cable management brackets (Figure 23). These relieve cable congestion from the upper PDUs when four (4) PDUs are present. Power jumpers are routed on the inboard side of each bracket as shown.



*Figure 23: Vertical Cable Management Brackets*

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## Chapter 4. Internal System Cables



**CAUTION:** The power distribution outlets provide 200 to 240 V ac. Use these outlets only for devices that operate within this voltage range. (C021)

**Note:** Caution is specifically applicable to high voltage inputs though, system supports both low and high voltage inputs.

On each end of the internal power jumpers and ethernet cables, there is a striped or solid-colored location flag label designating where the cable's should be plugged. The color on the label serves as a visual aid to distinguish entities from each other. The solid-colored flag indicates the primary source, and the striped-colored flag indicates the secondary source. Installation personnel shall use the provided printed label data to ensure correct cable plugging locations are used.

The following subsections of this chapter are listed in the prioritized installation order:

- 1) Ethernet Network Cables
- 2) Power Jumpers
- 3) SMP Cables
- 4) PCIe+ I/O Cables

**Note:** Line cords shall be installed after all internal system cables have been installed, routed and strain-relieved.

### Ethernet Network Cables

Internal system ethernet network cables interconnect the system's internal service processor network. External ethernet cables will be discussed later in this document. Ethernet cables plugged to elements on the left-side of the rack should be routed along the left-side of the rack and vice versa for elements on the right-side of the rack. Some ethernet cables will have two (2) ferrite cores, and others will not.

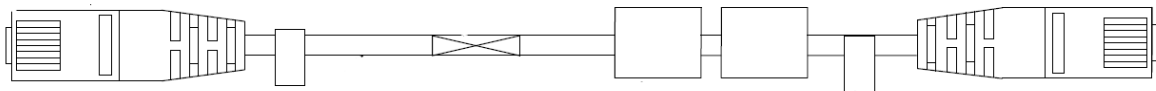


Figure 24: 2D Drawing of an Ethernet Cable

### Power Jumpers

Power jumpers are internal system cables used to connect the power supply units to the system's power distribution system (i.e., iPDU). Note, these cords are all point-to-point connections.

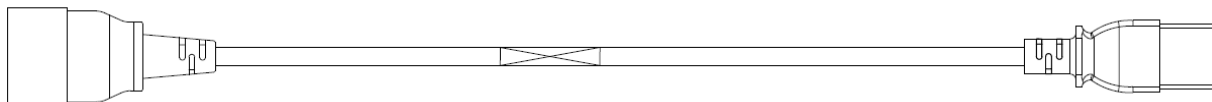


Figure 25: 2D Drawing of a Power Jumper

IBM Z PDUs are exclusively designed for IBM Z hardware. Customers are not permitted to use or handle dedicated Z PDUs. Factory-installed port fillers in unused PDU ports prevent plug access and may only be removed by IBM SSRs



Figure 26: Port Cap Fillers

The following power jumper routing scheme shall only be used in a maximum configuration of 2 CPC drawers and 3 PCIe+ I/O drawers. Since there are a limited amount of ethernet cables in the frame, the power jumpers will be routed along the frame using the ethernet clips shown in Figure 27. Any excess slack will be routed in a loop using the ethernet clip and the outer edge of the power jumper clip. The cable is then routed down and plugged into the proper PDU port location.



Figure 27: Routing of Excess Power Jumper Cable Slack Using Ethernet Clips



Figure 28: Routing of Excess Power Jumper Cable Slack in Loops Using Clips

## SMP Cables

The SMP cables enable the processor network by interconnecting the system's CPC drawers to each other.

**Note:** For iPDU service actions, the hook-and-loop fastener that attaches the SMP cable to the CPC bracket will need to be removed to release the cable so they can be moved out of the way during servicing. Do not unplug the cable but rather gently move them aside to make clearance for service activities.

