



## Solid Dielectric Switchgear

*Providing load and fault interrupting switching for systems rated through 38kV, 800A continuous, 12.5 and 16kA symmetrical interrupting*



- Submersible vault designs
- Dead-front padmount designs
- Time proven, solid epoxy insulation
- Modular construction
- Maintenance-free operation
- Ease of automation
- Lazer™ ready



**CATALOG TS11**  
November, 2011

**G&W**

Engineered to Order  
Built to Last

## GENERAL FEATURES

### WORLDWIDE EXPERIENCE AND PERFORMANCE

Since 1905, G&W has been providing custom electrical products and innovative solutions to power users around the world. Today, G&W continues that tradition with a full line of solid dielectric switchgear using the industry's latest insulation technology. Trident switchgear combines the best solid dielectric insulation materials with time proven, rugged, and reliable switching designs. Drawing on many years of field experience in the areas of load break switching and vacuum fault interrupter technology, G&W offers one of the widest selections of electrical distribution switchgear in the industry.

### SOLID DIELECTRIC TECHNOLOGY

Trident switchgear utilizes G&W's time proven, submersible epoxy polymer system to fully encapsulate the vacuum interrupters. This system provides excellent insulation properties and incorporates a permanently bonded semi-conductive external coating providing a fully shielded, void-free construction. Internal shields limit the electrical stress in the epoxy, therefore increasing its electrical integrity. All modules are 100% factory tested for partial discharge. Dual ratio current transformers are encapsulated within each module providing either 500:1 or 1000:1 protection characteristics.

### SUBMERSIBILITY

Solid dielectric switchgear is dead-front and fully submersible. Units have remained fully operable after withstanding years of submersion at depths of up to 10 feet (3m).

### MAINTENANCE BENEFITS

Solid dielectric insulation means no more routine maintenance as with oil and air switchgear. Solid dielectric insulation also offers an alternative to SF6 insulated devices.



▲ Three phase Trident-S fault interrupters in a submersible vault application.

### APPLICATION FLEXIBILITY

Solid dielectric switchgear offers compact, modular construction. Module configurations permit elbow style connections to be all front mounted or front/back mounted depending on user preference. The same size modules can function as either load break or fault interrupting. Three phase switches can be linked together to create tailored multi-way switch configurations. Trident fault interrupters offer a wide variety of electronic over-current controls for customized system protection coordination. Automation is easy whether it is an automatic transfer scheme or a fully integrated distribution automation "Smart Grid" project.

### IDEAL REPLACEMENT FOR OIL FUSE CUTOUTS

Trident fault interrupters are an ideal replacement for single phase or three phase oil fuse cutouts by offering the following advantages:

- No more fuse links to stock or replace
- Maintenance-free, nonflammable solid dielectric insulation
- Positive load break operation and easy reset of tripped circuits
- Electronic controls mirror fuse link curves
- Easy to automate
- 200A well or 600A separable connector bushing

### FULLY TESTED

Trident switches are designed and tested to applicable standards including IEEE C37.74 (IEEE C37.71 and C37.72), IEEE 386, IEC 60265, IEEE 592 and IEEE 57.12.28. All fault interrupter devices must pass recloser-class duties as outlined in IEEE C37.60.

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# THE FLEXIBILITY OF SOLID DIELECTRIC TECHNOLOGY

## OPERATING MECHANISM

### FLEXIBILITY

Trident-SP, S and ST switches incorporate integral single phase or three phase spring-assisted mechanisms for positive open and close operations. The operating mechanisms are located within a welded stainless steel housing, constructed to withstand continuous submersible environments. The spring mechanisms operate the vacuum interrupters, encapsulated within the epoxy modules, to accomplish load break switching and fault interrupting protection.

Trident-SR switches incorporate an internal magnetic actuator in place of the spring-assisted mechanism, providing high speed operation. The magnetic actuator eliminates the need for add-on external motors and cabling making it an ideal solution for automated switching applications.

## CABLE ENTRANCE

### FLEXIBILITY

Cable entrances can be either 200A well or 600A separable connector bushings for accepting elbow style connectors. The rugged epoxy surface minimizes the force required for removing elbow connections compared to rubber-to-rubber junctions. Different module orientations permit cable entry from the front, side, bottom or back of the unit.

## INTERRUPTER CONTROL

### FLEXIBILITY

Trident switchgear offers a variety of overcurrent controls including many Schweitzer Engineering Laboratories (SEL) models for fault interrupting switches to suit most any protection requirement. All G&W controls are self-powered from the integral current transformers and offer over 30 different Time Current Characteristic (TCC) curve families. Optional features include inrush protection (cold load pick up), instantaneous, ground fault, time delay, minimum response

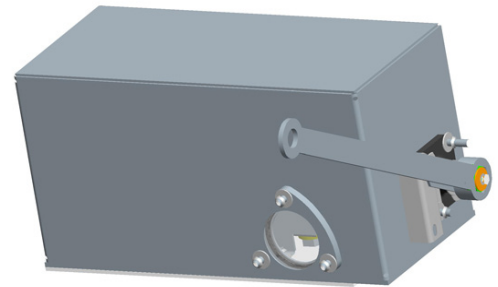
time, and manual trip push buttons. Others may be programmed through a laptop computer, or with a front panel interface. Trident controls may be mounted within an external NEMA 4X (IP56) or 6P (IP67) enclosure, or within the switch mechanism housing (IP68), eliminating the need for external cabling. G&W can also integrate other manufacturer's controls depending on user preference.

## MOUNTING FLEXIBILITY

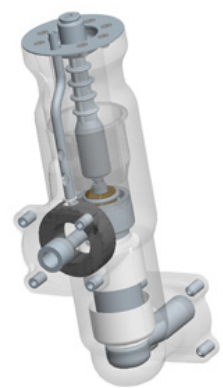
Trident switchgear is suitable for submersible vault or padmount installations. They may be mounted vertically or horizontally, on a wall or floor, and in any attitude. The small footprint is ideal for space restricted applications. Stainless steel mounting brackets are available for maximum corrosion resistance. Parking stands are available.

## Modular Flexibility

- Spring-assisted or magnetic actuator operation
- Submersible, welded construction
- Operating handle options
- Cable entrance options



“C” Module-  
Front access



“Z” Module-  
Front/ back  
access

## Operating Handle Flexibility

Various styles of operating handles are available depending upon user preference. Handles can be removable or permanently fixed to the switch. Handles can be straight or angled providing the best mechanical advantage for operating personnel. Handles can be located on the front or side of the switch. All are hookstick operable.

## AUTOMATION FLEXIBILITY

Trident switchgear is easily adapted for automation requirements. From simple remote control through sophisticated distribution automation schemes, G&W has the products and integration expertise to do the job.

## TRIDENT®-S THREE PHASE SWITCHGEAR



▲ Fault interrupter with wall mounted control box and side mounted operating handle.

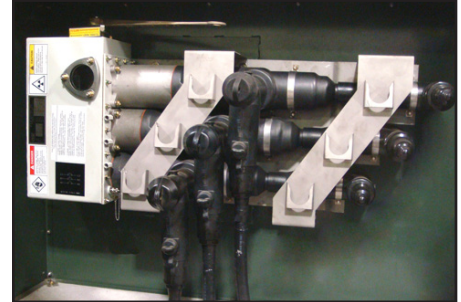
Trident-S three phase, spring-assisted switchgear is available for load break or fault interrupting switching. The Trident-S is ideal for three phase distribution switching and protection, as well as for three phase oil fuse cut-out and oil switchgear replacements. Fault protection can be provided using vacuum interrupters with integral current transformers and a variety of overcurrent controls.

### FEATURES

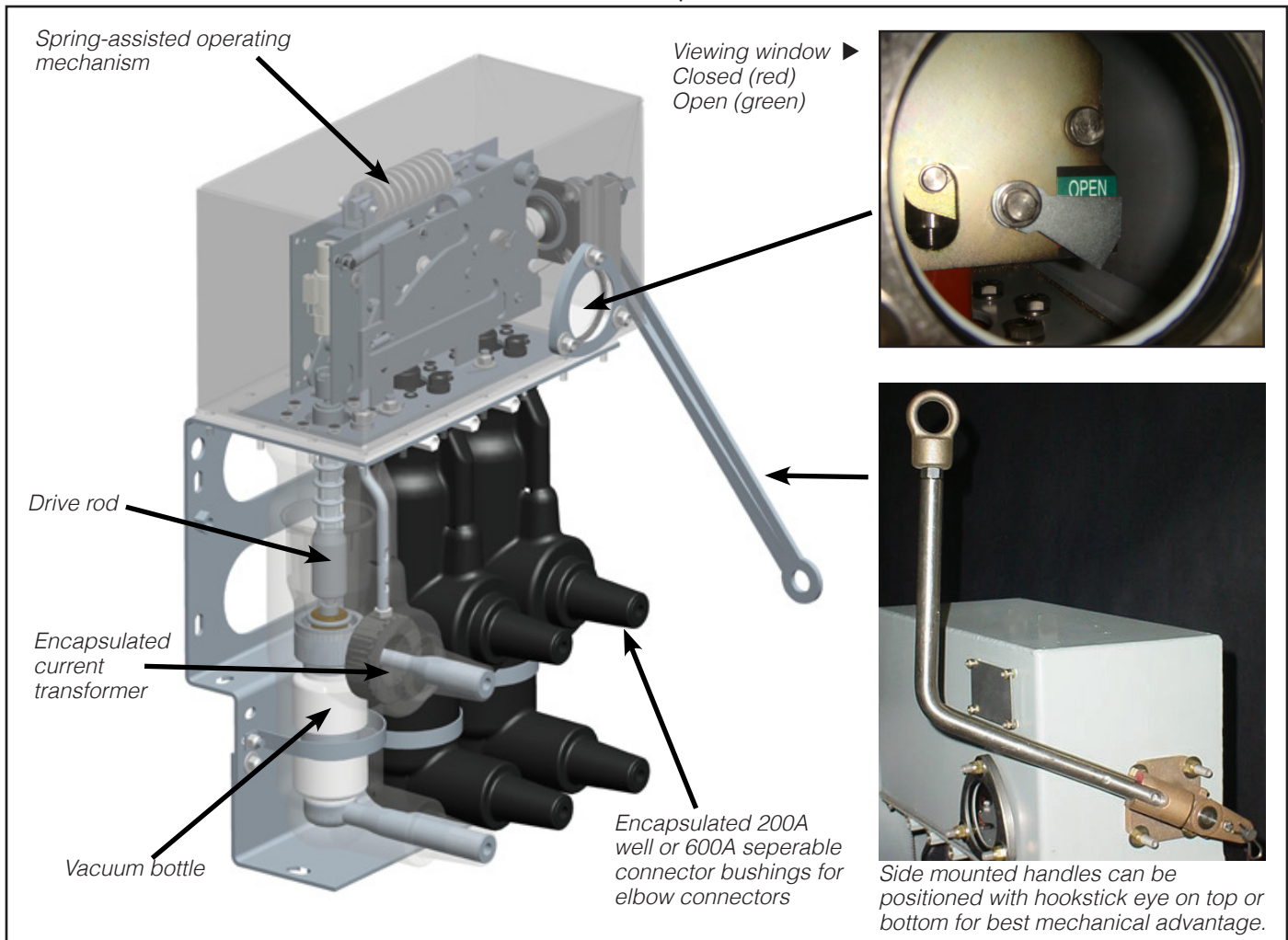
- 15.5, 27, or 38kV, 800A continuous current
- 12.5kA symmetrical interrupting with 16kA available at 15.5kV
- Manual or automated operation
- Padmount and vault designs
- Vertical or horizontal mounting
- Hookstick operable with permanent or removable handles
- Submersible construction
- Optional handle permitting switch to function as a load break or fault interrupter



▲ Horizontal mounted fault interrupter in a submersible vault.



▲ Padmount switch with horizontal mounting and diagonal, spread bushing configuration.





