1. **Scope**

1.1. This specification describes the features of the Eaton Cooper Power series Form 6 Pole Mount Microprocessor-Based Recloser Control with ProView 5.x application software. The recloser control shall include extensive system protection functionality, including phase, ground and negative sequence overcurrent protection, over/underfrequency, over/undervoltage, sensitive ground fault, directionality, and sync check.

1.1.1. Analysis tools shall include fault locating, event recording, and oscillography functions.

1.1.2. Metering functions shall include demand and instantaneous current on a per phase basis, instantaneous voltage and power factor on a per phase basis, and power (real, reactive, apparent) on a per phase or total basis. Harmonics shall be provided for on a per phase basis. Symmetrical components for both voltage and current shall be displayed along with kilowatt-hours for energy metering. All the above values shall be recordable in a Data Profiler that contains user selectable inputs and sampling rates.

1.1.3. The front panel Human/Machine Interface (HMI) shall be used to configure the operating settings for the recloser control. It shall also be used to display metering, counter information, control parameters, reset alarms, and provide diagnostic information including the ability to view at a minimum the 25 most recent event files.

1.1.4. Control parameters shall also be programmed via a personal computer connected to the control through the front panel RS-232 port. The control programming, interrogation, and operations shall be accomplished using ProView interface software residing on a personal computer.

1.1.5. The ProView application software provided with the control shall include additional functions used to create and graphically display Time Current Curves and provide the Idea Workbench for configuring user-selected inputs and outputs, configurable event and alarm data, and selectable communication points for serial communication. The user shall be able to connect to the control via the application software and open a scheme from file or device, or open a saved event with a single menu command.

1.1.6. The control shall operate on 50 and 60 Hz systems.

2. **Applicable Standards**

2.1. The Quality Management System shall be ISO 9001 Certified. The control shall be designed and tested in accordance with the following standards as applicable:


3. Control Housing

3.1. The control shall be housed in a weatherproof outdoor cabinet with accessible dual-entry (front and rear) through two doors. Each door shall include gasketing to assure a weathertight seal and include locking provisions for utility grade locks. A minimum of two latch points shall be required for each door. A nameplate shall be attached to the front door. Front door entry shall allow access to the operating panel without exposure to exposed AC sensing power supply.

3.2. Rear door entry shall allow direct access to all control wiring including voltage connections, thermostatically-controlled heater, serial communications/hardwired inputs and outputs. As part of the housing, a factory-mounted and pre-wired control receptacle shall allow the user a quick-disconnect from the recloser. The control housing shall also have a provision for standard conduit or cable entry. Four vent holes shall be included to maintain ventilation.

3.3. The control shall have a standard 15 Watt thermostatically-controlled heater (ON 70°F, OFF 85°F) for humidity control. The heater shall be powered from the power supply board.

4. Configuration Firmware/Interface Software

4.1. The recloser control shall use a Windows® operating system-based interface software. The software, ProView, shall be separate from the recloser control. The executable configuration interface software shall allow the user the ability to save and edit files based upon user requirements independent of connectivity to the control. All settings, metering, and analysis tools shall use standard dialog boxes, including available minimum and maximum values, for each setting.

4.2. Firmware upgrades shall be available through direct connection to the dedicated RS-232 port on the control front panel without any additional equipment required.

5. Temperature Range

5.1. The operating range of the control shall be -40°C to +70°C ambient.

5.2. The enclosure design shall allow internal self-heating to raise the enclosure interior an additional 15°C, such that all components, assemblies, and sub-assemblies shall operate from -40°C to +85°C. All components selected in the design of the control shall have a temperature rating of -40°C to +85°C. Validation of temperature range through production sorting is not acceptable.

5.3. The control shall not be damaged by storage at ambient temperatures from -40°C to +85°C.

6. Front Operating Panel

6.1. The Front Operating Panel shall be intuitively-designed to minimize training costs and avoid potential misoperation. The operating panel shall be separated into two sections clearly identified by color-coding or another acceptable user-approved method. The top portion of the control shall be used for programming the control. The lower portion of the control shall be used for operation. The recloser control shall be integrated as a system to include proper status of the recloser on the front operating panel.
7. Programming/Status

7.1. The control programming section shall allow the user LED status indication. Each LED shall be rated for visibility in bright sunlight. The control shall have a total of thirty LEDs available for direct control and recloser status information. As a minimum, dedicated LEDs shall include status indication as follows:

