RCA TUBE
HANDBOOK
HB-3

THYRATRON, IGNITRON, & GLOW-DISCHARGE TUBE SECTION

This Section contains data on thyratrons, ignitrons, and glow-discharge (cold-cathode) tubes used for voltage-regulator, relay, and voltage-reference applications.

For further Technical Information, write to Commercial Engineering, Tube Division, Radio Corporation of America, Harrison, N. J.

RCA THYRATRON, GLOW-DISCHARGE, IGNITRON, & VACUUM-GAUGE TUBE GUIDE

THYRATRONS

Triodes

MAXIMUM RATINGS						
Anode Current		Temperature Range °C	Peak Inverse Anode Volts	Filament-F or Heater-H		RCA Type
Av Amp	Peak Amp			Volts	Amp	
Mercury-Vapor Types						
0.5	2	-40 to +80	5000	2.5 F	5	5557
0.65	2.5	-25 to +70	2500	2.5 F	6	627
1.8	10	-25 to +75	15000	5.0 F	10	5563A
2.5	15	-40 to +80	5000	5.0 H	4.5	5559
4	16	-30 to +50	10000	5.0 H	10	677
6.4	40	-40 to +80	2500	5.0 H	10	676
Gas Types						
0.04	0.2	-40 to +70	350	2.5 H	2.6	692
0.045	35	-50 to +90	3000	6.3 H	2.3	6130/3C45
0.075	0.3	-75 to +90	350	6.3 H	0.6	884
0.075	0.3	-75 to +90	350	2.5 H	1.5	885
1	8	-55 to +75	1250	2.5 F	6.3	C1K/6014
2.5	30	-55 to +75	1250	2.5 F	9	C3J/5632
2.5	30	-55 to +75	1250	2.5 F	9	C3JA/5684
2.5	30	-55 to +75	1250	2.5 F	9	C3JL
6.4	77	-55 to +75	1250	2.5 F	21	C6J/5C21
6.4	77	-55 to +75	1250	2.5 F	21	C6JA/5685
18	100	-55 to +75	1250	2.5 F	31	C16J/5665
Gas and Mercury-Vapor Types						
1	3	-40 to +80	1250	2.5 F	5	714/7021
1	8	-40 to +80	1250	2.5 F	6.3	716/6855
1.5	6	-40 to +80	1250	2.5 F	7	3C23
2.5	30	-40 to +80	1500	2.5 F	9	710/6011
6.4	77	-40 to +80	1500	2.5 F	21	760/6858

Tetrodes

Mercury-Vapor Types						
2.5	15	-40 to +80	1000	5 H	4.5	5560
2.5	30	-40 to +80	1500	5 H	5	632B
3.2	40	-40 to +80	2500	5 H	5	672A
6.4	40	-40 to +80	2000	5 H	10	172
6.4	40	-40 to +80	2500	5 H	10	105
Gas Types						
0.025	0.1	-75 to +90	500	6.3 H	0.15	5696[a]
0.1	0.5	-75 to +90	1300	6.3 H	0.6	2D21[a]
0.1	0.5	-75 to +150	1300	6.3 H	0.6	5727[a]
0.1	1	-55 to +90	1300	6.3 H	0.6	502A

Tetrodes (Cont'd)

MAXIMUM RATINGS						
Anode Current		Temperature Range °C	Peak Inverse Anode Volts	Filament-F or Heater-H		RCA Type
Av Amp	Peak Amp			Volts	Amp	
Gas Types (Cont'd)						
0.[illegible]	[illegible]	[illegible] to +[illegible]	1500	[illegible]	[illegible]	2050
0.[illegible]	[illegible]	−75 to +90	1500	6.3 H	.6	2050A
0.[illegible]	[illegible]	−75 to +90	1500	6.3 H	.8	6012
0.[illegible]	[illegible]	−75 to +90	1500	6.3 H	.6	3D22A

GLOW-DISCHARGE TUBES

Average DC Operating Volts	DC Operating Current Range Milliamperes	Average DC Starting Volts	RCA Type
Voltage-Regulator Types			
[illegible]	0.1 to [illegible]	[illegible]	991
[illegible]	[illegible] to 30	[illegible]	0C2[a]
[illegible]	[illegible] to 40	200	0A3
78	5 to 40	200	0A3A
108	5 to 30	11[illegible]	0B2[a]
108	[illegible] to 30	11[illegible]	607Y[a,b]
110	[illegible] to 10	11[illegible]	0C3A
150	[illegible] to [illegible]	160	0D3A
151	[illegible] to 30	1[illegible]	0A2[a]
151	5 to 5	156	6073[c]
153	5 to [illegible]	1[illegible]	0D3
Voltage-Reference Types			
80.5	[illegible].5 to [illegible].5	107	5651A[a,d]
87	[illegible] to [illegible]	107	5651[a]
Relay Types			
Maximum Peak Inverse Anode Volts	Maximum Cathode Milliamperes		RCA Type
	Peak	Average	
180	[illegible]	[illegible]	1C21[e]
200	100	[illegible]	5823[a,f]
225	100	2[illegible]	0A4G[f]

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IGNITRONS

MAXIMUM RATINGS *For power-supply frequencies of 25 to 60 Hz*						
Anode Current						
Av *for* Time Intervals		Peak	Demand Power	RMS Supply	Peak Anode Inverse *or* Forward Volts	RCA Type
Amp	Sec	Amp	KVA	Volts		
Resistance-Welding Control Service[h]						
4.4	22.5	440	150	250	–	5550
4.86	11.6	364	150	600	–	
12.1	22	1692	300	250	–	
12.1	9.4	704	300	600	–	
20	22	1400	500	250	–	5551A
30.	7.5	2410	600	600	–	
30	15	1130	200	250	–	
50	7.5	1660	200	600	–	
75.6	14	4800	1200	250	–	5552A
75.6	5.6	2930	1200	600	–	
140	14	2260	400	250	–	
140	5.6	4400	400	600	–	
Intermittent Rectifier Service and Frequency-Changer Welder Service						
4	10	480	–	–	1500	5551A
5	10	600	–	–	1200	
10	6	700	–	–	500	
200	.	1600	–	–	400	5552A[j]
Resistance-Welding-Capacitor Discharge Service						
[k]	1.65	900	60 discharges/sec		k 3000	5550
[k]	0.6[f]	500	60 discharges/sec			

VACUUM-GAUGE TUBES

Gas Pressure Range		Gauge Type	RCA Type
in mm of Hg (Torr)	in microns		
1 to 0.0001 1 to 0.001[m]	1000 to 0.1 1000 to 1[m]	Thermocouple	1946
1.5 to below 0.01 1.5 to 0.1[m]	1500 to below 10 500 to 1[m]	Pirani	1947
0.01 to below 0.0001 0.001 and below[m]	1 to below 0.1 0.1 and below[m]	Ionization (Hot-Cathode)	1949

[a] Miniature.
[b] "Premium" version of OB2 intended for applications critical to shock and vibration.
[c] "Premium" version of OA2 intended for applications critical to shock and vibration.
[d] Like the 5651 but has greater voltage stability.
[e] For operation from a dc supply.
[f] For operation from an ac supply.
[g] Per tube.
[h] Two tubes in inverse-parallel circuit.
[j] Intermittent Rectifier Service only.
[k] Forward volts = 6000, inverse volts = 3000.
[m] Range of greatest sensitivity.

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GRID-CONTROLLED RECTIFIER CIRCUITS

Numerical Relationships Among Electrical Quantities

E = Trans. Sec. Voltage (RMS)
E_{av} = Average DC Output 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_{al} = Line Volt-Amperes
P_{ap} = Trans. Pri. Volt-Amperes
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	Fig. 5*	Fig. 6	Fig. 7	Fig. 8
Voltage Ratios								
E/E_{av}	2.22	1.11	1.11	0.854	0.854	0.427	0.785	0.74
E_{bmi}/E	1.41	2.83	1.41	2.45	2.45	2.45	2.83	2.83
E_{bmi}/E_{av}	3.14	3.14	1.57	2.09	2.09	1.05	2.22	2.09
E_m/E_{av}	3.14	1.57	1.57	1.21	1.05	1.05	1.11	1.05
E_r/E_{av}	1.11	0.472	0.472	0.177	0.04	0.04	0.106	0.04
Frequency Ratio								
f_r/f	1	2	2	3	6	6	4	6
Current Ratios								
I_p/I_{av}	1.57	0.785	0.785	0.578	0.289	0.578	0.5	0.408
I_b/I_{av}	1	0.5	0.5	0.33	0.167	0.33	0.25	0.167
Resistive Load								
I_{pm}/I_{av}	3.14	1.57	1.57	1.21	0.52	1.05	1.11	1.05
I_{pm}/I_b	3.14	3.14	3.14	3.63	3.14	3.14	4.5	6.3
Inductive Load●								
I_{pm}/I_{av}	—	1	1	1	0.5	1	1	1
Power Ratios								
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	—	—	—	—	—
Inductive Load●								
P_{as}/P_{dc}	—	1.57	1.11	1.71	1.48	1.05	1.57	1.81
P_{ap}/P_{dc}	—	1.11	1.11	1.21	1.05	1.05	1.11	1.29
P_{al}/P_{dc}	—	1.11	1.11	1.21	1.05	1.05	1.11	1.05

* Bleeder current of 2% full-load current will provide exciting current for balance coil and thus avoid poor regulation at light loading.

● The use of a large filter-input choke is assumed.

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GRID-CONTROLLED RECTIFIER CIRCUITS

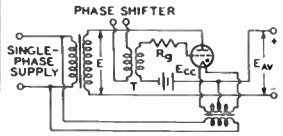


FIG. 1 HALF-WAVE SINGLE-PHASE

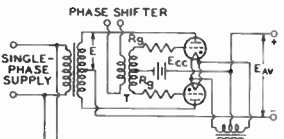


FIG. 2 FULL-WAVE SINGLE-PHASE

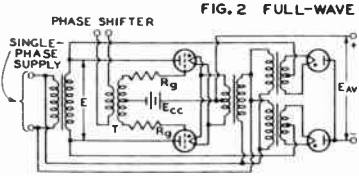


FIG. 3 SERIES SINGLE-PHASE

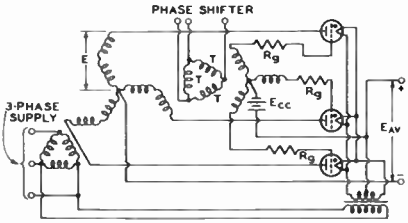


FIG. 4 HALF-WAVE THREE-PHASE

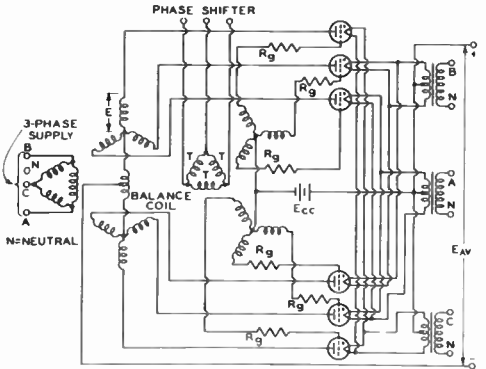


FIG. 5 PARALLEL THREE-PHASE (QUADRATURE OPERATION)

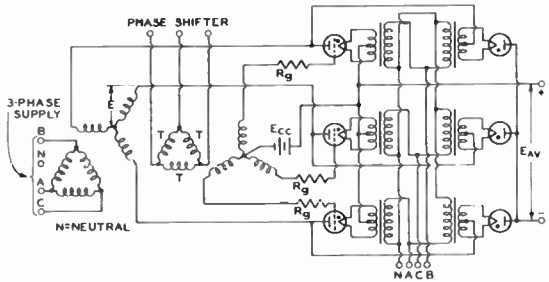


FIG. 6 SERIES THREE-PHASE (QUADRATURE OPERATION)

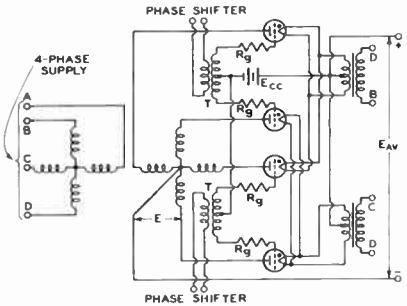


FIG. 7 HALF-WAVE FOUR-PHASE (QUADRATURE OPERATION)

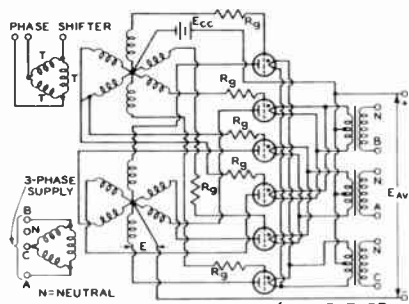


FIG. 8 HALF-WAVE SIX-PHASE (QUADRATURE OPERATION)

NOTE

T = PEAKING TRANSFORMER

92CL-8340

RCA

OA2

VOLTAGE REGULATOR

MINIATURE GLOW-DISCHARGE TYPE

GENERAL DATA

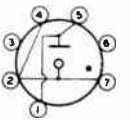
Electrical:

Cathode. . . . . Cold

Mechanical:

Mounting Position. . . . . Any
Maximum Overall Length . . . . . 2-5/8"
Maximum Seated Length. . . . . 2-3/8"
Length, Base Seat to Bulb Top (Excluding tip) . . . . 2" ±3/32"
Maximum Diameter . . . . . 3/4"
Weight (Approx.) . . . . . 0.3 oz ←
Bulb T-5-1/2
Base . . . . . Small-Button Miniature 7-Pin (JETEC No. E7-1) ←
Basing Designation for BOTTOM VIEW 5B0

Pin 1 – Anode
Pin 2 – Cathode
Pin 3 – Internal Connection – Do Not Use
Pin 4 – Cathode



Pin 5 – Anode
Pin 6 – Internal Connection – Do Not Use
Pin 7 – Cathode

Maximum and Minimum Ratings, *Absolute Values*:

AVERAGE STARTING CURRENT♦	75 max.	ma
DC CATHODE CURRENT	30 max. 5 min.	ma
FREQUENCY.	0 max.	cps ←
AMBIENT-TEMPERATURE RANGE.	-55 to +90	°C

Circuit Values:

Shunt Capacitor. . . . . 0.1 max. μμf
Series Resistor. . . . . *See Operating Considerations*

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN ←

	Min.	*Av.*	*Max.*	
DC Anode-Supply Voltage.	185■	–	–	volts
Anode Breakdown Voltage.	–	156	185*	volts
Anode Voltage Drop	140●	151	168*	volts
Regulation (5 to 30 ma).	–	2	6*	volts

♦ Averaged over starting period not exceeding 10 seconds. This starting period must be followed by a steady-state operating condition of at least 20 minutes, or tube performance will be impaired.

■ Not less than indicated supply voltage should be provided to insure "starting" throughout tube life.

* Maximum individual tube value during useful life.

● Minimum individual tube value during useful life.

←Indicates a change.

OA2

OA2
VOLTAGE REGULATOR

OPERATING CONSIDERATIONS

Sufficient resistance must always be used in series with the OA2 to limit the current through the tube. The value for the series resistor is dependent on the maximum anode-supply voltage and the ratio of the current through the load to the operating current of the OA2, and should be chosen to limit the operating current through the tube to 30 milliamperes at all times after the starting period.

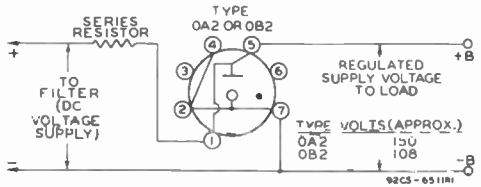
The maximum load current that can be regulated by the OA2 is determined by the minimum and maximum values of the supply voltage. After the value of series resistor for the maximum supply voltage has been calculated as indicated above, it is then in order to determine if this value will permit adequate starting voltage when the supply voltage falls to its minimum value. If adequate starting voltage is not obtained, a new load current of lower value must be used and the calculations repeated. It will be apparent from such calculations that the higher the minimum supply voltage and the smaller the difference between its minimum and maximum values, the higher will be the load current that can be regulated.

When equipment utilizing the OA2 is "turned on", a starting current in excess of the average operating current is permissible as indicated under Maximum Ratings. When the tube is subjected to such high starting currents, the regulated voltage may require up to 20 minutes to drop to its normal operating value. This performance is characteristic of voltage-regulator tubes of the glow-discharge type. Similarly, the regulation is affected by changes in current within the operating current range. For example, the regulation of a tube operated for a protracted period at 5 milliamperes and then changed to 25 milliamperes, may be somewhat different from the value that will be obtained after a long period of operation at 25 milliamperes. Likewise, the regulation may change somewhat after a long idle period.

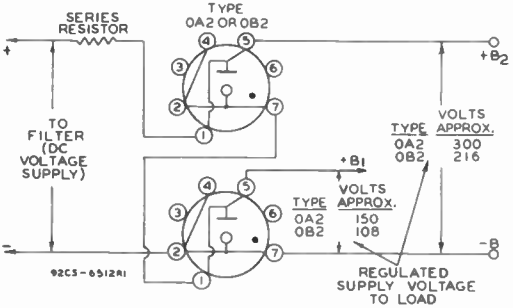
In order to handle more load current, two or more OA2's may be operated in parallel, but such parallel operation requires that a resistance of approximately 100 ohms be used in series with each OA2 in order to equalize division of the current between the paralleled tubes. The disadvantage of this method, of course, is that the use of resistors impairs the regulation which can be obtained.

If the associated circuit has a capacitor in shunt with the OA2, the capacitor should be limited in value to 0.1 μf. A larger value may cause the OA2 to oscillate and thus give unstable regulation performance.

OA2
VOLTAGE REGULATOR



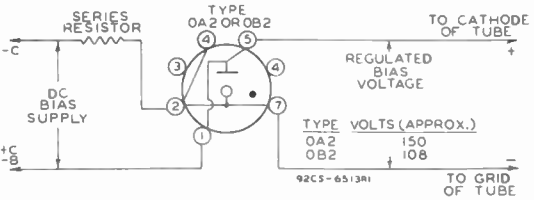
Typical circuit to provide regulated supply voltage of approximately 150 or 108 volts to load. Removal of tube from socket removes voltage from load.



Typical circuit using two OA2's or two OB2's to provide regulated supply voltages of approximately 300 or 216 volts and 150 or 108 volts to load. Socket connections are so made that voltage on load is removed when either tube is taken from its socket.

CIRCUIT FOR BIAS-SUPPLY REGULATION IS SHOWN ON NEXT PAGE.

OA2
VOLTAGE REGULATOR



Typical circuit for bias-supply regulation. Removal of tube from socket opens B-supply circuit of regulated tubes.

OA3
VOLTAGE REGULATOR

GLOW-DISCHARGE TYPE

GENERAL DATA

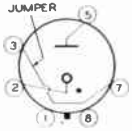
Electrical:

Cathode	Cold

Mechanical:

Mounting Position	Any
Maximum Overall Length	4-1/8"
Seated Length	3-3/8" ± 3/16" ←
Maximum Diameter	1-9/16"
Dimensional Outline	*See General Section*
Weight (Approx.)	1.3 oz ←
Bulb	ST-12
Base	Small-Shell Octal 6-Pin (JETEC No. B6-3) ←
Basing Designation for BOTTOM VIEW	4AJ

Pin 1 – No Connection
Pin 2 – Cathode
Pin 3 – Jumper▲



Pin 5 – Anode
Pin 7 – Jumper▲
Pin 8 – No Connection

Maximum and Minimum Ratings, *Absolute Values:*

AVERAGE STARTING CURRENT♦	100 max.	ma
DC CATHODE CURRENT	40 max.	ma
	5 min.	ma
FREQUENCY	0 max.	cps ←
AMBIENT-TEMPERATURE RANGE	-55 to +90	°C

Circuit Values: ←

Shunt Capacitor	0.1 max.	μf
Series Resistor	*See Operating Considerations*	

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN ←

	Min.	Av.	Max.	
DC Anode-Supply Voltage	105■	–	–	volts
Anode Breakdown Voltage	–	100	105*	volts
Anode Voltage Drop	68●	75	85*	volts
Regulation (5 to 40 ma)	–	5	6.5*	volts

▲ With suitable socket connections, jumper within base acts as a switch to open power-supply circuit when voltage regulator tube is removed from socket.

♦ Averaged over starting period not exceeding 10 seconds. This starting period must be followed by a steady-state operating condition of at least 20 minutes, or tube performance will be impaired.

■ Not less than indicated supply voltage should be provided to insure "starting" throughout tube life.

* Maximum individual tube value during useful life.

● Minimum individual tube value during useful life.

← Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

OA3

VOLTAGE REGULATOR

OPERATING CONSIDERATIONS

Sufficient resistance must always be used in series with the OA3 to limit the current through the tube. The value for the series resistor is dependent on the maximum anode-supply voltage and the ratio of the current through the load to the operating current of the OA3, and should be chosen to limit the operating current through the tube to 40 milliamperes at all times after the starting period.

The maximum load current that can be regulated by the OA3 is determined by the minimum and maximum values of the supply voltage. After the value of series resistor for the maximum supply voltage has been calculated as indicated above, it is then in order to determine if this value will permit adequate starting voltage when the supply voltage falls to its minimum value. If adequate starting voltage is not obtained, a new load current of lower value must be used and the calculations repeated. It will be apparent from such calculations that the higher the minimum supply voltage and the smaller the difference between its minimum and maximum values, the higher will be the load current that can be regulated.

When equipment utilizing the OA3 is "turned on", a starting current in excess of the average operating current is permissible as indicated under Maximum Ratings. When the tube is subjected to such high starting currents, the regulated voltage may require up to 20 minutes to drop to its normal operating value. This performance is characteristic of voltage-regulator tubes of the glow-discharge type. Similarly, the regulation is affected by changes in current within the operating-current range. For example, the regulation of a tube operated for a protracted period at 5 milliamperes and then changed to 35 milliamperes, may be somewhat different from the value that will be obtained after a long period of operation at 35 milliamperes. Likewise, the regulation may change somewhat after a long idle period.

In order to handle more load current, two or more OA3's may be operated in parallel, but such parallel operation requires that a resistance of approximately 100 ohms be used in series with each OA3 in order to equalize division of the current between the paralleled tubes. The disadvantage of this method, of course, is that the use of resistors impairs the regulation which can be obtained.

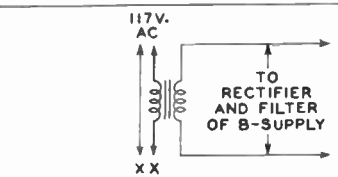
If the associated circuit has a capacitor in shunt with the OA3, the capacitor should be limited in value to 0.1 μf. A larger value may cause the OA3 to oscillate and thus give unstable regulation performance.

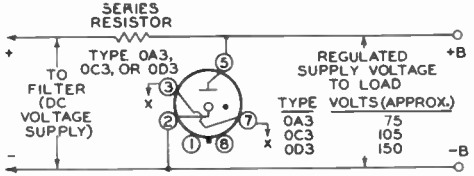
→ Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

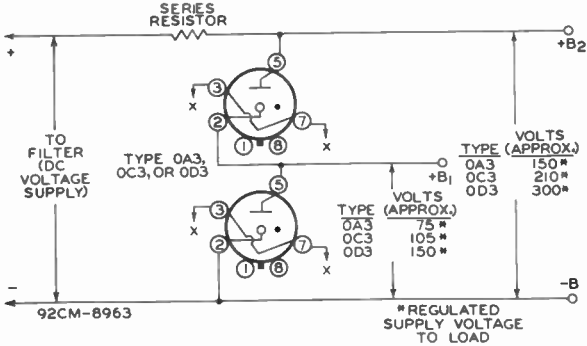
OA3

VOLTAGE REGULATOR





Typical circuit to provide regulated supply voltage of approximately 75, 105, or 150 volts to load. Removal of tube from socket removes voltage from load.



Typical circuit using two OA3's, two OC3's, or two OD3's to provide regulated supply voltages of approximately 150, 210, or 300 volts and 75, 105, or 150 volts to load. Socket connections are so made that voltage on load is removed when either tube is taken from its socket.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

0A3A

Voltage-Regulator

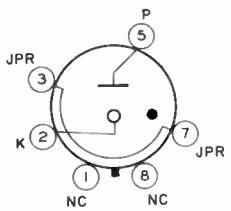
GLOW-DISCHARGE TYPE

75 VOLTS

For Applications Requiring a Relatively Constant DC Output Voltage, Independent of Load and Supply-Voltage Variations

Mechanical:

Operating Position . . . . . Any
Base . . . . . Medium Shell Diode, Small-Pin Version (JEDEC No. B7-38)
Bulb T-9
Mounting Position . . . . . Vertical, Base Down or Base Up
Maximum Diameter . . . . . 1-5/8"
Maximum Length . . . . . 4-1/2"
Net Weight . . . . . 2 oz.
Cathode Lead . . . . . Flexible, 2" Long
Anode Lead . . . . . Flexible, 2" Long
Base . . . . . See General Section
Bulb T-9
Base . . . . . Medium Shell Diode, Small-Pin Version (JEDEC No. B7-38)
Maximum Overall Length . . . . . 4-1/2"



Pin 1 – Internal Connection
Pin 2 – Cathode
Pin 3 – Jumper[a]
Pin 5 – Anode
Pin 7 – Jumper[a]
Pin 8 – No Internal Connection

VOLTAGE REGULATOR

Maximum and Minimum Ratings, *Absolute-Maximum Values:*

Average Cathode Current[b] . . . . . 100 ma.
DC Cathode Current . . . . . { 50 max. / 5 min. } ma
DC or AC Jumper Current . . . . . 2 ma.
Ambient-Temperature Range . . . . . -55° to +90°C

Circuit Values:

Shunt Capacitor . . . . . 0.1 mf.
Series Resistor . . . . . See *Operating Considerations*

[a] With suitable external connection, the jumper within the tube base (between pins 3 and 7) provides for opening the power-supply circuit to protect circuit components when the voltage-regulator tube is removed from its socket.

[b] Averaged over any interval not exceeding 10 seconds. When starting current greatly exceeds the maximum d-c-cathode-current rating of 40 milliamperes are encountered, it may be necessary to operate the tubes for as much as 20 minutes under steady-state conditions to ensure stable operation.

CHARACTERISTICS RANGE VALUES

Values are initial unless otherwise specified

	Note	Min.	Av.	Max.	
Heater Current					
DC Anode-Cathode Voltage					
Peak Inverse Voltage					
Average Cathode Current					
Peak Anode Voltage					
Peak Anode Current					
Average Anode Current					
Peak Heater-Cathode Voltage					
Heater Positive with Respect to Cathode					
Heater Negative with Respect to Cathode					
Tube Voltage Drop					
Peak Anode Current					
Heater-Cathode Voltage					
Heater Positive with Respect to Cathode					
Heater Negative with Respect to Cathode					

Note 1: Measured in the following circuit with the anode voltage applied through a 10-megohm resistor and with the cathode voltage adjusted to give the specified value of anode current.

Note 2: The minimum value for this characteristic applies only to tubes with controlled heater warm-up time.

OPERATING CONSIDERATIONS

In applying 0A3A tubes, the following operating considerations must be met to assure adequate and reliable operation:

1. The dc anode current must be kept within the minimum and maximum values specified.
2. The dc anode starting voltage, $E_{b(s)}$, must be available before the rest of the circuit.

Starting anode-cathode current in excess of the maximum dc cathode-current rating (10 milliamperes) are permissible if limited to the Maximum and Minimum Ratings. When the tube is subjected to such high starting currents, as may occur when the supply voltage is applied to a circuit having a relatively low value of resistance between the anode and cathode, a suitable voltage-dropping resistor should be used to assure that the rated dc cathode current is not exceeded.

After the tube has started to conduct, the anode current, sometimes referred to as "latch", may be reduced to a relatively low value by the action of the grid. A suitable grid resistor, in the range of 0.5 to 1 megohm, should be used to limit the anode current to a value below the minimum dc-cathode-current rating (10 milliamperes)

to be sure that the glow covers a substantial portion of the cathode surface.

The level of ambient radiation directly affects the dc anode starting voltage of VR tubes. The maximum values required to start the tube under normal ambient-light conditions and in total darkness are given under *Characteristics Range Values*. Shielding should be considered when the tube is operated in the presence of strong, varying, magnetic, or nuclear radiation fields to assure proper performance.

Ambient temperature should be kept relatively constant to minimize voltage drift.

Coupling effects can be minimized by shunting the VR tube with a capacitor not larger than 0.1 μf.

Series connection of VR tubes may be employed to obtain dc regulated voltages greater than those obtainable from a single tube. Different types may be used provided the series current is kept within the maximum dc-cathode-current rating of the lowest-rated tube.

Parallel connection of VR tubes may be employed where it is necessary to obtain dc load currents greater than those obtainable from a single tube but at a loss in regulation. This loss in regulation results from the requirement that a resistor be used in series with each VR tube when in parallel operation.

Combinations of regulated dc voltages may also be obtained by series connection of VR tubes with tapped output as shown in *Typical Circuit* .

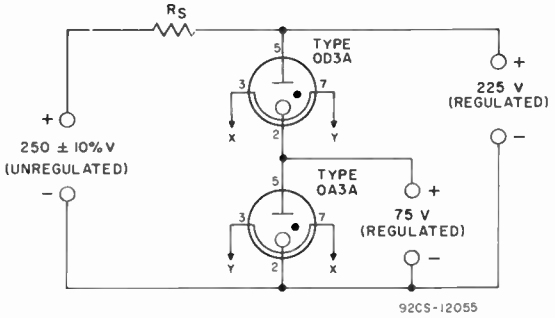
To determine the value of the series resistor for small load currents in a circuit of this type, disconnect the loads and adjust the series resistor for a tube current of not more than 4 milliamperes.

Regulated bias voltages may also be obtained as shown in *Typical Circuit* . In this circuit, a single 0A3A can supply a regulated dc voltage of −75 volts.

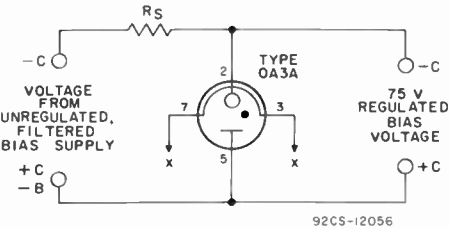
The *jumper* between pins 5 and 7 inside the base makes it possible with suitable socket connections, to open power-supply circuits to protect circuit components when one of the VR tubes is removed from its socket.

0A3A

TYPICAL CIRCUIT 1



TYPICAL CIRCUIT 2

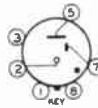


0A4-G

GAS-TRIODE

COLD-CATHODE STARTER-ANODE TYPE

Maximum Overall Length	4-1/8"
Maximum Diameter	1-9/16"
Bulb	ST-12
Base	Small Shell Octal 6-Pin
Pin 1 - No Connection	Pin 5 - Anode
Pin 2 - Cathode	Pin 7 - Starter-Anode
Pin 3 - No Connection	Pin 8 - No Connection



BOTTOM VIEW

CHARACTERISTICS

Peak Anode Breakdown Voltage (Starter anode tied to cathode)	225 min.	volts
Peak Positive Starter-Anode Breakdown Voltage	70 min. 90 max.	volts volts
Starter-Anode Current (For transition of discharge to anode at 140 volts peak)	100 max.	μamp.
Starter-Anode Drop	60 approx.	volts
Anode Drop	70 approx.	volts

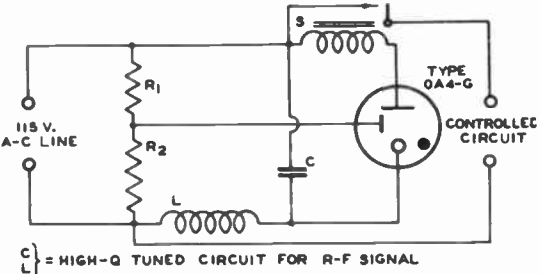
MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS

Relay Service

Peak Cathode Current	100 max.	ma.
D-C Cathode Current	25 max.	ma.
Typical Operation with A-C Supply:		
Anode-Supply Voltage (RMS)	105 - 130	volts
A-C Starter-Anode Voltage (peak)	70 max.	volts
R-F Starter-Anode Voltage (peak)	55 min.	volts
Sum of A-C and R-F Starter-Anode Voltages (peak)	110 min.	volts

SCHEMATIC RELAY CIRCUIT USING TYPE 0A4-G

A-C OPERATION



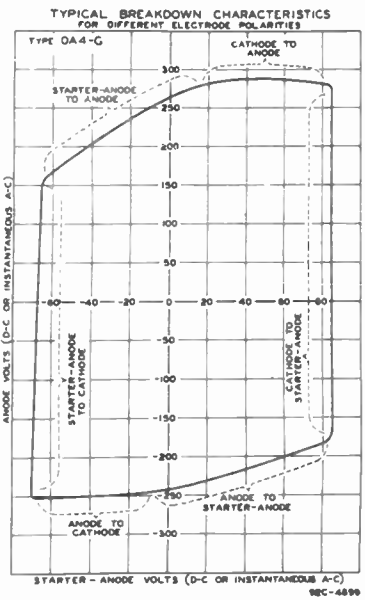
C, L = HIGH-Q TUNED CIRCUIT FOR R-F SIGNAL

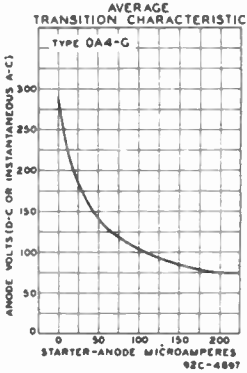
R_1 = 15000 OHMS (½ WATT)

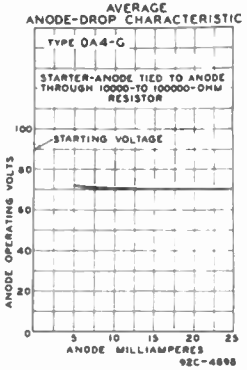
R_2 = 10000 OHMS (½ WATT)

S = RELAY - CHOSEN FOR DESIGN REQUIREMENTS

0A4-G
GAS-TRIODE







OB2

VOLTAGE REGULATOR

MINIATURE GLOW-DISCHARGE TYPE

GENERAL DATA

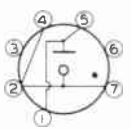
Electrical:

Cathode . . . . . Cold

Mechanical:

Mounting Position . . . . . Any
Maximum Overall Length . . . . . 2-5/8"
Maximum Seated Length . . . . . 2-3/8"
Length, Base Seat to Bulb Top (Excluding tip) . . . 2" ± 3/32"
Maximum Diameter . . . . . 3/4"
Weight (Approx.) . . . . . 0.3 oz ←
Bulb T-5-1/2
Base . . . . . Small-Button Miniature 7-Pin (JETEC No.E7-1) ←
Basing Designation for BOTTOM VIEW 5B0

Pin 1 – Anode
Pin 2 – Cathode
Pin 3 – Internal Connection–Do Not Use
Pin 4 – Cathode



Pin 5 – Anode
Pin 6 – Internal Connection–Do Not Use
Pin 7 – Cathode

Maximum and Minimum Ratings, *Absolute Values*:

AVERAGE STARTING CURRENT♦	75 max.	ma
DC CATHODE CURRENT	30 max. 5 min.	ma ma
FREQUENCY	0 max.	cps ←
AMBIENT-TEMPERATURE RANGE	-55 to +90	°C

Circuit Values:

Shunt Capacitor	0.1 max.	μμf
Series Resistor	*See note below*	

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN ←

	Min.	Av.	Max.	
DC Anode-Supply Voltage . . .	133■	–	–	volts
Anode Breakdown Voltage . . .	–	115	133*	volts
Anode Voltage Drop	101●	108	114*	volts
Regulation (5 to 30 ma.) . . .	–	1	4*	volts

♦ Averaged over starting period not exceeding 10 seconds. This starting period must be followed by a steady-state operating condition of at least 20 minutes, or tube performance will be impaired.

■ Not less than indicated supply voltage should be provided to insure "starting" throughout tube life.

* Maximum individual tube value during useful life.

● Minimum individual tube value during useful life.

The operating considerations and circuit information shown under Type OA2 also apply to Type OB2

←Indicates a change.

OC2

VOLTAGE REGULATOR

7-PIN MINIATURE, 75-VOLT, GLOW-DISCHARGE TYPE

GENERAL DATA

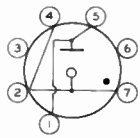
Electrical:

Cathode . . . . . Cold

Mechanical:

Operating Position . . . . . Any
Maximum Overall Length . . . . . 2.63"
Maximum Seated Length . . . . . 2.38"
Length, Base Seat to Bulb Top (Excluding tip) . 2.00" ± 0.09"
Maximum Diameter . . . . . 0.75"
Dimensional Outline . . . . . *See General Section*
Bulb T5-1/2
Base . . . . . Small-Button Miniature 7-Pin (JETEC No.E7-1)
Basing Designation for BOTTOM VIEW 5B0

Pin 1 – Anode
Pin 2 – Cathode
Pin 3 – Internal Connection—Do Not Use
Pin 4 – Cathode



Pin 5 – Anode
Pin 6 – Internal Connection—Do Not Use
Pin 7 – Cathode

Maximum and Minimum Ratings, *Absolute Values:*

AVERAGE STARTING CURRENT▲	75 max.	ma
DC CATHODE CURRENT	30 max. 5 min.	ma ma
FREQUENCY	0 max.	cps
AMBIENT-TEMPERATURE RANGE	-55 to +90	°C

Maximum Circuit Values:

Shunt Capacitance	0.1 max.	μf

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Min.	*Av.*	*Max.*	
DC Anode-Supply Voltage	•	–	–	volts
Anode Breakdown Voltage:				
Under total darkness	–	–	145••	volts
Under normal ambient light conditions	–	105	115••	volts
Anode Voltage Drop	68•	75	83	volts
Regulation (5 to 30 ma.)	–	3	4.5	volts

▲ Averaged over starting period not exceeding 10 seconds. This starting period must be followed by a steady-state operating condition of at least 20 minutes, or tube performance will be impaired.

• The minimum value to insure "starting" throughout tube life must be equal to the anode breakdown voltage plus the voltage drop across the series resistor at the maximum value of the load current.

•• Maximum individual tube value during useful life.

• Minimum individual tube value during useful life.

OC2

VOLTAGE REGULATOR

OPERATING CONSIDERATIONS

Sufficient resistance must always be used in series with the OC2 to limit the current through the tube.

The value for the series resistor is dependent on the dc supply voltage, anode voltage drop, load current, and cathode current and should be chosen to limit the operating current through the tube to 30 milliamperes at all times after the starting period.

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

TENTATIVE DATA

OC3

VOLTAGE REGULATOR

GLOW-DISCHARGE TYPE

GENERAL DATA

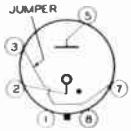
Electrical:

Cathode . . . . . Cold

Mechanical:

Mounting Position . . . . . Any
Maximum Overall Length . . . . . 4-1/8"
Seated Length . . . . . 3-3/8" ± 3/16" ←
Maximum Diameter . . . . . 1-9/16"
Dimensional Outline . . . . . *See General Section*
Weight (Approx.) . . . . . 1.3 oz ←
Bulb ST-12
Base . . . . . Small-Shell Octal 6-Pin (JETEC No. B6-3) ←
Basing Designation for BOTTOM VIEW 4AJ

Pin 1 – No Connection
Pin 2 – Cathode
Pin 3 – Jumper▲



Pin 5 – Anode
Pin 7 – Jumper▲
Pin 8 – No Connection

Maximum and Minimum Ratings, *Absolute Values:*

AVERAGE STARTING CURRENT♦	100 max.	ma
DC CATHODE CURRENT	40 max.	ma
	5 min.	ma
FREQUENCY	0 max.	cps ←
AMBIENT-TEMPERATURE RANGE	-55 to +90	°C

←

Circuit Values:

Shunt Capacitor	0.1 max.	μf
Series Resistor	*See note below*	

←

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN ←

	Min.	*Av.*	*Max.*	
DC Anode-Supply Voltage	133■	–	–	volts
Anode Breakdown Voltage	–	115	133*	volts
Anode Voltage Drop	103●	108	116*	volts
Regulation (5 to 40 ma)	–	2	4*	volts

▲ With suitable socket connections, jumper within base acts as a switch to open power-supply circuit when voltage regulator tube is removed from socket.

♦ Averaged over starting period not exceeding 10 seconds. This starting period must be followed by a steady-state operating condition of at least 20 minutes, or tube performance will be impaired.

■ Not less than indicated supply voltage should be provided to insure "starting" throughout tube life.

* Maximum individual tube value during useful life.

● Minimum individual tube value during useful life.

