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TMC SPECIFICATION NO. S 635

TITLE:

GENERAL DESCRIPTION, PERFORMANCE SPECIFICATIONS,

THEORY OF OPERATION AND TROUBLE SHOOTING DATA

FOR TMC MODEL HFP-1 POWER SUPPLY

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CHARTS AND GRAPHS

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1. GENERAL DESCRIPTION

The TMC model HFP-1 is a self-contained power supply used to supply A, B+, C-, primary A.C. and blower voltage for the individual units comprising the TMC model DDR-5 receiver systems.

1.1 Physical Size: The HFP-1 is designed for rack mounting on non-tilt slides. The panel space required for the unit is the standard 19" width and 5¼" height. Chassis depth excluding rear interconnecting plugs is approximately 18" and the unit weighs approximately 65 pounds.

1.2 Output Connections: Six TMC type JJ-200 quick-disconnect multi-conductor jacks and three TMC type JJ-235 three prong twist-lock AC outlets are used to connect the various units within the system to the power supply. All the HFP-1 voltage outputs are separately fused. The B+ LINE and FIL. LINE fuses are located on the front panel. The remaining eight fuses are located on a fuseholder mounting chassis directly behind the front panel.

1.3 Switches & Controls: The HFP-1 has no front panel mounted switches or controls. The MAIN POWER switch on the rear plate controls all power input to the system and is used to set the HFP-1 from OFF to STANDBY. To go from STANDBY to OPERATE, remote turn-on through interconnecting jack J8005 is required. Two VOLTAGE ADJUST potentiometers for the B+ voltage regulator sections are located beneath the top cover, front section.

2. PERFORMANCE SPECIFICATIONS

2.1 Primary A.C. Voltages: The HFP-1 supplies primary A.C. line voltage to the TMC model DVM (if used) through jack J8003; to the rack blower through J8004, to the TMC model AFC-3 ovens through J8009 and to the frequency standard power supply located in the HFR-1 (if used) through J8010. A utility outlet J8002 is provided to supply primary line voltage to other units when used. Either 115V or 230V lines may be used with the proper modification of transformer primaries.

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2.2 Filament Voltages: Two external filament lines are utilized to supply filament power to the rack mounted units. The combined output of these lines is 6.8 volts at 34 amperes. Individual filament lines are provided for the two audio channels, 6.3 volts at 1.5 amperes each.

2.3 Oven Heater Voltages: The HFP-1 supplies 6.3 volts at 5.5 amperes to TMC model SBS-2 (if used) for oscillator crystal ovens.

2.4 Bias Voltage: A regulated bias voltage of -105 volts is supplied to jacks J8005, J8008, J8009 and J8010 for distribution to the individual units requiring it.

2.5 B+ Voltage: Two regulator sections provide a +200 volt 1 ampere total capacity. The B+ voltage is adjustable internally and is regulated $\pm$ 1% against line voltage variations between 105 and 125 volts at full load and load current variations from zero to full. B+ voltage is distributed to the individual units through jacks J8005, J8006, J8007, J8008, J8009, and J8010.

2.6 AGC Line: The HFP-1 interconnects the RF section of the receiver with either the HFI-1 or the AFC-3/SBS-2 combination for the application of AGC voltage.

2.7 Remote Turn-On: The HFP-1 may be switched from the STANDBY position to the TIME DELAY position and then automatically to OPERATE by grounding pin U, J8005. TMC model HFA-1 performs this function in most systems, the TMC model SBS-2 in others.

3. THEORY OF OPERATION

Power distribution and operational sequence are best illustrated in BLOCK DIAGRAM, HFP-1, engineering sketch number (4) E-1597. Component values and circuitry are shown in SCHEMATIC DIAGRAM, HFP-1, TMC drawing number CK-546 (8 size). It is assumed the reader has these drawings available for reference to clarify any further explanations contained in sections 3 and 4.

3.1 Sequence of Operation:

3.1.1. Off-Standby: With A.C. line voltage applied to J8001, setting the MAIN POWER switch S8001 to the STANDBY position will place the HFP-1 in a standby condition as indicated by DS-8001 (Green). In this condition, A.C. line voltage is applied to J8002 through F8001 and F8002 and to the primaries of T8001 and T8002 through F8003 and F8004. A.C. line voltage is also applied to J8009 and J8010. The secondary of T8001 supplies 6.3 volts A.C. between terminal 5 and ground. The filament circuit for DS-8001 through R8001 is completed to ground by a normally closed contact of K8001, causing DS-8001 to light. The secondary voltage of T8002 supplies 6.3 volts between pins C and D of J8005 for the crystal ovens used in TMC model SBS-1. The A.C. line voltage applied between pins A and B on J8009 is utilized by the oscillator ovens in TMC model AFC-2. The standard power supply in the TMC model HFR-1 is provided with primary voltage through pins A and B, J8010. If TMC model HFF-1 is used instead of the HFR-1, the filament transformer primary in the HFF-1 supplied through pins A and B. If an external frequency standard such as the TMC model CSS-1 is used, it should be connected to J8002 to insure its operating in the STANDBY condition. It can be seen from the above explanation that the frequency standard and oscillator ovens will be operating when the HFP-1 is in the STANDBY position. MAIN POWER switch S8001 should be left in the STANDBY position for normal operation and should be set in the OFF position for rack or power supply servicing only.

3.1.2. Time Delay: The TIME DELAY step is necessary to allow the series regulator and D.C. amplifier tubes in the B+ regulators a sufficient cathode (30 sec. min) warm-up period. The nominal duration of the time delay step before the unit will automatically switch to OPERATE is one minute.

When the operator wishes to place the unit. (DDR-5 etc.) into the OPERATE position from STANDBY, he will set the STANDBY-ON switch located on the HFA-1 or SBS-2 to the ON position. This action will short pins U and P of J8005, completing the coil voltage circuit to Control Relay K8001 and causing K8001 to energize. Filament voltage will be removed from DS-8001 and applied to Time Delay Indicator DS-8002 (amber) through the normally op n contact of K8001 and the normally closed contact of K8002.

cont'd.

3.1.2 Heater voltage is applied to Time Delay Relay K8003 through the normally open contact of K8001 which completes the filament circuit of K8003 to ground. Line voltage is applied to two normally open contacts of K8002, to J8003 and J8004 and to the primaries of T8003 and T8004,,through K8001. The secondary of T8003 supplies 6.3 volts filament voltage to V8001 and V8002 in B+ regulator section "A" and the secondary of T8004 supplies 6.3 volts filament voltage to V8003 and V8004 in B+ regulator section "B".

