GENERAL FEATURES

Since 1905, G&W has provided custom power solutions to utilities and electric power users around the world. G&W has a wide selection of reliable, quality switching and fault interrupting products to meet the most stringent customer requirements. Whether the application involves load switching, line sectionalizing, fault interruption or distribution automation, G&W can provide a solution for distribution system switching and protection. When specifying switchgear, consider these features:

Maximum Operator Safety

SF_6 gas is a nontoxic, nonflammable switching dielectric. Dead-front switch construction eliminates any exposed live parts. Spring-assisted mechanisms assure quick-make, quick-break operation. Viewing windows permit visual verification of open or closed contacts. Tamper-resistant enclosures utilize penta-head bolts and padlocking provisions. Motor actuators are available permitting remote operation. The result is maximum operator safety.

Minimal Maintenance

G&W SF_6 switches are corrosion-resistant, totally sealed and factory filled. No more field adjustments of critical contact areas or concerns with environmental contamination or intrusions. A periodic check of the pressure gauge is all that is required. Galvaneal type enclosures assure maximum corrosion resistance.

Application Versatility

Multi-way Configurations — Switches are available for either two-position or three-position (incorporating an integral ground, tie or test position) switching. Single or multiple sources can feed multiple loads. Bus tie configurations are available permitting multiple sources to feed different loads within the same switch.

Mounting Flexibility — Horizontal and vertical configurations are available with operating apparatus accessible from the front, top or side compartments. Enclosures are removable for easy cable installation or field replacement.

Bushing Variety — Many bushing styles are available including an exclusive disconnectable style permitting field changeout. Cable entry can be bottom, front, back or side.

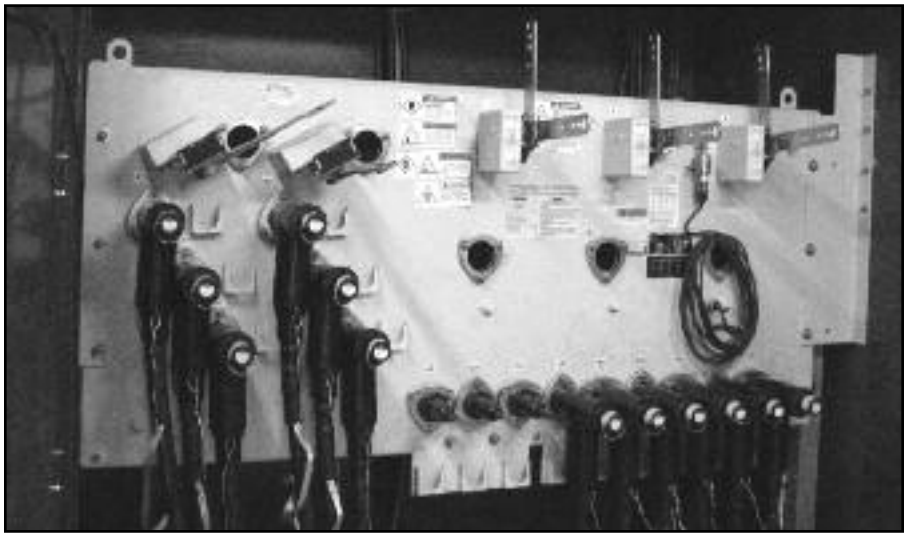
Visible Break — Load break switches can incorporate a visible break of all three phases.

Overcurrent Protection — Fusing or electronically controlled, resettable vacuum interrupters are available.

Smart Grid / Lazer Solutions — Complete SCADA distribution automation and Smart Grid solutions are available including automatic transfer. G&W's Lazer distribution automation systems provide pre-engineered, time-proven solutions for automatic power restoration.

PUFFER VACUUM INTERRUPTERS

G&W load and fault interrupting combination switches combine the total cost and operating benefits of fuseless, electronically controlled, resettable overcurrent protection with the safety and maintenance benefits of a totally sealed, dead-front, SF_6 insulated device. The switches are designed for automatic single or three phase fault interruption with manual load break capabilities for systems through 35kV, 630A continuous. Ratings to 900A continuous are available on certain models. Single side access designs are available for confined space applications.



PNI single side access switch.

FEATURES

Operator Safety — G&W combination switches are totally sealed, dead-front and insulated with nonflammable, nontoxic SF_6 gas. Operators are spring assisted for positive quick-make, quick-break operation. A trip-free mechanism permits interruption independent of the operating handle if closing into a fault. Viewing windows permit visible indication of interrupter contact position.

Minimal Maintenance — No more routine inspections or dielectric testing as with oil gear. No more contact contamination, rodent problems or insulator maintenance as with air gear. A periodic check of the gas pressure gauge is all that is required.

Three Phase Tripping — No more single phasing problems. Simultaneous three phase tripping is available through the electronics and with three phase operating handles for manual operation and reset.

Protection Curve Compatibility — G&W solid state electronic controls permit extremely accurate, consistent protection curve characteristics compared to conventional fuses. The exclusive controls can emulate the most common time current curves (TCC) for power fuses, relays and fuse links (oil fuse cutouts). Optional controls can provide ground trip, inrush restraint and adjustable time delay capability.

Fully Tested — Switches are designed and tested per applicable sections of IEEE C37.72, C37.74 C37.60, and IEC 265 standards.

APPLICATIONS

G&W combination switches provide a direct replacement for power fused air and vacuum-in-oil switchgear. Some ideal applications include:

Transformer and Motor Protection — The three phase trip feature and high continuous current make PVIs ideal for protecting three phase motors and transformers through 600A continuous.

Loop and Tap Switching — Standard 630A and optional 900A loop switching is accomplished using the latest puffer technology. Tap switching through 630A and up to 25kA symmetric fault protection is accomplished using resettable, electronically controlled vacuum interrupters. The vacuum interrupters also function as load break switches.

Automatic Transfer — For critical load applications, switches can be supplied with an automatic transfer control package to provide automatic transfer from one source to another to minimize downtime.

Smart Grid / Lazer Solutions— Switches can be supplied with motor actuators on both the line and load side providing remote control capability. Various control packages including portable controls are available.

For Smart Grid applications, G&W works with the top control manufacturers of the industry, including Schweitzer and GE, to match the right control for the job. For automatic power restoration, G&W's Lazer solution provides a pre-engineered, field proven system which can be pre-assembled and factory tested prior to shipment.

Metalclad Switchgear Replacement — Front access designs can provide up to a 900A rated main bus with up to six 25kA symmetric protected load ways for a compact, economical alternative to metalclad and metal enclosed lineups. All switches can be equipped with SEL relays, providing flexibility, as well as complete remote monitoring and control capabilities.

TWO POSITION, FRONT ACCESS, PUFFER VACUUM INTERRUPTERS
CONTINUED

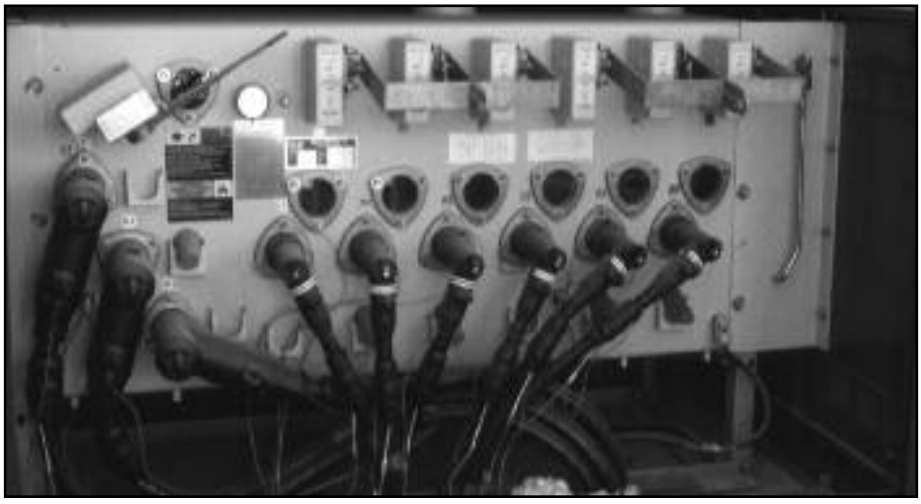
LINEAR PUFFER (PVI)
Provides load break switch with visible break and single phase or three phase fault interrupting. Fault interrupters can be changed from single phase to three phase operation in the field.

