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Figure 1-1. 820D-2 1-kW AM Transmitter.
1.1 INTRODUCTION

The 820D-2 1-kW AM Transmitter is an amplitude-modulated standard broadcast transmitter (figure 1-1) that operates in the 540- to 1600-kHz frequency range. The 820D-2 has two output power operating modes – high and low. The nominal power output in each mode is controlled by tap connections on the plate transformer and a fixed attenuator in the audio input circuit. Three nominal power options are available and are listed in table 1-1. Both the high and low power modes are adjustable by 10 percent using the power control on the control panel.

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<td>LOW POWER MODE</td>
</tr>
<tr>
<td>1</td>
<td>250 watts</td>
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<tr>
<td>2</td>
<td>250 watts</td>
</tr>
<tr>
<td>3</td>
<td>500 watts</td>
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Table 1-1. Nominal Power Output Options.

1.2 PHYSICAL DESCRIPTION

The 820D-2 transmitter is completely self-contained in a steel-framed, sheet metal cabinet. The cabinet is structured for front and rear access with all access panels interlocked to remove high voltages upon opening. Compartments where screen and plate voltages are exposed are equipped with high-voltage grounding switches that short-circuit the appropriate power supplies as panels are removed. An optional front door is available to enhance transmitter appearance. The front door is not interlocked.

The 820D-2 transmitter is divided into four major assemblies – RF Compartment A1, Power Supply Assembly A2, Control Circuits Assembly A3, and Control Panel A4. Each assembly is accessible by removing one or more of the access panels. The windowed upper front panel provides access to the rf and modulator compartment tubes and circuit cards. The lower front panel and rear cabinet panel provide access to the power supply assembly, power transformers, and control circuits assembly. An additional cover at the upper rear portion of the cabinet provides access to the rf output network.

One blower, mounted beneath the rf compartment, cools the rf and modulator tubes. A flushing fan draws air through the air filter mounted on the rear cabinet panel and blows the air through the rf compartment. All air outlets are located in the cabinet top cover.
1.3 TECHNICAL DESCRIPTION

Except for the high-voltage power supply transformers, filters, and large control components mounted on the 820D-2 transmitter cabinet floor (A5), all functional circuits are contained on the four major assemblies described in paragraph 1.2. The various components and assemblies are interconnected as shown in the block diagram, figure 5-1, and the overall schematic, figure 5-8. Functional descriptions of the individual circuits are provided in the following paragraphs.

1.3.1 RF Compartment A1

1.3.1.1 Audio Driver

The 820D-2 transmitter receives a +10 dBm ±2 dB, 150/600-ohm audio input signal at audio driver A1A1. The solid-state audio driver uses two stages of class A, push-pull amplification to drive the modulator tubes without an interstage transformer. The first stage uses 2N3053 transistors. The second stage, the audio driver output amplifier, uses 2N3585 transistors with outputs directly into the modulator grids. This final driver stage is supplied 290 volts dc to ensure ample collector swing capability. Feedback voltage (10 dB at 1 kHz) is derived from the modulator plates via resistor-capacitor ladder networks and is applied to the audio driver input to reduce distortion.

1.3.1.2 Modulator

The modulator for the 820D-2 consists of a circuit using two, push-pull, 5-500A pentode tubes that operate class AB1. The circuit is a conventional modulation transformer/reactor circuit with the tubes operating at a nominal plate voltage of 3100 volts (for 1.1-kW power output). Individual controls are provided for adjustment of the modulator fixed bias, and for dynamic adjustment of the grid drive and filament voltage.

1.3.1.3 RF Exciter

A dual oscillator card, A1A3, with two independent crystal oscillator circuits is the rf excitation source for the 820D-2 transmitter. A selector switch determines which oscillator is used to excite the transmitter. The dual oscillator circuit provides backup support to reduce transmitter downtime in case of an oscillator failure.

For stability, both oscillators operate at four times the carrier frequency from 540 kHz to 1020 kHz or at two times the carrier frequency from 1080 kHz to 1600 kHz. The oscillator output is divided, amplified, and shaped in A1A3. The final output is transformer coupled to the rf driver. A potentiometer controls the duty cycle of the signal applied to the rf driver and determines the drive level to the power amplifier.

1.3.1.4 RF Driver

A single 2N5039 transistor on card A1A2 is the rf driver. This transistor operates class C and supplies drive to the power amplifier grids through a transformer with a tuned secondary.

1.3.1.5 Power Amplifier

The power amplifier (pa) consists of two parallel 5-500A tubes connected as tetrodes and operated class C with conventional plate modulation. The screen is self-modulated using dropping resistors in the screen voltage supply lead. Power output is controlled by the
voltage supplied to the pa plate. For a maximum carrier power level of 1.1 kilowatts at the antenna terminal, a nominal voltage of 3100 volts is supplied to the pa plate. Proportionate voltage levels are supplied for reduced maximum power outputs of 275 watts and 550 watts. Nominal plate impedance is 3250 ohms regardless of the power level.

The pa tubes operate with the cathodes grounded and the screens near rf ground potential. The -155-volt bias supply provides protective voltage during drive loss and combines with the grid operating bias of the tubes to supply the -200-volt grid voltage.

1.3.1.6 Output Network

The 820D-2 transmitter output network is a 3-node bandpass filter. All components, except for the pa tuning capacitor, are fixed tuned. The pa tuning capacitor, a vacuum variable capacitor adjusted from the control panel, varies the plate tuning. Filter nodes one and two are bottom coupled by an inductor. Nodes two and three are top coupled by an inductor that serves as a fixed loading adjustment. All nodes are tuned to the operating frequency with the coupling circuits providing 90° phase delay between nodes.

1.3.2 Power Supply Assembly A2

The power supply assembly contains most small circuit components for each of the 820D-2 transmitter power supplies. Large power supply components, including the power transformer, are mounted on the cabinet floor. All power transformers are provided with primary taps for transmitter operation at nominal input voltages of 208 to 240 volts ac.

1.3.2.1 28-Volt DC Power Supply

The 28-volt dc power supply supplies +28 volts to the control circuits, pilot lamps, oscillator, rf driver, and the first audio driver stages. Primary power from the low-voltage circuit breaker and fuse A4F1 is stepped down by a transformer, rectified by silicon rectifiers, and regulated by conventional series regulators.

1.3.2.2 PA and Modulator Filament Voltage Supplies

Separate transformers receive primary power from the low-voltage circuit breaker, reduce the voltage, and supply the pa and modulator tubes with filament voltage. The filament voltage is adjusted by transformer taps and series rheostats. An optional constant voltage transformer may be added at A3TB5 to improve tube life.

1.3.2.3 Bias Supply

The bias supply provides -155-volt bias for the pa and modulator control grids. A stepdown transformer receives primary power via the low-voltage circuit breaker and fuse A4F2, and supplies the bias voltages to full-wave silicon rectifiers and a conventional filter.

1.3.2.4 Screen Power Supply

The screen power supply receives primary power from the high-voltage circuit breaker and fuse A4F3, and employs a step-up transformer, silicon rectifier, and LC filter. Zener diodes connected across the screen supply provide the +290 volts required by the audio driver.
1.3.2.5 Plate Power Supply

The plate power supply uses a step-up transformer and a full-wave silicon rectifier with an L-section filter to provide the 3100 volts required (for 1.1-kW power output) at the pa plate. Since power output in the 820D-2 transmitter is controlled by varying the plate voltage, transformer taps are provided to reduce maximum power output to 550 or 275 watts. In addition, a 10-percent variation of power output is provided by a motor-driven rheostat in the power amplifier plate supply circuit. This rheostat is controlled by the RAISE/LOWER POWER CONTROL switch on the control panel or by the optional Automatic Power Control Assembly.

1.3.3 Control Circuit Assembly A3

The control circuit assembly contains a printed circuit board and relays used for 820D-2 transmitter control. Other circuits on the A3 assembly allow overload shutdown and push-button control of the filament and plate voltage. Overloads in the pa or modulator tubes are monitored by relays in the cathode circuit return. These relays remove transmitter control voltage in the A3 assembly. Automatic recycling of temporary overloads is provided to shorten transmitter downtime. The main control sequences for filament and plate voltages are pushbutton controlled from the control panel or a remote control system.

1.3.4 Control Panel A4

The control panel, mounted in the front center of the transmitter, contains all meters, operating controls, and status indicators. See section 3 of this instruction book for a description of operating controls.

