

Apr 21/65

BALLAST-REGULATING TUBE



WHAT IT IS

Amperite is an automatic "rheostat" designed to keep the current in a circuit at a definite value, for example, 0.5 amps. Should the supply voltage increase, the Amperite will automatically increase in resistance enough to take up the increase in supply voltage — keeping the voltage on the load constant (Fig. 1). It consists of an iron wire hermetically sealed in a bulb containing hydrogen or helium — the two gases with the highest heat conductivity. Its regulating action is based on the high temperature co-efficient of resistance of the iron wire and the rapid cooling of hydrogen or helium gas.

CONTROLS FIXED LOAD ONLY

Being a constant current device, the Amperite can be used only to regulate a constant load — fixed wattage. An exception is the voltage control of the water wheel generator shown in Fig. 5 — where the Amperite is used in parallel with the series field.

Thermostatic relays can sometimes be included in an Amperite Ballast Tube to reduce initial surge.

CAPACITIES AVAILABLE:

- Current values of 60 ma. to 5 amps.
- Threshold voltage (see Fig. 3) 0.4 to 40 V
- Max. dissipation per Amperite 50 W per tube (ST19 Bulb)
- Amperite can be used on AC, DC, or pulsating current.
- Ballast tubes should not be operated in series.
- Any number of Amperites with the same voltage range can be operated in parallel.

BASES AVAILABLE and BASE WIRING:

- Radio octal—7 pin miniature—9 pin miniature—standard wiring prongs 2-7.
- 4 Prong Radio—for current over 3 amps.—wiring FF.



MINIATURE UNIT

Only 3/4" x 2 3/8" overall. Ideal where efficient space-saving Regulators are required.

GENERAL ADVANTAGES

- Light, compact
- No moving parts
- Rugged, will stand vibration of 10G. minimum
- Hermetically sealed; not affected by altitude or humidity changes
- Can be changed as easily as a radio tube
- Operates equally well on A.C. or D.C.
- Inexpensive

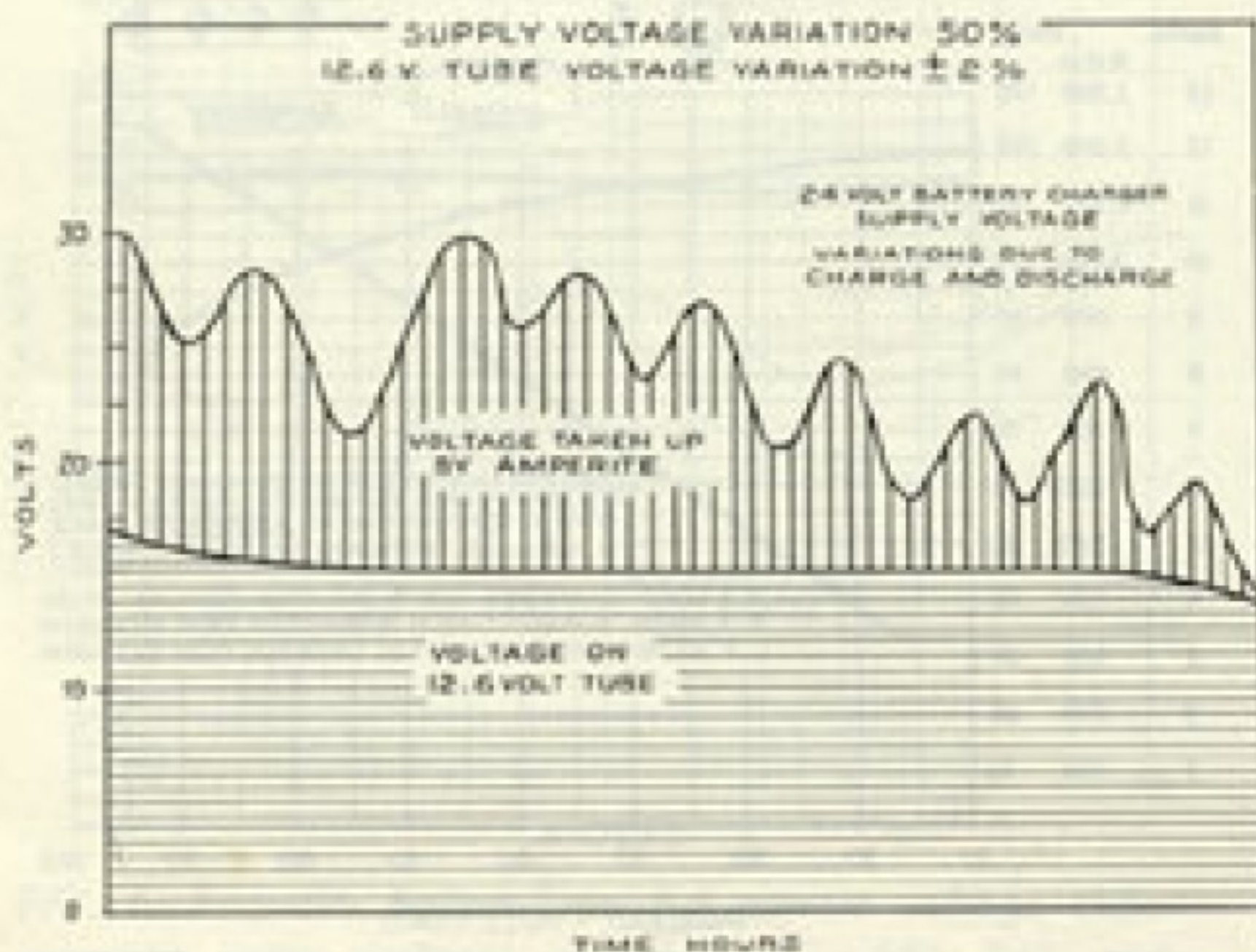


FIG. 1—The voltage fluctuations of a battery-charger system can be smoothed out as shown.