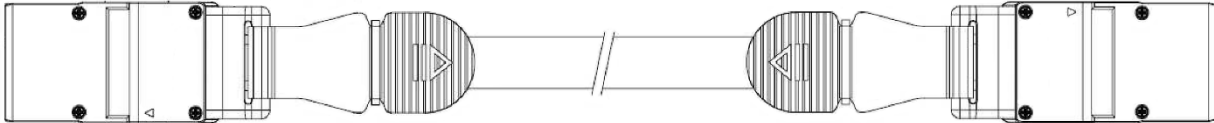


Figure 29: 2D Drawing of an SMP10 Cable

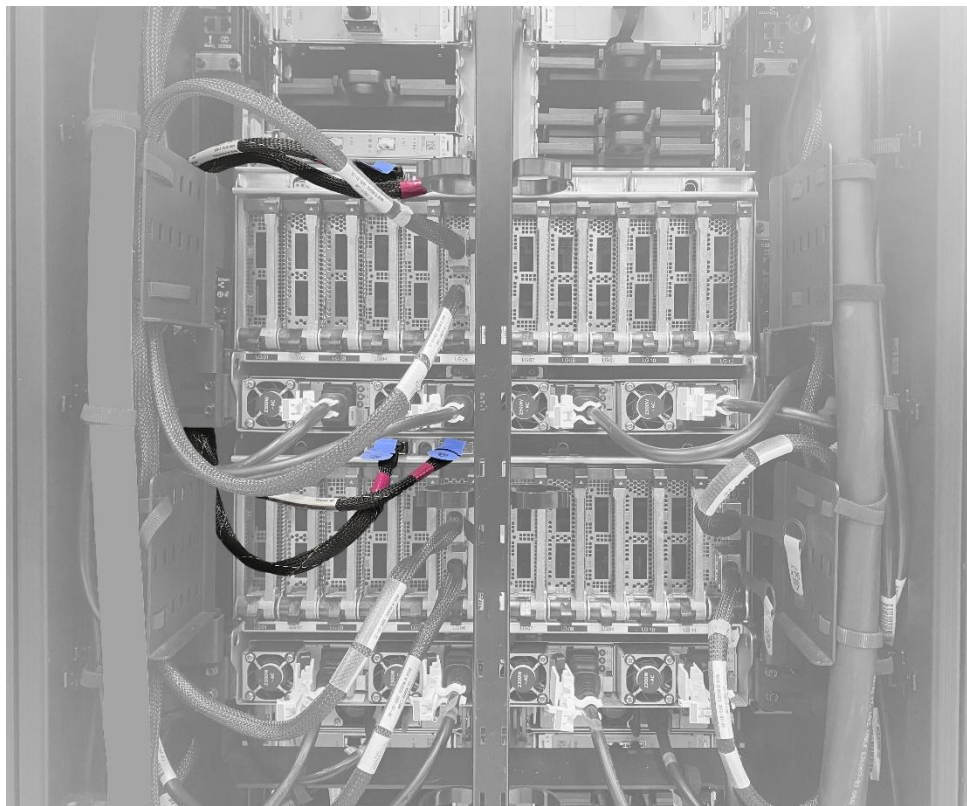


Figure 30: Required SMP Cable Routing

## PCIe+ I/O Cables

PCIe+ I/O cables connect the System's CPC drawers to the PCIe+ I/O drawers. The recommended routing of these cables within the frame is provided in Figure 32.

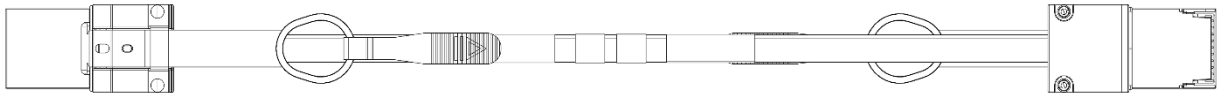


Figure 31: 2D Drawing of a PCIe+ I/O Cable

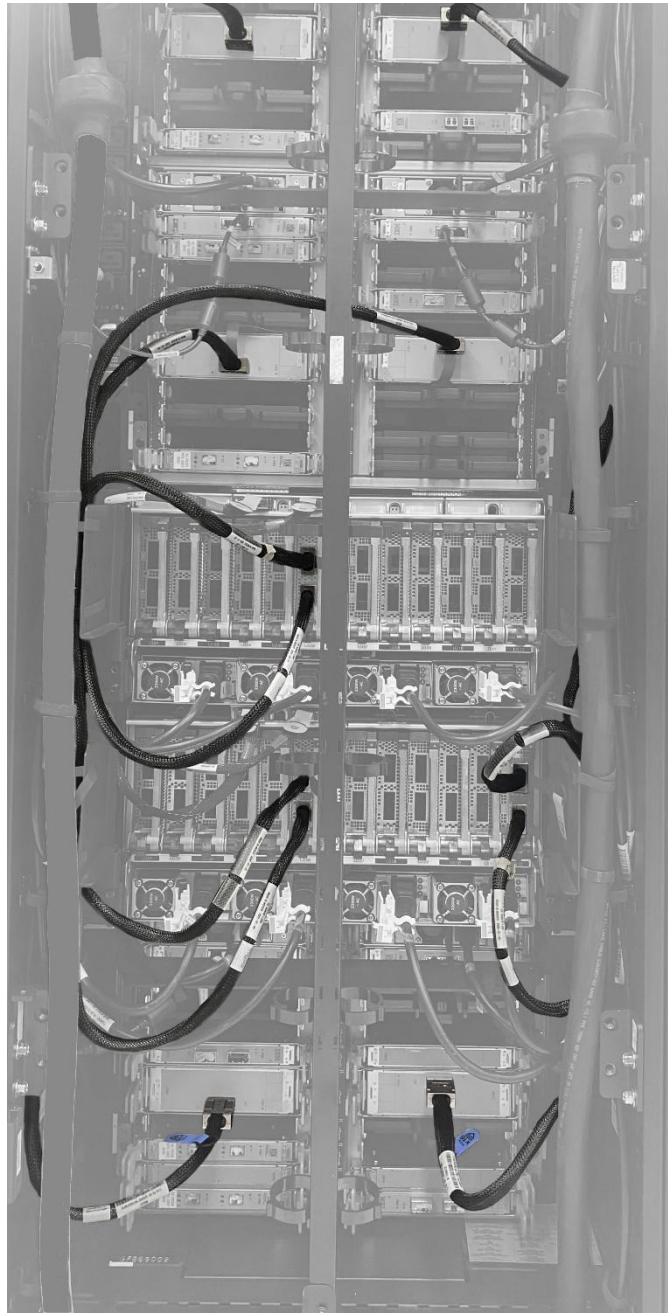


Figure 32: PCIe+ I/O Cables Routed

## Chapter 5. External System Cables



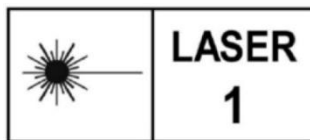
**CAUTION:** Data processing environments can contain equipment transmitting on system links with laser modules that operate at greater than Class 1 power levels. For this reason, never look into the end of an optical fiber cable or open receptacle. Although shining light into one end and looking into the other end of a disconnected optical fiber to verify the continuity of optic fibers may not injure the eye, this procedure is potentially dangerous. Therefore, verifying the continuity of optical fibers by shining light into one end and looking at the other end is not recommended. To verify continuity of a fiber optic cable, use an optical light source and power meter. (C027)



**CAUTION:** This product contains a Class 1M laser. Do not view directly with optical instruments. (C028)



**CAUTION:**



The system might contain separately approved low-power optical devices for communication through closed fiber links. Unless otherwise noted, these inherent eye-safe component options each have an Accessible Emission Limit (AEL) that comply as a:

CLASS 1 LASER PRODUCT

IEC 60825-1 : 2014 (or latest accepted published version)

China standard GB/T 7247.1 - 2024 (or latest accepted published version) (C056)

External cables can enter or egress a system through the top and/or bottom exit frame locations according to the options provided in Table 1 below. External cables may include Optical I/O or Coupling, Ethernet, and Line Cords. Fiber Quick Connect (FQC) options are available for FICON I/O optical cabling.

