

## V3 TELEPHONE REPEATER

### ADJUSTMENT OF BATTERY SUPPLY CIRCUITS

#### 1. GENERAL

**1.01** This section describes methods of adjusting the battery supply voltage for supplying heater current to the J68647A amplifiers used in V3 repeaters, when initially connecting the amplifiers to the filament supply circuit.

**1.02** This section has been reissued to add adjusting procedures due to wiring changes. Due to extensive changes marginal arrows have been omitted.

**1.03** The methods described cover the following:

- (A) Adjustment of Heater Circuits with Resistors A to M and Rheostats R1A and R1B on Battery Side of 1-1/3 Ampere Fuses — Nominal 24-volt Battery for 10 to 220 Amplifiers.
- (B) Adjustment of Heater Circuits with Resistors A to Y and Rheostat R1B on Battery Side of 1-1/3 Ampere Fuses—Nominal 48-volt Battery for 10 to 220 Amplifiers.
- (C) Adjustment of Heater Circuits with Resistors A to F on Ground Side of Amplifiers Using Regulated Filament or Nominal 24-volt Battery for 1 to 12 Amplifiers or Nominal 48-volt Battery for 1 to 24 Amplifiers.
- (D) Adjustment of Heater Circuits with Resistors A to M and Multitapped Resistor R1 on Battery Side of 1-1/3 Ampere Fuses — Nominal 24-volt Battery for 10 to 220 Amplifiers.
- (E) Adjustment of Heater Circuits with Resistors A to Y and Multitapped Resistor R1 on Battery Side of 1-1/3 Ampere Fuses — Nominal 48-volt Battery for 10 to 220 Amplifiers.

#### 2. APPARATUS

**2.01** Weston Model No. 1 Voltmeter or equivalent.

#### 3. METHOD

**(A) Adjustment of Heater Circuits with Resistors A to M and Rheostats R1A and R1B on Battery Side of 1-1/3 Ampere Fuses — Nominal 24-volt Battery for 10 to 220 Amplifiers**

**3.01** The following procedure shall be followed for initially connecting J68647A amplifiers to this circuit.

- (1) Start with none of the 1-1/3 ampere fuses installed, rheostat R1 in approximately midposition, and all resistance strapping connections open.
- (2) Connect the first group of 10 amplifiers by inserting the 1-1/3 ampere fuse, and measure the voltage from the load side of this fuse to the ground bar on the fuse panel.
- (3) Strap connections B to N as required to make this voltage  $20 \pm 1$  volts. The strap connections shall be made in alphabetical order from left to right, starting with B. Each strap added will reduce the circuit resistance approximately 1 ohm.
- (4) Similarly insert other 1-1/3 ampere fuses one at a time, and after each fuse is added connect additional strapping to keep the voltage at  $20 \pm 1$  volts.
- (5) After all of the fuses have been installed, proceed with the following method for making a final adjustment with rheostat R1.
- (6) If the power plant is not a closely regulated automatic plant, determine the mean battery voltage by measuring the voltage at

the power board or other convenient point with the battery voltage at the upper and lower settings at which the voltage alarm or automatic relay operates, and then take the average of these two readings.

(7) The final adjustment of rheostat R1 shall be made when the office battery voltage is within 0.5 volt of the mean battery voltage. The final adjustment of R1 shall be such that the voltage from the load side of the 1-1/3 ampere fuses to the ground bar will be  $20.0 \pm 0.3$  volts *at mean battery voltage*. Measure the office battery voltage as before with the same meter connected in the same way. Determine the difference between this value and the mean battery voltage. Apply this deviation as a correction to the 20.0-volt value specified above and make the final adjustment of R1 to obtain this corrected value.

**Note:** The  $\pm 0.3$  volt limit is for adjusting purposes only, and the result of any subsequent check with a different meter cannot be expected to be within this limit. For example, measurements of the same voltage with two meters each having a 30-volt scale accurate to  $\pm 0.5$  per cent of full scale might differ by as much as 0.3 volt.

**Example:**

Mean battery voltage	23.75
Office battery voltage	23.90
Deviation	+0.15

Applying deviation as correction to 20.0 value, make final adjustment of R1 to obtain  $20.15 \pm 0.3$  volts from load side of 1-1/3 ampere fuses to ground bar.

**3.02** When amplifiers are added to an existing battery supply connecting circuit, Steps (4) through (7) of 3.01 shall be followed.

