# SECTION 264313 - SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

A. Section includes field-mounted SPDs for low-voltage (120 to 600 V) power distribution and control equipment.

| | | | |
|---|---|---|---|
| 1. | SPD-MDP | (Main Distribution Panel/Switchboard 'MDP') | 480/277V, 3-phase, 4-wire. |
| 2. | SPD-EDP | (Emergency Dist. Panel/Switchboard 'EDP') | 480/277V, 3-phase, 4-wire. |
| 3. | SPD-E1HA | (Emergency Power Panelboard 'E1HA') | 480/277V, 3-phase, 4-wire. |
| 4. | SPD-E1HB | (Emergency Power Panelboard 'E1HB') | 480/277V, 3-phase, 4-wire. |
| 5. | SPD-E1HC | (Emergency Power Panelboard 'E1HC') | 480/277V, 3-phase, 4-wire. |
| 6. | SPD-E1HD | (Emergency Power Panelboard 'E1HD') | 480/277V, 3-phase, 4-wire. |
| 7. | SPD-E2HA | (Emergency Power Panelboard 'E2HA') | 480/277V, 3-phase, 4-wire. |
| 8. | SPD-L1HA | (Legal Power Panelboard 'L1HA') | 480/277V, 3-phase, 4-wire. |
| 9. | SPD-E1PA | (Emergency Lighting Panelboard 'E1PA') | 208/120V, 3-phase, 4-wire. |
| 10. | SPD-E1PB | (Emergency Lighting Panelboard 'E1PB') | 208/120V, 3-phase, 4-wire. |
| 11. | SPD-E1PE | (Emergency Lighting Panelboard 'E1PE') | 208/120V, 3-phase, 4-wire. |
| 12. | SPD-E1PF | (Emergency Lighting Panelboard 'E1PF') | 208/120V, 3-phase, 4-wire. |
| 13. | SPD-E2PA | (Emergency Lighting Panelboard 'E2PA') | 208/120V, 3-phase, 4-wire. |
| 14. | SPD-L1PA | (Legal Lighting Panelboard 'L1PA') | 208/120V, 3-phase, 4-wire. |
| 15. | SPD-LDH | (Emergency Power Panelboard 'LDH') | 480/277V, 3-phase, 4-wire. |
| 16. | SPD-LDPA | (Emergency Lighting Panelboard 'LDPA') | 208/120V, 3-phase, 4-wire. |
| 17. | SPD-LDPB | (Emergency Lighting Panelboard 'LDPB') | 208/120V, 3-phase, 4-wire. |
| 18. | SPD-E1PC | (Emergency Lighting Panelboard 'E1PC') | 208/120V, 3-phase, 4-wire. |
| 19. | SPD-E1PD | (Emergency Lighting Panelboard 'E1PD') | 208/120V, 3-phase, 4-wire. |

B. Section includes ALTERNATE BID field-mounted SPDs for low-voltage (120 to 600 V) power distribution and control equipment.

| | | | |
|---|---|---|---|
| 1. | SPD-LTH | (Emergency Power Panelboard 'LTH') | 480/277V, 3-phase, 4-wire. |
| 2. | SPD-LTP | (Emergency Lighting Panelboard 'LTP') | 208/120V, 3-phase, 4-wire. |

### 1.3 REFERENCED STANDARDS

A. IEEE C62.41: IEEE Guide for Surge Voltages in Low Voltage AC Power Circuits (ANSI).

B. IEEE C62.45: IEEE Guide for Surge Suppressor Testing (ANSI).

C. NETA ATS: Acceptance Testing Specifications; Section 7.19, "Low-Voltage Surge Protection Devices".

D. NEMA 250: Enclosures for Electrical Equipment (1000 Volts Maximum).

E. NEMA WD 6: Wiring Device--Dimensional Requirements.

F. NFPA 70: National Electrical Code.

G. UL 486A: Wire Connectors and Soldering Lugs for Use with Copper Conductors.

H. UL 1283: Electromagnetic Interference Filters.

I. UL 1449 (3rd Edition Effective 9/29/2009): UL1149 4th Edition Effective 3/26/2016 Surge Protection Devices.

## 1.4 DEFINITIONS

A. Inominal: Nominal discharge current.

B. MCOV: Maximum continuous operating voltage.

C. Mode(s), also Modes of Protection: The pair of electrical connections where the VPR applies.

D. SCCR: Short-circuit current rating.

E. SPD: Surge protective device.

F. VPR: Voltage protection rating.

## 1.5 SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Copy of UL Category Code VZCA certification, as a minimum, listing the tested values for VPRs, Inominal ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.
3. Shipping, installed, and operating weights; furnished specialties; and accessories.

