



# Viper<sup>®</sup>-5

Solid Dielectric, Three Phase Reclosers

Providing electronic three phase overcurrent protection for systems rated through 38kV, 800A continuous current, 12.5kA symmetrical interrupting



- Reliable performance
- Control flexibility including SEL-351 series, SEL-651R2, GE controls and more
- Operator safety with mechanical block
- Maintenance-free operation
- Overhead, substation and dead-front padmount designs
- Ease of installation
- Three internal current transformers
- Up to six internal voltage sensors
- Smart Grid/Lazer<sup>®</sup> solutions
- RUS accepted

**G&W** Engineered to order. Built to last.

# Viper-S

Viper-S solid dielectric, three phase reclosers combine the time proven reliability of electronically controlled, vacuum fault interrupters with the maintenance benefits of a solid dielectric insulated device. The reclosers are designed for three phase automatic or manual trip operation providing overcurrent protection for systems rated up to 38kV maximum, 800A continuous, and 12.5kA rms symmetrical interrupting.

## FEATURES

**Reliable Performance** - Viper-S reclosers utilize G&W's time proven epoxy system to fully encapsulate the vacuum interrupters. This system provides excellent insulation properties while providing fully shielded, void-free construction. All modules are UV protected and 100% factory tested for partial discharge. The Viper-S recloser utilizes the latest in magnetic actuator technology. The interrupter and actuator assembly are tested annually for 10,000 mechanical operations to ensure a long service life. If main power is lost, the recloser has enough stored energy to trip once, after the control sends the trip command, within a 24 hour period.

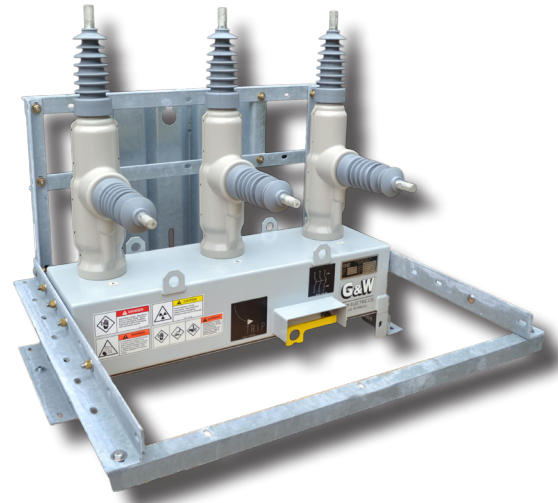
**Control Flexibility** - Viper-S reclosers are designed to work with a variety of different controls including SEL-351 series, SEL-651R2, GE controls and more.

**Operator Safety** - Vacuum interrupters are sealed within a solid dielectric insulation. A hookstick operable manual trip and lockout handle prohibits operation either from the control or remotely. A mechanical blocking device further assures against accidental close. An open and closed contact indicator verifies contact position. Contact status and lockout condition can also be verified at the control.

**Maintenance-free** - Solid dielectric insulation provides a maintenance-free installation. Electronic equipment associated with the operation of the magnetic actuator is located inside the Viper-S tank.

**Ease of Installation** - Mounting bracket with key hole and lifting provisions provide ease of installation. Site-ready designs provide all accessories including mounting bracket, arresters and voltage transformers preassembled prior to shipment significantly reducing installation time. The control cable brings all current, the handle status and trip/close information into the control.

**Application Flexibility** - Units are designed for overhead, substation and padmount applications. Pole mounted units can be equipped with either horizontal or vertical insulators. Removable silicone insulators are standard for overhead applications. This feature permits easy field replacement if an insulator is damaged. Higher external BIL rated insulators can also be retrofitted if necessary.



▲ 15kV Viper-S recloser with polemount center bracket and surge arrester provisions.

**Smart Grid / Lazer® Automation Solutions** - The Viper-S is automation ready, simplifying conversion for any future automation requirements. A multi-ratio current transformer is encapsulated within the module. The current transformer is provided with 1000/500:1 ratios. A 400/200:1 dual ratio CT option is also available for lower current detection. Inputs to the control are field changeable.

CT accuracy is +/-1%. Capacitive voltage sensors encapsulated within each module permit voltage reading for network reconfiguration while eliminating the need for add-on sensors and cabling. When Low Energy Analog Voltage Sensors (LEA VS) are used, accuracy is +/-2% over the temperature range -20°C (-4°F) through +40°C (104°F) when tested as a system. The accuracy is +/-4% from -60°C (-76°F) through +65°C (149°F). The phase angle accuracy is +/-1° throughout the full temperature range. Two voltage ratios are available: a 10,000:1 for applications above 13.8 kV L-G and a 2,500:1 ratio below that voltage. External voltage and current sensors can also be used depending on application requirements.

Complete Lazer automation packages are available offering a pre-engineered solution for applications requiring intelligent automatic switching and power restoration. The packages feature one or more protective relays, equipped with distribution and communication capabilities. Available communication devices include fiber optic transceivers and wireless radio. The typical control paired with the Viper-S is the SEL-351R4.