7.1.1. Control OK
7.1.2. Control Power
7.1.3. Control Lockout
7.1.4. Recloser Open
7.1.5. Recloser Closed
7.1.6. A-Phase Fault
7.1.7. B-Phase Fault
7.1.8. C-Phase Fault
7.1.9. Ground Fault
7.1.10. Sensitive Ground
7.1.11. Alarm
7.1.12. Above Minimum Trip
7.1.13. Indicator 1
7.1.15. Indicator 3
7.1.16. A-Phase Voltage
7.1.17. B-Phase Voltage
7.1.18. C-Phase Voltage
7.1.19. Frequency Trip
7.1.20. Voltage Trip
7.1.21. Indicator 4
7.1.22. Indicator 5
7.1.23. Indicator 6
7.1.24. Indicator 7
7.1.25. Indicator 8

7.2. The user shall be enabled to remove all insert labels (a total of 31 relabeled LEDs) to customize the LEDs as required. Removable labels shall be included with the control to enable the user to easily customize the control for their protection requirements. Removable inserts shall be available to customize LEDs for all 9 Option LEDs and all Target Indicators except CONTROL OK, CONTROL POWER, AND ALARM. Removable inserts and labels shall be designed to enable the user to change inserts without the use of adhesives, labelmakers, or temporary labels.

7.3. The user shall have the ability to access critical operation functions through the use of eight Analysis One-Touch Keypads. It shall not be acceptable to scroll through a series of menus for the following functions:

7.3.1. Metering
7.3.2. Reset Targets
7.3.3. Events
7.3.4. Lamp Test
7.3.5. Settings

7.3.6. Operations Counter

7.3.7. Alarms

7.3.8. Change

7.4. A sharp, backlit 4 line x 20 character display shall be included in the programming section. The LCD panel contrast shall be field-adjusted to allow for various mounting heights and applications. The LCD shall provide extensive status information regarding the distribution system, recloser, and control using a minimum of eight navigational keypads in an organized menu structure. The navigational keypads shall include accelerated plus and minus keypads for quick setting changes; direct scroll up, down, left, and right keypads; along with immediate enter and menu keypads for direct operation. The LCD shall also use four clearly-identified function keys for setting and operation instructions.

7.5. The programming section shall also include a DB-9 RS-232 connector for direct connection to a personal computer (PC). The interface shall be designated DCE to directly connect to the serial port of the PC without any special cables or connectors.

8. Operating Section

8.1. The operating section shall allow the user direct open and close operation of the recloser along with pre-defined and customized operating functions.

8.1.1. The TRIP and CLOSE buttons shall have a minimum surface area of one square inch (6.45 cm2) with a protective guard around the perimeter of each button to prevent incidental trip or close. The TRIP button shall be green and the CLOSE button shall be red. No exceptions to the surface area or color of the TRIP and CLOSE button standards shall be accepted.

8.1.2. The TRIP button shall be hardwired to the recloser independent of the microprocessor. All trip commands from the TRIP Button shall trip the recloser, even in the event of a microprocessor failure.

8.1.3. The CLOSE button shall be connected to the microprocessor for establishing temporary operating requirements such as cold load pickup.

8.2. The front operating panel shall include the following push-button keypads with LED Indicators:

8.2.1. Ground Trip Blocked

8.2.2. Non-Reclosing

8.2.3. Supervisory Off

8.2.4. Alternate Profile #1

8.2.5. Alternate Profile #2

8.2.6. Alternate Profile #3

8.2.7. Option #1

8.2.8. Option #2

8.2.9. Option #3

8.3. The front operating panel shall also include the following:

8.3.1. Hot Line Tag On/Off Toggle Switch

8.3.2. Hot Line Tag LED Indicator

8.3.3. Close Circuit Disable removable link

8.3.4. RS-232 Port

9. Operating Power

9.1. Incoming AC power shall be routed to the Power Supply/Battery Charger Board from either 120 Vac or 240 Vac. The battery charger shall include a temperature-compensated design to optimally charge the control
battery. The power supply/battery charger board shall also include an auxiliary power supply for connection to communication equipment (radios, modems, etc.). The auxiliary power supply shall be rated 28 Vdc, 65 Watts peak. A separate 28 Vdc to 13.8 Vdc power supply accessory shall be available for communication equipment rated for 12 Vdc.

