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STANDARD RECEIVER MEASUREMENTS

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TABLE OF CURVES

STANDARD RECEIVER MEASUREMENTS

A curve showing gain change versus temperature voltage variations was plotted for each unit in the standard receiver. A temperature variation of 50 °C (from 0 °C to 50 °C) was used and is large enough to cover any expected deviation in practical usage. A voltage variation of 5% was selected to give an expanded view of operation around the nominal voltage required for the unit under test. The results of the tests show that the "standard receiver" is relatively insensitive to temperature and voltage variations. The actual sensitivity of any particular unit is shown on the attached curves.

Figure 1

These curves show how the receiver output varies when the individual units are subjected to a temperature variation from 0 °C to 50 °C. Room temperature, 23 °C, was used as reference temperature. The calibration was obtained by using a precision attenuator after the signal source. The curve for the intermediate frequency amplifier looks a little strange because the slope changes sign at approximately 30 or 35 °C. The shape of this curve was checked using another IF strip, and the curves compared close enough to assume that this is the general shape of the IF output versus temperature. It is interesting to note that the increase in gain of the IF strip is almost equal to the combined decrease in gain of the gain modulator and the integrator in the range of 23 °C to 33 °C. The combined output variation for these three units would be almost zero.

Figure 2

Output variations with respect to plate potential. -- These curves are straightforward and show that the output of the receiver will vary linearly with changes in the B+ voltage. It was expected that the IF strip would be more sensitive to B+ voltage than the gain modulator. The curves show that the IF strip is about twice as sensitive as the gain modulator to changes in B+ voltage. To maintain deviation less than 0.1 db for the IF strip, a power supply regulation better than 1.5% would be necessary. Actual regulation of the B+ supply is .05%. Therefore, there is no serious problem from this source.

Figure 3

Total power output versus filament voltage. -- These curves show that the total power output in db versus filament voltage is virtually a straight line. As was the case with the B+ voltage, the IF amplifier is more sensitive to variations in filament than the gain modulator. This is to be expected since the IF strip has more tubes than the gain modulator. For a deviation less than 0.1 db, filament voltage regulation must be better than about 0.2%. Manufacturer's specifications for the Sorenson regulator are .01%. Measured regulation is closer to .1%.

Figure 4

Figure 4 is a plot of switch driver oscillator frequency versus filament voltage. While the filament voltage was varied from 6 to 6.6 volts, the frequency varied only 0.2 cycles. For practical purposes it is safe to say that the frequency of the square wave driver is not sensitive to filament voltage within this range.

Figure 5

Driver oscillator output versus B+ voltage. -- This curve is virtually linear. A 5% change in B+ results in a 16% change in the oscillator rms output voltage. This is not of any great concern because the amplitude of the output voltage of the oscillator is not critical. Also, the 150 volt supply is regulated within 0.05%, as long as the temperature remains approximately constant.

Figure 6

150 volt power supply variation versus temperature. This curve is nearly linear, and shows that within a temperature range of 5 °C to 55°C the output voltage varies approximately 200 millivolts, or about .13%. This is low enough to maintain power output variation less than 0.1 db.

Figure 7

Filament voltage variation versus temperature. -- The validity of this curve is doubtful. Starting from 5 °C, the voltage begins to drop. This drop can be explained by the increase in resistance of the transformer windings with an increase in temperature. But at 25 °C the output voltage takes a sharp rise. The curve was run again using another transformer, with the same results. The variation in filament voltage over a 20 °C change in temperature is about 0.3%. This will give a total power output variation of approximately 0.15 db.

Figure 8

10 volt DC power supply output versus temperature. -- The output voltage of the 10 volt supply rises linearly with temperature, about 1.5 MV/°C. This rise with temperature can be attributed to the method the supply voltage is regulated. Reference voltage is obtained from a zener diode in a bridge circuit. By proper circuit technique it is believed that this variation can be reduced to less than 0.5 MV/°C.

Figures 9 and 10

Phase detector. -- The Sanborn phase detector presented a special problem in these measurements because it can be divided into four distinct sections: (1) The AC, or signal channel, (2) reference channel, (3) the phase detector, and (4) the DC amplifier. The measurements were made with a reference signal applied to the reference input, but no signal applied to the signal channel. The drift in the output was measured in millivolts. This drift was short-term and varied about ± 10 millivolts. The short-term drift was noticeable during a sudden temperature change. After the temperature stabilized, drift was limited to about ± 1 millivolt around a given point. While some of this drift can be charged to variations in our measuring equipment, it is believed that at least 90% of the drift comes directly from the DC amplifier. From the curve shown in Figure 10A it is apparent that the drift in the phase detector output is directly related to the drift in the plus and minus 150 volt supplies. This was expected because of the differential input circuit configuration for the DC amplifier. From Figure 10B it is seen that the phase detector output is also directly related to the -10 volt supply. This was also expected from investigation of the DC amplifier. There is a transistor emitter follower in the output stage (PNP Transistor) that receives collector voltage from the -10 volt supply. Any variation of the 10 volt supply shows up as an output variation because the tube filaments in the DC amplifier are heated with the 10 volt DC, and also because the transistor base is indirectly biased by the tube output. It is possible to heat the DC amplifier filaments with AC and eliminate the 10 volt DC supply altogether. This will be attempted in the near future.

Power Regulation

Figures 11 and 12 show the variation in output voltage of two Sorenson AC regulators under a 6 amp load. It is obvious that the Sorenson leaves something to be desired if AC regulation is to be better than 0.01%. The regulation of the Sorensons that were tested is about 0.1%. Under these conditions, the value of the Sorenson AC regulator is questionable. Of course, without the Sorenson, some means would be necessary to obtain regulated filament voltage. This is possible by using a regulated DC supply for the filaments. If it seems desirable to retain over-all AC regulation, a much better choice of AC regulator (at a correspondingly higher price) is the Stevens and Evans Model R760. From Figure 13 it can be seen that over a 20-hour period there was no measurable drift in the output voltage.