Customer Environment	Bottom Exit Cabling	Top Exit Cabling	FCs to be Ordered	Comments
Raised Floor	Yes	No	7804 only	Ships with Bottom Exit Tailgate & supports Bottom FQC FC 5827
Raised Floor	Yes	Yes, no Top Exit Enclosure	7803 & 7804	Ships with Bottom Exit Tailgate & supports Bottom FQC FC 5827
Raised Floor	Yes	Yes, with Top Exit Enclosure	7804 & 5823	Ships with Bottom Exit Tailgate & supports FQC FCs 5824, 5826 & 5827
Raised Floor	No	Yes, no Top Exit Enclosure	7803	Ships with Bottom Seal Plate and does not support FQC FCs
Raised Floor	No	Yes, with Top Exit Enclosure	5823 & 7803	Ships with Bottom Seal Plate and only supports FQC FC 5824 & 5826
Non-Raised Floor	No (not supported)	Yes, no Top Exit Enclosure	7998* & 7803	Ships with Bottom Seal Plate and does not support FQC FCs
Non-Raised Floor	No (not supported)	Yes, with Top Exit Enclosure	7998* & 5823	Ships with Bottom Seal Plate and & supports FQC FCs 5824 & 5826

\*FC 7998: Non-Raised Floor Support (flag)

Table 1: 9176 Cabling Feature Codes Combinations

## FICON & FCP Cables

Fiber optic cables that attach to PCIe+ I/O cards can exit through the top or the bottom of the frame. FICON, FCP, OSA Express, and Coupling connection types are included in this grouping. For further details on the connection type options, refer to the [IMPP](#), Chapter 8: I/O Cabling and Connectivity and [Fiber Optic Cabling Guide](#).

The following important notes should be understood when installing fiber optic cables:

- 1) Follow recommended cleaning and installation procedures for all fiber optic cable products for optimal performance (see Fiber Optic Cabling Guide).
- 2) If using FQC, make sure the coupler type matches the correct cable plug type. There are two polarity options:
  - Key up-key up (**FC 5826**) Top Exit only.
  - Key up-key down (**FC 5824**) Top Exit, (**FC 5827**) Bottom Exit.
- 3) The Top Exit Enclosure (TEE) (**FC 5823**) is not required to route fiber optic cables through the top of the machine.

The spine is factory installed. It is used for cable management and strain relief. These cables will route parallel to the central channel for both top and bottom exiting systems (Figure 34).

If the TEE FQC (**FC 5824 or 5826**) is used, the FQC brackets should be populated from the outside inward (Figure 34). If the Bottom Exit FQC (**FC 5827**) is selected, the FQC brackets are factory installed (Figure 40).

Please note the warning provided in Figure 33 when line cords are running through the top exit.



