

prolec®



Voltage Regulator Transformers



Voltage Regulator Transformers

The voltage on modern distribution circuits is becoming increasingly difficult to manage. New distributed energy resources, such as solar, combined with the growth of sophisticated loads creates voltage challenges on distribution network systems.

Existing voltage control devices cannot maintain a consistent voltage profile, especially when trying to manage the intermittency of these resources and loads, which tend to drive the voltage regulation beyond its designed capability.

Prolec GE's family of Voltage Regulators set the industry standard in terms of robust design and product reliability. Prolec GE Voltage Regulators can operate up to 2 million mechanical operations and a total cost of ownership nearly 20% better than competing products.

Additionally, Prolec GE is one of the first in the market to incorporate measured Reverse Power Flow capability to the voltage regulator. This feature provides precise synchronous operation of the tap changer and control during normal and reverse power flow, which is critical on today's distribution circuits where distributed generation is present.



Applications of Single Phase Voltage Regulation

- Pole-mounted Voltage Regulator
- Platform-mounted Voltage Regulator
- Substation Voltage Regulator

Voltage Regulator Applications

Voltage regulation on electrical networks is a complex process. It involves a number of key assets working collaboratively to maintain a consistent voltage profile while the variable loads and distributed generation within the network are continually changing.

The transformers located within the substation, usually operate with a Load Tap Changer (LTC) and manage the voltage levels for the bus that may feed multiple circuits served from the substation. The transformer provides a baseline voltage level that all circuits need in order to operate within the

Feeder Regulation Within the Substation

In circumstances where various feeders have significantly different loads and cannot maintain voltage regulation between circuits on the same transformer, a substation voltage regulator is used to adjust the voltage level of a specific feeder. This allows the loads served from the transformer to safely operate at their intended voltage level, and is typically controlled and adjusted in conjunction with the transformer's LTC.

Regulation for Specific Loads on a Feeder

In instances where the entire feeder does not need to be adjusted, such as an industrial complex with a large number of motors and other inductive loads, a pole-mounted voltage regulator is used within the circuit to adjust the voltage level in order to adequately serve the end user. It is typically adjusted automatically, and operates in conjunction with the substation's voltage regulator and transformer.

Benefits of Voltage Regulation

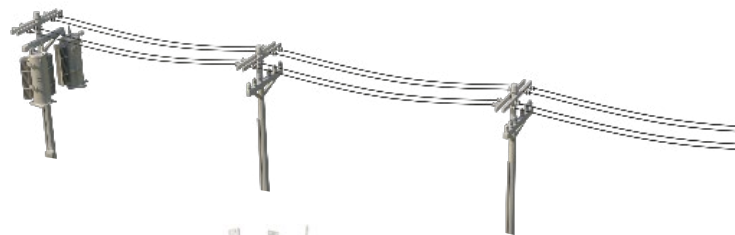
Managing voltage profiles with voltage regulator devices is a cost effective option for utilities, and provides precise control of the voltage profile at specific locations within the circuit where voltage regulation is needed most.

The addition of smart integrated controllers, as well as communications capability enhances the coordinated control of these devices minimizing system losses and enhancing profitability.



Prolec GE Substation Voltage Regulator (VR-SS)

- Increased reliability and performance over 3-phase units
- Lowest total cost of ownership (TCO)
- 20 years maintenance free operation



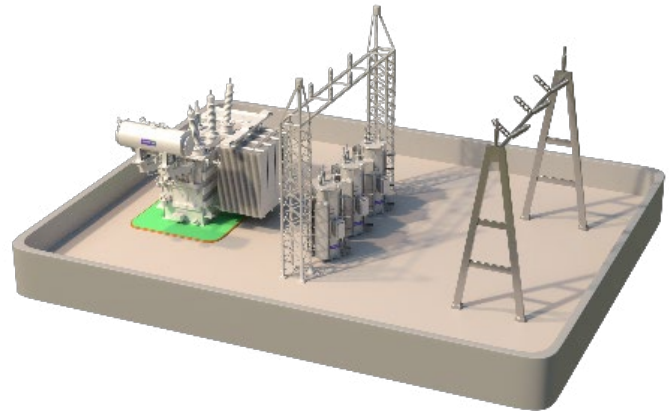
Prolec GE Pole-Mounted Voltage Regulator (VR-PM)