9.2. Some additional features shall be included as follows:

9.2.1. Positive LED indicator for power supply presence.

9.2.2. Selectable 120/240 Vac switch for adapting to multiple transformer connections. The selector switch shall be factory-set based upon each customer order.

9.2.3. Self-protective fuse (5 amp, 250 Vac).

9.3. The control shall have a standard 15 Watt thermostatically-controlled heater (ON 70°F, OFF 85°F) for humidity control and voltage input independent. The heater shall be powered from the power supply board.

9.4. The control shall be equipped with either an 8 Amp-Hour or 13 Amp-Hour 24 Vdc lead acid battery for operation upon loss of AC power. The battery shall have a life expectancy of four to six years. The control shall maintain full operation from the battery for a period of time dependent upon the battery size:

9.4.1. 8 Amp-Hour — 15 hour maximum (20°C)

9.4.2. 13 Amp-Hour — 25 hour maximum (20°C)

9.5. In the event that the AC power has not returned within the times listed above, the control shall disconnect the battery from the circuit.

9.6. The control shall continuously monitor the battery voltage. To prevent battery damage, the control shall shut down automatically upon detection of low battery voltage (below 22 Vdc) for 60 seconds.

9.7. Control programming settings and parameters—including event recorder—shall be stored in non-volatile memory and retained upon loss of control power. The time/date clock shall continue to operate for approximately 30 days after loss of control power.

9.8. Phase B (Ø) shall be the factory default phase. Unless changed by the user, the B PHASE VOLTAGE red LED shall illuminate indicating AC is the operating power. If BØ (or the user-indicated phase) loses AC power, the ALARM red indicator LED shall illuminate. The ALARM log on the LCD Display shall indicate NO AC PRESENT.

10. Terminal Blocks

10.1. Two terminal blocks shall be used for connection to the recloser control. Both terminal blocks shall be fit for a #6 screw which shall allow a maximum ring size for a #10 AWG wire.

11. Power Connections

11.1. The transformer required for power shall have a minimum of 5kVA for low-voltage AC closing reclosers and 1kVA for high voltage AC closing reclosers and NOVA-DC reclosers.

12. Protocols

12.1. Four serial communications protocol options shall be supported in the control.

12.1.1. Modbus

12.1.2. DNP3

12.1.3. 2179

12.1.4. IEC 870-5

12.2. The protocol ports are configured as follows:

12.2.1. Front Panel Port – This port shall be used exclusively with the ProView interface software supplied with the control.

12.2.2. Rear Panel Ports (2 – Standard supplied RS232 and 1 that is user selectable at time of order) – The rear port selections shall be:
12.2.3. RS-485 (Isolated)
12.2.4. Serial Fiber Optic
12.2.5. Ethernet (Wire or Fiber)
12.2.6. The user shall configure which back port shall have the communication protocol. The other port shall automatically be assigned ProView protocol.

12.3. The RS-485 or serial fiber-optic communications cards shall not support ProView protocol.

13. Control Security

13.1. The control shall have a customer-programmable security code to limit access of control programming and viewing functions to authorized personnel.

13.2. There shall be a connection password when communicating between the control and a computer.

14. Protection Profiles

14.1. Six protection profiles shall be provided, each capable of fully specifying the operation of the control. The profiles shall be selected from front push-button overlays or through interface software and serial communication ports. Each protection profile shall include the following as a minimum:

14.1.1. Overcurrent Protection
14.1.2. Over and Undervoltage Protection
14.1.3. Over and Underfrequency Protection
14.1.4. Directional Protection
14.1.5. Sync Check
14.1.6. Sensitive Ground Fault Protection
14.1.7. Operation Settings

15. Time-Current Curve

15.1. Time-current curves shall be available for fast and delayed operations. Each time-current shall be selected from a defined fifty curves which can be further customized by the user. The time-current curves shall also be selected from a graphical TCC editor to visualize any modifications prior to configuring the control.

15.2. The time-current curves shall include the following modifications for phase, ground, and negative sequence protection:

15.2.1. Time Multiplier with a range of .1 to 25 in .1 increments.
15.2.2. Time Adder with a range of 0 to 30 seconds in .01 second increments.
15.2.3. Minimum Response Time with a range of 0 to 1 seconds in .001 second increments.
15.2.4. High Current Trip with a range of 1 to 32 multiples of minimum trip.
15.2.5. HCT Time Delay with a range of .016 to .150 second in .001 second increments.

