SECTION 264313 (formerly SECTION 16289)

**SURGE PROTECTIVE DEVICES (SPD)**

* 1. **GENERAL**
  2. **SUMMARY**

The specifications in this section describe the electrical and mechanical requirements for a protection system provided by high-energy transient voltage surge suppressors. The specified system shall provide effective, high-energy surge current diversion and be suitable for application in ANSI/IEEE C62.41 Category A, B and C environments (as tested by ANSI/IEEE C62).

* 1. **STANDARDS**

The specified system shall be designed, manufactured, tested and installed in compliance with the following codes and standards:

Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.11, C62.41, C62.45)

American National Standards Institute

Federal Information Processing Standards Publication 94 (FIPS PUB 94)

National Electrical Manufacturer Association

National Fire Protection Association (NFPA 70, 75 and 780)

MIL Standard 220A Method of Insertion Loss Measurement

National Electric Code

Underwriters Laboratories UL 1283/UL 60384-14 and UL 1449 (most recent edition)

* 1. **ENVIRONMENTAL REQUIREMENTS**
     1. The operating temperature range shall be -40° to 70° C ( -40° to 160° F).
     2. The unit shall be capable of operation up to 13,000 feet above sea level.
     3. No appreciable magnetic fields shall be generated.
  2. **SUBMITTALS**
     1. Product Data: Provide catalog sheets showing voltage, physical size, IEEE let through voltage for each waveform listed, UL1449 latest revision, latest edition, suppressed voltage ratings, dimensions showing construction, lifting and support points, enclosure details, per mode and per phase peak surge current, modes of discrete suppression circuitry, warranty period and replacement terms, conductor size, conductor type and lead length.
     2. Submit product data for all components and accessories.
     3. Manufacturer’s Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product. Indicate maximum size of circuit breaker or fuse to be connected for each unit.
     4. List and detail all protection systems such as fuses, disconnecting means and protective features.
     5. Provide verification that the TVSS device complies with the required UL1449 Fifth Edition.
     6. Provide actual let through voltage test data in the form of oscillograph results for the ANSI/IEEE C62.41 Category B3/C1 (combination wave) and ANSI/IEEE C62.41 and C62.45, 1991, A1 (ring wave) tested in accordance with ANSI/IEEE C62.45.
     7. Provide spectrum analysis of each unit based on MIL-STD-220A test procedures between 10 kHz and 100 kHz verifying the devices noise attenuation equals or exceeds 40 dB at 100 kHz.
     8. For retrofit mounting applications, provide electrical/mechanical drawings showing unit dimensions, weights, installation instruction details, and wiring configuration.
  3. **QUALITY ASSURANCE AND WARRANTY**

## 

## **WARRANTY**

1. The following warranty requirements shall be in addition to, and run concurrent with, other warranty requirements provided in project Contract Documents.

### **Minimum Requirements:**

1. Fifteen (15) Years Unlimited Replacement Warranty on all parallel-wired surge protective devices (SPD). Additionally, the warranty shall state that during the applicable warranty period any SPD which fails due to any transient surge activity, including lightning, shall be repaired or replaced by the manufacturer without charge.
2. **Special or optional warranties in excess of the unit’s standard warranty for purposes of this bid are not acceptable.**
3. Warranty shall be for purchaser, building owner or end user and shall not be dependent on specific purchase entity for unit. **A copy of the warranty which includes all rights, conditions and limitations must be provided.** This is in addition to the simple warranty term that is listed on the unit’s data sheet.
4. In the event the SPD is destroyed, there shall be full replacement of damaged or failed suppressor.  Pro-rating is not allowed.
5. No exclusions from transient surge events (i.e. lightning strike, arcing fault on system, facility or utility transients). Gross negligence is excluded (i.e. removing system neutral to ground bond, Hi-Pot testing with SPDs on-line, etc.).
6. Since “Acts of Nature” or similar statements typically include the threat of lightning to which the SPDs shall be exposed, any such clause limiting warranty responsibility in the general conditions of this specification shall not apply to this particular section. That is, the warranty must specifically provide for unlimited free replacements of the SPD in the event of failure caused by the effects of lightning and all other electrical anomalies. The warranty shall cover the entire device, not just various components, such as modules only.
7. Provide electrically operated equipment specified in this Section that is listed and labeled. As defined in the National Electrical Code, Article 100, Listing and Labeling Agency Qualifications: A “Nationally Recognized Testing Laboratory” as defined in OSHA Regulation 1910.7.
8. Comply with NFPA 70 and former NEMA LS1.
   1. **MANUFACTURER QUALIFICATIONS**

