APC by Schneider Electric
APC InfraStruxure Power Distribution Unit, 60 kVA and 150 kVA, 208 Volt Output
60 kVA - 150 kVA PDU/Distribution

THIS GUIDE SPECIFICATION IS WRITTEN IN ACCORDANCE WITH THE CONSTRUCTION SPECIFICATIONS INSTITUTE (CSI) MASTERFORMAT. THIS SECTION MUST BE CAREFULLY REVIEWED AND EDITED BY THE ARCHITECT OR THE ENGINEER TO MEET THE REQUIREMENTS OF THE PROJECT. COORDINATE THIS SECTION WITH OTHER SPECIFICATION SECTIONS IN THE PROJECT MANUAL AND WITH THE DRAWINGS.
WHERE REFERENCE IS MADE THROUGHOUT THIS SECTION TO "PROVIDE", "INSTALL", "SUBMIT", ETC., IT SHALL MEAN THAT THE CONTRACTOR, SUBCONTRACTOR, OR CONTRACTOR OF LOWER TIER SHALL "PROVIDE", "INSTALL", "SUBMIT", ETC., UNLESS OTHERWISE INDICATED.

SECTION [26 26 53] [16471]

STATIC UNINTERRUPTIBLE POWER SUPPLY POWER DISTRIBUTION UNIT

PART 1 - GENERAL

1.1 SUMMARY
A. Scope: Provide design and engineering, labor, material, equipment, related services, and supervision required, including, but not limited to, manufacturing, fabrication, erection, and installation for a power distribution unit (PDU) as required for the complete performance of the work, and as shown on the Drawings and as herein specified.
B. Section Includes: The work specified in this Section includes, but shall not be limited to, requirements for a complete power distribution system for powering IT loads.

1.2 REFERENCES
A. General: The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.
B. Electronic Industries Association (EIA):
1. EIA 310, "Racks, Panels, and Associated Equipment" (copyrighted by EIA, ANSI approved).
C. International Organization for Standardization (ISO):
1. ISO 9001, "Quality Management Systems - Requirements."
2. ISO 14001, "Environmental Management Systems - Requirements With Guidance for Use."
D. National Electrical Manufacturers Association (NEMA):
1. NEMA TP 1, "Standard for the Labeling of Distribution Transformer Efficiency."
E. Underwriters Laboratories, Inc. (UL):
1. UL 60950, "Standard for Information Technology Equipment."
2. UL 891, "Switchboards."

1.3 SYSTEM DESCRIPTION

SELECT OR INSERT APPLICABLE VALUE BELOW.
A. **Design Requirements:** The PDU shall be sized for [60 kVA] [150 kVA].

