

## VOLTAGE REGULATORS

### AC-DC AUTOMATIC ROTATING CAM TYPES

### OPERATING METHODS

#### 1. GENERAL

1.01 This section describes the method of operating the a-c. and d-c. automatic rotating cam type voltage regulators per KS-5016 and KS-5117 and outlines the general troubles which may be encountered in the operation of these regulators.

1.02 Reference shall be made to the section covering the Apparatus Requirements and Adjusting Procedures for information necessary for the proper maintenance of apparatus referred to herein.

#### 2. OPERATION

2.01 The operation of the a-c. and d-c. automatic rotating cam type voltage regulators is entirely automatic with the exception of operation by the manual momentary contact push-button switch. For a detailed description of the sequence of automatic operation of this equipment, refer to the section covering the Descriptive Information for this equipment.

##### Operation from the Manual Momentary Contact Push-Button Switch

2.02 When the momentary contact push-button switch is operated by pushing the Raise or Lower button as desired, it operates the voltage regulator as in automatic regulation.

##### Operation from the Handwheel of the Generator Field Rheostat

(a) Regulator arranged for operation with only one generator.

2.03 When the D.P.D.T. Reg. Rheo. switch is thrown to the "Hand Reg." position, the generator voltage is under the control of the handwheel of the generator field rheostat and the automatic voltage regulator is entirely cut out of the generator field circuit.

(b) Regulator arranged for operation with either of two generators.

2.04 When the S.P.D.T. Chg. G. — switch, corresponding to one of the generators, is closed to the "Hand Reg." position, the voltage of that generator is under the control of the handwheel of the generator field rheostat and the automatic voltage regulator rheostat is cut out of the generator field circuit.

##### To Put a Voltage Regulator Into Service

2.05 Close the control coil switch to the "On" position at least 20 minutes before placing the regulator in operation.

2.06 Close the motor switch to the "On" position.

2.07 See that the regulator rheostat has sufficient resistance cut in to limit the no-load voltage of the generator to its nameplate rating. The proper setting of the rheostat may be obtained by operating the Raise-Lower push-button switch.

2.08 See that the handwheel of the field rheostat of the generator to be used is set at the "Auto. Reg." position.

(a) Regulator arranged for operation with only one generator.

2.09 Close the Chg. G-Reg. Rheo. switch to the "Auto. Reg." position.

(b) Regulator arranged for operation with either of two generators.

2.10 Close the D.P.D.T. Reg. Rheo. switch to the "Chg. G" — position, corresponding to the generator to be used, and close the associated Chg. G. — switch to the "Auto. Reg." position.

2.11 Start the motor-generator set in the usual manner.

2.12 Adjust the voltage of the generator by means of the manual Raise-Lower push-buttons until the voltage is approximately 1 volt above the voltage of the battery to which it is to be connected and connect the generator to the battery in the usual manner.

2.13 Throw the Auto. switch to the "On" position. The regulator will now control the voltage at the points of connection as long as the load on its generator is within the capacity of the generator.

##### To Take a Voltage Regulator Out of Service

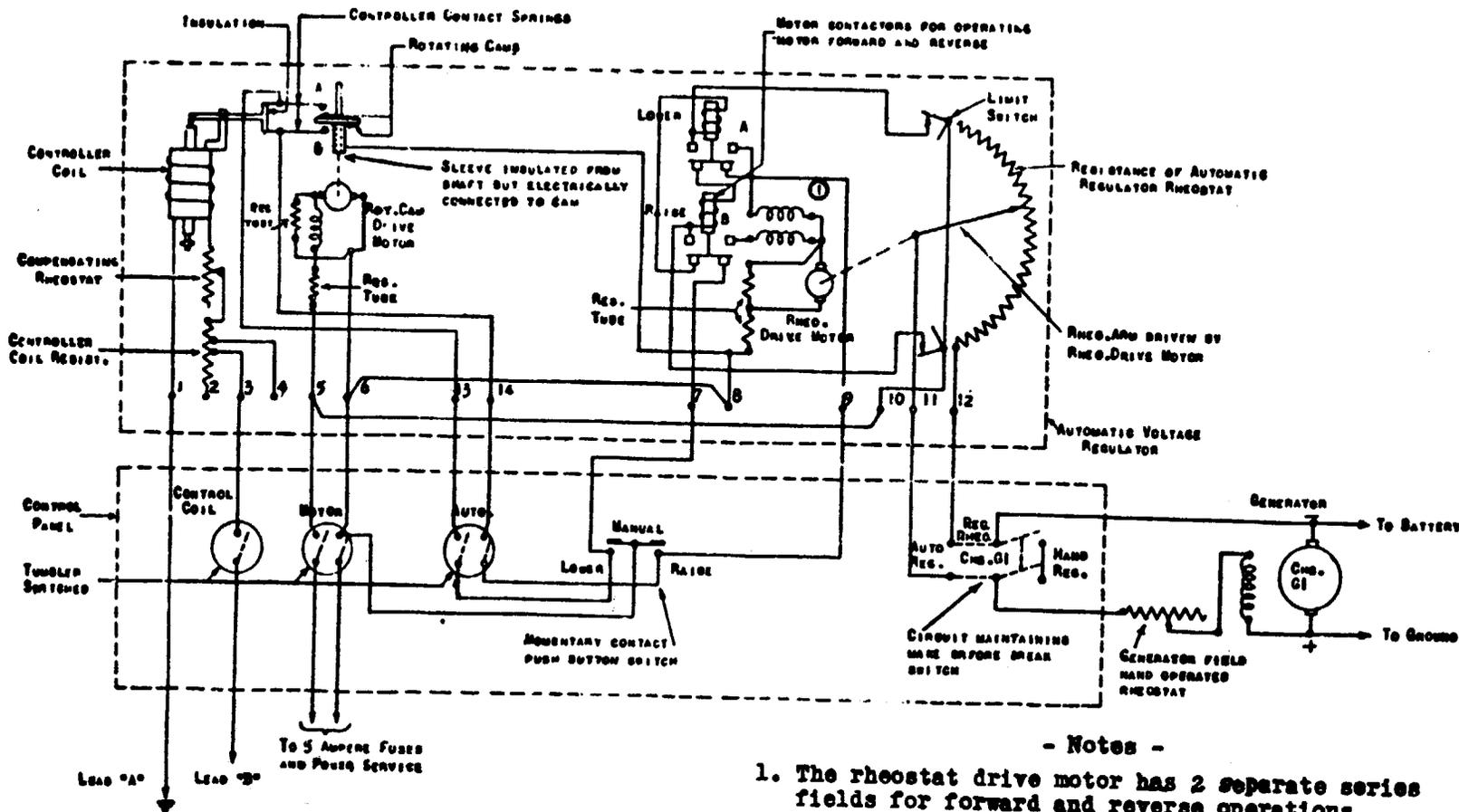
2.14 Throw the Auto. switch to the "Off" position.