3.1.3 Operate: After a nominal period of one minute, K8003 will close. The coil voltage circuit to Operate. Relay K8002 is now completed and K8002 will energize. Filament voltage is removed from DS-8002 and DS-8002 will exstinguish. Heater voltage is maintained on K8003 to insure instantaneous re-cycling if a momentary loss of line voltag is encountered. A loss of line voltage in excess of approximately 30 seconds will cause K8003 to open and thus insure a time delay on re-cycle. Primary voltage is applied through K8002 to T8005 and T8006. The secondary of T8005 supplies Fil Line "A" voltage through F8009. F8011 and F8015 to output jacks J8006, J8007 and J8009. T8005 also supplies channel "A" and channel "B" filaments for th two audio channels to output jack J8005. The secondary of T8006 supplies Fil. Line "B" voltage through F8013, F8017 and F8020 to output jacks J8005, J8008 and J8010. Filament voltage for DS-8003, th Operate Indicator, is applied by the secondary of T8006 through R8002 and DS-8003 will light (r d). The higher voltage windings of both T8005 and T8006 will be discussed in the descriptions of their associated circuits. To conclude this explanation of the OPERATE condition. We shall state that B+ will be applied to output jacks J8005, J8006, J8007, J8008, J8009, and J8010. Bias voltage will be appli d to J8005, J8008, J8009, and J8010.

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

R ctifier and Filter: Th secondary of T8005 supplies 240V RMS between terminals 5 and 7, cent r tapp d at terminal 6.

This voltage is rectified by two silicon rectifiers, CR8005 and CR8006, of type 1N547. The resultant negative D.C. voltage developed across input capacitor C8002 is approximately -160 volts. The LC filter consisting of C8002, L8001 and C8003 is used for ripple reduction and the DC voltage across C8003 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 r gulator and series resistor R8008. Input voltage and load current variations are absorbed by the Zener Diode, CR8007, 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 R8008. As a result of this characteristic, diode dissipation will be max. at min. load. CR8007 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 5MV with 125 volts line voltage at full load.

3.3 The B+ Supply; The B+ supply is comprised of two separate sections, each containing a full wave bridge rectifier, filter capacitor, and voltage r gulator. Both sections are operationally identical and though the following description refers to the "A" section of the supply, symbols can easily be exchanged for reference to the "B" section.

3.3.1. Rectifiers and Filter: The secondary of T8005 provides a 270V RMS output between terminals 8 and 9 for rectification by a full wave bridge circuit consisting of CR8001, CR8002, CR8003, and CR8004 of type 1N547. A 50 ohm surge resistor, R8003, is used to prevent excessive surge currents from destroying the silicon diodes in the bridge circuit. The resultant D.C. output voltage across C8001 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, V8001; a D.C. amplifier tube, V8002; a voltage reference, CR8012 (Zener shunt regulator); and a comparator network of R8013, R8014 and R8015. Th voltage betwe n TP8001 and ground is B+.

a. The output voltage between TP8001 and ground is the difference between the voltage across C8001 and the voltage drop across V8001. V8001 acts as a variable resistor, controlled by its grid potential.

b. The plate of V8002 is direct coupled to the grids of V8001 through parasitic suppressors R8006 and R8007. It can be seen that the plate of V8002 and the grids of V8001 are at the same potential and a change in V8002 plate voltage will change the resistance of V8001.

c. The comparator network of R8013, R8014 and R8015 is connected between TP8001 and CR8012. The arm of potentiometer R8014 is direct coupled through parasitic suppressor R8028 to the control grid of V8002. The difference between the voltage at the arm of R8014 and the cathode of V8002 is the bias voltage for V8002 and hence will determine the quiescent point of the tube. The plate voltage at this point will determine the grid voltage of V8001 and hence the output voltage at TP8001. The output voltage at TP8001 can be adjusted by changing the position of the arm of R8014 and in the HFP-1 is set at 200 volts.

d. If the voltage across CR8012 is a constant, then any change in output voltage at TP8001 will produce a change of grid bias on V8002 and a resultant change in the resistance of V8001. The change in this resistance and the resultant I.R. drop across V8001 will compensate for the original change at TP8001 and maintain the output voltage at TP8001 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 between TP8001 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 C8001. The output voltage at TP8001 will also decrease as a result, causing the grid of V8002 to go more negative. Plate current in V8002 will decrease with a resultant increase in V8002 plate voltage. The grid of V8001 will become less negative with respect to the cathode, causing the resistance of V8001 to decrease. The voltage drop across V8001 will decrease, causing the output voltage at TP8001 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 V8002 to go less negative increasing the plate current. The plate current increase will cause a reduction in plate voltage and therefore the grid of V8001 will become more negative with respect to the cathode. The resistance of V8001 will increase and the voltage drop across V8001 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 TP8001 and ground at a certain load current. The load in this case being across TP8001 and ground. If the load current increases, the output voltage across the load will decrease due to a re-division of voltage between V8001 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 TP8001 will increase due to a re-division of voltage between V8001 and the load. A feedback action as in paragraph (f) occurs, returning the output voltage to 200 volts.

3.3.3. B+ Distribution: The output of Regulator Section "A" is applied to pin K on output jacks J8005 and J8007 through fuses F8019 and F8012 respectively. The output of Regulator Section "B" is applied to pin K on output jacks J8006, J8008, J8009 and J8010 through fuses F8010, F8014, F8016 and F8018 respectively.

4. Trouble Shooting Data: This section is devoted to aiding the technition in determining troubles that may develop in the HFP-1. Charts are provided for obtaining voltage measurements and graphs illustrating unit performance are also included.

4.1. Normal Operation: Figures 4.1.1, 4.1.2, 4.1.3 and 4.1.4 show normal performance of the HFP-1 unit. The HFP-1 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 Measurement Charts: Figures 4.2.1, 4.2.2 and 4.2.3 contain charts of normal voltages to be expected during proper operation at no load and full load conditions with the line voltage at 115 volts. The B+ output voltage may creep above 200 volts when the HFP-1 is removed from the rack, due to the loss of forced air cooling and the resultant increase in operating temperature. This voltage should not be re-adjusted unless component or tube replacement is required. Re-adjustment of B+ voltage after parts replacement will be covered in section 4.3.6.

4.2.1 Procedure For Making Voltage Measurements: Because the HFP-1 is mounted on non-tilting slides, every effort has been made to make all necessary test points accessable from the top. The two component mounting boards, TB8001 and TB8002, supply a number of test points. The test points are numbered on Fig. 4.2.1 and 4.2.2. and will be used to determine tube' voltages. This method must be used as the tube sockets are not easily accessable. Figure 4.2.3 lists the proper A.C. voltages to be found at various test points on TB8001 and TB8002. To gain access to the terminal boards, remove the four screws holding the HFP-1 in the rack and slide the unit forward. Remove the FRONT SECTION of the top cover. The circuit boards will be exposed for voltage measurements. All D.C. voltages in Figs. 4.2.1 and 4.2.2 were measured to chassis ground with a 20,000-ohms-per-volt-meter. Fig. 4.2.3 notes the type meter or scope used for the voltage measurements contained therein.

