RCA-7580 is a very small and compact forced-air-cooled beam power tube constructed with ceramic-metal seals throughout and having a maximum plate dissipation of 250 watts. It is intended for use in single-sideband suppressed-carrier service, and in other linear rf power amplifier applications. The 7580 can be used with full ratings at frequencies up to 500 megacycles per second.

The ceramic-metal-seal construction employed in the 7580 permits operation at higher temperatures than a glass-seal construction and thus provides improved reliability. The specially designed, high-efficiency louvered radiator which is brazed directly to the plate for better heat transfer, makes possible the maximum plate-dissipation rating of 250 watts with no sacrifice in tube reliability.

The terminal arrangement of the 7580 facilitates use of the tube with tank circuits of the coaxial type. Effective isolation of the output circuit from the input circuit is provided at the higher frequencies by the ring terminal for grid No.2. A base-pin termination for grid No.2 is also available for operation of the 7580 at the lower frequencies.

**GENERAL DATA**

**Electrical:**
- Heater, for Unipotential Cathode:
  - Voltage (AC or DC) 6.0 ± 10% volts
  - Current at 6.0 volts 2.6 amp
  - Minimum heating time 30 seconds
- Mu-Factor, Grid No.2 to Grid No.1, for grid-No.2 volts = 300 and grid-No.2 ma. = 50: 4

**Direct Inter electrode Capacitances:**
- Grid No.1 to plate 0.03 μf
- Grid No.1 to cathode, grid No.2, and heater 17 μf
- Plate to cathode, grid No.2, and heater 4.5 μf

**Mechanical:**
- Operating Position: Any
- Maximum Overall Length: 2.464"
- Maximum Seated Length: 1.910"
- Maximum Diameter: 1.640"
- Base: Special B-Pin Socket: Air-System Socket, such as Johnson No.124-110-111 (Supplied with Air Chimney)
- Radiator: Integral part of tube
- Air Flow: Through Indicated Air-System Socket—This fitting directs the air over the base seals, past the grid-No.2 seal, envelope, and plate seal, and through the radiator to provide effective cooling with minimum air flow. When the tube is operated at maximum plate dissipation for each class of service, a minimum air flow of 3.6 cfm through the system is required. The corresponding pressure drop is approximately 0.3 inch of water. These requirements are for operation at sea level and at an ambient temperature of 20°C. At higher altitudes and ambient temperatures, the air flow must be increased to maintain the respective seal temperatures and the plate temperature within maximum ratings.

**LINEAR RF POWER AMPLIFIER**

**Single-Sideband Suppressed-Carrier Service**
- Peak envelope conditions for a signal having a minimum peak-to-average power ratio of 2
- Maximum CCS® Rating, Absolute-Maximum Values:
  - For Altitude up to 2000 ft: Up to 500 Mc
  - DC PLATE VOLTAGE 2000 max. volts
  - DC GRID-No.2 (SCREEN-GRID) VOLTAGE 500 max. volts

Available from E. F. Johnson Co., Waseca, Minn.
DC GRID-No.1 (CONTROL-GRID) VOLTAGE . -250 max. volts
DC PLATE CURRENT AT PEAK OF ENVELOPE . 350 max. ma
PLATE DISSIPATION . 250 max. watts
GRID-No.2 DISSIPATION . 12 max. watts
PEAK HEATER-CATHODE VOLTAGE:
Heater negative with respect to cathode . 150 max. volts
Heater positive with respect to cathode . 150 max. volts

Typical CCS Operation with "Two-Tone Modulation":