**3.03** If for any reason more than 10 amplifiers are to be disconnected, they shall be disconnected one group at a time, and strapping removed each time as required to keep the voltage at  $20 \pm 1$  volts. The strapping shall be removed in reverse alphabetical order proceeding from right to left. The final adjustment for the remaining amplifiers shall be made as specified in Steps (5) through (7) of 3.01 above.

**3.04** On new installations after the heater circuits have been adjusted, a check shall be made that the voltage across terminals 8 and 9 of each amplifier socket is  $20 \pm 1$  volts. This check shall be made only when the battery voltage is within 0.5 volt of its mean value.

**(B) Adjustment of Heater Circuits with Resistors A to Y and Rheostat R1B on Battery Side of 1-1/3 Ampere Fuses — Nominal 48-volt Battery for 10 to 220 Amplifiers**

**3.05** The following procedure shall be followed for initially connecting J68647A amplifiers to this circuit.

(1) Start with none of the 1-1/3 ampere fuses installed, rheostat R1 in approximate mid-position, and all resistance strapping connections open.

(2) Connect the first group of 10 amplifiers by inserting the 1-1/3 ampere fuse, and measure the voltage from the load side of this fuse to the ground bar on the fuse panel.

(3) Strap connections B to Z as required to make this voltage  $40 \pm 2$  volts. The strap connections shall be made in alphabetical order from left to right, starting with B. Each strap added will reduce the circuit resistance approximately 2 ohms.

(4) Similarly insert other 1-1/3 ampere fuses one at a time, and after each fuse is added connect additional strapping to keep the voltage at  $40 \pm 2$  volts.

(5) After all of the fuses have been installed, proceed with the following method for making a final adjustment with rheostat R1.

(6) If the power plant is not a closely regulated automatic plant, determine the mean battery voltage by measuring the voltage at the power board or other convenient point with the battery voltage at the upper and lower settings at which the voltage alarm or automatic relay operates, and then taking the average of these two readings.

(7) The final adjustment of rheostat R1 shall be made when the office battery voltage is within 0.5 volt of the mean battery voltage. The final adjustment of R1 shall be such that

the voltage from the load side of the 1-1/3 ampere fuses to the ground bar will be 40.0  $\pm$ 0.5 volts **at mean battery voltage**. Measure the office battery voltage the same as before with the same meter connected in the same way. Determine the difference between this value and the mean battery voltage. Apply this deviation as a correction to the 40.0-volt value specified above and make the final adjustment of R1 to obtain this corrected value.

**Example:**

Mean battery voltage	48.30
Office battery voltage	47.90
Deviation	<u>-0.40</u>

Applying deviation as correction to 40.0 value, make final adjustment of R1 to obtain 39.60  $\pm$ 0.5 volts from load side of 1-1/3 ampere fuses to ground bar.

**3.06** When amplifiers are added to an existing battery supply connecting circuit, Steps (4) through (7) of 3.05 above shall be followed.

**3.07** If for any reason more than 10 amplifiers are to be disconnected, they shall be disconnected one group at a time, and strapping removed each time as required to keep the voltage at 40  $\pm$ 2 volts. The strapping shall be removed in reverse alphabetical order proceeding from right to left. The final adjustment for the remaining amplifiers shall be made as specified in Steps (5) through (7) of 3.05 above.

**3.08** On new installations after the heater circuits have been adjusted, a check shall be made that the voltage across terminals 8 and 9 of each amplifier socket is 20  $\pm$ 1 volts. This check shall be made only when the battery voltage is within 1.0 volt of its mean value.

**(C) Adjustment of Heater Circuits with Resistors A to F on Ground Side of Amplifiers Using Regulated Filament or Nominal 24-volt Battery for 1 to 12 Amplifiers, or Nominal 48-volt Battery for 1 to 24 Amplifiers**

**3.09** The heater circuit resistances shall be strapped to give the nominal resistance shown in Table A or Table B for the reference fuse panel voltage and for the number of amplifiers in the circuit. (V3 repeaters have two amplifiers per repeater.)

**3.10** If the reference voltage method (described in Section 024-720-801) is employed for adjusting the filament circuits of V1 repeaters or other equipment on the same fuse panel with the V3 repeaters, the reference voltage for the fuse panel shall be determined by that method. Otherwise, the mean fuse panel voltage under normal load conditions shall be determined with equivalent meters and used as the reference voltage. To determine the mean fuse panel voltage, measure the voltage under normal load conditions from the fuse panel battery bar to ground with the battery voltage at the upper and lower settings at which the voltage alarm or automatic relay operates, and take the average of these two readings.