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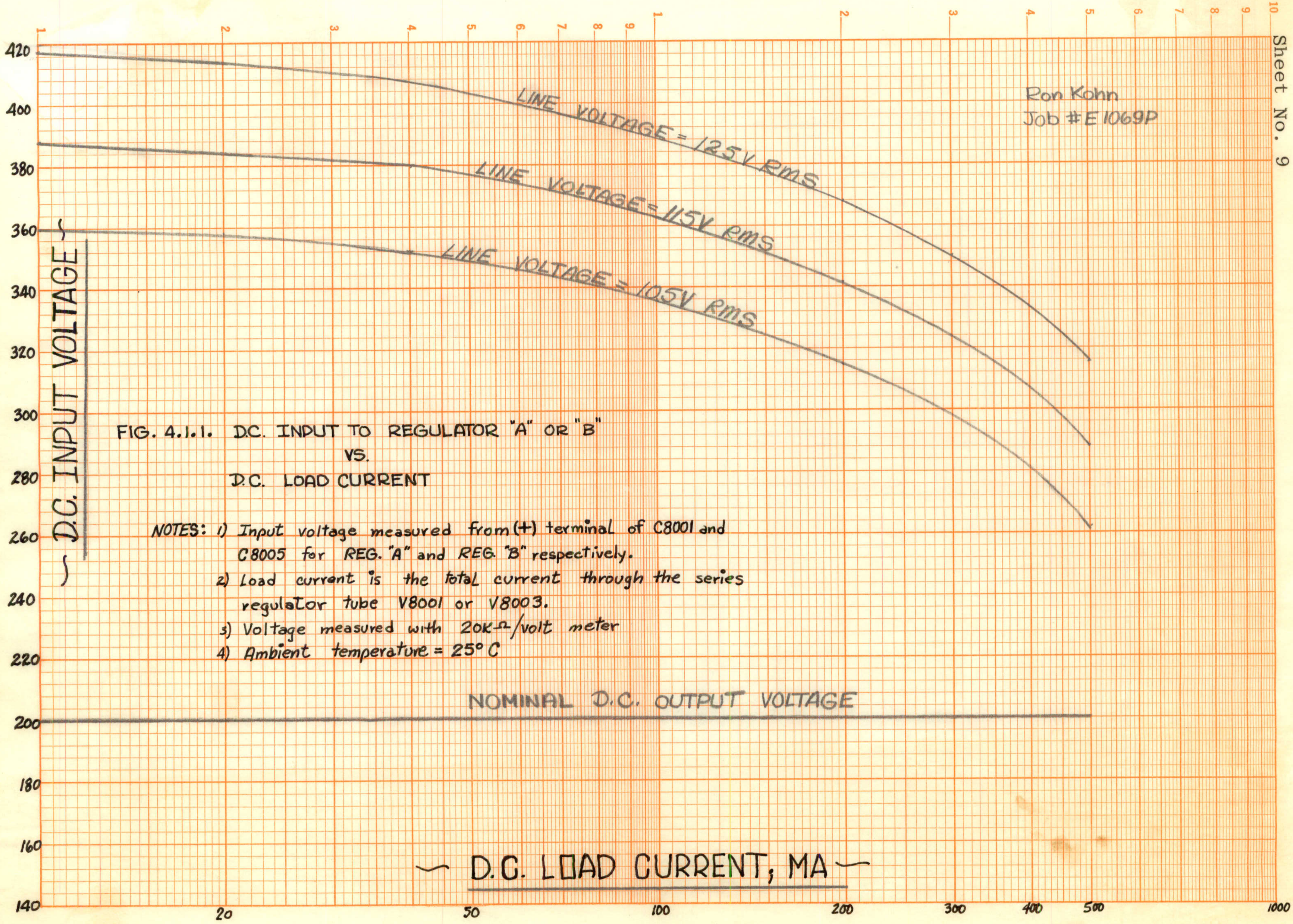

FIG. 4.1.1. D.C. INPUT TO REGULATOR "A" OR "B"
VS.
D.C. LOAD CURRENT

NOTES:
1) Input voltage measured from (+) terminal of C8001 and C8005 for REG. "A" and REG. "B" respectively.
2) Load current is the total current through the series regulator tube V8001 or V8003.
3) Voltage measured with 20KΩ/volt meter
4) Ambient temperature = 25° C

FIG. 4.1.2
HFP-1; B+ D.C. OUTPUT VOLTAGE VS. LOAD CURRENT

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WITH LINE VOLTAGE CONSTANT AT 115VAC, 60 CPS
Eo ADJUSTED AT 200V, NO LOAD

