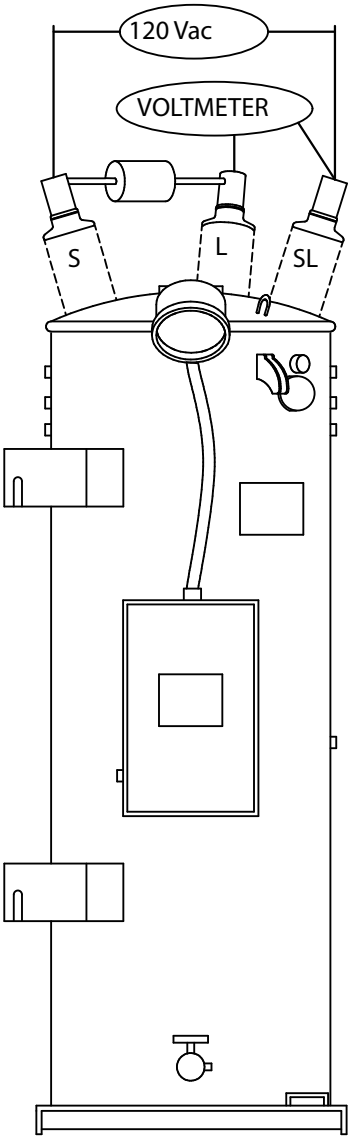
Series winding ratio test procedure instructions



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Contents

Safety for life

Eaton's Cooper Power series products meet or exceed all applicable industry standards relating to product safety. We actively promote safe practices in the use and maintenance of our products through our service literature, instructional training programs, and the continuous efforts of all Eaton employees involved in product design, manufacture, marketing and service.

We strongly urge that you always follow all locally approved safety procedures and safety instructions when working around high-voltage lines and equipment and support our "Safety For Life" mission.

Safety information

The instructions in this manual are not intended as a substitute for proper training or adequate experience in the safe operation of the equipment described. Only competent technicians, who are familiar with this equipment should install, operate and service it.

A competent technician has these qualifications:

- Is thoroughly familiar with these instructions.
- Is trained in industry-accepted high- and low-voltage safe operating practices and procedures.
- Is trained and authorized to energize, de-energize, clear, and ground power distribution equipment.
- Is trained in the care and use of protective equipment such as flash clothing, safety glasses, face shield, hard hat, rubber gloves, clampstick, hotstick, etc.

Following is important safety information. For safe installation and operation of this equipment, be sure to read and understand all cautions and warnings.

Hazard Statement Definitions

This manual may contain four types of hazard statements:

DANGER

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

CAUTION

Indicates a hazardous situation which, if not avoided, could result in equipment damage only.

Safety instructions

Following are general caution and warning statements that apply to this equipment. Additional statements, related to specific tasks and procedures, are located throughout the manual.

DANGER

Hazardous voltage. Contact with high voltage will cause death or severe personal injury. Follow all locally approved safety procedures when working around high- and low-voltage lines and equipment.

WARNING

Before installing, operating, maintaining, or testing this equipment, carefully read and understand the contents of this manual. Improper operation, handling or maintenance can result in death, severe personal injury, and equipment damage.

WARNING

This equipment is not intended to protect human life. Follow all locally approved procedures and safety practices when installing or operating this equipment. Failure to comply may result in death, severe personal injury and equipment damage.

WARNING

Power distribution and transmission equipment must be properly selected for the intended application. It must be installed and serviced by competent personnel who have been trained and understand proper safety procedures. These instructions are written for such personnel and are not a substitute for adequate training and experience in safety procedures. Failure to properly select, install or maintain power distribution and transmission equipment can result in death, severe personal injury, and equipment damage.

Product information

Introduction

Service Information *MN225060EN* provides procedures for performing a ratio test on the series winding of a voltage regulator. The ratio test determines:

- If incorrect series winding tap changer connections have been made.
- If an open or short-circuit exists in the series or shunt winding.

Refer to *MN225003EN*, CL-7 voltage regulator control installation, operation, and maintenance instructions and *MN225008EN* VR-32 voltage regulator with Quik-Drive™ tap changer installation, operation, and maintenance instructions or the literature applicable to your equipment for detailed service information on Eaton's Cooper Power series voltage regulators and controls.

