Open Rack V3 Power Shelf Universal Input Connector

Rev: 0.3

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Table of Contents

1. Scope

This document defines the technical specifications for an Open Rack V3 Power Shelf Universal Input Connector used in Open Compute Project.

2. Overview

This power from the data center enters the power shelf through this connector set. The set is designed to allow the shelf to adjust to a wide range of input power types while allowing the cabling to the data center to adapt to regional regulatory needs.

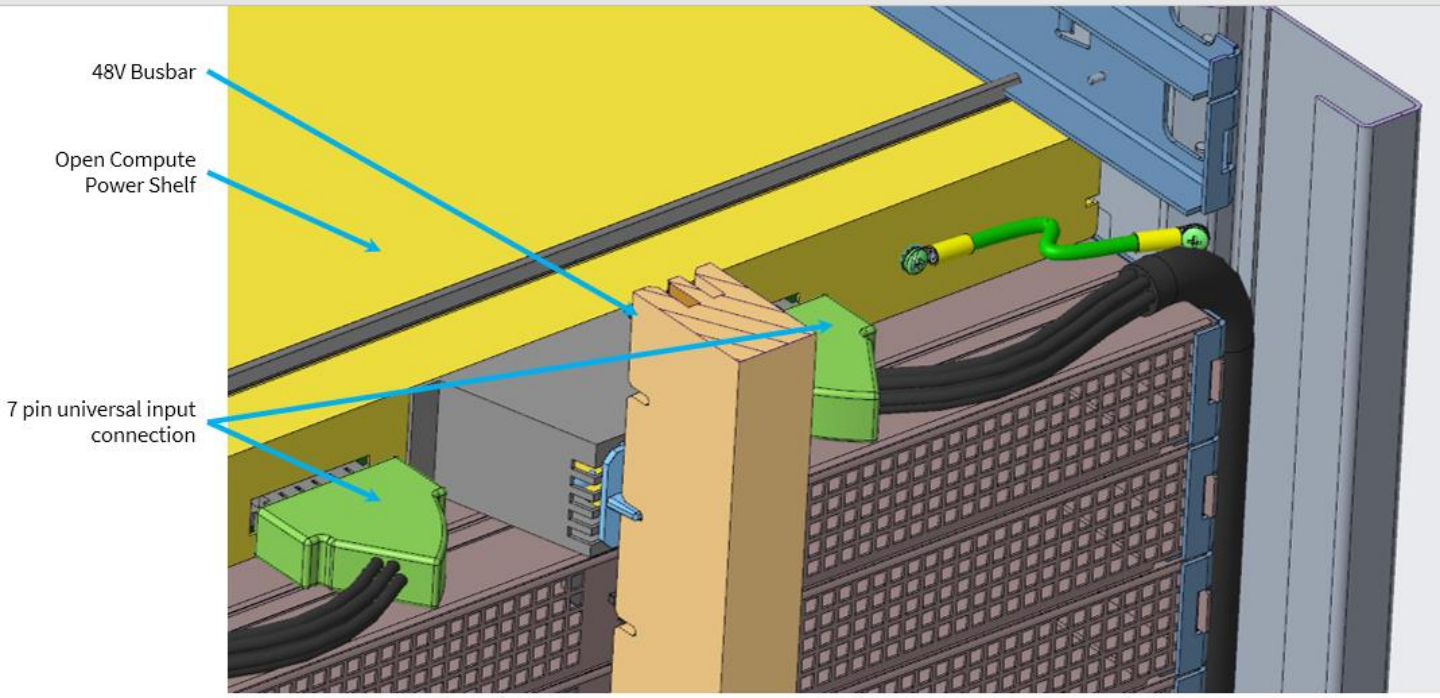


Figure 1. Layout of open rack power shelf in the rack assembly

3. Electrical

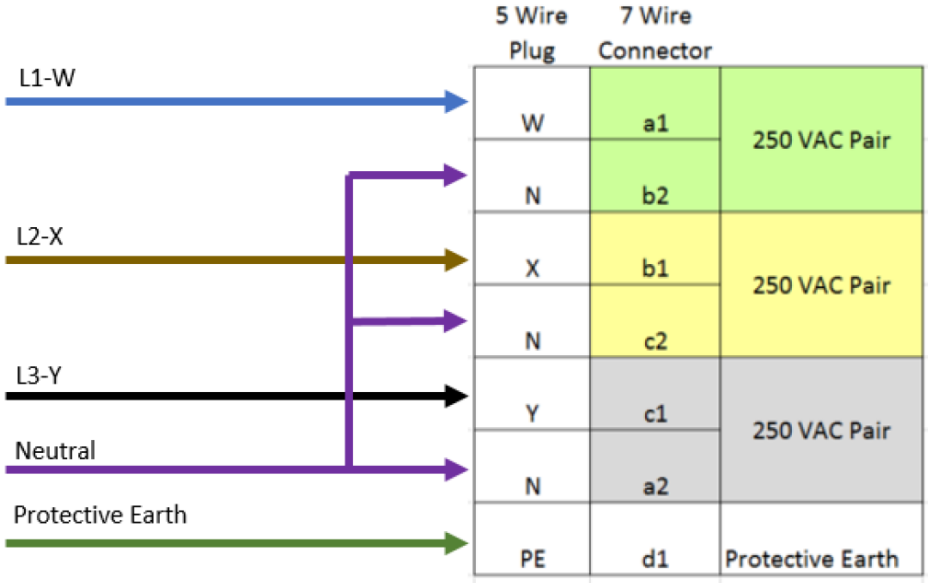
- Seven pin connector with three inputs, three returns, and one Ground (Earth).
- Nominal Voltage (rms) rating:
  - Pin to pin 480V AC
  - 380V DC
  - Frequency: DC, 50 Hz, 60 Hz
- Current Rating: 32A @ 30C temperature rise in still air
- Inrush current:
  - 10X for 100 micro sec
  - two times rated current for 5mS.

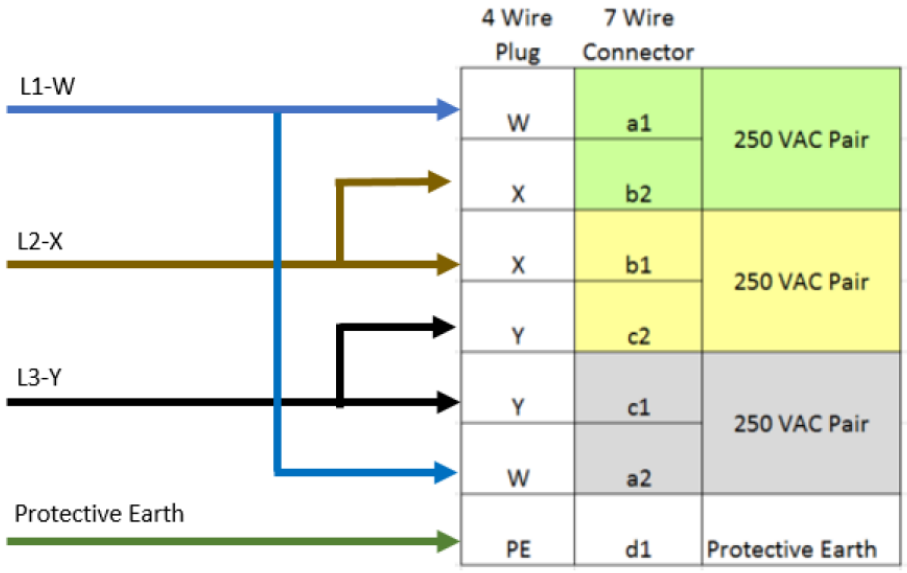
3.1 Connector wiring

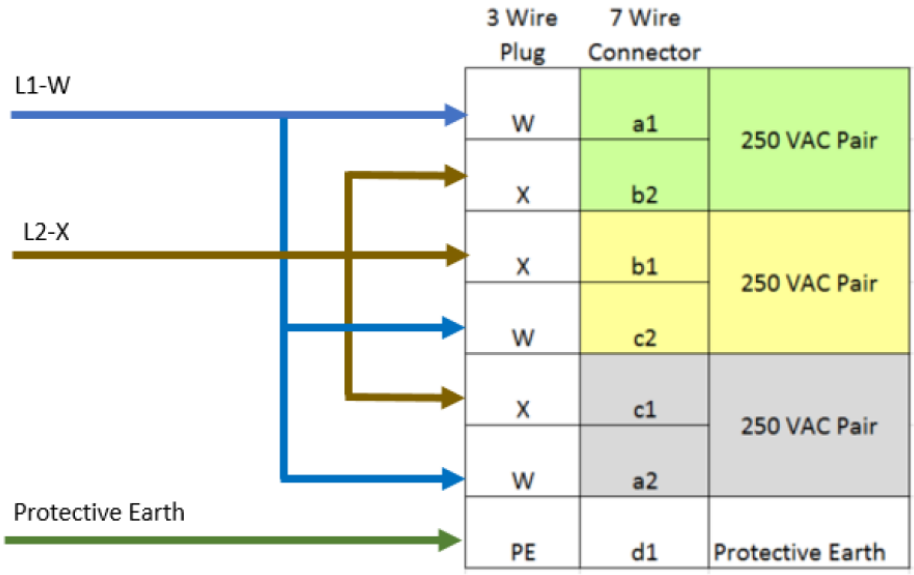
Connector shall take the following input wiring:

- 3 phase, 5 wire in Star configuration.
- 3 phase, 4 wire in Delta configuration.
- 1 phase, 3 wire configuration.
- High-voltage DC, 3 wire configuration

The following diagrams show the wiring of different configurations the connector shall support:





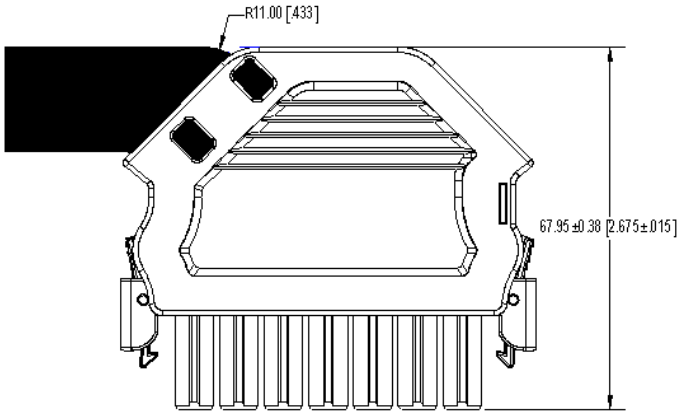


4. Mechanical

Height must fit within the envelope of a 1 RU EIA chassis (44.45mm). And pass within the cable trough of 23.8 mm minimum.

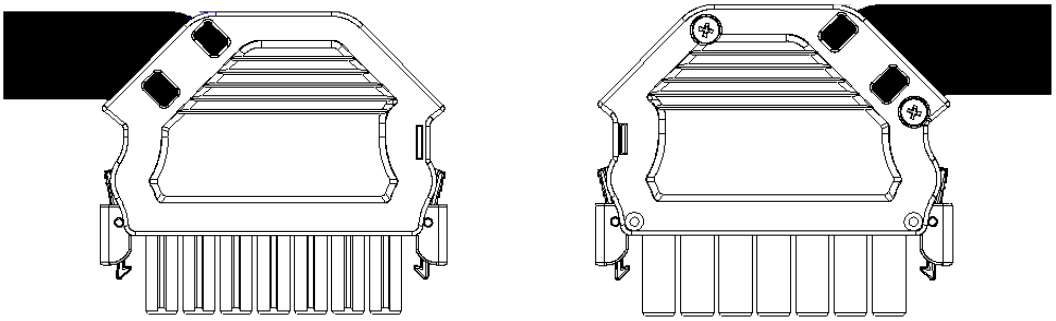
Height and width of the connector shall be sized so that a connector and a whip wire bundle of max diameter (7 X 8 AWG) high strand count) will fit into the Open Rack channel at the same time. This will allow the whip cable to be replaced without moving the rack.

The distance from the back surface of the power shelf chassis to the tip of the tangent of the <of the bend radius of the worst-case cable bundle supported> entering the cable side connector shall be less than 65mm so the whip cable will always remain inside the rack frame.

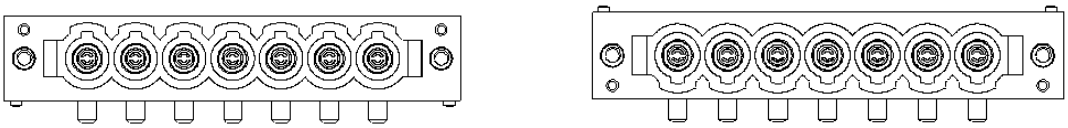


The cable hood shall be reversible so the cable can exit the hood towards either side of the rack.

Wire AWG: 12



Reversible Female Connector - Cable



Male Connector - Right

Male Connector - Left

Male Connector – Two versions to match Female Connector

5. Dimensions:

Receptacle:
For details of the PCB Pin-out for each individual connector configurations:
Right angle PCB contact with threaded insert screw mount:
- For Right connector, refer to Figure 5.3 (SP10RSSS48M220A1/AA-2269)
- For Left connector, refer to Figure 5.7 (SP10RSSS48RM220A1/AA-2269)

Right angle PCB contact with angle bracket board lock mount:
- For Right connector, refer to Figure 5.5 (SP10RSSS48M2LN0A1/AA-2269)
- For Left connector, refer to Figure 5.9 (SP10RSSS48RM2LN0A1/AA-2269)

Straight PCB contact with self-tapping screw mount:
- For Right connector, refer to Figure 5.11 (SP10RSSS38M200A1/AA-2269)
- For Left connector, refer to Figure 5.15 (SP10RSSS38RM200A1/AA-2269)

Straight PCB contact with push-on fastener mount:
- For Right connector, refer to Figure 5.13 (SP10RSSS38M2N0A1/AA-2269)
- For Left connector, refer to Figure 5.17 (SP10RSSS38RM2N0A1/AA-2269)

Detail of the Panel cut out for the chassis connector
1> Cabled internal with strain relief to the chassis
2> PCB version with strain relief
Please refer to individual connector drawings for detail panel cut out dimensions.

Receptacle Types:
- PCB straight pin
- PCB Right angle
- Panel mount with wire mount

PCB Thickness: 1.60mm to 2.00mm
Note: Connectors can be customized for different PCB thickness.