The SPDs shall be manufactured in the USA by a manufacturer that has been regularly engaged in the design, manufacturing and testing of SPDs of the types and ratings required for a period of not less than five years. Manufacturers requesting product approval must meet or exceed the written specification contained herein. Manufacturers requesting approval must receive written verification of product acceptance by the specifying engineer 10 days prior to the bid date.

**PART 2 - PRODUCTS**

* 1. **PERFORMANCE**
     1. **GENERAL**

1. The SPD shall be listed by ETL, UL, or other nationally recognized test laboratory to UL’s 1283 and UL’s 1449 standards (latest edition, latest revision), and not merely the components or modules. All SPDs shall be Type 1 for use in Type 1 and Type 2 locations.

2. The SPD shall protect all modes L-G, L-N, L-L, and N-G, for WYE systems have discrete suppression circuitry in L-G, L-N and N-G, and have bidirectional, positive and negative impulse protection. Line-to-neutral-to-ground protection is not acceptable where line-to-ground is specified, and accordingly reduced mode units with suppression circuitry built into only 4 modes are not acceptable.

3. The maximum continuous operating voltage (MCOV) of all components shall not be less than 125% for a 120V system and 120% for 220 and 240V systems, and 115% for 277 and 480V systems.

4. All SPDs shall be equipped with a comprehensive monitoring system which shall include a visual LCD panel display providing information on unit status and phase loss/protection loss.

5. All SPDs shall be Transient Protection Design or approved equal. No unit will be accepted as an “approved equal” unless it meets the warranty, strength, safety features, IEEE let-through levels, modes of discrete suppression circuitry, fusing, and all other requirements of this specification.

6. If a disconnect switch is specified, the disconnect switch and the SPD as a system shall be capable of interrupting up to a 100kA symmetrical fault current with 600 VAC applied.

1. **SPD shall be separate from panelboard.  To reduce the risk of arc flash to service personal and reduce the risk of liability to facility owners, to help be NFPA-70e compliant and to reduce the risk of extended downtime due to catastrophic failure of an SPD mounted inside panels, integral SPD shall not be acceptable.**
2. ANSI/UL Fifth Edition Nominal Discharge Current Ratings shall be a minimum of 20kA per mode for SPD’s to be installed at the Service Entrance (or where direct lightning strike potential exists on outdoor feeder or branch circuit conductors feeding electrical equipment) and a minimum of 10kA per mode for all other locations.

8. For technical support and ordering information call 717-436-5380 or 888-281-7856.

* + 1. **SERVICE ENTRANCE PROTECTION**

1. SPD(s) for this location shall be as indicated on project drawings. SPD shall be separate from panelboard. Integral SPD shall not be acceptable. SPDs shall be certified to UL 60384-14 (formerly UL 1283), and UL1449 Fifth Ed. Type 1 or 2 for use in Type 1 and Type 2 locations.

2. Electrical panels shall be protected by a Transient Protection Design panel mounted SPD, model TPX3Y480-E-200 for 277/480 (4W+G) volt panels, TPX-3Y208-E-200 for 120/208 (4W+G) volt panels and TPX-1S240-E-200 for 120/240 (3W+G) volt split phase panels:

3. The manufacturer shall provide written specifications showing let-through voltage of the unit with six inches of lead length (at the module or at the lug data is not acceptable as it does not represent true "as installed" performance) pursuant to ANSI/IEEE C62.41 and C62.45, 1991, category A1 ring wave, 180 degree phase angle, category B3/C1 and C3 impulse and UL suppressed voltage ratings, 90 degree phase angle, positive polarity, measurements in peak voltage from the zero reference, all dynamic tests except N-G, which shall be no higher than:

