TWIN-UNIT BEAM POWER AMPLIFIER

**GENERAL DATA**

**Electrical:**

Heater, for Unipotential Cathodes:

<table>
<thead>
<tr>
<th>Series</th>
<th>Parallel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>12.6*</td>
</tr>
<tr>
<td>Current</td>
<td>1.125</td>
</tr>
</tbody>
</table>

Transconductance, per Unit (Approx.):

- For plate current of 60 ma: 8500 μμhos
- Grid-Screen Mu-Factor, per unit: 9

Direct Interelectrode Capacitances (Each Unit):
- Grid No.1 to Plate: 0.12 max. μμf
- Input: 14.5 μμf
- Output: 7.0 μμf
- Grid-No.2 to Cathode Capacitance, (Including internal grid-No.2 by-pass capacitor): 65 μμf

* Should not deviate more than +10% or -5% from value shown.

**Mechanical:**

Mounting Position: Vertical, base up or down horizontal, plane of each plate vertical

Overall Length: 4-1/8" ± 3/16"

Seated Length: 3-11/16" ± 3/16"

Maximum Diameter: See Outline Drawing

Bulb: 1-1/8"

Bulb Terminals (Two): See Outline Drawing

Base: Medium Molded-Flare Septar 7-Pin Basing Designation for BOTTOM VIEW: 7BP

Pin 1 = Heater
Pin 2 = Grid No.1 of Unit No.2
Pin 3 = Grid No.2 of Both Units
Pin 4 = Cathode, Grid No.3 of Both Units
Pin 5 = Heater Center-Tap
Pin 6 = Grid No.1 of Unit No.1
Pin 7 = Heater
Pin 8 = Plate Terminal of Unit No.1
Pin 9 = Plate Terminal of Unit No.2

PLANE OF ELECTRODES OF EACH UNIT IS PARALLEL TO PLANE THROUGH AXIS OF TUBE AND "A"
TWIN-UNIT BEAM POWER AMPLIFIER

MODULATOR - Rectangular-Wave Modulation

Maximum CCS® Ratings, Absolute Values:

(Values for both units in parallel)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>7 max.</th>
<th>1.2 max.</th>
<th>µsec</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC PLATE-SUPPLY VOLTAGE</td>
<td>5000 max.</td>
<td>5000 max.</td>
<td>volts</td>
</tr>
<tr>
<td>INSTANTANEOUS PLATE VOLTAGE</td>
<td>5750 max.</td>
<td>5750 max.</td>
<td>volts</td>
</tr>
<tr>
<td>DC GRID-No.2 (SCREEN) SUPPLY VOLT.</td>
<td>850 max.</td>
<td>850 max.</td>
<td>volts</td>
</tr>
<tr>
<td>DC GRID-No.1 (CONTROL) GRID) SUPPLY VOLTAGE</td>
<td>-200 max.</td>
<td>-200 max.</td>
<td>volts</td>
</tr>
<tr>
<td>INSTANTANEOUS GRID-No.1 VOLT</td>
<td>-600 max.</td>
<td>-600 max.</td>
<td>volts</td>
</tr>
<tr>
<td>PEAK POSITIVE GRID-No.1 VOLT</td>
<td>250 max.</td>
<td>250 max.</td>
<td>volts</td>
</tr>
<tr>
<td>PEAK PLATE CURRENT</td>
<td>1.5 max.</td>
<td>10 max.</td>
<td>amp</td>
</tr>
<tr>
<td>PEAK GRID-No.2 CURRENT</td>
<td>0.5 max.</td>
<td>0.5 max.</td>
<td>amp</td>
</tr>
<tr>
<td>PEAK GRID-No.1 CURRENT</td>
<td>0.6 max.</td>
<td>4 max.</td>
<td>amp</td>
</tr>
<tr>
<td>PLATE INPUT</td>
<td>85 max.</td>
<td>60 max.</td>
<td>watts</td>
</tr>
<tr>
<td>GRID-No.2 INPUT</td>
<td>3 max.</td>
<td>3 max.</td>
<td>watts</td>
</tr>
<tr>
<td>GRID-No.1 INPUT</td>
<td>1 max.</td>
<td>1 max.</td>
<td>watt</td>
</tr>
<tr>
<td>PLATE DISSIPATION</td>
<td>15 max.</td>
<td>15 max.</td>
<td>watts</td>
</tr>
<tr>
<td>PEAK HEATER-CATHODE VOLTAGE:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heater negative with respect to cathode</td>
<td>100 max.</td>
<td>100 max.</td>
<td>volts</td>
</tr>
<tr>
<td>Heater positive with respect to cathode</td>
<td>100 max.</td>
<td>100 max.</td>
<td>volts</td>
</tr>
</tbody>
</table>

