SECTION 26 43 00

~~~ PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
ARCHITECT OF RECORD/ENGINEER OF RECORD IS RESPONSIBLE FOR REVIEWING THIS SPECIFICATION SECTION IN DETAIL FOR COORDINATION WITH THE PROJECT SCOPE OF WORK.

ALL "PROJECT NOTE" TEXT IS TO BE REMOVED FOLLOWING REVIEW OF THE CONTENT OF EACH NOTE BY THE ARCHITECT OF RECORD/ENGINEER OF RECORD.

EDIT THE DOCUMENT FOOTER TO INCLUDE THE PROJECT NAME AND NUMBER.

EDIT THE DOCUMENT HEADER TO INDICATE THE ARCHITECT OF RECORD PROJECT ISSUE" DATE. THE "CPS CONTROL" DATE SHOULD NOT BE EDITED.

ANY MODIFICATIONS TO THE TECHNICAL STANDARDS IN THIS SECTION - INCLUDING THE REMOVAL OR ADDITION OF MANUFACTURERS - MUST BE APPROVED BY CPS.

REQUESTS FOR MODIFICATION ARE TO BE SUBMITTED TO THE DESIGN MANAGER DURING THE DESIGN PHASE FOR REVIEW AND APPROVAL.

~~~ END OF PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~

SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

PART 2 -
~~~ PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
ADJUST SELECTION FOR SPD ITEMS TO BE INCLUDED IN SCOPE OF PROJECT.

~~~ END OF PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~

2.01 SECTION INCLUDES

A. Surge protective devices for service entrance locations.

B. Surge protective devices for distribution locations.

C. Surge protective devices for branch panelboard locations.

2.02 ABBREVIATIONS AND ACRONYMS

A. EMI/RFI: Electromagnetic Interference/Radio Frequency Interference.

B. SPD: Surge Protective Device.

2.03 REFERENCE STANDARDS

A. City of Chicago Building Code - Municipal Code of Chicago for the Building Industry; 2017.

B. Chicago Electrical Code - Municipal Code of the City of Chicago, Building/Electrical Code Requirements; 2018.

C. IEEE 1100 - IEEE Recommended Practice for Powering and Grounding Sensitive Electronic Equipment; 2005.

D. IEEE C62.41.1 - IEEE Standard Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits; 2002 (Reaffirmed 2008).

E. IEEE C62.45 - Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits; 2002.

F. MIL-STD-220 - Method of Insertion Loss Measurement; Revision C, 2009.

G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

H. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2016.

I. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2017.

J. UL 1283 - Standard for Electromagnetic Interference Filters; Current Edition, Including All Revisions.

K. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

L. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

2.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate size and location of overcurrent device compatible with the actual surge protective device and location to be installed. Notify Architect/Engineer of Record of any conflicts or deviations from the contract documents to obtain direction prior to ordering equipment.

B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Board's Representative or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify Architect/Engineer of Record and Board's Representative not less than seven (7) days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's/Engineer of Record and Board's Representative written permission.

2.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Include detailed component information, voltage, surge current ratings, repetitive surge current capacity, voltage protection rating (VPR) for all protection modes, maximum continuous operating voltage (MCOV), nominal discharge current (I-n), short circuit current rating (SCCR), connection means including any required external overcurrent protection, enclosure ratings, outline and support point dimensions, weight, service condition requirements, and installed features.
1. SPDs with EMI/RFI filter: Include noise attenuation performance.

C. Shop Drawings: Include wiring diagrams showing all factory and field connections with wire and circuit breaker/fuse sizes.

D. Certificates: Manufacturer's documentation of listing for compliance with the following standards:
   1. UL 1449.
   2. UL 1283 (for Type 2 SPDs).

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

F. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Operation and Maintenance Data: Include information on status indicators and recommended maintenance procedures and intervals.

H. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Board's name and registered with manufacturer.

