DATE
SHEET 1 OF 15

TMC SPECIFICATION NO. S657 | A

COMPILED | CHECKED RK CMP

TITLE:

Ben Kohn BL
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GENERAL DESCRIPTION, PERFORMANCE SPECIFICATION,

THEORY OF OPERATION AND TROUBLE SHOOTING DATA

FOR THE
SBS-1 POWER SUPPLY
SBS-2 POWER SUPPLY
MFP-1 POWER SUPPLY (SEE SHEET 15)

TMC SPECIFICATION NO. S 657 A

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CHARTS AND GRAPHS

TMC SPECIFICATION NO. S657 A

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1. GENERAL DESCRIPTION:

The SBS-1 Power Supply Section is a self contained power supply used not only to supply power to the SBS-1 but to the TMC Model AFC-2 as well when the two are combined in the SBC-1 system. The supply also provides power to the TMC model HFR-1 in some combinations of the DDR-5 receiver systems. In the DDR-5 system, the power supply is re-designated SBS-2 Power Supply Section and supplies power to the AFC-3 as well as the SBS-2. The supply provides B+, C-, oven heater voltage and primary A.C. to the system.

1.1 Physical Size: The power supply is designed to fit on top of the filter chassis of the SBS-1 and is fastened by seven screws holding the supply to the sideplates. The power supply is 16 3/4" wide x 5 1/2" deep x 5 1/8"high and weighs approximately 30 pounds.

1.2 Output Connections: Three TMC type JJ-200 quick disconnect multi-conductor jacks are used to connect the various units to the power supply. The input power receptacle is a TMC type JJ-235, three prong twist lock. Three fuses are used within the unit to provide overload protection for the B+, C- and A.C. Line and are located on the rear plate.

1.3 Switches & Controls: The power supply requires remote turn-on by the SBS-1 through interconnect jack J7002. A voltage adjust potentiometer is located on the rear plate for setting the B+ output voltage.

1.4 Blower: A muffin fan is contained within the power supply and is mounted on a sub-chassis which is connected to the rear plate. The fan is readily made accessable by prying off the grill in front of the fan. The fan provides forced air cooling for the SBS-1 system.

2. PERFORMANCE SPECIFICATION:

2.1 Primary A.C. Voltages: AC line voltage is supplied to the Frequency standard/oven amplifier power supply in the HFR-1 (if used) through pins A & B, J7004. AC line voltage for the AFC-2 oscillator ovens is supplied through pins A & B, J7003. Either 115V or 230V lines may be used with the proper modifications of transformer primaries.

2.2 Filament Voltages: A 6.3V 17 ampere line is used to supply filament voltage to all the units in the system. This voltage is applied to pins E & F, J7003 and J7004, and pins E,Z,W and F,Y,X of J7002. Separate filament lines for the audio channels are supplied through J7002.

2.3 Oven Heater Voltage: In addition to the oven heater voltage to the AFC-2 noted in paragraph 2.1, 6.3 volts AC is applied to pins C and D of J7002 for the ovens in the SBS-1 converter section.

2.4 Bias Voltage: A regulated bias voltage of -105 volts is supplied to the units in the system through pin H, J7002, J7003, J7004.

2.5 B+ Voltage: Regulated B+ voltage is supplied to the units in the system through pin K, J7002, J7003, J7004.

2.6 AGC Line: The AGC line from the AFC-2 is supplied to the SBS-1 through interconnection in the power supply. The HFR-1 is also connected to the AGC line within the power supply.

2.7 Remote Turn-On: The power supply may be switched from the STANDBY condition to the OPERATE condition by connecting pin U, J7002 to pin P, J7002. The POWER switch, S6208 in the SBS-1, performs this function.

3. THEORY OF OPERATION:

Power distribution and circuitry are illustrated in "Schematic Diagram, Power Supply Section", TMC drawing number CK-523 (8 SIZE). It is assumed the reader has this drawing available for reference to clarify any further explanations contained in sections 3 and 4. CK-561 (ROLL SIZE) should also be consulted.

3.1 Sequence of operation:

3.1.1 OFF: The unit will be completely OFF only if the line cord is removed from J7001 or if F7002 is open or missing.

3.1.2 Standby: When the line cord is inserted into J7001, the power supply is placed in the STANDBY condition. Primary voltage is applied to T7001 and T7002, resulting in filament voltage being applied to V7001 and V7002 by the secondary T7002. The secondary of T7001 supplies heater voltage to K7001, the TIME DELAY RELAY, as well as oven heater voltage to pins C & D, J7002. One side of this line is also connected to the coil of K7002, the ON/OFF relay. In the STANDBY position, A.C. line voltage is applied directly to pins A & B, J7003 and J7004. The STANDBY indicator in the SBS-1 is across the oven heater line and will light.

