TD-2 RADIO SYSTEM

CONTENTS

1. CHANNEL OPERATION

1.01 Over-all channel operation will generally be under the control of the TD-2 system terminal up until the system is turned up for service. A suggested lining-up procedure is given below:

(1) Place in operation repeater and terminal equipments of the particular channel at all stations as per paragraphs 2.01 to 2.04.

(2) Patch output of terminal transmitter to the input of the buffer amplifier, through the switching equipment if required.

(3) Check PWR OUT indication on the transmitter control panel at the transmitting terminal.

Requirement: 0 db.

(4) (a) If the stations are unattended, have alarm centers note the clearing out of the alarms.

(b) For stations which are attended, have checks made of the RCVR OUTPUT and PWR OUT.

(5) At the receiving terminal, check the power output of the IF main amplifier,

Requirement: +8 dbm.

and connect output to the FM terminal receiver, through the switching equip- if required.

(6) If being lined up for television service, transmit a test pattern.

(7) Notify the television operating center or the carrier terminal room that channel is ready for service.

2. STATION OPERATION

(A) Auxiliary Repeater Station

2.01 If the station is already in operation:

(1) Upon entering, close the door and notify the alarm center on the order circuit.

(2) Operate the alarm switch at the door which actuates the audible alarm.

(3) Observe the floor pilot lights at the entrance which indicate the floor on which there is trouble.

(4) Determine the unit in trouble from the alarm panel on the floor in question.

Note: The engine room alarms are on the second floor. A centralizing panel with visual alarms for the entire station is on the radio floor.

(5) Operate alarm cutoff key ACO which will cut off the audible alarm, except for blown fuses.

Note: There is an ACO key on each of the four power plant bays, one on the radio transmitter-receiver bay and one on the C1 alarm bay which will cut off alarms associated with the room thermostat, waveguide gas pressure, tube cooling, microwave generator oven temperature and with low microwave power.

(6) If it is necessary to remove the panel from the bay, remove the discharge fuses in the various power supply circuits which feed the particular bay. These are located in the cabinets on the second and third floors.

(7) Upon clearing trouble, check with alarm center.

2.02 If initial operation or if the station is to be placed in service without regard for any previous operation:

(1) Connect the a-c distribution circuits as outlined in paragraph 3.03.

(2) Place the 24-volt power plant into operation as outlined in paragraph 3.04.

(3) Place the 130-volt power plant into operation as outlined in paragraph 3.06.

(4) Put the order wire and alarm circuits into operation as outlined in BSP Section A820.912.

(5) Place the 12-volt power plant into operation as outlined in paragraph 3.05.

(6) Place the 250-volt power plant into operation as outlined in paragraph 3.07.

(7) Be assured that no foreign material is lodged in the waveguide and fill with nitrogen gas to a pressure of 3 lbs. per square inch.

(8) Start the blower motor for tube cooling and check that all tubes are being supplied with air.

(a) Insert the 15 amp TUBE COOLING MOTOR fuse in the a-c distribution cabinet on the 130-volt power plant floor.

(b) On the radio equipment floor, inspect the glass filter in the blower output.

Note: Under no condition shall this system be operated without the fibre glass filters since any foreign material entering the system may seriously change the tuning or shorten the tube life.

(c) Connect the armoured lead with the twistlock plug attached to the blower to the outlet receptacle provided near the blower.

(d) Check operation of the gas pressure switch and check that air is available at the 416A and 418A vacuum tubes.

(9) Place the radio equipment in operation as outlined in paragraph 4.02.

(10) Place the C1 alarm equipment in operation and check the operation of the individual alarms as outlined in BSP Section A820.911. The suggested order is as follows: Sequence Signaling, Indications and Alarms.

(11) Check operation of the engine-alternator as outlined in paragraphs 3.08 to 3.13.

(B) Main Repeater Station

2.03 Except for the facts that a main repeater station is normally attended and that switching and monitoring equipment is provided, the steps of paragraphs 2.01 and 2.02 apply generally. It will therefore be necessary to place the switching and monitoring equipment in service in accordance with paragraph 6.01. Furthermore, occasionally it will be necessary to perform two operating functions, namely

(a) Patch in spurs as required.