Figure 33: Top Exit Enclosure Grounding Warning

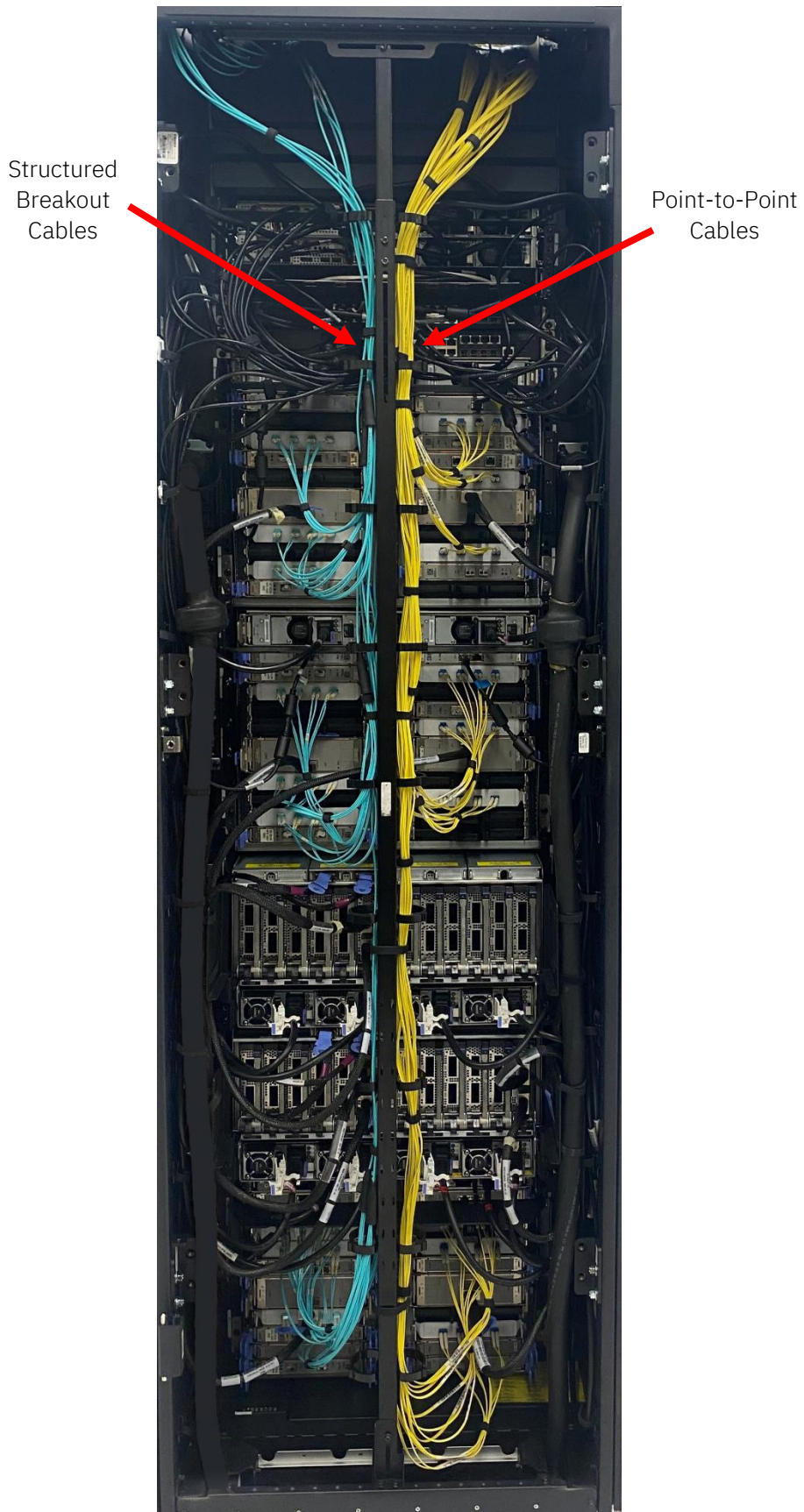


Figure 34: Example Fiber Optic Cables in Spine  
(Structured Breakout Cables on Left, Point-to-Point Cables on Right)

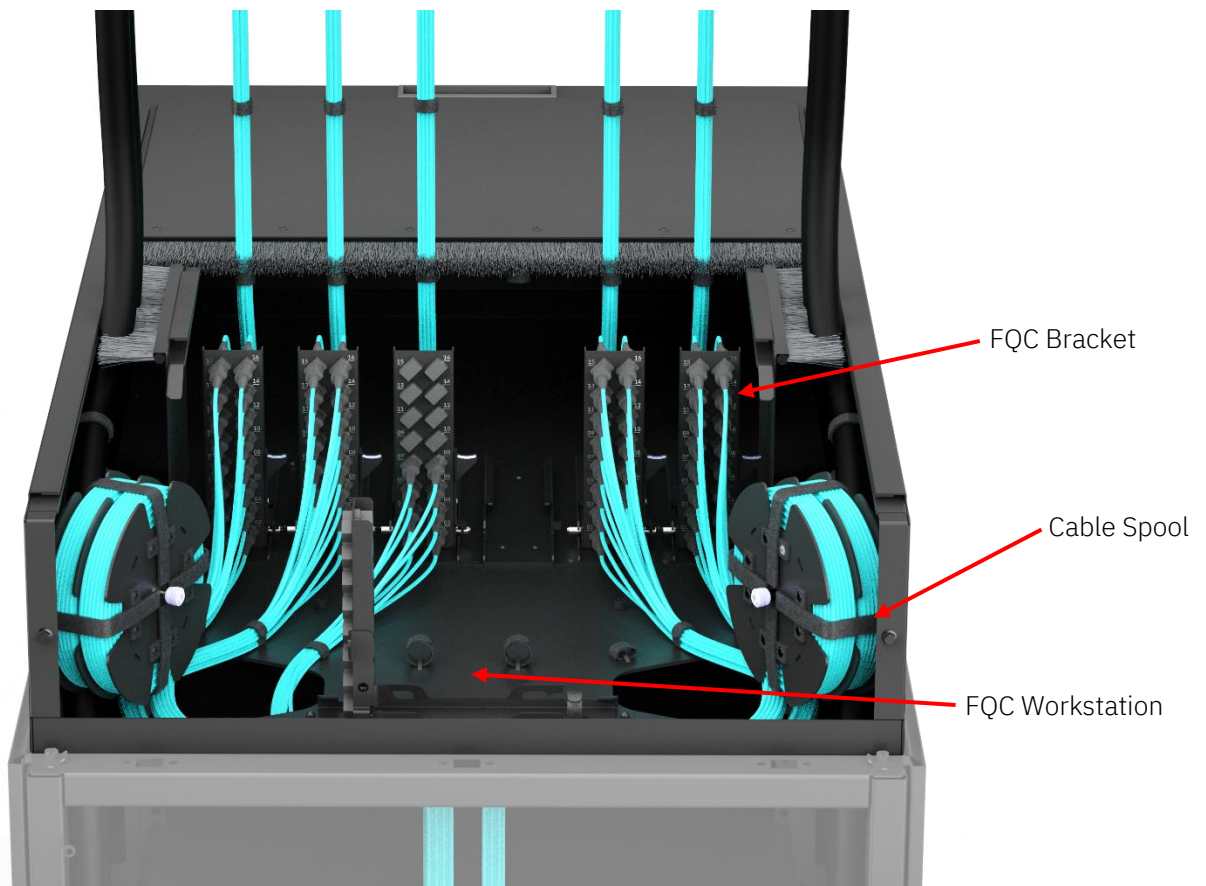
The TEE is an optional feature (**FC 5823**) to support:

- Top exit of power cables to be mounted along the side walls, two on each side.
- Top exit of fiber optic cables routed through the brushes and into the frame routed securely away from power cables.
- Management of cable slack.
- Ease of integration with hot/cold aisle airflow containment system.
- Restricted TEE access when frame covers are locked.

