RCA-7203/4CX250B 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 as an rf power amplifier and modulator, a wideband amplifier in video applications, a linear rf power amplifier in single-sideband suppressed-carrier equipment, and a class C amplifier and oscillator. The 7203 can be used with full ratings at frequencies up to 500 megacycles per second.

The ceramic-metal seal construction employed in the 7203 permits operation at higher temperatures than a glass-seal construction and thus provides improved reliability. The specially designed, high-efficiency 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 7203 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 7203 at the lower frequencies.

The 7203 is unilaterally interchangeable with the 4X250B and bilaterally interchangeable with the 4CX250F.

**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
- Direct Inter-electrode Capacitances (Approx.).
  - Grid No. 1 to plate, 0.03 μf
  - Grid No. 1 to cathode, grid No. 2, and heater, 16 μf
  - Plate to cathode, grid No. 2, and heater, 4.4 μf

**Mechanical:**
- Operating Position: Any
- Maximum Overall Length: 2.864 in.
- Maximum Seated Length: 1.910 in.
- Maximum Diameter: 1.640 in.
- Base: Special 8-Pin Air-System Socket, such as SX-606 and SX-606 Air Chimney, or 124-110-1 (Supplied with Air Chimney)
- Radiator: Integral part of tube

**Air Flow:**
- Through Indicated Air-System Socket—This fitting directs 1.5 ft³ 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 0.1 inch of water. These requirements are for operation at sea level and at an ambient temperature of 200°F. 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.

Without Air-System Socket—if an air-system socket is not used, it is essential that adequate cooling air be directed over the base seals, past the envelope, and through the radiator. Under these conditions and with the tube operating at maximum plate dissipation for each class of service, a minimum air flow of 3.6 cfm must pass through the radiator. The corresponding pressure drop is approximately 0.1 inch of water. These requirements are for operation at sea level and at an ambient temperature of 200°F. 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.

**Plate Temperature** (Measured on base end of plate surface at junction with fins):
- 250 max. °C

**Temperature of Plate Seal, Grid-No.2 Seal, and Base Seals:**
- 250 max. °C

**Weight** (Approx.):
- 4 ounces

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**Superior Quality** RCA Electron Tube Division

RADIO CORPORATION OF AMERICA. HARRISON, NEW JERSEY

7203/4CX250B 2-61

Printed in U.S.A.
AF POWER AMPLIFIER & MODULATOR—Class AB1

Maximum CCS Ratings, Absolute-Maximum Values:

- DC PLATE VOLTAGE: 2000 max. volts
- DC GRID-No.2 VOLTAGE: 400 max. volts
- MAX.-SIGNAL DC PLATE CURRENT: 250 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:

Values are for 2 tubes

- DC PLATE Voltage: 1000 1500 2000 volts
- DC Grid-No.2 Voltage: 350 350 350 volts
- DC Grid-No.1 Voltage: 500 500 500 volts
- Peak A.F. Grid-No.1-to-Grid-No.2 Voltage: 94 94 94 volts
- Zero-Signal DC Plate Current: 166 166 166 ma
- Max.-Signal DC Plate Current: 500 500 500 ma
- Zero-Signal DC Grid-No.2 Current: 0 0 0 ma
- Max.-Signal DC Grid-No.2 Current (Approx.): 8 8 8 ma
- Effective Load Resistance (Plate to plate): 3300 6000 8700 ohms
- Max.-Signal Driving Power (Approx.): 0 0 0 watts
- Max.-Signal Power Output (Approx.): 220 400 590 watts

Maximum Circuit Values:
- Grid-No.1-Circuit Resistance (Per tube): 0.1 max. megohms

RF POWER AMPLIFIER—Class B Television Service

Synchronizing-level conditions per tube unless otherwise specified

Maximum CCS Ratings, Absolute-Maximum Values:

- 4V to 216 Mc

DC PLATE VOLTAGE: 2000 max. volts
DC GRID-No.2 VOLTAGE: 400 max. volts
DC GRID-No.1 VOLTAGE: -250 max. volts
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 with Bandwidth of 5 Mc:

- DC PLATE Voltage: 1000 1500 2000 volts
- DC Grid-No.2 Voltage: 350 350 350 volts
- DC Grid-No.1 Voltage: 500 500 500 volts
- Peak RF Grid-No.1 Voltage:
  - Synchronizing level: 65 71 76 volts
  - Pedestal level: 52 57 62 volts
- DC PLATE Current:
  - Synchronizing level: 355 360 360 ma
  - Pedestal level: 250 250 250 ma
- DC Grid-No.2 Current:
  - Synchronizing level: 27 29 29 ma
  - Pedestal level: 4 0 0 ma
- DC Grid-No.1 Current:
  - Synchronizing level: 2 5 5 ma
  - Pedestal level: 0 0 0 ma
- Driving Power (Approx.):
  - Synchronizing level: 0.4 1.2 1.2 watts
  - Pedestal level: 0 0 0 watts

Power Output (Approx.):
- Synchronizing level: 160 300 440 watts
- Pedestal level: 90 170 250 watts

LINEAR RF POWER AMPLIFIER

Single-Sideband Suppressed-Carrier Service

Maximum CCS Ratings, Absolute-Maximum Values:

Up to 500 Mc

- DC PLATE VOLTAGE: 2000 max. volts
- DC GRID-No.2 VOLTAGE: 400 max. volts
- MAX.-SIGNAL DC PLATE CURRENT: 250 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 Class AB1 "Single-Tone" Operation

Up to 175 Mc:

- DC PLATE Voltage: 1000 1500 2000 volts
- DC Grid-No.2 Voltage: 350 350 350 volts
- DC Grid-No.1 Voltage: -55 -55 -55 volts
- Zero-Signal DC Plate Current: 83 83 83 ma
- Effective RF Load Resistance: 4500 3000 4350 ohms
- Max.-Signal DC Plate Current: 250 250 250 ma
- Max.-Signal DC Grid-No.2 Current: 5 5 5 ma
- Max.-Signal Peak RF Grid-No.1 Voltage: 47 47 47 volts
- Max.-Signal Driving Power (Approx.): 0 0 0 watts
- Max.-Signal Power Output (Approx.): 110 200 295 watts

Typical CCS Operation with "Two-Tone Modulation" at 30 Mc:

- DC PLATE Voltage: 1000 1500 2000 volts
- DC Grid-No.2 Voltage: 350 350 350 volts
- DC Grid-No.1 Voltage: -55 -55 -55 volts
- Zero-Signal DC Plate Current: 83 83 83 ma
- Effective RF Load Resistance: 4500 3000 4350 ohms
- Peak Plate Current at Peak of Envelope: 250 250 250 ma
- Average DC Plate Current: 175 175 175 ma
- DC Grid-No.2 Current at Peak of Envelope: 30 30 30 ma
- Average DC Grid-No.2 Current: 6 9.5 15 ma
- Average DC Grid-No.1 Current: 0 0 0 ma
- Peak-Envelope Driver Power (Approx.): 1 1 1 watt
- Output-Circuit Efficiency (Approx.): 95 95 95 %

Distortion Products Level:
- Third Order: 29 29 30 db
- Fifth Order: 40 38 39 db

Useful Power Output (Approx.):
- Average: 55 100 147.5 watts
- Peak Envelope: 110 200 295 watts

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

PLATE-MODULATED RF POWER AMP.—Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum CCS Ratings, Absolute-Maximum Values:

Up to 500 Mc

- DC PLATE VOLTAGE: 1500 max. volts
- DC GRID-No.2 VOLTAGE: 300 max. volts
- DC GRID-No.1 VOLTAGE: -250 max. volts
- DC PLATE CURRENT: 200 max. ma