The operating considerations and circuit information shown under Type 0A3 also apply to Type OC3

← Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

OD3

OD3
VOLTAGE REGULATOR

GLOW-DISCHARGE TYPE

GENERAL DATA

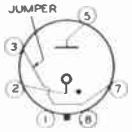
Electrical:

Cathode . . . . . Cold

Mechanical:

Mounting Position . . . . . Any
Maximum Overall Length. . . . . 4-1/8"
→ Seated Length . . . . . 3-3/8" ± 3/16"
Maximum Diameter. . . . . 1-9/16"
Dimensional Outline . . . . . *See General Section*
→ Weight (Approx.). . . . . 1.3 oz
Bulb ST-12
→ Base . . . . . Small-Shell Octal 6-Pin (JETEC No. B6-3)
Basing Designation for BOTTOM VIEW. 4AJ

Pin 1 – No Connection
Pin 2 – Cathode
Pin 3 – Jumper▲



Pin 5 – Anode
Pin 7 – Jumper▲
Pin 8 – No Connection

Maximum and Minimum Ratings, *Absolute Values:*

AVERAGE STARTING CURRENT♦	100 max.	ma
DC CATHODE CURRENT	40 max.	ma
	5 min.	ma
→ FREQUENCY	0 max.	cps
AMBIENT-TEMPERATURE RANGE	-55 to +90	°C

→ **Circuit Values:**

Shunt Capacitor	0.1 max.	μf
Series Resistor	*See note below*	

→ **CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN**

	Min.	*Av.*	*Max.*	
DC Anode-Supply Voltage	185■	-	-	volts
Anode Breakdown Voltage	-	160	185*	volts
Anode Voltage Drop.	142●	153	165*	volts
Regulation (5 to 40 ma)	-	4	5.5*	volts

▲ With suitable socket connections, jumper within base acts as a switch to open power-supply circuit when voltage regulator tube is removed from socket.

♦ Averaged over starting period not exceeding 10 seconds. This starting period must be followed by a steady state operating condition of at least 20 minutes, or tube performance will be impaired.

■ Not less than indicated supply voltage should be provided to insure "starting" throughout tube life.

* Maximum individual tube value during useful life.

● Minimum individual tube value during useful life.

The operating considerations and circuit information shown under Type OA3 also apply to Type OD3

→ Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

0C3A

Voltage-Regulator

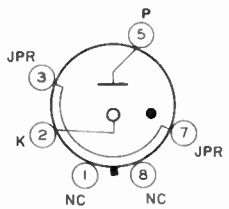
GLOW-DISCHARGE TYPE — 105 VOLTS

For Applications Requiring a Relatively Constant DC Output Voltage, Independent of Load and Supply-Voltage Variations

Mechanical:

Operating Position	Any
Maximum Overall Length	1-1/2"
Maximum Diameter	1-1/2"
Base	Diagram 1
Bulb	T-9
Basing	Diagram 1

Pin 1—No Internal Connection
Pin 2—Cathode
Pin 3—Jumper[a]
Pin 5—Anode
Pin 7—Jumper[a]
Pin 8—No Internal Connection



VOLTAGE REGULATOR

Maximum and Minimum Ratings, *Absolute-Maximum Values:*

Average Cathode-Starting Current[b]	100 max.	ma
DC Cathode Current	40 max. 5 min.	ma ma
DC or AC Jumper Current	2 max.	rms
Ambient-Temperature Rating	-55 to +90	°C

Circuit Values:

Shunt Capacitor	0.1 max.	μf
Series Resistor	See *Operating Considerations*	

[a] With suitable socket connections, the jumper within the tube base (between pins 3 and 7) provides for opening the cathode circuit to protect circuit components when the voltage-regulator tube is removed from its socket.

[b] Average over starting period not exceeding 10 seconds. With starting current greatly in excess of the maximum dc-cathode-current rating of 40 milliamperes encountered, it may be necessary to operate the tube as much as 20 minutes under steady-state conditions to assure stable operation.

OC3A

CHARACTERISTICS RANGE VALUES

OPERATING CONSIDERATIONS

shown under Type OA3A also apply to the OC3A

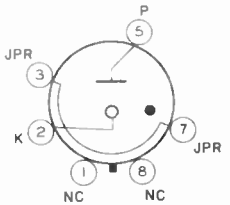
0D3A

Voltage-Regulator

GLOW-DISCHARGE TYPE — 150 VOLTS

For Applications Requiring a Relatively Constant DC Output Voltage, Independent of Load and Supply-Voltage Variations

Mechanical:



VOLTAGE REGULATOR

Maximum and Minimum Ratings, Absolute-Maximum Values:

Circuit Values:

See Operating Considerations

a

b

OD3A

CHARACTERISTICS RANGE VALUES

Values are initial unless otherwise specified

	Note	Min.	Av.	Max.	
DC Anode Supply Voltage				See Note 1	
DC Grid Supply Voltage:					
for all tubes		–		2	volts
Normal Control Bias*					
for zero operating current		–	–30	–45	volts
Anode Voltage Drop					
for 1 cathode current of:					
1 ma		–	10	–	volts
5 ma		–	110	140	volts
10 ma		–	120	160	volts
Amplification Factor (Grid-to-Cathode Current Range of):					
0 to 0.3 ma	2	–	2	3	volts
0.3 to 10 ma	2	–	4	5.5	volts
Peak Heater-Cathode Voltage:					
10 ma		–	–	125	rms mv
Cathode Current for an anode supply voltage of 300 volts and anode resistor of 20,000 ohms		–		30	μa

Note 1: The maximum value to be used during throughout useful tube life must be equal to the anode starting voltage plus the voltage drop across the series resistor at the maximum value of the load current.

Note 2: The maximum values for the peak inverse voltage ratings apply throughout useful tube life.

OPERATING CONSIDERATIONS

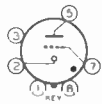
shown under Type OA3A also apply to the OD3A

IC21

GAS-TRIODE

COLD-CATHODE GLOW-DISCHARGE TYPE

Maximum Overall Length	2-5/8"
Maximum Seated Height	2-1/16"
Maximum Diameter	1-5/16"
Bulb	T-9
Base	Intermed. Sh. Octal 6-Pin
Pin 1 - No Connection	Pin 7 - Grid
Pin 2 - Cathode	Pin 8 - No Connection
Pin 3 - No Connection	● - Gas Tube Type
Pin 5 - Anode	
Mounting Position	Any



BOTTOM VIEW (G-4V)

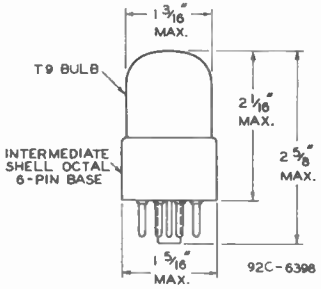
CHARACTERISTICS

Peak Anode Breakdown Voltage (Grid tied to cathode)	180 min.	volts
Peak Positive Grid Breakdown Voltage	66 min. 80 max.	volts volts
D-C Anode Extinction Voltage	73 approx.	volts
Grid Current (For transition of discharge to anode at 100 volts peak)	25 av. 50 max.	μamp. μamp.
Anode Voltage-Drop	73 approx.	volts
Grid Voltage-Drop	55 approx.	volts

Maximum Ratings Are Design-Center Values

MAXIMUM RATINGS

Peak Cathode Current	100 max.	ma.
D-C Cathode Current	25 max.	ma.
Typical Operation as Relay Tube:		
D-C Anode-Supply Voltage	125 - 145	volts
Peak Positive Grid-Bias Voltage	66 max.	volts
Peak Grid-Signal Voltage	40 min.	volts
Sum of Grid-Bias and Grid-Signal Voltages (Peak)	100 min.	volts
D-C Grid Current	100	uamp.



Dec. 1, 1942

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC.

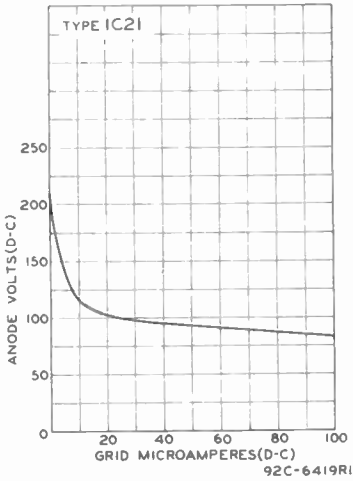
TENTATIVE DATA

RCA

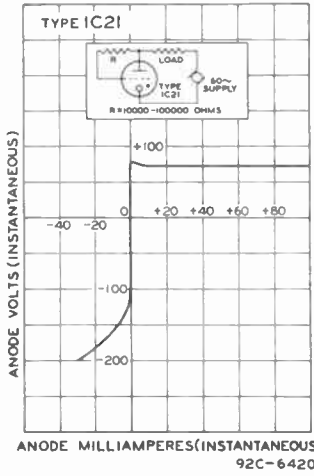
IC21

GAS-TRIODE

AVERAGE TRANSITION CHARACTERISTIC



AVERAGE ANODE CHARACTERISTIC



RCA

2D21

THYRATRON

GAS TETRODE, MINIATURE TYPE

GENERAL DATA

Electrical:

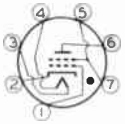
	Min.	Av.	Max.	
Heater, for Unipotential Cathode:				
Voltage (AC or DC)	5.7	6.3	6.9	volts
Current, with heater volts = 6.3	0.54	0.60	0.66	amp
Cathode:				
Heating Time, prior to tube conduction	10	–	–	sec
Direct Interelectrode Capacitances (Approx.):[o]				
Grid No.1 to Anode			0.026	μμf
Input			2.4	μμf
Output			1.6	μμf
Ionization Time (Approx.):				
For conditions: dc anode volts = 100; grid-No.1 square-pulse volts = 50; peak anode amp. during conduction = 0.5			0.5	μsec
Deionization Time (Approx.):				
For conditions: dc anode volts = 125; grid-No.1 volts = −100, grid-No.1 resistor (ohms) = 1000; dc anode amp. = 0.1			35	μsec
For conditions: dc anode volts = 125; grid-No.1 volts = −10; grid-No.1 resistor (ohms) = 1000; dc anode amp. = 0.1			75	μsec
Maximum Critical Grid Current, with ac anode-supply volts (rms) = 460, and average anode amp. = 0.1			0.5	μamp
Anode Voltage Drop (Approx.)			8	volts
Grid-No.1 Control Ratio (Approx.) with grid-No.1 resistor (megohms) = 0; grid-No.2 volts = 0			250	
Grid-No.2 Control Ratio (Approx.) with grid-No.1 resistor (megohms) = 0; grid-No.2 resistor (megohms) = 0; grid-No.1 volts = 0			1000	

[o] Without external shield.

Mechanical:

Mounting Position	Any
Maximum Overall Length	2-1/8"
Maximum Seated Length	1-7/8"
Length, Base Seat to Bulb Top (excluding tip)	1-1/2" ± 3/32"
Maximum Diameter	3/4"
Bulb	T-5-1/2
Base	Small-Button Miniature 7-Pin
Basing Designation for BOTTOM VIEW	7BN

Pin 1 – Grid No.1
Pin 2 – Cathode
Pin 3 – Heater
Pin 4 – Heater



Pin 5 – Grid No.2
Pin 6 – Anode
Pin 7 – Grid No.2

← Indicates a change.

2D21

2D21
THYRATRON

RELAY and GRID-CONTROLLED RECTIFIER SERVICE

Maximum Ratings, *Absolute Values*:

PEAK ANODE VOLTAGE:			
Forward		650 max.	volts
Inverse		1300 max.	volts
GRID-No.2 (SHIELD-GRID) VOLTAGE:			
Peak, before anode conduction		−100 max.	volts
→ Average, during anode conduction■		−10 max.	volts
GRID-No.1 (CONTROL-GRID) VOLTAGE:			
Peak, before anode conduction		−100 max.	volts
→ Average, during anooe conduction■		−10 max.	volts
CATHODE CURRENT:			
Peak		0.5 max.	amp
Average■		0.1 max.	amp
→ Surge, for duration of 0.1 sec. max.		10 max.	amp
GRID-No.2 CURRENT:			
→ Average■		+0.01 max.	amp
GRID-No.1 CURRENT:			
→ Average■		+0.01 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

→ Typical Operating Conditions for Relay Service:

RMS Anode Voltage	117	400	. .	volts
Grid-No.2 Voltage	0	0	. .	volts
RMS Grid-No.1 Bias Voltage□	5	–	. .	volts
DC Grid-No.1 Bias Voltage	–	−6	. .	volts
Peak Grid-No.1 Signal Voltage	5	6	. .	volts
Grid-No.1-Circuit Resistance	1.0	1.0	. .	megohm
Anode-Circuit Resistance#	1200	2000	. .	ohms

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	10 max.	megohms

■ Averaged over any interval of 30 sec. max.

□ Approximately 180° out of phase with the anode voltage.

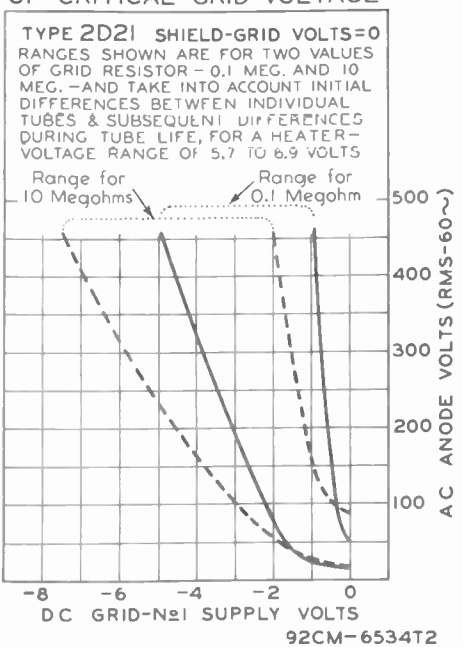
Sufficient resistance, including the tube load, must be used under any conditions of operation to prevent exceeding the current ratings.

→ Indicates a change.

RCA

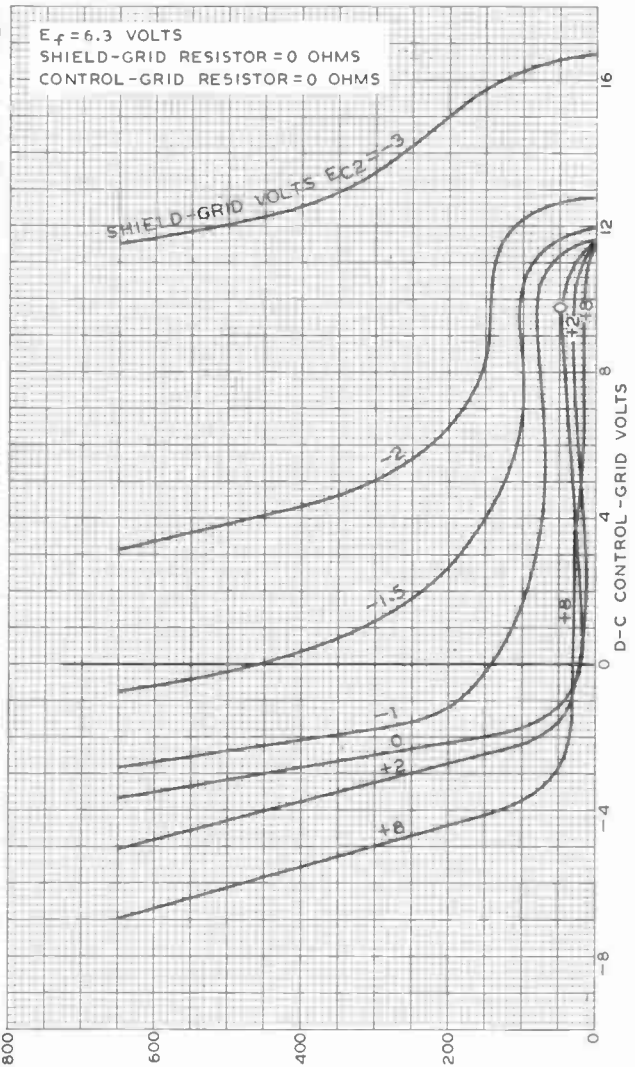
2D21
THYRATRON

OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE



2D21

AVERAGE CONTROL CHARACTERISTICS



MAY 2, 1944

RCA VICTOR DIVISION

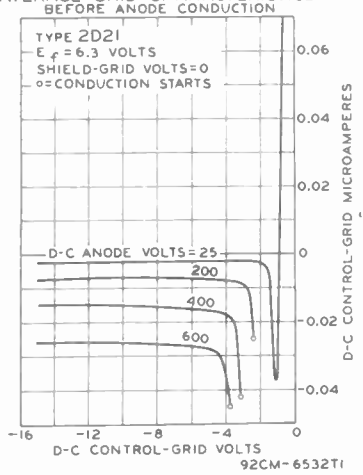
92CM—6531R1

RCA

2D21

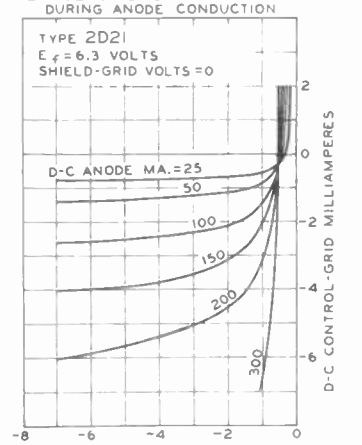
THYRATRON

AVERAGE GRID CHARACTERISTICS
BEFORE ANODE CONDUCTION



92CM-6532TI

AVERAGE GRID CHARACTERISTICS
DURING ANODE CONDUCTION



92CM-6533T

RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

3C23

GAS-AND-MERCURY-VAPOR THYRATRON

NEGATIVE-CONTROL TRIODE TYPE

GENERAL DATA

Electrical:

Filament, Coated:		
Voltage	2.5 ± 5%	ac or dc volts ←
Current at 2.5 volts	7	amp
Minimum heating time prior to tube conduction	15	sec
Direct Interelectrode Capacitance (Approx.):[o]		
Grid to anode	1.0	μμf
Ionization Time (Approx.):		←
For conditions: dc anode volts = 100, peak grid volts = +30, and peak anode amperes = 6	3	μsec ←
Deionization Time (Approx.):		
For conditions: dc anode volts = 120, dc grid-supply volts = −20, grid resistor (ohms) = 10000, and dc anode amperes = 1.5	360	μsec
For conditions: dc anode volts = 120, dc grid-supply volts = −500, grid resistor (ohms) = 100000, and dc anode amperes = 1.5	60	μsec
Anode Voltage Drop (Approx.)	15	volts

Mechanical:

Mounting Position	Vertical, base down
Maximum Overall Length	6-1/8"
Seated Length	5-1/4" ± 1/4"
Maximum Diameter	2-1/16"
Cooling	Natural circulation of air around tube
Weight (Approx.)	3 oz
Bulb	ST-16
Cap	Medium (JETEC No.C1-5) ←
Base	Medium-Shell Small 4-Pin with Bayonet (JETEC No.A4-10) ←
Basing Designation for BOTTOM VIEW	3G ←

Pin 1 – Filament
Pin 2 – No Connection
Pin 3 – Grid

Pin 4 – Filament
Cap – Anode

CONTROL SERVICE

Maximum Ratings, *Absolute Values:* *For supply frequency up to 400 cps*

	Operating Condensed-Mercury Temperature Range −40° to +100°C	−40° to +80°C	
PEAK ANODE VOLTAGE:			
Forward	200 max.	1250 max.	volts
Inverse	200 max.	1250 max.	volts

[o] without external shield.

← Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

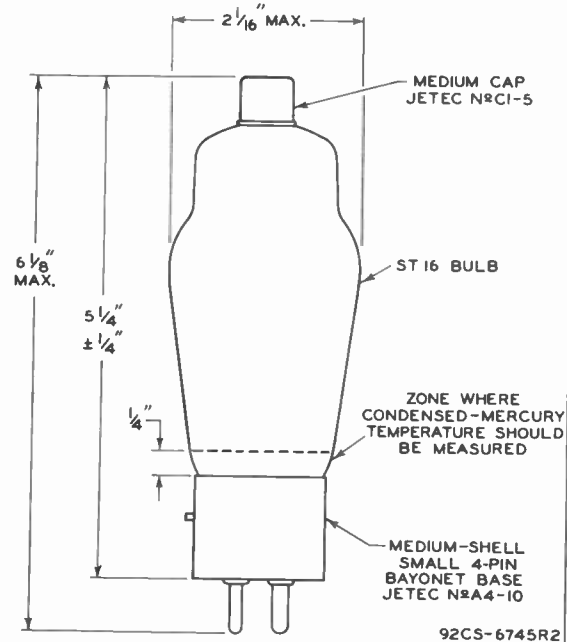
RCA

3C23

GAS-AND-MERCURY-VAPOR THYRATRON

	Operating Condensed-Mercury Temperature Range -40° to +100°C	-40° to +80°C	
GRID VOLTAGE:			
Peak or DC, before tube conduction	-500 max.	-500 max.	volts
Average▲, during tube conduction	-10 max.	-10 max.	volts
ANODE CURRENT:			
Peak	6 max.	6 max.	amp
Average●	1.5 max.	1.5 max.	amp
Fault, for duration of 0.1 second max.	120 max.	120 max.	amp
GRID CURRENT:			
Average◆	+0.01 max.	+0.01 max.	amp

▲ Averaged over one conducting period.
● Averaged over any interval of 5 seconds maximum.
◆ Averaged over period of grid conduction.



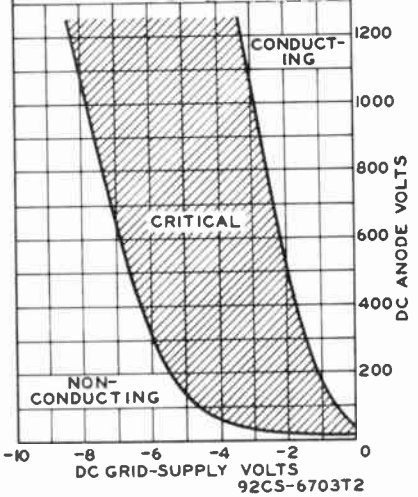
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

3C23

GAS-AND-MERCURY-VAPOR THYRATRON

OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

RANGE IS FOR CONDITIONS WHERE: E_f=2.5 VOLTS AC ±5%; CIRCUIT RETURNS TO CENTER TAP OF FILAMENT TRANSFORMER. THE RANGE INCLUDES INITIAL AND LIFE VARIATIONS OF INDIVIDUAL TUBES. GRID RESISTOR=0 TO 100000 OHMS. CONDENSED-MERCURY TEMPERATURE=-40°C TO +80°C.



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

3D22-A
GAS THYRATRON

NEGATIVE-CONTROL TETRODE TYPE

Supersedes Type 3D22

GENERAL DATA

Electrical:

	Min.	Av.	Max.		
Heater, for Unipotential Cathode:					
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.)[o]					
Grid No.1 to anode*			0.1		μμf
Grid No.1 to cathode, grid No.2, base shell, and heater			8.5		μμf
Anode to cathode, grid No.2, base shell, and heater			4.6		μμf
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		

[o] Without external shield.

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

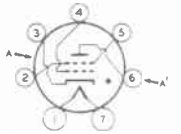
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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)
Ratings 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	6 max.	amp
Average*	0.8 max.	amp
Fault*, for duration of 0.1 second max.	40 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	45 max.	volts
AMBIENT-TEMPERATURE RANGE	-75 to +90	°C

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	0.1 max. megohm

* Averaged over any interval of 30 seconds maximum.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

3D22-A
GAS THYRATRON

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 ± 2 cps with a fixed amplitude of 0.040" ± 0.005" (total maximum excursion i.e. double the amplitude). Maximum acceleration is 10g. No voltage is applied during vibration. Tube is vibrated for 10 minutes in each 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) Thyratron High-Voltage Operation:

	Min.	Max.	
Grid-No.1 Supply Voltage (1)	-8.1	-9.2	volts

This test is made after two light taps with a volt hammer (similar to type used for noise tests) in direction from cathode to anode under the following condition: 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)	4.1	-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.

3D22-A

GRID-CONTROLLED RECTIFIER CIRCUITS

DC Voltage Control

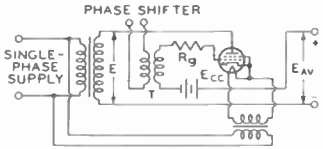


FIG. 1 HALF-WAVE SINGLE-PHASE

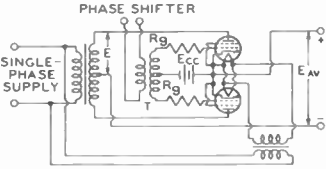


FIG. 2 FULL-WAVE SINGLE-PHASE

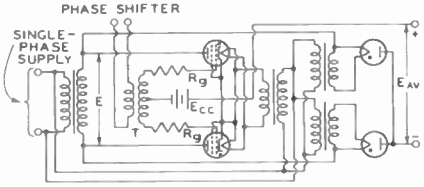


FIG. 3 SERIES SINGLE-PHASE

AC Voltage Control

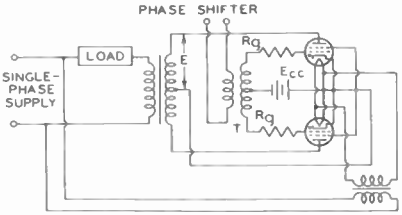


FIG. 4 FULL-WAVE SINGLE-PHASE

NOTES

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 №2 AND №1 TO CATHODE (PIN 3)

3D22-A

GRID-CONTROLLED RECTIFIER CIRCUITS

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-Amperes
P_{al} = Line Volt-Amperes
P_{ap} = Trans. Pri. Volt-Amperes
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
Voltage Ratios				
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■	1.41	2.83	1.41	1.41
Frequency Ratio				
f_r/f	1	2	2	–
Current Ratios				
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■				
I_{pm}/I_{av}	--	1	1	–
Power Ratios				
$P_{ac}/I_b E_{bmf}$	--	–	–	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	–

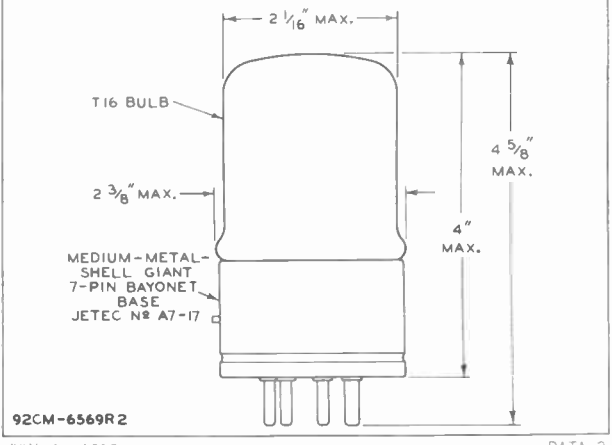
■: See next page.

3D22-A
GAS THYRATRON

RATIO	Fig. 1	Fig. 2	Fig. 3	Fig. 4
Power Ratios (Cont'd)				
Inductive Load■				
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	.8	65	-
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	46	-	-	-	800

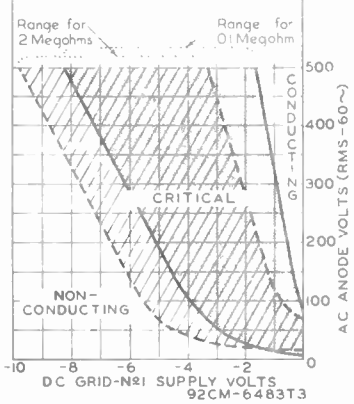


TUBE DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

3D22-A
GAS THYRATRON

OPERATIONAL RANGE OF CRITICAL GRID-№1 VOLTAGE

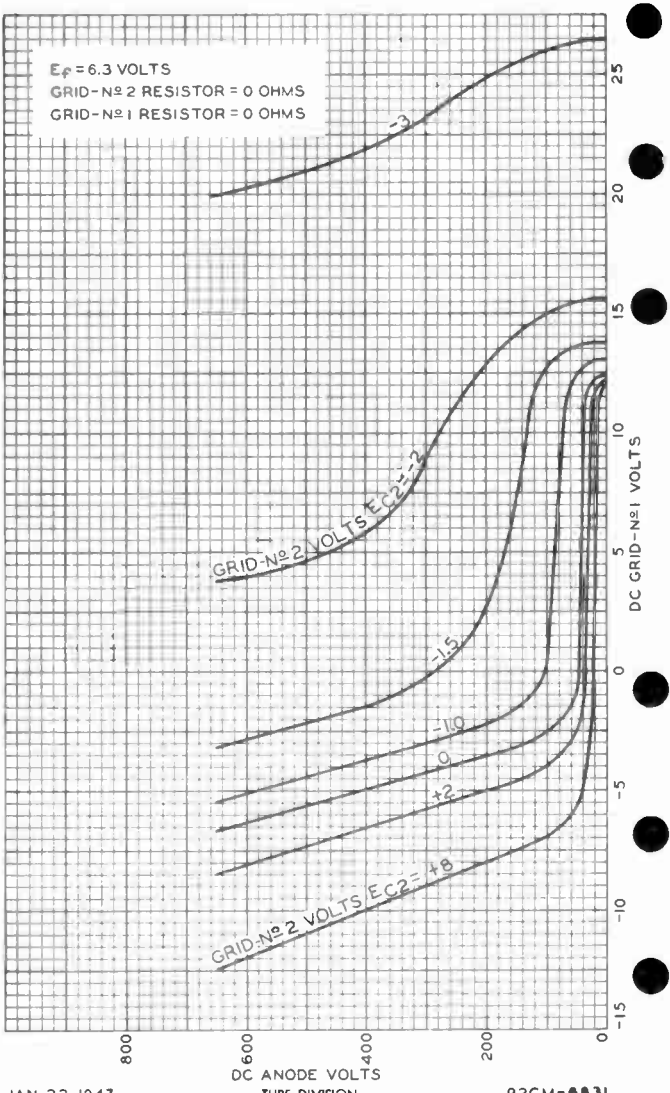
GRID №2 (SHIELD) CONNECTED TO CATHODE. RANGES SHOWN ARE FOR TWO VALUES OF GRID-№1 RESISTOR, .01MEG. AND 2 MEG., AND TAKE INTO ACCOUNT INITIAL DIFFERENCES BETWEEN INDIVIDUAL TUBES AND SUBSEQUENT DIFFERENCES DURING TUBE LIFE. FOR HEATER VOLTAGE RANGE OF 6.3 TO 6.9 VOLTS, AND FOR AN AMBIENT TEMPERATURE RANGE OF -40 TO +90°C



RCA

3D22-A

AVERAGE CONTROL CHARACTERISTICS



JAN. 22, 1947

TUBE DIVISION

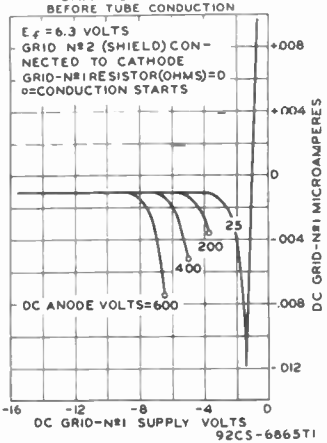
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6831

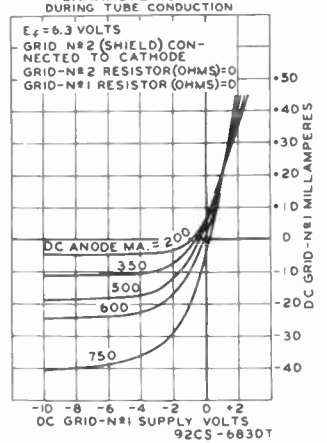
3D22-A

CHARACTERISTIC CURVES

AVERAGE GRID-Nº1 CHARACTERISTICS
BEFORE TUBE CONDUCTION



AVERAGE GRID-Nº1 CHARACTERISTICS
DURING TUBE CONDUCTION



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THYRATRON

MERCURY-VAPOR TETRODE

DATA

Electrical:

	Continuous Service		Intermittent Service		
Heater, for Unipotential Cathode:					
Voltage*	5.0	5.0	5.5	5.0	volts
Current	10.0	10.0	11.0	10.0	amp
Direct Interelectrode Capacitance:					
Grid-No.1 to Anode (Approx.)	0.3	0.3	0.3	0.3	µµf
Peak Voltage Drop (Approx.)	16	16	16	16	volts
Approx. Control Characteristics:					
Anode Voltage	100	1000	100	1000	volts
Grid-No.2 Voltage	0	0	0	0	volts
Grid-No.1 Voltage	+1	-9	+1	-9	volts
Ionization Time (Approx.)	10	10	10	10	µsec.
Deionization Time (Approx.)	1000	1000	1000	1000	µsec.

Mechanical:

Mounting Position	Vertical, Base Down
Overall Length	11" ± 1/4"
Seated Length	10-1/4" ± 1/4"
Greatest Radius	2-13/16"
Bulb	ST-30
Caps	No. 3917
Base	Super-Jumbo 4-Pin, with Bayonet

Maximum Ratings, Absolute Values:

	Continuous Service	Intermittent Service		
PEAK FORWARD ANODE VOLT.	2500	750	10000	max.volts
PEAK INVERSE ANODE VOLT.	2500	750	10000	max.volts
GRID-No.1 (CONT.GRID) VOLT.:				
Before Conduction	-1000	-1000	-1000	max.volts
During Conduction	-10	-10	-10	max.volts
GRID-No.2 (SH'LD GRID) VOLT.:				
Before Conduction	-500	-500	-500	max.volts
During Conduction	-10	-10	-10	max.volts
INSTANTANEOUS ANODE CUR.:				
Below 25 Cycles	12.8	5.0	8.0	max.amp
25 Cycles and Higher	40	77	16	max.amp
AVERAGE ANODE CURRENT	6.4	2.5	4.0	max.amp
SURGE ANODE CUR., for 0.1 sec., max.	400	400	160	max.amp
INSTANTANEOUS GRID-No.1 CUR.	1.0	1.0	1.0	max.amp
AVERAGE GRID-No.1 CUR.	0.25	0.25	0.25	max.amp
INSTANTANEOUS GRID-No.2 CUR.	2.0	2.0	2.0	max.amp
AVERAGE GRID-No.2 CUR.	0.5	0.5	0.5	max.amp
TIME OF AVERAGING CURRENT	15	5	15	max.sec
COND.-MERCURY TEMP. RANGE▲	40-80	30-95	25-50	°C

* Must be applied 5 minutes before anode voltage is applied.

▲ Recommended condensed-mercury temperature = 40°C.

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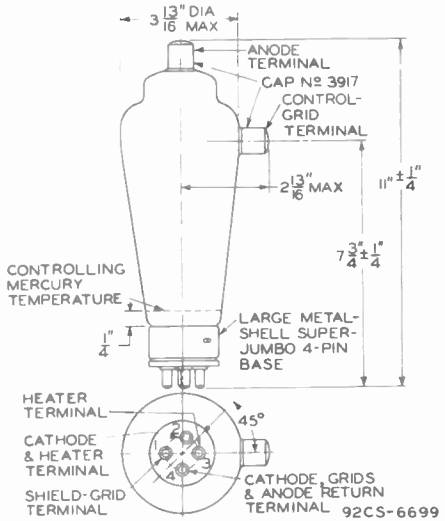
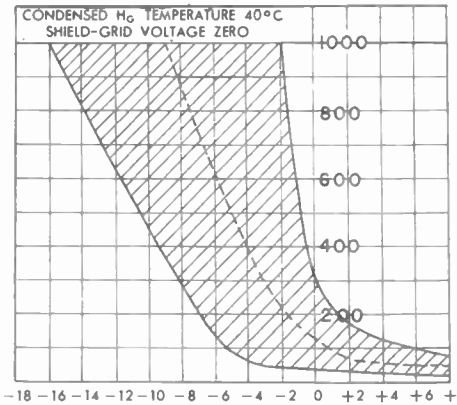
THYRATRON



OPERATIONAL REGION OF CRITICAL GRID VOLTAGE



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

627

THYRATRON

MERCURY-VAPOR TRIODE

DATA

Electrical:

Filament:		
Voltage*	2.5	volts
Current	6.0	amp
Direct Interelectrode Capacitance:		
Anode to Grid (Approx.)	2.5	μμf
Peak Voltage Drop	12	volts
Control Characteristic	Negative	
Ionization Time (Approx.)	10	μseconds
Deionization Time (Approx.)	1000	μseconds

Mechanical:

Mounting Position	Vertical, Base Down
Overall Length	6-3/8" ± 1/4"
Seated Length	6" ± 1/4"
Maximum Diameter	2-1/16"
Bulb	S-19
Cap	Medium Metal
Base	Small Shell Super-Jumbo 4-Pin

Maximum Ratings, Absolute Values:
For frequencies up to 150 cycles

PEAK FORWARD ANODE VOLTAGE	1250 max.	volts
PEAK INVERSE ANODE VOLTAGE	2500 max.	volts
PEAK GRID VOLT. (Before Conduction)	-500 max.	volts
PEAK ANODE CURRENT	2.5 max.	amp
AVERAGE ANODE CURRENT**	0.64 max.	amp
SURGE ANODE CURRENT for 0.1 sec. max.	25 max.	amp
GRID CURRENT, Before Conduction (Grid Neg.)	4 max.	μamp
PEAK GRID CURRENT	0.25 max.	amp
AVERAGE GRID CURRENT**	0.06 max.	amp
COND.-MERCURY TEMPERATURE RANGE▲	25-70	°C

* Filament voltage must be applied at least 10 seconds before start of tube conduction.

** Averaged over any 30-second interval.

▲ Recommended Condensed-Mercury Temperature 40 to 45°C.

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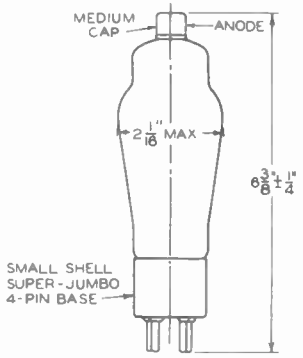
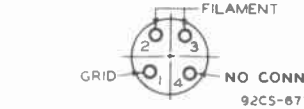
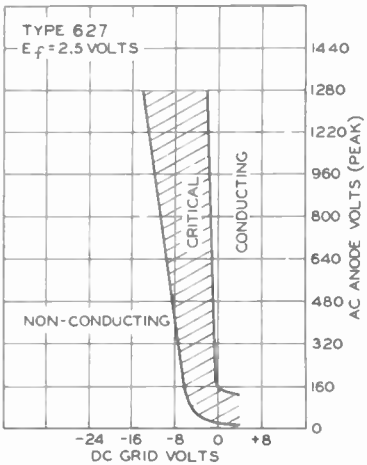
THYRATRON





92CS-6739

OPERATIONAL REGION OF CRITICAL GRID VOLTAGE



92CS-6738

632-B
MERCURY-VAPOR THYRATRON

NEGATIVE-CONTROL TETRODE TYPE

GENERAL DATA

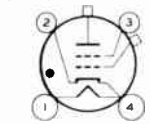
Electrical:

Heater, for Unipotential Cathode:		
Voltage	5●	ac or dc volts
Current	5	amp
Cathode:		
Minimum heating time prior to tube conduction	5	minutes
Direct Interelectrode Capacitances (Approx.):		
Grid No.1 to anode	0.04	μμf
Grid No.2 to anode	3	μμf
Ionization Time (Approx.)	10	μsec
Deionization Time (Approx.)	1000	μsec
Maximum Critical Grid-No.1 Current	2	μamp
Anode Voltage Drop (Approx.)	12	volts

Mechanical:

Mounting Position	Vertical, base down
Maximum Overall Length	8-5/16"
Seated Length	7-1/2" ± 1/4"
Maximum Radius (Including side cap)	1-3/4"
Weight (Approx.)	9 oz
Bulb	T-18
Top Cap	Skirted Medium (JETEC No.C1-29)
Side Cap	Saddle Medium
Base	Skirted-Medium-Shell Small 4-Pin with Bayonet (JETEC No.A4-71)
Basing Designation for BOTTOM VIEW	4CD

Pin 1 – Heater
Pin 2 – Cathode, Circuit Returns
Pin 3 – Grid No.2



Pin 4 – Heater, Cathode
Top Cap – Anode
Side Cap – Grid No.1

Temperature Control:

Heating--When the ambient temperature is so low that the normal rise of condensed-mercury temperature above the ambient temperature will not bring the condensed-mercury temperature up to the minimum value of the operating range specified under *Maximum Ratings*, some form of heat-conserving enclosure or auxiliary heater will be required.

Cooling--When the operating conditions are such that the maximum value of the operating condensed-mercury temperature is exceeded, provision should be made for forced-air cooling sufficient to prevent exceeding the maximum value.