- 20 years maintenance free operation
- Robust design tested and certified to comply with latest IEEE C57.15 standards
- Switch verified to deliver 2 million mechanical operations

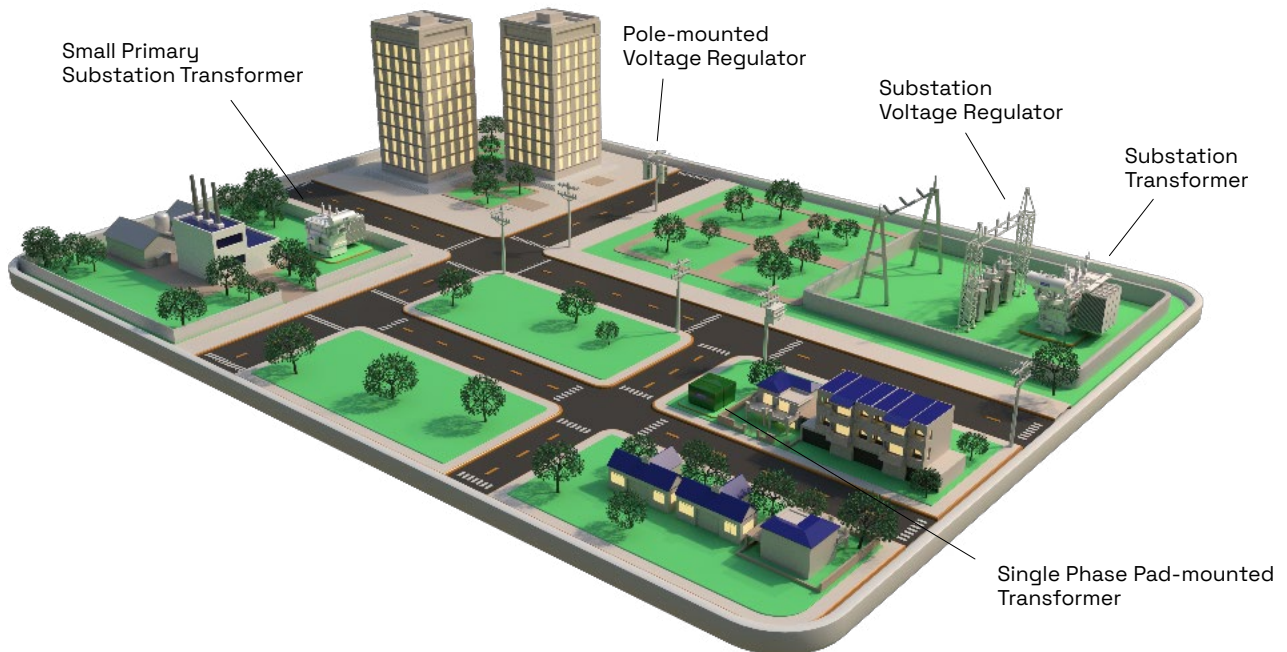
Prolec GE Voltage Regulation Solutions

Transforming the Americas with energy solutions for over 50 years, Prolec GE offers a full range of products to meet distribution transformer market demands for a variety of industries and applications.

With distributed generation, roof-top solar, and the proliferation of complex variable speed drives, the electrical network is experiencing new dynamics that present challenges for stabilizing the voltage on the network.



Prolec GE's portfolio of products are all uniquely designed for ultimate reliability to optimize voltage levels and stability, especially in areas with a high penetration of renewable generation where reverse power flows can occur.



The Benefits of Reverse Power Flow

The reverse power flow feature by Prolec GE provides precise synchronous operation of the tap changer and control during normal and reverse power flow, eliminating unnecessary equipment and control adjustments.

Reverse Power Flow Benefits

- Measured source side control & addition of source side PT
- Redesign of coil winding
- Tap switch tolerances and position tolerances reduced by 80%
- More ridged and accurate mechanical connection from switch to position indicator

Incorporating this feature into utility volt-var schemes can increase revenue, reduce operational costs and increase lineman safety.

Changing load types, along with the intermittency of distributed generation, drives an unprecedented number of operations for the voltage control equipment. In anticipation of this, and to provide a product that can withstand an increase number of operations, Prolec GE offers the VR-1 switch mechanism in our voltage regulators, one of the most robust in the industry.

