SECTION 26 43 13 - SURGE PROTECTION DEVICES

1. GENERAL
   1. RELATED DOCUMENTS
      1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
   2. SUMMARY
      1. Section includes field-mounted (installed external to electrical equipment) SPDs for low-voltage (120 to 600 V) power distribution and control equipment.
      2. The SPD for Service Entrance Section application shall provide TOV protection in addition to surge protection.
      3. The requirements of this specification section supersede those in other specification sections.
   3. DEFINITIONS
      1. Inominal: Nominal discharge current.
      2. MCOV: Maximum continuous operating voltage.
      3. Mode(s), also Modes of Protection: The pair of electrical connections where the VPR applies.
      4. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.
      5. OCPD: Overcurrent protective device.
      6. SCCR: Short-circuit current rating.
      7. SPD: Surge protective device.
      8. TOV: Temporary overvoltage.
      9. VPR: Voltage protection rating.
   4. ACTION SUBMITTALS
      1. Products will only be considered for approval if the request is accompanied with the appropriate SPD SPECIFIED PERFORMANCE COMPLIANCE FORM attachment(s), for each unit, at the conclusion of this specification, fully executed with the required supporting documentation and signed by an authorized company representative. For any approval request to be considered complete, the required supporting documentation shall be provided for each model to be supplied. (Information shall be organized in tabular content according to the numerical identifier shown on the right side of each Performance Specification section.)
      2. 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. Documentation of Performance
         1. Provide a copy of peak surge current test report, certifying that the SPD has been tested to, and survives, the peak surge current rating as specified.
         2. Provide a copy of repetitive impulse test report, certifying that the SPD has been tested to, and survives, the number of repetitive impulses as specified.
         3. Provide a copy of TOV performance testing.
      4. Method and Equipment to be Used for Installed Testing (For Spec Section 3.2)
   5. INFORMATIONAL SUBMITTALS
      1. Field quality-control reports.
      2. Sample Warranty. For manufacturer’s special warranty.
   6. CLOSEOUT SUBMITTALS
      1. Maintenance Data: For SPDs to include in maintenance manuals.
      2. Copy of installed test report.
   7. WARRANTY
      1. Manufacturer's Warranty: Manufacturer agrees to repair or replace SPDs that fail in materials or workmanship within specified warranty period.
         1. Warranty period for Service Entrance SPD
            1. Twenty (20) years from date of Substantial Completion.
         2. Warranty period for Switchboard and Panelboard SPD
            1. Without upstream Service Entrance SPD as per this specification: Fifteen (15) years from date of Substantial Completion.
            2. With upstream Service Entrance SPD as per this specification: Twenty (20) years from date of Substantial Completion.
2. – PRODUCTS
   1. GENERAL SPD REQUIREMENTS
      1. SPD and Accessories. Listed and labeled as defined by NFPA 70, by a qualified testing agency, and marked for intended location and application.
      2. Comply with NFPA 70.
      3. Comply with UL 1449.
      4. MCOV of the SPD shall be the nominal system voltage.
   2. SERVICE ENTRANCE SUPPRESSOR
      1. Manufacturer: Subject to compliance with requirements, provide product by one of the following:
         1. Current Technology SL3 Series (Basis of Design).
         2. Engineer Approved Equal.
            1. Other manufacturers wishing to have specific products evaluated for equivalence shall provide, for each unit, ATTACHMENT 1 – SERVICE ENTRANCE SPD SPECIFIED PERFORMANCE COMPLIANCE FORM, fully executed with the required documentation. For any approval request to be considered complete, the required supporting documentation shall be provided for each model to be supplied. (Information shall be organized in tabular content according to the numerical identifier shown on the right side of each Performance Specification section.) The request for approval shall be signed by an authorized company representative and submitted no less than 10 days prior to the bid date.
            2. Failure to provide the required documentation, for each model to be supplied, no less than 10 days prior to the bid date will disqualify products from consideration for this project.
      2. SPDs: Comply with UL 1449 3rd Edition, Type 1.
         1. SPDs with the following features and accessories.
            1. Mounted external to electrical equipment.
            2. Integral disconnect switch, where indicated on the drawings.
            3. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
            4. SPD monitoring shall include:

Indicator lights which display protection status.

Audible alarm with silence switch.

Form C contacts rated at 5 A and 250 V, one normally open and one normally closed for remote monitoring of protection status.

Component tracking and visual indication of percent protection remaining.

Surge counter which measures, discriminates between and indicates the level of surges.

Low level surge: 100 A to 500 A

Medium level surge: 500 A to 3000A.

