INVERTER

J87322

OPERATING METHODS

1. GENERAL

1.01 The J87322 20-Hz, 1.5A dc-to-ac ringing inverter circuit is intended for use with the 852A and 862A Ringing and Tone Power Plants. It may also be used if the voltage and current capacities meet the requirements with which it will be associated. The basic function of this inverter is to provide two isolated filtered 86-volt rms, 20-Hz outputs and one isolated 105-volt rms, 20-Hz output. Each of these two isolated 86-volt outputs is provided with a transformer winding tap that supplies a 97-volt rms, 20-Hz output for dial long line circuits. The isolated 105-volt output is also provided with a winding tap that supplies an additional unfiltered 86-volt rms, 20-Hz output. A step-down transformer whose primary winding is connected across the 86-volt (B) output, provides two center-tapped secondary output voltages of 14.2 volts rms and two 14.6 volts rms, both at 20 Hz for solid state ringing switches within the ringing and tone power plants.

1.02 This issue does affect the Equipment Test List.

1.03 Electrically, the dc-to-ac inverter is comprised of a low pass dc input line filter, a 20-Hz oscillator inverter, a driver inverter, a power inverter, a two-coil filtered ferroresonant regulator, and 86-volt output filters. The ***low pass dc input line filter*** consists of an L1 inductor, C1 capacitor, and CR1 and CR2 diodes. The components comprising the ***20-Hz oscillator inverter*** are contained in the oscillator (J87322B) plug-in package. Most of the components which comprise the ***driver inverter*** are included in the oscillator (J87322B) plug-in package. The one exception is the T2 transformer, which is mounted on the inverter chassis. The ***power inverter*** is contained in the amplifier (J87322C) plug-in package. The C3.1 and C3.2 capacitors in combination with the T3A inductor and T3B transformer comprise the ***two-coil filtered ferroresonant regulator*** which is mounted on the inverter chassis. The components which comprise the ***86-volt output filters*** mounted on the inverter chassis are the L3 inductor, C4.1 through C4.4 capacitors, the C5 capacitor used for the 86-volt (A) output, the L4 inductor, C6.1 through C6.4 capacitors, and the C7 capacitor used for the 86-volt (B) output.

> ***Caution: The voltages in the inverter unit are as high as 400 volts to ground and between parts of the circuit. Every precaution should be observed to avoid any contact with exposed metal parts or terminals when the inverter is in operation. Do not allow a test pick to touch two metal parts at the same time or dangerous and destructive short circuits may occur.***

1.04 The instructions in this practice are based on circuit schematic drawing SD-81768-01. For a detailed description of operation, see the corresponding circuit description.

2. LIST OF TOOLS AND TEST APPARATUS

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
KS-16346 L2	Soldering Copper
—	3-Inch C Screwdriver
—	P Long-Nose Pliers
TEST APPARATUS	
KS-14510	Volt-Ohm-Milliammeter
—	Voltmeter, AC Weston Model 904, Ranges 300/150 volts

3. OPERATION

3.01 The dc-to-ac inverter has no disconnecting switches and is permanently connected to both the dc input power and the output load from the ringing and tone power plant when all external connections are made. If it is necessary to remove an inverter from service, refer to the operating practice of the ringing and tone power plant for the recommended procedure for removing the power from either side of the plant. Ensure that the inverter is not supplying ringing power to the ringing and tone power plant; then remove the alarm fuses and the 10A fuses in the ringing distribution circuit.

3.02 To restore the inverter to normal service, replace the 10A fuses and the alarm fuses in the ringing distribution circuit; then refer to the operating practice of the ringing and tone power plant for the recommended procedure to restore power to the plant.

4. ROUTINE CHECKS

4.01 Electrolytic capacitors should be maintained in accordance with Section 032-110-701.

4.02 Circuit packs and semiconductor devices should be maintained in accordance with Section 032-173-301.

4.03 The ac output voltage should be checked periodically or whenever experience indicates the need. Using the model 904 voltmeter, set for the 150-volt scale, connect the meter leads across the terminals specified in Table A or B to indicate the correct output voltages.

Caution: Frequency, output voltage, and output noise adjustments are made at the factory. Under no circumstances are the taps on the L2, T3A inductors, T3B transformers, and the setting of the R1 potentiometer to be changed in the field.