1.4 820D-2 TRANSMITTER OPTIONS

1.4.1 Remote Control

The 820D-2 transmitter is suitable for installation at an unattended site and for operation from a remote control system in a studio. Optional remote control relays provide the following switching functions:

- Filament ON/OFF
- High Power ON/Plate OFF
- Low Power ON/Plate OFF
- Power Adjust Raise/Lower
- Remote Control Failsafe
- Manual/Automatic Power Control

The optional 8-relay assembly required is mounted on control circuits assembly A3. Each relay will operate with control voltages of 115 volts ac, 115 volts dc, 28 volts dc, or 48 volts dc.

Each transmitter contains built-in meter shunts for remote samples of plate voltage and current. Also, the modulation monitor sampling coil has two adjustable taps that are switched to a common output lead for equal-level sampling during reduced power operation.
1.4.2 Automatic Power Control

An optional automatic power control (APC) assembly provides unattended control of the power output. The APC assembly consists of a servo amplifier and a power output sensing unit. The sensing unit rectifies and filters a sample of rf output current and supplies the sample as a dc voltage to the servo amplifier. The servo amplifier determines the difference between the sample dc voltage and a reference voltage. This difference voltage becomes the servo input error signal. The error signal activates relays in the APC assembly that control the power adjust rheostat motor. (See paragraph 1.3.2.5.) The relays raise or lower power output until the error signal reduces to 0 ±10 millivolts dc.

Two potentiometer adjustments control the level of the reference input voltage. One potentiometer controls the reference voltage in the low power mode; the other controls the reference voltage in the high power mode. These potentiometers allow exact adjustment of the output power. Switching between the two potentiometers occurs automatically with mode change in the transmitter. The APC power is turned off when plate voltage is off to prevent the motor from running to a limit in the absence of an output sample. Automatic or manual power control is selected by a power control switch on control panel A4 or by a remote automatic power adjust control function.

1.5 TECHNICAL SPECIFICATIONS

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<tr>
<td>Frequency Range:</td>
<td>540 to 1600 kHz</td>
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<td>Frequency Stability:</td>
<td>±5 Hz, 0° to +35°C (+32 to +95°F)</td>
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<td></td>
<td>±10 Hz, -10° to +45°C (+14° to +113°F)</td>
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<tr>
<td></td>
<td>±20 Hz, -25° to +45°C (-13° to +113°F)</td>
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<td>Audio Input Impedance:</td>
<td>150/600 ohms, balanced</td>
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<td>Audio Input Level:</td>
<td>+10 dBm, ±2 dB</td>
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<td>Audio Frequency Response:</td>
<td>±1 dB, 50 to 10,000 Hz</td>
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<td>Audio Harmonic Distortion:</td>
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<td>(Typically 1% or less)</td>
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<tr>
<td>Carrier Shift</td>
<td>Less than 3%, 0% to 100% modulation, 400 Hz reference</td>
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<tr>
<td>Noise, Unweighted:</td>
<td>60 dB below 100% modulation at 1 kHz</td>
</tr>
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<td>Modulation Type:</td>
<td>High level plate</td>
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<td>Ambient Temperature Range:</td>
<td>-25 to +45 °C (-13 to +113 °F)</td>
</tr>
<tr>
<td>Ambient Humidity Range:</td>
<td>95% maximum</td>
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| Altitude:                   | 7,500 ft (2,286 m) maximum
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<td>Power Requirement at 1100 Watts, 0% Modulation:</td>
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2.1 UNPACKING AND INSPECTING

2.1.1 Domestic Shipments

The uncrated transmitter is shipped on a shipping skid via a commercial air-ride van. Unpack the transmitter as follows:

**CAUTION**

Use care in moving the transmitter. Use appropriate lifting and moving equipment with at least 1250-lb (567-kg) capacity. Some components may be damaged if the transmitter is dropped or severely jarred.

a. Remove the transmitter from the van to a position near its installation site.

b. Lift the transmitter from the shipping skid.

c. Remove the two screws from the bottom of the rear access panel. Lift the panel from the transmitter.

d. Inspect the transmitter for loose hardware. Ensure that all controls operate freely. Examine the cabinet for dents and scratches.

e. Remove the four modulator and power amplifier tubes and chimneys from their separate containers. Inspect for damage.

f. File any damage claims properly with the transportation company. Retain all packing material if a claim is filed.

2.1.2 Foreign Shipments

The transmitter is shipped in a skid-type crate via a commercial transportation company. Unpack the transmitter as follows:

**CAUTION**

Use care in unpacking and moving the transmitter. Use appropriate lifting and moving equipment with at least 1250-lb (567-kg) capacity. Some components may be damaged if the transmitter is dropped or severely jarred.

a. Position the crated transmitter near its installation site.

b. Refer to the instructions stenciled on the side of the shipping crate and carefully uncrate the transmitter.
c. Remove the two screws from the bottom of the rear access panel. Lift the panel from the transmitter.

d. Inspect the transmitter for loose hardware. Ensure that all controls operate freely. Examine the cabinet for dents and scratches.

e. Remove the four modulator and power amplifier tubes and chimneys from their separate containers. Inspect for damage.

f. File any damage claims properly with the transportation company. Retain all packing material if a claim is filed.

2.2 LOCATION AND SPACING REQUIREMENTS

The 820D–2 transmitter may be installed in either an attended or, with remote control options installed, unattended location. Refer to figure 2–1 for transmitter dimensions and cable entry information. Observe the following siting practices to ensure optimum transmitter operation.

a. Allow at least 3.5 feet (1.1 m) of clearance at front and rear for servicing access.

b. Ascertain that environmental conditions are within the temperature, humidity, and altitude limits listed in paragraph 1.5.

c. Make certain that the transmitter site is clean and that the air is not excessively dusty or dirty.

![NOTE]

The air flow is approximately 500 CFM. If ducted to the outside, an equivalent volume of cool clean air must be provided to the transmitter to prevent air starvation and overheating.

The heat load to the room (if it is not ducted) is approximately 7200 BTU/HOUR for a transmitter output of 1100 watts, modulated at a 30% average level.

![WARNING]

HIGH VOLTAGE is used in this equipment.

DEATH ON CONTACT may result if you fail to observe safety precautions.

When working inside the equipment, be sure that all circuit breakers are OFF and that primary power is disabled at the wall disconnect or circuit breaker unless otherwise directed. If a procedure requires transmitter operation with access panels removed, do not allow bodily contact with any electrical component, tap, or terminal. Use heavily insulated tools to adjust variable components.

2.3 PRIMARY POWER

2.3.1 General

The 820D–2 transmitter requires a 208–, 230–, or 240-volt ±5-percent, single-phase, 50- or 60-Hz ac power source that delivers a minimum of 4500 watts of power at a 0.9 power...
Figure 2–1. 820D-2 1-kW AM Transmitter Outline and Installation Diagram.
installation

factor. Make provisions for a fused main power disconnect switch or circuit breaker capable of handling 50 amperes. Connect the primary power to terminal board A3TB6 with no. 8 AWG gauge wire as follows:

a. Connect the hot wires to A3TB6-1 and A3TB6-2.
b. Connect the neutral wire to A3TB6-3.
c. Connect the station ground to A3TB6-4.

CAUTION

Voltage between neutral and either hot wire must be between 110 and 125 volts ac. Measure and confirm the proper voltage before closing circuit breaker A4CB1.

2.3.2 Transformer Connections

The range of allowable voltage sources is made possible by the availability of different tap connections on terminal boards A1TB1, A1TB2, and A2TB1, and on plate transformer T1. The tap connections on the terminal boards are made to correspond to the primary power input (208, 230, or 240 volts). The tap connections on plate transformer T1 are made to correspond to both primary power input and rf power output requirements.

NOTE

All 830D-2 transmitters are factory adjusted at 240 V primary power and to specific customers frequency, and power output requirements. The following procedures are not to be performed if power source, frequency, and power output requirements are the same as the parameters listed in the production test data sheet supplied with each new transmitter.

CAUTION

If the constant filament voltage regulator option is factory installed, DO NOT change taps on transformers A1T1, A1T2, or A2T2.