(b) Patch in channel sections as required for routine maintenance or for emergency reasons.

(C) Terminal Stations

2.04 Terminal stations are attended and are provided with FM terminal equipment and switching and monitoring equipment. In general, however they will use the 24-volt central office battery supply instead of a separate power plant and will not have an emergency engine-alternator. In addition to the duties of a main station attendant, it will be necessary to operate the FM transmitter and FM receiver in accordance with paragraphs 5.01 to 5.06.

3. POWER EQUIPMENT

(A) General

3.01 Once the 12, 24, 130, and 250-volt plants are in service, they are entirely automatic and the units are continuously in service.

3.02 For putting the plants into operation initially or if for some reason it becomes necessary to put the plants into operation without regard for past performance, it is suggested that the fuses in the a-c input supply and the d-c output load fuses for all plants be removed. The general procedure should then be along the lines suggested below.

(B) A-C Distribution Circuits

3.03 Procedure:

(1) Insure that the engine will not start by operating the EMERGENCY STOP AND CONTROL CUTOFF SWITCH to STOP.

(2) See that the main a-c power switch in the building service cabinet in the engine room is open.

(3) With an ohmmeter, check various a-c load circuits for short circuits.

(4) Close the main power switch and insert fuses in the a-c supply and in the load circuits.

(5) Check building lights, obstruction lighting, operation of blower motor, supply at outlets for test bay.

(C) 24-volt Plant

3.04 Procedure:

(1) Operate rheostats OC1 and OC2 completely counterclockwise.

(2) Check discharge circuits for short circuits.

(3) Insert fuses in the d-c discharge and in the a-c supply circuits and place the plant in operation in accordance with BSP Section A301.824 and Section A301.335. (Additional references - CD-81091-01 and CD-81093-01.)

(4) Check that the charging voltage is 25.3 ±0.25 volts.

(5) Check that the battery float voltage is 23.8 ±0.25 volts.

(6) Check the operation of the FLOAT voltage relay.

Requirements: 23 to 26 volts.

(7) Check operation of the high-low voltage relay.

Requirements: 20 to 28 volts.

(8) Check operation of the discharge fuse failure alarm.

(9) Check that the timer TD1 is set for a 6-hour charge.

(10) Check the 24-volt supply at the alarm bays.

(D) 12-volt Plant

3.05 Procedure:

(1) Check that the discharge resistors have been connected correctly for the particular load as indicated on SD-81086-011.

(2) Check discharge circuits for short circuits.

(3) Insert fuses in the d-c discharge and in the a-c supply circuits and place the plant in operation in accordance with BSP Section A301.823 and Section A301.336. (Additional references - CD-81086-01 and CD-81088-01.)

(4) Check that the charging voltage is 13.4 ±0.02 volts and that the battery voltage is 13 ±0.13 volts.

(5) Check the operation of the FLOAT relay.

Requirement: Float limits 12.5 to 13.5 volts.

(6) Check the operation of the high-low voltage alarm.

Requirement: Limits 11.5 to 14 volts.

(7) Check the rectifier failure and the discharge fuse failure alarms.

(8) Check that the timer TD1 is set for a 6-hour charge.

(9) Check the voltage at load distribution points with 13.0 volts battery voltage.

Requirement: 10.9 to 11.1 ±0.13 volts.

(10) To overcharge, momentarily operate the CHG key on the 12-volt power bay.

(E) 130-volt Plant

3.06 Procedure:

(1) Check that switch AC on each rectifier is in the OFF position.

(2) Check discharge circuits for short circuits.

(3) Insert fuses in the d-c discharge and in the a-c supply circuits.

(4) Operate the AC switch on each rectifier to ON beginning with the lowest numbered unit and place the plant in operation in accordance with BSP Section A301.821 and BSP A301.332. (Additional references - CD-81084-01 and CD-81076-01.)

(5) Check that the charging voltage is 139 ±0.2 volts.