3.1.3 Time Delay: If the POWER switch S6208 in the SBS-1 is set to the POWER ON position immediately upon insertion of the line cord, the unit will remain in the STANDBY position for a nominal 60 seconds before switching to POWER ON. This is the time required for

TIME DELAY RELAY K7001 to close. The time delay is required on initial turn-on to allow regulator tubes V7001 and V7002 the proper cathode warm up period. The relay and regulator tube filaments are operated continuously and the time delay will no longer be encountered when switching from STANDBY to POWER ON after initial turn-on under the conditions noted.

3.1.4 Power On: Let us assume 60 seconds have elapsed since insertion of the line cord. K7001 has closed and we now set S6208 on the SBS-1 from STANDBY to POWER ON. Pin P, J7002 is now connected to pin U, J7002, through S6208 in the SBS-1. Connecting pins P & U places 6.3 VAC from the secondary of T7001 (the oven heater line) across the coil of ON/OFF Relay K7002 and K7002 will energize. Primary voltage is applied through K7002 to T7003. The muffin fan, B7001, will start running as 115V is applied to its windings. The secondary of T7003 supplies filament voltage to the SBS-1, AFC-2 and HFR-1 from pins 10 & 11 and filament voltage for the audio channels in the SBS-1 from pins 14 & 15 (Channel "A") and 12 & 13 (Channel "B"). The higher voltage windings will be discussed in the detailed descriptions of their associated circuits so for the present we shall say that B+ and C- will be applied to the system through J7002, J7003 and J7004. Setting S6208 from STANDBY to POWER-ON will cause the STANDBY indicator to extinquish and the POWER-ON indicator to light.

3.2 The Bias Supply Circuit: The bias supply circuit consists of a full wave rectifier, an LC filter and a Zener Diode controlled shunt regulator.

3.2.1 Rectifier and Filter: The secondary of T7003 supplies 240V RMS between terminals 5 and 7, center tapped at terminal 6. This voltage is rectified by two silicon rectifiers, CR7005 and CR7006, of type 1N547. The resultant negative D.C. voltage developed across input capacitor C7004 is approximately -160 volts. The LC filter consisting of C7004, L7001 and C7005 is used for ripple reduction and the DC voltage across C7005 is approximately -150 volts.

3.2.2 Shunt Regulator: The shunt regulator section of the bias supply is made up of a Zener Diode voltage regulator and series resistor R7014. Input voltage and load current variations are absorbed by the Zener Diode, CR7007, type 1N3006RB. The Zener breakdown voltage is a nominal -105 volts. The diode regulator maintains this voltage by adjusting its Zener current to vary the IR drop across R7014. As a result of this characteristic, diode dissipation will be max. at min. load. CR7007 dissipates a maximum power of 7 watts. The Zener Diode acts against ripple variations in the same manner as input voltage variations and the ripple output of the bias supply is less than 1MV with 125 volts line voltage at full load.

3.3 The B+ Supply: The B+ supply is comprised of a bridge type full-wave rectifier, filter capacitor, and output voltage regulator.

3.3.1 Rectifiers and Filter: The secondary of T7003 provides a 270V RMS output between terminals 8 and 9 for rectification by a full-wave bridge circuit consisting of CR7001, CR7002, CR7003, and CR7004 of type 1N547. A 50 ohm surge resistor, R7012, is used to prevent excessive surge currents from destroying the silicon diodes in the bridge circuit. The resultant D.C. output voltage across C7003 is a nominal +300 volts at full load. This voltage will exceed 400 volts under no load conditions.

3.3.2 Regulator Section: The B+ regulator section is comprised of four sub-sections; a series regulator or passing tube, V7001; a D.C. amplifier tube, V7002; a voltage reference, CR7007 (Zener bias regulator); and a comparator network of R7006,R7007 and R7008. The voltage between F7001 and ground is B+.

a. The output voltage between F7001 and ground is the difference between the voltage across C7003 and the voltage drop across V7001. V7001 acts as a variable resistor, controlled by its grid potential.

b. The plate of V7002 is direct coupled to the grids of V7001 through parasitic suppressors R7004 and R7005. It can be seen that the plate of V7002 and the grids of V7001 are at the same potential and a change in V7002 plate voltage will change the resistance of V7001.