2.3.2.1 Terminal Board A1TB1 Transformer Connections

Modulator tube filament transformer A1T2 tap connections are wired to the front side of terminal board A1TB1 terminals 33 through 36. Tap adjustments are made by moving the wires attached to the back side of A1TB1 terminal 34, 35, or 36. (The wire connected to A1TB1-33 is not moved.) If primary power source changes require tap adjustments, disconnect the tap adjustment wires and reconnect them as described in table 2-1.
Table 2-1. Terminal Boards A1TB1 and A2TB1 Transformer Connections.

<table>
<thead>
<tr>
<th>TRANSFORMER</th>
<th>TERMINAL BOARD CONNECTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>COMMON</td>
</tr>
<tr>
<td>A1T1</td>
<td>NA</td>
</tr>
<tr>
<td>A2T1</td>
<td>A2TB1-1</td>
</tr>
<tr>
<td>A2T2</td>
<td>A2TB1-6</td>
</tr>
<tr>
<td>A2T3</td>
<td>A2TB1-9</td>
</tr>
</tbody>
</table>

2.3.2.2 Terminal Board A1TB2 Transformer Connections

Power amplifier tube filament transformer A1T1 tap connections are wired to the front side of terminal board A1TB2 terminals 1, 2, and 3. Tap adjustments are made by moving the wire attached to the back side of A1TB2-1, 2, or 3. If primary power source changes require tap adjustments, disconnect the tap adjustment wire and reconnect it as described in table 2-1.

2.3.2.3 Terminal Board A2TB1 Transformer Connections

Screen power supply transformer A2T1 tap connections are wired to the top side of terminal board A2TB1 terminals 1, 2, and 3. Tap adjustments are made by moving the wire attached to the bottom side of A2TB1 terminal 2 or 3. (The wire connected to A2TB1-1 is not moved.) If primary power source changes require tap adjustments, disconnect the tap adjustment wire and reconnect it as described in table 2-1.

Bias supply transformer A2T2 tap connections are wired to the top side of terminal board A2TB1 terminals 4, 5, and 6. Tap adjustments are made by moving the wire attached to the bottom side of A2TB1 terminal 4 or 5. (The wire attached to A2TB1-6 is not moved.) If primary power source changes require tap adjustments, disconnect the tap adjustment wire and reconnect it as described in table 2-1.

The 28-volt power supply transformer, A2T3, tap connections are wired to the top side of terminal board A2TB1 terminals 7, 8, and 9. Tap adjustments are made by moving the wire attached to the bottom side of A2TB1 terminal 7 or 8. (The wire connected to A2TB1-9 is not moved.) If primary power source changes require tap adjustments, disconnect the tap adjustment wire and reconnect it as described in table 2-1.

2.3.2.4 Plate Transformer T1 Tap Connections

There are three tap connections on plate supply transformer T1. One connection is a common connection to terminal 1, 2, or 3. Another connection is a low power connection to terminal 5, 6, 7, 8, 9, or 10. The last connection is a high power connection to terminal 4, 5, 6, or 7. These tap connections are made to correspond to the primary source voltage and the desired nominal output option. (See paragraph 1.1.) If primary power source changes or output changes are required, adjust the T1 tap connections as follows:

a. Disconnect the three wires attached to the T1 terminals.
b. Use an ohmmeter to determine which of the three wires is connected to terminal board A3TB3 terminal 9. Label this wire HIGH POWER.

c. Use an ohmmeter to determine which of the two remaining wires is connected to terminal board A3TB3 terminal 10. Label this wire COMMON.

d. Label the last wire LOW POWER.

e. Refer to table 2-2 and reconnect the wires to the appropriate terminals.

2.4 AF INPUT AND RF OUTPUT CONNECTIONS

2.4.1 AF Input Terminal Board Connections

The 820D-2 transmitter accepts audio input at a level of +10 dBm ±2 dB from a source requiring a 150- or 600-ohm input impedance. Use no. 22 AWG gauge, shielded, twisted-pair wire (Belden 8451, or equivalent) to connect the audio input source to terminal board TBI. The audio "high" wire connects to terminal 1; the "common" wire connects to terminal 2; and, the shield connects to terminal 3.

Table 2-2. Transformer T1 Connections.

<table>
<thead>
<tr>
<th>SOURCE VOLTAGE</th>
<th>LOW POWER OUTPUT</th>
<th>HIGH POWER OUTPUT</th>
<th>COMMON WIRE</th>
<th>LOW POWER WIRE</th>
<th>HIGH POWER WIRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>208</td>
<td>250 watts</td>
<td>500 watts</td>
<td>3</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>250</td>
<td>1000</td>
<td>3</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>500</td>
<td>1000</td>
<td>3</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>230</td>
<td>250</td>
<td>500</td>
<td>2</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>250</td>
<td>1000</td>
<td>2</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>500</td>
<td>1000</td>
<td>2</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>240</td>
<td>250</td>
<td>500</td>
<td>1</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>250</td>
<td>1000</td>
<td>1</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>500</td>
<td>1000</td>
<td>1</td>
<td>7</td>
<td>4</td>
</tr>
</tbody>
</table>

2.4.2 AF Input Strapping Connections

NOTE

All 820D-2 transmitters are factory adjusted at 240V primary power and to specific customer's frequency, and power output requirements. The following procedures are not to be performed if power source, frequency, and power output requirements are the same as the parameters listed in the production test data sheet supplied with each new transmitter.
a. Remove the upper front access panel.

b. Refer to the parts list in section 6 and locate resistors R6, R7, and R8 on audio driver card A1A1.

c. Check the values of the resistors and compare them with the values listed in table 2-3.

d. If the resistor values are different from the tabulated values, replace the resistors with 1/4-watt, 5-percent resistors with values equal to the tabulated values.

e. If the audio input source requires a 600-ohm impedance, strap A1A1-E2 to A1A1-E3.

2.4.3 RF Output Connection

Output connector A1J1 for the 820D-2 transmitter is a 50-ohm, type LC, female connector. Use standard 50-ohm coax to connect A1J1 to a balanced, 50-ohm antenna or dummy load capable of dissipating at least 1.5 kilowatts.

Table 2-3 Audio Attenuator Values.

<table>
<thead>
<tr>
<th>LOW POWER OUTPUT</th>
<th>A1A1R6</th>
<th>A1A1R7</th>
<th>A1A1R8</th>
</tr>
</thead>
<tbody>
<tr>
<td>500 watts</td>
<td>100 ohms</td>
<td>100 ohms</td>
<td>1800 ohms</td>
</tr>
<tr>
<td>250 watts</td>
<td>160 ohms</td>
<td>160 ohms</td>
<td>680 ohms</td>
</tr>
</tbody>
</table>

CAUTION

Do not operate the transmitter unless output connector A1J1 is properly connected.

2.5 MODULATOR AND POWER AMPLIFIER TUBE INSTALLATION

a. Remove the upper front access panel.

b. Insert the four 5-500A modulator and power amplifier tubes (V1 through V4) into sockets A1V1 through A1V4.

c. Install the four tube chimneys.

d. Connect the four tube caps to the four tubes.

e. Replace the upper front access panel.

2.6 OPTION INSTALLATION

2.6.1 Remote Control and Remote Monitoring

NOTE

If the remote control option was factory installed, skip to paragraph 2.6.1.2.
2.6.1.1 Remote Control Assembly A7 Installation

a. Remove the 820D-2 lower front access panel and the rear access cover.

b. Remove the straps between the following A3TB2 terminals: 1 and 2, 5 and 6, 7 and 8, 9 and 10, 21 and 22.

c. Refer to figure 5-6 and table 2-4. Strap the Remote Control Assembly, CPN 627-9721-001, for the control voltage provided by the customer-supplied remote control system.

d. Mount remote control assembly A7 to control circuits assembly A2.

e. Refer to figures 5-6 and 5-8. Connect the wires from the remote control assembly relays to the appropriate terminals on A3TB2.

Table 2-4. Optional Remote Control Assembly Control Voltage Strapping Connections.

<table>
<thead>
<tr>
<th>SOURCE CONTROL VOLTAGE</th>
<th>STRAPPING CONNECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FROM</td>
</tr>
<tr>
<td>24 Vdc, positive common</td>
<td>E1</td>
</tr>
<tr>
<td>24 Vdc, negative common</td>
<td>E1</td>
</tr>
<tr>
<td>48 Vdc, positive common</td>
<td>E1</td>
</tr>
<tr>
<td>48 Vdc, negative common</td>
<td>E2</td>
</tr>
<tr>
<td>115 Vac</td>
<td>E3</td>
</tr>
</tbody>
</table>

2.6.1.2 Remote Control and Monitoring External Connections

Refer to figure 5-7 and make the remote control and monitoring external connections as follows:

a. Remove the lower front access panel and the rear access cover (if installed).

b. Connect the customer-supplied remote control panel to the remote control assembly terminal board (A7TB1).

c. Connect the customer-supplied remote plate voltage monitor to A1TB1-4 and 5.

d. Connect the customer-supplied remote plate current monitor to A1TB1-6 and 5.

e. Connect the customer-supplied modulation monitor to MOD MON connector A1J2.

f. Connect the customer-supplied frequency monitor to FREQ MON connector A1J3.
g. Replace all access panels.