(6) Check that the battery float voltage is 136 ±1.3 volts.

(7) Check that each rectifier unit is adjusted to transfer from voltage to current control at 9 ±0.1 amperes and at current control is adjusted to deliver 8 ±0.1 amperes at the battery floating voltage.

(8) Check that the rectifiers start in sequence and operate properly on voltage or current control by cutting off the rectifiers and letting the battery discharge until the low float alarm operates; then reconnect the rectifiers simultaneously.

(9) Check operation of float alarms.

Requirement: 132 to 140 volts.

(10) Check operation of high-low voltage alarms.

Requirement: 120 to 144 volts.

(11) Check operation of rectifier failure and discharge fuse failure alarms.

(12) Check that the timer TD1 is set for a 6-hour charge.

(13) Check the 130-volt supply at the radio transmitter-receiver bay.

(14) Check the operation of the emergency lighting by disconnecting the CONT fuse in the customers lighting cabinet in power room.

(15) To overcharge, momentarily operate the CHG key on the 130-volt power bay.

(F) 250-volt Plant

3.07 Procedure:

(1) Take precautionary measures as voltages in this plant are higher than those usually encountered in telephone power plants, some equipment being normally 250 volts to ground with the possibility of higher voltages to ground during charging or trouble conditions.

(2) Check that switch AC on each rectifier is in the OFF position.

(3) Check discharge circuits for short circuits.

(4) Insert fuses in the d-c discharge and in the a-c supply circuits.

(5) Close battery cabinets and operate the battery switches 250V A and 250V B to ON.

(6) Operate the AC switch on each rectifier to ON beginning with the lowest numbered unit and place the plant in operation in accordance with BSP Section A301.822 and Section A301.322. (Aditional references - CD-81085-01 and CD-81077-01.)

(7) Check that the charging voltage is 125 ±0.2 volts.

Note: The 130-volt battery and the 120-volt battery are in series to provide 250 volts.

(8) Check that the battery float voltage is 121 ±1.2 volts. Check that each rectifier unit is adjusted to transfer from voltage to current control at 8.5 ±0.1 amperes and on current control is adjusted to deliver 8 ±0.1 amperes at the battery floating voltage.

(9) Check that the rectifiers start in sequence and operate properly on voltage and current control by cutting off the rectifiers and letting the battery discharge until the low float alarm operates; then reconnect the rectifiers simultaneously.

(10) Check operation of float alarms.

Requirement: 117 to 126 volts.

(11) Check operation of high-low voltage alarms.

Requirement: 225 to 270 volts.

(12) Check operation of the rectifier failure and the discharge fuse failure alarm.

(13) Check that the timer TD1 is set for a 6-hour charge.

(14) Check the interlocking of the battery compartments.

(15) To overcharge, operate the CHG key on the 250V power bay momentarily.

(G) Engine Alternator

3.08 Operation of the engine alternator is treated in BSP Section A301.247. The following paragraph references are in that Practice.

3.09 Inspect battery electrolyte, fuel, cooling water, and lubrication as in paragraphs 2.05 to 2.08.

3.10 For automatic and remote control of operation, follow steps outlined in paragraphs 2.09 to 2.13.

3.11 For emergency stopping, either operate the EMERGENCY RUN-STOP switch on the engine panel to STOP as outlined in paragraph 2.20 or by operating the EMERGENCY STOP AND CONTROL CUTOFF SWITCH to OFF if it is a toggle switch or if a pushbutton type, depress its red button far enough to permit the locking ring to be turned to the right as far as it will go (STOP) and then release. The latter method is outlined in paragraph 2.21.

3.12 Remote operation of the engine alternator is controlled from the alarm center:

(a) Operate proper station key.

(b) Operate SIG key to the proper direction.

(c) Operate the ORD key for order 7.

(d) Push START key.

(e) Wait for red lamp alarm indication (7 to 9 minutes) and interrogate station to determine whether the GAS ENGINE OPER indication is received.