B. Product Certificates: Signed by manufacturers of surge protection devices, certifying that products furnished comply with the following testing and labeling requirements:

1. UL 1283 certification by an OSHA approved NRTL.

2. UL 1449 (3rd Edition Effective 9/29/2009) 4th Edition Effective 3/26/2016 listing and classification by an OSHA approved NRTL.
3. NEMA LS-1 Single Pulse

C. Field Test Reports: Written reports of tests specified in Part 3 of this Section. Include the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Failed test results and corrective action taken to achieve requirements.

D. Maintenance Data: For surge protection devices to include in maintenance manuals specified in Division 1.

E. Warranties: Special warranties specified in this Section.

1.6 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For manufacturer's special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For SPDs to include in maintenance manuals.

1.8 WARRANTY

A. General Warranty: Special warranties specified in this Article 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 Contractor under requirements of the Contract Documents.

B. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of surge suppressors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Fifteen (15) years from date of Substantial Completion.

1.9 SERVICE CONDITIONS

A. Rate surge protective devices for continuous operation under the following conditions, unless otherwise indicated:

1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
2. Operating Temperature: minus 20 degrees F to plus 120 degrees F.
3. Humidity: 0 to 85 percent, non-condensing.
4. Altitude: Less than 20,000 feet above sea level.

PART 2 - PRODUCTS

2.1 GENERAL SPD REQUIREMENTS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Current Technology Inc.

2. Substitution requests shall be submitted for Engineer review a minimum of ten (10) working days prior to bid date; provide product data sheets, technical specifications and testing, warranty, and other pertinent information demonstrating equipment is a performance equal; include a list of all deviations or exceptions where taken.

B. SPD with Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NFPA 70.

D. Comply with UL 1449. 4$^{th}$ Edition Effective 3/26/2016.

E. MCOV of the SPD shall be the nominal system voltage.

2.2 PANEL SUPPRESSORS

A. Comply with UL 1449 (4$^{th}$ Edition) Type 1, tested at Inominal Rating: 20 kA.

B. Per ANSI/IEEE C62.41.1-2002, C62.41.2-2002 and C62.45-2002, the SPD system shall be repetitive surge current capacity tested in every mode using a 1.2 x 50 µsec, 20KV open circuit voltage, 8 x 20 µsec, 200KA short circuit current ANSI/IEEE C62.41 Category C3 waveform at one minute interval. Minimum repetitive strikes with less than 10% degradation of clamping voltage shall be 3500 repetitive C3 strikes per mode.

C. Single Pulse Surge Testing: The maximum single-pulse surge current capacity per mode shall be verified through testing at an independent third-party testing facility. Testing shall be conducted in each mode of the device and all tested modes shall be from the same test sample. This test shall include all components of the SPD system, including disconnects (if applicable) and fusing as a completed assembly. Individual component testing, module testing only, or subsystem testing of the SPD for compliance with this section will not be acceptable. Ratings based on the arithmetic sum of the ratings of the individual MOVs in a given mode are not acceptable. Testing that causes damage to the device, fuse operation, or voltage clamping

performance degradation by more than 10% is not acceptable. The Single Pulse Surge Current Capacity shall be as indicated below:

1. 480/277V, 3-phase, 4-wire Current Technology TG3 Series

| | | | |
|---|---|---|---|
| a. | SPD-MDP | 200KA | TG3-200-480-3Y-MNB-M3-F-2 |
| b. | SPD-EDP | 150KA | TG3-150-480-3Y-MNB-M3-F-2 |
| c. | SPD-LDH | 150KA | TG3-150-480-3Y-MNB-M3-F-2 |
| d. | SPD-LTH | 150KA | TG3-150-480-3Y-MNB-M3-F-2 (ALT BID) |

2. 480/277V, 3-phase, 4-wire Current Technology CGP3 Series

| | | | |
|---|---|---|---|
| a. | SPD-L1HA | 100KA | CGP3-100-480-3Y-PL-U-F |
| b. | SPD-E1HA | 100KA | CGP3-100-480-3Y-PL-U-F |
| c. | SPD-E1HB | 80KA | CGP3-080-480-3Y-PL-U-F |
| d. | SPD-E1HC | 100KA | CGP3-100-480-3Y-PL-U-F |
| e. | SPD-E1HD | 100KA | CGP3-100-480-3Y-PL-U-F |
| f. | SPD-E2HA | 100KA | CGP3-100-480-3Y-PL-U-F |

