

3D22-A

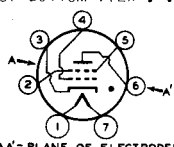


# 3D22-A GAS THYRATRON

## Mechanical:

Mounting Position . . . . .	Any
Maximum Overall Length . . . . .	4-5/8"
Maximum Seated Length . . . . .	4"
Maximum Diameter . . . . .	2-3/8"
Weight (Approx.) . . . . .	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
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# Averaged over any interval of 30 seconds maximum.



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NEGATIVE-CONTROL TETRODE TYPE

Supersedes Type 3D22

## GENERAL DATA

### Electrical:

Heater, for Unipotential Cathode:

	Min.	Av.	Max.	
Voltage . . . . .	5.7	6.3	6.9	ac or dc volts
Current at 6.3 volts. . .	-	2.6	2.85	amp

### Cathode:

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

### Direct Interelectrode Capacitances

(Approx.):<sup>o</sup>

Grid No.1 to anode*. . . . .	0.1	μf
Grid No.1 to cathode, grid No.2, base shell, and heater . . . . .	8.5	μf
Anode to cathode, grid No.2, base shell, and heater . . . . .	4.6	μf

### 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
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### 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
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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
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### 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
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<sup>o</sup> Without external shield.

\* With all other electrodes and base shell connected to ground.



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## SPECIAL PERFORMANCE TESTS

Made in conformance with indicated sections of  
MIL-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  $50 \pm 2$  cps with a fixed amplitude of  $0.040" \pm 0.0025"$  (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:

Min. Max.

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

This test is made after two light taps with a felt hammer (similar to type used for noise tests) in direction from cathode to anode 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 megohms. 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), except 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.

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## GRID-CONTROLLED RECTIFIER CIRCUITS

### DC Voltage Control

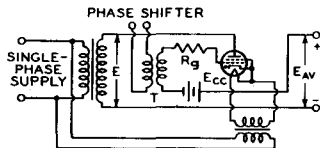


FIG. 1 HALF-WAVE SINGLE-PHASE

### PHASE SHIFTER

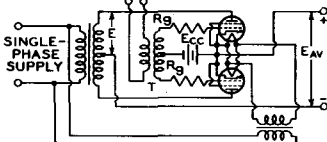


FIG. 2 FULL-WAVE SINGLE-PHASE

### PHASE SHIFTER

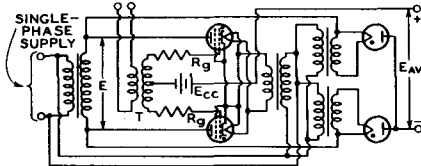


FIG. 3 SERIES SINGLE-PHASE

### AC Voltage Control

#### PHASE SHIFTER

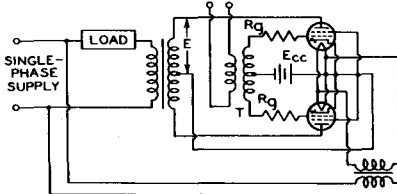


FIG. 4 FULL-WAVE SINGLE-PHASE

#### NOTES

92CL-8596

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 N<sup>o</sup>2 AND N<sup>o</sup>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.



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**GRID-CONTROLLED RECTIFIER CIRCUITS**  
**Numerical Relationships Among Electrical Quantities**

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

RATIO	Fig. 1	Fig. 2	Fig. 3	Fig. 4
<b>Voltage Ratios</b>				
$E/E_{av}$	2.22	1.11	1.11	-
$E_{bmi}/E$	1.41	2.83	1.41	1.41
$E_{bmi}/E_{av}$	3.14	3.14	1.57	-
$E_m/E_{av}$	3.14	1.57	1.57	-
$E_r/E_{av}$	1.11	0.472	0.472	-
$E_{bmf}/E$ :				
Resistive Load	1.41	1.41	1.41	1.41
Inductive Load <sup>■</sup>	1.41	2.83	1.41	1.41
<b>Frequency Ratio</b>				
$f_r/f$	1	2	2	-
<b>Current Ratios</b>				
$I_p/I_{av}$	1.57	0.785	0.785	-
$I_b/I_{av}$	1	0.5	0.5	-
Resistive Load				
$I_{pm}/I_{av}$	3.14	1.57	1.57	-
$I_{pm}/I_b$	3.14	3.14	3.14	3.14
Inductive Load <sup>■</sup>				
$I_{pm}/I_{av}$	--	1	1	-
<b>Power Ratios</b>				
$P_{ac}/I_b E_{bmf}$	--	-	-	1.57
Resistive Load				
$P_{as}/P_{dc}$	3.49	1.74	1.24	-
$P_{ap}/P_{dc}$	2.69	1.23	1.24	-
$P_{al}/P_{dc}$	2.69	1.23	1.24	-

■: See next page.