c. The comparator network of R7006, R7007 and R7008 is connected between F7001 and CR7007. The arm of potentiometer R7007 is direct coupled to the grid of the D.C. amplifier tube.(Pin 1 of V7002). The difference between the voltage at the arm of R7007 and the cathode of V7002 is the bias voltage for V7002 and hence will determine the quiescent point of the tube. The plate voltage at this point will determine the grid voltage of V7001 and hence the output voltage at F7001. The output voltage at F7001 can be adjusted by changing the position of the arm of R7007 and should normally be set at 200 volts.

d. If the voltage across CR7007 is a constant, then any change in output voltage at F7001 will produce a change of grid bias on V7002 and a resultant change in the resistance of V7001. The change in this resistance and the resultant I.R. drop across V7001 will compensate for the original change at F7001 and maintain the output voltage at F7001 a constant. The circuit operates as a closed loop system to compensate for line voltage variations and changes in load current.

e. Let us assume that the voltage at F7001 is adjusted for 200 volts at a constant load. If the line voltage decreases, the D.C. input voltage to the regulator will decrease across C7003.

The output voltage at F7001 will also decrease as a result, causing the grid of V7002 to go more negative. Plate current in V7002 will decrease with a resultant increase in V7002 plate voltage. The grid of V7001 will become less negative with respect to the cathode,causing the resistance of V7001 to decrease. The voltage drop across V7001 will decrease, causing the output voltage at F7001 to return to 200 volts.

f. If the line voltage increases, the input to regulator will increase, causing an increase in output voltage. This increase in output voltage will cause the grid of V7002 to go less negative increasing the plate current. The plate current increase will cause a reduction in plate voltage and therefore the grid of V7001 will become more negative with respect to the cathode. The resistance of V7001 will increase and the voltage drop across V7001 will increase to reduce the output voltage to 200 volts. The regulator acts against ripple voltage in a similiar manner.

g. Let us assume that the line voltage is constant, and that the output voltage is adjusted at 200 volts between F7001 and ground at a certain load current. The load in this case being across F7001 and ground. If the load current increases, the output voltage across the load will decrease due to a re-division of voltage between V7001 and the load. A feedback action as in paragraph (e) occurs, returning the output voltage to 200 volts.

h. If the load current decreases, the output voltage at F7001 will increase due to a re-division of voltage between V7001 and the load. A feedback action as in paragraph (f) occurs, returning the output voltage to 200 volts.

4. TROUBLE SHOOTING DATA

This section is devoted to aiding the technitian in locating troubles which may develop in the power supply.

4.1 Normal Operation: Figures 4.1.1, 4.1.2, 4.1.3 and 4.1.4 show normal performance of the power supply. The unit is fully tested at the factory to insure proper operation and no adjustment of any kind is required upon installation of the equipment.

4.2 Voltage Measurements: Before voltage measurements can be made, the power supply section must be removed from the SBS-1 chassis. Fig. 4.2.1 shows power supply removal. The bottom of the power supply is open to facilitate access to components and tube sockets. After removal, the power supply may be turned upside—down and and the SBS-1 reconnected to J7002.

4.2.1 Voltage Measurement Chart: Terminal board TB7001 mounts almost all of the circuit components and is a handy place to perform voltage measurements Figure 4.2.2 shows the board with numbered test points for voltage measurement. The chart of Fig. 4.2.2 refers to these test points. All D.C. voltage measurements made with a 20,000-ohms-per-volt meter. A.C. voltages measured with a DAVEN model 861 VTVM. The voltages noted are for 115V line voltage.

4.2.3 Adjustment of B+ Voltage: The output of the B+ supply should be adjusted at 200 volts with the system units connected and working. Place a voltmeter between F7001 and ground and adjust R7007 for 200 volts. F7001 is accessable through the top cover.