## CATALOG NUMBERS

Voltage Class	Catalog Number
15.5kV	VIP378ER-12S
27kV	VIP388ER-12S
38kV	VIP398ER-12S

Approximate weight less bracket = 325 lbs. (148 kg).

## OPERATION OPTIONS

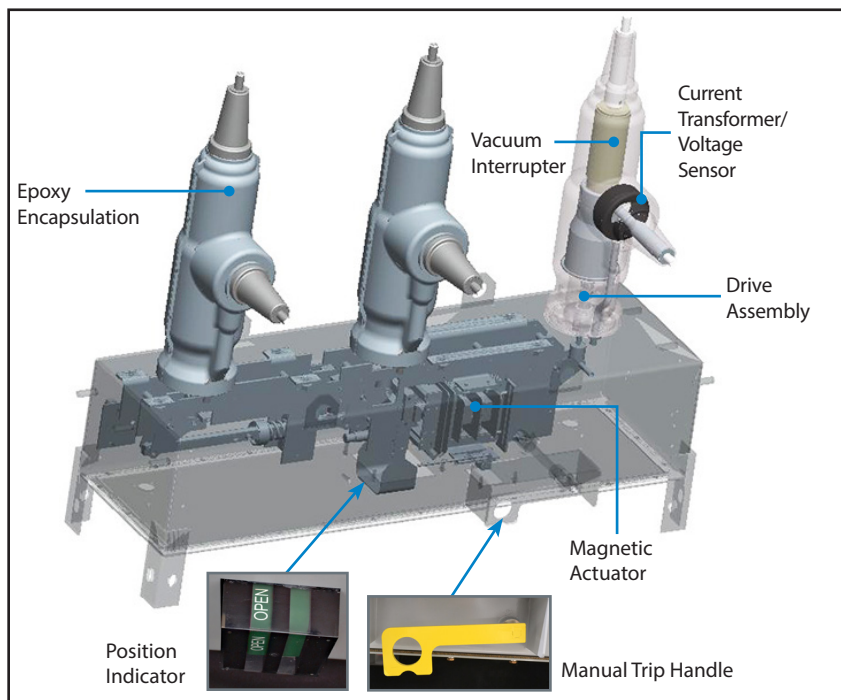
**Dead-line Operation** - Permits using the batteries located in the control for operation of the recloser when main control power is lost. A remote status signal reports the operational status of the interrupter power supply permitting remote indication of the control's capability to open or close the recloser.

**Custom Relay Solutions (CRS)** - The CRS option permits using 48VDC or 125VDC control logic voltage as an alternative to traditional 14-pin SEL, Cooper and GE controls which use 24VDC for control logic. Recloser power is not affected. This flexibility reduces installed cost for retrofit projects by limiting the need to change relays or replacing the input/output boards.

**Internal Voltage Sensing** - Permits voltage reading for network reconfiguration applications and provides a secondary analog 120V AC output accepted by most relays such as the SEL-351R family. Up to 3 or 6 optional internal voltage sensors are available. LEA VS can be used when the Viper-S is paired with the SEL-651R2.

## MANUAL TRIP OPERATION

Operation of the hookstick operable manual trip handle trips and locks out the recloser. A contact position indicator is provided indicating open or closed status of the contacts. Module contact status is also displayed at the control. Operation of the manual trip handle disables any local or remote closing operation until the handle is reset. A mechanical blocking device further assures against accidental close. The handle is operable from ground level. Once reset, the recloser can be closed from the control.



## CONTROL CONNECTIONS

The traditional 14-pin recloser control connector design is the same as other Cooper reclosers permitting easy change out of previously installed controls and/or reclosers.



▲ 14-pin with 2-pin AC cable connectors.

## CONTROL CAPABILITIES

Various style controls are available depending upon application requirements. Typical control settings include:

- Minimum trip for phase, ground and sensitive ground faults.
- Numerous pre-programmed and user-defined time current curves for sensing phase or ground faults.
- Three independent recloser interval times. Capable of up to four shots to lockout.
- Reset time.
- Sequence coordination.
- Cold load pickup.
- Advanced parameters. Refer to control specifications for more details.



▲ Schweitzer SEL-351R control

◀ Isometric view of the Viper-S without insulators.

# Viper-S

## CONTROL POWER VIPER-S

Many of today's reclosers require two to three cables between the control and the recloser to provide AC power to the recloser, control signals and commands, and in many cases, deadline operation. Now there is a cleaner, more efficient way to do the same tasks using G&W's Control Power Viper-S.

The Control Power Viper-S provides a single cable solution for all current, control, breaker status, and auxiliary power to operate the Viper-S. This package uses the power from the control to operate the Viper-S through a four-shot sequence. The power in the recloser control is backed up by batteries and provides an excellent solution for applications requiring deadline operation.

The Control Power Viper-S paired with the SEL-651R2 provides deadline operation which the 14-pin connector cannot provide. The Control Power Viper-S provides a more economical solution compared to the traditional SEL-651R2 14-pin configuration. This is accomplished by utilizing the SEL-651R2 power source to drive the Viper-S magnetic actuator and eliminate the AC/DC power supply within the Viper-S. The Control Power Viper-S has less electronics in the recloser than traditional 14-pin reclosers on the market today.