VR-1 Switch Mechanism

Prolec GE's Voltage Regulator switch mechanism (VR-1) is the most robust load tap changer in the industry, with a mechanical stop for all the ratings per the latest C57.131 standard. It does not utilize electronic holding or limit switches that could potentially fail. The stationary and moving switch contacts are optimally designed in size and material properties to maximize the current density per cross sectional area.

Key Benefits

- Best in class Load Tap Changer (LTC) Switch
- Proven 2,000,000 mechanical operation life mechanism
- 20 years of maintenance free operation
- 3 Amperage ratings available:
300A, 668A, & 668A High Voltage
- Heavy duty stationary and moving switch contacts



Prolec GE Substation Voltage Regulator

In today's environment, average load profiles have radically increased and are more dynamic for unit transformers alone to efficiently support across the circuits.

The cost-effective Prolec GE Substation Voltage Regulator (VR-SS) is a single phase voltage regulator intended to support this type of application within a substation. Single phase units provide the ability to manage each phase independently in the event of unbalanced loads and redundancy when compared to an individual 3-phase unit.

Key Benefits of the VR-SS

- One of the lowest total costs of ownership when compared to other single phase or 3-phase voltage regulators.
- Best-in-class Load Tap Changer (LTC) switch life, with up to two million mechanical operations for up to 20 years of maintenance free usage.
- Forward and reverse power flow measurements for volt-var management on distributed generation feeders.
- Custom control cabinet configurable for most major control and communications options; meets NEMA 3R/4 and UL50 requirements and testing.



Lowest Total Cost of Ownership

20
YEARS

Maintenance Free Usage



Global Installations

*Special Offering



- Superior internal series arrester provides optimum surge protection against abnormal voltage surges by leveling the internal stresses in the winding during surge and fault events.
- Seismic certified and can be installed in most applications around the world.

Adjustable Height Sub base

The Prolec GE adjustable height sub base is constructed of galvanized steel and fits voltage regulators up to 6,000 lbs for a 40+ year life expectancy. It adjusts in 3" increments and meets the stringent requirements for seismic certification.

21 and 25 Inch Tanks

Sub Base Group Numbers	Adjustable Height Options (In)			
7025B108G01	24.5	27.5	30.5	33.5
7025B108G02	15.5	18.5	21.5	24.5
7025B108G03	33.5	36.5	39.5	42.5

28 Inch Tanks

Sub Base Group Numbers	Adjustable Height Options (In)			
7025B108G06	24.5	27.5	30.5	33.5
7025B108G07	15.5	18.5	21.5	24.5
7025B108G08	33.5	36.5	39.5	42.5




	Standard Offering	Optional Offering
Power Ratings	100 - 833 kVA (Single Phase Only)	Type A and B Designs
Voltage Ratings	Primary Voltages from 2.5 kV through 19.9 kV	22kV *50Hz only
BIL Ratings	Primary BIL ratings 60 kV to 150 kV BIL	110 kV BIL
Thermal Rating	Thermal rating of 55°C/65°C rise	
Frequency	60 Hz frequency	50 Hz frequency
Special Ratings		<ul style="list-style-type: none"> • Designs for elevations > 3300 feet • Low loss designs available in all ratings
Insulating Fluid	ANSI® Type 2 Mineral Oil	
Tank & Features	<ul style="list-style-type: none"> • Steel construction per C57.15-2017, C57.12 & C57.90 • Round, sealed carbon steel tank with durable weather-resistant powdercoat-finish (ANSI #70 Grey) • Three cover bushings (S, L, SL) with ANSI clamp-type terminals • Two heavy duty lifting lugs on tank and cover • Black diagrammatic anodized aluminum nameplate on tank and control cabinet • Standard, waterproof, 3/8 inch lockable pad lock, and heavy duty constructed NEMA® 3R carbon steel control cabinet with handle • Flex-Connect Control Cabinet equipped with standard connector integrates with most control modules • 18" to 36" procelain bushings • 15" radiator panels, 3 and 5 bank maximum (15" only) • Removable, sealed hand-hole cover • One cabinet available control modules by all suppliers • Square base - unit can be used in substation. Tank 	<ul style="list-style-type: none"> • Stainless steel • Zinc primer and epoxy topcoat finish for corrosive environments • NEMA 2 or 4 hole spade, SEFCOR 2 or 4 hole clamp type terminals, 1.00 threaded stud, H&J vertical or horizontal terminals. • Laser-etched stainless steel namplate • Adjustable control cabinet heater for condensation removal. Bottom entry control cable. • Bird guard for bushings and lightning arresters • Seismic certified galvanized adjustable sub-base; heights from 15.5" to 42.5" • Empty cabinet • Armored cable
Internal Features	<ul style="list-style-type: none"> • Load Tap Changer (LTC) Switch with expected life of 2,000,000 mechanical operations • 65°C rated oven-bonded, patterned, epoxy-coated insulation paper for core and coil assembly • Superior short circuit withstand ability (25x rated current) • Center-tapped, internally mounted, zinc-oxide series winding bypass arrester for superior distribution of voltage stresses across the series winding/protects arrester from physical damage during transport and service 	<ul style="list-style-type: none"> • 668 Amperage Max • Reverse power flow measurement • 40x rated current
Gauges & Valves	<ul style="list-style-type: none"> • Liquid level sight gauge • 15° and 45° Dial-type position indicator with drag hand and load bonus adjustment for additional current carrying ability • 1" brass oil drain valve, brass minimum oil sight gauge and upper fillter press connection for cycling oil • Pressure relief valve (10 psig vent pressure) 	<ul style="list-style-type: none"> • Stainless steel drain valves and oil sampling valves • Temperature gauge (0° to 160°C) • Pressure relief valve (5 psig vent pressure)