ANSI/IEEE C62.41-1991 Measured Limiting Voltage

A1 Ring Wave (2kV, 67A) Tested at 180 degree phase angle

Voltage (Voltage Code) L-N

120/240 (1S240) 58V

120/208 (3Y208) 58V

277/480 (3Y480) 58V

B3/C1 Impulse (6kV, 3kA) Tested at 90 degree phase angle

Voltage (Voltage Code) L-N L-G L-L N-G

120/240 (1S240) 552V 531V 1150V 568V

120/208 (3Y208) 552V 531V 1150V 568V

277/480 (3Y480) 950V 950V 1860V 973V

UL Suppressed Voltage Ratings – UL Fourth Edition

Voltage (Voltage Code) L-N L-G L-L N-G

120/240 (1S240) 600V 600V 1200V 600V

120/208 (3Y208) 600V 600V 1200V 600V

277/480 (3Y480) 1000V 1000V 2000V 1000V

4. The SPD shall be capable of attenuating internally generated ringing type transients and noise, which are present in every facility and shall have a transient filter supported by a specification sheet which lists the former 1991 IEEE A1 Ring Wave let-through levels no higher than those set forth above.

5. The unit shall have a peak surge current of no less than 200kA/phase, 100kA/mode, 8 X 20 us waveform, single impulse.

6. The SPD shall have component level fusing intended for use without need for external or supplemental overcurrent controls. Every Metal Oxide Varistor suppression component of every mode, including N-G, shall be protected by internal thermal over temperature controls. Overcurrent fusing that limits the listed peak surge current of the SPD is not acceptable. SPDs relying upon external or supplementary installed safety disconnectors are not acceptable. Fusing shall be present in every mode, including Neutral-to-Ground. The fusing shall be capable of interrupting up to a 100kA symmetrical fault current with 600VAC applied, and the 100kA rating shall be on the listing label on the unit.

7. The TVSS shall protect all modes L-G, L-N, L-L, and N-G, for SPLIT PHASE and WYE systems have discrete suppression circuitry in L-G, L-N and N-G, and have bidirectional, positive and negative impulse protection. Line-to-neutral-to-ground protection is not acceptable where line-to-ground is specified, and accordingly reduced mode units with suppression circuitry built into only 4 modes are not acceptable.

8. The maximum continuous operating voltage (MCOV) of all components shall not be less than 125% for a 120V system and 120% for 220 and 240V systems, and 115% for 277 and 480V systems.

9. All SPDs shall be equipped with a monitoring system which shall include a visual LCD panel display providing information on unit status and phase loss/protection loss.

10. The SPD shall come standard with not less than a Fifteen Year Warranty, and the warranty shall include unlimited free replacements of the unit if destroyed by lightning or other transients during the warranty period. Special or optional warranties in excess of the unit's standard warranty for purposes of this bid are not acceptable.

11. The suppressor shall have at minimum a Nema 4 enclosure.

12. Because of space limitation, the enclosure shall not exceed 3.0” D x 4.5” W x 13.0” H to allow close-to-the load installation on flush mount panels and between adjacent panelboards. For recessed panels, add “-FMP” to model number.

13. Follow the SPD manufacturer’s recommended installation practice as outlined in the equipment installation manual. The electrical contractor shall ensure that all neutral conductors are bonded to the system ground at the service entrance or the serving isolation transformer prior to installation of the associated SPD.

14. All service entrance panel SPDs shall be Transient Protection Design. No unit will be accepted as an “approved equal” unless it meets the warranty, strength, safety features, IEEE let-through levels, modes of discrete suppression circuitry, fusing, and all other requirements of this specification.

15. Submittals: Provide detailed specification sheets showing voltage, physical size, IEEE let through voltage for each waveform listed, UL1449 latest revision, latest edition, suppressed voltage ratings, dimensions showing construction, lifting and support points, enclosure details, per mode and per phase peak surge current, modes of discrete suppression circuitry, warranty period and replacement terms, conductor size, conductor type and lead length. Provide actual let through voltage test data in the form of oscillograph results for the ANSI/IEEE C62.41-1991 Category C1 (combination wave) and A1 (ring wave) tested in accordance with ANSI/IEEE C62.45.