Typical Operation with Rectangular-Wave Shapes:

(In accompanying test circuit)

With duty factor* of \( 2 \times 10^{-3} \) and \( 10^{-3} \)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>DC Plate-Supply Voltage</th>
<th>DC Grid-No.2 Supply Volt</th>
<th>DC Grid-No.1 Supply Volt</th>
<th>Peak Positive Grid-No.1 Volt</th>
<th>Peak Plate Current</th>
<th>DC Plate Current</th>
<th>DC Grid-No.2 Current</th>
<th>DC Grid-No.1 Current</th>
<th>Load Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>2000</td>
<td>650</td>
<td>-175</td>
<td>50</td>
<td>5</td>
<td>10</td>
<td>1.1</td>
<td>1.0</td>
<td>300</td>
</tr>
<tr>
<td>Units</td>
<td>volts</td>
<td>volts</td>
<td>volts</td>
<td>volts</td>
<td>amp</td>
<td>amp</td>
<td>ma.</td>
<td>ma.</td>
<td>ohms</td>
</tr>
</tbody>
</table>

* Continuous Commercial Service.

▲ For tube protection, it is essential that the dc resistance of the plate supply and of the screen supply be sufficiently large to limit the short-circuit current to 0.5 ampere in either circuit.

# Duty factor = pulse length multiplied by repetition rate.

OUTLINE DIMENSIONS for the 3E29 are the same as those shown for Type 829-8"
TWIN-UNIT BEAM POWER AMPLIFIER

TEST CIRCUIT

R1 R2: 20 Ohms, non-inductive
R3: 1500 Ohms
R4: 25 Ohms, non-inductive
R5: 1500 Ohms
R6 R7: 10 Ohms, non-inductive
R8: 10000 Ohms
R9: 400 Ohms
R10: 10 Ohms

C1: 0.1 \(\mu F\), 600 V., DC
C2: 0.1 \(\mu F\), 1000 V., DC
C3: 0.1 \(\mu F\), 5000 V., DC

Ecc1: Grid-Supply Voltage
Ecc2: Screen-Supply Voltage
Ebb: Plate-Supply Voltage
Egl1: Signal Voltage

The license extended to the purchaser of tubes appears in the License Notice accompanying them. Information contained herein is furnished without assuming any obligations.

DEC. 20, 1946
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
CE-6542
AVERAGE CHARACTERISTICS
BOTH UNITS IN PARALLEL IN TEST CIRCUIT *

E_F = 12.6 VOLTS
GRID-N°2 VOLTS = 850
SERIES HEATER ARRANGEMENT

* TEST CIRCUIT SHOWN ON PRECEDING PAGE

NOV. 25, 1946
TUBE DEPARTMENT
92CM-6530RI
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
TWIN-UNIT BEAM POWER TUBE

Unless Otherwise Specified, Values are on a Per Tube Basis

GENERAL DATA

Electrical:
Heater, for Unipotential Cathodes:
Arrangement
Voltage (AC or DC) .......... 6.3 +10% -5% 12.6 +10% -5% volts
Current at 6.3 volts ........ 2.25 amp
Current at 12.6 volts ....... 1.125 amp
Transconductance (Each Unit):
With plate volts = 250, grid-
No. 2 volts = 175, and plate
ma. = 60 ..... 8500 µmhos
Mu-Factor, Grid No.2 to Grid No.1
(Each Unit):
With plate volts = 225, grid-
No. 2 volts = 225, and plate
ma. = 60 ..... 9
Direct Interelectrode Capacitances (Each Unit):
Grid No.1 to plate (with
external shield Q) ... 0.12 max. µuf
Input ................. 14 µuf
Output .................. 7 µuf

Mechanical:
Mounting Position .......... Vertical, base up or down;
Horizontal, plane of each plate vertical
Overall Length ............ 4-1/8" ± 3/16"
Seated Length .............. 3-11/16" ± 3/16"
Maximum Diameter .......... 2-3/8"
Bulb ...................... T-16
Bulb Terminals (Two) ....... See Dimensional Outline
Weight (Approx.) ............ 3.5 oz.
Base ..................... Medium Molded-Flare Septar 7-Pin
(JETEC No.E7-2)

BOTTOM VIEW

Pin 1 - Heater
Pin 2 - Grid No.1 of
Unit No.2
Pin 3 - Grid No.2 of
Both Units
Pin 4 - Cathode,
Grid No.3 of
Both Units
Pin 5 - Heater,
Center-Tap
Pin 6 - Grid No.1 of
Unit No.1
Pin 7 - Heater
PU1 - Plate Terminal
of Unit No.1
PU2 - Plate Terminal
of Unit No.2

Planes of Electodes of Each Unit
Is Parallel To Plane Through Axis
Of Tube and An

Q: See next page.