**3.11** No allowance is made in Table A or Table B for wire resistance between the fuse panel and the amplifiers when in separate locations. The resistance values shown in Tables A and B should be reduced 0.25 ohm for each 60 feet of cable (approximately) between the fuse panel and amplifier bays.

**3.12** After the heater circuits have been adjusted, a check shall be made that the voltage across terminals 8 and 9 of each amplifier socket is 20  $\pm$ 1. This check shall be made only when the battery voltage is within 0.5 volt of its mean value for 24-volt battery and within 1.0 volt for 48-volt battery.

**(D) Adjustment of Heater Circuits with Resistors A to M and Multitapped Resistor R1 on Battery Side of 1-1/3 Ampere Fuses — Nominal 24-volt Battery for 10 to 220 Amplifiers**

**3.13** The following procedure shall be followed for initially connecting J68647A amplifiers to this circuit.

(1) Start with none of the 1-1/3 ampere fuses installed, all straps on resistors A to M open, and with resistor R1 in the circuit (all straps removed from taps).

(2) Connect the first group of 10 amplifiers by inserting the 1-1/3 ampere fuse, and measure the voltage from the load side of this fuse to the ground bar on the fuse panel.

(3) Strap connections B to N as required to make this voltage between 19.0 and 20.0 volts. The strap connections shall be made in

alphabetical order from left to right starting with B. Each strap added will reduce the circuit resistance approximately 1 ohm.

(4) Similarly insert other groups of amplifiers by installing the 1-1/3 ampere fuse, one at a time, and after each fuse is added connect additional strapping to keep the voltage between 19 and 20 volts.

(5) After all amplifiers and fuses have been installed, proceed with the following method for making a final adjustment with the taps on resistor R1.

(6) If the power plant is not a closely regulated automatic plant, determine the mean battery voltage by measuring the voltage at the power board or other convenient point with the battery voltage at the upper and lower settings at which the voltage alarm or automatic relay operates, and then taking the average of these two voltage readings.

(7) The final adjustment by strapping R1 shall be made when the office battery voltage is within 0.5 volt of the mean battery voltage. The final adjustment of R1 shall be such that the voltage from the load side of the 1-1/3 ampere fuses to the ground bar will be  $20.0 \pm 0.3$  volts *at mean battery voltage*. Measure the office battery voltage at the same place as in (6) with the same meter connected in the same way. Determine the difference between this value and the mean battery voltage. Apply this deviation as a correction to the 20.0-volt value specified above and make the final adjustment of R1 to obtain this corrected value.

**Note:** The  $\pm 0.3$  volt limit is for adjusting purposes only, and the result of any subsequent check with a different meter cannot be expected to be within this limit. For example, measurements of the same voltage with two meters each having a 30-volt scale accurate to  $\pm 0.5$  per cent of full scale might differ by as much as 0.3 volt.

**Example:**

Mean battery voltage	23.75
Office battery voltage	23.90
Deviation	<u>+0.15</u>

Applying deviation as a correction to 20.0 value, make final adjustment of R1 to obtain 20.15

$\pm 0.3$  volts from load side of 1-1/3 ampere fuses to ground.

**3.14** When amplifiers are added to existing battery supply connecting circuits, Steps (4) through (7) of 3.13 shall be followed.

**3.15** If for any reason more than 10 amplifiers are to be disconnected, they shall be disconnected one group at a time, and the strapping B to N removed each time as required to keep the voltage between 19 and 20 volts. The strapping shall be removed in reverse alphabetical order proceeding from the last strap right to left. The final adjustment for the remaining amplifiers shall be made as specified in Steps (5) through (7) of 3.13 above.

**3.16** On new installations after the heater circuits have been adjusted, a check shall be made that the voltage across terminals 8 and 9 of each amplifier socket is  $20 \pm 1.0$  volts. This check shall be made only when the battery voltage is within 0.5 volt of its mean value.

**(E) Adjustment of Heater Circuits with Resistors A to Y and Multitapped Resistor R1 on Battery Side of 1-1/3 Ampere Fuses — Nominal 48-volt Battery for 10 to 220 Amplifiers**

**3.17** The following procedures shall be followed for initially connecting J68647A amplifiers in this circuit.

(1) Start with none of the 1-1/3 ampere fuses installed, all straps removed from resistors A to Y, and with resistor R1 in the circuit (all straps removed from taps).