<table>
<thead>
<tr>
<th>DC Plate Voltage</th>
<th>2000</th>
<th>2000</th>
<th>volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC Grid-No.2 Voltage</td>
<td>400</td>
<td>400</td>
<td>volt</td>
</tr>
<tr>
<td>DC Grid-No.1 Voltage: From fixed supply</td>
<td>70</td>
<td>70</td>
<td>volts</td>
</tr>
<tr>
<td>Zero-Signal DC Plate Current</td>
<td>35</td>
<td>35</td>
<td>ma</td>
</tr>
<tr>
<td>Effective RF Load Resistance</td>
<td>3050</td>
<td>3050</td>
<td>ohms</td>
</tr>
<tr>
<td>DC Plate Current at Peak of Envelope</td>
<td>35</td>
<td>35</td>
<td>ma</td>
</tr>
<tr>
<td>Average DC Plate Current</td>
<td>225</td>
<td>225</td>
<td>ma</td>
</tr>
<tr>
<td>DC Grid-No.2 Current at Peak of Envelope</td>
<td>16</td>
<td>16</td>
<td>ma</td>
</tr>
<tr>
<td>Average DC Grid-No.1 Current</td>
<td>0.05</td>
<td>0.05</td>
<td>ma</td>
</tr>
<tr>
<td>Peak-Envelope Driver Power Output (Approx.)</td>
<td>1</td>
<td>1</td>
<td>watts</td>
</tr>
<tr>
<td>Output-Circuit Efficiency (Approx.)</td>
<td>95</td>
<td>95</td>
<td>%</td>
</tr>
<tr>
<td>Distortion Products Level (Approx.)</td>
<td>21</td>
<td>21</td>
<td>%</td>
</tr>
<tr>
<td>Third order</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Fifth order</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Useful Power Output (Approx.)</td>
<td>180</td>
<td>180</td>
<td>watts</td>
</tr>
<tr>
<td>Peak envelope</td>
<td>30</td>
<td>30</td>
<td>watts</td>
</tr>
</tbody>
</table>

Maximum Circuit Values:
Grid-No.1-Circuit Resistance Under Any Condition:
With fixed bias . . . . . . . . . 25000 max. ohms
With cathode bias . . . . . . . . Not recommended

DC GRID-No.2 Voltage: -250 max. volts
DC PLATE CURRENT AT PEAK OF ENVELOPE . 350 max. ma
PLATE DISSIPATION . 250 max. watts
GRID-No.2 DISSIPATION . 12 max. watts
PEAK HEATER-CATHODE VOLTAGE:
Heater negative with respect to cathode . 150 max. volts
Heater positive with respect to cathode . 150 max. volts

Maximum Circuit Values:
Grid-No.1-Circuit Resistance Under Any Condition:
With fixed bias . . . . . . . . . 25000 max. ohms
With cathode bias . . . . . . . . Not recommended

Linear RF Power Amplifier — AM Telephony
Carrier conditions per tube for use with a maximum modulation factor of 1.0

Maximum CCS Ratings, Absolute-Maximum Values:
For Altitude up to 20000 ft

DC GRID-No.2 (SCREEN-GRID) VOLTAGE . 500 max. volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE . -250 max. volts
DC PLATE CURRENT . 180 max. ma
PLATE DISSIPATION . 250 max. watts
GRID-No.2 DISSIPATION . 12 max. watts
GRID-No.1 DISSIPATION . 2 max. watts
PEAK HEATER-CATHODE VOLTAGE:
Heater negative with respect to cathode . 150 max. volts
Heater positive with respect to cathode . 150 max. volts

Typical CCS Operation:

<table>
<thead>
<tr>
<th>DC PLATE VOLTAGE</th>
<th>2000</th>
<th>2000</th>
<th>volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC Grid-No.2 Voltage</td>
<td>400</td>
<td>400</td>
<td>volt</td>
</tr>
<tr>
<td>DC Grid-No.1 Voltage: From fixed supply</td>
<td>175</td>
<td>175</td>
<td>volts</td>
</tr>
<tr>
<td>DC Grid-No.2 Current</td>
<td>6</td>
<td>6</td>
<td>ma</td>
</tr>
<tr>
<td>Effective RF Load Resistance</td>
<td>3050</td>
<td>3050</td>
<td>ohms</td>
</tr>
<tr>
<td>Driver Power Output (Approx.)</td>
<td>0.25</td>
<td>0.25</td>
<td>watts</td>
</tr>
<tr>
<td>Output-Circuit Efficiency (Approx.)</td>
<td>95</td>
<td>95</td>
<td>%</td>
</tr>
<tr>
<td>Useful Power Output (Approx.)</td>
<td>100</td>
<td>100</td>
<td>watts</td>
</tr>
</tbody>
</table>

Maximum Circuit Values:
Grid-No.1-Circuit Resistance Under Any Condition:
With fixed bias . . . . . . . . . 25000 max. ohms
With cathode bias . . . . . . . . Not recommended