MAY 3, 1954
MODULATOR—Rectangular-Wave Modulation

Values are for Units in Parallel

Maximum CCS® Ratings, Absolute Values:
For Duty Factor® between 0.0001 and 1.0
and Maximum Averaging Time of 1200 μsec in Any Interval

DC PLATE SUPPLY VOLTAGE .......... 5000 max. volts
INSTANTANEOUS PLATE VOLTAGE .... 5750 max. volts
DC GRID-No.2 (SCREEN) SUPPLY VOLTAGE* .... 850 max. volts
DC GRID-No.1 (CONTROL-GRID) SUPPLY VOLTAGE* .... −225 max. volts
INSTANTANEOUS GRID-No.1 VOLTAGE .. −600 max. volts
PEAK POSITIVE GRID-No.1 VOLTAGE .... 250 max. volts
PEAK PLATE CURRENT ................. See Rating Chart
PEAK GRID-No.2 CURRENT ............. 3.5 max. amp
PEAK GRID-No.1 CURRENT .......... 4 max. amp
PLATE INPUT ......................... 85 max. watts
GRID-No.2 INPUT ..................... 3 max. watts
GRID-No.1 INPUT ..................... 1 max. watt
PLATE DISSIPATION#.................. 15 max. watts
PEAK HEATER—CATHODE VOLTAGE:
Heater negative with respect to cathode .... 100 max. volts
Heater positive with respect to cathode .... 100 max. volts

Typical Operation with Rectangular-Wave Shapes in
Accompanying Test Circuit:

With Duty Factor® of 0.002 0.001
DC Plate Supply Voltage ......... 2000 5000 volts
DC Grid-No.2 Supply Voltage .... 650 850 volts
DC Grid-No.1 Supply Voltage .... −175 −200 volts
Peak Positive Grid-No.1 Voltage .... 50 150 volts

* Having length of 3/4" and inside diameter of 2–3/8". Shield is placed around base end of tube and is connected to cathode.
® Continuous Commercial Service.

For tube protection, it is essential that sufficient dc resistance be used in the plate supply circuit, the grid-No.2 supply circuit, and the grid-No.1 supply circuit so that the short-circuit current is limited to 0.5 ampere in each circuit.

Duty Factor for the 3E29 is defined as the "on" time in microseconds divided by 1200 microseconds.

"On" Rise is defined as the sum of the durations of all the individual pulses which occur during any 1200-microsecond interval.

Pulse Duration is defined as the time interval between the two points on the pulse at which the instantaneous value is 70% of the peak value. The pulse value is defined as the maximum value of a smooth curve through the average of the fluctuations over the top portion of the pulse.

# Averaged over any interval not exceeding 1200 microseconds. Care should be used in determining the plate dissipation. A calculated value based on rectangular pulses can be considerably in error when the actual pulses have a finite rise and fall time. Plate dissipation should preferably be determined by measuring the bulb temperature under actual operating conditions; then, with the tube in the same socket and under the same ambient-temperature conditions, apply to the tube sufficient dc input to obtain the same bulb temperature. This value of dc input is a measure of the plate dissipation.

→ indicates a change

MAY 3, 1955
TUBE DIVISION
RADIO CORPORATION OF AMERICA, MARRIOTT, NEW JERSEY
**RATING CHART**

\[ E_f = \begin{cases} 6.3 \text{ VOLTS (PARALLEL-HEATER ARRANGEMENT)} \\ 2.6 \text{ VOLTS (SERIES-HEATER ARRANGEMENT)} \end{cases} \]

AVERAGING TIME (\(\mu\text{SEC}\)) = 1200 MAXIMUM

**AVERAGE CHARACTERISTICS**

UNITS IN PARALLEL IN TEST CIRCUIT *

\[ E_f = 12.6 \text{ VOLTS} \]

(SERIES-HEATER ARRANGEMENT)

GRID-N=2 SUPPLY VOLTS = 850

GRID-N=2 VOLT=EC1

*TEST CIRCUIT SHOWN ON PRECEDING SHEET.