Load break switch (LP) ratings

Maximum design voltage,
kV .....15.5.....27 38
Voltage class,
kV .....15 .....25 35
Impulse level (BIL),
kV .....110.....125 ..150
One minute withstand,
AC kV .....35 .....60 70
One minute withstand,
Production test rating
AC kV .....34 .....40 50
15 minute withstand,
DC kV .....53 .....78 103
Continuous and load break current,
Amps* .....630.....630 ..630
Momentary current,
kA asym .....40 .....40 40
Fault-close current, (3 times)
kA asym .....40 .....40 40
One second current,
kA sym .....25 .....25 25
Open gap withstand,
kV .....200.....200 ..200
10 operation overload interrupting capability,
Amps.....3000....3000 ..3000
Operations load interrupting
at 600A .....1200....1200 ..1200
Mechanical endurance,
operations.....2000....2000 ..2000
**900A continuous available*

Fault interrupter (VI) ratings

Maximum design voltage,
kV .....15.5.....27 38
Voltage class,
kV .....15 .....25 35
Impulse level (BIL),
kV .....95.....125....150
One minute withstand,
AC kV .....50 .....60 70
One minute withstand,
Production test rating
AC kV .....34 .....40 50



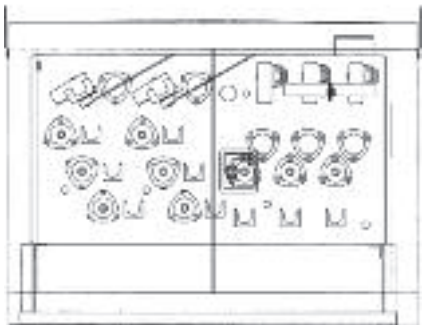
▲ *Model PVI-7F with three phase operating handle shown.*

15 minute withstand,
DC kV .....53 .....78 103
Continuous and load break current,
Amps.....630.....630....630
Symmetrical interrupting rating,
kA**.....12 .....12 12
***20kA available*

IEEE C37.60
Fault Interrupting Duty
Total number of fault interruptions: 116

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%	12,000	16

Model PVI-6F shown with three phase operating handle

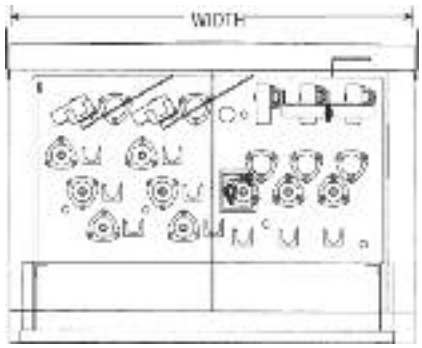


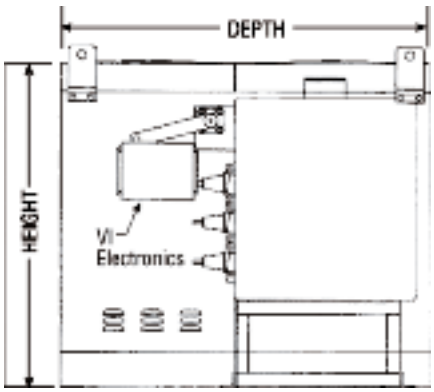
▲ *Hookstick operable load break handle.*

▲ *Single phase interrupter operating handles.*

▲ *Load break switch visible break.*

TWO POSITION, FRONT ACCESS, PUFFER VACUUM INTERRUPTERS
CONTINUED





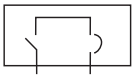
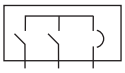
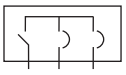
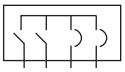
For typical specifications, go to www.gwelec.com. For contact principle, see pages 32-35.

**For RPFI styles:*
height = 59" (1499mm),
depth = 49" (1245mm).

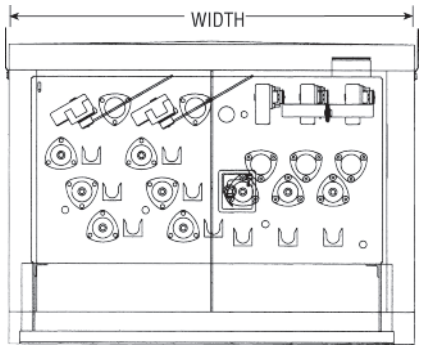
For LPFI styles:
height = 61" (1549mm),
depth = 54" (1372mm).

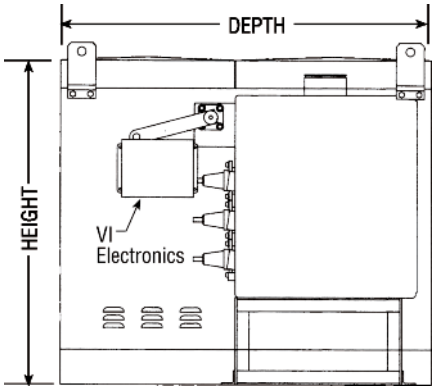
For PNI styles:
height = 65" (1651mm),
depth = 55" (1397mm).

For PVI styles:
height = 57" (1448mm),
depth = 54.5" (1384mm).

Model	One-line Diagram	Voltage (kV)	Catalog Number	Approximate Width in. (mm)*	Approximate Wt. w/SF_6 lbs (kg)
4F		15	PNI20-376-25-4F	47.5 (1207)	1500 (682)
			PFI20-376-12-4F	38.2 (969)	1200 (545)
			PVI20-376-12-4F	54.8 (1392)	1600 (727)
		25	PNI20-386-25-4F	47.5 (1207)	1500 (682)
			PFI20-386-12-4F	38.2 (969)	1200 (545)
			PVI20-386-12-4F	54.8 (1392)	1600 (727)
		35	PNI20-396-12-4F	47.5 (1207)	1500 (682)
			PVI20-396-12-4F	54.8 (1392)	1600 (727)
5F		15	RPFI21-376-12-5F	38.2 (969)	1200 (545)
			LPFI21-376-12-5F	43.5 (1111)	1475 (670)
			PNI21-376-25-5F	47.5 (1207)	1550 (705)
			PVI21-376-12-5F	54.8 (1392)	1600 (727)
		25	RPFI21-386-12-5F	38.2 (969)	1200 (545)
			LPFI21-386-12-5F	43.5 (1111)	1475 (670)
			PNI21-386-25-5F	47.5 (1207)	1550 (705)
			PVI21-386-12-5F	54.8 (1392)	1600 (727)
		35	PNI21-396-12-5F	47.5 (1207)	1550 (705)
			PVI21-396-12-5F	61.0 (1549)	1750 (795)
6F		15	RPFI32-376-12-6F	50.1 (1274)	1500 (681)
			LPFI32-376-12-6F	56.3 (1429)	1775 (807)
			PNI32-376-25-6F	62.5 (1588)	1920 (873)
			PVI32-376-12-6F	67.3 (1709)	1900 (864)
		25	RPFI32-386-12-6F	50.1 (1274)	1500 (681)
			LPFI32-386-12-6F	56.3 (1429)	1775 (807)
			PNI32-386-25-6F	62.5 (1588)	1920 (873)
			PVI32-386-12-6F	67.3 (1709)	1900 (864)
		35	PNI32-396-12-6F	62.5 (1588)	1920 (873)
			PVI32-396-12-6F	73.5 (1867)	2050 (932)
7F		15	RPFI31-376-12-7F	50.1 (1274)	1600 (726)
			LPFI31-376-12-7F	55.7 (1415)	2100 (955)
			PNI31-376-25-7F	62.5 (1588)	2050 (932)
			PVI31-376-12-7F	75.8 (1925)	2100 (955)
		25	RPFI31-386-12-7F	50.1 (1274)	1600 (726)
			LPFI31-386-12-7F	55.7 (1415)	2100 (955)
			PNI31-386-25-7F	62.5 (1588)	2050 (932)
			PVI31-386-12-7F	75.8 (1925)	2100 (955)
		35	PNI31-396-12-7F	62.5 (1588)	2050 (932)
			PVI31-396-12-7F	91.0 (2311)	2450 (1114)
9F		15	RPFI42-376-12-9F	62.1 (1578)	1800 (817)
			LPFI42-376-12-9F	68.3 (1734)	2100 (955)
			PNI42-376-25-9F	77.5 (1969)	2300 (1045)
			PVI42-376-12-9F	88.3 (2242)	2400 (1091)
		25	RPFI42-386-12-9F	62.1 (1578)	1800 (817)
			LPFI42-386-12-9F	68.3 (1734)	2100 (955)
			PNI42-386-25-9F	77.5 (1969)	2300 (1045)
			PVI42-386-12-9F	88.3 (2242)	2400 (1091)
		35	PNI42-396-12-9F	77.5 (1969)	2300 (1045)
			PVI42-396-12-9F	103.5 (2629)	2700 (1227)