2.6.2 Automatic Power Control A6

NOTE

If the APC option was factory installed, do not perform this procedure.

a. Remove the lower front access panel, the rear cabinet panel, and the output network access panel.

b. Remove the wire connected between A1L7 and rf output connector A1J1.

c. Mount APC sensor A6A2 to the rf output network chassis directly behind A1L5. (Refer to the silk-screened diagram on the output network access panel.)

d. Mount transformer A6T1 to control circuits assembly A3 just below the front end of A3TB2. (Refer to the silk-screened diagram on the lower front access panel.)

e. Mount APC servo board A6A1 to control circuits assembly A3 just behind A3TB2. (Refer to the silk-screened diagram on the lower front access panel.)

f. Refer to table 2-5 and connect the APC assembly as instructed.

g. Replace all access panels.

2.6.3 Filament Voltage Regulator Transformer Assembly A8

NOTE

If the constant filament voltage option was factory installed, do not perform this procedure.

a. Remove the lower front access panel and the rear cabinet cover.

b. Mount transformer T3 to transmitter floor with the hardware supplied.

c. Remove the jumpers between A3TB5-1 and 3, and A3TB5-2 and 4.

d. Connect the transformer terminals as described in table 2-6 using the 16 gauge wire supplied with the assembly.

e. Set tap connections on A1TB1 and A1TB2 for A1T1 and A1T2 at the 230-volt terminal. (See table 2-1.)

f. Replace all access panels.

2.7 INITIAL TURN-ON PROCEDURE

a. Ensure that all required installation procedures in paragraphs 2-1 through 2-6 are complete.

b. Ensure that all access panels are secured in place.

c. Apply primary power to transmitter.
d. Turn on the LOW VOLTAGE and HIGH VOLTAGE circuit breakers.

e. Press the FIL ON (filament on) pushbutton.

f. Set the AUTO/MANUAL POWER CONTROL to MANUAL.

g. Press the LP ON (low power on) pushbutton.

h. Adjust PA TUNE control (on control panel A4) for a minimum indication of PLATE CURRENT.

i. Readjust the PA TUNE control until PLATE CURRENT exceeds minimum current of step h. by 20 mA.

NOTE

Allow a 5-minute warmup period.

Table 2-5. Optional APC Assembly Connections.

<table>
<thead>
<tr>
<th>WIRE COLOR</th>
<th>TO</th>
<th>FROM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>A2TB2-1</td>
<td>A6T1-1</td>
</tr>
<tr>
<td>Brown</td>
<td>A2TB2-2</td>
<td>A6T1-4</td>
</tr>
<tr>
<td>Red</td>
<td>A6T1-2</td>
<td>A6T1-3</td>
</tr>
<tr>
<td>Orange</td>
<td>A6T1-6</td>
<td>A6A1-12</td>
</tr>
<tr>
<td>Yellow</td>
<td>A6T1-5</td>
<td>A6A1-11</td>
</tr>
<tr>
<td>Shielded, Twisted Pair</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red</td>
<td>A2TB2-16</td>
<td>A6A1-15</td>
</tr>
<tr>
<td>Black</td>
<td>A2TB2-15</td>
<td>A6A1-17</td>
</tr>
<tr>
<td>Shield</td>
<td>A2TB2-17</td>
<td>A6A1-16</td>
</tr>
<tr>
<td>Green</td>
<td>A2TB2-10</td>
<td>A6A1-13</td>
</tr>
<tr>
<td>Blue</td>
<td>A2TB2-11</td>
<td>A6A1-14</td>
</tr>
<tr>
<td>Violet</td>
<td>A2TB2-12</td>
<td>A6A1-1</td>
</tr>
<tr>
<td>Gray</td>
<td>A2TB2-17</td>
<td>A2TB2-12</td>
</tr>
<tr>
<td>White</td>
<td>A2TB2-13</td>
<td>A6A1-2</td>
</tr>
<tr>
<td>White/Black</td>
<td>A2TB2-14</td>
<td>A6A1-3</td>
</tr>
<tr>
<td>White/Brown</td>
<td>A2TB2-4</td>
<td>A6A1-6</td>
</tr>
</tbody>
</table>
Table 2-5. Optional APC Assembly Connections (cont).

<table>
<thead>
<tr>
<th>WIRE COLOR</th>
<th>TO</th>
<th>FROM</th>
</tr>
</thead>
<tbody>
<tr>
<td>White/Red</td>
<td>A2TB2-5</td>
<td>A6A1-4</td>
</tr>
<tr>
<td>White/orange</td>
<td>A2TB2-6</td>
<td>A6A1-5</td>
</tr>
<tr>
<td>White/green</td>
<td>A2TB2-7</td>
<td>A6A1-7</td>
</tr>
<tr>
<td>White/blue</td>
<td>A2TB2-3</td>
<td>A6A1-10</td>
</tr>
<tr>
<td>White/black/red</td>
<td>A2TB2-8</td>
<td>A6A1-9</td>
</tr>
<tr>
<td>White/black/orange</td>
<td>A2TB2-9</td>
<td>A6A1-8</td>
</tr>
<tr>
<td>Shielded, twisted pair</td>
<td>A6A2-3</td>
<td>A1C20</td>
</tr>
<tr>
<td>Red</td>
<td>A6A2-4</td>
<td>A1C21</td>
</tr>
<tr>
<td>Black</td>
<td>A6A2-3</td>
<td>A1C20</td>
</tr>
<tr>
<td>Shield</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>1/2-in. Copper Strap</td>
<td>A1L7</td>
<td>A6A2-1</td>
</tr>
<tr>
<td>1/2-in. Copper Strap</td>
<td>A1J1</td>
<td>A6A2-2</td>
</tr>
</tbody>
</table>

Table 2-6. Optional Filament Voltage Regulator Connections.

<table>
<thead>
<tr>
<th>WIRE COLOR</th>
<th>TO</th>
<th>FROM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>T3-H2</td>
<td>T3-H4</td>
</tr>
<tr>
<td>Brown</td>
<td>T3-H1</td>
<td>T3-H3</td>
</tr>
<tr>
<td>Red</td>
<td>A3TB5-1</td>
<td>T3-H1</td>
</tr>
<tr>
<td>Orange</td>
<td>A3TB5-2</td>
<td>T3-H4</td>
</tr>
<tr>
<td>Yellow</td>
<td>A3TB5-3</td>
<td>T3-X3</td>
</tr>
<tr>
<td>Green</td>
<td>A3TB5-4</td>
<td>T3-X1</td>
</tr>
</tbody>
</table>
installation

j. Adjust the RAISE/LOWER POWER CONTROL until the desired low power output (250 or 500 watts) is indicated on the customer-supplied antenna or common point rf ammeter.

k. Compare the control panel meter readings with the values listed in table 3-2.

l. Press the HP ON (high power on) pushbutton.

m. Adjust the RAISE/LOWER POWER CONTROL until the desired high power output (500 or 1000 watts) is indicated on the customer-supplied antenna rf ammeter or wattmeter.

n. Compare the control panel meter readings with the values listed in table 3-2.

o. If the optional automatic power control option is installed, switch the AUTO/MANUAL POWER CONTROL switch to AUTO.

p. The 820D-2 is ready for normal operation.
3.1 CONTROLS AND INDICATORS

All controls and indicators required for normal transmitter operation are contained on control panel assembly A4. Refer to figure 3-1 and table 3-1 for locations and descriptions.

3.2 NORMAL TURN-ON PROCEDURE

Initial (first-time) turn-on for the transmitter is accomplished by performing the procedures in paragraph 2.7. All subsequent transmitter turn-ons are accomplished by the following procedure:

a. Press FIL ON pushbutton. FIL ON indicator will light.

b. Press LP ON or HP ON pushbutton to allow low power or high power transmission. Appropriate indicator will light.

c. If manual power control is used, adjust POWER CONTROL RAISE/LOWER switch until the desired rf output is displayed on the customer-supplied rf ammeter or rf wattmeter. No power adjustment is necessary if the APC is installed and the POWER CONTROL AUTO/MANUAL switch is set to AUTO.

d. Compare control panel meter readings with those listed in table 3-2.