- - -
PLATE DISSIPATION .......................... 165 max. watts
GRID-No.2 DISSIPATION ..................... 6 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 at Frequencies up to 175 Mc:
DC Plate Voltage .................... 500 1000 1500 volts
DC Grid-No.2 Voltage (Modulated approx. 55%) .... 250 250 250 volts
DC Grid-No.1 Voltage .................. -100 -100 -100 volts
Peak RF Grid-No.1 Voltage ................ 113 113 113 volts
DC Plate Current ..................... 200 200 200 ma
DC Grid-No.2 Current .................. 32 32 32 ma
DC Grid-No.1 Current (Approx.) .......... 6 6 6 ma
Driving Power (Approx.) .................. 0.7 0.7 0.7 watt
Power Output (Approx.) ................. 50 140 235 watts

Maximum Circuit Values:
Grid-No.2-Circuit Resistance Under Any Condition ....... 25000 max. ohms

RF POWER AMPLIFIER & OSC.—Class C Telegraphy† and RF POWER AMPLIFIER—Class C FM Telephony

Maximum CCS Ratings, Absolute-Maximum Values:
Up to 500 Mc
DC PLATE VOLTAGE .................... 2000 max. volts
DC GRID-No.2 VOLTAGE .................. 300 max. volts
DC GRID-No.1 VOLTAGE ................ -250 max. volts
DC PLATE DISSIPATION .................. 250 max. ma
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 at Frequencies up to 175 Mc:
DC Plate Voltage .................... 500 1000 1500 2000 2500 3000 volts
DC Grid-No.2 Voltage .................. 250 250 250 250 250 250 volts
DC Grid-No.1 Voltage .................. -90 -90 -90 -90 -90 -90 volts
Peak RF Grid-No.1 Voltage ............... 109 109 109 109 109 109 volts
DC Plate Current ..................... 250 250 250 250 250 250 ma
DC Grid-No.2 Current .................. 48 47 46 45 43 36 ma
DC Grid-No.1 Current (Approx.) ......... 12 11 11 11 11 11 ma
Driving Power (Approx.) ............... 1 1 1 1 1 watt
Power Output (Approx.) ............... 65 180 290 400 watts

Typical CCS Operation at Frequency of 500 Mc with Coaxial Cavity:
DC Plate Voltage .................... 2000 volts
DC Grid-No.2 Voltage .................. 300 volts
DC Grid-No.1 Voltage .................. -90 volts
DC Plate Current ..................... 250 ma
DC Grid-No.2 Current .................. 10 ma
DC Grid-No.1 Current (Approx.) ........ 25 ma
Driving Power Output (Approx.) .......... 18 watts
Power Output (Approx.) ............... 250 watts

Maximum Circuit Values:
Grid-No.2-Circuit Resistance Under Any Condition ....... 25000 max. ohms

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater Current</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type 7203</td>
<td>1</td>
<td>2.3</td>
</tr>
<tr>
<td>Type 7204</td>
<td>2</td>
<td>0.50</td>
</tr>
</tbody>
</table>

Note: Min. = Minimum; Max. = Maximum

Direct Intererelectrod Capacitances (Types 7203 & 7204):
Grid-No.1 to plate ..................... -- -- 0.06 \( \mu \)F
Grid-No.1 to cathode, grid No.2, and heater. -- 14.2 17.2 \( \mu \)F
Plate to cathode, grid No.2, and heater. -- 6.0 8.4 \( \mu \)F

Grid-No.1 Voltage:
Type 7203. .................. 1.3, 7, 8
Type 7204. .................. 2.3, 7, 8 -32 -96 volts
Grid-No.2 Current:
Type 7203. .................. 1.3, 7, 8 -7 +3 ma
Type 7204. .................. 2.3, 7, 8 -7 +3 ma

Useful Power Output:
Type 7203. .................. 5.7, 8
Type 7204. .................. 6.7, 8 225 - watts

Note 1: With 6.0 volts on heater.
Note 2: With 26.5 volts on heater.
Note 3: With dc plate voltage of 1000 volts, dc grid-No.2 voltage of 500 volts, and grid-No.1 voltage adjusted to give plate current of 150 ma.
Note 4: With plate floating, dc grid-No.2 voltage of 300 volts, and grid-No.1 voltage adjusted to give grid-No.2 current of 50 ma.
Note 5: With heater voltage of 5.5 volts, dc plate voltage of 2000 volts, dc grid-No.2 voltage of 300 volts, dc grid-No.1 bias -90 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 470 Mc.
Note 6: Same as Note 5 except heater voltage is 24.3 volts.
Note 7: With Forced-Air Cooling as specified under GENERAL DATA—Air-System Socket.
Note 8: Heater voltage must be applied for at least 30 seconds before application of other voltages.

