SECTION 264313 – SURGE-PROTECTIVE DEVICES, 1KV or Less

PART 1 - GENERAL

1.1 DESCRIPTION OF SYSTEM

A. Provide and install all materials, labor and auxiliaries required to furnish and install complete Surge Protective Devices (SPDs) for the protection of building electrical and electronics systems from the effects of line induced transient voltage surge and lightning discharge as indicated on drawings or specified in this section for power systems with voltages between 120VAC to 480VAC (single phase or three phase) and for all communications and alarm systems (i.e. data, voice, security, etc.)

B. Provide surge protective devices (SPDs) for the following equipment:

1. Each main electrical service panel as shown on the drawings. Include branch circuit breakers in the main service panel to disconnect and protect the Surge Protective Device and its connecting conductors.
2. Each distribution and branch panel as shown on the drawings. Include branch circuit breakers in the distribution and branch panels to disconnect and protect the Surge Protective Device and its connecting conductors.
3. All or any electronic equipment installed under Division 26 including electronic time clocks, controls systems, security, telephone, etc.
4. All or any electronic equipment installed under Division 25 including: electronic time clocks, control systems, building management systems, etc.
5. Site lighting pole light circuits (at the pole base).
6. Additional locations as required by NFPA 780.
7. On each emergency power feeder entering the building and before the emergency feeder is connected to Automatic Transfer Switch.
8. On all telephone lines, DSL lines, T1 lines where they enter the building or at the telephone board.
9. Existing SPDs shown on the drawings shall remain active unless noted for replacement.

C. It is understood that each manufacturer of the electronic equipment being protected has different circuit requirements; therefore this specification is a modified performance specification. Provide the best type SPD that matches these specifications and matches the equipment being protected.

D. Install SPDs on the outside of control panels and electrical equipment.

1.2 REFERENCES
B. UL 1283, Standard for Electromagnetic Interference Filters
C. UL 96A Installation Requirements for Lightning Protection Systems
E. IEEE Std. 1100-2005 Section 8.6.1
F. ANSI C84.1, American National Standard for Electric Power Systems and Equipment - Voltage Ratings (60 Hertz).
H. NFPA 70 - National Electrical Code (NEC), current adopted year. Article 285
J. UL 497, Standard for Protectors for Paired-Conductor Communications Circuits
K. UL 497A, Standard for Secondary Protectors for Communications Circuits
L. UL 497B, Standard for Protectors for Data Communications and Fire-Alarm Circuits
M. UL 497C, Standard for Protectors for Coaxial Communications Circuits

1.3 DEFINITIONS

A. ATS: Acceptance Testing Specifications
B. In: Nominal discharge current rating as required by UL 1449 third edition
C. MCOV: Maximum Continuous Operating Voltage
D. VPR: Voltage Protection Rating (Clamping voltage)
E. SCCR: Short Circuit Current Rating
F. SPD: Surge Protective Device

1.4 SUBMITTALS

A. Submit under provisions of the General Requirements of the Contract Documents and Section 260501.
B. Product Data: For each type of product indicated. Include rated capacities, bill of materials of number of MOVs installed per phase with MOV part number and surge current rating, operating weights, operating characteristics, furnished specialties, and accessories.
C. Product Certificates: SPD submittals shall include Listing documentation, signed by product manufacturer certifying compliance with the following standards:
1. UL 1283 compliance verified information is posted at www.UL.com, under Certifications, searching using UL Category Code: FOKY.
2. UL 1449 3rd Edition certification listing and classification page, VPR, MCOV, In, and Type 1 information is posted at www.UL.com, under Certifications, searching using UL Category Code: VZCA. SCCRs are posted in manufacturer’s UL docs.
3. UL 497, UL 497A, UL 497B, UL 497C as applicable.

D. Field quality-control test reports, including the following:
   1. Test procedures used.
   2. Measure the continuity of each conductor between the equipment being protected and the SPD. The maximum resistance is 1 milliohm.
   3. Failed test results and corrective action taken to achieve requirements.

E. Operation and Maintenance Data: For Surge protective Devices to include in emergency, operation, and maintenance manuals.

F. Warranties: Special warranties specified in this Section.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance (O&M) data as called for in Section 260507.

B. O&M data to include:
   1. All approved shop drawings, product data, and/or cutsheets.
   2. Installation, connection, and maintenance information on each type of surge suppression.
   3. Procedure and/or timetable for recommended periodic inspection of devices to determine continued usefulness, as applicable.