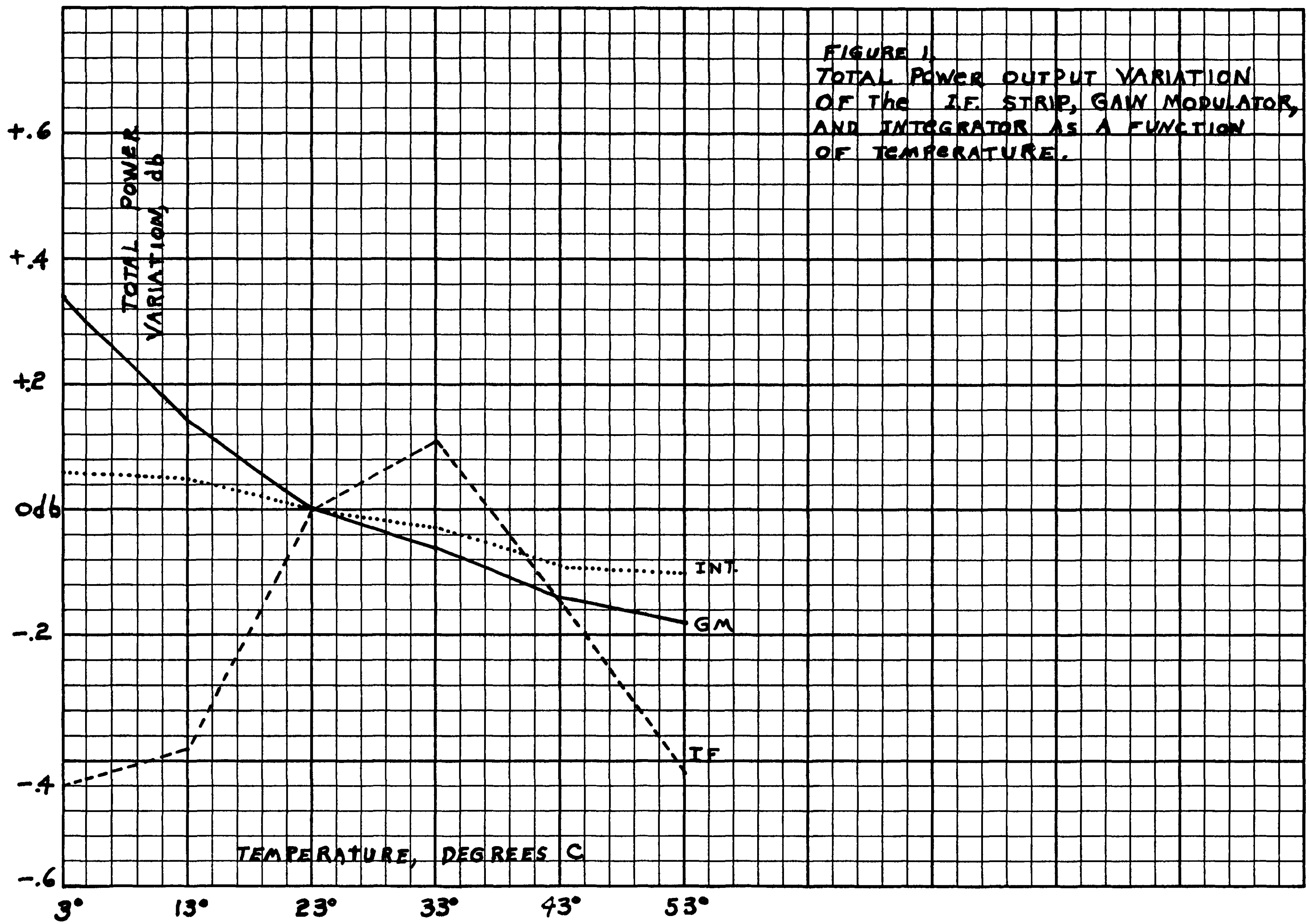


FIGURE 1.
TOTAL POWER OUTPUT VARIATION
OF The I.F. STRIP, GAW MODULATOR,
AND INTEGRATOR AS A FUNCTION
OF TEMPERATURE.
TOTAL POWER
VARIATION, db
+.6
+.4
+.2
odb
-.2
-.4
-.6
INT.
GM
IF
TEMPERATURE, DEGREES C
3°
13°
23°
33°
43°
53°

