RINGING POWER PLANT
806F (J86456)
OPERATING METHODS

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1. GENERAL

1.01 This section describes the operation of the J86456 ringing power plant which provides ringing current, tones, and signaling interruptions for step-by-step and No. 5 crossbar systems. A battery-operated inverter automatically provides emergency power in the event of an ac service power failure. The equipment in this plant is operated on 120-volt, 60-cycle, commercial ac service.

Caution 1: This power plant includes automatically controlled equipment. Care must be exercised to prevent automatic transfer to those parts of the plant on which maintenance work is to be done. Before starting work, prevent automatic transfer of equipment by removing fuses, blocking relays, etc, as necessary. When maintenance work has been completed, make sure that the circuit has been restored to normal.

Caution 2: Voltages inside the ringing generator case are over 150 volts. Avoid all contact with terminals. Do not allow a test pick to touch two metal parts at the same time or destructive and dangerous short circuits may occur. Disconnect both the ac supply and the output before doing any work inside of the ringing generator case.

1.02 The section is reissued to include information covering the J86807 dc-to-dc converters used in the 610D power plant, and to bring the section up to date. Since this reissue covers a general revision, the arrows ordinarily used to indicate changes have been omitted.

1.03 Routine checks should preferably be made during a period when they will cause the least service reaction.

1.04 Circuit drawings, on which these instructions are based, are listed below. For a detailed description of the circuit operation, see the corresponding circuit descriptions.

SD-81131-01 — Ringing Circuit, AC-DC or Superimposed Ringing

SD-81132-01 — Ringing Circuit, Superimposing and Tripping Batteries

SD-81139-01 — Ringing Circuit, Auxiliary Interrupters

SD-81225-01 — Ringing Circuit, AC-DC or Superimposing Ringing

SD-81244-01 — Ringing Circuit, Interrupter Equipment

SD-81278-01 — Ringing Circuit, Surge Absorbing Equipment

SD-81558-01 — Ringing Circuit, AC-DC or Superimposing Ringing

SD-81571-01 — Power Supply Circuit, DC to DC Transistor Converter

SD-81575-01 — Ringing Circuit, Interrupter Equipment

1.05 For more detailed information on the operation and maintenance of individual equipment or apparatus, refer to the appropriate Bell System Practices. All relays, etc, should

be adjusted, when required, in accordance with these sections and the circuit requirements table on the circuit drawings.

2. TOOLS, GAUGES, AND TEST APPARATUS

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
265C	Burnishing Tool
411B	Test Pick
KS-6278	Connecting Clip
—	3-Inch C Screwdriver
GAUGES	
KS-3008	Stopwatch (or watch with second hand)
KS-14510 L1	Volt-Ohm-Milliammeter
—	Voltmeter AC-DC Thermo, Weston Model 622, 300/150/30/3 Volt (or equivalent, such as Hewlett-Packard 3400A RMS Voltmeter or Greibach True RMS Voltmeter Model 500)
—	Test Cords, Weston No. D-79650 and D-79651
TEST APPARATUS	
716C	Receiver
2W21A	Cord
W1AF	Cord

3. OPERATION

Description

3.01 These plants provide ringing current, tones, and ringing and signaling interruptions for 355A community dial offices and No. 5 crossbar offices. 20-cycle audible ringing is generated by KS-15529 static frequency generators or 109B frequency generators which contain no relays or moving parts and furnish regulated output. Low tones are provided by 101A frequency generators, and high tone, when required, by a 102A frequency generator. The plant uses J86445C motor-driven cam and spring interrupter assemblies, which use KS-15634 interrupters. Duplicate 20-cycle and low-tone generators and interrupters and a single high-tone generator are furnished. One 20-cycle generator, low-tone generator, and an interrupter are in use normally, with automatic transfer to a spare if the first should fail. Ringing and tone generators and interrupters all operate from commercial 60-cycle ac on a call-start or optional continuous basis.