5. TROUBLE

5.01 Trouble in the inverter is normally detected by a low-voltage monitor in the associated ringing and tone power plant, providing trouble indicating lamps and audible minor or major alarms.

Since some unsatisfactory conditions damage more than one component, all checks listed under a given symptom of the trouble chart should be made even though defective components are revealed before the entire checks have been completed. The following restrictions for adjustment and replacement of certain critical components must be observed in the field.

(a) Under no circumstances are the taps on the L2, T3A inductors, T3B transformer, and the settings of the R1 potentiometer to be changed in the field.

(b) In the event that either coil of the 2119A transformer (composed of the T3A inductor

TABLE A

		NORMAL INPUT VOLTAGE BETWEEN 48 AND 52.5V DC		EMERGENCY INPUT VOLTAGE BETWEEN 43 AND 53.5V DC	
OUTPUT	CONNECT METER LEADS TO (TB2) TERM.	OUTPUT VOLTS RMS MINIMUM	MAXIMUM	OUTPUT VOLTS RMS MINIMUM	MAXIMUM
86V (A)	2 and 8	84	88	75	90
86V (B)	4 and 9	84	88	75	90
86V (C)	6 and 7	80	92	70	92
97V (A)	1 and 2	94	101	84.5	101.6
97V (B)	3 and 4	94	101	84.5	101.6
105V	5 and 7	102	110	90	110

TABLE B

		NORMAL INPUT VOLTAGE BETWEEN 48 AND 52.5V DC		EMERGENCY INPUT VOLTAGE BETWEEN 43 AND 53.5V DC	
OUTPUT	CONNECT METER LEADS TO (TB3) TERM.	OUTPUT VOLTS RMS MINIMUM	MAXIMUM	OUTPUT VOLTS RMS MINIMUM	MAXIMUM
14.2V	1 and 2	12.9	15.5	12.55	15.85
14.2V	2 and 3	12.9	15.5	12.55	15.85
14.6V	4 and 5	13.25	15.95	11.7	16.3
14.6V	5 and 6	13.25	15.95	11.7	16.3

and T3B transformer) fails, both must be replaced with a factory adjusted unit.

(c) In the event that the L2 inductor, C2 capacitor, CR5 diode, R4 resistor or the variable R1 potentiometer fails, the complete oscillator (J87322B) must be replaced with a factory adjusted unit.

Caution: Indiscriminate substitution of replacements for these components will detune the ferroresonant regulator and result in the output voltages going out of limits.

5.02 When it is necessary to disconnect the dc input power from the inverter, first operate the appropriate POWER OFF switch in the ringing power plant; then remove the 1/2-ampere alarm fuse and then its associated 10-ampere line fuse. These fuses (G0 and G1) are part of the ringing distribution circuit. To reconnect the dc input power, insert the 10-ampere line fuse and then the associated 1/2-ampere fuse and operate the appropriate POWER ON switch in the ringing power plant.

5.03 ***Input Voltage:*** To check the dc input voltage, connect the KS-14510 meter, set on the 60-volt scale, across terminals 1 and 2 of TB1 observing the correct polarity. The dc voltage indication should be between 48 and 52 volts.

Note: Terminal 1 of TB1 is positive and ground, while terminal 2 is negative.

5.04 ***Output Voltages:*** To check the output of the inverter, proceed as follows.

(a) Disconnect the dc input power from the inverter as described in 5.02.

(b) Disconnect the external ringing distribution circuit from the output of the inverter by removing the leads from terminals 1 through 9 from TB2 and terminals 1 through 6 from TB3 (use screwdriver). Mark or record the connections.

(c) Connect the dc input power to the inverter as described in 5.02.

(d) Verify the inverter output by connecting the model 904 ac voltmeter, using the 150-volt scale, across the indicated output terminals of TSA (furnished with the T3 transformer) as shown on Table C.