● Under operating conditions where the average anode current does not exceed 0.5 ampere, the heater voltage may be increased to 5.5 volts.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

632-B

MERCURY-VAPOR THYRATRON

IGNITOR-FIRING AND GRID-CONTROLLED RECTIFIER SERVICE

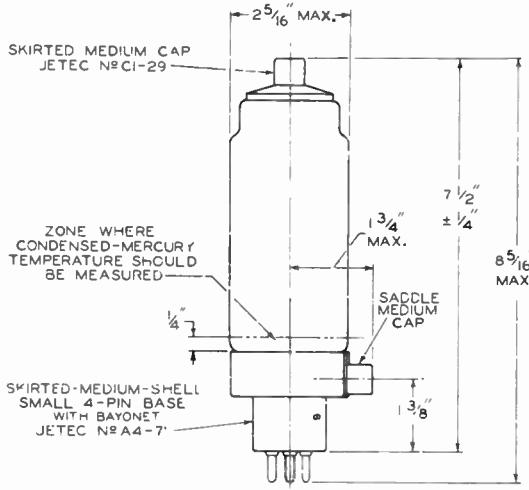
Maximum Ratings, *Absolute Values.*

For anode-supply frequency of 60 cps

	Operating Condensed-Mercury Temperature Range 40° to 80°C■	
PEAK ANODE VOLTAGE:		
Forward	1500 max.	volts
Inverse	1500 max.	volts
GRID-No.2 (SHIELD-GRID) VOLTAGE:		
Peak, before tube conduction	-300 max.	volts
GRID-No.1 (CONTROL-GRID) VOLTAGE:		
Peak, before tube conduction	-1000 max.	volts
CATHODE CURRENT:		
Peak	30 max.	amp
Average#	2.5 max.	amp
Fault, for duration of 0.1 second max.	150 max.	amp
AVERAGE GRID-No.2 CURRENT#	+0.25 max.	amp
AVERAGE GRID-No.1 CURRENT#	+0.25 max.	amp

■ Recommended temperature range of condensed mercury is 45° to 50°C.

\# Averaged over any interval of 30 seconds maximum.

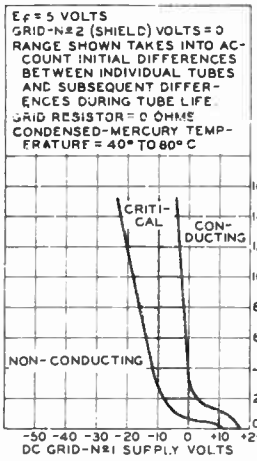


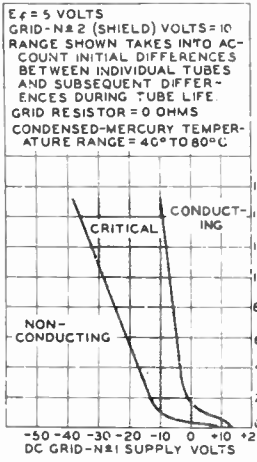
TENTATIVE DATA

TUBE DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

632-B
MERCURY-VAPOR THYRATRON

OPERATIONAL RANGES OF CRITICAL GRID-№1 VOLTAGE





TUBE DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

672-A
THYRATRON
MERCURY-VAPOR TETRODE

Supersedes Type 672

GENERAL DATA

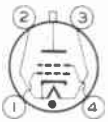
Electrical:

Heater, for Unipotential Cathode:	
Voltage	5 ac or dc volts
Current	5 amp
Cathode:	
Min. Heating Time, prior to tube conduction	5 minutes
Direct Interelectrode Capacitances:	
Grid No.1 to Anode	0.04 μμf
Grid No.2 to Anode	3 μμf
Ionization Time (Approx.)	10 μsec
Deionization Time (Approx.)	1000 μsec
Maximum Critical Grid Current	2 μamp
Anode Voltage Drop (Approx.)	12 volts

Mechanical:

Mounting Position	Vertical, Base Down
Overall Length	7-7/8" ± 1/4"
Seated Length	7-1/8" ± 1/4"
Maximum Diameter	2-5/16"
Bulb	T-18
Cap	Skirted Medium
Base	Large-Shell Super-Jumbo 4-Pin, Bayonet
Basing Designation for BOTTOM VIEW	4CE

Pin 1 - Grid No.1
Pin 2 - Heater, Cathode



Pin 3 - Heater
Pin 4 - Grid No.2
Cap - Anode

GRID-CONTROLLED RECTIFIER SERVICE

For frequencies up to 150 cycles

Maximum Ratings, ***Absolute Values:***

PEAK ANODE VOLTAGE:		
Forward	2500 max.	volts
Inverse	2500 max.	volts
GRID-No.2 (SHIELD-GRID) VOLTAGE:		
Peak, before anode conduction	-300 max.	volts
GRID-No.1 (CONTROL-GRID) VOLTAGE:		
Peak, before anode conduction	-1000 max.	volts
CATHODE CURRENT:		
Peak	40 max.	amp
Average■	3.2 max.	amp
Surge, for duration of 0.1 sec. max.	150 max.	amp

■ See next page.

(continued on next page)

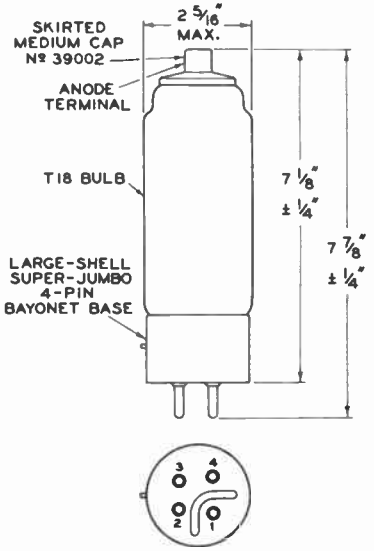
RCA

672-A
THYRATRON

GRID-No. 2 CURRENT:		
Peak	1 max.	amp
Average■	0.25 max.	amp
GRID-No. 1 CURRENT:		
Peak	1 max.	amp
Average■	0.25 max.	amp
COND.-MERCURY TEMPERATURE RANGE▲	40 to 80	°C

■ Averaged over any interval of 15 sec. max.

▲ Recommended condensed-mercury temperature is between 45° and 50°C.

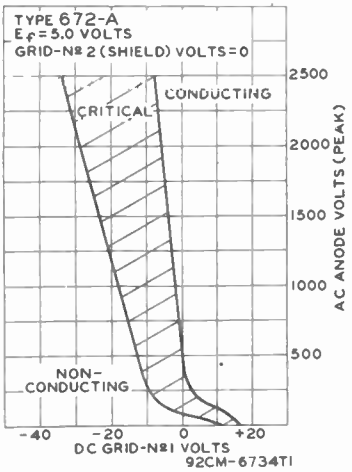


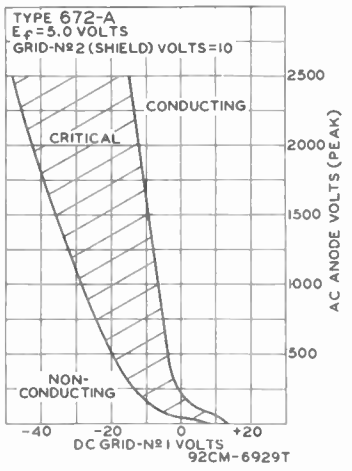
BOTTOM VIEW OF BASE

92CS-6735RI

672-A
THYRATRON

OPERATIONAL RANGES OF CRITICAL GRID-№1 VOLTAGE





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THYRATRON

MERCURY-VAPOR TRIODE

DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage*	5	volts
Current	10	amp
Direct Interelectrode Capacitance:		
Grid to Anode (Approx.)	5	μμf
Peak Voltage Drop	12	volts
Control Characteristic	Negative	
Ionization Time (Approx.)	10	μseconds
Deionization Time (Approx.)	1000	μseconds

Mechanical:

Mounting Position	Vertical, Base Down
Overall Length	11-1/4" ± 1/2"
Maximum Diameter	3-13/16"
Bulb	ST-30
Cap	No. 3985
Base	Large Shell Super-Jumbo 4-Pin

Maximum Ratings, Absolute Values:

For frequencies up to 150 cycles

	Continuous Service	Welder-Control Service	
PEAK FORWARD ANODE VOLTAGE	2500 max.	750 max.	volts
PEAK INVERSE ANODE VOLTAGE	2500 max.	750 max.	volts
PEAK GRID VOLTAGE: Before Conduction	-500 max.	-500 max.	volts
PEAK ANODE CURRENT	40 max.	77 max.	amp
AVERAGE ANODE CURRENT	6.4 max.	2.5 max.	amp
SURGE ANODE CURRENT for 0.1 sec. max.	200 max.	200 max.	amp
GRID CURRENT: Before conduction (Grid Negative)	5 max.	5 max.	μamp
PEAK GRID CURRENT	1 max.	1 max.	amp
AVERAGE GRID CURRENT	0.25 max.	0.25 max.	amp
TIME OF AVERAGING CURRENTS	15 max.	5 max.	sec
COND.-MERCURY TEMP. RANGE▲	40 - 80	40 - 90	°C

* Heater voltage must be applied for at least 5 minutes before anode voltage is applied.

▲ Recommended condensed-mercury temperature range, 45 - 55°C.

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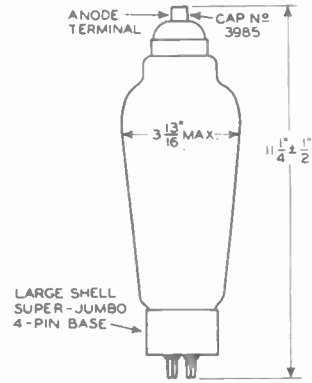
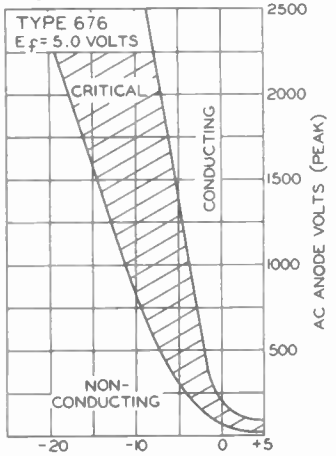
THYRATRON



OPERATIONAL REGION OF CRITICAL GRID VOLTAGE



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TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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THYRATRON

MERCURY-VAPOR TRIODE

DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage*	5	volts
Current	10	amp
Direct Interelectrode Capacitance:		
Grid to Anode (Approx.)	5	μμf
Peak Voltage Drop	12	volts
Control Characteristic	Negative	
Ionization Time (Approx.)	10	μseconds
Deionization Time (Approx.)	1000	μseconds

Mechanical:

Mounting Position	Vertical, Base Down
Overall Length	11-1/4" ± 1/2"
Maximum Diameter	3-13/16"
Bulb	ST-30
Cap	No. 3985
Base	Large Shell Super-Jumbo 4-Pin

Maximum Ratings, Absolute Values:

For frequencies up to 150 cycles

PEAK FORWARD ANODE VOLTAGE	10000 max.	volts
PEAK INVERSE ANODE VOLTAGE	10000 max.	volts
PEAK GRID VOLTAGE:		
Before Conduction	-500 max.	volts
Anode Negative	10 max.	volts
PEAK ANODE CURRENT	15 max.	amp
AVERAGE ANODE CURRENT**	4 max.	amp
SURGE ANODE CURRENT for 0.1 sec., max.	16 max.	amp
GRID CURRENT: Before Conduction (Grid Neg.)	5 max.	μamp
PEAK GRID CURRENT	1 max.	amp
AVERAGE GRID CURRENT**	0.25 max.	amp
COND.-MERCURY TEMPERATURE RANGE▲	30 - 50	°C

* Heater voltage must be applied for at least 5 minutes before anode voltage is applied.

** Averaged over any 15-second interval.

▲ Recommended condensed-mercury temp. range, 35 - 45°C.

RCA

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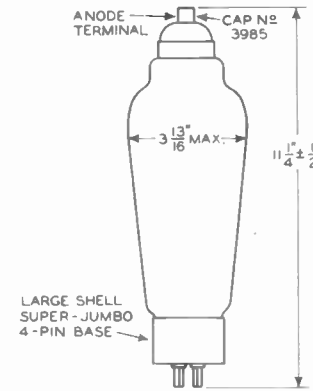
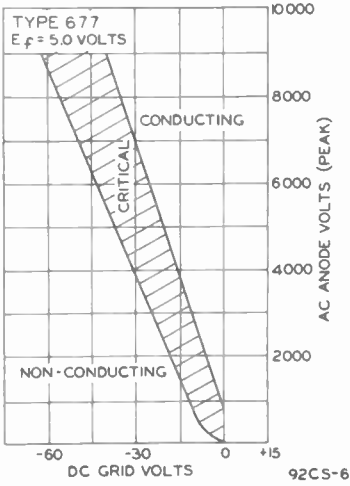
THYRATRON



OPERATIONAL REGION OF CRITICAL GRID VOLTAGE



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

Gas and Mercury-Vapor Thyratron

NEGATIVE-CONTROL TRIODE TYPE

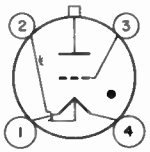
GENERAL DATA

Electrical:

Filament, Coated:		
Voltage (AC or DC) between pins 1 and 4	2.5	volts
Current at 2.5 volts	9 ± 2	amp
Minimum heating time prior to tube conduction	20	sec
Direct Interelectrode Capacitances (Approx.):[a]		
Grid to anode	2	μμf
Grid to cathode	12	μμf
Ionization Time (Approx.)	10	μsec
Deionization Time (Approx.)	1000	μsec
Peak Tube Voltage Drop at anode amperes = 8	10	volts

Mechanical:

Operating Position	Vertical, base down
Maximum Overall Length	6-1/4"
Maximum Diameter	1-5/8"
Weight (Approx.)	4 oz
Bulb	T13
Cap	Medium (JEDEC No.C1-5)
Socket	Small 4-Contact
Base	Medium-Shell Small 4-Pin with Bayonet (JEDEC No.A4-10)
Basing Designation for BOTTOM VIEW	4CF



Pin 1 – Filament
Pin 2 – Filament Tap, Circuit Returns
Pin 3 – Grid
Pin 4 – Filament Cap – Anode

Thermal:

Type of Cooling	Convection	
Temperature Rise of Condensed Mercury to Equilibrium Above Ambient Temperature (Approx.):		
No load	25	°C
Full load	30	°C

GRID-CONTROLLED-RECTIFIER SERVICE

Maximum and Minimum Ratings, *Absolute-Maximum Values:*

For anode-supply frequency of 60 cps

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

PEAK NEGATIVE GRID VOLTAGE:		
Before tube conduction.	500 max.	volts
During tube conduction.	10 max.	volts
CATHODE CURRENT:		
Peak.	30 max.	amp
Average[b].	2.5 max.	amp
Fault	250 max.	amp
CONDENSED-MERCURY TEMPERATURE RANGE (Operating)[c].	-40 to +80	°C

[a] Without external shield.

[b] Averaged over any interval of 5 seconds maximum.

[c] For longest life, the operating condensed-mercury temperature range after warm-up should be kept between +40° and +80° C which corresponds approximately to +10° to +50° C ambient.

Gas and Mercury-Vapor Thyratron

NEGATIVE-CONTROL TRIODE TYPE

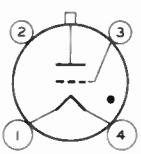
GENERAL DATA

Electrical:[a]

Filament, Coated:		
Voltage (AC or DC)	2.5	volts
Current at 2.5 volts	5.0 ± 0.5	amp
Minimum heating time prior to tube conduction	5	sec
Direct Interelectrode Capacitance (Approx.)[b]		
Grid to anode	2	μμf
Ionization Time (Approx.)	10	μsec
Deionization Time (Approx.)	1000	μsec
Maximum Critical Grid Current	5	μa
Peak Tube Voltage Drop at anode amperes = 3	15	volts

Mechanical:

Operating Position	Vertical, base down
Maximum Overall Length	6-1/8"
Maximum Diameter	2-1/16"
Weight (Approx.)	3 oz
Bulb	ST16
Cap	Medium (JEDEC No.C1-5)
Socket	Small 4-Contact
Base	Medium-Shell Small 4-Pin with Bayonet (JEDEC No.A4-10)
Basing Designation for BOTTOM VIEW	3G



Pin 1 – Filament
Pin 2 – No Internal Connection
Pin 3 – Grid
Pin 4 – Filament
Cap – Anode

Thermal:

Type of Cooling	Convection	
Temperature Rise of Condensed Mercury to Equilibrium Above Ambient Temperature (Approx.)	15	°C

GRID-CONTROLLED-RECTIFIER SERVICE[a]

Maximum and Minimum Ratings, *Absolute-Maximum Values:*

For anode-supply frequency of 60 cps

PEAK ANODE VOLTAGE:		
Forward	1250 max.	volts
Inverse	1250 max.	volts
PEAK NEGATIVE GRID VOLTAGE:		
Before tube conduction	500 max.	volts
During tube conduction	10 max.	volts

ANODE CURRENT:		
Peak	3 max.	amp
Average[c]	1 max.	amp
Fault	50 max.	amp
CONDENSED-MERCURY TEMPERATURE		
RANGE (Operating)[d]	-40 to +80	°C

[a] With circuit returns to filament-transformer center-tap.

[b] Without external shield.

[c] Averaged over any interval of 5 seconds maximum.

[d] For longest life, the operating condensed-mercury temperature range after warm-up should be kept between +40° and +80° C which corresponds approximately to +100° to +50° C ambient.

Gas and Mercury-Vapor Thyratron

NEGATIVE-CONTROL TRIODE TYPE

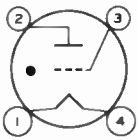
GENERAL DATA

Electrical:[a]

Filament, Coated:		
Voltage (AC or DC)	2.5	volts
Current at 2.5 volts	6.3 ± 0.8	amp
Minimum heating time prior to tube conduction	15	sec
Direct Interelectrode Capacitance (Approx.):[b]		
Grid to anode	3	μμf
Ionization Time (Approx.)	10	μsec
Deionization Time (Approx.)	1000	μsec
Maximum Critical Grid Current	10	μa
Peak Tube Voltage Drop at anode amperes = 5	8	volts

Mechanical:

Operating Position	Vertical, base down
Maximum Overall Length	4-3/8"
Diameter	1.438" to 1.562"
Weight (Approx.)	3 oz
Bulb	T12
Socket	Small 4-Contact
Base	Medium-Shell Small 4-Pin with Bayonet (JEDEC No.A4-10)
Basing Designation for BOTTOM VIEW	4D



Pin 1 – Filament
Pin 2 – Anode
Pin 3 – Grid
Pin 4 – Filament

Thermal:

Type of Cooling	Convection	
Temperature Rise of Condensed Mercury to Equilibrium Above Ambient Temperature (Approx.)	30	°C

GRID-CONTROLLED-RECTIFIER SERVICE[a]

Maximum and Minimum Ratings, *Absolute-Maximum Values:*

For anode-supply frequency of 60 cps

PEAK ANODE VOLTAGE:		
Forward	1250 max.	volts
Inverse	1250 max.	volts
PEAK NEGATIVE GRID VOLTAGE:		
Before tube conduction	500 max.	volts
During tube conduction	10 max.	volts

CATHODE CURRENT:		
Peak	8 max.	amp
Average[c]	1 max.	amp
Fault	80 max.	amp
CONDENSED-MERCURY TEMPERATURE		
RANGE (Operating)[d]	-40 to +80	°C

[a] With circuit returns to filament-transformer center-tap.

[b] Without external shield.

[c] Averaged over any interval of 5 seconds maximum.

[d] For longest life, the operating condensed-mercury temperature range after warm-up should be kept between +40° and +80° C which corresponds approximately to +10° to +50° C ambient.

Gas and Mercury-Vapor Thyratron

NEGATIVE-CONTROL TRIODE TYPE

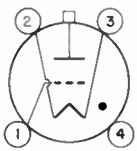
GENERAL DATA

Electrical:[a]

Filament, Coated:		
Voltage (AC or DC)	2.5	volts
Current at 2.5 volts	21 ± 2	amp
Minimum heating time prior to tube conduction	60	sec
Direct Interelectrode Capacitance (Approx.):[b]		
Grid to anode	4	μμf
Ionization Time (Approx.)	10	μsec
Deionization Time (Approx.)	1000	μsec
Maximum Critical Grid Current	10	μa
Peak Tube Voltage Drop at anode amperes = 20	12	volts

Mechanical:

Operating Position	Vertical, base down
Maximum Overall Length	9-1/2"
Maximum Diameter	2-9/16"
Weight (Approx.)	9 oz
Cap	Medium (JEDEC No.C1-5)
Socket	Super-Jumbo 4-Contact
Base	Large-Metal-Shell Super-Jumbo 4-Pin with Bayonet (JEDEC No.A4-18)
Basing Designation for BOTTOM VIEW	4BZ



Pin 1 – Grid
Pin 2 – Filament
Pin 3 – Filament
Pin 4 – No Internal Connection
Cap – Anode

Thermal:

Type of Cooling	Convection	
Temperature Rise of Condensed Mercury to Equilibrium Above Ambient Temperature (Approx.)	30	°C

GRID-CONTROLLED-RECTIFIER SERVICE[a]

Maximum and Minimum Ratings, *Absolute-Maximum Values:*

For anode-supply frequency of 60 cps

PEAK ANODE VOLTAGE:		
Forward	1500 max.	volts
Inverse	1500 max.	volts
PEAK NEGATIVE GRID VOLTAGE:		
Before tube conduction	500 max.	volts
During tube conduction	10 max.	volts

CATHODE CURRENT:		
Peak	77 max.	amp
Average[c]	6.4 max.	amp
Fault	770 max.	amp
CONDENSED-MERCURY TEMPERATURE RANGE		
(Operating)[d]	-40 to +80	°C

[a] With circuit returns to filament-transformer center-tap.

[b] Without external shield.

[c] Averaged over any interval of 15 seconds maximum.

[d] For longest life, the operating condensed-mercury temperature range after warm-up should be kept between +40° and +80° C which corresponds approximately to +10° to +50° C ambient.

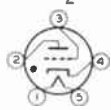
884, 885
THYRATRONS
TRIODE TYPES

For new equipment design, RCA-884 is recommended.

GENERAL DATA

Electrical:	*Type 884*	*Type 885*	
Heater.	Coated Unipotential Cathode		
Voltage	6.3 ± 10%	2.5 ± 10%	a-c or d-c volts
Current	0.6	1.5	. . . . . amp. ←
Direct Interelectrode Capacitances:			←
Grid to Anode . . .	6	6	. . . . . μμf
Grid to Cathode . .	2	2	. . . . . μμf
Anode to Cathode. .	0.8	0.6	. . . . . μμf
Tube Voltage Drop . .	16	16	. . approx. volts
Physical:			
Mounting Position . .	Any	Any	
Maximum Overall Length	4-1/8	4-3/16	. . . . . inches
Maximum Seated Length	3-9/16	3-9/16	. . . . . inches
Maximum Diameter. . .	1-9/16	1-9/16	. . . . . inches
Bulb.	ST-12	ST-12	
Base.	Small Shell Octal 6-Pin	Small 5-Pin	
Basing Designation	$G\text{-}6Q_2$	$5A_2$	

Pin 1 – No Connection
Pin 2 – Heater
Pin 3 – Anode
Pin 5 – Grid
Pin 7 – Heater
Pin 8 – Cathode



Pin 1 – Heater
Pin 2 – Anode
Pin 3 – Grid
Pin 4 – Cathode
Pin 5 – Heater

BOTTOM VIEWS

RELAXATION OSCILLATOR — Sweep-Circuit Service△

Maximum Ratings, *Absolute Values:*		
PEAK ANODE VOLTAGE.	300 *max.*	volts
PEAK CATHODE CURRENT●	300 *max.*	ma.
PEAK GRID CURRENT▲	1 *max.*	ma. ←
PEAK VOLTAGE BETWEEN ANY TWO ELECTRODES OR BETWEEN ANY ELECTRODE AND HEATER . .	350 *max.*	volts
D-C HEATER-CATHODE POTENTIAL.	-100 to +25	volts ←
AMBIENT TEMPERATURE RANGE	-75 to +90	°C ←

△ For best life results, it is desirable to delay tube conduction for about 10 seconds after applying heater voltage in order to allow the cathode to reach normal operating temperature.

● In sweep circuits designed so that the peak cathode current of 300 milliamperes will not be exceeded during condenser discharge, the resultant average cathode current is so small in comparison with the average-current capability of the cathode that a maximum rating for average cathode current is omitted because it has no practical significance.

▲ The resistance of the grid resistor should be not less than 1000 ohms per maximum instantaneous volt applied to the grid. Resistance values in excess of 500000 ohms may cause circuit instability.

←Indicates a change.

884, 885

THYRATRONS

(continued from preceding page)

RELAY & GRID-CONTROLLED RECTIFIER SERVICE □
At Frequencies Below 75 Cycles per Second

Maximum Ratings, *Absolute Values*:

PEAK ANODE VOLTAGE	350 *max.*	volts
PEAK CATHODE CURRENT	300 *max.*	ma.
AVERAGE CATHODE CURRENT #	75 *max.*	ma.
PEAK VOLTAGE BETWEEN ANY TWO ELECTRODES OR BETWEEN ANY ELECTRODE AND HEATER	350 *max.*	volts
← D-C HEATER-CATHODE POTENTIAL	-100 to +25	volts
← AMBIENT TEMPERATURE RANGE	-75 to +90	°C

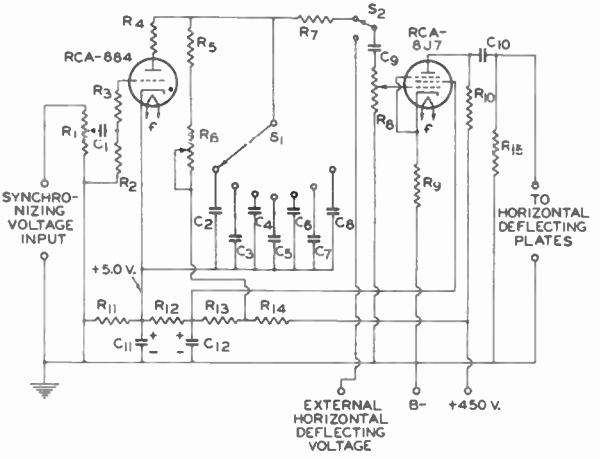
□ The heater voltage should be applied for 10 seconds before tube conduction occurs.

For an averaging period of 30 seconds.

← Indicates a change.

884

LINEAR SWEEP-CIRCUIT OSCILLATOR AND AMPLIFIER



C_1 = 0.25 μf OR GREATER
C_2 = 0.25 μf, 500 V.
C_3 = 0.1 μf, 500 V.
C_4 = 0.04 μf, 500 V.
C_5 = 0.015 μf, 500 V.
C_6 = 0.005 μf, 500 V.
C_7 = 0.002 μf, 500 V.
C_8 = 0.0008 μf, 500 V.
C_9 = 0.5 μf, 250 V.
C_{10} = 0.5 μf, 500 V.
C_{11} = 25 μf, 15 V.
C_{12} = 8 μf, 200 V.
R_1 = 5000 OHM(MAX.)POTENTIOMETER
R_2 = NOT GREATER THAN 50000 OHMS
R_3 = 2000-3000 OHMS, 0.5 WATT

R_4 = 350-500 OHMS, 0.5 WATT
R_5 = 0.3-0.5 MEGOHM, 0.5 WATT
R_6 = 1 MEGOHM POTENTIOMETER
R_7 = 1 MEGOHM, 0.5 WATT
R_8 = 0.5 MEGOHM POTENTIOMETER
R_9 = 850 OHMS, 0.5 WATT
R_{10} = 0.1 MEGOHM, 0.5 WATT
R_{11} = 1500 OHMS, 0.5 WATT
R_{12} = 25000 OHMS, 1.0 WATT
R_{13} = 80000 OHMS, 1.0 WATT
R_{14} = 60000 OHMS, 1.0 WATT
R_{15} = 2.0 MEGOHMS, 1.0 WATT
S_1 = 7-CONTACT S.P. SWITCH
S_2 = S.P.D.T. SWITCH

92CM-4875R1

APPROXIMATE FREQUENCY RANGE (CYCLES/SEC.)

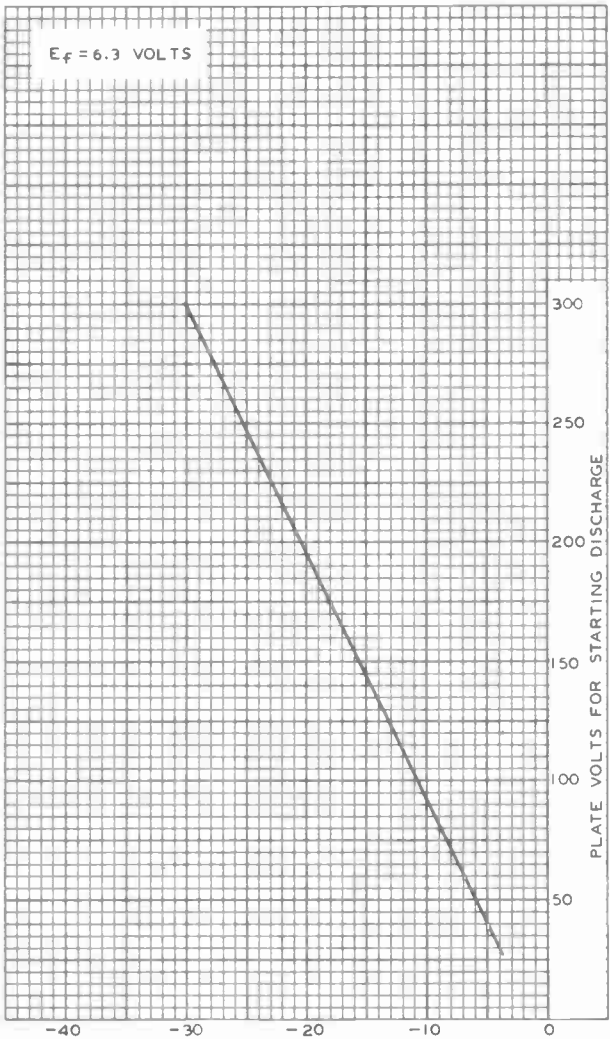
SWITCH (S_1) ON		C_2	C_3	C_4	C_5	C_6	C_7	C_8
R_6 AT	MAX.	20	40	110	280	670	1500	3600
	MIN.	60	130	340	880	2200	4900	11400

 ← Indicates a change.

884

884

AVERAGE CONTROL CHARACTERISTIC



JAN. 4, 1945

RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

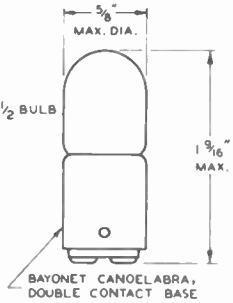
92CM-4883R1

991

VOLTAGE REGULATOR

Type	Glow Discharge
Maximum Overall Length	1-9/16"
Maximum Diameter	5/8"
Bulb	T-4-1/2
Base	Bayonet Candelabra, Double Contact
Operating Conditions:	
Starting-Supply Voltage (D.C.)	87 min. volts
Peak Current *	3 max. ma.
Continuous Current (D.C.) **	2 max. ma.
Operating Voltage Δ	67 max. volts 48 min. volts

* If the 991 is used with a pulsating or alternating supply voltage, the peak current should be limited to 3 ma.
** Sufficient resistance must always be used in series with this tube to limit its d-c current to 2 ma.
Δ For d-c operating current between 0.4 and 2 ma.

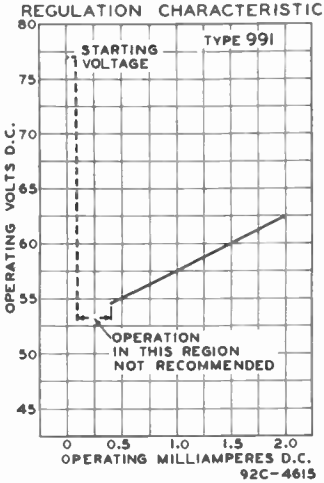


BOTTOM VIEW OF BASE

92C-4614

TUBE MOUNTING POSITION
VERTICAL OR HORIZONTAL

REGULATION CHARACTERISTIC



92C-4615

1946
VACUUM-GAUGE TUBE

THERMOCOUPLE TYPE

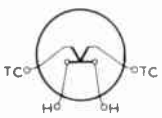
DATA

General:

Heater, for Thermocouple:	
Voltage (Approx.)	1 ac or dc volts
Current	0.070 amp
Resistance of Thermocouple	5 approx. ohms
Maximum Overall Length (with tubulation)	6-1/4"
Maximum Diameter	1-11/16"
Bulb	T-12
Tubulation	3/8" Diameter Hard Glass, Corning Code 772 Nonex
Mounting Position	Any
Terminal Arrangement	See Outline Drawing

Terminal Connections:

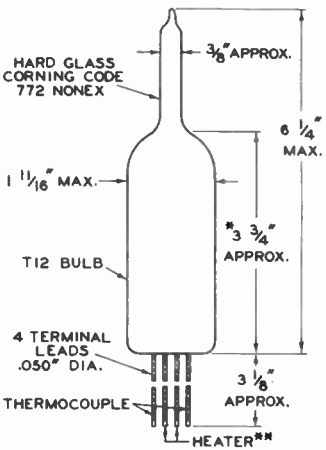
H – Heater



TC – Thermocouple

Calibration:

See next page.



*MEASURED FROM BULB END TO BULB-TOP LINE AS DETERMINED BY RING GAUGE OF 1/2" I.D.

**BROWN HEATER LEAD SHOULD BE CONNECTED TO POSITIVE TERMINAL OF DC HEATER SUPPLY. 92CS-6815

1946

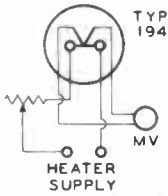
RCA

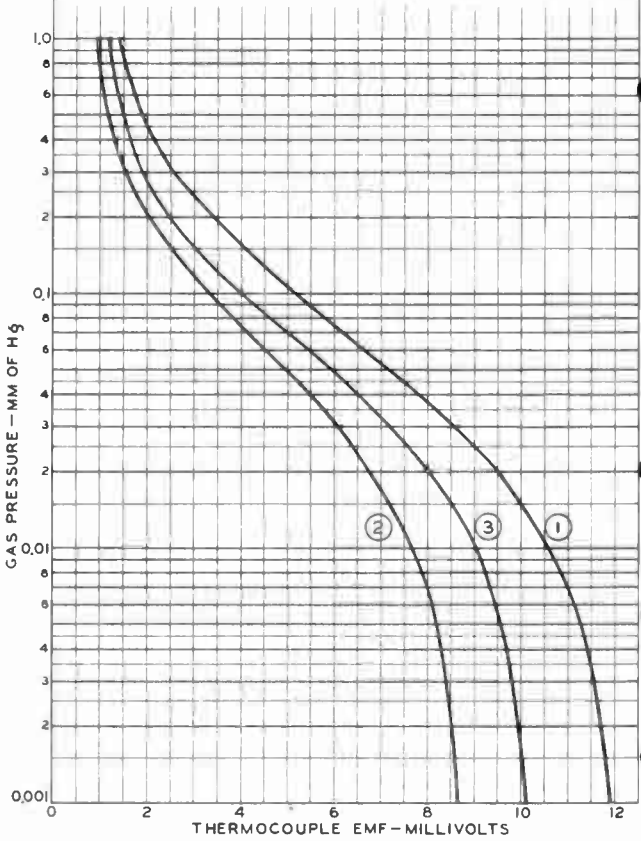
1946

CALIBRATION CURVES

CURVE	HEATER		
	BROWN LEAD	UNMARKED LEAD	CURRENT AMP.
1	+	−	0.070 DC
2	−	+	0.070 DC
3	±	∓	0.070 RMS

GAS = DRY AIR
TO CONVERT MM TO MICRONS, MULTIPLY VALUES BY 1000





MAR. 11, 1947 TUBE DEPARTMENT 92CM-6852

RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

1947
VACUUM-GAUGE TUBE

PIRANI TYPE

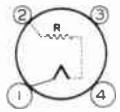
DATA

General:

Filament, Platinum Iridium:		
Voltage (Approx.)	10	dc volts
Current (Varies with Gas Pressure)	70 – 100	ma.
Resistance between base pins No.1 & No.2 under vacuum better than 3 x 10–5 mm of mercury	135.8	ohms
Maximum Overall Length (Including tubulation)		7-9/16"
Maximum Diameter		1-3/16"
Bulb		T-9
Tubulation		7/32" Diameter Sort Glass, Corning Code 001 Lead
Mounting Position		Any
Base		Small-Shell Small 4-Pin

BOTTOM VIEW

Pin 1 – Filament
Pin 2 – Filament
Pin 3 – No Connection
Pin 4 – Internal Connection – Do Not Use



R – Series Filament-- Calibrating Resistor in base of tube

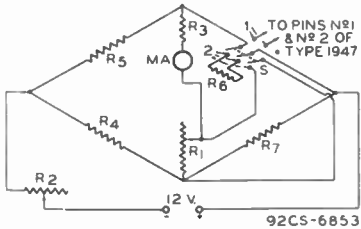
Maximum Ratings, *Absolute Values*:

FILAMENT VOLTAGE . . . . . 16 max. volts

Calibration for 1947 in Accompanying Circuit:

See curve on following sheet.

PIRANI GAUGE BRIDGE CIRCUIT



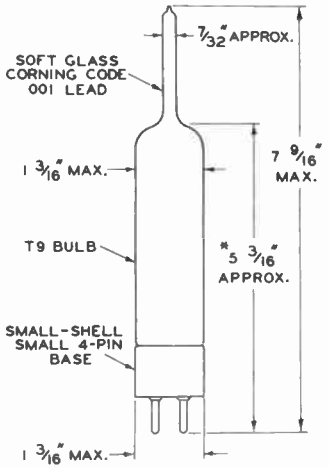
R1: 50 Ohms R3 + METER: 15 Ohms R6: 120.7 Ohms
R2: 25 Ohms R4 R5: 10 Ohms each R7: 135.8 Ohms

STEP 1: With switch S in position 2, adjust R2 so that meter reads 2.5 milliamperes.

STEP 2: With switch S in position 1, and with dry air at atmospheric pressure in the 1947, adjust R1 so that meter reads 5.0 milliamperes.

STEP 3: With no further adjustments and with switch S in position 1, proceed to use gauge.

1947
VACUUM-GAUGE TUBE



*MEASURED FROM END OF BASE PINS TO BULB-TOP LINE AS DETERMINED BY RING GAUGE OF 1/2" I.D.

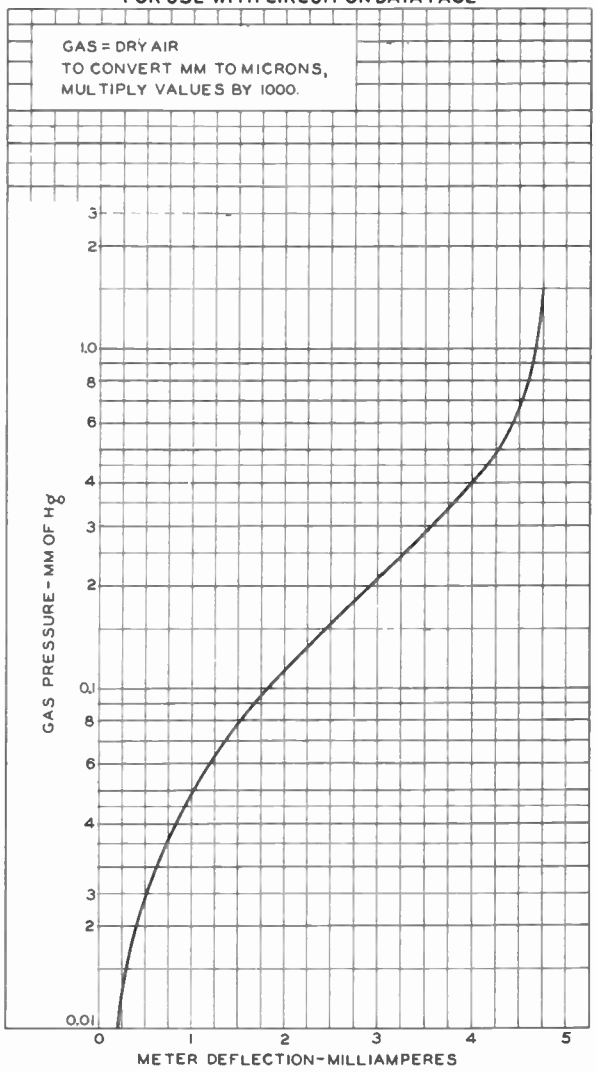
92CS-6816

RCA

1947

CALIBRATION CURVE

FOR USE WITH CIRCUIT ON DATA PAGE



MARCH 10, 1947

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6849

1949

1949
VACUUM-GAUGE TUBE

HARD-GLASS BULB, IONIZATION TYPE

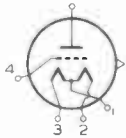
DATA

General:

Filament, Tungsten:*	
Voltage (Approx.)	5 ac or dc volts
Current (Approx.)	3.5 amp
Maximum Tube Length (Including tubulation)	11-1/2"
Maximum Tube Radius	2-3/16"
Maximum Bulb Length	5-1/8"
Maximum Bulb Diameter	2-1/16"
Bulb	T-16
Tubulation	1/2" Diameter Hard Glass, Corning Code 772 Nonex
Operating Position	Vertical with tubulation up or down; Horizontal, with stem press in vertical plane
Terminal Arrangement	See Outline Drawing

Terminal Lead Connections:

Lead 1 – Common Lead to Filaments
Lead 2 – Filament
Lead 3 – Filament (Spare)



Lead 4 – Grid
Top Lead – Plate

Maximum Ratings, *Absolute Values:*

FILAMENT VOLTAGE	6.5 max.	volts
DC PLATE VOLTAGE DURING OPERATION	−100 max.	volts
DC GRID VOLTAGE DURING OPERATION	+200 max.	volts
VOLTAGE ON GRID & PLATE TIED TOGETHER DURING DEGASSING (DC OR PEAK AC)	650 max.	volts
GRID & PLATE DISSIPATION (TOTAL) DURING DEGASSING	150 max.	watts
AMBIENT TEMPERATURE DURING OPERATION.	100 max.	°C
GAS PRESSURE	0.001 max.	mm of Hg

Typical Degassing Conditions:

Grid Connected to Plate

Filament Voltage (AC or DC)	6	6	volts
Grid & Plate Voltage	350 rms	500 dc	volts
Grid & Plate Current (Average)	100	150	ma

Typical Operation:

DC Plate Voltage	−22.5	−22.5	−22.5	volts

* The 1949 contains two filaments, one of which is a spare. Values shown are for either filament operated alone. The filament voltage should be kept as low as possible during degassing because use of a low filament voltage materially increases filament life.