Ground pin should be first mate/last break under all entry angles.
- First mate / Last break at center position as shown in Figure 5.1 for left and right connector

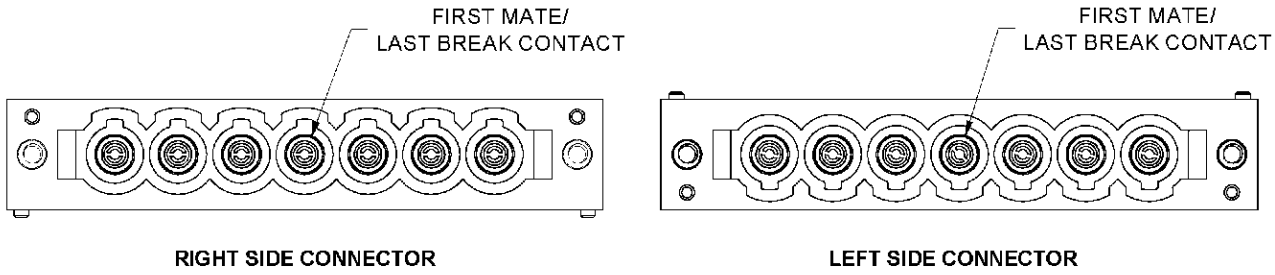
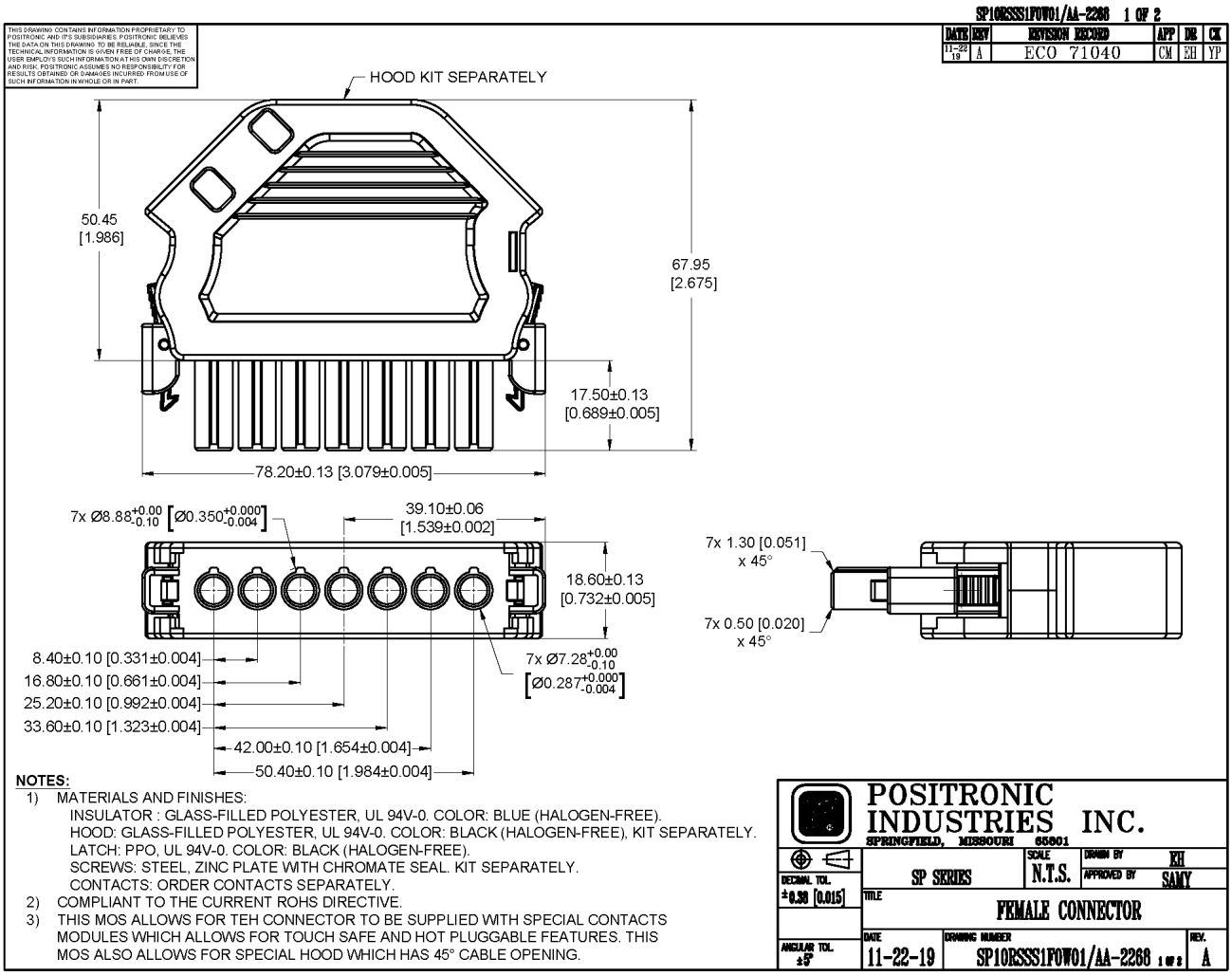


Figure 5.1 Left side and Right side connector

Female Cable Connector – Reversible for Right side and Left side (**SP10RSSS1F0W01/AA-2268)**



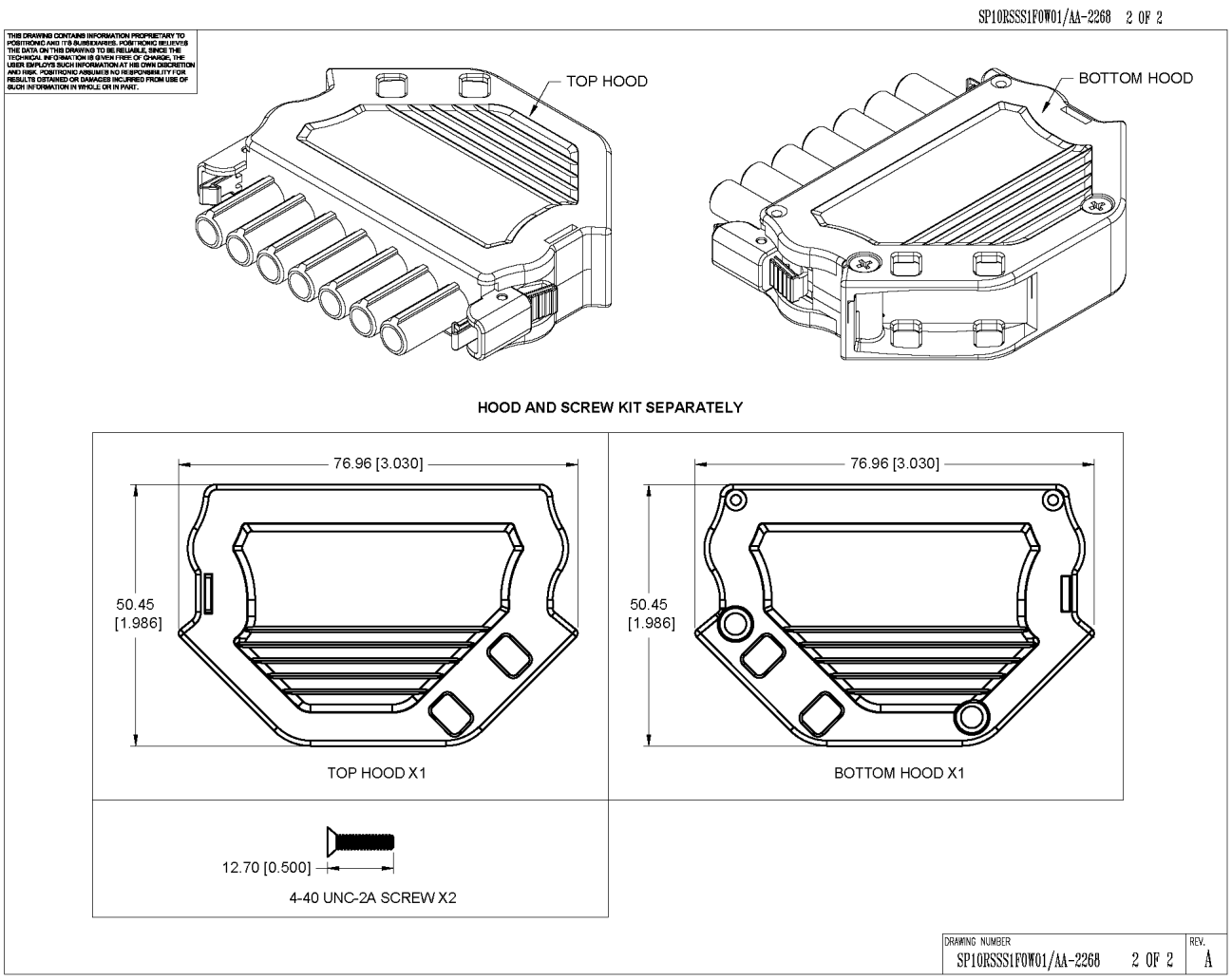
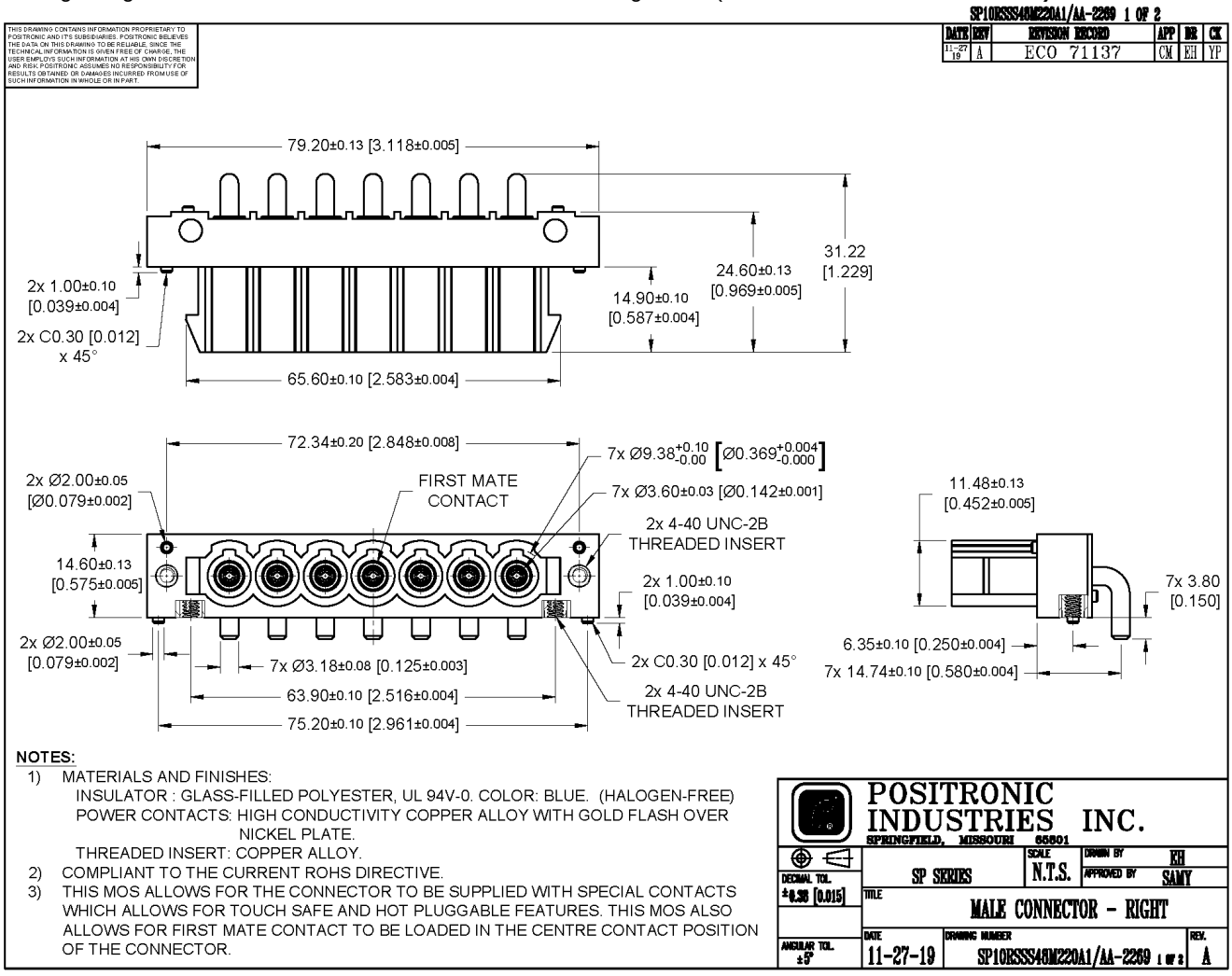


Figure 5.2 SP10RSSS1F0W01/AA-2268

Male right angle PCB Connector with threaded insert mount – Right side (**SP10RSSS48M220A1/AA-2269)**