(2) Connect the first group of 10 amplifiers by inserting the 1-1/3 ampere fuse, and measure the voltage from the load side of this fuse to the ground bus bar on the fuse panel.

(3) Strap connections B to Z as required, to make this voltage between 38 and 40 volts. The strap connections shall be made in alphabetical order from left to right, starting with B. Each strap added will reduce the circuit resistance approximately 2 ohms.

(4) Similarly insert other 1-1/3 ampere fuses one at a time, and after each fuse is added, connect additional strapping to keep the voltage between 38 and 40 volts.

(5) After all of the fuses have been installed, proceed with the following method for making a final adjustment with multitapped resistor R1.

(6) If the power plant is not a closely regulated automatic plant, determine the mean battery voltage by measuring the voltage at the power board or other convenient point with the battery voltage at the upper and lower settings at which the voltage alarm or automatic relay operates, and then taking the average of these two readings.

(7) The final adjustment by strapping R1 shall be made when the office battery voltage is within 0.5 volt of the mean battery voltage. The final adjustment of R1 shall be such that the voltage from the load side of the 1-1/3 ampere fuses to the ground bus bar will be  $40.0 \pm 0.5$  volts *at mean battery voltage*. Measure the office battery voltage at the same place as in (6) with the same meter connected in the same way. Determine the difference between this value and the mean battery voltage. Apply this deviation as a correction to the 40.0-volt value specified above and make the final adjustment of R1 to obtain this corrected value.

**Example:**

Mean battery voltage	48.30
Office battery voltage	47.90
Deviation	<u>-0.40</u>

Applying deviation as a correction to 40.0 value, make final adjustment of R1 to obtain  $39.60 \pm 0.5$  volts from load side of 1-1/3 ampere fuses to ground bar.

**3.18** When amplifiers are added to an existing battery supply connecting circuit, Steps (4) through (7) of 3.17 above shall be followed.

**3.19** If for any reason more than 10 amplifiers are to be disconnected, they shall be disconnected one group at a time, and strapping removed each time as required to keep the voltage between 38 and 40 volts. The strapping shall be removed in reverse alphabetical order proceeding from right to left. The final adjustment for the remaining amplifiers shall be made as specified in Steps (5) through (7) of 3.17 above.

**3.20** On new installation after the heater circuits have been adjusted, a check shall be made that the voltage across terminals 8 and 9 of each amplifier socket is  $20 \pm 1.0$  volts. This check shall be made only when the battery voltage is within 1.0 volt of its mean value.