# TRIDENT®-S THREE PHASE SWITCHGEAR

## RATINGS

Voltage Class (kV)	15	25	35
Maximum (kV)	15.5	27*	38
BIL Impulse (kV)	110	125	150
Continuous Current (A)	800	800	800
Load Break Current (A)	800	800	800
1 Min AC Withstand (kV)	35	60	70
1 Min AC Withstand dry (kV)	34	40	50
15 Min DC Withstand (kV)	53	78	103
Momentary Current (kA) asym	20	20	20
Fault-Close 3-times (kA) asym	20	20	20
Fault Interrupting Current (kA) asym	12.5**	12.5	12.5
1 Sec Current (kA) sym	12.5	12.5	12.5
Mechanical Operations	2K	2K	2K

\* 29.3kV available

\*\* 16kA available

## IEEE C37.60 FAULT INTERRUPTING DUTY

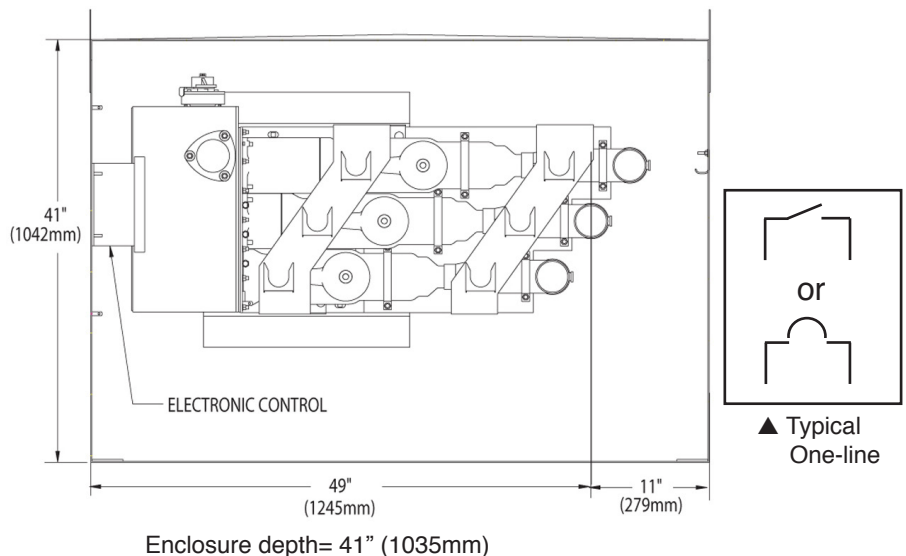
Percent of Maximum Interrupting Rating	Approx. Interrupting Current, Amps	No. of Fault Interruptions
15-20%	2,000	44
45-55%	6,000	56
90-100%	12,500	16
Total # of Fault Interruptions: 116		

### Padmount style, front access, horizontal mount

Approximate Dimensions

Approximate Weight= 700 lbs. (318 kg)

Spread bushing configuration

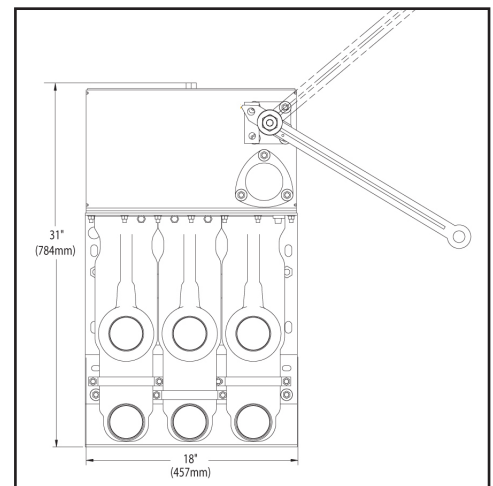


### Vault style

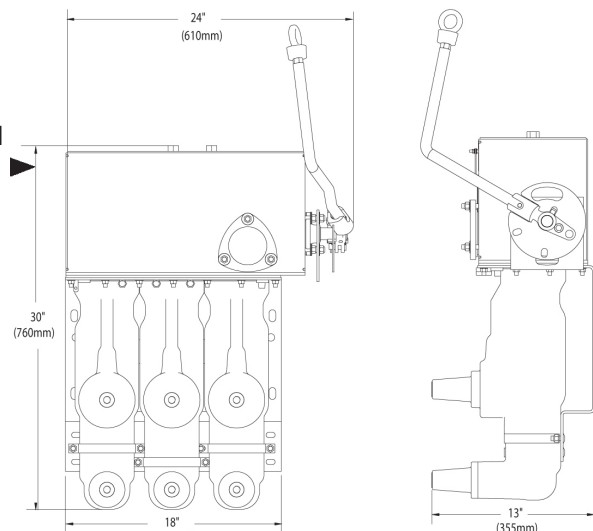
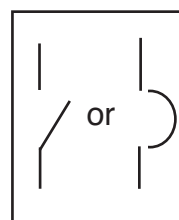
Approximate Dimensions

Approximate Weight= 200 lbs. (91 kg)

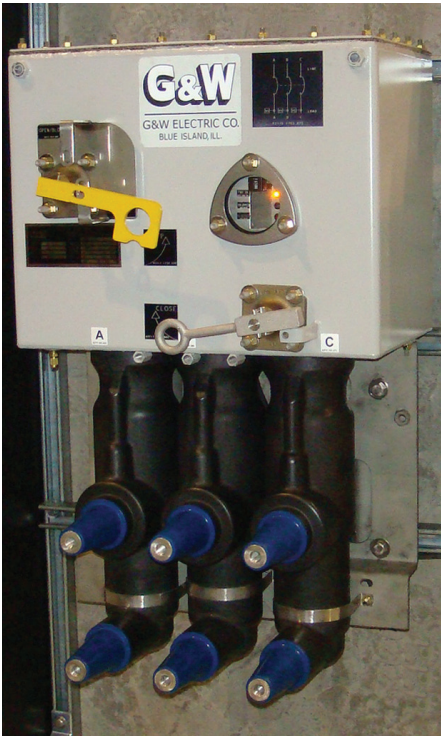
**Configuration "B"** with bushing front and handle front mounted.



**Configuration "A"** with bushing front and handle side mounted.



## TRIDENT®-SR THREE PHASE SWITCHGEAR



▲ Vault style Trident-SR with front mounted bushings.

Trident-SR, high speed magnetic actuator (3-1/2 cycles), SCADA ready switches simplify the process of automated switching and fault interruption on systems rated through 38kV. The extremely flexible design permits the user to customize the best solution for their particular application. From remote operation, to fully automated distribution automation or Smart Grid schemes, the Trident-SR offers multiple application functionality, all within the same compact switch footprint. Compare these features:

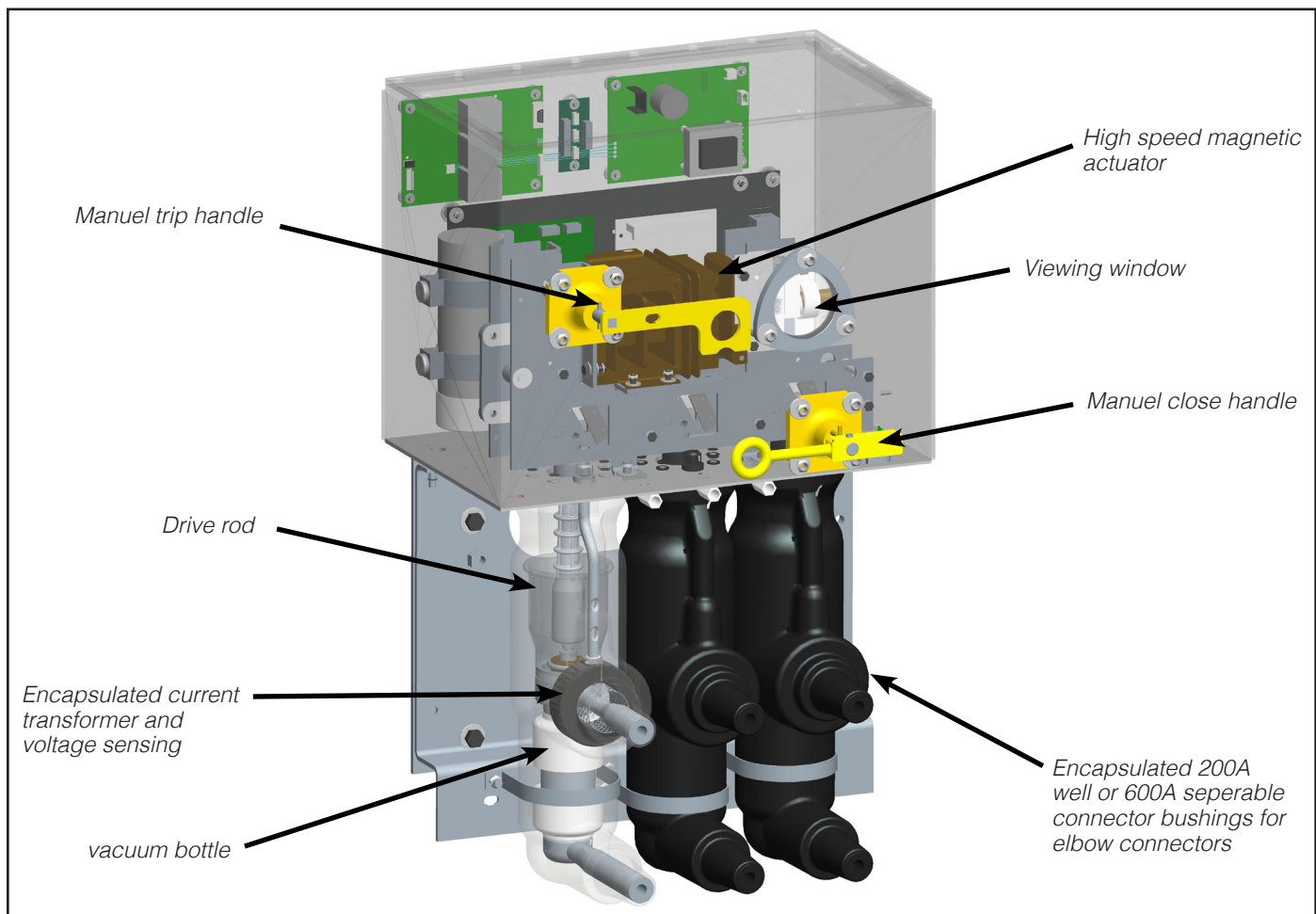
### FEATURES

- 15.5, 27, or 38kV, 800A continuous current
- 12.5kA symmetrical interrupting
- Magnetic actuator for automated operations
- Padmount and vault designs
- Vertical or horizontal mounting
- Hookstick operable with front mounted handles.

**For load break switching** - The rugged magnetic actuator is tested to over 10,000 mechanical load break operations.

**For fault interrupting** - A variety of Schweitzer Engineering Laboratories (SEL) relays and G&W electronic controls are available to best meet the specific protection needs of the application. Programming using a laptop computer or built-in LCD display are available options. G&W controls are powered by current transformers housed within the epoxy module. Other style controls are also available.

**For remote operation** - Hand held remote operators are available permitting pushbutton operation from either above ground for vault applications or from a control adjacent to the enclosure for padmount applications.





## TRIDENT®-SR THREE PHASE SWITCHGEAR

### SCADA ready automation -

Current transformers encapsulated within the epoxy modules provide integral current sensing. Integral capacitively coupled voltage screens provide three phase analog voltage values for connection to a wide selection of relays and RTUs.

### For Lazer® ready automation -

Trident-SR switches are an integral part of G&W's pre-engineered Lazer control package to provide automatic power restoration. Using SEL relays with distributed capabilities and peer-to-peer communication, G&W's Lazer solution with Trident switchgear can greatly simplify the automation process from small scale through large scale system requirements.

### For future Smart Grid -

Thinking of automating in the near future but need switches now? The built-in features and application flexibility of the Trident-SR can help simplify your decision.

### Compact, clean design -

No add-on motors or linkage. No external current transformers or voltage sensors hanging from elbow connectors. Trident-SR switches feature built-in components.

### Maintenance benefits -

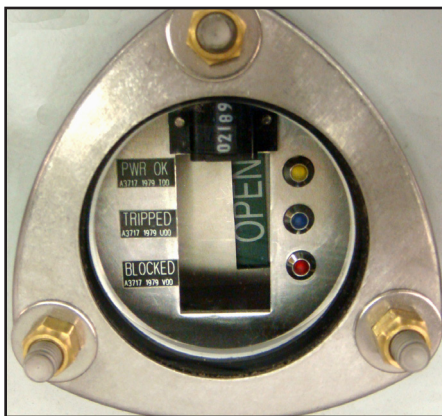
Solid dielectric insulation eliminates any concern about liquid or gaseous dielectrics. That means no more routine switch maintenance.

### Submersibility -

Solid dielectric switchgear is dead-front and fully submersible. Units have remained fully operable after withstanding a 20 foot head of water for 20 days.

### Contact position indicator -

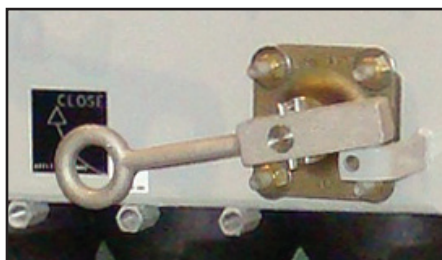
A large viewing window permits visual verification of vacuum contact position, either open or close. The position indicator is connected directly to the drive assembly. In addition, three different color LEDs can also be provided to verify either Power OK, Tripped, or Blocked position. LED verification of "open" and



▲ Contact position indicator with LEDs



▲ Manual trip handle



▲ Manual close handle

"close", in addition to the flag indicator, can also be two of the three LED options. An operation counter is also included.

### Manual trip handle -

A hookstick operable handle permits manual opening of the switch. Once opened, the switch is then blocked from any remote commands thereby prohibiting any close operation. The open and blocked positions are padlockable providing true mechanical lockout.

### Manual close handle -

A hookstick operable handle permits manual closing of an electronically tripped or manually opened fault interrupter.

### Cable entrance flexibility -

Cable entrances can be either 200A well or 600A separable connector bushings for accepting elbow style connectors. In-line or diagonal spread version configurations are available to facilitate cable training.