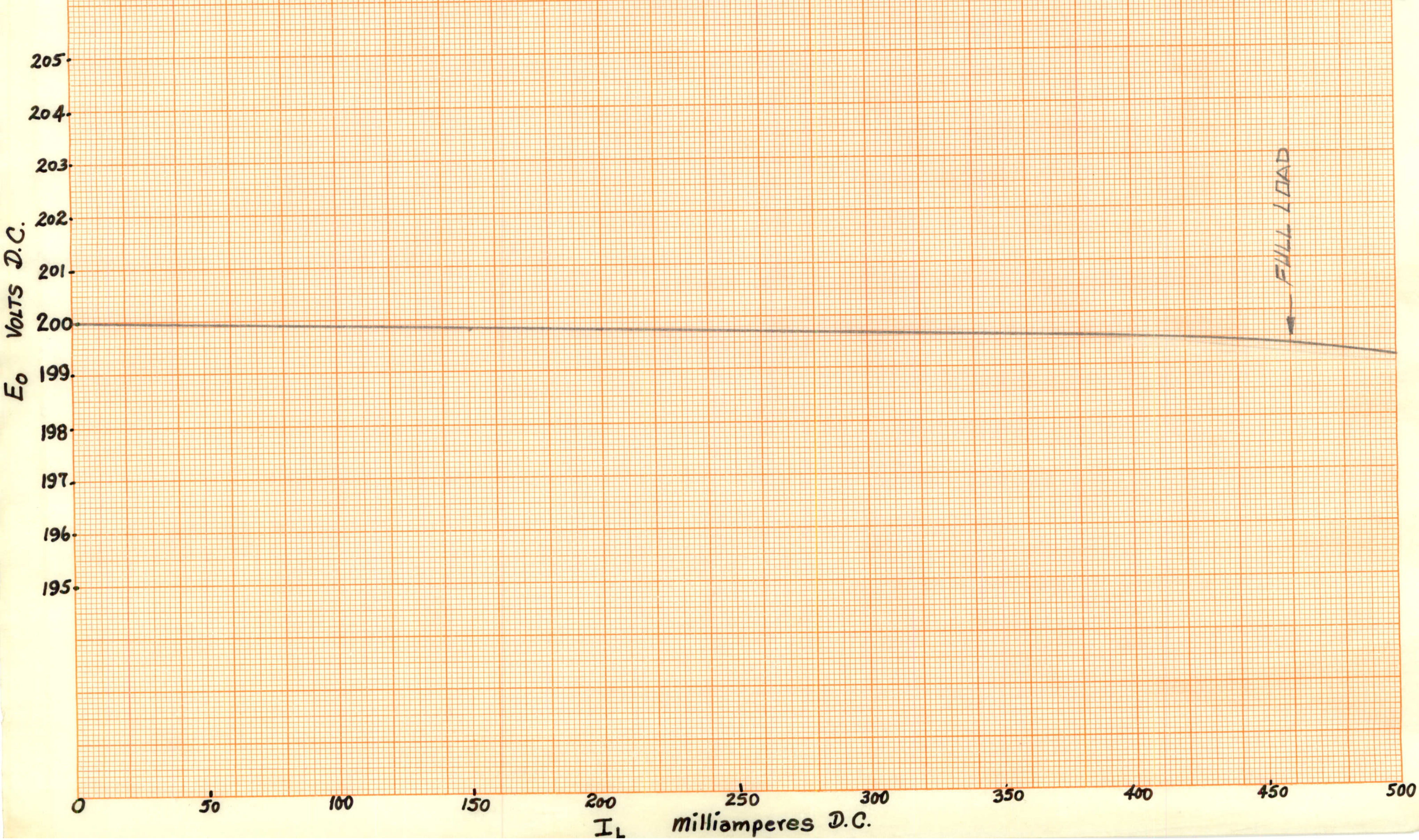

FIG. 4.1.3
HFP-1; B+ SUPPLY OUTPUT VOLTAGE VS. LINE VOLTAGE
WITH CONSTANT LOAD

NOTES: D.C. OUTPUT VOLTAGE ADJUSTED AT 200 VOLTS WITH 460 MA
LOAD CURRENT AT 115V LINE VOLTAGE

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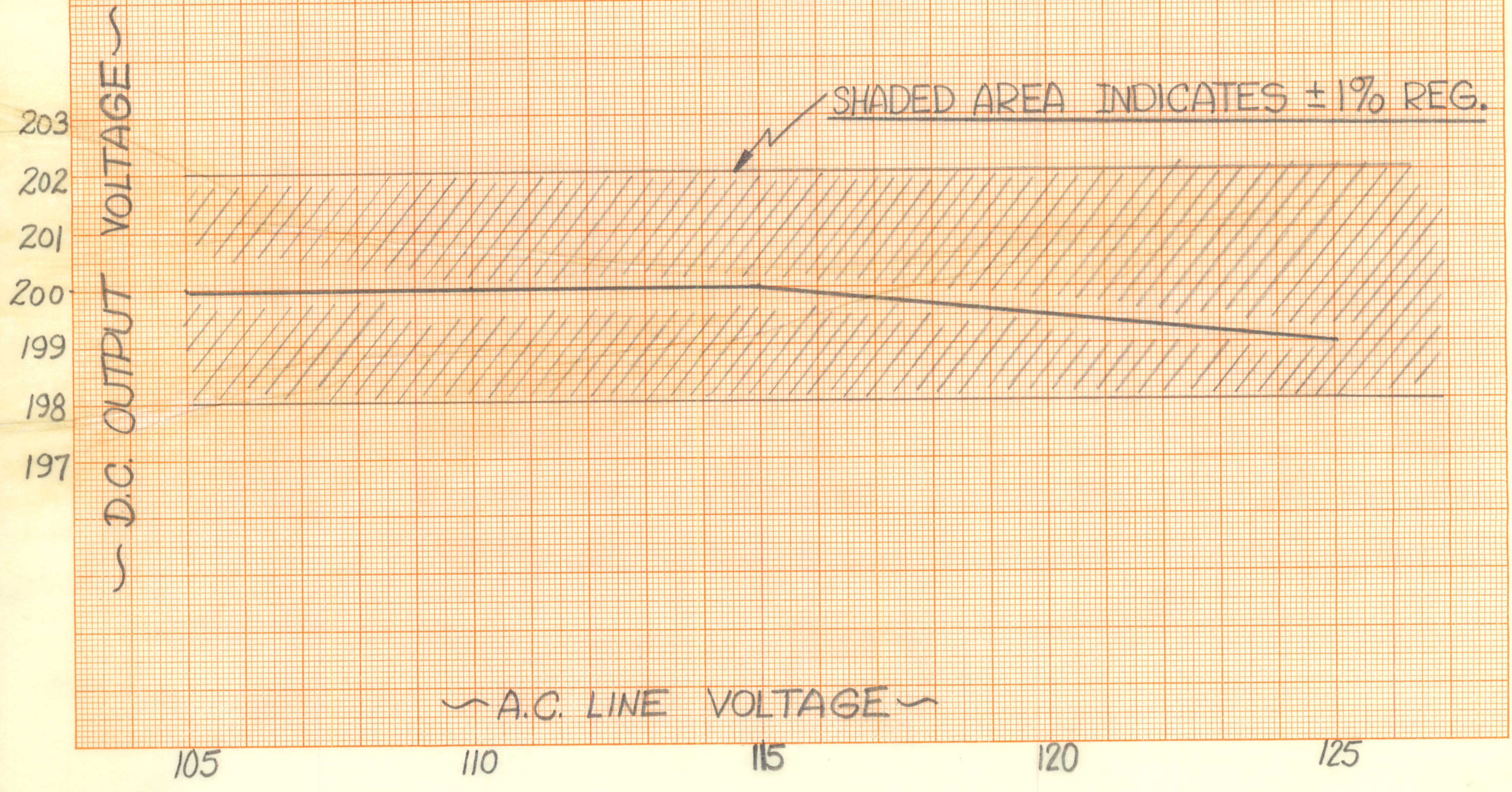