TWO POSITION, FRONT ACCESS, PUFFER VACUUM INTERRUPTERS
CONTINUED





For typical specifications, go to www.gwelec.com. For contact principle, see pages 32-35.

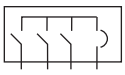
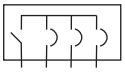
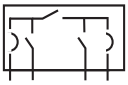
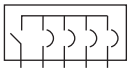
**For RPFI styles:*
height = 59" (1499mm),
depth = 49" (1245mm).

For LPFI styles:
height = 61" (1549mm),
depth = 54" (1372mm).

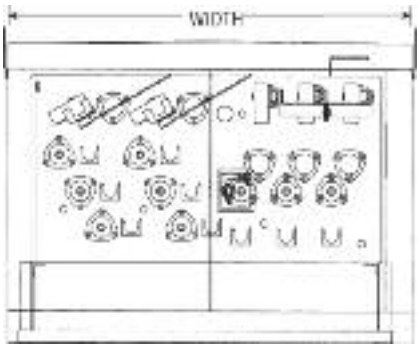
For PNI styles:
height = 65" (1651mm),
depth = 55" (1397mm).

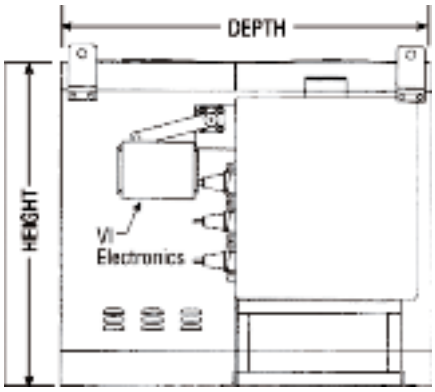
For PVI styles:
height = 57" (1448mm),
depth = 54.5" (1384mm).

FRONT ACCESS PUFFER VACUUM INTERRUPTERS

Model	One-line Diagram	Voltage (kV)	Catalog Number	Approximate Width in. (mm)*	Approximate Wt. w/SF_6 lbs (kg)
11F		15	RPFI43-376-12-11F	62.1 (1578)	1800 (817)
			LPFI43-376-12-11F	68.8 (1746)	2075 (943)
			PNI43-376-25-11F	77.5 (1969)	2400 (1091)
			PVI43-376-12-11F	79.8 (2026)	2200 (1000)
		25	RPFI43-386-12-11F	62.1 (1578)	1800 (817)
			LPFI43-386-12-11F	68.8 (1746)	2075 (943)
			PNI43-386-25-11F	77.5 (1969)	2400 (1091)
			PVI43-386-12-11F	79.8 (2026)	2200 (1000)
		35	PNI43-396-12-11F	77.5 (1969)	2400 (1091)
			PVI43-396-12-11F	86.0 (2184)	2450 (1114)
12F		15	RPFI41-376-12-12F	62.1 (1578)	1800 (817)
			LPFI41-376-12-12F	67.8 (1721)	2150 (977)
			PNI41-376-25-12F	77.5 (1969)	2400 (1091)
			PVI41-376-12-12F	96.8 (2459)	2600 (1182)
		25	RPFI41-386-12-12F	62.1 (1578)	1800 (817)
			LPFI41-386-12-12F	67.8 (1721)	2150 (977)
			PNI41-386-25-12F	77.5 (1969)	2400 (1091)
			PVI41-386-12-12F	95.0 (2413)	2600 (1182)
		35	PNI41-396-12-12F	77.5 (1969)	2400 (1091)
			PVI41-396-12-12F	121.0 (3073)	3000 (1364)
43F	 **Bus Tie**	15	RPFI43-376-12-43F-BT	74.1 (1883)	2100 (953)
			LPFI43-376-12-43F-BT	80.2 (2037)	2300 (1045)
			PNI43-376-25-43F-BT	92.5 (2350)	2750 (1250)
			PVI43-376-12-43F-BT	101 (2565)	2700 (1227)
		25	RPFI43-386-12-43F-BT	74.2 (1885)	2250 (1023)
			LPFI43-386-12-43F-BT	80.2 (2037)	2300 (1045)
			PNI43-386-25-43F-BT	92.5 (2350)	2750 (1250)
			PVI43-386-12-43F-BT	101 (2565)	2700 (1227)
		35	PNI43-396-12-43F-BT	92.5 (2350)	2750 (1250)
			PVI43-396-12-43F-BT	116 (2946)	3000 (1364)
51F		15	RPFI51-376-12-51F	74.1 (1883)	2300 (1044)
			LPFI51-376-12-51F	79.7 (2025)	2600 (1182)
			PNI51-376-25-51F	92.5 (2350)	2900 (1318)
			PVI51-376-12-51F	118 (2997)	3100 (1409)
		25	RPFI51-386-12-51F	74.2 (1885)	2250 (1023)
			LPFI51-386-12-51F	79.7 (2025)	2600 (1182)
			PNI51-386-25-51F	92.5 (2350)	2900 (1318)
			PVI51-386-12-51F	118 (2997)	3100 (1409)
		35	PNI51-396-12-51F	92.5 (2350)	2900 (1318)
			PVI51-396-12-51F	151 (3835)	3600 (1636)

TWO POSITION, FRONT ACCESS, PUFFER VACUUM INTERRUPTERS
CONTINUED





For typical specifications, go to www.gwelec.com. For contact principle, see pages 32-35.

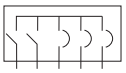
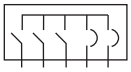
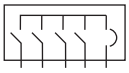
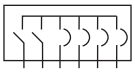
**For RPFI styles:*
height = 59" (1499mm),
depth = 49" (1245mm).

For LPFI styles:
height = 61" (1549mm),
depth = 54" (1372mm).