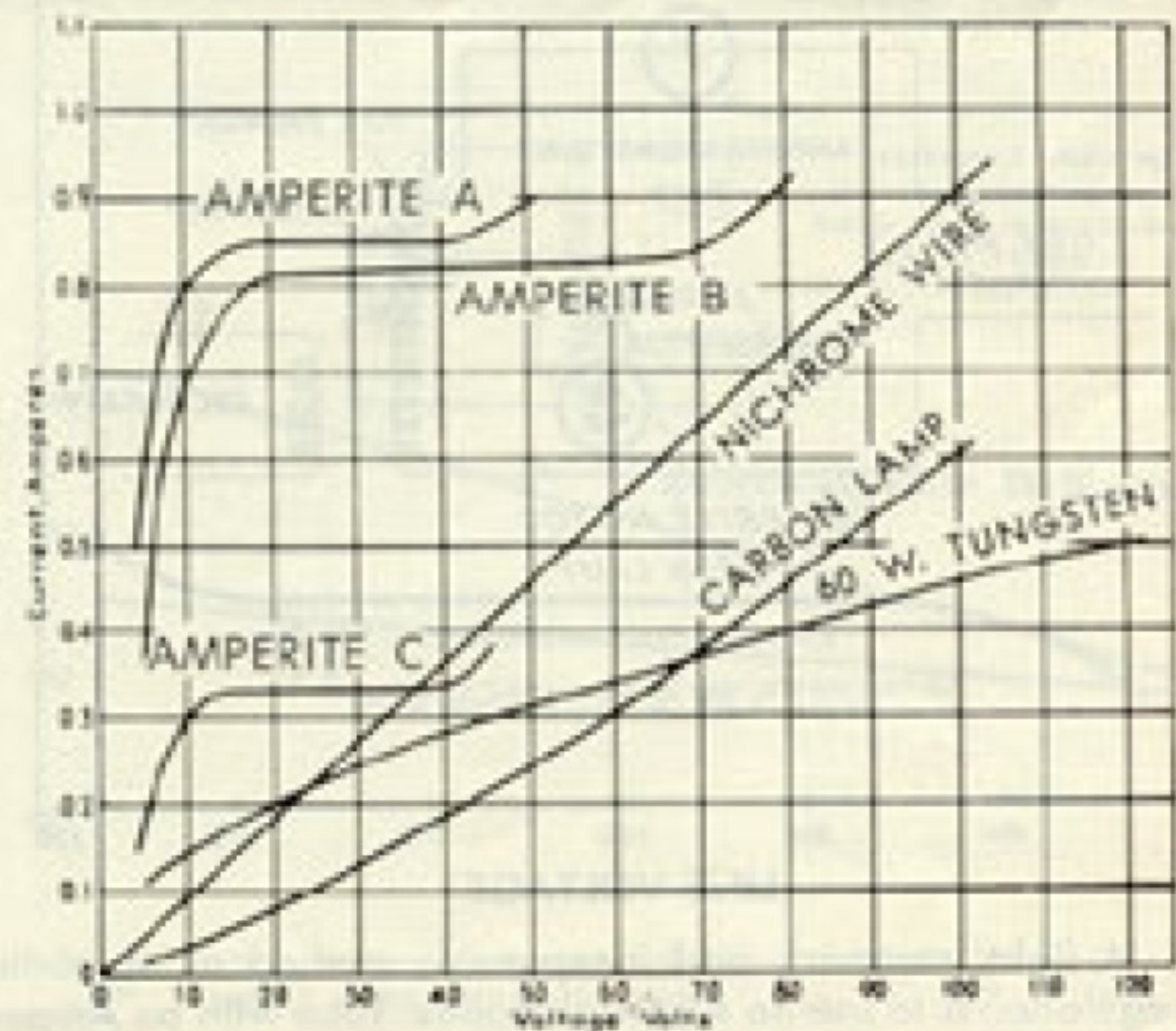


FIG. 2—Showing for superior regulating characteristics of the Amperite Ballast-Regulating Tube.

AMPERITE BALLAST-REGULATING TUBE



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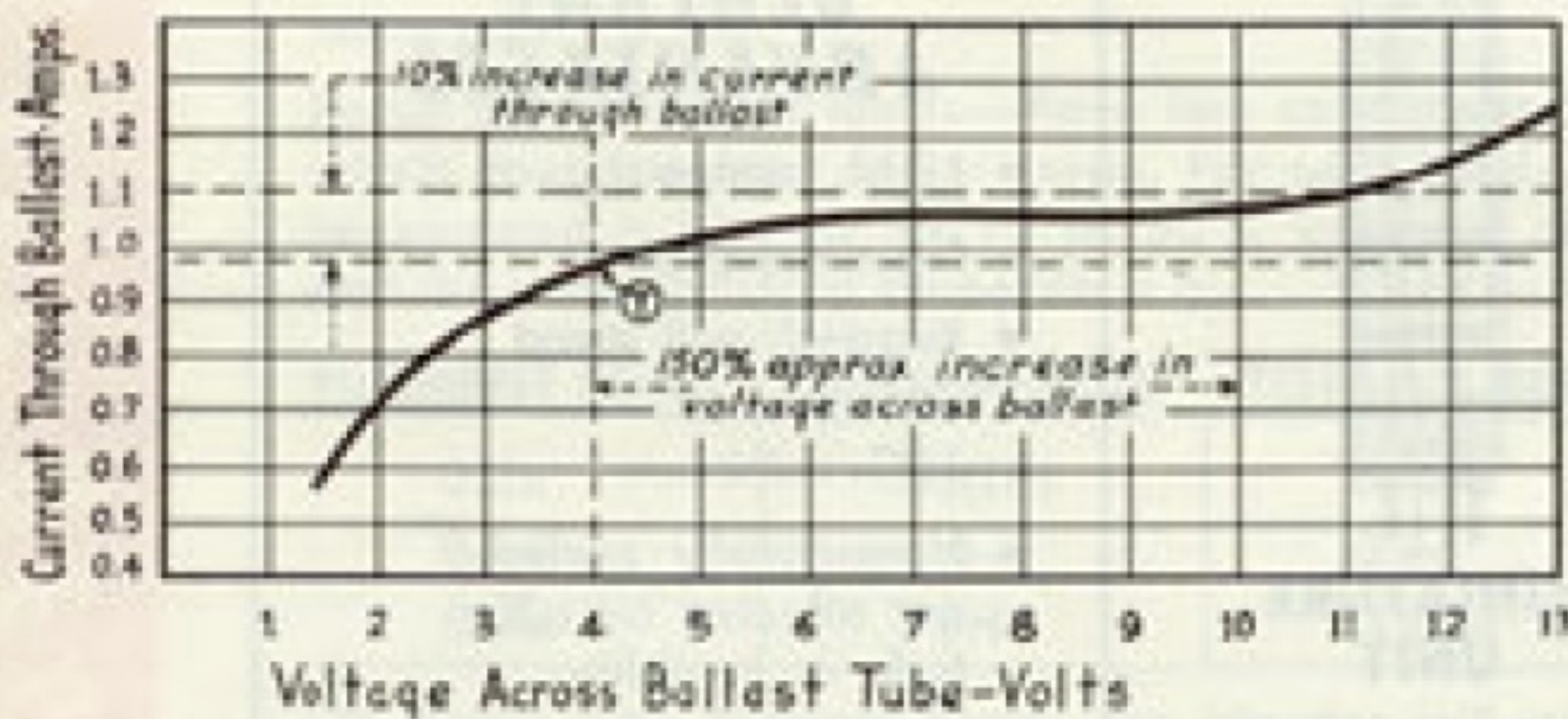