Prolec GE Pole-Mounted Voltage Regulator

The Prolec GE Pole-Mount/Platform-Mount Voltage Regulator (VR-PM) is the premium product for voltage control outside the substation with an established benchmark in the industry for robust design and operational reliability.

The economic benefits of voltage management have become better understood, especially given the adoption of technologies that can adjust the voltage profiles dynamically. Distributed generation, an increase of loads with variable speed and customer expectation of power quality all contribute to the need for voltage regulating devices to operate more often to keep the voltage in the targeted operational range.

Prolec GE's engineered design, material selection and strict manufacturing processes of the VR-PM Voltage Regulator operate in this manner to best serve the operational and economic interests for utilities.

-  **2 MILLION** Switch Operations
-  **40x** Rated Current
-  **20 YEARS** Maintenance Free Usage

*Special Offering



Key Benefits of the VR-PM:

- Seismic and Rural Utilities Service (RUS) certified.
- Superior internal series arrester for optimum surge protection against abnormal voltage surges and fault events for an extended service life.
- Forward and reverse power flow measurements for volt-var management on distributed generation feeders
- Custom control cabinet configurable for most control and communications options; meets NEMA 3R and UL50 requirements and testing.

	Standard Offering	Optional Offering
Power Ratings	38 - 333 kVA (Single Phase Only)	Type A and B Designs
Voltage Ratings	Primary Voltages from 2.5 kV through 19.9 kV	22kV for 50 Hz only
BIL Ratings	Primary BIL ratings 60 kV to 150 kV BIL	110 kV BIL
Thermal Rating	Thermal rating of 55°C/65°C rise	
Frequency	60 Hz frequency	50 Hz frequency
Special Ratings		<ul style="list-style-type: none"> • Designs for elevations > 3,300 ft • Low loss designs available in all ratings
Insulating Fluid	ANSI Type 2 Mineral Oil	
Tank & Features	<ul style="list-style-type: none"> • Steel construction per C57.15-2017, C57.12 & C57.90 • Round, sealed carbon steel tank with durable weather-resistant powdercoat-finish (ANSI #70 Grey) • Cover bushings (S, L, SL) with ANSI clamp-type terminals • Two heavy duty lifting lugs on tank and cover • Black diagrammatic anodized aluminum nameplate on tank and control cabinet • Waterproof NEMA 3R carbon steel control cabinet with padlock and handle • Flex-Connect Control Cabinet equipped with standard connector integrates with most control modules • Flex-Connect cabinet • 18" to 36" porcelain bushings • 15" radiator panels, 2 bank maximum • Removable, sealed hand-hole cover • One cabinet available control modules by all suppliers • Square base - unit can be used in substation or platform mounting. Hanger Brackets included for pole mounting. Tank grounding (Qty 2 - diagonal opposite on all bases) 	<ul style="list-style-type: none"> • Stainless steel (304L) • Zinc primer and epoxy topcoat finish for corrosive environments. • NEMA 2 or 4 hole spade, SEFCOR 2 or 4 hole clamp type terminals, 1.00 threaded stud, H&J vertical or horizontal terminals. • Laser-etched stainless steel nameplate • Adjustable control cabinet heater for condensation removal. • Bottom entry control cable. • Bird guard for bushings and lightning arresters • 9" radiator panels • Seismic certified galvanized adjustable sub-base; heights available from 15.5" to 42.5" • Empty cabinet • Armored cable
Internal Features	<ul style="list-style-type: none"> • Load Tap Changer (LTC) Switch with expected life of 2,000,000 mechanical operations • 65°C rated oven-bonded, patterned, epoxy-coated insulation paper for core and coil assembly • Superior short circuit withstand ability (25x rated current) • Center-tapped, internally mounted, zinc-oxide series winding bypass arrester with very low failure rate for superior distribution of voltage stresses across the series winding/protects arrester from physical damage during transport and service 	<ul style="list-style-type: none"> • 668 Amperage Max • Reverse power flow measurement • 40x rated current
Gauges & Valves	<ul style="list-style-type: none"> • Liquid level sight gauge • 15° to 45° Dial-type position indicator with drag hand and load bonus adjustment for additional current carrying ability • 1" brass oil drain valve, brass minimum oil sight gauge and upper filter press connection for cycling oil • Pressure relief valve (10 psig vent pressure) 	<ul style="list-style-type: none"> • Stainless steel drain valves and oil sampling valves • Temperature gauge (0° to 160°C) • Pressure relief valve (5 psig vent pressure)