3.02 Surge-absorbing equipment will be furnished on all standard ringing plants and may be added to existing plants. The purpose of surge absorption is to prevent the damage to thermistors and varistors which might otherwise result from high, short-duration surges in key telephone circuits with thermistor-varistor type relays.

3.03 Provision has been made for adding dial transfer of the ringing and low-tone generators and interrupters where this feature is considered desirable. This feature supplements the normal automatic transfer.

3.04 The plant also includes a KS-15511 rotary inverter to furnish 60-cycle ac supply during power service failures. To save battery drain, the inverter is also under call-start control. If the ac line voltage falls below 85 percent of normal, the plant transfers automatically to the inverter. About 15 seconds later the plant transfers back if the line has recovered to at least 90 percent of normal voltage, or if not, remains on the reserve until the line does recover. As the inverter output is affected by battery voltage, the 20-cycle output voltage limits, while operating on the reserve, are subject to wider variation than when the plant is operating on 60-cycle ac service.

> ***Note:*** While the inverter is supplying 60-cycle ac to the 101A and 102A frequency generators, the quality of the dial busy tone is degraded.

3.05 ***Superimposing or Tripping Supply***

(a) ***Dry Cell Battery Supply:*** In selective superimposed offices, 45- to 52-volt dc is used for both ringing and tripping potentials. In addition to central office battery, only a single positive dry cell battery is needed to furnish all dc requirements. A spare dry battery is also furnished with the usual manual controls for load transfer and tests.

(b) ***DC-to-DC Converter (610 power plant):*** Two parallel connected converters of the 610D power plant are provided to supply +48 volt, 1-ampere dc power from −48 volt central

office battery. Both converters operate simultaneously and share the connected load. Failure of one converter causes the other converter to automatically increase its current output to carry the entire load. Failure of either converter will cause a minor alarm and failure of both converters will cause a major alarm. A NV alarm lamp is provided for each converter.

3.06 Auxiliary interrupter equipment covered in J86445 is available for 10- or 20-code ringing. This consists of an additional interrupter or pair of interrupters which function generally as described above for the main interrupters. Provision is also made for converting a single interrupter unit into one with two interrupters with automatic transfer.

3.07 These plants may also furnish 105-volt continuous ringing for miscellaneous uses such as manual switchboards. An option is available to provide for continuous instead of call-start operation of ringing and tone generators and interrupters, including continuous operation during ac power service failures. This option may be necessary for supply to manual switchboards. In addition, the superimposed plant furnishes 97-volt ringing for dial long line circuits.

3.08 The plants furnish a major alarm to show loss of ringing or low-tone output, ringing fuse failure, or failure of the interrupters, and a minor alarm for a power service failure lasting over 15 seconds, a transfer from regular to spare interrupter, or a transfer from regular to spare ringing and low-tone generators.

3.09 In 355A offices, start-ground for the inverter is applied only for the dialing and ringing interval of each call, so the inverter will be shut down most of the time unless a permanent signal trouble condition exists, or the plant is wired for continuous operation.

Preparing to Start Initially

3.10 When putting the plant into service:

(a) Turn C and M potentiometers on the inverter control panel to the extreme clockwise position.

(b) Using the crank furnished with each interrupter, turn all interrupters by hand until the conditions specified below are met.

LIST NO.	CONDITION
1	Spring 1 operated, spring 8 not operated
2	Spring 1 operated, spring 2 not operated
3	Spring 13 operated
4	Spring 1 operated, spring 2 not operated

(c) Check that the plugs of the 20-cycle ringing generator, tone frequency generators, and interrupters have been inserted into the proper sockets.

(d) Check that the correct size fuses are in place where required.

(e) Using a headset, an experienced attendant should listen to the outputs of the low- and high-tone frequency generators to ascertain that the tones sound normal.

Note: Avoid holding the receiver close to the ear as the tones or battery clicks are loud. Battery clicks can be nullified by using a receiver equipped with a 161A capacitor.

(f) When provided, check that the proper dry batteries are installed for the superimposing and tripping circuit and that each set of batteries has the taps connected to put 31 cells in circuit.