TABLE A												
TOTAL VALUE IN OHMS OF RESISTORS A TO E												
FOR REFERENCE FUSE PANEL VOLTAGES OF 20 TO 28 VOLTS												
FOR 1 TO 12 J68647A VOICE FREQUENCY AMPLIFIERS												
REFERENCE FUSE PANEL VOLTAGE	NO. OF AMPLIFIERS (V3 Repeaters Have 2 Amplifiers Per Repeater)											
	1	2	3	4	5	6	7	8	9	10	11	12
20.0	0	0	0	0	0	0	0	0	0	0	0	0
.1	1.5	0.5	0.25	0	0	0	0	0	0	0	0	0
.2	3.5	1.5	0.75	0.5	0.25	0.25	0	0	0	0	0	0
.3	5.5	2.5	1.5	1.0	0.75	0.5	0.25	0.25	0.25	0	0	0
.4	7.5	3.5	2.25	1.5	1.0	0.75	0.75	0.5	0.5	0.25	0.25	0
.5	9.5	4.5	2.75	2.0	1.5	1.25	1.0	0.75	0.5	0.5	0.5	0.25
.6	11.5	5.5	3.5	2.5	2.0	1.5	1.25	1.0	0.75	0.75	0.5	0.5
.7	13.5	6.5	4.25	3.0	2.2	1.75	1.5	1.25	1.0	1.0	0.75	0.5
.8	15.5	7.5	4.75	3.5	2.75	2.25	1.75	1.5	1.25	1.0	1.0	0.75
.9	17.5	8.5	5.5	4.0	3.0	2.5	2.0	1.75	1.5	1.25	1.25	1.0
21.0	19.5	9.5	6.25	4.5	3.5	2.75	2.25	2.0	1.75	1.5	1.25	1.25
.1	21.5	10.5	7.0	5.0	4.0	3.0	2.5	2.25	2.0	1.75	1.5	1.5
.2	23.5	11.5	7.5	5.5	4.25	3.5	2.75	2.5	2.25	2.0	1.75	1.5
.3	25.5	12.5	8.25	6.0	4.75	3.75	3.25	2.75	2.5	2.0	1.75	1.75
.4	27.5	13.5	8.75	6.5	5.0	4.25	3.5	3.0	2.75	2.25	2.0	1.75
.5	29.5	14.5	9.5	7.0	5.5	4.5	3.75	3.25	3.0	2.5	2.25	2.0
.6	31.5	15.5	10.0	7.5	6.0	4.75	4.0	3.5	3.0	2.75	2.5	2.25
.7	33.5	16.5	10.75	8.0	6.25	5.25	4.25	3.75	3.25	3.0	2.75	2.25
.8	35.5	17.5	11.5	8.5	6.75	5.5	4.75	4.0	3.5	3.0	2.75	2.5
.9	37.5	18.5	12.0	9.0	7.0	6.0	5.0	4.25	3.75	3.25	3.0	2.5
22.0	39.5	19.5	12.75	9.5	7.5	6.25	5.25	4.5	4.0	3.5	3.25	2.75
.1	41.5	20.5	13.5	10.0	8.0	6.50	5.5	4.75	4.25	3.75	3.5	3.0
.2	43.5	21.5	14.0	10.5	8.25	7.0	5.75	5.0	4.50	4.0	3.5	3.0
.3	45.5	22.5	14.75	11.0	8.75	7.25	6.0	5.25	4.75	4.0	3.75	3.25
.4	47.5	23.5	15.5	11.5	9.0	7.5	6.25	5.5	5.0	4.25	4.0	3.5
.5	49.5	24.5	16.25	12.0	9.5	8.0	6.75	5.75	5.25	4.5	4.25	3.75
.6	51.5	25.5	16.75	12.5	10.0	8.25	7.0	6.0	5.25	4.75	4.25	3.75
.7	53.5	26.5	17.5	13.0	10.25	8.5	7.25	6.25	5.50	5.0	4.5	4.0
.8	55.5	27.5	18.25	13.5	10.75	8.75	7.5	6.5	5.75	5.0	4.75	4.25
.9	57.5	28.5	19.0	14.0	11.0	9.25	7.75	6.75	6.0	5.25	4.75	4.25
23.0	59.5	29.5	19.5	14.5	11.5	9.5	8.0	7.0	6.25	5.5	5.0	4.5
.1	61.5	30.5	20.25	15.0	12.0	9.75	8.25	7.25	6.5	5.75	5.25	4.75
.2	63.5	31.5	21.0	15.5	12.25	10.25	8.5	7.5	6.75	6.0	5.25	4.75
.3	65.5	32.5	21.5	16.0	12.75	10.5	9.0	7.75	7.0	6.0	5.5	5.0
.4	67.5	33.5	22.25	16.5	13.0	10.75	9.25	8.0	7.25	6.25	5.75	5.25
.5	69.5	34.5	23.0	17.0	13.5	11.25	9.5	8.25	7.5	6.5	6.0	5.5
.6	71.5	35.5	23.5	17.5	14.0	11.5	9.75	8.5	7.5	6.75	6.0	5.5
.7	73.5	36.5	24.25	18.0	14.25	11.75	10.0	8.75	7.75	7.0	6.25	5.75
.8	75.5	37.5	25.0	18.5	14.75	12.0	10.5	9.0	8.0	7.0	6.5	6.0
.9	77.5	38.5	25.5	19.0	15.0	12.5	10.75	9.25	8.25	7.25	6.5	6.0
24.0	79.5	39.5	26.25	19.5	15.5	12.75	11.0	9.5	8.5	7.5	6.75	6.25
.1	81.5	40.5	27.0	20.0	16.0	13.0	11.25	9.75	8.75	7.75	7.0	6.5
.2	83.5	41.5	27.5	20.5	16.25	13.5	11.5	10.0	9.0	8.0	7.0	6.5
.3	85.5	42.5	28.25	21.0	16.75	13.75	11.75	10.25	9.0	8.0	7.25	6.75
.4	87.5	43.5	28.75	21.5	17.0	14.25	12.0	10.5	9.25	8.25	7.5	6.75
.5	89.5	44.5	29.5	22.0	17.5	14.5	12.5	10.75	9.5	8.5	7.75	7.0
.6	91.5	45.5	30.25	22.5	18.0	14.75	12.75	11.0	9.75	8.75	7.75	7.25
.7	93.5	46.5	30.75	23.0	18.25	15.25	13.0	11.25	10.0	9.0	8.0	7.25
.8	95.5	47.5	31.5	23.5	18.75	15.5	13.25	11.5	10.0	9.0	8.25	7.5
.9	97.5	48.5	32.0	24.0	19.0	16.0	13.5	11.75	10.25	9.25	8.25	7.5