## RATINGS

Voltage Class (kV)	15	25	35
Maximum (kV)	15.5	27*	38
BIL Impulse (kV)	110	125	150
Continuous Current (A)	800	800	800
Load Break Current (A)	800	800	800
1 Min AC Withstand (kV)	35	60	70
1 Min AC Withstand dry (kV)	34	40	50
15 Min DC Withstand (kV)	53	78	103
Momentary Current (kA) asym	20	20	20
Fault-Close 3-times (kA) asym	20	20	20
Fault Interrupting Current (kA) asym	12.5	12.5	12.5
1 Sec Current (kA) sym	12.5	12.5	12.5
Mechanical Operations	10K	10K	10K

\* 29.3kV available

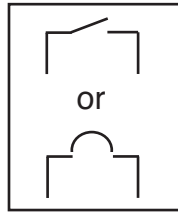
## IEEE C37.60 FAULT INTERRUPTING DUTY

Percent of Maximum Interrupting Rating	Approx. Interrupting Current, Amps	No. of Fault Interruptions
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90-100%	12,500	16
Total # of Fault Interruptions: 116		

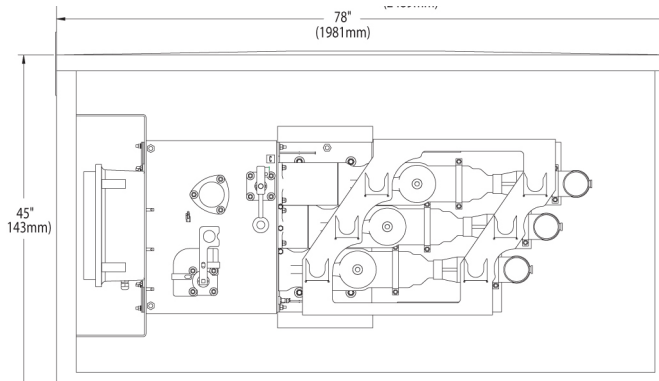
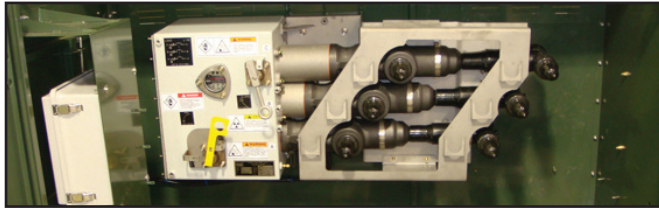
# TRIDENT®-SR THREE PHASE SWITCHGEAR

## Padmount, front access, horizontal

Spread bushing configuration Approximate Dimensions  
Approximate Weight= 1100 lbs. (500 kg)

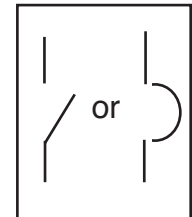
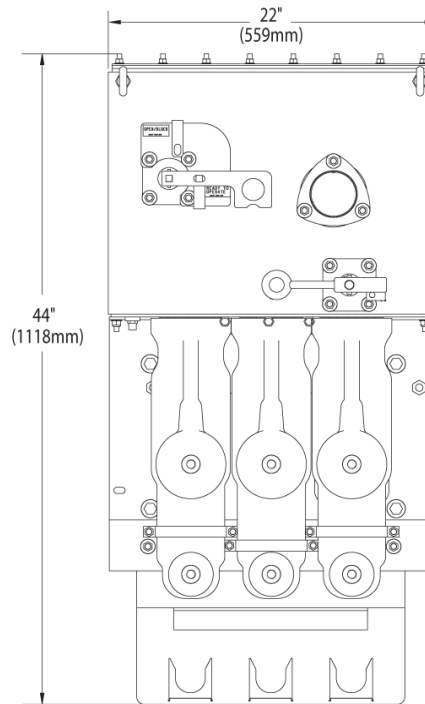


▲ Typical One-line



Depth= 41" (1041mm)

## Vault style Approximate Dimensions. Approximate Weight= 400 lbs. (180 kg)



▲ Typical One-line

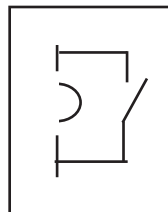
Depth to end of handle= 18" (457mm)

## Trident-SR with integral Bypass Switch- Approximate Dimensions. Approx. Weight= 900 lbs. (408 kg)

Combination Trident-SR with Trident-S switch permitting the Trident-SR and its relay to be fully tested without de-energizing the circuit.

### Options

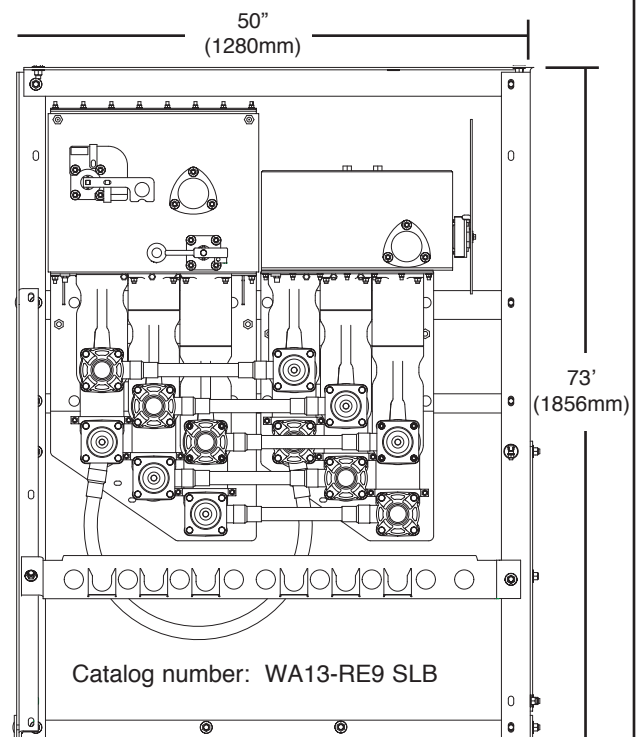
- 1) 200A tap bushings to power potential transformers for control power or voltage sensing.
- 2) Various relays available in NEMA 4, 4X, submersible 6P and submersible IP68 (20 foot, 20 day) ratings.



▲ Typical One-line



▲ SEL's 751A relay makes an ideal solution.



Catalog number: WA13-RE9 SLB

▲ Front access, vault style bypass switch.



## TRIDENT®-ST THREE PHASE SWITCHGEAR



▲ Trident-ST with individual, single phase operating handles.

Trident-ST three phase, spring-assisted switchgear can provide either three phase or single phase fault protection. The Trident-ST is ideal for three phase distribution switching and protection, as well as for three phase oil fuse cutout and oil switchgear replacements. Fault protection can be provided using vacuum interrupters with integral current transformers and a variety of overcurrent controls.

### FEATURES

- 15.5, 27, or 29.3kV, 630A continuous current
- 12.5kA symmetrical interrupting
- Padmount and vault designs
- Vertical or horizontal mounting
- Hookstick operable with permanent or removable handles.
- Optional 3-phase external ganged linkage for 3-phase operation

### RATINGS

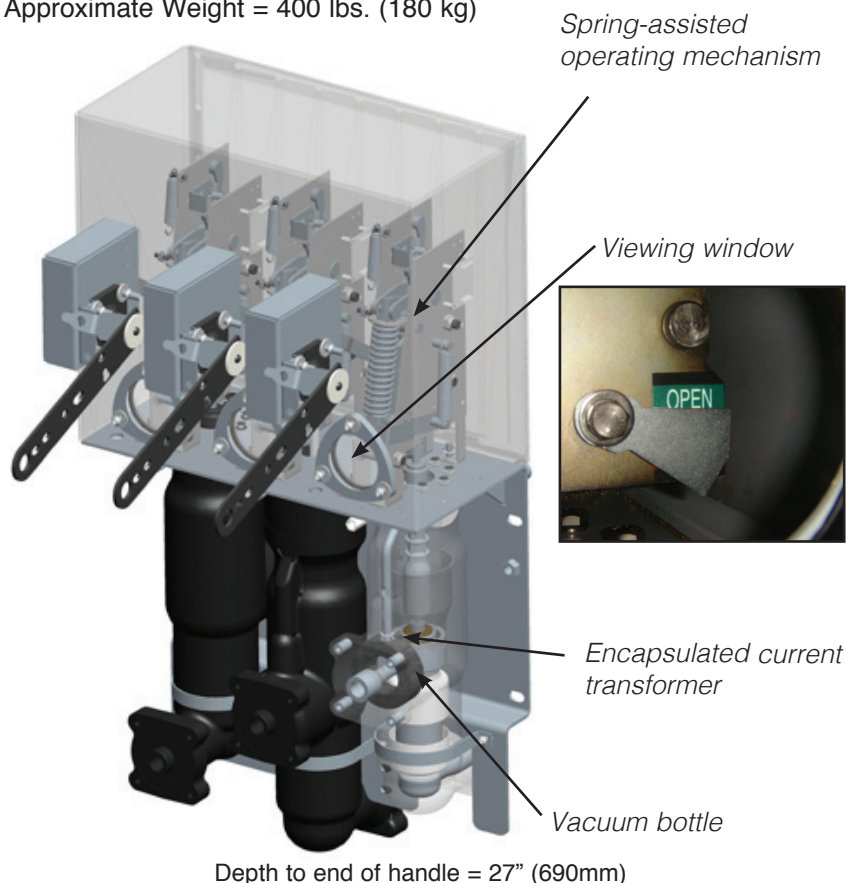
Voltage Class (kV)	15	25
Maximum (kV)	15.5	27*
BIL Impulse (kV)	110	125
Continuous Current (A)	630	630
Load Break Current (A)	630	630
1 Min AC Withstand (kV)	35	60
1 Min AC Withstand dry (kV)	34	40
15 Min DC Withstand (kV)	53	78
Momentary Current (kA) asym	20	20
Fault-Close 3-times (kA) asym	20	20
Fault Interrupting Current (kA) asym	12.5	12.5
1 Sec Current (kA) sym	12.5	12.5
Mechanical Operations	2000	2000

\* 29.3kV available

### Vault style

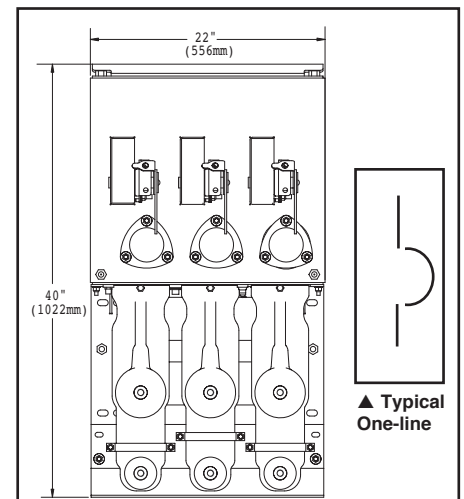
Approximate Dimensions.

Approximate Weight = 400 lbs. (180 kg)



### IEEE C37.60 FAULT INTERRUPTING DUTY

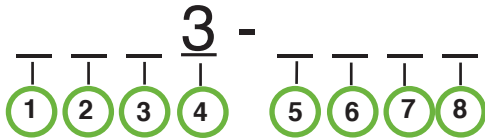
Percent of Maximum Interrupting Rating	Approx. Interrupting Current, Amps	No. of Fault Interruptions
15-20%	2,000	44
45-55%	6,000	56
90-100%	12,500	16
Total # of Fault Interruptions: 116		



# How To ORDER TRIDENT® THREE PHASE SWITCHGEAR

## HOW TO ORDER:

Select from the various catalog breakdown chart options below. Enter the desired selection in the corresponding catalog number position.