Characteristics Range Values for Equipment Design

<table>
<thead>
<tr>
<th>Note</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater Current</td>
<td>1</td>
<td>2.3</td>
</tr>
<tr>
<td>Direct Inter electrode Capacitances:µF</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Grid-No.1 to plate</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Grid-No.1 to cathode</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Grid-No.2 to plate</td>
<td>16.0</td>
<td>18.5</td>
</tr>
<tr>
<td>Plate to CA-Air System Socket</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Grind-No.1 Voltage</td>
<td>55</td>
<td>100 volts</td>
</tr>
<tr>
<td>Positive</td>
<td>3</td>
<td>12 volts</td>
</tr>
<tr>
<td>Grid-No.2 Current (1)</td>
<td>4</td>
<td>10 volts</td>
</tr>
<tr>
<td>Grid-No.2 Current (2)</td>
<td>260</td>
<td>150 ma</td>
</tr>
<tr>
<td>Grid-No.1 Current</td>
<td>4.5</td>
<td>225</td>
</tr>
</tbody>
</table>

Note 1: With 6.0 volts on heater.
Note 2: With dc plate voltage of 2000 volts, dc grid-No.2 voltage of 800 volts, and grid-No.1 voltage adjusted to give plate current of 67 ma.
Note 3: With dc plate voltage of 1000 volts, dc grid-No.2 voltage of 300 volts, and grid-No.1 voltage adjusted to give plate current of 150 ma.
Note 4: With heater voltage of 8.5 volts, dc plate voltage of 2000 volts, dc grid-No.2 voltage of 300 volts, dc grid-No.1 bias of 495 volts, dc grid-No.1 current of 25 ma maximum, grid-No.1 signal voltage adjusted to produce dc plate current of 250 ma, and coaxial-cavity amplifier circuit operating at a frequency of 475 Mc.
Note 5: With Forced-Air Cooling as specified under GENERAL
Note 6: Heater voltage must be applied for at least 30 seconds before application of other voltages.
Note 7: With dc plate voltage of 250 volts, dc grid-No.2 voltage of 250 volts, and grid-No.1 voltage adjusted to give peak plate current of 1.0 ampere. This test is performed using pulse technique to prevent tube damage. Square pulses of 4500 μs duration at a repetition rate of 11 ± 1pps are used.

Special Performance Data
Inter electrode Leakage:
This test is destructive and is performed on a sample lot of tubes from each production run under the following conditions: ac heater volts = 6.6, no voltage on other elements, and specified forced-air cooling for Air-System Socket. At the end of 500 hours, with tube at 250 C, and with no voltage applied to heater, the minimum resistance between indicated electrodes as measured with a 500-ohm Megger-type ohmmeter having an internal impedance of 2.5 megohms, will be:

Grid No.1 and Grid No.2 . . . . . . . . . . 10 min. megohms
Grid No.1 and Cathode . . . . . . . . . . . 10 min. megohms
Grid No.2 and Cathode . . . . . . . . . . . 10 min. megohms

Because the cathode is subjected to considerable back bombardment as the frequency is increased with resultant increase in temperature, the heater voltage should be reduced depending on operating conditions and frequency to prevent overheating the cathode and resultant short life.

With cylindrical shield JEDEC No.320 surrounding radiator; and with a cylindrical shield JEDEC No.321 surrounding the grid-No.2 Fing terminal. Both shields are connected to ground.

Continuous Commercial Service.

The maximum rating for a signal having a minimum peak-to-average power ratio less than 2, such as is obtained in "Single-Tone" operation, is 250 ma. During short
periods of circuit adjustment under "Single-Tone" conditions, the average plate current may be as high as 350 ma.

Two-Tone Operation refers to that class of amplifier service in which the input consists of two equal mono-frequency signals, having constant amplitude. These signals are produced in a single-sideband suppressed-carrier system when two equal-and-constant amplitude audio frequencies are applied to the input of the system.

Obtained preferably from a fixed supply.

This value represents the approximate grid-No.1 current obtained due to initial electron velocities and contact-potential effects when grid No.1 is driven to zero volts at maximum signal.

Driver power output represents circuit losses and is the actual power measured at input to grid-No.1 circuit of the 7580. The actual power required depends on the operating frequency and the circuit used. The tube driving power is approximately zero watts.

This value of useful power is measured at load of output circuit having indicated efficiency.

Without the use of feedback to enhance linearity.

