**3D22-A GAS THYATRATRON**

**NEGATIVE-CONTROL TETRODE TYPE**

**Supersedes Type 3D22**

### GENERAL DATA

**Electrical:**

Heater, for Unipotential Cathode:

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Min.</th>
<th>Ave.</th>
<th>Max.</th>
<th>ac or dc volts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5.7</td>
<td>6.3</td>
<td>6.9</td>
<td></td>
</tr>
</tbody>
</table>

Current at 6.3 volts:

|         | 2.6  | 2.85 |

Cathode:

- Minimum heating time prior to tube conduction: 30 sec
- Maximum outage time without reheating: 3 sec

Direct Interelectrode Capacitances (Approx.):

<table>
<thead>
<tr>
<th>Grid No.1 to anode*</th>
<th>0.1 μf</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid No.1 to cathode, grid No.2, base shell, and heater</td>
<td>8.5 μf</td>
</tr>
<tr>
<td>Anode to cathode, grid No.2, base shell, and heater</td>
<td>4.6 μf</td>
</tr>
</tbody>
</table>

Ionization Time (Approx.):

- For conditions: dc anode volts = 100, grid-No.1 square-pulse volts = +100, and peak anode amperes during conduction = 8, 0.5 μsec

Deionization Time (Approx.):

- For conditions: dc anode volts = 125, dc grid-No.1 volts = -200, grid-No.1 resistor (ohms) = 1000, and dc anode amperes = 0.8, 150 μsec
- For conditions: dc anode volts = 125, dc grid-No.1 volts = -14.8, grid-No.1 resistor (ohms) = 1000, and dc anode amperes = 0.8, 400 μsec

Maximum Critical Grid-No.1 Current:

- For conditions: ac anode-supply volts = 460 (rms), and average anode amperes = 0.8, 0.8 μamp

Anode Voltage Drop (Approx.): 10 volts

Grid-No.1 Control Ratio (Approx.):

- For conditions: grid-No.1 resistor (megohms) = 0 to 0.1, grid-No.2 resistor (megohms) = 0, and grid-No.2 volts = 0, 150

Grid-No.2 Control Ratio (Approx.):

- For conditions: grid-No.1 resistor (megohms) = 0, grid-No.2 resistor (megohms) = 0 to 0.1, and grid-No.1 volts = -3, 650

* Without external shield.
* With all other electrodes and base shell connected to ground.

**JULY 1, 1955**

**RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY**

**DATA 1**
GAS THYRATRON

Mechanical:
Mounting Position ........................................ 4-5/8" Any
Maximum Overall Length .................................. 4"
Maximum Seated Length .................................. 2-3/8"
Maximum Diameter ........................................ 5 oz
Bulb ......................................................... T-16
Base ......................................................... Medium-Metal-Shell Giant 7-Pin with Bayonet (JETEC No. A7-17)
Basing Designation for BOTTOM VIEW ............... 7BV

Pin 1 - Heater  Pin 2 - Grid No. 2  Pin 3 - Cathode  Pin 4 - Grid No. 1  Pin 5 - Grid No. 2  Pin 6 - Anode  Pin 7 - Heater

AA = PLANE OF ELECTRODES

RELAY AND GRID-CONTROLLED RECTIFIER SERVICE

Maximum Ratings, Absolute Values:

PEAK ANODE VOLTAGE:
Forward .................................................. 650 max. volts
Inverse .................................................. 1500 max. volts

GRID-No.2 (SHIELD-GRID) VOLTAGE:
Peak, before tube conduction .............. -100 max. volts
Average#, during tube conduction ........ -10 max. volts

GRID-No.1 (CONTROL-GRID) VOLTAGE:
Peak or DC, before tube conduction ........ -200 max. volts
Average#, during tube conduction ........ -10 max. volts

CATHODE CURRENT:
Peak .................................................. 8 max. amp
Average# ........................................ 0.8 max. amp
Fault, for duration of 0.1 second max. ... 30 max. amp

AVERAGE GRID-No.2 CURRENT# ................. +0.1 max. amp
AVERAGE GRID-No.1 CURRENT# ................. +0.05 max. amp

PEAK HEATER-CATHODE VOLTAGE:
Heater negative with respect to cathode .......... 100 max. volts
Heater positive with respect to cathode ........ 25 max. volts

AMBIENT-TEMPERATURE RANGE ................. -75 to +90 °C

Maximum Circuit Values:
Grid-No.1-Circuit Resistance ............. 2 max. megohms

* Averaged over any interval of 30 seconds maximum.
SPECIAL PERFORMANCE TESTS

Made in conformance with indicated sections of
NIL-E-1B Specifications dated 2 May 1952

4.9.19.2 (F-66) High-Frequency Vibration:
The tube is rigidly mounted on a table vibrating with simple
harmonic motion at a frequency of 50 ± 2 cps with a fixed
amplitude of 0.040" ± 0.0025" (total excursion is double
the amplitude). Maximum acceleration is 10g. No voltage
is applied during vibration. Tube is vibrated for 10
minutes in such manner that table motion is along shortest
line between anode and cathode. This test will not cause
tube to be inoperative.