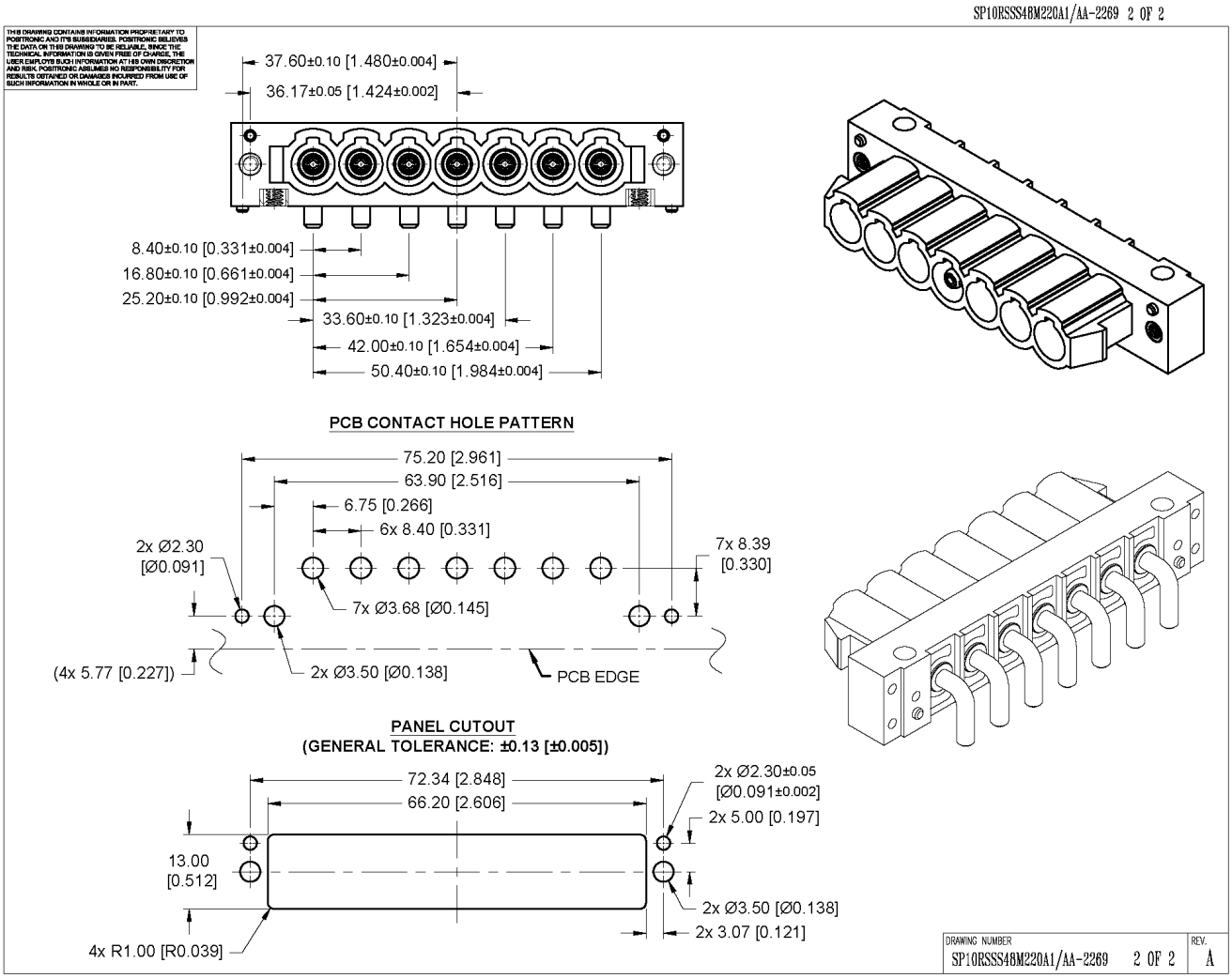


Figure 5.3 SP10RSSS48M220A1/AA-2269

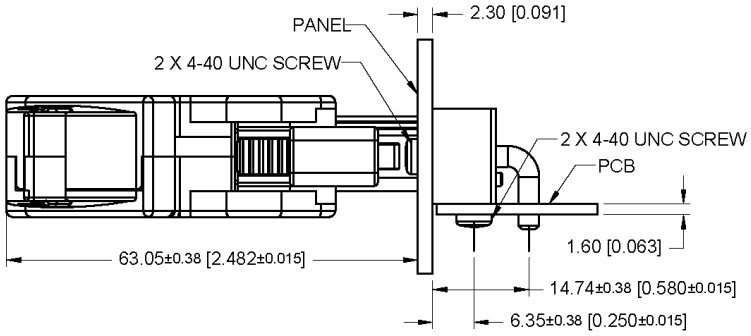
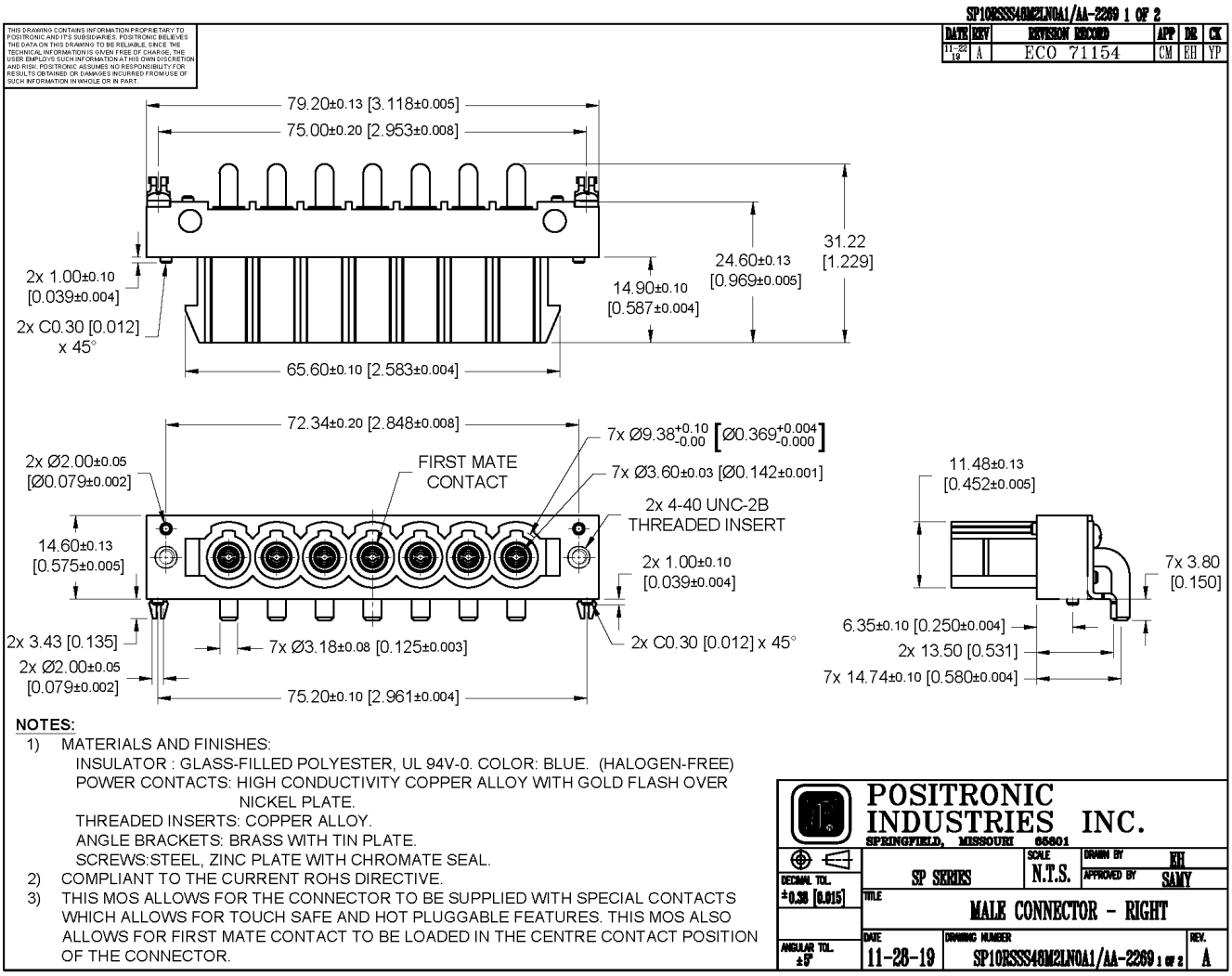


Figure 5.4
Mating Connector – Female cable to Male right angle PCB contacts with threaded insert mount – Right side

Male right angle PCB Connector with angle bracket board lock mount – Right side.
(**SP10RSSS48M2LN0A1/AA-2269)**



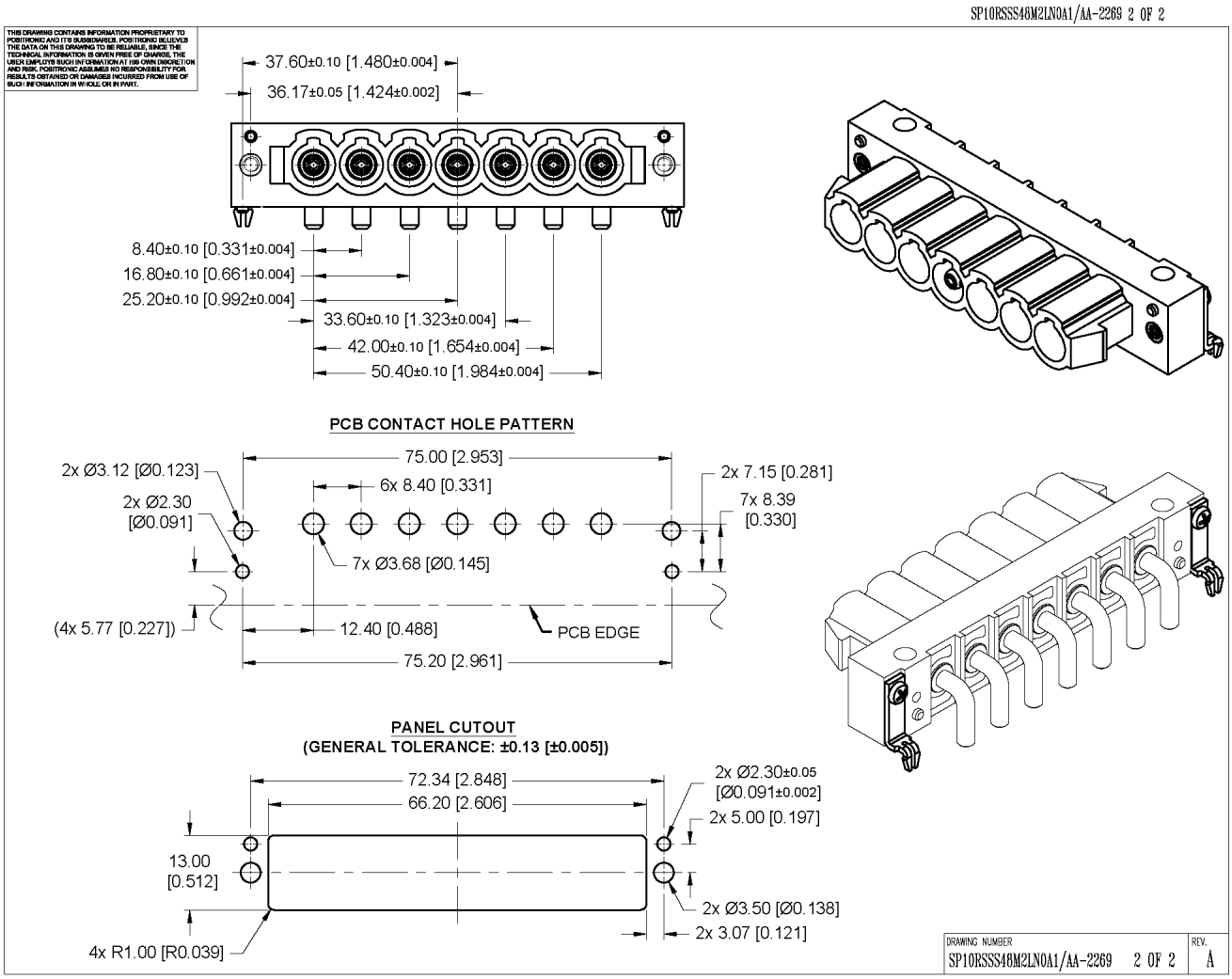


Figure 5.5 SP10RSSS48M2LN0A1/AA-2269

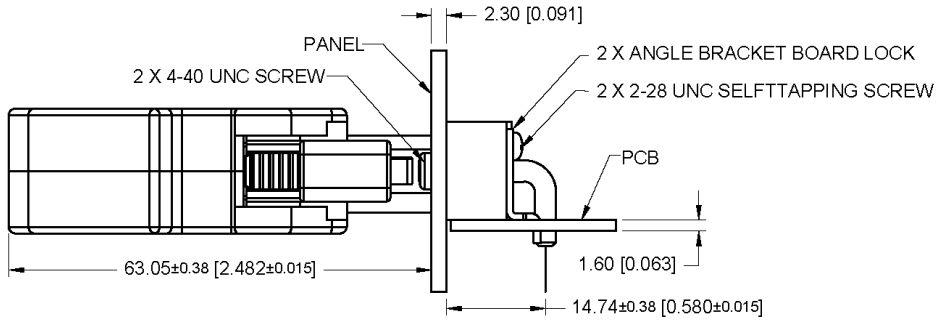
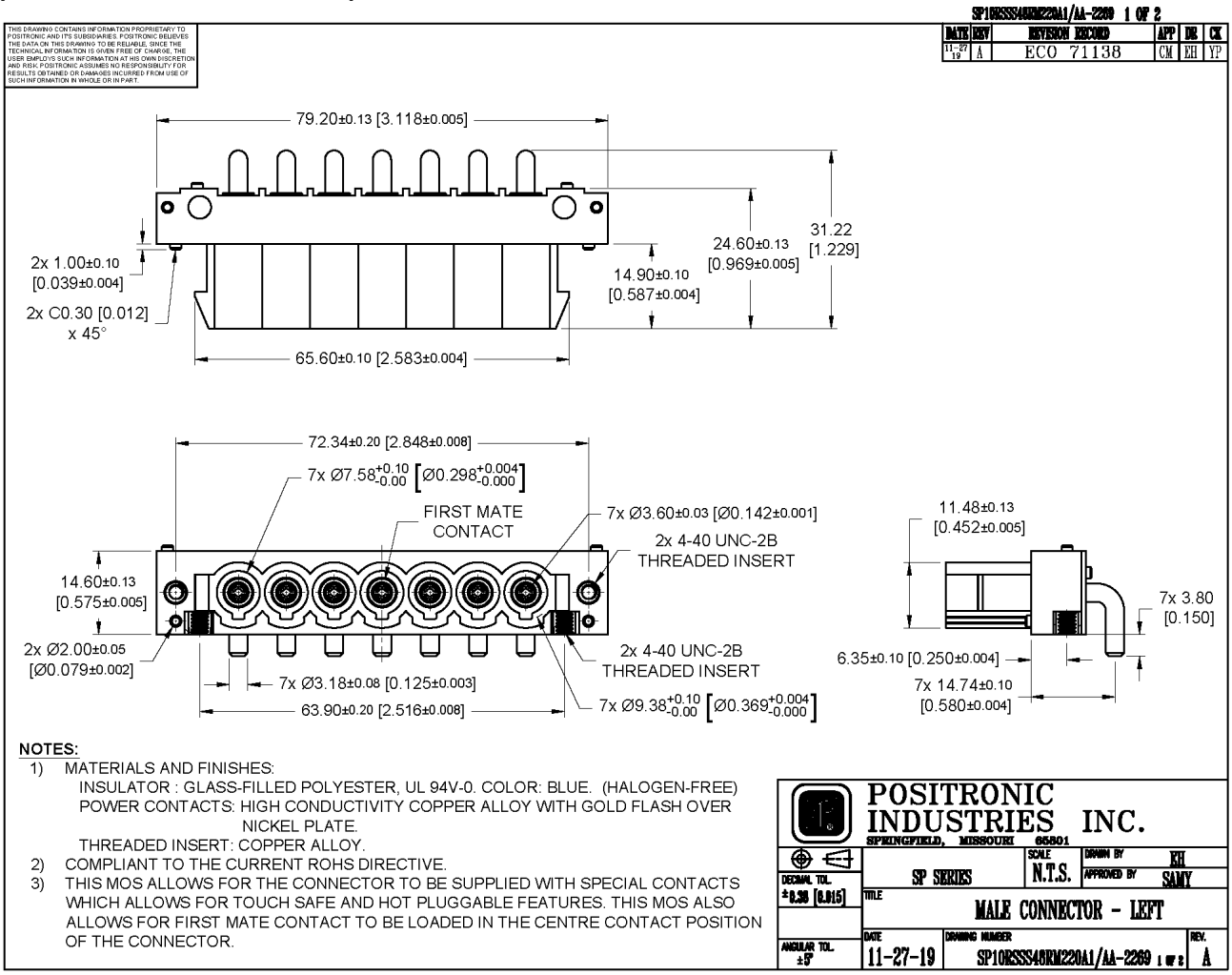


Figure 5.6
Mating Connector – Female cable to Male right angle PCB contacts with angle bracket board lock mount – Right side

Male right angle PCB contacts Connector with threaded insert mount – Left side
(SP10RSSS48RM220A1/AA-2269)