High level surge: > 3000 A.

Time/date stamp, duration and magnitude of the following events:

Sag

Swell

Voltage drop-outs

Power outages

THD

Frequency excursions

Volts (RMS, per phase)

* + - * 1. Information from monitoring shall be available through the facility network.

Via ModBus.

Via Ethernet.

* + - * 1. Integral Test Point with test data from factory provided for comparison. Information is provided in the form of suppressed voltage rating given by portable test set and written on a Diagnostic Signature Card which will be provided with the device. See section 3.2.
    1. Comply with UL 1283.
    2. Performance Ratings
       1. Peak Surge Current Rating
          1. The peak surge current withstand rating per mode shall be as indicated in the table below, for the respective Service Entrance current rating.
          2. The peak surge current rating shall the surge current at which the SPD was tested and which the SPD survived—with less than a 10% degradation in VPR. Testing documentation shall be provided. (Due to present industry testing limitations, surge currents ratings greater than 200 kA will be tested at 200 kA.)
          3. Peak surge current ratings which are the arithmetic sum of the ratings of individual MOVs in a given mode are not acceptable.
       2. Repetitive Impulse Rating
          1. The minimum repetitive impulse capacity (10 kA and 20 kV) of the SPD per mode shall not be less than as indicated in the table below, for the respective Service Entrance current rating.
          2. The minimum repetitive impulse capacity shall be the number of impulses at which the SPD was tested and which the SPD survived—with less than a 10% degradation in VPR. Testing documentation shall be provided.
          3. Minimum repetitive ratings which are derived by calculations are not acceptable.

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| Product Application and Performance Rating Chart | | | | | | |
| Service Entrance  Current Rating | Surge Current Rating  per Mode | | Surge Current Rating  per Phase | | Repetitive Impulse Rating per Mode | |
| Single Service Entrance | Multiple Service Entrances\* | Single Service Entrance | Multiple Service Entrances\* | Single Service Entrance | Multiple Service Entrances\* |
| 3000 A (and above) | 300 kA | 200 kA | 600 kA | 400 kA | 17,000 | 15,000 |
| 2500 A | 250 kA | 200 kA | 500 kA | 400 kA | 16,000 | 15,000 |
| 2000 A | 200 kA | 150 kA | 400 kA | 300 kA | 15,000 | 14,500 |
| 1600 A | 150 kA | 125 kA | 300 kA | 250 kA | 14,500 | 14,000 |
| 1000 A - 1200 A | 125 kA | 125 kA | 250 kA | 250 kA | 14,000 | 14,000 |
| 800 A | 100 kA | 80 kA | 200 kA | 160 kA | 14,000 | 12,000 |
| 400 A - 600 A | 80 kA | 50 kA | 160 kA | 100 kA | 12,000 | 10,000 |
| 200 A | 50 kA | 50 kA | 100 kA | 100 kA | 10,000 | 10,000 |

\*Multiple Service Entrances to be understood as one feed from a utility substation feeding multiple (i.e., more than one) utility transformers and/or utility meters for their respective Service Entrance sections.

* + - 1. Overvoltage Performance
         1. The SPD shall be able to prevent common temporary overvoltages and high impedance faults from damaging the MOVs, increasing their longevity and ability to protect the critical load.
         2. For limited and intermediate current TOVs (as specified in UL 1449 article 39.3 and 39.4) of 30 cycles, the voltage to the MOVs shall be reduced from 173% of nominal voltage, at the intermediate currents listed to the values below.

