



# Guideform Specifications

Single phase, oil-immersed, self-cooled, outdoor-type, automatic step-voltage regulator.

GE Type VR-1, \_\_\_\_\_ hertz, \_\_\_\_\_ kVA (55°C rise), \_\_\_\_\_ volts, \_\_\_\_\_ amps, to provide voltage regulation of 10% raise and 10% lower in (32) 5/8% steps.

Catalog number: \_\_\_\_\_

The step voltage regulator shall be designed and manufactured in accordance with the latest applicable ANSI, ASTM and NEMA standards.

### External Construction (Standard Features)

- Round, sealed tank with durable weather-resistant finish (ANSI No. 70 gray)
- Three cover bushings (S, L, SL) with clamp-type terminal for No. 6 to 4/0 AWG (150 amperes and below) or No. 2 AWG to 800 MCM (above 150 amperes)
- Hand-hole cover
- Lifting lugs on tank
- Oil drain and sampling device
- Minimum oil sight gauge
- Provisions for mounting line-to-ground surge arresters
- Provisions for grounding tank with clamp-type terminals for cable sizes No. 2 AWG to 250 MCM on pole-type and No. 2 AWG to 500 MCM on station-type regulators
- Dial-type position indicator with drag hand and load bonus adjustment
- Provisions for direct-to-pole mounting for ratings 138 kVA and below up to 13,800 volts. For 7620 volt ratings, pole-mounting available up through 250 kVA. Use of adapter plates is required for some ratings.
- Diagrammatic anodized aluminum nameplate on tank and control cabinet

### Internal Construction (Standard Features)

- Switching mechanism to have a quick-break, slow-make operation, and be provided with electrostatic shielding. Vendor to furnish published expected minimum number of operations.
- Core and coil assembly to be provided with patterned, epoxy-coated insulation paper and oven-bonded to provide short-circuit withstand as specified by ANSI C57.15.
- Switching reactor
- Equalizer windings to balance reactor voltage where necessary
- Oil level line inside tank to indicate 25° C oil level
- By-pass protection for series winding mounted internally using zinc-oxide disks.
- Self-contained voltage supply for motor and control devices

- Current transformer

*The following regulator optional features shall be provided when selected:*

**Remote Cable Kit.** Extra-length control cable shall be provided for remote mounting of the control cabinet at the base of the pole. Circle length required: 12, 18, 24, 30, 35 ft..

**Sub-base.** Height to lowest live part shall be \_\_\_\_\_ inches.

**Surge Arresters.** Qty \_\_\_\_\_ surge arresters of \_\_\_\_\_ kV shall be provided and mounted on the tank wall adjacent to Source, Load, and/or Source-Load bushings as required.

### GE VR-1 Static Control (Standard)

The control shall provide Class 1 accuracy with modular, pre-calibrated solid-state components and circuitry. The control shall be designed to operate in typical environmental conditions such as temperature extremes, humidity cycling, and corrosive areas.

The following control elements shall be provided as standard features, mounted on the front of the control panel located in a removable cabinet mounted on the regulator.

- VOLTAGE-LEVEL DIAL continuously adjustable from 105 to 135 volts
- BANDWIDTH LEVEL DIAL continuously adjustable from 1.5 to 3.0 volts
- TIME-DELAY DIAL continuously adjustable from 10 to 90 seconds
- LINE-DROP COMPENSATOR with separately adjustable resistance and reactance dials
- TEST RHEOSTAT to eliminate the need for an external varying voltage to check controls
- POLARITY SWITCH for reversed reactance and resistance
- CONTROL SWITCH, five position; 'Auto' for automatic operation, 'Test' for quick-check procedure, 'Lower/Raise' for manual operation of motor, and 'Off' for preventing control operation.
- INDICATING LIGHT for 'High' and 'Low' band-edge indication
- NEUTRAL INDICATING LIGHT
- DRAG HAND RESET
- TEST TERMINALS for measuring output voltage
- CONTROL POWER CIRCUIT BREAKER to double as over-current protection and on/off switch
- OPERATION COUNTER
- INTERNAL/EXTERNAL SWITCH for power supply
- LOCKING FEATURE on all control dials