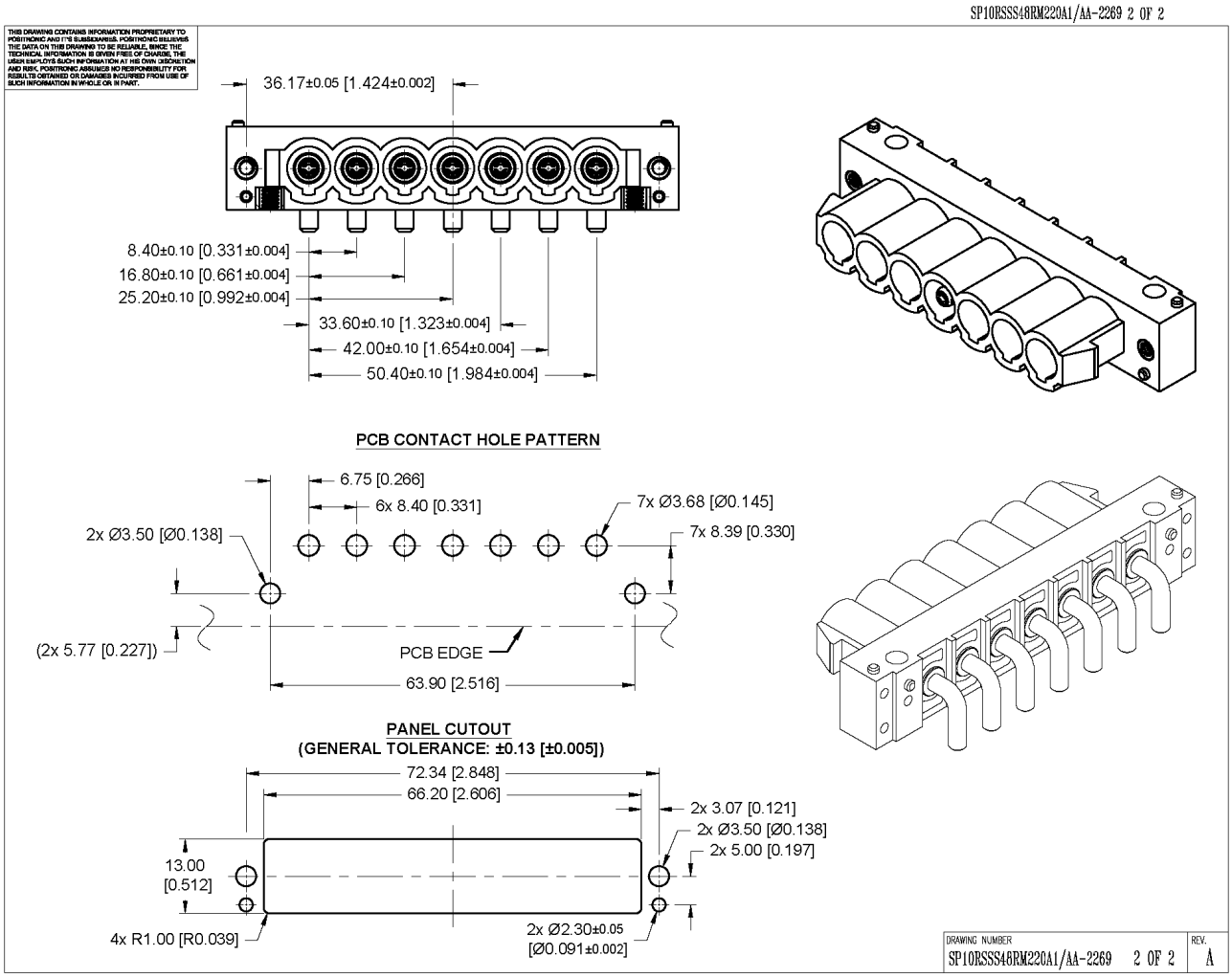


Figure 5.7 SP10RSSS48RM220A1/AA-2269

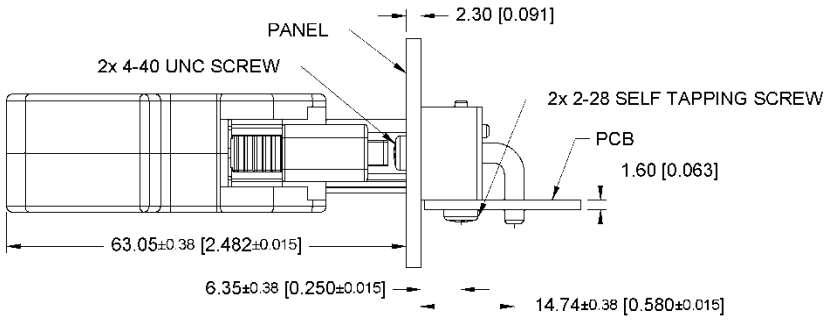
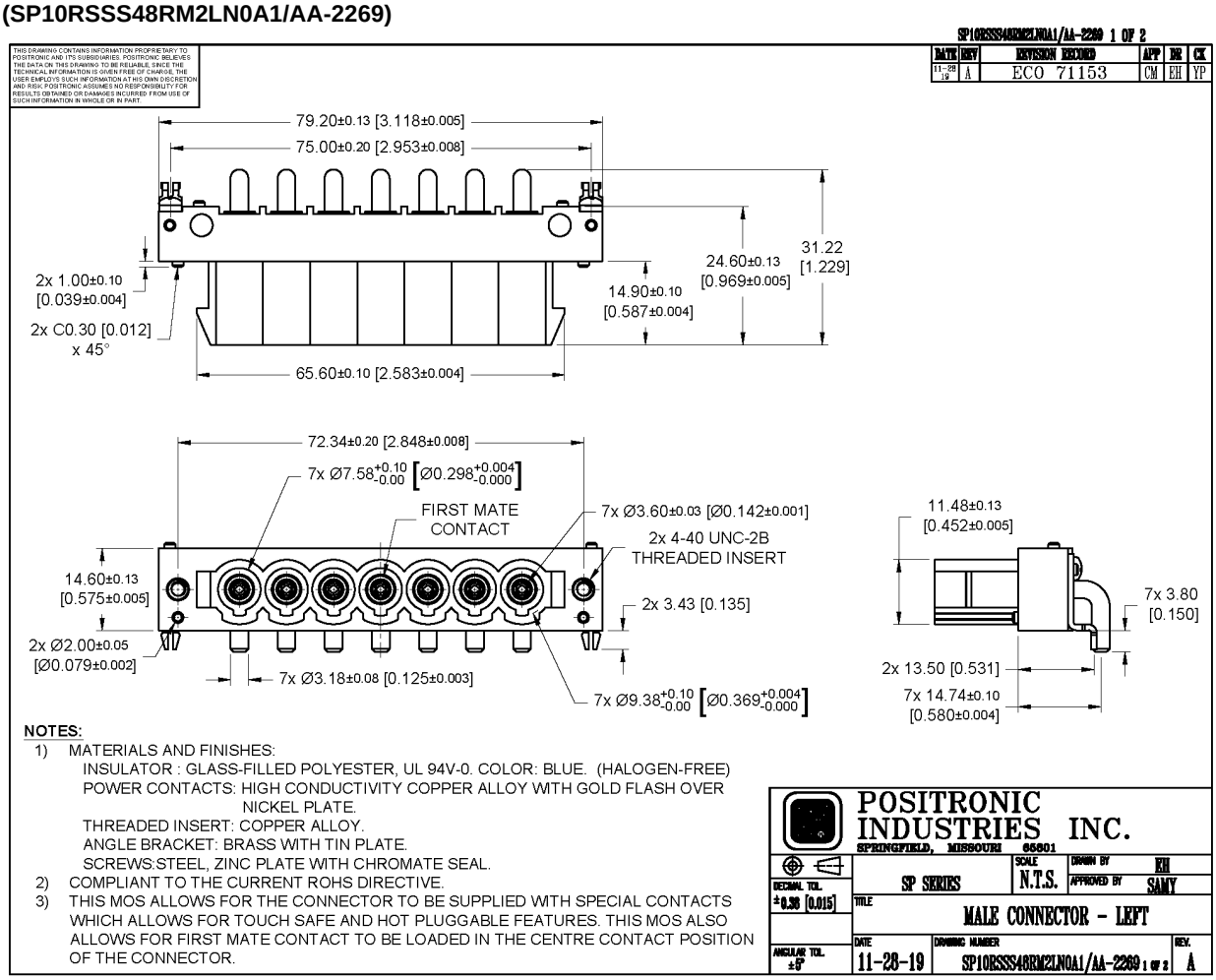


Figure 5.8
Mating Connector – Female cable to Male right angle PCB contacts with threaded insert mount – Left side

Male right angle PCB contacts Connector with angle bracket board lock mount – Left side
(SP10RSSS48RM2LN0A1/AA-2269)



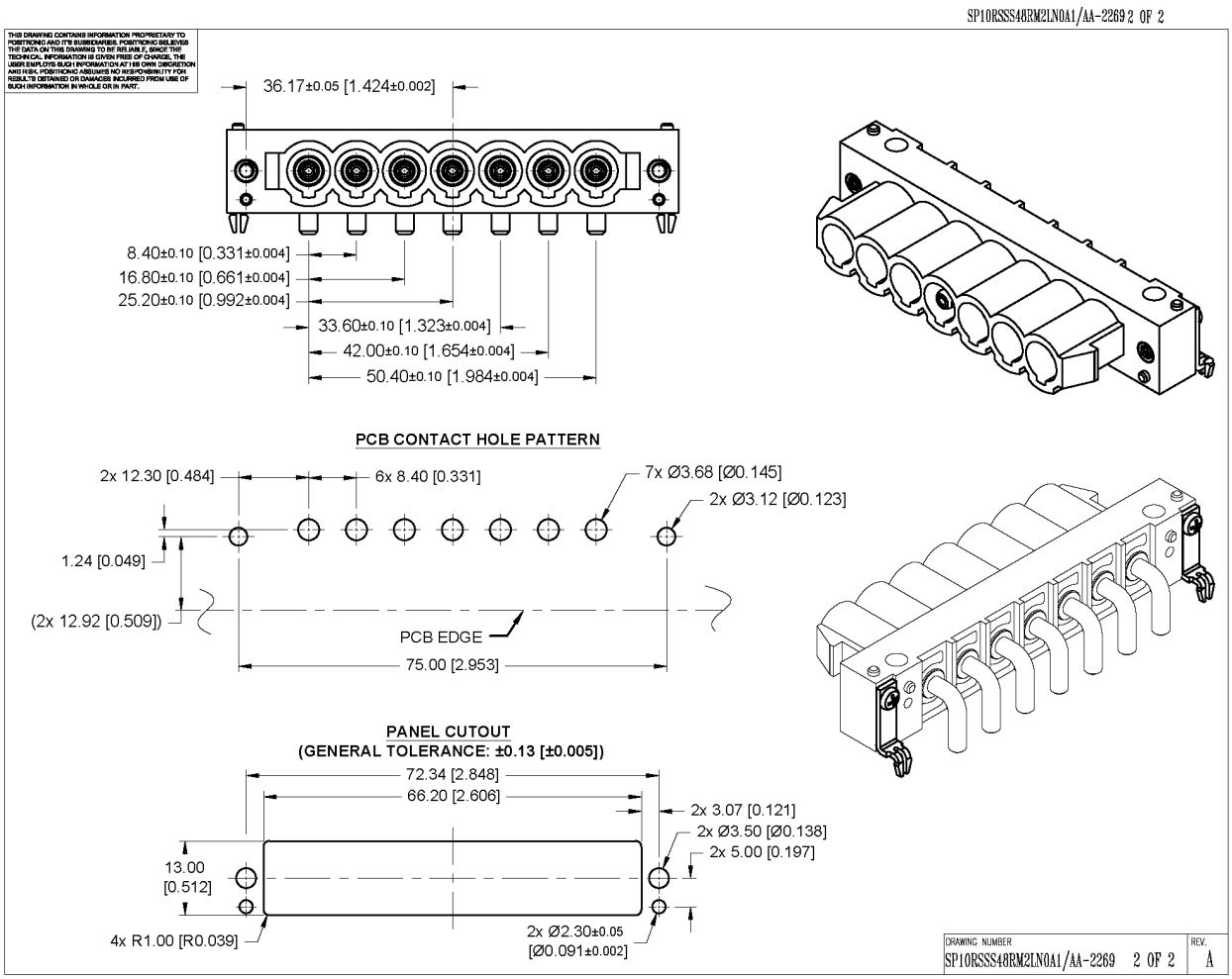


Figure 5.9 SP10RSSS48RM2LN0A1/AA-2269

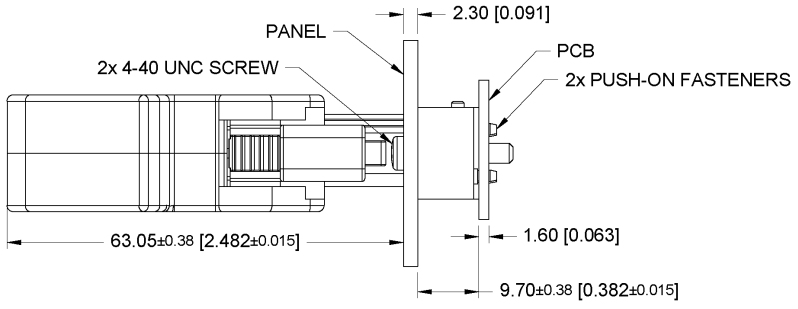
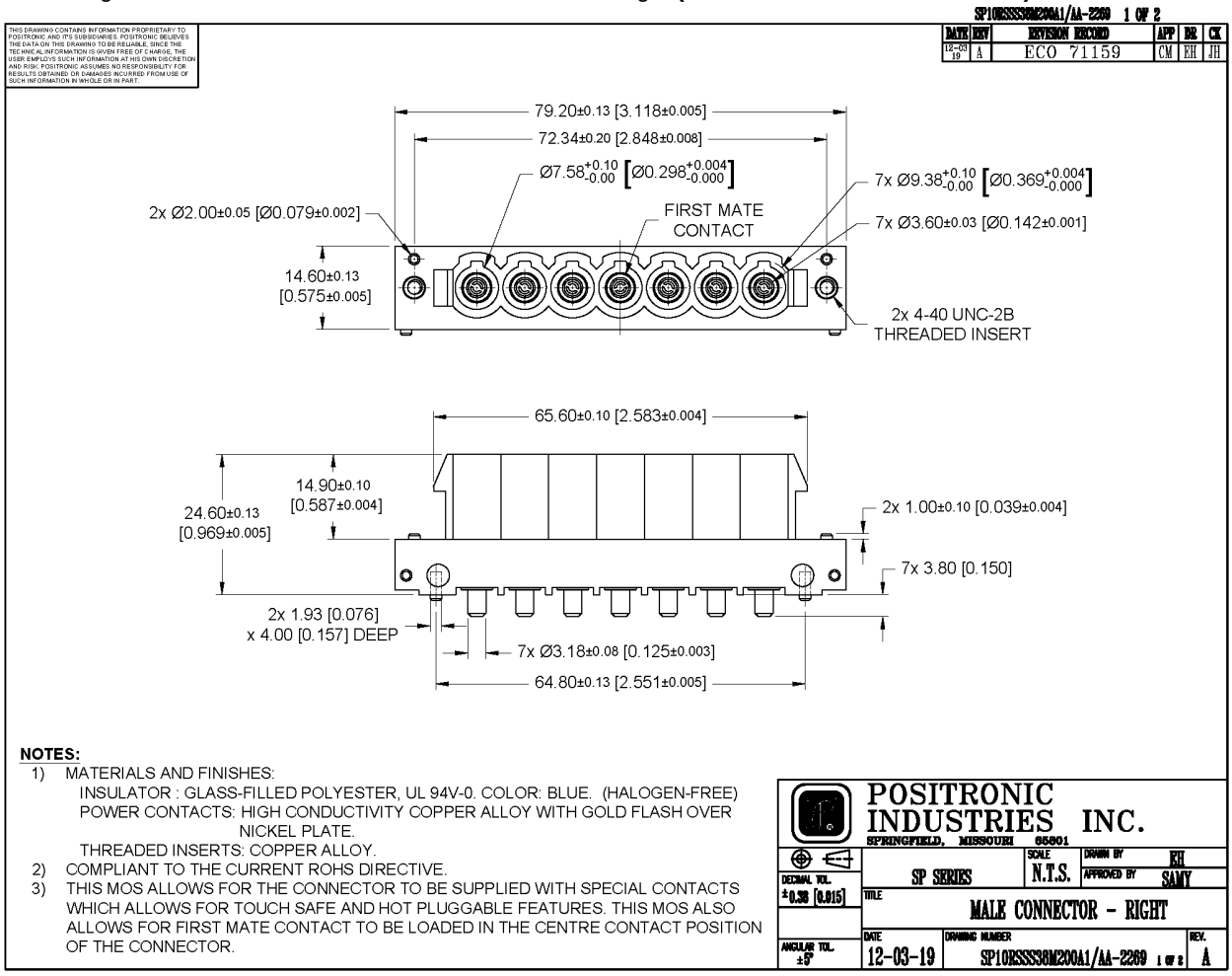


Figure 5.10
Mating Connector – Female cable to Male right angle PCB with angle bracket board lock mount – Left side

Male straight PCB contacts Connector with screw mount – Right **(SP10RSSS38M200A1/AA-2269)**