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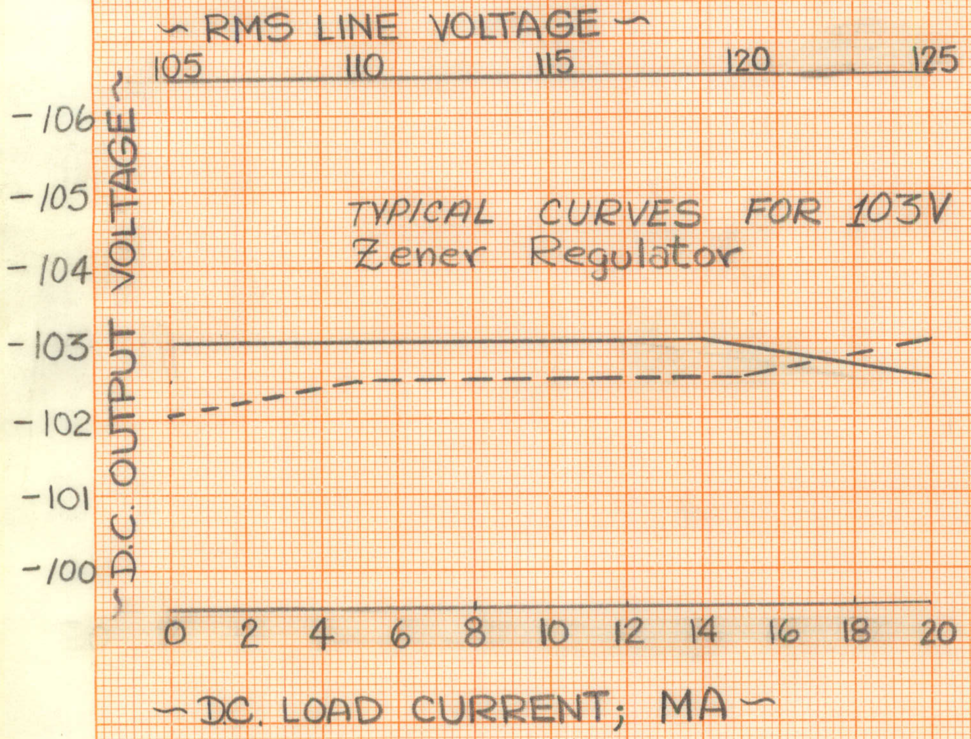
FIG. 4.1.4

HFP-1; BIAS SUPPLY & B+ REGULATOR VOLTAGE REFERENCE

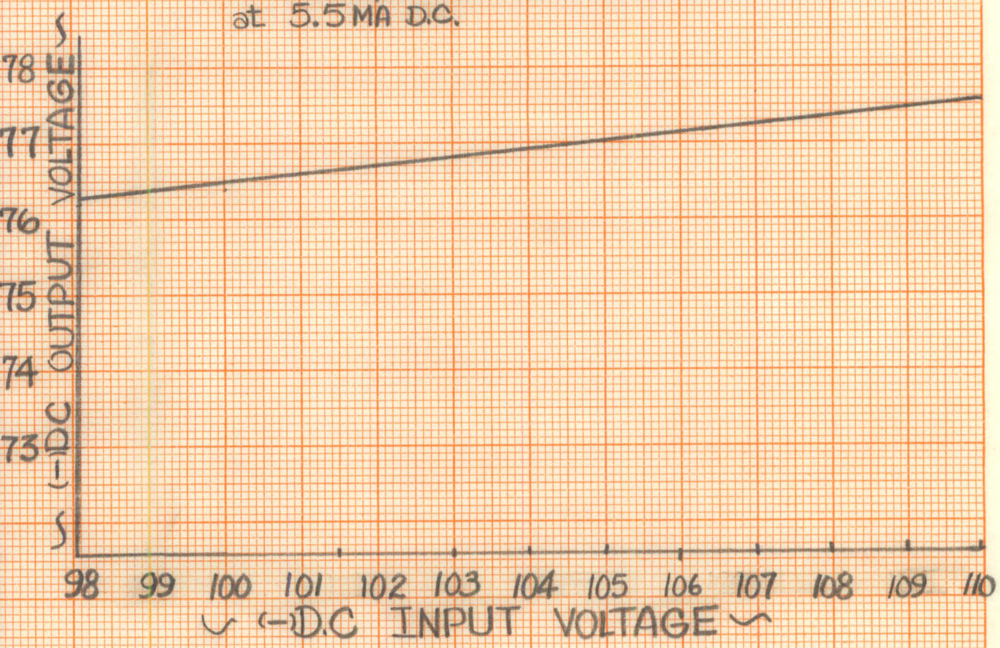
A) BIAS SUPPLY
- D.C. OUTPUT VOLTAGE
VS.
LINE VOLTAGE & LOAD CURRENT

▬▬ Denotes Output VS. Load at 115V line
■ ■ ■ Denotes Output VS. Line at 20MA load.



B) B+ REGULATOR VOLTAGE REFERENCE
- D.C. OUTPUT VOLTAGE
VS.
- DC INPUT VOLTAGE AT CONSTANT LOAD

NOTE: Load current in the voltage reference circuit is the current drawn by the two comparator networks and is constant at 5.5MA D.C.



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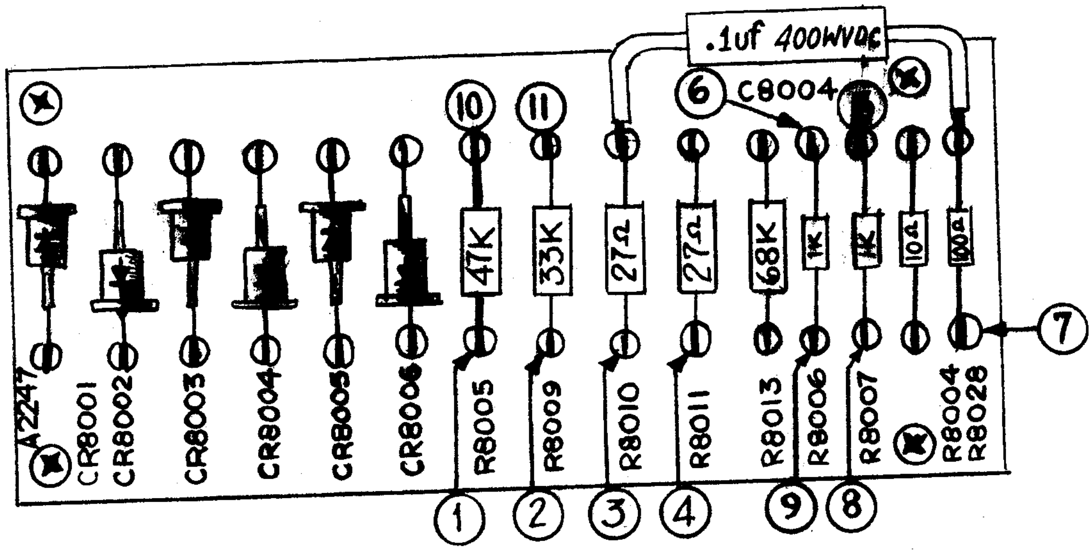

