Palo Alto Networks, Inc.

PAN-OS 9.0 Firewalls

PA-220, PA-220R, PA-800 Series, PA-3000 Series, PA-3200 Series, PA-5200 Series, and PA-7000 Series

FIPS 140-2 Non-Proprietary Security Policy

Version: 1.3

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Table of Contents

1. Module Overview

Palo Alto Networks offers a full line of next-generation security appliances that range from the PA-220, designed for enterprise remote offices, to the PA-7080, which is a modular chassis designed for high-speed datacenters. Our platform architecture is based on our single-pass engine, PAN-OS, for networking, security, threat prevention, and management functionality that is consistent across all platforms. The devices differ only in capacities, performance, and physical configuration.

The Palo Alto Networks PA-220, PA-220R, PA-800 Series, PA-3000 Series, PA-3200 Series, PA-5200 Series, and PA-7000 Series Firewalls (hereafter referred to as the modules) are multi-chip standalone modules that provide network security by enabling enterprises to see and control applications, users, and content – not just ports, IP addresses, and packets – using three unique identification technologies: App-ID, User-ID, and Content-ID. These identification technologies, found in Palo Alto Networks' enterprise firewalls, enable enterprises to create business-relevant security policies – safely enabling organizations to adopt new applications, instead of the traditional "all-or-nothing" approach offered by traditional port-blocking firewalls used in many security infrastructures.

Features and Benefits

- **Application visibility and control:** Accurate identification of the applications traversing the network enables policy-based control over application usage at the firewall, the strategic center of the security infrastructure.
- **Visualization tools:** Graphical visibility tools, customizable reporting and logging enables administrators to make a more informed decision on how to treat the applications traversing the network.
- **Application browser:** Helps administrators quickly research what the application is, its' behavioral characteristics and underlying technology resulting in a more informed decision making process on how to treat the application.
- **User-based visibility and control:** Seamless integration with enterprise directory services (Active Directory, LDAP, eDirectory) facilitates application visibility and policy creation based on user and group information, not just IP address. In Citrix and terminal services environments, the identity of users sitting behind Citrix or terminal services can be used to enable policy-based visibility and control over applications, users and content. An XML API enables integration with other, 3rd party user repositories.
- **Real-time threat prevention:** Detects and blocks application vulnerabilities, viruses, spyware, and worms; controls web activity; all in real-time, dramatically improving performance and accuracy.
- **File and data filtering:** Taking full advantage of the in-depth application inspection being performed by App-ID, administrators can implement several different types of policies that reduce the risk associated with unauthorized file and data transfer.
- **Legacy firewall support:** Support for traditional inbound and outbound port-based firewall rules mixed with application-based rules smooth the transition to a Palo Alto Networks next generation firewall.
- **Networking architecture**: Support for dynamic routing (OSPF, RIP, BGP), virtual wire mode and layer 2/layer 3 modes facilitates deployment in nearly any networking environment.
- **Policy-based Forwarding**: Forward traffic based on policy defined by application, source zone/interface, source/destination address, source user/group, and service.
- **Virtual Systems**: Create multiple virtual "firewalls" within a single device as a means of supporting specific departments or customers. Each virtual system can include dedicated administrative accounts, interfaces, networking configuration, security zones, and policies for the associated network traffic.
- **VPN connectivity**: Secure site-to-site connectivity is enabled through standards-based IPSec VPN support while remote user access is delivered via SSL VPN connectivity.
- **Quality of Service (QoS):** Deploy traffic shaping policies (guaranteed, maximum and priority) to enable positive policy controls over bandwidth intensive, non-work related applications such as streaming media while preserving the performance of business applications.
- **Real-time bandwidth monitor:** View real-time bandwidth and session consumption for applications and users within a selected QoS class.
- **Purpose-built platform:** combines single pass engine with parallel processing hardware to deliver the multi-Gbps performance necessary to protect today's high-speed networks.

The configurations for this validation are:

Table 1 - Validated Version Information

Module	Part Number	Hardware Version	FIPS Kit Part Number	FIPS Kit Hardware Version	Firmware Version
PA-220	910-000128	Rev. A	920-000084	Rev. A	9.0.9-h1
PA-220R	910-000147	Rev. B	920-000226	Rev. A	9.0.9-h1
PA-820	910-000120	Rev. A	920-000185	Rev. A	9.0.9-h1
PA-850	910-000119	Rev. A	920-000185	Rev. A	9.0.9-h1
PA-3020	910-000017	Rev. J	920-000081	Rev. A	9.0.9-h1
PA-3050	910-000016	Rev. J	920-000081	Rev. A	9.0.9-h1
PA-3060	910-000104	Rev. C	920-000138	Rev. A	9.0.9-h1
PA-3220	910-000162	Rev. A	920-000212	Rev. A	9.0.9-h1
PA-3250	910-000163	Rev. A	920-000212	Rev. A	9.0.9-h1
PA-3260	910-000164	Rev. A	920-000212	Rev. A	9.0.9-h1
PA-5220	910-000132	Rev. A	920-000186	Rev. A	9.0.9-h1
PA-5250	910-000131	Rev. A	920-000186	Rev. A	9.0.9-h1
PA-5260	910-000125	Rev. A	920-000186	Rev. A	9.0.9-h1
PA-5280	910-000157	Rev. A	920-000186	Rev. A	9.0.9-h1
PA-5280-K2-EXP	910-000257	Rev. A	920-000186	Rev. A	9.0.9-h1
PA-5280-K2-SEC	910-000357	Rev. B	920-000186	Rev. A	9.0.9-h1
PA-7050**	910-000102	Rev. B	920-000112	Rev. A	9.0.9-h1

PA-7080**	910-000122	Rev. A	920-000119	Rev. A	9.0.9-h1

** Palo Alto Networks PA-7000 Series firewalls are tested with the following NPC, LFC, NPC, and SMCs that can be configured for use in the Approved mode of operation

Network Processing Cards:

- PAN-PA-7000-20G-NPC: P/N: 910-000028-00B
- PAN-PA-7000-20GQ-NPC: P/N: 910-000117-00A
- PAN-PA-7000-20GXM-NPC: P/N: 910-000137-00A
- PAN-PA-7000-20GQXM-NPC: P/N: 910-000136-00A
- PAN-PA-7000-100G-NPC-A: P/N: 910-000156-00A
- PAN-PA-7000-100G-NPC-A-K2-EXP: P/N: 910-000256-00A
- PAN-PA-7000-100G-NPC-A-K2-SEC: P/N: 910-000356-00B

Log Forwarding Card:

- PAN-PA-7000-LFC-A: P/N: 910-000183-00A

Log Processing Card:

- PAN-PA-7000-LPC: P/N: 910-0000014-00A

Switch Management Cards:

- PAN-PA-7080-SMC-B: P/N: 910-000186-00A
- PAN-PA-7080-SMC-B-K2-EXP: P/N: 910-000286-00D
- PAN-PA-7080-SMC-B-K2-SEC: P/N: 910-000386-00D
- PAN-PA-7050-SMC-B: P/N: 910-000185-00A
- PAN-PA-7050-SMC-B-K2-EXP: P/N: 910-000285-00C
- PAN-PA-7050-SMC-B-K2-SEC: P/N: 910-000385-00C
- PA-7050-SMC: P/N: 910-000013-00P
- PA-7080-SMC: P/N: 910-000012-00L

Figure 1 depicts the logical block diagram for the modules. The cryptographic physical boundary includes all of the logical components of the modules and the boundary is the physical enclosure of the firewall.

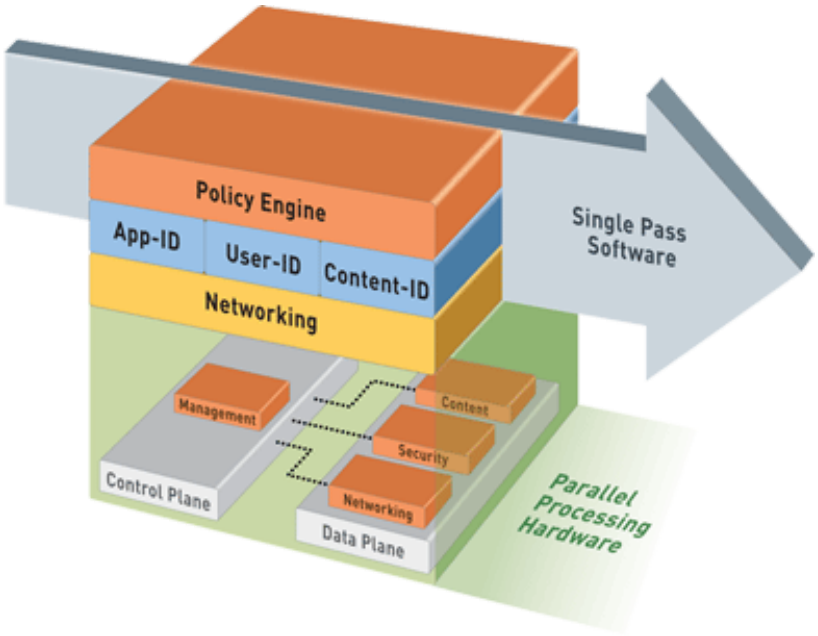


Figure 1 - Logical Diagram

2. Security Levels

The cryptographic modules meet the overall requirements applicable to Level 2 security of FIPS 140-2.

Table 2 - Module Security Level Specification

Security Requirements Section	Level
Cryptographic Module Specification	2
Module Ports and Interfaces	2
Roles, Services, Authentication	3
Finite State Model	2
Physical Security	2
Operational Environment	N/A
Cryptographic Key Management	2
EMI/EMC	2
Self-Tests	2
Design Assurance	3
Mitigation of Other Attacks	N/A

3. Modes of Operation

FIPS Approved Mode of Operation

The modules support both a FIPS-CC mode (FIPS Approved mode) and a Non-Approved mode. The following procedure will put the modules into the FIPS-approved mode of operation:

- Install FIPS kit opacity shields and tamper evidence seals according to the Physical Security Policy section. FIPS kits must be correctly installed to operate in the Approved mode of operation. The tamper evidence seals and opacity shields shall be installed for the module to operate in a FIPS Approved mode of operation.
- During initial boot up, break the boot sequence via the console port connection (by pressing the maint button when instructed to do so) to access the main menu.
- Select "Continue."
- Select the "Set FIPS-CC Mode" option to enter CC mode.
- Select "Enable FIPS-CC Mode".
- When prompted, select "Reboot" and the module will re-initialize and continue into CC mode (FIPS mode).
- The module will reboot.
- In FIPS-CC mode, the console port is available as a status output port.

The module will automatically indicate the FIPS Approved mode of operation in the following manner:

- Status output interface will indicate "**** FIPS-CC MODE ENABLED ****" via the CLI session.
- Status output interface will indicate "FIPS-CC mode enabled successfully" via the console port.
- The module will display "FIPS-CC" at all times in the status bar at the bottom of the web interface.

Should one or more power-up self-tests fail, the FIPS Approved mode of operation will not be achieved. Feedback will consist of:

- The module will output "FIPS-CC failure"
- The module will reboot and enter a state in which the reason for the reboot can be determined.
- To determine which self-test caused the system to reboot into the error state, connect the console cable and follow the on-screen instructions to view the self-test output.

Non-Approved Mode of Operation

The following procedure will put the modules into the non-Approved mode of operation:

- Access the module's CLI via SSH, and command the module to enter maintenance mode; the module will reboot
  - Note: Establish a serial connection to the console port
- After reboot, select "Continue."
- Select the "Set FIPS-CC" option, and press enter.
- Select "Disable FIPS-CC Mode", and press enter.
- The module will disable FIPS-CC mode, and perform a factory reset (zeroization)
- Once complete, the module will provide the following status output:
  - "Set FIPS-CC Mode Status: Success"

The following procedure will zeroize the module:

- Access the module's CLI via SSH, and command the module to enter maintenance mode; the module will reboot
  - Note: Establish a serial connection to the console port
- After reboot, select "Continue."
- Select "Factory Reset"
- The module will perform a zeroization, and provide the following message once complete:
  - "Factory Reset Status: Success"

Approved and Allowed Algorithms

Insert relevant information for the algorithm and their certificate numbers

Table 3 - FIPS Approved Algorithms Used in the Module

FIPS Approved Algorithm	CAVP Cert. #
AES [FIPS 197, SP800-38A]: Functions: Encryption, Decryption ECB, CBC, CTR modes; Encrypt/Decrypt; 128, 192 and 256-bit CFB128 mode; Encrypt/Decrypt; 128-bit Note: AES-OFB (128, 192, 256 bit), AES-CFB1 (128, 192, 256 bit), AES-CFB8 (128, 192, 256 bit) and AES-CFB128 (192, 256 bit) were also tested but are not available for use	C1005
AES-CCM [SP800-38C]: Encrypt and Decrypt, 128-bit	C1005
AES-GCM [SP800-38D]: Encrypt and Decrypt, 128 and 256-bit (192 bit was tested but not available for use) Note 1: GCM IV handling is compliant with FIPS IG A.5 and SP800-38D.* Note 2: GCM 192-bit was tested, but it is not used by the module. Note 3: GMAC was tested, but not used by the module.	C1005
CKG (SP800-133) Key Generation Vendor Affirmed - Asymmetric Key Generation; SP800-133 §6, seed results from an unmodified DRBG output - Symmetric Key Generation; SP800-133 §7.1 (symmetric key results from an unmodified DRBG output), §7.2, and §7.3	Vendor Affirmed
CVL: KDF, Application Specific [SP800-135] - TLS 1.0/1.1/1.2 KDF - SNMPv3 KDF - SSHv2 KDF - IKE v1/v2 KDF	C1005
CVL: RSA [SP800-56B] - RSADP Note: Tested but not used.	C1005
CVL: ECDSA Signature Generation P-256 SHA: SHA-224, SHA-256, SHA-384, SHA-512 P-384 SHA: SHA-224, SHA-256, SHA-384, SHA-512 P-521 SHA: SHA-224, SHA-256, SHA-384, SHA-512 Note: Tested, but not used by the module.	C1005
DRBG [SP800-90A]: CTR DRBG with AES-256, one instantiation per plane Derivation function enabled	C1005
DSA [FIPS 186-4]: Key Generation -Key Generation: 2048 bits	C1005
ECDSA [FIPS 186-4] - Key Pair Generation P-256, P-384, and P-521 - Public Key Validation P-256, P-384, and P-521 - Signature Generation P-256, P-384 and P-521; with all SHA-2 sizes+ - Signature Verification P-224, P-256, P-384 and P-521; with SHA-1 and all SHA-2 sizes+ +Does not include the “short SHA-512” sizes SHA-512/224 or SHA-512/256	C1005

HMAC [FIPS 198] - HMAC-SHA-1 with λ=96, 160 - HMAC-SHA-256 with λ=256 - HMAC-SHA-384 with λ=384 - HMAC-SHA-512 with λ=512	C1005
KAS-SSC: SP 800-56A Rev.3 Elliptic Curve Diffie-Hellman Exchange (key agreement; key establishment methodology provides between 128 and 256 bits of encryption strength) and Diffie-Hellman Exchange (key agreement; key establishment methodology provides 112 bits of encryption strength)	A2670
KAS (KAS-SSC Cert. #A2670, CVL Cert. #C1005): SP 800-56A Rev3 compliant key agreement scheme, where testing was performed separately for the shared secret computation and for a TLS, SSH, and IKE KDF compliant with SP 800-135 Rev1	KAS-SSC Cert. #A2670 CVL Cert. #C1005
KTS [SP800-38F §3.1]: AES-CBC (128/192/256 bit) plus HMAC AES-CTR (128/192/256 bit) plus HMAC (Key wrapping; key establishment methodology provides between 128 bit and 256 bits of encryption strength)	C1005
KTS [SP800-38F §3.1]: AES-GCM (Key wrapping; key establishment methodology provides 128 bit or 256 bits of encryption strength)	C1005
RSA [FIPS 186-4] - Key Pair Generation: 2048 and 3072 bits - Signature Generation (ANSI X9.31, RSASSA-PKCS1_v1-5, RSASSA-PSS): 2048, 3072, and 4096-bit (per IG A.14) with hashes (SHA-1^{+}/256/384/512) - Signature Verification (ANSI X9.31, RSASSA-PKCS1_v1-5, RSASSA-PSS): 1024^{++}, 2048, 3072, 4096-bit (per IG A.14) with hashes (SHA-1/224^{+++}/256/384/512) $^{+}$: Only used for signature generation in SSH in the Approved Mode; Mod 4096 does not support SHA-1 $^{++}$: This size is not supported for RSASSA-PKCS1_v1-5 $^{+++}$: This Hash algorithm is not supported for ANSI X9.31 Note: FIPS 186-2 SigGen was tested, but not used by the module.	C1005
Safe Primes Key Generation and Verification using MODP-2048	A2670
SHS (SHA-1 and SHA-2 [FIPS 180-4]): - Hashes: SHA-1, SHA-256, SHA-384, SHA-512 - Usage: Digital Signature Generation & Verification, Non-Digital Signature Applications (e.g., component of HMAC) (Note: SHA-224 was tested, but not used in the module)	C1005

The module is compliant to IG A.5: GCM is used in the context of TLS, IPsec/IKEv2, SSH, and IPsec/IKEv1:

- For TLS, The GCM implementation meets Scenario 1 of IG A.5: it is used in a manner compliant with SP 800-52 and in accordance with Section 4 of RFC 5288 for TLS key establishment. (From this RFC, the GCM cipher suites in use are TLS_RSA_WITH_AES_128_GCM_SHA256, TLS_RSA_WITH_AES_256_GCM_SHA384, TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256, TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384, TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256, and TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384.) During operational testing, the module was tested against an independent version of TLS and found to behave correctly.

- For IPsec/IKEv2, The GCM implementation meets Scenario 1 of IG A.5: it is used in a manner compliant with RFCs 4106 and 7296 (RFC 5282 is not applicable, as the module does not use GCM within IKEv2 itself). During operational testing, the module was tested against an independent version of IPsec with IKEv2 and found to behave correctly.
- For SSH, the module meets Scenario 4 of IG A.5. The fixed field is 32 bits in length and is derived using the SSH KDF; this ensures the fixed field is unique for any given GCM session. The invocation field is 64 bits in length and is incremented for each invocation of GCM; this prevents the IV from repeating until the entire invocation field space of 2^{64} is exhausted. (It would take hundreds of years for this to occur.)
- For IPsec/IKEv1, the module meets Scenario 4 of IG A.5. The behavior is the same as the above description for SSH, except the fixed field is derived using the IKEv1 KDF instead of the SSH KDF.

In all of the above cases, the nonce_explicit is always generated deterministically. AES GCM keys are zeroized when the module is power-cycled. For each new TLS or SSH session, a new AES GCM keys is established.

The cryptographic modules support the following non-FIPS Approved algorithms that are allowed for use in FIPS-CC mode.

Table 4 - FIPS Allowed Algorithms used in the Module

FIPS Allowed Algorithms
CMAC – A self-test is performed for this algorithm, but it is not used by the module
MD5 (within TLS)
NDRNG (used to seed SP 800-90A DRBG): one NDRNG per plane. This provides a minimum of 256 bits of entropy.
RSA wrap, non-compliant to SP800-56B RSA (key wrapping: key establishment methodology provides 112 or 128 bits of encryption strength)

Table 5 - Supported Protocols in FIPS Approved Mode

Supported Protocols in FIPS Approved Mode*
TLSv1.0**, v1.1, and v1.2
SSHv2
IPSec, IKEv1, and IKEv2
SNMPv3

*Note: These protocols were not reviewed or tested by the CMVP or CAVP.

**See vendor imposed security rule #3.a in Security Rules section.

Non-Approved, Non-Allowed Algorithms

The cryptographic modules support the following non-Approved algorithms. No security claim is made in the current modules for any of the following non-Approved algorithms. All algorithms in this mode of operation are deemed as non-compliant.

Table 6 - Non-Approved Mode of Operation

Non-Approved Algorithms in Non-FIPS-CC Mode
Digital Signatures (non-Approved strengths, non-compliant): RSA Key Generation: 512, 1024, 4096 RSA signature generation: Modulus bit length less than 2048 or greater than 4096 bits; up to 16384 bits RSA signature verification: Modulus bit length less than 1024 or greater than 4096 bits; up to 16384 bits ECDSA: B, K, P curves not equal to P-256, P-384 or P-521 DSA: 768 to 4096 bits
Encrypt/Decrypt: Camellia, SEED, Triple-DES (non-compliant), Blowfish, CAST, RC4, DES
Hashing: RIPEMD, MD5
Key Exchange (non-Approved strengths): Elliptic Curve Diffie-Hellman: B, K, P curves not equal to P-256, P-384 or P-521 Diffie-Hellman: 768, 1024 and 1536-bit modulus RSA: Less than 2048-bit modulus
Message Authentication: UMAC, HMAC-MD5, HMAC-RIPEMD

4. Ports and Interfaces

The modules are multi-chip standalone modules with ports and interfaces as shown below.