Flex-Connect Seamless Controller Integration

The Flex-Connect control cabinet design allow utilities to utilize existing assets and seamlessly integrate with major controller brands without the risk of programming concerns.

All functions and voltage settings are done within the control assembly to provide safer operation and maintenance of the unit without the risk of water entering the tank interior or the control cabinet.

The standard controls and voltage source requires no correction factor as the Prolec GE units provide a true 120 Vac signal to the NN terminal block and controller. *Optional voltage taps can be provided with a ratio correction transformer located in the cabinet.

Key Benefits of Flex-Connect

- Fits most industry standard control modules:
 - GE 2011C & E
 - SEL 2431
 - Beckwith M6200A
 - Cooper CL-7
- NEMA 3R certified, meets all UL50 requirements
- No voltage adjustment required in control software



- Control Options
 - Multiple communication ports as specified
 - 3'-120' cable lengths for remote mounting
 - Sloped carbon steel, stainless steel or polycarbonal control cabinet
 - Bottom or top cable entry
 - Thermostatically controlled cabinet heater
 - Ratio correction transformer
 - Control relays
- Design Features
 - Large knockouts standard on bottom and side of cabinet
 - Rain shield protects top gasket seal
 - Increased door depth for storage
 - Adjustable latch design

Prolec GE Manufacturing Facility

Prolec GE designs, manufactures and tests to the highest standards in the industry at its state-of-the-art facility in Shreveport, Louisiana. With an excellent track record in safety and dedication to the research, application and development of an extensive range of technology solutions, they serve customers in the utility and energy industries around the world.

Exceptional Quality and Reliability

- Third-party product certifications, including KEMA Labs certification for 40x rated current for exceptional short-circuit strength
- Multiple checkpoints in the production, assembly and inspection process yield high quality products
- Rigorous electrical, oil quality, and leak testing

Advanced Technology and Manufacturing

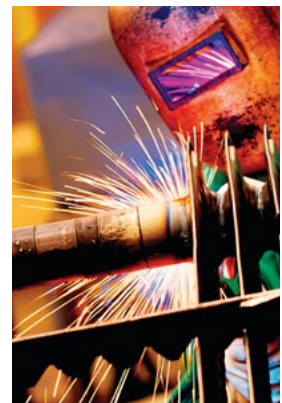
- 600,000 ft² manufacturing facility comprised of operations such as metal fabrication, welding, cold welding, core assembly and coating.
- The manufacturing site is ISO 9001 certified
- Robust product technology
- Quality inspections for purchased and outsourced materials
- 3D dimensional modeling



Coil winding



Interior assembly



Cooling panel welding



External fabrication

Voltage Regulator Testing

All Prolec GE Voltage regulators adhere to rigorous testing and certification to meet industry standards and provide robust, maintenance free, long life cycle products.