![Figure 3-1. 820D-2 1-kW AM Transmitter Controls and Indicators.](image-url)
Table 3-1. 820D-2 1-kW AM Transmitter Controls and Indicators.

<table>
<thead>
<tr>
<th>REF DES</th>
<th>CONTROL OR INDICATOR NAME</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>A2F1</td>
<td>28 VDC FUSE</td>
<td>3.0-ampere slow-blow fuse mounted internally, protects 28-volt power supply.</td>
</tr>
<tr>
<td>A4F1</td>
<td>CNTRL</td>
<td>0.5-ampere control fuse protects 28-volt power supply</td>
</tr>
<tr>
<td>F2</td>
<td>BIAS</td>
<td>0.5-ampere fuse protects bias power supply</td>
</tr>
<tr>
<td>F3</td>
<td>SCRN</td>
<td>1.0-ampere fuse protects screen power supply</td>
</tr>
<tr>
<td>F4</td>
<td>BLOWER</td>
<td>2.0-ampere fuse protects blower motors</td>
</tr>
<tr>
<td>F5</td>
<td>PWR CNTRL</td>
<td>1.0-ampere fuse protects power adjust rheostat motor</td>
</tr>
<tr>
<td>M1</td>
<td>PLATE VOLTAGE</td>
<td>Dc voltmeter displays amount of voltage across the pa plate</td>
</tr>
<tr>
<td>M2</td>
<td>PLATE CURRENT</td>
<td>Dc ammeter displays amount of current applied to pa plate</td>
</tr>
<tr>
<td>M3</td>
<td>TEST METER</td>
<td>Dc meter monitors one of eight internal voltage or current levels as selected by the test meter select switch</td>
</tr>
<tr>
<td>CB1</td>
<td>LOW VOLTAGE</td>
<td>6.0-ampere circuit breaker controls power applied to low voltage power supplies</td>
</tr>
<tr>
<td>CB2</td>
<td>HIGH VOLTAGE</td>
<td>30.0-ampere circuit breaker controls power applied to high voltage power supplies</td>
</tr>
<tr>
<td>S1</td>
<td>FIL OFF</td>
<td>Filament off indicator switch turns off the low voltage power supplies and shuts down the transmitter</td>
</tr>
<tr>
<td>S2</td>
<td>FIL ON</td>
<td>Filament on indicator switch turns on the low voltage power supplies and activates transmitter</td>
</tr>
</tbody>
</table>
Table 3-1. 820D-2 1-kW AM Transmitter Controls and Indicators (Cont).

<table>
<thead>
<tr>
<th>REF DES</th>
<th>CONTROL OR INDICATOR NAME</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>A4S3</td>
<td>PLT OFF</td>
<td>Plate off indicator switch turns off the high voltage power supplies and plate voltage</td>
</tr>
<tr>
<td>S4</td>
<td>LP ON</td>
<td>Low power on indicator switch activates the high voltage power supplies and places transmitter in low power output mode</td>
</tr>
<tr>
<td>S5</td>
<td>HP ON</td>
<td>High power on indicator switch activates the high voltage power supplies and places transmitter in high power output mode</td>
</tr>
<tr>
<td>S6</td>
<td>MOD PA</td>
<td>Modulator/power amplifier fault indicator/reset switch alerts operator that a fault has occurred and resets overload indicator circuits</td>
</tr>
<tr>
<td>S9</td>
<td>POWER CONTROL RAISE/LOWER</td>
<td>3-position spring-loaded toggle switch controls power adjust rheostat when AUTO/MANUAL switch is set to MANUAL</td>
</tr>
<tr>
<td>S10</td>
<td>POWER CONTROL AUTO/MANUAL</td>
<td>3-position spring-loaded toggle switch selects manual or optional automatic power control</td>
</tr>
<tr>
<td>S11</td>
<td>Test meter select switch</td>
<td>Selects one of eight voltages or currents to be displayed on TEST METER M3. Value listed under each switch position is the full-scale test meter value for that position.</td>
</tr>
<tr>
<td>NA</td>
<td>PA TUNE</td>
<td>Screwdriver control adjusts PA tuning capacitor A1C11.</td>
</tr>
</tbody>
</table>
operation

Table 3-2. Normal Control Panel Meter Readings at Maximum Power Outputs.

<table>
<thead>
<tr>
<th>METER</th>
<th>POWER OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>275 WATTS $\frac{\nu}{\theta}$</td>
</tr>
<tr>
<td>PLATE VOLTAGE</td>
<td>1550 V</td>
</tr>
<tr>
<td>PLATE CURRENT</td>
<td>235 mA</td>
</tr>
<tr>
<td>TEST METER</td>
<td></td>
</tr>
<tr>
<td>28 V SUPPLY</td>
<td>28 ±2 V</td>
</tr>
<tr>
<td>290 V SUPPLY</td>
<td>290</td>
</tr>
<tr>
<td>SCREEN SUPPLY</td>
<td>750 V</td>
</tr>
<tr>
<td>SCREEN CURRENT</td>
<td>200 mA</td>
</tr>
<tr>
<td>DVR COLL I</td>
<td>1.0 to 1.5A, maximum</td>
</tr>
<tr>
<td>PA GRID I</td>
<td>50 to 75 mA</td>
</tr>
<tr>
<td>BIAS SUPPLY</td>
<td>-155 V</td>
</tr>
<tr>
<td>MOD CATHODE I</td>
<td>130 to 240 mA</td>
</tr>
</tbody>
</table>

Note: Except where specific tolerances are given, the above are approximations. The individual transmitters will vary with source voltage and installation.

3.3 EMERGENCY SHUTDOWN

Turn off LOW VOLTAGE and HIGH VOLTAGE circuit breakers or turn off primary power at source.

3.4 NORMAL SHUTDOWN

Make normal transmitter shutdowns as follows:

a. Press PLT OFF switch.

b. Press FIL OFF switch.

3.5 OVERLOAD RESETTING

The MOD PA overload indicator/reset switch on the control panel indicates a fault in either the modulator or pa circuits. The 820D-2 transmitter contains a recycle circuit that re-applies plate voltage for a maximum of three restarts in 10 seconds. The MOD PA indicator
will light to alert the transmitter operator that a fault has occurred and that the recycle circuits have restarted the transmitter. Pressing the MOD PA switch resets the indicator and turns the lamp off. If the transmitter recycle circuits do not restart the transmitter (more than three restarts in 10 seconds are required), the transmitter may be restarted by pressing the LP ON or HP ON pushbutton. Repeated complete transmitter shutdown indicates a transmitter malfunction.

3.6 FREQUENCY CHANGE

All 820D-2 transmitters are factory adjusted for the specific customer's frequency requirements. Frequency change requires test equipment not normally available to broadcast station technicians or engineers. Certain preliminary adjustment graphs and tables are provided in section 4 for reference. Do not make any frequency adjustments without consulting your Collins Broadcast Sales Engineer or:

Collins Commercial Telecommunications Division
Rockwell International
Broadcast Field Service Dept.
Dallas, Texas 75207
Phone: (214) 690-5055

3.7 POWER OUTPUT MODE CHANGE

The 820D-2 transmitter output power mode is switched by pressing the appropriate LP ON or HP ON switch. If MANUAL power control is used, adjust the POWER CONTROL RAISE/LOWER switch until the desired rf output is displayed on the customer-supplied rf ammeter or rf wattmeter. No POWER CONTROL adjustment is necessary if the optional automatic power control is installed and the POWER CONTROL AUTO/MANUAL switch is set to AUTO.
4.1 GENERAL

The 820D-2 has been carefully designed, inspected, and adjusted at the factory to reduce maintenance to a minimum. However, to ensure peak performance, adhere to a regular schedule of inspection and cleaning procedures. Refer to the parts list, section 6, for the location of components in the 820D-2.

WARNING

HIGH VOLTAGE is used in this equipment.

DEATH ON CONTACT may result if you fail to observe safety precautions.