Additional optional FQC bracket features (**FC 5824 and 5826**) support:

- Structured cabling with built in strain relief.
- FQC workstation at the back edge of the TEE, enabling unimpeded access to either side of the FQC brackets while cabling.

When using the TEE (**FC 5823**), cable routing and length may be managed with provided cable spools and hook-and-loop strain relief. For Bottom Exit FQC configurations, vertical cable spools are provided. Use of these spools is optional, but when used, are mounted to the central spine.



*Figure 35: Fiber Optic Cables in Top Exit Cabling Enclosure (FC 5823)*

Added Hook-and-Loop for Support

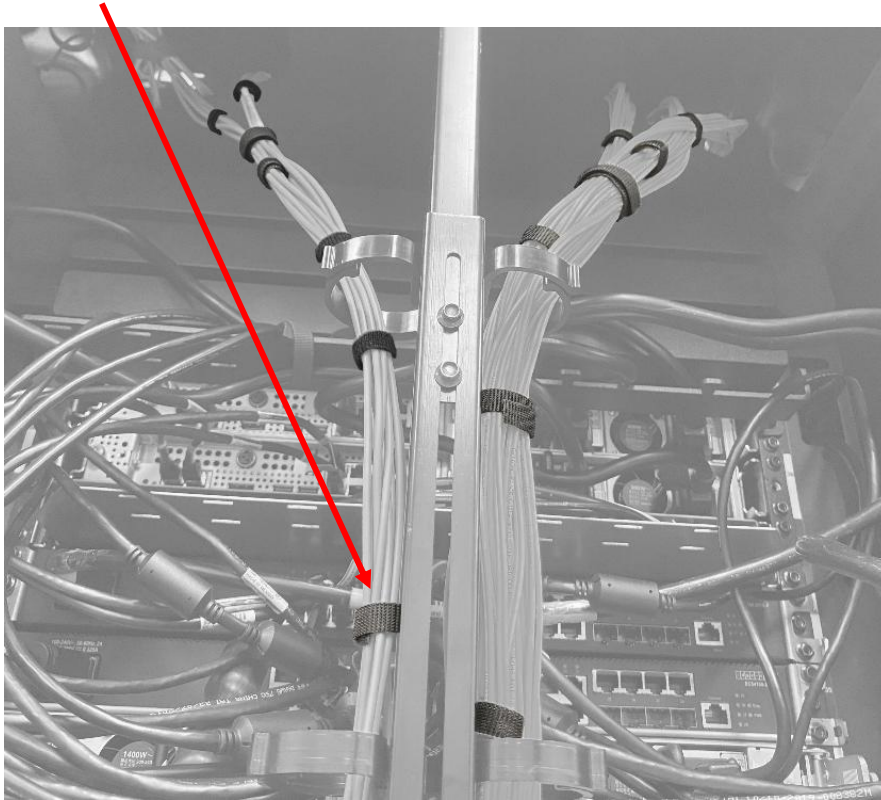


Figure 36: Fiber Optic Cables Strapped to Center Spine

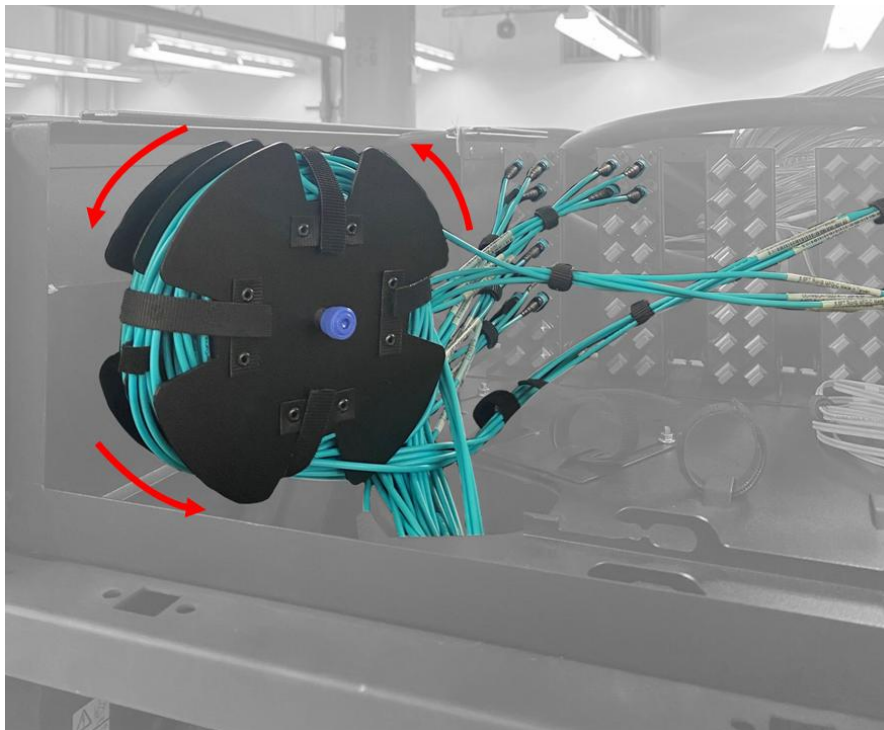


Figure 37: Fiber Optic Cables in Top Exit Cabling Enclosure Including Optional Cable Spools (Red arrows indicate the direction of cable routing around the spool)

The Bottom Exit Tailgate is required for any bottom exit cabling (**FC 7804**). It supports line cords, ethernet cabling, and both point-to-point and structured fiber optic cabling.

Strain relief clamps are used to secure any cables that pass through the tailgate. There are two types:

- Line cord strain relief clamps integrated with tailgate (Figure 38)
- Optional strain relief foam clamps for point-to-point I/O, coupling, and/or ethernet cabling (Figure 39)



Figure 38: Strain Relief Line Cord Clamp for Bottom Exiting



Figure 39: Strain Relief Clamp

Additional optional FQC brackets (**FC 5827**) are also available (Figure 40).