16. Sequence Coordination

16.1. A Sequence Coordination feature shall be included which allows the control to step through selected operations in the operating sequence without tripping. The number of Sequence Coordination advances is programmable from one to three operations to provide trip coordination with a downline recloser. This feature shall be independently selectable for each protection profile.

17. Cold Load Pickup

17.1. The control shall include a Cold Load Pickup feature to prevent the control from tripping due to inrush current. This feature shall have an independently programmable minimum trip value, time-current curve, reclose interval, and number of operations to lockout for each protection profile.

18. Hot Line Tag
18.1. A Hot Line Tag feature to block all closing operations for live-line work shall be included in the design of the control as a standard feature. When selected, the control shall trip on one operation to lockout on the composite curve of the Hot Line Tag definite time and the TCC1 curve (whichever is faster). Hot Line Tag time delay shall be independently selectable for each protection profile.

19. Fast Trips Disabled

19.1. The control shall include a Fast Trips Disabled feature to modify the protection, so that all trip operations use the programmed TCC2. This feature shall be independently selectable for each protection profile. The total trip operations shall remain the same. As an example, the control shall change its sequence from two fast and two delayed operations to four delayed operations when Fast Trips Disabled is active.

20. High Current Lockout

20.1. A High Current Lockout feature that will automatically lockout the control when current exceeds a programmable level shall be included in the control. The active shot numbers for the lockout shall be selectable for phase, ground, and negative sequence. Also, direct values, not multiples of minimum trip, shall be provided. This feature shall be independently selectable for each protection profile.

21. Sensitive Ground/Earth Fault Operation

21.1. The control shall include a Sensitive Ground/Earth Fault Trip feature that will provide tripping of the recloser for ground currents below normal ground minimum trip levels. The feature shall have programmable operations to lockout and reclose intervals independent of the ground settings. This feature shall be independently selectable for each protection profile.

22. Metering

22.1. The control shall provide instantaneous and/or demand metering with programmable integration intervals for the following functions:
   22.1.1. Real and reactive power for each phase and total, including directional, on an individual phase basis.
   22.1.2. Demand currents on a per phase basis.
   22.1.3. Instantaneous currents, including ground current.
   22.1.4. Instantaneous voltage on a per phase basis.
   22.1.5. Instantaneous frequency.
   22.1.6. Positive, negative, and zero sequence voltages.
   22.1.7. Harmonics on a per phase basis for voltage and current.
   22.1.8. Instantaneous power factor on a per phase basis.
   22.1.9. Metering settings to include demand interval, and alarm thresholds for current, single-phase kW, three-phase kW, single-phase kVAR, and three-phase kVAR.

22.2. An onboard Data Profiler shall be provided to record user configured demand values. These values will be taken at a user selectable sampling rate. Based on the number of values recorded the Data Profiler should be able to record a minimum of 30 days’ worth of data.

23. Data Profiler

23.1. The Data Profiler shall record configurable analog data for a specific period of time. The Data Profiler shall be configured to allow periodic recording with ranges from 1 minute to 24 hours for all selected parameters. The Data Profiler shall be capable of selecting up to 150 analog data points along with 8 user-customized analog data points. The data profiler shall present the data in table form and allow exporting to external spreadsheet application software.

24. Event Recorder

24.1. The recloser control shall contain capabilities to perform Sequence of Events for up to 33 event types. The event recorder shall include the date and time of the event and appropriate metering analogs based upon event type. Sixteen additional event types are user-defined through the Idea Workbench.
24.2. Some factory-defined event types shall be as follows:
   24.2.1. Overcurrent Protection Trip
   24.2.2. External Trip
   24.2.3. Non-Reclose Trip
   24.2.4. External Close
   24.2.5. Lockout
   24.2.6. Reset

24.3. The Event Recorder shall maintain a minimum of 90 events.

25. Recloser Duty Monitor
   25.1. The recloser control software shall be equipped with a Recloser Interrupting Duty Monitor. The Duty Monitor shall accumulate the summation of $I^{1.5}$ for all interrupted currents on each interrupter. This feature shall permit programmable entries to preset the duty of an existing recloser.