When working inside the equipment, be sure that all circuit breakers are OFF and that primary power is disabled at the wall disconnect or circuit breaker unless otherwise directed. If a procedure requires transmitter operation with access panels removed, do not allow bodily contact with any electrical component, tap, or terminal. Use heavily insulated tools to adjust variable components.

CAUTION

Make certain all meters and test equipment are switched to appropriate measuring scales before connecting them to the transmitter. Connect test equipment only to the terminals designated in the procedure.

4.2 INSPECTION

Perform a periodic visual inspection of the 820D-2 at least once each week. Inspect all metal parts for rust, corrosion, and general deterioration. Check wiring and components for signs of overheating. Check the blower for normal operation. Check all operating controls for smoothness of operation. Check all connections and tighten loose nuts, bolts, or screws.

4.3 CLEANING

Clean the 820D-2 whenever dust accumulates at any point inside the equipment. A solvent consisting of the following mixture by volume may be used as a cleaning material: methylene chloride, 25 percent; perchloroethylene, 5 percent; and drycleaning solvent, 70 percent.

4.3.1 General Cleaning Procedure

a. Remove dust from chassis, panels, and components with a soft-bristled brush.

b. Remove any foreign matter from flat surfaces and accessible areas with a lintless cloth moistened with solvent. Dry with a clean, dry, lintless cloth.
c. Wash switch contacts and the less accessible areas with solvent lightly applied with a small soft-bristled brush.

d. Clean accumulated dust from the modular and power amplifier tubes with a lintless cloth moistened with solvent. Dry with a clean, dry, lintless cloth.

4.3.2 Air Filter

The air filter on the 820D-2 transmitter is a 16- by 20- by 1-inch disposable commercial filter. Replace the air filter whenever a noticeable quantity of dust or dirt restricts airflow. Replace the filter as follows:

a. Remove the two screws retaining the louvered filter panel to the rear cabinet panel.

b. Extract the filter from its holder and discard.

c. Install a new 16- by 20- by 1-inch disposable commercial filter.

d. Replace the louvered panel and two screws.

4.4 LUBRICATION

The 820D-2 transmitter requires no lubrication. All motor bearings are permanently lubricated and sealed.

4.5 TROUBLESHOOTING

If the transmitter fails to operate properly, isolate the malfunction to a particular circuit using the TEST METER readings (table 3-2), maintenance checks in paragraph 4.7, and diagrams in section 5. Check each circuit in the order that it is made operative. If a malfunctioning circuit has an adjustment procedure provided in paragraph 4.8, perform the adjustment. Refer to the circuit descriptions in section 1 for aid in troubleshooting. Refer to the parts list in section 6 for parts locations.

4.6 TEST EQUIPMENT

Table 4-1 lists test equipment necessary for transmitter maintenance checks and adjustments. The reference column lists the paragraph number of the maintenance check or adjustment procedure that requires the equipment.

4.7 MAINTENANCE CHECKS

**WARNING**

HIGH VOLTAGE is used in this equipment.

DEATH ON CONTACT may result if you fail to observe safety precautions.

When working inside the equipment, be sure that all circuit breakers are OFF and that primary power is disabled at the wall disconnect or circuit breaker unless otherwise directed. If a procedure requires transmitter operation with access panels removed, do not allow bodily contact with any electrical component, tap, or terminal. Use heavily insulated tools to adjust variable components.
Table 4-1. Test Equipment.

<table>
<thead>
<tr>
<th>ITEM</th>
<th>RECOMMENDED MANUFACTURER/MODEL</th>
<th>REFERENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dummy load, 50 ohms, 2.5-kW</td>
<td>Bird Model 8720</td>
<td>4.7, 4.8</td>
</tr>
<tr>
<td>Rf ammeter</td>
<td>Weston 743-60</td>
<td>4.7, 4.8</td>
</tr>
<tr>
<td>Multimeter</td>
<td>Triplett Model 630 N/A</td>
<td>4.7.1, 4.7.2, 4.7.3, 4.8.1, 4.8.5</td>
</tr>
<tr>
<td>Audio signal generator</td>
<td>Hewlett Packard Model 206A</td>
<td>4.8.3</td>
</tr>
<tr>
<td>Audio voltmeter</td>
<td>Hewlett Packard Model 403B</td>
<td>4.8.3</td>
</tr>
<tr>
<td>Modulation monitor</td>
<td>Belar Model AMM-1</td>
<td>4.8.3</td>
</tr>
<tr>
<td>Oscilloscope</td>
<td>Tektronix Model 545</td>
<td>4.8.3</td>
</tr>
<tr>
<td>Distortion analyzer</td>
<td>Hewlett-Packard Model 334A</td>
<td>4.8.3</td>
</tr>
</tbody>
</table>

CAUTION

Make certain all meters and test equipment are switched to appropriate measuring scales before connecting them to the transmitter. Connect test equipment only to the terminals designated in the procedure.

NOTE

(1) Initial control panel switch settings for all maintenance checks are as follows:

LOW VOLTAGE - ON
HIGH VOLTAGE - ON
PLT OFF
FIL OFF

(2) RF output jack A1J1 must be connected through an rf ammeter to a 50-ohm dummy load, or to the normal 50-ohm antenna system.

4.7.1 28-Volt DC Power Supply and Metering Circuit Check

a. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power OFF.
b. Remove lower front access panel. Short all high voltage terminals with grounding stick. Block open the interlock switch.

c. Connect a multimeter (30-Vdc scale) positive lead to A2TB1-14 and negative lead to chassis ground.

d. Set primary power and LOW VOLTAGE circuit breaker ON. Note that FIL OFF indicator/switch lights.

e. Check multimeter for an indication of 28 ±2 volts dc.

f. Set the test meter select switch to 28V SUPPLY 30 VFS.

g. Compare the TEST METER indication with the multimeter indication. Note that the indications do not differ by more than 10 percent.

h. Set LOW VOLTAGE circuit breaker and primary power OFF. Short all high voltage terminals with ground stick.

i. Disconnect the multimeter. Replace the lower front access panel.

j. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power ON.

4.7.2 Bias Power Supply and Metering Circuit Check

a. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power OFF.

b. Remove lower front access panel. Short all high voltage terminals with grounding stick. Block open the interlock switch.

c. Connect a multimeter (300-Vdc scale) negative lead to A2TB1-10 and positive lead to chassis ground.

d. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power ON. Press FIL ON pushbutton.

e. Check the multimeter for an indication of -155 ±10 volts dc.

f. Set the test meter select switch to BIAS SUPPLY 300 VFS.

g. Compare the TEST METER indication with the multimeter indication. Note that the indications do not differ by more than 5 percent.

h. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power OFF. Short all high voltage terminals with grounding stick.

i. Disconnect the multimeter. Replace the lower front access panel.

j. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power ON.
4.7.3 Screen Power Supply and Metering Circuits Check

a. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power OFF.

b. Remove lower front access panel. Short all high voltage terminals with grounding stick. Block open the interlock switch.

c. Connect a multimeter (1200-Vdc scale) positive lead to A2E1 and negative lead to A3E1.

d. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power ON. Press FIL ON and LP ON pushbuttons.

e. Check the multimeter for an indication of 750 ±20 volts dc.

f. Set the test meter select switch to SCREEN SUPPLY 1500 VFS.

g. Compare the TEST METER indication with the multimeter indication. Note that the indications do not differ by more than 5 percent.

h. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power OFF. Short all high voltage terminals with grounding stick.

i. Disconnect the multimeter. Replace lower front access panel.

j. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power ON.

4.8 ADJUSTMENTS
All 820D-2 transmitters are factory adjusted to provide optimum transmitter operation at the specific customer's power output and frequency. All 820D-2 transmitters are factory adjusted at 240 VAC power input. Do not perform adjustments unless components are replaced, the transmitter fails to operate properly, power input or output requirements change, or frequency requirements change.

**WARNING**

HIGH VOLTAGE is used in this equipment.

DEATH ON CONTACT may result if you fail to observe safety precautions.

When working inside the equipment, be sure that all circuit breakers are OFF and that primary power is disabled at the wall disconnect or circuit breaker unless otherwise directed. If a procedure requires transmitter operation with access panels removed, do not allow bodily contact with any electrical component, tap, or terminal. Use heavily insulated tools to adjust variable components.
CAUTION

Make certain all meters and test equipment are switched to appropriate measuring scales before connecting them to the transmitter. Connect test equipment only to the terminals designated in the procedure.