4.2.1 D.C. Voltage Measurement Chart For TB8001:

TEST POINT NUMBER	CORRESPONDING TUBE AND PIN NUMBER	NORMAL D.C. VOLTAGE AT: NO LOAD	FULL LOAD	REMARKS:
1	V8001, pins 2,5	380	290	D.C. input regulator "A"
2	V8001, pins 2,5	380	290	
3	V8001, pin 3	200	205	
4	V8001, pin 6	200	205	
5	V8001, pin 1	130	195	
6	V8001, pin 4	130	195	
7	V8002, pin 1	-5.4	-5.7	Bias on V8002
8	V8002, pin 5	130	195	
9	V8002, pin 5	130	195	
10	V8002, pin 5	130	195	
11	V8002, pin 6	320	270	

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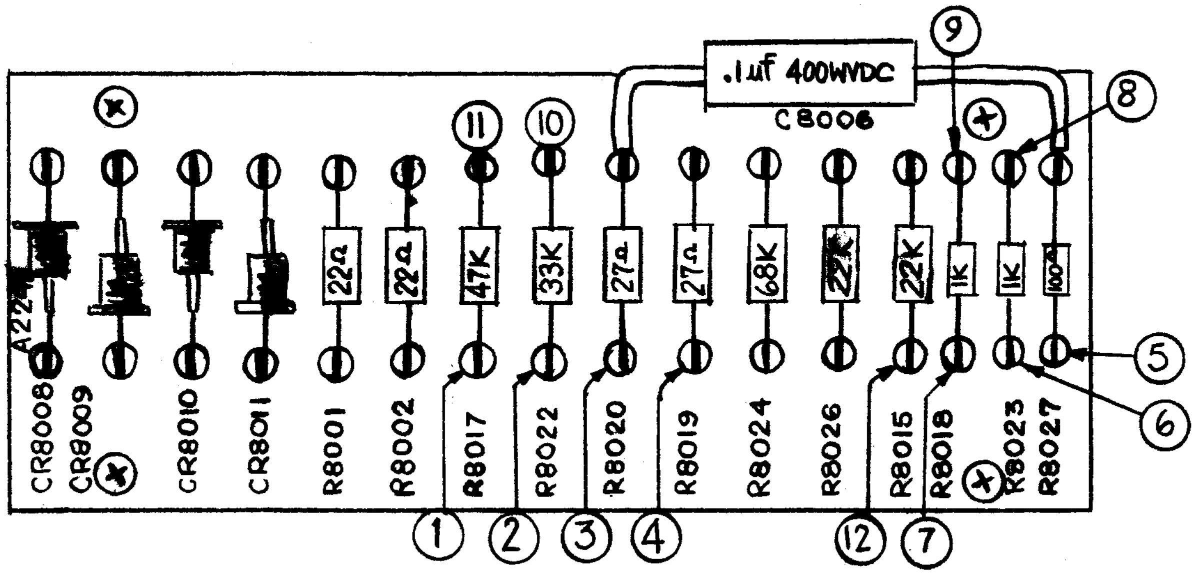
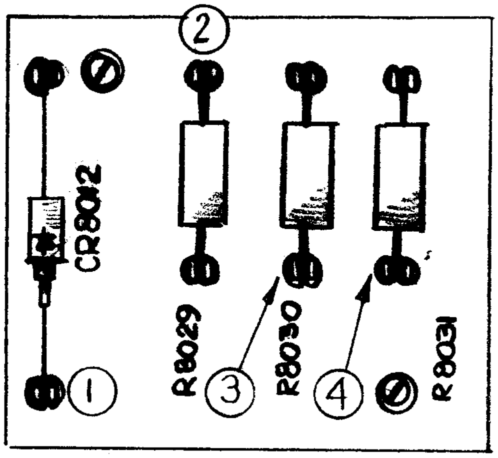


4.2.2. D.C. Voltage Measurement Chart For TB8002:

TEST POINT NUMBER	CORRESPONDING TUBE AND PIN NUMBER	NORMAL D.C. VOLTAGE AT: NO LOAD	FULL LOAD	REMARKS:
1	V8004, pin 5	130	195	
2	V8004, pin 6	320	270	
3	V8003, pin 3	200	205	
4	V8003, pin 6	200	205	
5	V8004, pin 1	-5.4	-5.7	Bias on V8004
6	V8004, pin 5	130	195	
7	V8004, pin 5	130	195	
8	V8003, pin 1	130	195	
9	V8003, pin 4	130	195	
10	V8003, pin 2,5	380	290	D.C. input to regulator "B"
11	V8003, pins 2,5	380	290	

4.2.3 A.C. And D.C. Voltage Measurement Chart:



TB 8003

NOTES: 1) All D.C. voltages measured with a 20,000 ohms-per-volt meter.
2) All A.C. voltages measured with a Daven model 170 VTVM.

A) D.C. VOLTAGES

FROM	TO	VOLTAGE	REMARKS
TP8001	GND	+200; see Fig. 4.1.3 and 4.1.3	Regulator "A" output voltage
TP8002	GND	+200; see Fig. 4.1.2 and 4.1.3	Regulator "B" output voltage
Test point 3, TB8003	GND	See Fig. 4.1.1.	Voltage across C8001
Test point 4, TB8003	GND	See Fig. 4.1.1.	Voltage across C8005
Test point 2, TB8003	GND	-105 nominal; see Fig. 4.1.4 for typical regulation curves.	Output voltage of negative bias supply.
Test point, TB8003	GND	-75V ± 5%	Voltage reference for B+ regulator sections.
Test point 12, TB8002	GND	-75V ± 5%	

B) A.C. VOLTAGES

FROM	TO	VOLTAGE	REMARKS
TP8001	GND	100 MV, RMS; maximum	Ripple output of regulator "A"

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B) A.C. VOLTAGES

FROM	TO	VOLTAGE	REMARKS
TP8002	GND	100 MV, RMS: maximum	Ripple output of Regulator "B"
Test point 2, TB8001	GND	5 MV, RMS; maximum	Ripple output of bias supply

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4.3 Parts Replacement: This section is devoted to the proper procedure to be followed for replacement of parts. The procedures noted herein have proved to be the best; requiring a minimum of time and effort. The HFP-1 may be serviced as/per sections 4.3.1 and 4.3.2.by extending the unit outward from the rack on its slides.