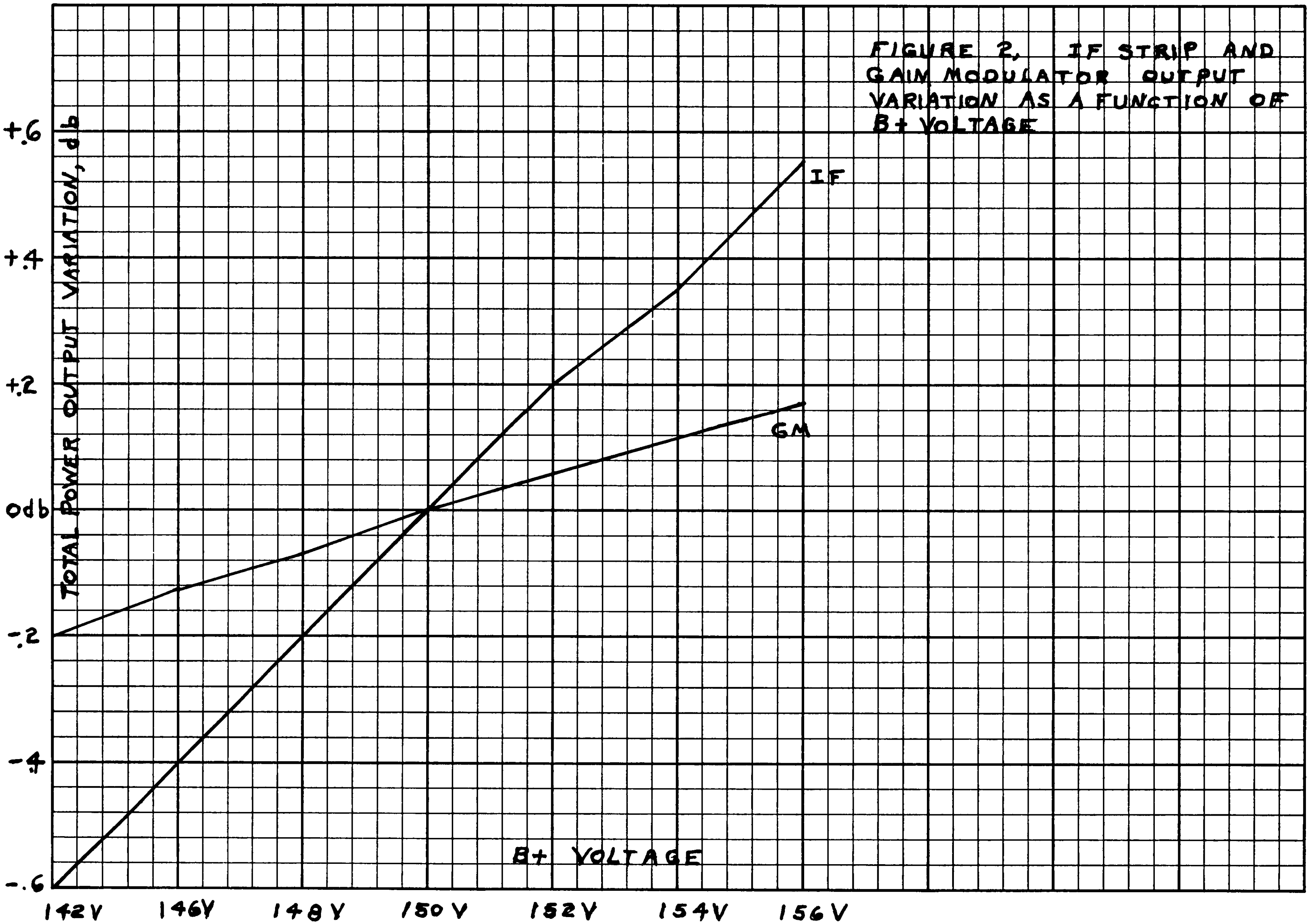


FIGURE 2, IF STRIP AND GAIN MODULATOR OUTPUT VARIATION AS A FUNCTION OF B+ VOLTAGE

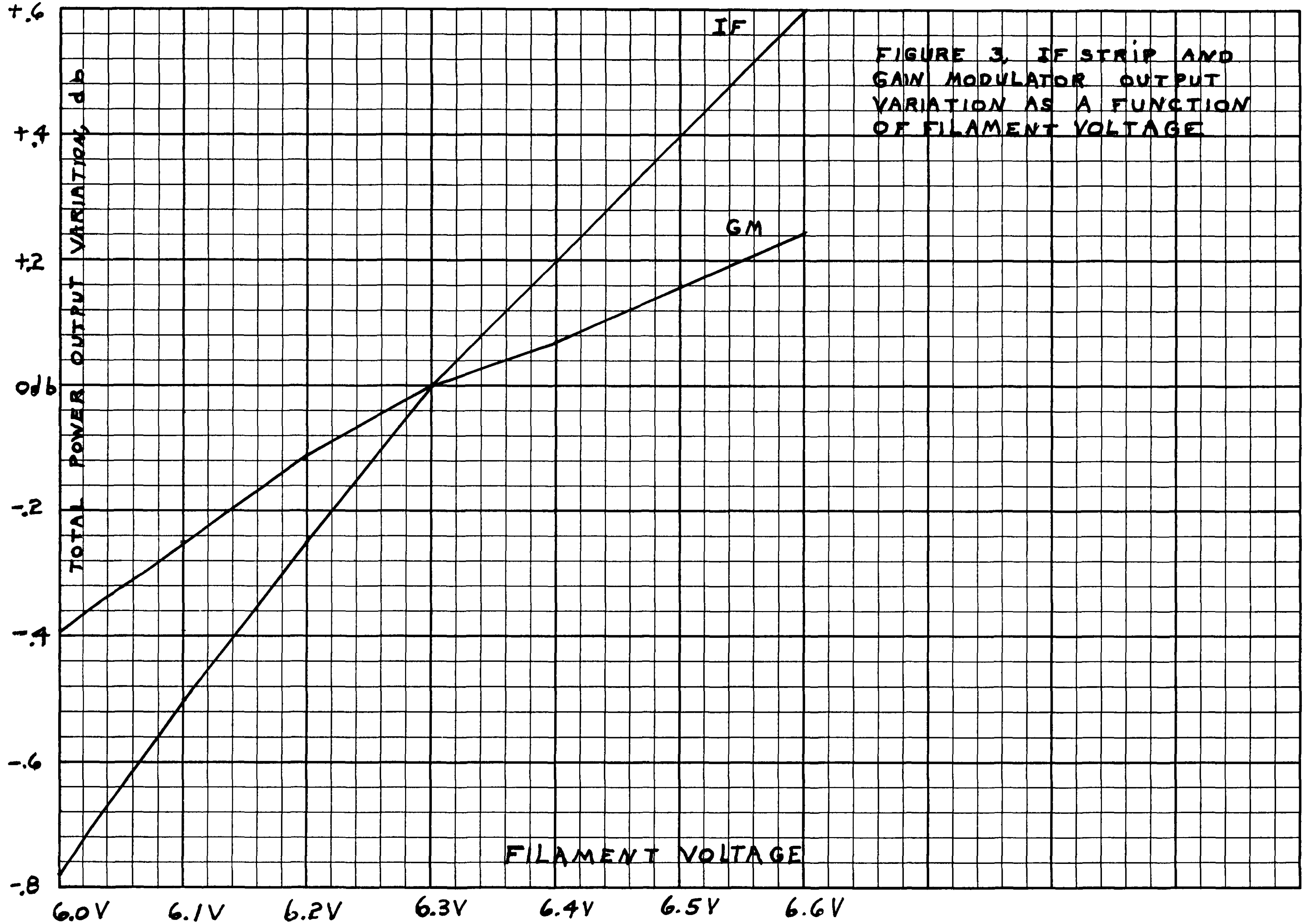


FIGURE 3. IF STRIP AND GAIN MODULATOR OUTPUT VARIATION AS A FUNCTION OF FILAMENT VOLTAGE

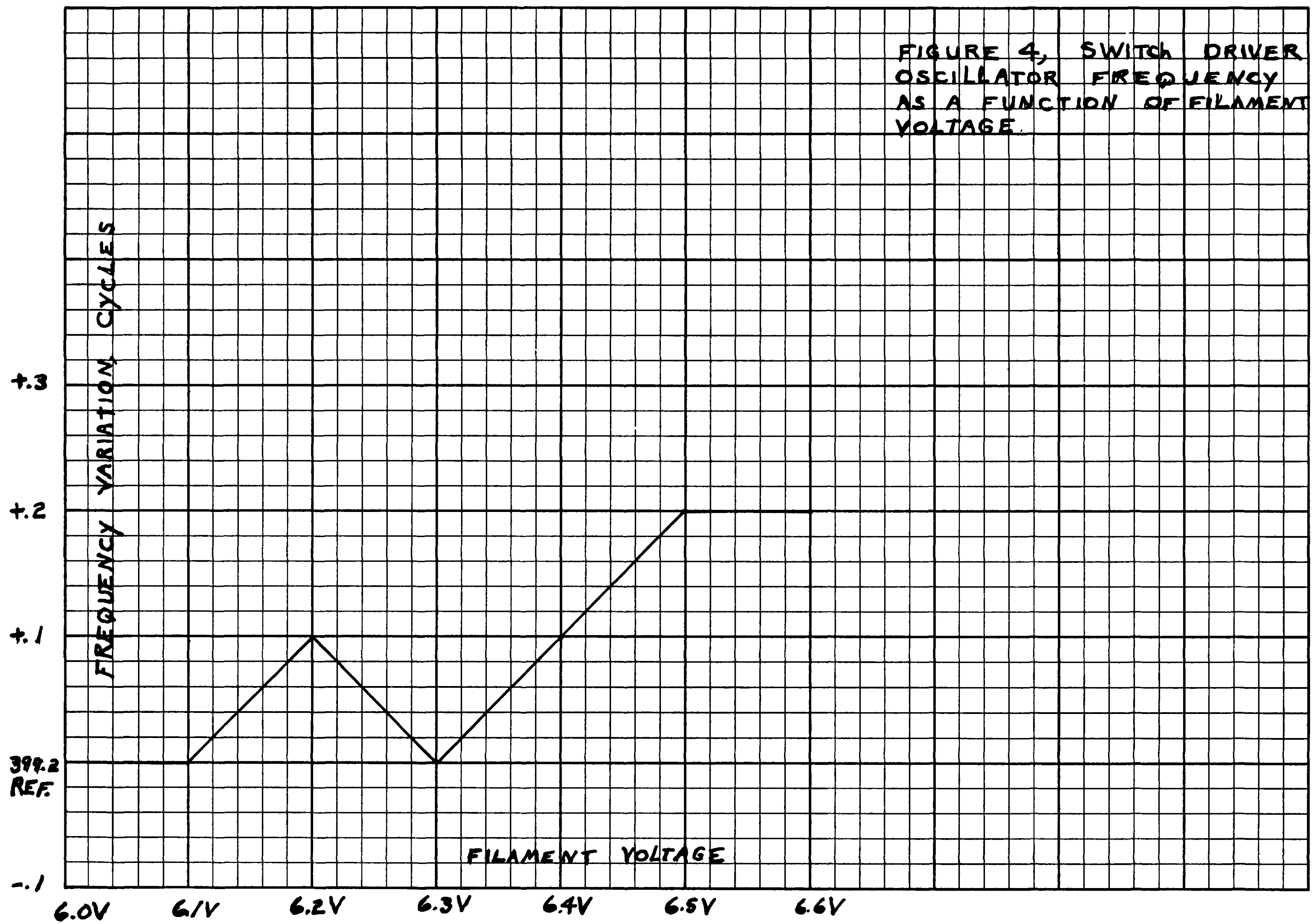


FIGURE 4, SWITCH DRIVER OSCILLATOR FREQUENCY AS A FUNCTION OF FILAMENT VOLTAGE.