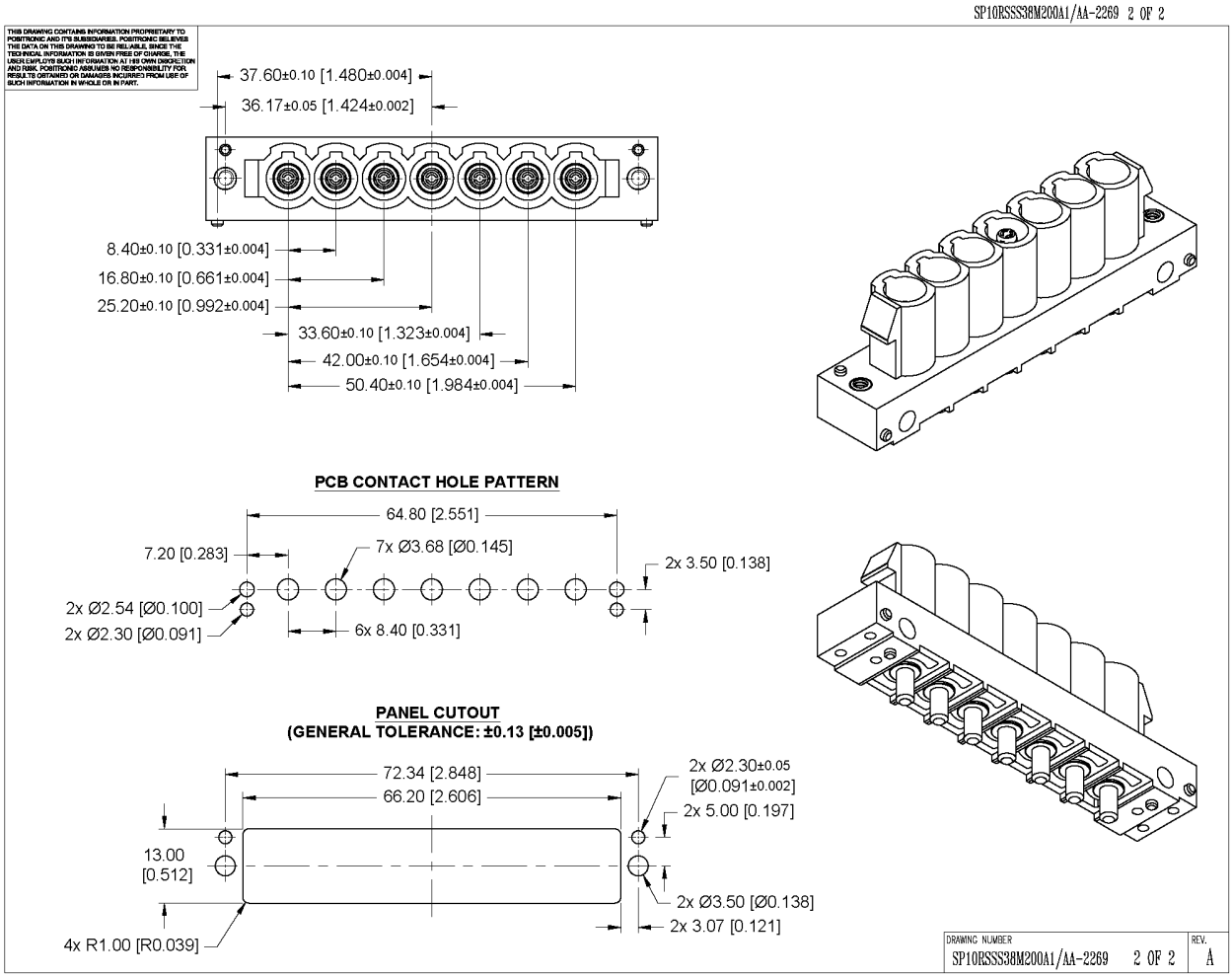


Figure 5.11 SP10RSSS38M200A1/AA-2269

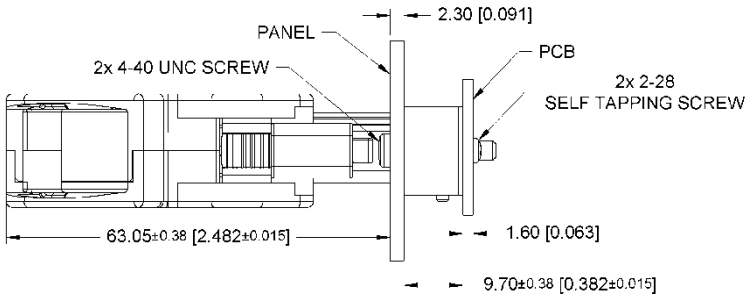
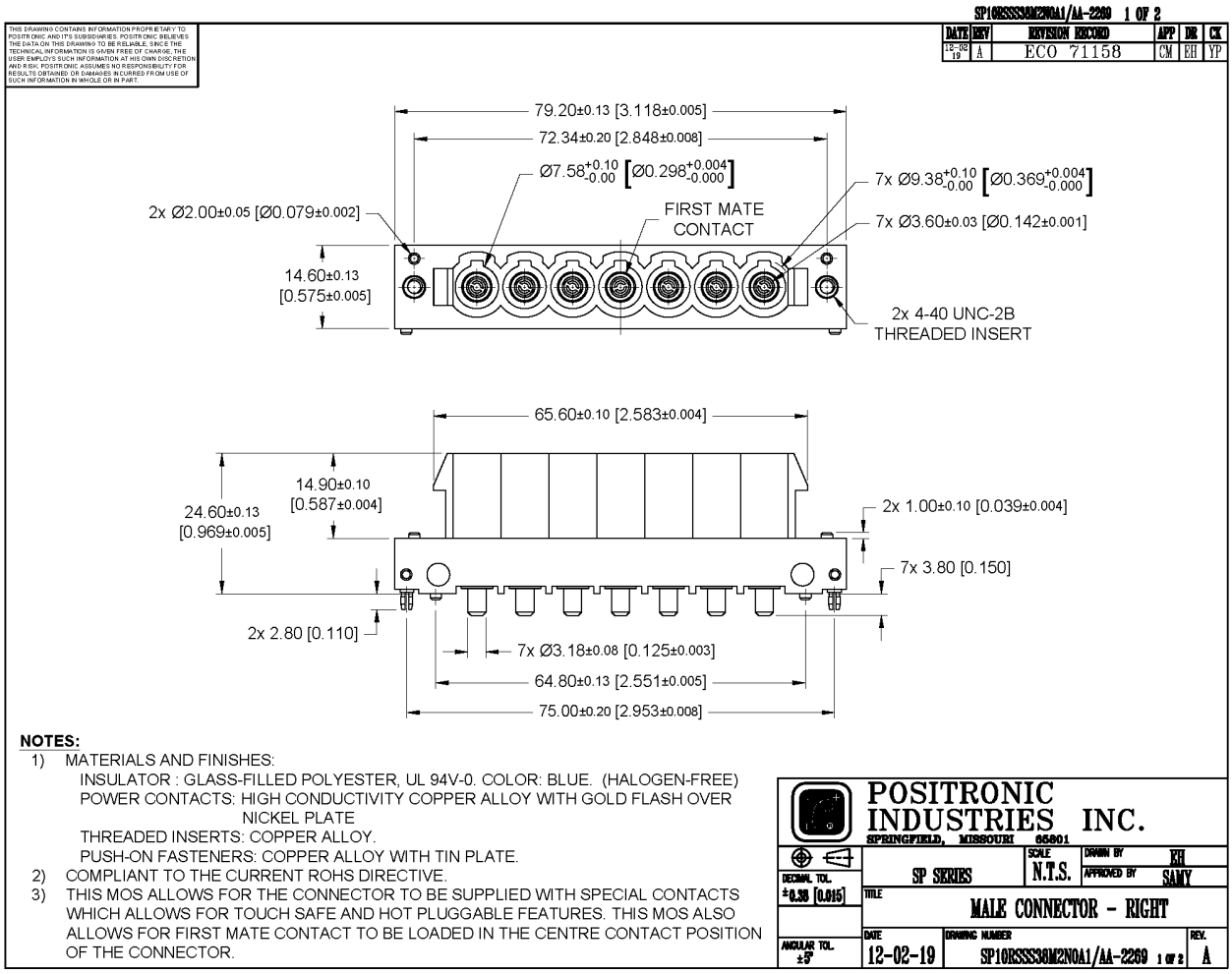


Figure 5.12
Mating Connector – Female cable to Male straight PCB with screw mount – Right side

Male straight PCB contacts Connector with push-on fasteners –Right **(SP10RSSS38M2N0A1/AA-2269)**



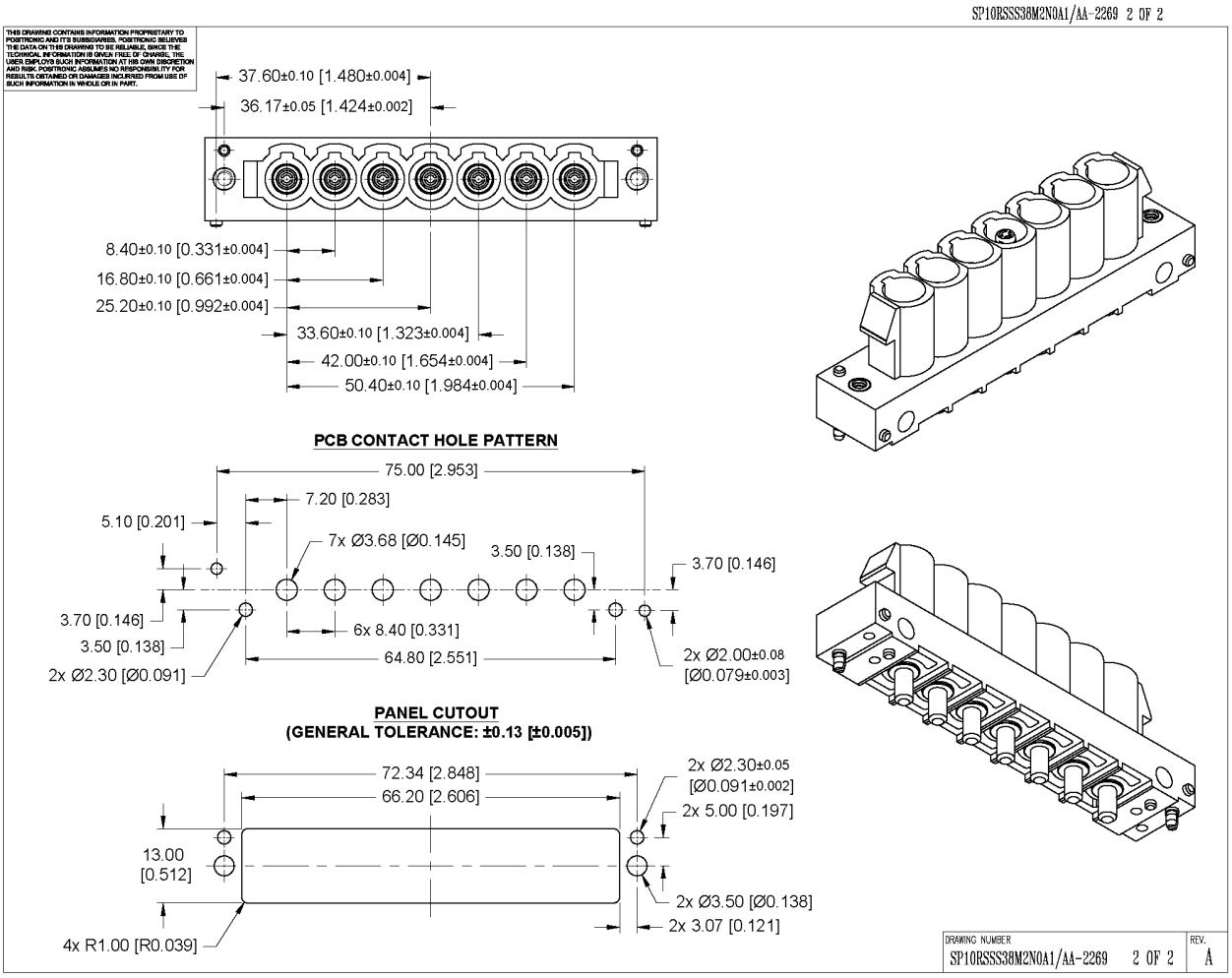


Figure 5.13 SP10RSSS38M2N0A1/AA-2269

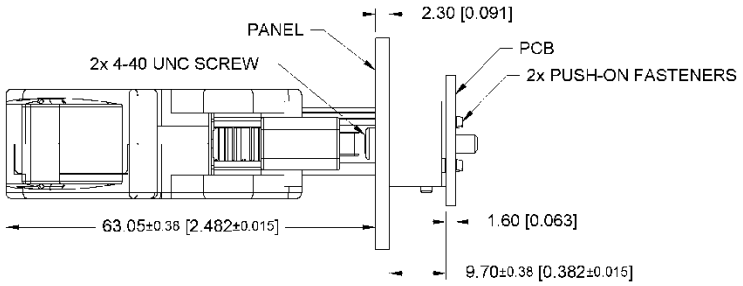
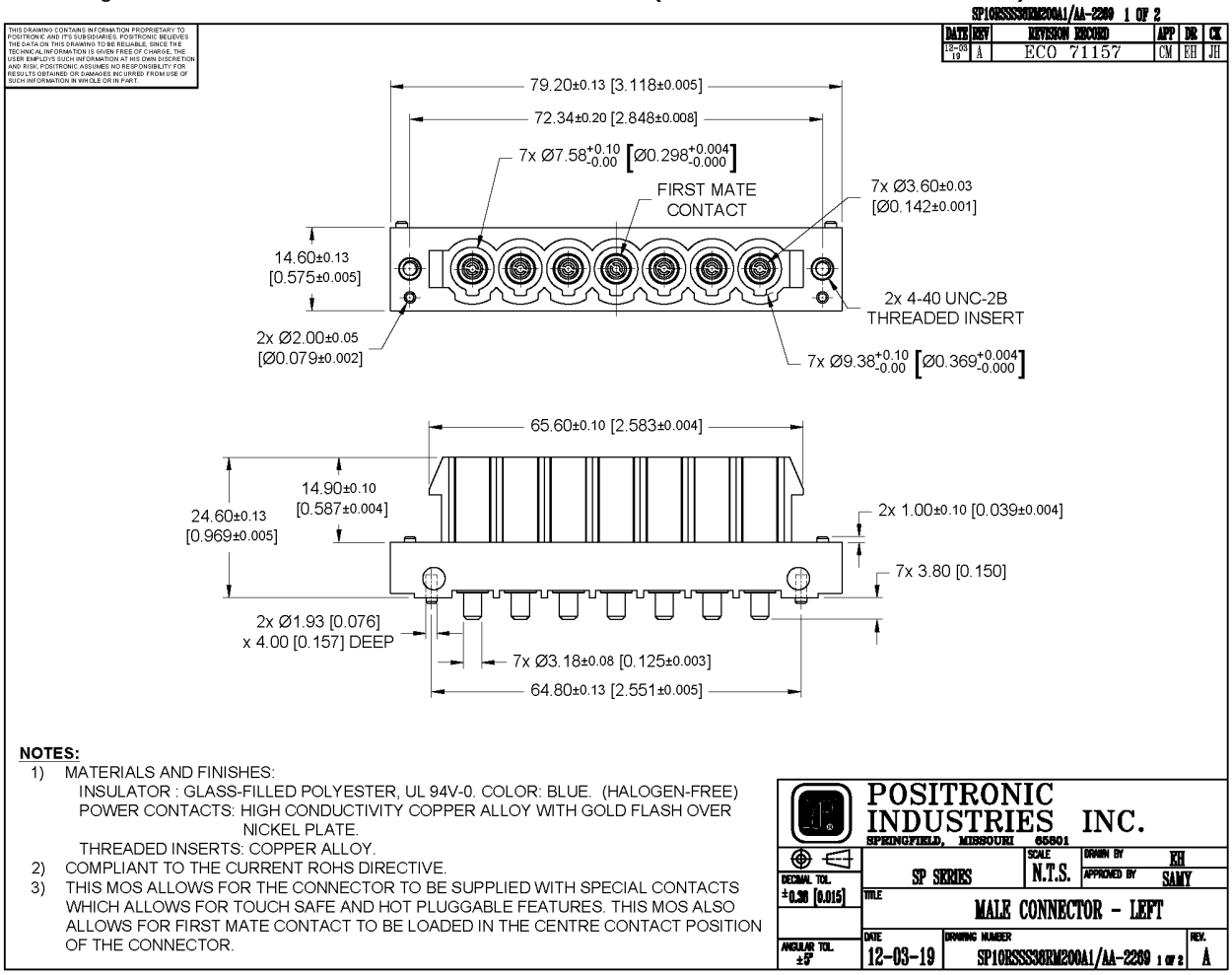