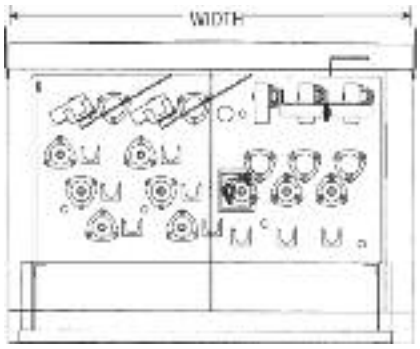
For PNI styles:
height = 65" (1651mm),
depth = 55" (1397mm).

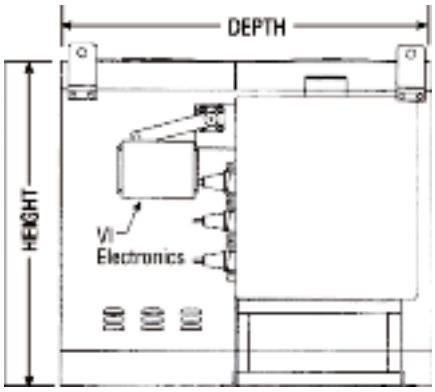
For PVI styles:
height = 57" (1448mm),
depth = 54.5" (1384mm).

FRONT ACCESS PUFFER VACUUM INTERRUPTERS

Model	One-line Diagram	Voltage (kV)	Catalog Number	Approximate Width in. (mm)*	Approximate Wt. w/SF_6 lbs (kg)
52F		15	RPFI52-376-12-52F	74.1 (1883)	2100 (953)
			LPFI52-376-12-52F	80.3 (2038)	2525 (1148)
			PNI52-376-25-52F	92.5 (2350)	2800 (1273)
			PVI52-376-12-52F	109.3 (2776)	2900 (1318)
		25	RPFI52-386-12-52F	74.1 (1883)	2100 (953)
			LPFI52-386-12-52F	80.3 (2038)	2525 (1148)
			PNI52-386-25-52F	92.5 (2350)	2800 (1273)
			PVI52-386-12-52F	109.3 (2775)	2900 (1318)
		35	PNI52-396-12-52F	92.5 (2350)	2800 (1273)
			PVI52-396-12-52F	133.5 (3391)	3250 (1477)
53F		15	RPFI53-376-12-53F	74.1 (1883)	2100 (953)
			LPFI53-376-12-53F	80.8 (2051)	2450 (1114)
			PNI53-376-25-53F	92.5 (2350)	2750 (1250)
			PVI53-376-12-53F	101 (2565)	2700 (1227)
		25	RPFI53-386-12-53F	74.1 (1883)	2100 (953)
			LPFI53-386-12-53F	80.8 (2051)	2450 (1114)
			PNI53-386-25-53F	92.5 (2350)	2750 (1250)
			PVI53-386-12-53F	101 (2565)	2700 (1227)
		35	PNI53-396-12-53F	92.5 (2350)	2750 (1250)
			PVI53-396-12-53F	116 (2946)	3000 (1364)
54F		15	RPFI54-376-12-54F	74.1 (1883)	2000 (908)
			LPFI54-376-12-54F	81.3 (2064)	2400 (1091)
			PNI54-376-25-54F	92.5 (2350)	2650 (1205)
			PVI54-376-12-54F	93 (2362)	2500 (1136)
		25	RPFI54-386-12-54F	74.1 (1883)	2000 (908)
			LPFI54-386-12-54F	81.3 (2064)	2400 (1091)
			PNI54-386-25-54F	92.5 (2350)	2650 (1205)
			PVI54-386-12-54F	93 (2362)	2500 (1136)
		35	PNI54-396-12-54F	92.5 (2350)	2650 (1205)
			PVI54-396-12-54F	98.5 (2502)	2700 (1227)
62F		15	RPFI62-376-12-62F	86.1 (2188)	2400 (1089)
			LPFI62-376-12-62F	92.3 (2343)	2800 (1273)
			PNI62-376-25-62F	107.5 (2731)	3300 (1500)
			PVI62-376-12-62F	130.3 (3308)	3400 (1545)
		25	RPFI62-386-12-62F	86.1 (2188)	2400 (1089)
			LPFI62-386-12-62F	92.3 (2343)	2800 (1273)
			PNI62-386-25-62F	107.5 (2731)	3300 (1500)
			PVI62-386-12-62F	130.3 (3310)	3400 (1545)
		35	PNI62-396-12-62F	107.5 (2731)	3300 (1500)

TWO POSITION, FRONT ACCESS, PUFFER VACUUM INTERRUPTERS
CONTINUED





For typical specifications, go to www.gwelec.com. For contact principle, see pages 32-35.

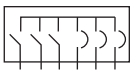
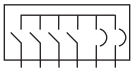
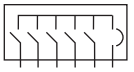
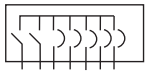
**For RPFI styles:*
height = 59" (1499mm),
depth = 49" (1245mm).

For LPFI styles:
height = 61" (1549mm),
depth = 54" (1372mm).

For PNI styles:
height = 65" (1651mm),
depth = 55" (1397mm).

For PVI styles:
height = 57" (1448mm),
depth = 54.5" (1384mm).

FRONT ACCESS PUFFER VACUUM INTERRUPTERS

Model	One-line Diagram	Voltage (kV)	Catalog Number	Approximate Width in. (mm)*	Approximate Wt. w/SF_6 lbs (kg)
63F		15	RPFI63-376-12-63F	86.1 (2188)	2400 (1089)
			LPFI63-376-12-63F	92.8 (2356)	2750 (1250)
			PNI63-376-25-63F	107.5 (2731)	3200 (1455)
			PVI63-376-12-63F	122 (3099)	3200 (1455)
		25	RPFI63-386-12-63F	86.1 (2188)	2400 (1089)
			LPFI63-386-12-63F	92.8 (2356)	2750 (1250)
			PNI63-386-25-63F	107.5 (2731)	3200 (1455)
			PVI63-386-12-63F	122 (3099)	3200 (1455)
		35	PNI63-396-12-63F	107.5 (2731)	3200 (1455)
			PVI63-396-12-63F	146 (3708)	3600 (1636)
64F		15	RPFI64-376-12-64F	86.1 (2188)	2300 (1044)
			LPFI64-376-12-64F	93.3 (2369)	2700 (1227)
			PNI64-376-25-64F	107.5 (2731)	3100 (1409)
			PVI64-376-12-64F	113 (2870)	3000 (1364)
		25	RPFI64-386-12-64F	86.1 (2188)	2300 (1044)
			LPFI64-386-12-64F	93.3 (2369)	2700 (1227)
			PNI64-386-25-64F	107.5 (2731)	3100 (1409)
			PVI64-386-12-64F	113 (2870)	3000 (1364)
		35	PNI64-396-12-64F	107.5 (2731)	3100 (1409)
			PVI64-396-12-64F	129 (3277)	3300 (1500)
65F		15	RPFI65-376-12-65F	86.1 (2188)	2300 (1044)
			LPFI65-376-12-65F	93.7 (2381)	2650 (1205)
			PNI65-376-25-65F	107.5 (2731)	3000 (1364)
			PVI65-376-12-65F	105 (2667)	2800 (1273)
		25	RPFI65-386-12-65F	86.1 (2188)	2300 (1044)
			LPFI65-386-12-65F	93.7 (2381)	2650 (1205)
			PNI65-386-25-65F	107.5 (2731)	3000 (1364)
			PVI65-386-12-65F	105 (2667)	2800 (1273)
		35	PNI65-396-12-65F	107.5 (2731)	3000 (1364)
			PVI65-396-12-65F	111 (2819)	3000 (1364)
72F		15	RPFI72-376-12-72F	98.1 (2493)	2500 (1136)
			LPFI72-376-12-72F	104.3 (2648)	3100 (1409)
			PNI72-376-25-72F	122.5 (3112)	3850 (1750)
			PVI72-376-12-72F	151.3 (3842)	3850 (1750)
		25	RPFI72-386-12-72F	98.1 (2493)	2500 (1136)
			LPFI72-386-12-72F	104.3 (2648)	3100 (1409)
			PNI72-386-25-72F	122.5 (3112)	3850 (1750)
			PVI72-386-12-72F	151.3 (3842)	3850 (1750)
		35	PNI72-396-12-72F	122.5 (3112)	3850 (1750)