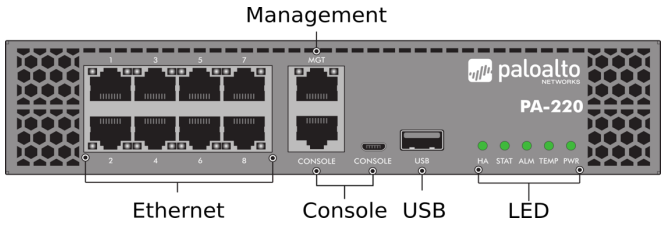


Figure 2 - PA-220 Front Interfaces

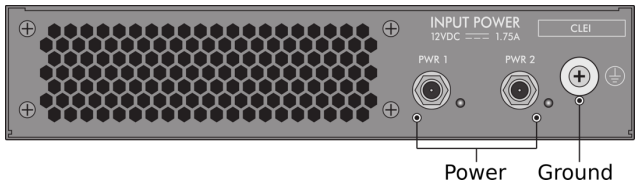


Figure 3 - PA-220 Rear Interfaces

Table 7 - PA-220 FIPS 140-2 Ports and Interfaces

Interface	Quantity	FIPS 140-2 Designation	Name and Description
RJ45	1	Data input, control input, data output, status output	Console port
Micro-USB	1	Data input, control input, data output, status output	Console port
RJ45	1	Data input, control input, data output, status output	Out of band management
RJ45	8	Data input, control input, data output, status output	10/100/1000 Ethernet interface
DC-12V	2	Power input	Power interface
LEDs	5	Status output	Status indicators
USB	1	Disabled except for power	Disabled except for power

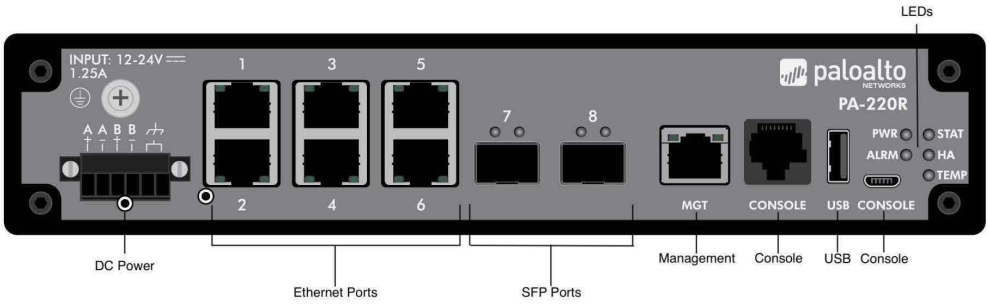


Figure 4 - PA-220R Front Interfaces

Figure 5 - PA-220R Rear Interfaces

Table 8 - PA-220R FIPS 140-2 Ports and Interfaces

Interface	Quantity	FIPS 140-2 Designation	Name and Description
DC Power	1	Power	Power interface
RJ-45	6	Data input, control input, data output, status output	10/100/1000 Ethernet interface
SFP	2	Data input, control input, data output, status output	SFP (1 Gbps) ports
RJ-45	1	Data input, control input, data output, status output	Out of bound management
RJ-45	1	Data input, control input, data output, status output	Console port
USBs	1	Disabled except for power	Disable except for power
Micro-USB	1	Data input, control input, data output, status output	Console port
LEDs	5	Status output	Status indicators

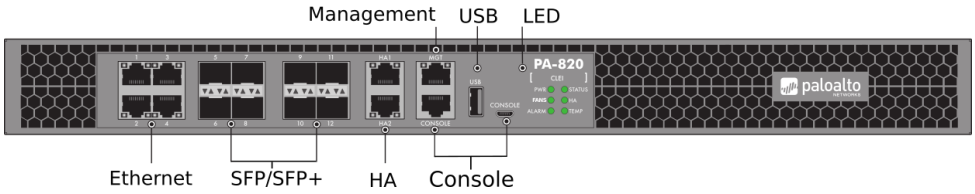


Figure 6 - PA-820 / PA-850 Front Interfaces

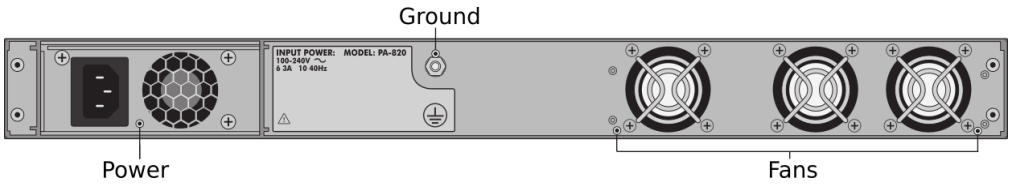


Figure 7 - PA-820 Rear Interfaces

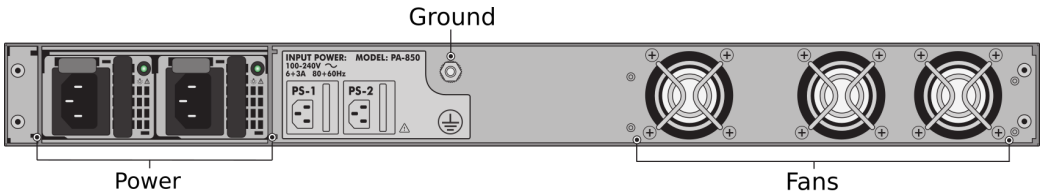


Figure 8 - PA-850 Rear Interfaces

Table 9 - PA-800 Series FIPS 140-2 Ports and Interfaces

Interface	PA-820 Qty	PA-850 Qty	FIPS 140-2 Designation	Name and Description
RJ45	1	1	Data input, control input, data output, status output	Console port
Micro-USB	1	1	Data input, control input, data output, status output	Console port
RJ45	1	1	Data input, control input, data output, status output	Out of band management
RJ45	2	2	Data input, control input, data output, status output	10/100/1000 HA Ethernet interface
RJ45	4	4	Data input, control input, data output, status output	10/100/1000 Ethernet interface
SFP	8	4	Data input, control input, data output, status output	Gigabit Ethernet interface

SFP/SFP+	N/A	4	Data input, control input, data output, status output	Gigabit or 10 Gigabit Ethernet interface
100-240 V	1	2	Power input	Power interface
LEDs	6	6	Status output	Status indicators
USB	1	1	Disabled except for power	Disabled except for power

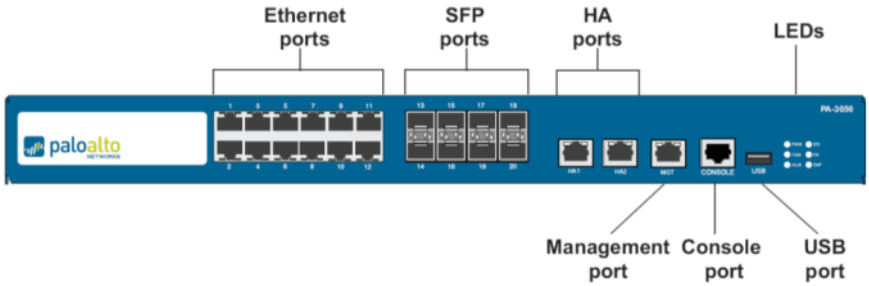


Figure 9 - PA-3020 / PA-3050 Front Interfaces

Figure 10 - PA-3020 / PA-3050 Back Interfaces

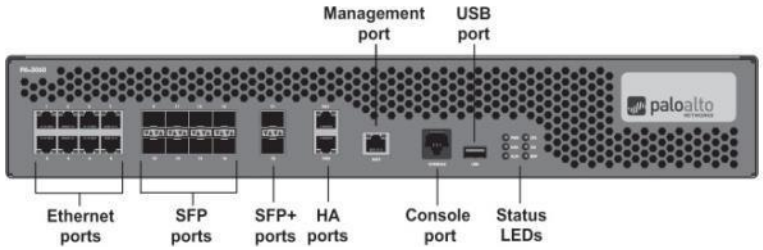


Figure 11 - PA-3060 Front Interfaces

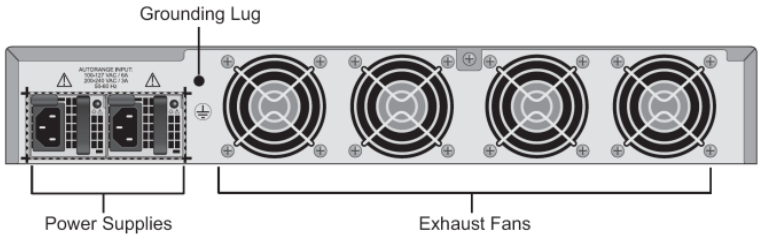


Figure 12 - PA-3060 Back Interfaces

Table 10 - PA-3000 Series FIPS 140-2 Ports and Interfaces

Interface	PA-3050 Qty	PA-3020 Qty	PA-3060 Qty	FIPS 140-2 Designation	Name and Description
RJ45	1	1	1	Data input, control input, data output, status output	Console port
RJ45	1	1	1	Data input, control input, data output, status output	Out of band management
RJ45	2	2	2	Data input, control input, data output, status output	10/100/1000 HA Ethernet interface
SFP+	N/A	N/A	2	Data input, control input, data output, status output	Ethernet 10-gigabit interface
SFP	8	8	8	Data input, control input, data output, status output	Ethernet gigabit interface
RJ45	12	12	8	Data input, control input, data output, status output	10/100/1000 Ethernet interface
100-240 V	1	1	2	Power input	Power interface
LEDs	6	6	6	Status output	Status indicators
USB	1	1	1	Disabled except for power	Disabled except for power

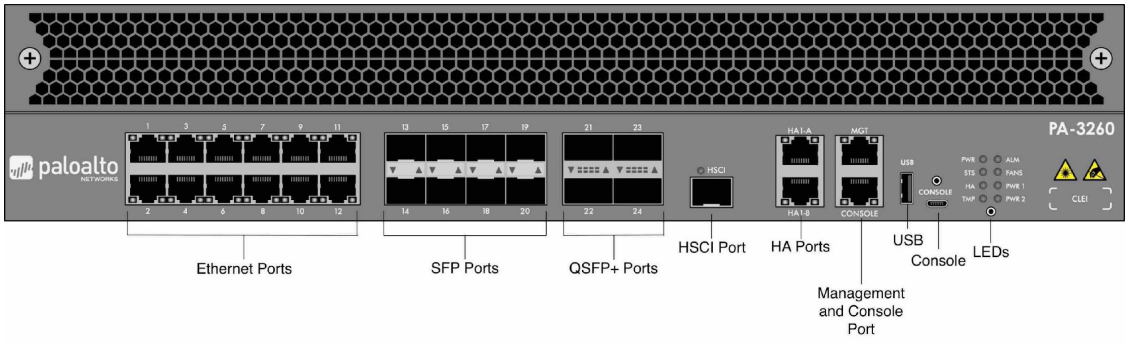


Figure 13 - PA-3200 Series Front Interfaces

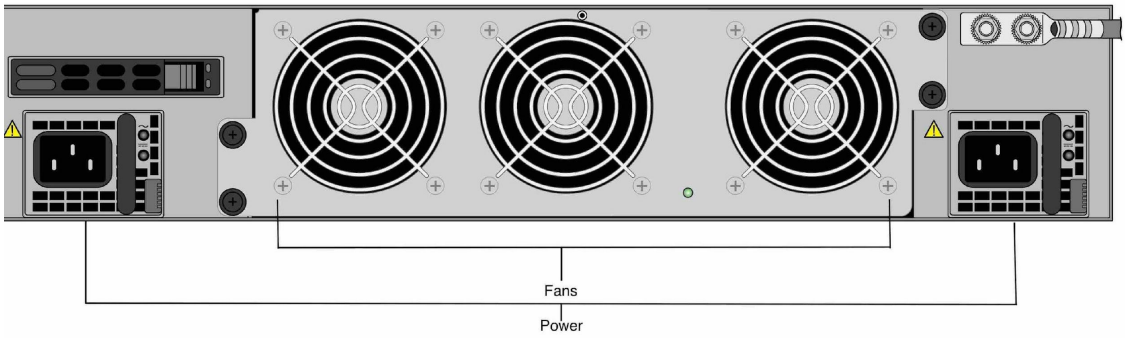


Figure 14 - PA-3200 Series Rear Interfaces

Table 11 - PA-3200 Series FIPS 140-2 Ports and Interfaces

Interface	PA-3220 Qty	PA-3250 Qty	PA-3260 Qty	FIPS 140-2 Designation	Name and Description
RJ45	12	12	12	Data input, control input, data output, status output	10/100/1000 Ethernet interface
SFP/SFP+	8	8	8	Data input, control input, data output, status output	SFP (1Gbps) or SFP+ (10Gbps)
QSFP+	N/A	N/A	4	Data input, control input, data output, status output	QSFP+ interfaces
HSCI	1	1	1	Data input, control input, data output, status output	SFP+ (10 Gbps) for HA
RJ-45	2	2	2	Data input, control input, data output, status output	10/100/1000 HA Ethernet interface
RJ-45	1	1	1	Data input, control input, data output, status output	Out of band management

RJ-45	1	1	1	Data input, control input, data output, status output	Console port
USB	1	1	1	Disabled except for power	Disabled except for power
Micro-USB	1	1	1	Data input, control input, data output, status output	Console port
LED	8	8	8	Status output	LED status indicators
Power	2	2	2	Power	Power supplies

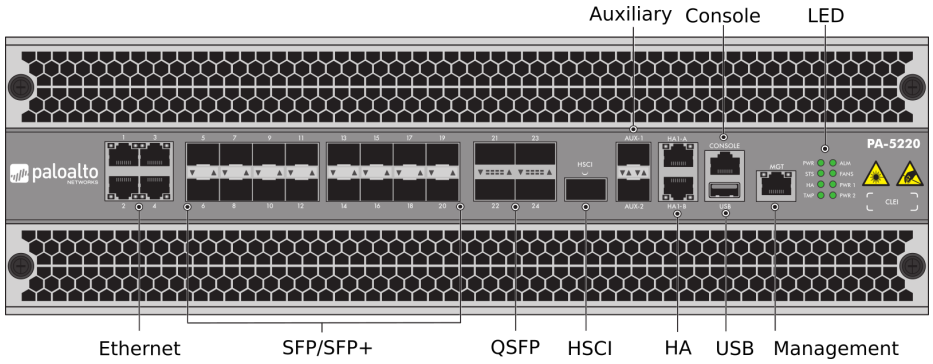


Figure 15 - PA-5200 Series Front Interfaces

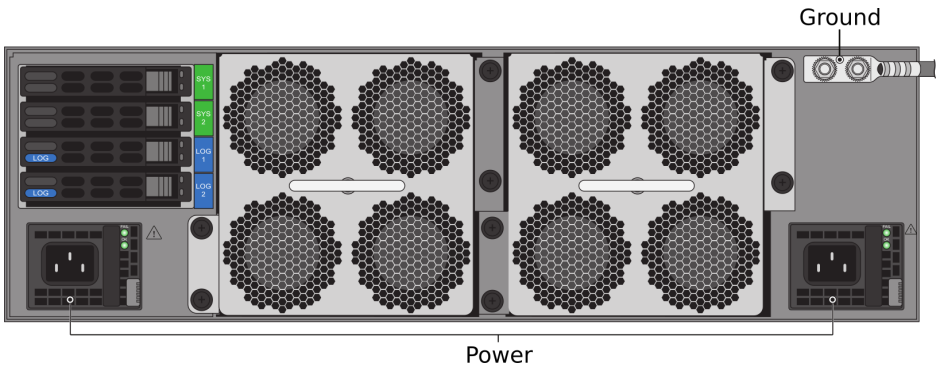


Figure 16 - PA-5200 Rear Interfaces

Table 12 - PA-5200 Series FIPS 140-2 Ports and Interfaces

Interface	PA-5220 Qty	PA-5250 Qty	PA-5260 Qty	PA-5280 Qty	FIPS 140-2 Designation	Name and Description
RJ45	1	1	1	1	Data input, control input, data output, status output	Console port
RJ45	1	1	1	1	Data input, control input, data output, status output	Out of band management
RJ45	2	2	2	2	Data input, control input, data output, status output	10/100/1000 HA Ethernet interface
RJ45	4	4	4	4	Data input, control input, data output, status output	10/100/1000 Ethernet Interfaces
SFP/SFP+	16	16	16	16	Data input, control input, data output, status output	Gigabit or 10 Gigabit Ethernet interface
QSFP28	N/A	4	4	4	Data input, control input, data output, status output	40/100 Gigabit defined by the IEEE 802.3ba
QSFP+	4	4	4	4	Data input, control input, data output, status output	40 Gigabit interfaces defined by the IEEE 802.3ba
HSCI	1	1	1	1	Data input, control input, data output, status output	QSFP HA interface
SFP+	2	2	2	2	Data input, control input, data output, status output	Auxiliary SFP+ HA/Management Port
100-240 V	2	2	2	2	Power input	Power interface
LEDs	8	8	8	8	Status output	Status indicators
USB	1	1	1	1	Disabled except for power	Disabled except for power

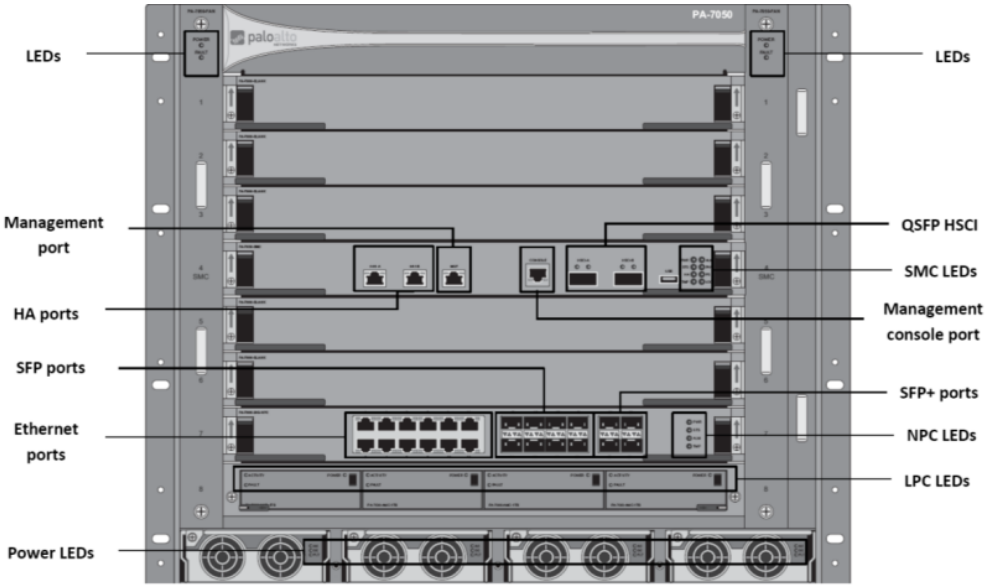


Figure 17 - PA-7050 Front Interfaces

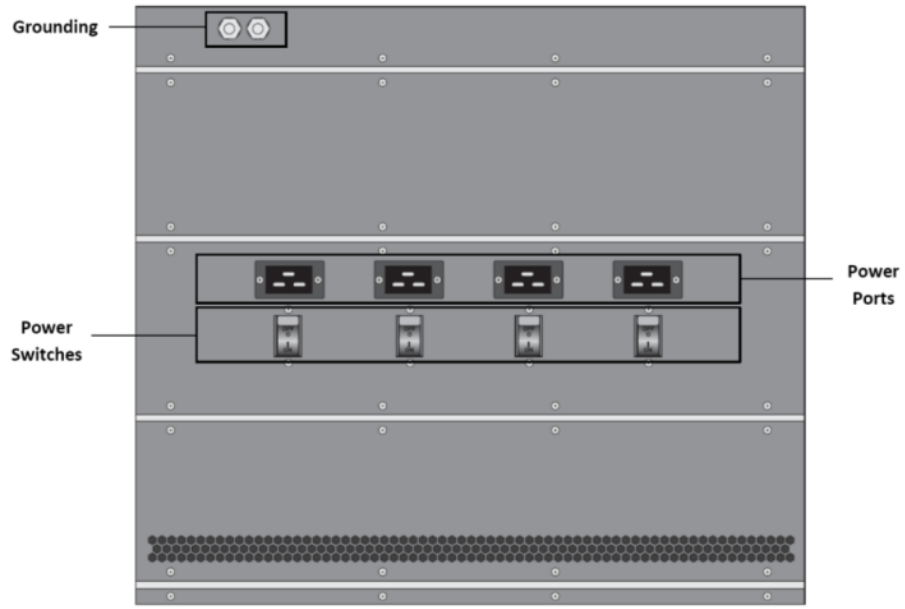


Figure 18 - PA-7050 Back Interfaces

Table 13 - PA-7050 FIPS 140-2 Ports and Interfaces

Interface	Chassis Qty	20G or 20GXM NPC Qty	20GQ or 20GQXM NPC Qty	100G NPC Qty	FIPS 140-2 Designation	Name and Description
RJ45	1	N/A	N/A	N/A	Data input, control input, data output, status output	Console port
RJ45	1	N/A	N/A	N/A	Data input, control input, data output, status output	Out of band management
RJ45	N/A	12	N/A	N/A	Data input, control input, data output, status output	10/100/1000 Ethernet Interfaces
SFP	N/A	8	N/A	8	Data input, control input, data output, status output	Ethernet gigabit interfaces
SFP+	N/A	4	12	N/A	Data input, control input, data output, status output	Ethernet 10-gigabit interface
RJ45	2	N/A	N/A	N/A	Data input, control input, data output, status output	10/100/1000 HA Ethernet interface
HSCI	2	N/A	N/A	N/A	Data input, control input, data output, status output	QSFP HA interface
QSFP+	N/A	N/A	2	4	Data input, control input, data output, status output	40 Gigabit interfaces defined by the IEEE 802.3ba interface
100-240 V	4	N/A	N/A	N/A	Power input	Power interface
Power switch	4	N/A	N/A	N/A	Control input	Power input switch
LEDs	48[d]	52[c]	32[c]	50	Status output	Status indicators
USB	1	N/A	N/A	N/A	Disabled except for power	Disabled except for power

a. The PA-7050 chassis includes two cards that are installed in the front slots of the chassis. These cards include the following: The Switch Management Card (SMC) provides management connectivity to the chassis and the Log Processing Card (LPC) handles all log processing and log storage for the firewall or the Log Forwarding Card (LFC).
b. NPC (Network Processing Card) - The PA-7050 may contain up to six (6) NPC cards. At least one (1) Network Processing Card (NPC) must be installed before the firewall can process data traffic. The PA-7000-20GXM-NPC and PA-7000-20GQXM-NPC doubles the memory of the PA-7000-20G-NPC and PA-7000-20GQ-NPC respectively, enabling support for eight million sessions (up from four million). See Table 1 for other cards available.
c. NPC - With the four (4) standard status LED, each networking interface contains two (2) LED, the link status and activity LED.
d. PA-7050 - Status LED count (48) includes the following: 4 for fan status, 12 for the LPC and 20 for the SMC, 12 for power supplies.