⚠ Read this manual first

Read and understand the contents of this manual and follow all locally approved procedures and safety practices before installing or operating this equipment.

Additional information

These instructions cannot cover all details or variations in the equipment, procedures, or processes described nor provide directions for meeting every possible contingency during installation, operation, or maintenance. For additional information, contact your Eaton representative.

Standards

ISO 9001 Certified Quality Management System

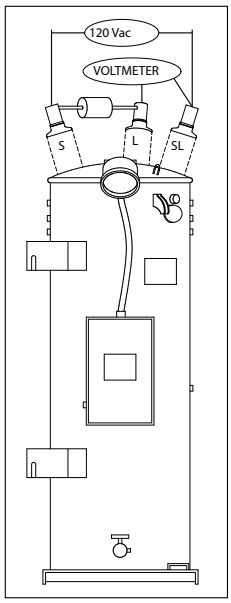

Figure 1. Ratio test connections.

Procedure instructions

1. Ensure that the regulator operates correctly. Perform the steps in the **Operational check** section of the document MN225008EN.
2. Connect a voltmeter between the Load (L) and Source Load (SL) bushing terminals.
3. Use a variac to apply 120 Vac between the source (S) and SL bushing terminals, as shown in Figure 1.

⚠ CAUTION

Electrical Shock Hazard. Connecting an energized variac to the bushings will expose the tester to 120 Vac. Contact with the bushings will result in an electrical shock.

4. Connect a separate 120 Vac supply to the external source terminals on the control front panel. Consult the document *MN225003EN* and the section **Connecting Power to External Source Terminals** for instructions.
5. Move the control power switch to the external position to power up the control.

⚠ WARNING

Electrical Shock Hazard. The V1 and V6 (if present) knife-blade switches must be open when connecting external power to the control. If 120 Vac is incorrectly applied to the voltmeter terminals and the V1 and V6 switches remain closed, rated voltage may be created on the bushings. Contact with the bushings in such a case could result in death or serious injury.

CAUTION

Incorrect connection of an external power source to the control or supply of an over-voltage will result in damage to the control panel.

6. Increase the voltage on the variac connected between the S and SL bushings to 120 Vac. This will provide 12 volts on the series winding.

   120 Vac x 10% regulation = 12 volts

7. Calculate the change in volts per tap change as follows:

$$\frac{\text{series winding volts}}{\text{16 steps}} = \frac{12}{16} = 0.75 \text{ volts per step}$$

Note: If 160 Vac is applied between the S and SL bushings, and the calculations in item 5 and 6 are computed, you will see that a 1.0 volt difference between steps will result. Doing this will simplify the ratio check.

Table 1. Typical meter readings with 120 Vac connected between the S and SL bushings

Lower		Raise	
16L	108.0	16R	132.0
15L	108.75	15R	131.25
14L	109.5	14R	130.5
13L	110.25	13R	129.75
12L	111.0	12R	129.0
11L	111.75	11R	128.25
10L	112.50	10R	127.5
9L	113.25	9R	126.75
8L	114.0	8R	126.0
7L	114.75	7R	125.25
6L	115.5	6R	124.50
5L	116.25	5R	123.75
4L	117.0	4R	123.0
3L	117.75	3R	122.25
2L	118.5	2R	121.5
1L	119.25	1R	120.75
Neutral	120		

8. Operate the tap changer with the control switch through all 32-steps from 16R to 16L. Record the voltmeter reading at each tap position. The change in voltage should be almost the same between each step (± 0.10 volts). If a substantial difference in any reading exists, then there is a problem with the windings or their connection. Readings will be the same with or without the equalizer winding.

Note: On a type B regulator, the difference between the taps will be slightly less than calculated as the regulator is tapped toward 16 lower. This is normal and inherent in the design of the type B regulator.

Questions about the described procedure may be directed to your Eaton Representative.

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Eaton
1000 Eaton Boulevard
Cleveland, OH 44122
United States
Eaton.com

Eaton's Power Systems Division
2300 Badger Drive
Waukesha, WI 53188
United States
Eaton.com/cooperpowerseries

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For Eaton's Cooper Power series product information
call 1-877-277-4636 or visit:
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