← indicates a change

RCA

1949

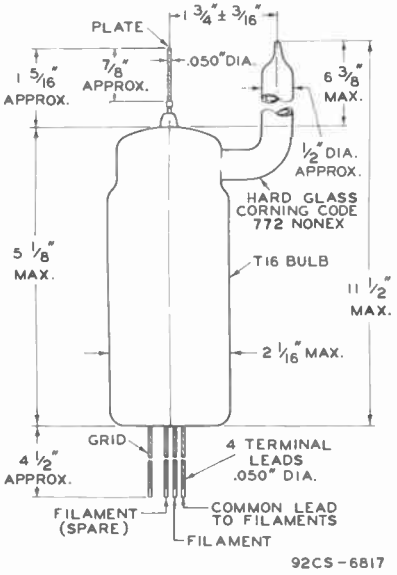
VACUUM-GAUGE TUBE

DC Grid Voltage	+80	+110	+160	volts
Grid Current	10	10	10	μa
Sensitivity	80	110	140	μa/micron▲

Calibration:

See curve on following sheet.

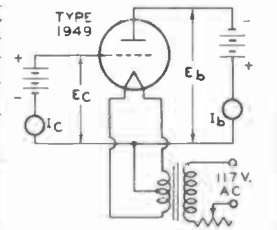
▲ 1 micron = 0.001 mm of mercury.



RCA

1949

CALIBRATION CURVES



GAS = DRY AIR
GRID MILLIAMPERES(i_C) = 10
PLATE VOLTS(E_b) = -22.5
TO CONVERT MM TO MICRONS, MULTIPLY VALUES BY 1000

GAS PRESSURE — MM OF Hg

GRID VOLTS (E_C) = +80, +110, +160

PLATE MICROAMPERES (I_b)

MAR. 11, 1947

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6851

2050
THYRATRON
GAS TETRODE

GENERAL DATA

Electrical:

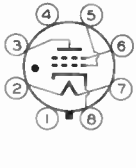
	Min.	Av.	Max.	
Heater, for Unipotential Cathode:				
Voltage (AC or DC)	5.7	6.3	6.9	volts
Current, with heater volts = 6.3	0.54	0.60	0.66	amp
Cathode:				
Heating Time, prior to tube conduction	10	-	-	sec
Direct Interelectrode Capacitances (Approx.):●				
Grid No.1 to Anode			0.26	μμf
Input			4.2	μμf
Output			3.6	μμf
Ionization Time (Approx.):				
For conditions: dc anode volts = 100; grid-No.1 square-pulse volts = 50; and peak anode amp. during conduction = 1.0			0.5	μsec
Deionization Time (Approx.):				
For conditions: dc anode volts = 125; grid-No.1 volts = −250; grid-No.1 resistor (ohms) = 1000; dc anode amp. = 0.1			50	μsec
For conditions: dc anode volts = 125; grid-No.1 volts = −10; grid-No.1 resistor (ohms) = 1000; dc anode amp. = 0.1			100	μsec
Maximum Critical Grid Current, with ac anode-supply volts (rms) = 460, and average anode amp. = 0.1			0.5	μamp
Tube Voltage Drop (Approx.)			8	volts
Grid-No.1 Control Ratio (Approx.) with grid-No.1 resistor (megohms) = 0; grid-No.2 volts = 0			250	
Grid-No.2 Control Ratio (Approx.) with grid-No.1 resistor (megohms) = 0; grid-No.2 resistor (megohms) = 0; grid-No.1 volts = 0			800	

● Without external shield.

Mechanical:

Mounting Position	Any
Maximum Overall Length	4-1/8"
Maximum Seated Length	3-9/16"
Maximum Diameter	1-9/16"
Bulb	ST-12
Base	Small-Shell Octal 8-Pin
Basing Designation for BOTTOM VIEW	6BS

Pin 1 - No Connection
Pin 2 - Heater
Pin 3 - Anode
Pin 4 - No Connection
Pin 5 - Grid No.1
Pin 6 - Grid No.2
Pin 7 - Heater
Pin 8 - Cathode



← Indicates a change.

2050
THYRATRON

RELAY and GRID-CONTROLLED RECTIFIER SERVICE

Maximum Ratings, *Absolute Values*:

PEAK ANODE VOLTAGE:			
Forward	180 max.	650 max.	volts
Inverse	360 max.	1300 max.	volts
GRID-No.2 (SHIELD-GRID) VOLTAGE:			
Peak, before anode conduction	-100 max.	-100 max.	volts
Average, during anode conduction■	-10 max.	-10 max.	volts
GRID-No.1 (CONTROL-GRID) VOLTAGE:			
Peak, before anode conduction	-250 max.	-250 max.	volts
Average, during anode conduction■	-10 max.	-10 max.	volts
CATHODE CURRENT:			
Peak	1.0 max.	1.0 max.	amp
Average■	0.2 max.	0.1 max.	amp
Surge, for duration of 0.1 sec. max.	10 max.	10 max.	amp
→ GRID-No.2 CURRENT:			
Average■	+0.01 max.	+0.01 max.	amp
→ GRID-No.1 CURRENT:			
Average■	+0.01 max.	+0.01 max.	amp
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	100 max.	100 max.	volts
Heater positive with respect to cathode	25 max.	25 max.	volts
AMBIENT TEMPERATURE RANGE	-75 to +90	-75 to +90	°C

→ Typical Operating Conditions for Relay Service:

RMS Anode Voltage	117	400	volts
Grid-No.2 Voltage	0	0	volts
RMS Grid-No.1 Bias Voltage	5□	–	volts
DC Grid-No.1 Bias Voltage	–	-6	volts
Peak Grid-No.1 Signal Voltage	5	6	volts
Grid-No.1-Circuit Resistance	1.0	1.0	megohm
Anode-Circuit Resistance#	1200	2000	ohms

Maximum Circuit Values:

Grid-No.1-Circuit Resistance:		
For average anode current below 0.1 amp.	10 max.	megohms
For average anode current above 0.1 amp.	2 max.	megohms

■ Averaged over any interval of 30 sec. max.

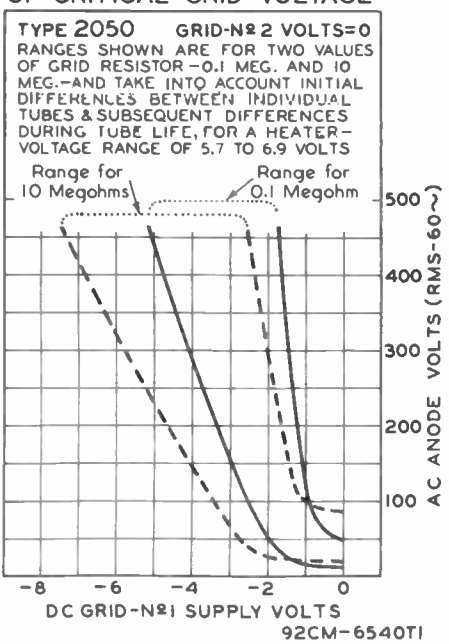
□ Approximately 180° out of phase with the anode voltage.

\# Sufficient resistance, including the tube load, must be used under any conditions of operation to prevent exceeding the current ratings.

→ Indicates a change.

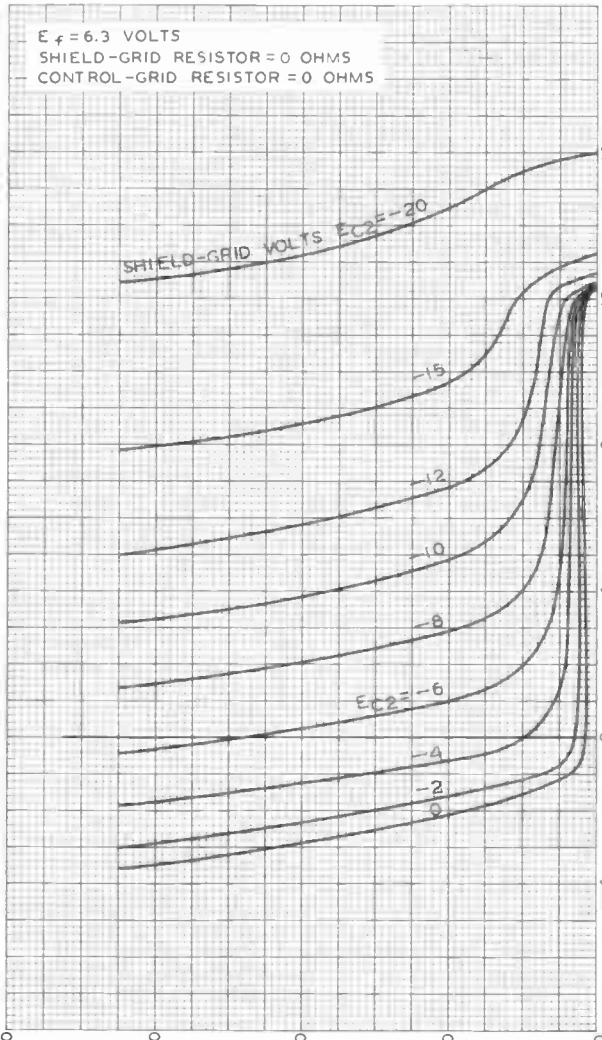
2050
THYRATRON

OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE



2050

AVERAGE CONTROL CHARACTERISTICS



RCA VICTOR DIVISION

MAY 3, 1944

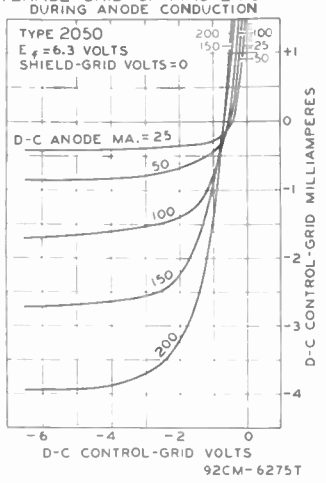
92CM-6274RI

RCA

2050

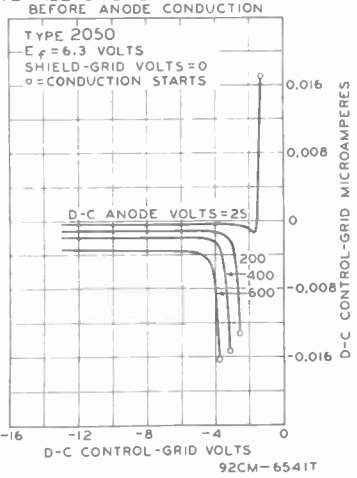
THYRATRON

AVERAGE GRID CHARACTERISTICS
DURING ANODE CONDUCTION



92CM-6275T

AVERAGE GRID CHARACTERISTICS
BEFORE ANODE CONDUCTION



92CM-6541T

RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

Gas Thyratron

TETRODE TYPE

For Relay and Grid-Controlled-Rectifier Service

GENERAL DATA

Electrical:

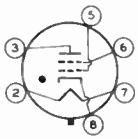
Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.6	amp
Cathode:		
Minimum heating time prior to tube conduction	10	sec
Direct Interelectrode Capacitances (Approx.):[a]		
Grid No.1 to anode	0.15	μμf
Grid No.1 to cathode and grid No.2	2.2	μμf
Ionization Time (Approx.):		
For dc anode volts = 100, grid-No.1 volts (square-wave pulse) = 50, peak anode amperes during conduction = 1	0.5	μsec
Deionization Time (Approx.):		
With dc anode volts = 125, grid-No.1 volts = -250, grid-No.1 resistor (ohms) = 1000, dc anode amperes = 0.1	50	μsec
With dc anode volts = 125, grid-No.1 volts = -10, grid-No.1 resistor (ohms) = 1000, dc anode amperes = 0.1	100	μsec
Maximum Critical Grid-No.1 Current for dc anode supply volts (rms) = 460, average anode amperes = 0.1	0.5	μa
Anode Voltage Drop (Approx.)	8	volts
Grid-No.1 Control Ratio (Approx.) for grid-No.1 resistor (ohms) = 0, grid No.2 connected to cathode at socket	250	
Grid-No.2 Control Ratio (Approx.) for grid-No.1 resistor (ohms) = 0, grid-No.2 resistor (ohms) = 0, grid No.1 connected to cathode at socket	800	

Mechanical:

Operating Position	Any
Maximum Overall Length	3-1/16"
Maximum Seated Length	2-1/2"
Maximum Diameter	1-9/32"
Dimensional Outline	See *General Section*
Bulb	T9
Base	Intermediate-Shell Octal 6-Pin, Arrangement 3, with External Barriers (JEDEC Group 1, B6-229)

2050-A

Basing Designation for BOTTOM VIEW. 6BS



Pin 2 – Heater
Pin 3 – Anode
Pin 5 – Grid No.1
Pin 6 – Grid No.2
Pin 7 – Heater
Pin 8 – Cathode

RELAY AND GRID-CONTROLLED-RECTIFIER SERVICE

Maximum and Minimum Ratings, *Absolute-Maximum Values:*

For anode supply frequency of 60 cps

PEAK ANODE VOLTAGE:				
Forward.	180	max.	650 max.	volts
Inverse.	360	max.	1300 max.	volts
GRID-No.2 (SHIELD-GRID) VOLTAGE:				
Peak, before tube conduction	-100	max.	-100 max.	volts
Average[b], during tube conduction	-10	max.	-10 max.	volts
GRID-No.1 (CONTROL-GRID) VOLTAGE:				
Peak, before tube conduction	-250	max.	-250 max.	volts
Average[b], during tube conduction	-10	max.	-10 max.	volts
CATHODE CURRENT:				
Peak	1	max.	1 max.	amp
Average[b]	0.2	max.	0.1 max.	amp
Fault, for duration of 0.1 second maximum	10	max.	10 max.	amp
GRID-No.2 CURRENT:				
Average[b]	+0.01	max.	+0.01 max.	amp
GRID-No.1 CURRENT:				
Average[b]	+0.01	max.	+0.01 max.	amp
PEAK HEATER-CATHODE VOLTAGE:				
Heater negative with respect to cathode . . .	100	max.	100 max.	volts
Heater positive with respect to cathode . . .	25	max.	25 max.	volts
AMBIENT-TEMPERATURE RANGE. .	-75 to +90		-75 to +90	°C

Typical Operation for Relay Service:

RMS Anode Voltage.	117	400	volts
Grid No.2.	*Connected to cathode at socket*		
RMS. Grid-No.1 Bias Voltage[c].	5	–	volts
DC Grid-No.1 Bias Voltage. .	–	-6	volts
Peak Grid-No.1 Signal Voltage.	5	6	volts
Grid-No.1-Circuit Resistance	1	1	megohm
Anode-Circuit Resistance[d]. .	1200	2000	ohms

Maximum Circuit Values:

Grid-No.1-Circuit Resistance:

For average anode current below 0.1 ampere	10 max.	megohms
For average anode current above 0.1 ampere	2 max.	megohms

[a] Without external shield.

[b] Averaged over any interval of 30 seconds maximum.

[c] Approximately 180° out of phase with the anode voltage.

[d] Sufficient resistance, including the tube load, must be used under any conditions of operation to prevent exceeding the current ratings.

OPERATING CONSIDERATIONS

The *heater* is designed to operate on either ac or dc at 6.3 volts. Regardless of the heater-voltage supply used, *the heater voltage must never be allowed to deviate from its rated range.* Heater operation outside of this voltage range will impair tube performance and may cause tube failure. Low heater voltage causes low cathode temperature with resultant cathode sputtering and consequent destruction of the cathode; high heater voltage causes high cathode temperature with resultant heating of the grid and consequent grid emission which produces unpredictable shifts in the critical grid-No.1 voltage for conduction.

The *cathode* should be allowed to reach normal operating temperature before anode current is drawn. *The delay period should not be less than 10 seconds after application of heater voltage.* Unless this recommendation is followed, the cathode will be damaged.

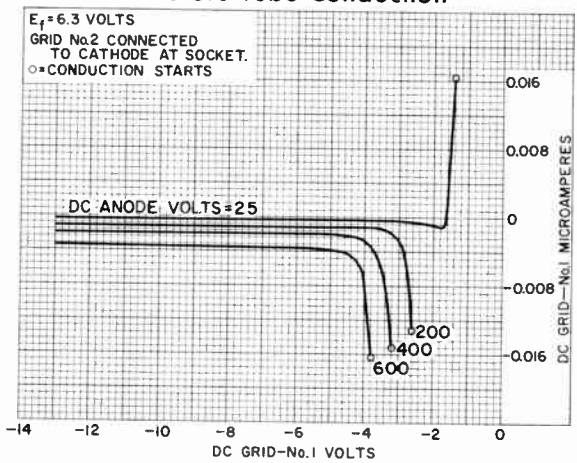
The *shield grid* (grid No.2) is normally connected to the cathode at socket. It may, however, be used as a control electrode because the control characteristic of grid No.1 may be shifted by varying the potential of grid No.2. As grid No.2 is made negative, the grid-No.1 characteristic is shifted in the positive direction. The use of grid No.2 as the control electrode (with grid No.1 connected to cathode at socket) has the advantage of increased sensitivity but consideration must be given to the higher preconduction current, higher capacitance to anode, and less stability of operation.

A *grid-No.1 resistor* having a value as high as 10 megohms to give circuit sensitivity can be used with the 2050-A because its control-grid current is very low. However, when a high value of grid resistor is used, care should be taken to keep the tube base and socket clean and dry in order to make the effect of leakage currents between the control-grid base pin and anode base pin very small.

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.

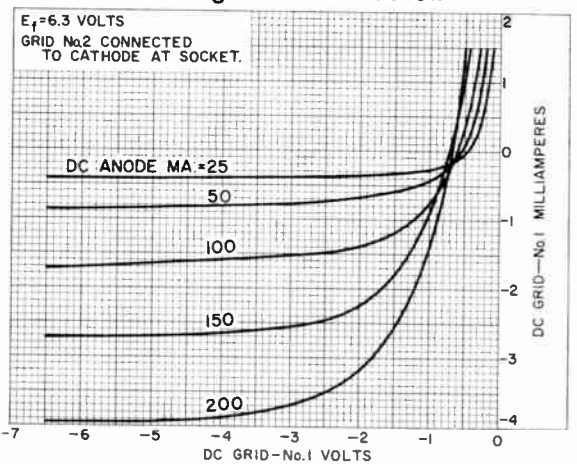
AVERAGE GRID-No.1 CHARACTERISTICS

Before Tube Conduction



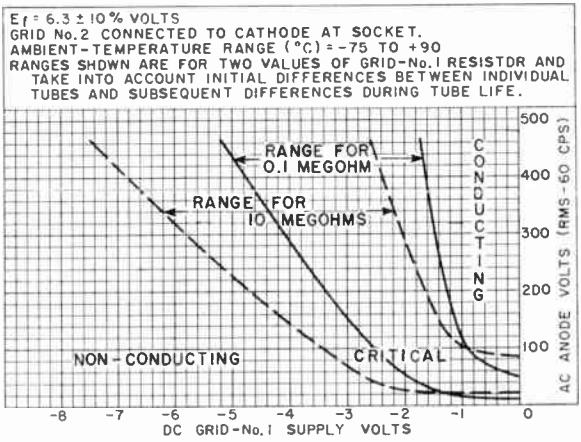
92CS-6541R2

During Tube Conduction



92CS-6275R2

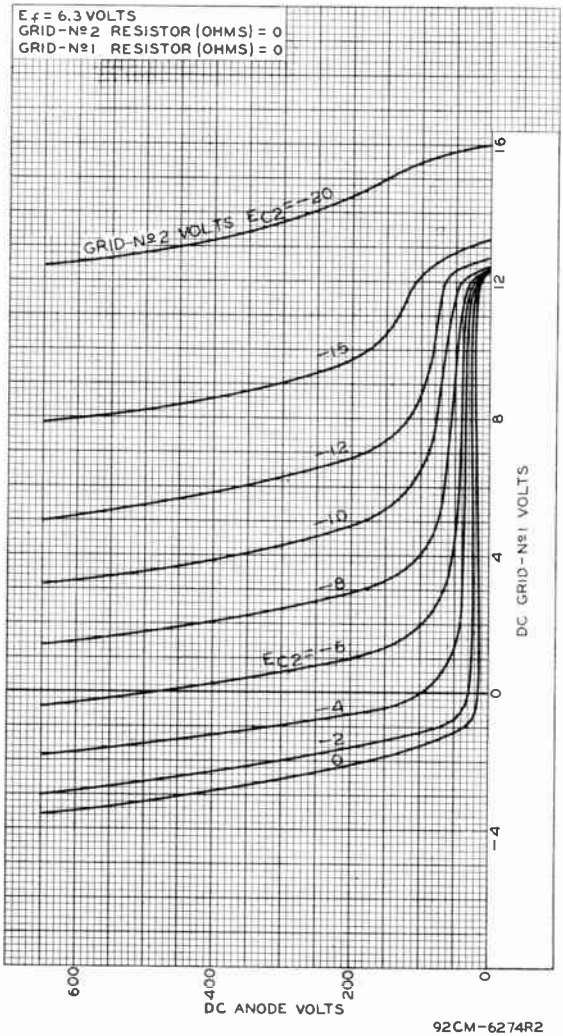
OPERATIONAL RANGE OF CRITICAL GRID-No.1 VOLTAGE



92CS-6540R3

2050-A

AVERAGE CONTROL CHARACTERISTICS



92CM-6274R2

SEALED, CLAMP-COOLED, MERCURY-POOL-CATHODE TYPE
For Resistance-Welding Control

GENERAL DATA

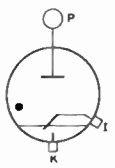
Electrical:

Cathode Excitation. . . . . .Cyclic
Cathode-Spot Starting . . . . . .By Ignitor
Minimum Requirements for Cathode Excitation:
  Peak ignitor voltage required to fire . . . . . 200 volts
  Peak ignitor current required to fire . . . . . 30 amp
  Starting time at required voltage or current . . 100 μsec
Tube Voltage Drop:
  At peak anode current of 1697 amperes . . . . . 30 volts
  At peak anode current of 70.4 amperes . . . . . 12 volts

Mechanical:

Operating Position. . . . . .Vertical, flexible lead up
Maximum Overall Length (Including flexible lead). . . . . 17-5/8"
Maximum Diameter. . . . . 2-1/2"
Weight (Approx.). . . . . 1.5 lbs
Terminal Diagram (See *Dimensional Outline*):

P – Anode Terminal (Flexible lead)
K – Cathode Terminal (Lower portion of shell)



I – Ignitor Terminal (Adjacent to exhaust tube)

Cooling:
  Type. . . . . Air or water-cooled clamp
  Clamp height (Approx.). . . . . 1-7/8"
  Clamp location. . . . . See *Dimensional Outline*

RESISTANCE-WELDING-CONTROL SERVICE[a]

Two Tubes in Inverse-Parallel Circuit

Maximum Ratings, *Absolute-Maximum Values:*

For frequencies from 25 to 60 cps

Ratings I-A and I-B Apply to Operation with a Clamp-Temperature Range of 10° to 75° C

RATING I-A

	Column 1[b]	*Column 2*[b]	
SUPPLY VOLTAGE (RMS).	250 max.	250 max.	volts
DEMAND POWER (During conduction) .	50 max.	150 max.	kva

→ Indicates a change.

	Column 1[b]	Column 2[b]	
DUTY[c,d]	10 max.	1.8 max.	%
ANODE CURRENT (Per tube):			
Peak	282 max.	846 max.	amp
Demand (RMS, during conduction)[e]	200 max.	600 max.	amp
Average (Averaged over any interval of 27.8 seconds maximum)[e]	9 max.	4.86 max.	amp
Fault, for duration of 0.15 second maximum	1680 max.	1680 max.	amp

RATING I-B

	Column 1[b]	Column 2[b]	
SUPPLY VOLTAGE (RMS)	600 max.	600 max.	volts
DEMAND POWER (During conduction)	50 max.	150 max.	kva
DUTY[c,d]	24 max.	4.32 max.	%
ANODE CURRENT (Per tube):			
Peak	118 max.	354 max.	amp
Demand (RMS, during conduction)[e]	83 max.	250 max.	amp
Average (Averaged over any interval of 11.6 seconds maximum)[e]	9 max.	4.86 max.	amp
Fault, for duration of 0.15 second maximum	700 max.	700 max.	amp

Ratings II-A and II-B Apply to Operation with a Clamp-Temperature Range of 10° to 50° C

RATING II-A

	Column 1[b]	Column 2[b]	
SUPPLY VOLTAGE (RMS)	250 max.	250 max.	volts
DEMAND POWER (During conduction)	100 max.	300 max.	kva
DUTY[c,d]	12.4 max.	2.24 max.	%
ANODE CURRENT (Per tube):			
Peak	564 max.	1692 max.	amp
Demand (RMS, during conduction)[e]	400 max.	1200 max.	amp
Average (Averaged over any interval of 2.2 seconds maximum)[e]	22.4 max.	12.1 max.	amp
Fault, for duration of 0.15 second maximum	3360 max.	3360 max.	amp

RATING II-B

	Column 1[b]	Column 2[b]	
SUPPLY VOLTAGE (RMS)	600 max.	600 max.	volts
DEMAND POWER (During conduction)	100 max.	300 max.	kva
DUTY[c,d]	30 max.	5.4 max.	%

ANODE CURRENT (Per tube):			
Peak	236 max.	708 max.	amp
Demand (RMS, during conduction)[e]	167 max.	500 max.	amp
Average (Averaged over any interval of 9.2 seconds maximum)[e]	22.4 max.	12.1 max.	amp
Fault, for duration of 0.15 second maximum	1400 max.	1400 max.	amp

RESISTANCE-WELDING CAPACITOR-DISCHARGE SERVICE

Maximum Ratings, *Absolute-Maximum Values:*

RATING I

CLAMP TEMPERATURE	70 max.	40 max.	°C
NUMBER OF DISCHARGES PER SECOND	60 max.	60 max.	
PEAK ANODE VOLTAGE:			
Forward	3000 max.	3000 max.	volts
Inverse	3000 max.	3000 max.	volts
ANODE CURRENT:			
Peak	500 max.	500 max.	amp
Average[f]	3 max.	15 max.	amp
Averaging time-interval[f]	3.3 max.	0.66 max.	sec
DURATION OF CATHODE-SPOT PER DISCHARGE	0.02 max.	0.02 max.	sec

RATING II

CLAMP TEMPERATURE	60 max.	40 max.	°C
NUMBER OF DISCHARGES PER SECOND	60 max.	60 max.	
PEAK ANODE VOLTAGE:			
Forward	6000 max.	6000 max.	volts
Inverse	3000 max.	3000 max.	volts
ANODE CURRENT:			
Peak	500 max.	500 max.	amp
Average[f]	2.5 max.	8 max.	amp
Averaging time-interval[f]	4 max.	1.25 max.	sec
DURATION OF CATHODE-SPOT PER DISCHARGE	0.02 max.	0.02 max.	sec

IGNITOR

Maximum Ratings, *Absolute-Maximum Values:*

PEAK IGNITOR VOLTAGE:		
Positive	900 max.	volts
Negative	5 max.	volts
IGNITOR CURRENT:		
Peak	100 max.	amp
Average (Averaged over any interval of 5 seconds maximum)	1 max.	amp
RMS	10 max.	amp

← Indicates a change.

[a] RMS voltage, current, and demand kva are on the basis of full-cycle conduction (no phase delay) regardless of whether or not phase control is used.

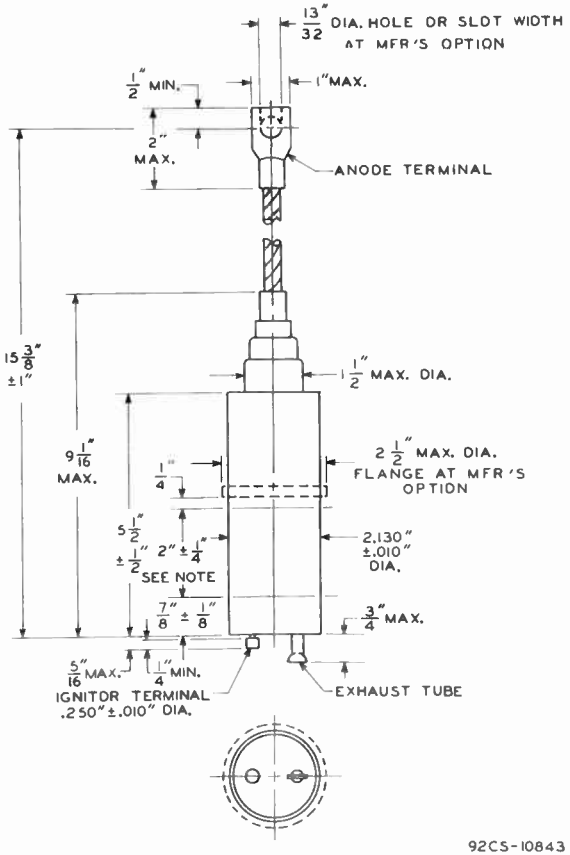
[b] *Column 1* represents operation at maximum average anode current; *Column 2* represents operation at maximum demand power.

[c] Defined as (cycles "on")/(cycles "on" + cycles "off") during the specified averaging time.

[d] For supply voltages between 250 volts and 600 volts, duty is proportional to supply voltage. For supply voltages lower than 250 volts, the values for 250 volts apply.

[e] For supply voltages between 250 volts and 600 volts, demand anode current and averaging time are each inversely proportional to supply voltage. For supply voltages lower than 250 volts, the values for 250 volts apply.

[f] With the use of log-log paper, straight-line interpolation between tabulated points may be used to obtain average-anode-current and maximum-averaging-time ratings at clamp temperatures between the two tabulated values.

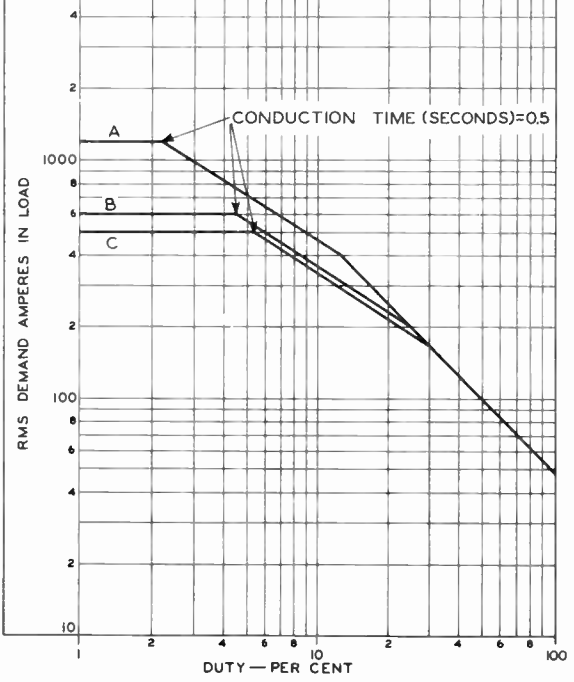


NOTE: CATHODE TERMINAL AND CLAMP-COOLED AREA.

RATING CHART 1
Resistance-Welding-Control Service

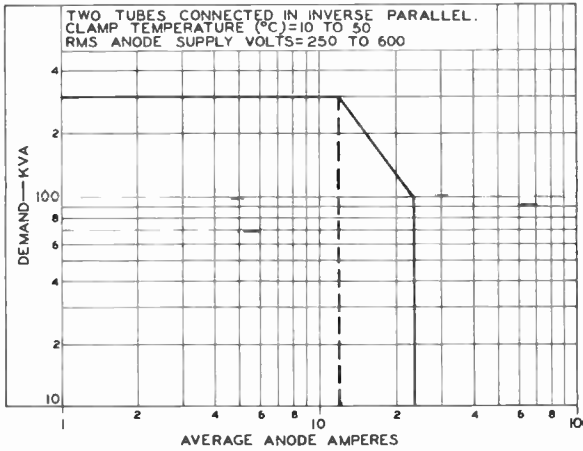
TWO TUBES CONNECTED IN INVERSE PARALLEL.
CLAMP TEMPERATURE (°C)=10 TO 50

CURVE	RMS ANODE SUPPLY VOLTS	MAXIMUM AVERAGING TIME— SECONDS
A	250	22
B	500	11
C	600	9.2



92CM-10840RI

RATING CHART 2
Resistance-Welding-Control Service



92CS-10842RI

5551-A
IGNITRON

WATER-COOLED, STEEL-JACKETED, MERCURY-POOL-CATHODE TYPE HAVING MOUNTING PLATE FOR THERMOSTATIC CONTROL

For resistance-welding control

GENERAL DATA

Electrical:

Cathode Excitation	Cyclic	
Cathode-Spot Starting	By Ignitor	
Minimum Requirements for Cathode Excitation:		
Peak ignitor voltage required to fire	200	volts
Peak ignitor current required to fire	30	amp
Starting time at required voltage or current	100	μsec
Tube Voltage Drop:		
At peak anode current of 3400 amperes	26	volts
At peak anode current of 176 amperes	13	volts

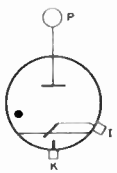
Mechanical:

Operating Position	Vertical, flexible lead up
Maximum Overall Length (Including flexible lead)	23-1/4"
Maximum Radius (Including water connections)	2-7/8"
Weight	3.6 lbs

Terminal Connections *(See Dimensional Outline):*

P – Anode Terminal (Flexible lead)

K – Cathode Terminal (Bar opposite anode terminal)



I – Ignitor Terminal (Within jacket skirt at cathode end)

Cooling:

Type	Water	
Minimum inlet water temperature	10	°C
Maximum outlet water temperature	40	°C
Minimum water flow	1	gpm
Maximum water-temperature rise	4	°C
Maximum pressure drop	2.5	psi

INTERMITTENT RECTIFIER SERVICE and FREQUENCY-CHANGER WELDER SERVICE

Maximum Ratings, *Absolute-Maximum Values:*

For zero phase-control angle and frequencies from 50 to 60 cps

RATING I

PEAK ANODE VOLTAGE:		
Forward	500 max.	volts
Inverse	500 max.	volts

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IGNITRON

ANODE CURRENT:			
Peak		700 max.	amp
Average (Averaged over any interval of 6 seconds maximum)		40 max.	amp
Fault, for duration of 0.15 second maximum		8750 max.	amp
RATING II			
PEAK ANODE VOLTAGE:			
Forward	1200 max.	1200 max.	volts
Inverse	1200 max.	1200 max.	volts
ANODE CURRENT:			
Peak	135 max.	600 max.	amp
Average (Averaged over any interval of 10 seconds maximum)	22.5 max.	5 max.	amp
Average (Averaged over any interval of 0.2 second maximum)	22.5 max.	100 max.	amp
Fault, for duration of 0.15 second maximum	7500 max.	7500 max.	amp
RATING III			
PEAK ANODE VOLTAGE:			
Forward	1500 max.	1500 max.	volts
Inverse	1500 max.	1500 max.	volts
ANODE CURRENT:			
Peak	108 max.	480 max.	amp
Average (Averaged over any interval of 10 seconds maximum)	18 max.	4 max.	amp
Average (Averaged over any interval of 0.2 second maximum)	18 max.	80 max.	amp
Fault, for duration of 0.15 second maximum	6000 max.	6000 max.	amp

RESISTANCE-WELDING-CONTROL SERVICE*

Two Tubes in Inverse-Parallel Circuit

Maximum Ratings, *Absolute-Maximum Values:*

For frequencies from 25 to 60 cps

Ratings I-A and I-B Apply to Operation Either (1) Without Water-Saving Thermostat, or (2) With Water-Saving Thermostat Shunted by Auxiliary Contactor

RATING I-A			
SUPPLY VOLTAGE (RMS)	250 max.	250 max.	volts
DEMAND POWER (During conduction)	200 max.	600 max.	kva

*: See next page.

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IGNITRON

DUTY▲†	15 max.	2.8 max.	%
ANODE CURRENT (Per tube):			
Peak	1130 max.	3400 max.	amp
Demand (RMS, during conduction)#	800 max.	2400 max.	amp
Average (Averaged over any interval of 18 seconds maximum)#	56 max.	30.2 max.	amp
Fault, for duration of 0.15 second maximum	6720 max.	6720 max.	amp
RATING I-B			
SUPPLY VOLTAGE (RMS)	600 max.	600 max.	volts
DEMAND POWER (During conduction)	200 max.	600 max.	kva
DUTY▲†	37 max.	6.7 max.	%
ANODE CURRENT (Per tube):			
Peak	466 max.	1410 max.	amp
Demand (RMS, during conduction)#	333 max.	1000 max.	amp
Average (Averaged over any interval of 7.5 seconds maximum)#	56 max.	30.2 max.	amp
Fault, for duration of 0.15 second maximum	2800 max.	2800 max.	amp
Ratings II-A and II-B Apply to Operation with Water-Saving Thermostat Not Shunted by Auxiliary Contactor			
RATING II-A			
SUPPLY VOLTAGE (RMS)	250 max.	250 max.	volts
DEMAND POWER (During conduction)	200 max.	600 max.	kva
DUTY▲†	9.7 max.	1.9 max.	%
ANODE CURRENT (Per tube):			
Peak	1130 max.	3400 max.	amp
Demand (RMS, during conduction)#	800 max.	2400 max.	amp
Average (Averaged over any interval of 25.6 seconds maximum)#	36 max.	21 max.	amp
Fault, for duration of 0.15 second maximum	6720 max.	6720 max.	amp
RATING II-B			
SUPPLY VOLTAGE (RMS)	600 max.	600 max.	volts
DEMAND POWER (During conduction)	200 max.	600 max.	kva
DUTY▲†	23 max.	4.7 max.	%

●,▲,†,#: See next page.

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IGNITRON

ANODE CURRENT (Per tube):			
Peak	466 max.	1410 max.	amp
Demand (RMS, during conduction)#.	333 max.	1000 max.	amp
Average (Averaged over any interval of 10.7 seconds maximum)#.	36 max.	21 max.	amp
Fault, for duration of 0.15 second maximum	925 max.	2800 max.	amp

IGNITOR

Maximum Ratings, *Absolute-Maximum Values:*

PEAK IGNITOR VOLTAGE:		
Positive	Equal to anode volts	
Negative	5 max.	volts
IGNITOR CURRENT:		
Peak	100 max.	amp
Average (Averaged over any interval of 5 seconds maximum)	1 max.	amp
RMS	10 max.	amp

● RMS voltage, current, and demand kva are on the basis of full-cycle conduction (no phase delay) regardless of whether or not phase control is used.

▲ Defined as (cycles "on")/(cycles "on" + cycles "off") during the specified averaging time.

† For supply voltages between 250 volts and 600 volts, duty is proportional to supply voltage. For supply voltages lower than 250 volts, the values for 250 volts apply.

For supply voltages between 250 volts and 600 volts, demand anode current and averaging time are each inversely proportional to supply voltage. For supply voltages lower than 250 volts, the values for 250 volts apply.

OPERATING CONSIDERATIONS

The 5551-A is equipped for mounting a thermostatic control with a mounting plate calibrated either for controlling the flow of cooling water through the water jacket, or for protection of the ignitron against overheating.

When the cooling water is circulated successively through the water jackets of two or more ignitrons, the *water-saving thermostat*, if used should be mounted on the ignitron connected directly to the water supply.

The water-saving thermostat, which has normally open contacts, is calibrated to close a circuit energizing a solenoid valve in the water-supply line and thus permit water flow to start when the temperature of the thermostat mounting plate exceeds approximately 35° C. Because of the lag between the heating of the ignitron envelope and the functioning of the water-saving thermostat to start water flow through the water jackets, the ignitron may overheat before the flow of cooling water starts.

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Such overheating can be prevented by the use of an auxiliary contactor shunted across the contacts of the water-saving thermostat and actuated by the welding-control switch. The contactor causes the solenoid valve in the water-supply line to open as soon as welding current flows.

If the water-saving thermostat is not shunted by an auxiliary contactor, it will be necessary to use a lower value of maximum average current than that which is specified when the auxiliary contactor is employed. The lower average current value is achieved by increasing the maximum averaging time and decreasing the maximum duty. Although the same maximum conduction time is permitted for both of these operating conditions, the use of the water-saving thermostat alone, without the auxiliary contactor requires a longer interval between successive welds than when the thermostat is shunted by the contactor.