4.3.1 Replacement of Components Located on TB8001, TB8002 and/or TB8003: All components located on these boards, with the exceptions of R8023, R8028 and C8006 can be replaced after removing the front section of the top cover. The component (s) may be unsoldered and lifted off the boards. The new compenent (s) may then b soldered into the proper place. Care must be taken when replacing CR8012, type 1N3041B. A longnose pliers or similar tool must be used to hold the lead wire being soldered in order to transfer heat away from the diode junction.

Terminal Board TB8002 must be moved from its mounting position to facilitate replacement of R8023, R8028 and/or C8006. TB8002 can be moved by removing the four mounting screws and pulling the board toward the center of the unit and up. Care should be taken to insure that none of the connecting wires to TB8002 are pinched by the screws or spacers when remounting the terminal board.

4.3.2 Replacement of Electron Tubes and Time Delay Relay K8003: All tubes and relay K8003 may be replaced by removing the rear section, top cover. A cooling period should be allowed before tube replacement and the unit should be disconnected from the A.C. line. V8002, V8004 and K8003 can be removed by first disconnecting and removing the tube shields and then pulling the tube(s) toward the rear of the unit and then up through the top. V8001 and V8003 can be removed in a similar manner after first loosening the tube clamp by pulling the catch upwards.

4.3.3 Replacement of Transformers T8005 and T8006: The HFP-1 must be removed from the rack and both the bottom cover and front section, top cover, removed from the unit. Sketch the connections to the transformer, noting the colors and wire sizes. Note the plac ment of jumpers and the size buss wire used. With a pair of cutting pliers or a similar tool, cut the transformer connecting wires off as close to the transformer terminals as possible. Place the unit on the workbench with the bottom of the front panel ext nded slightly over the front of the bench.

Cont'd

4.3.3 Using a number 3 Phillips screwdriver, remove the four transformer mounting screws which hold the transformer to the sideplate. Carefully push the cable wires toward the center of the unit so that they clear the transformer terminals. Lifting the unit vertically will cause the transformer to remain on the bench. After stripping and tinning the transformer connecting wires extending from the cable, a new transformer may be inserted in a reverse manner as to removal of the defective one.

4.3.4 Replacement of Transformers T8001, T8002, T8003, T8004 and Filter Choke L8001: Replacement of T8001, 8002, 8003, 8004 and/or L8001 necessitates removal of the bottom cover, front section top cover, and the moving of either TB8001, TB8002 and/or TB8003. Transformers T8001 and T8003 are located beneath TB-8001 while T8002 and T8004 are located beneath TB8002. Filter choke L8001 is located beneath TB8003. Set the unit on a workbench top up. To replace eith r T8001 or T8003, remove the four mounting screws holding TB8001 with a number 1 Phillips screwdriver and move the board by pulling in toward the center of the unit and upwards. Sketch the connections to the transformer, noting wire color and size. Using a pair of cutting pliers, cut the connecting wires as close to the transformer terminals as possible. Remove the two remaining transformer mounting screws with a number 1 Phillips screwdriver. The transformer will drop through the bottom of the unit onto the bench. After stripping and tinning the transformer connecting wires, replace the transformer and TB8001. Care should be taken when replacing the terminal board to insure that the mounting screws and spacers do not pinch the transformer connecting wires. The same procedure should be followed when replacing T8002, T8004 or L8001.

4.3.5 Replacement of Fuseholders and Wirewound Resistors R8008, R8012, and R8021: Resistors R8008, 8012, 8021 are located on the underside of the fuseholder mount= ing chassis, directly behind the front panel. Removal of the bottom cover and front section top cover provide easy access to these components as well as all the fuseholders contained within the unit.

cont'd

4.3.5 The resistors are mounted through the use of a long screw passing through the length of the resistor and fastened with a ¼ hex nut. Removing this screw will enable replacement after unsoldering the conn cting wires. All the fuseholders are mounted with a 11/16 hex nut and may be pulled up through the mounting chassis after the unsoldering of the connecting wires is accomplished.

4.3.6 Replacement of Voltage Adjust Potentiometers R8014 and R8025: These potentiometers may be replaced by first removing the bottom cover and front section, top cover. Removing first the lock nut and then the 9/16 mounting nut will cause the potentiometer to become loose. The connecting wires should be sketched and noted as to colors and then cut as closely to the potentiometer terminals as possible. The conn cting wires should be stripped and tinned and then soldered to the new potentiometer. The new potentiometer may then be inserted and mounted with the 9/16 hex nut. Readjustment of the potentiometer should be performed as follows:

1. Replace the bottom cover.
2. Replace the unit into the rack and set the MAIN POWER switch on the rear of the HFP-1 to STANDBY.
3. Set the POWER switch on either the TMC model HFA-1 or SBS-1 to ON.
4. After the OPERATE indicator lights, place a D.C. voltmeter between TP8001 and ground if R8014 was replaced or between TP8002 and ground if R8025 was replaced, and measure the D.C. voltage to ground. Adjust the voltage at 197 volts by turning the potentiometer adjustment screw with a flat head screwdriver or other tool.

NOTE: The voltage is adjusted for 197 volts instead of 200 volts to allow for the voltage creep experienced when the unit warms up under normal load. The above four steps should be followed after the replacement of any components related to the B+ regulator circuits.

4.3.7 Replacement of Components Located On The Regulator Chassis and Rear Plate: The components located on the rear plate include all input and output connectors and the MAIN POWER switch, S8001. Most of the larger components excluding transformers are mounted on the regulator chassis. Included among these are V8001, V8002, V8003, V8004, K8001, K8002, K8003, C8001, C8002, C8003, C8004, C8007, R8003 and R8016.

cont'd

4.3.7 The replacement of the electron tubes and delay relay K8003 has been covered in section 4.3.2. It will be necessary to follow this paragraph when replacing all the other components mentioned above. First we must remove the HFP-1 from the rack and then remove all covers, top and bottom. The unit should then be stood upright ON ITS HANDLES and the six screws removed from the rear plate with a number 2 Phillips screw-driver. Flip the rear plate UPWARDS and to the REAR, fitting the lip on the rear plate into the notch s formed by the bends between the bottom and rear of the sideplates. Figure 4.3.1 shows the HFP-1 in the above mentioned position with the tubes and relay K8003 removed.

a) Wirewound resistors R8003 and R8016 may be replaced by removing the single mounting screw which runs through the center of the resistor into a threaded swage nut. The swage nut is permanently attached to the chassis.

b) Capacitors C8002 and C8003 may be unplugged after removal of the holding bracket. This bracket can be removed by taking out the bracket mounting screw which is threaded into a swage nut on the chassis.

c) Removal of capacitor C8007 may be done by removing the mounting screw on each side of the capaictor. These screws are threaded into swage nuts mounted on the chassis.