TABLE A (Cont)												
REFERENCE FUSE PANEL VOLTAGE	NO. OF AMPLIFIERS (V3 Repeaters Have 2 Amplifiers Per Repeater)											
	1	2	3	4	5	6	7	8	9	10	11	12
25.0	99.5	49.5	32.75	24.5	19.5	16.25	13.75	12.0	10.5	9.5	8.5	7.75
.1	101.5	50.5	33.5	25.0	20.0	16.5	14.0	12.25	10.75	9.75	8.75	8.0
.2	103.5	51.5	34.0	25.5	20.25	17.0	14.25	12.5	11.0	10.0	9.0	8.0
.3	105.5	52.5	34.75	26.0	20.75	17.25	14.75	12.75	11.25	10.0	9.0	8.25
.4	107.5	53.5	35.5	26.5	21.0	17.5	15.0	13.0	11.5	10.25	9.25	8.5
.5	109.5	54.5	36.25	27.0	21.5	18.0	15.25	13.25	11.75	10.5	9.5	8.75
.6	111.5	55.5	36.75	27.5	22.0	18.25	15.5	13.5	11.75	10.75	9.75	8.75
.7	113.5	56.5	37.5	28.0	22.25	18.5	15.75	13.75	12.0	11.0	10.0	9.0
.8	115.5	57.5	38.25	28.5	22.75	18.75	16.25	14.0	12.25	11.0	10.0	9.25
.9	117.5	58.5	38.75	29.0	23.0	19.25	16.5	14.25	12.5	11.25	10.25	9.25
26.0	119.5	59.5	39.5	29.5	23.5	19.5	16.75	14.5	12.75	11.5	10.5	9.5
.1	121.5	60.5	40.25	30.0	24.0	19.75	17.0	14.75	13.0	11.75	10.75	9.75
.2	123.5	61.5	40.75	30.5	24.25	20.25	17.25	15.0	13.25	12.0	10.75	9.75
.3	125.5	62.5	41.5	31.0	24.75	20.5	17.5	15.25	13.5	12.0	11.0	10.0
.4	127.5	63.5	42.25	31.5	25.0	20.75	17.75	15.5	13.75	12.25	11.25	10.25
.5	129.5	64.5	43.0	32.0	25.5	21.25	18.25	15.75	14.0	12.5	11.5	10.25
.6	131.5	65.5	43.5	32.5	26.0	21.5	18.5	16.0	14.0	12.75	11.5	10.5
.7	133.5	66.5	44.25	33.0	26.25	21.75	18.75	16.25	14.25	13.0	11.75	10.75
.8	135.5	67.5	45.0	33.5	26.75	22.0	19.0	16.5	14.5	13.0	12.0	11.0
.9	137.5	68.5	45.5	34.0	27.0	22.5	19.25	16.75	14.75	13.25	12.0	11.0
27.0	139.5	69.5	46.25	34.5	27.5	22.75	19.5	17.0	15.0	13.5	12.25	11.25
.1	141.5	70.5	47.0	35.0	28.0	23.0	19.75	17.25	15.25	13.75	12.5	11.5
.2	143.5	71.5	47.5	35.5	28.25	23.5	20.0	17.5	15.5	14.0	12.5	11.5
.3	145.5	72.5	48.25	36.0	28.75	23.75	20.25	17.75	15.75	14.0	12.75	11.75
.4	147.5	73.5	48.75	36.5	29.0	24.25	20.5	18.0	16.0	14.25	13.0	11.75
.5	149.5	74.5	49.5	37.0	29.5	24.5	21.0	18.25	16.25	14.5	13.25	12.0
.6	151.5	75.5	50.25	37.5	30.0	24.75	21.25	18.5	16.25	14.75	13.25	12.25
.7	153.5	76.5	50.75	38.0	30.25	25.25	21.5	18.75	16.5	15.0	13.5	12.25
.8	155.5	77.5	51.5	38.5	30.75	25.5	21.75	19.0	16.75	15.0	13.75	12.5
.9	157.5	78.5	52.0	39.0	31.0	26.0	22.0	19.25	17.0	15.25	13.75	12.5
28.0	159.5	79.5	52.75	39.5	31.5	26.25	22.25	19.5	17.25	15.5	14.0	12.75