**C. DISTRIBUTION PANEL PROTECTION**

1. SPD(s) for this location shall be as indicated on project drawings. SPD shall be separate from panelboard. Integral SPD shall not be acceptable**.** SPDs shall be certified to UL 60384-14 (formerly UL 1283), and UL1449 Fifth Ed. Type 1 or 2 for use in Type 1 and Type 2 locations.

2. Electrical panels shall be protected by a Transient Protection Design or approved equal panel mounted SPD, model TPX3Y480-E-150 for 277/480 (4W+G) volt panels, TPX-3Y208-E-150 for 120/208 (4W+G) volt panels and TPX-1S240-E-150 for 120/240 (3W+G) volt split phase panels:

3. The manufacturer shall provide written specifications showing let-through voltage of the unit with six inches of lead length (at the module or at the lug data is not acceptable as it does not represent true "as installed" performance) pursuant to ANSI/IEEE C62.41 and C62.45, 1991, category A1 ring wave, 180 degree phase angle, category B3/C1 and C3 impulse and UL suppressed voltage ratings, 90 degree phase angle, positive polarity, measurements in peak voltage from the zero reference, all dynamic tests except N-G, which shall be no higher than:

ANSI/IEEE C62.41-1991 Measured Limiting Voltage

A1 Ring Wave (2kV, 67A) Tested at 180 degree phase angle

Voltage (Voltage Code) L-N

120/240 (1S240) 58V

120/208 (3Y208) 58V

277/480 (3Y480) 58V

A3 Ring wave (6kV, 200A) Tested at 180 degree phase angle

Voltage (Voltage Code) L-N

120/240 (1S240) 155V

120/208 (3Y208) 155V

277/480 (3Y480) 155V

B3/C1 Impulse (6kV, 3kA) Tested at 90 degree phase angle

Voltage (Voltage Code) L-N L-G L-L N-G

120/240 (1S240) 552V 531V 1150V 568V

120/208 (3Y208) 552V 531V 1150V 568V

277/480 (3Y480) 950V 950V 1860V 973V

UL Suppressed Voltage Ratings – UL Fourth Edition

Voltage (Voltage Code) L-N L-G L-L N-G

120/240 (1S240) 600V 600V 1200V 600V

120/208 (3Y208) 600V 600V 1200V 600V

277/480 (3Y480) 1000V 1000V 2000V 1000V

4. The SPD shall be capable of attenuating internally generated ringing type transients and noise, which are present in every facility and shall have a transient filter supported by a specification sheet which lists the former 1991 IEEE A1 Ring Wave let-through levels no higher than those set forth above.

5. The unit shall have a peak surge current of no less than 150kA/phase, 75kA/mode, 8 X 20 us waveform, single impulse.

6. The SPD shall have component level fusing intended for use without need for external or supplemental overcurrent controls. Every Metal Oxide Varistor suppression component of every mode, including N-G, shall be protected by internal thermal over temperature controls. Overcurrent fusing that limits the listed peak surge current of the SPD is not acceptable. SPDs relying upon external or supplementary installed safety disconnectors are not acceptable. Fusing shall be present in every mode, including Neutral-to-Ground. The fusing shall be capable of interrupting up to a 100kA symmetrical fault current with 600VAC applied, and the 100kA rating shall be on the listing label on the unit.

7. The TVSS shall protect all modes L-G, L-N, L-L, and N-G, for SPLIT PHASE and WYE systems have discrete suppression circuitry in L-G, L-N and N-G, and have bidirectional, positive and negative impulse protection. Line-to-neutral-to-ground protection is not acceptable where line-to-ground is specified, and accordingly reduced mode units with suppression circuitry built into only 4 modes are not acceptable.

8. The maximum continuous operating voltage (MCOV) of all components shall not be less than 125% for a 120V system and 120% for 220 and 240V systems, and 115% for 277 and 480V systems.

9. All SPDs shall be equipped with a monitoring system which shall include a visual LCD panel display providing information on unit status and phase loss/protection loss.

10. The SPD shall come standard with not less than a Fifteen Year Warranty, and the warranty shall include unlimited free replacements of the unit if destroyed by lightning or other transients during the warranty period. Special or optional warranties in excess of the unit's standard warranty for purposes of this bid are not acceptable.