4.10.19 (F-64) Thyatron High-Voltage Operation:

<table>
<thead>
<tr>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.1 Supply Voltage (1)</td>
<td>-4.4</td>
</tr>
</tbody>
</table>

This test is made after two light taps with a felt hammer
(similar to type used for noise tests) in direction from
anode to cathode under the following conditions: heater
voltage of 6.3 volts rms, anode supply voltage of 500 volts
rms, grid No.2 tied to cathode, load resistance of 2000
ohms, and grid-No.1 circuit-resistance of 2 megarhms. Tube
conduction is indicated by an oscilloscope connected between
anode and cathode and ceases when the grid-No.1 supply
voltage is increased negatively within indicated range.

| Grid-No.1 Supply Voltage (2) | -4.4 | -9.2 volts |

This test is made as for Grid-No.1 Supply Voltage (1), ex-
cept that the taps are made in direction from anode to
cathode.

Voltage Difference | -1 volt |

The difference between the value of grid-No.1 supply voltage
in the first and second grid-No.1 supply voltage tests will
not exceed the specified value.

OPERATING CONSIDERATIONS

Sufficient anode-circuit resistance, including the tube
load, must be used under any conditions of operation to
prevent exceeding the current ratings of the tube.
3D22-A
GRID-CONTROLLED RECTIFIER CIRCUITS

DC Voltage Control

FIG. 1 HALF-WAVE SINGLE-PHASE

FIG. 2 FULL-WAVE SINGLE-PHASE

FIG. 3 SERIES SINGLE-PHASE

AC Voltage Control

FIG. 4 FULL-WAVE SINGLE-PHASE

NOTES

T = PEAKING TRANSFORMER
IN FIG. 3, THE RECTIFIER TUBES MAY BE
3D22-A's USED AS DIODES. THE 3D22-A
IS USED AS A DIODE BY CONNECTING
GRIDS NBR 2 AND NBR 1 TO CATHODE (PIN 3)

Devices and arrangements shown or described herein may use patents of RCA or others. Information contained herein is furnished without responsibility by RCA for its use and without prejudice to RCA's patent rights.

JULY 1, 1955
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
TUBE DIVISION
DATA 2
### Numerical Relationships Among Electrical Quantities

- $E$ = Trans. Sec. Voltage (RMS)
- $E_{av}$ = Average DC Output Voltage
- $E_{bmf}$ = Peak Forward Anode Voltage
- $E_{bmi}$ = Peak Inverse Anode Voltage
- $E_m$ = Peak DC Output Voltage
- $E_r$ = Major Ripple Voltage (RMS)
- $f$ = Supply Frequency
- $f_r$ = Major Ripple Frequency
- $I_{av}$ = Average DC Output Current
- $I_b$ = Average Anode Current
- $I_p$ = Anode Current (RMS)
- $I_{pm}$ = Peak Anode Current
- $P_{ac}$ = Load Volt-Ampere
- $P_{al}$ = Line Volt-Ampere
- $P_{ap}$ = Trans. Pri. Volt-Ampere
- $P_{as}$ = Trans. Sec. Volt-Ampere
- $P_{dc}$ = DC Power ($E_{av} \times I_{av}$)

**Note:** Conditions assumed involve sine-wave supply; zero voltage drop in tubes; no losses in transformer and circuit; no back emf in the load circuit; and no phase-back.

<table>
<thead>
<tr>
<th>Voltage Ratios</th>
<th>Fig. 1</th>
<th>Fig. 2</th>
<th>Fig. 3</th>
<th>Fig. 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E/E_{av}$</td>
<td>2.22</td>
<td>1.11</td>
<td>1.11</td>
<td>-</td>
</tr>
<tr>
<td>$E_{bmi}/E$</td>
<td>1.41</td>
<td>2.83</td>
<td>1.41</td>
<td>1.41</td>
</tr>
<tr>
<td>$E_{bmi}/E_{av}$</td>
<td>3.14</td>
<td>3.14</td>
<td>1.57</td>
<td>-</td>
</tr>
<tr>
<td>$E_m/E_{av}$</td>
<td>3.14</td>
<td>1.57</td>
<td>1.57</td>
<td>-</td>
</tr>
<tr>
<td>$E_r/E_{av}$</td>
<td>1.11</td>
<td>0.472</td>
<td>0.472</td>
<td>-</td>
</tr>
</tbody>
</table>

**Resistive Load**

- Resistive Load

<table>
<thead>
<tr>
<th>Current Ratios</th>
<th>Fig. 1</th>
<th>Fig. 2</th>
<th>Fig. 3</th>
<th>Fig. 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_p/I_{av}$</td>
<td>1.57</td>
<td>0.785</td>
<td>0.785</td>
<td>-</td>
</tr>
<tr>
<td>$I_b/I_{av}$</td>
<td>1</td>
<td>0.5</td>
<td>0.5</td>
<td>-</td>
</tr>
</tbody>
</table>