1.6 QUALITY ASSURANCE

A. All SPDs shall be manufactured by a company normally engaged in the design, development, and manufacture of such devices for electrical and electronics systems equipment for a minimum of five years.

B. Manufacturing facility shall operate a Quality System Certified as ISO 9001:2008 (or latest version) Compliant.

C. The SPD manufacturer shall provide requested technical assistance through support (including on-site as needed) by a factory-trained representative.

D. Source Limitations: Obtain SPDs and accessories for like applications through one source from a single manufacturer located in the United States.
E. Product Options: Drawings indicate size, dimensional requirements, and electrical performance of SPDs and are based on the specific system indicated. Refer to Division 1 Section “Product Requirements”.

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

G. Product Standards:


3. NFPA 70, National Electrical Code article 285 latest edition

1.7 REGULATORY REQUIREMENTS

A. Equipment Certification: SPDs shall be listed by Underwriter Laboratories, shall bear the U.L. seal and be marked in accordance with referenced standard. SPDs shall be U.L. listed and labeled for intended use.

B. SPDs shall be installed and located in accordance with requirements of all applicable National Fire Protection Association (NFPA) codes (including NFPA 780 and NFPA 70).

C. Comply with all standards and guides as listed under “References” above as applicable.

1.8 COORDINATION/PROJECT CONDITIONS

A. Verify proper grounding is in place.

B. Verify proper clearances, space, etc. is available for SPD.

C. Coordinate so that proper overcurrent device, as recommended by manufacturer, is installed to feed each surge suppression device.
D. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Department not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Department's written permission.

E. Service Conditions: 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: 30 to 120 deg F (0 to 50 deg C).
3. Humidity: 0 to 85 percent, no condensing.
4. Altitude: Less than 20,000 feet (6090 m) above sea level.

1.9 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of SPDs that fail in materials or workmanship within five years from date of Substantial Completion.

B. For Data line SPDs, Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge SPDs that fail in materials or workmanship within two years from date of Substantial Completion.

C. Any SPD, that shows evidence of failure or incorrect operation during the warranty period (to include failure of visual failure indicators) shall be replaced or repaired by the manufacturer during the warranty period. The manufacturer shall provide replacement units to the Department for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following. (Any product that meets or exceeds the performance of the following manufacturers will be considered.)

1. Advanced Protection Technologies
2. Liebert
3. L.E.A. International
4. Surge Suppression Incorporated
For Data Line and Telephone SPDs

1. Advanced Protection Technologies/Surgeassure
2. Superior Electric/Stabiline
3. Circa Telecom
4. Emerson Network Power
5. Scientific Atlantic
6. Surge Suppression Incorporated

2.2 SERVICE ENTRANCE SURGE PROTECTIVE DEVICE

A. Surge protective Device Description: Provide the following features and accessories:

1. The SPD shall be UL 1449 Third Edition, listed.
2. The SPD shall be UL 1449 Third Edition, labeled as Type 1 intended for use without need for external or supplemental overcurrent protection.
3. The SPD shall be UL 1449 Third Edition, labeled with 20kA I-nominal (In) (verifiable at UL.com) for compliance to UL 96A Lightning Protection Master Label and NFPA 780.
4. Install the SPD externally to the distribution equipment with the leads as short and straight as possible. Gently twist conductors together. Installer may reasonably rearrange breaker locations to ensure short and straightest possible leads to the SPD. If any lead lengths exceed 24”, the Contractor responsible for installation must contact the specifying electrical engineer and the surge protective device manufacturer or distributor for installation assistance.
6. 
7. Provide a branch circuit breaker as a disconnecting means or provide a factory installed integral disconnect switch as a disconnecting means for the SPD modules.
8. Provide field replaceable SPD module.
10. The SPD shall include visual LED indicator lights for power and protection integrity.
11. Audible alarm with silence switch and diagnostic test function (excluding branch).
12. Each SPD shall contain one set of form C contacts that change state when the SPD requires service.
B. Minimum Surge Current Capability: 200 kA per phase with less than 1 nanosecond response time.

C. Connection Means: Permanently wired, connected on the load side of the service entrance overcurrent protection, and meet the SPD manufacturer’s instructions for overcurrent protection (breaker or fuse size).