SPECIAL PERFORMANCE DATA

Interelectrode Leakage:
This test is destructive and is performed on a sample lot of tubes from each production run under the following conditions: ac heater voltages 6.6 for type 7203 or 29.1 for type 7204, no voltage on other elements, and specified forced-air cooling for Air-System Socket. At the end of 500 hours with tube at 75°C, and with no voltage applied to heater, the minimum resistance between indicated electrodes as measured with 1000-ohm Megger-type ohmmeter, having no 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 resulting short life.

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

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, environmental conditions, and variations in device characteristics.

- Subscript 1 indicates that grid-No. 1 current does not flow during any part of the input cycle.
- Continuous Commercial Service.
- Averaged over any audio-frequency cycle of sine-wave form.
- Averaged over any frame.

The driver stage is required to supply tube losses and rf circuit losses. The driver stage should be designed to provide an excess of power above the indicated values to take care of variations in line voltage, in components, in initial tube characteristics, and in tube characteristics during life.

- "Single-Tone" operation refers to that class of amplifier service in which the grid-No. 1 input consists of a monofrequency rf signal having constant amplitude. This signal is produced in a single-sideband suppressed-carrier system when a single audio frequency of constant amplitude is applied to the input of the system.
- Preferably obtained from a fixed supply.
- "Two-Tone Modulation" operation refers to that class of amplifier service in which the input consists of two equal monofrequency rf 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 from a fixed supply.
- ☑ Without the use of feedback to enhance linearity.
- ☑ Measured at load of output circuit having indicated efficiency.
- ☑ The dc grid-No. 2 voltage must be modulated approximately 58% in phase with the plate modulation in order to obtain 100% modulation of the 7203. The use of a series grid-No. 2 resistor or reactor may not give satisfactory performance and is therefore not recommended.
- ✺ Obtained from grid-No. 1 resistor or from a combination of grid-No. 1 resistor with either fixed supply or cathode resistor.
- ☑ Key-down conditions per tube without amplitude modulation. Amplitude modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 15% of the carrier conditions.

**OPERATING CONSIDERATIONS**

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 11, N.Y. in the form of liquid and stick.

The socket for the 7203 should be of a type (such as is 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 means of 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 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 cannot possibly come in contact with any high-potential point in the electrical system. The interlock devices should function to break 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.
Fig. 1 - Typical Plate Characteristics of Type 7203.

Fig. 2 - Typical Characteristics of Type 7203.
Fig. 3 - Typical Constant-Current Characteristics of Type 7203.

Fig. 4 - Typical Constant-Current Characteristics of Type 7203.
DIMENSIONAL OUTLINE

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:

A. 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.

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.

C. 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.

BASING DIAGRAM

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>0.2565* + 0.005</td>
</tr>
<tr>
<td>G₁ - 2</td>
<td>0.2600* + 0.005</td>
</tr>
<tr>
<td>G₁ - 3</td>
<td>0.2625* + 0.005</td>
</tr>
<tr>
<td>G₁ - 4</td>
<td>0.2650* + 0.005</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* + 0.0005*</td>
</tr>
<tr>
<td>G₂ - 2</td>
<td>0.2980* + 0.0005*</td>
</tr>
<tr>
<td>G₂ - 3</td>
<td>0.3080* + 0.0005*</td>
</tr>
</tbody>
</table>

### Suggested Design for Extractor to Remove Tube from Cavity

**Material:** Spring-hardened steel, 0.02" thick x 1/4" wide.

**Note:** Burrs must not exceed 0.002" in direction perpendicular to flat surfaces. The corresponding flat surfaces of the two legs should be in the same plane within 1/64.

**Tolerances are not cumulative.**

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