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COMPILED	RK CHECKED	TITLE: FIG. 4.1.1	
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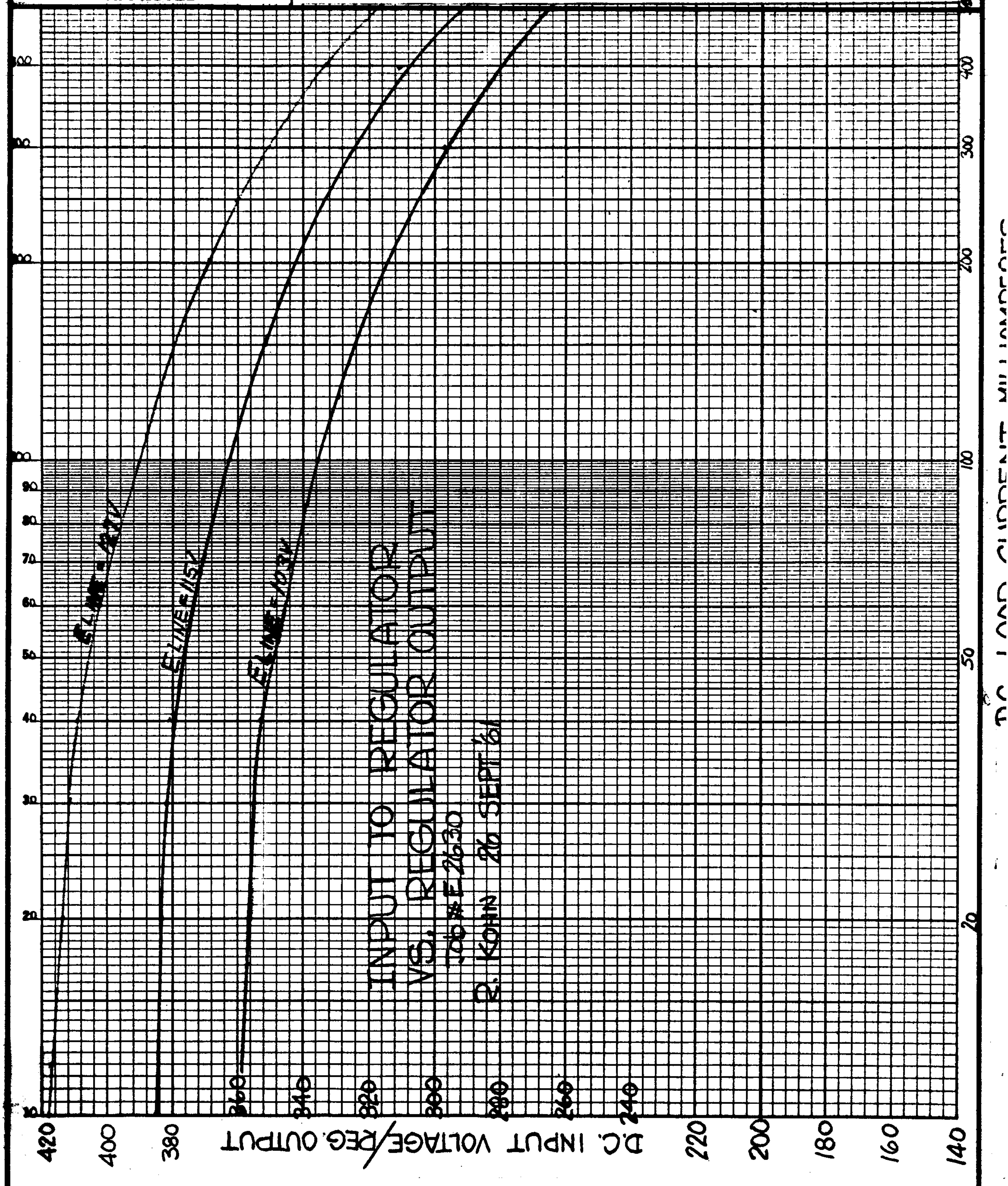