2.15 Reduce the load on the generator to practically zero by operating the manual Lower push-button and disconnect the generator from the battery.

2.16 Open the motor and control coil switches.

##### Parallel Operation of Charging Generators

2.17 When the load increases and approaches the capacity of the regulated generator, a second generator should be connected to the battery and its field rheostat adjusted so that nearly all the load is carried by this generator, leaving the



OFFICE	CONTROL BY	LEAD "A" CONNECTED TO GROUND BUZZER AT	LEAD "B" CONNECTED TO 1-1/3 OR 2 AMP. FUSE AND
PANEL, S x S <sub>1</sub> , OR PANEL OR S x S COMBINED WITH TOLL	24 VOLT BAY.	48 VOLT B.D.F. PANEL	24 VOLT BAY. NEG. BUS BAR AT BAY. PANEL
TOLL OR TOLL COMBINED WITH MANUAL	24 VOLT BAY.	FILAMENT FUSE PANEL	24 VOLT BAY. NEG. BUS BAR AT FILAMENT FUSE PANEL

Fig. 1—Schematic Diagram of Connections  
Automatic Voltage Regulator with Control Panel for One 33 Volt Generator  
Continuous Floating Routine

regulated generator to take further increments of load. To allow the regulator to function during the transfer of load to the second generator, decrease the load on the regulated generator by means of the manual Lower push-button at the same time the load on the second-generator is being built up by operating its field rheostat.

2.18 When the load decreases so that the regulated generator is of sufficient capacity to carry it, transfer the load to the regulated generator by properly operating the manual Raise-Lower push-buttons together with the field rheostat of the second generator. Shut down the second generator.

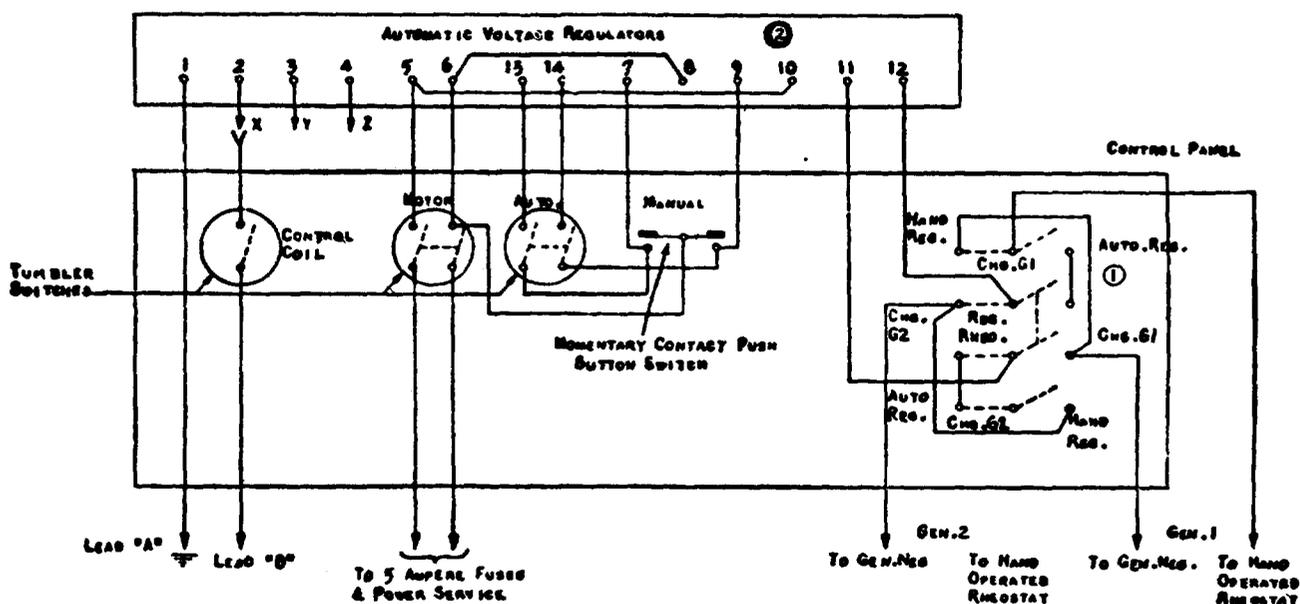
**Charging Emergency Cells in Series with the Load**

