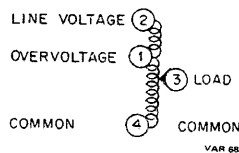


General Specifications

Ball Bearings Ball bearings at both ends of the shaft are offered for all units. They are useful where more precise alignment, more constant torque, and longer life are required. Ball bearings are standard on all motor-driven Variac® autotransformers, and on all 4- to 12-gang types W30, W30H, W50, and W50H manually-operated models.

Connections, Output "Line-voltage connection" refers to the connection of the Variac autotransformer for an output-voltage range of zero to line voltage. "Overvoltage connection" refers to the input-voltage connection for a range of output voltage from 0 to 117% of line voltage.



Current, Maximum Maximum current can be drawn at maximum voltage only when the line-voltage connection is used.

Current, Rated This current can be drawn at any dial setting, independent of overvoltage or line-voltage connection.

Dial Dial plates for single units are reversible. They read 0 to 120 volts output on one side and 0 to 140 volts on the other. H models have similar scale readings of 0 to 240 and 0 to 280. Dial plates are calibrated for mounting on a panel or on the front of a case; output voltage increases with clockwise rotation of the knob. All ganged assemblies are supplied with dials calibrated on one side only, reading 0 to 10.

Frequency, Line W-series units are specified for 50-to-60 Hz service except for the L types which are for 60-Hz service only.

However, both of these units can be operated at rated values at line frequencies to 400 Hz. For 350-to-1200 Hz service the M-series units are preferred. Models intended for 240-volt, 60-Hz service can be used at 25 Hz at their normal current rating but at one-half their 60-Hz voltage rating.

kVA Ratings The kVA rating is the maximum load current multiplied by the nominal input line voltage.

Resolution Variac resolution is virtually infinite as the resistive brush always spans 2 or more turns of the autotransformer winding.

Motor-Driven Units All Variac autotransformers, both single and ganged units, can be furnished with motor drive.

Mounting Hardware All models are supplied with the necessary mounting hardware.

Special Designs We welcome requests for modifications of any model. These include different windings, shifting taps, different shafts, or basic new designs to furnish output voltages or voltage ranges differing from standard models. On special order, all W-series Variac autotransformers can be manufactured to conform to military requirements that are standard with the M-series units.

Temperature Rise Ratings are based upon operation at ambient temperatures of up to 50°C. When the ambient temperature exceeds this figure, current ratings should be decreased (see Figure 2).

Terminals All models have combined soldering and screw-type terminals with the exception of the types W30 and W50 which are equipped with clamping terminals. Models for 120-volt lines have five terminals for either 120- or 140-volt maximum output connections; 240-volt units have two extra terminals to provide for either 120- or 240-volt input for 280-volt output.

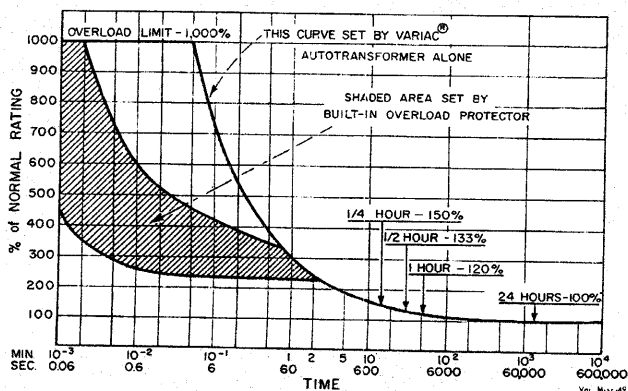


Figure 1. Short-time overload characteristic of Variac autotransformers with line-voltage connection.

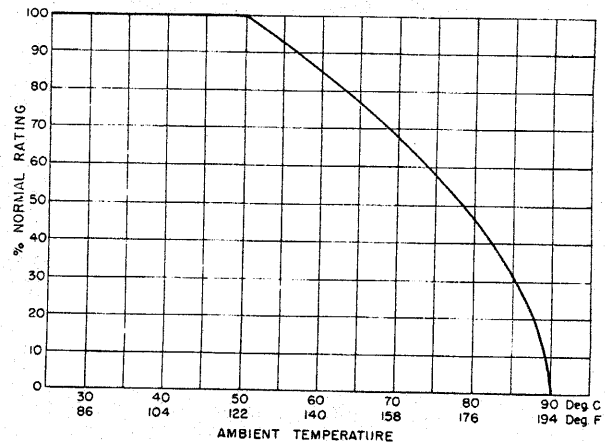


Figure 2. Variac autotransformer derating versus ambient temperature.