I. Project Record Documents: Record actual connections and locations of surge protective devices.

2.06 QUALITY ASSURANCE

A. Comply with City of Chicago Building Code.

B. Comply with IEEE 1100, IEEE C62.41.1 and test devices according to IEEE C62.45.

C. Comply with UL 1449

D. Permanently affix surge ratings to the unit.

E. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

F. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.
   1. Manufacturer shall be certified ISO 9001 or 9002.

G. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

H. Electrical Components, Devices, and Accessories: Listed and labeled as defined in Chicago Electrical Code, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

2.07 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in accordance with manufacturer's written instructions.

2.08 FIELD CONDITIONS

A. Deliver SPD in original factory shipping cartons, with manufacturer's labels intact.

B. Store SPD indoors in clean, dry space, protected from weather, with uniform temperature and humidity to prevent condensation. Protect SPD from exposure to dirt, fumes, water, corrosive substances, and physical damage.

C. Handle SPD in accordance with manufacturer's instructions and to avoid damage.

2.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer's Warranty: Provide minimum ten (10) year warranty covering repair or replacement of surge protective devices showing evidence of failure due to defective materials or workmanship.

C. Special Warranty for Cord-Connected, Plug-in Surge Suppressors: Manufacturer's standard form in which manufacturer agrees to repair or replace electronic equipment connected to circuits protected by surge suppressors.

D. Exclude surge protective devices from any clause limiting warranty responsibility for acts of nature, including lightning, stated elsewhere.

E.

~~~ PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
SELECT TYPES OF SPD ITEMS TO BE UTILIZED IN PROJECT SCOPE.
~~~ END OF PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~~

PART 3 - PRODUCTS

3.01 MANUFACTURERS

A. Field-installed, Externally Mounted Surge Protective Devices:
1. ABB/GE: www.geindustrial.com/#sle.
2. Advanced Protection Technologies, Inc (APT): www.aptsurge.com.
3. Current Technology; a brand of Thomas & Betts Power Solutions: www.tnbpowersolutions.com.
4. Schneider Electric; Square D Brand Surgelogic Products: www.surgelogic.com.
5. Cutler-Hammer, Inc.; Eaton Corporation: www.eaton.com.
6. LEA International: www.powerlogics.com/lea-international
7. Liebert Corporation; a division of Emerson: Emerson.com
8. Siemens: www.siemens.com

B. Factory-installed, Internally Mounted Surge Protective Devices:
1. Same as manufacturer of equipment containing surge protective device, to provide a complete listed assembly including SPD.

C. Source Limitations: Furnish surge protective devices produced by a single manufacturer and obtained from a single supplier.

3.02 SURGE PROTECTIVE DEVICES - GENERAL REQUIREMENTS

A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service; listed, classified, and labeled as suitable for the purpose intended; system voltage as indicated on the drawings.

B. Protected Modes:

1. Wye Systems: L-N, L-G, N-G, L-L.
2. Delta Systems: L-G, L-L.
3. Single Split Phase Systems: L-N, L-G, N-G, L-L.
4. High Leg Delta Systems: L-N, L-G, N-G, L-L.

C. UL 1449 Voltage Protection Ratings (VPRs):
1. 208Y/120V System Voltage: Not more than 1,000 V for L-N, L-G, and N-G modes and 1,200 V for L-L mode.
2. 240/120V System Voltage: Not more than 1,000 V for L-N, L-G, and N-G modes and 1,200 V for L-L mode.
3. 480Y/277V System Voltage: Not more than 1,500 V for L-N, L-G, and N-G modes and 2,000 V for L-L mode.
4. 480V Delta System Voltage: Not more than 1,800 V for L-G mode and 3,000 V for L-L mode.

D. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal system voltage.

E. Operating Frequency: 47 to 63 Hertz.

F. Integral OCPD for Suppression: The unit shall require the associated switchgear assembly to have an integral OCPD as a means of disconnecting the suppression/filter system for maintenance and/or test purposes without interruption of power to the facility's distribution system. The OCPD shall be 3-pole for three-phase applications and shall be padlockable.

