1.0 GENERAL

1.1 The automated distribution fault-interrupting system shall conform to the following specification.

1.2 The fault-interrupting system shall be an outdoor, three-pole device incorporating vacuum fault interrupters individually operated by magnetic latching actuators capable of 2-millisecond Close-Open (pulse) operation; an integral power module(s); an integral protection and control module; an integral communication module; and integral sensors. All components shall be mounted on a unitized stainless steel base.

1.3 The unitized base shall be furnished with single-point lifting means to facilitate installation.

1.4 The unitized base shall include provisions for mounting and grounding three surge arresters on each side. No additional grounding connections shall be required for the surge arresters.

1.5 Optionally, polymer-housed metal-oxide surge arrestors shall be factory-installed and wired on both sides of the fault-interrupting system.

1.6 Appropriate venting shall be provided to prevent gas and moisture buildup within the unitized base. Vents and seals shall prevent insects, dust, wind-driven rain, and fluid from pressure-washing from entering the base, protection and control module, and communication module.

1.7 The fault-interrupting system shall be furnished in the Non-Disconnect Style, in the Upright-Crossarm mounting configuration.

or

1.7 The fault-interrupting system shall be furnished in the Disconnect Style, in the Upright-Crossarm mounting configuration. The integral three-pole group-operated disconnect shall provide a visible air gap. It shall be interlocked to permit operation only when the fault interrupters are open. The disconnect shall include:

(1) Wiping contacts to prevent operational difficulties arising from corrosion or frost

(2) Bearings

(3) Low-resistance contacts indicating the Open and Closed positions of the disconnect

1.8 Control power shall be derived from an integral power module fed from one phase on one side of the fault-interrupting system.

or

1.8 Control power shall be derived from two integral power modules, each fed from a different phase on both sides of the fault-interrupting system.

1.9 The integral power module(s) shall provide all control power for the fault-interrupting system in standalone (non-communicating) applications. No batteries shall be required, but ac line voltage must be available to the integral power module(s).

1.10 Optionally, wildlife protection shall be furnished for the fault-interrupting system to reduce wildlife-related nuisance outages.

1.11 The fault-interrupting system shall be suitable for application in an ambient temperature range of -40°F (-40°C) to +104°F (+40°C).

1.12 The manufacturer shall have a minimum of 20 years experience in the production of distribution automation and protection equipment.

1.13 The manufacturer shall supply all internal wiring for the fault-interrupting system.

1.14 The following design tests shall have been performed on the fault interrupter, and certified test reports shall be provided upon request:

Interrupting: . . . . . ANSI C37.60-2003

Dielectric: . . . . . ANSI C37.60-2003

Temperature Rise: . . . . . ANSI C37.60-2003

Short Time: . . . . . ANSI C37.60-2003

Fault Closing: . . . . . ANSI C37.60-2003

Mechanical Endurance:. . . . . ANSI C37.60-2003

The following design tests shall have been performed on the control, and certified test reports shall be provided upon request:

Electrostatic Discharge: . . . . . IEC 801.2 (IEC 1000-4-2)

Fast Transient: . . . . . IEC 801.4

Power Line Surge:. . . . . .ANSI C62.41

Surge Withstand: . . . . . ANSI C37.90.1

Radio-Frequency Interference: . . . . . ANSI C37.90.2

Electromagnetic Interference: . . . . . .FCC Part 15 Class B

Electromagnetic Compatibility:. . . . . EN 61000-4-3

Dielectric: . . . . . .ANSI C37.90

2.0 FAULT INTERRUPTERS

2.1 Each fault interrupter shall be furnished with a magnetic latching actuator, described in Section 3.0, providing a Close-Open (pulse) of 2 milliseconds or less.

2.2 The fault interrupter housing shall be molded from cycloaliphatic epoxy resin.

2.3 The fault interrupter and actuator shall have been tested and rated for at least 10,000 mechanical Close-Open operations.

2.4 A color-coded open/close indicator shall be provided for each fault interrupter, on the underside of the unitized base, that indicates green for open and red for closed. The indicator shall be readily visible from the ground.

or

2.4 A color-coded open/close indicator shall be provided for each fault interrupter, on the underside of the unitized base, that indicates red for open and green for closed. The indicator shall be readily visible from the ground.

2.5 Mechanical loading from jumpers to the fault interrupter terminal pads shall not exceed 90 lbs. in-line and 30 lbs. perpendicular to the terminal pads, per IEEE Standard ANSI C37.32-1996 Section 8.8.2.2.

2.6 Ratings

Select the appropriate ratings from the following tables:

60-HZ APPLICATIONS

Ratings				
kV①			Amperes, RMS	
Minimum	Maximum	BIL	Continuous②	Interrupting, Sym.
11.43 18.81	15.5 27	110 125	630	12 500

① Minimum and maximum ratings ensure adequate power from the integral power module(s).