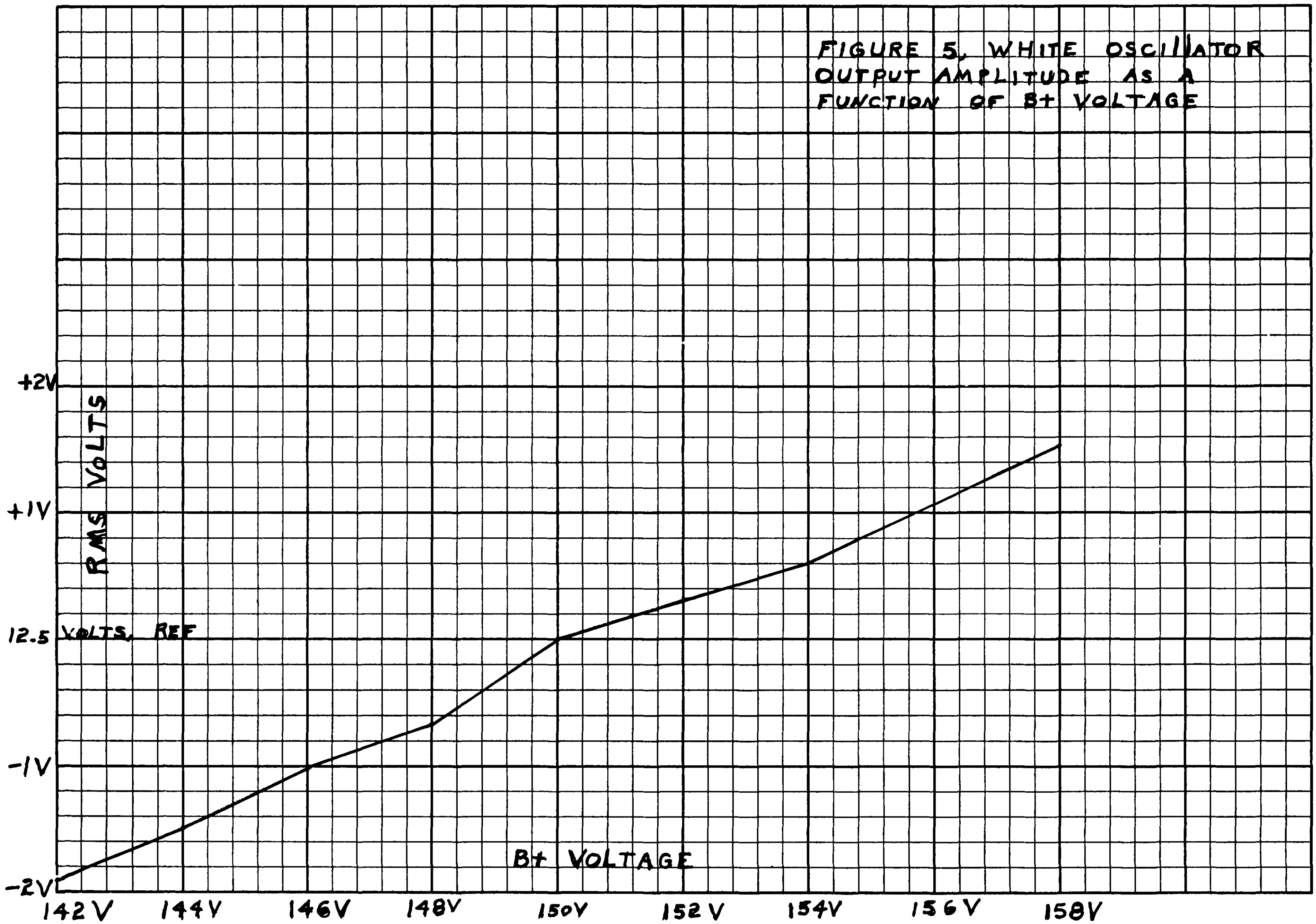


FIGURE 5, WHITE OSCILLATOR OUTPUT AMPLITUDE AS A FUNCTION OF B+ VOLTAGE

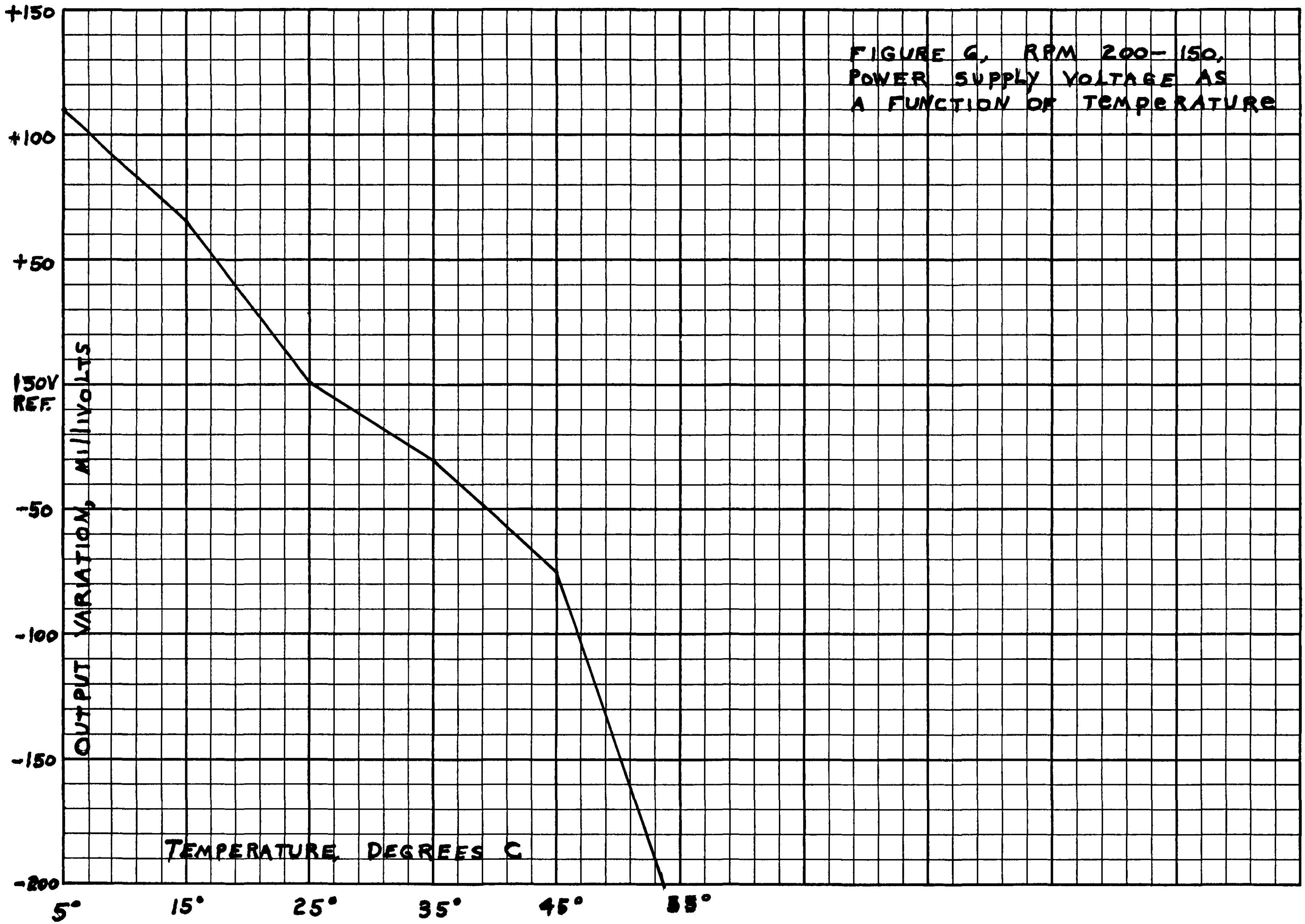


FIGURE 6, RPM 200-150, POWER SUPPLY VOLTAGE AS A FUNCTION OF TEMPERATURE

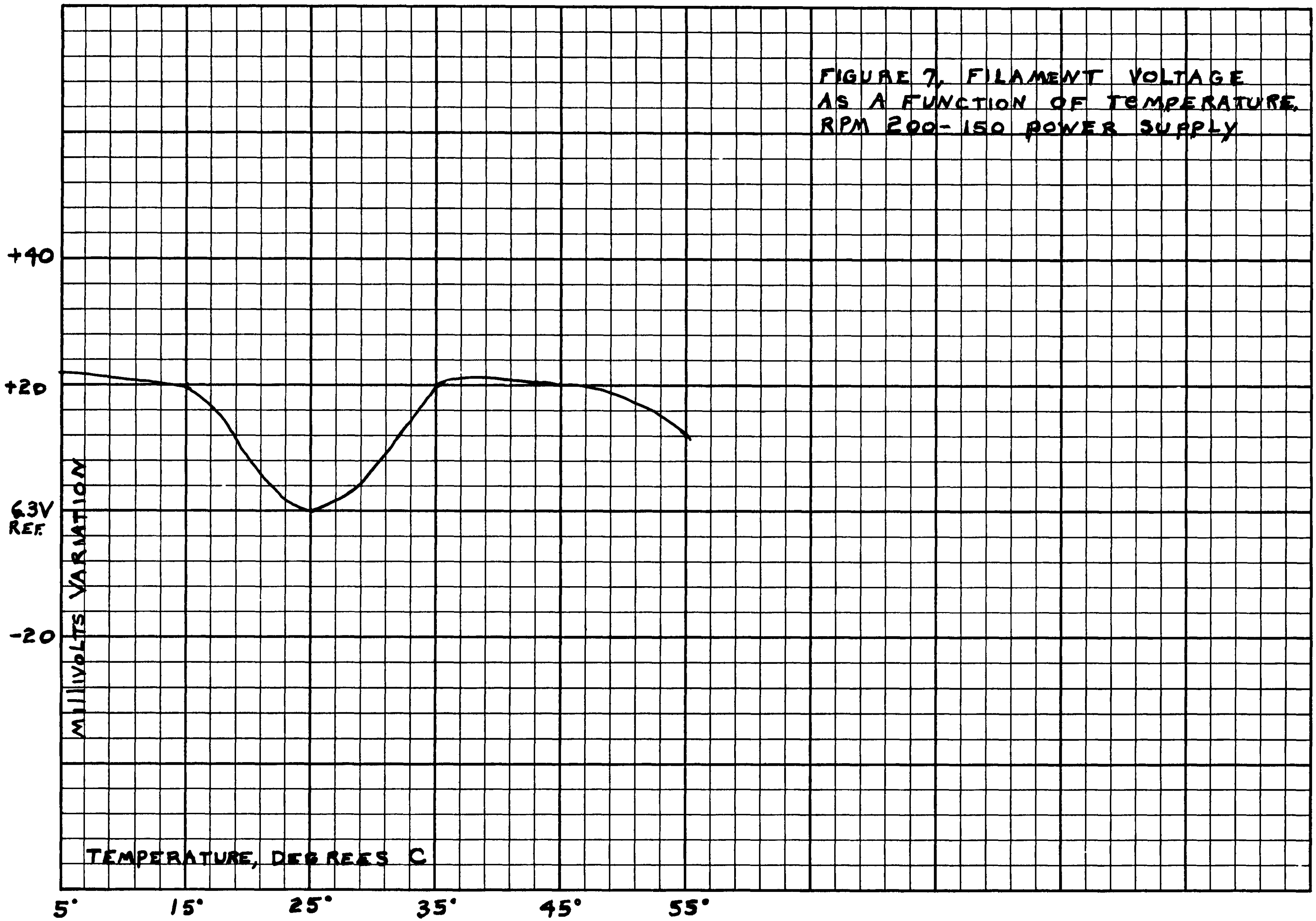


FIGURE 7, FILAMENT VOLTAGE AS A FUNCTION OF TEMPERATURE, RPM 200-150 POWER SUPPLY