**The following VR-1 control optional features shall be provided when selected:**

**First House Voltage Protection** with upper and lower limits. Upper limit level shall be determined by setting control dial calibrated in one volt increments from 120 to 135 volts. The lower limit shall be determined by setting control dial calibrated in one-volt increments from 105 to 118 volts. In addition, unit shall have automatic run-back feature so that output voltage cannot exceed the blocking-voltage level.

**Remote Operation** allowing auxiliary contacts to interrupt automatic operation of the regulator and control tap-changer motor from a remote location.

### **GE SM3 Micro-Processor Control** (Alternate)

The control shall utilize micro-processor circuitry to allow user-friendly programming through the panel or via an RS-232 nine-pin serial port with a laptop PC using manufacturer's software. System data is to be displayed on a two-line vacuum fluorescent display, easily readable in ambient light. System data from the control shall be able to be accessed remotely through an optional fiber-optic digital communication link. The following system data shall be available, including Min/Max where appropriate:

- LOAD VOLTS
- LOAD AMPS
- POWER FACTOR
- KW
- KVA
- KVARs
- LDC VOLTS
- SOURCE VOLTS
- LOAD CENTER VOLTS
- TIME DELAY
- HARMONICS (1st-31st)

The following set points shall also be programmable either from the panel or using a laptop PC:

- VOLTAGE LEVEL 105 to 135 volts
- BANDWIDTH 1.0 to 6.0 volts
- TIME DELAY 10 to 180 seconds
- LDC RESISTIVE -24 to +24 volts
- LDC REACTIVE -24 to +24 volts
- FIRST HOUSE PROTECTION (programmable with automatic run-back/run-up)
- VOLTAGE REDUCTION (three stage, fully programmable)
- REVERSE POWER FLOW (operation with or without source-side sensing PT)
- AUTOMATIC LOAD BONUS (programmable to automatically activate)

The following regulator data shall be accessible from the control display or using a laptop PC:

- ELECTRONIC OPERATION COUNTER
- POSITION
- CONTROL CONFIGURATION

In addition, several Auxiliary Functions will be made available:

- ERROR STATUS
- TEST FUNCTION
- DATA-LOGGER (date/time)
- DIGITAL COMMUNICATIONS
- CALIBRATE CONTROL

All settings and calibrations shall be saved in a Non-Volatile Random Access Memory (NOVRAM). The control shall have power disconnect capability allowing the removal of electronics without having to disconnect from the position indicator.

**The following SM3 Control optional features shall be provided when selected:**

**Fiber-Optic Digital Link** for communication with a customer-supplied RTU. This link provide transient-proof communication at multiple baud rates utilizing Modbus® or 2179 protocol.

**Source Voltage Measurement.** For reverse power flow conditions, a source-side transformer can be utilized for measured sensing.

**Parallel Operation.** The SM3 can be configured to operate in a parallel application.

**Programming and data retrieval with a computer:**

The control shall have available a user-friendly PC-based programming and data retrieval software compatible with the SM3. At a minimum, the software shall perform the following:

- DOWNLOAD SETPOINTS AND DATA FROM CONTROL PANEL
- UPLOAD SETPOINTS AND DATA TO CONTROL PANEL
- READ SETPOINTS FROM A FILE
- SAVE SETPOINTS AND DATA TO A FILE

In addition, the software shall provide the ability to display retrieved data with minimum and maximum parameters (time and date stamped), along with the regulator position and operation count. The software shall provide data on load current and voltage harmonic data including Total Harmonic Distortion (THD) and the percent of THD, percent of fundamental, and RMS values of individual harmonics.



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