② Allowable continuous current capability: 800 amperes with a minimum wind velocity of 2 ft./sec.

50-HZ APPLICATIONS

Ratings				
kV①			Amperes, RMS	
Minimum	Maximum	BIL	Continuous②	Interrupting, Sym.
10 20	17.5 24	110 125	630	12 500

① Minimum and maximum ratings ensure adequate power from the integral power module(s).

② Allowable continuous current capability: 800 amperes with a minimum wind velocity of 2 ft./sec.

3.0 MAGNETIC LATCHING ACTUATORS, OPERATING MECHANISM, AND EXTERNAL CONTROL LEVERS

3.1 The magnetic latching actuators shall be capable of electrically opening and reclosing the fault interrupters and performing circuit testing using a pulse.

3.2 Circuit testing using a pulse shall rapidly close and open the interrupters to produce a current pulse of 2- to 8-millisecond duration. Detection algorithms shall analyze the current pulse to determine whether a fault is present. The fault-interrupting system shall not close if the fault is still present.

3.3 The operating mechanism shall have the option to provide three-phase or single-phase tripping of the vacuum interrupters and shall have the option to provide three-phase or single-phase lookout.

3.4 An external OPEN/CLOSE/READY lever shall be provided, allowing manual three-phase tripping of the vacuum interrupters using a standard or extendible hookstick. Control power shall not be required.

3.5 When the interrupters have been tripped by means of the OPEN/CLOSE/READY lever, electrical closing of the interrupters by the magnetic latching actuators shall be mechanically blocked until the lever is returned to its Ready position. The OPEN/CLOSE/READY lever shall have provision for tagging or locking in the Open position.

3.6 The magnetic latching actuators shall be electrically interlocked with the integral disconnect discussed in Section 1.07, when furnished, such that the magnetic actuators can only be operated when the disconnect is in the fully Open or fully Closed position. The disconnect shall be mechanically interlocked such that it can only be operated when the fault interrupters are open.

3.7 An external lever shall be provided to allow manual application of a hot line tag. The lever shall have a provision for tagging or locking in the hot line tag Active position. It shall only be possible to remove a manually applied hot line tag using this lever. If the lever is operated to give a second Remove command, it shall also remove a hot line tag applied by a SCADA or secure Wi-Fi command.

4.0 CONTROL AND COMMUNICATION

4.1 A control group, consisting of a protection and control module and a communication module, shall be located in the base of the fault-interrupting system. The modules shall be removable with a module-handling fitting attached to a standard 8-foot hookstick.

4.2 The communication module shall communicate via a secure Wi-Fi connection to a user-furnished laptop computer within range. Required configuration software shall be provided with the fault-interrupting system. The control program shall permit the selection of Local or Remote operation. It shall also indicate the Open/Closed position of each fault interrupter, phase voltages and currents, reason for a phase trip, etc. When local operation has been selected, the control program shall command local electrical opening and closing of the fault interrupters.

4.3 The control program shall indicate the position of the integral disconnect discussed in Section 1.07, when furnished.

4.4 The communication module shall include an integrated Global Positioning System clock for 1-millisecond accurate event time-stamping of events.

4.5 A status light on the protection and control module shall provide local indication of normal operation, Wi-Fi connection and disconnection, and loss of control voltage. The status light shall also provide local indication that the OPEN/CLOSE/READY lever has

been moved from the Ready position to the Open position, from the Open position to the Ready position, and from the Ready position to the Closed position.

4.6 A hot line tag light on the protection and control module shall provide local indication of hot line tag application or removal.

4.7 A female N-Type antenna connector with integral surge suppressor shall be mounted to the unitized base for use with a radio in SCADA applications. The connector shall permit installation of a remotely located antenna.

4.8 A non-volatile memory module installed in the unitized base shall back up configuration data and site-specific information, such as the device identifier, sensor calibration data, and operation counter reading. If the protection and control module is replaced, site-specific information shall be loaded in the new module and, as an option, the module shall be fully configured automatically upon insertion in the base. Sensor-calibration data and the operation-counter reading shall not change when new set points are loaded in the memory module.

4.9 The IntelliTeam® SG Automatic Restoration System SpeedNet control group shall be furnished with a SpeedNet™ Cell Edge Gateway, providing high-speed network communication via DNP 3.0 Protocol, and IntelliTeam SG software. User-replaceable batteries in the communication module shall support operation for a minimum of four hours after loss of ac line voltage on both sides of the fault-interrupting system, permitting extended dead-line switching and SCADA communication.