## FEATURES

The Control Power Viper-S utilizes the same magnetic actuators, with integrated trip spring, and the proven solid dielectric encapsulated dead tank modules with screw-on silicone insulators. The Viper-S has been upgraded to proficiently meet the growing demand of the SEL-651R2 recloser control for mechanically ganged applications.

The Control Power Viper-S provides an alternative source of reclosers to use with existing recloser controls in the field.

With the addition of the 19-pin interface, the Viper-S is now compatible with many of the popular recloser controls. The chart of controls is a non-exhaustive list. Other relays can be integrated with the Viper-S using our Custom Relay Solution for 48 or 125 VDC I/O applications. Please contact your G&W representative for more details.



▲ Traditional configuration: 2-pin AC, 14-pin for control, and 8-pin 120VAC Voltage sensing connectors.



▲ Control powered solution: 8-pin quick-disconnect for LEA Voltage Sensors and 19-pin connector with integrated dead-line operation control.



▲ GE R650 recloser control with 14 pin interface

Viper-S Recloser Control Comparison Chart*			
Manufacturer	Control	Connectors Accepted	
		14-pin	19-pin
SEL	351R/ 651RA	•	
	751-751A	•	
	651R2	•	•
Cooper	Form 6	•	•
	Form 5	•	•
	Form 4D	•	•
	Form 4C	•	•
	FXB	•	
GE	URC	•	
	R650	•	
Beckwith	M-7679	•	

\*Special applications with SEL-311L; GE-845; and more. Consult factory for more information.

## INTERFACE CONFIGURATIONS

The Viper-S come with various interface configurations depending on the control used. The tables below give additional details of the connectors for each of the following configurations:

Viper-S, Traditional 14-pin, SEL-351R/651RA*		
Configuration	Type	Description
Required	14-pin, multi-turn	Control
	2-pin, multi-turn	AC (heaters, cap charging)
Optional	6-pin, multi-turn	Dead-line operation
	8-pin, multi-turn	Three 120VAC internal VS
	Hard-wired or connectorized	Additional aux. contacts

\*Note: For additional compatible controls with these configurations see table on page 4.

Viper-S, 14-pin, SEL-651R2*		
Configuration	Type	Description
Required	14-pin, multi-turn	Control
	2-pin, multi-turn	AC (heaters, cap charging)
Optional	4-pin, 1/4 turn	3 LEA VS
	8-pin, 1/4 turn	3 or 6 LEA VS
	8-pin, multi-turn	Three 120VAC internal VS
	Hard-wired or connectorized	Additional aux. contacts

\*Note: No Dead-line operation available with this configuration, use the 19-pin Control Powered version instead.

Viper-S, 19-pin, Custom Relay Solution (CRS)		
48 VDC or 125 VDC control powered		
Configuration	Type	Description
Required	19-pin, multi-turn	Control
	6-pin, multi-turn	AC: heaters* & DC: cap charging
Optional	8-pin, multi-turn	Three 120VAC internal VS
	Hard-wired or connectorized	Additional aux. contacts
Compatible controls with these configurations:		
SEL	351, 351S and 751A	

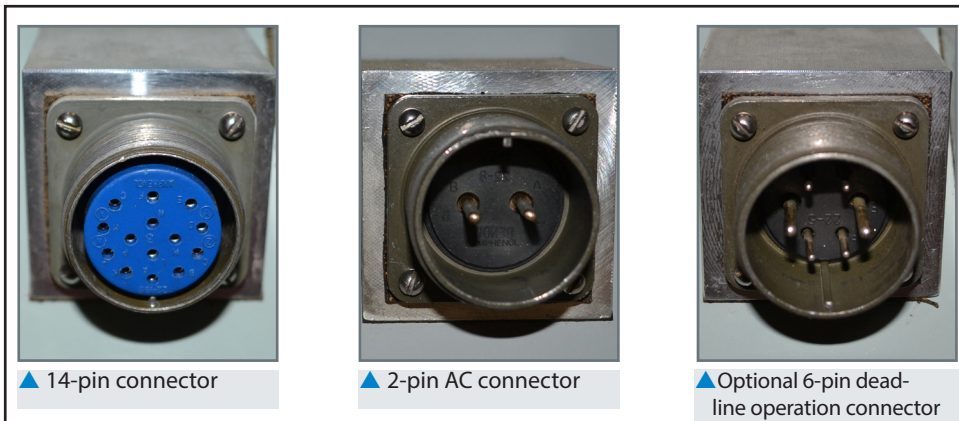
\*Note: If AC is not available, optional heaters can work on DC. Mostly used for substation applications where only DC is available.

Viper-S, 19-pin, Control Powered SEL-651R2		
Configuration	Type	Description
Required	19-pin, multi-turn	Control*
Optional	4-pin, 1/4 turn	3 LEA VS
	8-pin, 1/4 turn	3 or 6 LEA VS
	8-pin, multi-turn	Three or Six 120VAC internal VS
	Hard-wired or connectorized	Additional aux. contacts

\*Note: Control cable includes AC for heaters and dead-line operation feature if battery is provided.