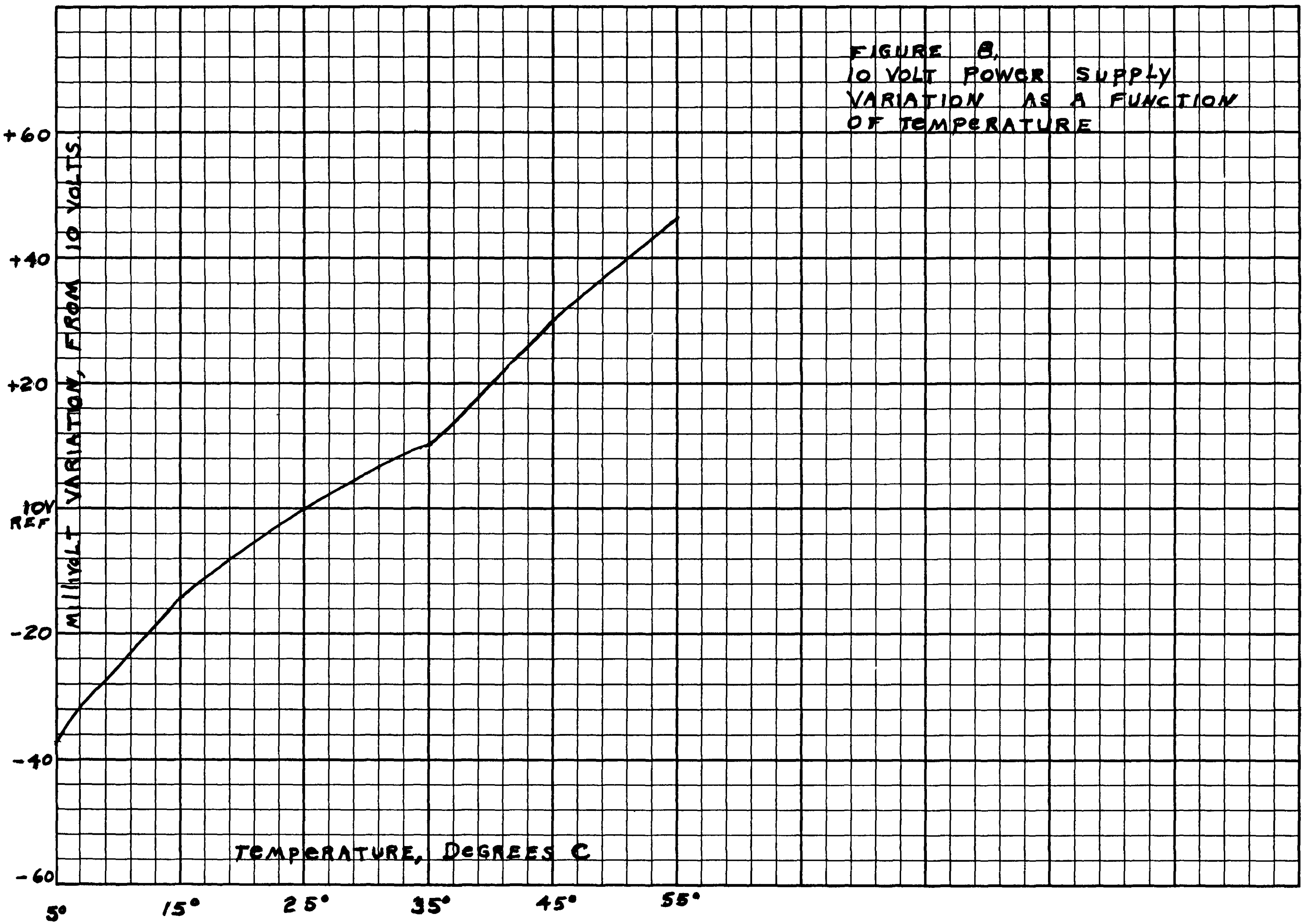


FIGURE 8.
10 VOLT POWER SUPPLY
VARIATION AS A FUNCTION
OF TEMPERATURE

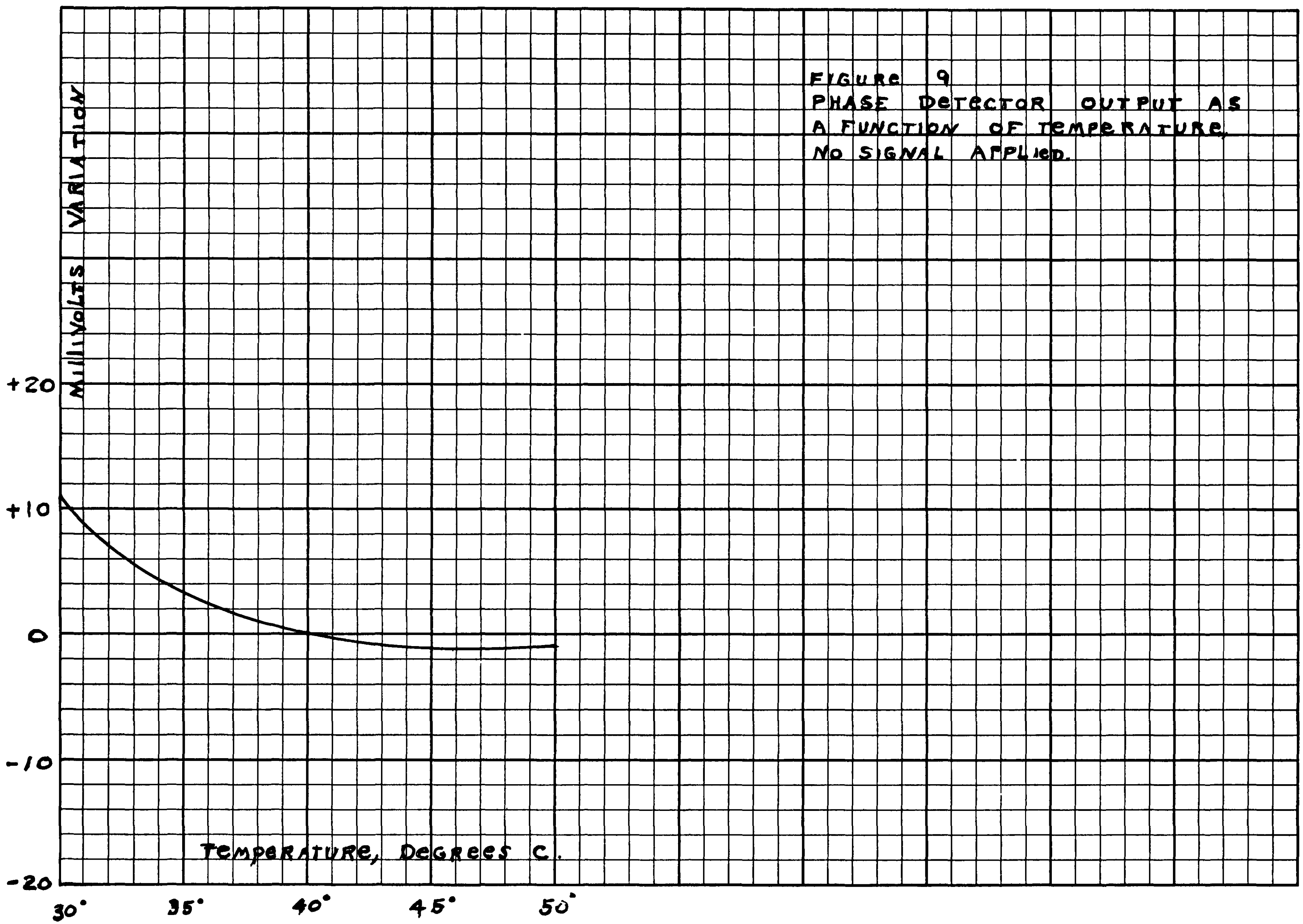


FIGURE 9
PHASE DETECTOR OUTPUT AS
A FUNCTION OF TEMPERATURE,
NO SIGNAL APPLIED.
MILLIVOLTS VARIATION
+20
+10
0
-10
-20
30°
35°
40°
45°
50°
TEMPERATURE, DEGREES C.