Figure 5.14
Mating Connector – Female cable to Male straight PCB with
push-on fasteners – Right side

Male straight PCB contacts Connector with screw mount –Left **(SP10RSSS38RM200A1/AA-2269)**



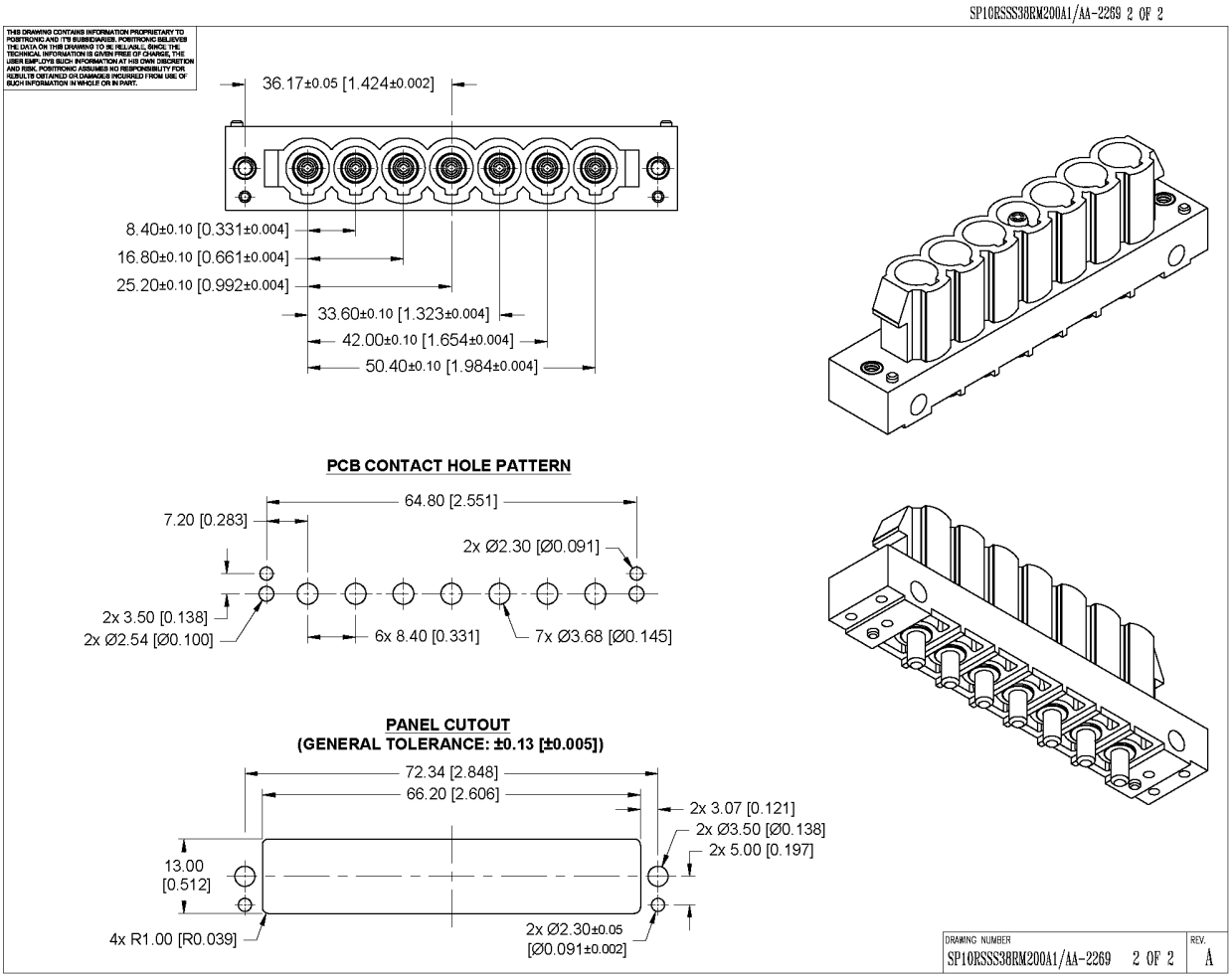


Figure 5.15 SP10RSSS38RM200A1/AA-2269

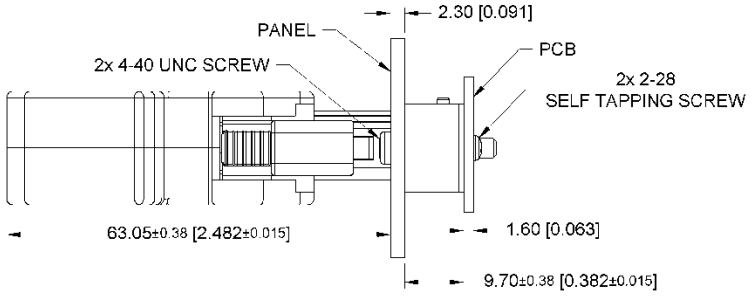
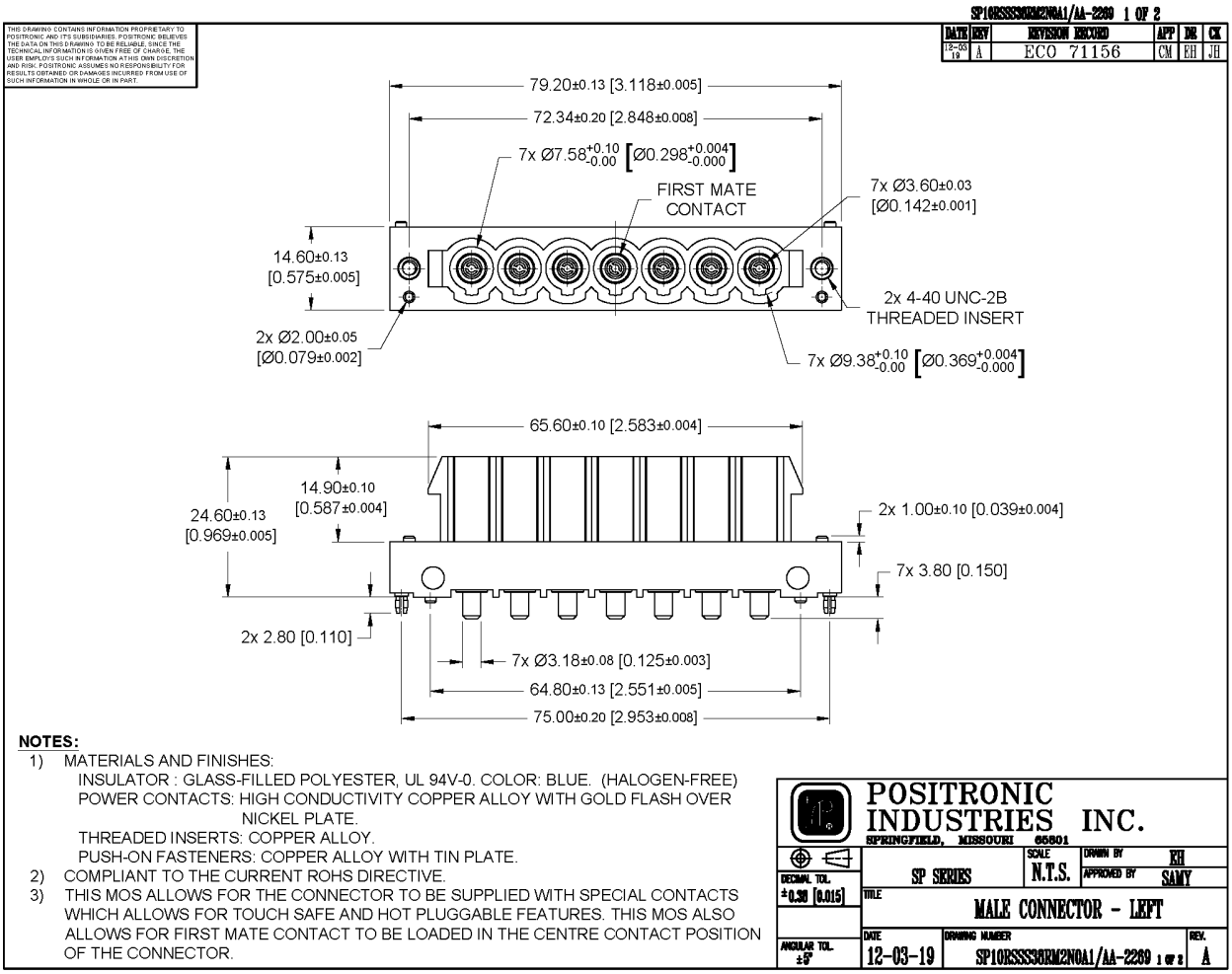


Figure 5.16
Mating Connector – Female cable to Male straight PCB with screw mount – Left side

Male straight PCB contacts Connector with push-on fasteners –Left **(SP10RSSS38RM2N0A1/AA-2269)**