AMBIENT EFFECTS:

Ambient temperature variation of -50° to $+70^{\circ}\text{C}$ — will change the current value of an Amperite approximately 2% on regulating portion of curve (Fig. 6). Being hermetically sealed the Amperite is not affected by altitude or humidity changes.

TIME LAG CHARACTERISTICS:

Time lag encountered in an Amperite Ballast Tube depends upon the wattage consumed by the ballast and the size of the bulb. Where the wattage is small for the size of the bulb, the action can be made practically instantaneous — less than 1 second. In such cases the bulb will remain at practically ambient temperature. When the wattage is high enough to heat the bulb to a temperature uncomfortable to the hand (160°F) the lag might be as much as several minutes for final readings—but normally reaches within 90% of final readings within a few seconds.



T* Threshold Current & Voltage

FIG. 3—Characteristic curve of a typical Amperite. Approximate curve of any other Amperite can be obtained by multiplying or dividing the current or voltage scale by any number.

LIFE EXPECTANCY:

- Average life if operated as recommended 2000 Hours
- If operated continuously at maximum voltage 1000 Hours
- If operated continuously at 80% maximum voltage 5000 Hours
- If filament is operated below glow point 5000 Hours up

In operation, the Amperite filament starts to glow at one point; as the voltage is increased, the glow spreads over the entire filament. Like incandescent lamps, turning Amperite on and off reduces its life, especially if operating near its maximum voltage.

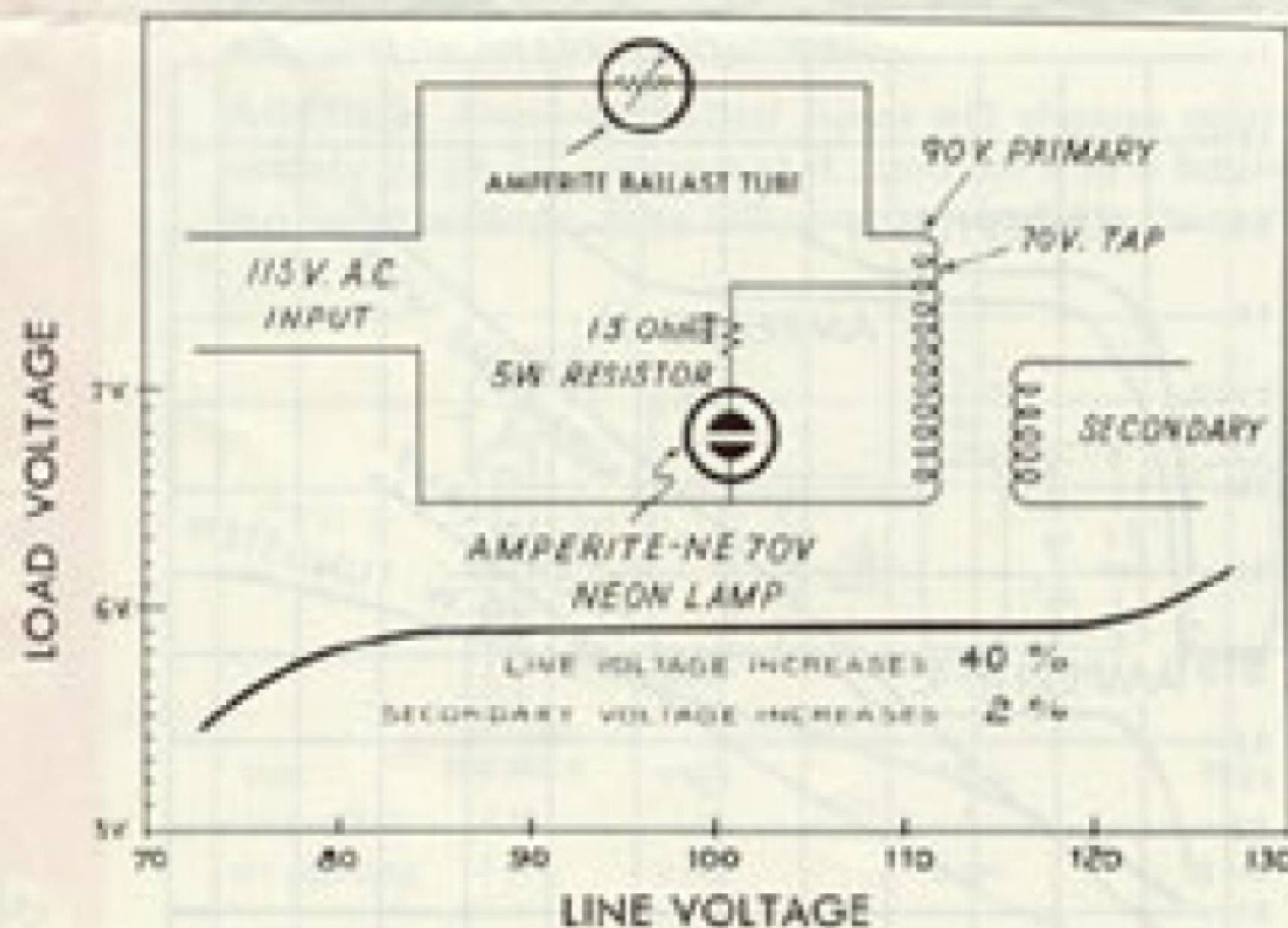


FIG. 4—A light, compact, and inexpensive method of obtaining close regulation is to use an Amperite Ballast Tube with an Amperite Neon Lamp—type NE70V. Base octal—base wiring—prongs 2-5. One NE70V is used for all loads up to 100W.