11. The suppressor shall have at minimum a Nema 4 enclosure.

12. Because of space limitation, the enclosure shall not exceed 3.0” D x 4.5” W x 13.0” H to allow close-to-the load installation on flush mount panels and between adjacent panelboards. For recessed panels, add “-FMP” to model number.

13. Follow the SPD manufacturer’s recommended installation practice as outlined in the equipment installation manual. The electrical contractor shall ensure that all neutral conductors are bonded to the system ground at the service entrance or the serving isolation transformer prior to installation of the associated SPD.

14. All distribution panel SPDs shall be Transient Protection Design or approved equal. No unit will be accepted as an “approved equal” unless it meets the warranty, strength, safety features, IEEE let-through levels, modes of discrete suppression circuitry, fusing, and all other requirements of this specification.

15. Submittals: Provide detailed specification sheets showing voltage, physical size, IEEE let through voltage for each waveform listed, UL1449 latest revision, latest edition, suppressed voltage ratings, dimensions showing construction, lifting and support points, enclosure details, per mode and per phase peak surge current, modes of discrete suppression circuitry, warranty period and replacement terms, conductor size, conductor type and lead length. Provide actual let through voltage test data in the form of oscillograph results for the ANSI/IEEE C62.41-1991 Category C1 (combination wave) and A1 (ring wave) tested in accordance with ANSI/IEEE C62.45.

**D. LIGHTING AND SUBPANEL PROTECTION**

1. SPD(s) for this location shall be as indicated on project drawings. SPD shall be separate from panelboard. Integral SPD shall not be acceptable. SPDs shall be certified to UL 1283 and UL1449 Fifth Edition Type 1 and Type 2 for use in Type 1 and Type 2 locations.

2. Electrical panels shall be protected by a Transient Protection Design or approved equal panel mounted SPD, model TPX3Y480-E-100 for 277/480 (4W+G) volt panels, TPX-3Y208-E-100 for 120/208 (4W+G) volt panels and TPX-1S240-E-100 for 120/240 (3W+G) volt split phase panels. No unit will be accepted as an “approved equal” unless it meets the warranty, strength, safety features, IEEE let-through levels, modes of discrete suppression circuitry, fusing, and all other requirements of this specification.

3. The manufacturer shall provide written specifications showing let-through voltage of the unit with six inches of lead length (at the module or at the lug data is not acceptable as it does not represent true "as installed" performance) pursuant to ANSI/IEEE C62.41 and C62.45, 1991, category A1 ring wave, 180 degree phase angle, category B3/C1 and C3 impulse and UL suppressed voltage ratings, 90 degree phase angle, positive polarity, measurements in peak voltage from the zero reference, all dynamic tests except N-G, which shall be no higher than:

ANSI/IEEE C62.41-1991 Measured Limiting Voltage

A1 Ring Wave (2kV, 67A) Tested at 180 degree phase angle

Voltage (Voltage Code) L-N

120/240 (1S240) 58V

120/208 (3Y208) 58V

277/480 (3Y480) 58V

A3 Ring wave (6kV, 200A) Tested at 180 degree phase angle

Voltage (Voltage Code) L-N

120/240 (1S240) 155V

120/208 (3Y208) 155V

277/480 (3Y480) 155V

B3/C1 Impulse (6kV, 3kA) Tested at 90 degree phase angle

Voltage (Voltage Code) L-N L-G L-L N-G

120/240 (1S240) 552V 531V 1150V 568V

120/208 (3Y208) 552V 531V 1150V 568V

277/480 (3Y480) 950V 950V 1860V 973V

UL Suppressed Voltage Ratings – UL Fourth Edition

Voltage (Voltage Code) L-N L-G L-L N-G

120/240 (1S240) 600V 600V 1200V 600V

120/208 (3Y208) 600V 600V 1200V 600V

277/480 (3Y480) 1000V 1000V 2000V 1000V

4. The SPD shall be capable of attenuating internally generated ringing type transients and noise, which are present in every facility and shall have a transient filter supported by a specification sheet which lists the former IEEE A1 Ring Wave let-through levels no higher than those set forth above.