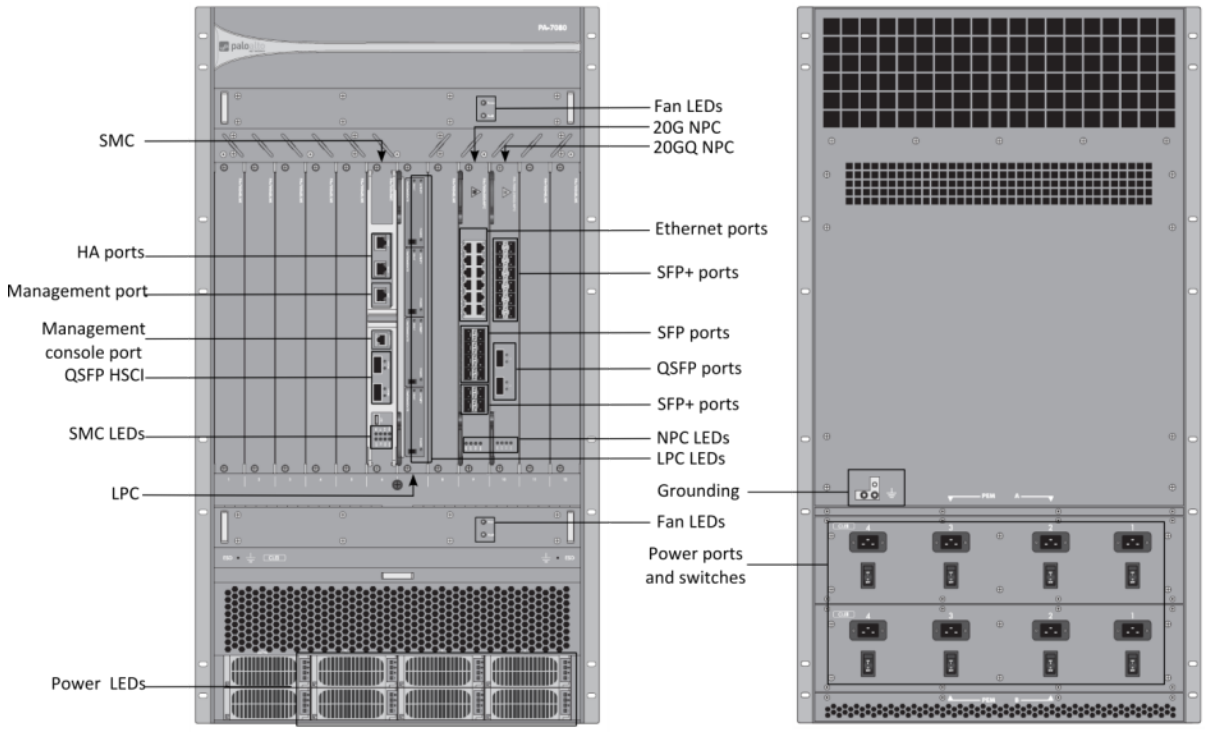


Figure 19 - PA-7080 Front (on Left) and Back (on Right) Interfaces

Table 14 - PA-7080 FIPS 140-2 Ports and Interfaces

Interface	Chassis Qty	20G or 20GXM NPC Qty	20GQ or 20GQXM NPC Qty	100G NPC Qty	FIPS 140-2 Designation	Name and Description
RJ45	1	N/A	N/A	N/A	Data input, control input, data output, status output	Console port
RJ45	1	N/A	N/A	N/A	Data input, control input, data output, status output	Out of band management
RJ45	N/A	12	N/A	N/A	Data input, control input, data output, status output	10/100/1000 Ethernet Interfaces
SFP	N/A	8	N/A	8	Data input, control input, data output, status output	Ethernet gigabit interfaces
SFP+	N/A	4	12	N/A	Data input, control input, data output, status output	Ethernet 10-gigabit interface
RJ45	2	N/A	N/A	N/A	Data input, control input, data output, status output	10/100/1000 HA Ethernet interface
HSCI	2	N/A	N/A	N/A	Data input, control input, data output, status output	QSFP HA interface
QSFP+	N/A	N/A	2	4	Data input, control input, data output, status output	40 Gigabit interfaces defined by the IEEE 802.3ba interface

100-240 V	4	N/A	N/A	N/A	Power input	Power interface
Power switch	4	N/A	N/A	N/A	Control input	Power input switch
LEDs	48[d]	52[c]	32[c]	50	Status output	Status indicators
USB	1	N/A	N/A	N/A	Disabled except for power	Disabled except for power

a. The PA-7000 series chassis includes two cards that are installed in the front slots of the chassis. These cards include the following: The Switch Management Card (SMC) provides management connectivity to the chassis and the Log Processing Card (LPC) handles all log processing and log storage for the firewall. The Log Forwarding Card (LFC) can also be utilized.

b. NPC (Network Processing Card) - The PA-7080 may contain up to ten (10) NPC cards. At least one (1) Network Processing Cards (NPC) must be installed before the firewall can process data traffic. The PA-7000-20GXM-NPC and PA-7000-20GQXM-NPC doubles the memory of the PA-7000-20G-NPC and PA-7000-20GQ-NPC respectively, enabling support for eight million sessions (up from four million). See Table 1 for other available cards.

c. NPC - With the four (4) standard status LED, each networking interface contains two (2) LED, the link status and activity LED.

d. PA-7080 - Status LED count (52) includes the following: 4 for fan status, 12 for the LPC and 20 for the SMC, 16 for power supplies.

5. Roles, Services, and Authentication

Assumption of Roles

The modules support four distinct operator roles, User and Cryptographic Officer (CO), Remote Access VPN, and Site-to-site VPN. The cryptographic modules enforce the separation of roles using unique authentication credentials associated with operator accounts. The modules support concurrent operators.

The modules do not provide a maintenance role or bypass capability.

Table 15 - Roles and Required Identification and Authentication

Role	Description	Authentication Type	Authentication Data
CO	This role has access to all configuration, show status and update services offered by the modules. Within the PAN-OS firmware, this role maps to the "Superuser" administrator role.	Identity-based operator authentication	Username/password and/or public-key/certificate based authentication
User	This role has limited access to services offered by the modules. This role does not have access to modify or view the passwords associated with other administrator accounts; it may not view CSPs of any type stored on the module. The User may change their own password. Within the PAN-OS firmware, this role maps to the "Superuser (read-only)" administrator role (also referred to as "Superreader").	Identity-based operator authentication	Username/password and/or public-key/certificate based authentication
Remote Access VPN (RA VPN)	Remote user accessing the network via VPN.	Identity-based operator authentication	Username/password and/or certificate-based authentication
Site-to-site VPN (S-S VPN)	Remote VPN device establishing a VPN session to facilitate access to the network.	Identity-based operator authentication	IKE/IPSec Pre-shared keys - Identification with the IP Address and authentication with the Pre-Shared Key or certificate based authentication

Table 16 - Strengths of Authentication Mechanisms

Authentication Mechanism	Strength of Mechanism
Username and Password	Minimum length is six (6) characters[1] (95 possible characters). The probability that a random attempt will succeed or a false acceptance will occur is $1/(95^6)$ which is less than 1/1,000,000. The probability of successfully authenticating to the module within one minute is $10/(95^6)$, which is less than 1/100,000. The firewall's configuration supports at most ten failed attempts to authenticate in a one-minute period.
Public-Key/Certificate based authentication	The security modules support public-key based authentication using RSA 2048 and certificate-based authentication using RSA 2048, RSA 3072, RSA 4096, ECDSA P-256, P-384, or P-521. The minimum equivalent strength supported is 112 bits. The probability that a random attempt will succeed is $1/(2^{112})$ which is less than 1/1,000,000. The probability of successfully authenticating to the module within a one minute period is $3,600,000/(2^{112})$, which is less than 1/100,000. The firewall supports at most 60,000 new sessions per second to authenticate in a one-minute period.
IKE/IPSec pre-shared keys	The pre-shared key authentication method has a minimum security strength of 2^{112}. The probability of successfully authenticating to the module is $1/(2^{112})$, which is less than 1/1,000,000. The number of authentication attempts is limited by the number of new connections per second supported (120,000) on the fastest platform of the Palo Alto Networks firewalls. The probability of successfully authenticating to the module within a one minute period is $7,200,000/(2^{112})$, which is less than 1/100,000.

Roles and Services

The Approved and non-Approved mode of operation provide identical services. While in the Approved mode of operation all CO and User services are accessed via SSH or TLS sessions. Approved and allowed algorithms, relevant CSPs, and public keys related to these protocols are accessed to support the following services. CSP access by services is further described in the following tables.

The services listed below are also available in the non-Approved mode. In the Non-Approved mode, SSH, TLS, and VPN processes will use non-Approved Algorithms and Approved algorithms with non-Approved strength.

Table 17 - Authenticated Service Descriptions

Service	Description
Security Configuration Management	Configuring and managing cryptographic parameters and setting/modifying security policy, creating User accounts and additional CO accounts, as well as configuring usage of third party external HSMs.

[1] In FIPS-CC Mode, the module checks and enforces the minimum password length of six (6).

Other Configuration	Networking parameter configuration, logging configuration, and other non-security relevant configuration.
View Other Configuration	Read-only of non-security relevant configuration (see above).
Show Status	View status via the web interface, command line interface or VPN session.
VPN	Provide network access for remote users or site-to-site connections.
Firmware Update	Provides a method to update the firmware on the firewall.

Note: Additional information on the services the module provides can be found at https://www.paloaltonetworks.com/documentation.html

Table 18 - Authenticated Services

Service	Crypto Officer	User	RA VPN	S-S VPN
Security Configuration Management	Y	Y(*)	N	N
Other Configuration	Y	N	N	N
View Other Configuration	Y	Y	N	N
Show Status	Y	Y	Y	Y
VPN	N	N	Y	Y
Firmware Update	Y	N	N	N
*Note: The User role has use of this service only to change their own password.				

Unauthenticated Services

The cryptographic module supports the following unauthenticated services:

Table 19 - Unauthenticated Services

Service	Description
Zeroize	The device will overwrite all CSPs.
Self-Tests	Run power up self-tests on demand by power cycling the module.
Show Status (LEDs)	View status of the module via the LEDs.

The zeroization procedure is invoked when the operator exits FIPS-CC mode. The procedure consists of overwriting keystore files, formatting the harddisk, and overwriting with a reinstalled firmware image. The operator must be in control of the module during the entire procedure to ensure that it has successfully completed. During the zeroization procedure, no other services are available.

Security Parameters

The module contains the following CSPs:

Table 20 - CSPs

CSP #	CSP/Key Name	Type	Description
1	RSA Private Keys	RSA	RSA Private keys for generation of signatures, authentication or key establishment. (RSA 2048, 3072, or 4096-bit)
2	ECDSA Private Keys	ECDSA	ECDSA Private key for generation of signatures and authentication (P-256, P-384, or P-521)
3	TLS Pre-Master Secret	TLS Secret	Secret value used to derive the TLS Master Secret along with client and server random nonces
4	TLS Master Secret	TLS Secret	Secret value used to derive the TLS session keys
5	TLS DHE/ECDHE Private Components	DH, ECDH	Ephemeral Diffie-Hellman private FFC or EC component used in TLS (DHE 2048, ECDHE P-256, P-384, P-521)
6	TLS HMAC Keys	HMAC	HMAC keys used in TLS connections (SHA-1, 256, 384) (160, 256, 384 bits)
7	TLS Encryption Keys	AES	AES (128 or 256 bit) keys used in TLS connections (GCM; CBC)
8	SSH Session Authentication Keys	HMAC	Authentication keys used in all SSH connections to the security module's command line interface (HMAC-SHA-1, HMAC-SHA2-256, HMAC-SHA2-512) (160, 256, 512 bits)
9	SSH Session Encryption Keys	AES	Used in all SSH connections to the security module's command line interface. (128, 192, or 256 bits: CBC or CTR) (128 or 256 bits: GCM)

10	SSH DH/ECDH Private Components	DH, ECDH	Diffie Hellman or EC Diffie-Hellman private (DH Group 14 2048 bit keys, ECDH P-256, ECDH P-384, ECDH P-521)
11	S-S VPN IPSec/IKE Authentication Keys	HMAC	(HMAC-SHA-1, SHA-256, SHA-384 or SHA-512) Used to authenticate the peer in an IKE/IPSec tunnel connection. (160, 256, 384, 512 bits)
12	S-S VPN IPSec/IKE Session Keys	AES	Used to encrypt IKE/IPSec data. These are AES (128, 192, or 256 CBC) IKE keys and (128, 192 or 256 CBC, 128 CCM, 128 or 256 GCM) IPSec keys
13	S-S VPN IPSec/IKE DHE or ECDHE Private Components	DH, ECDH	Diffie-Hellman or EC Diffie-Hellman private component used in key establishment (DHE 2048, ECDHE P-256, P-384)
14	S-S VPN IPSec Pre-Shared Keys	Part of HMAC	PSK used in conjunction with HMAC listed above for authentication. Entered into the module by the Crypto Officer once authenticated
15	RA VPN IPSec Session Keys	AES	Used to encrypt remote access sessions utilizing IPSec. (128 CBC, 128/256-GCM)
16	RA VPN IPSec Authentication	HMAC	(HMAC-SHA-1, 160 bits) Used in authentication of remote access IPSec data.
17	CO, User, RA VPN Password	Password	Authentication string with a minimum length of six (6) characters.
18	DRBG seed/state/input string	DRBG	DRBG seed and input string coming from the NDRNG and AES 256 CTR DRBG state (V and Key) used in the generation of a random values
19	SNMPv3 Authentication Secret	SNMPv3 Secret	SNMPv3 secret used for localization (Minimum eight (8) characters)
20	SNMPv3 Privacy Secret	SNMPv3 Secret	SNMPv3 secret used for localization (Minimum eight (8) characters)
21	Authentication Key	HMAC	HMAC–SHA1 Authentication protocol key (160 bits)
22	Session Key	AES	Privacy protocol encryption key (AES 128 CFB)
23	Protocol Secrets	Password	Secret used by RADIUS or TACACS+ (minimum length of six (6) characters)
24	Master Key	AES-256 CBC	Used to protect private keys and CSPs

Note: The CSPs in Volatile memory locations are zeroized by overwrite with a pseudo random pattern followed by read-verify. Intermediate plaintext key material (CSP) is zeroized when it is copied from one to another memory location. All keys (CSPs) are zeroized when they expire. Session keys (CSPs) are zeroized as soon as the associated session has ended/timed out/ or been closed. Private keys (CSPs) are zeroized when their corresponding public keys (certificates) expire.

The module contains the following public keys:

Table 21 – Public Keys

Key ID	Key Name	Description
A	CA Certificates	ECDSA/RSA Public key – Used to trust a root CA intermediate CA and leaf /end entity certificates (RSA 2048, 3072, and 4096 bits) (ECDSA P-256, P-384, and P-521)
B	ECDSA Public Keys	ECDSA public keys managed as certificates for the verification of signatures, establishment of TLS, operator authentication and peer authentication. (ECDSA P-256, P-384, or P-521)
C	RSA Public Keys	RSA public keys managed as certificates for the verification of signatures, establishment of TLS, operator authentication and peer authentication. (RSA 2048, 3072, or 4096-bit)
D	TLS DHE/ECDHE Public Components	Diffie-Hellman or EC Diffie-Hellman Ephemeral values used in key agreement (DHE 2048, ECDHE P-256, P-384, P-521)
E	SSH DH/ECDH Public Components	Diffie-Hellman or EC Diffie-Hellman public component (DH Group 14, ECDH P-256, ECDH P-384, ECDH P-521)
F	SSH Host Public Key	SSH Host Public Key (RSA 2048, RSA 3072, RSA 4096, ECDSA P-256, P-384, or P-521) (The matching private key is among the RSA Private Keys or ECDSA Private Keys, in Table 21.)
G	SSH Client Public Key	Public RSA key used to authenticate client (RSA 2048, 3072 or 4096 bits)
H	S-S VPN IPSec/IKE DHE or ECDHE Public Component	Diffie-Hellman or EC Diffie-Hellman public component used in key agreement (DHE 2048, ECDHE P-256, P-384)
I	Public key for firmware content load test	Used to authenticate firmware and content to be installed on the firewall (RSA 2048 with SHA-256)
J	Firmware integrity verification key	Used to check the integrity of crypto-related code. (HMAC-SHA-256 and ECDSA P-256)

Definition of CSPs Modes of Access

The table below defines the relationship between access to CSPs and the different module services. The modes of access shown in the table are defined as:

- **R** = Read: The module reads the CSP. The read access is performed when a CSP is either exported from the module or executed by a security function.
- **W** = Write: The module writes the CSP. The write access is typically performed after a CSP is imported into the module, or the module generates a CSP, or the module overwrites an existing CSP.
- **Z** = Zeroize: The module zeroizes the CSP.

Table 22 - CSP and Public Key Access Rights within Roles & Services

Role	Authorized Service	Mode	Cryptographic Key or CSP
CO	Security Configuration Management	RW	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 17, 18, 19, 20, 21, 22, 23, 24, A, B, C, D, E, F, G, I
CO	Other Configuration	RW	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, A, B, C, D, E, F, G
User, CO	View Other Configuration	RW	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 18, A, B, C, D, E, F, G (operator's own password)
User	Security Configuration Management	RW	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 17, A, B, C, D, E, F, G (operator's own password)
User, CO	Show Status	R	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, A, B, C, D, E, F, G
S-S VPN	VPN	R	11, 12, 13, 14, 24, B, C, H
RA VPN	VPN	R	1, 2, 3, 4, 5, 6, 7, 15, 16, 18, 24, A, B, C, D
CO	Firmware Update	RW	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 17, A, B, C, D, E, F, G
Unauthenticated	Self-Tests	R	J
Unauthenticated	Show Status (LEDs)	N/A	N/A
Unauthenticated	Zeroize	Z	All CSPs and public keys are zeroized.

6. Operational Environment

The FIPS 140-2 Area 6 Operational Environment requirements are not applicable because the Firewalls do not contain modifiable operational environments. The operational environment is limited since the modules include a firmware load service to support necessary updates. New firmware versions within the scope of this validation must be validated through the FIPS 140-2 CMVP. Any other firmware loaded into these modules is out of the scope of this validation and requires a separate FIPS 140-2 validation.