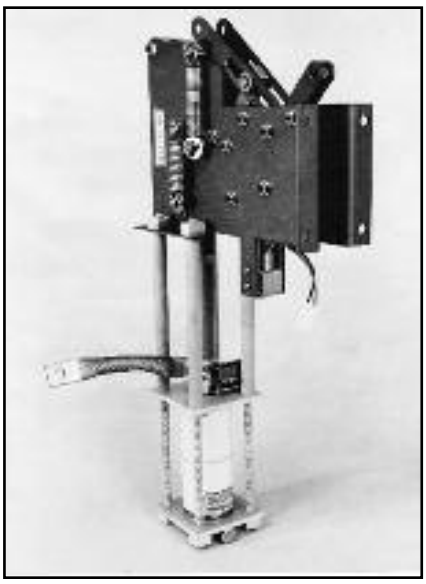
MODEL VI VACUUM INTERRUPTER MECHANISM PRINCIPLE

Add to appropriate switch specifications.

Ratings available through 35kV, with 12kA interrupting with an option for 20kA. Mechanisms are field retro-fittable between single phase and three phase operation.

For single phase operation, the model VI vacuum interrupter consists of a single vacuum bottle mechanically linked to a spring-assisted operating mechanism. For three phase operation, the single phase mechanisms are mechanically linked together with an external operating handle assembly. These mechanisms are field retrofittable between single phase and three phase operation. In both cases, once initiated, the interrupting time of the vacuum bottles is approximately 3 cycles (50 millisec). A position indicator (open-green, closed-red) is mounted to the moving contact and is visible through a viewing window for positive contact position. The mechanical linkage assembly provides a "trip-free" operation permitting the vacuum interrupter to interrupt independent of the operating handle if closing into a faulted circuit.

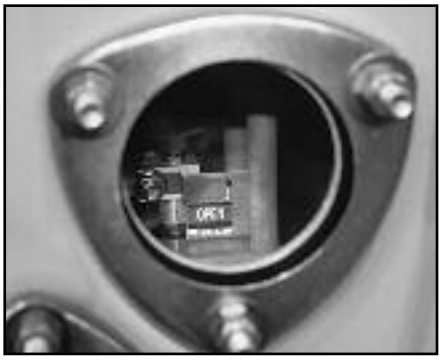
The control monitors the current on each phase and activates a trip solenoid to open one or all three vacuum interrupters if an overcurrent on any phase is sensed. The control is self-powered by current transformers mounted inside the sealed switch tank. No external power source is required. Load current is required for the control to be activated unless the optional remote power feature is specified. The trip selector is used to select the time-current response curve for the tap circuits. Factory setting for single or three phase tripping is standard.



◄ *Single phase VI mechanism.*

Photos below: Interrupter operating handles for manual single phase (below) or three phase (left) operation and reset. Motor actuators can be added to three phase for remote operation. ▼

Position indicators (right) provide contact position indication through viewing windows. ►



The time-current response curves are chosen with the phase selector switches on the face plate of the control. Selection of time-current characteristics may be made under load or no-load conditions with continuous current ranges in twelve selectable levels.

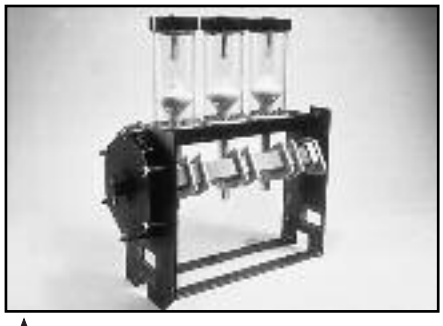
The manual trip and reset of the vacuum interrupter is accomplished through an operating handle. Motor actuators can be provided for remote control. Optional push-button on the control also permits manual tripping.

Two Position, Linear Puffer Style

G&W's patented Linear Puffer (LP) style, two-position switches are ideal for heavy duty manual load break switching, automatic transfer or automated sectionalizing applications rated through 35kV, 900A continuous and 40kA asymmetrical short circuit. Switches are tested to 1200 loadbreak and 2000 mechanical operations. Current limiting fuses or electronically controlled vacuum interrupters can be added for overcurrent protection. G&W's LP style contact system provides extremely efficient, high speed arc extinction for maximum service life.

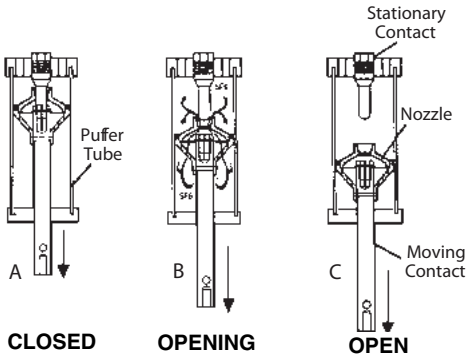
Stored Energy Mechanism
Linear puffer switches can be supplied with internal stored energy (cock and trip) mechanisms for both the open and close operators permitting high speed local or remote operation. A separate external trip handle is provided. An optional internal solenoid permits remote operation.

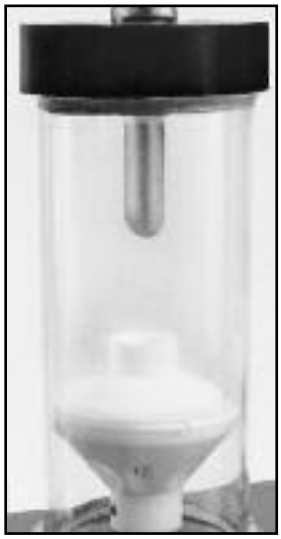
Three phase visible position of contacts.



Three phase linear puffer mechanism.

Two Position, Linear Puffer Contact Principle



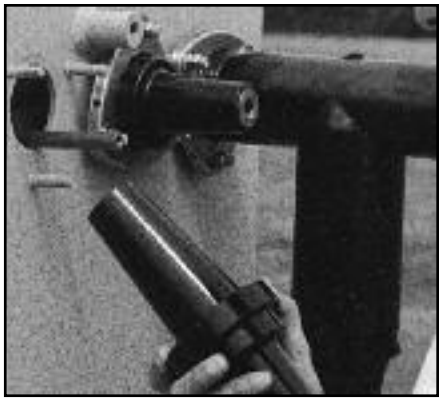


A. The stationary contact and piston assembly (containing the moving contact and nozzle) are housed in clear cylindrical tubes. These are mounted in a modular three-phase assembly which is independent of the switch tank. The stationary contacts are supported independent of the cable entrance bushings, eliminating possible misalignment resulting from tank deflections. Tank deflections are caused by normal tank pressure variance due to ambient temperature fluctuations. This construction eliminates contact alignment difficulties caused by deflections of the switch tank walls. The modular construction also allows testing of the module during assembly and complete flexibility in switch design and configuration. The nozzle which directs the flow of SF_6 has a converging/diverging geometry (see photo) which improves the arc interruption capability over designs using straight throated nozzles. The converging portion of the nozzle has a constantly decreasing flow area up to the nozzle throat minimizing velocity changes in the flow of SF_6 gas, while improving arc interruption and dielectric recovery.

B. As the contacts separate, the SF_6 is compressed by the piston assembly and directed into the arc zone by the nozzle. The compressed SF_6 flows (is puffed) across the contacts and around the arc established by the separating contacts. The cooling action of the gas is increased by the higher pressure (due to compression) and the flow which constantly provides a supply of cool SF_6 into the arc zone.