### 1 Mounting

Description	Code
Padmount, front access, vertical mount	P
Padmount, front access, horizontal mount	H
Padmount, front/back access, vertical	B
Padmount, front/back access, horizontal	R
Vault style with non-submersible electronics (if supplied)	V
Vault style with submersible electronics (if supplied)	W

### 2 Configuration\*

Description	Code
Bushings front; side mounted handle	A
Bushings front; front mounted handle	B
Bushings back; side mounted handle	C
Bushings back; front mounted handle	D

\* Contact your G&W representative for other configurations

### 3 Voltage Class

kV	Code
15	1
25	2
35	3

### 4 Number of Phases

Phase	Code
Three	3

### 5 Switch Style

Description	Code
Trident-S	S
Trident-ST	T
Trident-SR	R

### 6 Controls, if applicable

Description	Code
Load break switch	L
Type 1	1
Type 2	2
Type 3	3
Type 4	4
Type 7	7
ATS control: ATC451	A
Connectorized: SEL 351R or SEL 651R	R
Pre-engineered control: Relay, RTU, IED	E
Provisions for future use: Junction box	P
Customer to wire and supply control	W

### 7 Options

Description	Code
No options	0
Auxiliary contacts	1
Motor actuator ( <i>Trident-S only</i> )	2
Stationary or portable ( <i>Trident-S only</i> ) or stationary or hand held control ( <i>Trident-SR only</i> )	3
Voltage sensing	4
Auxiliary contacts and voltage sensing ( <i>Trident-SR only</i> )	5
Auxiliary contacts, voltage sensing and stationary or hand held control ( <i>Trident-SR only</i> )	6
Auxiliary contacts and stationary or portable ( <i>Trident-S only</i> ) or stationary or hand held control ( <i>Trident-SR only</i> )	7
Voltage sensing and stationary or hand held control ( <i>Trident-SR only</i> )	8
Custom engineered	9
Load break/fault interrupter switch	A
Bypass switch	B
Ground cut in/cut out switch	C

### 9 Bushing Arrangement

Closest to Housing	Away from Housing	Code
200A	200A	2
200A	600A	3
600A	200A	4
600A	600A	6

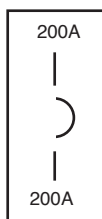


## ORDERING EXAMPLES - TRIDENT<sup>®</sup> -S SWITCHGEAR

### Example 1:

#### Oil Fuse Cutout Replacement

Vault style, 15kV, three phase fault interrupter with all 200A deepwell bushings and a NEMA 6P Type 2 overcurrent control. A side mounted handle is required. **The catalog number would be: WA13-S202**



### Example 3:

#### Fault interrupter with three phase electronic and manual trip, and three phase manual reset

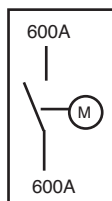
Padmount style, 35kV, three phase fault interrupter with all 200A bushings and a Type 7 overcurrent control. A side mounted handle is required. **The catalog number would be: PA33-S702**



### Example 2:

#### Automated Load Break Switch

Vault style, 15kV, three phase, load break switch with all 600A bushings. A side mounted motor actuator with NEMA 4X stationary control is required. **The catalog number would be: VA13-SL36**



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## ORDERING EXAMPLES - TRIDENT<sup>®</sup> -SR SWITCHGEAR

### Example 1:

#### Automated Load Break Switch

Vault style, 27kV, three phase, load break switch with all 600A bushings. A front mounted handle with a hand held control is required. **The catalog number would be: VB23-RL36**

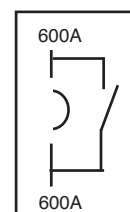


### Example 3:

#### Fault Interrupter with Integral Bypass

Submersible vault style, 15kV, three phase, fault interrupter with integral bypass switch, side mounted handle and all 600A bushings. An SEL-751A control is required.

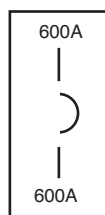
**The catalog number would be: WA13-RE9 SLB**



### Example 2:

#### Fault Interrupter with SEL351R Connectorized Control and Voltage Sensing

Padmount style, horizontal, front access, spread bushings, 35kV, three phase fault interrupter with all 600A bushings. A front mounted handle is required. **The catalog number would be: HB33-RR06**



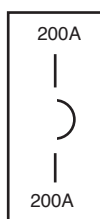
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## ORDERING EXAMPLES - TRIDENT<sup>®</sup> -ST SWITCHGEAR

### Example 1:

#### Oil Fuse Cutout Replacement

Submersible vault style, 15kV, three phase fault interrupter with all 200A deepwell bushings and a Type 1 overcurrent control. A front mounted handle is required. **The catalog number would be: WB13-T102**



# TRIDENT<sup>®</sup> MULTI-WAY SWITCHGEAR

Multi-way Trident switches consist of individual three phase modules linked together through a flexible inter-way bus connection. Design your own switch combination to ideally match your application requirements. Build multiple ways using the same style modules or combine Trident styles S, ST, SP or SR in whatever combination you desire. Modules may be either fault interrupters or load break switches.

## RATINGS

Voltage Class (kV)	15	25
Maximum (kV)	15.5	27*
BIL Impulse (kV)	110	125
Continuous Current (A)**	630	630
Load Break Current (A)	630	630
1 Min AC Withstand (kV)	35	60
1 Min AC Withstand dry (kV)	34	40
15 Min DC Withstand (kV)	53	78
Momentary Current (kA) asym	20	20
Fault-Close 3-times (kA) asym	20	20
Fault Interrupting Current (kA) asym	12.5#	12.5
1 Sec Current (kA) sym	12.5	12.5
Mechanical Operations, Trident-S	2000	2000
Mechanical Operations, Trident-SR	10K	10K

\* 29.3kV available

\*\* 800A available using Trident-S and Trident-SR only

# 16kA available using Trident-S only



▲ Automated padmount switch utilizing magnetic actuators and integral voltage sensing electronics for a high speed automatic transfer application.



▲ Flexible inter-way bus connection system provides reliable performance in a low profile, compact design.

## IEEE C37.60 FAULT INTERRUPTING DUTY

Percent of Maximum Interrupting Rating	Approx. Interrupting Current, Amps	No. of Fault Interruptions
15-20%	2,000	44
45-55%	6,000	56
90-100%	12,500	16
Total # of Fault Interruptions: 116		

## FEATURES

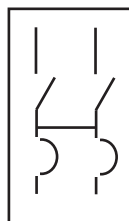
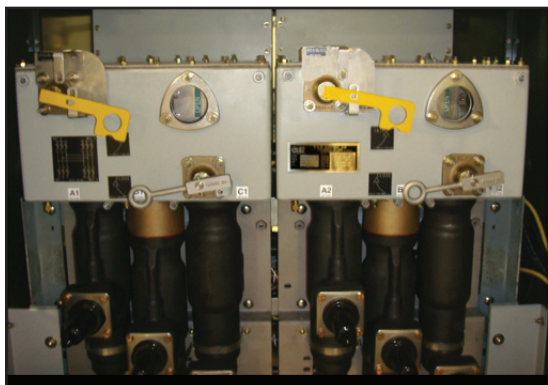
- 15.5, 27kV and 29.3kV maximum design voltage
- 12.5kA symmetrical interrupting with 16kA available at 15.5kV
- Manual, motor actuator or magnetic actuator operation
- Padmount and vault designs
- Hookstick operable, either permanent or removable style handle
- Automatic source transfer applications available
- Integral PT for control power available
- Compact construction
- All front access or front/back access designs



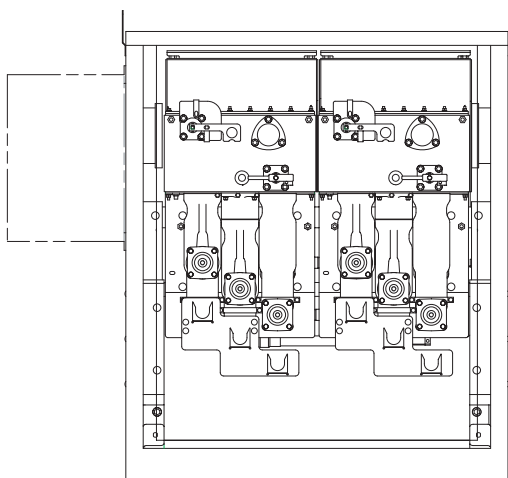
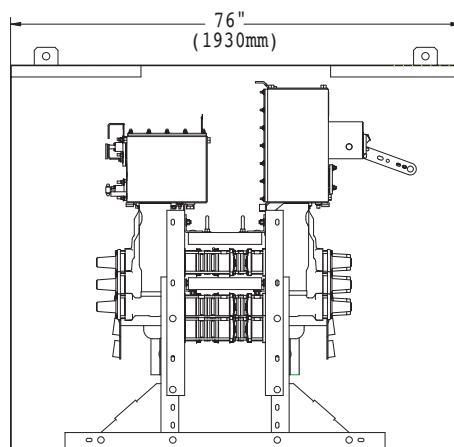
## Padmount style, Trident-SR and Trident-ST, front / back access

Approximate Dimensions.

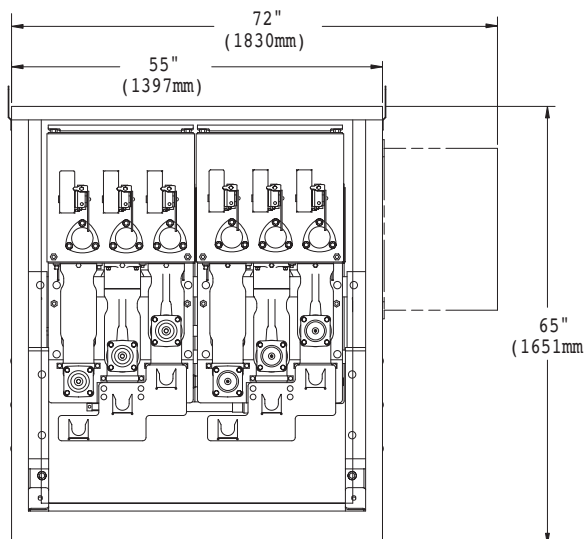
Approximate Weight = 2600 lbs. (1182 kg)



▲ Typical One-line



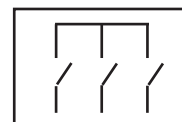
Trident-SR side



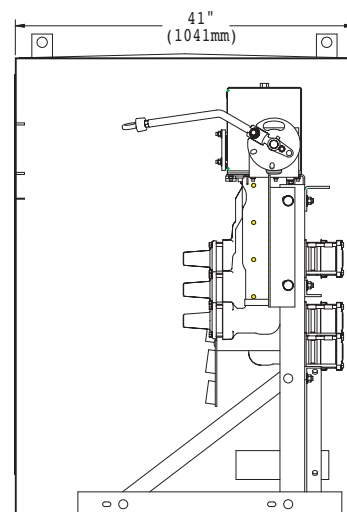
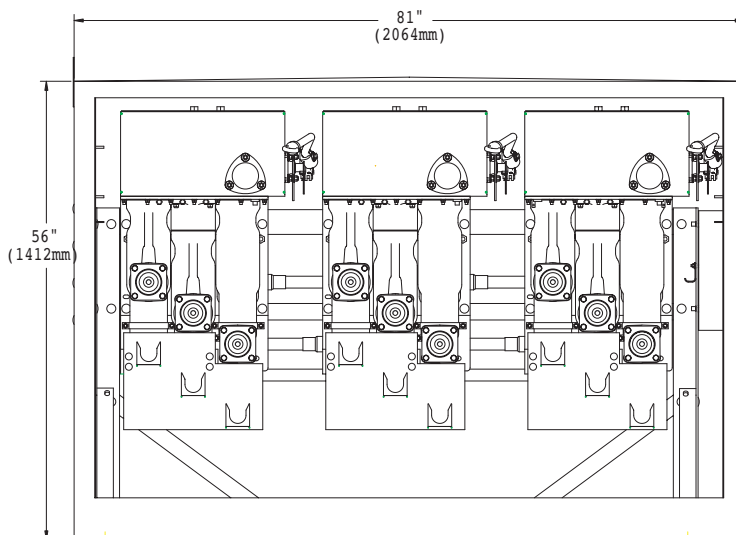
Trident-ST side

## Padmount style, Trident-S front access

Approximate Dimensions. Approximate Weight = 1800 lbs. (817 kg)



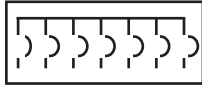
◀ Typical One-line



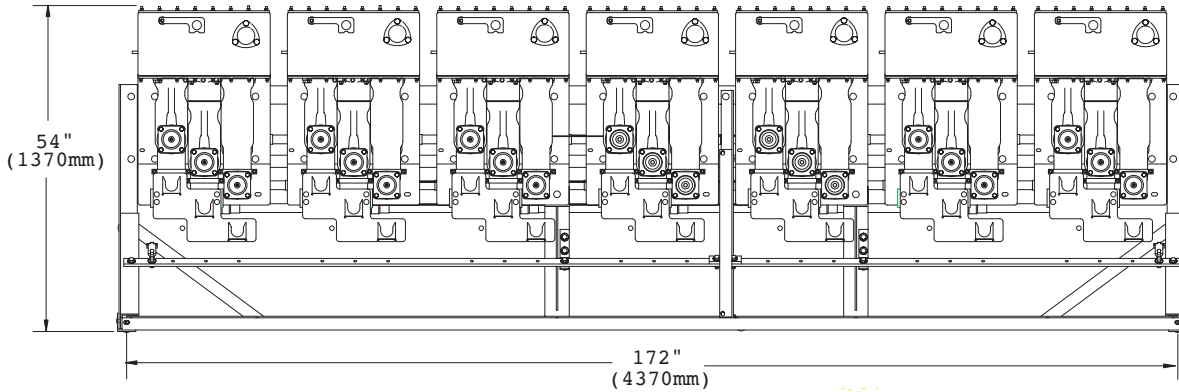
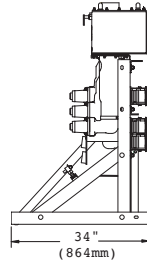
## Vault style, Trident-SR front access

Approximate Dimensions

Photo right: Seven-way vault style Trident-SR switch with front mounted operating handles.