7. Self-Tests / Security Rules

The module design corresponds to the module security rules. This section documents the security rules enforced by the cryptographic module to implement the security requirements of this FIPS 140-2 Level 2 module.

1. The cryptographic module provides four distinct operator roles. These are the User role, Remote Access VPN role, Site-to-site VPN role, and the Cryptographic Officer role.
2. The cryptographic module provides identity-based authentication.
3. The cryptographic module clears previous authentications on power cycle.
4. When the module has not been placed in a valid role, the operator does not have access to any cryptographic services.
5. The cryptographic module performs the following tests
    A. Power up Self-Tests
        1. Cryptographic algorithm tests
            a. AES ECB Encrypt Known Answer Test
            b. AES ECB Decrypt Known Answer Test
            c. AES CMAC Known Answer Test
            d. AES GCM Encrypt Known Answer Test
            e. AES GCM Decrypt Known Answer Test
            f. AES CCM Encrypt Known Answer Test
            g. AES CCM Decrypt Known Answer Test
            h. RSA Sign Known Answer Test
            i. RSA Verify Known Answer Test
            j. RSA Encrypt Known Answer Test
            k. RSA Decrypt Known Answer Test
            l. ECDSA Sign Known Answer Test
            m. ECDSA Verify Known Answer Test
            n. HMAC-SHA-1 Known Answer Test
            o. HMAC-SHA-256 Known Answer Test
            p. HMAC-SHA-384 Known Answer Test
            q. HMAC-SHA-512 Known Answer Test
            r. SHA-1 Known Answer Test
            s. SHA-256 Known Answer Test
            t. SHA-384 Known Answer Test
            u. SHA-512 Known Answer Test
            v. DRBG SP800-90A Known Answer Tests
            w. SP 800-90A Section 11.3 Health Tests
            x. DH Known Answer Test
            y. ECDH Known Answer Test
        2. Firmware Integrity Test –verified with HMAC-SHA-256 and ECDSA P-256.
    B. Critical Functions Tests
        1. N/A

C. Conditional Self-Tests
    1. Continuous Random Number Generator (RNG) test – performed on NDRNG and DRBG
    2. RSA Pairwise Consistency Test
    3. ECDSA Pairwise Consistency Test
    4. Firmware Load Test – Verify RSA 2048 with SHA-256 signature on firmware at time of load
    5. If any conditional test fails, the module will output a description of the error condition.
2. The operator can command the module to perform the power-up self-test by cycling power of the module.
3. Power-up self-tests do not require any operator action.
4. Data output is inhibited during power-up self-tests, zeroization and error states.
5. Status information does not contain CSPs or sensitive data that if misused could lead to a compromise of the module.
6. There are no restrictions on which keys or CSPs are zeroized by the zeroization service.
7. The module maintains separation between concurrent operators.
8. The module does not support a maintenance interface or role.
9. The module does not have any external input/output devices used for entry/output of data.
10. The module does not enter or output plaintext CSPs.
11. The module does not output intermediate key generation values.

Vendor imposed security rules:

1. If the cryptographic module remains inactive in any valid role for the administrator specified time interval, the module automatically logs out the operator.

2. The module enforces a timed access protection mechanism that supports at most ten authentication attempts per minute. After the administrator specified number of consecutive unsuccessful password validation attempts have occurred, the cryptographic module shall enforce a wait period of at least one (1) minute before any more login attempts can be attempted. This wait period shall be enforced even if the module power is momentarily removed.

3. In FIPS-CC mode, the following rules shall apply:
    a. The operator should not enable TLSv1.0; it is disabled by default.
    Note that TLSv1.0 can be used in an Approved mode of operation (Approved TLS KDF algorithm); however, TLSv1.0 protocol is no longer considered as secure because of the Cipher Block Chaining IV attack.
    b. Pre-shared keys used for IKE/IPsec must be at least 14 bytes in length.
    c. If using RADIUS, it must be configured using TLS. In all other cases, the module shall be configured in non-Approved mode of operation.
    d. If using TACACS+, configure the service route via an IPSec tunnel, and ensure the TACACS+ server is configured for a minimum password length of six (6) characters (to match Table 17 of this document), or greater. In all other cases, the module shall be configured in non-Approved mode of operation.
    e. The operator shall not generate 4096-bit RSA key in FIPS-CC mode. If the operator wants to generate 4096-bit RSA key, the module shall be configured in non-Approved mode of operation.

8. Physical Security

The multi-chip standalone modules are production quality containing standard passivation. Chip components are protected by an opaque enclosure. There are tamper evident seals that are applied on the modules by the Crypto-Officer. All unused seals are to be controlled by the Crypto-Officer. The seals prevent removal of the opaque enclosure without evidence. The Crypto-Officer must ensure that the module surface is clean and dry. Tamper evident seals must be pressed firmly onto the adhering surfaces during installation and once applied the Crypto- Officer shall permit 24 hours of cure time for all tamper-evident seals. The Crypto-Officer should inspect the seals and shields for evidence of tamper every 30 days. If the seals show evidence of tamper, the Crypto-Officer should assume that the modules have been compromised and contact Customer Support.

Note: For ordering information, see Table 1 for FIPS kit part numbers and versions. Opacity shields and Tamper Seals are included for the FIPS kits.

Refer to the Appendix for instructions on installation of the tamper seals and opacity shields.

Table 23 - Inspection/Testing of Physical Security Mechanisms

Model	Physical Security Mechanisms	Recommended Frequency of Inspection/Test	Inspection/Test Guidance Details
PA-7080, PA-7050, PA-5220, PA-5250, PA-5260, PA-5280, PA-3220, PA-3250, PA-3260, PA-3060, PA-3050, PA-3020, PA-820, PA-850, PA-220R, PA-220	Tamper-Evident Seals	30 days	Verify integrity of tamper-evident seals in the locations identified in the FIPS Kit Installation Guide. Seal integrity to be verified within the modules operating temperature range.
PA-7050	Top, Bottom, Front and Rear Opacity Shields	30 days	Verify that the plenums and opacity shields have not been deformed from their original shape, thereby reducing their effectiveness
PA-3050, PA-3020	Front Cover and Side Opacity Shields	30 days	Verify that front cover and side opacity shields have not been deformed from their original shape, thereby reducing their effectiveness
PA-3060, PA-3220, PA-3250, PA-3260	Front and Rear Covers	30 days	Verify that front and rear covers have not been deformed from their original shape, thereby reducing their effectiveness
PA-7080	Front Cover	30 days	Verify that front cover has not been deformed from its original shape thereby reducing its effectiveness
PA-220	Front cover and Cage Enclosure	30 days	Verify that front cover and cage enclosure have not been deformed from their original shape, thereby reducing their effectiveness

9. Mitigation of Other Attacks

The module is not designed to mitigate any specific attacks outside the scope of FIPS 140-2. These requirements are not applicable.

10. Definitions and Acronyms

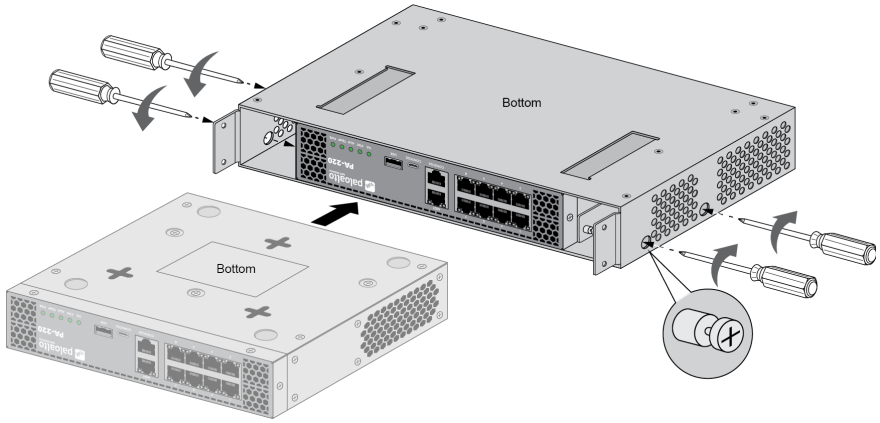
API – Application Programming Interface
App-ID – Application Identification - Palo Alto Networks' ability to identify applications and apply security policy based on the ID rather than the typical port and protocol-based classification.
BGP – Border Gateway protocol – Dynamic routing protocol
CA – Certificate authority
Content-ID – Content Identification – Palo Alto Networks' threat prevention features including Antivirus, Antispyware, and Intrusion Prevention.
CO – Cryptographic Officer
DLP – Data loss prevention
Gbps – Gigabits per second
HA – High Availability
HSCI - High Speed Chassis Interconnect
IKE – Internet Key Exchange
IP – Internet Protocol
IPSec – Internet Protocol Security
LDAP – Lightweight Directory Access Protocol
LED – Light Emitting Diode
NDRNG – Non-deterministic random number generator
OCSP – Online Certificate Status Protocol
OSPF – Open Shortest Path First – Dynamic routing protocol
PAN-OS – Palo Alto Networks' Operating System
QoS – Quality of Service
QSFP - Quad Small Form-factor Pluggable
RA VPN – Remote Access Virtual Private Network
RIP – Routing Information Protocol – Dynamic routing protocol
RJ45 – Networking Connector
RNG –Random number generator
S-S VPN – Site to site Virtual Private Network
SFP – Small Form-factor Pluggable Transceiver
SSL – Secure Sockets Layer
TLS – Transport Layer Security
USB – Universal Serial Bus
User-ID – User Identification – Palo Alto Networks' ability to apply security policy based on who initiates the traffic rather than the typical IP-based approach.
VPN – Virtual Private Network
XML – Extensible Markup Language

11. Reference Documents

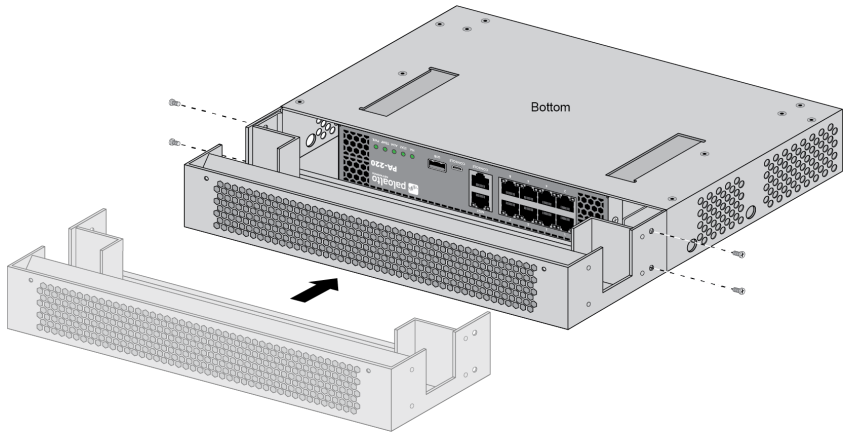
FIPS 140-2 - FIPS Publication 140-2 Security Requirements for Cryptographic Modules

Appendix A - PA-220 - FIPS Accessories/Tamper Seal Installation (6 Seals)

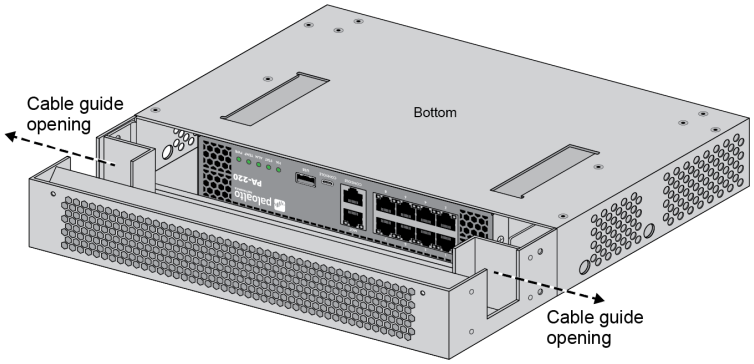
1. Place the firewall upside down on a flat Electrostatic Discharge (ESD) protected surface and ground yourself by touching a metal surface on the firewall.
2. Slide the firewall in to the FIPS chassis cover and attach it to the cover using a Phillips-head screwdriver to tighten four (4) captive screws (two (2) screws on each side of the cover).



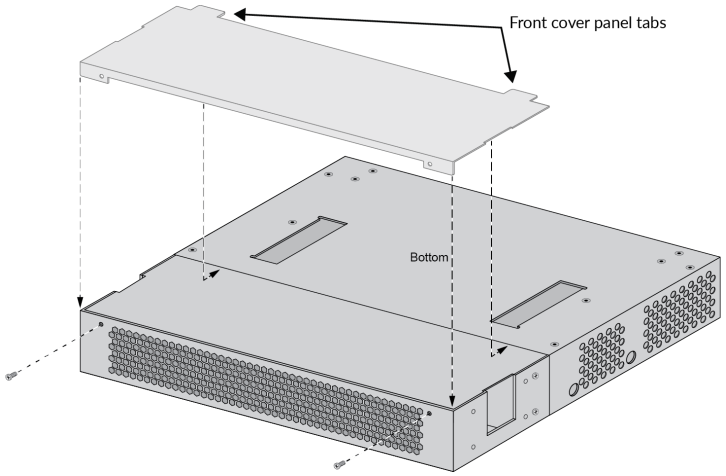
3. Install the front (network, management, and console) cables (you cannot access the front ports after you complete the front-cover install described in the following steps).
4. Place the FIPS front cover onto the FIPS chassis cover and attach it using four (4) #4-40 x .25” screws (two (2) screws on each side of the cover).



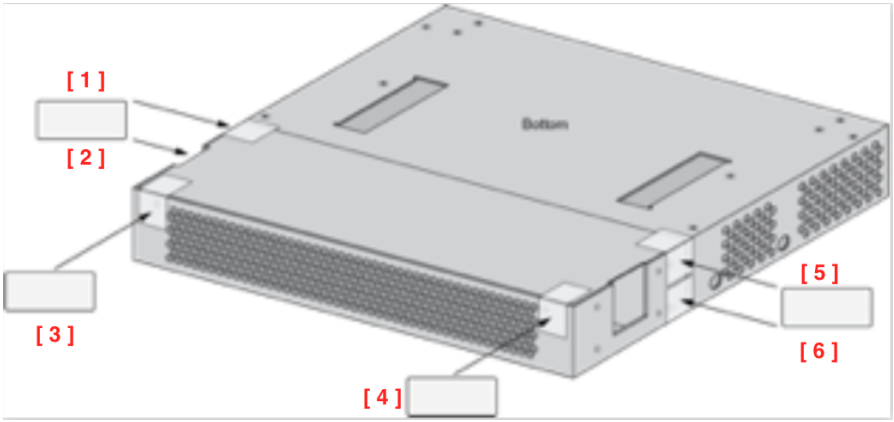
5. Route the front-port cables through the front-cover cable-guide openings.



6. Attach the FIPS front-cover panel to the FIPS front cover by sliding the two (2) panel tabs under the FIPS chassis cover and then attach the panel using two (2) #4-40 x .25” screws.

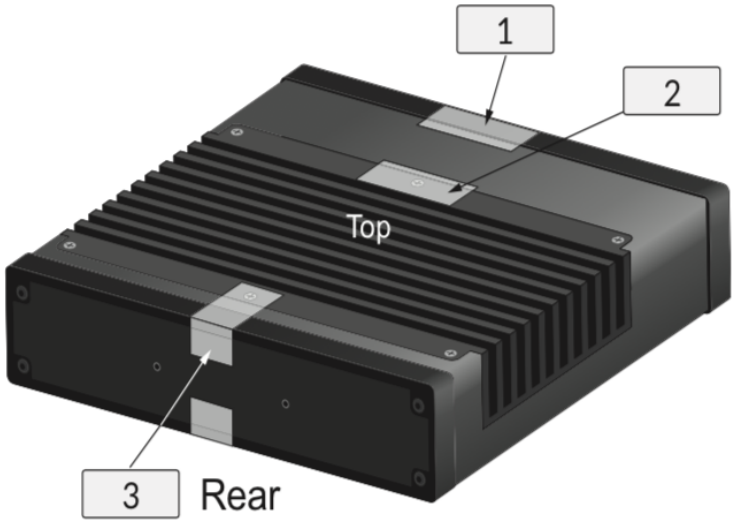


7. Apply a tamper-evident seal to each location shown in the following illustration (six (6) seals total). After all seals are applied, place the firewall right-side up.

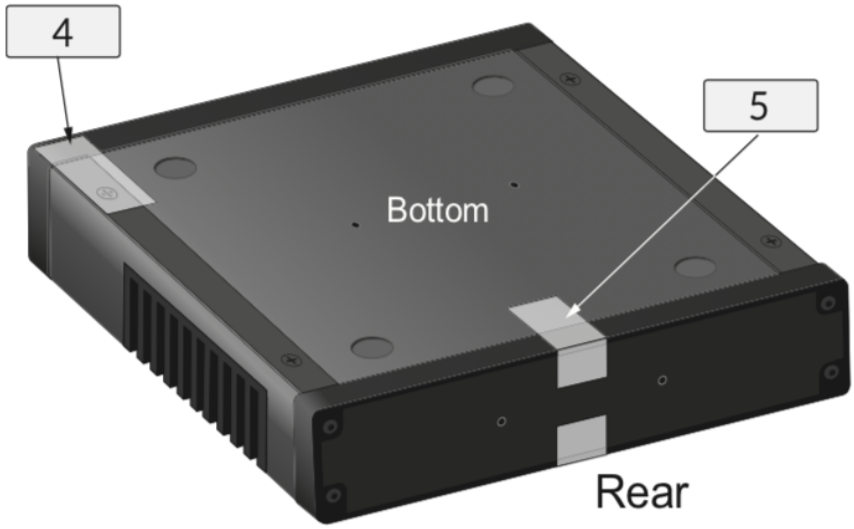


Appendix B - PA-220R- FIPS Accessories/Tamper Seal Installation (5 Seals)

1. Place three tamper-evident seals on the top of the module.

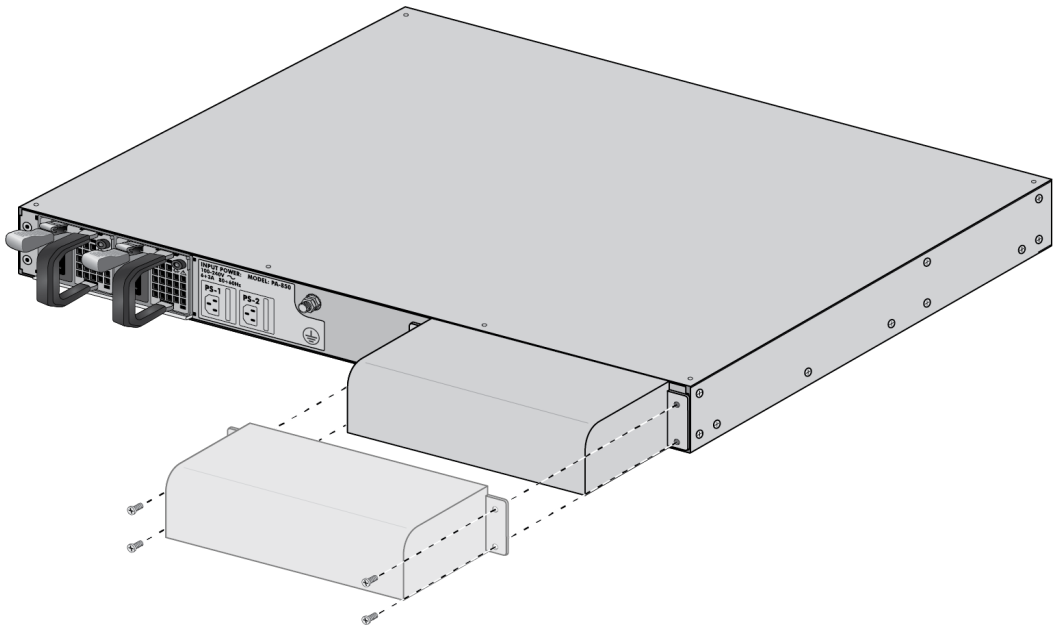


2. Place two tamper-evident seals on the bottom of the module.

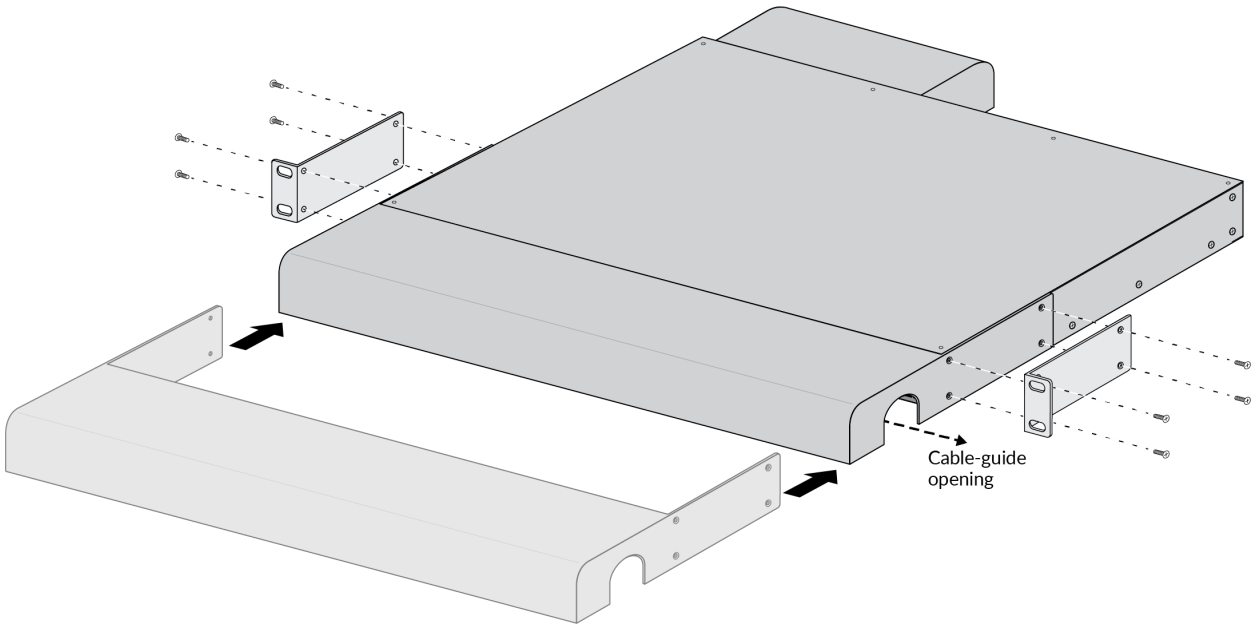


Appendix C - PA-800 series - FIPS Accessories/Tamper Seal Installation (11 Seals)