**Diagram**

Graph showing the relationship between maximum peak plate amperes and duty factor for different voltages.

**Table**

<table>
<thead>
<tr>
<th>PLATE VOLTS</th>
<th>GRID-N=2 AMPERES</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>500</td>
<td>0.5</td>
</tr>
<tr>
<td>1000</td>
<td>0.5</td>
</tr>
<tr>
<td>1500</td>
<td>0.5</td>
</tr>
<tr>
<td>2000</td>
<td>0.5</td>
</tr>
</tbody>
</table>

\[ EC1 = \pm 50 \]

\[ \pm 25 \]

\[ \pm 100 \]

\[ \pm 50 \]

\[ \pm 25 \]
AVERAGE CHARACTERISTICS
UNITS IN PARALLEL IN TEST CIRCUIT*

\[ E_c = 12.6 \text{ VOLTS (SERIES-HEATER ARRANGEMENT)} \]
GRID-N\#2 SUPPLY VOLTS = 850
GRID-N\#1 VOLTS = E_c

*TEST CIRCUIT SHOWN ON PRECEDING SHEET.
Plate Current:
- Peak: 5 10 amp
- DC: 0.010 0.010 amp
- DC Grid-No.2 Current: 0.0011 0.002 amp
- DC Grid-No.1 Current: 0.001 0.001 amp
- Load Resistance: 300 400 ohms

**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 (Parallel connection)</td>
<td>1</td>
<td>2.00</td>
</tr>
<tr>
<td>Heater Current (Series connection)</td>
<td>2</td>
<td>1.00</td>
</tr>
<tr>
<td>Grid-No.1-to-Plate Capacitance (Each unit)</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Input Capacitance (Each unit)</td>
<td>-</td>
<td>12.8</td>
</tr>
<tr>
<td>Output Capacitance (Each unit)</td>
<td>-</td>
<td>5.25</td>
</tr>
<tr>
<td>Plate Current (Each unit)</td>
<td>1,4</td>
<td>38</td>
</tr>
<tr>
<td>Grid-No.1 Voltage</td>
<td>1,5</td>
<td>-</td>
</tr>
<tr>
<td>Grid-No.2 Current (Each unit)</td>
<td>1,4</td>
<td>-</td>
</tr>
<tr>
<td>Peak Plate Current</td>
<td>1,6</td>
<td>9</td>
</tr>
</tbody>
</table>

**Notes:**

1. With 6.3 volts on heater.
2. With 12.6 volts on heater.
3. With external shield having length of 3/4" and inside diameter of 2-3/8". Shield is placed around base end of tube and is connected to cathode.
4. With dc plate voltage of 250 volts, dc grid-No.2 voltage of 175 volts, and dc grid-No.1 voltage of -11 volts. Grid No.1 of unit not under test is biased -100 volts with respect to its cathode.
5. With units in parallel, dc plate voltage of 400 volts, dc grid-No.2 voltage of 225 volts, and dc grid-No.1 voltage adjusted to give dc plate current of 200 microamperes.
6. With the units in parallel in the accompanying test circuit under the following conditions: rectangular-wave modulation applied to grid No.1; pulse duration of 1 microsecond approx; pulse repetition rate of 1500 cps approx; dc plate-supply voltage of 5000 volts; dc grid-No.2 voltage of 850 volts; dc grid-No.1 voltage of -225 volts; peak positive grid-No.1 swing of 150 volts; and dc plate current of 15 ma. Minimum obtained by adjusting the pulse repetition rate.

**Dimensional Outline**

shown under Type 8298 also applies to the 3E29

← Indicates a change.
R1 R2: 20 ohms, 1 watt non-inductive
R3: 15000 ohms, 1 watt
R4: 25 ohms, 1 watt, non-inductive
R5: 10000 ohms, 1 watt
R6 R7: 10 ohms, 5 watts, non-inductive
R8: 10000 ohms, 50 watts
R9: 400 ± 5% ohms, 50 watts non-inductive
R10: 10 ± 1% ohms, 5 watts
C1: 0.1 μf, 600 v dc
C2: 0.1 μf, 1000 v dc
C3: 0.1 μf, 5000 v dc
Ecc1: Grid-No.1 Supply Voltage
Ecc2: Grid-No.2 Supply Voltage
Ebb: Plate Supply Voltage
Egl: Signal Voltage