2.19 When charging emergency cells in series with the load with the regulator operating,

disregard the "Auto. Reg." position of the generator field rheostat and readjust in order to raise the voltage of the generator by an amount equal to the voltage of the emergency cells.

**Adjustment of Generator Field Rheostat**

2.20 The proper setting of the generator hand rheostat for operation with a voltage regulator should be marked when the regulator is installed and the rheostat usually will not have to be shifted except when changing from one voltage range to another, or when it is desired to charge emergency cells in series with a battery being regulated. If it should become necessary to check the marking of this rheostat, the method outlined under Replacement Parts and Procedures for this equipment should be followed.



OFFICE	CONTROL OF	LEAD A CONNECTED TO GROUND BUS BAR AT	LEAD B CONNECTED TO 1-1/3 OR 2 AMP. FUSE AND
PANEL, 3 x 3 <sub>1</sub> , OR PANEL OR 3 x 3 COMBINED WITH REPEATERS	24 VOLT BAT.	48" B.D.F. PANEL	24V BAT.NEG.BUSBAR AT BAT.PANEL (Y WIRING)
	48 VOLT BAT.	48" B.D.F. PANEL	48V BAT.NEG.BUSBAR AT D.F.PANEL (X WIRING)
TOLL OR TOLL COMBINED WITH MANUAL	24 VOLT BAT.	FILAMENT FUSE PANEL	24V BAT.NEG.BUSBAR AT FILAMENT FUSE PANEL (Y OR Z WIRING)

- Notes: 1. Double pole "Reg. Rheo." switch mechanically interlocked with 2 single pole circuit maintaining switches.  
 2. For regulator connections see Fig. 1.

**Fig. 2—Schematic Diagram of Connections**  
**Automatic Voltage Regulator with Control Panel for Two 33 or Two 65 Volt Generators**  
**Continuous Floating Routine**

3. GENERAL TROUBLES

3.01 Failure in Regulation

<u>Cause</u>	<u>Action</u>
Limits too wide or too narrow.	Adjust spring contacts.
Regulated voltage too high or too low.	Adjust compensating rheostat.
Defective voltage relay assembly.	Check and repair or replace any defective parts of voltage relay assembly.

3.02 Failure to Operate

<u>Cause</u>	<u>Action</u>
Open circuits.	Check and repair all circuits.
Incorrect service voltage.	Check service voltage and report to supervisor.
Defective motors.	Check and repair or replace motors if necessary.
Defective motor contactors.	Check and repair or replace contactors if necessary.
Defective voltage relay assembly.	Check and repair or replace any defective parts of voltage relay assembly.

3.03 Overheating of Bearings

<u>Cause</u>	<u>Action</u>
Improper lubrication.	Clean out bearings and repack with vaseline or Superla 4X as required.
Bent shaft.	Replace armature and shaft.
Rough bearing surface.	Replace bearing.

3.04 Overheating of Commutator

<u>Cause</u>	<u>Action</u>
Excessive sparking.	See 3.06.
Defective commutator or winding trouble.	Repair or replace armature.

3.05 Overheating of Motor Windings

<u>Cause</u>	<u>Action</u>
Short-circuited or grounded windings.	Repair or replace.

3.06 Excessive Sparking

<u>Cause</u>	<u>Action</u>
Brushes too short.	Replace brushes.
Incorrect brush pressure.	Replace brush and spring as required.
Oily or dirty commutator.	Clean commutator.
Rough or pitted commutator.	Smooth commutator.
Defective armature winding such as an open or short-circuit.	Repair or replace armature.
Defective condenser.	Replace condenser.

3.07 Excessive Noise and Vibration

<u>Cause</u>	<u>Action</u>
Loose bolts and nuts.	Tighten.
Rough commutator.	Smooth commutator.
Chattering brushes.	Replace brushes.
Bent shaft.	Replace armature and shaft.
Worn bearings.	Replace bearings.
Armature striking pole-piece.	Replace bearings.