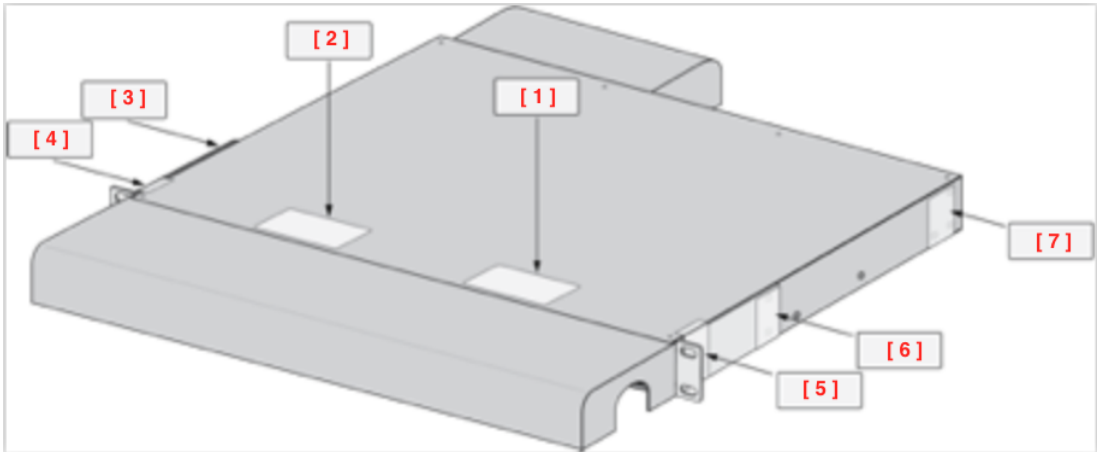
1. Place the firewall on a flat Electrostatic Discharge (ESD) protected surface and ground yourself by touching a metal surface on the firewall.
2. Place the FIPS back cover onto the back of the firewall and attach it using four #4-40 x 5/16 screws (two screws on each side of the back cover).

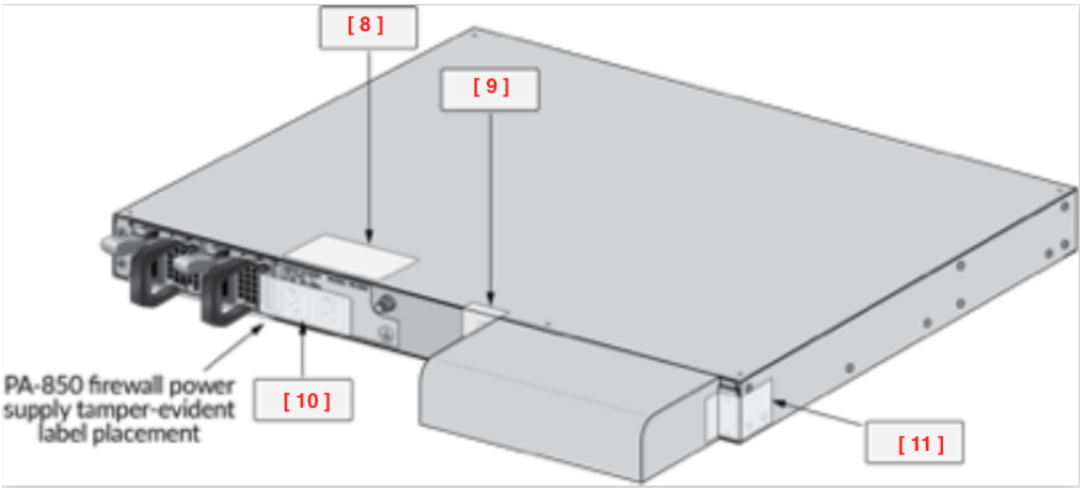


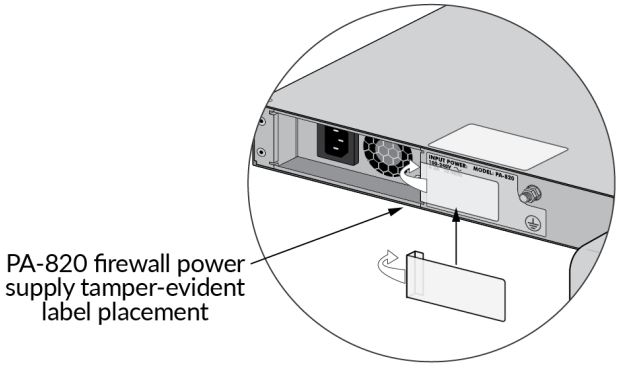
3. Insert the front (network, management, and console) cables in to the front ports.
4. Place the FIPS front cover onto the front of the firewall and place the rack-mount brackets over the holes on the front cover. Attach the front cover and rack-mount brackets to the firewall using eight (8) #6-32 x 5/16” rack-mount bracket screws (shipped with the firewall)—use four (4) screws on each side. Route the front cables through the front-cover cable-guide opening.



5. Apply a tamper-evident seal to each location shown in the following illustrations (eleven (11) seals total). The seal placement over the power supply of the PA-820 firewall and PA-850 firewall is slightly different as shown.

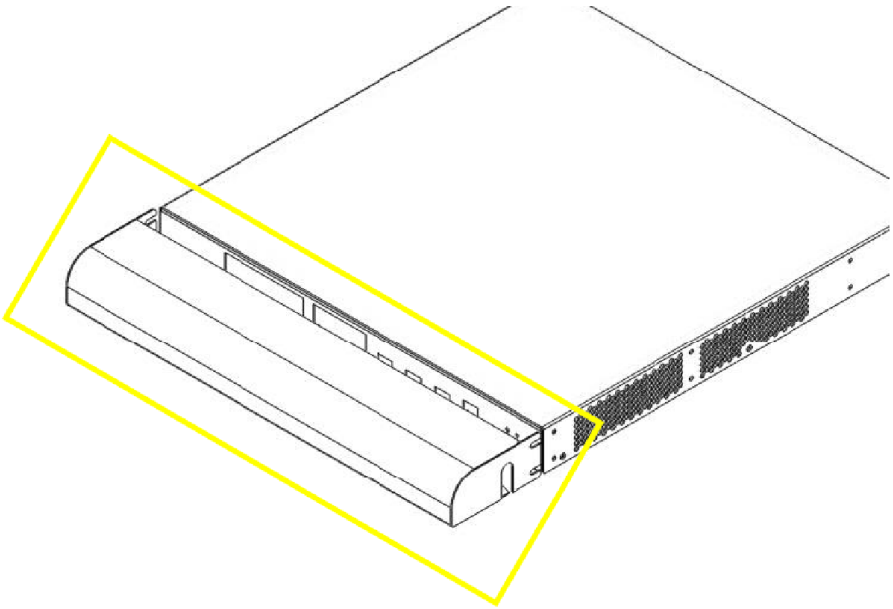




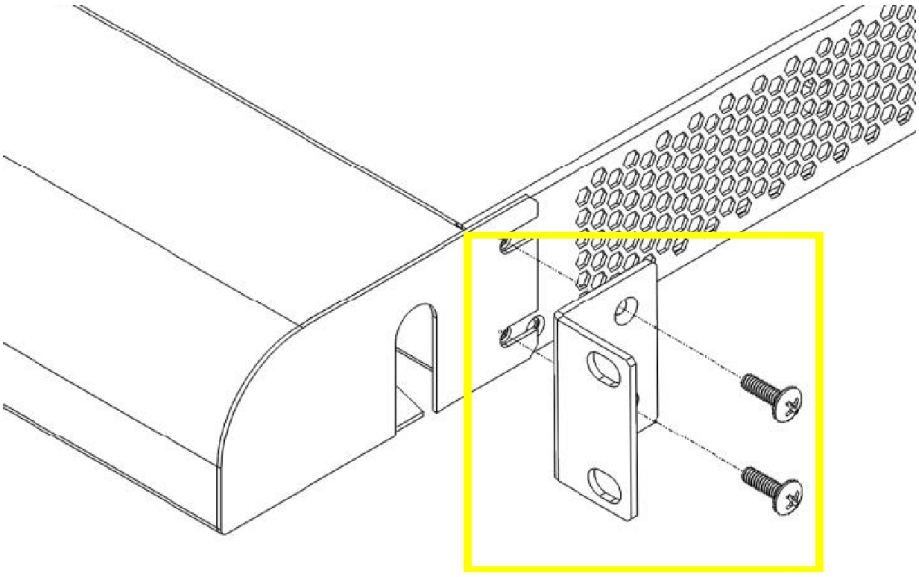


Appendix D - PA-3020 and PA-3050 - FIPS Accessories/Tamper Seal Installation (7 Seals)

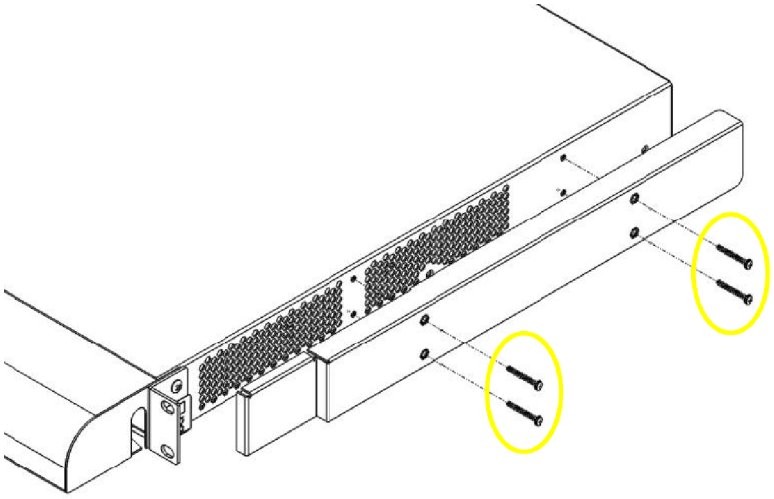
1. Install the front panel with the curve side up and line it up to the left and right side ear mounting holes.



2. Install and secure the right side mounting ear and two (2) #6-32x1/2” screws provided in the kit. Repeat the same step on the left side of the chassis.

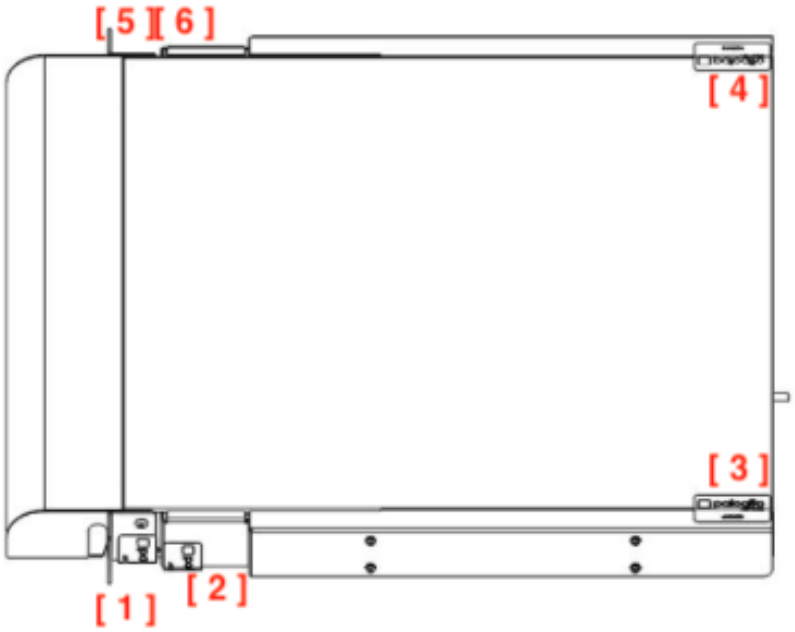


3. Install the right side FIPS plenum and secure with four (4) #6-32x1” SEM screws provided by the kit. Repeat the same steps for the left side.

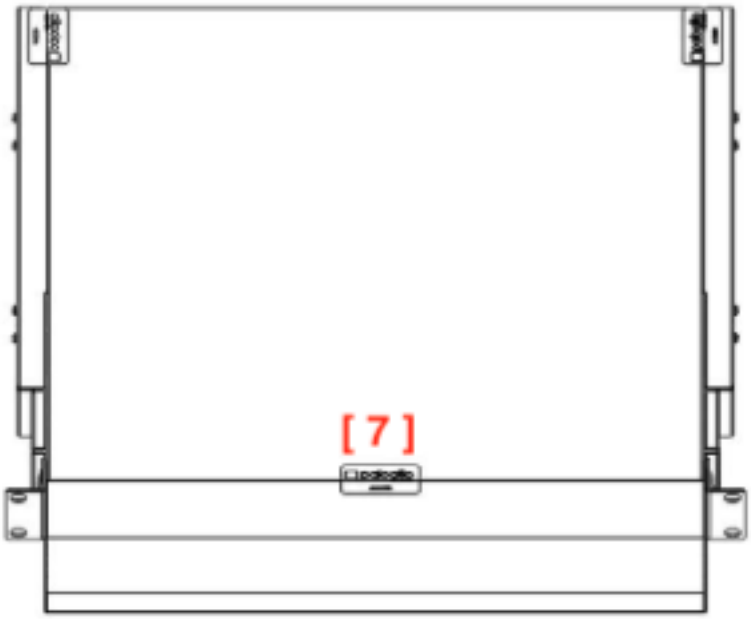


4. Affix a tamper seal to cover the right side bottom ear mounting bracket screw. Repeat the same steps for the left side.

   Affix a tamper seal at right side of the chassis between the top cover and the FIPS plenum. Affix another tamper seal between the bottom of the chassis and the FIPS plenum. Repeat the same steps for the left side.

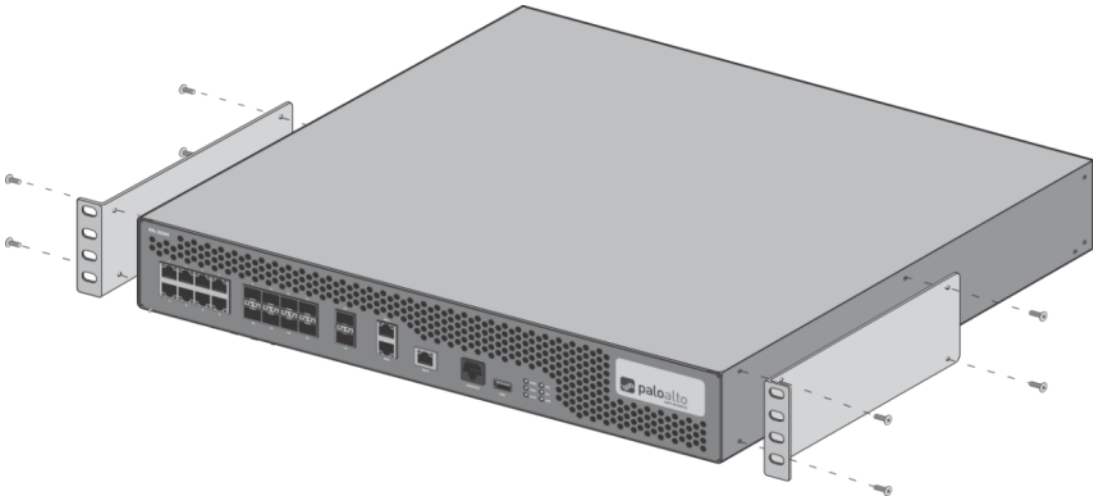


5. Affix a tamper seal on top of the cover / panel.

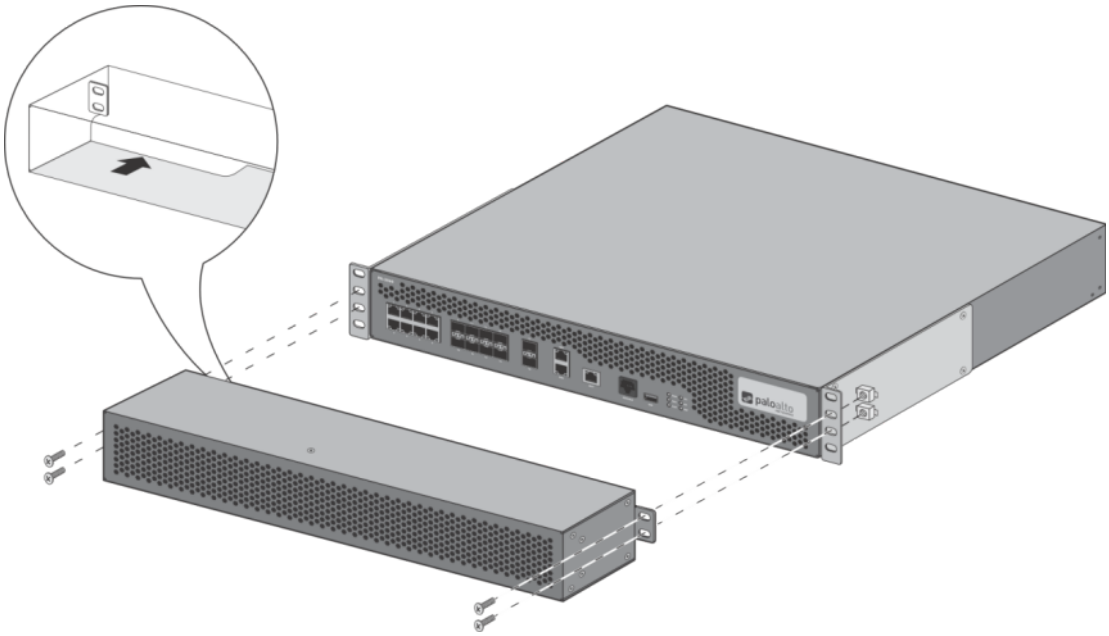


Appendix E - PA-3060 - FIPS Accessories/Tamper Seal Installation (8 Seals)

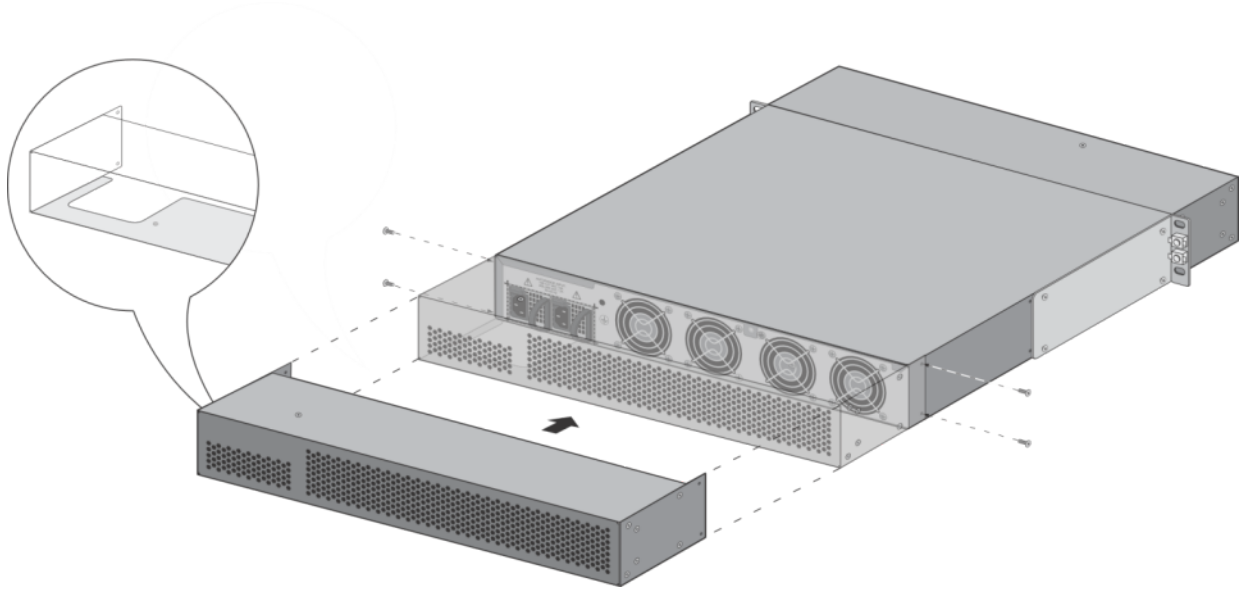
1. From the front of the PA-3060, attach the Left and Right Front Cover brackets using the screws provided.