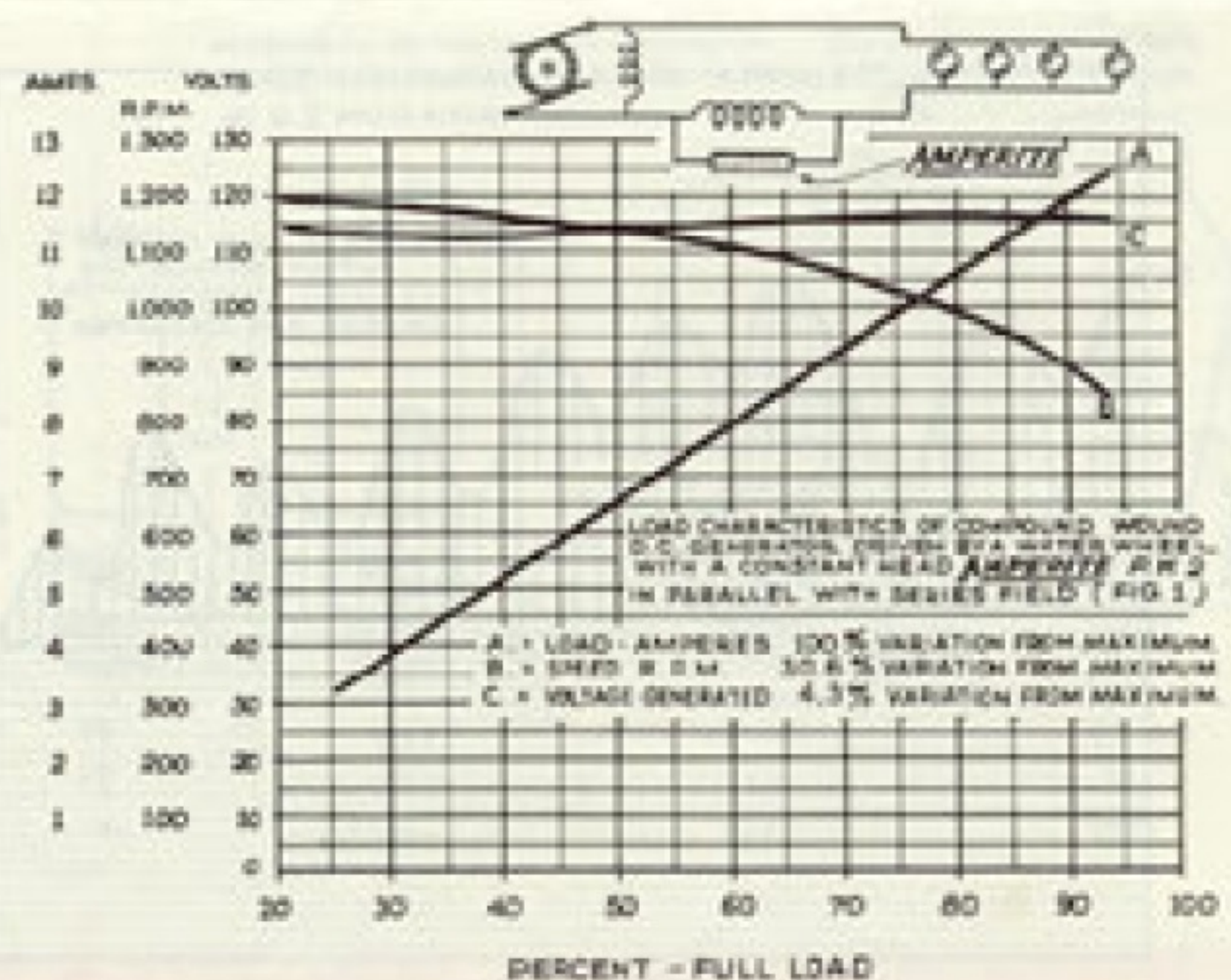


FIG. 5—Excellent regulation of generator is obtained with an Amperite in parallel with series field.

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DELAY ACTION

DELAY RELAY ACTION WITH AN AMPERITE BALLAST TUBE — AND MAGNETIC RELAY

By shunting the proper *Amperite* across the coil of an ordinary relay, a delay action relay of a fraction of a second to 3 seconds is obtainable. When the actuating current is first applied the *Amperite* acts as low resistance by-pass. The current causes the *Amperite* resistance to rise — increasing the voltage across it until the operating voltage of the relay is reached. The *Amperite* must be carefully matched by us to the relay type used. A dropping resistor must be used in series with relay — consuming at least half the voltage. An *Amperite* operating in this way will stand up for millions of operations — and can be made to recycle in approximately 2 seconds.

BATTERY CHARGING AND DISCHARGING

Amperite Ballast Tubes are very successfully used for keeping the current constant in charging and discharging batteries. Any number of *Amperites* of the same voltage range can be placed in parallel in order to obtain the proper current. The current can be kept to $\pm 1\%$. Advise voltage variation and currents desired.

AMPERITE NUMBERING SYSTEM

In general the *Amperite* number denotes the current-voltage threshold value (Fig. 3). The system of course is only approximate and does not give the exact value. For example:

AMPERITE NUMBER	3-4	3H4	10-7	12-11	12H11
THRESHOLD CURRENT (a)	0.3	0.35	1.0	1.2	1.25
THRESHOLD VOLTAGE (V)	4.0	4.0	7.0	11.0	11.0