All Prolec GE Voltage Regulators are tested in accordance with the latest IEEE/ANSI C57.15-2017 standards including:

- Resistance measurements of all windings
- Ratio tests on full windings
- Polarity test
- No load loss at rated voltage and rated frequency
- Excitation current at rated voltage and rated frequency
- Impedance and load loss at rated current and rated frequency
- Applied potential
- Induced potential
- Insulation power factor test
- Standard voltage impulse testing (BIL)
- Paint testing
- Oil power factor testing
- LTC life cycle test
- Polychlorinated Biphenyl testing

Notes:

1. All regulators are shipped oil-filled.
2. These regulators have provisions for direct-to-pole (Type B and Type C hanger brackets), platform, or crossarm mounting. For crossarm mounting, suspension hooks will be required and may be obtained from hardware manufacturer.
3. These regulators are furnished with taps in the control circuit to operate at 2,500 V and 2,400 V.
4. These regulators are furnished with taps in the control circuit to operate at 5,000 V, 4,800 V and 2,500 V.
5. 150 KV BIL on S, L and SL are available for 14,000 V and 19,920 V.
6. These 7,620 V regulators can be operated at 7,970 V, 7,620 V, 7,200 V.
*Units can be shipped connected for 7,200 V operation or per customer specifications.
7. Can apply currents up to the current determined by the rated kVA and the voltage level for voltage levels below 7,200 V.
8. These regulators are furnished with taps in the control circuit to operate at 14,400 V and 7,200 V.
9. 150 kV BIL on S and L, 95 kV BIL on SL.
10. Lowest Live Part.

IEEE is a registered trademark of the Institute of Electrical and Electronics Engineers.

ANSI is a registered trademark of American National Standards Institute, Incorporated.

KEMA is a registered trademark of DNV.

ISO is a registered trademark of the International Organization for Standardization.

NEMA is the registered trademark and service mark of the National Electrical Manufacturers Association.

Prolec GE reserves the right to make changes to specifications of products described at any time without notice and without obligation to notify any person of such changes.