When a *protective thermostat* is used, it should be mounted on an ignitron from which the cooling water discharges into the drain. The protective thermostat is calibrated to open a set of normally closed contacts at a jacket temperature of approximately 52° C. The opening of these contacts causes a protective device to function. This device may be a relay opening the ignitor firing controls, or preferably, a circuit breaker which removes power from the ignitrons.

Care must be taken to insure that the water jacket of each ignitron is completely filled before power is applied. Tube operation with a partially filled water jacket may cause abnormal heating of the tube envelope, with resultant arc-back which impairs tube life. It is also necessary to arrange the cooling system so as to prevent any draining of the water jackets when the flow of water ceases.

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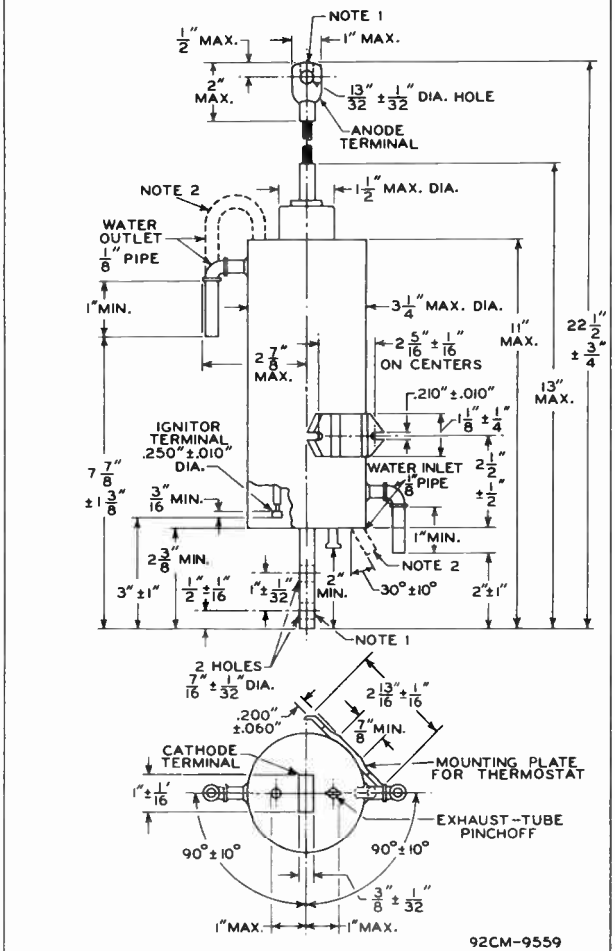
5551-A
IGNITRON



NOTE 1: MAY BE SLOTTED.
NOTE 2: DASHED POSITION MANUFACTURER'S OPTION.

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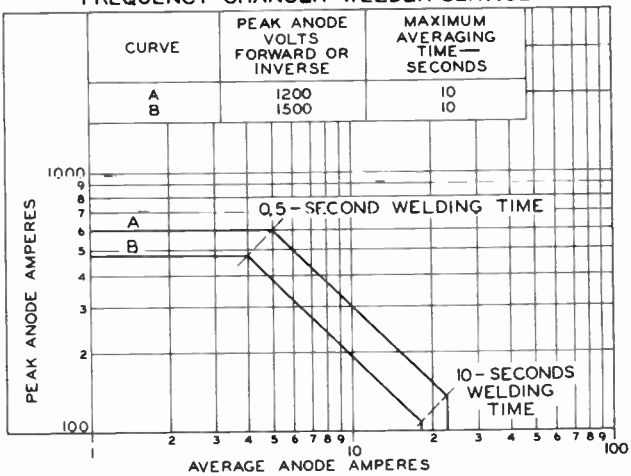
5551-A

RATING CHARTS

FREQUENCY-CHANGER-WELDER SERVICE

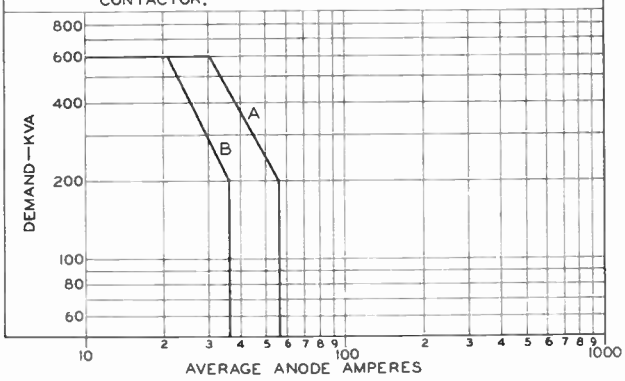
CURVE	PEAK ANODE VOLTS FORWARD OR INVERSE	MAXIMUM AVERAGING TIME— SECONDS
A	1200	10
B	1500	10



92CS-9695

RESISTANCE-WELDING-CONTROL SERVICE

TWO TUBES CONNECTED IN INVERSE PARALLEL.
RMS ANODE-SUPPLY VOLTS = 250 TO 600
CURVE A: NO WATER-SAVING THERMOSTAT, OR WATER-SAVING THERMOSTAT SHUNTED BY AUXILIARY CONTACTOR.
CURVE B: WATER-SAVING THERMOSTAT WITHOUT AUXILIARY CONTACTOR.



92CS-9698

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

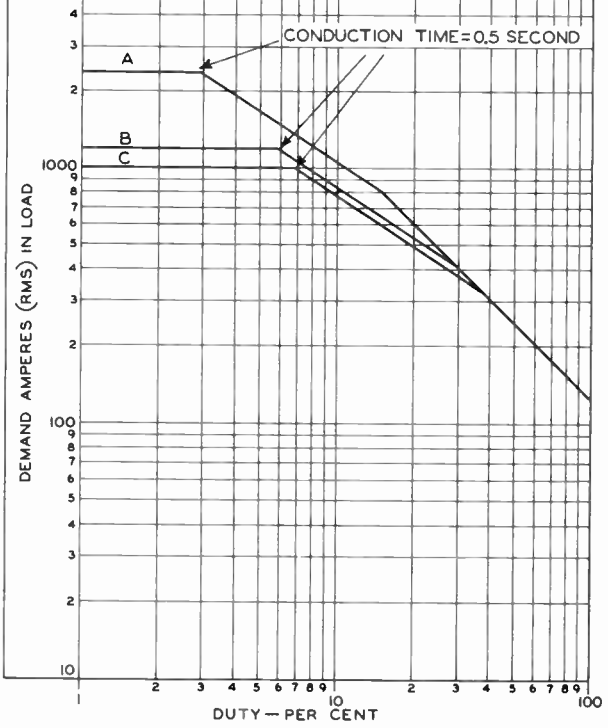
5551-A

RATING CHART

RESISTANCE-WELDING-CONTROL SERVICE

TWO TUBES CONNECTED IN INVERSE PARALLEL
NO WATER-SAVING THERMOSTAT, OR WATER-SAVING THERMOSTAT SHUNTED BY AUXILIARY CONTACTOR.
PROTECTIVE THERMOSTAT OPTIONAL.

CURVE	RMS ANODE-SUPPLY VOLTS	MAXIMUM AVERAGING TIME—SECONDS
A	250	18
B	500	9
C	600	7.5



ELECTRON TUBE DIVISION 92CM-9696

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

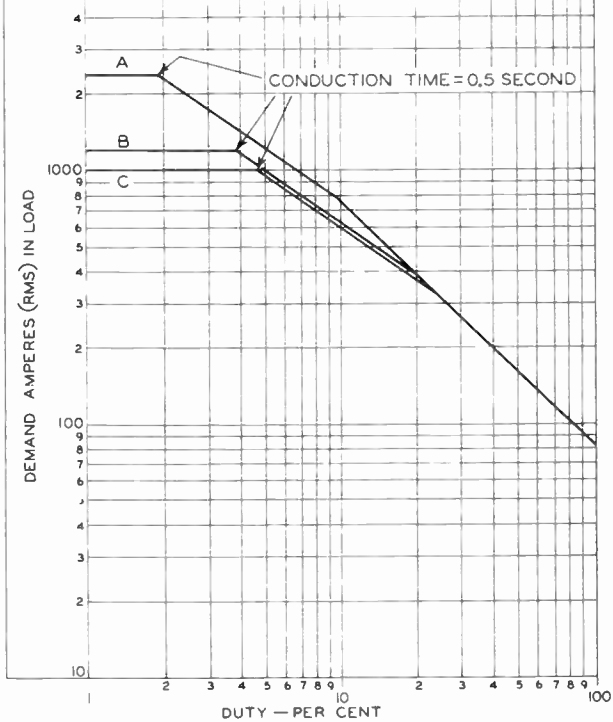
5551-A

RATING CHART

RESISTANCE-WELDING-CONTROL SERVICE

TWO TUBES CONNECTED IN INVERSE PARALLEL.
WATER-SAVING THERMOSTAT WITHOUT AUXILIARY CONTACTOR.
PROTECTIVE THERMOSTAT OPTIONAL.

CURVE	RMS ANODE-SUPPLY VOLTS	MAXIMUM AVERAGING TIME—SECONDS
A	250	25.6
B	500	12.8
C	600	10.7



5552-A
IGNITRON

WATER-COOLED, STEEL-JACKETED, MERCURY-POOL-CATHODE
TYPE HAVING MOUNTING PLATE FOR THERMOSTATIC CONTROL
For resistance-welding control

GENERAL DATA

Electrical:

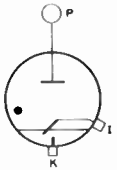
Cathode Excitation	Cyclic	
Cathode-Spot Starting	By Ignitor	
Minimum Requirements for Cathode Excitation:		
Peak ignitor voltage required to fire	200	volts
Peak ignitor current required to fire	30	amp
Starting time at required voltage or current	100	μsec
Tube Voltage Drop:		
At peak anode current of 6800 amperes	28	volts
At peak anode current of 440 amperes	14	volts

Mechanical:

Operating Position	Vertical, flexible lead up
Maximum Overall Length (Including flexible lead)	27-1/4"
Maximum Radius (Including water connections)	3-5/8"
Weight	8 lbs

Terminal Connections (*See Dimensional Outline*):

P – Anode Terminal (Flexible lead)
K – Cathode Terminal (Bar opposite anode terminal)



I – Ignitor Terminal (Within jacket skirt at cathode end)

Cooling:		
Type	Water	
Minimum inlet water temperature	10	°C
Maximum outlet water temperature	40	°C
Minimum water flow	1.5	gpm
Maximum water-temperature rise	6	°C
Maximum pressure drop	6	psi

INTERMITTENT RECTIFIER SERVICE

Maximum Ratings, *Absolute-Maximum Values:*

For zero phase-control angle and frequencies from 25 to 60 cps

PEAK ANODE VOLTAGE:		
Forward	500 max.	volts
Inverse	500 max.	volts

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5552-A

IGNITRON

ANODE CURRENT:			
Peak	1600 max.		amp
Average (Averaged over any interval of 6 seconds maximum)	100 max.		amp
Fault, for duration of 0.15 second maximum	6000 max.		amp

RESISTANCE-WELDING-CONTROL SERVICE*

Two Tubes in Inverse-Parallel Circuit

Maximum Ratings, *Absolute-Maximum Values:*

For frequencies from 25 to 60 cps

Ratings I-A and I-B Apply to Operation Either (1) Without Water-Saving Thermostat, or (2) With Water-Saving Thermostat Shunted by Auxiliary Contactor

RATING I-A

	*Column 1**	*Column 2**	
SUPPLY VOLTAGE (RMS)	250 max.	250 max.	volts
DEMAND POWER (During conduction)	400 max.	1200 max.	kva
DUTY▲†	19 max.	3.5 max.	%
ANODE CURRENT (Per tube):			
Peak	2260 max.	6800 max.	amp
Demand (RMS, during conduction)#	1600 max.	4800 max.	amp
Average (Averaged over any interval of 14 seconds maximum)#	140 max.	75.6 max.	amp
Fault, for duration of 0.15 second maximum	13450 max.	13450 max.	amp

RATING I-B

	*Column 1**	*Column 2**	
SUPPLY VOLTAGE (RMS)	600 max.	600 max.	volts
DEMAND POWER (During conduction)	400 max.	1200 max.	kva
DUTY▲†	47 max.	8.5 max.	%
ANODE CURRENT (Per tube):			
Peak	945 max.	2830 max.	amp
Demand (RMS, during conduction)#	666 max.	2000 max.	amp
Average (Averaged over any interval of 5.8 seconds maximum)#	140 max.	75.6 max.	amp
Fault, for duration of 0.15 second maximum	5600 max.	5600 max.	amp

*,▲,†,#,•: See next page.

5552-A

IGNITRON

Ratings II-A and II-B Apply to Operation with Water-Saving Thermostat Not Shunted by Auxiliary Contactor

RATING II-A

	Column 1*	Column 2*	
SUPPLY VOLTAGE (RMS)	250 max.	250 max.	volts
DEMAND POWER (During conduction)	400 max.	1200 max.	kva
DUTY▲†	11 max.	2 max.	%
ANODE CURRENT (Per tube):			
Peak	2260 max.	6800 max.	amp
Demand (RMS, during conduction)#	1600 max.	4800 max.	amp
Average (Averaged over any interval of 23.5 seconds maximum)#	80 max.	43 max.	amp
Fault, for duration of 0.15 second maximum.	13450 max.	13450 max.	amp

RATING II-B

	Column 1*	Column 2*	
SUPPLY VOLTAGE (RMS)	600 max.	600 max.	volts
DEMAND POWER (During conduction)	400 max.	1200 max.	kva
DUTY▲†	26 max.	4.8 max.	%
ANODE CURRENT (Per tube):			
Peak	945 max.	2830 max.	amp
Demand (RMS, during conduction)#	666 max.	2000 max.	amp
Average (Averaged over any interval of 10 seconds maximum)#	80 max.	43 max.	amp
Fault, for duration of 0.15 second maximum.	5600 max.	5600 max.	amp

IGNITOR

Maximum Ratings, ***Absolute-Maximum Values:***

PEAK IGNITOR VOLTAGE:		
Positive	Equal to anode volts	
Negative	5 max.	volts
IGNITOR CURRENT:		
Peak	100 max.	amp
Average (Averaged over any interval of 5 seconds maximum)	1 max.	amp
RMS	10 max.	amp

●,▲,†,#,*: See next page.

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5552-A
IGNITRON

● RMS voltage, current, and demand kva are on the basis of full-cycle conduction (no phase delay) regardless of whether or not phase control is used.

▲ Defined as (cycles "on")/(cycles "on" + cycles "off") during the specified averaging time.

† For supply voltages between 250 volts and 600 volts, duty is proportional to supply voltage. For supply voltages lower than 250 volts, the values for 250 volts apply.

For supply voltages between 250 volts and 600 volts, demand anode current and averaging time are each inversely proportional to supply voltage. For supply voltages lower than 250 volts, the values for 250 volts apply.

• Column 1 represents operation at maximum average anode current; Column 2 represents operation at maximum demand current.

OPERATING CONSIDERATIONS
for the 5552-A are the same as
those shown for Type 5551-A

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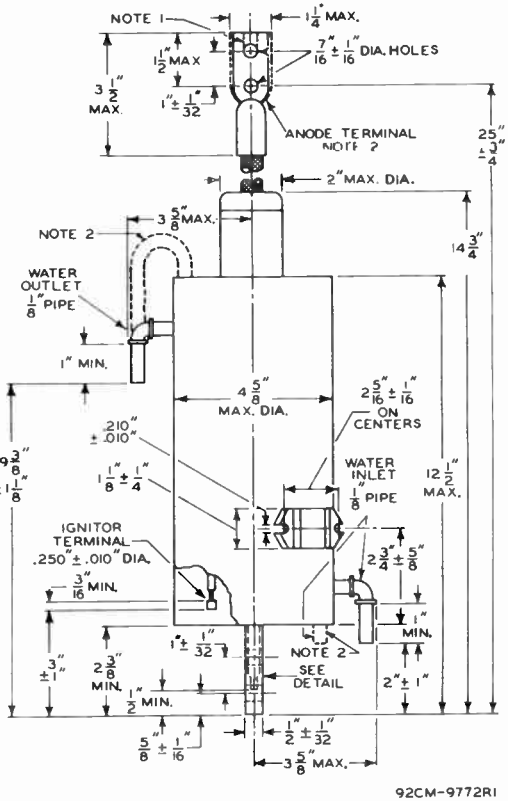
TENTATIVE DATA 2

5552-A

IGNITRON



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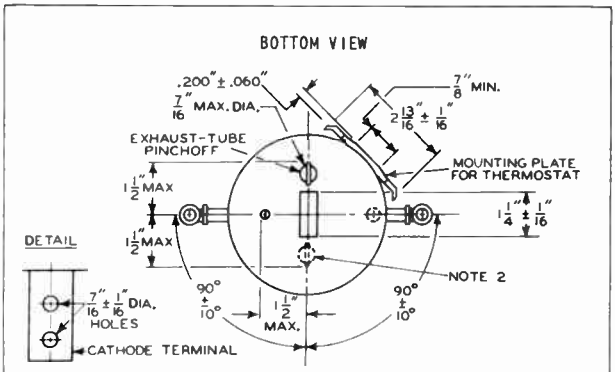
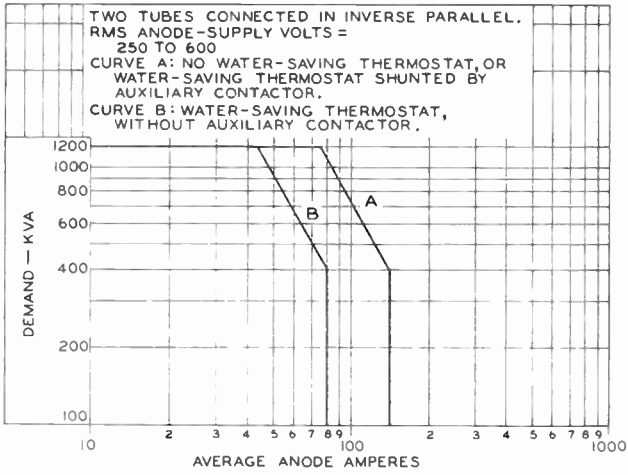
IGNITRON



4-54 CE-9772R1B

RATING CHART
RESISTANCE-WELDING-CONTROL SERVICE



ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

92CS-9712

RCA

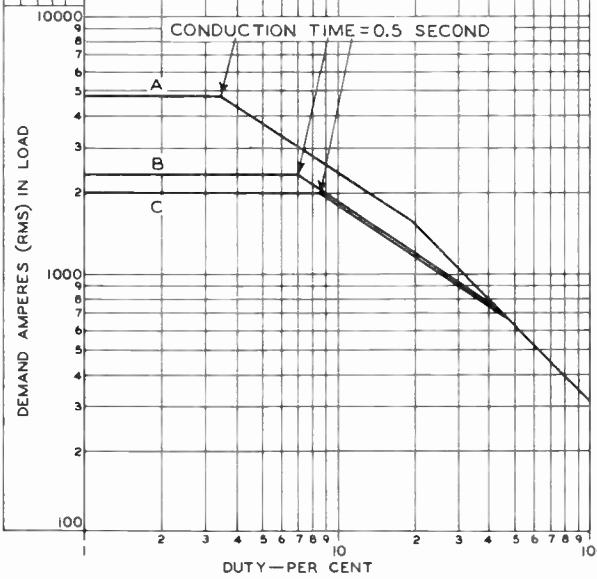
5552-A

RATING CHART

RESISTANCE-WELDING-CONTROL SERVICE

TWO TUBES CONNECTED IN INVERSE PARALLEL, NO WATER-SAVING THERMOSTAT, OR WATER-SAVING THERMOSTAT SHUNTED BY AUXILIARY CONTACTOR PROTECTIVE THERMOSTAT OPTIONAL.

CURVE	RMS ANODE-SUPPLY VOLTS	MAXIMUM AVERAGING TIME—SECONDS
A	250	14
B	500	7
C	600	5.8



RCA

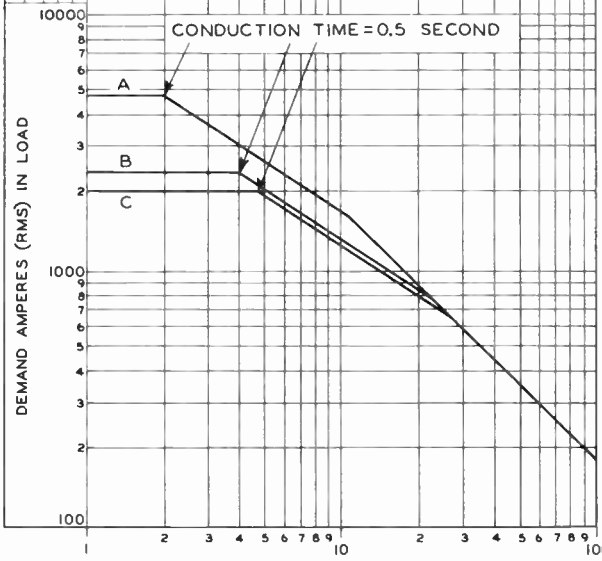
5552-A

RATING CHART

RESISTANCE-WELDING-CONTROL SERVICE

TWO TUBES CONNECTED IN INVERSE PARALLEL.
WATER-SAVING THERMOSTAT WITHOUT AUXILIARY CONTACTOR.
PROTECTIVE THERMOSTAT OPTIONAL.

CURVE	RMS ANODE-SUPPLY VOLTS	MAXIMUM AVERAGING TIME—SECONDS
A	250	23.5
B	500	11.8
C	600	10



ELECTRON TUBE DIVISION 92CM-9711

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

5557

MERCURY-VAPOR THYRATRON

NEGATIVE-CONTROL TRIODE TYPE

GENERAL DATA

Electrical:

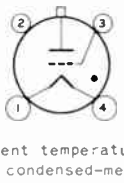
Filament, Coated:

	Min.	Av.	Max.	
Voltage	2.38	2.5	2.62	ac or dc volts
Current at 2.5 volts	–	5.0	5.5	amp
Minimum heating time prior to tube conduction				sec

Direct Interelectrode Capacitances (Approx.):°		
Grid to anode	2.5	μμf
Grid to cathode	7	μμf
Ionization Time (Approx.)	10	μsec
Deionization Time (Approx.)	1000	μsec
Anode Voltage Drop (Approx.)	16	volts

Mechanical:

Operating Position	Vertical, base down
Maximum Overall Length	6-1/8"
Seated Length	5-1/4" ± 1/4"
Maximum Diameter	2-1/16"
Weight (Approx.)	3 oz
Bulb	ST16
Cap	Medium (JETEC No.C1-5)
Base	Medium-Shell Small 4-Pin with Bayonet (JETEC No.A4-10)
Basing Designation for BOTTOM VIEW	3G



Pin 1 – Filament
Pin 2 – No Connection
Pin 3 – Grid
Pin 4 – Filament
Cap – Anode

Temperature Control:

Heating--When the ambient temperature is so low that the normal rise of condensed-mercury temperature above the ambient temperature will not bring the condensed-mercury temperature up to the minimum value of the operating ranges specified under *Maximum Ratings*, some form of heat-conserving enclosure or auxiliary heater will be required.

Cooling--When the operating conditions are such that the maximum value of the operating condensed-mercury temperature is exceeded, provision should be made for forced-air cooling sufficient to prevent exceeding the maximum value.

Temperature Rise of Condensed Mercury to Equilibrium Above Ambient Temperature (Approx.):*		
No load	17.5	°C

° without external shield.

* with filament volts = 2.38 and no heat-conserving enclosure.

ELECTRON TUBE DIVISION
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5557

MERCURY-VAPOR THYRATRON

CONTROL SERVICE

→ **Maximum Ratings,** *Absolute Values:*

For anode-supply frequency of 60 cps

	Operating Condensed-Mercury-Temperature Range 40° to 90° C	40° to 80° C	40° to 60° C	
PEAK ANODE VOLTAGE:				
Forward	1250 max.	2500 max.	5000 max.	volts
Inverse	1250 max.	5000 max.	10000 max.	volts
GRID VOLTAGE:				
Peak or DC, before tube conduction	-500 max.	-500 max.	-500 max.	volts
Average▲, during tube conduction	-10 max.	-10 max.	-10 max.	volts
ANODE CURRENT:				
Peak	3 max.	2 max.	1 max.	amp
Average#	1 max.	0.5 max.	0.25 max.	amp
Fault, for duration of 0.1 second maximum	40 max.	40 max.	40 max.	amp
GRID CURRENT:				
Average🌡, positive with anode positive	0.05 max.	0.05 max.	0.05 max.	amp

▲ Averaged over one conducting period.

\# Averaged over any interval of 15 seconds maximum.

🌡 Averaged over period of grid conduction.

DIMENSIONAL OUTLINE

for Type 5557 is the same as that shown for Type 3C23

→ Indicates a change.

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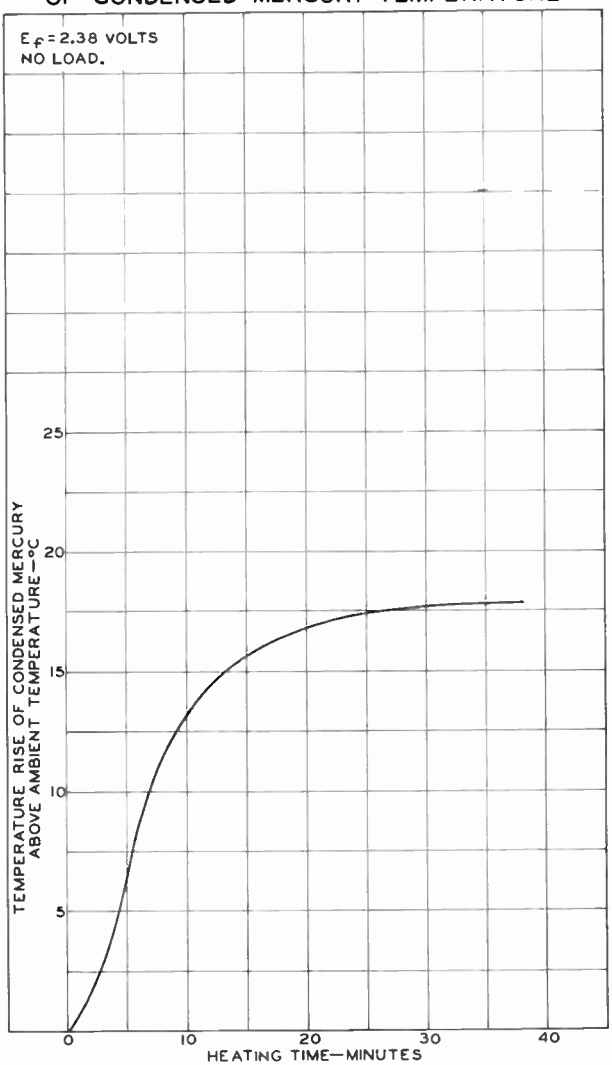
5557
RATE OF RISE OF CONDENSED-MERCURY TEMPERATURE



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

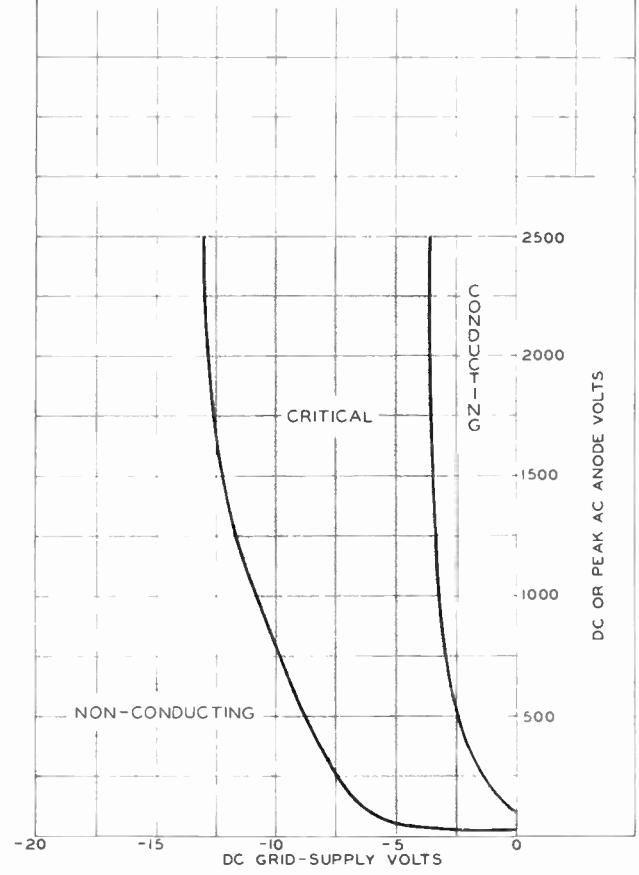
92CM-9301T

5557

5557

OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

RANGE IS FOR CONDITIONS WHERE:
E_f = 2.5 VOLTS AC ± 5%
CIRCUIT RETURNS TO FILAMENT TRANSFORMER CENTER-TAP.
FILAMENT VOLTAGE AT PIN 1 IS (+) WHEN ANODE VOLTAGE IS (+).
THE RANGE INCLUDES INITIAL AND LIFE VARIATIONS OF INDIVIDUAL TUBES.
GRID RESISTOR (OHMS) = 1000
CONDENSED-MERCURY-TEMPERATURE RANGE = 40 TO 80 °C



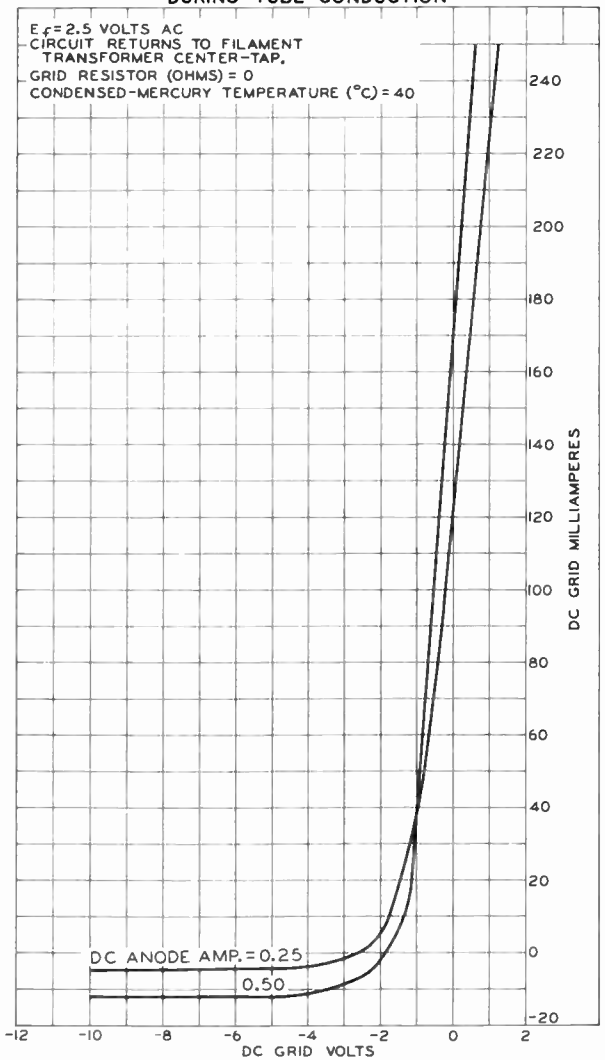
TUBE DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

92CM-9300T

RCA

5557

AVERAGE GRID CHARACTERISTICS
DURING TUBE CONDUCTION



5559

THYRATRON

MERCURY-VAPOR TRIODE

DATA

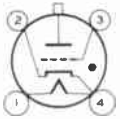
Electrical:

Heater, for Unipotential Cathode:		
Voltage	5.0	volts
Current	4.5	amp
Cathode:		
Minimum Heating Time, prior to tube conduction	5	minutes
Direct Interelectrode Capacitances (Approx.):		
Grid to Anode	2.5	μμf
Grid to Cathode	10	μμf
Ionization Time (Approx.)	10	μsec
Deionization Time (Approx.)	1000	μsec
Anode Voltage Drop (Approx.)	16	volts
Grid-No.1 Control Ratio (Approx.) with grid-No.1 resistor (megohms) = 0		220

Mechanical:

Mounting Position	Vertical, Base Down
Overall Length	7" ± 1/4"
Seated Length	6-3/8" ± 1/4"
Maximum Diameter	3"
Bulb	ST-23
Cap	Medium
Base	Medium-Shell Small 4-Pin, Bayonet
Basing Designation for BOTTOM VIEW	4BL

Pin 1 – Heater
Pin 2 – Cathode; Circuit Returns
Pin 3 – Grid
Pin 4 – Heater, Cathode
Cap – Anode



Maximum Ratings, *Absolute Values*:

PEAK ANODE VOLTAGE:		
Forward	1000 max.	volts
Inverse	1000 max.	volts
GRID VOLTAGE:		
Before Conduction	-500 max.	volts
During Conduction	-10 max.	volts
CATHODE CURRENT:		
Peak	15 max.	amp
Average**	2.5 max.	amp
Fault, for 0.1 sec. maximum	200 max.	amp
GRID CURRENT:		
Average**	+0.25 max.	amp
COND.-MERCURY TEMPERATURE RANGE▲	+40 to +80	°C
OPERATING FREQUENCY	150 max.	cps

** Averaged over any interval of 15 sec. max.

▲ Recommended operating temperature is 40°C.

← Indicates a change.

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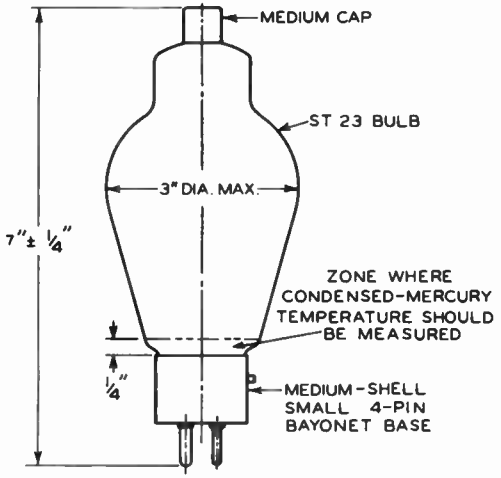
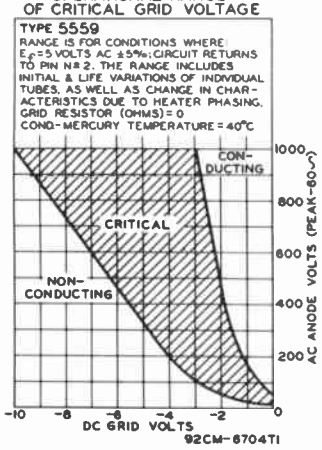
5559
THYRATRON



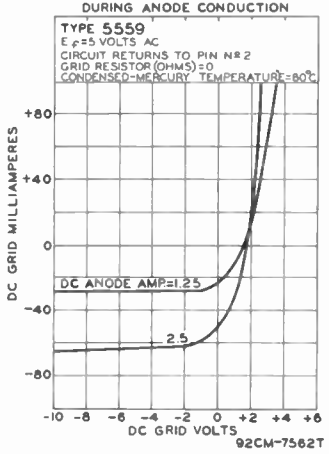
5559

THYRATRON

OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE



AVERAGE GRID CHARACTERISTICS DURING ANODE CONDUCTION

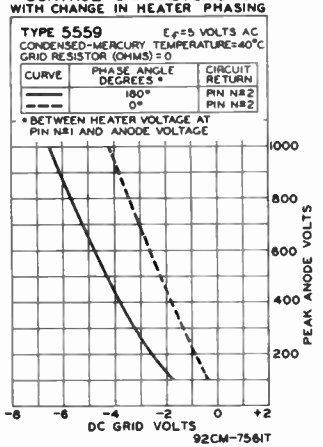


RCA

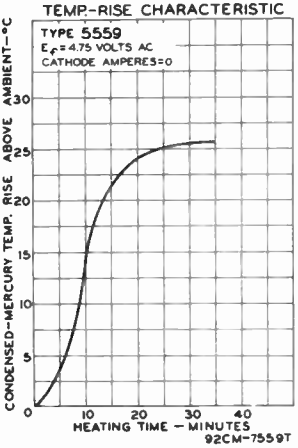
5559

THYRATRON

SHIFT OF AVERAGE CONTROL CHARACTERISTIC WITH CHANGE IN HEATER PHASING



TEMP-RISE CHARACTERISTIC



TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

5560

THYRATRON

MERCURY-VAPOR TETRODE

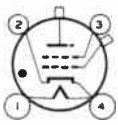
DATA

Electrical:

Heater, for Unipotential Cathode:				
Voltage	5.5□	5.0		volts
Current	5.0□	4.5		amp
Cathode:				
Minimum Heating Time, prior to tube conduction		5		minutes
Direct Interelectrode Capacitances (Approx.):				
Grid No.1 to Anode		0.2		μμf
Grid No.1 to Cathode		4.4		μμf ←
Ionization Time (Approx.)		10		μsec
Deionization Time (Approx.)		1000		μsec
Anode Voltage Drop (Approx.)		16		volts
Grid-No.1 Control Ratio (Approx.) with grid-No.1 resistor (ohms) = 0; grid-No.1 and grid-No.2 volts = 0				170 ←
Grid-No.2 Control Ratio (Approx.) with grid No.1 resistor (ohms) = 0; grid-No.1 and grid-No.2 volts = 0				300 ←

Mechanical:

Mounting Position	Vertical, Base Down
Overall Length	7-11/16" ± 1/4"
Seated Length	7-1/16" ± 1/4" ←
Greatest Radius	2-1/4"
Bulb	ST-23
Caps (Two)	Medium
Base	Medium-Shell Small 4-Pin, Bayonet
Basing Designation for BOTTOM VIEW	4CD



Pin 1 – Heater
Pin 2 – Cathode; Circuit Returns
Pin 3 – Grid No.2
Pin 4 – Heater, Cathode
Top Cap – Anode
Side Cap – Grid No.1

Maximum Ratings, ***Absolute Values:***

PEAK ANODE VOLTAGE:			
Forward		1000 max.	volts
Inverse		1000 max.	volts
GRID-No.2 (SHIELD-GRID) VOLTAGE:			
Before Conduction		-300 max.	volts
During Conduction		-5 max.	volts
GRID-No.1 (CONTROL-GRID) VOLTAGE:			
Before Conduction		-1000 max.	volts
During Conduction		-10 max.	volts ←
CATHODE CURRENT:			
Peak	30 max.□	15 max.	amp
Average**	0.5 max.□	2.5 max.	amp
Fault, for 0.1 sec. maximum		200 max.	amp

□ **: See next page. ←Indicates a change.

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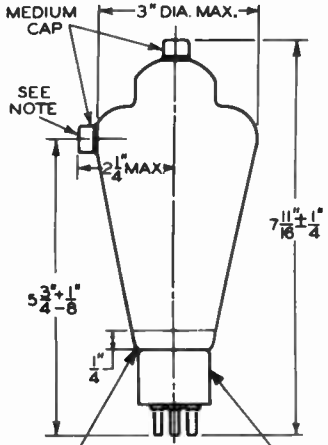
THYRATRON

GRID-No.2 CURRENT:		
Average**	0.25 max.	amp
GRID No.1 CURRENT:		
Average**	0.25 max.	amp
COND.-MERCURY TEMPERATURE RANGE▲	+40 to +80	°C
OPERATING FREQUENCY	150 max.	cps

□ Applies when this tube is used for ignitor firing.
** Averaged over any interval of 15 sec. max.
▲ Recommended operating temperature is 40°C.



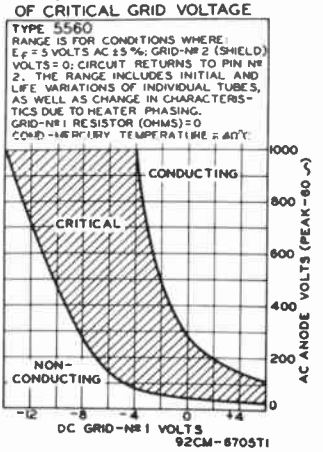
92CS-6742RI

NOTE: THE PLANE THROUGH TUBE AXIS AND CENTER OF GRID-№1 CAP IS 45° ± 5° FROM THE PLANE THROUGH THE TUBE AXIS AND CENTER OF BAYONET PIN. GRID-№1 CAP IS ON SAME SIDE AS PIN №3.