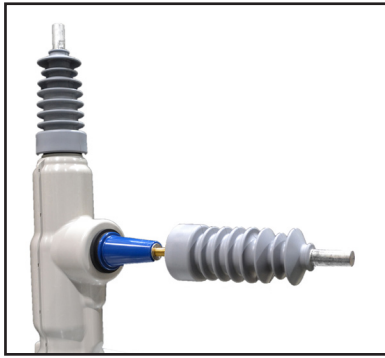
VS = Voltage Sensors  
LEA = Low Energy Analog

### Traditional 14-pin configuration



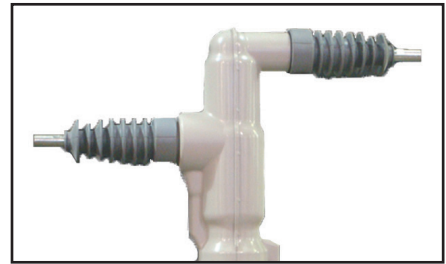
### 19-pin configuration





### Insulator Flexibility

Polemounted units can be equipped with either horizontal or vertical insulators. Removable silicone insulators are standard for overhead applications. This feature permits easy field replacement if an insulator is damaged. Higher external BIL rated insulators can also be retrofitted if necessary. 3 or 6 internal VS are available in either L or Z modules.

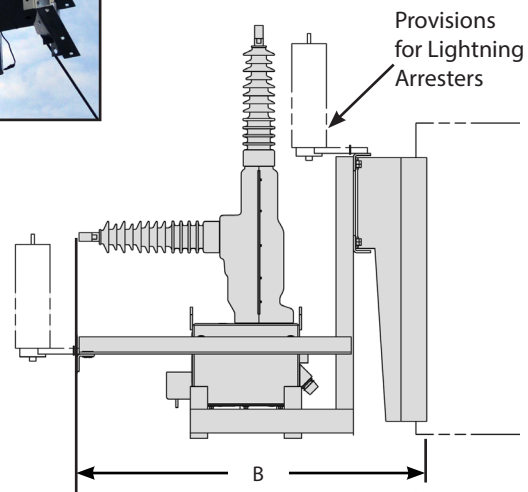
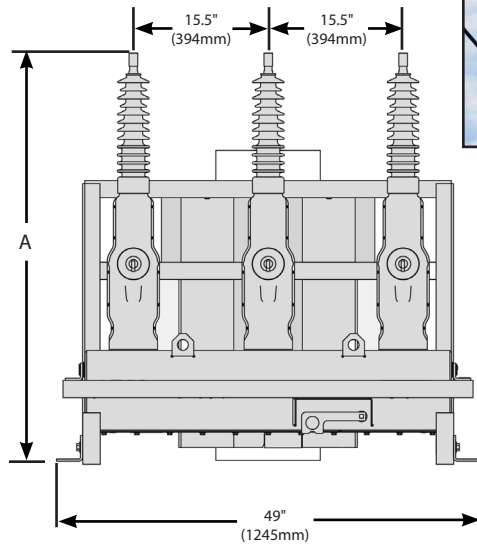


▲ Shown with horizontal insulator configuration (Z module)

### Polemount Center Bracket\*



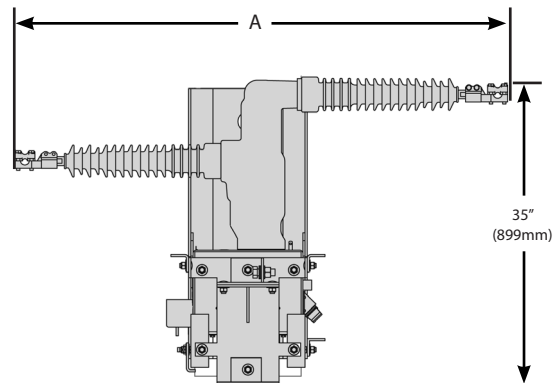
Approx. Dimensions*- ins. (mm)			
	15.5kV	27kV	38kV
A	42 (1067)	47 (1204)	51 (1295)
B	39 (991)	44 (1118)	48 (1219)