C. At current zero the temperature of the arc is reduced to the point of deionization, ceasing the flow of current. The SF_6 rapidly recovers dielectric strength withstanding the system recovery voltage across the contacts.

D. As the contacts are closing, the piston assembly compresses the SF_6 between the contacts. This increases the dielectric strength of the gap, minimizing prestrike. The contacts are designed using a tulip bayonet construction (see photo). The sliding action of the contacts on engagement provides a self cleaning action of the main current carrying sur-faces. The contact fingers are designed for increasing contact pressure with increasing current for proper operation during momentary or close-into-fault conditions. The contacts have arc resistant copper tungsten tips to minimize erosion of material during load switching and prevent damage to the main current transfer area of the contacts.



3-1/C, 600A Quik-Change Apparatus Bushings

Cable entrance bushings can be damaged at any time due to improper handling, accidental shifting during shipment, elbow failure or even normal wear and tear. In the case of SF_6 gas insulated switches where the tank is totally welded, conventional bushing replacement means sending the switch back to the factory for repair. G&W's exclusive Quik-Change Disconnectable Bushing permits quick, easy field replacement without having to open the switch tank.

Bushings are designed to IEEE 386 standards with standard interface accepting conventional elbow style connectors and include an aluminum conductor with 5/8"-11 aluminum threaded stud and aluminum single hole pad **(elbows must be ordered separately).** Copper studs are available. For bottom entry switches, recommended switch frame height is 42" for all voltages.

3-1/C, 600A Voltage Sensing Bushings

G&W's Voltage Sensing Bushing (VSB) system is a temperature compensated, built-in, voltage measuring system that eliminates the need for PTs when three phase analog voltage monitoring is required. Compared to potential transformers, the VS bushing system offers these benefits:

- Significant cost savings
- Cleaner, less cumbersome installation
- Less space required
- Fewer add-on components which could potentially fail
- Installed and tested prior to shipment
- Can be field calibrated
- One digital output per way for threshold voltage detection

The VS bushing system utilizes a capacitively coupled screen which is embedded within the epoxy bushing. The low energy output of the screen is amplified by integral circuitry, resulting in a 0-120 VAC analog output suitable for direct connection to any relay, IED or RTU. The circuitry incorporates built-in calibration and temperature compensation which improve accuracy.

Bushings are designed to IEEE 386 standards with standard interface accepting conventional elbow style connectors and include an aluminum conductor with 5/8"-11 aluminum threaded stud and aluminum single hole pad **(elbows must be ordered separately).** Bushings are bolt-on style. Copper studs are available. For bottom entry switches, recommended switch frame height is 42" for all voltages.

SPECIFICATIONS

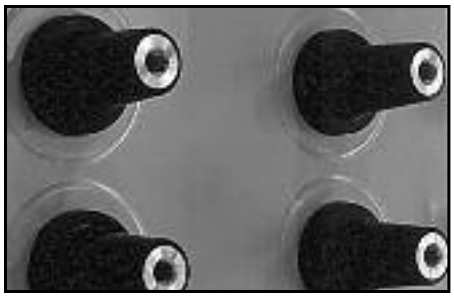
Operating temperature:
-40°C to +65°C
Input voltage range (phase-to-phase):
10.7kV - 38kV
Nominal output voltage: 120 VAC
Analog voltage outputs: 3 or 6
Number of digital outputs: 1 or 2
Digital pick-up voltage:
90% of Vnom (on all phases)
Digital drop-off voltage:
75% of Vnom (on any phase)
Maximum burden (per output): 0.06VA
Voltage accuracy:
+/- 2% from 0°C to 65°C and +/- 5% from -40°C to 0°C.
Voltage signal delay: 1/2 cycle max

3-1/C, 600A / 900A Apparatus Bushings

Bushings are designed to IEEE 386 standards with standard interface accepting conventional elbow style connectors and include an aluminum conductor with 5/8"-11 aluminum threaded stud and aluminum single hole pad for a 600A rating **(elbows must be ordered separately).** A copper conductor is available which extends the continuous current rating to 900A. For bottom entry switches, recommended switch frame height is 42" for all voltages. Welded flange bushings are available.

3-1/C, 200A Deepwell Bushings

Bushings are designed to IEEE 386 standards with standard interface accepting deadbreak or loadbreak inserts and conventional elbow connectors **(inserts and elbows must be ordered separately).** A copper conductor is standard. For bottom entry switches, recommended switch frame height is 42" for all voltages. Welded flange bushings are available.



3-1/C, 600A Apparatus Bushings

Welded Flange style

Bushings are designed to IEEE 386 standards with standard interface accepting conventional elbow style connectors. Bushings include a stainless steel flange and an aluminum conductor with 5/8"-11 aluminum threaded stud. **Elbows must be ordered separately.** 200A deepwell welded flange bushings are also available.

3-1/C, 600A Universal Bushings

The combination Universal Cable End and Universal bushing provides an extremely versatile interface between cable and equipment for easy connecting, disconnecting, and isolating of distribution cable circuits. End caps for both bushing and splice module permit dead-ending of the cable and equipment for fast cable sectionalizing if required.

Universal bushings are designed to accept G&W universal bushing cable ends **(G&W Universal bushing cable ends must be ordered separately. See chart below).** An aluminum conductor and aluminum single hole pad is standard. For bottom entry switches, recommended switch frame height is 36" for all voltages. Hi-pot test kits are available.

NOTE: Universal bushings can accept up to two G&W Universal bushing cable ends per phase. For applications requiring this feature, consult factory.

Universal Bushing Cable Ends (per phase)

Complete cable data required before order can be processed.

Configuration	Catalog Number	
	15.5kV	27kV
Terminate 1 cable per phase	15CE	27CE
Terminate 2 cables per phase	15CE-CE	27CE-CE
Dead End Kit	15DCE	27DCE
Change 1 cable per phase to 2 cables per phase*	151V2	271V2
Change 2 cables per phase	152V1	272V1

**Kit includes second cable end (CE) and hardware necessary for connection.*

ACCESSORIES AND OPTIONS

For standard components, refer to typical specifications at www.gwelec.com under Support.

Gas Pressure Gauge and Fill Valve (Standard)
The pressure gauge is a "GO-NO-GO" style which is color coded to simplify verification of proper operating conditions. A Schraeder type fill valve permits refilling in the field. The gauge and fill valve are made of brass for corrosion resistance. Both components are protected by a steel guard.

Temperature Compensated Gas Density Gauge (Optional)
measures internal tank gas density for maximum precision of switch operating conditions. The gauge is colored coded to simplify reading by operating personnel.

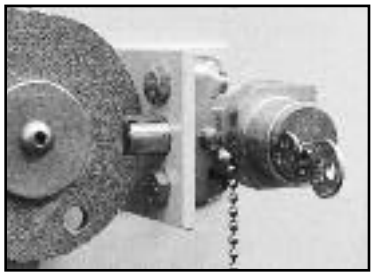
Viewing Windows (Standard)
provide a means to visibly verify switch contact position. Single phase or three phase contact viewing is available.

Auxiliary switches

Window Cover (Optional)
Available for Type 1, Type 2, or Type 3 interrupter controls.

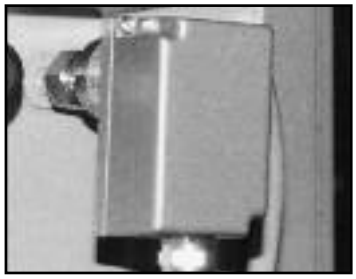
Pressure gauge and fill valve

Temperature compensated gauge



Key interlocks

Low pressure warning device



SF_6 density switch

Key Interlocks (Optional)
may be used as an added safety measure to prevent operation by unauthorized personnel or to assure safe coordination of energized equipment. Switches can be provided with provisions only (two maximum per operating mechanism) or with key interlocks factory installed. Specify locking scheme when ordering, i.e. lock in open, lock in closed or lock in both open and closed position. For key interlocks to be coordinated with other equipment, manufacturer's information must be provided.