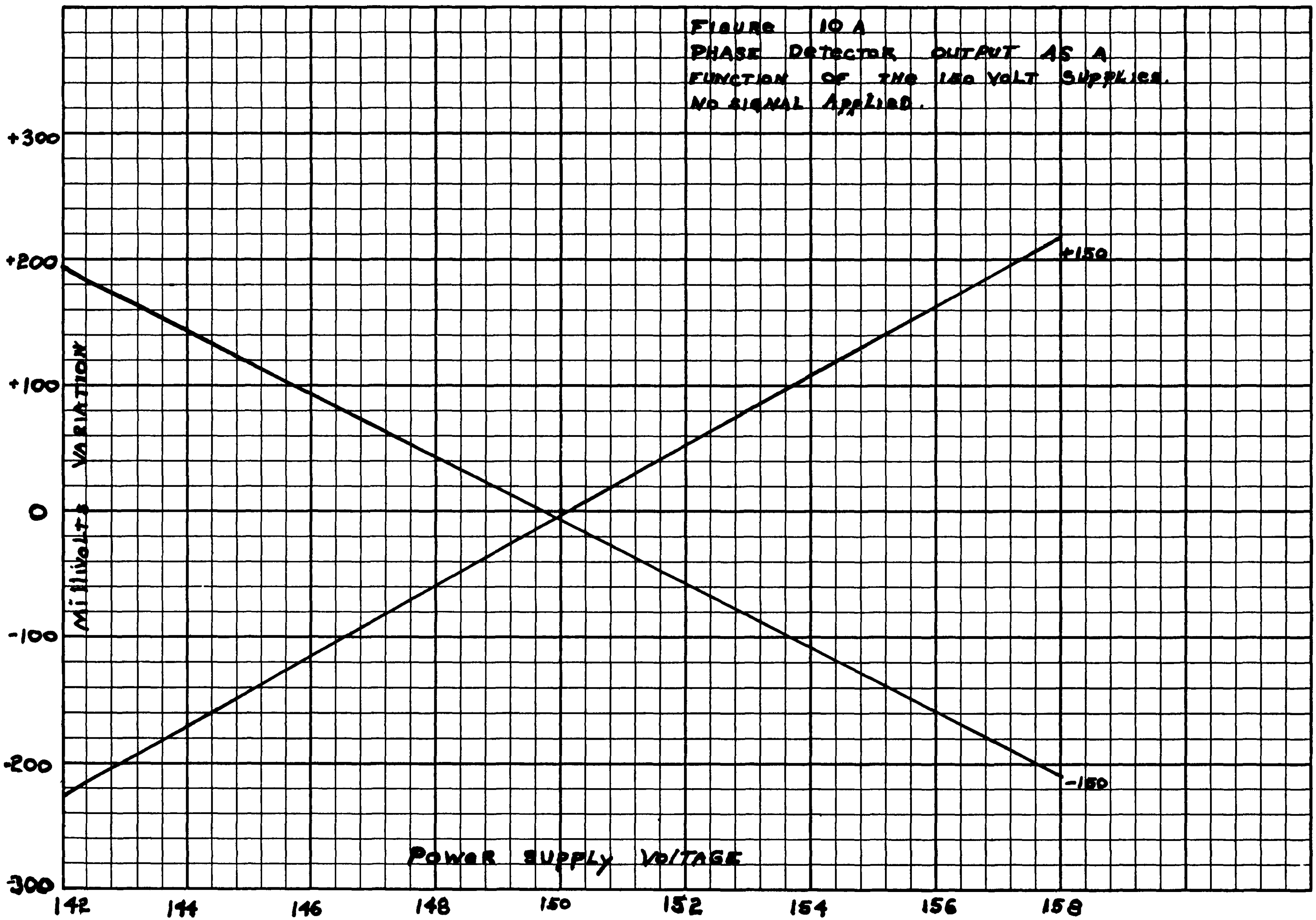


Figure 10 A
Phase Detector Output as a Function of the 150 Volt Supplies.
No Signal Applied.

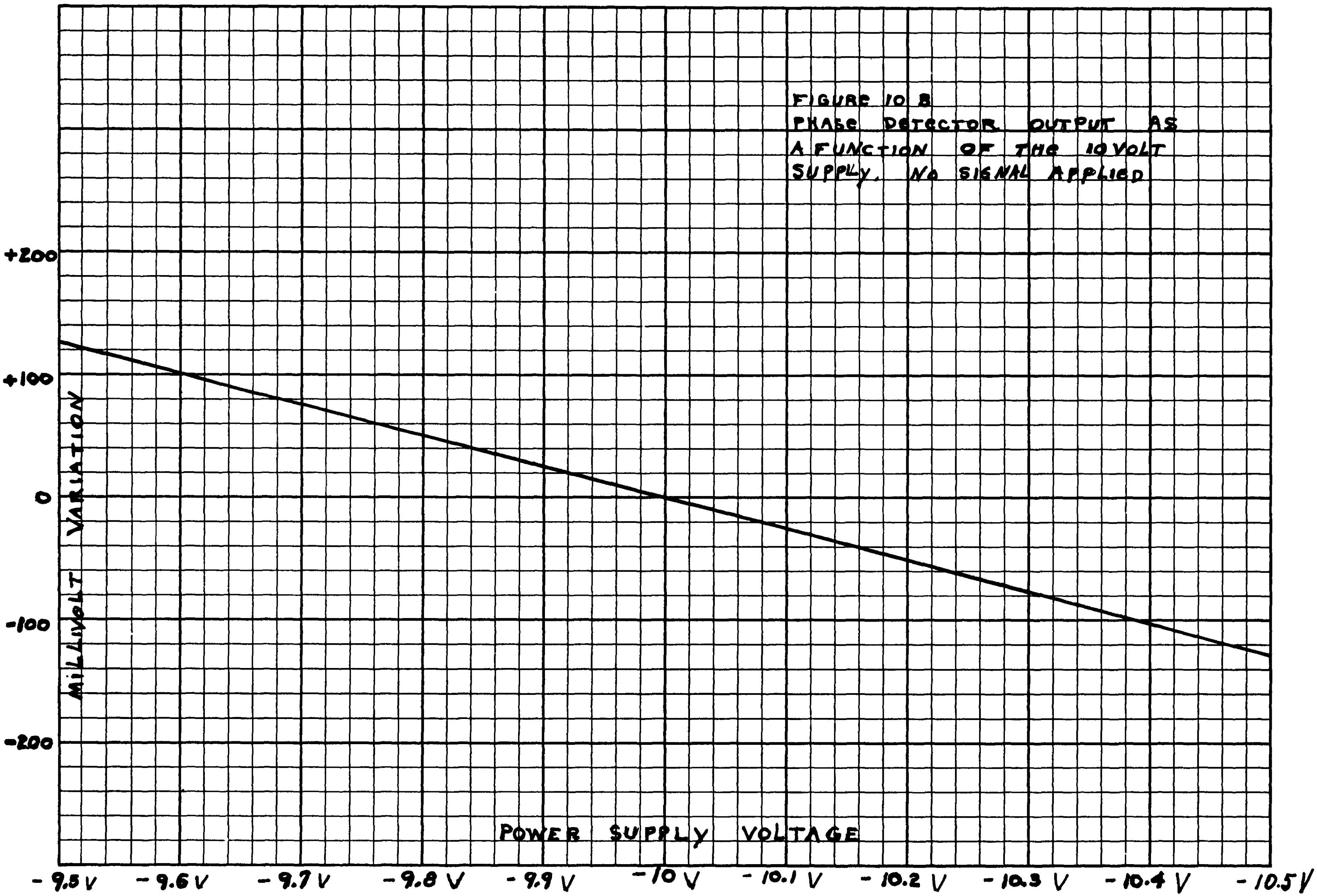


FIGURE 10 B
PHASE DETECTOR OUTPUT AS
A FUNCTION OF THE 10 VOLT
SUPPLY. NO SIGNAL APPLIED
+200
+100
0
-100
-200
MILLIVOLT VARIATION
POWER SUPPLY VOLTAGE
- 9.5 V
- 9.6 V
- 9.7 V
- 9.8 V
- 9.9 V
-10 V
- 10.1 V
- 10.2 V
- 10.3 V
- 10.4 V
- 10.5 V