**Inductive Load**

<table>
<thead>
<tr>
<th>Power Ratios</th>
<th>Fig. 1</th>
<th>Fig. 2</th>
<th>Fig. 3</th>
<th>Fig. 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>$P_{ac}/I_bE_{bmf}$</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1.57</td>
</tr>
</tbody>
</table>

**Resistive Load**

<table>
<thead>
<tr>
<th>Power Ratios</th>
<th>Fig. 1</th>
<th>Fig. 2</th>
<th>Fig. 3</th>
<th>Fig. 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>$P_{as}/P_{dc}$</td>
<td>3.49</td>
<td>1.74</td>
<td>1.24</td>
<td>-</td>
</tr>
<tr>
<td>$P_{ap}/P_{dc}$</td>
<td>2.69</td>
<td>1.23</td>
<td>1.24</td>
<td>-</td>
</tr>
<tr>
<td>$P_{al}/P_{dc}$</td>
<td>2.69</td>
<td>1.23</td>
<td>1.24</td>
<td>-</td>
</tr>
</tbody>
</table>

*: see next page.
# GAS THYRATRON

## Power Ratios (Cont'd)

<table>
<thead>
<tr>
<th>Ratio</th>
<th>Fig. 1</th>
<th>Fig. 2</th>
<th>Fig. 3</th>
<th>Fig. 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inductive Load</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$P_{as}/P_{dc}$</td>
<td></td>
<td>1.57</td>
<td>1.11</td>
<td>-</td>
</tr>
<tr>
<td>$P_{ap}/P_{dc}$</td>
<td></td>
<td>1.11</td>
<td>1.11</td>
<td>-</td>
</tr>
<tr>
<td>$P_{a1}/P_{dc}$</td>
<td></td>
<td>1.11</td>
<td>1.11</td>
<td>-</td>
</tr>
</tbody>
</table>

*The use of a large filter-input choke is assumed, except for the circuit in Fig. 4.*

## Circuit Data

<table>
<thead>
<tr>
<th>Circuit</th>
<th>Single-Phase</th>
<th>Max. Trans. Sec. Volts (RMS)</th>
<th>Approx. DC Output Volts to Filter $E_{av}$</th>
<th>Max. DC Output Amperes $I_{av}$</th>
<th>Max. DC Output Watts to Filter $P_{dc}$</th>
<th>Max. AC Output Volt-Ampere $P_{ac}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fig. 1</td>
<td>Half-Wave</td>
<td>460</td>
<td>205</td>
<td>0.8</td>
<td>165</td>
<td>-</td>
</tr>
<tr>
<td>Fig. 2</td>
<td>Full-Wave:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resistive Load</td>
<td>460</td>
<td>410</td>
<td>1.6</td>
<td>660</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Inductive Load</td>
<td>230</td>
<td>205</td>
<td>1.6</td>
<td>330</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Fig. 3</td>
<td>Series</td>
<td>460</td>
<td>410</td>
<td>1.6</td>
<td>660</td>
<td>-</td>
</tr>
<tr>
<td>Fig. 4</td>
<td>Full-Wave</td>
<td>460</td>
<td></td>
<td></td>
<td></td>
<td>800</td>
</tr>
</tbody>
</table>

## Diagram

- **T16 BULB**
- **2 3/8" MAX.**
- **4 5/8" MAX.**
- **4" MAX.**
- **MED. METAL SHELL GIANT 7-PIN BAYonet BASE**
- **JETEC NO. A7-47**

---

*92CM-6569R2*

**JULY 1, 1955**

**RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY**

**DATA 3**
OPERATIONAL RANGE OF CRITICAL GRID-NO.1 VOLTAGE

GRID NO. 2 (SHIELD) CONNECTED TO CATHODE. RANGES SHOWN ARE FOR TWO VALUES OF GRID-NO.1 RESISTOR. 0.1 MEG. AND 2 MEG., AND TAKE INTO ACCOUNT INITIAL DIFFERENCES BETWEEN INDIVIDUAL TUBES AND SUBSEQUENT DIFFERENCES DURING TUBE LIFE, FOR HEATER-VOLTAGE RANGE OF 5.7 TO 6.9 VOLTS, AND FOR AN ANODE TEMPERATURE RANGE OF -40 TO +90°C.

Range for 2 Megohms

Range for 0.1 Megohm

AC ANODE VOLTS (RMS 50-60)

DC GRID-NO.1 SUPPLY VOLTS

92CM-6483T3

JULY 1, 1955

TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
AVERAGE CONTROL CHARACTERISTICS

E_f = 6.3 VOLTS
GRID-N&2 RESISTOR = 0 OHMS
GRID-N&1 RESISTOR = 0 OHMS

JAN. 22, 1947
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY