

# Typical Specifications

## TEROS™ SOLID DIELECTRIC THREE PHASE RECLOSERS

### PART 1- GENERAL

#### 1.1 DESCRIPTION

This specification covers the requirements for an electronically controlled, three phase solid dielectric vacuum reclosers for use on 15 and 27kV distribution systems. The recloser shall be designated G&W Electric Teros.

#### 1.2 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturers shall have at least 15 years of experience in manufacturing solid dielectric reclosers. The manufacturer of the reclosers shall be completely and solely responsible for the performance of the reclosers as well as the complete integrated assembly and testing as rated.
- B. The manufacturer shall furnish certification of ratings of the reclosers upon request.
- C. The recloser shall be designed and tested to comply with requirements of the latest revision of applicable industry recloser standards, which are defined and dated as follows:
  - IEEE C37.60-2018 / IEC 62271-111: 2019
- D. The recloser manufacturer shall be ISO 9001 and 14001 certified.

#### 1.3 DELIVERY, STORAGE, AND HANDLING

- A. Recloser and any included site-ready components listed as accessories shall be shipped in organized shipping pallet(s) with complete documentation for any necessary assembly.
- B. The contractor, if applicable, shall handle, transfer and move the reclosers in accordance with manufacturer's recommendations.

### PART 2- PRODUCTS

#### 2.1 RECLOSER CONFIGURATION

Recloser configuration shall be (choose one):

- Polemount, Alley Arm
- Polemount, Center mount
- Substation

#### 2.2 RECLOSER CONSTRUCTION

- A. Mechanism Enclosure  
The magnetic actuator and corresponding linkage assembly shall be housed within an integral, air insulated, stainless steel enclosure painted light gray using a corrosion-resistant epoxy paint. The mechanism housing shall be of a sealed nature to prevent any moisture ingress. A ground boss shall be provided for system ground connection.

B. Operating Mechanism

The operating mechanism shall utilize a magnetic actuator for opening and closing of the vacuum interrupters. The actuator shall be powered externally with no operating electronics located in the mechanism enclosure.

A manual trip and lockout provision shall be provided by an external, hook-stick operable, handle. This handle shall be made of stainless steel for maximum corrosion resistance. Operation of the manual trip handle shall activate a true physical mechanical block device, disabling any local or remote closing operation, until the handle is restored to the normal/reset position.

Vacuum interrupter contact position indication shall be accomplished using highly visible green (open) and red (closed) reflective indicator located on the bottom of the mechanism enclosure. Manufacture shall have an ordering option for alternate color indication where green (close) and red (open) can be selected at the time of ordering.

C. Vacuum Interrupters

Interruption of the fault or load current shall be accomplished through vacuum interrupters located inside the solid dielectric modules.

D. Solid Dielectric Modules

The solid dielectric modules shall utilize a time proven maintenance-free solid dielectric epoxy insulation to fully encapsulate each of the three vacuum interrupters. The solid dielectric modules shall be track resistant and UV stable. No gas or liquid insulation will be accepted.

Modules to incorporate integrated current and voltage sensing with the following specifications:

- a) Three (3) dual ratio 600/300:1 with +/- 1% accuracy through nominal current ratings and an overall 10P20 rating.
- b) Six (6) LEA (Low Energy Analog) capacitive voltage sensor with a ratio of 6,000:1 and accuracy of +/- 4%.

E. Smart Grid / Lazer Automation Ready

The recloser shall be automation ready in order to simplify conversion for any future automation requirements utilizing internally integrated three (3) dual ratio 600/300:1 current transformers and six (6) LEA capacitive voltage sensors with ratio of 6,000:1 for network monitoring and reconfiguration. Available communication options and capability to include serial, ethernet, fiber optic transceivers and wireless.

F. Electronic Control

The recloser shall be controlled using the following relay module:

- GE Multilin R650 relay

## 2.3 DESIGN RATINGS

### A. Reclosers

The recloser shall be rated (choose appropriate column):

Ratings		
Voltage Class	15kV	27kV
Nominal System Voltage (kV RMS)	15.0	25.0
Rated Maximum Voltage (kV RMS)	15.5	27.0
Nominal Frequency (Hz)	50/60	50/60
Phase Spacing on 3-Phase Units (mm)	381	381
BIL (kV)	110	125
Power Frequency Withstand – Dry (kV)	50	60
Power Frequency Withstand – Wet (kV)	50	60
Continuous (Normal) Current (A RMS)	630	630
CT Ratio	600/300:1	600/300:1
Voltage Sensor Ratio	6000:1	6000:1
Short-circuit Breaking Current (kA, RMS Symmetrical)	16	16
Short-circuit Making Current (kA, Asymmetrical Peak)	41.6	41.6
Short-Time Withstand Current (3 seconds)	16	16
Peak Withstand Current (kA, peak)	41.6	41.6
Top Terminal (Z-side) – Ground Creepage Distance (mm)	1315	1315
Side Terminal (Y-side) – Ground Creepage Distance (mm)	955	955
Terminal – Terminal Creepage Distance (mm)	1090	1090
Arc-Extinction Medium	Vacuum	Vacuum
Insulation Medium	Solid Dielectric	Solid Dielectric
Mechanical Operations	10,000	10,000
Normal Operating Temperature Range (°C)	-10 to +65	-10 to +65
CT Accuracy	+/- 1%	+/- 1%
Voltage Sensor Accuracy (Load/Source)	+/- 3%	+/- 3%
Recloser Weight (kg)	225	225
IP Rating	Recloser: IP66 Recloser control: IP43	Recloser: IP66 Recloser control: IP43