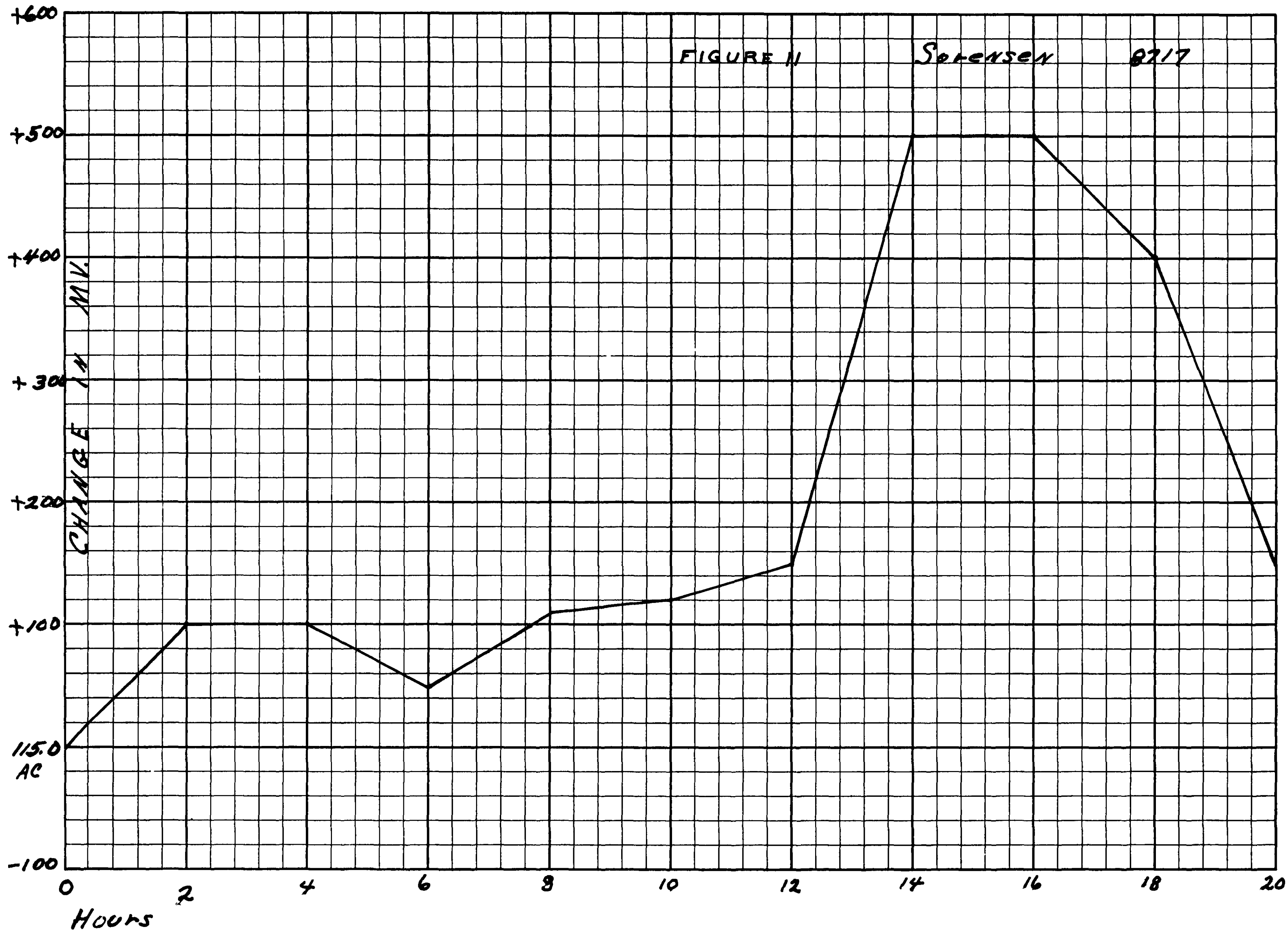


FIGURE 11
Sorensen
8717
CHANGE IN MV.
+600
+500
+400
+300
+200
+100
115.0 AC
-100
0
2
4
6
8
10
12
14
16
18
20
Hours

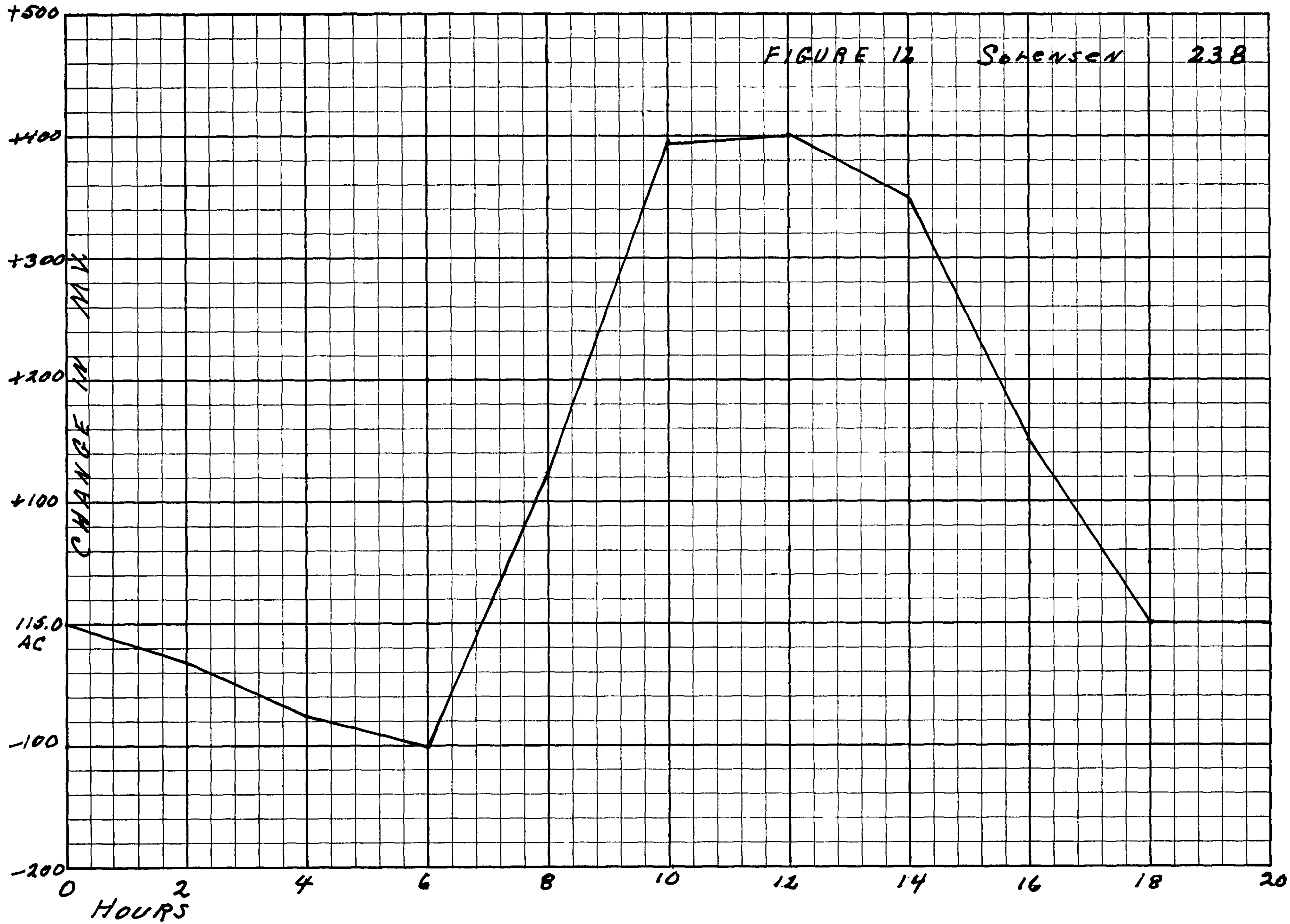


FIGURE 12
Sorensen
238
CHANGE IN MV
+500
+400
+300
+200
+100
115.0 AC
-100
-200
0
2
4
6
8
10
12
14
16
18
20
HOURS