3.13 For local operation, follow the steps outlined in paragraphs 3.02 to 3.05 (Section A301.247).

4. RADIO EQUIPMENT

4.01 The detailed steps for placing the radio equipment in operation are given in part 2 of BSP Section R90.312. Summaries of these procedures are given below.

(A) Placement in Service - Auxiliary Station

4.02 Procedure:

(1) Insert fuses in the fuse mountings of the various panels.

(2) Operate the FIL circuit breakers to ON.

(3) Operate the FIL ACT switches to NOR.

(4) Adjust the FIL ADJ potentiometers for the microwave generator, transmitter modulator and transmitter amplito 6.3 volts.

(5) Check meter readings on the various units.

(6) Operate the CONT key on the receiver control unit to AUTO and adjust +BIAS to 9 volts.

(7) With an incoming signal present, operate momentarily the RESET key on the transmitter control panel and read the PWR OUT meter. If this does not read 0 DB, adjust the AUTO CONT potentiometer on the receiver control unit.

Note: For normal operation, the power at the OUT jack of the IF main amplifier should be between +6 and +10 dbm depending on the modulator requirements. One should be assured that the power output meter on the transmitter control unit is properly calibrated.

(8) Operate the meter switch on the receiver control unit to RCVR OUTPUT and record the reading. This value may be used to set the output power until maintenance work is done on the receiver portion of the repeater after which a new value should be obtained.

(B) Placment in Service - Terminal or Main Station

4.03 Procedure:

(1) to (6) as in paragraph 4.02.

(7) With an incoming signal present, adjust the AUTO CONT potentiometer on the receiver control unit so that the power at the OUT jack of the IF main amplifier is +8 dbm. (May require a power measurement.)

(8) Operate the meter switch on the receiver control unit to RCVR OUTPUT and record the reading.

(9) Connect the OUTPUT of the IF main amplifier to the IF patching bay through a 6 db pad.

(10) Connect the transmitting trunk from the IF patching bay to the buffer amplifier input and connect the buffer amplifier output to the transmitter modulator input.

(11) With a transmitting IF signal applied to the buffer amplifier input, operate momentarily the RESET key on the transmitter control panel and read the PWR OUT meter. If this does not read 0 DB, adjust the GAIN potentiometer on the buffer amplifier with a screwdriver.

Note: For normal operation the input to the buffer amplifier is +3 dbm. The buffer amplifier output will vary from -1 to +5 dbm depending upon the modulator requirements.

(C) Removal of Radio Equipment from Service

4.04 Operate the FIL circuit breakers on the various units to OFF.

5. FM TERMINAL EQUIPMENT

5.01 Detailed steps for placing the FM terminal equipment in service are given in BSP Section R10.302 for the FM transmitter and in BSP Section R20.362 for the FM receiver. Summaries of these procedures are given below.

(A) Placement of the FM Transmitter in Service for Telephony

5.02 Procedure:

(1) Set switches as follows:

FIL ACT	to NORM
AFC (toggle switch)	to OFF
TUNE	to TEL
AFC	to TEL
CLAMP	to TEL
FREQ ADJ	to TEL

(2) Insert 130-volt and 250-volt fuses and check voltages.

(3) Operate -11V circuit breaker to ON and check voltage.

(4) Check LIM CUR and XTAL CUR before and after operating AFC toggle switch to ON.

(5) Check all meter readings.

(6) Check that the TST lamp is out.

(7) Connect the output of the L-carrier terminal (at -34.5 db transmission level) to the transmitter input jacks at the monitoring bay.

(B) Placement of the FM Transmitter in Service for Television

5.03 Procedure:

(1) to (6) as in paragraph 5.02.

(7) Operate the following switches to TV: CLAMP, AFC, FREQ ADJ and TUNE.

(8) Apply 0.2 volt peak-to-peak television signal to the transmitter at the monitoring bay and measure the frequency deviation using the FM test set as described in BSP Section R10.304.

Requirement: Deviation should be 8 mc.

(C) Placement of the FM Receiver in Service for Telephony

5.04 Procedure:

(1) Check that the FIL ACT switch is operated to NORM.