### B. IEEE C37.60/ IEC 62271-111 Fault Interrupting Duty

Percent of Maximum: Interrupting Rating	Approx. Interrupting: Current Amps	No. of Fault: Interruptions
15-20%	3000	44

45-55%	8000	56
100%	16000	16
Total Number of Fault Interruptions: 116		

C. Control relay and package specification requirements:

Category	Selection
Power Supply	Universal Voltage Input: 110 - 220V AC
Battery Backup	Two (2) 12Vdc, 17Ahr Battery
Enclosure	Standard: Painted Steel Alternate: Stainless Steel
Power Outlet	Standard: 110V/120V AC Optional: 220/240V AC GFCI
Heater	Optional
Control Cable Interface	23-pin quick-disconnect control cable with connectors on both end with the following available lengths (m): 3, 6, 10 (standard), 15, 18 and 21.5
Relay Module	GE Multilin R650 Control Model: Standard: R650MALF1G0LOE7LH – MG Alternate: R650MALF1G0LOE7LH
Display	Enhanced Graphical Display
Rear Serial Com Board 1	Redundant RS485
Rear Ethernet Com Board 2	PRP, 1588, 10/100 Base TX* + Redundant 100 Base TX
I/O Board in Slot F	16 Digital Inputs + 8 Outputs
I/O Board in Slot G	None
Auxiliary Voltage	24-48 Vdc (range 19.2 – 57.6)
Language	English
Communication Protocol	IEC 61850 Edition 2, Modbus RTU & TCP/IP, DNP 3.0 Level 2, IEC 60870-5-104, IEC 60870-5-103, IEC 60870-5-101
Voltage & Current Analog Measurements	LEA/Standard CT – 6x LEA Phase Voltage Inputs + 3 Phase Current Inputs VT/CT + 1 Ground Current Input + 1 Sensitive Ground Current
Environmental Protection	Harsh (Chemical) Environment Conformal Coating
Push Button (Open/Close)	Standard: Red=Close and Green=Open Alternate: Red=Open and Green=Close
Communication Equipment Mounting Provisions	Standard provisions include removal 200mm x 235mm panel.

### **GE R650 Relay Elements and Functionality Requirements:**

- 50 – Instantaneous Overcurrent (*Phase, Neutral, Ground, Negative Sequence*)
- 51 – Time Overcurrent (*Phase, Neutral, Ground, Negative Sequence*)
- 79 – Autoreclosing
- 25 – Synchronization Check
- 27 – Undervoltage
- 32 – Directional Power
- 46 – Negative Sequence Time Overcurrent
- 47 – Negative Sequence Voltage
- 49 – Thermal Model
- 50BF – Breaker Failure Overcurrent
- 59 – Overvoltage (*Phase, Ground, Negative Sequence*)
- 67 – Directional Overcurrent (*Phase, Ground, Negative Sequence*)
- 81 – Frequency (Over, Under)

## **2.4 FACTORY PRODUCTION TESTS**

Each individual recloser shall undergo a mechanical operation check verifying contact trip/close velocity, travel profile, timing and phase synchronicity.

The recloser shall be power frequency withstand tested for one-minute phase-to-phase and across the open contacts. Circuit resistance shall be checked and recorded on all phases.

Timing tests shall be conducted to verify TCC performance.

## **2.5 STANDARD COMPONENTS**

The following shall be included as standard:

- Galvanized steel polemount brackets
- Stainless steel mechanism enclosure painted light gray using a corrosion-resistant epoxy paint with ultra-violet protection
- Integrated lifting provisions
- Grounding provisions on both mechanism and control enclosures
- Corrosion-resistant three-line diagram and nameplate(s)
- Manual open and lockout handle with a true mechanical block
- Control cable with weather tight environmental connectors on both ends that mate with the corresponding recloser mechanism and the control to allow easy and quick connection of the cable.
- Provision for lightning arresters (both source and load side)

## **2.7 OPTIONS**

The following options shall be supplied: (Selected as required):

- Clamp style aerial lug with cable range: 35 mm<sup>2</sup> – 240 mm<sup>2</sup> (#2-500 MCM)
- NEMA 2-hole aerial lug
- NEMA 4-hole aerial lug
- Wildlife protectors

## 2.8 LABELING

### A. Hazard Alerting Signs

Appropriate hazard signs shall be applied to each unit, frame or enclosure as applicable.

- Danger sign shall warn of hazardous voltage and the need for qualified operating personnel.
- Warning signs shall warn against product misapplication in excess of the unit's specified ratings, only use provided lifting provisions and the hazards when accessing moving components inside the mechanism housing.
- Caution signs shall warn of harmful X-ray potential during Power Frequency Withstand Voltage testing.

### B. Nameplates, Ratings Labels, and Connection Diagrams

Each recloser shall be provided with a nameplate label and connection diagram on each unit.

Ratings and information listed on nameplate shall indicate the following:

- Maximum Voltage
- Continuous Current RMS
- Impulse Level (BIL)
- Short-Circuit Breaking Current
- Peak Withstand Current
- Short-Circuit Making Current (Peak)
- Rated Duration of Short-Circuit
- Kpp
- Power Frequency Withstand Voltage
- Catalog Number
- Serial Number
- Manufacturing Date
- Weight