G. Refer To Section 26 05 53 - Identification for Electrical Systems for labeling requirements.

H.

~~~ PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
MODIFY ENCLOSURE FOR INDOOR AND OUTDOOR INSTALLATIONS.
~~~ END OF PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~

I. Enclosure Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
1. Indoor clean, dry locations: Type 1.
2. Outdoor locations: Type 3R.

J. Mounting for Field-installed, Externally Mounted SPDs: Unless otherwise indicated, as specified for the following locations:
1. Provide surface-mounted SPD where mounted in non-public areas or adjacent to surface-mounted equipment.
2. Provide flush-mounted SPD where mounted in public areas or adjacent to flush-mounted equipment.

K. Equipment Containing Factory-installed, Internally Mounted SPDs: Listed and labeled as a complete assembly including SPD.

L.

~~~ PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
SELECT LOCATIONS OF SPD INSTALLATION. BUSWAYS NOT TYPICAL

~~~ END OF PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~
1. Switchboards: See Section 26 24 13 - Switchboards.
2. Panelboards: See Section 26 24 16 - Panelboards.

3.03 SURGE PROTECTIVE DEVICES FOR SERVICE ENTRANCE LOCATIONS

A. Unless otherwise indicated, provide field-installed, externally mounted or factory-installed, internally mounted SPDs.

B. Type 1 as defined by UL 1449.

C. Short Circuit current rating complying with UL 1449, and matching or exceeding short circuit current value available at the point of connection.

D. Voltage Protection Rating shall be in compliance with test and evaluation procedures described in UL 1449.

E. Provide SPDs utilizing field-replaceable modular or non-modular protection circuits.

F. Surge Current Rating: Not less than 100kA per mode / 200 kA per phase minimum..

G. UL 1449 Nominal Discharge Current (I-n): 20 kA.

H. EMI/RFI Filtering: Provide EMI/RFI filter to attenuate electrical noise; listed as complying with UL 1283 for Type 2 SPDs (UL 1283 listing not available for Type 1 SPDs).
   1. Noise Attenuation: Not less than 40 dB at 100 kHz using MIL-STD-220 insertion loss test method.

I. Fabrication using bolted compression lugs for internal wiring.

J. Integral disconnect switch or circuit breaker.

K. Redundant suppression circuits.

L. Arrangement with copper bus bars and for bolted connections to phase buses, neutral bus, and ground bus.

M. Diagnostics:
   1. Protection Status Monitoring: Provide indicator lights to report the protection for each phase.
   2. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.
   3. Remote Status Monitoring: Provide Form C dry type contacts (normally open and normally closed) for remote annunciation of status.
   4. Surge Counter: Provide surge event counter with manual reset button, surge count retention upon power loss, and six digit LCD display that indicates quantity of surge events.

N. Provide surge rated integral disconnect switch for SPDs not connected to a dedicated circuit breaker or fused switch or not direct bus connected.

O. All primary transient path wiring shall be of copper minimum size as required by the manufacturer but not less than No. 2 AWG, or via bus bar of equivalent capacity to provide equal impedance interconnection between phases. No plug-in modules, components or printed circuit boards shall be used in surge carrying path.

P. Connection Means: Permanently wired, integral to the switchboard or externally mounted adjacent to the switchboard.

Q. VPR (Voltage Protection Rating) under UL 1449, 6kV 3000A testing should fall within:
   1. 120V system 700-800V L-N,L-G, 600-800V N-G and 1000-1,200V L-L.
   2. 277V system 1,000-1,200V L-N, N-G, 1,200V L-G and 1,800-2,000V L-L.
   3. 480V Delta system 1,500-2,500V L-L, L-G

3.04 SURGE PROTECTIVE DEVICES FOR DISTRIBUTION LOCATIONS

A. Unless otherwise indicated, provide field-installed, externally mounted or factory-installed, internally mounted SPDs.