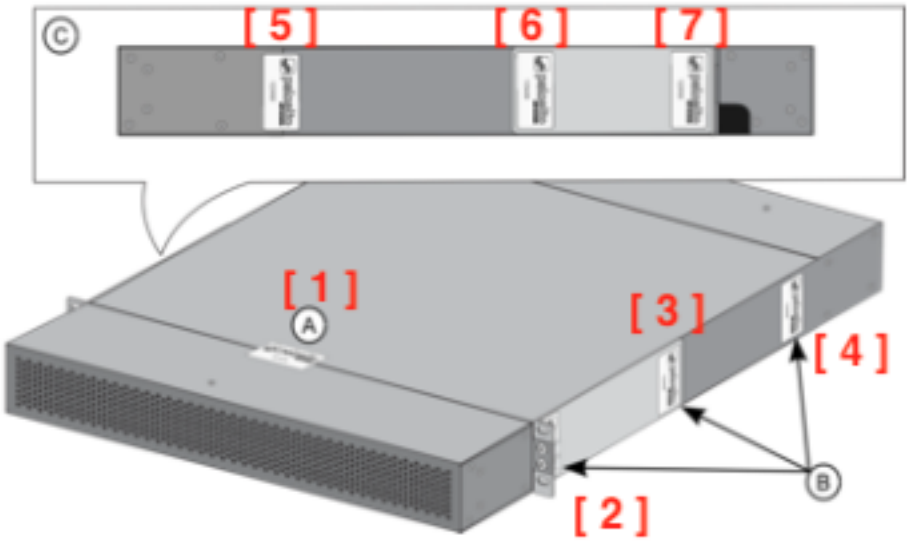
2. Attach Front cover to the front of the PA-3060 using the brackets and the supplied bolts and nuts. Ensure the gap in the cover is positioned below the networking interfaces.



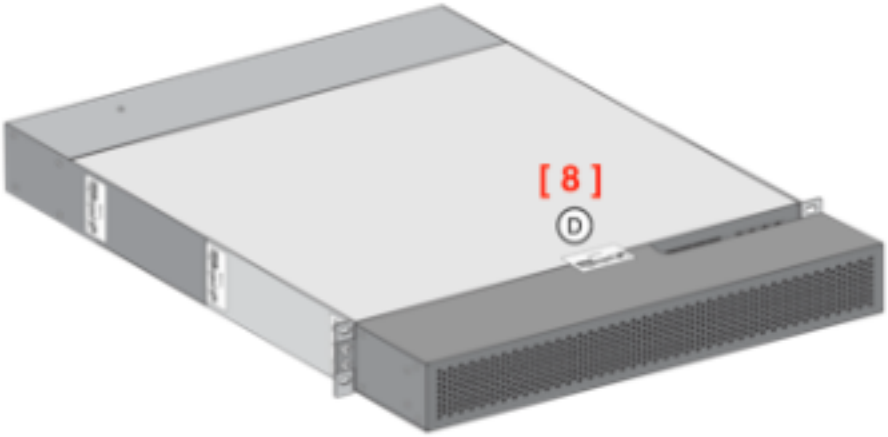
3. Attach Rear Cover to the rear of the PA-3060. Ensure the gap in the cover is positioned below the power supplies.



4. Affix tamper evident seals as follows.
    A. Attach a tamper seal to the top of the module overlapping the front opacity shield and the PA-3060.
    B. Attach three (3) seals to the right side of the PA-3060 covering each screw used to attach the front bracket and rear opacity cover.
    C. Attach three (3) seals to the left side of the PA-3060 covering each screw used to attach the front bracket and rear opacity cover.

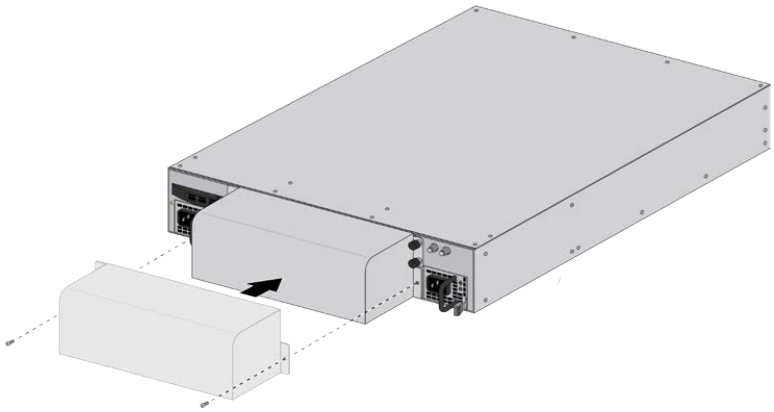


5. Viewing the bottom of the PA-3060.
   D. Attach a tamper seal overlapping the front opacity shield and the PA-3060.

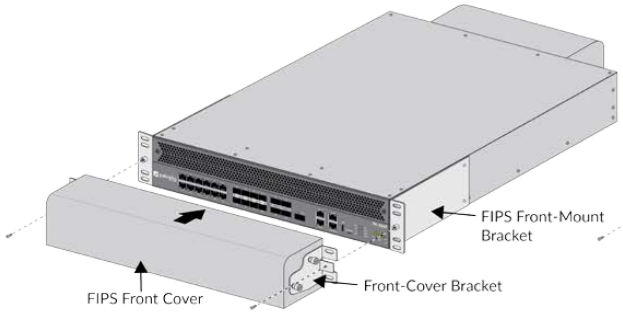


Appendix F – PA-3200 Series – FIPS Accessories/Tamper Seal Installation (19 Seals)

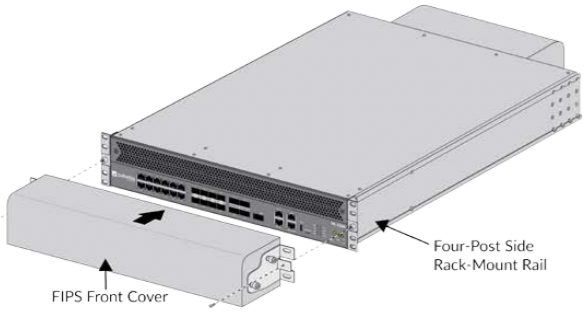
1. Install the back cover to the back of the firewall



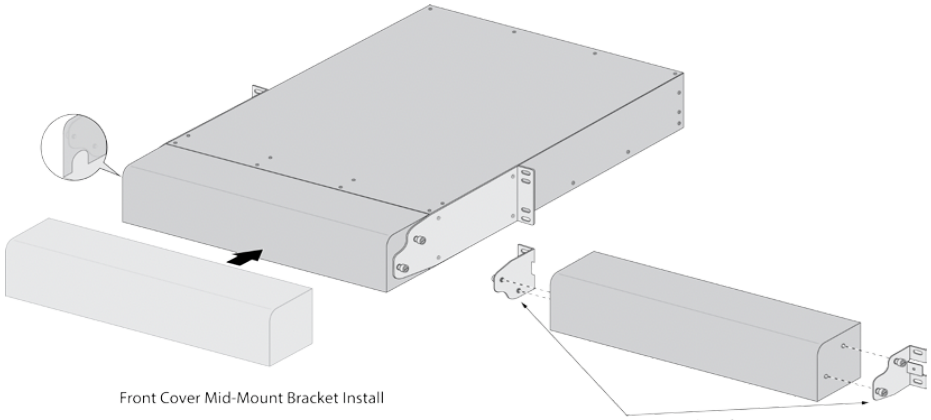
2. Attach the bracket to the firewall that will be used. Note: The firewall can use a mid-mount, front-mount or four-post mount. All seal placement is the same for the various use cases.



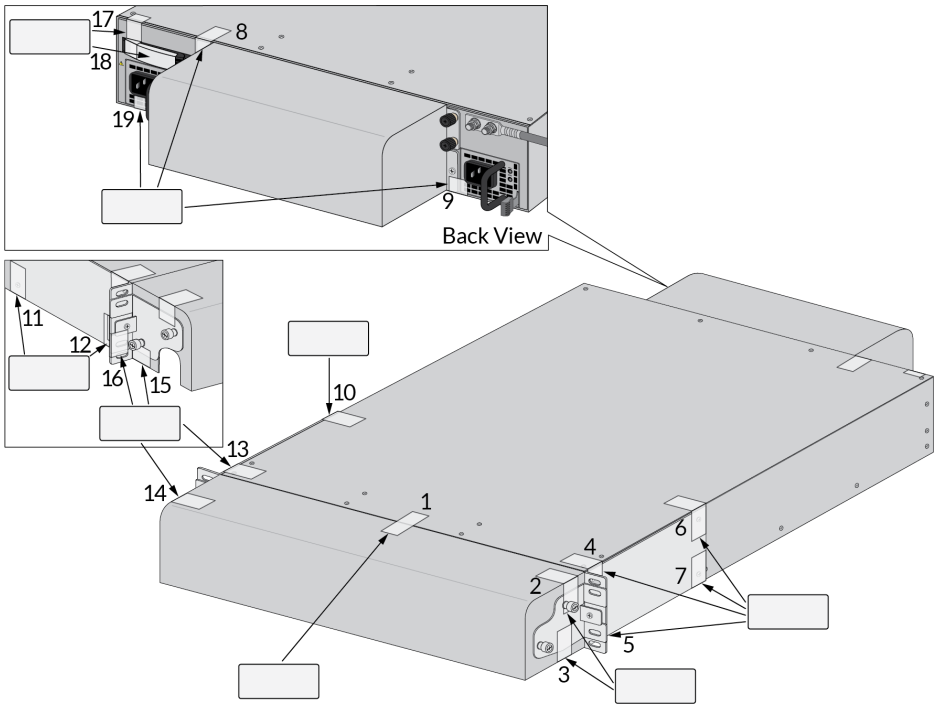
Front-Mount Install



Four-Post Rack Kit Install

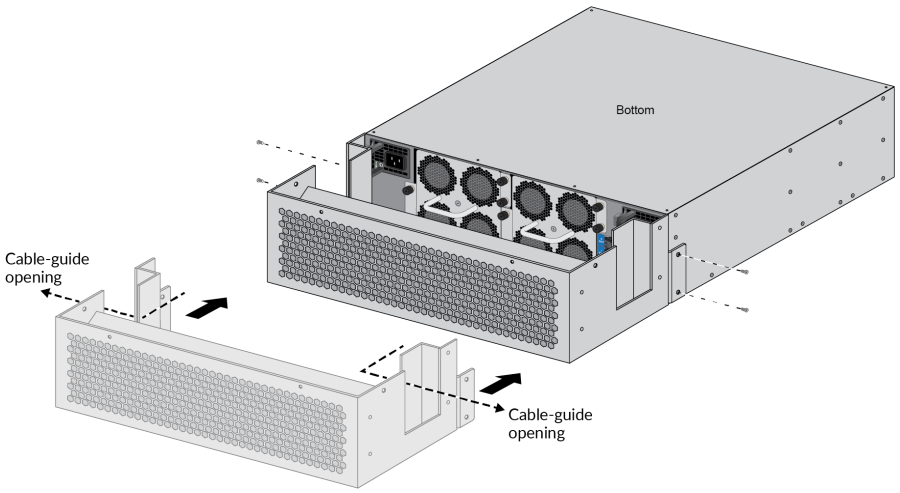


3. Place 19 tamper seals on the module. Note: Tamper seal placement is the same for all mount types. Seal #16 is required only for the front-mount of four-post rack installations. It is not required for the mid-mount installation

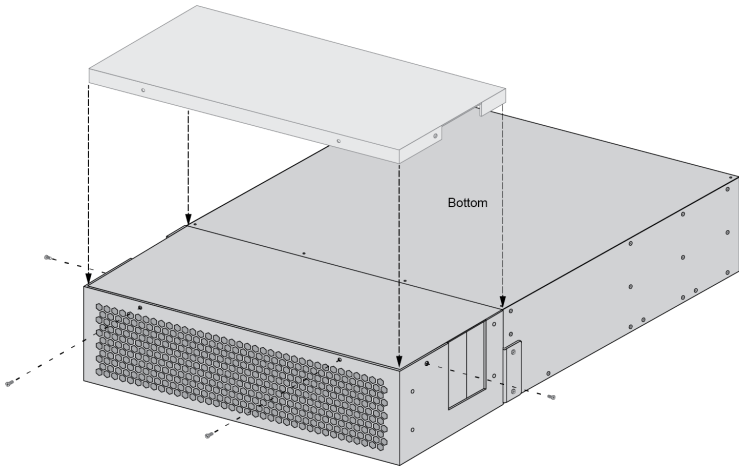


Appendix G - PA-5200- FIPS Accessories/Tamper Seal Installation (28 Seals)

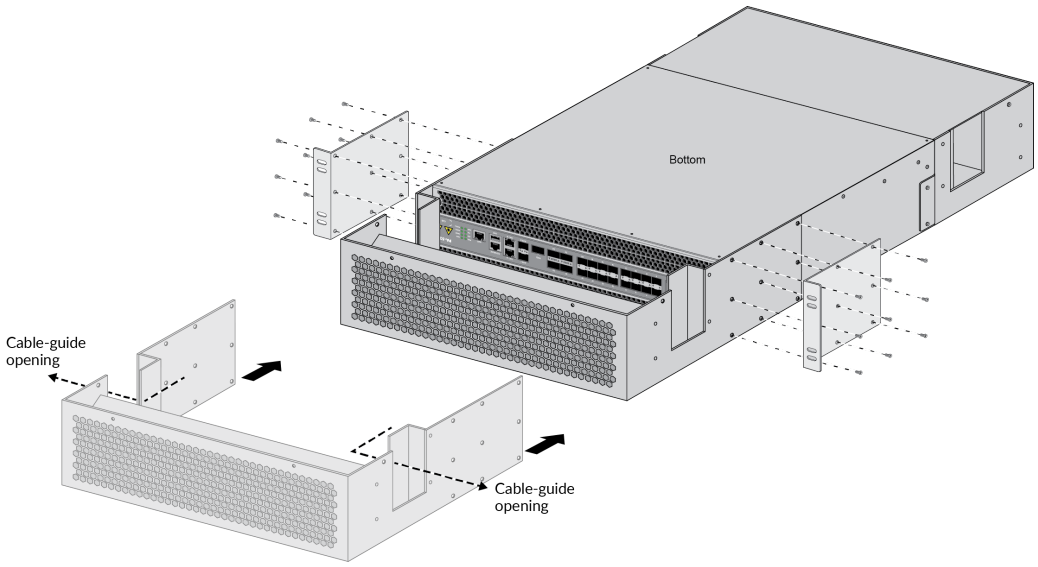
1. Place the firewall upside down on a flat Electrostatic Discharge (ESD) protected surface and ground yourself by touching a metal surface on the firewall.
2. Install power cables: plug the power cords in to the power inlets located on the back of the firewall and connect the ground lug and ground cable to the ground lug bolts (you cannot access these back ports after you attach the FIPS back cover).
3. Place the FIPS back cover onto the back of the firewall and attach it to the firewall using four (4) #8-32 x 1/4" screws (two (2) screws on each side of the cover). Route the power cables through the back-cover cable-guide openings.



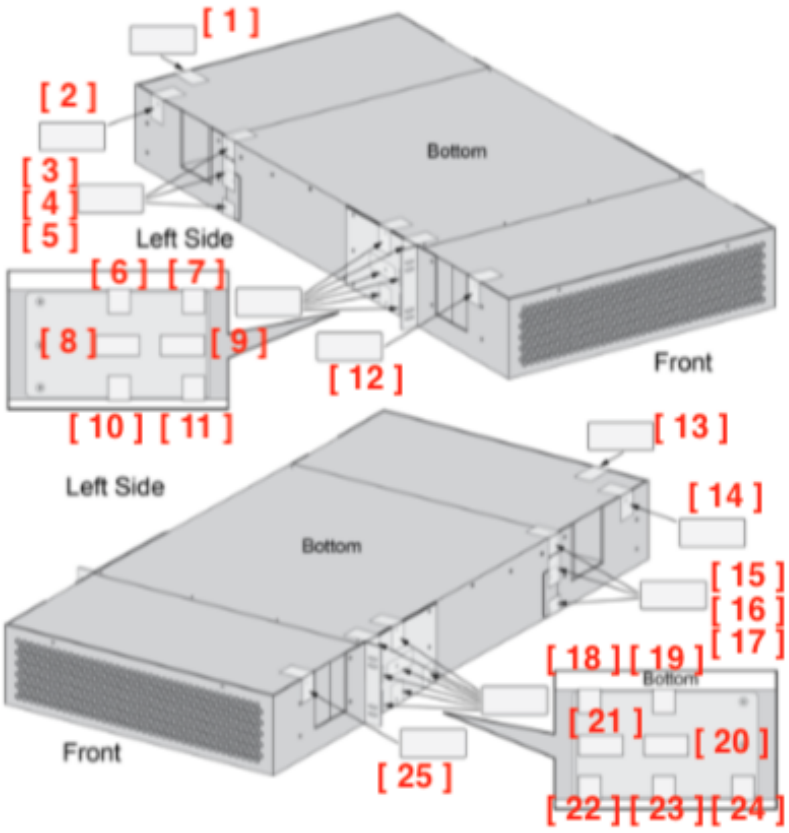
4. Attach the FIPS back-cover panel to the FIPS back cover using four (4) #4-40 x 1/4" screws (one (1) screw on each side of the cover and two (2) screws on the back of the cover).

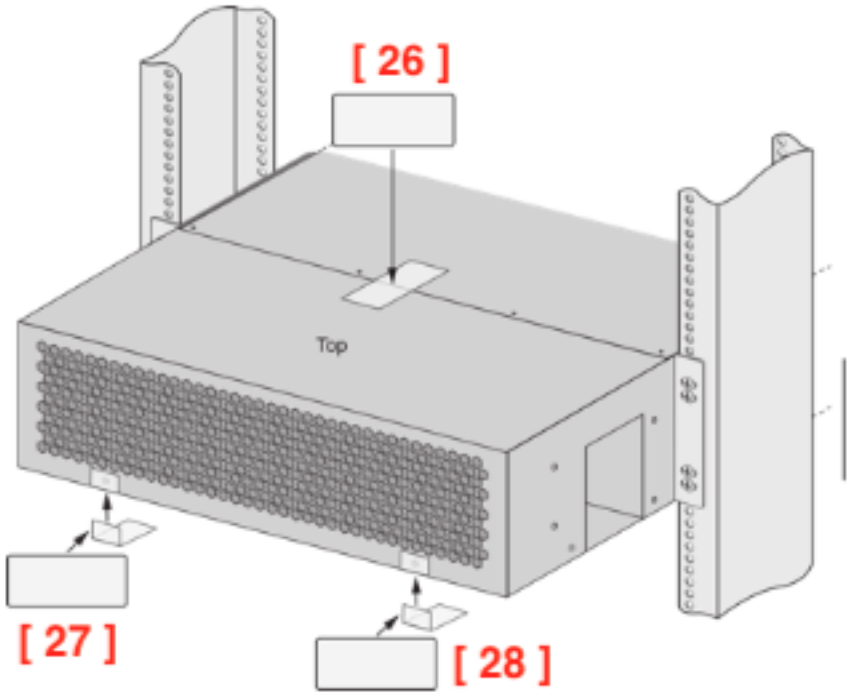


5. Place the FIPS front cover onto the front of the firewall and place the rack-mount brackets over the holes on the front cover. Attach the front cover and rack-mount brackets to the firewall using eighteen (18) #8-32 x 5/16" screws (shipped with the firewall)—use nine (9) screws on each side.