Ground Lugs (Optional)
are bronze, eyebolt style for 4/0 maximum conductor cable.

Auxiliary Switches (Optional)
can be included to provide remote indication of contact position. One N.O. and one N.C. contact is supplied and can be wired by G&W or the customer. A maximum of two auxiliary switches can be installed per operating mechanism.

Low SF_6 Remote Monitoring Devices:
1) Low Pressure Warning Devices
are factory set at 5 psig and permit remote indication of internal tank pressure. It can also be used for low pressure control lockout. One Form C contact is provided for wiring by the customer.
Recommended for installations where ambient temperature does not fall below 0°F (-15°C).

2) SF_6 Density Switches
permit remote indication of internal tank gas density to assure proper pressure/temperature operating conditions. One Form C contact is provided for wiring by the customer.
Recommended for installations where ambient temperatures fall below 0°F (-15°C).

Engineered to order. Built to last.

Vacuum Interrupter Overcurrent Controls

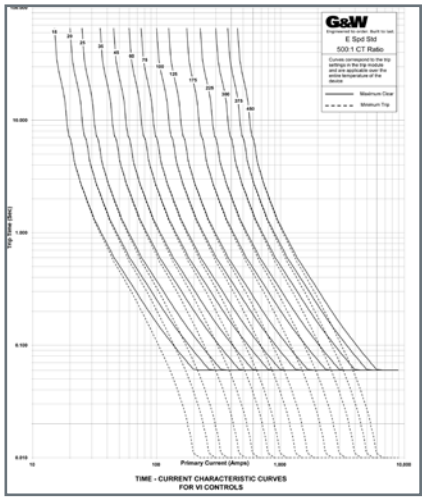
G&W Overcurrent Controls

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 (CTs) located inside the switch. Controls can also be equipped to accept a trip input from another device, such as a transformer overpressure sensor.

The standard control enclosure for padmount applications is fiberglass NEMA 4X (IP56) rated. An optional NEMA 6P (IP67) rated enclosure is available for applications where the possibility of flooding or short term submersion is possible. Optional enclosures and control designs are available for applications where short or long term submersion is possible.

Operation

Load and fault current are sensed by current transformers mounted internally around each bushing of the switch. The CTs also provide power to the control thus eliminating the need for an external power supply. Approximately 6-10 Amps per phase of load current is required for self powering. If not present, the control is in sleep mode. The control will power-up and trip once that load is present (either normal load or during a fault). There will be an approximate 1/2 cycle delay for power-up in this case. In addition, a "READY" light is provided which flashes when the control is powered up by sufficient load current on the sensing CTs, or when the control is provided with external power. The incoming load or fault current is converted to a digital signal. The control constantly compares the measured current to the Time Current Characteristic (TCC) curve programmed into the memory. Based on the programmed settings, the control determines when to trip open the vacuum interrupter to interrupt the fault. All trip settings are in Minimum Trip Amperes. An approximate conversion of minimum trip to approximate fuse equivalent is provided. The VI Control can be tested in the field using primary or secondary current injection.



▲ *Example of TCC curve*

▲ *Type 1 control*

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 handles. 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 user selectable Time Current Characteristic (TCC) curves. The curve selection can be set or changed while the switch is energized.

An 8 pole dip switch allows the user to choose the TCC that best matches their individual coordination requirements. A label 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 while the switch is energized. Pressing 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 Control

▲ *Type 2 control*

Type 2 controls provide a user friendly interface for quick and easy programming. 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 user selectable Time Current Characteristic (TCC) curves. The curve selection can be set or changed while the switch is energized.

An 8 pole dip switch allows the user to choose the TCC curve that best matches their specific coordination requirements. 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. Pressing the manual trip button when the control is powered up trips all three phases of the vacuum interrupter. Each control also includes "Last Cause of Trip" LEDs. These LEDs indicate what caused the control to issue a trip command - an over current condition, Ground Fault, Instantaneous, or an external or manual trip command.

Since the control is three phase only, one minimum trip level for all three phases is set via a single selector knob. The control has a built-in, adjustable phase time delay. The control also provides a ground fault (phase imbalance) feature with adjustable trip and time delay settings as well as instantaneous trip and inrush restraint features.

Features of Type 2 control

Phase Time Delay

For applications requiring coordination with other protection devices, the Type 2 provides field selectable phase time delay capability. The phase time delay selector switch provides a phase delay range from 0 to 0.50 seconds before the programmed TCC time is initiated. This permits the user to select which protective device will trip the circuit first. The phase time delay allows sectionalizing schemes to be implemented while maintaining full line capacity throughout the circuit.

Ground Fault (Phase Imbalance)

The ground fault or phase imbalance feature continuously checks for phase imbalance or unequal currents in each of the three phases. Protection from this condition is a common requirement for large three phase motors or other sensitive loads. The ground fault trip current can be adjusted in the field by the user and is represented on the control panel as a percent (%) of the user programmed phase overcurrent minimum trip level. A time delay minimizes nuisance tripping caused by temporary phase imbalances. The Minimum Trip selector sets the desired trip level in amperes depending upon the desired protection scheme. The ground trip feature protects against high impedance faults and loss of phase.

Instantaneous Trip

The instantaneous trip multiplier aids in customizing the protection capabilities of the Type 2 control. The rotary switch has nine positions. The first position, OFF, disables this feature. The other positions (x1, x3, x5, x7, x9, x11, x13, and x15) affect how the Type 2 calculates the trip time for overcurrent conditions. When any phase exceeds the current value defined by the minimum trip setting times the instantaneous trip multiplier, the Type 2 will initiate a trip command to all three phases within half a cycle, 8.3 msec at 60 Hz (10 msec at 50 Hz).

Inrush Restraint

The inrush restraint function is helpful in preventing nuisance trips due to cold load pickup. The inrush restraint function is active when the Type 2 is initially powered up and will reactivate if the average three phase primary current drops below 7.5 Amps (15-300 Amp controls) or 15 Amps (30-600 Amp controls). The inrush restraint function consists of two selectable parameters, the Inrush Trip Multiplier (x1, x2, x3, x4, x5, x6, x7, x8, x9, x11, x13, and x15) and the Inrush Time Delay (0.00, 1.75, 3.25, 5.25, and 7.00 seconds).

The inrush trip multiplier increases the minimum trip value for the selected inrush time delay duration.

Type 3, 4, and 7 Controls

▲ *Type 3 control*

Type 3 and 4 controls provide advanced protection functions. There are two versions of these controls, each with different protection elements.

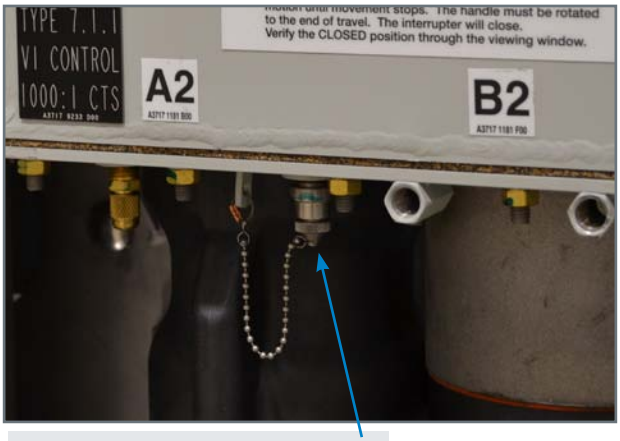
The Type 3 and 4 controls are each available in NEMA 4X or NEMA 6P control enclosures. Each control includes a programming port on the enclosure for programming via a notebook computer or for retrieving event reports.