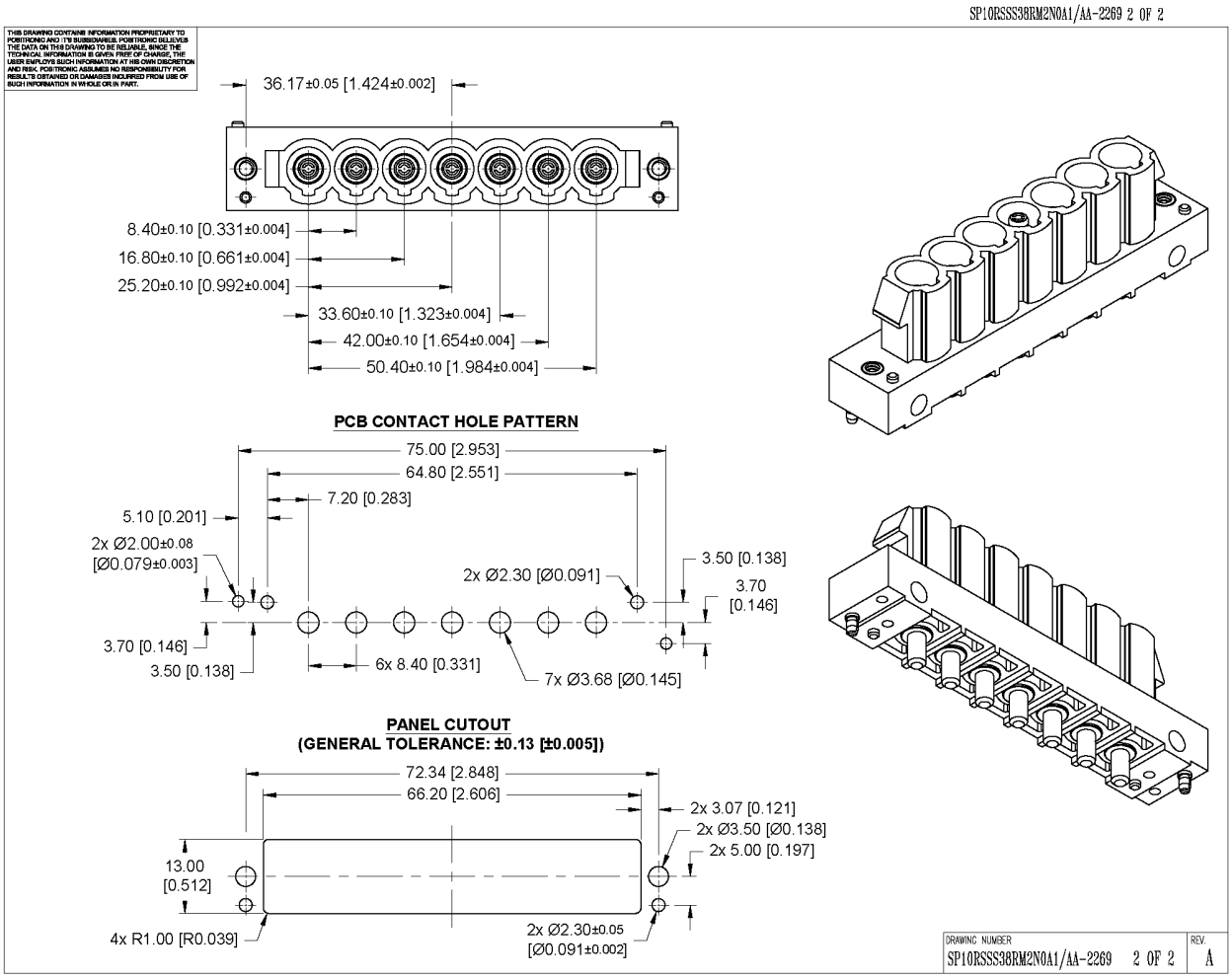


Figure 5.17 SP10RSSS38RM2N0A1/AA-2269

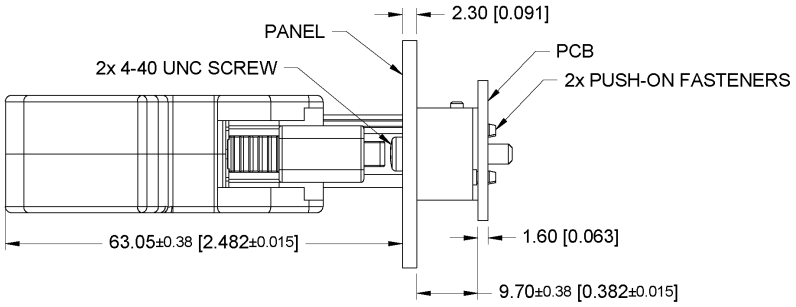
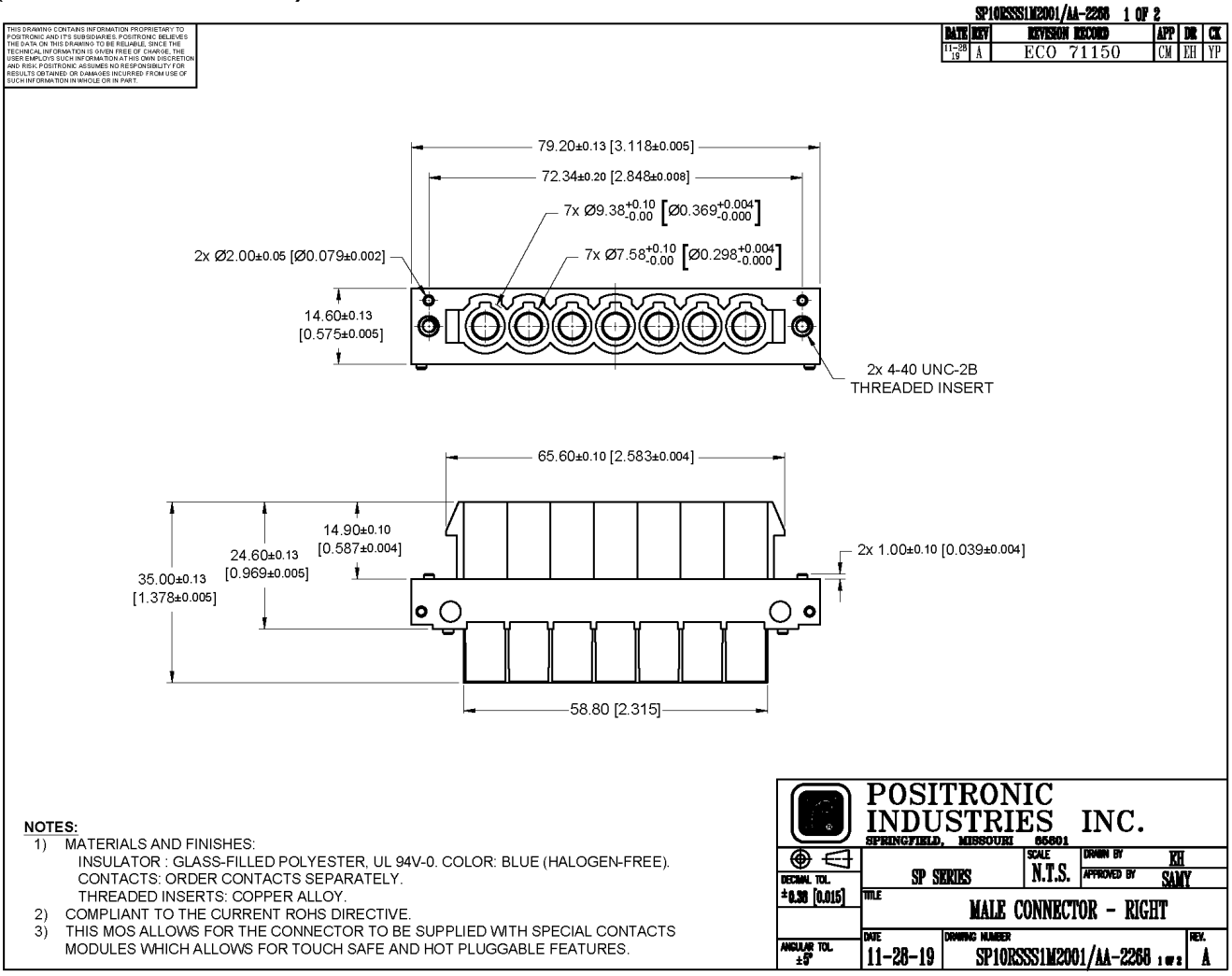


Figure 5.18
Mating Connector – Female cable to Male straight PCB contacts with push-on fasteners – Left side

Male crimp contacts Connector – Right side
(**SP10RSSS1M2001/AA-2268)**



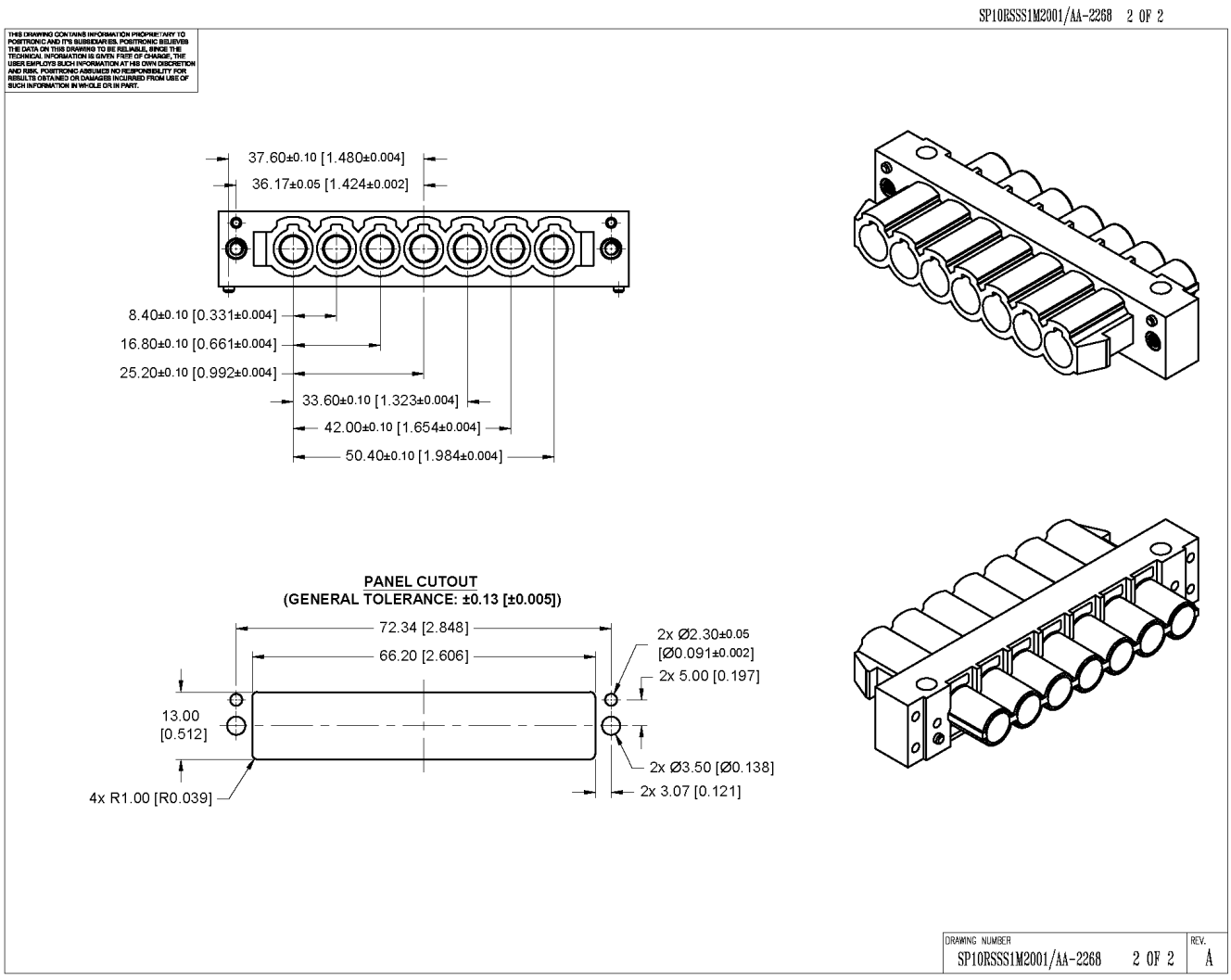


Figure 5.19 SP10RSSS1M2001/AA-2268

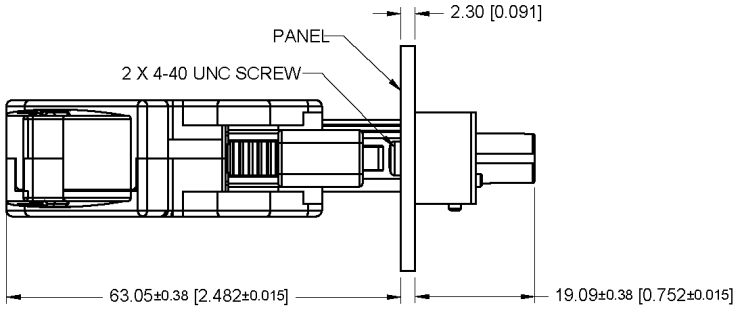
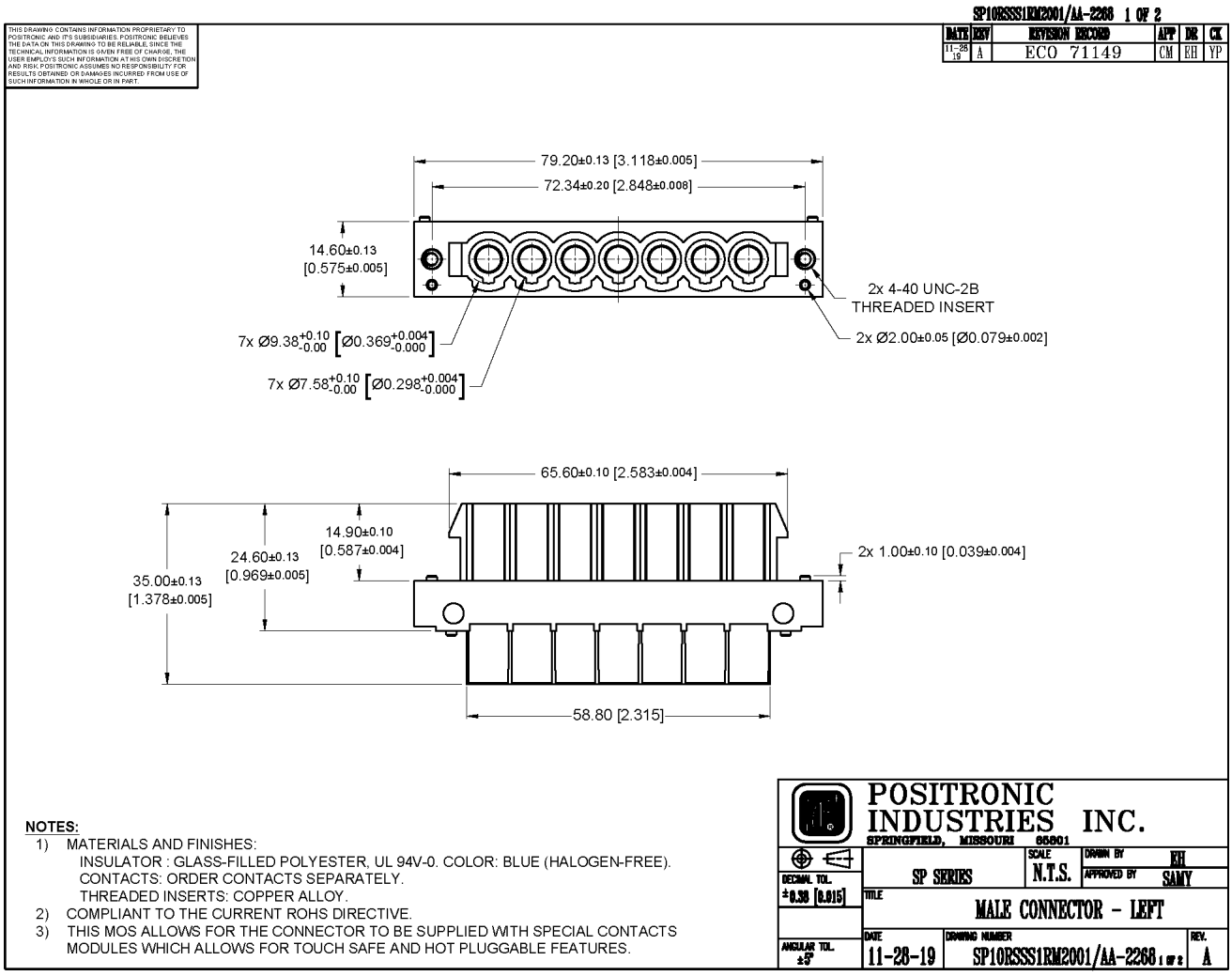


Figure 5.20
Mating Connector – Female cable to Male crimp contacts

Male crimp contacts Connector – Left side
(**SP10RSSS1RM2001/AA-2268)**



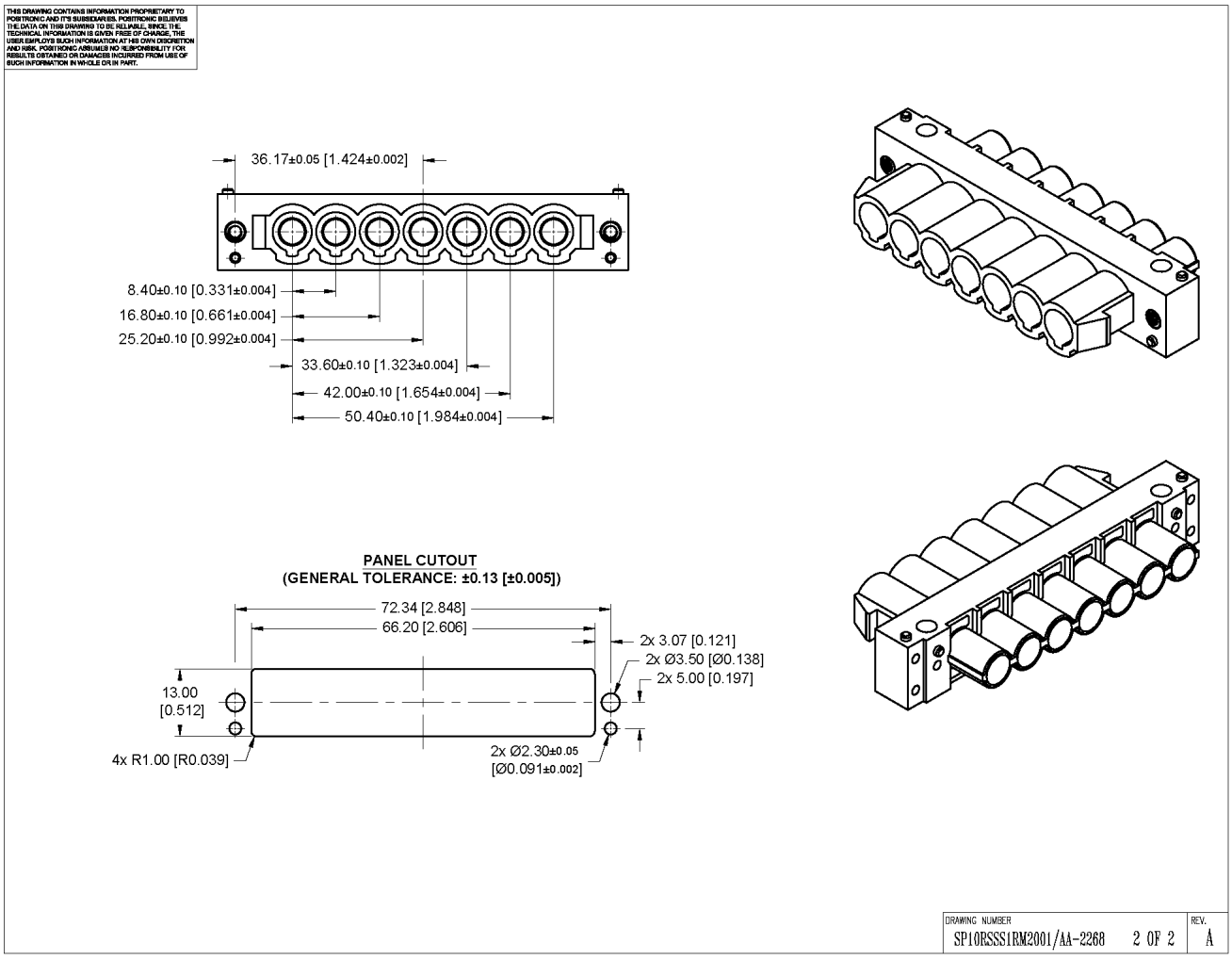


Figure 5.21 SP10RSSS1RM2001/AA-2268

6. Contacts

Female Crimp Size 8 contact for 12 AWG wire
(FC4012DS/AA-14-2272)