d) The threaded stud of Zener Diode CR8007 is screwed into a swage nut attached to the chassis. The diode can be removed by unscrewing with a 7/16 hex wrench. Silicon grease should be applied to the underside of the new Zener before mounting. This grease, Dow Corning type number 4 Silicone Lubricant is used to decrease the thermal resistance of the diode stud to chassis.

e) The two big electrolytic capacitors C8001 and C8005 may be removed by first loosening the clamping screw on the mounting bracket with a flat head screwdriver. Pulling the capacitor slowly upwards will cause it to clear the mounting bracket and expose the terminals. Easy access to the mounting screws on the terminals will be obtained by tilting the capacitor. The red wires should be connected to the terminal stamped + or the terminal marked with a red dot. After inserting a new capacitor, set the capacitor height equal to the height of the other large capacitor.

f) Replacement of Relays K8001 or K8002 should only be attempted after a careful sketch of the relay cable connections and jumpers has been made. To remove the relay, first cut the connecting wires off as close to the relay terminals as possible. Next, remove the four relay plate mounting screws located in the four corners of the plate. Lifting the plate and tilting to either side will expose the relay mounting screw. Removal of this screw will cause the relay to become free.

g) MAIN POWER switch S101 may be removed from the rear plate of removing the 11/16 mounting nut.

h) A.C. Jacks J8001 through J8004 and Output Jacks J8005 through J8010 are mounted on the rear plate and may be removed by removing the mounting screws. When removing J8005 through J8010, a careful sketch should be made of the cable connections prior to the cutting of the wires. Unsoldering of cable connections is not recommended as the heat will undoubtably damage the sleeving and insulation.

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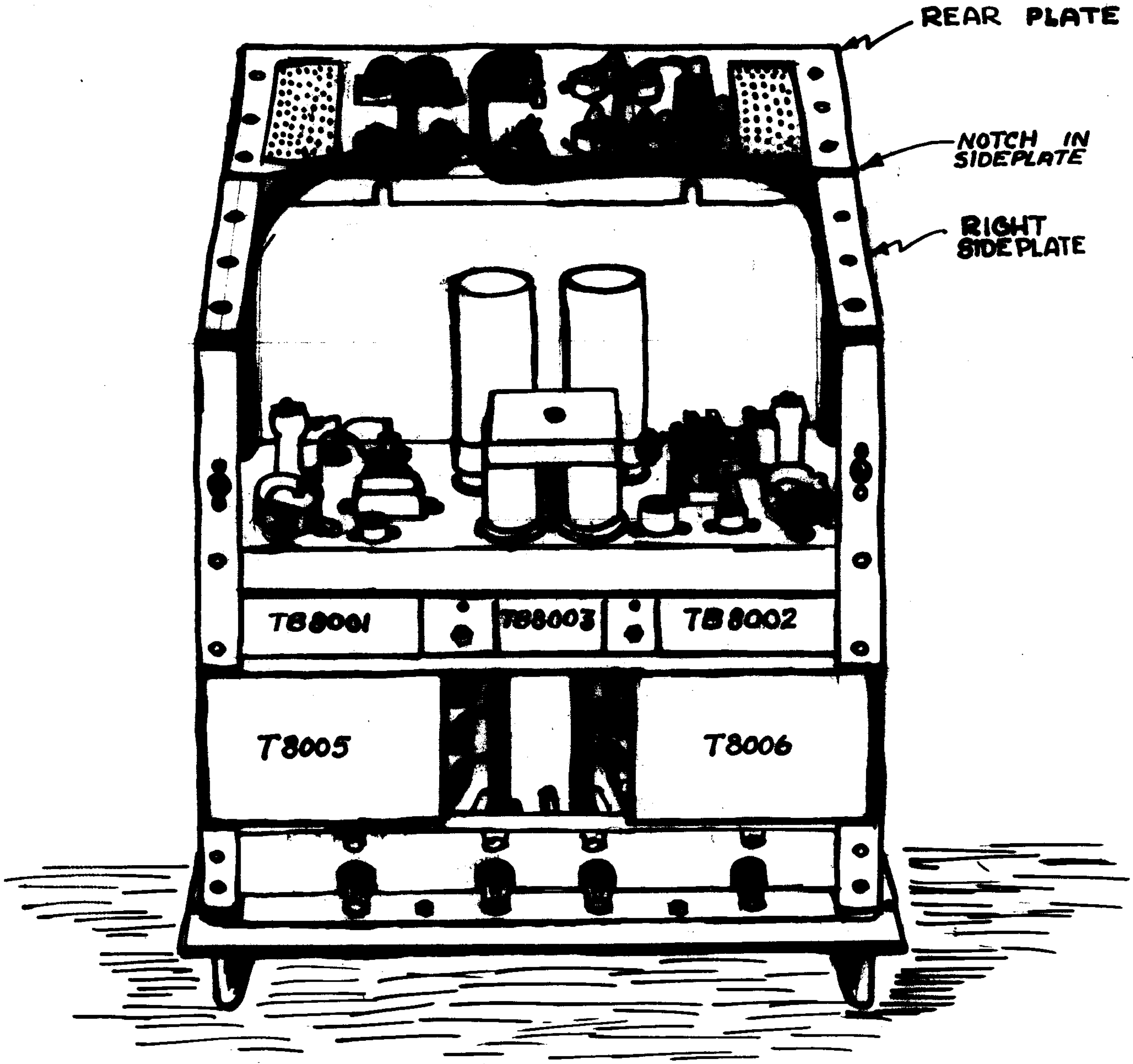
Fig. 4.3.1



TMC Model HFP-1 SHOWN STANDING UPRIGHT ON ITS HANDLES FOR SERVICING OF COMPONENTS LOCATED ON THE REAR PLATE AND REGULATOR CHASSIS.

4.4 Recommended Spare Parts: The following sections are devoted to the listing of spare parts which the designer feels should be the most likely to fail after the period of time noted.

4.4.1 Running Spares: In accordance with Signal Corps specifications, the following plug-in components should be included as running spares.

TMC PART #	UNIT SYMBOL	TOTAL PER UNIT	DESCRIPTION
6AH6	V8002, V8004	2	Tube, electron; pentode
6336A	V8001, V8003	2	Tube, electron; dual triod .
RL-111-6-NO-60T	K8003	1	Relay, thermostatic delay.
CE51F450P	C8002, C8003	2	Capacitor, el c-trolytic, 45UFD, 350WVDC.

In addition to the above listed items, all indicator lamps and fuses should be included.

4.4.2 Electrolytic Capacitors; Because of the life expectancy of electrolytic capacitors, the following item should definitely appear on any spare parts list. CE-112; symbol C8001, C8005; total quantity p r unit of 2; capacitor, fixed, electrolytic; 250UF, 450WVDC.

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