30 A: 140%

100 A: 150%

500 A: 160%

1000 A: 160%

* + - * 1. The SPD shall be able to withstand multiple TOVs without damage to the MOVs by shunting current away from the MOVs during the overvoltage. SPD must have the ability to withstand greater than 100 TOVs with a source current of 30A, duration of 30 cycles, with 10 seconds between TOV events. Testing documentation shall be provided.
    1. Protection modes and UL 1449 VPR for the applicable modes of grounded WYE/delta and high leg delta circuits shall not exceed the following.
       1. For 480Y/277 V and 480 V delta systems:
          1. Line to Neutral: 1200 V
          2. Line to Ground: 1200 V
          3. Neutral to Ground: 1000 V
          4. Line to Line: 2000 V
       2. For 208Y/120 V and 208 V delta systems:
          1. Line to Neutral: 700 V
          2. Line to Ground: 700 V
          3. Neutral to Ground: 700 V
          4. Line-to-Line 1200 V
    2. SCCR: Equal to or exceed 200 kA.
    3. Inominal rating: 20 kA.
  1. SWITCHBOARD AND PANELBOARD SUPPRESSOR
     1. Manufacturer: Subject to compliance with requirements, provide product by one of the following:
        1. Current Technology TG3 Series (Basis of Design).
        2. Engineer Approved Equal.
           1. Other manufacturers wishing to have specific products evaluated for equivalence shall provide, for each unit, ATTACHMENT 2 – SWITCHBOARD AND PANELBOARD SPD SPECIFIED PERFORMANCE COMPLIANCE FORM, fully executed with the required documentation. For any approval request to be considered complete, the required supporting documentation shall be provided for each model to be supplied. (Information shall be organized in tabular content according to the numerical identifier shown on the right side of each Performance Specification section.) The request for approval shall be signed by an authorized company representative and submitted no less than 10 days prior to the bid date.
           2. Failure to provide the required documentation, for each model to be supplied, no less than 10 days prior to the bid date will disqualify products from consideration for this project.
     2. SPDs: Comply with UL 1449 3rd Edition, Type 1.
        1. SPDs with the following features and accessories.
           1. Mounted external to electrical equipment.
           2. Integral disconnect switch, where indicated on the drawings.
           3. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
           4. SPD monitoring shall include:

Indicator lights which display protection status.

Audible alarm with silence switch.

Form C contacts rated at 5 A and 250 V, one normally open and one normally closed for remote monitoring of protection status.

Component tracking and visual indication of percent protection remaining.

Surge counter which measures, discriminates between and indicates the level of surges.

Low level surge: 100 A to 500 A

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High level surge: > 3000 A.

Time/date stamp, duration and magnitude of the following events:

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Voltage drop-outs

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THD

Frequency excursions

Volts (RMS, per phase)

* + - * 1. Information from monitoring shall be available through the facility network.

Via ModBus.

Via Ethernet.

* + - * 1. Integral Test Point with test data from factory provided for comparison. Information is provided in the form of suppressed voltage rating given by portable test set and written on a Diagnostic Signature Card which will be provided with the device. See section 3.2.
    1. Comply with UL 1283.
    2. Performance Ratings
       1. Peak Surge Current Rating
          1. The peak surge current withstand rating per mode shall be as indicated in the table below, for the respective Service Entrance current rating.
          2. The peak surge current rating shall the surge current at which the SPD was tested and which the SPD survived—with less than a 10% degradation in VPR. Testing documentation shall be provided. (Due to present industry testing limitations, surge currents ratings greater than 200 kA will be tested at 200 kA.)
          3. Peak surge current ratings which are the arithmetic sum of the ratings of individual MOVs in a given mode are not acceptable.
       2. Repetitive Impulse Rating
          1. The minimum repetitive impulse capacity (10 kA and 20 kV) of the SPD per mode shall not be less than as indicated in the table below, for the respective Service Entrance current rating.
          2. The minimum repetitive impulse capacity shall be the number of impulses at which the SPD was tested and which the SPD survived—with less than a 10% degradation in VPR. Testing documentation shall be provided.
          3. Minimum repetitive ratings which are derived by calculations are not acceptable.

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| Product Application and Performance Rating Chart | | | | | | |
| Service Entrance  Current Rating | Surge Current Rating  per Mode | | Surge Current Rating  per Phase | | Repetitive Impulse Rating per Mode | |
| With No Upstream SPD | With Upstream SPD | With No Upstream SPD | With Upstream SPD | With No Upstream SPD | With Upstream SPD |
| 3000 A (and above) | 300 kA | 150 kA | 600 kA | 300 kA | 11,000 | 8,000 |
| 2500 A | 250 kA | 125 kA | 500 kA | 250 kA | 10,000 | 7,500 |
| 2000 A | 200 kA | 100 kA | 400 kA | 200 kA | 9,000 | 7,000 |
| 1600 A | 150 kA | 80 kA | 300 kA | 160 kA | 8,000 | 6,000 |
| 1000 A - 1200 A | 125 kA | 80 kA | 250 kA | 160 kA | 7,500 | 6,000 |
| 800 A | 100 kA | 50 kA | 200 kA | 100 kA | 7,000 | 5,000 |
| 400 A - 600 A | 80 kA | 50 kA | 160 kA | 100 kA | 6,000 | 5,000 |
| 200 A | 50 kA | 50 kA | 100 kA | 100 kA | 5,000 | 5,000 |

* + 1. Protection modes and UL 1449 VPR for the applicable modes of grounded WYE/delta and high leg delta circuits shall not exceed the following.
       1. For 480Y/277 V and 480 V delta systems:
          1. Line to Neutral: 1200 V
          2. Line to Ground: 1200 V
          3. Neutral to Ground: 1000 V
          4. Line to Line: 2000 V
       2. For 208Y/120 V and 208 V delta systems:
          1. Line to Neutral: 700 V
          2. Line to Ground: 700 V
          3. Neutral to Ground: 700 V
          4. Line-to-Line 1200 V
    2. SCCR: Equal to or exceed 200 kA.
    3. Inominal rating: 20 kA.