### Polemount Alley-Arm\*

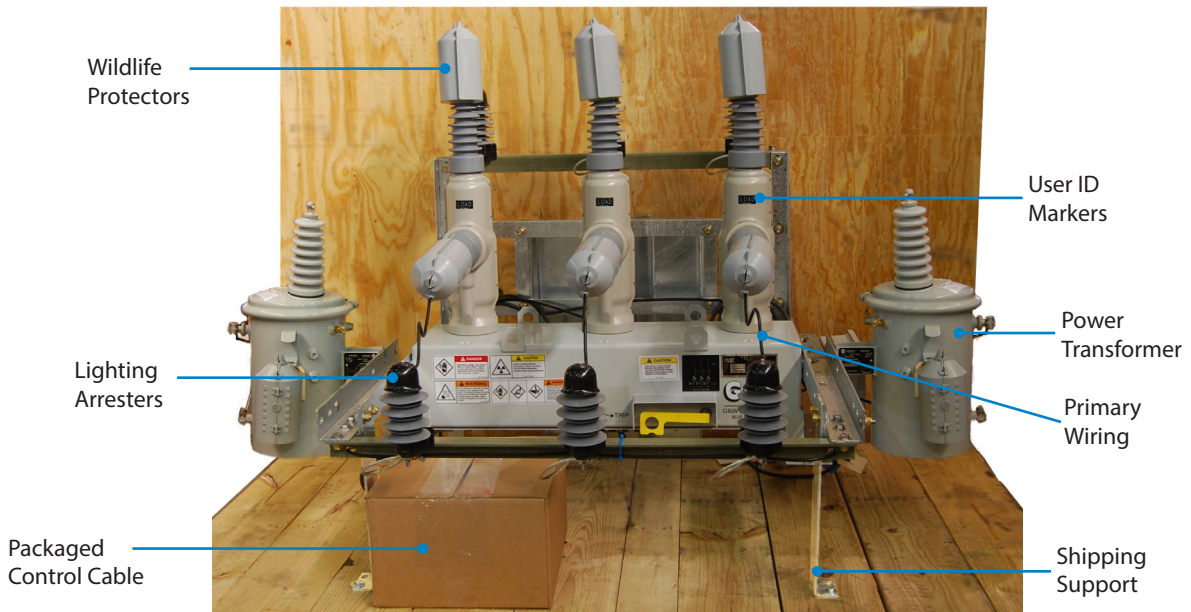
Horizontal Side Mounting Brackets with "Z" modules are ideal for overhead configurations where all three phase conductors are on one side of the pole.

Approx. Dimensions*- ins. (mm)			
	15.5kV	27kV	38kV
A	42 (1067)	50 (1270)	58 (1473)

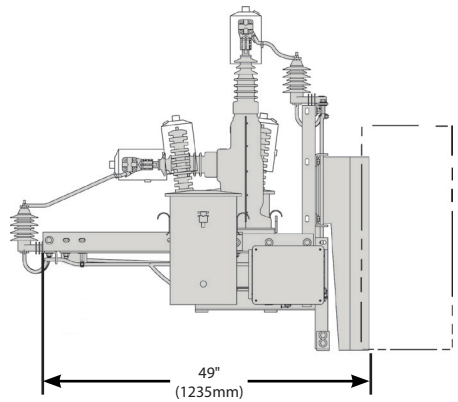
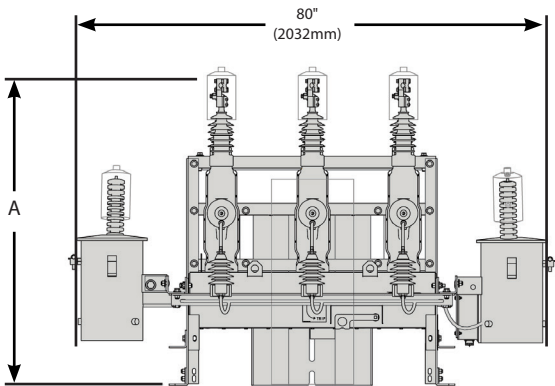


**Polemount Site-Ready Assembly\***

Preassembly of all auxiliary equipment significantly reduces recloser preparation time for product installation in the field. Includes potential transformers or voltage transformers, arresters, aerial lugs, terminal/junction boxes, wildlife protectors and all associated wiring. Control cables are connectorized on both ends and cut to length for a cleaner installation. User identification markers can be applied to each unit prior to shipment further reducing installation time.



Approx. Dimensions*- ins. (mm)			
	15.5kV	27kV	38kV
A	54 (1378)	58 (1473)	62 (1575)



\* Dimensions are approximate. Do not use for construction. Galvanized steel bracket is standard. Stainless steel is available.