B. **System Characteristics:**
   1. **Physical:**
      a. External width dimensions shall be 23.5 inches (597 mm) for 60 kVA PDU, and 24 in. (609.6mm) for 150 kVA PDU.
      b. External depth dimensions shall be 35.4 inches (900 mm) for 60 kVA PDU, and 42 in. (1066.8mm) for 150kVA PDU.
      c. The PDU shall have a maximum external height of 81.5 inches (2070 mm) for 60kVA PDU, and 81 in (2057.4mm) for 150kVA PDU, to allow passage through a standard 7 foot (2134 mm) doorway without tipping.
   2. **Input:**
      a. AC input nominal voltage:
         1) 60kVA InfraStruxure PDU: [208 volts] [480 volts] [600 volts], three-phase, 3 wires, [delta] [wye], 60 Hz.
         2) 150kVA InfraStruxure PDU: 480 volts, three-phase, 3W + G, 60 Hz.
      b. The PDU shall contain a [60 kVA] [150 kVA] NEMA TP-1 compliant, energy efficient, isolation transformer, which shall be rated for modern data center IT loads.
   3. **PDU Output:**
      a. AC nominal output voltage
         1) 60kVA InfraStruxure PDU: 208 volts, three-phase, 4 wires, grounded wye, 60 Hz.
         2) 150kVA InfraStruxure PDU: 208 volts, 3-phase, 60 Hz.
      b. 150kVA InfraStruxure PDU Efficiency
         1) 35% load: 98.4%
         2) 50% load: 98.3%
         3) 75% load: 98%
         4) 100% load: 97.7%
      c. 150 kVA InfraStruxure PDU Heat Dissipation
         1) 35% load: 2914 BTU/hr
         2) 50% load: 4427 BTU/hr
         3) 75% load: 7836 BTU/hr
         4) 100% load: 12052 BTU/hr
   4. **Output Distribution:**
      a. 60kVA InfraStruxure PDU Distribution Panels: Two (2) 42 position output distribution panels
         1) Nominal current rating : 225A per panel
         2) Withstand rating: 22kA. The withstand rating of the PDU shall be limited by the rating of the distribution breakers to 10kA.
         3) Breakers: 1 pole, 2 pole, or 3 pole snap-in or bolt-in breakers
            a) Current capacity range: 10 to 150 amperes.
            b) Current capacity of factory-installed breakers: 20A, 30A, 50A, and 60A
      b. 150kVA InfraStruxure PDU Distribution Panels: Two (2) 42-position output distribution panels
         1) Nominal current rating: 225A per panel
         2) Maximum short circuit withstand rating: 65kA. (The maximum short circuit withstand level was not evaluated by Underwriters Laboratories.) The withstand rating of the PDU shall be limited by the rating of the distribution breakers to 10kA.
         3) Breakers: 1 pole, 2 pole, or 3 pole snap-in or bolt-in breakers
            a) Current capacity range: 10 to 150 amperes.
            b) Current capacity of factory-installed breakers: 15, 20, 30, 50, and 60A breakers
      c. **Flexible Distribution Conductors:** For purposes of overhead distribution wiring of data center branch circuits, flexible conductors of the TC type shall be available as a distribution means. Flexible conductors shall be equipped with NEMA cord caps and shall be agency-approved under UL 60950.
      d. **Connectors:** Connector selection varies based on breaker rating.
         1) L21-20
         2) L21-30
         3) L15-30
4) L14-20
5) L14-30
6) L5-15
7) L5-20
8) L5-30
9) L6-15
10) L6-20
11) L6-30
12) Hubbell CS8354C
13) 60A IEC-309

e. **Subfeed breaker:** 150kVA InfraStruxure PDU only: The PDU shall include one 250A subfeed

f. **Transformer:** 150kVA InfraStruxure PDU
   1) Size: 150kVA
   2) Type: Dry
   3) Configuration: Delta-Wye
   4) Input voltage: 480
   5) Input current: 186
   6) Inrush current: Not to exceed 10 x nominal input current Per Phase
   7) Output voltage: 208
   8) Output current: 416
   9) Weight: 920lb
   10) Impedance: 3-6%
   11) Frequency: 60Hz
   12) Frequency range: 57-63Hz
   13) Noise: <50 dBA @ 1m at full load
   14) Standards: TP-1, UL 1561
   15) Windings: Copper only; no aluminum
   16) Insulation class: 180°C minimum
   17) Ventilation: Forced air convection
   18) Temperature sensors: Yes
   19) Efficiency: 98.3% efficiency at 35% of Nameplate load.

### 1.1 SUBMITTALS

A. **Product Data:** Submit product data showing material proposed. Submit sufficient information to determine compliance with the Drawings and Specifications. Product data shall include, but shall not be limited to, the following:
   1. As bid system bill of materials.
   2. Product catalog sheets or equipment brochures.

B. **Shop Drawings:** Submit shop drawings for each product and accessory required. Include information not fully detailed in manufacturer's standard product data, including, but not limited to, the following:
   1. Installation information, including, but not limited to, weights and dimensions.
   2. Information about terminal locations for power and control connections.
   3. Drawings for requested optional accessories.

C. **Wiring Diagrams:** Submit wiring diagrams detailing power, signal, and control systems, clearly differentiating between manufacturer-installed wiring and field-installed wiring, and between components provided by the manufacturer and those provided by others.
   1. Submit system single-line operation diagram.

D. **Operation and Maintenance Data:** Submit operation and maintenance data to include in operation and maintenance manuals, including, but not limited to, safe and correct operation of PDU functions.
   1. Submit an installation manual, which shall include, but shall not be limited to, instructions for storage, handling, examination, preparation, installation, and start-up of PDU.
2. Submit an operation and maintenance manual, which shall include, but shall not be limited to, operating instructions.
3. Submit project record equipment drawings.

1.2 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer Qualifications: Manufacturer shall be a firm engaged in the manufacture of PDUs of types and sizes required, and whose products have been in satisfactory use in similar service for a minimum of 20 years.
   a. The manufacturer shall be ISO 9001 certified and shall be designed to internationally accepted standards.