D. Protection modes and UL 1449 3rd Edition VPRs for circuits with voltages of 120/240V, 1-Phase, 3-Wire shall not exceed:

1. Line to Neutral: 600V for 120/240V, 1PH, 3W
2. Line to Ground: 600V for 120/240V, 1PH, 3W
3. Neutral to Ground: 600V for 120/240V, 1PH, 3W
4. Line to Line: 1200V for 120/240V, 1PH, 3W

2.3 SURGE-PROTECTIVE DEVICE (SPD) FOR DISTRIBUTION PANELBOARDS

A. Surge protective Device Description: Provide the following features and accessories:

1. SPD shall be UL 1449 3rd Edition listed.
2. UL 1283 listed as an Electromagnetic Interference Filter
3. SPD shall be UL 1449 Third Edition, labeled as Type 1 intended for use without need for external or supplemental overcurrent controls or labeled as Type 2 with manufacturer approved over current protection.
4. SPD shall be UL 1449 Third Edition labeled with 20kA nominal discharge current (I_{n}) (verifiable at UL.com) for compliance to UL 96A Lightning Protection Master Label and NFPA 780.
5. Install the SPD externally to the distribution equipment with the leads as short and straight as possible. Gently twist conductors together. Installer may reasonably rearrange breaker locations to ensure short and straightest possible leads to the SPD. If any lead lengths exceed 24”, the Contractor responsible for installation must contact the specifying electrical engineer and the surge protective device manufacturer or distributor for installation assistance.
6. SPD marked with a 200kA short-circuit current rating (SCCR).
7. Modes of Protection: Line to Neutral, Line to Ground, Line to Line, and Neutral to Ground
8. The SPD shall include visual LED indicator lights for power and protection integrity.
9. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
10. Each SPD shall contain one set of form C contacts that change state when the SPD requires service.
B. Minimum Surge Current Capability: 120 kA per phase

C. Protection modes and UL 1449 3rd Edition VPRs for circuits with voltages of 120/240V, 1-Phase, 3-Wire shall not exceed:

1. Line to Neutral: 600V for 120/240V, 1PH, 3W
2. Line to Ground: 600V for 120/240V, 1PH, 3W
3. Neutral to Ground: 600V for 120/240V, 1PH, 3W
4. Line to Line: 1200V for 120/240V, 1PH, 3W

2.4 DIRECT WIRED (120 VAC) SPDs

A. Surge-protective Device Description: Provide the following features and accessories:

1. SPD shall be UL 1449 3rd Edition listed/recognized.
2. 15 & 30 Amp, 120 V rated. All continuous current bearing components must be either 15 or 30 Amp rated, minimum; depending on Location Load usage.
3. SPDs shall provide three suppression modes: Line-to-neutral, line-to-ground, and neutral-to-ground.
4. SPD shall provide a pulse life rating of 3,000 amperes (8/20µs waveform) every thirty (30) seconds for 2,000 occurrences.

B. Peak Single-Impulse Surge Current Rating: 20kA per mode, 60kA per protected circuit

C. SPD shall include visual LED diagnostic indicator for power and protection integrity.

D. SPD shall allow for chase nipple or DIN RAIL mounting.

2.4 DATA LINE, ETHERNET, RS 422, and RS-232 SPD’s

A. Surge-protective Device Description: Modular DIN RAIL design.

1. Listed and meets the requirements of UL 497A, UL 497B, or UL 497C as applicable.
2. Plug-in replaceable DIN RAIL modules
3. Shall employ hybrid circuitry that combines metal oxide varisters with silicon avalanche diodes.
4. Let through voltages for SPD’s protecting the following circuits shall not exceed the following:
   a. Ethernet – 10 Volts
   b. Power over Ethernet – 75 Volts
   c. RS 485 – 10 Volts
d. RS 232 – 27 Volts  
e. Coaxial – 90 Volts  
f. 4 – 20 milliAmp – 30 Volts

B. Peak Single-Impulse Surge Current Rating: 10 kA per mode.

2.5 TELEPHONE LINE SPDS

A. Surge-protective Device Description: Modular design.

1. Listed and meets the requirements of UL 497A, UL 497B, or UL 497C as applicable.
2. Plug-in replaceable modules design to fit on standard M1-50, 66 connecting block
3. Must be installed with matching ground rail or external ground post for extending metallic frame to building ground.
4. Provide applicable breakdown voltages of either 270V, 200V, or 65V

B. Peak Single-Impulse Surge Current Rating (8x20 µs): 250A Tip and Ring to Ground

2.6 ENCLOSURES

A. NEMA Type 1 enclosures shall be used for all enclosures inside of the building and NEMA Type 3R enclosures for exterior applications.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide, install and connect an SPD’s at the first electrical service disconnecting means. Normally at the MDP. Branch breakers in the MDP shall serve as the disconnecting means for the SPD.