(2) Insert fuses in the +130V and +250V fuse holders and check voltages.

(3) Operate the -11V circuit breaker to ON and check voltage.

(4) Check that no signal is patched into the receiver at the IF patching bay.

(5) Check all meter readings.

(6) Apply an IF signal (+3 dbm) to the input jack of the FM receiver (at the IF patching bay).

(7) Check LIM 1 CUR and LIM 2 CUR.

(8) Set the GAIN ADJ knob on the receiver so that the TEL index tab coincides with the index mark.

(9) At the monitoring bay, patch the receiver output to the trunk to the carrier terminal room.

(D) Placement of the FM Receiver in Service for Television

5.05 Procedure:

(1) to (7) as in paragrapn 5.04.

(8) At the IF patching bay, measure the frequency deviation of the incoming television signal using the FM test console as described in BSP Section R70.165.

Requirement: Frequency deviation should be 8 mc.

(9) Set the GAIN ADJ knob on the receiver so that the TV index tab coincides with the index mark.

(10) Operate the MTR switch to VIDEO VOLTS and note voltage.

Requirement: Voltage should be 2 ±0.2 volts.

(11) At the monitoring bay, patch the receiver output to the trunk to the television operating center.

(E) Removal From Service

5.06 Procedure:

(1) Operate the -11V circuit breakers to OFF and remove the +130 and +250V fuses.

6. PATCHING AND MONITORING EQUIPMENT

6.01 Means for making patchcord connections between various units in a terminal or main station, connections to the television operating center or carrier terminal equipment, and connections

tc spur channels are provided on the patching and monitoring bays. Various application schematics show in detail how these patches should be made. These schematics, which are attached to Section R90.305, are as follows:

SD-59367 FM Terminal Video Circuits
SD-59389 IF Patching Circuits
SD-59391 IF and Video Monitoring Circuits

Below are listed the different kinds of connections and the references to the figures in the above circuit drawings which indicate how the connection should be made.

FM Terminal Receiver Output to Television Operating Center	SD-59367	Fig. 101
FM Terminal Receiver Output to Broadband Telephone Terminal	SD-59367	Fig. 103
FM Terminal Transmitter Input to Television Operating Center	SD-59367	Fig. 102
FM Terminal Transmitter Input to Broadband Telephone Terminal	SD-59367	Fig. 104
Radio Receiver to FM Receiver	SD-59389	Figs. 101, 106, 111, 104
Radio Channel, With No Line Switching, Terminating in FM Receiver		Fig. 114
Radio Channel With Line Switching Terminating in FM Receiver		Fig. 116
Radio Transmitter to FM Transmitter	SD-59389	Figs. 102, 107, 110, 103
Radio Channel With No Line Switching Originating from FM Transmitter		Fig. 113
Radio Channel With Line Switching Originating from FM Transmitter		Fig. 115
Through Radio Channel With Line Switching		Fig. 117
Typical Channel Arrangement With Line and Program Switching and Branch Radio Circuit or FM Terminal		Fig. 118
Typical Channel Arrangements With Line and Program Switching for 4 Through Radio Channels 4 Channels to FM Receivers 2 Channels to FM Transmitters 1 Outgoing Branch Circuit		Fig. 119
IF Program Switching		Figs. 108, 112
Picture Monitor Connection to IF Switching Amplifier	SD-59391	Fig. 101
Picture Monitor to Video Monitor Jacks	SD-59391	Fig. 102
Picture Monitor to IF Distributing Amplifier	SD-59391	Fig. 103
FM Test Console Oscilloscope to Video Monitor Jacks	SD-59391	Fig. 102

7. ORDER AND ALARM CIRCUITS

7.01 The order wire and alarm circuits should be put in service in accordance with BSP Section A820.912.

8. C1 ALARM AND CONTROL SYSTEM

8.01 The C1 Alarm and Control System should be placed in service in accordance with BSP Section A820.911 and Section A220.961. The order suggested is as follows: (1) Sequence Signaling Circuits, (2) Indication Circuits, and (3) Alarm Circuits.