TABLE C

	MEASUREMENT TAKEN		METER READINGS VOLTS RMS	
OUTPUT	FROM TSA	TO TSA	MIN	MAX
86V(A)	TERM 6	TERM 7	84	88
86V(B)	9	10	84	88
86V(C)	12	13	80	92
97V(A)	5	7	94	101
97V(B)	8	10	94	101
105V	11	13	102	110

TROUBLE	POSSIBLE CAUSE	SUGGESTED REMEDY
(1) High, low or no ac output voltage (output fuses are not operated)	(a) Defective T3A inductor and/or T3B transformer (part of 2119A transformer)	Check the input and output voltages as in 5.03 and 5.04; then disconnect the dc input as in 5.02. Short-circuit capacitors C1, C2, C3.1, C3.2, C4.1 — C4.4, C5, C6.1 — C6.4, and C7 with a 100-ohm resistor to ensure a complete discharge. Disconnect the lead from terminal 1 on TSA. Use KS-14510 VOM set on lowest range, check each winding of T3 transformer for continuity. Reconnect lead on terminal 1 of TSA.
	(b) Defective C3.1 and/or C3.2 capacitor	Disconnect leads from one side of each capacitor. Use KS-14510 VOM set on X1000 scale, check for shorts or opens. Resistance reading should be low initially, then increase as capacitor charges. If resistance remains low, capacitor is shorted. If resistance is high initially, capacitor is open or has high resistance. Reconnect leads to capacitors.
	(c) Defective C4.1 — C4.4, C6.1 — C6.4 and/or C5, C7 capacitors	Disconnect C4.1 — C4.4 capacitors from L3 inductor and C6.1 — C6.4 capacitors from L4 inductor. Disconnect leads from C5 and C7 capacitors. Check parallel C4.1 — C4.4 capacitors and parallel C6.1 — C6.4 capacitors using KS-14510 VOM for shorts or opens. If defect is found, disconnect leads between capacitors to isolate defective unit. Check C5 and C7 capacitors in similar manner. Reconnect all leads to capacitors.
	(d) Defective L3 and/or L4 inductor	Disconnect leads from terminals 1 of the L3 and L4 inductors. Use KS-14510 VOM set on X1 scale, check winding continuity of L3 and L4 inductors. The resistance is .066 ohm and short circuit is difficult to detect. Reconnect leads to inductors.

TROUBLE	POSSIBLE CAUSE	SUGGESTED REMEDY
	(e) Defective L1 inductor	Disconnect the CR1 and CR2 diode and check winding similar to (1) (d). The resistance is .005 ohm and short circuit is difficult to detect. Reconnect diodes.
	(f) Defective C1 capacitor (polarized)	Disconnect lead from one side of C1 capacitor. Use KS-14510 VOM set on X1000 scale, connect — test lead of meter to + terminal of capacitor, and + test lead of meter to — terminal of capacitor. Check capacitor similar to (1) (b). Reconnect lead to capacitor.

Note: If a defective component is found, replace it subject to the restrictions in 5.01. Recheck the inverter output voltage as in 5.04(d); reconnect the external ringing distribution circuit that was removed in 5.04(b); and reconnect the dc input as in 5.02. If a defective component is not found, continue testing in accordance with (2) as follows.

(2) No output voltage (output fuses are operated)	(a) Defective component in plug-in oscillator unit (J87322B)	Connect the dc input voltage as in 5.02. Use model 904 voltmeter and check point-to-point voltage as specified in SD-81768-01-2. If defective, disconnect the dc input voltage as in 5.02 and remove the oscillator unit (J87322B). Replace with new or repaired unit.
	(b) Defective component in plug-in amplifier unit (J87322C)	Repeat similar check as in (2) (a). If defective, disconnect the dc input voltage as in 5.02 and remove the amplifier unit (J87322C). Replace with new or repaired unit.
	(c) Defective T2 transformer	Disconnect the dc input as in 5.02. Temporarily remove the oscillator unit (J87322B) and the amplifier unit (J87322C) from their respective connectors. Using KS-14510 VOM set on lowest range, check each winding of T2 transformer for continuity. If defective, replace the T2 transformer. Replace the amplifier (J87322C) and oscillator (J87322B) units to their respective connectors.

Note: If no defects are found, continue testing as outlined in (1) of the trouble chart. If a defect is found, and after correction, recheck the inverter output voltage as in 5.04(d). Reconnect the external ringing distribution circuit if removed in 5.04(b), and reconnect the dc input as in 5.02.