(g) When provided, check that the 610D dc-to-dc converters are properly connected in accordance with the SD- drawings.

Initial Adjustments

3.11 Check to see that the proper tap on the terminal strip for the T transformer primary on the inverter transfer panel has been selected for the local ac service. Measure the ac service voltage with a KS-14510 L1 voltmeter and connect to the tap marked nearest to that voltage.

3.12 The inverter transfer panel circuit should be adjusted as follows. Block the LV1 relay operated. Hold the ADJ key depressed and turn the C potentiometer counterclockwise until the LV relay releases, then clockwise until it just operates. Still holding the ADJ key depressed, turn the M potentiometer counterclockwise until the LV relay releases, then clockwise until it just

operates, and then turn it 10 or 15 degrees further clockwise. Remove the block from the LV1 relay.

3.13 The ***inverter speed*** and associated ringing voltage should be adjusted as described in (a) through (f).

(a) Measure the central office battery which supplies the inverter. Switch countercells in or out as required, or shut off enough rectifiers in the battery charging circuit to bring the battery voltage to approximately 49.5 volts.

(b) Remove the ac fuse in the plant supply, or operate the power service circuit breaker, which supplies the ringing plant, to cause a power failure and automatic transfer to inverter supply.

(c) Start the ringing plant by either blocking the MS relay operated or taking a handset off the hook in the associated circuit.

(d) Using the Weston model 622 ac thermocouple voltmeter equipped with test leads, measure the static ringing generator output voltage between the 0 and 86V terminals of winding A. The voltmeter should read 90 ±2 volts. See (e).

Caution: To obtain access to the terminals, it is necessary to remove the static ringing generator cover. Use care not to touch any of the exposed parts as high voltages are present.

(e) Change the adjustable field resistor mounted on the inverter frame as necessary to meet the 90-volt requirement in (d). An increase in resistance will raise inverter speed and thus raise the static ringing generator output voltage.

Caution: Do not make adjustments while the inverter is running.

(f) Restore the plant to normal by unblocking MS relay or replacing the handset on the hook, replacing the static ringing generator cover, and installing the ac fuse or operating the circuit breaker which supplies the ringing plant to the ON position.

Routine Adjustments

3.14 Since the plant is fully automatic, no routine adjustments need be made.

3.15 When the ***dial transfer*** feature is furnished, it should not be used to transfer the load from one set of generators and interrupters on a periodic schedule, as has been done in the case of battery-driven ringing machines, to equalize wear on commutators, etc. It is intended only for emergency use in case of failure due to an open lead or similar circumstance which the automatic transfer features will not detect. Wear on the interrupters may be equalized by interchanging the input and output cords of each interrupter. It may be desirable to interchange the two covers to show that this change has been made. The ringing and tone generators have no moving parts; therefore, no provision is made for interchanging them.

3.16 Under certain conditions a trouble may be temporarily isolated by using the dial transfer feature. If the regular machines are assumed to be running, dial the number which has been assigned to the spare machines. A busy signal indicates that the equipment dialed for is in use and the number assigned to the regular equipment should be dialed. Whether or not the trouble is cleared by use of the dial transfer feature, the original cause of the trouble should be found and remedied as soon as possible.

4. ROUTINE CHECKS

General

4.01 The purpose of making routine checks is to determine whether or not the plant is in proper operating condition. Checks should be made when they will cause the least interference with service. The procedures shown in this part are also to be used when temporarily removing equipment from service for maintenance.

Power Failure

4.02 Remove the ac service fuse. This should light the PF lamp, bring in a minor alarm, and start the inverter. Restore the fuse and check that the plant has transferred back to ac service.

Inverter

4.03 Periodically (about twice a year) operate the INV ST key to check that the inverter will start and let it run for about 15 minutes to loosen coagulated grease in the bearings. The

GD lamp should light. Restore the INV ST key to its original position to shut off the inverter and the GD lamp.