## Substation Mount Recloser\*



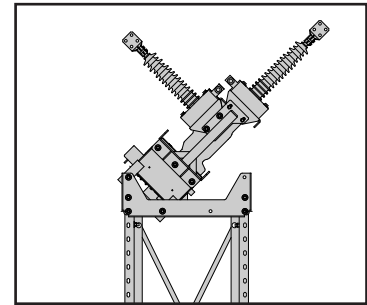
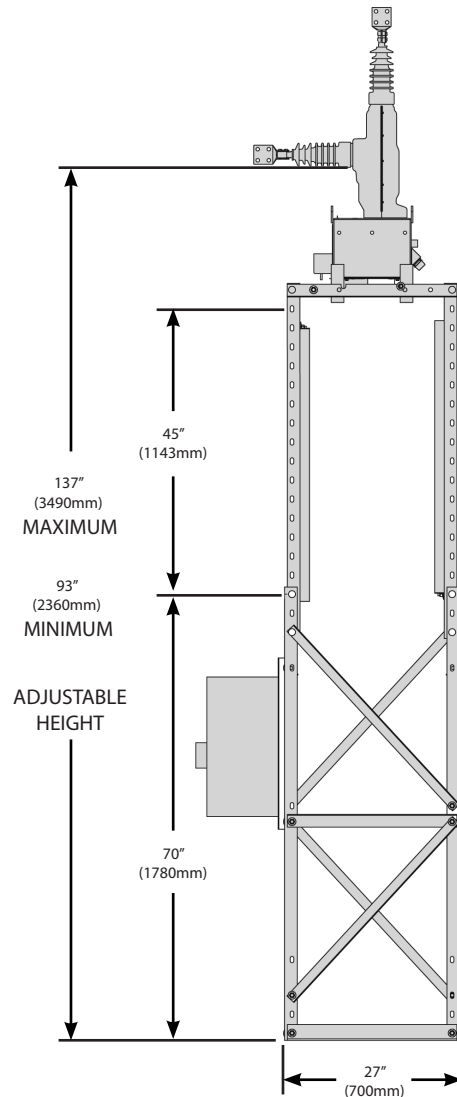
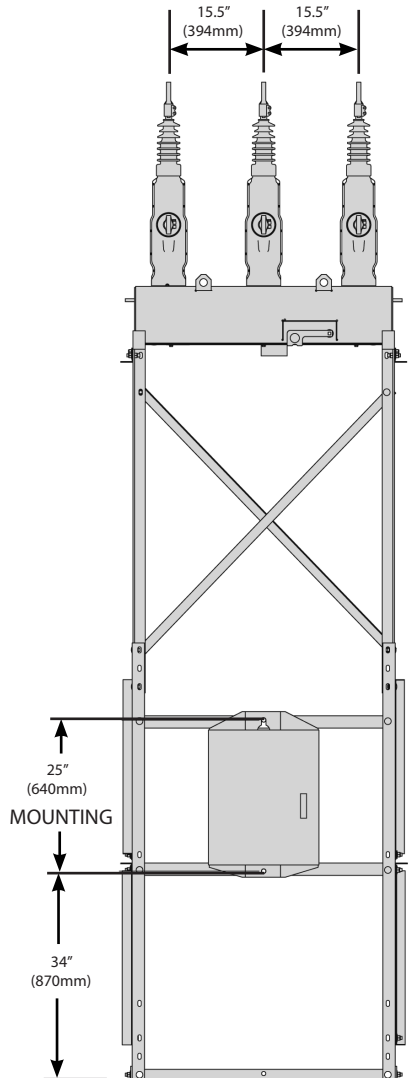
▲ 45° angle mounting for applications requiring the same load and line side connector height.

Substation frames are adjustable. Standard frames are galvanized. Stainless steel is available. Custom frames available including conversion for direct replacement of existing reclosers.

Dead-tank construction makes it ideal for substation circuit breaker applications and ensures the shielded solid dielectric module is grounded to earth potential.

For applications where extended creepage is required, larger insulators can be applied up to 940mm of creepage distance and 150kV BIL. External bushing CTs can be mounted at the base of the insulator where they can be used for metering or relay protection schemes like bus differential. The mechanism housing for substation applications is rated IP46 for maximum protection from water intrusion.

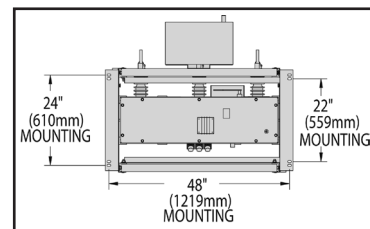
Externally mounted CTs - provide current monitoring on both the load and line side. Individual CTs and cabling are available.



▲ Viper-S substation mount shown with CTs.



▲ Custom mounted frame required for replacement of previously installed oil filled equipment.



Bottom View



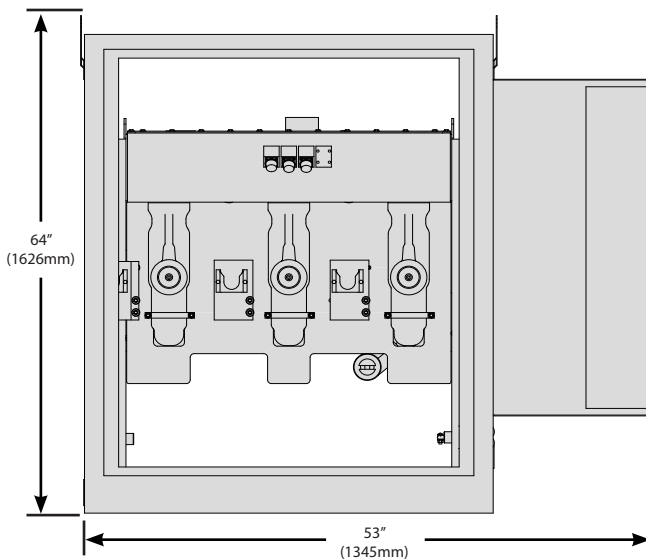
## PADMOUNT APPLICATIONS

For applications where space is limited at the substation or where underground feeders require protection, Viper-S solid dielectric reclosers can provide an ideal solution using a dead-front padmount design. The padmounted Viper-S can be used as a breaker or as a tie-switch. Padmount applications can be considered for fenceless substations. In this configuration, the cable connections can be provided with either a standard IEEE 600A apparatus or 200A deepwell interface for elbow connectors. Separate compartments are provided for accessing the cables and operators. Controls can be mounted directly to the recloser frame or within a separate adjacent low voltage enclosure. Up to six internal LEA voltage sensors can be provided on padmounted designs with Z or C modules, perfect for tie points on FDIR schemes and automatic transfers.