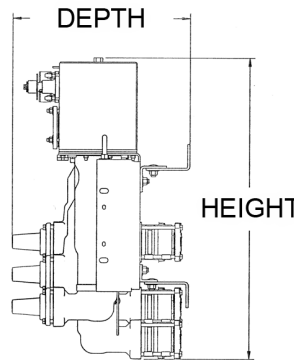
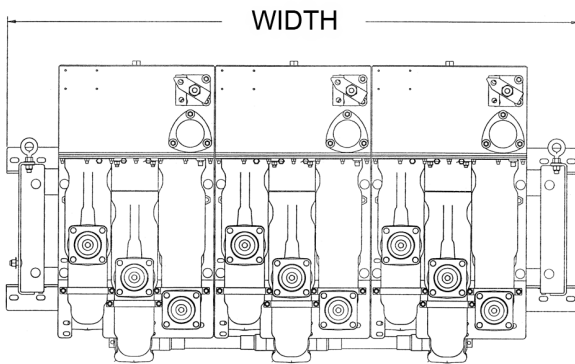


◀ Typical One-line



## Vault and Padmount style, Trident-S front access with front handle

Approximate Dimensions



### Configurations B & D

Vault Wall Mount, Front Handle

Approximate Width of Switch

3 Way.....66" (1676mm)

4 Way.....84" (2134mm)

5 Way.....102" (2591mm)

6 Way.....120" (3048mm)

Approximate Depth.....21" (533mm)

Approximate Height.....35" (889mm)

Padmount, Front Handle

Approximate Width of Enclosure

3 Way.....80" (2032mm)

4 Way.....98" (2489mm)

5 Way.....116" (2946mm)

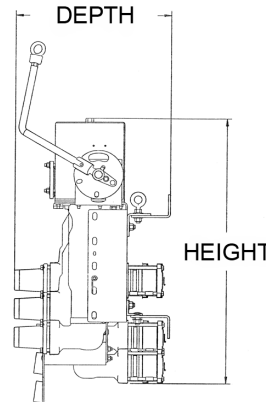
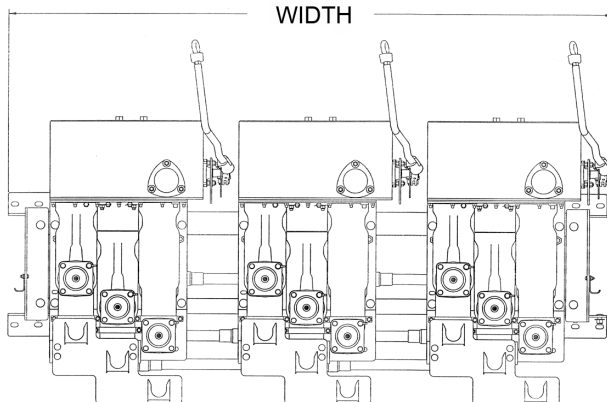
6 Way.....134" (3404mm)

Approximate Depth.....44" (1118mm)

Approximate Height.....68" (1727mm)

## Vault and Padmount style, Trident-S front access with side handle

Approximate Dimensions



### Configurations A & C

Vault Wall Mount, Side Handle

Approximate Width of Switch

3 Way.....78" (1981mm)

4 Way.....103" (2616mm)

5 Way.....128" (3251mm)

6 Way.....153" (3886mm)

Approximate Depth.....21" (533mm)

Approximate Height.....35" (889mm)

Padmount, Side Handle

Approximate Width of Enclosure

3 Way.....80" (2032mm)

4 Way.....105" (2667mm)

5 Way.....130" (3302mm)

6 Way.....155" (3937mm)

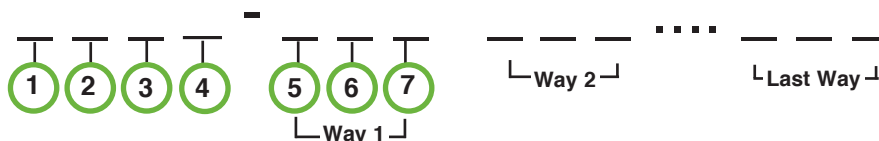
Approximate Depth.....44" (1118mm)

Approximate Height.....68" (1727mm)

# HOW TO ORDER - TRIDENT® MULTI-WAY SWITCHGEAR

## HOW TO ORDER:

Select from the various catalog breakdown chart options below. Enter the desired selection in the corresponding catalog number position.



### 1 Mounting

Description	Code
Padmount, front access, vertical mount	P
Padmount, front/back access, vertical	B
Vault style with non-submersible electronics (if supplied)	V
Vault style with submersible electronics (if supplied)	W

### 2 Configuration\*

Description	Code
Bushings front; side mounted handle	A
Bushings front; front mounted handle	B
Bushings back; side mounted handle	C
Bushings back; front mounted handle	D

\* Contact your G&W representative for other configurations

### 3 Voltage Class

kV	Code
15	1
25	2

### 4 Number of Phases

Phase	Code
Single	1
Three	3

### 5 Switch Style

Description	Code
Trident-S	S
Trident-ST	T
Trident-SR	R
Trident-SP	P

### 6 Controls, if applicable

Description	Code
Load break switch	L
Unswitched way	U
Type 1	1
Type 2	2
Type 3	3
Type 4	4
Type 7	7
ATS control: ATC451	A
Connectorized: SEL 351R or SEL 651R	R
Pre-engineered control: Relay, RTU, IED	E
Provisions for future use: Junction box	P
Customer to wire and supply control	W

### 7 Options

Description	Code
No options	0
Auxiliary contacts	1
Motor actuator (Trident-S only)	2
Stationary or portable (Trident-S only) or stationary or hand held control (Trident-SR only)	3
Voltage sensing (Trident-SR only)	4
Auxiliary contacts and voltage sensing (Trident-SR only)	5
Auxiliary contacts, voltage sensing and stationary or hand held control (Trident-SR only)	6
Auxiliary contacts and stationary or portable (Trident-S only) or stationary or hand held control (Trident-SR only)	7
Voltage sensing and stationary or hand held control (Trident-SR only)	8
Custom engineered	9
Load break/fault interrupter switch	A
Ground cut in/cut out switch	C
Bus Tie Switch	T

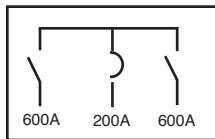


## ORDERING EXAMPLES - TRIDENT<sup>®</sup> MULTI-WAY SWITCHGEAR

### Example 1:

#### 3-Way Load Break with Auto Source Transfer

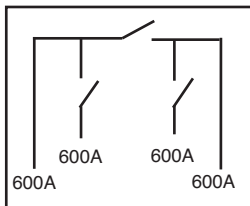
Vault style, 25kV switch. Ways 1 and 3 are load break switches with magnetic actuators and voltage sensing for the auto transfer and have 600A bushings. Way 2 is a fault interrupter and has 200A bushings. Fault interrupter controls to be Type 7. All ways to have side mounted operating mechanisms/handles. A NEMA 6P rated ATC 451 control used. **The catalog number would be: WA23-RA4 S70 RA4.**



### Example 2:

#### Bus Tie Switch with Two Unswitched Ways

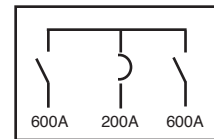
Vault style, 15kV, three phase, load break switch with two unswitched ways and all 600A bushings. Side mounted handles are required. **The catalog number would be: WA13-U00 SL0 SLT SL0 U00**



### Example 3:

#### 3-Way Combination Load Break and Fault Interrupter Switch

Padmount style, 25kV, 3-way switch with two 600A load break switch modules (ways 1 and 3) and one 200A fault interrupter (way 2). Fault interrupter controls to be Type 3. Switch operators to be front mounted with all bushings out the back. **The catalog number would be: PC23-SL0 S30 SL0.**

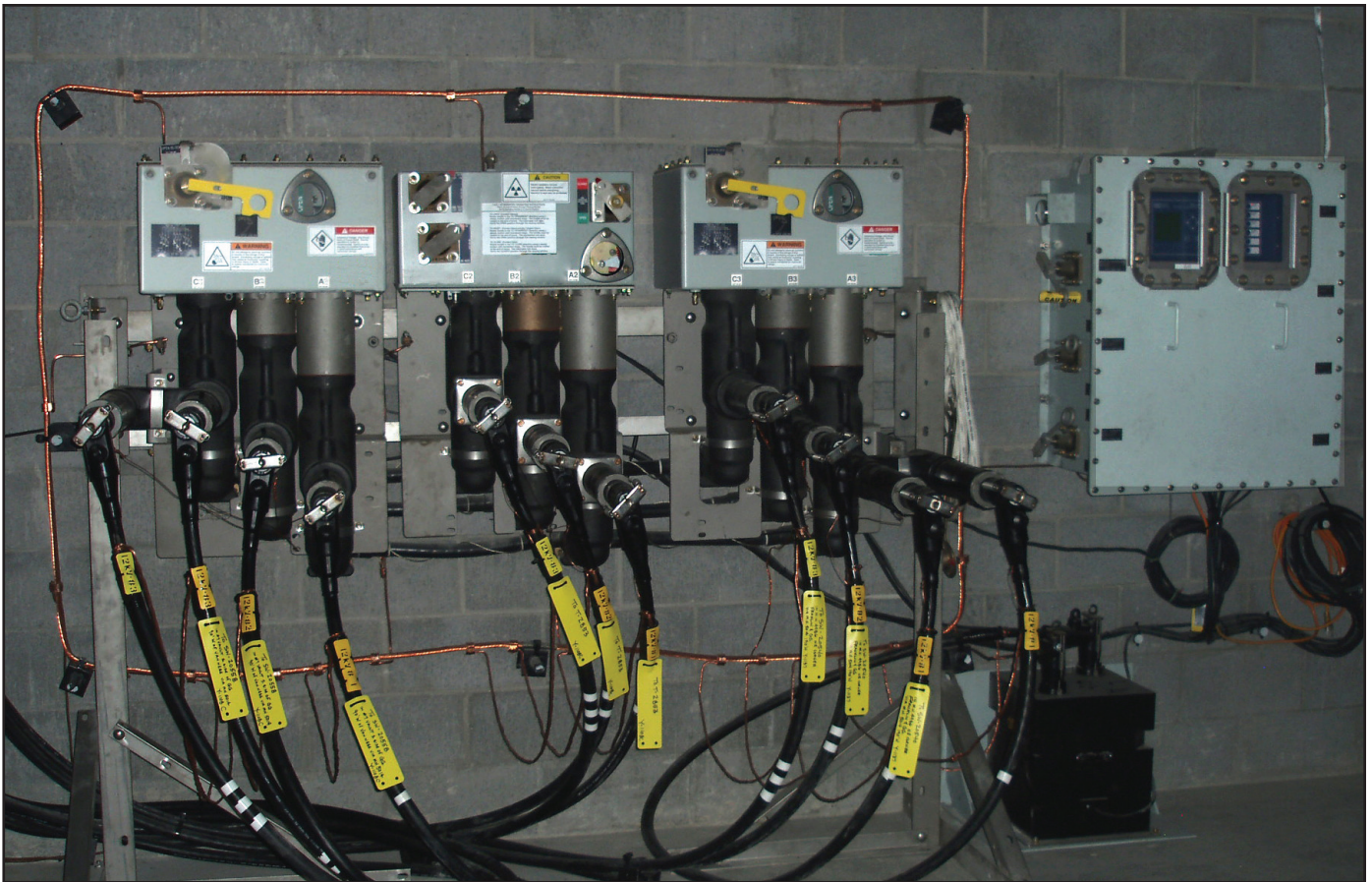


▲ Automated multi-way, Trident-S in a submersible vault installation.



▲ Four-way front access, padmount Trident-S.





▲ Three-way, submersible vault, automatic transfer switch including submersible G&W ATC451 control.

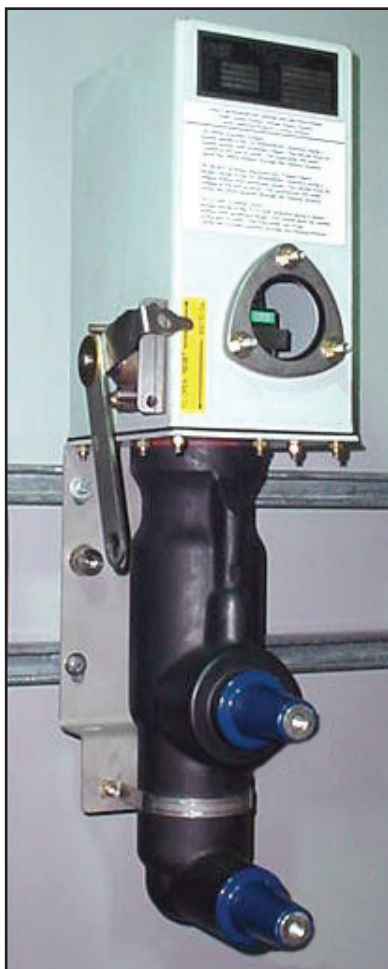
### Submersible Application Example

Installation shows a 3-way switch, frame mounted so the unit faces upward with side operating handles hookstick operable from above ground. The location is subject to complete submersion for extended periods of time. The yellow cable is connected to a laptop computer permitting programming of the overcurrent protection parameters for the switch.





# TRIDENT<sup>®</sup> -SP SINGLE PHASE SWITCHGEAR



Trident-SP single phase, spring-assisted switchgear is available for load break or fault interrupting switching. The compact units are ideal for switching residential loops and for oil fuse cutout replacements. Fault protection can be provided using vacuum interrupters with integral current transformers and a variety of overcurrent controls.