NOTE

(1) Initial control panel switch settings for all adjustments are as follows:

- LOW VOLTAGE - ON
- HIGH VOLTAGE - ON
- PLT OFF
- FIL OFF

(2) Rf output jack A1J1 must be connected through an rf ammeter to a 50-ohm dummy load.

4.8.1 Filament Voltage Adjustment

a. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power OFF.

b. Remove the rear access panel. Short all high voltage terminals with grounding stick. Block open the interlock switch.

c. Connect a multimeter (12-Vac scale) from A1T1-5 to A1T1-7.

d. Set LOW VOLTAGE circuit breaker and primary power ON. Press FIL ON pushbutton.

WARNING

3000 VOLTS is exposed when transmitter is operated with access panels removed.

DEATH ON CONTACT may occur if you fail to observe safety precautions.

e. Adjust AIR7 until 9.5 Vac is indicated on the multimeter.

f. Press FIL OFF pushbutton. Set LOW VOLTAGE circuit breaker and primary power OFF.

g. Move multimeter (12-Vac scale) leads to A1T2-5 and A1T2-7.

h. Set LOW VOLTAGE circuit breaker and primary power ON. Press FIL ON pushbutton.

WARNING

3000 VOLTS is exposed when transmitter is operated with access panels removed.

DEATH ON CONTACT may occur if you fail to observe safety precautions.
i. Adjust A1R8 until 9.5 Vac is indicated on the multimeter.

j. Press FIL OFF pushbutton. Set LOW VOLTAGE circuit breaker and primary power OFF. Short all high voltage terminals with grounding stick.

k. Remove multimeter and replace access door.

l. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power ON.

4.8.2 RF Tuning Adjustment

a. Press FIL ON and LP ON pushbuttons.

b. Set test meter select switch to PA GRID I 150 MAFS.

c. Adjust P. A. GRID TUNING capacitor A1C47 (at upper front access panel) until maximum grid current is displayed on the TEST METER. Note the grid current value.

NOTE

The P. A. GRID TUNING capacitor must be tuned at some point within its adjustment range and not at a fully open or fully closed position.

d. If the current value (noted in step c.) is 50 to 75 mA, skip the remainder of this procedure. If the grid current is not within the specified limits, adjust A1A3R17 as described in steps e. through k.

e. Press PLT OFF and FIL OFF pushbuttons. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power OFF.

f. Remove the upper front access panel. Short all high voltage terminals with grounding stick.

g. Adjust A1A3R17 counterclockwise to lower the grid current or clockwise to raise the grid current.

h. Replace the upper front access panel.

i. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power ON. Press FIL ON and LP ON pushbuttons.

j. Check grid current displayed on the TEST METER.

k. Repeat steps f. through j. until grid current is 50 to 75 mA.

l. Press PLT OFF and FIL OFF pushbuttons.
4.8.3 Modulator Adjustments

4.8.3.1 Modulator Static Adjustments

NOTE

Access holes for the modulator adjustments are located on the upper front access panel.

a. Set L MOD BIAS and R MOD BIAS controls fully counterclockwise.
b. Set L MOD DRIVE and R MOD DRIVE controls fully clockwise.
c. Press FIL ON and HP ON pushbuttons.
d. Set test meter select switch to MOD CATHODE I 1.5 AFS. Record TEST METER reading \( I_o \).
e. Adjust L MOD BIAS clockwise until \( 0.150 + I_o/2 \) amperes is displayed on the TEST METER.
f. Adjust R MOD BIAS clockwise until \( 0.300 \) ampere is displayed on the TEST METER.
g. Press PLT OFF and FIL OFF pushbuttons.

4.8.3.2 Modulation Monitor Voltage Adjustment

NOTE

Procedures in paragraph 4.8.3.1 must be performed before beginning this procedure.
a. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power OFF.
b. Remove the rear cabinet panel. Short all high voltage terminals with grounding stick. Block open the interlock switch.
c. Connect a distortion analyzer, modulation monitor, and an oscilloscope with a X10 isolation probe to modulation monitor jack A1J2.
d. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power ON. Press FIL ON and HP ON pushbuttons.

WARNING

3000 VOLTS is exposed when transmitter is operated with access panels removed. DEATH ON CONTACT may occur if you fail to observe safety precautions.
e. Observe the oscilloscope and determine the peak-to-peak voltage displayed. If the voltage is 12 ±2 volts peak-to-peak, skip to step j. If the voltage is not within acceptable limits, adjust A1L8 pin 4 as described in steps f. through i.

f. Press PLT OFF and FIL OFF pushbuttons. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power OFF.

g. Remove the rf output network access cover. Short all high voltage terminals with grounding stick.

h. Pin 4 is the adjustable slide on the A1L8 shaft nearer the front of the transmitter. Slide pin 4 down to reduce the peak-to-peak voltage observed in step e.; slide pin 4 up to increase the voltage.

i. Replace the rf output network access cover. Repeat steps d. and e., and, if necessary, steps f. through h.

j. Press the LP ON pushbutton.

k. Observe the oscilloscope and determine the peak-to-peak voltage displayed. If the voltage is 12 ±2 volts peak-to-peak, skip to step q. If the voltage is not within acceptable limits adjust A1L8 pin 3 as described in steps l. through o.

l. Press PLT OFF and FIL OFF pushbuttons. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power OFF.

m. Remove the rf output network access cover. Short all high voltage terminals with grounding stick.

n. Pin 3 is the adjustable slide on the A1L8 shaft nearer the rear of the transmitter. Slide pin 3 down to reduce the voltage in step k.; slide pin 3 up to increase the voltage.

o. Replace the rf output network access cover. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power ON. Press FIL ON pushbutton.

p. Repeat steps j. and k., and, if necessary, steps l. through n.

q. Press PLT OFF and FIL OFF pushbuttons.

4.8.3.3 Audio Frequency Distortion Adjustment and Audio Frequency Response Check

NOTE

Procedures in paragraph 4.8.3.2 must be performed before beginning this procedure.

a. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power OFF. Short all high voltage terminals with grounding stick.

b. Connect an audio signal generator and an audio voltmeter to audio input terminals A1TB1-1, 2, and 3. Set the audio oscillator to 7500 Hz.
c. Set the LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power ON. Press the FIL ON and HP ON pushbuttons.

**WARNING**

3000 VOLTS is exposed when transmitter is operated with access panels removed.

DEATH ON CONTACT may occur if you fail to observe safety precautions.

d. Adjust the audio frequency generator level until 95-percent modulation is indicated on the modulation monitor.

e. Adjust the L MOD DRIVE control for minimum distortion as indicated on the distortion analyzer. Record the distortion level and return the L MOD DRIVE control fully clockwise.

f. Adjust the R MOD DRIVE control for minimum distortion as indicated on the distortion analyzer. Record the distortion level and return the R MOD DRIVE control fully clockwise.

g. Compare the distortion levels recorded in steps e. and f. Readjust the control with the lower recorded distortion level for minimum distortion as indicated on the distortion analyzer. Leave the remaining control fully clockwise.

h. Adjust the audio oscillator at 1.0 kHz to produce 25-percent modulation as indicated on the modulation monitor.

i. Record the input level \(V_o\) indicated on the audio voltmeter in decibels.

j. Readjust the audio oscillator to 50 Hz and 25-percent modulation. Record the input level \(V_1\) indicated on the audio voltmeter in decibels.

k. Calculate the audio response in decibels using the following formula:

\[
\text{Audio Response (dB)} = V_1 - V_o
\]

l. Repeat steps c. and d. at frequencies of 100, 400, 5000, 7500, and 10,000 Hz.

m. Repeat steps a. through e. at 50- and 100-percent modulation.

n. Note that the frequency response does not deviate more than \(\pm 1.0\) dB in the 50-Hz to 10-kHz range.

o. Press the PLT OFF and FIL OFF pushbuttons. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power OFF. Short all high voltage terminals with grounding stick.

p. Disconnect all test equipment. Replace all access panels.

q. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power ON.
4.8.4 PA Efficiency Adjustment

a. Press FIL ON and HP ON pushbuttons.

b. Adjust the PA TUNE control on the control panel for minimum indication on PLATE CURRENT meter. Record this plate current.

c. Readjust the PA TUNE control in the direction of maximum antenna or common point current until the PLATE CURRENT meter indication exceeds the recorded plate current by 20 milliamperes.

d. Press PLT OFF and FIL OFF pushbuttons.