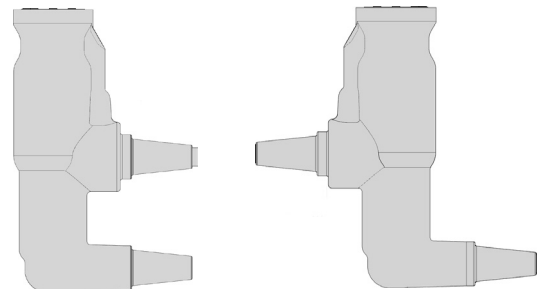
### Padmount Reclosers with Front / Back Access\*

Padmount Reclosers are available with "Z" Modules for cable entrances front and back, or with "C" Modules for cable entrances in front. A galvanized steel enclosure is standard. 304 and 316 stainless steel are available. Photo above shows C module design. Drawing below shows Z module design.



Padmounted Viper-S used in place of a circuit breaker in a solar generation intertie application ▶

### MODULE CONFIGURATIONS



"C" Module

"Z" Module



\* Dimensions are approximate. Do not use for construction.

# Typical Specifications

## A. GENERAL

This specification covers the requirements for an electronically controlled, mechanically ganged solid dielectric vacuum recloser for use on distribution systems through 38kV. The recloser shall be manufactured by G&W Electric Company designated as Viper-S solid dielectric recloser. Recloser configuration shall be (check one):

- Polemount, center
- Polemount, side horizontal (alley-arm)
- Polemount, facing pole
- Substation, 90° mount
- Substation, 45° mount
- Padmount, dead-front
- Phase-over-phase

## B. DESIGN RATINGS AND STANDARDS

Reclosers shall be designed, tested and built per IEEE C37.60 and IEC 62271-111 standards. Certified test reports shall be provided. The recloser shall be rated: (select column):

Voltage Class (kV)	15	25	35
Max System Voltage (kV)	15.5	27	38
BIL (kV)	110	125	150
Continuous Current (A)	800A*	800A*	800
8 Hr. Overload, at 20° C	960	960	960
60Hz Withstand, kV rms Dry, 1 min	50	60	70
60Hz Withstand, kV rms Wet, 10 sec	45	50	60
Interrupting Rating RMS (kA)	12.5	12.5	12.5
Making Current, RMS, asym, KA	20	20	20
Peak, asym (kA)	32	32	32
Short Circuit Current, kA sym, 3 second	12.5	12.5	12.5
Mechanical Operations	10k	10k	10k
Temperature range, -60°C to +65°C (-76°F to 150°F)			

\*Consult factory for higher continuous current up to 1000A.

## C. RECLOSER CONSTRUCTION

### C1: Mechanism Enclosure

The magnetic actuator and corresponding linkage assembly shall be housed within a light gray painted stainless steel tank. A contact position indicator easily visible from the ground, a mechanical counter and air vent shall be provided.

### C2. Operating Mechanism

The operating mechanism shall utilize a magnetic actuator for opening and closing of the vacuum interrupters. The magnetic actuator shall be powered by capacitors located in the recloser tank. The manual trip and lockout handle shall be made of stainless steel for maximum corrosion resistance. Vacuum interrupter contact position indication shall be accomplished using green (open) and red (closed) indicators located on the bottom of the tank and through LEDs inside the control.

### C3. Vacuum Interrupters

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

### C4. Solid Dielectric Modules

The solid dielectric modules shall utilize a time-proven solid dielectric epoxy insulation to fully encapsulate each of the three vacuum interrupters. The solid dielectric modules shall be fully shielded and incorporate a high impact poly-carbonate, track resistant, UV stable covering. The modules shall be dead tank or dead front technology and shall conduct a fault to ground through their external surface in case of a flash over. The operating temperature range shall be -60°C to +65°C. A 1000/500:1 or a 400/200:1 dual ratio current transformer and optional voltage sensor(s) shall be integrally molded into each module. CT accuracy shall be +/-1%. Modules shall be molded with one (1) source side and one (1) load side, IEEE apparatus bushing interfaces. The bushing interfaces shall accommodate either connection of an underground cable elbow for padmount applications or silicone insulators for pole top and substation applications.

### C5. Bushings

Bushing types shall be (check one):

For Overhead design:

- Air insulated, removable silicone insulators over an IEEE bushing interface

For Riser Pole:

- Air insulated, silicone insulators on one side and elbow connectors on the other side.

For Padmount design:

- 600A apparatus bushing
- 200A deep well bushing

## D. OPERATION

Monitoring of the circuit shall be accomplished using internal multi-ratio current transformers and voltage sensors. The unit shall be powered by an external 120/240 VAC or 48/125 VDC source. In the event main power is lost, the unit shall have trip/close operating capabilities through the battery located in the control.

The magnetic actuator shall use a permanent magnet to hold a solenoid plunger in the closed position while maintaining a charge on the opening spring. Trip/close operation shall be accomplished by energizing the trip coil which generates a magnetic flux in the opposite direction and releases the trip spring. The trip spring guarantees an open gap of the contacts inside the vacuum interrupter resulting in a fail-safe operation.