## FEATURES

- 15.5, 27, or 29.3kV, 630A continuous current
- 12.5kA symmetrical interrupting
- Padmount and vault designs
- Vertical or horizontal mounting
- Large viewing windows simplify visual identification of open (green) or closed (red) vacuum contact position. The position indicator is connected directly to the drive assembly.
- Hookstick operable, permanent mounted operating handles
- Submersible switch construction
- Submersible controls available
- Manual operation

## IDEAL REPLACEMENT FOR OIL FUSE CUTOUTS

Trident fault interrupters offer the following advantages:

- No more fuse links to stock or replace
- Maintenance-free, nonflammable solid dielectric insulation
- Safe, positive load break operation and easy reset of tripped circuits
- Electronic controls mirror fuse link curves
- Compact footprint for easy change out
- Submersible construction
- 200A well or 600A separable connector bushings

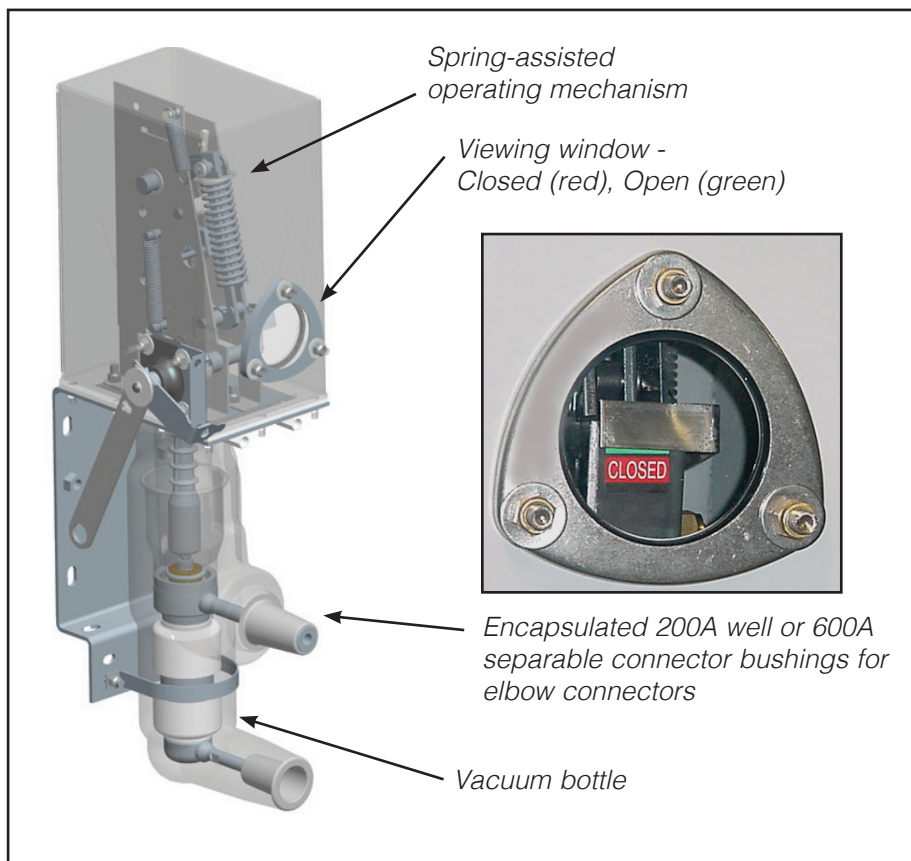
## RATINGS

Voltage Class (kV)	15	25
Maximum (kV)	15.5	27*
BIL Impulse (kV)	110	125
Continuous Current (A)	630	630
Load Break Current (A)	630	630
1 Min AC Withstand (kV)	34	40
1 Min AC Withstand dry (kV)	53	78
15 Min DC Withstand (kV)	53	78
Momentary Current (kA) asym	20	20
Fault-Close 3-times (kA) asym	20	20
Fault Interrupting Current (kA) asym	12.5	12.5
1 Sec Current (kA) sym	12.5	12.5
Mechanical Operations	2000	2000

\* 29.3kV available

## IEEE C37.60 FAULT INTERRUPTING DUTY

Percent of Maximum Interrupting Rating	Approx. Interrupting Current, Amps	No. of Fault Interruptions
15-20%	2,000	44
45-55%	6,000	56
90-100%	12,500	16
Total # of Fault Interruptions: 116		

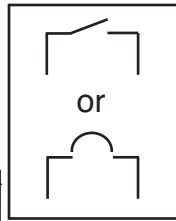
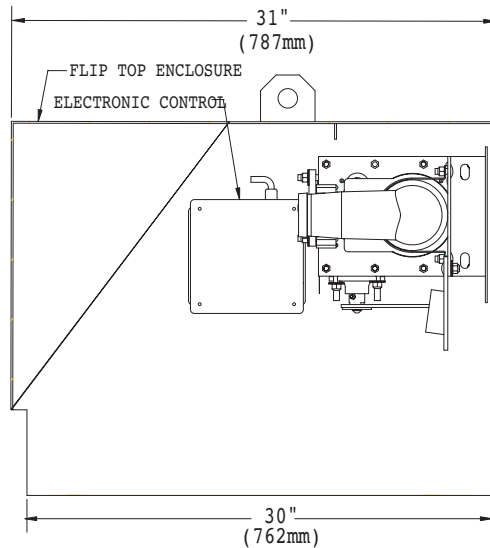




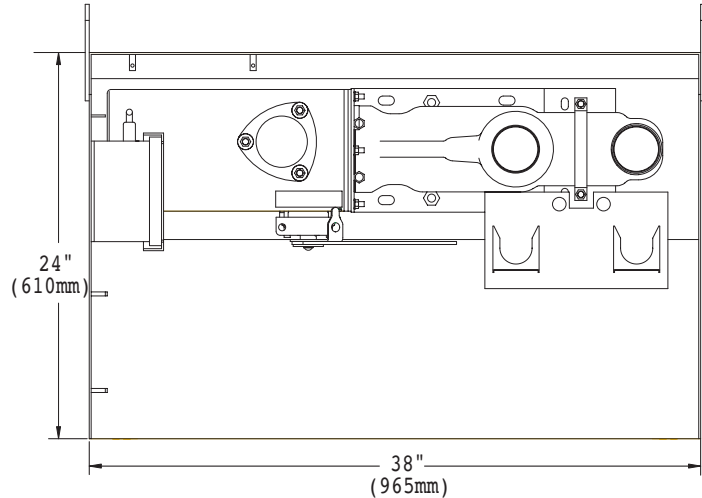
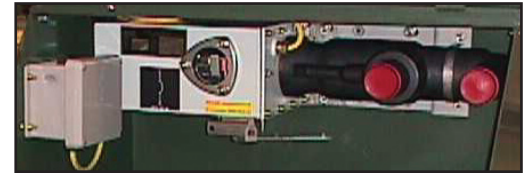
## Padmount style

Approximate Dimensions

Approximate Weight = 150 lbs. (68 kg)



◀ Typical One-line



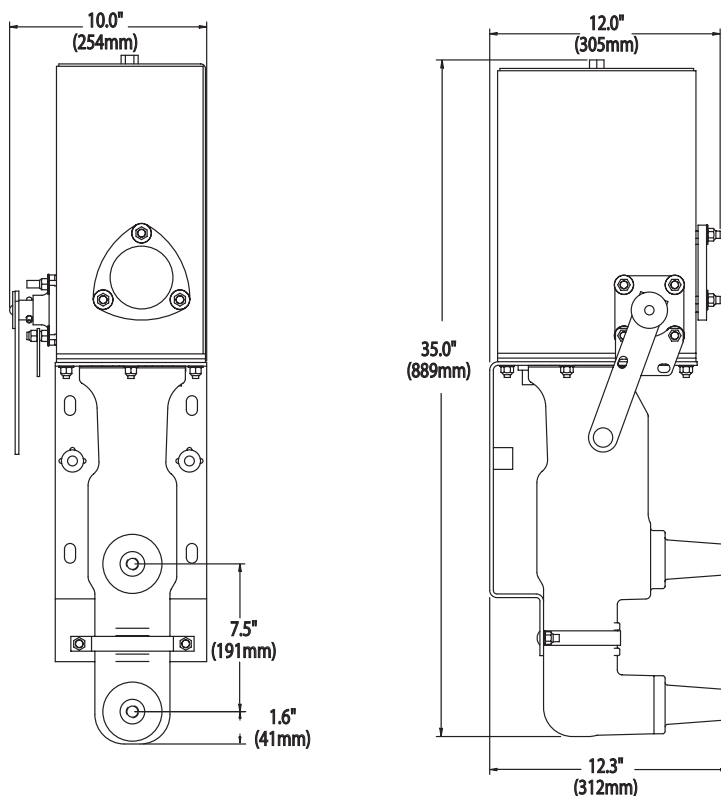
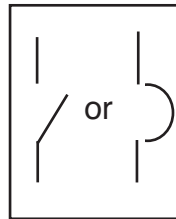
## Vault style

Approximate Dimensions

Approximate Weight = 75 lbs. (34 kg)

**Configuration 'A'** with front mounted bushings.

Typical One-line ▶

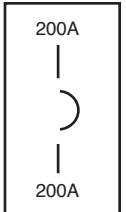


## ORDERING EXAMPLES

### Example 1:

#### Oil Fuse Cutout Replacement

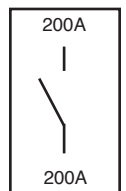
Vault style, 15kV, single phase fault interrupter. The fault protection scheme requires the oil fuse cutout Time Current Characteristic (TCC) curve and a single phase setting (Type 7). All 200A deepwell, front positioned bushings. **The catalog number would be: WA11-P702**



### Example 2:

#### Load Break Switch

Vault style, 25kV, single phase load break switch with all 200A deepwell front positioned bushings. **The catalog number would be: VA21-PL02**

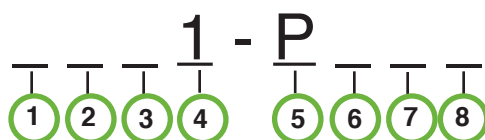


▲ Submersible, subsurface installation permitting hookstick operation from above ground.

# HOW TO ORDER - TRIDENT<sup>®</sup> -SP SINGLE PHASE SWITCHGEAR

## HOW TO ORDER:

Select from the various catalog breakdown chart options below. Enter the desired selection in the corresponding catalog number position.



### 1 Mounting

Description	Code
Padmount, front access, vertical mount	P
Padmount, front access, horizontal mount	H
Padmount, front/back access, vertical	B
Padmount, front/back access, horizontal	R
Vault style with non-submersible electronics (if supplied)	V
Vault style with submersible electronics (if supplied)	W

### 2 Configuration\*

Description	Code
Bushings front; side mounted handle	A
Bushings back; side mounted handle	C

\* Contact your G&W representative for other configurations

### 3 Voltage Class

kV	Code
15	1
25	2

### 4 Number of Phases

Phase	Code
Single	1

### 5 Switch Style

Description	Code
Trident-SP single phase	P

### 6 Controls, if applicable

Description	Code
Load break switch	L
Type 1	1
Type 3	3
Type 4	4
Type 7	7

### 7 Options

Description	Code
No options	0
Auxiliary contacts	1

### 8 Bushing Arrangement

Closest to Housing	Away from Housing	Code
200A	200A	2
200A	600A	3
600A	200A	4
600A	600A	6

## CONTROL OPTIONS

### G&W INTERRUPTER OVERCURRENT CONTROLS

The overcurrent control monitors the current and sends a trip signal which opens the vacuum interrupters and interrupts the fault current. G&W controls are self-powered from the current transformers located inside the solid dielectric module. Optional remote tripping is available. G&W also offers other manufacturer's controls, such as SEL relays, depending on the application.

Standard control enclosures are NEMA 4X (IP56) rated. Optional submersible enclosures are NEMA 6P (IP67) rated. The Type 7 is mounted inside the switch's mechanism housing and has an IP68 rating.

### G&W CONTROL OPTIONS

**Type 1** controls operate three, single phase vacuum interrupting mechanisms. The Type 1 can be field set for either single phase or three phase trip mode. It is used on switches with either single phase reset or three phase reset. When in the three phase mode, all three phases trip if the selected trip level of any individual phase is reached. Trip level selections can be made under load or no-load conditions with current ranges in 12 selectable levels. Two ranges of minimum trip settings are available, 15 to 300 amps and 30 to 600 amps. Each unit is pre-programmed with 30 Time Current Characteristic (TCC) curves. The curve selection can be set or changed at any time.

An 8 pole dip switch allows the user to choose the TCC curve that best matches their individual coordination requirements. A label, located on the inside of the lid, provides a key for the dip switch settings. The control can be factory preset to meet the user's requirements. As protection or coordination requirements change, settings can easily be changed in the field. Depressing the manual trip button when the control

is powered up electronically trips all three phases of the vacuum interrupter. Each control also includes "Last Cause of Trip" LEDs. These LEDs indicate which phase experienced an overcurrent condition, or that the control was given an external or manual trip command.