26. Discrete SCADA Communications
   26.1. The control shall provide a minimum of five configurable output status contacts. Each status contact shall be configurable using graphical interface software to combine status functionality along with Boolean algebra. Default output status shall be: Lockout, Open, Close, Ground Trip Block, and Hot Line Tag. One output status contact shall be a solid state output with a pickup time no longer than two milliseconds.
   26.2. The control shall also provide a minimum of three configurable control input contacts. Each control contact shall be configurable using a graphical interface software. Each contact shall accept a voltage range of 12-240 Vac, 12-250 Vdc as the whetting voltage. Each control input shall be configured for either a momentary, latched, or latched with precedence contact. Default control input contacts shall be: Supervisory Trip and Lockout, Supervisory Close, and Remote Trip and Lockout.
   26.3. A Discrete Interface Board shall also be available as an accessory to provide an additional eight output status contacts and eight control input contacts. The Discrete Interface Board shall be user-configurable via the Idea Workbench.

27. Time Current Curve Editor
   27.1. Coordination and actual time current modifications shall be available with a graphic interactive Time Current Curve Editor or similar graphical software.
   27.2. The Time Current Curve Editor shall include a complete database of standard industry recloser time current curves (TCC), both ANSI and IEC types, along with the ability to customize the TCCs with multipliers, constant time adders, or minimum response time adders. Also, the user shall be able to derive their own specific TCC through data point entry. Each modified time current curve shall be able to be identified with a user-customized name and shall be selectable for configuring the control. The grid and format for presenting the TCCs shall have a user-adjustable scale, including the option of presenting multiple TCCs in various user-configured colors.

28. Oscillography
   28.1. Oscillography shall be provided to present current and voltage waveforms, along with protection function and recloser response status changes.
   28.2. The recorded values shall be super-imposed on the protection scheme, and the state or value at any point in the scheme shall be displayed. The user shall have the capability to move through the event and watch the response of all available functions. All analog signals, digital inputs, and contact outputs shall be monitored. The oscillography sampling rate shall be a minimum of 16 samples per cycle. The oscillography data on the analog signals shall be post-filtered values. Event size shall be user selectable from 2 to 30 cycles with the capability of recording a minimum of 20 events for a 12 cycle event.

29. Idea Workbench
29.1. The Idea Workbench application included with the control interface software shall allow the user to program the control using simple graphical logic characters, internal alarms, status, and target. The user shall have the ability to perform logical functions with a combination of these variables using drag and drop functionality supported by the control.

29.2. The Idea Workbench shall provide a true graphical programming environment. Logical equation programming shall not be acceptable.

30. Over/Undervoltage Protection

30.1. The control shall include single-phase and three-phase undervoltage tripping. The control shall also include three-phase overvoltage tripping. Both over and under voltage functions shall include a phase pickup, a phase time delay, a three-phase pick-up, and a time delay. Voltage protection shall be included as part of each protection profile.

31. Over/Underfrequency Protection

31.1. The control shall include two-stage operation for both Underfrequency and Overfrequency protection. Frequency protection shall have the ability to enable either over or under frequency protection or both functions simultaneously. A fixed time delay ranging from 0 to 100 seconds in .001 second increments shall be available for both over and under frequency. A frequency voltage supervision threshold with a range from 0 to 300 Volts in .1 Volt increments shall be included to prevent spurious frequency trip operations. A frequency restoration function, enabled or disabled by the user, shall be provided to allow the recloser to automatically close should frequency return to within configured settings for a user-settable time. Over/Under Frequency Protection shall be included as part of each protection profile.

32. Directional

32.1. Directional functionality shall be included to maintain system coordination from multiple sources, as well as circuit reconfiguration for each profile. Directional shall apply to phase, ground, and negative sequence protection, selected independently. A maximum torque angle shall have a range of 0–90 degrees in 1 degree increments.

33. Fault Location

33.1. The control shall include an impedance-based fault locator based upon the Takagi algorithm. A load-compensated impedance calculation shall be used for calculating the distance. The user shall be able to configure the positive and zero sequence in ohms, and the fault locator line length in kilometers and/or miles.