4.10 The control shall include the following protection and control elements:

(1) Simultaneous independent directional phase, ground, and negative-sequence time-overcurrent elements

(2) Simultaneous independent directional phase, ground, and negative-sequence instantaneous-overcurrent elements

(3) Simultaneous independent directional phase, ground, and negative-sequence definite-time elements

(4) Directional blocking overcurrent elements

(5) Intelligent fuse saving overcurrent elements

(6) Overvoltage/undervoltage elements

The protection and control elements shall enable sequence coordination, phase unbalance detection, and synchronization check functions, and include a cold-load pickup modifier.

5.0 SOURCE-TRANSFER CONTROL OPERATION DESCRIPTION

5.1 Ready Condition

The Ready condition shall occur with the normally closed fault-interrupter switch energizing the high-voltage bus and the normally open fault-interrupter switch and its

associated circuit available to supply the bus. The normally closed and normally open designations shall be field configurable through a setup-software interface.

5.2 Transfer on Loss of Primary Source Voltage

Automatic switching shall be initiated when voltage at the normally closed fault-interrupter switch is lost (or reduced to a predetermined level) for a predetermined period of time sufficient to confirm the loss is not transient. Automatic switching shall open the normally closed fault interrupter switch and then close the normally open fault-interrupter switch to restore power to the high-voltage bus.

Transfer shall be initiated when the fault-interrupter switch opens for: extended loss-of-voltage, phase-loss detection, or voltage-loss counts.

5.3 Return to Normal on Return of Primary Source Voltage—return to normal mode Closed Transition

When voltage returns to the normally closed fault-interrupter switch for a preset time, automatic switching shall be initiated to close the normally closed fault-interrupter switch and open the normally open fault-interrupter switch.

5.4 Return to Normal on Return of Primary Source Voltage—return to normal mode Open Transition

When voltage returns to the normally closed fault-interrupter switch for a preset time, automatic switching shall be initiated to open the normally open fault-interrupter switch and then close the normally closed fault-interrupter switch.

5.5 Return to Normal on Return of Primary Source Voltage—return to normal mode None

When voltage returns to the normally closed fault-interrupter switch no automatic operation will occur.

While the normally open fault-interrupter switch is closed and energizing the high-voltage bus, automatic switching shall be initiated when voltage at the normally open fault-interrupter switch is lost (or reduced to a predetermined level) for a predetermined period of time sufficient to confirm that the loss is not transient. Automatic switching shall open the normally open fault-interrupter switch and then close the normally closed fault-interrupter switch to restore power to the high voltage bus.

Transfer is initiated when the fault-interrupter switch opens for: extended loss-of-voltage, phase-loss detection, or voltage-loss counts.

5.6 Fault Isolation

When a fault is detected through the fault-interrupter switch providing power to the high-voltage bus, the fault-interrupter switch shall operate in accordance with the active protection elements. If the fault is temporary in nature and the fault-interrupter switch is able to successfully reclose, the source-transfer system shall remain ready to transfer. If the fault is permanent and the fault-interrupter switch locks out, automatic operation

shall be disabled and require manual intervention to return the transfer system to a Ready condition.

5.7 Open Source Time To Trip shall be configurable from 1 to 600 seconds.

5.8 Voltage-loss counts shall be configurable from 1 to 10 counts.

5.9 Automatic return shall be configurable for 1 to 60 minutes in 1 minute increments.

5.10 The number of breaker operations needed to open the closed switch shall be configurable.

5.11 Phase-loss protection shall be provided and operate for the loss of one or two phases.

5.12 Phase-loss voltage threshold shall be configurable in RMS volts.

5.13 Phase-loss current threshold shall be configurable in amperes.

6.0 SCADA

6.1 The fault-interrupter switch shall be capable of SCADA communication using DNP 3.0 Protocol.

6.2 The fault-interrupter switch shall have an optional factory-installed radio or fiber-optic communication device.

6.3 The fault-interrupter switch shall have a SCADA input point for the Ready condition.

6.4 The fault-interrupter switch shall have a SCADA input point for low battery.

6.5 The fault-interrupter switch shall have a SCADA control point to disable and enable automatic operation.

6.6 All fault-interrupter switch analog and status indications shall be available as SCADA input points.

6.7 The fault-interrupter switch shall have optional user interface software that provides remote-setup capability to allow setup over the radio system or a dial-up modem.

7.0 SENSORS

7.1 Voltage and current sensors shall be integrally molded into the fault-interrupter housings.

7.2 The sensors shall provide three-phase monitoring of line current and three-phase monitoring of system line voltage on both sides of the fault-interrupting system.

7.3 Total system voltage sensing accuracy shall be within ±0.5% across the tested temperature range of -40°F (-40°C) to +104°F (+40°C).

7.4 Total system current sensing accuracy shall be within ±0.5% across the tested temperature range of -40°F (-40°C) to +104°F (+40°C), and linear over the full range of load and fault current.