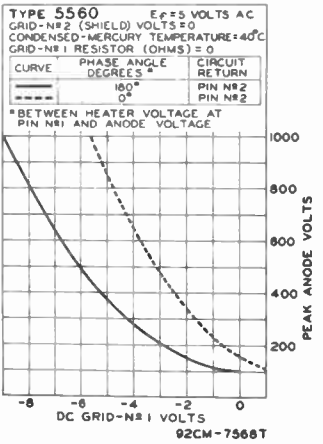
TEMPERATURE-RISE CHARACTERISTIC of the 5560 is the same as that shown for Type 5559

5560
THYRATRON

OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE



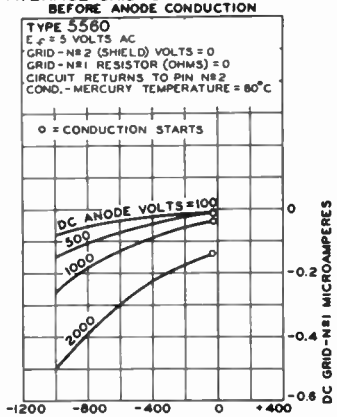
SHIFT OF AVERAGE CONTROL CHARACTERISTIC WITH CHANGE IN HEATER PHASING



5560

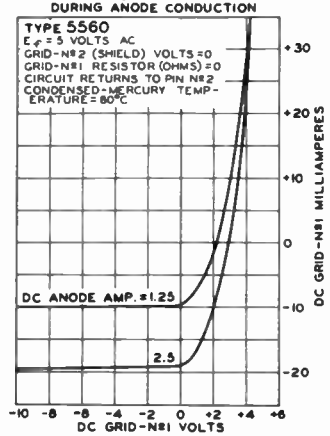
THYRATRON

AVERAGE GRID CHARACTERISTICS
BEFORE ANODE CONDUCTION



92CM-7556T

AVERAGE GRID CHARACTERISTICS
DURING ANODE CONDUCTION



92CM-7570T

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

5563
THYRATRON
MERCURY-VAPOR TRIODE

GENERAL DATA

Electrical:

Filament, Coated:			
Voltage	5		volts
Current	10		amp
Minimum Heating Time:			
At initial installation without anode voltage, for proper distribution of condensed mercury	15		minutes
During subsequent operation and prior to conduction, for bringing condensed-mercury temperature within operating range.		Not less than 60 seconds to provide adequate filament heating; longer, if required by low ambient temperatures.	
Direct Interelectrode Capacitances:[o]			
Grid to Anode	10 max.		μμf
Grid to Cathode	20 max.		μμf
Ionization Time	10 approx.		μseconds
Deionization Time	1000 approx.		μseconds
Anode Voltage Drop	15 approx.		volts
Grid Control Ratio[▲]	200 approx.		

[o] With no external shield.

Mechanical:

Mounting Position	Vertical, base down
Overall Length	10-1/8" to 11-1/16"
Maximum Diameter	3-7/8"
Cooling	Convection
Bulb	T-24
Cap	Skirted Medium No. 3985
Base	Medium-Metal-Shell Jumbo 4-Pin, Bayonet

BOTTOM VIEW

Pin 1 – Grid
Pin 2 – Filament, Internal Shield
Pin 3 – No Connection
Pin 4 – Filament
Cap – Anode

Maximum Ratings, ***Absolute Values*****:**
For Anode-Supply Frequencies between 25 and 150 cps

COND. MERCURY TEMP. RANGE[□]	25 – 55	25 – 50	°C
PEAK ANODE VOLTAGE:			
Forward	10000 max.	15000 max.	volts
Inverse	10000 max.	15000 max.	volts
GRID VOLTAGE:			
Before Anode Conduction (Peak or DC)	-500 max.	-500 max.	volts
During Anode Conduction (Average)[●]	-10 max.	-10 max.	volts

▲,□,●: See next page.

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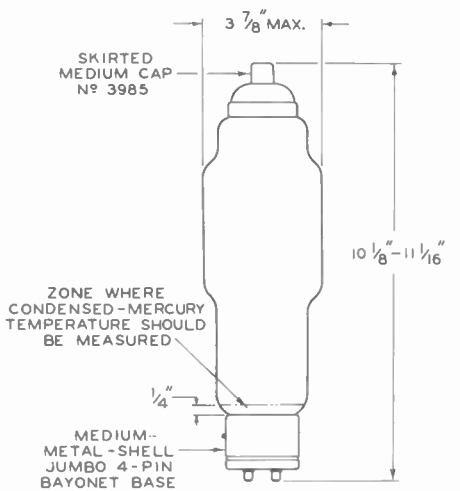
THYRATRON

CATHODE CURRENT:			
Peak	10 max.	6.4 max.	amp
Average	1.8 max.	1.6 max.	amp
Surge, for max. duration of 0.1 second	200 max.	200 max.	amp
Averaging Time	1	1	cycle
GRID CURRENT:			
Peak	+1 max.	+1 max.	amp
Average	+0.1 max.	+0.1 max.	amp
Averaging Time	1	1	cycle
Maximum Circuit Values:			
Grid-Circuit Resistance	0.1 max.	0.1 max.	megohm

▲ For conditions with 0.1-megohm grid resistor, circuit returns to pin No.2 as datum of potential, and filament voltage at pin No.4 180° out of phase with the anode voltage.

□ Recommended operating value is 40° ± 5°C.

● Averaged over one conducting cycle.



92CS-6832

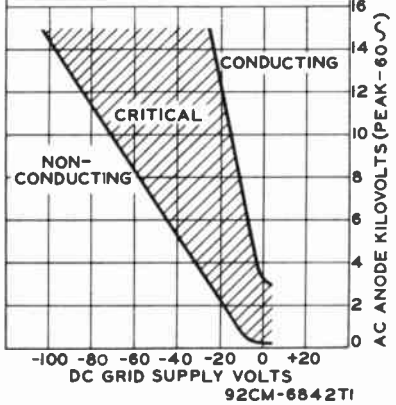
5563
THYRATRON

OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

TYPE 5563

RANGE IS FOR CONDITIONS WHERE:

E_f = 5 VOLTS AC ± 5%; CIRCUIT RETURNS TO PIN №2; FIL. VOLTAGE AT PIN №4 IS(-) WHEN ANODE VOLTAGE IS(+). THE RANGE INCLUDES INITIAL & LIFE VARIATIONS OF INDIVIDUAL TUBES. GRID RESISTOR = 10000 TO 100000 OHMS. COND. MERCURY TEMPERATURE = 25° TO 50°C.



RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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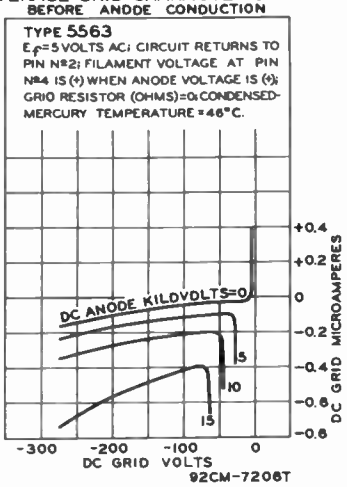
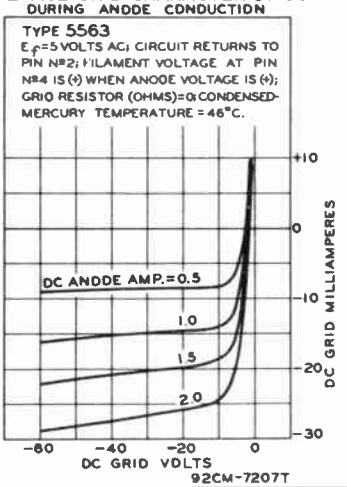
5563
THYRATRON

AVERAGE GRID CHARACTERISTICS
BEFORE ANODE CONDUCTION



AVERAGE GRID CHARACTERISTICS
DURING ANODE CONDUCTION



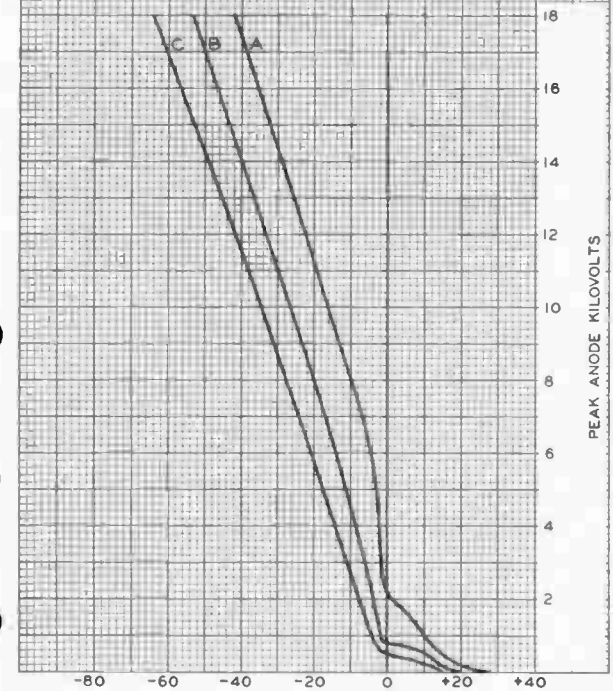
RCA

5563

AVERAGE CONTROL CHARACTERISTICS

E_f=5 VOLTS AC
CIRCUIT RETURNS TO PIN №2.
FILAMENT VOLTAGE AT PIN №4 IS (+) WHEN ANODE VOLTAGE IS (+).
GRID RESISTOR=25000 OHMS

CURVE	CONDENSED MERCURY TEMPERATURE
A	25°C
B	40°C
C	55°C



RCA

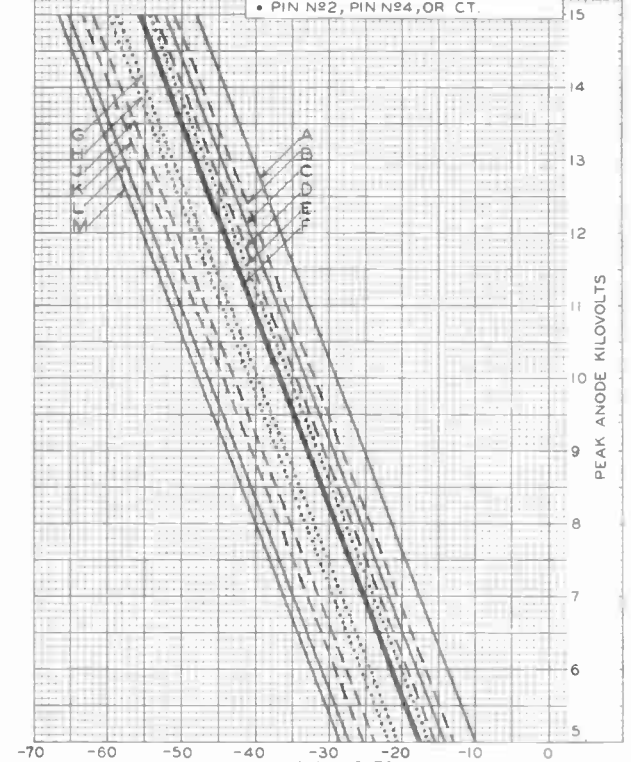
5563

SHIFT OF AVERAGE CONTROL CHARACTERISTICS
WITH CHANGE IN FILAMENT PHASING AND CIRCUIT RETURN

E_f=5 VOLTS AC

CURVE	PHASE ANGLE DEGREES*	CIRCUIT RETURN	CURVE	PHASE ANGLE DEGREES*	CIRCUIT RETURN
A ——	0	PIN №2	G ·····	135	PIN №4
B – – –	0	CT°	H ·····	180	PIN №4
C ——	45	PIN №2	J – – –	135	CT°
D – – –	45	CT°	K – – –	180	CT°
E ·····	0	PIN №4	L ——	135	PIN №2
F ——	90	ANY°	M ——	180	PIN №2

* BETWEEN FILAMENT VOLTAGE AT PIN №4 AND ANODE VOLTAGE
° CENTER TAP OF FILAMENT TRANSFORMER
• PIN №2, PIN №4, OR CT.



MAY 17, 1949 TUBE DEPARTMENT 92CM-7285

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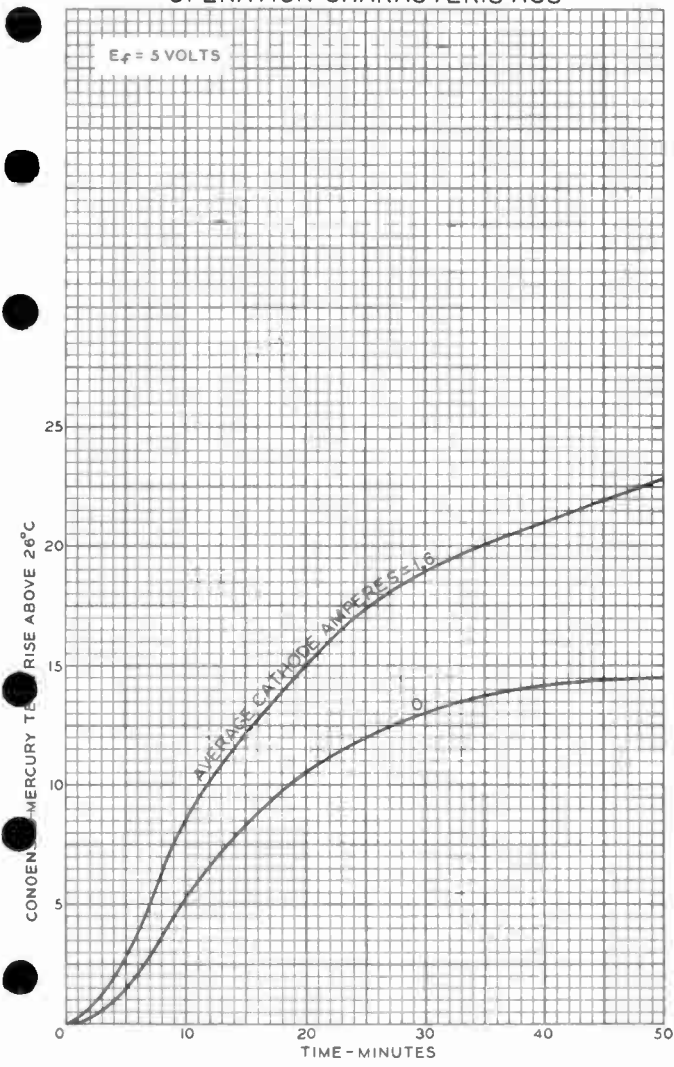
OPERATION CHARACTERISTICS



RCA

5563-A

MERCURY-VAPOR THYRATRON

NEGATIVE-CONTROL TRIODE TYPE

Supersedes Type 5563

GENERAL DATA

Electrical:

Filament, Coated:

	Min.	Av.	Max.	
Voltage	4.75	5	5.25	volts
Current at 5 volts	–	10	11	amp

Minimum Heating Time:

On initial installation, with no voltage on grid or anode, for redistribution of mercury to lower part of tube	15	minutes
During subsequent operation, to allow filament to reach operating temperature prior to tube conduction	1	minute

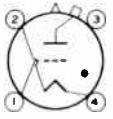
Direct Interelectrode Capacitances:[o]

Grid to anode	4	μμf
Grid to cathode	16	μμf
Ionization Time (Approx.)	10	μsec
Deionization Time (Approx.)	1000	μsec
Maximum Critical Grid Current for instantaneous anode volts = 20000	50	μa
Anode Voltage Drop (Approx.):		
At anode amperes = 11.5	15	volts
At anode amperes = 70	25	volts
Grid Control Ratio (Approx.):		
Under conditions: 10000-ohm grid resistor, circuit returns to pin 2, filament voltage at pin 4 out of phase with anode voltage by 180°, and condensed-mercury temperature of 40 °C	275	

Mechanical:

Operating Position	vertical, base down
Overall Length	10-3/32" ± 7/16"
Maximum Diameter	2-5/8"
Bulb	T20
Weight (Approx.)	13 oz
Cap.	Medium with Tubular Support (JETEC No.C1-39)
Socket	Johnson No.123-211, or equivalent
Base	Skirted Medium-Metal-Shell Jumbo 4-Pin with Bayonet (JETEC No.A4-69)
Basing Designation for BOTTOM VIEW	3X

Pin 1 – Grid
Pin 2 – Filament, Internal Shield, Circuit Returns



Pin 3 – No Connection
Pin 4 – Filament
Cap – Anode

[o] Without external shield.

← Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA HARRISON NEW JERSEY

5563-A

MERCURY-VAPOR THYRATRON

Temperature Control:

Heating--when the ambient temperature is so low that the normal rise of condensed-mercury temperature above the ambient temperature will not bring the condensed-mercury temperature up to the minimum value of the operating range specified under *Maximum Ratings*, some form of heat-conserving enclosure or auxiliary heater will be required.

Cooling--when the operating conditions are such that the maximum value of the operating condensed-mercury temperature for the applicable service rating is exceeded, provision should be made for forced-air cooling sufficient to prevent exceeding the maximum value.

Temperature Rise of Condensed Mercury to Equilibrium Above Ambient Temperature (Approx.):*		
No load	13	°C
Full load	17	°C

CONTROL SERVICE--1n-Phase Operation●

Maximum Ratings, *Absolute Values:*

For supply frequency of 25 to 60 cps

	Operating Condensed-Mercury-Temperature Range 25 to 55 °C	25 to 50 °C	
PEAK ANODE VOLTAGE:			
Forward	15000 max.	20000 max.	volts
Inverse	15000 max.	20000 max.	volts
GRID VOLTAGE:			
Peak or DC, before tube conduction	-500 max.	-500 max.	volts
Average▲, during tube conduction	-10 max.	-10 max.	volts
ANODE CURRENT:			
Peak	10 max.	6.4 max.	amp
Average●●	1.8 max.	1.6 max.	amp
→ Fault, for duration of 0.1 second maximum	70 max.	70 max.	amp
GRID CURRENT:			
→ Average positive●●	100 max.	100 max.	ma
Peak positive with anode negative	5 max.	5 max.	ma

Maximum Circuit Values:

Grid-Circuit Resistance	0.1 max.	0.1 max.	megohm

* With filament volts = 4.75 and no heat-conserving enclosure.

● Filament voltage has a phase angle of either 0° or 180° with respect to the anode voltage.

▲,●●: See next page. → Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

5563-A

MERCURY-VAPOR THYRATRON

CONTROL SERVICE--Quadrature Operation[OO]

Maximum Ratings, *Absolute Values:*

For supply frequency of 25 to 60 cps

	Operating Condensed-Mercury-Temperature Range 25 to 55 °C	25 to 50 °C	
PEAK ANODE VOLTAGE:			
Forward	15000 max.	20000 max.	volts
Inverse	15000 max.	20000 max.	volts
GRID VOLTAGE:			
Peak or DC, before tube conduction	-500 max.	-500 max.	volts
Average[▲], during tube conduction	-10 max.	-10 max.	volts
ANODE CURRENT:			
Peak	11.5 max.	11.5 max.	amp
Average[●●]	2.5 max.	2.5 max.	amp
Fault, for duration of 0.1 second maximum	70 max.	70 max.	amp ←
GRID CURRENT:			
Average positive[●●]	100 max.	100 max.	ma ←
Peak positive with anode negative	5 max.	5 max.	ma

Maximum Circuit Values:

Grid-Circuit Resistance	0.1 max.	0.1 max.	megohm

HIGH-SPEED LOAD-CIRCUIT PROTECTION SERVICE[♦] ←

Maximum Ratings, *Absolute Values:*

	Operating Condensed-Mercury-Temperature Range 40 to 55 °C	40 to 50 °C	
PEAK ANODE VOLTAGE:			
Forward	15000 max.	20000 max.	volts
Inverse	15000 max.	20000 max.	volts
GRID VOLTAGE:			
Peak or DC, before tube conduction	-500 max.	-500 max.	volts
Average[▲], during tube conduction	-10 max.	-10 max.	volts
ANODE CURRENT:			
Peak	100 max.	100 max.	amp
Average[□]	70 max.	70 max.	amp
Average[§]	1.05 max.	1.05 max.	amp

Maximum Circuit Values:

Grid-Circuit Resistance	0.1 max.	0.1 max.	megohm

▲ ●● OO ♦ □ §: See next page. ← Indicates a change.

RCA

5563-A

MERCURY-VAPOR THYRATRON

▲ Averaged over one grid-conducting period.

●● Averaged over any period of 20 seconds maximum.

∞ Filament voltage is 60° to 120° out of phase (leading or lagging) with the anode voltage.

In this service, the faults may occur in quick succession or may be separated by several months.

□ Averaged over any period of 0.1 second maximum.

§ Averaged over any period of 20 seconds maximum. This average-anode-current value is specified to indicate the number of faults that are permissible within the 20-second interval. The number of faults that may occur in any 20-second interval depends on the value of anode current over the averaging period less than 0.1 second and may be determined by

$$\text{Number of Faults} = \frac{1.05 \times 20}{\text{Average Anode Current during fault} \times \text{Duration of Fault}}$$

Example:

Assume that the maximum average anode current is 70 amperes for the maximum duration of 0.1 second. On substitution of these values in the equation, the permissible number of faults is determined to be 3. If the average anode current is less than 70 amperes over an averaging period of less than 0.1 second, it will be obvious that a greater number of faults may occur.

OPERATING CONSIDERATIONS

X rays are produced when the 5563-A is operated with a peak inverse anode voltage above 16000 volts (absolute value). These rays can constitute a health hazard unless the tube is adequately shielded for X-ray radiation. Although relatively simple shielding should prove adequate, make sure it provides the required protection to the operator.

→ *Shields and rf filter circuits* should be provided for the 5563-A if it is subjected to extraneous high-frequency fields during operation. These fields tend to produce breakdown effects in mercury vapor and are detrimental to tube life and performance. When shields are used, special attention must be given to providing adequate ventilation and to maintaining normal condensed-mercury temperature. Radio-frequency filters are employed to prevent damage caused by rf currents which might otherwise be fed back into the 5563-A.

→ Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

5563-A
MERCURY-VAPOR THYRATRON

For Circuit Figures, see Front of this Section

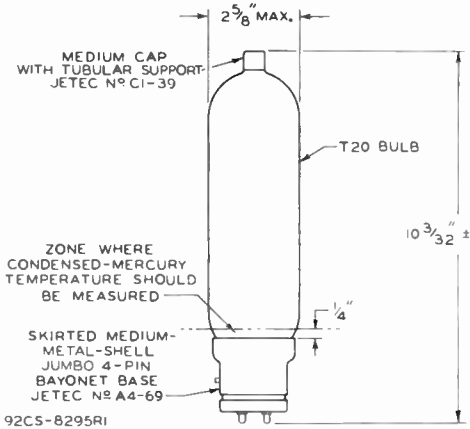
CIRCUIT	MAX. TRANS. SEC. VOLTS (RMS) E	APPROX. DC OUTPUT VOLTS TO FILTER E_{av}	MAX. DC OUTPUT AMPERES I_{av}	MAX. DC OUTPUT KW TO FILTER P_{dc}
Fig. 1 Half-Wave Single-Phase In-Phase Operation	14000□	6300	1.6	10
	10600▲	4700	1.8	8.5
Fig. 2 Full-Wave Single-Phase In-Phase Operation	7000□	6300	3.2	20
	5300▲	4700	3.6	17
Fig. 3 Series Single-Phase In-Phase Operation	14000□	12700	3.2	40
	10600▲	9500	3.6	34
Fig. 4 Half-Wave Three-Phase In-Phase Operation	8100□	9500	4.8	45
	6100▲	7100	5.4	38
Fig. 5 Parallel Three-Phase Quadrature Operation	8100□	9500	15.0	143
	6100▲	7100	15.0	106
Fig. 6 Series Three-Phase Quadrature Operation	8100□	19000	7.5	143
	6100▲	14200	7.5	106
			Resistive Load / *Inductive Load*	*Resistive Load* / *Inductive Load*
Fig. 7 Half-Wave Four-Phase Quadrature Operation	7000□	9000	10.0 / 10.0	90 / 90
	5300▲	6700	10.0 / 10.0	67 / 67
			Resistive Load / *Inductive Load*	*Resistive Load* / *Inductive Load*
Fig. 8 Half-Wave Six-Phase Quadrature Operation	7000□	9500	11.0 / 11.5	105 / 110
	5300▲	7100	11.0 / 11.5	78 / 81

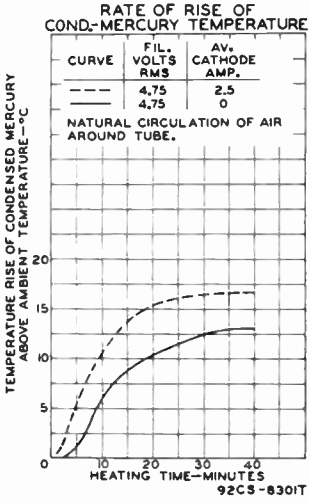
□ For maximum peak inverse anode voltage of 20000 volts, and condensed-mercury-temperature range of 25 to 50 °C.

▲ For maximum peak inverse anode voltage of 15000 volts, and condensed-mercury-temperature range of 25 to 55 °C.

5563-A

MERCURY-VAPOR THYRATRON

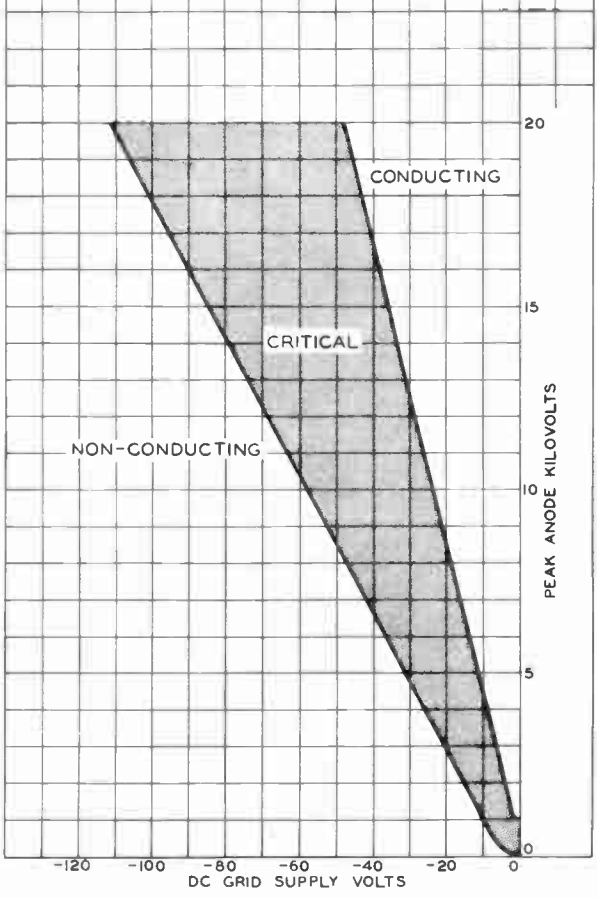




TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

5563-A
OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

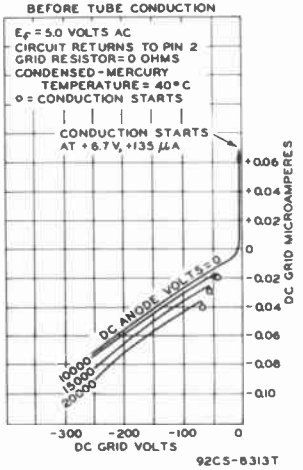
RANGE IS FOR CONDITIONS WHERE:
E_f = 5.0 VOLTS AC ± 5%; CIRCUIT RETURNS TO PIN 2.
FILAMENT VOLTAGE AT PIN 4 IS (-) WHEN ANODE VOLTAGE IS (+).
THE RANGE INCLUDES INITIAL AND LIFE VARIATIONS OF INDIVIDUAL TUBES.
GRID RESISTOR = 10000 TO 100000 OHMS
CONDENSED-MERCURY TEMPERATURE RANGE = 25° TO 55°C



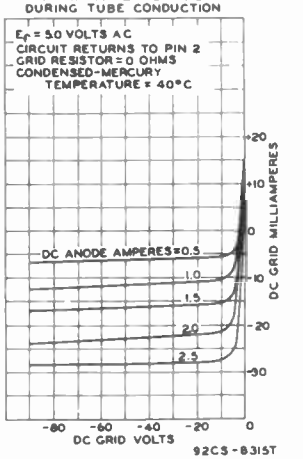
5563-A

CHARACTERISTIC CURVES

AVERAGE GRID CHARACTERISTICS
BEFORE TUBE CONDUCTION



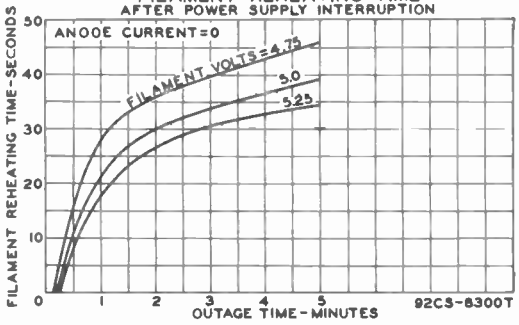
AVERAGE GRID CHARACTERISTICS
DURING TUBE CONDUCTION

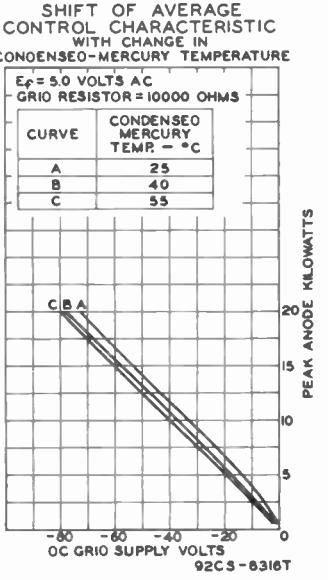


TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

5563-A

CHARACTERISTIC CURVES





RCA

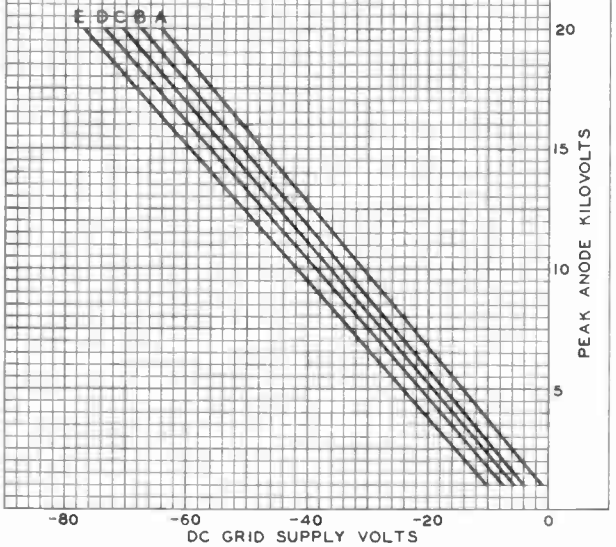
5563-A

SHIFT OF AVERAGE CONTROL CHARACTERISTICS
WITH CHANGE IN FILAMENT PHASING AND CIRCUIT RETURN

E_f = 5.0 VOLTS AC
GRID RESISTOR = 10000 OHMS
CONDENSED-MERCURY TEMPERATURE = 40°C

CURVE	PHASE ANGLE*	CIRCUIT RETURN
A	0°	PIN 2
B	0°	CT□
C	0°, 180° 90°	PIN 4 ANY•
D	180°	CT□
E	180°	PIN 2

*BETWEEN FILAMENT VOLTAGE AT PIN 4 AND ANODE VOLTAGE
□CENTER TAP OF FILAMENT TRANSFORMER
• PIN 2, PIN 4, OR CT



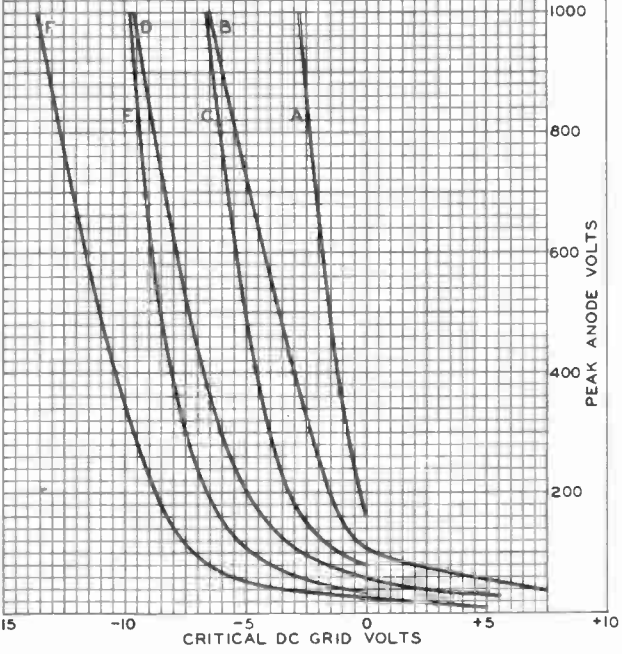
5563-A
SHIFT OF AVERAGE CONTROL CHARACTERISTICS WITH CHANGE IN FILAMENT PHASING AND CIRCUIT RETURN AT LOW ANODE VOLTAGES

E_f = 5.0 VOLTS AC
GRID RESISTOR = 10000 OHMS
CONDENSED-MERCURY TEMPERATURE = 40°C

CURVE	PHASE ANGLE *	CIRCUIT RETURN
A	0°	PIN 2
B	180°	PIN 4
C	0°	CT □
D	180°	CT □
E	0°	PIN 4
F	180°	PIN 2

* BETWEEN FILAMENT VOLTAGE AT PIN 4 AND ANODE VOLTAGE

□ CENTER TAP OF FILAMENT TRANSFORMER



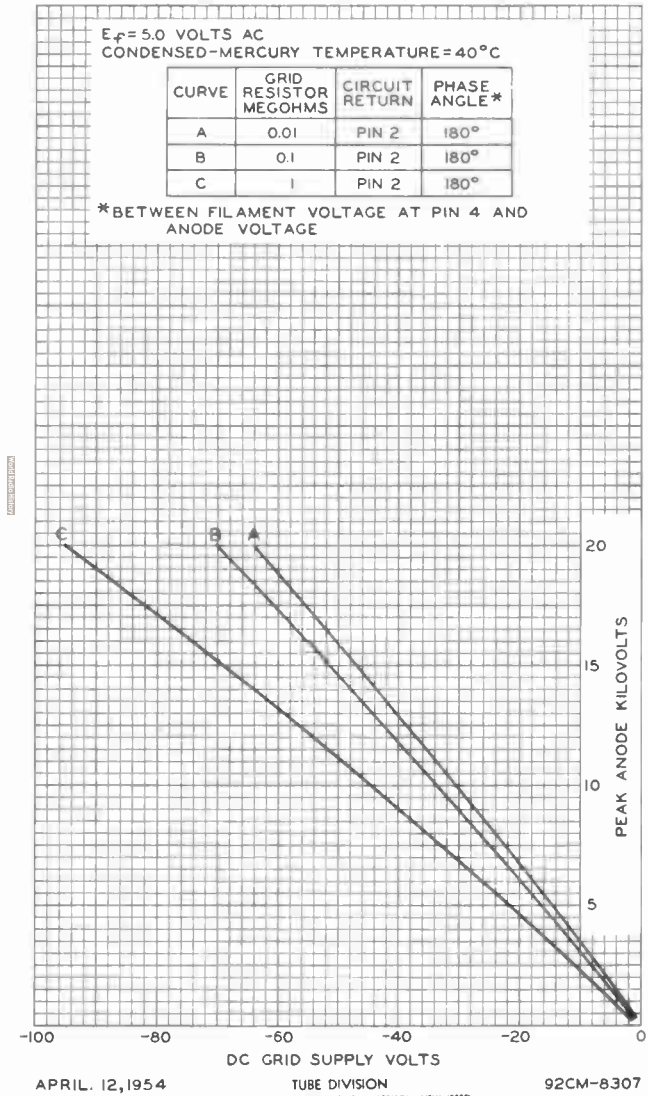
5563-A

SHIFT OF AVERAGE CONTROL CHARACTERISTICS
WITH CHANGE IN GRID-RESISTOR VALUE

E_f = 5.0 VOLTS AC
CONDENSED-MERCURY TEMPERATURE = 40°C

CURVE	GRID RESISTOR MEGOHMS	CIRCUIT RETURN	PHASE ANGLE*
A	0.01	PIN 2	180°
B	0.1	PIN 2	180°
C	1	PIN 2	180°

*BETWEEN FILAMENT VOLTAGE AT PIN 4 AND ANODE VOLTAGE



5696
THYRATRON

GAS-TETRODE, MINIATURE TYPE

GENERAL DATA

Electrical:

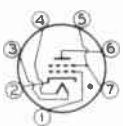
Heater, for Unipotential Cathode:		
Voltage	6.3	ac or dc volts
Current	0.150	amp
Cathode:		
Minimum Heating Time, prior to tube conduction	10	sec
Direct Interelectrode Capacitances (Approx.):[a]		
Grid No.1 to Anode	0.03	μμf
Input	1.8	μμf
Output	0.54	μμf
Ionization Time (Approx.):		
For conditions: dc anode volts = 100; grid-No.1 square-pulse volts = +50; peak cathode amperes during conduction = 0.150	0.5	μsec
Deionization Time (Approx.):		
For conditions: dc anode volts = 500; grid-No.1 volts = -100, grid-No.1 resistor (ohms) = 1000; dc cathode amperes = 0.025	25	μsec
For conditions: dc anode volts = 500; grid-No.1 volts = -13; grid-No.1 resistor (ohms) = 1000; dc cathode amperes = 0.025	40	μsec
Maximum Critical Grid-No.1 Current, with ac anode-supply volts (rms) = 350, and average cathode amperes = 0.025	0.5	μamp
Anode Voltage Drop (Approx.)	10	volts
Grid-No.1 Control Ratio (Approx.) with grid-No.1 resistor (megohms) = 0; grid-No.2 volts = 0	250	
Grid-No.2 Control Ratio (Approx.) with grid-No.1 volts = 0, grid-No.2 resistor (ohms) = 0	15	

[a] Without external shield.

Mechanical:

Mounting Position	Any
Maximum Overall Length	1-3/4"
Maximum Seated Length	1-1/2"
Length, Base Seat to Bulb Top (excluding tip)	1-1/8" ± 3/32"
Maximum Diameter	3/4"
Bulb	T-5-1/2
Base	Small-Button Miniature 7-Pin
Basing Designation for BOTTOM VIEW	7BN

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



5696

5696

THYRATRON

RELAY and GRID-CONTROLLED RECTIFIER SERVICE

Maximum Ratings, *Absolute Values*:

PEAK ANODE VOLTAGE:		
Forward	500 max.	volts
Inverse	500 max.	volts
GRID-No.2 (SHIELD-GRID) VOLTAGE:		
Peak, before anode conduction	-50 max.	volts
Average, during anode conduction■	-10 max.	volts
GRID-No.1 (CONTROL-GRID) VOLTAGE:		
Peak, before anode conduction	-100 max.	volts
Average, during anode conduction■	-10 max.	volts
CATHODE CURRENT:		
Peak	0.1 max.	amp
Average■	0.025 max.	amp
Surge, for duration of 0.1 sec. max.	2 max.	amp
GRID-No.2 CURRENT:		
Average■	+0.005 max.	amp
GRID-No.1 CURRENT:		
Average■	+0.005 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	-55 to +90	°C

Typical Operating Conditions for Relay Service:

RMS Anode Voltage	117	volts
Grid No.2	Connected to cathode at socket	
RMS Grid-No.1 Bias Voltage□	5	volts
Peak Grid-No.1 Signal Voltage	5	volts
Grid-No.1-Circuit Resistance	0.1	megohm
Anode-Circuit Resistance#	5000	ohms

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	10 max.	megohms

■ Averaged over any interval of 30 sec. max.

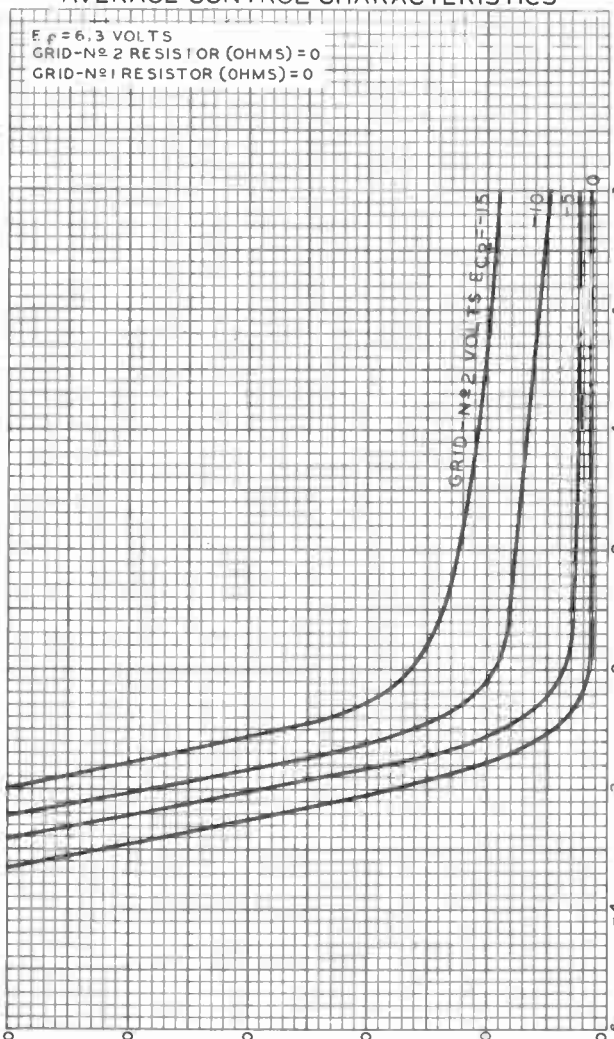
□ Approximately 180° out of phase with the anode voltage.

Sufficient resistance, including the tube load, must be used under any conditions of operation to prevent exceeding the current ratings.