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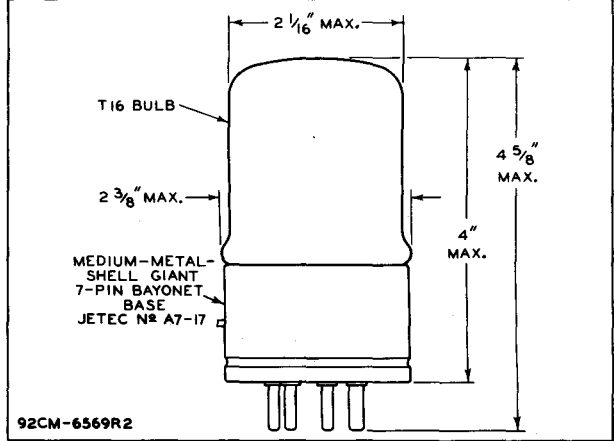


# 3D22-A GAS THYRATRON

RATIO	Fig. 1	Fig. 2	Fig. 3	Fig. 4
<b>Power Ratios (Cont'd)</b>				
<i>Inductive Load</i> <sup>■</sup>				
$P_{as}/P_{dc}$	—	1.57	1.11	—
$P_{ap}/P_{dc}$	—	1.11	1.11	—
$P_{al}/P_{dc}$	—	1.11	1.11	—

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

CIRCUIT Single-Phase	MAX. TRANS. SEC. VOLTS (RMS) $E$	APPROX. DC OUTPUT VOLTS TO FILTER $E_{av}$	MAX. DC OUTPUT AMPERES $I_{av}$	MAX. DC OUTPUT WATTS TO FILTER $P_{dc}$	MAX. AC OUTPUT VOLT-AMPERES $P_{ac}$
Fig. 1 Half-Wave	460	205	0.8	165	—
Fig. 2 Full-Wave: Resistive Load	460	410	1.6	660	—
Inductive Load	230	205	1.6	330	—
Fig. 3 Series	460	410	1.6	660	—
Fig. 4 Full-Wave	460	—	—	—	800



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JULY 1, 1955

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DATA 3

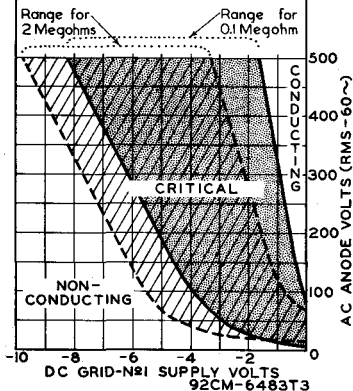


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## OPERATIONAL RANGE OF CRITICAL GRID-N<sub>2</sub>1 VOLTAGE

GRID N<sub>2</sub>1 (SHIELD) CONNECTED TO CATHODE. RANGES SHOWN ARE FOR TWO VALUES OF GRID-N<sub>2</sub>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 AMBIENT TEMPERATURE RANGE OF -40 TO +90 °C.



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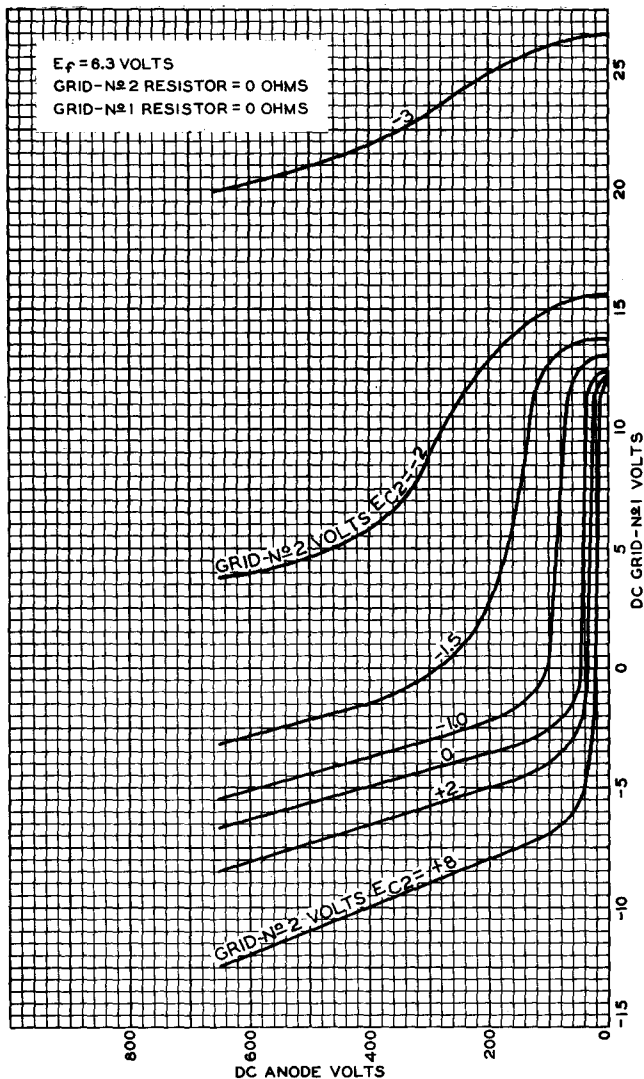
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## AVERAGE CONTROL CHARACTERISTICS



JAN. 22, 1947

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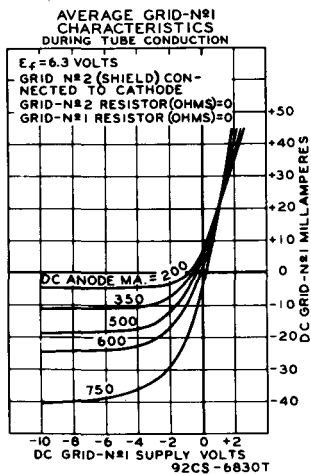
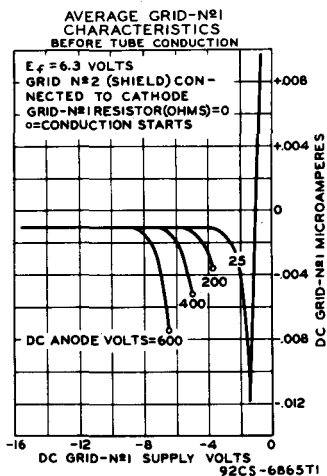




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CHARACTERISTIC CURVES

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