General Specifications (Cont'd)

Military Environmental Specifications Most Variac autotransformers have been tested and do meet some or all of the following Military Specifications: MIL-STD-202, MIL-STD-810, MIL-STD-167, MIL-E-4158, MIL-E-4970, MIL-E-5272, MIL-E-5400, MIL-E-16400, MIL-R-23098, MIL-S-901C, MIL-T-945, and MIL-T-5422. "Certification of Compliance" can be furnished at no charge for units tested. Copies of the test data are also available for a small fee. For further information on environmental tests, please contact your local GR District Office.

Overload Protection Today's improved core materials permit the use of higher flux densities than were formerly practical. Under certain conditions of core magnetization and line-voltage phase, an inrush transient or surge having an initial value up to ten times the rated current of the unit may occur. This does no harm except to ordinary "quick-blow" fuses. For this reason, time-current integrating circuit breakers or "slow-blow" fuses are recommended for primary protection. They will hold during transients but will protect against sustained and potentially damaging overloads. Such a protective device on the *input* side of the Variac should be capable of handling a 1000% overload for the duration of one cycle of the power-line frequency.

Overload protection for variable-ratio transformers differs from that used with fixed-ratio transformers, where safe primary and secondary currents are determined by the ratio of secondary to primary turns. For example, in a fixed-ratio transformer having 100 primary turns and 20 secondary turns, if the safe secondary current is 10 amperes, the safe primary current will be 2 amperes. Equal protection will be provided by a 10-ampere secondary fuse or a 2-ampere primary fuse.

This is not true with Variac autotransformers. As the brush traverses the winding, the transformation ratio continually changes. Under the conditions of a varying transformation ratio, primary protection is of little or no value, but output protection is all important; it is the output current that must be held within safe limits. For this reason a Variac autotransformer should be protected by a fuse or circuit breaker in the brush lead, where the load is normally connected.

The nature of the protective devices selected should be partially determined by the service requirements. Variac autotransformers have an inherently high short-time overload capacity because temperature is dependent upon time for a given rise. They can safely absorb relatively infrequent short-time overloads (due to motor starting or lamp inrush) without being derated.

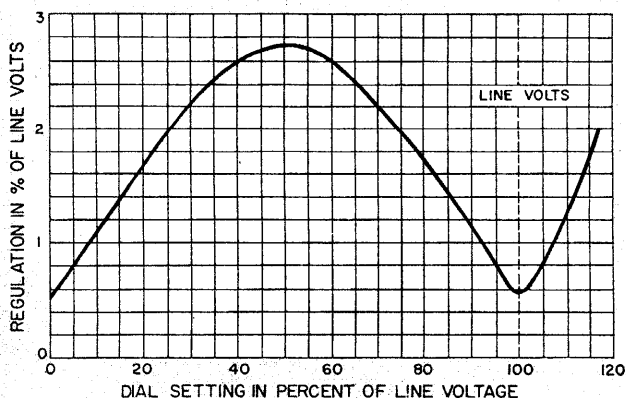
The upper curve in Figure 1 applies to units without built-in fuse protection. Models with built-in protection in the brush arm (models W5L, W20H, W30, W30H, W50, and W50H) have overload characteristics corresponding to the shaded area on the curve. The fuse is purposely made inaccessible to guard against careless replacement with fuses of wrong value. Its basic purpose is to provide thermal protection to the autotransformer, and it is not intended to serve as the sole protective device for the unit. It is essential that the user add ex-

ternal overload protection to the output of the variac, that is, between the brush and the load.

To benefit fully from the short-term overload characteristic, the overload capacity must not be unduly limited by the protective device. Since quick-blow fuses cannot withstand surges, their use is discouraged except for loads not subject to inrush. Slow-blow fuses are better; time-current integrating circuit breakers are better still. Thermal breakers are to be preferred, since they automatically derate with increasing ambient temperature. They most nearly conform to the requirements shown in Figure 2. This type of protector is standard in the Type MT (portable, cased) models of the W-series Variac autotransformers.

Regulation Regulation is defined as the change in output voltage from no load to full load current (varying load resistance), with constant input voltage, and is expressed as a percentage of line voltage.

In an autotransformer, regulation varies with dial setting, largely because of IR drop in the winding, and is minimum at transformation ratios of zero and one. Note that, at zero and line-voltage settings, there is some slight regulation attributable to the resistance of the brush. Regulation is also due in part to leakage reactance caused by stray flux that does not link all the turns. While this is a minor factor at low frequencies, it becomes dominant at some higher frequency and actually imposes an upper-frequency limit on the operation of the autotransformer. This limit depends on the load conditions.



Typical regulation curve with normal rated current.

Paralleling Choke, W50-P1 Many of the Variac autotransformers listed on the following pages are indicated to require one or more Type W50-P1 Chokes (catalog number 3150-5016). This unit is used when two or more autotransformer outputs are to be connected in parallel; it impedes the flow of potentially destructive-circulating currents. Instructions for proper interconnecting are included with each unit.