OPERATING CONSIDERATIONS

The maximum ratings in the tabulated data are established in accordance with the following definition of the Absolute-Maximum Rating System for rating electron devices.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron device of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

The device manufacturer chooses these values to provide acceptable serviceability of the device, taking no responsibility for equipment variations, environment variations, and the effects of changes in operating conditions due to variations in device characteristics.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environment conditions, and variations in device characteristics.

The maximum temperatures in the tabulated data for the base seals, grid-No.2 seal, plate seal, and plate are tube ratings and are to be observed in the same manner as other tube ratings. The temperature of the respective seals and of the plate may conveniently be measured with temperature-sensitive paint such as Tempilaq. The latter is made by the Tempil Corporation, 132 W. 22nd Street, New York II, N.Y. in the form of liquid and stick.

The socket for the 7580 should be of a type (such as that indicated in the tabulated data) which permits adequate air-cooling of the tube. Although the base will fit a conventional lock-in socket, the latter does not permit adequate cooling and its use is therefore not recommended.

The plate connection is made by a metal band or spring contacts to the cylindrical surface of the radiator. It is essential that the contact areas be kept clean to minimize rf losses especially at the higher frequencies.

The plate circuit should be provided with a time-delay relay which will prevent the application of plate voltage before the cathode has reached normal operating temperature.

Protective devices should be used to protect not only the plate but also grid No.2 against overload. In order to prevent excessive plate-current flow and resultant overheating of the tube, the common ground lead of the plate circuit should be connected in series with the coil of an instantaneous overload relay. This relay should be adjusted to open the circuit breakers.

Fig.1 - Typical Plate Characteristics of Type 7580.
in the primary of the rectifier transformer at slightly higher than normal plate current.

A protective device in the grid-No.2 supply lead should remove the grid-No.2 voltage when the dc grid-No.2 current reaches a value slightly higher than normal.

the primary circuit of the high-voltage supplies when any gate or door on the protective housing is opened, and should prevent the closing of this primary circuit until the door is again locked.

Forced-air cooling of the 7580 is required as indicated under GENERAL DATA. A suitable air

*Fig. 2 - Typical Characteristics of Type 7580.

The rated plate and grid-No.2 voltages of this tube are extremely dangerous to the user. Great care should be taken during the adjustment of circuits. The tube and its associated apparatus, especially all parts which may be at high potential above ground, should be housed in a protective enclosure. The protective housing should be designed with interlocks so that personnel can not possibly come in contact with any high-potential point in the electrical system. The interlock devices should function to break

*Fig. 3 - Typical Constant-Current Characteristics of Type 7580.

filter is required in the air supply. Care should be given to cleaning or replacing the filter at intervals in order that accumulated dirt will not obstruct the required flow of air through the socket and radiator.

The cooling system should be properly installed to insure safe operation of the tube under all conditions and for this reason should be electrically interconnected with the heater and plate power supplies. This arrangement is
necessary to make sure that the tube is supplied with air simultaneously with electrode voltages. Air-flow interlocks which open the power transformer primaries are desirable for protecting the tube when the air flow is insufficient or ceases.

The typical plate characteristics of Type 7580 are shown in Fig. 4. The unipotential cathode is connected within the tube to base pins 2, 4, 6, and 8. The corresponding socket terminals should all be used for connection to the circuit. The leads should have ample cross-section and be as short as possible to minimize cathode-lead inductance.

The cathode of the 7580 in uhf service is subjected to considerable bombardment resulting from transit-time effects. This back bombardment raises the temperature of the cathode. The magnitude of the heating caused by back bombardment is a function of the operating conditions and frequency, and must be compensated by reduction of heater input in order to prevent overheating of the cathode and resultant short life. When long life in continuous service is desired, the 7580 should always be put in operation with full rated heater voltage (6 volts) which should then be reduced to a value depending on the operating conditions and frequency.

The proper operating value may be found by reducing the heater voltage, with normal modulation applied to the transmitter, until a reduction in output is observed. The heater voltage must then be increased by an amount equivalent to the maximum percentage regulation of the heater-
voltage supply, and then further increased by about 2 percent to allow for other variations. After the heater voltage is reduced, circuit readjustment may be necessary. It is suggested that the adjustment procedure be carried out daily. However, if no significant changes in the operating voltage are found necessary, the adjustment procedure can be scheduled less frequently. Good regulation of the heater voltage is in general economically advantageous from the viewpoint of tube life.