Interrupters — Regular and Spare

4.04 Check that the spare (not the auxiliary) interrupter will operate as follows:

(a) Start the regular interrupter, if not already running, by any convenient means such as taking a handset on the same circuit off the hook or blocking the MS relay operated.

(b) Momentarily depress the INT TRNS key. The GD lamp will light and when the regular interrupter reaches the end of its code cycle, the spare interrupter will start, the load will be transferred to the spare interrupter, the MT lamp will light, and the regular interrupter will stop.

(c) When the spare interrupter starts, let it run for a few minutes.

(d) Hold the INT RST key depressed until the MT lamp goes out, and then release the key. The regular interrupter should start and the spare interrupter should stop.

(e) Proceed to the next check or unblock the MS relay or return the handset to the hook.

4.05 ***Interrupter Transfer***

(a) Start the regular interrupter, if not already running, by taking a handset on the same circuit off the hook or blocking operated MS relay. Remove the ac power plug of INT 1 and note that the load transfers to INT 2 and a minor alarm sounds.

(b) Note whether the 120 IPM contacts of the INT 1 transfer cam are operated or non-operated when the interrupter stops.

(c) When the spare interrupter has run long enough for at least one code cycle, pull its power plug to stop it. This should bring in a major alarm and light the RF lamp.

(d) Reinsert both of the interrupter power plugs and manually transfer back to the regular interrupter by holding the INT RST key depressed until the MT lamp goes out. When the end of the code cycle is reached, the regular interrupter will start, the load will be transferred to it, and the spare interrupter will stop.

(e) Repeat (a) through (d), as necessary, to insure that the load transfers when the 120 IPM contacts of the INT 1 transfer cam are in the position opposite to that previously noted in (b).

(f) Proceed to the next check or unblock the MS relay or return the handset to the hook.

Interrupters — 20-Code Auxiliary and Spare

4.06 Check that the spare interrupter will operate as follows:

(a) Start the auxiliary interrupter INT 1, if not already running, by taking a handset on the same circuit off the hook or blocking operated the MS relay.

(b) Momentarily depress the INT TRNS key. The GD lamp will light, and when the auxiliary interrupter reaches the end of its code cycle, the spare auxiliary interrupter will start. The load will transfer to the spare auxiliary interrupter and the regular auxiliary interrupter will stop.

(c) When the spare interrupter starts, let it run for a few minutes.

(d) Hold the RST key depressed until the MT lamp is extinguished, then release. The spare interrupter should stop and the auxiliary interrupter should start.

(e) Proceed to the next check or unblock the MS relay or return the handset to the hook.

4.07 Start the 20-code auxiliary interrupter, if not already running, by taking a handset on the same circuit off the hook or blocking operated the MS relay. Remove the power plug of INT 1 and note that the load transfers to INT 2 and a minor alarm sounds. When the spare interrupter has run long enough to reach the end of its code cycle, pull its power plug to stop it. This should bring in a major alarm and light the MF lamp. Reinsert both interrupter power plugs and manually transfer back to the auxiliary interrupter by holding the RST key depressed until the MT lamp is extinguished. When the end of the code cycle is reached, the auxiliary interrupter will start, the load will be transferred to it, and the spare interrupter will stop. Proceed to the next check or unblock the MS relay or return the handset to the hook.

Ringing Generators

4.08 Call the regular ringing generator into service by taking a handset on the same circuit off the hook or blocking operated the MS relay. Check that operation of the GEN TRNS key to the MAN position transfers the load to RING G2. This can sometimes be detected by feeling the cover of each generator. The active generator will have a slight vibration. Another method is to look at the T9 relay. When the T9 relay is operated, RING G2 is in use. Returning the GEN TRS key to the AUTO position returns the load to RING G1. Proceed to the next check or unblock the MS relay or return the handset to the hook.