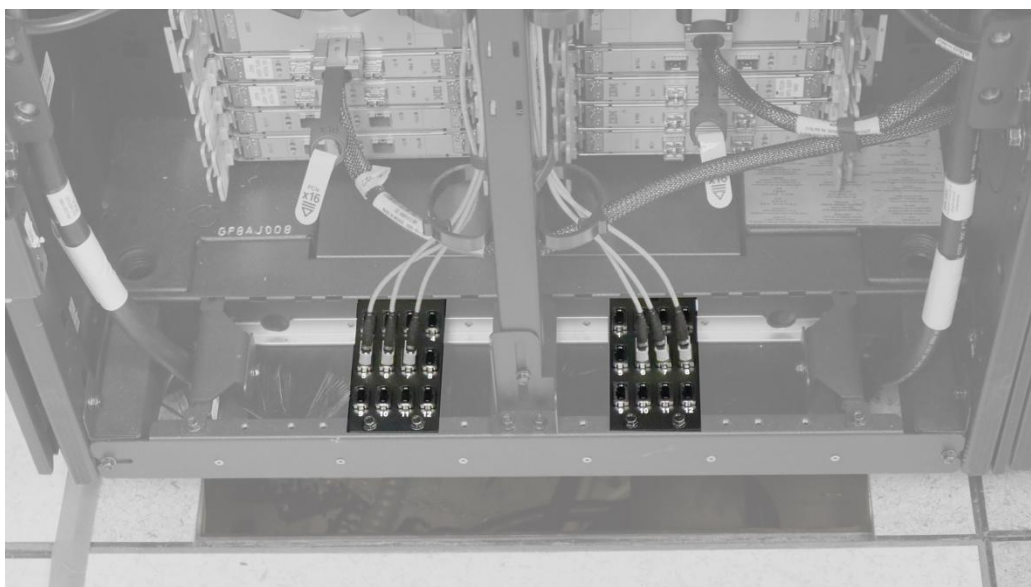


Figure 40: FQC on Tailgate (FCs 7804 and 5827)

Optional cabling spools are provided to organize and retain excess fiber optic cabling when both the bottom exit (**FC 7804**) and FQC brackets (**FC 5827**) are ordered. It is recommended to install these spools just above the FQC brackets (Figure 41 and 42), however if there is interference with other cabling it may be beneficial to move the spools higher in the frame. To ensure adequate cable service loop, it is recommended that the spool be placed in its service position prior to wrapping any excess cable length around it and then moved to the final installed position on either side of the spine (Figure 41 and 42).



*Figure 41: FICON Cabling Spool in its Service Position*



*Figure 42: FICON Cabling Spools in their Regular Positions*

As part of final system check-out and/or following any system upgrade or service actions, verify that all cables are properly routed, terminated, and strain relieved (i.e., via the provided clamps, brackets, filler plates and fasteners). This is to ensure the system is working properly.

### ***OSA Network Cables***

Open Systems Adapter-Express (OSA-Express) features enable connectivity to industry-standard local area networks (LANs). These cables may be either fiber optic or copper (carry-forward FC only), and are routed through the center spine. Configuration information is found in the [IMPP](#), and reference information is found in the [Fiber Optic Cabling Guide](#)

## External Ethernet (HMC)

If a Hardware Management Console (HMC) is ordered, the customer must supply the necessary ethernet cables to connect the remote HMC to the IBM Z system's Support Element (SE). These cables are routed either through the top or bottom of the system depending on the frame configuration. If entering through the top, the cables shall enter through the D-holes at the front of the frame (red line in Figure 43) or through the large cutouts at the rear of the frame (blue line in Figure 43).