B. List and label as complying with UL 1449, Type 1 or Type 2.

C. Distribution locations include SPDs connected to distribution panelboards, motor control centers, and busway.

D. Provide SPDs utilizing field-replaceable modular or non-modular protection circuits.

E. Surge Current Rating: Not less than 80 kA per mode/160 kA per phase.

F. Repetitive Surge Current Capacity: Not less than 3,500 impulses.

G. UL 1449 Nominal Discharge Current (I-n): 20 kA.

H. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.

I. EMI/RFI Filtering: Provide EMI/RFI filter to attenuate electrical noise; listed as complying with UL 1283 for Type 2 SPDs (UL 1283 listing not available for Type 1 SPDs).
   1. Noise Attenuation: Not less than 40 dB at 100 kHz using MIL-STD-220 insertion loss test method.

J. Diagnostics:
   1. Protection Status Monitoring: Provide indicator lights to report the protection status for each phase.
   2. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.
   3. Remote Status Monitoring: Provide Form C dry type contacts (normally open and normally closed) for remote annunciation of status.
   4. Surge Counter: Provide surge event counter with manual reset button, surge count retention upon power loss, and six digit LCD display that indicates quantity of surge events.

K. Provide surge rated integral disconnect switch for SPDs not connected to a dedicated circuit breaker or fused switch or not direct bus connected.

L. Integral disconnect switch when required by contract documents.

M. Voltage Protection Rating shall be in compliance with test and evaluation procedures described in UL 1449.

N. Fabrication using bolted compression lugs for internal wiring.

O. Redundant suppression circuits.

P. Arrangement with wire connections to phase buses, neutral bus, and ground bus.

3.05 SURGE PROTECTIVE DEVICES FOR BRANCH PANELBOARD LOCATIONS

A. Unless otherwise indicated, provide field-installed, externally mounted or factory-installed, internally mounted SPDs.

B. List and label as complying with UL 1449, Type 1 or Type 2.

C. Provide SPDs utilizing field-replaceable modular or non-modular protection circuits.

D. Surge Current Rating: Not less than 50 kA per mode/100 kA per phase.

E. Repetitive Surge Current Capacity: Not less than 2,000 impulses.

F. UL 1449 Nominal Discharge Current (I-n): 20 kA.

G. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.

H. EMI/RFI Filtering: Provide EMI/RFI filter to attenuate electrical noise; listed as complying with UL 1283 for Type 2 SPDs (UL 1283 listing not available for Type 1 SPDs).
   1. Noise Attenuation: Not less than 40 dB at 100 kHz using MIL-STD-220 insertion loss test method.

I. All primary transient path wiring shall be of a No, 6 AWG copper minimum or via bus bar of equivalent capacity to provide equal impedance interconnection between phased. No plug-in modules, components, or printed circuit boards shall be in use in surge carrying paths.

J. Diagnostics:
   1. Protection Status Monitoring: Provide indicator lights to report the protection status.
   2. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.
   3. Remote Status Monitoring: Provide Form C dry type contacts (normally open and normally closed) for remote annunciation of status.
   4. Surge Counter: Provide surge event counter with manual reset button, surge count retention upon power loss, and six digit LCD display that indicates quantity of surge events.

K. Provide surge rated integral disconnect switch for SPDs not connected to a dedicated circuit breaker or fused switch or not direct bus connected.

L. Integral disconnect switch when required by contract documents.

M. Voltage Protection Rating shall be in compliance with test and evaluation procedures described in UL 1449.

N. Nominal Discharge Current Rating: 10 kA minimum as determined by the actual Nominal Discharge Current test.

O. Fabrication using bolted compression lugs for internal wiring.

P. Redundant suppression circuits.

Q. Arrangement with wire connections to phase buses, neutral bus, and ground bus.

R. The system protection modules shall contain an array of metal oxide varistors (MOV). The SPD shall be listed in accordance with UL 1449.

S. Provide visible status indicator mounted on the front of the panel or a glass window shall be installed on the enclosing cabinet to make indicators on the modules visible.