B. Provide, install and connect an SPD at each branch panelboard that serves outdoor equipment. Branch breakers in the panelboard shall serve as the disconnecting means for the SPD.

C. Provide, install and connect an SPD at each Critical Power Panelboard. i.e. Panel C. Branch breakers in the panelboard shall serve as the disconnecting means for the SPD.
D. Provide, install and connect an SPD to protect the backup generator feeder at each Automatic Transfer Switch (ATS) in project. The SPD will include an integral disconnecting means installed by the SPD manufacturer.

E. Provide, install, and connect SPD at location where Division 27 and 28 equipment is connected to line voltage (120V). Provide cords and receptacles as required to connect SPD equipment to equipment being protected and maintain U.L. listing.

F. Surge protection equipment must be selected by contractor to match the equipment being protected including wire sizes, operating volts, amps, and circuit impedance.

G. Installation of SPD equipment and its grounding must be in accordance with the manufacturer’s recommendations to assure short and proper ground paths.

H. Install external SPDs with a maximum of 24” length leads. Position the SPD as close to the circuit breaker used as possible. Utilize the breakers closest to the SPD mounting.

I. Install the leads slightly twisted together, but as short and straight as possible with no kinks or coils and an eight-inch minimum bending radius.

3.2 INSTALLATION OF SPDS

A. SPDs for other than Division 27 and 28 equipment shall be installed as close as practical to the electric panel or electronic equipment to be protected, consistent with available space.

B. SPDs shall be close-nippled to the device being protected in a position nearest the neutral bus (if present) to minimize wire lead length between SPD and the buses or control breaker to which the SPD connects. SPD leads shall not extend beyond the SPD manufacturer’s recommended maximum lead length without specific approval of the engineer.

C. SPDs shall be installed in a neat, workmanlike manner. Lead dress shall be as short and as straight as possible and be consistent with recommended industry practices for the system on which these devices are installed.

D. SPDs shall be installed in a manner that allows simple replacement within short periods of downtime.

E. SPDs other than point of use type shall be installed with a means of disconnecting the SPD at the panel. At the main service entrance location, provide a dedicated 60 amp, breaker for the SPD device. At the distribution secondary and/or
subpanels location, provide dedicated 30 Amp, breaker for the SPD device. Change rating of CB’s noted above as required to properly provide system as recommended by manufacturer.

3.3 TELEPHONE CIRCUITS

A. Systems utilizing telephone company pairs as a transmission medium shall be provided with SPD conforming to respective device in Part 2 of this specification.

B. SPDs shall be installed at each point where interface is made to telephone company pairs.

C. In cases where a modem or other device is used to interface with the telephone circuit the following procedure shall apply:
   1. Where the modem or coupling device is furnished by the telephone company the SPDs shall be installed on the system side of the modem or coupling device.
   2. Where the modem or coupling device is furnished by the system contractor, the SPD shall be installed on the telephone line side of the modem or coupling device.

3.4 SIGNALING, COMMUNICATIONS AND DATA CONDUCTORS

A. Any signaling conductor, CCTV conductor, Ethernet conductor, Power over Ethernet (PoE) conductor, or SCADA system conductor that is routed outside of the toll building shall be protected by a surge protection device (SPD). The SPD’s will be mounted within the toll building.

3.5 PLACING SYSTEM INTO SERVICE

A. Before energizing any SPD, the installer shall measure the electrical system voltage and frequency and verify that each SPD is properly rated for use with measured voltage and frequency.

3.6 FIELD QUALITY CONTROL

A. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

B. Testing: Perform the following field tests and inspections.
1. After installing surge protective devices, but before the electrical circuitry has been energized, measure the continuity of each lead. Measure between the equipment being protected and the point of connection to the SPD.

2. Complete startup checks according to manufacturer's written instructions.

3.7 DEMONSTRATION

A. Train Department’s maintenance personnel to adjust, operate, and maintain SPDs.

END OF SECTION 264313