In addition, the Type 3 includes a Vacuum Fluorescent Display to view present load currents, last cause of trip events, and the settings present within the control, without the need for a notebook computer.

Each control is available with either the EZset or Plus programming option. Refer to the table on Page 4.

The Type 3 and 4 controls record the most recent 16 Cause of Trip Events. The Type 3 EZset includes a display and keypad for entering programming parameters and viewing the Cause of Trip Events. The Type 3 Plus, and Type 4 EZset and Plus utilize a notebook computer programming kit to enter the settings. The notebook computer programming kit can also be used to download and store the settings and Cause of Trip Events.

Type 7 controls provide the same protection features and options as the Type 3 and 4 controls. For vault and subsurface applications, utilizing Trident® solid dielectric switchgear, G&W recommends the Type 7 control. The Type 7 is mounted within the switch's mechanism housing and has an IP68 rating for long term submersion. This eliminates the need for a separate control enclosure and associated cabling. The control is programmed using a notebook computer. A notebook computer programming kit is available.



▲ *Type 7 control programming port*

Programming Kit

For Type 3, Type 4 or Type 7

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

Catalog Number for Type 3, Type 4, Type 7: LPK7-VICSS

▲ *Programming Kit*

Type 3, 4, and 7 Programming Options

Feature	EZset	Plus
Trip Selection	1 or 3 Phase	1 or 3 Phase
Minimum Trip	12 Set Points (Amps) 30, 40, 50, 70, 90, 120, 150, 200, 250, 350, 450, 600 Or 15, 20, 25, 35, 45, 60, 75, 100, 125, 175, 225, 300	30 – 900 Amps, Or 15 – 450 Amps 1 Amp increments
Phase Time Delay	12 Set Points (Seconds) 0, 0.03, 0.06, 0.10, 0.15, 0.2, 0.25, 0.3, 0.35, 0.4, 0.45, 0.5	0 -10.0 Seconds, 0.01 Second increments
Instantaneous Setting	8 Multipliers 1, 3, 5, 7, 9, 11, 13, 15	Phase Min Trip to 12,000 Amps, 1 Amp increments
Inrush Setting	12 Multipliers 1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 13, 15	15 Multipliers 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15
Inrush Timer	5 Set Points (Seconds) 0, 1.75, 3.25, 5.25, 7.0	0.0 to 60.0 Seconds, 0.1 Second increments
Minimum Response Time	Settings (Seconds) 0, 0.05, 0.1, 0.145, 0.205, 0.26 0.335, 0.405, 0.495, 0.58	0 – 10.0 Seconds, 0.01 increments.
Ground Fault Setting 3 Phase Models Only	10 Settings Off, 10%, 15%, 20%, 25%, 30%, 35%, 40%, 45%, 50%	3 Amps – 50% of the Phase Min Trip, 1 Amp increments.
Ground Fault Curve	Separate from Phase Curve	Separate from Phase Curve
Ground Fault Instantaneous 3 Phase Models Only	n/a	Ground Min Trip – 6,000 Amps, 1 Amp increments
Ground Fault Minimum Response Time 3 Phase Models Only	n/a	0 – 10.0 Seconds, 0.01 increments.
Ground Fault Time Delay 3 Phase Models Only	n/a	0 -10.0 Seconds, 0.01 Second increments
Ground Fault Inrush Setting 3 Phase Models Only	n/a	15 Multipliers 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15
Ground Fault Inrush Timer 3 Phase Models Only	n/a	0.0 to 60.0 Seconds, 0.1 Second increments
Control ID	n/a	Device ID, Feeder Name/ Number, Other Information.
Protection Setting Method	VFD or Laptop	Laptop
Curves	30 Emulated Fuse and Electromechanical Relays	64 Emulated Fuse, Electromechanical Relays, C37.112 U1 – U5, and 5 User Created

Product Specification

Power Requirements	Powered by current from the current transformers
External Power Requirements (optional)	12-24 VDC (Standard), 48VDC, 120VAC, 220VAC
Type 1 or 2 Minimum Trip Setting Options (500:1 CT)	15A, 20A, 25A, 35A, 45A, 60A, 75A, 100A, 125A, 175A, 225A, 300A
Type 1 or 2 Minimum Trip Setting Options (1000:1 CT)	30A, 40A, 50A, 70A, 90A, 120A, 150A, 200A, 250A, 350A, 450A, 600A
Type 3, 4, of 7 Minimum Trip Setting Options	See table page 4
Enclosure	NEMA 4X or optional NEMA 6P
Frequency	60 Hz (Standard) 50 Hz (Optional)
Environment	Operating Temperature: -40°C to +65°C Storage Temperature: -50°C to +85°C Humidity: 10% to 95%

Type Tests:

Electrostatic Discharge test	IEC 60255-22-2 Level 4 contact discharge
Radiated Electromagnetic Field Disturbance test	IEC 60255-22-3 Level 3
Radiated Electromagnetic Interference	IEEE C37.90.2-1995 - 35V/m
Surge Withstand	IEEE C37.60
Vibration	IEC 60255-21-1 First Edition – 1988 (EN 60255-21-1 First Edition – 1995) Electrical relays, Part 21: Vibration, shock, bump, and seismic tests on measuring relays and protection equipment; Section One – Vibration tests (sinusoidal); Severity: Class 1 Endurance; Class 2 Response. IEC 60255-21-2 First Edition – 1988 (EN 60255-21-2 First Edition – 1995) Electrical relays, Part 21: Vibration, shock, bump, and seismic tests on measuring relays and protection equipment; Section Two – Shock and Bump tests. Severity Level: Class 1 Shock withstand, Bump; Class 2 Shock Response

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ISO 9001: 2008 Certified
ISO 14001:2004 Certified

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OPTIONS

Select from the following options and add to the appropriate switch specification:

- ❑ Stainless steel tank, type 304
- ❑ Stainless steel enclosure, type 304 or 316
- ❑ Temperature compensating pressure gauge
- ❑ Low pressure warning device
- ❑ SF_6 density switch
- ❑ 4/0 brass ground lug
- ❑ Key interlock provisions
- ❑ Key interlocks to lock in open position
- ❑ Current transformers for load break ways
- ❑ Potential transformers for voltage monitoring and/or control power
- ❑ Automatic transfer control type ATC451-4
- ❑ Motor actuators for remote switch operation
- ❑ Auxiliary switches for remote switch position indication
- ❑ Stationary switch controls for remote switch operation and SCADA integration
- ❑ Portable switch controls for remote switch operation
- ❑ Remote terminal units and communication packages for SCADA integration
- ❑ Operation counters
- ❑ Voltage sensors with 120 VAC output or a contact to indicate presence of voltage
- ❑ 200A deepwell bushings
- ❑ 600A apparatus bushings
- ❑ 600A voltage sensing bushings
- ❑ 600A Quik-Change apparatus bushings
- ❑ 600A Universal bushings (through 25kV)
- ❑ Type 2 vacuum interrupter control including ground fault trip and time delay selector switches (three phase only)
- ❑ Type 3 vacuum interrupter control including ground fault trip, inrush restraint, programmable vacuum fluorescent display (VFD) and RS232/485 port
- ❑ Type 4 vacuum interrupter control (same as Type 3 with laptop programming only)
- ❑ Clear window cover for Type 1, Type 2, or Type 3 interrupter controls
- ❑ Submersible NEMA 6P enclosure for vacuum interrupter control
- ❑ SEL relays including 751A, 501, 551 and others
- ❑ External power / trip for vacuum interrupter control
- ❑ Refill kit consisting of regulator, hose and SF_6 bottle