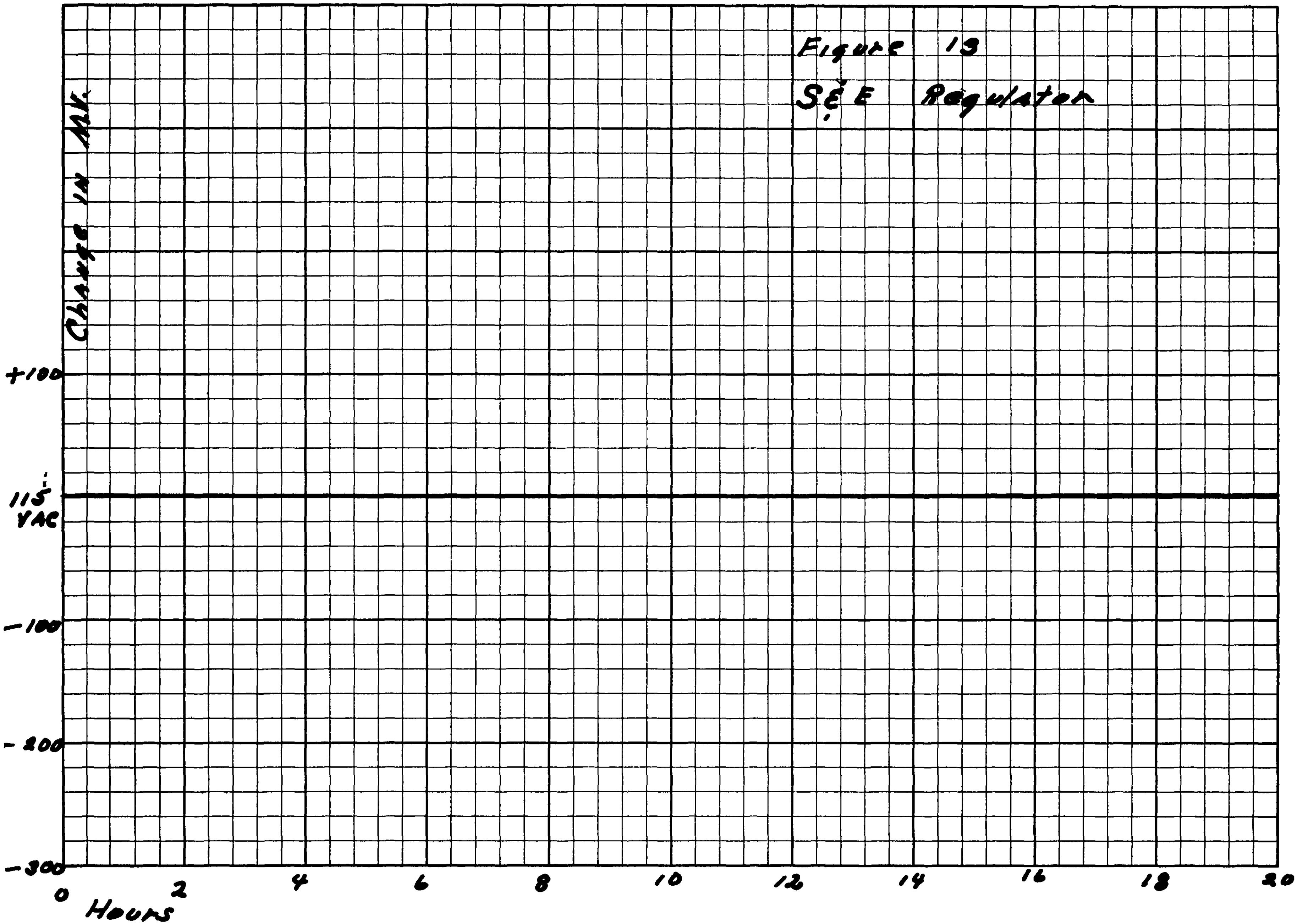
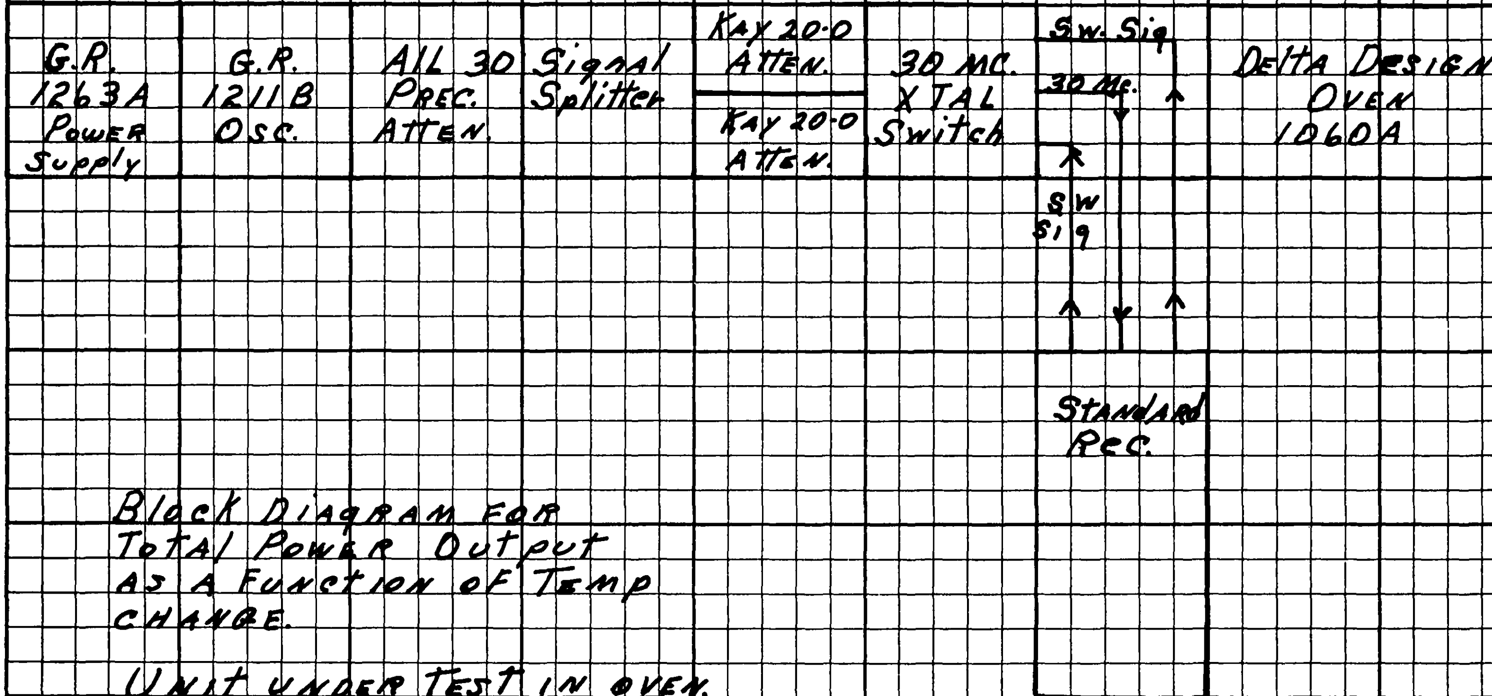


Figure 13
S&E Regulator
Change in MV.
+100
115 VAC
-100
-200
-300
0
2
4
6
8
10
12
14
16
18
20
Hours

FIG, 14



Block Diagram for
Total Power Output
as a Function of Temp
Change.

Unit under test in oven.

FIG. 15

Output verses Fil. & B+ change