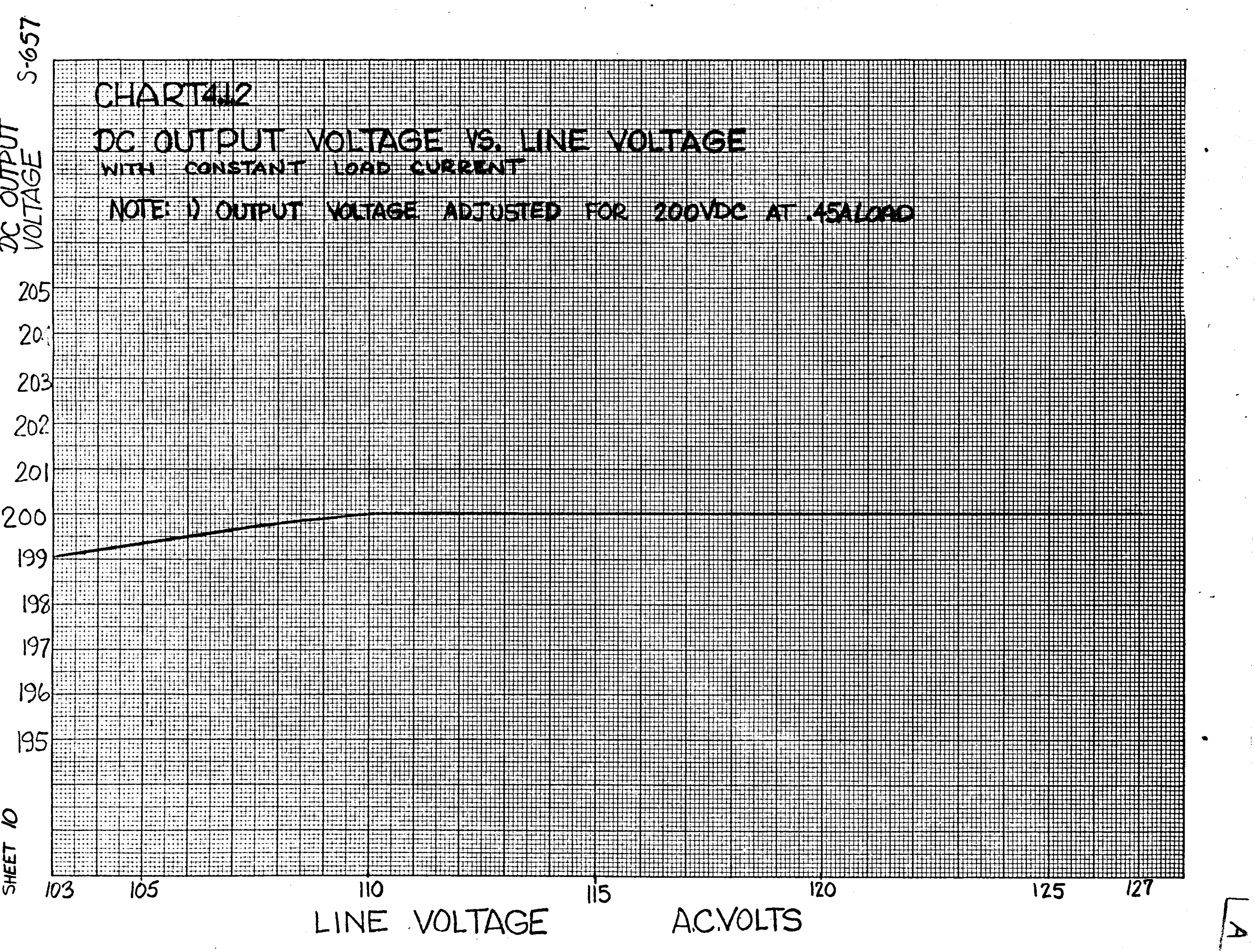
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CHART 4.12
DC OUTPUT VOLTAGE VS. LINE VOLTAGE
WITH CONSTANT LOAD CURRENT
NOTE: 1) OUTPUT VOLTAGE ADJUSTED FOR 200VDC AT .45A LOAD
DC OUTPUT VOLTAGE
205
203
202
201
200
199
198
197
196
195
103
105
110
115
120
125
127
LINE VOLTAGE A.C.VOLTS
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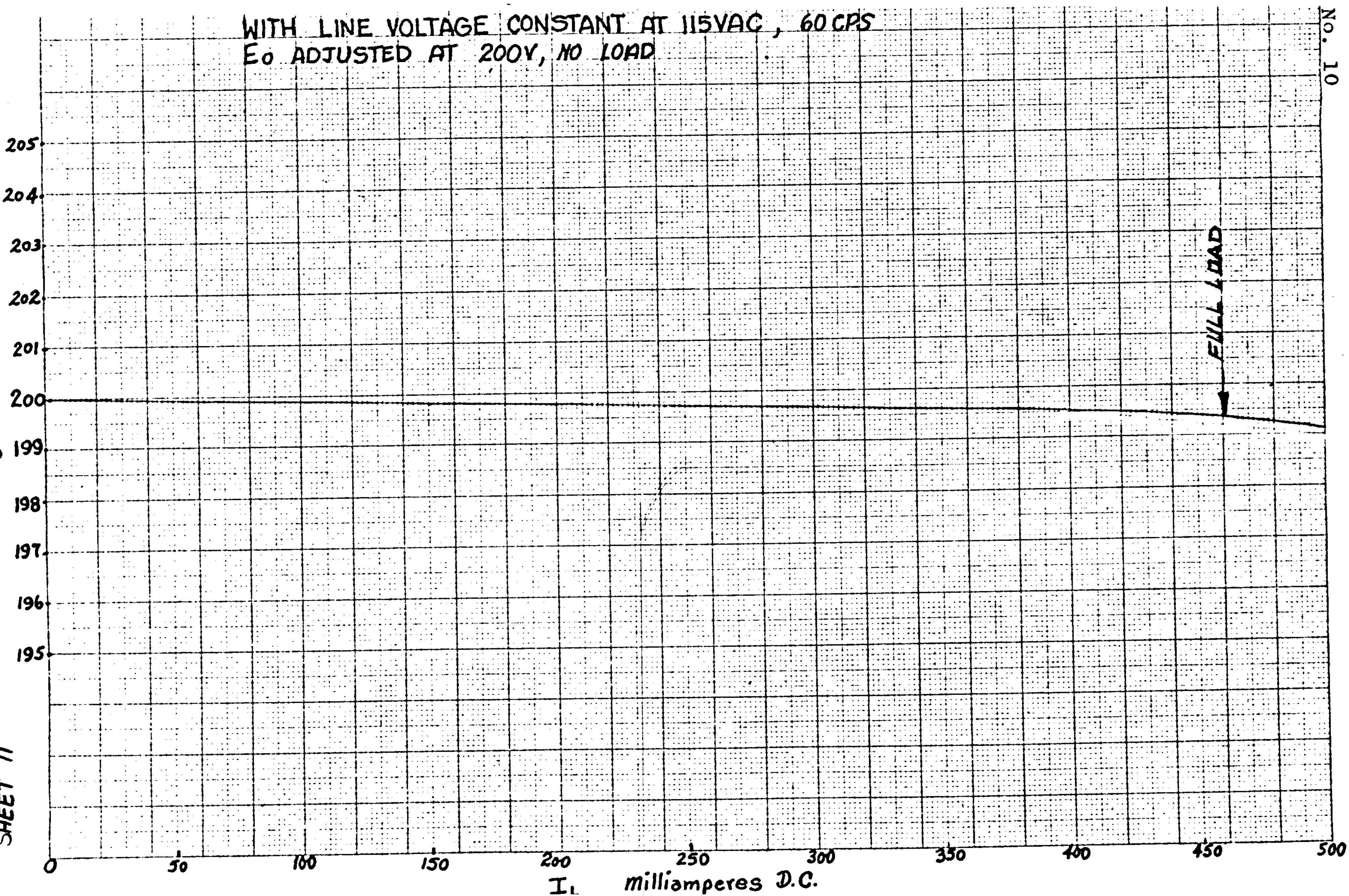
FIG. 4.1.3 D.C. OUTPUT VOLTAGE VS. LOAD CURRENT