4.09 Call the regular ringing generator into service by taking a handset in the same circuit off the hook or blocking operated the MS relay. Disconnect the ac input power cord plug for RING G1. A minor alarm should sound, the GF lamp should light, and the load should be transferred to RING G2. Remove the ac power plug for RING G2; this should bring in a major alarm. Replace the plugs of RING G1 and RING G2 and operate the GEN RST key. The alarms should stop and the load will return to RING G1. Proceed to the next check or unblock the MS relay or return the handset to the hook.

Tone Generators

4.10 Call the regular tone generator into service by taking a handset on the same circuit off the hook or blocking operated the MS relay. Check that operation of the GEN TRNS key to the MAN position transfers the load to LT G2. To check this, note that the T9 relay is operated. Returning the GEN TRNS key to the AUTO position returns the load to LT G1. Proceed to the next check or unblock the MS relay or return the handset to the hook.

4.11 Call the regular tone generator into service by taking a handset in the same circuit off the hook or blocking operated the MS relay. Disconnect the ac input power cord plug for LT G1. A minor alarm should sound, the GF lamp should light, and the load should be transferred to LT G2. Remove the ac power plug for LT G2; this should bring in a major alarm. Replace the plugs of LT G1 and LT G2 and operate the GEN RST key. The alarms should stop and the load will return to LT G1. Unblock the MS relay or return the handset to the hook.

Tripping and Superimposing Batteries

4.12 Check and switch the tripping or superimposing dry batteries monthly, or as operating experience indicates, as follows:

(a) Connect a KS-14510 L1 voltmeter (60-volt scale) to the VM pin jacks.

(b) Operate the TST key to the unused battery position (if key +BAT is in position 1, operate the TST key to position B2, and vice versa).

(c) Hold LOAD key depressed for 10 seconds, read the voltage while LOAD key is still depressed, and then release the key.

(d) The voltage should be between 45 and 52 volts. As the batteries age in service, additional cells may be connected by changing battery taps to meet the voltage requirements. Select taps to obtain 48 volts or higher. When all 45 cells of the three batteries are required to meet the voltage requirements, replace all the batteries. When new batteries are installed, connect taps to put 31 cells in circuit and repeat the voltage check.

Caution: Where dry cell terminals are within a foot of countercells, changing of taps and replacement of dry cells should be done when countercells are not gassing, that is, not during boost charges.

(e) Operate the +BAT key to the other position and repeat (b), (c), and (d).

Dial Transfer

4.13 Check the dial transfer feature as described in 3.15 and 3.16.

Fuse Alarms

4.14 Short the alarm terminal to battery on the −TRP and +TRP fuses. This should bring in a major alarm and light the TRP lamp. Remove the short. See 4.15.

4.15 Check 70-type fuse alarm using the W1AF cord equipped with one 411B test pick and one KS-6278 connecting clip as follows. Connect the clip end of the cord to the 48-volt

battery supply and then carefully insert the test pick through the aperture in front of the fuse holder, adjacent to the colored bead, to a point where contact is made with the alarm surface of the fuse cap. This should cause the fuse alarm to sound.

4.16 Check the NV alarms, if provided, on the dc-to-dc converters as covered in Section 167-684-304.

Miscellaneous Equipment

4.17 Replace the 313C electron tube every 2 years and readjust the circuit as instructed in 3.12.

4.18 Check the operation of the inverter and interrupters and maintain them in accordance with their individual sections.

5. TROUBLES AND ALARMS

General

5.01 Troubles in units of equipment such as inverters and interrupters are covered in separate sections. Before putting an interrupter that has been removed for maintenance or repair back into service, turn the interrupter motor high-speed shaft by hand with the crank until the contacts are in the positions specified in 3.10 to prevent splitting ringing codes during a manual transfer.

5.02 The 101A or 102A low-tone or high-tone frequency generators are sealed units and have no adjustments. Replace if defective.

5.03 If the inverter transfer circuit does not function properly, try installing a new 313C electron tube. If a new tube is installed, readjust in accordance with the instructions in 3.12.