1. – EXECUTION
   1. INSTALLATION
      1. Comply with NECA 1.
      2. Install SPD external to electrical equipment.
      3. Install an OCPD or disconnect if required to comply with the UL listing of the SPD.
      4. Install SPDs with conductors between suppressor and points of attachment 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 specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
      5. Use crimped connectors and splices only. Wire nuts are not acceptable.
      6. Utilize the following conductors for connection of the device to the source, for all phase conductors, neutral (if applicable) and ground conductors.
         1. Service Entrance Suppressor
            1. For Service Entrances 1200 A and above, utilize #2 AWG conductors.
            2. For Service Entrances 400 A - 1000 A, utilize Current Technology HPI-6Y low impedance cable assembly.
            3. For Service Entrances 200 A, utilize Current Technology HPI-10Y low impedance cable assembly.
         2. Switchboard and Panelboard Suppressor
            1. For Switchboards, 1200 A and above, utilize #2 AWG conductors.
            2. For Switchboards and Panelboards 400 A - 1000 A, utilize Current Technology HPI-6Y low impedance cable assembly.
            3. For Switchboards and Panelboards 200 A, utilize Current Technology HPI-10Y low impedance cable assembly.
   2. FIELD QUALITY CONTROL
      1. Perform the following 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. Testing: Perform the following field tests and inspections and prepare test reports:
            1. After installation of surge protection devices, but before electrical circuitry has been energized, test for compliance with requirements.
            2. Utilize a portable test set and test devices to confirm:

The suppressed voltage rating of the installed unit is within 10% of the suppressed voltage rating of the device when tested prior to shipment from the factory.

The SPD is properly installed.

The presence of an X0 bond at the most proximal upstream separately derived source.

* + 1. An SPD will be considered defective if it does not pass tests and inspections.
    2. Repeat tests and inspection after replacement or repair of defective units.
    3. Prepare test-result and inspection reports and submit them to the project engineer.
  1. STARTUP SERVICE
     1. Complete startup checks according to manufacturer’s written instructions.
     2. 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 completed.
     3. Energize SPDs after power system has been energized, stabilized, and tested.
  2. DEMONSTRATION
     1. Engage a factory authorized service representative to train Owner’s maintenance personnel to operate and maintain SPDs.

END OF SECTION 26 43 14

**ATTACHMENT 1 – SERVICE ENTRANCE SPD SPECIFIED PERFORMANCE COMPLIANCE FORM**

**Required for all requests for approval for each model to be supplied.**

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| PERFORMANCE SPECIFICATION | SPEC. SECTION REFERENCE | SPECIFICATION REQUIREMENT | PROPOSED | CONFIRMING DOCUMENTATION REQUIRED | COMPLANCE  VERIFIED?  YES / NO | TAB |
| Product | 2.2 A. 1. | Current Technology SL3 |  | Product Data Sheet |  | 1 |
| Warranty | 1.7 A. 1. | 20 Years |  | Published Warranty Certificate |  | 2 |
| Tested Surge Current Capacity | 2.2 D. 1. | As Per Drawings & Chart in Specification |  | Independent Test Report |  | 3 |
| Repetitive Impulse Capacity | 2.2 D. 2. | As Per Drawings & Chart in Specification |  | Repetitive Test Report Summary |  | 4 |
| Overvoltage Protection | 2.2 D. 3. | As Per Specification |  | Test Documentation Confirming Compliance |  | 5 |
| Voltage Protection Rating(s) | 2.2 E. 2. | 120 V Systems:  L-N: 700 V,  L-G: 700 V,  N-G: 700 V,  L-L: 1200 V | L-N: ­­­­ \_\_\_\_\_\_  L-G: ­­­­\_\_\_\_\_\_  N-G: \_\_\_\_\_\_  L-L: \_\_\_\_\_\_ | Page(s) from UL File Showing Voltage Protection Ratings |  | 6 |
| 2.2 E. 1. | 277 V Systems:  L-N: 1200 V,  L-G: 1200 V,  N-G: 1000 V,  L-L: 2000 V | L-N: ­­­­ \_\_\_\_\_\_  L-G: ­­­­\_\_\_\_\_\_  N-G: \_\_\_\_\_\_  L-L: \_\_\_\_\_\_ |  |
| Integrated Monitoring System | 2.2 B. 1. d. 4) | Indication of % Protection |  | Product Data Sheet for Monitoring System |  | 7 |
| 2.2 B. 1. d. 5) | Count & Time & Date of:  Surges -Low (100-500A)  -Med. (500-3000A)  -High (Over 3000A) |  |  |
| 2.2 B. 1. d. 6) | Count of, and Time and Data Stamp and Magnitude and Duration Recording for:  Sags  Swells  Voltage drop-out Power outages  THD excursions  Frequency excursions  Voltage excursions  (RMS & per phase) |  |  |
| Facility Network-Based Monitoring System | 2.2 B. 1. e. | Information available through the facility network |  | Print Screen Copy of System Home Page |  | 8 |
| Integral Test Port | 2.2 B. 1. f. | Integral Interface with Portable Test Set/Surge Generator |  | Product Data Sheet Showing Test Port Option |  | 9 |
| Installed/Field Test Service after Installation | 3.2 A. 4. | Confirm Proper Installation and Wiring to SPD and Provide Benchmark of Initial Performance |  | Provide Data Sheet(s) for Equipment Used to Perform Installed Testing |  |