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COMPILED	CHECKED RK	TITLE: FIG. 4.1.4	
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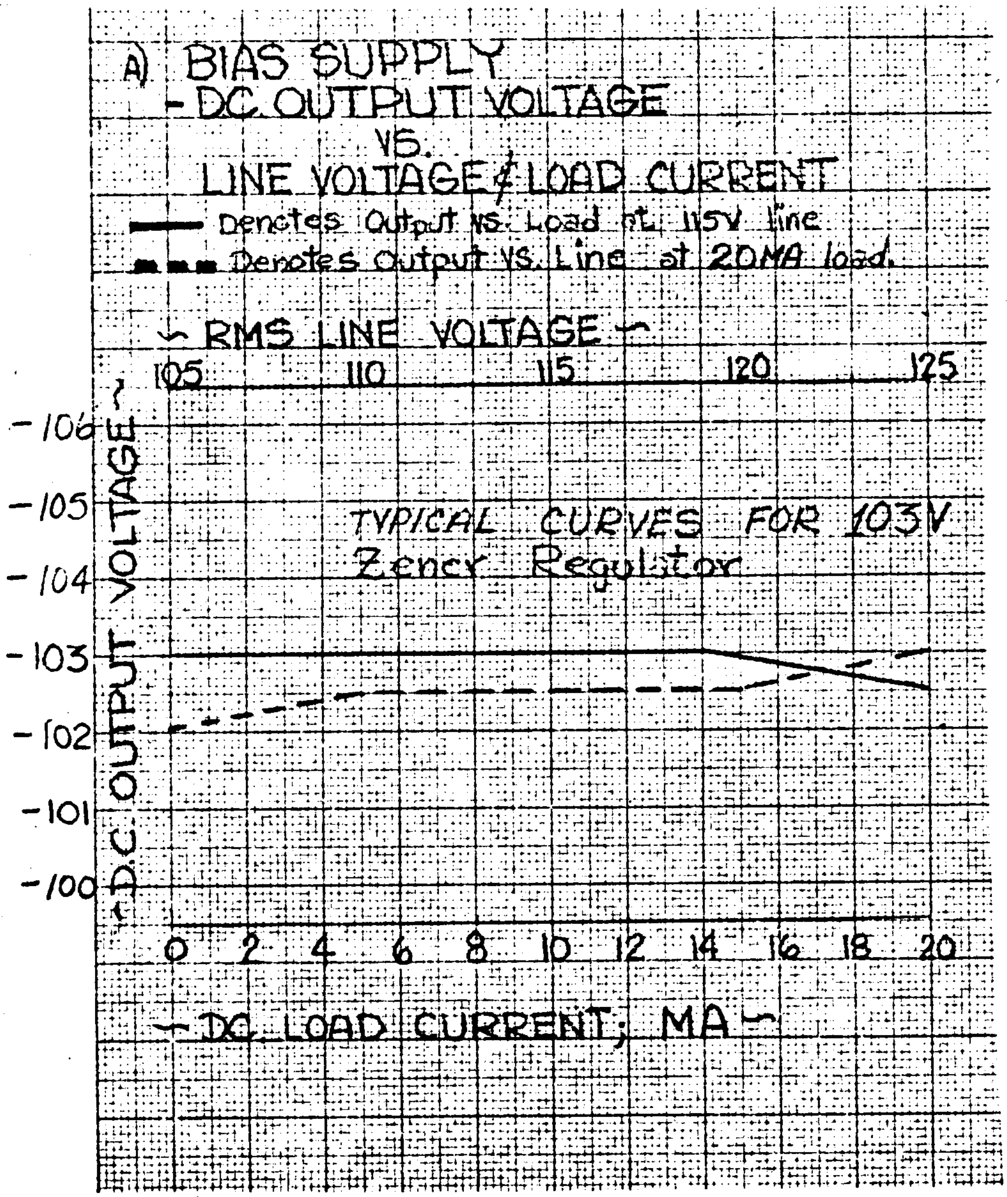