5.04 If the 20-cycle static ringing generator output is suspected of being incorrect when being supplied by the inverter, the trouble may be due to wrong inverter speed. The inverter speed is affected by battery voltage, causing the output frequency to vary; this in turn changes the output voltage of the static ringing generator. The inverter is provided with an adjustable field resistor (originally set at the factory) mounted on the machine frame. This resistor can be readjusted to change inverter speed and thus change the output voltage of the static ringing generator as desired. After checks have been made to see that the static ringing generator operates satisfactorily on ac service voltage and that the inverter meets its individual requirements, the inverter speed may be adjusted to provide the proper static ringing generator output voltage described in 3.13.

Indicator and Alarm Lamps

5.05 Troubles which may develop in the 806F power plant will be accompanied with one or more visual and audible alarms. The table below lists all of the visual alarm lamps that may be present in a 806F power plant (some plants do not have them all) and some of the possible causes for the lighting of an alarm lamp.

LAMP	FUNCTION AND ACTION
DT	Indicates dial transfer from No. 1 to the No. 2 ringing generator, low-tone generator, and interrupter. Dial back to the No. 1 machines to find the trouble, if any. Dial transfer may be due to a subscriber's accidentally dialing the assigned number. See 3.15 and 3.16. For additional information, see Part 10 of CD-81225-01.
GD	Indicates that the spare interrupter is running as a result of operating the INT TRNS key. See 4.04 and 4.06 or Indicates that the inverter is running as a result of operating the INV ST key or Indicates that the spare ringing and low-tone generators are running as a result of operating the GEN TRNS key. See 4.08.
GF	Indicates generator failure with automatic transfer to the spare. After trouble is found, operate GEN RST key until regular generator reconnects. See 4.09 and 4.11.
MF	Indicates failure of both auxiliary interrupters. See 4.07. Also see procedure for MT lamp if it is lighted.

LAMP	FUNCTION AND ACTION
MT	Indicates manual or automatic transfer to spare interrupter. After fixing trouble and resetting interrupter by hand as covered in 3.10, operate INT RST or RST key to extinguish MT lamp and return regular machine to service. See 4.04 through 4.07.
NV	Indicates failure of 610D power plant. See Section 167-684-304.
PF	Indicates power failure. Check 3-ampere fuse supplying alternating current to this equipment. See 4.02.
RF	Ringing failure alarm. Indicates that the regular and spare interrupters or generators are out of service. See 4.05, 4.08, and 4.09.
TRP	Failure of tripping battery fuse. See 4.14.

Keys

5.06 The table below shows the function of each key and the paragraph which explains its use.

KEY	
+BAT	Choice of No. 1 or No. 2 battery for positive tripping and superimposing battery. See 4.12.
GEN RST	Generator restore. See 4.09 and 4.11.
GEN TRNS	Generator transfer. See 4.08 and 4.10.
INT RST	Interrupter restore. See 4.04 through 4.07.
INT TRNS	Interrupter transfer. See 4.04 and 4.06.
INV ST	Inverter start. See 4.03.
LOAD	Battery test load. See 4.12.
RST	Interrupter restore. See 4.06 and 4.07.
TST	Battery test. See 4.12.

5.07 ***Trouble Chart:*** Should any of the following troubles occur, a check of the possible causes is given below.

TROUBLE	POSSIBLE CAUSES
(a) No ringing voltage	Defective static ringing generator or short circuit on output.
(b) No ringing voltage after an ac service power failure	Bad contact in transfer circuit relays or contactors Defective 313C tube Bad contact in M potentiometer Defective inverter or blown RING Fusetron
(c) Low or high ringing voltage after an ac service power failure	Inverter commutator or brushes require maintenance Inverter field resistor out of adjustment or making poor contact Inverter battery supply voltage high or low
(d) Wrong ringing codes	Interrupter out of adjustment
(e) No low or high tones	Defective low- or high-tone frequency generator
(f) Low superimposing or tripping battery voltage	Discharged superimposing or tripping dry cell batteries or, when provided, defective 610D power plant Open leads or blown fuses