Technical Specifications

kVA	Catalog No.	Load Amps at Raise & Lower 10% Regulation	Approx. Wt. (lbs.) Including Oil		Approx. Gallons Oil (1) Net @ 7.45 lbs per Gal.	Approximate Standard Dimensions Over-all Inches		Type
			Ship	Net		Proj. Floor Space	LLP (10)	
2,500 VOLTS - 60 kV BIL (for 2,500/4,330 Y, 2,400/4,160 Y volt circuits)								
50	33D3050 (2)(3)	200	1,300	1,200	66	29 X 36	67.2	Pole/Platform/Sub-Station
75	33D3075 (2)(3)	300	1,480	1,380	74	29 X 42	69.1	Pole/Platform/Sub-Station
100	33D3100 (2)(3)	400	2,100	2,000	111	30 X 46	74.2	Pole/Platform/Sub-Station
167	33D3167 (2)(3)	668	2,390	2,290	120	43 X 49	74.7	Platform/Sub-Station
5,000 VOLTS - 75 kV BIL (for 5,000/8,660 Y, 4,800/8,310 Y, 2,500/4,330 Y volt circuits)								
50	33D4050 (2)(4)	100	1,630	1,530	75	29 X 41	74.2	Pole/Platform/Sub-Station
100	33D4100 (2)(4)	200	1,680	1,580	75	29 X 41	74.2	Pole/Platform/Sub-Station
167	33D4167 (2)(4)	334	2,080	1,980	78	39 X 44	74.7	Pole/Platform/Sub-Station
250	33D4250 (4)	500	2,910	2,810	126	48 X 47	83.8	Platform/Sub-Station
333	33D4333 (4)	666	3,110	3,010	136	48 X 47	83.8	Platform/Sub-Station
7,620 VOLTS - 95 kV BIL (for 7,960/13,800 Y, 7,620/13,200 Y, 7,200/12,470 Y volt circuits)								
38.1	33D5038 (2)	50	1,700	1,600	69	29 X 35	74.1	Pole/Platform/Sub-Station
57.2	33D5057 (2)	75	1,750	1,650	69	29 x 36	74.1	Pole/Platform/Sub-Station
76.2	33D5076 (2)(6)	100	1,750	1,650	69	29 X 35	74.1	Pole/Platform/Sub-Station
114.3	33D5114 (2)(6)	150	1,720	1,620	74	29 X 41	74.1	Pole/Platform/Sub-Station
167	33D5167 (2,6,7)	219	2,070	1,970	80	39 X 44	74.6	Pole/Platform/Sub-Station
250	33D5250 (2,6,7)	328	3,060	2,960	134	43 X 48	83.8	Pole/Platform/Sub-Station
333	33D5333 (6)(7)	438	3,300	3,200	131	46 X 50	83.8	Platform/Sub-Station
416	33D5416 (6)(7)	546	3,750	3,650	148	51 X 48	89	Platform/Sub-Station
509	33D5509 (6)	668	4,040	3,940	147	55 X 50	89	Platform/Sub-Station
13,800 VOLTS - 95 kV BIL (suitable for 13,800, 13,200 or 12,000 volt circuits at rated amperes)								
69	33D6069 (2)	50	1,630	1,530	79	29 X 39	74	Pole/Platform/Sub-Station
138	33D6138 (2)	100	2,660	2,560	126	29 X 39	83.6	Pole/Platform/Sub-Station
207	33D6207 (2)	150	2,750	2,650	131	32 X 45	83.6	Pole/Platform/Sub-Station
276	33D6276	200	3,300	3,200	136	46 X 50	83.8	Platform/Sub-Station
414	33D6414	200	3,788	3,688	149	51 x 49	89	Platform/Sub-Station
552	33D6552	400	5,133	5,033	189	49 x 46	104	Platform/Sub-Station
14,400 VOLTS - 150 kV BIL(9) (for 14,400/24,940 Y volt circuits, also 7,200/12,470 circuits at rated amperes)								
72	33D7072 (2)(8)	50	2,680	2,580	110	29 X 39	83.9	Pole/Platform/Sub-Station
144	33D7144 (8)	100	2,880	2,780	118	29 X 39	83.9	Pole/Platform/Sub-Station
288	33D7288 (8)	200	3,440	3,340	141	44 X 50	88.9	Platform/Sub-Station
333	33D7333 (8)	231	3,940	3,840	172	43 X 46	92.8	Platform/Sub-Station
432	33D7432 (8)	300	4,320	4,220	184	54 X 52	92.9	Platform/Sub-Station
576	33D7576 (8)	400	5,250	5,150	190	58 X 54	99.2	Platform/Sub-Station
667	33D7667 (8)	463	5,500	5,400	199	56 X 48	99.2	Platform/Sub-Station
833	33D7833 (8)	578	6,240	6,140	216	54 X 49	104.4	Platform/Sub-Station
19,920 VOLTS - 150 kV BIL(9) (for 34,500/19,920 volt circuits)								
100	33D8100 (2)	50.2	3,200	3,100	140	38 X 45	92.9	Pole/Platform/Sub-Station
200	33D8200 (2)	100.4	3,250	3,150	146	38 X 45	92.9	Pole/Platform/Sub-Station
333	33D8333	167	4,130	4,030	171	47 X 48	92.9	Platform/Sub-Station
400	33D8400	201	4,370	4,270	175	50 X 49	99.2	Platform/Sub-Station
667	33D8667	334	5,630	5,530	203	59 X 48	99.2	Platform/Sub-Station
833	33D8833	418 (65C)	6,030	5,930	216	66 X 54	99.2	Platform/Sub-Station



LOCATIONS

USA

SHREVEPORT

7000 W Bert Kouns Industrial Loop
Shreveport, LA 71129
+1 (318) 687-6600

MEXICO

APODACA

Blvd. Carlos Salinas de Gortari
Km. 9.25 Apodaca, NL 66600
+52 (81) 8030 2000

WAUKESHA

400 S Prairie Ave.
Waukesha, WI 53186
+1 (262) 547-0121

GOLDSBORO

2701 US Highway 117 South
Goldsboro, NC 27530
+1 (919) 734-8900

DALLAS

9011 Governors Row
Dallas, TX 75247
+1 (214) 637-4434

BRAZIL

CANOAS

Avenida Guilherme Schell, 11500
Bairro Industrial - Canoas
RS 92.420-820
+55 (51) 3477-8700

For more information:
info@prolec.energy

prolec.energy/prolecge