Grid-No.2 voltage should be obtained from a source of good regulation. The plate voltage should be applied before or simultaneously with the grid-No.2 voltage; otherwise, with voltage on grid No.2 only, its current may be large enough to cause excessive grid-No.2 dissipation. A dc milliammeter should be used in the grid-No.2 circuit so that its current may be measured and the screen dissipation determined.

```
E_p=6 VOLTS
GRID-NA2 VOLTS=500
I_p=PLATE MILLIAMPERES
I_c=GRID-NA1 MILLIAMPERES
I_c2=GRID-NA2 MILLIAMPERES
```

Fig. 6 - Typical Constant-Current Characteristics of Type 7580.
GRID-No.1 PLUG DIMENSIONS ARE MEASURED BY THE USE OF THE SERIES OF GAUGES SHOWN IN SKETCHES G1 AND G2. IN THE FOLLOWING INSTRUCTIONS FOR THE USE OF THESE GAUGES, "GO" INDICATES THAT THE ENTIRE GRID-No.1 PLUG KEY WILL ENTER THE GAUGE; AND "NO-GO" INDICATES THAT THE GRID-No.1 PLUG KEY WILL NOT ENTER THE GAUGE MORE THAN 1/16". INSTRUCTIONS FOR THE USE OF THE GAUGES FOLLOW:

GAUGES G1-1, G1-2, G1-3, AND G1-4:
USING ONLY SLOT C, TRY THESE GAUGES IN NUMERICAL ORDER UNTIL ONE IS FOUND THAT WILL ACCEPT THE ENTIRE GRID-No.1 PLUG. USING THE FIRST GAUGE THUS FOUND, IT WILL NOT BE POSSIBLE TO INSERT THE GRID-No.1 PLUG IN SLOT B.

GAUGES G2-1, G2-2, AND G2-3:
THE GRID-No.1 PLUG WILL BE REJECTED BY GAUGES G2-1 AND G2-2, BUT WILL BE ACCEPTED BY GAUGE G2-3.

BASE-PIN POSITIONS ARE HELD TO TOLERANCES SUCH THAT THE ENTIRE LENGTH OF THE PINS WILL, WITHOUT UNDUE FORCE, PASS INTO AND DISENGAGE FROM THE FLAT-PLATE GAUGE SHOWN IN SKETCH G3.

** SOCKET CONNECTIONS **

** Bottom View **

PIN 1: GRID No.2 (For use at the lower frequencies)
PIN 2: CATHODE
PIN 3: HEATER
PIN 4: CATHODE
PIN 5: INTERNAL CONNECTION--DO NOT USE
PIN 6: CATHODE

PIN 7: HEATER
PIN 8: CATHODE
BASE INDEX PLUG: GRID No.1
RADIATOR: PLATE
RING TERMINAL: GRID No.2
(For use at the higher frequencies)
Gauge Sketch G₁

<table>
<thead>
<tr>
<th>Gauge</th>
<th>Dimension A</th>
</tr>
</thead>
<tbody>
<tr>
<td>G₁-1</td>
<td>0.2575&quot; ± 0.0005&quot;</td>
</tr>
<tr>
<td>G₁-2</td>
<td>0.2600&quot; ± 0.0006&quot;</td>
</tr>
<tr>
<td>G₁-3</td>
<td>0.2625&quot; ± 0.0006&quot;</td>
</tr>
<tr>
<td>G₁-4</td>
<td>0.2650&quot; ± 0.0006&quot;</td>
</tr>
</tbody>
</table>

Gauge Sketch G₂

<table>
<thead>
<tr>
<th>Gauge</th>
<th>Dimension A</th>
</tr>
</thead>
<tbody>
<tr>
<td>G₂-1</td>
<td>0.2550&quot; ± 0.0005&quot;</td>
</tr>
<tr>
<td>G₂-2</td>
<td>0.2960&quot; ± 0.0005&quot;</td>
</tr>
<tr>
<td>G₂-3</td>
<td>0.3080&quot; ± 0.0005&quot;</td>
</tr>
</tbody>
</table>

Suggested Design for Extractor to Remove Tube from Cavity

Gauge Sketch G₃

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