SECTION 16289
SURGE PROTECTIVE DEVICES

SECTION INDEX

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes surge protective devices for low-voltage power equipment.

1.2 REFERENCES

A. American National Standards Institute (ANSI).
   1. C62.41 - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
   2. C62.45 - Guide on Surge Suppression Testing for Equipment Connected to Low-Voltage AC Power Circuits.

B. National Electrical Manufacturer Association (NEMA)
   1. LS1 - Low Voltage Surge Protective Devices.

C. Underwriters Laboratories Inc. (U.L.)
   1. 1449, second edition - Transient Voltage Surge Suppressors

1.3 SUBMITTALS

A. Product Data

1. For each type of product indicated, include rated capacities; dimensions; weights; furnished options.
2. For each type of product indicated, submit let through voltage results as tested in accordance with ANSI/IEEE C62.41-1991 Category C3, combination waveform, for all the applicable surge currents: up to 40kA min. (for auxiliary panel units) or up to 100kA min. (for panelboard units).
3. For each type of product indicated, submit independent test report showing that the suppression modules are capable of surviving the manufacturer's claimed peak single-impulse surge current rating when tested in accordance with ANSI/IEEE C62.41-1991 and NEMA LS1 (details of the test set-up and the results should be provided).

B. Product Certificates

1. Certify that products furnished comply with the following testing and labeling requirements:
   UL 1449, second edition listing and classification.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain suppression devices and accessories through one source from a single manufacturer.

1.5 PROJECT CONDITIONS

A. Do not energize or connect electrical equipment specified with surge protective devices to their sources until the surge protective devices are installed and connected.

B. 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; 125 percent preferred.
2. Operating Temperature: 30 to 140 deg F (0 to 60 deg C).
3. Humidity: 0 to 95 percent, non-condensing.
4. Altitude: Less than 20,000 feet (6000 m) above sea level.

C. Coordinate location of field-mounted surge protective devices to allow adequate clearances for maintenance and minimum lead length.

PART 2 – PRODUCTS

2.1 SURGE PROTECTIVE DEVICES

A. Manufacturers:
Keyitec, Inc.

B. General
1. Comply with applicable requirements of ANSI C62.41, C62.45, NEMA LS1 and UL 1449, second edition.

2.2 PANELBOARD SURGE SUPPRESSORS

A. Modular design with field-replaceable modules and the following features and accessories:
1. Arrangement with copper bus bars and for bolted connections to phase buses, neutral bus, and ground bus. Fabrication using bolted compression lugs for internal wiring.
2. MOV technology for each suppression element. Single, high energy handling MOV element preferred. “Fuseless” design preferred: no overcurrent fuse to be used for the purpose of protecting the unit. If fuses are used, then fuse each phase of the surge current diversion module with 200kAIC surge rated fuses.
3. For Wye configured systems, units to provide surge current diversion paths between each phase conductor and the neutral conductor, between each phase conductor and the ground and between the neutral conductor and the ground. For Delta configured systems, units to provide surge current diversion paths between each phase conductor and the ground.
4. Copper bus bars for the surge current path. Connect surge current diversion modules to the bus bars of the service entrance equipment for reliable low impedance connections. “In-line” installation recommended on the load side of a 200A breaker or less.
5. Red and green LED indicator lights for power and protection status.
6. Audible alarm, with silencing switch, to indicate when protection has failed.
7. One set of dry contacts, for remote monitoring of protection status. Coordinate with building power monitoring and control system.
8. Surge-event operations counter. The surge counter shall be responsive to the current flowing through the MOV module or the real operation of the protecting device, counting only the events that represent real threats to the protected equipment. It shall detect positive and negative spikes.

B. Peak Single-Impulse Surge Current Rating: 200 kA per mode of protection

C. Designed to withstand a maximum continuous operating voltage (MCOV) of not less than 115% of nominal RMS voltage; 125% preferred.

D. Protection modes for grounded Wye circuits with voltages of 208Y/120 or 480Y/277 or 600Y/347 3-phase, 4-wire circuits, shall be as follows:

1. UL 1449 Second Edition Listed and Recognized Component Suppression Voltage Ratings shall not exceed the following:

Voltage	L-N	L-G	N-G
208Y/120	400	400	400
480Y/277	1200	1200	1200
600Y/347	1200	1200	1200

2. The ANSI/IEEE C62.41 - 1991 Category C3 let through voltages shall not exceed the following:

Surge Current (kA)	208Y/120 L-N/L-G/N-G	480Y/277 L-N/L-G/N-G	600Y/347 L-N/L-G/N-G
1.5	400V	1200V	1200V
3.0	410V	1300V	1300V
5.0	425V	1350V	1350V
10.0	460V	1420V	1420V
20.0	500V	1520V	1520V
40.0	540V	1650V	1650V
100.0	640V	2150V	2150V

E. *Protection modes and UL 1449 Second Edition Listed and Recognized Component Suppression Voltage Ratings for 240/120V., single-phase, 3-wire circuits, shall be as follows:

1. Line to Ground: 400 V.
2. Neutral to Ground: 400 V.

*Protection modes and UL 1449 Second Edition Listed and Recognized Component Suppression Voltage Ratings for 240/120V., 3-phase, 4-wire circuits, with high leg shall be as follows:

1. Line to Ground: 400 V., 700V. from high leg
2. Neutral to Ground: 400 V.

*Protection modes and UL 1449 Second Edition Listed and Recognized Component Suppression Voltage Ratings for 240V. or 480V., 3-phase, 3-wire Delta circuits shall be as follows:

Voltage	480V	240V
Line to Ground:	1200 V	700 V

*The ANSI/IEEE C62.41 - 1991 Category C3 let through voltages shall not exceed the following:

Surge Current (kA)	120/240V L-G/N-G	240 Delta L-G	480 Delta L-G
1.5	400V	730V	1200V
3.0	410V	780V	1300V
5.0	425V	810V	1350V
10.0	460V	870V	1420V
20.0	500V	920V	1520V
40.0	540V	1030V	1650V
100.0	640V	1320V	2150V

2.3 AUXILIARY PANEL SURGE SUPPRESSORS

A. Integral surge suppressors modular design with field-replaceable modules and the following features and accessories:

1. Arrangement with copper bus bars and for bolted connections to phase buses, neutral bus, and ground bus. Fabrication using bolted compression lugs for internal wiring.
2. MOV technology for each suppression element. Single, high energy handling MOV element preferred. “Fuseless” design preferred: no overcurrent fuse to be used for the purpose of protecting the unit. If fuses are used, then fuse each phase of the surge current diversion module with 200kAIC surge rated fuses.
3. For Wye configured systems, units to provide surge current diversion paths between each phase conductor and the ground and between the neutral conductor and the ground. For Delta configured systems, units to provide surge current diversion paths between each phase conductor and the ground.
4. Connect surge current diversion modules to the bus bars of the auxiliary panel equipment for reliable low impedance connections. “In-line” installation recommended on the load side of a 100A breaker or less.
5. LED indicator lights for power and protection status.
6. One set of dry contacts rated at 5A, 250-V ac, for remote monitoring of protection status.

B. Peak Single-impulse Surge Current Rating: 100 kA per mode of protection

C. Designed to withstand a maximum continuous operating voltage (MCOV) of not less than 115% of nominal RMS voltage; 125% preferred.

D. Protection modes for grounded Wye circuits with voltages of 480Y/277, 208Y/120; 3-phase, 4-wire circuits, shall be as follows:

1 . UL 1449 Second Edition Listed and Recognized Component Suppression Voltage Ratings shall not exceed the following:

Voltage	L-G	N-G
208Y/120	400	400
480Y/277	900	900

2. The ANSI/IEEE C62.41-1991 Category C3 let through voltages shall not exceed the following:

Surge Current (kA)	208Y/120 L-G/N-G	480Y/277 L-G/N-G
1.5	420V	975V
3.0	470V	1025V
5.0	500V	1135V
10.0	550V	1170V
20.0	630V	1400V
40.0	725V	1625V

E . *Protection modes and UL 1449 Second Edition Listed and Recognized Component Suppression Voltage Ratings for 240/120 V, single-phase, 3-wire circuits, shall be as follows:

1. Line to Ground: 400 V.
2. Neutral to Ground: 400 V.

F. *Protection modes and UL 1449 Second Edition Listed and Recognized Component Suppression Voltage Ratings for 240/120 V, 3-phase, 4-wire circuits, with high leg shall be as follows:

1. Line to Ground: 400 V.,700 V from high leg
2. Neutral to Ground: 400 V.

G. *Protection modes and UL 1449 Second Edition Listed and Recognized Component Suppression Voltage Ratings for 240V. or 480V., 3-phase, 3-wire, Delta circuits shall be as follows:

Voltage	480V	240V
Line to Ground:	1200V	700 V

*The ANSI/IEEE C62.41 - 1991 Category C3 let through voltages shall not exceed the following:

Surge Current (kA)	120/240V L-G/N-G	240 Delta L-G	480 Delta L-G
1.5	420V	770V	1285V
3.0	470V	810V	1380V
5.0	500V	890V	1485V
10.0	550V	960V	1625V
20.0	630V	1090V	1800V
40.0	725V	1265V	2070V

2.4 ENCLOSURES

A. NEMA 4 or better

B. Marking:

- Any marking shall be permanent and legible, and should not smear or be removed by rubbing.
- All terminals shall be appropriately marked: Line (Hot or Phase), Neutral, and Ground.
- The manufacturer's nameplate shall be visible after installation without the removal of any covers or components. It shall contain the following information:

  - Supplier's or manufacturer's name
  - Model number
  - Manufacturing date (indicating the month and year of manufacturing)
  - Voltage frequency
  - Nominal system voltage.
  - Connection diagram.
  - Short circuit rating.

PART 3 - PART 3 – EXECUTION

3.1 INSTALLATION OF SURGE PROTECTIVE DEVICES

Install devices at service entrance on load side, with ground lead bonded to service entrance ground.

- 200kA rated units to be connected “in line” for feeder rating of 200A or less (per phase). For feeder rating above 200 A, T connection with short leads may be used.

Install devices at auxiliary panels on load side

- 100kA rated units to be connected “in line” for feeder rating of 100A or less (per phase). For feeder rating above 100 A, T connection with short leads may be used unless enclosure is sized to accommodate feeders up to rating of 200A.

3.2 CONNECTIONS

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

3.3 FIELD QUALITY CONTROL

A. After installing surge protective devices, but before electrical circuitry has been energized, verify that electrical wiring installation complies with manufacturer's installation requirements.

B. After energizing the surge protective devices, verify that proper LED’s are lit. If applicable, test alarm and surge counter. Reset surge counter to zero.

3.4 DEMONSTRATION

A. Train maintenance personnel on procedures to replace the MOV modules, to test alarm and surge counter and to reset the surge counter whenever applicable.

END OF SECTION