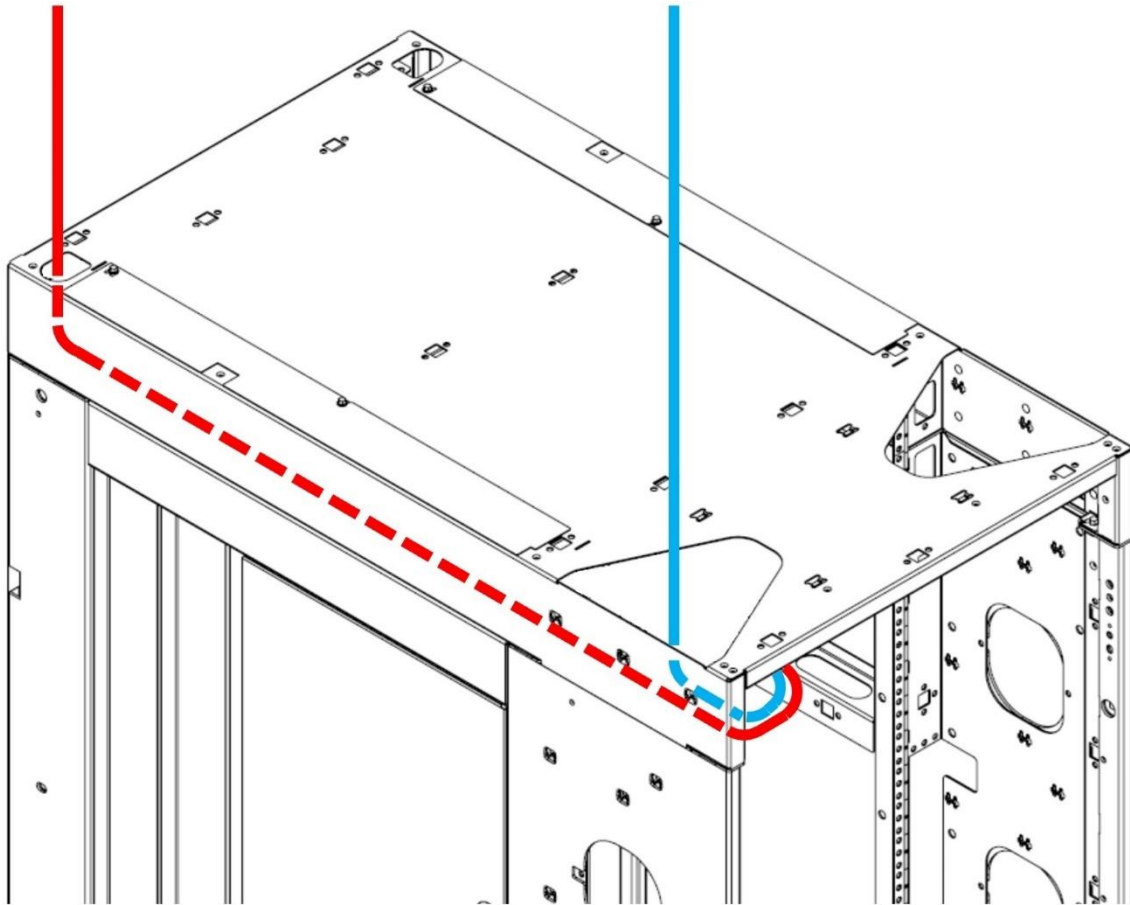


Figure 43: External Ethernet Cable Routing

## System Time Synchronization

A Server Time Protocol (STP) Coordinated Timing Network (CTN) has the capability of connecting to an External Time Source (ETS) via either a Network Time Protocol (NTP) or a Precision Time Protocol (PTP). This capability requires at least an ETS ethernet cable connection but may additionally include a pulse-per-second (PPS) signal via coaxial cable to augment the timing accuracy. The ETS and PPS cables are both connected to the oscillator (OSC) cards at the front of the CPC drawer(s) (Figure 44 and 45), assuming the client network operates in a firmware partition within the CPC drawer.

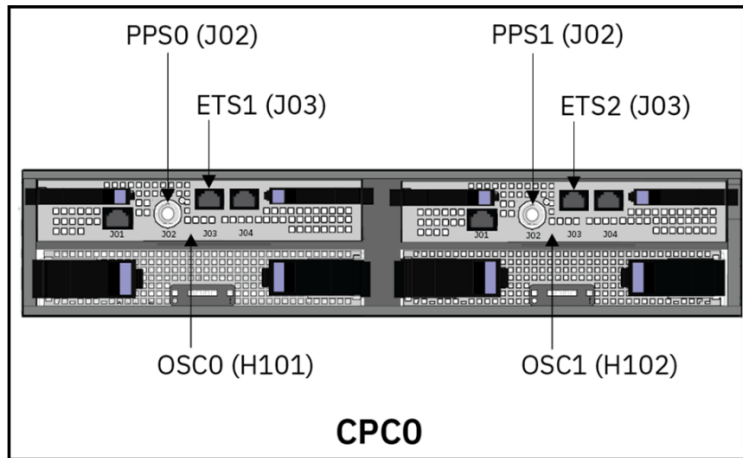


Figure 44: PPS Ports for One (1) CPC Drawer

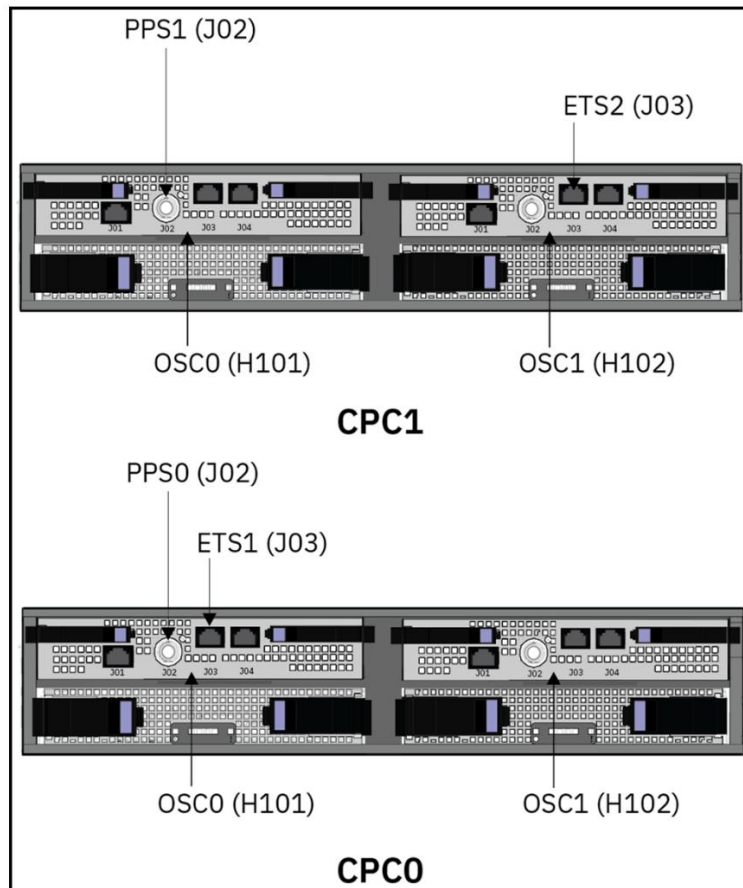



Figure 45: PPS Ports for Two (2) CPC Drawers

When installing the PPS coaxial cable, caution must be followed as detailed in the Install Manual. The PPS cable shall use a 90-degree BNC connector (included in the Ship Group) that has a bare grounded outer barrel. The warning provided below shall be followed when plugging or unplugging the coaxial cable (also reference the procedure provided in the system's Install Manual).