RCA

5696

AVERAGE CONTROL CHARACTERISTICS



AUG. 6, 1948

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

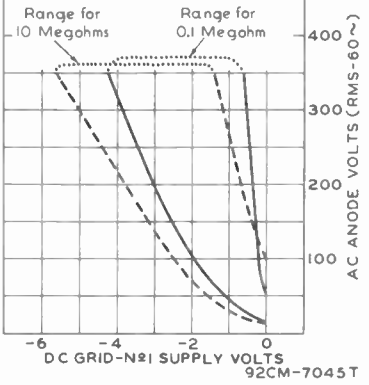
92CM-7044

5696

THYRATRON

OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

TYPE 5696
GRID-№2 (SHIELD) VOLTS=0
RANGES SHOWN ARE FOR TWO VALUES OF GRID RESISTOR-0.1 MEG. AND 10 MEG.-AND TAKE INTO ACCOUNT INITIAL DIFFERENCES BETWEEN INDIVIDUAL TUBES & SUBSEQUENT DIFFERENCES DURING TUBE LIFE, FOR A HEATER-VOLTAGE RANGE OF 5.7 TO 6.9 VOLTS AND FOR AN AMBIENT TEMPERATURE RANGE OF -55 TO +90 °C

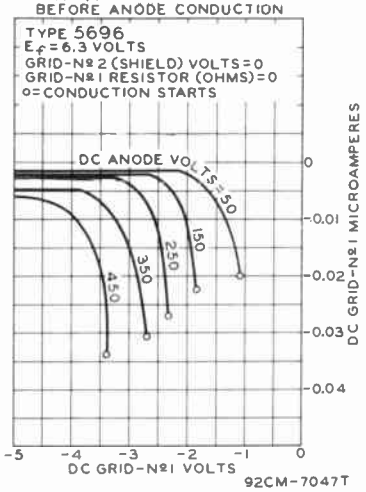


TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

5696

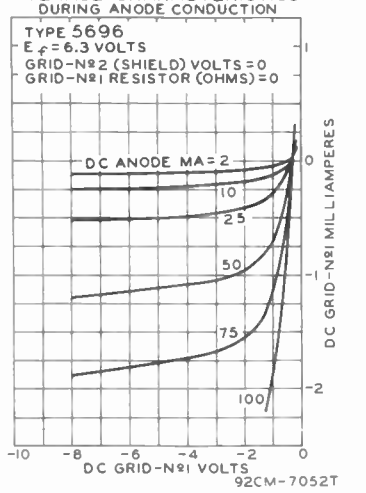
THYRATRON

AVERAGE CHARACTERISTICS
BEFORE ANODE CONDUCTION



92CM-7047T

AVERAGE CHARACTERISTICS
DURING ANODE CONDUCTION



92CM-7052T

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

5727

GAS THYRATRON

7-PIN MINIATURE TETRODE TYPE

5727 PREMIUM TYPE

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage	6.3 ± 10%*	ac or dc volts
Current	0.6	amp
Cathode:		
Minimum heating time prior to tube conduction	20	sec
Direct Interelectrode Capacitances (Approx.):°		
Grid No.1 to anode	0.026	μμf
Grid No.1 to cathode, grid No.2, and heater	2.4	μμf
Anode to cathode, grid No.2, and heater	1.6	μμf
Ionization Time (Approx.):		
For dc anode volts = 100, grid-No.1 volts (square-wave pulse) = 50, peak anode amperes during conduction = 0.5	0.5	μsec
Deionization Time (Approx.):		
For dc anode volts = 125, dc anode amperes = 0.1, grid-No.1 resistor (ohms) = 1000, and grid-No.1 volts = -100	35	μsec
For dc anode volts = 125, dc anode amperes = 0.1, grid-No.1 resistor (ohms) = 1000, and grid-No.1 volts = -10	75	μsec
Maximum Critical Grid-No.1 Current:		
For anode-supply volts (rms) = 460, and average anode amperes = 0.1	0.5	μa
Anode Voltage Drop (Approx.)	8	volts
Grid-No.1 Control Ratio (Approx.) with grid-No.1 resistor (megohms) = 0, grid-No.2 volts = 0	250	
Grid-No.2 Control Ratio (Approx.) with grid-No.1 resistor (megohms) = 0, grid-No.2 resistor (megohms) = 0, grid-No.1 volts = 0	1000	

Mechanical:

Operating Position	Any
Maximum Overall Length	2-1/8"
Maximum Seated Length	1-7/8"
Length, Base Seat to Bulb Top (Excluding tip)	1-1/2" ± 3/32"
Maximum Diameter	3/4"
Dimensional Outline	*See General Section*
Bulb	T5-1/2
Base	Small-Button Miniature 7-Pin (JETEC No.E7-1)

*,°: see next page.

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

5727

5727

GAS THYRATRON

Basing Designation for BOTTOM VIEW 7BN

RELAY AND GRID-CONTROLLED RECTIFIER SERVICE

Maximum and Minimum Ratings, *Absolute Values:*

For anode-supply frequency of 60 cps

PEAK ANODE VOLTAGE:		
Forward	650 max.	volts
Inverse	1300 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, before tube conduction	-100 max.	volts
Average■, during tube conduction	-10 max.	volts
CATHODE CURRENT:		
Peak	0.5 max.	amp
Average■	0.1 max.	amp
Fault, for duration of 0.1 second max.	10 max.	amp
GRID-No.2 CURRENT:		
Average■	+0.01 max.	amp
GRID-No.1 CURRENT:		
Average■	+0.01 max.	amp
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	100 max.	volts
Heater positive with respect to cathode	25 max.	volts
BULB TEMPERATURE (At hottest point on bulb surface)	150 max.	°C
AMBIENT TEMPERATURE	-75 min.	°C

Typical Operation for Relay Service:

RMS Anode Voltage	117	400	volts
Grid-No.2 Voltage	0	0	volts
RMS Grid-No.1 Bias Voltage□	5	-	volts
DC Grid-No.1 Bias Voltage	-	-6	volts
Peak Grid-No.1 Signal Voltage	5	6	volts
Grid-No.1-Circuit Resistance	1	1	megohm
Anode-Circuit Resistance#	1200	2000	ohms

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	10 max.	megohms

*,○,■,□,#: See next page.

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

TENTATIVE DATA 1

5727

GAS THYRATRON

PULSE-MODULATOR SERVICE

For rectangular-wave shapes, duty cycle of 0.001 max., pulse duration of 5 μsec. max., and pulse-repetition rate of 500 pps max.

Maximum and Minimum Ratings, *Absolute Values:*

PEAK ANODE VOLTAGE:		
Forward	500 max.	volts
Inverse	100 max.	volts
GRID-No.2 (SHIELD-GRID) VOLTAGE:		
Peak, before tube conduction	-50 max.	volts
Average, during tube conduction	-10 max.	volts
GRID-No.1 (CONTROL-GRID) VOLTAGE:		
Peak, before tube conduction	-100 max.	volts
Average, during tube conduction	-10 max.	volts
CATHODE CURRENT:		
Peak	10 max.	amp
Average	0.01 max.	amp
Rate of change	100 max.	amp/μsec
PEAK GRID-No.2 CURRENT	0.02 max.	amp
PEAK GRID-No.1 CURRENT	0.02 max.	amp
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	0 max.	volts
Heater positive with respect to cathode	0 max.	volts
BULB TEMPERATURE (At hottest point on bulb surface)	150 max.	°C
AMBIENT TEMPERATURE	-75 min.	°C

Maximum and Minimum Circuit Values:

Grid-No.1-Circuit Resistance	0.5 max.	megohm
Grid-No.2-Circuit Resistance	25000 max.	ohms
	2000 min.	ohms

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

Values are initial, unless otherwise specified

	Note	Min.	Max.	
Heater Current	1	540	660	ma
Grid-No.1 Supply Voltage for Tube Conduction (1)	1,2	-2.9	-4.5	volts
Grid-No.1 Supply Voltage for Tube Conduction (2)	1,3	-	-5.2	volts
Grid-No.1 Supply Voltage for Tube Conduction (3)	4,3	-	-6.4	volts
Anode-Supply Voltage for Tube Conduction (1)	1,5	-	38	volts
Anode-Supply Voltage for Tube Conduction (1) at 500 hours	1,5	-	50	volts
Anode-Supply Voltage for Tube Conduction (2)	6,5	-	50	volts

*,○,■,○,#: see next page.

TENTATIVE DATA 2

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

5727

GAS THYRATRON

	Note	Min.	Max.	
Anode-Supply Voltage for Tube Conduction (3)	7,8	650	–	volts
RMS Grid-No.2 Supply Voltage for Tube Conduction (This voltage is 180° out of phase with anode-supply voltage). .	1,9	1.9	3.3	volts
Heater-Cathode Leakage Current:				
Heater 25 volts positive with respect to cathode . .	1	–	15	μa
Heater 100 volts negative with respect to cathode . .	1	–	15	μa
Heater-Cathode Leakage Current at 500 hours:				
Heater 25 volts positive with respect to cathode . .	1	–	20	μa
Heater 100 volts negative with respect to cathode . .	1	–	20	μa
Leakage Resistance: Grid-No.2 to anode.	1,10	760	–	megohms
Leakage Resistance: Grid-No.2 to anode at 500 hours.	1,10	380	–	megohms

Note 1: With 6.3 volts ac or dc on heater.

Note 2: With anode-supply volts (rms) = 460, grid-No.2 volts = 0, load resistor (ohms) = 3000, and grid-No.1 resistor (megohms) = 0.1.

Note 3: With anode-supply volts (rms) = 460, grid-No.2 volts = 0, load resistor (ohms) = 3000, and grid-No.1 resistor (megohms) = 10.

Note 4: With 7.0 volts ac or dc on heater.

Note 5: With grid-No.2 volts = 0, grid-No.1 volts = 0, load resistor (ohms) = 1000, and grid-No.1 resistor (megohms) = 0.1.

Note 6: With 5.7 volts ac or dc on heater.

Note 7: With 0 volts on heater.

Note 8: With grid-No.1 volts = −100, grid-No.2 volts = 0, and load resistor (ohms) = 10000.

Note 9: With anode-supply volts (rms) = 150, grid-No.1 supply volts (rms and in phase with anode-supply voltage) = 16.

Note 10: With grid-No.2 volts = ±380 with respect to anode and all other electrodes floating.

* For pulse-modulator service, tolerance is +10%, −5%.

○ Without external shield.

■ Averaged over any interval of 30 seconds maximum.

□ Approximately 180° out of phase with the anode voltage.

\# Sufficient resistance, including the tube load, must be used under any conditions of operation to prevent exceeding the current ratings.

SPECIAL RATINGS AND PERFORMANCE DATA

Shock Rating:

Impact Acceleration . . . . . 750 max. g

This test is performed on a sample lot of tubes from each production run. Tubes are held rigid and are tested in

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

four different positions. At the end of this test, tubes will not show permanent or temporary shorts or open circuits, and are required to meet established limits for heater-cathode leakage current, grid-No.1 supply voltage for tube conduction (1) and anode-supply voltage for tube conduction (1).

Fatigue Rating:

Vibrational Acceleration . . . . . 2.5 max. g

This test is performed on a sample lot of tubes from each production run. Tubes are rigidly mounted and subjected in each of three positions to 2.5 g vibrational acceleration at 60 cycles per second for 32 hours. At the end of this test, tubes will not show permanent or temporary shorts or open circuits, and are required to meet established limits for heater-cathode leakage current, grid-No.1 supply voltage for tube conduction (1) and anode-supply voltage for tube conduction (1).

Heater-Cycling Life Performance:

Cycles of Intermittent Operation. . . . 2000 min. cycles

Under the following conditions: Heater volts = 7.5 cycled one minute on and one minute off, heater 100 volts negative with respect to cathode, and all other elements connected to ground.

Shorts and Continuity Test:

This test is performed on a sample lot of tubes from each production run. In this test a tube is considered inoperative if it shows a permanent or temporary short or open circuit.

1-Hour Stability Life Performance:

This test is performed on a sample lot of tubes from each production run to insure that tubes have been properly stabilized. Conditions of life testing are specified under 500-hour intermittent life performance, except test run at room temperature. Tubes are initially read for grid-No.1 supply voltage for tube conduction (1). At the end of 1 hour, grid-No.1 supply voltage is read. The variation in the 0-hour and 1-hour readings will not exceed 15 per cent. Tubes must also meet established limits of grid-No.1 supply voltage.

100-Hour Survival Life Performance:

This test is performed on a sample lot of tubes from each production run to insure a low percentage of early inoperatives. Conditions of life testing are specified under 500-hour intermittent life performance, except test run at room temperature. At the end of 100 hours, a tube is considered inoperative if it shows a permanent or

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GAS THYRATRON

temporary short or open circuit or fails to meet established limits of grid-No.1 supply voltage for tube conduction (1).

500-Hour Intermittent Life Performance:

This test is performed on a sample lot of tubes from each production run to insure high quality of the individual tube and to guard against epidemic failures of any of the characteristics indicated below. Life testing is conducted under the following conditions: Heater volts = 6.3, anode-supply volts (rms) = 460, grid-No.2 supply volts = 0, average anode milliamperes = 80, peak anode milliamperes = 500, grid-No.1 resistor (ohms) = 50000, and minimum bulb temperature (°C) = 150. At the end of 500 hours, tube will not show permanent shorts or open circuits and will be criticized for the total number of defects in the sample lot and for the number of tubes failing to pass established initial limits of heater current, grid-No.1 supply voltage (1), and 500-hour limits for anode-supply voltage (1), heater-cathode leakage current, and leakage resistance shown under CHARACTERISTICS RANGE VALUES.

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.

Curves shown under Type 2D21 also apply to the 5727

5728/FG-67

MERCURY-VAPOR THYRATRON

NEGATIVE/POSITIVE-CONTROL TRIODE TYPE

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:

	Min.	Av.	Max.	
Voltage (AC or DC)	4.75	5.0	5.25	volts
Current at 5.0 volts	-	4.5	4.9	amp

Cathode:

Minimum Heating Time, prior to tube conduction	5	minutes
Maximum Outage Time, without reheating		*See Curves*

Direct Interelectrode Capacitances (Approx., without external shield):

Grid to Anode	3.25	μμf
Grid to Cathode	8.9	μμf
Maximum Critical Grid Current with ac anode volts (rms) = 220	10	μamp
Anode Voltage Drop (Approx.)	16	volts
Ionization Time (Approx.): For conditions: dc anode-supply volts = 100, peak grid volts = +35, and peak anode amperes = 15	15	μsec
Deionization Time (Approx.): For conditions: dc anode volts = 120, dc grid-supply volts = -500, grid resistor (ohms) = 1000, and dc anode amperes = 2.5	5	μsec
For conditions: dc anode volts = 120, dc grid-supply volts = 0, grid resistor (ohms) = 1000, and dc anode amperes = 2.5	850	μsec

Mechanical:

Mounting Position	Vertical, base down
Maximum Overall Length	7"
Seated Length	6-1/8" ± 1/4"
Maximum Diameter	3"
Bulb	ST-23
Cap	Medium (JETEC No.C1-5)
Base	Medium-Shell Small 4-Pin, Bayonet (JETEC No.A4-10)

BOTTOM VIEW

Pin 1: Heater
Pin 2: Cathode (Grid & Anode Return)
Pin 3: Grid
Pin 4: Heater, Cathode

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MERCURY-VAPOR THYRATRON

Temperature Control:

Heating—When the ambient temperature is so low that the normal rise of condensed-mercury temperature above the ambient temperature will not bring the condensed-mercury temperature up to the minimum value of the operating range specified under *Maximum Ratings*, some form of heat-conserving enclosure or auxiliary heater will be required.

Cooling—When the operating conditions are such that the maximum value of the operating condensed-mercury temperature is exceeded, provision should be made for forced-air cooling sufficient to prevent exceeding the maximum value.

Temperature Rise of Condensed Mercury to Equilibrium Above Ambient Temperature (Approx.):*		
No Load	25	°C
Full Load	31	°C

INVERTER SERVICE

Maximum Ratings, *Absolute Values:*

PEAK ANODE VOLTAGE:		
Forward	1000 max.	volts
Inverse	1000 max.	volts
GRID VOLTAGE:		
Peak, before anode conduction	−500 max.	volts
Average•, during anode conduction	−5 max.	volts
CATHODE CURRENT:		
Peak	15 max.	amp
Average••	2.5 max.	amp
Fault, for duration of 0.1 sec. max.	200 max.	amp
GRID CURRENT:		
Average•	+0.3 max.	amp
CONDENSED-MERCURY TEMPERATURE RANGE	+40 to +80	°C

* With heater voltage = 4.75 volts and no heat-conserving enclosure.

• Averaged over one conducting cycle.

•• Averaged over any interval of 15 seconds maximum.

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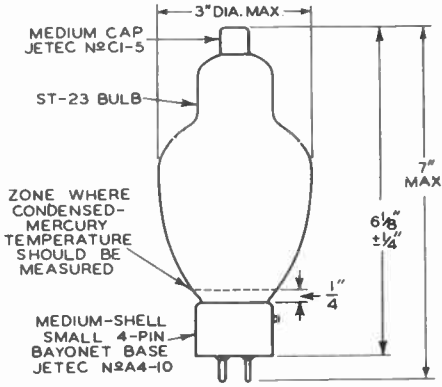
MERCURY-VAPOR THYRATRON



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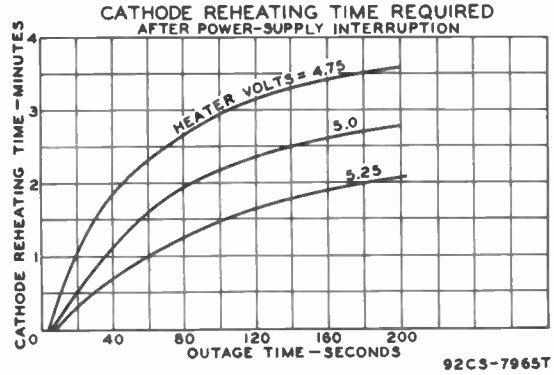

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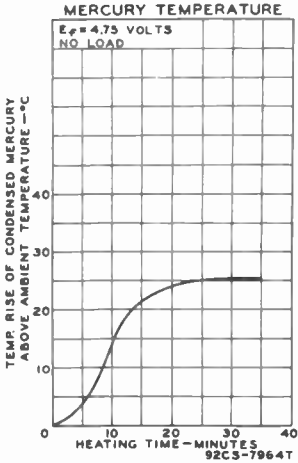
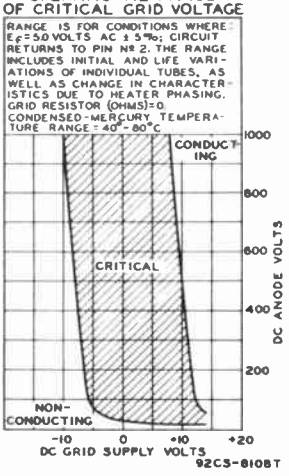
5728/FG-67
CHARACTERISTIC CURVES

RATE OF RISE OF COND.-MERCURY TEMPERATURE



OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE



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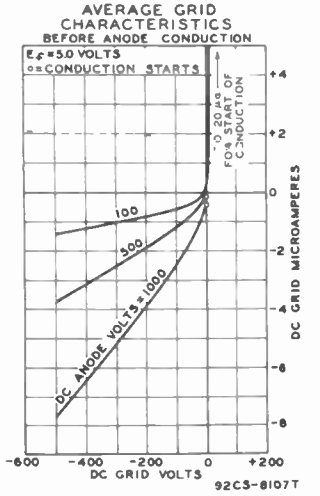
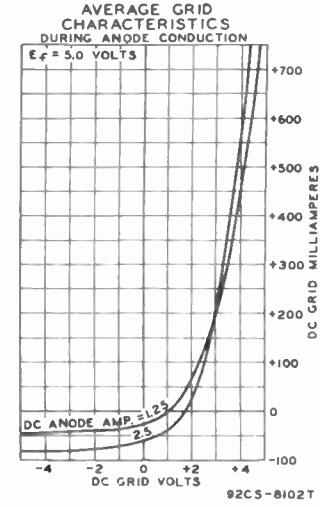
CHARACTERISTIC CURVES





5823

GLOW-DISCHARGE TRIODE

COLD-CATHODE; MINIATURE TYPE

GENERAL DATA

Electrical:

Cathode	Cold	
Ionization Time (Approx.):		
For conditions: Instantaneous anode volts = 185; peak positive starter-electrode pre-firing volts = 70; peak positive starter-electrode triggering volts = 50; anode-circuit series resistor (ohms) = 820; starter-electrode series resistor (ohms) = 100000	20	μsec
Deionization Time (Approx.):		
For conditions: (Same as for *Ionization Time*)	500	μsec
Anode Voltage Drop	62	volts
Starter-Electrode Voltage Drop	61	volts
Anode Breakdown Voltage	290	volts
Starter-Electrode Breakdown Voltage	80	volts
Required Transfer Current (DC or Instantaneous AC) for transition of discharge to anode at 140 volts peak	50	μamp

Mechanical:

Mounting Position	Any
Maximum Overall Length	2-1/8"
Maximum Seated Length	1-7/8"
Length, Base Seat to Bulb Top (excluding tip)	1-1/2" ±3/32"
Maximum Diameter	3/4"
Bulb	T-5-1/2
Base	Small-Button Miniature 7-Pin
Basing Designation for BOTTOM VIEW	4CK

Pin 1 – Anode
Pin 2 – Internal Connection – Do Not Use
Pin 3 – Cathode
Pin 4 – Starter Electrode
Pin 5 – Internal Connection – Do Not Use
Pin 6 – Internal Connection – Do Not Use
Pin 7 – Cathode

Maximum Ratings▲, *Absolute Values*:

For First-Quadrant Operation Only

PEAK ANODE AND STARTER-ELECTRODE VOLTAGE:		
Inverse	200 max.	volts
Forward	200 max.	volts

▲ These ratings apply to the 5823 when it is operated from a power supply having a frequency of 60 cycles per second. If a contemplated application involves higher supply frequencies, please write, stating the proposed operating frequency, to the attention of Commercial Engineering, RCA, Harrison, New Jersey for information as to required changes in maximum ratings and characteristics.

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5823
GLOW-DISCHARGE TRIODE

CATHODE CURRENT:		
Peak	100 max.	ma
Average*	25 max.	ma
PEAK STARTER-ELECTRODE CURRENT:		
With starter-electrode voltage positive	100 max.	ma
AMBIENT TEMPERATURE	-60 to +75	°C

Typical Operating Conditions:

For Relay Service with 60-Cycle AC Supply

AC Anode Supply Voltage (RMS)	117	volts
AC Starter-Electrode Voltage:		
Max. Peak Positive Pre-Firing Voltage	70	volts
Min. Peak Positive Triggering Voltage	35	volts
Min. Firing Voltage (Sum of In-Phase Instantaneous Pre-Firing Voltage and Instantaneous Triggering Voltage)	105	volts

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

For First-Quadrant Operation Only

	Note	Min.	Max.	
Anode Breakdown Voltage	1	200	-	volts
Starter-Electrode Breakdown Voltage	2	73	105□	volts
Required Transfer Current (DC or Instantaneous AC) for transition of discharge to anode at 140 volts peak	3	-	400□	μamp
Anode Voltage Drop	4	-	85□	volts
Starter-Electrode Voltage Drop	5	-	75□	volts

Note 1: With a variable dc anode voltage, dc starter-electrode voltage of 0 volts, anode-circuit series resistance of 3000 ohms, and starter-electrode series resistance of 50000 ohms.

Note 2: With dc anode voltage of 0 volts, variable dc starter-electrode voltage, anode-circuit series resistance of 3000 ohms, and starter-electrode series resistance of 50000 ohms.

Note 3: With a variable dc starter-electrode voltage, anode-circuit series resistance of 3000 ohms, and starter-electrode series resistance of 2 megohms.

Note 4: With dc anode voltage of 230 volts, dc starter-electrode voltage of 91 volts, dc cathode current of 50 milliamperes, anode-circuit series resistance of 3000 ohms, and starter-electrode series resistance of 50000 ohms.

Note 5: With dc anode voltage of 0 volts, variable dc starter-electrode voltage, dc starter-electrode current of 10 milliamperes, and starter-electrode series resistance of 3000 ohms.

* Averaged over any interval of 15 seconds maximum.

□ Maximum individual tube values during life.

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GLOW-DISCHARGE TRIODE

OPERATING NOTES

RCA-5823 is recommended for operation only in that part of the breakdown characteristic designated by Quadrant I. Operation in Quadrant II is satisfactory but changes in tube ratings are necessary. Operation in Quadrants III and IV is not recommended, because the anode and starter electrode are not designed for efficient cathode operation; their use in this manner will result in unstable operation and shorter tube life. The information given for Quadrants III and IV is of value to the equipment designer in that it indicates the need for precautions to be taken in order that the peak inverse voltage rating is not exceeded.

Because of the asymmetrical shape of its anode characteristic the 5823 can be used as a rectifier. When so used (with starter electrode connected through 50000-ohm resistor to anode), the 5823 has a maximum peak inverse anode voltage rating of 200 volts, a maximum peak cathode current of 100 milliamperes, and a maximum dc cathode current of 25 milliamperes. Operation at values of dc cathode current less than 8 milliamperes is not recommended because of resulting instability.

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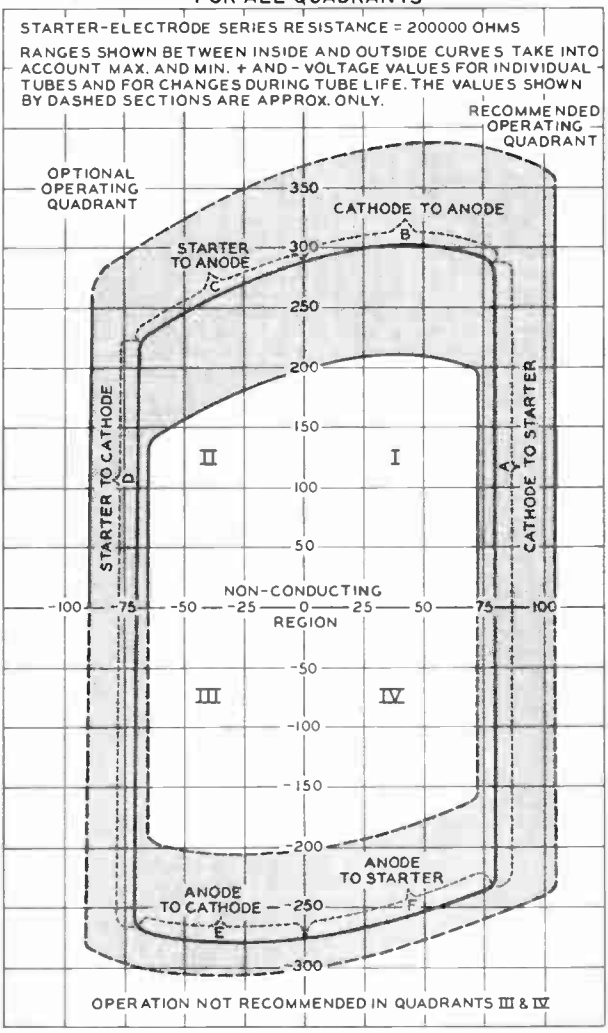
BREAKDOWN CHARACTERISTICS FOR ALL QUADRANTS



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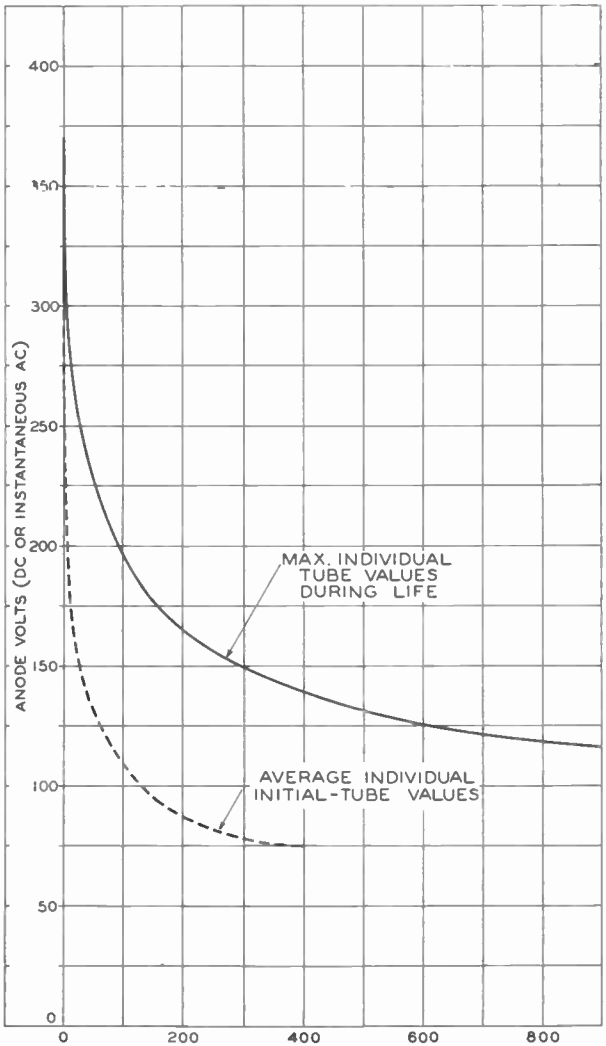
5823

TRANSITION CHARACTERISTIC



MAY 16, 1949

TUBE DEPARTMENT
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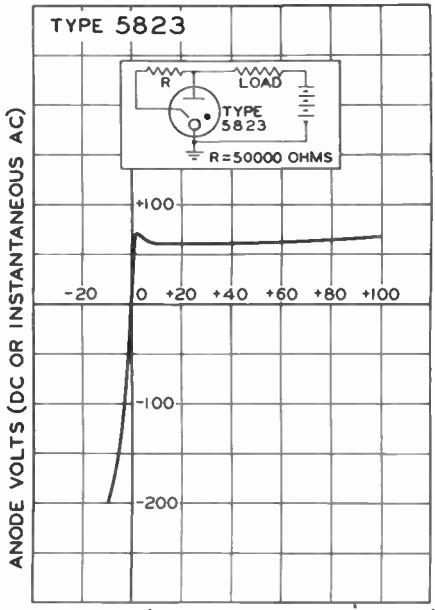
GLOW-DISCHARGE TRIODE

AVERAGE ANODE CHARACTERISTIC



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6012

GAS THYRATRON

NEGATIVE-CONTROL TETRODE TYPE

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	5	sec

Direct Interelectrode Capacitances (Approx.):°

Grid No.1 to anode	0.23	μμf
Grid No.1 to cathode, grid No.2, and heater	5.8	μμf
Anode to cathode, grid No.2, and heater	3.9	μμf

Ionization Time (Approx.):

For conditions: dc anode volts = 100, grid-No.2 volts = 0, grid-No.1 square-pulse volts = +50, and peak anode amperes during conduction = 5 . . . . . 0.5 μsec

Deionization Time (Approx.) . . . . . *See Table I* ←

Maximum Critical Grid-No.1 Current:

For conditions: ac anode-supply volts = 460 (rms), and average anode amperes = 0.5 . . . . . 3 μamp

Anode Voltage Drop (Approx.) . . . . . 10 volts

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

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

Mechanical:

Mounting Position	Any
Maximum Overall Length	3-7/8" ←
Maximum Seated Length	3-5/16" ←
Maximum Diameter	1-23/32"
Bulb	T-12
Base	Large-Wafer Octal 6-Pin ←
	with External Barriers and Sleeve (JETEC No.B6-100)

° Without external shield.

← Indicates a change.

TUBE DIVISION
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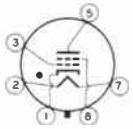
GAS THYRATRON

Basing Designation for BOTTOM VIEW 6C0

Pin 1 – Cathode
Pin 2 – Heater
Pin 3 – Grid No.1



Pin 5 – Anode
Pin 7 – Heater
Pin 8 – Grid No.2

RELAY AND GRID-CONTROLLED RECTIFIER SERVICE

For anode-supply frequency of 60 cps

Maximum Ratings, *Absolute Values:*

PEAK ANODE VOLTAGE:		
Forward.	650 max.	volts
Inverse.	1300 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, before tube conduction	-200 max.	volts
Average#, during tube conduction	-10 max.	volts
CATHODE CURRENT:		
Peak	5 max.	amp
Average#	0.5 max.	amp
Fault, for duration of 0.1 second max. .	20 max.	amp
AVERAGE GRID-No.2 CURRENT#	+0.05 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.

→ Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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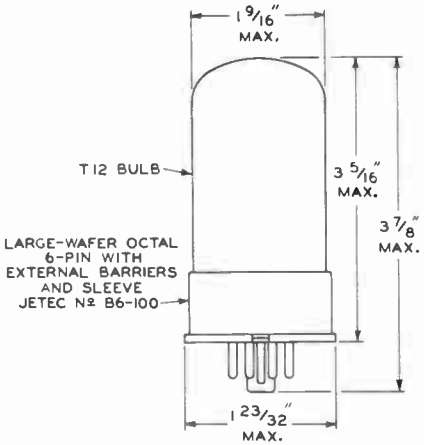
GAS THYRATRON

TABLE I

E_{cc_1} = DC Grid-No.1 Supply Voltage (Volts)
E_{cc_2} = DC Grid-No.2 Supply Voltage (Volts)
R_{g_1} = Grid-No.1 Resistor (Megohms)
R_{g_2} = Grid-No.2 Resistor (Ohms)

DC Anode Volts	125		250		R_{g_1}	E_{cc_1}	R_{g_2}*	E_{cc_2}
DC Anode Amperes	0.5	1.0	0.5	1.0				
DEIONIZATION TIME μsec (Approx.)	175	225	250	275	0.001	-13	1000	0
	350	375	450	475	0.1			
	650	700	1100	1200	2			
	100	125	100	125	0.001	-100	1000	0
	125	150	150	175	0.1			
	250	275	275	300	2			

* Series resistor between grid No.2 and cathode.



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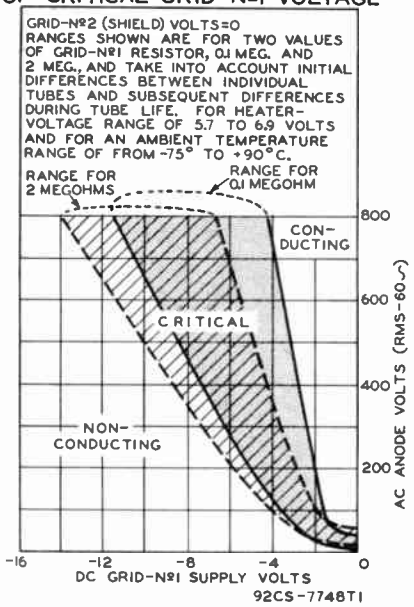
GAS THYRATRON

OPERATIONAL RANGE OF CRITICAL GRID-№1 VOLTAGE



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

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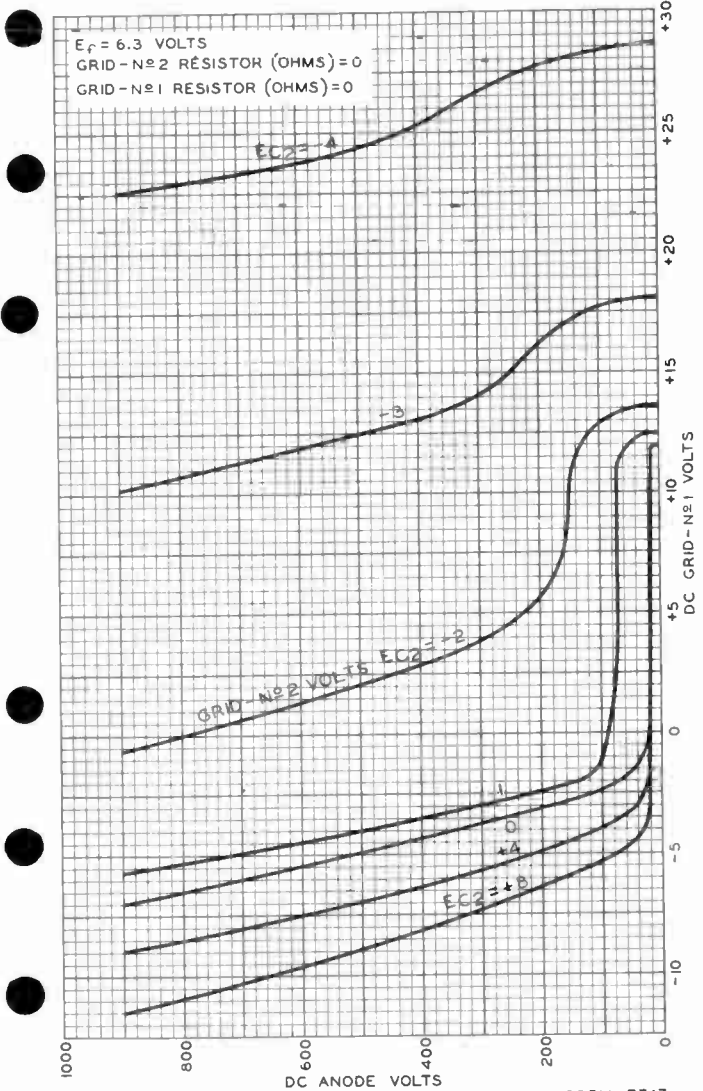
AVERAGE CONTROL CHARACTERISTICS



TUBE DIVISION

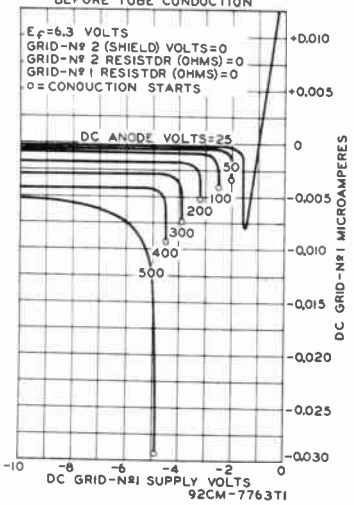
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7747

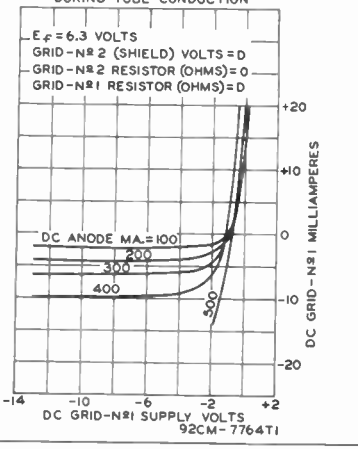
6012

CHARACTERISTIC CURVES

AVERAGE GRID-№1 CHARACTERISTICS
BEFORE TUBE CONDUCTION



AVERAGE GRID-№1 CHARACTERISTICS
DURING TUBE CONDUCTION



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6130/3C45

HYDROGEN THYRATRON

POSITIVE-CONTROL TRIODE TYPE

For Operation at Altitudes up to 50000 Feet

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage	6.3 +5% -10%	ac or dc volts
Current at 6.3 volts:		
Minimum	2.0	amp
Average	2.3	amp
Maximum	2.5	amp
Minimum heating time	2	minutes
Direct Interelectrode Capacitances (Approx.):		
Grid to anode	3.9	μμf
Grid to cathode	8.6	μμf
Ionization Time (Approx.)[a]	0.6	μsec
Deionization Time (Approx.)	25	μsec
Anode-Cathode Voltage Drop (Approx.):		
At middle of pulse duration	150	volts
Maximum Variation in Firing Time (Jitter)	0.06	μsec

Mechanical:

Operating Position	Any
Overall Length	5" ± 3/16"
Seated Length	4-3/8" ± 3/16"
Maximum Diameter	1-9/16"
Bulb	T-12
Cap	Small (JETEC No.C1-1)
Base . . . Medium-Vicanol-Shell Small 4-Pin	(JETEC No.A4-9)

BOTTOM VIEW

Pin 1 – Heater
Pin 2 – Cathode
Pin 3 – Grid
Pin 4 – Heater, Cathode
Cap – Anode

Cooling . . . . . Natural

PULSE MODULATOR SERVICE

Maximum and Minimum CCS● Ratings, *Absolute Values:*

	For Pressures Down to 70 mm of Hg#	
DC ANODE-SUPPLY VOLTAGE	800 min.	volts

[a] Defined as the time interval between the point on the rising portion of the grid pulse which is 26% of the peak unloaded pulse amplitude and the point on the anode-current pulse which is 26% of its peak amplitude. The anode-current pulse has a time rise of 0.05 microsecond maximum. The grid pulse has a peak amplitude of 130 volts minimum, has a rise time of 0.5 microsecond maximum, and is supplied by a driver having 1500 ohms maximum internal impedance.

● Continuous Commercial Service.

Corresponds to altitude of about 50000 feet.