6. Apply a tamper-evident seal to each location shown in the illustrations (28 seals).




[26]
Top
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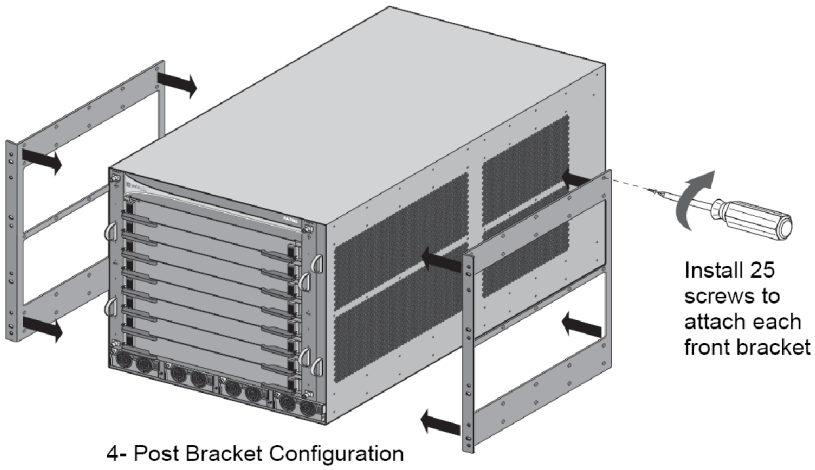
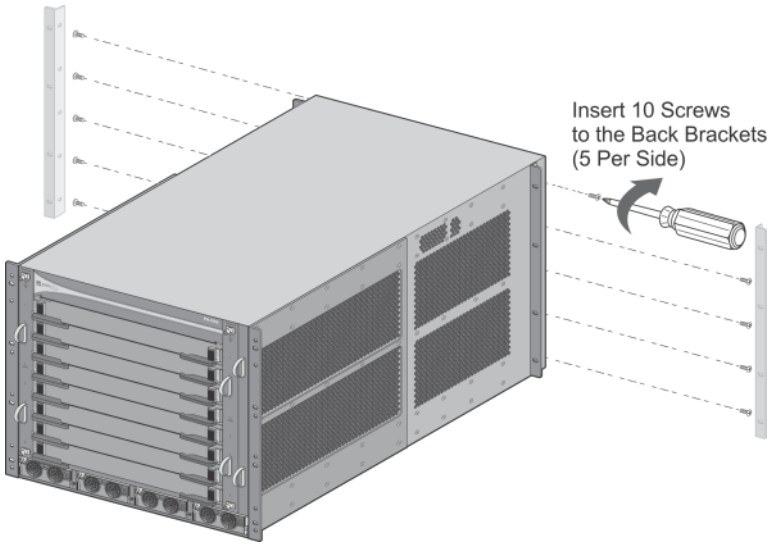
Appendix H - PA-7050 - FIPS Accessories/Tamper Seal Installation (24 Seals)

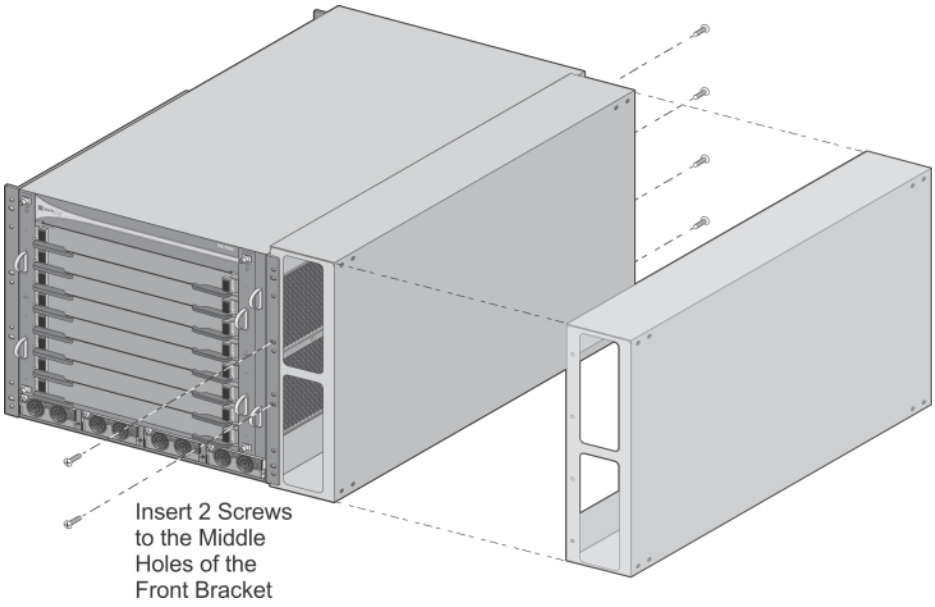
1. Attach front right rack mount brackets in 4-post rack position. Do not attach rear rack mount brackets. Note that brackets are rotated 180 degrees, so the screw holes lineup and the rack mount holes are now on the front of the chassis.



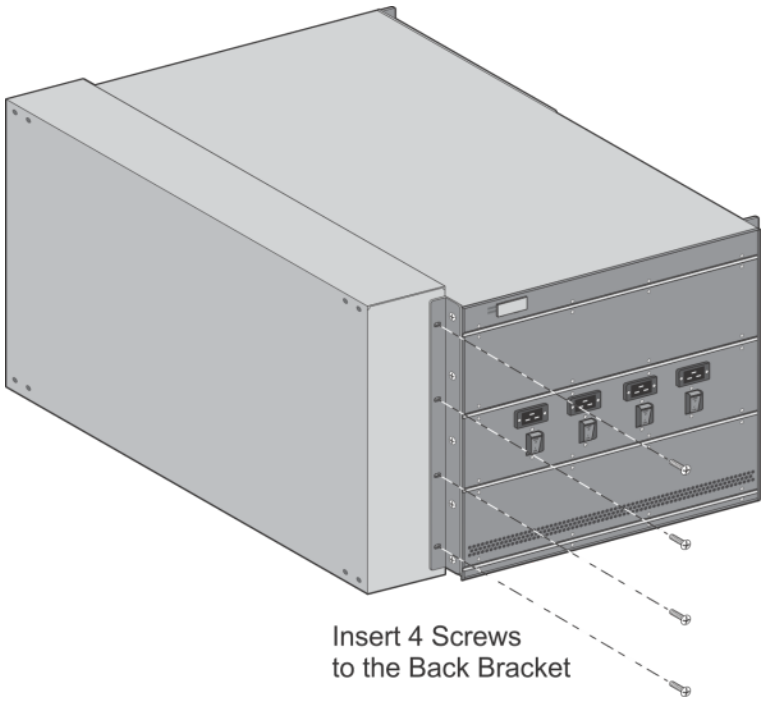
2. Align right plenum bracket with five (5) open screw holes. Attach air plenum brackets using five (5) of the remaining bracket screws as shown. Repeat for left side.



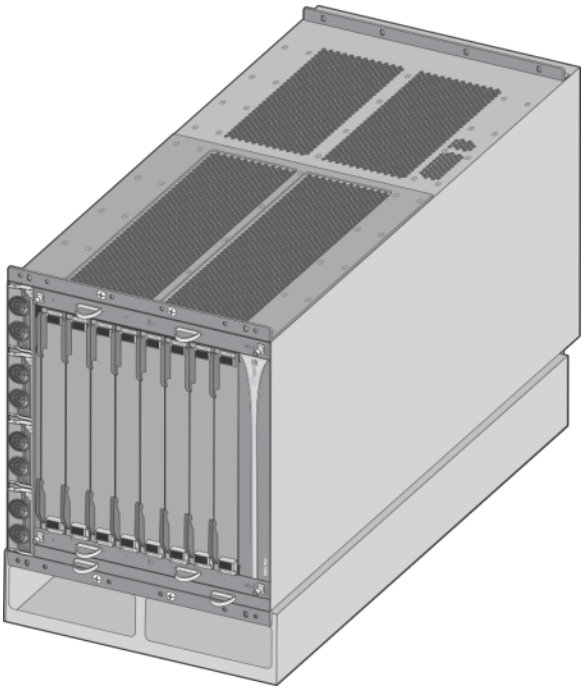
3. Attach bottom plenum to the front right rack mount bracket. Place only the middle two (2) screws.



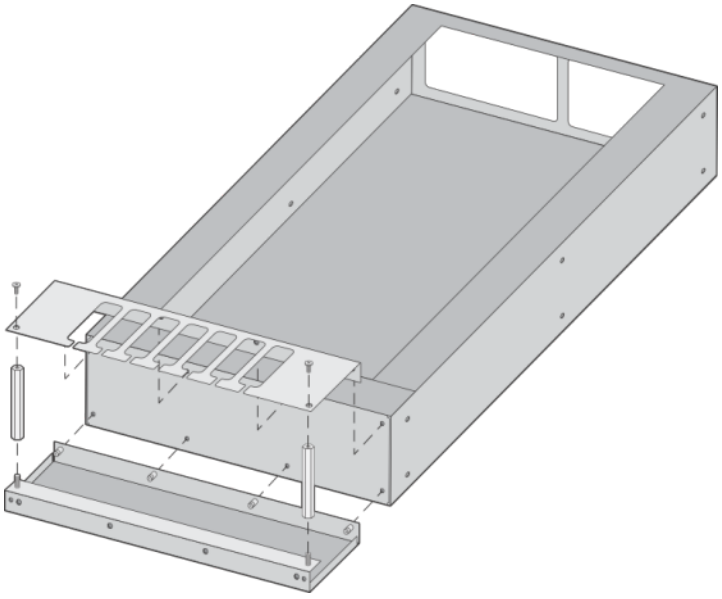
4. Attach the bottom plenum to the rearward right plenum bracket.



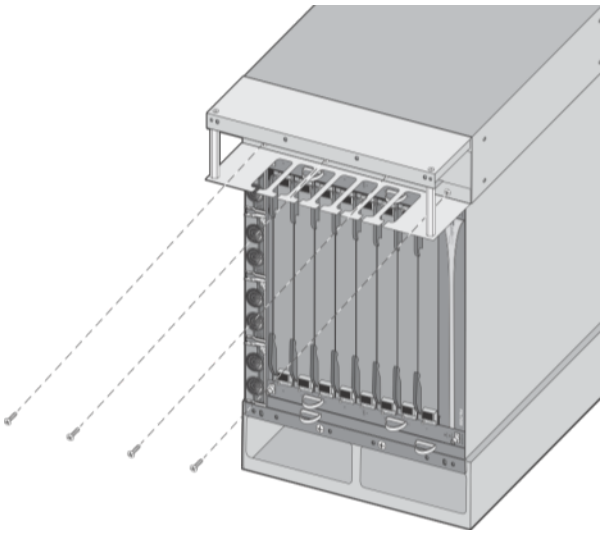
5. Rotate PA-7050 chassis clockwise 90 degrees onto the bottom plenum.



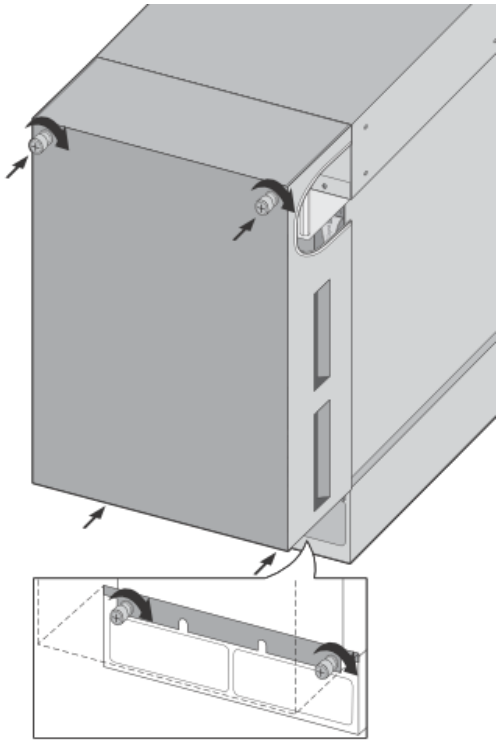
6. Assemble top plenum and cable guide hardware.



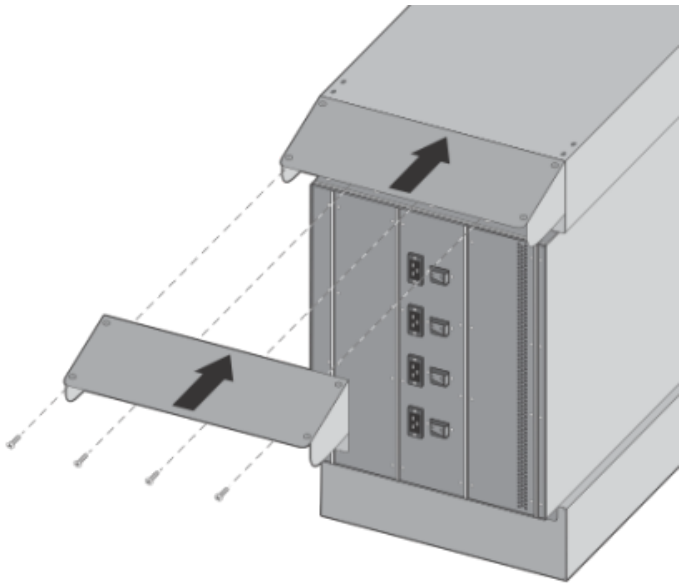
7. Attach top plenum to the front left rack mount bracket



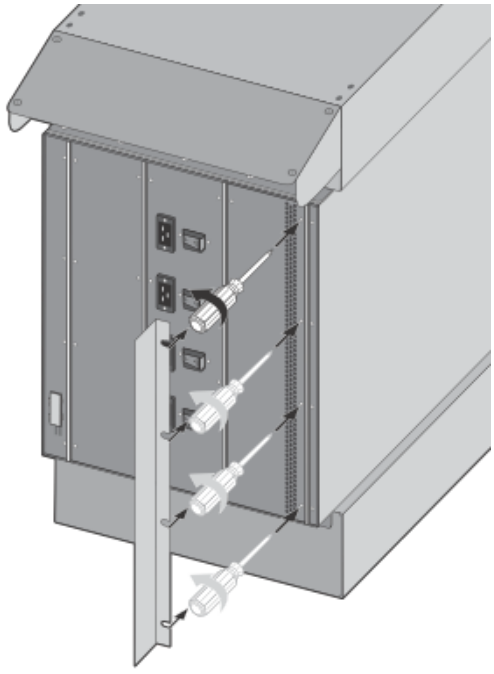
8. Attach front opacity shield using the four (4) captive screws



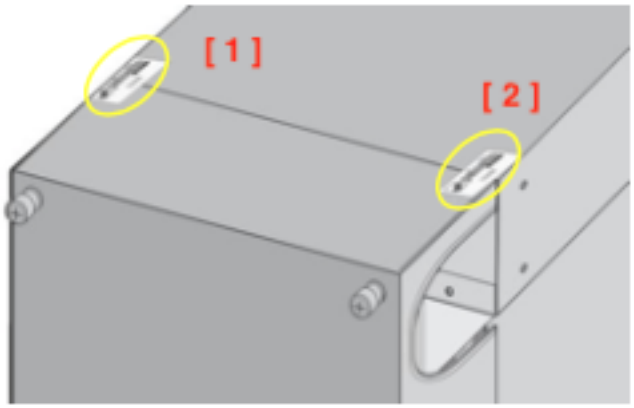
9. Attach top plenum to the rearward left plenum bracket along with plenum's rear opacity shield as shown



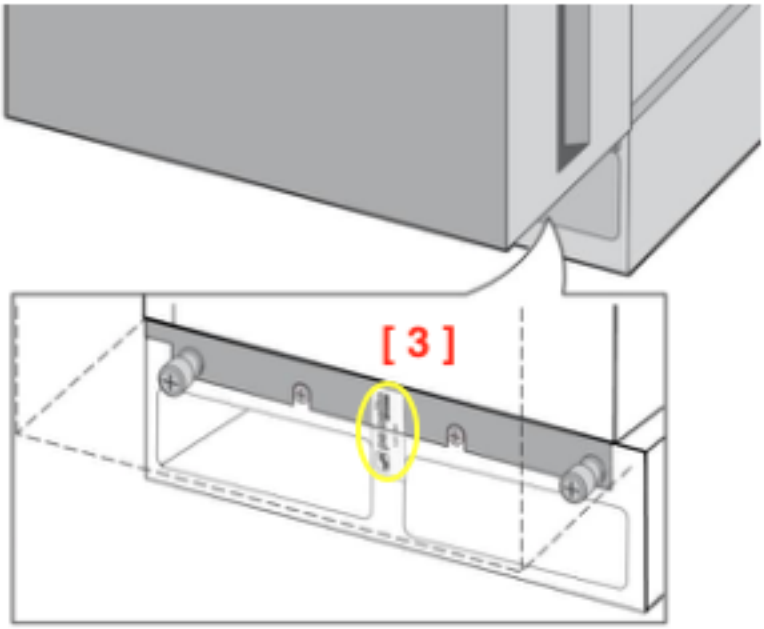
10. Loosen four (4) screws on the panel containing the power supply vent. Insert the power supply vent opacity shield and tighten screws.



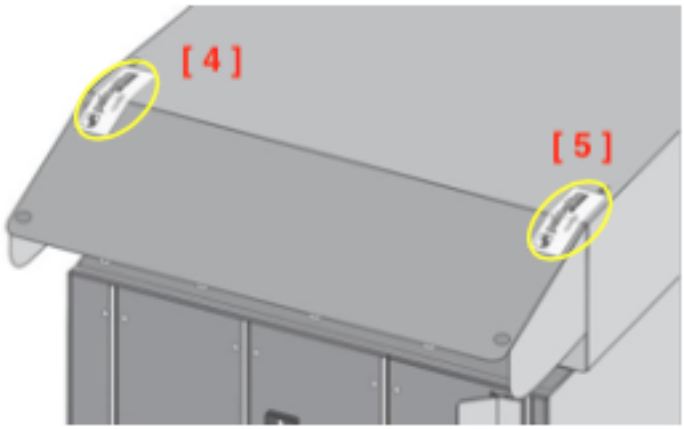
11. Facing the front of the module, affix two (2) seals to top of the front opacity shield, one (1) near left edge and one (1) near the right edge. Ensure the seals, when placed, overlap onto the top of the plenum, as shown. (2 total)



12. Facing the front of the module affix one (1) seal centered to the bottom of the front opacity shield to the bottom air plenum, as shown. (1 total)

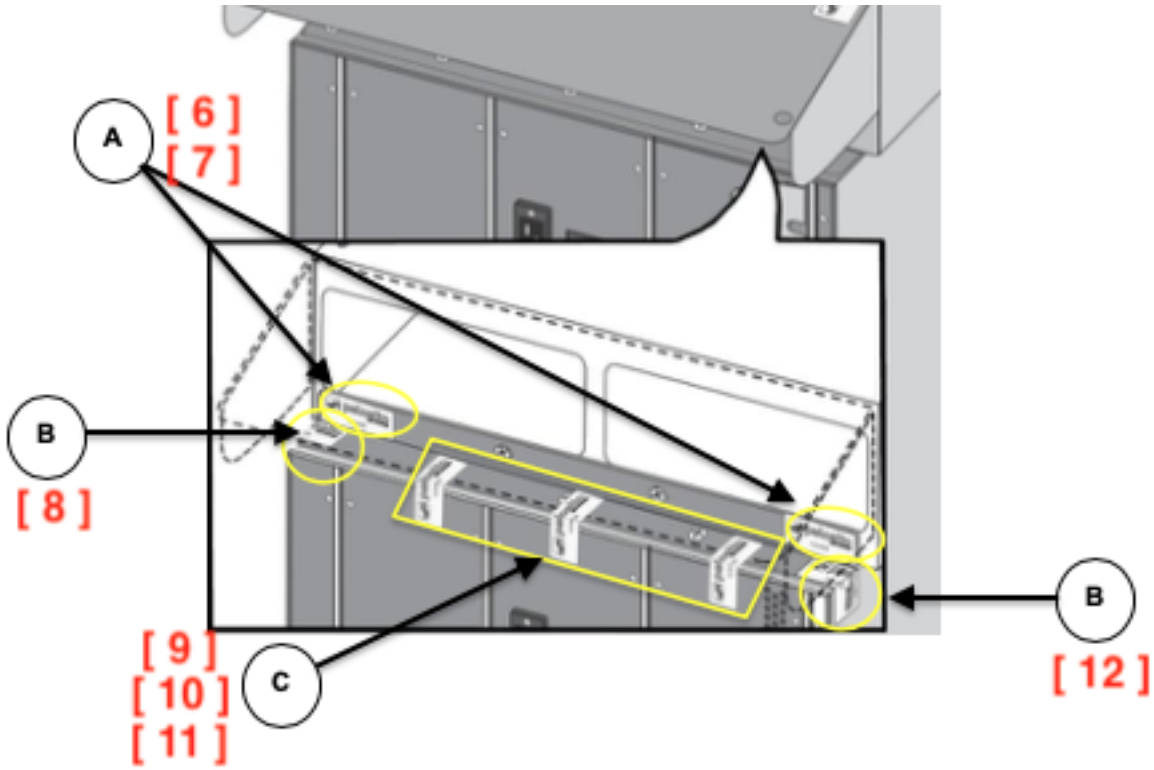


13. Facing the rear of the module, affix two (2) seals to top of the rear opacity shield, one (1) near left edge and one (1) near the right edge. Ensure the seals, when placed, overlap onto the top of the plenum, as shown.
(2 total)