3.06 PLUG-IN SURGE SUPPRESSORS

A. Description: Non-modular, plug-in suppressors with at least four 15-A, 120-V ac, NEMA WD 6, Configuration 15-15R receptacles, suitable to plug into a NEMA WD 6, Configuration 15-15R receptacle; with the following features and additional accessories:
1. LED indicator lights for reverse polarity and open outlet ground.
2. Circuit breaker and thermal fusing. When protection is lost, circuit opens and cannot be reset.
3. Close-coupled direct plug-in.
4. Rocker-type on-off switch, illuminated when in the on position.
5. One RJ11/12C telephone line protector, suitable for modem connection. Maximum clamping voltage 220 peak on pins No. 3 and No. 4.

B. Peak Single-Impulse Surge Current Rating: 33 kA per phase.

C. Protection modes and UL 1449 VPR shall be as follows:
1. Line to Neutral: 475 V.
2. Line to Ground: 475 V.
3. Neutral to Ground: 475 V.

PART 4 - EXECUTION

4.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the service voltage and configuration marked on the SPD are consistent with the service voltage and configuration at the location to be installed.

C. Verify that electrical equipment is ready to accept connection of the SPD and that installed overcurrent device is consistent with requirements of drawings and manufacturer's instructions.

D. Verify system grounding and bonding is in accordance with Section 26 05 26 - Grounding and Bonding for Electrical Systems, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.

E. Verify that conditions are satisfactory for installation prior to starting work.

4.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Installation shall be in accordance with the NEC 280 & 285 and Chicago Electrical Code.

C. Unless indicated otherwise, connect service entrance surge protective device on load side of service disconnect main overcurrent device.

D. Provide conductors with minimum ampacity as indicated on the drawings, as required by the City of Chicago Electrical Code, and not letss than manufacturer's recommended minimum conductor size.

E. Install conductors between SPD and equipment terminations as short and straight as possible, not exceeding manufacturer's recommended maximum conductor length. Breaker locations may be reasonably rearranged in order to provide leads as short and straight as possible. Twist conductors together to reduce inductance. Installation of leads shall avoid sharp and unnecessary bends. Terminals shall be provided for all necessary power and ground connections.
1. Where SPD cannot be mounted within five (5) feet of the panel at the service entrance, an internal SPD mounting shall be utilized.
2. Where SPD cannot be mounted within eighteen (18) inches of the panelboard, an internal SPD mounting shall be utilized.

F. Install devices for panelboard and auxiliary panels with conductors or buses between SPD and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
1. Comply with manufacturer's written recommendation for conductor and circuit-breaker size for connecting SPD to distribution system. Match circuit-breaker size to conductor size. Coordinate with Drawings.
2. Provide multipole, 30-A circuit breaker as a dedicated disconnect for SPD if mounted exterior to the switchboard or panelboard, unless otherwise indicated.
3. Where SPD cannot be mounted within 18-inches of the panel, high performance, low impedance cable as recommended by the manufacturer may be provided to eliminate any potential degradation of voltage protection.

G. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 26 05 26 - Grounding and Bonding for Electrical Systems where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.

H. Disconnect SPD prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPD connected.

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

J. System shall not require removal and replacement for warranty and/or other repairs. All internal component replacements shall be capable of being completed by a licensed electrician.

4.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS Section 7.19.1.

D. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

4.04 CONTRACTOR START UP AND REPORTING

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

B. Do not energize or connect service entrance equipment, panelboards, control terminals or data terminals to their sources until surge protection devices are installed and connected.

C. Testing: Perform the following field tests and inspections and prepare test reports:
1. After installing surge protection devices, but before electrical circuitry has been energized, test for compliance with manufacturer's requirements.
2. Complete startup checks according to manufacturer's written instructions.
3. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, "Surge Arresters, Low-Voltage Surge Protection Devices" Section. Certify compliance with test parameters.

D. Remove and replace malfunctioning units and retest as specified above.

4.05 CLEANING

A. Repair scratched or marred exterior surfaces to match original factory finish.

B. Do not used compressed air for cleaning.

END OF SECTION 26 43 00