5. The unit shall have a peak surge current of no less than 100kA/phase, 50kA/mode, 8 X 20 us waveform, single impulse, verified by third party test reports. National Electrical Manufacturer Association (prior to repeal NEMA LS-1 1992 Peak Current Testing)

6. The SPD shall have component level fusing intended for use without need for external or supplemental overcurrent controls. Every Metal Oxide Varistor suppression component of every mode, including N-G, shall be protected by internal thermal over temperature controls. Overcurrent fusing that limits the listed peak surge current of the SPD is not acceptable. SPDs relying upon external or supplementary installed safety disconnectors are not acceptable. Fusing shall be present in every mode, including Neutral-to-Ground. The fusing shall be capable of interrupting up to a 100kA symmetrical fault current with 600VAC applied, and the 100kA rating shall be on the listing label on the unit.

7. The TVSS shall protect all modes L-G, L-N, L-L, and N-G, for SPLIT PHASE and WYE systems have discrete suppression circuitry in L-G, L-N and N-G, and have bidirectional, positive and negative impulse protection. Line-to-neutral-to-ground protection is not acceptable where line-to-ground is specified, and accordingly reduced mode units with suppression circuitry built into only 4 modes are not acceptable.

8. The maximum continuous operating voltage (MCOV) of all components shall not be less than 125% for a 120V system and 120% for 220 and 240V systems, and 115% for 277 and 480V systems.

9. All SPDs shall be equipped with a monitoring system which shall include a visual LCD panel display providing information on unit status and phase loss/protection loss.

10. The SPD shall come standard with not less than a Fifteen Year Warranty, and the warranty shall include unlimited free replacements of the unit if destroyed by lightning or other transients during the warranty period. Special or optional warranties in excess of the unit's standard warranty for purposes of this bid are not acceptable.

11. The suppressor shall have at minimum a Nema 4 enclosure.

12. Because of space limitation, the enclosure shall not exceed 3.0” D x 4.5” W x 9.0” H to allow close-to-the load installation on flush mount panels and between adjacent panelboards. For recessed panels, add “-FMP” to model number.

13. Follow the SPD manufacturer’s recommended installation practice as outlined in the equipment installation manual. The electrical contractor shall ensure that all neutral conductors are bonded to the system ground at the service entrance or the serving isolation transformer prior to installation of the associated SPD.

14. Submittals: Provide detailed specification sheets showing voltage, physical size, IEEE let through voltage for each waveform listed, UL1449 latest revision, latest edition, suppressed voltage ratings, dimensions showing construction, lifting and support points, enclosure details, per mode and per phase peak surge current, modes of discrete suppression circuitry, warranty period and replacement terms, conductor size, conductor type and lead length. Provide actual let through voltage test data in the form of oscillograph results for the ANSI/IEEE C62.41-1991 Category C1 (combination wave) and A1 (ring wave) tested in accordance with ANSI/IEEE C62.45.

**PART 3 - EXECUTION**

* 1. **INSTALLATION**

1. Install the SPDs with the conductors as short and straight as practically possible.
2. Follow the SPD manufacturer’s recommended installation practice as outlined in the equipment installation sheet. The electrical contractor shall ensure that all neutral conductors are bonded to the system ground at the service entrance or the serving isolation transformer prior to installation of the associated SPD.
3. Main service entrance SPDs shall be installed on 30 to 60 amp dedicated breakers, or, where indicated, shall be installed on a non-fused disconnect switch that meets or exceeds the fault current rating of the switchgear.
4. Distribution panel and motor control center units shall be installed on 30 to 60 amp dedicated circuit breakers, or, where indicated, shall be wired directly to the main lugs or feed through lugs, or wired directly to the bus bars.
5. Branch panel SPDs fed from step-down transformers or located downstream of distribution panels shall be installed on 20 to 30 amp dedicated circuit breakers, or, where indicated, shall be wired directly to the main lugs or feed through lugs, or wired directly to the bus bars.
6. Install SPDs with conductors between suppressor and points of connection as short and straight as possible and adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless permitted by manufacturer. Do not extend the unit’s lead length unless necessary. If necessary, use crimped connectors and splices only. Wire nuts are unacceptable.
7. The installing contractor shall comply with all applicable codes.
8. For installation questions, technical support and ordering information phone 717-436-5380 or 888-281-7856.

**END OF SECTION 1 2024**