TABLE B

**TOTAL VALUE IN OHMS OF RESISTORS A TO F**  
**FOR REFERENCE FUSE PANEL VOLTAGES OF 45 TO 50.6 VOLTS**  
**FOR 1 TO 24 J68647A VOICE FREQUENCY AMPLIFIERS**

REFERENCE FUSE PANEL VOLTAGE	NO. OF AMPLIFIERS (V3 Repeaters Have 2 Amplifiers Per Repeater)											
	1 or 2	3 or 4	5 or 6	7 or 8	9 or 10	11 or 12	13 or 14	15 or 16	17 or 18	19 or 20	21 or 22	23 or 24
45.0	99.5	49.5	32.75	24.5	19.5	16.25	13.75	12.0	10.5	9.5	8.5	7.75
.1	101.5	50.5	33.50	25.0	20.0	16.5	14.0	12.25	10.75	9.75	8.75	8.0
.2	103.5	51.5	34.0	25.5	20.25	17.0	14.25	12.5	11.0	10.0	9.0	8.25
.3	105.5	52.5	34.75	26.0	20.5	17.25	14.75	12.75	11.25	10.0	9.0	8.25
.4	107.5	53.5	35.5	26.5	21.0	17.5	15.0	13.0	11.5	10.25	9.25	8.5
.5	109.5	54.5	36.25	27.0	21.5	18.0	15.25	13.25	11.75	10.5	9.5	8.75
.6	111.5	55.5	36.75	27.5	22.0	18.25	15.5	13.5	11.75	10.75	9.75	8.75
.7	113.5	56.5	37.5	28.0	22.25	18.5	15.75	13.75	12.0	11.0	10.0	9.0
.8	115.5	57.5	38.25	28.5	22.5	18.75	16.25	14.0	12.25	11.0	10.0	9.25
.9	117.5	58.5	39.0	29.0	23.0	19.25	16.5	14.25	12.5	11.25	10.25	9.25
46.0	119.5	59.5	39.5	29.5	23.5	19.5	16.75	14.5	12.75	11.5	10.5	9.5
.1	121.5	60.5	40.25	30.0	24.0	19.75	17.0	14.75	13.0	11.75	10.75	9.75
.2	123.5	61.5	41.0	30.5	24.25	20.25	17.25	15.0	13.25	12.0	10.75	9.75
.3	125.5	62.5	41.5	31.0	24.5	20.5	17.5	15.25	13.5	12.0	11.0	10.0
.4	127.5	63.5	42.25	31.5	25.0	20.75	17.75	15.5	13.75	12.25	11.25	10.25
.5	129.5	64.5	43.0	32.0	25.5	21.25	18.25	15.75	14.0	12.5	11.5	10.25
.6	131.5	65.5	43.5	32.5	26.0	21.5	18.5	16.0	14.0	12.75	11.5	10.5
.7	133.5	66.5	44.25	33.0	26.25	21.75	18.75	16.25	14.25	13.0	11.75	10.75
.8	135.5	67.5	45.0	33.5	26.5	22.0	19.0	16.5	14.5	13.0	12.0	10.75
.9	137.5	68.5	45.5	34.0	27.0	22.5	19.25	16.75	14.75	13.25	12.0	11.0
47.0	139.5	69.5	46.25	34.5	27.5	22.75	19.5	17.0	15.0	13.5	12.25	11.25
.1	141.5	70.5	47.0	35.0	28.0	23.0	19.75	17.25	15.25	13.75	12.5	11.25
.2	143.5	71.5	47.5	35.5	28.25	23.5	20.0	17.5	15.5	14.0	12.5	11.5
.3	145.5	72.5	48.25	36.0	28.5	23.75	20.25	17.75	15.75	14.0	12.75	11.75
.4	147.5	73.5	48.75	36.5	29.0	24.25	20.5	18.0	16.0	14.25	13.0	11.75
.5	149.5	74.5	49.5	37.0	29.5	24.5	21.0	18.25	16.25	14.5	13.25	12.0
.6	151.5	75.5	50.25	37.5	30.0	24.75	21.25	18.5	16.25	14.75	13.25	12.25
.7	153.5	76.5	50.75	38.0	30.25	25.25	21.5	18.75	16.5	15.0	13.5	12.25