2. Installer Qualifications: Installer shall be a firm that shall have a minimum of five years of successful installation experience with projects utilizing PDU’s similar in type and scope to that required for this Project.

B. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances, and regulations of Federal, State, and local authorities having jurisdiction. Obtain necessary approvals from such authorities.

1. Work shall also be designed in accordance with the following:
   a. UL 60950.

2. Where applicable, the PDU shall also be designed in accordance with publications from the following organizations and committees:
   b. National Electrical Manufacturers Association (NEMA).
   c. Occupational Safety and Health Administration (OSHA).
   d. ISO 9001.
   e. ISO 14001.
   f. Office of Statewide Health Planning and Development (OSHPD)

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project site in supplier’s or manufacturer’s original wrappings and containers, labeled with supplier’s or manufacturer’s name, material or product brand name, and lot number, if any.

B. The customer shall store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.4 PROJECT CONDITIONS

A. Environmental Requirements: Do not install PDUs until space is enclosed and weatherproof, wet work in space is completed and nominally dry, work above ceilings is complete, and ambient temperature and humidity conditions are and will be continuously maintained at values near those indicated for final occupancy.

1. Environmental:
   a. Storage Ambient Temperature: (-25°) to 65°C ((-13°) - 149 °F).
   b. Operating Ambient Temperature: 0 °C to 40 °C (32 °F to 104 °F)
   c. Relative Humidity: 0 percent to 95 percent, non-condensing.
   d. Altitude: Maximum installation with no derating of the PDU output shall be 10,000 feet (3048 m) above sea level.

1.5 WARRANTY

A. Special Warranty: The Contractor shall warrant the work of this Section to be in accordance with the Contract Documents and free from faults and defects in materials and workmanship for period
indicated below. This special warranty shall extend the one year period of limitations contained in the General Conditions. The special warranty shall be countersigned by the Installer and the manufacturer.

1. The PDU shall be covered by a full parts and labor warranty from the manufacturer for a period of 12 months from date of installation or acceptance by the Owner or 18 months from date of shipment from the manufacturer, whichever occurs first.
2. The battery manufacturer’s warranty shall be passed through to the final Owner and shall have a minimum period of one year.

B. **Additional Owner Rights:** The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

1.6 **MAINTENANCE**

A. A complete offering of preventative and full service maintenance contracts for the PDU system and the battery system shall be available from the manufacturer. Contract work shall be performed by factory-trained service personnel.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

A. **Basis of Design:** Product specified is “APC InfraStruxure Power Distribution Unit, 60 kVA or 150 kVA, 208 Volt Output; 60 kVA - 150 kVA PDU/Distribution” as manufactured by APC by Schneider Electric. Items specified are to establish a standard of quality for design, function, materials, and appearance.

**2.2 DISPLAY AND CONTROLS**

A. **Display Unit:** For purposes of providing local annunciation of status and alarm messages, the PDU shall have a microprocessor-controlled display unit located on a hinged door in front of the system. The display shall consist of an alphanumeric display with pushbutton switches, allowing retrieval of active alarms, system level programming, and event history of the PDU.

B. **Metered Data:** The following metered data shall be available on the alphanumeric display:
   1. Year, month, day, hour, minute, second of occurring events.
   2. Source input voltage.
   3. Output AC voltage.
   4. Output AC current.
   5. Output kVA per phase.
   6. Total output kVA.
   7. Power factor per phase.
   8. Input frequency.

C. **Event Log:** The display unit shall allow the Owner to display a time and date stamped log of the 64 most recent status and alarm events.

D. **Alarms:** The display unit shall allow the Owner to display a log of active alarms. The following minimum set of alarm conditions shall be available:
   1. Input under voltage (phase-to-phase).
   2. Input over voltage (phase-to-phase).
   3. Output under voltage.
   4. Output over voltage.
5. Output under current.
6. Output over current (phase).
7. Output over current (neutral).
8. Frequency out of tolerance.

E. **Controls:** The following controls or programming functions shall be accomplished by use of the display unit. Pushbutton membrane switches shall facilitate these operations.
   1. Silence audible alarm.
   2. Set the alphanumeric display language.
   3. Display or set the date and time.
   4. Adjust set points for different alarms.
   5. Map alarm dry contacts.
   6. Designate input dry contacts.

F. **Potential Free (Dry) Contacts:**
   1. Four dry contact inputs shall be able to be used to monitor external contact closure and shall be named by the operator through the Owner interface.
   2. Four dry output contacts shall be able to be mapped by the operator through the Owner interface to any of the alarm conditions listed above.