4.8.5 Optional Automatic Power Control Adjustment

a. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power OFF.

b. Remove the lower front access panel. Short all high voltage terminals with grounding stick.

c. Connect a multimeter between A2TB2 terminals 16 and 17.

d. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power ON. Press FIL ON and LP ON pushbuttons. Set POWER CONTROL AUTO/MANUAL to MANUAL.

e. Adjust the POWER CONTROL RAISE/LOWER until the transmitter output is at the customer's normal low power output requirement.

WARNING

3000 VOLTS is exposed when transmitter is operated with access panels removed. DEATH ON CONTACT may occur if you fail to observe safety precautions.

f. Adjust A6A1R2 on the APC assembly for a zero indication on the multimeter.

g. Press the HP ON pushbutton.

h. Adjust the POWER CONTROL RAISE/LOWER until the transmitter output is at the customer's normal high power output requirement.

i. Adjust A6A1R3 on the APC assembly for a 0-millivolt indication on the multimeter.

j. Adjust SENSE adjustment A6A1R7 to approximately 3/4 full clockwise, to decrease dead zone (carrier null).

k. Press the PLT OFF and FIL OFF pushbuttons. Set the LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power OFF. Short high voltage terminals with grounding stick.

l. Disconnect the multimeter. Replace the lower front access panel.

m. Set LOW VOLTAGE and HIGH VOLTAGE circuit breakers and primary power ON.
4.9 FREQUENCY CHANGE AND FREQUENCY DEPENDENT COMPONENT DATA

All 820D-2 transmitters are factory adjusted for the specific customer's frequency requirements. Frequency change requires test equipment not normally available to broadcast station technicians or engineers. Do not make any frequency adjustments without consulting your Collins Broadcast Sales Engineer or:

Collins Commercial Telecommunications Divisions
Rockwell International
Broadcast Field Service Dept.
Dallas, Texas 75207
Phone: (214) 690-3223

Figures 4-1 through 4-9 and tables 4-2 through 4-5 provide frequency change and frequency dependent component data. This data is required for frequency change and may be required for replacement of damaged frequency dependent components. Refer to the output network simplified schematic in figure 4-1 for strap and node identification.

Figure 4-1. 820D-2 1-kW AM Transmitter Output Network Simplified Schematic.
Figure 4-2. Approximate Settings for Output Network Strap 1 on A1L4.

Figure 4-3. Approximate Settings for Output Network Strap 2 on A1L5.
Figure 4-4. Approximate Settings for Output Network Strap 3 on A1L5.

Figure 4-5. Approximate Settings for Output Network Strap 4 on A1L6.
Figure 4-6. Approximate Settings for Output Network Strap 5 on A1L7.

Figure 4-7. Approximate Settings for Output Network Strap 6 on A1L7.
Figure 4-8. Resistance $R_{22} = R_{22c}$ Values.

Figure 4-9. Resistance $R_{33}$ Values.
<table>
<thead>
<tr>
<th>OPERATING FREQUENCY</th>
<th>COLLINS PART NUMBER</th>
<th>OPERATING FREQUENCY</th>
<th>COLLINS PART NUMBER</th>
<th>OPERATING FREQUENCY</th>
<th>COLLINS PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>289-7021-010</td>
<td></td>
<td>289-7021-690</td>
<td></td>
<td>1380</td>
</tr>
<tr>
<td>540</td>
<td>289-7021-030</td>
<td>960</td>
<td>289-7021-700</td>
<td></td>
<td>1390</td>
</tr>
<tr>
<td>550</td>
<td>289-7021-050</td>
<td>970</td>
<td>289-7021-710</td>
<td></td>
<td>1400</td>
</tr>
<tr>
<td>560</td>
<td>289-7021-070</td>
<td>980</td>
<td>289-7021-720</td>
<td></td>
<td>1410</td>
</tr>
<tr>
<td>570</td>
<td>289-7021-090</td>
<td>990</td>
<td>289-7021-730</td>
<td></td>
<td>1420</td>
</tr>
<tr>
<td>580</td>
<td>289-7021-110</td>
<td>1000</td>
<td>289-7021-740</td>
<td></td>
<td>1430</td>
</tr>
<tr>
<td>590</td>
<td>289-7021-130</td>
<td>1010</td>
<td>289-7021-750</td>
<td></td>
<td>1440</td>
</tr>
<tr>
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Note: Capacitor values and part no. are as follows:

A-240 pF, 10 kV, 912-4126-100
B-390 pF, 10 kV, 912-4126-110
C-430 pF, 10 kV, 912-4126-150
D-3900 pF, 6 kV, 912-4140-180
E-3000 pF, 6 kV, 912-4140-170
F-2400 pF, 6 kV, 912-4140-160
G-180 pF, 10 kV, 912-4126-090
H-2000 pF, 6 kV, 912-4140-150
I-1600 pF, 6 kV, 912-4140-140

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Table 4-4. RF Driver A1A2 Frequency Strapping (Cont).

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Table 4-5. Dual Oscillator Card A1A3 Frequency Strapping.

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<td>730 to 1080</td>
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<td>E3</td>
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<td></td>
<td>E5</td>
</tr>
<tr>
<td>1210 to 1600</td>
<td>E1</td>
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Figure 5-1. 820D-2 1-kW AM Transmitter Overall Block Diagram.
Figure 5-2. 820D-2 1-kW AM Transmitter Simplified Control Circuits Schematic Diagram.
Figure 5-3. Feedback/Divider Board A1A4 Schematic Diagram.
Figure 5-4. Optional Automatic Power Control Servo Card A6A1
Schematic Diagram.
Figure 5-5. Optional Automatic Power Control RF Sensor A6A2 Schematic Diagram.
TABLE 1. STRAPPING CONNECTIONS

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<td>24 VDC, NEGATIVE COMMON</td>
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<td>48 VDC, POSITIVE COMMON</td>
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<td>48 VDC, NEGATIVE COMMON</td>
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<td>115 VAC</td>
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Figure 5-6. Optional Remote Control Assembly
A7 Schematic Diagram.
Figure 5-7. Optional Remote Control External Connections Schematic Diagram.
The 820D-2 1-kW AM Transmitter overall schematic diagram is folded and inserted in an envelope attached inside the back cover.

Figure 5-8. 820D-2 1-kW AM Transmitter Overall Schematic Diagram.
6.1 GENERAL

This section provides parts lists and parts locations for all electrical components of the 820D-2 transmitter. Figures 6-1 through 6-8 provide general views of the 820D-2 transmitter with various access panels removed. The remaining figures with their corresponding parts lists identify all electrical components. These figures and parts lists are in order according to assembly reference designation.

6.2 ORDERING REPLACEMENT PARTS

Refer to the information inside the front cover for instructions on how to order replacement parts.
Figure 6-1. 820D-2 1-kW AM Transmitter, Front View.
Figure 6-3. 820D-2 1-kW AM Transmitter, Top Front View With Access Panel Removed.
Figure 6-2. 820D-2 1-kW AM Transmitter, Rear View With Access Panel Removed
Figure 6-4. RF Output Network.
Figure 6-5. Low Voltage Power Supply Assembly A2.
Figure 6-6. Control Circuits Assembly A3.
Figure 6-7. High Voltage Power Supply A5.
Figure 6-8. Oscillator Card A1A3.
### Parts List

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* Select values from Table 1. below.

## TABLE 1. OUTPUT NETWORK CAPACITOR VALUES

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Figure 6-9. RF (Tube) Compartment A1
(Sheet 1 of 3).
A6A2
AUTOMATIC POWER CONTROL
(OPTIONAL)
Figure 6-9. RF (Tube) Compartment A1 (Sheet 2 of 3).
Figure 6–9. RF (Tube) Compartment A1 (Sheet 3 of 3).
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ASSEMBLY: A1A2 - RF DRIVER CARD
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ASSEMBLY: A1A3 - OSCILLATOR CARD

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ASSEMBLY: A1A4 - METER/FEEDBACK CARD

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Figure 6-13. Feedback/Divider (Meter/Feedback) Board Assembly A1A4.
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Figure 6-17. Control Panel A4.
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Figure 6-18. Cabinet Floor A5.
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ASSEMBLY: A6 - AUTOMATIC POWER CONTROL
Figure 6-19. Automatic Power Control Servo Board Assembly A6A1.
## Parts List

### Assembly: A6A1 - Automatic Power Control Card

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Figure 6-20. Power Control Sensor A6A2.
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