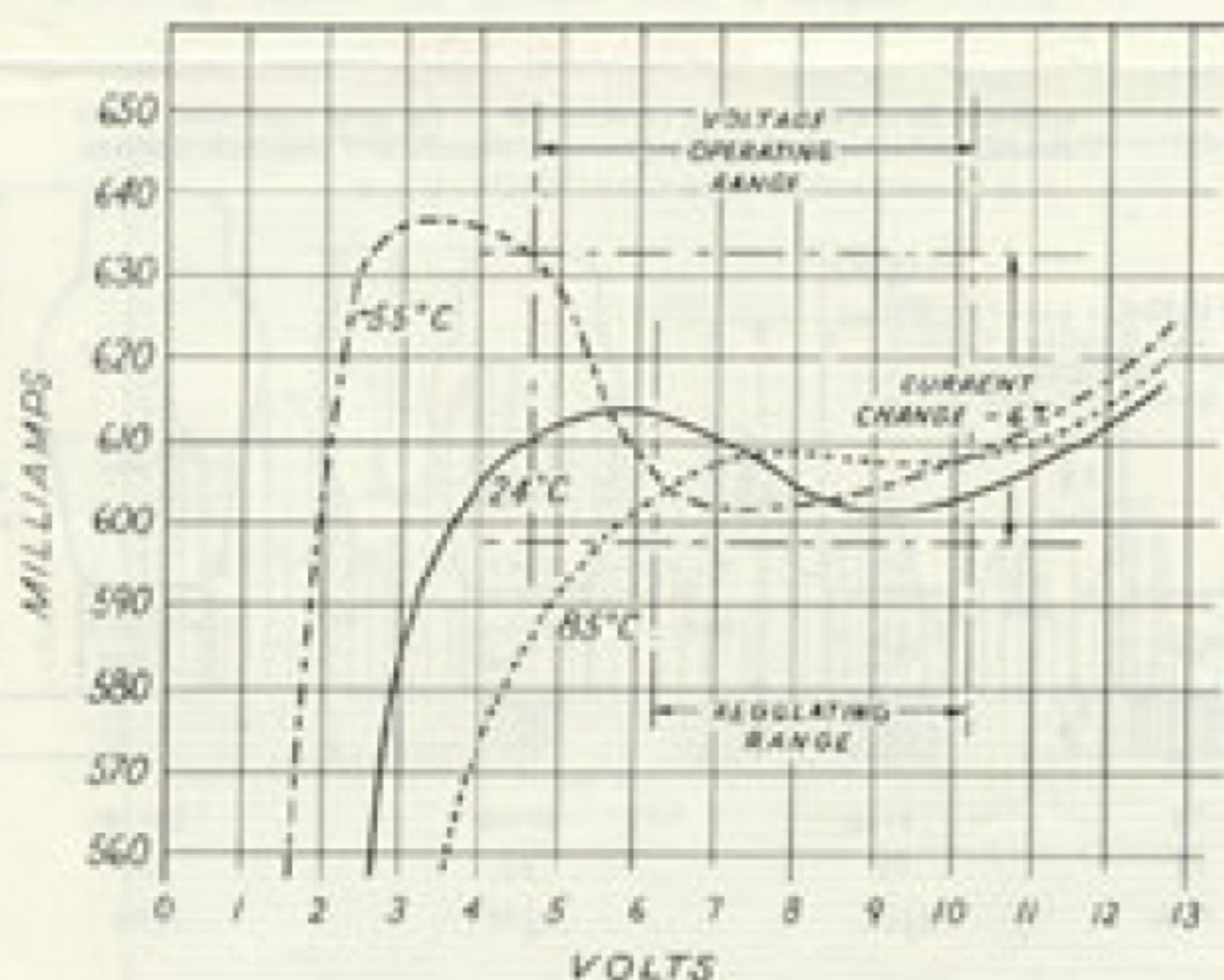


FIG. 6—*Amperite* Ballast-Type 6-4 current voltage characteristic under ambient conditions of -55° , 24° , and 85° C. The percentage change with ambient is approximately the same with all type *Amperite* ballasts.

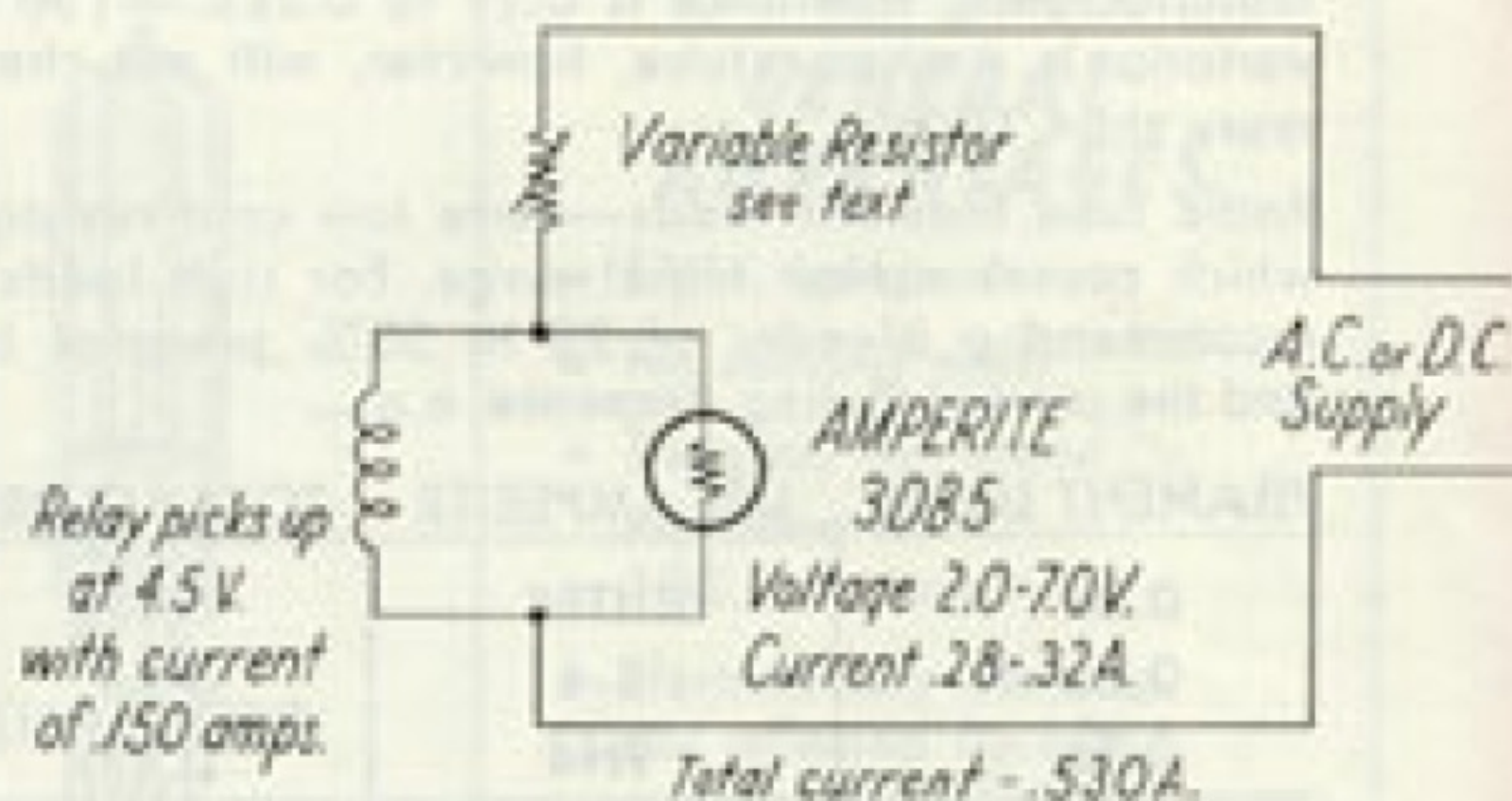


FIG. 7—*Amperite* Ballast Tube 3D85 used to delay action of magnetic relay. Delays from 0 to 3 seconds obtainable. For 12 volt supply use 20 ohm rheostat; for 26 volt supply use 50 ohm rheostat. A constant delay of 2 seconds, plus or minus 1 second, is obtainable from a 24-32 volt supply using an *Amperite* Type 5-9SP ballast tube and a 20 ohm fixed resistor in place of the variable resistor shown.