**Signature confirming the validity of the information given above:**

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**ATTACHMENT 2 – SWITCHBOARD & PANELBOARD SPD SPECIFIED PERFORMANCE COMPLIANCE FORM**

**Required for all requests for approval for each model to be supplied.**

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| PERFORMANCE SPECIFICATION | SPEC. SECTION REFERENCE | SPECIFICATION REQUIREMENT | PROPOSED | CONFIRMING DOCUMENTATION REQUIRED | COMPLANCE  VERIFIED?  YES / NO | TAB |
| Product | 2.3 A. 1. | Current Technology TG3 |  | Product Data Sheet |  | 1 |
| Warranty | 1.7 A. 2. | 15 Years  (20 Years w/SL3 Upstream) |  | Published Warranty Certificate |  | 2 |
| Tested Surge Current Capacity | 2.3 D. 1. | As Per Drawings & Chart in Specification |  | Independent Test Report |  | 3 |
| Repetitive Impulse Capacity | 2.3 D. 2. | As Per Drawings & Chart in Specification |  | Repetitive Test Report Summary |  | 4 |
| Voltage Protection Rating(s) | 2.3 E. 2. | 120 V Systems:  L-N: 700 V,  L-G: 700 V,  N-G: 700 V,  L-L: 1200 V | L-N: ­­­­ \_\_\_\_\_\_  L-G: ­­­­\_\_\_\_\_\_  N-G: \_\_\_\_\_\_  L-L: \_\_\_\_\_\_ | Page(s) from UL File Showing Voltage Protection Ratings |  | 5 |
| 2.3 E. 1. | 277 V Systems:  L-N: 1200 V,  L-G: 1200 V,  N-G: 1000 V,  L-L: 2000 V | L-N: ­­­­ \_\_\_\_\_\_  L-G: ­­­­\_\_\_\_\_\_  N-G: \_\_\_\_\_\_  L-L: \_\_\_\_\_\_ |  |
| Integrated Monitoring System | 2.3 B. 1. d. 4) | Indication of % Protection |  | Product Data Sheet for Monitoring System |  | 6 |
| 2.3 B. 1. d. 5) | Count & Time & Date of:  Surges -Low (100-500A)  -Med. (500-3000A)  -High (Over 3000A) |  |  |
| 2.3 B. 1. d. 6) | Count of, and Time and Data Stamp and Magnitude and Duration Recording for:  Sags  Swells  Voltage drop-out Power outages  THD excursions  Frequency excursions  Voltage excursions  (RMS & per phase) |  |  |
| Facility Network-Based Monitoring System | 2.3 B. 1. e. | Information available through the facility network |  | Print Screen Copy of System Home Page |  | 7 |
| Integral Test Port | 2.3 B. 1. f. | Integral Interface with Portable Test Set/Surge Generator |  | Product Data Sheet Showing Test Port Option |  | 8 |
| Installed/Field Test Service after Installation | 3.2 A. 4. | Confirm Proper Installation and Wiring to SPD and Provide Benchmark of Initial Performance |  | Provide Data Sheet(s) for Equipment Used to Perform Installed Testing |  |

**Signature confirming the validity of the information given above:**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**