34. Sync Check

34.1. Sync Check functionality shall include the following applications:

- 34.1.1. Hot Line/Hot Bus Closing
- 34.1.2. Dead Line/Hot Bus Closing
- 34.1.3. Hot Line/Dead Bus Closing
- 34.1.4. Dead Line/Dead Bus Closing

34.2. Sync Check Parameters shall include the following configurable settings:

- 34.2.1. Voltage Angle
- 34.2.2. Mechanism Operating Delay
- 34.2.3. Static Angle Delay
- 34.2.4. Dead Threshold
- 34.2.5. Live Threshold
- 34.2.6. Positive Sequence Dead Threshold
- 34.2.7. Upper Voltage Limit
- 34.2.8. Lower Voltage Limit
34.2.9. Lower Frequency Limit
34.2.10. Upper Frequency Limit
34.2.11. Fail to Close Timer

35. Hardware specifications

35.1. Frequency
   35.1.1. 50 / 60 Hz

35.2. Voltage Sensing Inputs
   35.2.1. •3 – 300 Vac (6 inputs)
   35.2.2. Each phase has a PT ratio and phase angle adjustment setting
   35.2.3. Burden < 0.1VA. Input impedance ~1Mohm

35.3. Control Power Supply
   35.3.1. 120/240 Vac ±15%, 350VA peak input power

35.4. Control Contact Inputs (Optically-Isolated)
   35.4.1. 9 Vdc - 290 Vdc (default range)
   35.4.2. 7 Vac - 265 Vac (default range)

35.5. Status Contact Outputs
   35.5.1. 240 Vac / 250 Vdc
   35.5.2. Make: 30 A peak, 8 A continuous
   35.5.3. Break: 0.2 A peak
   35.5.4. Pickup Time: <8ms
   35.5.5. Dropout Time: <5ms

35.6. Solid-State Contact
   35.6.1. 240 Vac / 250 Vdc
   35.6.2. Make: 30 A peak, 8 A continuous
   35.6.3. Break: 10 A peak
   35.6.4. Pickup Time: <2ms
   35.6.5. Dropout Time: <15ms

35.7. Local/Remote Communications
   35.7.1. Two EIA-RS-232 serial ports
      35.7.1.1. Front Panel – Used exclusively with ProView protocol (DCE)
      35.7.1.2. Rear Port – Configurable to be either the default SCADA protocol (DNP, 2179, Modbus, or IEC870-5-101) or ProView protocol (DTE)
   35.7.2. RS-485 / Fiber daughterport – Can be configured exclusively for any one of the SCADA protocols (DNP, 2179, Modbus, or IEC870-5-101) and, as a result, the ProView protocol is active on the rear RS-232 port.

35.8. Baud Rate

<table>
<thead>
<tr>
<th>Baud Rate</th>
<th>Protocol</th>
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<tr>
<td></td>
<td>ProView</td>
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35.9. Front Panel Display
   35.9.1. 4 x 20 LCD Display with LED Backlight, Contrast Adjustable

35.10. Front Panel Targets
   35.10.1. 25 Single-Element High-Intensity LED Targets
   35.10.1.1. 22 are user-configurable.

35.11. Front Analysis Keypad

35.12. Eight Momentary Contact One-Touch Keypads for Immediate System Analysis

35.13. Front Panel Keypad and Controls
   35.13.1. Nine Momentary Contact One-Touch Keypads with LED Indicators for Operating Functions
   35.13.1.1. All are user-configurable.
   35.13.2. Large TRIP and CLOSE Momentary Push-Buttons
   35.13.3. Hot-Line Tag Toggle Switch with High Intensity LED Local Indication

35.14. Pole Mount Cabinet Dimensions
   35.14.1. 345 mm (13.5 in) wide
   35.14.2. 710 mm (28 in) high
   35.14.3. 310 mm (12.25 in) deep

35.15. Operating Temperature
   35.15.1. -40°C to +70°C ambient
   35.15.2. IEC 68-2-1 & IEC68-2-2

35.16. Humidity Test
   35.16.1. IEC 68-2-30

35.17. Impulse/Dielectric Test
   35.17.1. IEC 255-5

35.18. Radio Frequency Interference
   35.18.1. ANSI / IEEE C37.90.2™.1995 standard
   35.18.2. IEC 61000-4-3 level X=35 V/M
   35.18.3. IEC 61000-4-2 ESD, Level 4
   35.18.4. IEC 61000-4-4 EFT, Level 4
   35.18.5. IEC 61000-4-6 Conducted immunity, level 3

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35.18.6. IEC 61000-4-11, voltage dips and interruptions [40% & 70% of nominal voltage]

35.19. Surge Withstand
   35.19.1. ANSI / IEEE C37.90.1™-2002 standard
   35.19.2. ANSI/ IEEE C37.60™-2003 standard sec. 6.13.2

35.20. Vibration/Shock Test
   35.20.1. MIL-STD-810-F
   35.20.2. IEC-255-21-1
   35.20.3. IEC-255-21-2

36. Approved Manufacturers

   Eaton