2.3 **ACCESSORIES**

A. **Branch Current Monitoring (60kVA InfraStruxure PDU):** Each pole of each circuit breaker shall be monitored, and shall report the load current drawn on each circuit breaker pole to a common infrastructure management system. Values metered by branch circuit monitoring shall be available through a web-based browsing system and shall be incorporated into the same monitoring system as the other components within this Section.

B. **Branch Current and Power Monitoring (150kVA InfraStruxure PDU only):** Each pole of each circuit breaker shall be monitored, and shall report the load current drawn on each circuit breaker pole to a common infrastructure management system. The power shall also be monitored and reported in kilowatt-amps. Values metered by branch circuit monitoring shall be available through a web-based browsing system and shall be incorporated into the same monitoring system as the other components within this Section.

C. **Rack Mount Power Distribution Units:** For purposes of distributing power within an IT enclosure, rack mount power distribution units shall be available for installation within the IT enclosure. The rack mount power distribution units shall be capable of being installed in the back of the accompanying enclosure to consume zero U-space in the front of the rack, and shall not require tools for installation within the rack.
   1. **Input Connection:** For ease of installation, the rack mount PDU shall be connected via a twist lock connector, and shall be capable of being fed from agency-approved flexible corded distribution wiring as described elsewhere in this Section.

MAKE APPLICABLE SELECTIONS

D. **Overhead Distribution:**
   1. **Flexible Distribution Conductors:** For purposes of overhead distribution wiring of data center branch circuits, flexible conductors of the TC type shall be available as a distribution means. Flexible conductors shall be equipped with NEMA or IEC style cord caps and shall be agency-approved under UL 60950 as part of the overall distribution system.
   2. **Cable Ladder:** For purposes of routing data and power cables between rows in a data center aisle layout, cable ladders shall be available to span the gap between rows. Cable ladders shall be agency-approved under UL 60950 as part of the overall distribution system. The use of overhead cable management shall minimize the need to run data and power cable beneath
a raised floor, thus minimizing potential air flow obstructions for down-flow type precision cooling solutions. This means of cable management shall also facilitate ease of installation of power and data cabling in data centers not utilizing raised floor. Optional covers shall be available for ladders as a means of adhering to local codes requiring such.

3. **Cable Trough:** For purposes of routing data and power cable along the length of a row of IT enclosures in a data center environment, cable troughs shall be available as a means of separating and housing data and power cable. Optional covers shall be available for troughs as a means of adhering to local codes requiring such. The use of overhead cable management shall minimize the need to run data and power cable beneath a raised floor, thus minimizing potential air flow obstructions for down-flow type precision cooling solutions. This means of cable management shall also facilitate ease of installation of power and data cabling in data centers not utilizing raised floor.

E. **Remote Power Panel (RPP):** For purposes of wiring convenience, a 144kVA Modular Remote Power Panel (RPP) shall be available to take a single feed from the 150kVA InfraStruxure PDU, and distribute power to the critical load.

F. **Rack Distribution Panel (RDP):** For purposes of wiring convenience, a Modular 5U Rack Distribution Panel (RDP) shall be available to take a single feed from the 150kVA InfraStruxure PDU, and distribute power to the critical load.

G. **Information Technology (IT) Enclosure:** IT enclosures shall be available for housing of Owner-supplied IT equipment. Enclosures shall be listed under the same UL 60950 agency approval as other products outlined elsewhere in this Section.

H. **Floor Anchor Brackets:** Floor anchor brackets shall be available to solidly connect the PDU enclosure to minimize unintended moving of the equipment.

I. **Seismic Anchor Brackets (150kVA InfraStruxure PDU only):** Seismic rated anchor brackets shall be available to support OSHPD pre-approval.

J. **Software and Connectivity:**
   1. **Network Adaptor:** The ethernet web/SNMP adaptor shall allow one or more network management systems (NMS) to monitor and manage the PDU in TCP/IP network environments. The management information base (MIB) shall be provided in DOS and UNIX tar formats. The SNMP interface adaptor shall be connected to the PDU via the serial port on the standard communication interface board.