3. 208/120V, 3-phase, 4-wire. Current Technology CGP3 Series

| | | | |
|---|---|---|---|
| a. | SPD-E1PA | 80KA | CGP3-080-208-3Y-PL-U-F |
| b. | SPD-E1PB | 60KA | CGP3-060-208-3Y-PL-U-F |
| c. | SPD-E1PE | 80KA | CGP3-080-208-3Y-PL-U-F |
| d. | SPD-E1PF | 80KA | CGP3-080-208-3Y-PL-U-F |
| e. | SPD-E2PA | 80KA | CGP3-080-208-3Y-PL-U-F |
| f. | SPD-L1PA | 60KA | CGP3-060-208-3Y-PL-U-F |
| g. | SPD-LDPA | 80KA | CGP3-080-208-3Y-PL-U-F |
| h. | SPD-LDPB | 80KA | CGP3-080-208-3Y-PL-U-F |
| i. | SPD-LTP | 80KA | CGP3-080-208-3Y-PL-U-F (ALT BID) |

4. 208/120V, 3-phase, 4-wire, flush mounted. Current Technology CGP3 Series

| | | | |
|---|---|---|---|
| a. | SPD-E1PC | 80KA | CGP3-080-208-3Y-M-F / CG3FMPMEDMETAL |
| b. | SPD-E1PD | 80KA | CGP3-080-208-3Y-M-F / CG3FMPMEDMETAL |

D. Filtering: The SPD shall provide a noise filtering system capable of attenuating noise levels produced by electromagnetic interference and radio frequency interference (EMI/RFI). The system's filtering characteristics shall be expressed in decibels (dB) of attenuation at no less than 8 points over a frequency spectrum between 50kHz and 100MHz. The noise filtering system shall also be listed to UL 1283 by an approved NRTC, as an electromagnetic interference filter.

E. Fusing: Each MOV shall be individually fused and designed to operate only in the event of an MOV failure within the SPD. In the event of an MOV failure, the fuse will operate to remove the failed MOV from the circuit. The remaining MOV's and fuses will stay intact to handle subsequent surges. The fusing included with the SPD system shall be required to meet the above requirement and shall be included with the above testing guidelines. Overcurrent

fusing that limits the rated single pulse surge current of the SPD is not acceptable. Replaceable cartridge type per phase or per mode overcurrent fusing is not acceptable where there is more than one MOV per mode.

F. Fault Current Capability: The unit shall be capable of interrupting up to a 200kA symmetrical fault current with 600VAC applied without the need of an upstream overcurrent protection device (fuse or circuit breaker).

G. UL 1449 Voltage Protection Rating: The unit shall be UL 1449 3rd Edition 4th Edition Effective 3/26/2016Listed by a Nationally Recognized Testing Laboratory and shall be as follows for L-N, L-G, N-G, and L-L, modes:

1. TG3-200-480-3Y-MNB-M3-F-2; TG3-150-480-3Y-MNB-M3-F-2

   a. Line to Neutral: 1200 V.
   b. Line to Ground: 1200 V.
   c. Neutral to Ground: 1000 V.
   d. Line to Line: 2000 V.

2. CGP3-100-480-3Y-PL-U-F

   a. Line to Neutral: 1200 V.
   b. Line to Ground: 1200 V.
   c. Neutral to Ground: 1200 V.
   d. Line to Line: 1800 V.

3. CGP3-080-480-3Y-PL-U-F

   a. Line to Neutral: 1000 V.
   b. Line to Ground: 1000 V.
   c. Neutral to Ground: 1000 V.
   d. Line to Line: 1800 V.

4. CGP3-080-208-3Y-PL-U-F & CGP3-060-208-3Y-PL-U-F

   a. Line to Neutral: 600 V.
   b. Line to Ground: 600 V.
   c. Neutral to Ground: 600 V.
   d. Line to Line: 1000 V.

5. CGP3-080-208-3Y-M-F / CG3FMPMEDMETAL

   a. Line to Neutral: 600 V.
   b. Line to Ground: 600 V.
   c. Neutral to Ground: 600 V.
   d. Line to Line: 1000 V.