Recloser sequencing, tripping and overcurrent sensing, shall be an automatic function of the electronic control. Manual trip and lockout shall be provided by an external, hook-stick operable handle. Operation of the manual trip handle shall activate a mechanical block device, disabling any local or remote closing operation until the handle is reset.

#### E. SMART GRID / LAZER® AUTOMATION

The recloser shall be automation ready simplifying conversion for any future automation requirements. Up to 6 optional LEA (Low Energy Analog) capacitive voltage sensors shall be encapsulated within each recloser module permitting voltage reading for network reconfiguration while eliminating the need for add-on external sensors and cabling. LEA voltage sensing accuracy is +/-2% over the temperature range -20°C (-4°F) through +40°C (+104°F) when tested as a system. The accuracy is +/-4% from -40°C (-40°F) through +65°C (+149°F). The phase angle accuracy is +/-1° throughout the full temperature range. Two voltage ratios are available: a 10,000:1 for applications above 13.8 kV L-G and a 2,500:1 ratio below that voltage. External voltage and current sensors can also be used depending on application requirements.

#### F. PADMOUNT ENCLOSURE

Enclosures shall be made of 12 gauge galvanized or stainless steel and manufactured to IEEE C37.72 and C57.12.28 standards. The enclosure shall be mounted independently to facilitate cable installation, if desired or for future replacement. Enclosures shall be tamper-resistant incorporating hinged access door(s) with penta-head locking bolts(s) and provisions for padlocking. The enclosure shall be provided with lifting provisions and painted with a Munsell 7.0GY3.29/1.5 green finish. Front cable connections or front/back cable connections shall be available. 3 or 6 voltage sensors shall be internal to the modules.

#### G. ELECTRONIC CONTROLS

The standard recloser control shall be the Schweitzer model SEL-351R4, SEL-351R3 Falcon, or SEL-651RA. The 351 family of controls shall be used when up to (4) 0-300 VAC voltage inputs will be monitored. The SEL-651R2 shall be the control used for up to 6 voltage inputs. Other traditional 14-pin and 19-pin interfaces controls shall also be available upon request.

#### H. 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 AC hi-pot tested one minute phase-to-phase, phase-to-ground and across the open contacts. Circuit resistance shall be checked on all phases. Time overcurrent tests shall be conducted to verify minimum pick up level performance. System testing shall be performed on each Viper-S with their respective matching control and any other site-ready add-on such as lightning arrester and potential transformers.

#### I. STANDARD COMPONENTS

The following shall be included as standard:

1. Lifting provisions
2. Grounding provisions
3. Mechanical counter
4. Manual trip and lockout handle with true mechanical block
5. SEL-351R recloser control and associated control cable
6. Fail-safe mechanically ganged operations
7. Dead Tank solid dielectric epoxy modules with up to six internal voltage sensors and three dual ratio CT's
8. Arrester mounting provisions (overhead applications only)
9. Field changeable silicone insulators
10. AC connectorized cable for heaters and power source to the magnetic actuator circuitry
11. Galvanized center polemount frame

#### J. OPTIONS

The following options shall be supplied:

(Check as necessary)

- NEMA 2-hole aerial lugs
- NEMA 4-hole aerial lugs
- Clamp style aerial lugs (#2- 500 kcmil)
- Clamp style aerial lugs (250-750 kcmil)
- 4/0 brass eyebolt ground lug
- Stainless steel polemount center bracket with arrester provisions on the load and source side.
- Stainless steel polemount side bracket (a.k.a. alley-arm frame) with arrester provisions on the load and source side.
- Galvanized steel substation frame.
- Polemount site-ready assembly
- Lightning arresters
- Dead-front padmounted design with stainless steel enclosure.
- External 1.0 KVA oil potential transformer for 120 VAC supply power with hardware to mount on standard frame
- External 0.75 KVA solid dielectric voltage transformer (0.3% accuracy) for 120 VAC supply power with hardware to mount on standard frame
- High impact, UV stable wildlife protectors for source and load insulators
- External CTs for current monitoring
- Six internal voltage sensors

# G&W offers a complete line of smart distribution voltage equipment including:

## Lazer® Automation

- Multiple levels of protection
- Open, flexible communication
- Pre-engineered, factory tested
- Transfer, loop, and network applications



## Solid Dielectric Switchgear

- To 38kV, 16kA interrupting
- Submersible vault and padmount
- Smart Grid / Lazer® solutions
- Single phase and three phase
- Integral Visible Break Designs



## SF6 Insulated Switchgear

- To 38kV, 25kA interrupting
- Submersible vault and padmount
- Smart Grid / Lazer® solutions
- Load and Fault Interrupting



## Solid Dielectric Reclosers

- To 38kV, 12.5kA interrupting
- To 27kV, 16kA interrupting
- Overhead, substation and padmount
- Smart Grid / Lazer® solutions
- Single phase and three phase
- Six voltage sensing available



**G&W** Engineered to order. Built to last.

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