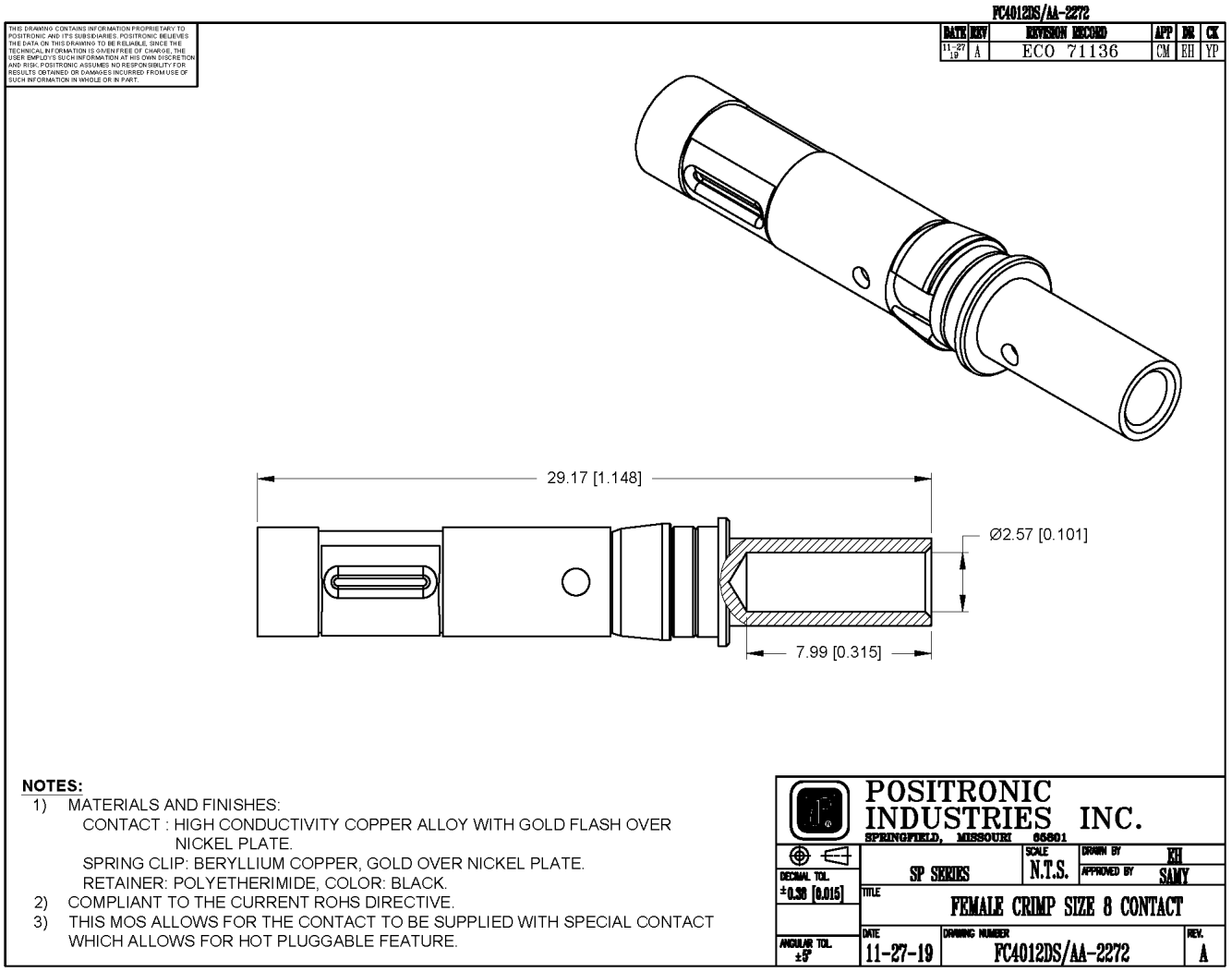


Figure 6.1 FC4012DS/AA-2272

For other contacts using different wire sizes, the female crimp contacts ordering part numbers as follows:
For 8 AWG wire: FC4008DS/AA-2272
For 10 AWG wire: FC4010DS/AA-2272
For 16 AWG wire: FC4016DS/AA-2272

7. Ordering Part number

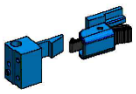
Ordering Information - Code Numbering System

Specify complete connector by selecting a code from each option

Example:	SP	10	RSSS	48	M	2	2	0	A1	/AA	-	2269

SERIES
SP : Scorpion Series

BODY STYLE
10 : Special Locking Latch System, for female cable to male panel/board connectors only



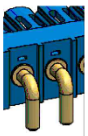
LAYOUT
Size 8 power contact module:
Module R or S


Code R


Code S

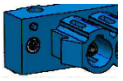
TERMINATION
1 : Crimp contacts, order separately
1R : Crimp contacts, order separately, (Molding Inverted)
3 : Solder, straight PCB mount, Standard conductivity power contacts
38 : Solder, straight PCB mount, High conductivity power contacts
38R : Solder, Inverted straight PCB mount, High conductivity power contacts
4 : Solder, right angle (90°) PCB mount, Standard conductivity power contacts
48 : Solder, right angle (90°) PCB mount, High conductivity power contacts
48R : Solder, Inverted right angle (90°) PCB mount, High conductivity power contacts


Code 38


Code 48

CONTACT GENDER
M : Male Pin
F : Female socket

PANEL MOUNT
0 : None (for female connector only)
2 : 4-40 threaded insert


Code 2

MOUNTING OPTIONS & LOCKING SYSTEMS
0 : None
2 : 4-40 threaded insert (for right angle PCB mount)
N : Boardlocks
LN : Angle brackets, boardlocks (for right angle PCB mount)
W* : Backshell

* Hood Opening 45°, ordering with MOS.


Code 2


Code N


Code LN


Code W

OPTIONAL FEATURES
0 : Not Vented
9 : Vented for improved cooling


Code 0


Code 9

CONTACT PLATING
1 : Wire, order contacts separately
A1 : Gold flash over 1.2µm Ni (nominal) over Cu
C1 : 0.76µm Au (min) over 1.27µm Ni (nominal) over Cu

ENVIRONMENTAL COMPLIANCE
/AA : RoHS 5/6 (< 4% lead)

SPECIAL OPTIONS
2268 : For code 1/1R in "Termination" (connector supplied with special contact modules which allows Touch Safe and Hot Pluggable. Hood Opening 45° if ordered with hood).
2269 : For code 3/38/38R/4/48/48R in "Termination" (connector supplied with special contact modules which allows Touch Safe and Hot Pluggable).

Positronic P/N	Amphenol P/N	Remarks
SP10RSSS1F0W01/AA-2268	xxx	
SP10RSSS48M220A1/AA-2269	xxx	
SP10RSSS48RM220A1/AA-2269	xxx	
SP10RSSS1M2001/AA-2268	xxx	
SP10RSSS1RM2001/AA-2268	xxx	
SP10RSSS48M2LN0A1/AA-2269	xxx	
SP10RSSS48RM2LN0A1/AA-2269	xxx	
SP10RSSS38M2N0A1/AA-2269	xxx	
SP10RSSS38RM2N0A1/AA-2269	xxx	
SP10RSSS38M200A1/AA-2269	xxx	
SP10RSSS38RM200A1/AA-2269	xxx	
FC4012DS/AA-2272	xxx	

The connector shall have a positive retention latch that can be unlatched with a finger release force less than 15 N

The insertion force of the cable connector shall be less than 156 N.

Field replaceable terminals are not required.

Connector set shall be polarized.

Connector system shall provide for a ground pin that will make first mate/last break

Provision for an optional protective cover for the connector when the cable is removed. Cover should provide a warning ISO 7010-W012 (shock warning)

The finger latches on the whip side connector need to be protected when the cable is extracted through the rack cable trough.

8. Environmental Requirements:

   Connectors to be stored in their original shipping cartons in a humidity controlled environment where the relative humidity remains below 75% and the ambient temperature is between 10°C and 27°C. With the above conditions, the products will have a minimum shelf life of five (5) years from date of manufacture.

9. Quality

The following tests will be conducted with three samples each per Table 1.

Table 1

Test	Test Standard	Test Condition/ Method	Pass/Fail Criteria	Additional Data to Collect for Review
Durability	EIA-364-09	100 mating/un-mating cycles 30~60mm per second travel speed	contact resistance before and after post test surface wear examination: no exposed nickel or copper	N/A
Contact Retention	EIA-364-29	Method A With minimum 15lbs axial load for minimum 6 seconds	no visible contact to housing displacement	N/A
Vibration	EIA-364-28 EIA-364-28F Condition II	Test condition VII Test condition letter E 15 minutes duration in each of the three mutually perpendicular direction	per standard in addition: contact resistance before and after	post test contact wear optical examination, SEM/EDX optional
Shock	EIA-364-27 EIA-364-27C Condition H	half-sine pulse test condition A 3 shocks * 3 perpendicular planes * 2 directions = 18 shocks	per standard in addition: contact resistance before and after	post test contact wear optical examination, SEM/EDX optional
Temperature Life	EIA-364-17	Method C Test condition 1: 125+/-2C Test duration: 168hrs	per standard, section 4.4 in addition: contact resistance before and after	monitor contact voltage drop during test
Thermal Shock	EIA-364-32	Method A Test condition VII: -55C to 105C Test duration: 10cycles	per standard, section 4.6	N/A
Humidity	EIA-364-31	Method IV	contact resistance before and after dielectric withstand voltage before and after insulation resistance before and after	N/A
Temperature rise	EIA-364-70	Method I Run at 32A through connector without exceeding 30°C above ambient temperature	Lower than 30C	N/A
Temperature rise	EIA-364-70	Method 2		N/A

Whip Connector wire cable pull test	-	Axial	489 N min.	N/A
Whip Side Connector drop test	UL 486A/B	Section 9.7	No mechanical damage other than cosmetic damage allowed	N/A
Voltage Proof Test	EIA-364-20	Per standard	2200 V r.m.s. typical	N/A
Insertion and Withdrawal Force Test	EIA-364-13	Per standard	Insertion force: 156 N max. Withdrawal force: 9.73 N min.	N/A
Insulation Resistance Test	EIA-364-21	Per standard	5G ohms minimum	N/A

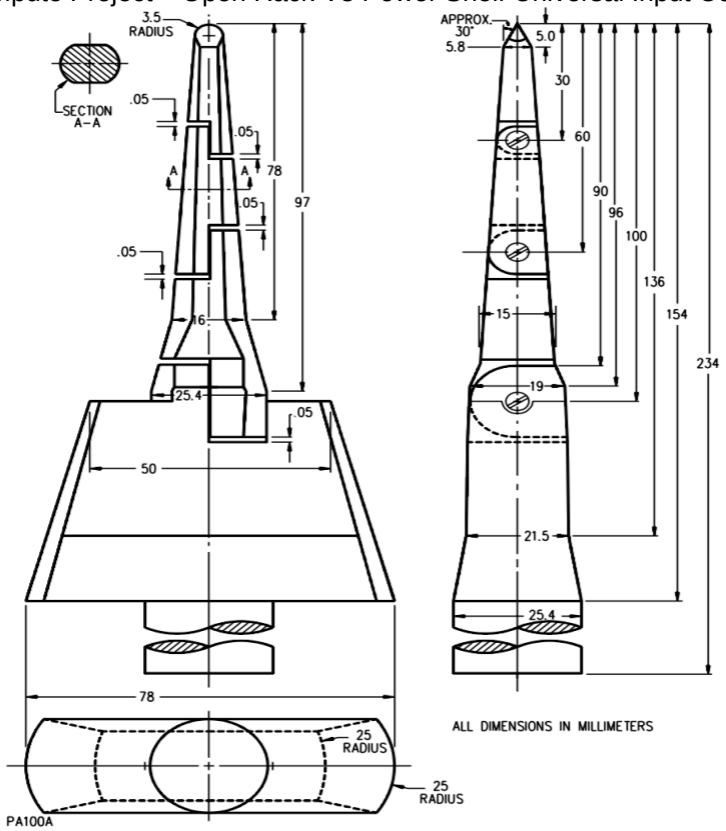
10. Compliance requirements for the connector

Connector shall be UL approved under UL1977, and it shall not cause any non-compliance issue with the latest amendment of the following Standards when it is integrated into the ORV3 rack.

- UL/IEC/EN 62368-1, Audio/video, information and communication technology equipment – Part 1: Safety requirements (applicable to meet anticipated effective date of December 20, 2020 for North America and Europe.)
- RoHS Directive (2011/65/EU, including proof by Declaration of Conformity and any other supporting documentation required for Deliverables, Components and Products, unless there are legal exemptions allowed); including aims to reduce the environmental impact of EEE by restricting the use of certain substances during manufacture.
- REACH Regulation (EC) No 1907/2006; registration with the European Chemicals Agency (ECHA), evaluation, authorization and restriction of chemicals.
- Halogen Free: IEC 61249-2-21, Definition of halogen free: 900ppm for Br or CI, or 1500ppm combined requires companies using tin, tantalum, tungsten, and gold (“3TG”) in their products to verify and disclose the mineral source.

Connector shall be designed to meet the following additional safety requirements

- A connector enclosure shall be constructed to reduce the risk of unintentional contact with any live parts. Live pins in the connector shall not be assessable when testing with the following pin as defined at UL standard.



- If the above requirement cannot be met, the plastic cap must be provided for use with the unused connector, so that unintentional contact to pins cannot happen.
- A connector enclosure shall be constructed not to be easily accessible by user without using special tool. User has no access to the internal wiring for AC power configurations.
- Connector shall be keyed, in such a way that prevent from mating in wrong direction.
- Cord strain relief shall be provided, and it shall have a retention latch that shall not be damaged when minimum 100N force is applied in the most unfavorable direction.
- Connector shall be designed to have a minimum of 3.2mm air-spacing between an uninsulated live and any other metal part (if any) in the connector construction.
- Any exposed non-current carrying metal part of a device that are likely to become energized shall be conductively connected to the ground.
- The following caution label should be placed near the connector.
  "**CAUTION** – Risk of Electric Shock. Do Not Disconnect Under Load
- Connector must survive 50 cycles of insertion/removal at 150% of the maximum rated current and voltage. There shall not be any electrical and mechanical failure or burning of the contacts. *In case any insulation material is used inside the connector and the insulator is exposed to the arcing*, total 250 cycles shall be performed.
- Dielectric voltage-withstand tests (1000Volts + 2x rated voltage) must be performed after insertion/removal tests. There shall not be any indication of electrical or mechanical failure, electrical tracking, formation of a permanent carbon path, or ignition of material.
- Trise on the wiring terminals in the connector should not exceed 30°C when the device is carrying its maximum rated current.
- Connector plastic housing shall meet 94V0 flammability requirements.

Appendix 1 – Compliance requirements for the cable assembly for reference

- Parts used in the cable assembly shall be UL recognized or listed under the following standards.

Standard	**Parts**
UL 1682	IEC 309 AC connector to the branch circuitry
UL498	NEMA AC connector to the branch circuitry
UL1977	Output connector that mates with connector in the power shelf
UL62 and UL817	Flexible power cord that can be used for AC wiring

- Power cord shall meet UL/CSA SOOW and EU CENELEC <HAR> H07RN-F with +75C temperature rating. Halogen free cord (including internal wires) must be evaluate to the 150 degree C of Heat-shock test. And the following wire size (minimum) shall be used.

Ratings	**Wire size**
50Amps	6AWG
32Amps	8AWG
30Amps	8AWG
20Amps	10AWG

11. Revisions

Rev	Date	Author	Changes
0.1	5 JUL 19	SM and HK	Initial Release
0.2	12 JUL 19	Steve Mills	Extensive updates from the JDA group
0.3	1 AUG 19	Ben Kim	Added detail to section 7 and created Appendix 1