H. SPD units shall provide protection status indication via a tri-colored LED per phase. The tri-colored LED shall report when the SPD has reached 75% of remaining useful life, and 40% of remaining useful life.

I. Monitoring Contacts: The unit shall come standard with Form C dry relay contacts (N.O. and N.C.) for remote monitoring capability, and internal audible alarm with silence button.

J. Event Counter: The unit shall come standard with a transient event counter with LCD panel display and reset button on the front cover.

K. Enclosure: The unit shall be supplied in a NEMA type 1 enclosure rated for indoor applications.

## 2.3 HIGH-PERFORMANCE INTERCONNECT CABLES

A. Contractor shall install cabling from panel bus to surge protective device. Where cabling length is great than 6'-0", a high-performance connection cable shall be used. Cable shall be a pre-manufactured, dual shielded, triple insulated, multi-core power conductor specially constructed to minimize interconnection impedance for SPD installations. Cable shall be UL approved for use with Current Technology SPD products.

1. Manufacturer/Model: Current Technology HPI

# PART 3 - EXECUTION

## 3.1 COORDINATION

A. Coordinate location of field-mounted surge suppressors to allow adequate clearances for maintenance.

## 3.2 INSTALLATION

A. Placing into Service: Do not energize or connect service entrance equipment, or power or lighting panelboards to their sources until the surge protective devices are installed and connected. Verify system voltage prior to energizing surge protective device. When the cable connection length, between the SPD and the switchboard or panelboard, exceeds more than 6 lineal feet, the Contractor shall furnish and install a low impedance connection system from Current Technology, Model HPI, to maximize the performance of the SPD in mitigating the effects of transient voltage surges to the client's protected systems

B. Comply with NECA 1.

C. Install an OCPD or disconnect as required to comply with the UL listing of the SPD.

D. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible; adjust circuit-breaker positions to achieve shortest and straightest leads.

Do not splice and extend SPD leads unless specifically permitted by manufacturer and Engineer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

E. Use crimped connectors and splices only. Wire nuts are unacceptable.

F. Wiring:

1. Power Wiring: Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

## 3.3 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

## 3.4 FIELD QUALITY CONTROL AND START-UP

A. Perform the following the following field quality-control tests and inspections with the assistance of a factory-authorized service representative.

1. Compare equipment nameplate data for compliance with Drawings and Specifications.
2. Inspect anchorage, alignment, grounding, and clearances.
3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.
4. After installing surge protective devices, but before electrical circuitry has been energized, test for compliance with requirements, using a diagnostic portable test kit.
5. Complete startup checks according to manufacturer's written instructions.
6. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests and reconnect them immediately after the testing is over.
7. Energize SPDs after power system has been energized, stabilized, and tested.

B. Manufacturer's Field Service: Upon completion of installation and prior to energization, a factory-authorized local service representative shall provide product start-up testing services. The tests shall include:

1. On-Line Testing: Verification that all suppression and filtering paths are operating with 100% protection as well as verification of proper facility neutral-to-ground bond by measuring neutral-to-ground current and voltage.
2. Off-line testing: Impulse injection to verify the system tolerances as well as verification of proper facility neutral-to-ground bond. To be compared to factory benchmark test parameters supplied with each individual unit.

C. The SPD manufacturer's technician shall perform a system checkout and start-up in the field to assure proper installation, operation and to initiate the warranty of the system. The technician will be required to do the following:

1. Verify voltage clamping levels utilizing a diagnostic test kit, comparing factory readings to installed readings.
2. Verify N-G connection.
3. Record information to a product signature card; keep a signature card with each SPD as reference for ongoing operation, maintenance, testing, or servicing.

D. Documentation and Reporting:

1. Prepare test and inspection reports.

a. A copy of the start-up test results and the factory benchmark testing results shall be provided to the Engineer and the Owner for confirmation of proper system function.
b. This letter shall also confirm that all neutral-to-ground bonds were verified through testing and visual inspection, and that all grounding bonds were observed to be in place.
c. Include Operation and Maintenance Manual.

E. An SPD will be considered defective if it does not pass tests and inspections. Repair or replace malfunctioning units. Retest after repairs or replacements are made.

## 3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate and maintain surge protective devices.

1. Train Owner's maintenance personnel on procedures and schedules for maintaining suppressors.
2. Review data to be included in operation and maintenance manuals. Refer to Division 017823 "Operation and Maintenance Data."
3. Schedule training with Owner, through Construction Manager, with a seven (7) day advanced notice.

END OF SECTION 264313

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