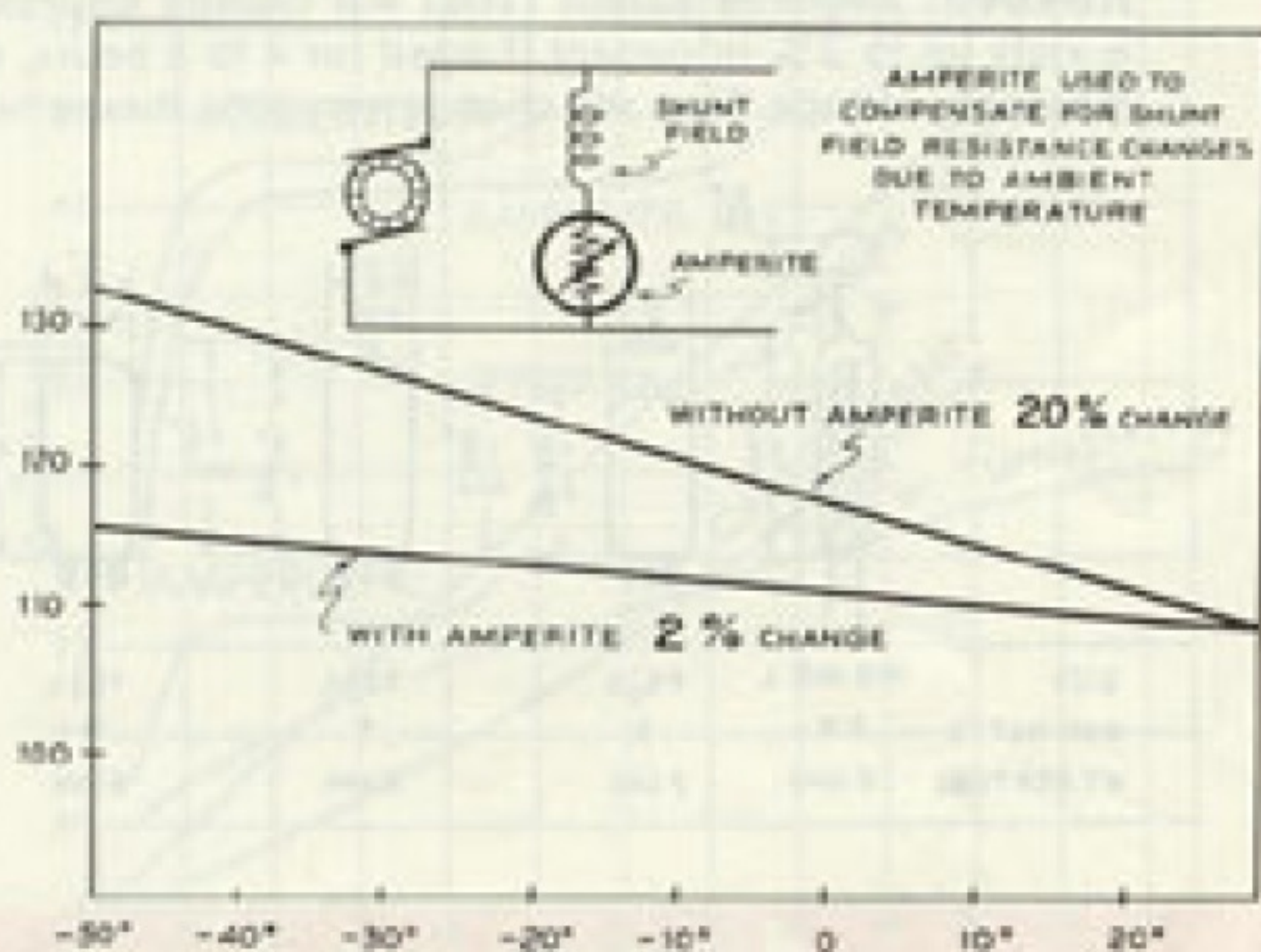


FIG. 8—Method of compensating for shunt field resistance changes due to ambient temperature changes.



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TYPICAL REGULATING PROBLEMS — WITH SUGGESTED VOLTAGE LOADS

FOR VARIOUS POWER SUPPLIES

We strongly recommend, for any particular application, to fill in and return one of our special problem sheets — ASP 343, and permit us to recommend the most suitable Amperite.

POWER SUPPLY	Dry Cells	6 Volts	12 Volts	26 Volts	115 Volts
Supply variation	2.2-3.0V	5.5-7.5V	11.4-13.8V	22.0-30.0V	105-125V
*Desired on load	1.8-2.0V	3.9-4.1V	6.1- 6.4V	12.4-12.8V	90- 95V
Required on Amperite	0.4-1.0V	1.6-3.4V	5.3- 7.4V	9.6-19.2V	15- 30V
Current variation	.29- .32a	.29- .32a	.29- .32a	.29- .32a	.29- .32a

*The above chart shows the maximum load voltage for the given supply to obtain $\pm 2\%$ current regulation on load. Better regulation is obtainable by increasing the voltage across the Amperite. In general, the higher the percent of the supply voltage taken by the Amperite, the better the regulation.

Current Tolerance in the above table is the manufacturing Tolerance which includes regulation and manufacturing variations. Any one tube, however, will change much less. For example, on the 12V supply the manufacturing tolerance is 0.29 to 0.32a.—(30 ma. variation). Any one tube, however, will not change more than 10 ma.