.8	155.5	77.5	51.5	38.5	30.5	25.5	21.75	19.0	16.75	15.0	13.75	12.5
.9	157.5	78.5	52.0	39.0	31.0	26.0	22.0	19.25	17.0	15.25	13.75	12.75
48.0	159.5	79.5	52.75	39.5	31.5	26.25	22.25	19.5	17.25	15.5	14.0	12.75
.1	161.5	80.5	53.5	40.0	32.0	26.5	22.5	19.75	17.5	15.75	14.25	13.0
.2	163.5	81.5	54.0	40.5	32.25	27.0	22.75	20.0	17.75	16.0	14.25	13.25
.3	165.5	82.5	54.75	41.0	32.5	27.25	23.25	20.25	18.0	16.0	14.5	13.25
.4	167.5	83.5	55.5	41.5	33.0	27.5	23.5	20.5	18.25	16.25	14.75	13.5
.5	169.5	84.5	56.25	42.0	33.5	28.0	23.75	20.75	18.5	16.5	15.0	13.75
.6	171.5	85.5	56.75	42.5	34.0	28.25	24.0	21.0	18.5	16.75	15.0	13.75
.7	173.5	86.5	57.5	43.0	34.25	28.5	24.25	21.25	18.75	17.0	15.25	14.0
.8	175.5	87.5	58.25	43.5	34.5	28.75	24.75	21.5	19.0	17.0	15.5	14.25
.9	177.5	88.5	59.0	44.0	35.0	29.25	25.0	21.75	19.25	17.25	15.5	14.25
49.0	179.5	89.5	59.5	44.5	35.5	29.5	25.25	22.0	19.5	17.5	15.75	14.5
.1	181.5	90.5	60.25	45.0	36.0	29.75	25.5	22.25	19.75	17.75	16.0	14.75
.2	183.5	91.5	61.0	45.5	36.25	30.25	25.75	22.5	20.0	18.0	16.25	14.75
.3	185.5	92.5	61.5	46.0	36.5	30.5	26.0	22.75	20.25	18.0	16.25	15.0
.4	187.5	93.5	62.25	46.5	37.0	30.75	26.25	23.0	20.5	18.25	16.5	15.25
.5	189.5	94.5	63.0	47.0	37.5	31.25	26.75	23.25	20.75	18.5	16.75	15.25
.6	191.5	95.5	63.5	47.5	38.0	31.5	27.0	23.5	20.75	18.75	17.0	15.5
.7	193.5	96.5	64.25	48.0	38.25	31.75	27.25	23.75	21.0	19.0	17.25	15.75
.8	195.5	97.5	65.0	48.5	38.5	32.0	27.5	24.0	21.25	19.0	17.25	15.75
.9	197.5	98.5	65.5	49.0	39.0	32.5	27.75	24.25	21.5	19.25	17.5	16.0

TABLE B (Cont)												
REFERENCE FUSE PANEL VOLTAGE	NO. OF AMPLIFIERS (V3 Repeaters Have 2 Amplifiers Per Repeater)											
	1 or 2	3 or 4	5 or 6	7 or 8	9 or 10	11 or 12	13 or 14	15 or 16	17 or 18	19 or 20	21 or 22	23 or 24
50.0	199.5	99.5	66.25	49.5	39.5	32.75	28.0	24.5	21.75	19.5	17.75	16.25
.1	201.5	100.5	67.0	50.0	40.0	33.0	28.25	24.75	22.0	19.75	18.0	16.25
.2	203.5	101.5	67.5	50.5	40.25	33.5	28.5	25.0	22.25	20.0	18.0	16.5
.3	205.5	102.5	68.25	51.0	40.5	33.75	29.0	25.25	22.5	20.0	18.25	16.75
.4	207.5	103.5	69.0	51.5	41.0	34.25	29.25	25.5	22.5	20.25	18.5	16.75
.5	209.5	104.5	69.5	52.0	41.5	34.5	29.5	25.75	22.75	20.5	18.5	17.0
.6	211.5	105.5	70.25	52.5	42.0	34.75	29.75	26.0	23.0	20.75	18.75	17.25