**Type 2** controls offer features similar to Type 1 with the following additional features:

- Three phase protection only
- Minimum trip set for all three phases with one selector switch
- Adjustable phase time delay
- Ground fault (phase imbalance) with separate adjustable time delay selector switch for protection of large three phase motors or transformers. The ground trip level is represented as a percent of the minimum trip level.
- Instantaneous trip and inrush restraint features

**Type 3** controls offer features similar to Type 2 and more including:

- Single phase or three phase trip
- Vacuum fluorescent display
- Keypad operation for programming parameters and retrieving status of current values
- Adjustable phase time delay
- Ground fault trip
- Inrush restraint
- Phase identification and magnitude of fault indication
- Readout of real-time current values
- Selectable instantaneous trip
- Selectable minimum response time
- RS232 or RS485 serial interface
- Laptop programming kit available

**Type 4** controls provide the same features as Type 3 controls; however, there is no keypad panel, display screen, or manual trip button. The control is programmed using a laptop computer. A laptop programming kit is available.



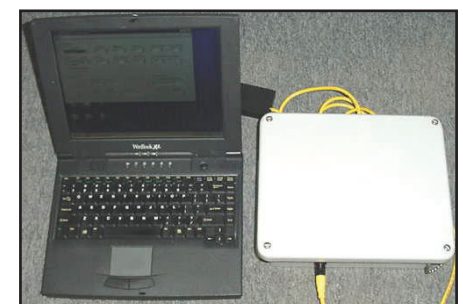
▲ Type 1 control



▲ Type 2 control



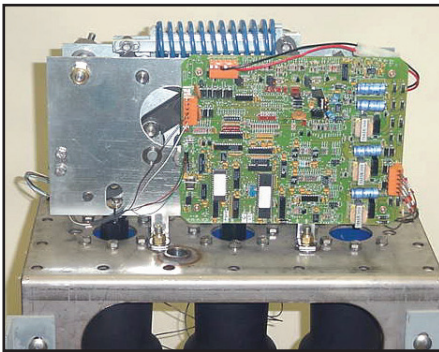
▲ Type 3 control



▲ Type 4 control



## CONTROL OPTIONS



▲ Type 7 control board mounted inside the mechanism housing.

**Type 7** controls provide the same features as Type 4 controls, except that the controls are mounted internal to the switch mechanism housing, eliminating the need for a separate control enclosure and associated cabling. The control is programmed using a laptop computer. A laptop programming kit is available. Single and three phase versions are available.

### LAPTOP PROGRAMMING KIT

#### For Type 3, Type 4 or Type 7

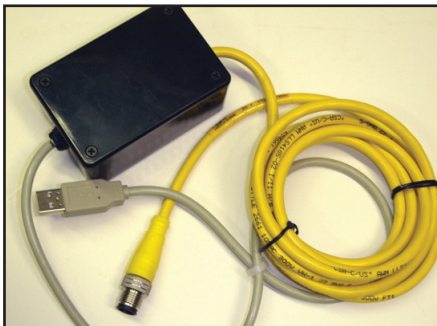
Provides software and cable connection to a portable laptop computer for programming or retrieving fault interrupter control information. One cable connects to the USB port of the computer and the other connects to the control box (Type 3 or 4) or mechanism housing (Type 7).

Catalog Number for Type 3:

For USB ports:.....LPK7-Type 3

Catalog Number for Type 4 and 7:

For USB ports:.....LPK7-USB



▲ Laptop Connector Cable



▲ Schweitzer's SEL-751A control is one of many control options.

### COMPATIBLE RELAYS

Besides G&W's interrupter controls, various other relays can be used with Trident switchgear including Schweitzer's model SEL Falcon, SEL-351R, SEL-651R, SEL-501, SEL-551, SEL-351S and SEL-751A.

### REMOTE OPERATION FOR TRIDENT-S

#### Motor Actuators

For spring-assisted switches, motor actuators are required for remote operation. Actuators are externally mounted to each switch operator. If controls are specified, the actuators are hardwired with 25 feet of cable. Padmount designs may have cables cut to length to fit within the enclosure. If no control is specified, the actuator is supplied with a male threaded connector for use with portable controls. Actuators are housed within a painted, stainless steel enclosure suitable for submersible applications.

### Stationary Controls

Single way and multi-way stationary controls are available for both load break switches and fault interrupters. Controls can be a combination of switch and fault interrupter ways, as required. Controls are designed for SCADA interface.



▲ Stationary Control

## CONTROL OPTIONS

### Portable Controls

For applications where AC power is not available at the switch site or if the flexibility of moving the control to different locations is desired, portable controls are ideal. The control is housed in an aluminum carrying case with handle and weighs approximately 12 lbs. (5.5kg). A 120 VAC cable is supplied to charge the batteries. The maximum control to motor actuator distance is 50 feet (15m). The Universal control can be used on both load break and fault interrupter switches.

### REMOTE OPERATION

#### FOR TRIDENT-SR

Trident-SR switchgear already incorporates an internal, high speed magnetic actuator and is SCADA ready by design. No external actuators required for remote operation. Various control options are available.

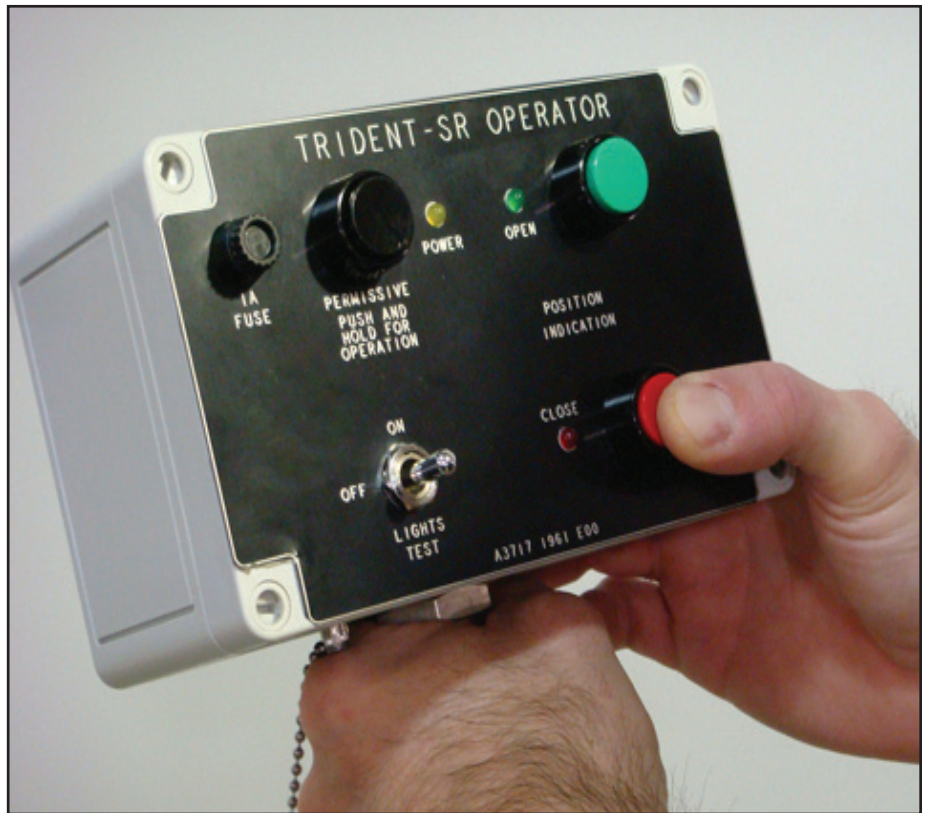
### SEL-751A Relay Control

Schweitzer's 751A relay makes an ideal control package for the Trident-SR. The relay includes voltage and current inputs which greatly simplifies any data monitoring capability available with the voltage and current sensing supplied with the Trident-SR. This switch and control package offers remote power status from inside the switch and remote open/block status through the control.

### Stationary Controls

A pushbutton control is available permitting local onsite or remote SCADA operation of the switch. The control is hardwired into the switch and housed within a submersible, polycarbonate enclosure approximately 6"W x 10"H. Standard control cable is 25 feet. Other cable lengths are available up to 100 feet.

The 24V DC control can be powered by the 120V AC supplied to the switch or from a separate AC source directly to the control.



▲ Hand held controls permit switch operation from outside the vault.



▲ Stationary controls permit either local or remote SCADA operation.

### Hand Held Controls

A hand held control is ideal for underground vault applications permitting switch operation from above ground. The control cable is hardwired into the switch and uses a threaded connector for attachment to the control. The polycarbonate control box is approximately 7"W x 4"H. The 24V DC control is powered by the switch.



## CONTROL OPTIONS

### AUTOMATIC TRANSFER

#### ATC 451

G&W ATC 451 automatic transfer controls are available for G&W Trident switchgear through 38kV. Switches can be vault (dry or submersible) or padmount styles. The two incoming source ways can be located in one switch, or in two separate switches for added redundancy. Manual switches can be retrofitted in the field. Standard transfer times are within 8-10 seconds.

#### FEATURES

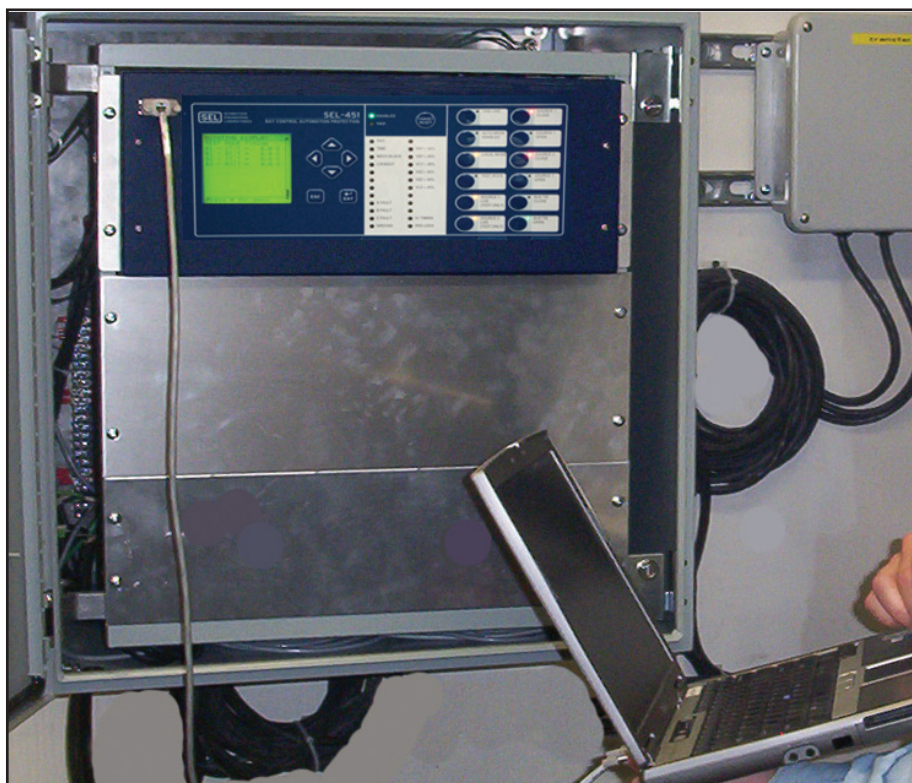
**Uses SEL-451 relay** - G&W's ATC 451 control utilizes the field proven Schweitzer SEL-451 relay for its protection logic and programming scheme.

**Plug and play construction** - The ATC 451 is pre-programmed and packaged with all required components to simplify installation and maximize reliable performance. Various styles of NEMA enclosures are available depending on the application.

**Overcurrent protection for up to two fault interrupting ways** - The ATC 451 can eliminate the need for separate vacuum interrupter controls. Depending on user preference and system protection schemes, various styles of separate interrupter controls are available.

**SCADA ready** - Each ATC 451 comes standard with several serial ports for communication to SCADA systems. Multiple protocols are available including DNP3.0 (standard), Mirrored Bits (standard), and IEC 61850 (option). Ethernet or fiber optic ports for communications are also available options.

**Lazer ready** - The SCADA ready capability simplifies the requirements for communication to other intelligent field devices for automatic power restoration schemes. This simplifies the integration of the ATC into any



▲ The ATC 451 is laptop programmable.



G&W pre-engineered Lazer automation system where automatic transfer is required.

**Generator source capability** - The 451 can be programmed to permit a standby generator to be used instead of a second utility source.

**Bus tie configurations** - The ATC 451 can be used with a bus-tie switch permitting automatic transfer where the load is normally balanced between two sources.

**User friendly controls** - Large pushbuttons are clearly labeled and provide easy control commands from the front panel.

▲ Close up of operating panel

**Sequence of event recorder** - Each ATC 451 includes a Sequence of Events Recorder which will record the last 1000 entries, including setting changes, powerups, and selectable logic elements.

**Flexible voltage sensing options** - Integral voltage sensing bushings are available which eliminate the need for cumbersome add-on devices. The bushings are 600A rated, fully submersible, and provide one analog output per phase and one digital output per way for voltage monitoring. Elbow mounted sensors and potential transformers are also available.



## CONTROL OPTIONS

### LAZER® DISTRIBUTION AUTOMATION

G&W's Lazer Distribution Automation solution is a pre-engineered package which performs automatic fault detection, isolation and restoration (FDIR) operations on overhead and underground distribution systems. G&W uses over 100 years of industry experience to match the proper switchgear, controls, and communication devices for the application. For a Lazer solution, G&W primarily uses Schweitzer Engineering Laboratories intelligent relays, one of the industry's most respected suppliers. Other manufacturer's relays are available on request.