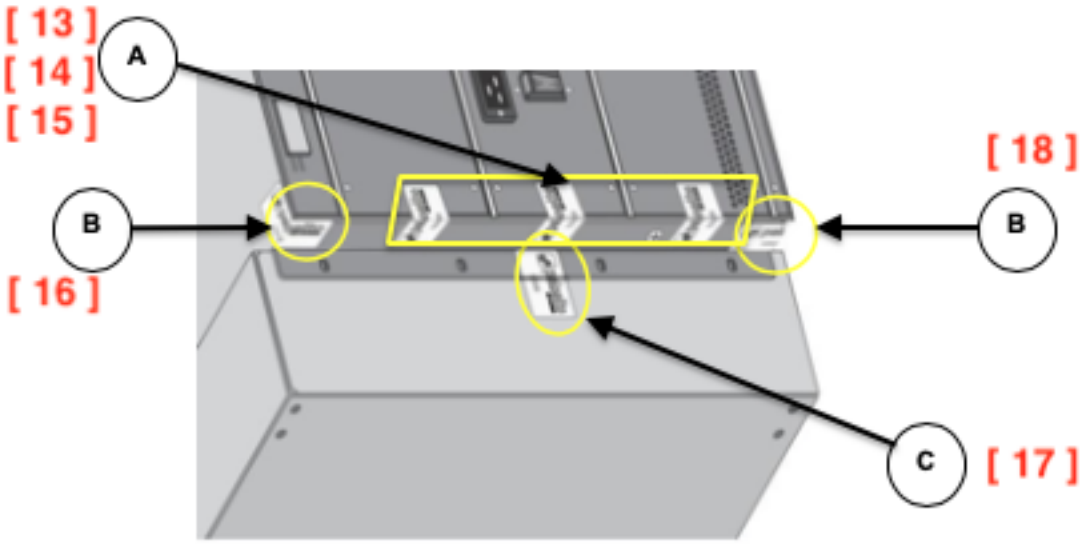
14. Facing the rear of the module;
    A. Affix one (1) seal to the top plenum/opacity shield, covering the left and right outermost screws, as shown.
    B. Affix one (1) seal to the left and right edge of the top plenum bracket folding over the outer edge of the module, as shown.
    C. Affix one (1) seal to the top of each rear panel (three (3). Ensure that the seals lap onto the top rear plenum brackets, as shown.

    (7 total)



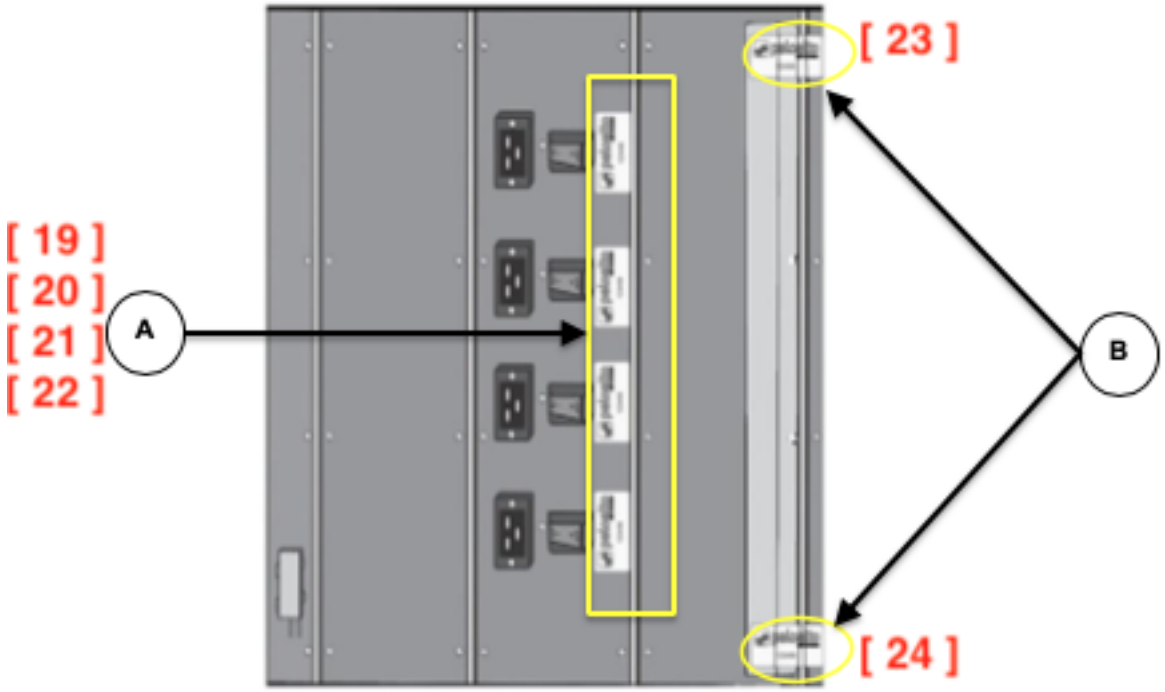
15. Facing the rear of the module,
    A. Affix one (1) seal to the bottom of each rear panel (three (3). Ensure that the seals laps onto the bottom rear plenum brackets, as shown.
    B. Affix one (1) seal to the left and right edge of the bottom plenum bracket folding over the outer edge of the module, as shown.
    C. Affix one (1) seal to the bottom plenum's rear side and the bottom plenum rear bracket.

    (6 total)



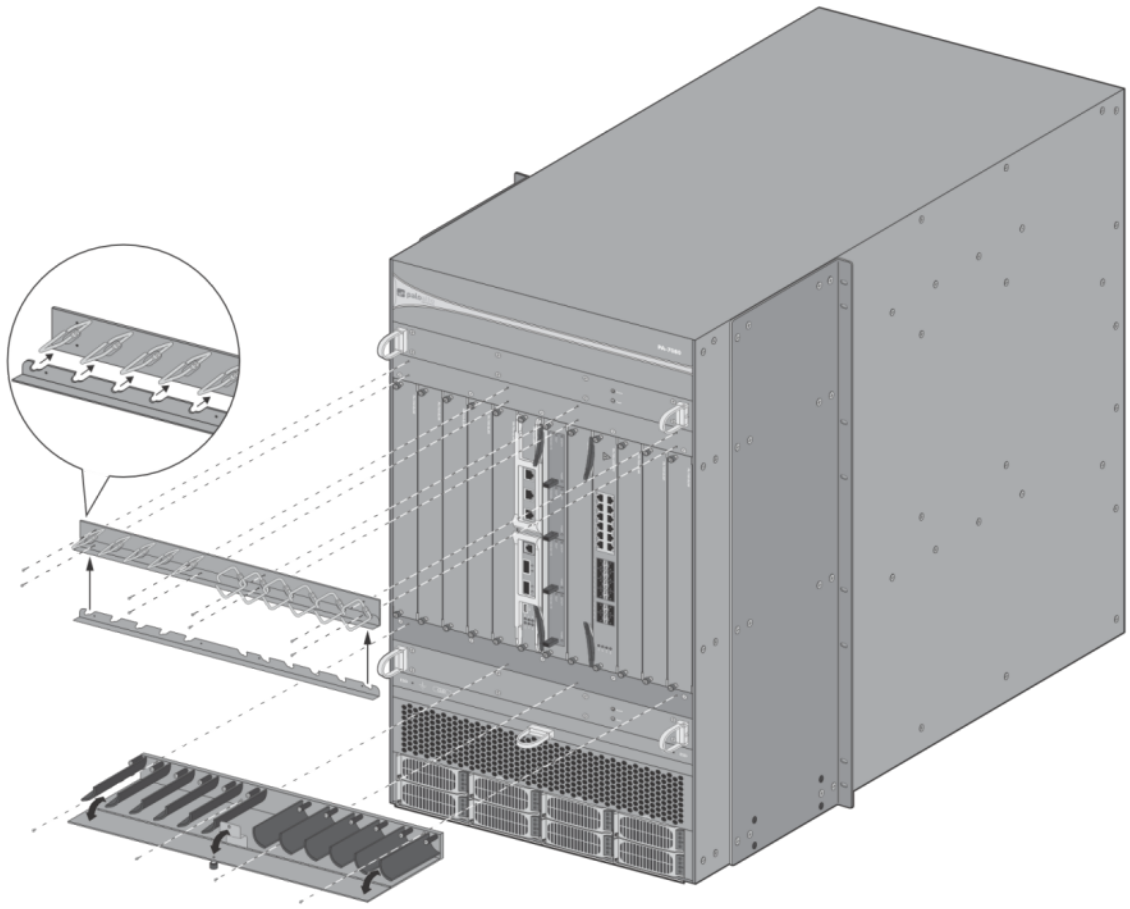
16. Facing the rear of the module;
    - Affix one (1) seal to cover one (1) screw for each power switch, as shown.
    - Affix one (1) seal to the top and bottom of the vent opacity shield, as shown. Please ensure that the captive screw is covered.

    (6 total)

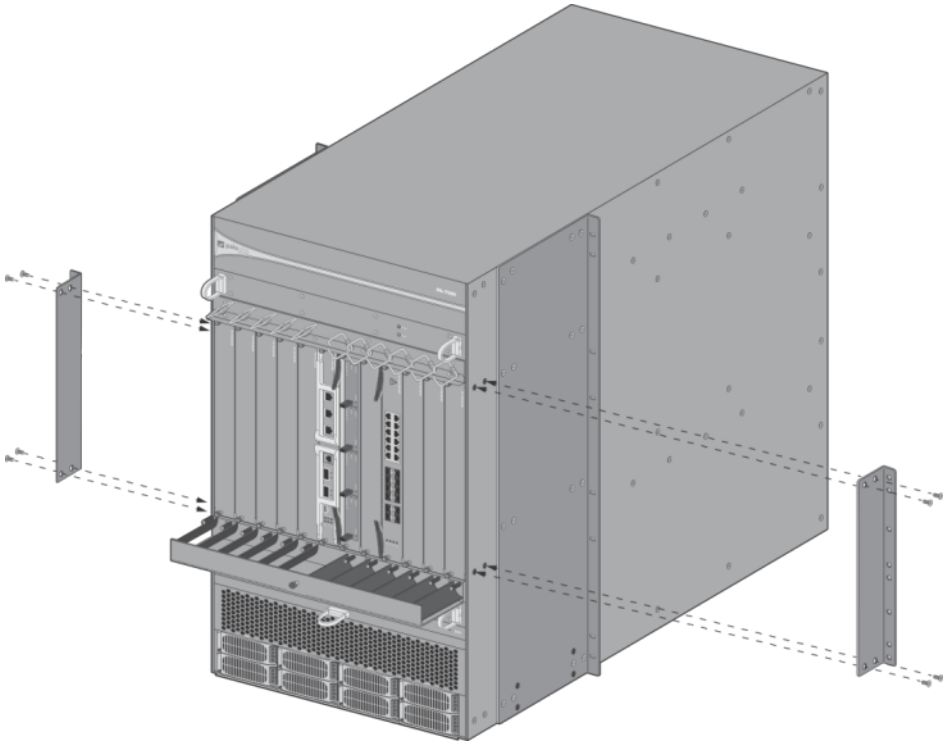


Appendix I - PA-7080 - FIPS Accessories/Tamper Seal Installation (10 Seals)

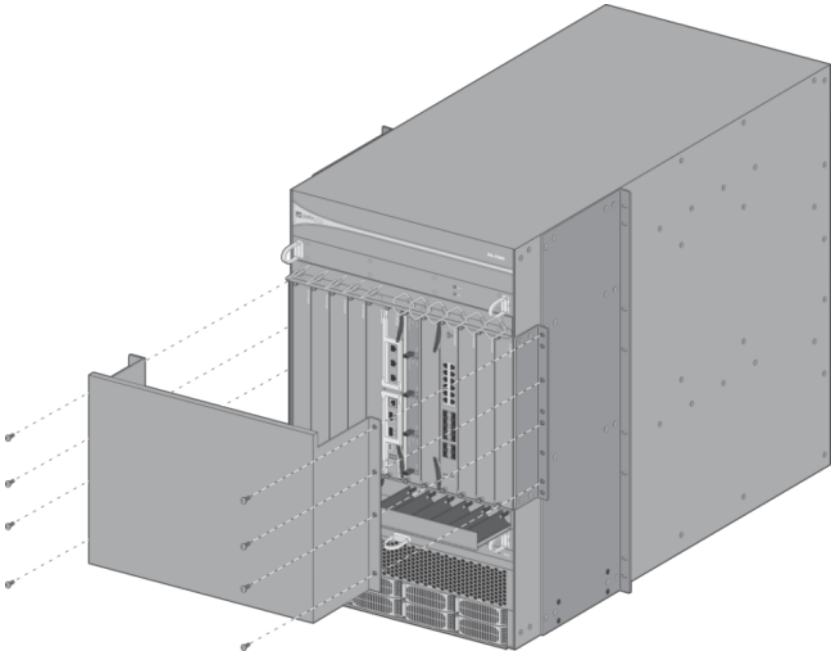
1. Using the supplied screws attach the Cable Manger Kit with upper opacity lip to the front of the PA-7080, as shown.



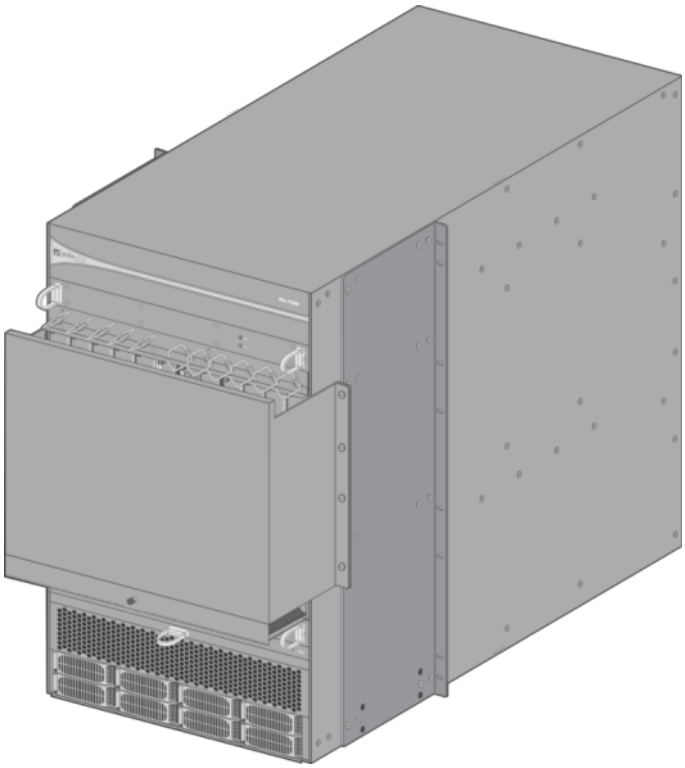
2. Using the supplied screws, attach the Left and Right Front Cover brackets to the sides of the PA-7080, as shown.



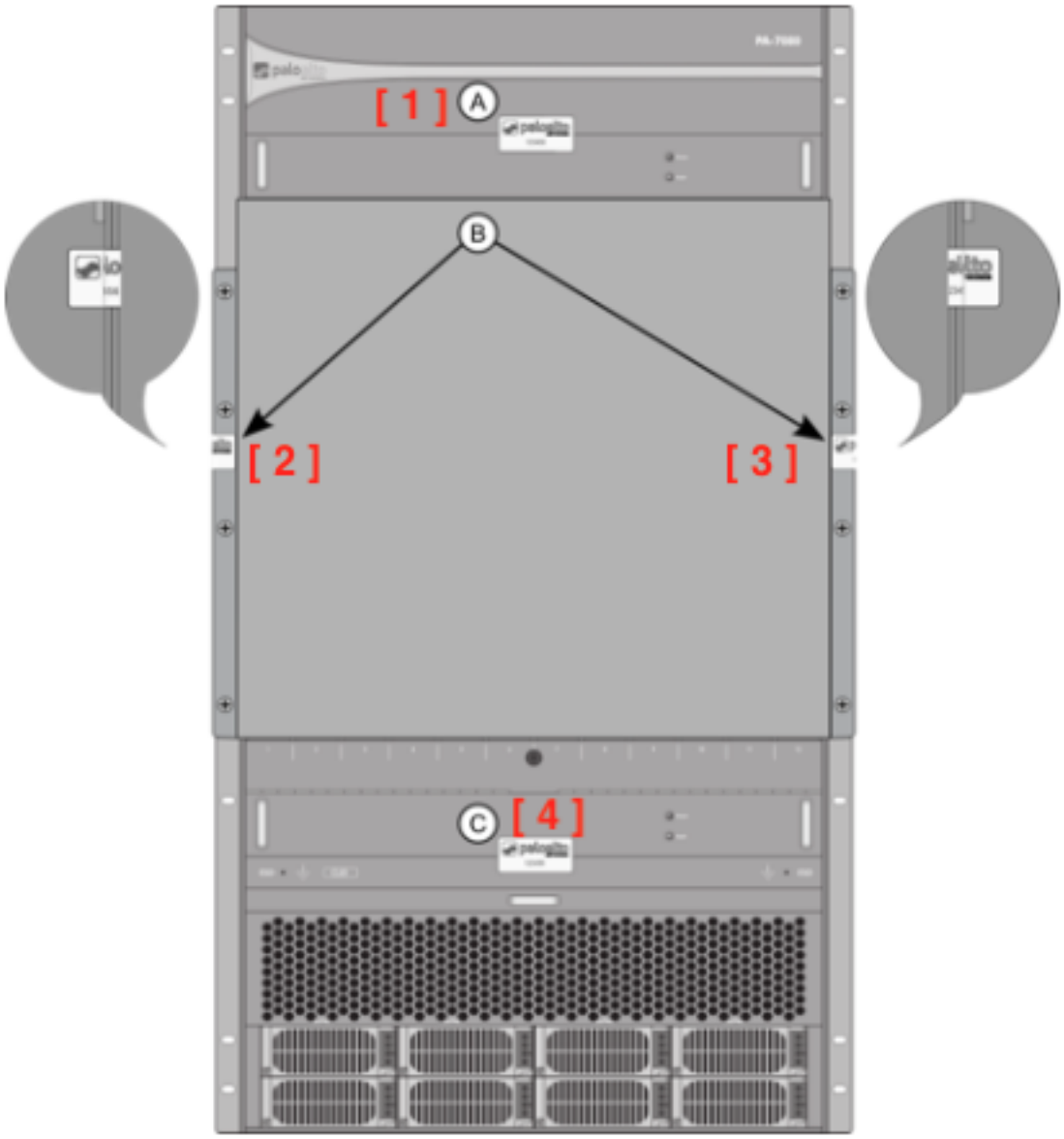
3. Using the supplied screws attach front opacity shield to the PA-7080 as shown.



4. The final assembly for the PA-7080 with the FIPS kit is as shown.



5. Facing the front of the PA-7080:
   A. Affix one (1) seal to the front and center of the exhaust fan tray. Ensure the seal overlaps the seam with the front PA-7080 branding panel as shown. (1 total)
   B. Affix one (1) seal to the left and right outer edge of mounting flanges for the front opacity shield. Seals should fold over the edge of the cover flange and mounting bracket onto the side of the PA-7080. (2 total)
   C. Affix one (1) seal to the front and center of the air intake fan tray. Ensure the seal overlaps the seam with the PA-7080 electrostatic discharge port panel as shown. (1 total)



6. Facing the rear of the PA-7080;
   D. Affix one (1) seal to the left and right outer edge of the upper back panel. Seals should be placed just below the rear exhaust vent as shown. Seals should wrap around onto the sides of the PA-7080 (2 total).
   E. Affix one (1) seal to the left and right outer edges of each power entry module as shown. Seals should wrap around onto the sides of the PA-7080 (4 total).