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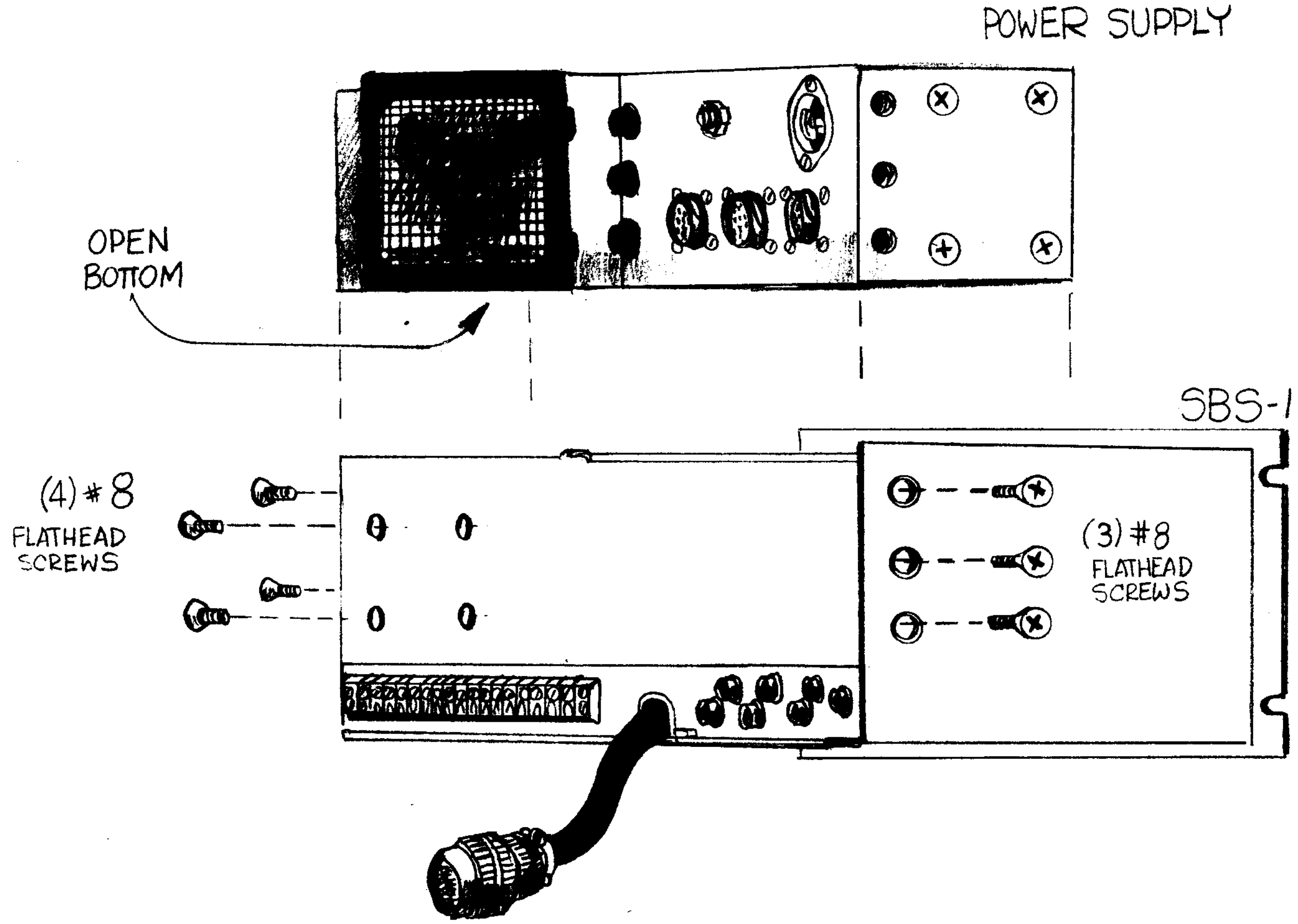
COMPILED / CHECKED RK	TITLE: FIG. 4.2.1	
APPROVED		