K. **StruxureWare Data Center Expert:** A centralized infrastructure management platform hereafter referred to as Data Center Expert shall be available for purposes of complete system monitoring and management of all components outlined in this specification used as a single solution for small IT or part of the StruxureWare software stack providing data to systems such as Data Center Operation.
   1. **Monitoring** - Data Center Expert shall be capable of monitoring a PDU through a network of Cat 5 cable and a 24 port hub, supplied by the PDU manufacturer. This 24 port hub shall relay information to Data Center Expert, which in turn shall allow access to this information via the user’s public network via a single IP address.
   2. **Monitored Values:** Data Center Expert shall be capable of monitoring alarms, general status parameters, voltage and current of the PDU.
   3. **Thresholds:** For individualized customer needs, Data Center Expert shall allow for user configurable thresholds for alarm notification. With this feature, Data Center Expert can notify clients of reaching thresholds for PDU capacity, or branch circuit breaker capacity. Other custom programmable alarm points for non-APC products shall also be available via dry contact input signal.
   4. **Public Network Monitoring:** Data Center Expert shall also be capable of monitoring other APC devices that are connected to the client’s public network.
L. **Remote System Monitoring:** The following methods of remote monitoring shall be available:
   1. **Web Monitoring:** Remote monitoring shall be available via a web browser such as Internet Explorer.
   2. **RS-232 Monitoring:** Remote monitoring shall be possible via either RS-232 or contact closure signals from the PDU.
   3. **Simple Network Management Protocol (SNMP):** Remote monitoring shall be possible through a standard MIB II compliant platform.
   4. **Modbus (150kVA InfraStruxure PDU):** Remote monitoring shall be possible through a customer-supplied building management system

**PART 3 - EXECUTION**

3.1 **EXAMINATION**

A. **Verification of Conditions:** Examine areas and conditions under which the work is to be installed, and notify the Contractor in writing, with a copy to the Owner and the Architect/Engineer, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.
   1. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Installer.

3.2 **INSTALLATION**

A. **General:** Preparation and installation shall be in accordance with reviewed product data, final shop drawings, manufacturer's written recommendations, and as indicated on the Drawings.

B. **Factory-Assisted Start-Up:** If a factory-assisted PDU start-up is requested, factory-trained service personnel shall perform the following inspections, test procedures, and on-site training:
   1. **Visual Inspection:**
      a. Inspect equipment for signs of damage.
      b. Verify installation per manufacturer's instructions.
      c. Inspect cabinets for foreign objects.
   2. **Mechanical Inspection:**
      a. Check PDU cabinet internal control wiring connections.
      b. Check PDU internal power wiring connections.
      c. Check PDU terminal screws, nuts, and/or spade lugs for tightness.
   3. **Electrical Inspection:**
      a. Verify correct input voltage.
      b. Verify correct phase rotation of mains connections.
      c. Verify neutral and ground conductors are properly landed.
   4. **Site Testing:**
      a. Ensure proper system start-up.
      b. Verify proper firmware control functions.
      c. Verify proper breaker operation.
      d. Verify system set points.
      e. Document, sign, and date test results.
   5. **On-Site Operational Training:** During the factory-assisted start-up, operational training for site personnel shall include, but shall not be limited to, key pad operation, LED indicators, start-up and shutdown procedures, maintenance bypass and AC disconnect operation, and alarm information.

3.3 **FIELD QUALITY CONTROL**

A. **Manufacturer Field Service:**
1. **Worldwide Service:** The PDU manufacturer shall have a worldwide service organization available, consisting of factory-trained field service personnel to perform start-up, preventative maintenance, and service of the PDU system and power equipment. The service organization shall offer 24 hours a day, 7 days a week, 365 days a year service support.

2. **Replacement Parts:** Parts shall be available through the worldwide service organization 24 hours a day, 7 days a week, 365 days a year. The worldwide service organization shall be capable of shipping parts within four working hours or on the next available flight, so that the parts may be delivered to the Owner within 24 hours.

3.4 **DEMONSTRATION**

A. **General:** Provide the services of a factory-authorized service representative of the manufacturer to provide start-up service and to demonstrate and train the Owner’s personnel.

1. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.

2. Train the Owner’s maintenance personnel on procedures and schedules related to start-up and shutdown, troubleshooting, servicing, and preventive maintenance.

3. Review data in operation and maintenance manuals with the Owner’s personnel.

4. Schedule training with the Owner, through the Architect/Engineer, with at least seven day’s advanced notice.

3.5 **PROTECTION**

A. Provide final protection and maintain conditions in a manner acceptable to the installer, which shall ensure that the PDU’s shall be without damage at time of Substantial Completion.

**END OF SECTION**