A Lazer distribution automation package consists of G&W's medium voltage switching devices, one or more protective relays, communication, and the integration knowledge to make it all work together. These packaged systems can be used for critical load applications as basic as two reclosers performing a transfer on voltage loss or as complicated as a networked switch/ SCADA system with load flow management capabilities.

## FEATURES

### Distributed and Centralized Intelligence

G&W provides three configuration options that can be selected to match almost any application.

**Peer-to-peer-** For high speed transfers and restoration, distributed intelligence and peer-to-peer communication using protocols like SEL Mirrored Bits® allow for restoration time that can be measured in cycles. All protection and restoration logic is stored in the individual relays. This option is perfect for high reliability, closed loop circuits.

**Distributed control-** This configuration is accomplished using a control like the SEL 3354 or RTAC computing platform that communicates to the intelligent relays in the system. These devices can be mounted on the switches or at a central location such as a substation. All of the relays are responsible for circuit protection and



▲ Padmount switch with SEL controls.

communicating their status back to the central control through open protocols like DNP 3.0.

**Central control-** This configuration is ideal for larger network circuits where advanced capabilities are required. It is controlled by SCADA or DMS software that offers unparalleled monitoring and control. G&W uses software from Survalent Technology like SmartVU™. This software offers a user-friendly interface as well as the advanced capability to handle automatic load flow adjustments and network management.

### Protection and Control

A wide variety of programmable features are available for protection including up to eight independent setting groups which offer multiple layers of protection. Advanced communication assisted tripping schemes, such as Permissive Overreaching Transfer Trip (POTT) and Directional Comparison Blocking (DCB) can be employed to offer extremely high speed fault isolation on closed loop systems. These tripping schemes can be backed up to maintain protection on failure of breakers or communication.

### Communication

Flexible communication and open protocols are critical for integrating to existing Smart Grids and expanding to handle future needs. Lazer solutions offer flexible communication using hardwired connections, fiber optic cable, or a range of wireless technologies on RS232, RS485, and Ethernet ports. Some of the different pro-

ocols available are:

- DNP 3.0
- SEL Mirrored Bits (proprietary)
- IEC61850 with GOOSE messaging

## A SMART GRID COMPONENT

A Smart Grid consists of all points in a power network communicating to automatically make decisions. The goal is to maximize the reliability and efficiency of the network while giving individual consumers control over their consumption. Some of the basic technologies are SCADA, automatic reconfiguration and restoration, AMR/AMI (meter reading) software, smart meters, and renewable energy integration.

G&W's Lazer Distribution Automation solutions are part of the 5kV to 38kV networks in a Smart Grid and function to automatically restore faulted lines or circuits that have lost voltage. Automation will improve a distribution system in the following ways:

### Improved reliability and metrics-

Quickly isolate faults and restore power to as many customers as possible.

### Improved operational efficiency-

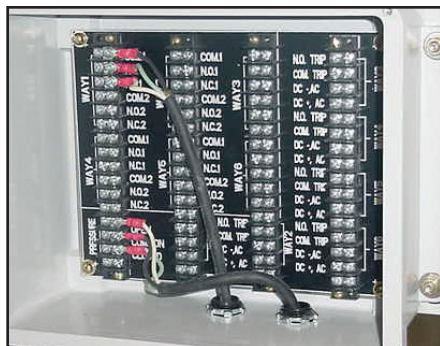
Knowing detailed information within the distribution system allows crews to quickly identify the location of faults and know the status of field devices.

**Safety-** Multiple levels of lock outs and remote switching from outside of enclosed spaces improves safety for operators.

## OPTIONS

### JUNCTION BOX

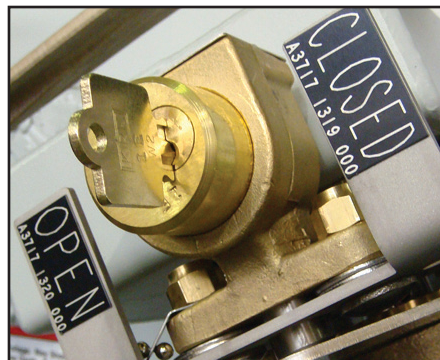
For auxiliary contacts and remote power/remote trip connections. Includes NEMA 4X (IP56) enclosure with terminal strip connections for terminating up to four sets of auxiliary contacts or four controls for remote power/remote trip.



▲ Junction Box

### KEY INTERLOCKS

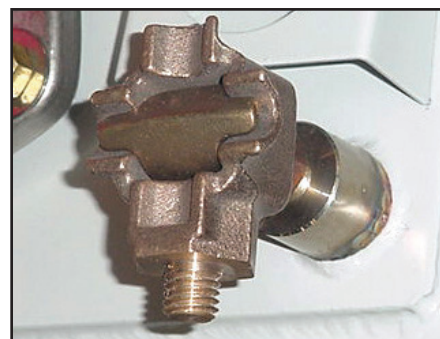
Key interlocks are available to assure safe coordination of equipment. Switches can be specified with keylocks factory installed. Specify locking scheme when ordering, either lock in open or lock in closed position. For keylocks to be coordinated with other equipment, other manufacturer's information must be provided.



▲ Key Interlock

### GROUND LUGS

Bronze, eyebolt style ground lugs are available for 4/0 maximum conductor cable.



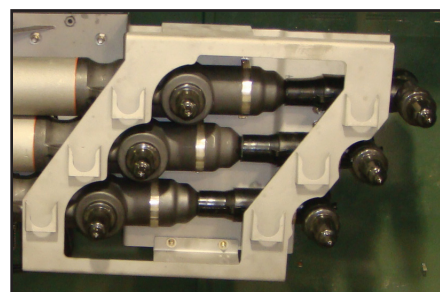
▲ Ground lug

### FRAMES

Bolted, galvanized mounting frames are available for vertical mounting of vault style switches providing a 24" distance from the ground to the center of the bottom bushing. Other size frames are available. Consult your G&W representative for availability.

### PARKING STANDS

Unpainted stainless steel parking stands are available for each entrance position. Parking stands can be designed to support mechanical dead break devices for visible break requirements. Consult your G&W representative with specific requirements.



▲ Diagonal bushing arrangement with parking stands

### SPREAD BUSHINGS

A diagonal bushing configuration is available which increases the distance between the bushings to facilitate cable training if required.



▲ Removable hookstick operating handle



▲ Permanently attached hookstick operating handle

### OPERATING HANDLES

An angled stainless steel handle with hookstick operable eye is available for permanent attachment to each switch operator. The handle can be positioned up or down to provide for optimum operating leverage. If a removable handle is desired, a bronze handle with hookstick eye is provided which positions over the hex nut of the switch operator. One handle is provided per switch.



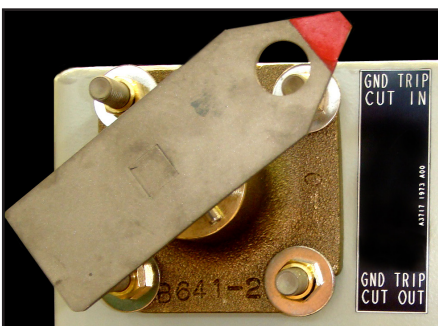
## OPTIONS

### LOAD BREAK / FAULT INTERRUPTER SELECTOR SWITCH

Fault interrupting switches are supplied with an external operating lever which, when operated, disables all overcurrent protection while still permitting load break switching. This permits the user to perform emergency switching to reconfigure loads without the worry of possible inadvertent tripping caused by temporary overcurrents which might otherwise happen if the overcurrent controls were still activated. This option eliminates the need for relay technicians to temporarily change the protection scheme. The switch levers are padlockable and operable by hookstick or rope.



▲ Load Break / Fault Interrupter Selector Switch



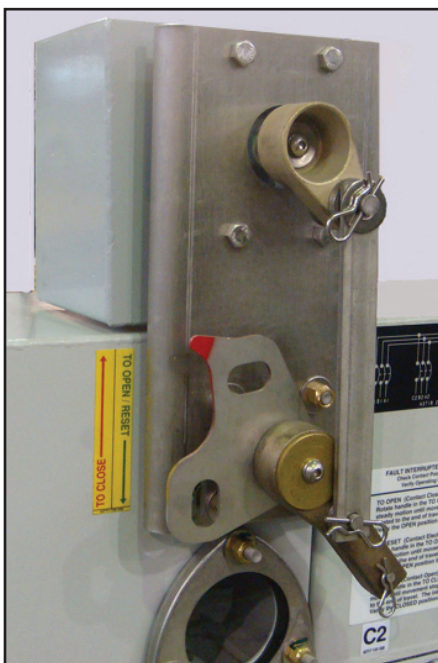
▲ Ground Cut In / Cut Out Selector Switch

### GROUND CUT IN / CUT OUT SELECTOR SWITCH

For fault interrupting switches incorporating ground fault protection. Switches are supplied with an external operating lever which, when operated, disables all ground fault protection while still permitting load break switching. This permits the user to perform emergency switching to reconfigure loads without the worry of possible inadvertent tripping caused by temporary current imbalances which might otherwise happen if the overcurrent controls were still activated. This option eliminates the need for relay technicians to temporarily change the protection scheme. The switch levers are padlockable and operable by hookstick or rope.

### MOTOR ACTUATOR

Automation begins with the addition of motor actuators to a manual switch. These actuators can be factory installed for new equipment or retrofitted to switchgear installed in the field. They are housed in a NEMA 6P enclosure for submersible installations.



▲ Front mounted motor actuator

### AUXILIARY CONTACTS

Auxiliary contacts are mounted internal to the mechanism housing to provide remote indication of switch contact position. One normally open and one normally closed form C contact is provided. Junction boxes with terminal strip connections for up to four auxiliary contacts are available.



▲ Side mounted motor actuator

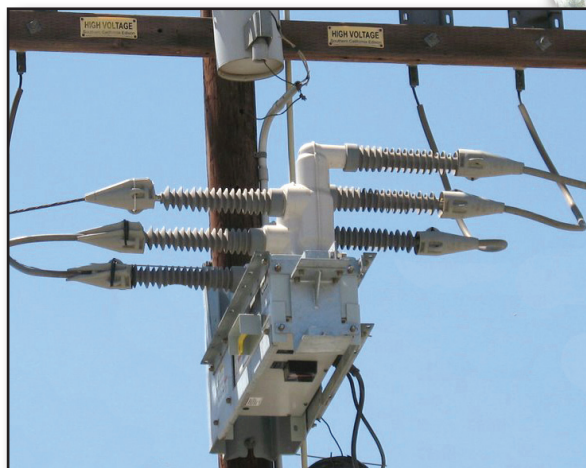


# The Flexibility of Solid Dielectric Technology ...

*G&W offers a variety of epoxy encapsulated products including:*

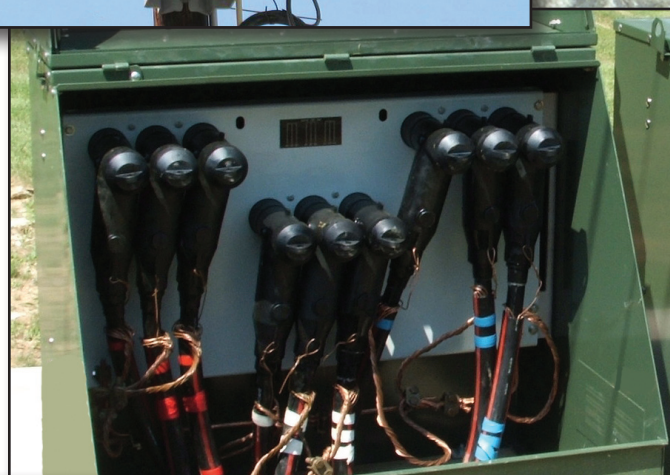
## **Solid Dielectric Viper® Reclosers**

- To 38kV, 12.5kA interrupting
- Overhead and padmount designs
- Maintenance-free operation
- Work with SEL controls



## **Other Solid Dielectric Products**

- Multiple point junction bars and
- Encapsulated current limiting fuses
- Distribution cable transition joints
- Variety of cable entrance bushings



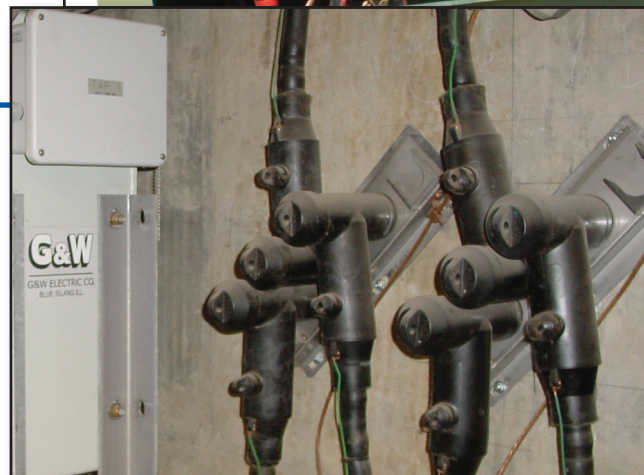
**ISO 9001:2008 Registered Company**

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Engineered to Order  
Built to Last



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