SBS-1 Power Supply Removal

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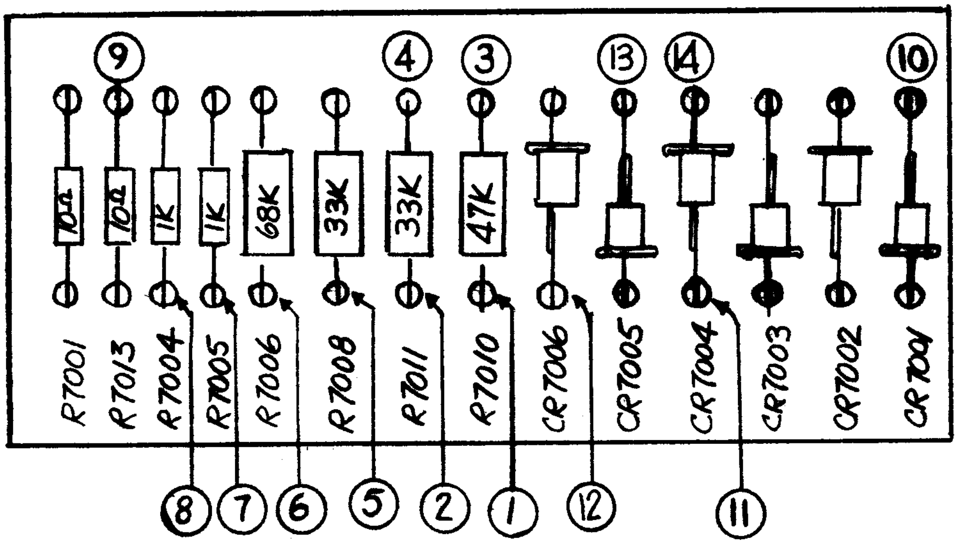
COMPILED	CHECKED RK	TITLE: FIG. 4.2.2.	
APPROVED RK			



Voltage Measurement Chart for TB 7001

FROM	TO	NORMAL D.C. VOLTAGE AT: NO LOAD	FULL LOAD	NORMAL AC VOLTAGE	REMARKS
TP #1	GND	380	290	—	Plate of V7001
TP #2	GND	380	290	—	Plate of V7001
TP #3	GND	130	195	—	Plate of V7002
TP #4	GND	320	270	—	Screen of V7002
TP #5	GND	-105	-105	less than 1MV RMS	Output of bias supply See FIG. 4.1.4
TP #6	GND	200	200	less than 100 MV RMS	Output of B+ supply See FIG.4.1.2 and 4.1.3
TP #7	GND	130	195	—	Pin 1,V7001.Control Grid.
TP #8	GND	130	195	—	Pin 4,V7001.Control Grid.
TP #9	GND	-160	-160		Output of bias rectifi rs

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TITLE: FIG. 4.2.2 Continued

Voltage Measurement Chart for TB 7001

FROM	TO	NORMAL D.C. VOLTAGE AT:		NORMAL AC VOLTAGE	REMARKS
		NO LOAD	FULL LOAD		
TP #10	TP #11	—	—	270 RMS	Input to B+ bridge rectifiers
TP #12	TP #13	—	—	240 RMS	Full secondary voltage input to bias rectifiers
TP #14	GND	380	310	—	Output of B+ bridge rectifiers.

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ADDENDUM

1. GENERAL DESCRIPTION

Add
A third application of this supply is to power the MULTIPLEX NOTCH FILTER MODULES in the MSGA-1 system, and when so used, shall be known as the MFP-1.

3.1.3 TIME DELAY

Add
It shall be noted that the indicator lamp on front panel will be lit in TIME DELAY SEQUENCE when unit is packaged as an MFP-1.

3.1.4 POWER ON

Add
It shall be noted that indicator lamp will be lit when in OPERATE CONDITION, when unit is packaged as an MFP-1.

REVISION SHEET | **THE TECHNICAL MATERIEL CORP.** **MAMARONECK NEW YORK** | S-657 LIST NO.

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