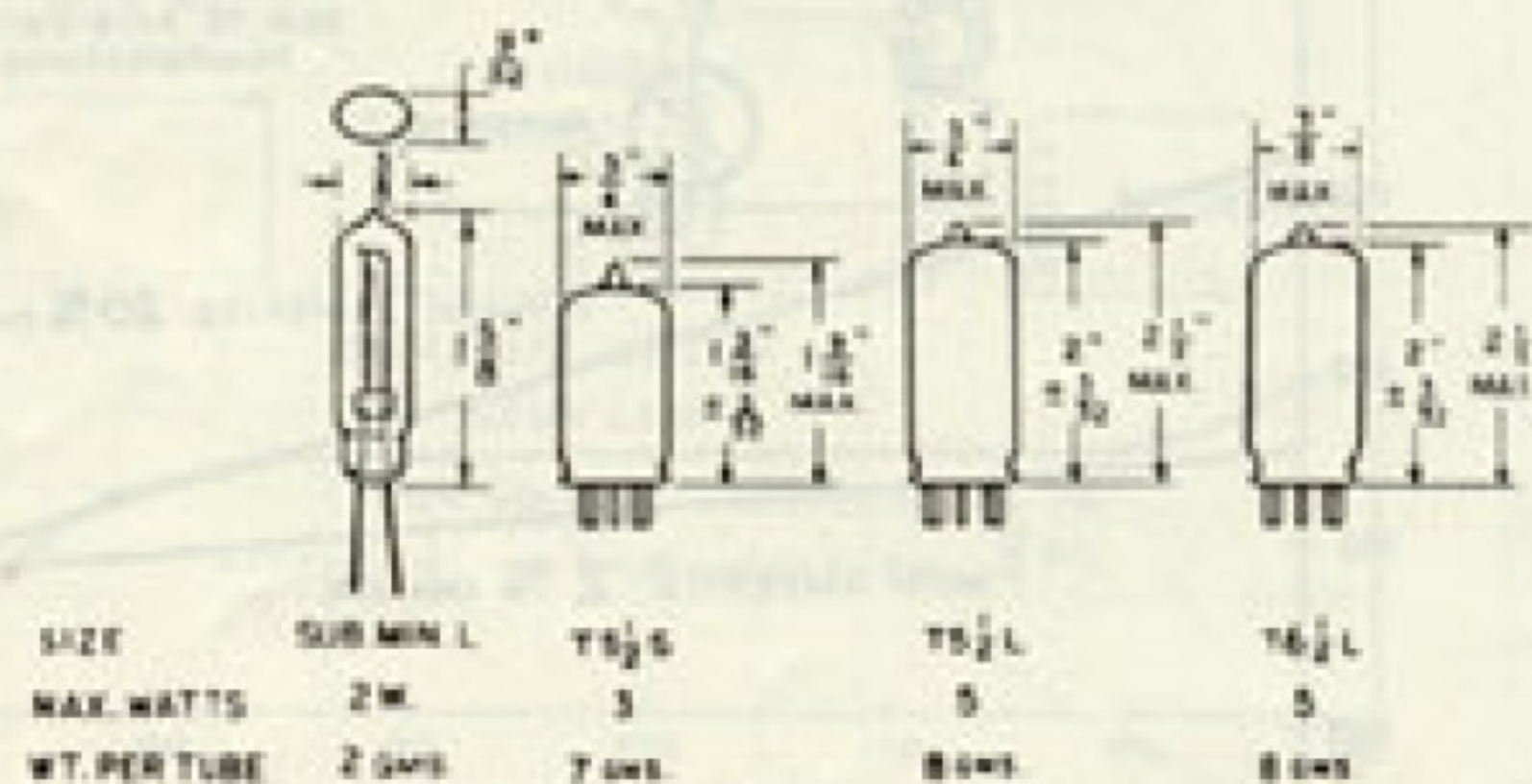
Radio tube filament loads—have low cold resistance which causes a high initial surge. For such loads we recommend a bleeder of 20 to 50% prox. of load and the corresponding Amperite, e.g.—

FILAMENT LOAD	USE AMPERITE	TOTAL CURRENT
0.3a	4HTF4	0.45a
0.6a	8-4	0.8a
0.7a	9H4	0.95a

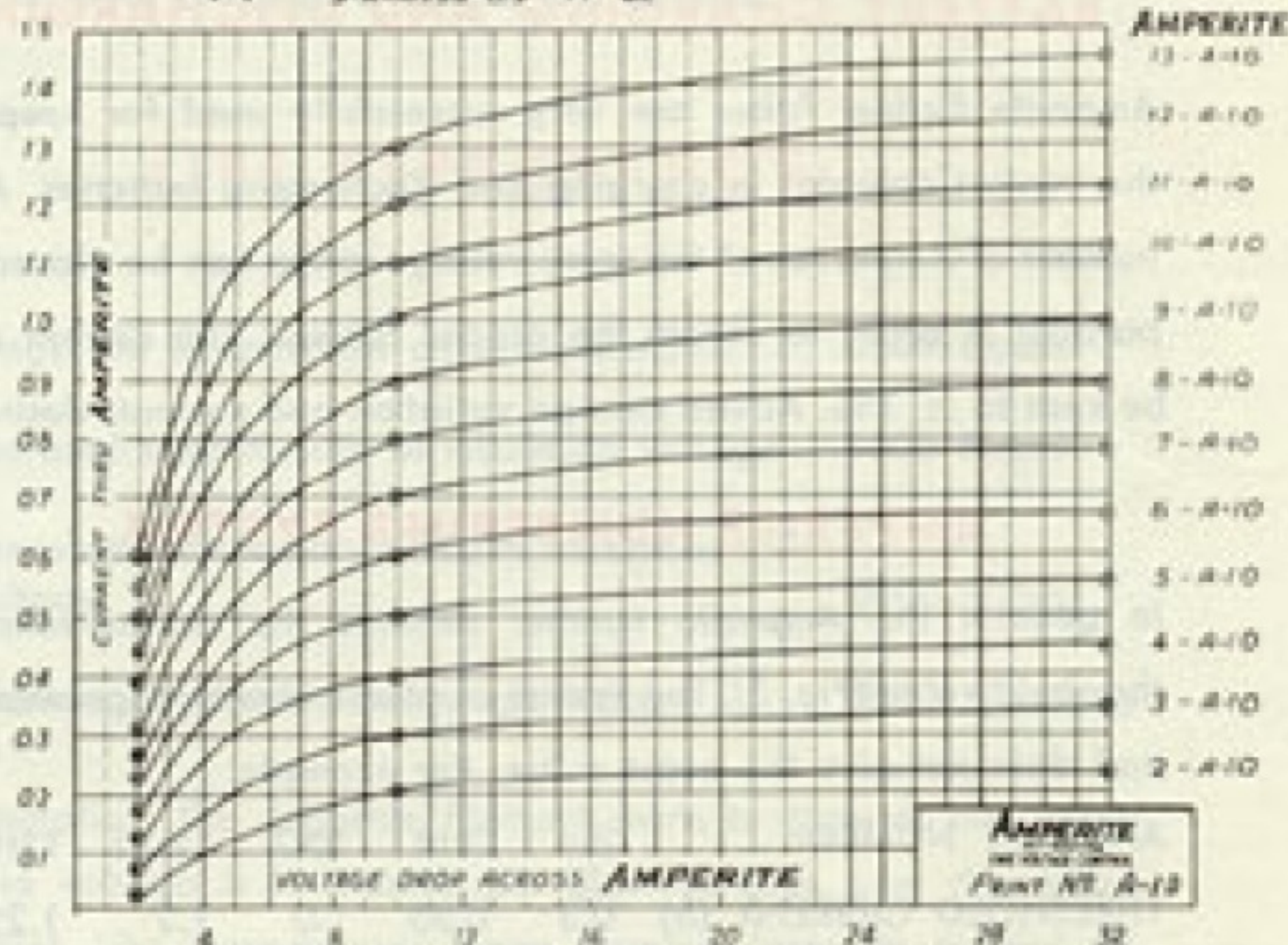
On Radio tube filament loads the bleeder will also improve the regulation.