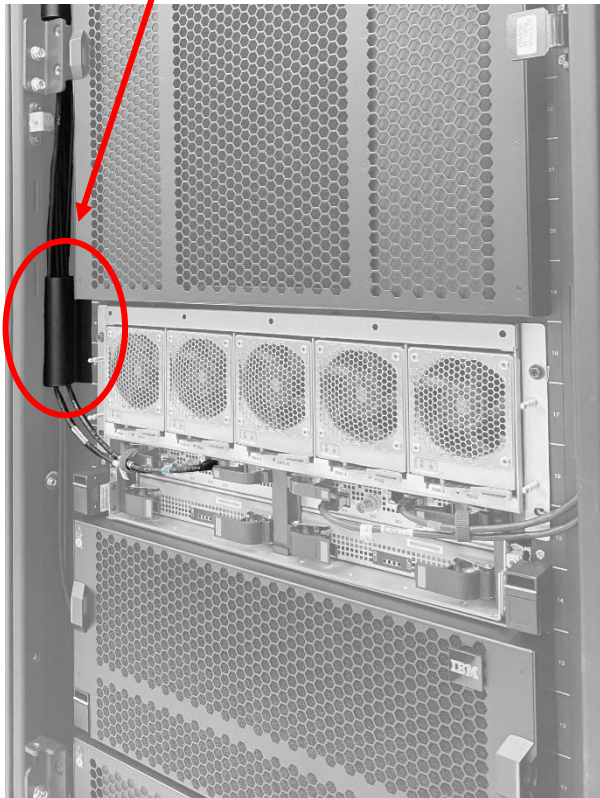
 **DANGER:** To prevent a possible shock from touching two surfaces with different protective ground (earth), use one hand, when possible, to connect or disconnect signal cables. (D001)

*Figure 46: Grounding Warning*

The ETS and PPS cables should be retained to the OSC card latches using hook-and-loop fasteners. The routing of these cables shall be along the same path as the pre-installed ethernet cables under the plastic cable organizers at the front of the frame (Figure 47 and 48). These cables are to be routed through the “front-to-rear cable passthrough” (Figure 48) at the top of the frame.

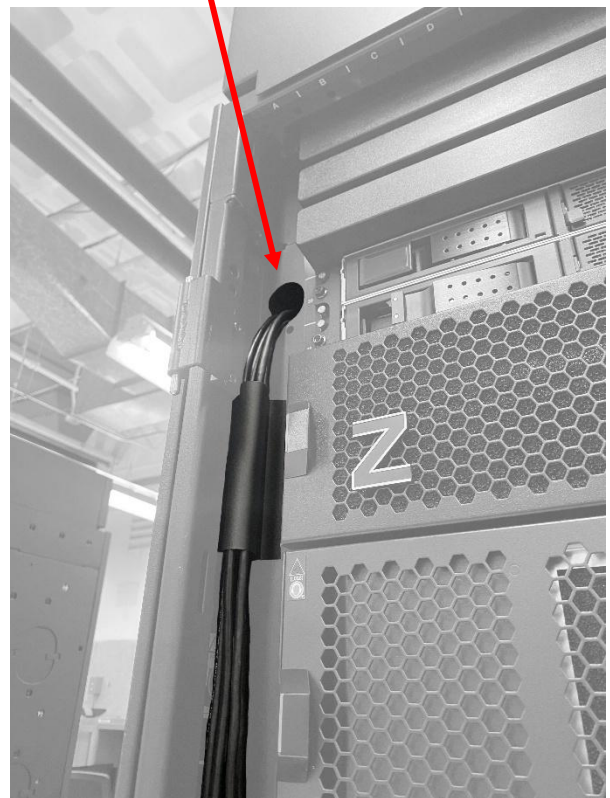
Cables routed on the left side of the frame shall only plug to the left oscillator card. Cables routed on the right side of the frame shall only plug to the right oscillator card (Figure 47 and 49).

Plastic Cable Organizer

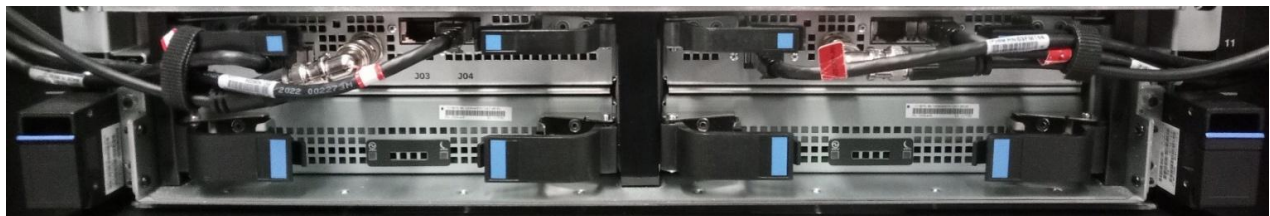


*Figure 47: Front of CPC Drawer*

Front-to-Rear Cable Passthrough



*Figure 48: Front-to-Rear Cable Passthrough*



*Figure 49: Front of CPC Drawer*

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## Appendix A. Notices

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CAN ICES-3 (A)/NMB-3(A)

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Warning: This equipment is compliant with Class A of CISPR 32. In a residential environment this equipment may cause radio interference.

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International Business Machines Corp.

New Orchard Road

Armonk, New York 10504

Tel: 914-499-1900

Der verantwortliche Ansprechpartner des Herstellers in der EU ist:

IBM Deutschland GmbH

Technical Relations Europe

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Tel: +49 (0) 800 225 5426

email: HalloIBM@de.ibm.com

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