On 115V supplies— $\pm 1\%$ regulation can be obtained by shunting the load or transformer primary with an Amperite—NE70V Neon Lamp (Fig. 4). One Amperite—NE70V Neon Lamp should be used for each 50 watts of load. This is the cheapest and most compact method of obtaining $\pm 1\%$ regulation. The Amperite is not affected by frequency changes.

AGEING: Amperite Ballast Tubes will change approximately up to 3% in current if aged for 4 to 8 hours, at maximum voltage. They will change very little thereafter.

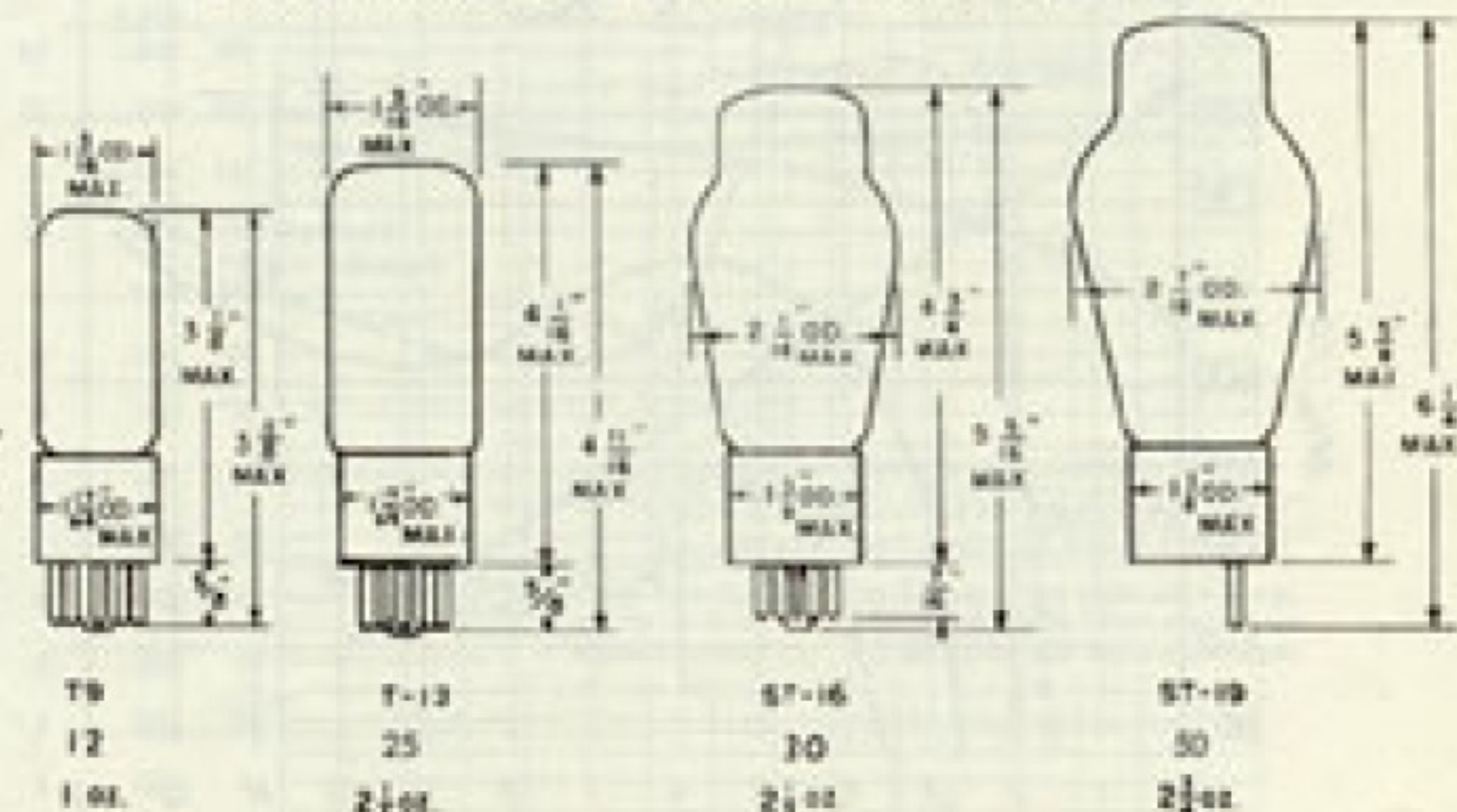


CHARACTERISTICS OF AMPERITE - A-10 SERIES
 IN GENERAL, WITH A 10% INCREASE IN CURRENT THROUGH AMPERITE, VOLTAGE DROP ACROSS IT INCREASES 200%



STANDARD SIZES

available for various voltage consumption. For good regulation, a bulb should not be required to dissipate more than 50% of maximum wattage.



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