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RCA

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HYDROGEN THYRATRON

PEAK ANODE VOLTAGE:		
Forward (E_{bmf})*	3000 max.	volts
Inverse	5% of E_{bmf} min.	volts
After anode-current pulse:▲		
During first 25 μsec	1500 max.	volts
After first 25 μsec	3000 max.	volts
GRID VOLTAGE:		
Negative (DC or Peak), before conduction	200 max.	volts
Peak positive pulse	175 min.	volts
ANODE CURRENT:		
Peak	35 max.	amp
Average○	0.045 max.	amp
Rate of Rise	750 max.	amp/μsec
OPERATION FACTOR†	3×10^8 max.	
PULSE DURATION*	6 max.	μsec
AMBIENT TEMPERATURE	-50 to +90	°C

Typical Operation♦ at 2000 pps in Accompanying Circuit:

	Pulse Duration of 0.5 μsec	
DC Anode-Supply Voltage	1250	volts
Peak Anode Voltage:		
Forward	3000	volts
Inverse:		
Immediately after anode-current pulse	530	volts
Grid Voltage:		
Negative, before conduction	0	volts
Peak positive pulse (Unloaded)	175	volts
Effective Grid-Circuit Resistance	1000	ohms
Anode Current:		
Peak	35	amp
Average○	0.035	amp
Operation Factor†	2.1×10^8	
Peak Power Output to Pulse Transformer (T)	43000	watts

Maximum Circuit Values:

Effective Grid-Circuit Resistance	1500 max.	ohms

* In applications where the anode voltage is applied instantaneously, the power-supply filter should be designed so that the peak forward anode voltage is applied at a rate not to exceed 75000 volts per second.

▲ Exclusive of spike not having more than 0.05 microsecond duration.

♦ Operation with a bulb temperature within the approximate range of 60° to 90°C measured on the bulb directly opposite the anode is recommended for longest life. To attain this temperature under operating conditions involving low ambient temperature, the use of a heat-conserving enclosure for the tube may be necessary.

○ Averaged over any cycle.

† Defined as *Peak Forward Anode Volts x Pulse Repetition Rate (pps) x Peak Anode Amperes* (excluding spike).

♦: See next page.

6073

VOLTAGE REGULATOR

MINIATURE GLOW-DISCHARGE TYPE

Intended for applications where very stable characteristics and dependable performance under shock and vibration are paramount. The 6073 is a "premium" version of the 0A2.

DATA

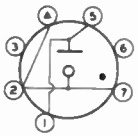
General:

Cathode	Cold

Mechanical:

Mounting Position	Any
Maximum Overall Length	2-5/8"
Maximum Seated Length	2-3/8"
Length, Base Seat to Bulb Top (Excluding tip)	2" ± 3/32"
Maximum Diameter	3/4"
Bulb	T-5-1/2
Base	Small-Button Miniature 7-Pin (JETEC No. E7-1)
Basing Designation for BOTTOM VIEW	5BQ

Pin 1 – Anode
Pin 2 – Cathode
Pin 3 – Internal Connection – Do Not Use
Pin 4 – Cathode



Pin 5 – Anode
Pin 6 – Internal Connection – Do Not Use
Pin 7 – Cathode

Maximum Ratings, *Absolute Values*:

AVERAGE STARTING CURRENT (See note below)	75 max.	ma
DC CATHODE CURRENT	30 max.	ma
	5 min.	ma
AMBIENT TEMPERATURE RANGE	−55 to +90	°C
FREQUENCY	0 max.	cps

Characteristics Range Values for Equipment Design:

	Min.	Av.	Max.	
DC Anode-Supply Voltage	185▲	–	–	volts
Anode Breakdown Voltage	–	156	185●	volts
Anode Voltage Drop	140★	151	168●	volts
Regulation (5 to 30 ma)	–	2	6●	volts

Circuit Values:

Shunt Capacitor	–	–	0.1	μf
Series Resistor			See note below	

NOTE: The notes and circuit information shown under Type 0A2 are also applicable to the 6073.

▲,●,★: See next page.

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6073

VOLTAGE REGULATOR

Shock and Vibration Tests:

These tests are made as indicated in the JAN Specifications JAN 1-A for Electron Tubes, May, 1946 under the sections as follows:

Section F-6b (9e) Shock Test: Instantaneous Impact Acceleration	900 max.	g
Section F-6b (9f) Vibration Test: Vibrational Acceleration.	2.5 max.	g

▲ Not less than indicated supply voltage should be provided to insure "starting" throughout tube life.

● Maximum individual tube value during life.

♠ Minimum individual tube value during life.

6074 PREMIUM TYPE

6074
VOLTAGE REGULATOR

MINIATURE GLOW-DISCHARGE TYPE

Intended for applications where very stable characteristics and dependable performance under shock and vibration are paramount. The 6074 is a "premium" version of the OB2.

DATA

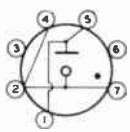
General:

Cathode	Cold

Mechanical:

Mounting Position	Any
Maximum Overall Length	2-5/8"
Maximum Seated Length	2-3/8"
Length, Base Seat to Bulb Top (Excluding tip)	2" ± 3/32"
Maximum Diameter	3/4"
Bulb	T-5-1/2
Base	Small-Button Miniature 7-Pin (JETEC No.E7-1)
Basing Designation for BOTTOM VIEW	5BQ

Pin 1 – Anode
Pin 2 – Cathode
Pin 3 – Internal Connection – Do Not Use
Pin 4 – Cathode



Pin 5 – Anode
Pin 6 – Internal Connection – Do Not Use
Pin 7 – Cathode

Maximum Ratings, *Absolute Values*:

AVERAGE STARTING CURRENT (See note below)	75 max.	ma
DC CATHODE CURRENT	30 max.	ma
	5 min.	ma
AMBIENT TEMPERATURE RANGE	-55 to +90	°C
FREQUENCY	0 max.	cps

Characteristics Range Values for Equipment Design:

	Min.	*Av.*	*Max.*	
DC Anode-Supply Voltage	133▲	–	–	volts
Anode Breakdown Voltage	–	115	133●	volts
Anode Voltage Drop	101▲	108	114●	volts
Regulation (5 to 30 ma)	–	1	4●	volts

Circuit Values:

Shunt Capacitor	–	–	0.1	μf
Series Resistor	See note below			

NOTE: The notes and circuit information shown under Type 0A2 are also applicable to the 6074.

▲,●,★: See next page.

6074
VOLTAGE REGULATOR

Shock and Vibration Tests:

These tests are made as indicated in the JAN Specifications JAN 1-A for Electron Tubes, May, 1946 under the sections as follows:

Section F-6b (9e) Shock Test:
Instantaneous Impact Acceleration . . . . 900 max. g

Section F-6b (9f) Vibration Test:
Vibrational Acceleration. . . . . 2.5 max. g

▲ Not less than indicated supply voltage should be provided to insure "starting" throughout tube life.

● Maximum individual tube value during life.

▲ Minimum individual tube value during life.

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6130/3C45
HYDROGEN THYRATRON

POSITIVE-CONTROL TRIODE TYPE

GENERAL DATA

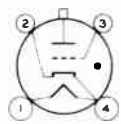
Electrical:

Heater, for Unipotential Cathode:		
Voltage. . . . . 6.3 $\begin{cases}+5\% \\ -10\%\end{cases}$	. . . ac or dc	volts
Current at 6.3 volts:		
Minimum.	2	amp
Average.	2.3	amp
Maximum.	2.5	amp
Minimum heating time	2	minutes
Direct Interelectrode Capacitances (Approx.):		
Grid to anode.	3.9	$\mu\mu$f
Grid to cathode.	8.6	$\mu\mu$f
Ionization Time (Approx.)□	0.6	μsec
Deionization Time (Approx.).	25	μsec
Anode-Cathode Voltage Drop (Approx.) at middle of pulse duration.	150	volts
Maximum Variation in Firing Time (Jitter).	0.06	μsec

Mechanical:

Operating Position	Any
Maximum Overall Length	5-3/16"
Seated Length.	4-3/8" ± 3/16"
Maximum Diameter	1-9/16"
Weight (Approx.)	3 oz
Cooling.	Natural
Bulb	T12
Cap.	Small (JEDEC No.C1-1)
Base . . . .Medium-Shell Small 4-Pin, Micanol (JEDEC No.A4-9)	
Basing Designation for BOTTOM VIEW	4BL

Pin 1 – Heater
Pin 2 – Cathode, Circuit Returns



Pin 3 – Grid
Pin 4 – Heater, Cathode
Cap – Anode

PULSE-MODULATOR SERVICE

Maximum and Minimum CCS● Ratings, *Absolute Values:*

	*For pressures down to 70 mm of Hg**	
DC ANODE-SUPPLY VOLTAGE.	800 min.	volts
PEAK ANODE VOLTAGE:		
Forward (E_{bmf})*.	3000 max.	volts
Inverse.	5% of E_{bmf} max.	volts
After anode-current pulse:▲		
During first 25 μsec . . .	1500 max.	volts
After first 25 μsec. . . .	3000 max.	volts

□,●,*,•,▲. See next page.

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6130/3C45
HYDROGEN THYRATRON

	For pressures doum to 70 mm of Hg [#]	
GRID VOLTAGE:		
Negative (DC or Peak), before conduction.	200 max.	volts
Peak positive-pulse.	175 min.	volts
ANODE CURRENT:		
Peak	35 max.	amp
Average[o]	0.045 max.	amp
Rate of rise	750 max.	amp/μsec
OPERATION FACTOR[†].	3×10^8 max.	
PULSE DURATION[▲].	6 max.	μsec
AMBIENT-TEMPERATURE RANGE. . . .	-50 to +90	°C

Typical Operation:[●]

	At 2000 pps in accompanying circuit with pulse duration of 0.5 μsec	
DC Anode-Supply Voltage.	1250	volts
Peak Anode Voltage:		
Forward.	3000	volts
Inverse:		
Immediately after anode-current pulse.	530	volts
GRID VOLTAGE:		
Negative, before conduction. . . .	0	volts
Peak positive-pulse (Unloaded) . .	175	volts
Effective Grid-Circuit Resistance. .	1000	ohms
ANODE CURRENT:		
Peak	35	amp
Average[o]	0.035	amp
Operation Factor[†].	2.1×10^8	
Peak Power output to Pulse Transformer (T).	43000	watts

Maximum Circuit Values:

Effective Grid-Circuit Resistance. .	1500 max.	ohms

□ Defined as the time interval between the point on the rising portion of the grid pulse which is 2% per cent of the peak unloaded-pulse amplitude and the point on the anode-current pulse which is 2% per cent of its peak amplitude. The anode-current pulse has a maximum time rise of 0.05 μsec. The grid pulse has a minimum peak amplitude of 130 volts, a maximum rise time of 0.5 μsec, and is supplied by a driver having a maximum internal impedance of 150 ohms.

● Continuous Commercial Service.

\# Corresponds to altitude of about 50,000 feet.

• In applications where the anode voltage is applied instantaneously, the power-supply filter should be designed so that the peak forward anode voltage is applied at a rate not to exceed 75,000 volts per second.

▲ Exclusive of spike not having more than 0.05 μsec duration.

o Averaged over any cycle.

† Defined as *Peak Forward Anode Volts* x *Pulse-Repetition Rate (pps)* x *Peak Anode Amperes* (excluding spike).

*, ●: See next page.

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

6130/3C45
HYDROGEN THYRATRON

* Pulse duration is defined as the time interval between points on the pulse envelope at which instantaneous amplitudes are equal to 70.7 per cent of the maximum amplitude excluding spike.

† Operation with a bulb temperature within the approximate range of 60° to 90° C measured on the bulb directly opposite the anode is recommended for longest life. To attain this temperature under operating conditions involving low ambient temperature, the use of a heat-conserving enclosure for the tube may be necessary.

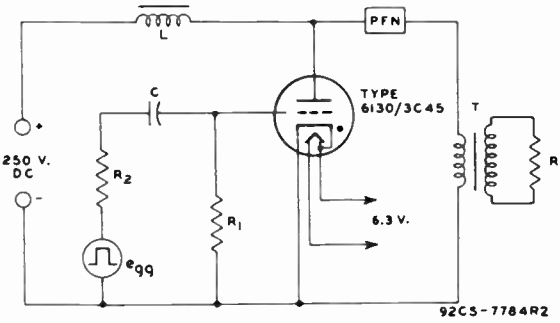
OPERATING CONSIDERATIONS

The *anode* is brought out of the tube to a small cap. The connector for this cap should be of the heat-radiating type and the connector lead should have ample current-carrying capability for the operating requirements.

Shielding of the 6130/3C45 should be provided if it is operated in the presence of strong electric fields which will ionize the gas within the tube. Any such ionization will cause erratic performance.

Cooling of the 6130/3C45 is accomplished by natural circulation of air around it. Under no circumstances should a stream of cooling air be applied to the glass envelope.

TYPICAL PULSE-MODULATOR CIRCUIT



C: Blocking Capacitor, 0.001 μf

egg: Pulse Generator supplying peak positive-pulse grid voltage of 175 volts (unloaded)

L: Charging Choke, 5 henries

PFN: Pulse-Forming Network with iterative impedance of 50 ohms, and a two-way transmission time of 0.5 μsec

R_1: Grid Resistor, 30,000 ohms

R_2: Effective Resistance of grid circuit, 1000 ohms

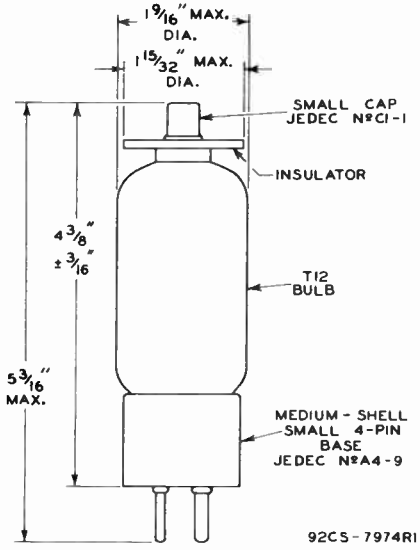
R_L: Load Resistance. Value reflected into primary of transformer (T) is 35 ohms.

T: Matching Pulse Transformer

6130

6130/3C45

HYDROGEN THYRATRON



5642

HALF-WAVE VACUUM RECTIFIER

SUBMINIATURE TYPE

For compact, portable high-voltage-rectifier applications

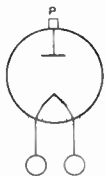
GENERAL DATA

Electrical:

Filament, Coated:		
Voltage	1.25	ac or dc volts
Current	0.2	amp
Direct Interelectrode Capacitance (Approx.):○		
Plate to filament	0.8	μμf

Mechanical:

Operating Position	Any
Maximum Length (Excluding flexible leads)	2.380"
Length, Base Seat to Bulb Top (Excluding tip)	1.700" ± 0.060"
Diameter	0.366" to 0.400"
Bulb	T3
Plate Terminal:	
Minimum length	0.250"
Leads, Flexible, Tinned	2
Minimum length	1.5"
Orientation and diameter	*See Dimensional Outline*
Maximum untinned distance from base seat	0.050"
Base	Special 2-Lead



P - Plate Terminal

F - Filament Lead

PULSED-RECTIFIER SERVICE

Maximum and Minimum Ratings, *Design-Center Values:*

For operation in a 525-line, 30-frame system□

PEAK INVERSE PLATE VOLTAGE	10000 max.	volts
PEAK PLATE CURRENT	5 max.	ma
DC PLATE CURRENT	0.25 max.	ma
FREQUENCY OF SUPPLY VOLTAGE	5 min.	kc

Typical Operation:

Peak-Pulse Plate Voltage®.	8000	volts
DC Output Voltage (2 tubes)	12000	volts
DC Output Current	0.15	ma

Characteristics:

Plate Current for plate volts = 30	4	ma

○,□,®: See next page.

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

TENTATIVE DATA

5642

5642

HALF-WAVE VACUUM RECTIFIER

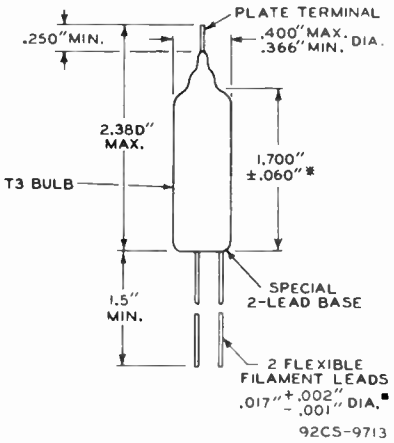
○ without external shield.

□ As described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission.

● The duration of the voltage pulse must not exceed 15 per cent of one horizontal scanning cycle. In a 525-line, 30-frame system, 15 per cent of one horizontal scanning cycle is 10 microseconds.

OPERATING CONSIDERATIONS

The *flexible leads* of the 5642 are usually soldered to the circuit elements. Soldering of the connections should be made as far as possible from the glass button and the glass tip. If this precaution is not followed, the heat of the soldering operation will crack the glass seals of the leads and damage the tube.



* Measured from base seat to full-top line as determined by a ring gauge of 1.211" ± 1.001" inside diameter.

■ The specified lead diameter applies only in the zone between .05" and 0.250" from the base seat. Between 0.250" and 1.500", a maximum diameter of 0.021" is held. Outside of these zones, the lead diameter is not controlled.

TENTATIVE DATA

5651A

Voltage-Reference Tube

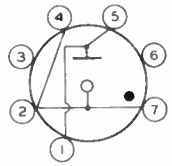
7-PIN MINIATURE, GLOW-DISCHARGE TYPE

Especially Useful as a Voltage-Reference Tube in DC Power Supplies

DATA

General:

Cathode . . . . . Cold
Operating Position . . . . . Any
Maximum Overall Length . . . . . 2-1/2"
Maximum Seated Length . . . . . 1-7/8"
Length, Base Reference Plane to Center of Gap . . . . . 1-1/4"
Diameter . . . . . Over-all 0.81"
Mounting Position . . . . . See General Section
Base . . . . . Miniature 7-Pin (JEDEC No. B7-1)
Basing Designation for 7BC



Pin 4 – Anode
Pin 5 – Cathode
Pin 3 – Do not use
Pin 6 – Do not use
Pin 2 – Do not use
Pin 7 – Cathode
Pin 1 – Cathode

Maximum and Minimum Ratings, *Absolute Maximum Values:*

DC CURRENT (continuous) . . . . . 5.5 max. ma
DC OPERATING CURRENT (continuous) . . . . . 1.5 max. ma
AMBIENT TEMPERATURE RANGE . . . . . -55 to 90 °C

Characteristics and Operation Range Values:

	Min.	Av.	Max.	
DC Starting Voltage	–	101	115[a]	volts
DC Operating Voltage (variation from tube to tube):				
At 1.5 ma	83	85	87	volts
At 2.5 ma	83.5	85.5	87.5	volts
At 3.5 ma	84.5	86.5	88.5	volts
Regulation (1.5 ma to 3.5 ma) .	–	–	3	volts
Temperature Coefficient of Operating Voltage (over ambient temperature range of -55 to 90° C)	–	-4	–	mv/°C
Percentage Variation of Operating Voltage:[b]				
During first 300 hours of life[c]	–	–	0.1	%
During subsequent 1000 hours of life	–	–	0.1	%

	Min.	Av.	Max.	
Short-term (100 hours) Variation of Operating Voltage after first 300 hours of life[b]	–	–	.05	%
Instantaneous Voltage Fluctuation (Voltage jump)[d]	–	–	0.1	volt

Circuit Values:

Shunt Capacitor	–	–	0.02	μf
Series Resistor[e]				

[a] A dc supply voltage of 115 volts minimum should be provided to insure "starting" throughout tube life.

[b] DC operating current = 2.5 ma.

[c] After initial 3-minute warm-up period.

[d] Defined as the maximum instantaneous voltage fluctuation at any current level within the operating current range.

[e] A series resistor must always be used with the 5651A. The resistance value must be chosen so that for the maximum current rating of 2.5 ma is not exceeded at the highest anode-supply voltage employed, and (2) the minimum current rating of 1.5 ma is always exceeded when the anode-supply voltage is at its lowest value.

SPECIAL TESTS AND PERFORMANCE DATA

Stability Life Performance:

This test is performed on a sample lot of tubes to assure that the tubes have been properly stabilized. Life testing is performed under the following conditions: DC anode-supply volts = 135, dc operating milliamperes = 2.5, anode-circuit resistance (ohms) = 20000. At the end of 300 hours of operation, tubes will not show a change in dc operating voltage greater than 0.1 per cent from the initial dc operating voltage. At the end of 1300 hours of operation, tubes will not show a change in dc operating voltage greater than 0.1 per cent from the operating voltage at 300 hours. During any 100-hour interval between 300 and 1300 hours of operation, tubes will not show a change in dc operating voltage greater than 0.05 per cent from the dc operating voltage at the start of the interval.

INSTALLATION AND APPLICATION

Make no connections to pins 3 and 6. Any potentials applied to these pins may cause erratic tube performance. The three pin terminals for the cathode (pins 2, 4, and 7) and the two for the anode (pins 1 and 5) offer the equipment designer several different possibilities for connection of the 5651A. Any pair of interconnected pins can be used as a jumper connection to a circuit common to either the cathode or to the anode. The use of such a jumper connection provides a means for opening the circuit to protect circuit components when the 5651A is removed from its socket. *Under no circumstances should the current through any pair of interconnected pins exceed one ampere.*

If the load for the regulated power supply is disconnected either directly or by removing the 5651A from its socket, the rectifier capacitors will charge to the rectifier peak voltage. It is important, therefore, that these capacitors be rated to withstand such voltage.

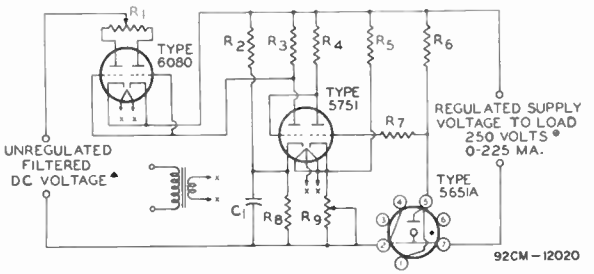
A warm-up period of 2 minutes should be allowed each time the equipment is turned on to insure minimum voltage drift of the 5651A.

When a shunt capacitor is used with the 5651A, its value should be limited to 0.02 μf. A large value of capacitance may cause the tube to oscillate and to give unstable performance.

Shielding should be utilized for the 5651A to insure maximum stability when the tube is operated in the presence of strong rf or magnetic fields.

SERIES-TYPE STABILIZED-VOLTAGE SUPPLY-CIRCUIT
Using RCA-5651A as Voltage-Reference Tube

The voltage regulation of this supply operated at a fixed line voltage of 117 volts and an output voltage of 250 volts is less than .2 volt over the current range of 0 to 225 milliamperes. At full current, the regulation for a variation of ±10 per cent in line voltage is less than 0.1 volt.



C_1 – 0.1 μf, 400 volts
R_1 – Plate current balancing potentiometer, 160 ohms, 10 watts
R_2 – 12000 ohms, 2 watts
R_3 – 470000 ohms, 1/2 watt
R_4 – 470000 ohms, 1/2 watt
R_5 – 12000 ohms, 2 watts
R_6 – 68000 ohms, 1 watt
R_7 – 1 megohm, 1/2 watt
R_8 – 15000 ohms, 2 watts
R_9 – Output voltage-control potentiometer, 10000 ohms

▲ 375 volts approx. at zero load current; 325 volts approx. at 225 milliamperes load current.

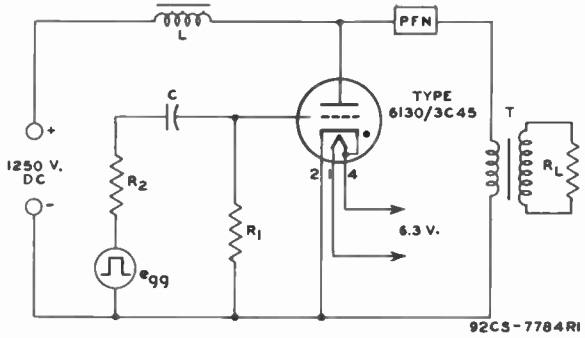
⊕ Socket connections are made so that removal of the 5651A from its socket opens the load.

6130

HYDROGEN THYRATRON

* Pulse duration is defined as the time interval between points on the pulse envelope at which instantaneous amplitudes are equal to 70.7% of the maximum amplitude excluding spike.

Typical Pulse-Modulator Circuit
Operating at 2000 pps



C: Blocking Capacitor, 0.001 μf

e_{gg}: Pulse Generator supplying peak positive-pulse grid voltage of 175 volts (unloaded)

L: Charging Choke, 5 henries

PFN: Pulse-Forming Network with iterative impedance of 50 ohms, and a two-way transmission time of 0.5 microsecond

R_1: Grid Resistor, 30000 ohms

R_2: Effective Resistance of pulse generator, 1000 ohms

R_L: Load Resistance. Value reflected into primary of transformer (T) is 35 ohms.

T: Matching Pulse Transformer

OPERATING CONSIDERATIONS

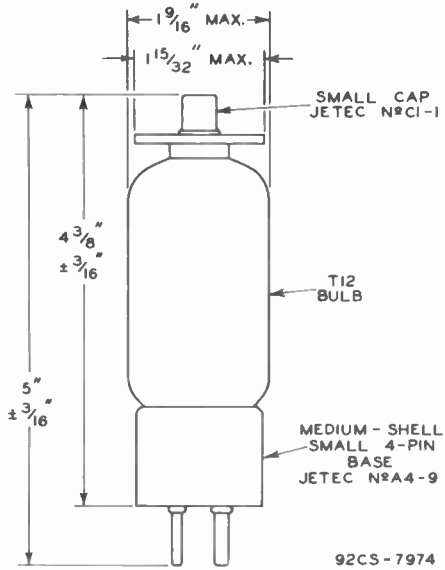
Cooling of the 6130/3C45 is accomplished by natural circulation of air around it. Under no circumstances should a stream of cooling air be applied to the glass envelope.

6130

RCA

6130

HYDROGEN THYRATRON



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

CIK/6014

XENON THYRATRON

NEGATIVE-CONTROL TRIODE TYPE

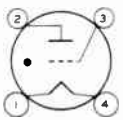
GENERAL DATA

Electrical:

	Min.	Av.	Max.	
Filament, Coated:				
Voltage	2.4	2.5	2.6	ac or dc volts
Current at 2.5 volts	5.5	6.3	7.1	amp
Minimum heating time prior to tube conduction			25	sec
Direct Interelectrode Capacitances (Approx.):				
Grid to anode			1	μμf
Grid to cathode			10	μμf
Maximum Deionization Time			500	μsec
Maximum Critical Grid Current			5	μamp
Anode Voltage Drop:				
Average, at beginning of life			8	volts
Maximum, at end of life			14	volts
Maximum Commutation Factor♦, averaged over first 500 volts of inverse anode voltage rise			0.15	$va/\mu s^2$
Grid Control Ratio (Approx.): For conditions: 10000-ohm grid resistor, circuit returns to filament transformer center-tap, dc anode voltage, and dc grid voltage			230	

Mechanical:

Mounting Position	Any
Maximum Overall Length	4-1/4"
Maximum Diameter	1-9/16"
Weight (Approx.)	3 oz
Bulb	T-12
Base	Medium-Metal-Shell Small 4-Pin with Bayonet (JETEC No.A4-89)
Basing Designation for BOTTOM VIEW	4D



Pin 1 – Filament

Pin 2 – Anode

Pin 3 – Grid

Pin 4 – Filament

GRID-CONTROLLED RECTIFIER SERVICE

Maximum Ratings, *Absolute Values:*

PEAK ANODE VOLTAGE:		
Forward	1000 max.	volts
Inverse	1250 max.	volts
GRID VOLTAGE:		
Peak, before tube conduction	-100 max.	volts

♦ Defined as the product of the rate of current decay in amperes per microsecond just before conduction ceases and the rate of inverse voltage rise in volts per microsecond following current conduction.

TUBE DIVISION

RADIO CORPORATION OF AMERICA HARRISON NEW JERSEY

CIK/6014

XENON THYRATRON

ANODE CURRENT:			
Peak		8 max.	amp
Average●		1 max.	amp
Overload*, for duration of	0.56 sec.	8 max.	amp
	1 sec.	4.5 max.	amp
	2 sec.	2.25 max.	amp
	3 sec.	1.5 max.	amp
	4 sec.	1.13 max.	amp
Fault, for duration of 0.1 second maximum.		77 max.	amp
AMBIENT-TEMPERATURE RANGE		-55 to +75	°C

● Averaged over any period of 4.5 seconds.

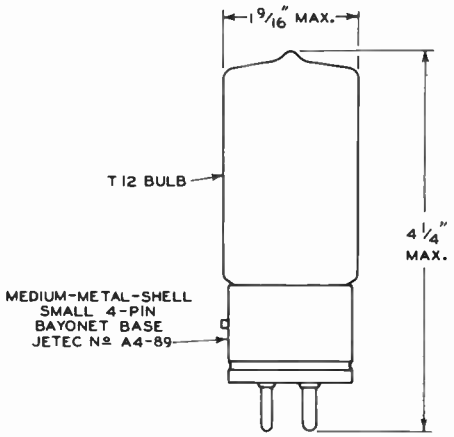
* Averaged for duration of overload occurring no more than once in any period of 4.5 seconds.

OPERATING CONSIDERATIONS

Circuit returns may be made to either side of filament or to transformer center-tap.

The *anode* of the CIK/6014 may show a red color when the tube is operated at full load.

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.



TUBE DIVISION
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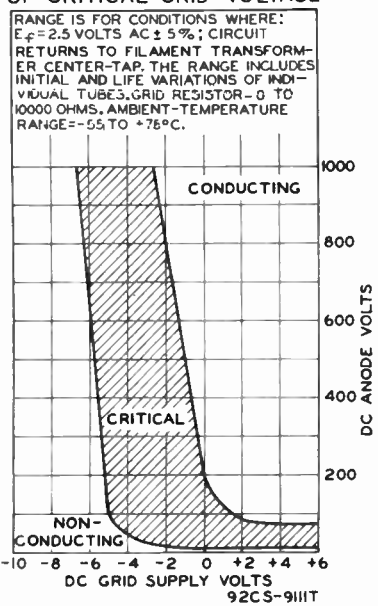
CIK/6014

XENON THYRATRON

OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE



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XENON THYRATRON

NEGATIVE-CONTROL TRIODE TYPE

FORCED-AIR COOLED

GENERAL DATA

Electrical:

Filament, Coated:*		
Voltage	2.5 ± 5%	ac volts
Current at 2.5 volts	92	amp
Minimum heating time, prior to tube conduction	60	sec
Direct Interelectrode Capacitances:◊		
Grid to anode	44	μμf
Grid to filament	7.5	μμf
Ionization Time (Approx.)	10	μsec
Deionization Time*	1000	μsec
Maximum Critical Grid Current for instantaneous anode volts = 650	50	μa
Peak Tube Voltage Drop	*See Characteristics Range Values*	
Maximum Commutation Factor⊕	400	$va/\mu sec^2$
Grid Control Ratio (Approx.): Under conditions: 10000-ohm grid resistor, returns to filament terminal FS, voltage on filament terminal F in phase with anode voltage (with respect to voltage at FS), anode voltage between 100 and 700 volts, and plate load of 2000 ohms	100	

Mechanical:

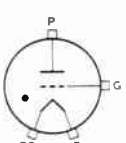
Operating Position	Any
Maximum Overall Length	11.8"
Maximum Radius (Including grid terminal)	2.88"
Maximum Diameter (Excluding grid terminal)	4.62"
Weight (Approx.)	3 lbs
Bulb	T36

Terminal Connections *(See Dimensional Outline)*:

P – Anode

G – Grid

F – Filament



FS – Filament Cathode Shield, Circuit Returns

Air Flow . . . . . 60 cfm

The specified air flow, from a 2- to 3-inch diameter nozzle located about 12 inches from the anode end of the tube and on the tube axis, should be directed at the anode cup and permitted to flow freely around the outside of the anode cup, grid-seal band, and glass bulb. These requirements are for operation at sea level and at an ambient temperature of

*, ◊, #, ⊕: See next page.

RCA

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XENON THYRATRON

30° C. At higher altitudes and ambient temperatures, the air flow must be increased to maintain the respective seal temperatures and the anode temperature within maximum ratings.

Anode Temperature (Measured within 1/2 inch of region where anode terminal blade joins anode surface)	300 max.	°C
Temperature of Anode Seal, Grid Seals, and Filament Seals	180 max.	°C

Maximum Ratings, ***Absolute Values:***

For supply frequency of 25 to 60 cps

	Continuous Service■	*Intermittent Service*♦	
PEAK ANODE VOLTAGE:			
Forward	650 max.	650 max.	volts
Inverse	650 max.	650 max.	volts
GRID VOLTAGE:			
Peak, before tube conduction	−150 max.	−150 max.	volts
Average, during tube conduction	−10 max.	−10 max.	volts
ANODE CURRENT:			
Peak	160 max.	400 max.	amp
Average	40 max.●□	7 max.★□	amp
Fault, for duration of 0.1 second maximum	4000 max.	4000 max.	amp
GRID CURRENT:			
Average positive	2.0 max.	2.0 max.	amp
Peak positive with anode negative	0.1 max.	0.1 max.	amp
AMBIENT-TEMPERATURE RANGE	−55 to +75	−55 to +75	°C

Typical Operation:

For intermittent ac control of X-ray tube power utilizing inverse-parallel circuit of Fig. 1 with anode-supply frequency of 60 cps

"On" (Conduction) Period	2	sec
"Off" (Non-Conduction) Period	34	sec
RMS Anode-Supply Voltage	220	volts
Grid-Bias Voltage	−50	volts
Grid-Circuit Resistance	0.1	megohm
Grid-Pulse Voltage	60	volts
Anode Current (Per Tube):		
Peak	400	amp
Average▲	127	amp
Load RMS Demand Current	280	amp

•,○,★,⊕,■,♦,●,□,★,▲: See next page.

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XENON THYRATRON

Maximum Circuit Values:

	Continuous Service	*Intermittent Service*	
Grid-Circuit Resistance. . .	0.1 max.	0.1 max.	megohm

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

Throughout Tube Life

	Note	*Min.*	*Max.*	
Filament Current	1	87	97	amp
Peak Tube Voltage Drop	1,2	-	40	volts
Peak Critical Anode Voltage.	1,3	-	100	volts

Note 1: With 2.5 volts rms on filament.

Note 2: With peak anode current of 400 amperes provided by a half-cycle pulse from a 60-cps sine wave. Pulse recurs once each second. Tube drop is measured by an oscilloscope connected between anode and the filament terminal FS. The grid is tied to anode through a 10,000-ohm resistor.

Note 3: The voltage at terminal F is in phase with the anode voltage (with respect to voltage at filament terminal FS). Circuit returns are made to terminal FS. Grid resistor = 0 to 100,000 ohms.

* In single-phase applications, to avoid excessive heating of the filament and for maximum tube life, the voltage at filament terminal F should be in phase with the voltage at the anode terminal (with respect to voltage at filament terminal FS). All returns should be made to filament terminal FS in order to reduce the amount of rms current flowing through the filament and filament leads. In polyphase installations, quadrature operation of the filament is recommended to reduce excessive heating of the filament and filament leads by the anode-return current. In quadrature operation, the filament and anode voltages should be 90° out of phase for optimum results. However, in practical applications, nearly full realization of the advantages of this type of excitation is possible with the filament and anode voltages between 60° and 120° out of phase. In polyphase operation where the anode voltage transfers from one phase to another during the current-conduction period, quadrature operation is obtained when the filament voltage passes through zero at the center of the current-conduction period.

○ Without external shield.

\# Measured by Capacitor-Discharge Method as described in "Standard on Electron Tubes: Methods of Testing, 1950 (50 IRE 7.S2)" available from The Institute of Radio Engineers, 1 East 79 St., New York 21, N. Y. Also available in "Proceedings of the I.R.E.", Vol.38, No.9, page 1092 (September 1950). Conditions of measurement involve anode-supply voltage (E_{bb}) of 300 volts, grid-supply voltage (E_{cc}) of -150 volts, grid resistor (r_g) of 5000 ohms and anode current (I_b) of 23 amperes.

⊕ Commutation factor is the product of the rate of current decay in amperes per microsecond just before conduction ceases and the rate of inverse-voltage rise in volts per microsecond following current conduction.

● Continuous Service is defined as service where conduction recurs for each cycle of the anode-supply voltage.

◐ Intermittent Service is defined as service where conduction does not take place as often as every cycle of the anode-supply voltage.

● Averaged over any period of 15 seconds maximum.

□ This rating applies when the average or the rms load current is at a maximum with respect to the phase-retard angle. This condition obtains with zero phase-retard angle. As the phase-retard angle is increased, the average or rms load current is reduced but the severity of duty on the 7086 is not reduced.

★, ▲: See next page.

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XENON THYRATRON

The angle of phase retard is the angle by which the grid signal (or the resultant tube conduction) lags the time at which the incoming and outgoing tubes have equal instantaneous values of voltage from the sinusoidal supply.

★ Averaged over any period of 36 seconds maximum.

▲ Averaged over the "on" period of 2 seconds.

OPERATING CONSIDERATIONS

The *mounting* may support the 7086 in any position. A suitable mounting arrangement is provided by the use of three insulated 1/4-inch-diameter studs set perpendicularly in a rigid surface at locations which are spaced to correspond with the spacing of the terminal holes as shown on the Dimensional Outline. The studs should extend a minimum distance of 5 inches out from the surface, and should be threaded for a minimum length of 2 inches on their free end. Place a nut followed by a brass or copper washer on each stud so that 1-1/2 inches of the free end extends beyond the washer. Then mount the tube by slipping the holes of the tube's terminals onto the studs. The terminal lugs of the connecting leads to the tube can then be slipped onto their respective studs. Tighten the connection with a second nut on each stud. ***In order not to subject the glass-to-metal seals to stress which may damage them, use two wrenches***--one on each side of the tube terminals when tightening a connection.

Filament leads should be made of No.2 stranded copper wire, or equivalent. The tube end of the wire lead should be hard soldered to a 225-ampere (minimum) copper terminal lug. Be sure that this terminal lug is placed in direct contact with the filament terminal before tightening the nut.

The anode lead should be made of No.5 copper wire, or equivalent, and terminate at the tube end in a 150-ampere (minimum) copper terminal lug.

The grid lead should terminate at the tube end in a lug that may be fastened to the grid terminal by a No.6 screw & nut.

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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XENON THYRATRON

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_1 = RMS Load Current
I_p = Anode Current (RMS)
I_{pm} = Peak Anode Current
P_{ac} = Average Power in Load
P_{al} = Line Volt-Amperes
P_{ap} = Trans. Pri. Volt-Amperes
P_{as} = Trans. Sec. Volt-Amperes
P_{dc} = DC Power ($E_{av} \times I_{av}$)
P_p = Peak Load Volt-Amperes

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	Fig. 5
Voltage Ratios					
E/E_{av}	–	–	2.22	1.11	1.11
E_{bmi}/E	1.41	1.41	1.41	2.83	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	1.41
Inductive Load■	1.41	1.41	1.41	2.83	1.41
Frequency Ratio					
f_r/f	–	–	1	2	2
Current Ratios					
I_b/I_{av}	–	–	1	0.5	0.5
Resistive Load					
I_p/I_{av}	–	–	1.57	0.785	0.785
I_{pm}/I_{av}	–	–	3.14	1.57	1.57
I_{pm}/I_b	3.14	3.14	3.14	3.14	3.14
I_1/I_b	2.22	2.22k*	–	–	–
Inductive Load■					
I_p/I_{av}	–	–	–	0.707	0.707
I_{pm}/I_{av}	–	–	–	1	1
I_{pm}/I_b	–	–	–	2	2
I_b/I_{av}	–	–	–	0.5	0.5

■, *: See next page.

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XENON THYRATRON

RATIO	Fig. 1	Fig. 2	Fig. 3	Fig. 4	Fig. 5
Power Ratios					
$P_{ac}/I_b E_{bmf}$	1.57	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_{a1}/P_{dc}	–	–	2.69	1.23	1.24
Inductive Load■					
P_{as}/P_{dc}	–	–	–	1.57	1.11
P_{ap}/P_{dc}	–	–	–	1.11	1.11
P_{a1}/P_{dc}	–	–	–	1.11	1.11

■ The use of a large filter-input choke is assumed except for the circuit of Figs.1 and 2.

* k = 1/2 number of turns in secondary of transformer T_p divided by the number of turns in the primary of T_p.

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 KW TO FILTER P_{dc}	MAX. AV. AC OUTPUT KVA P_{ac}
Fig. 1 Inverse-Parallel (AC Voltage Control)					
Intermittent Service	460	–	–	–	130▲ / 7♦
Continuous Service	460	–	–	–	40●
Fig. 2 Full-Wave Reflected Impedance (AC Voltage Control)	460	–	–	–	40●
Fig. 3 Half-Wave (DC Voltage Control)	460	205	40	8	–
Fig. 4 Full-Wave (DC Voltage Control)					
With Resistive Load	230	205	80	16	–
With Inductive Load	230	205	80	16	–
Fig. 5 Series (DC Voltage Control)	460	410	80	32.5	–

▲ Under conditions with "on" period of 2 seconds and "off" period of 34 seconds.

♦ Averaged over any period of 36 seconds maximum.

● Averaged over any period of 15 seconds maximum.

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XENON THYRATRON

AC Voltage Control

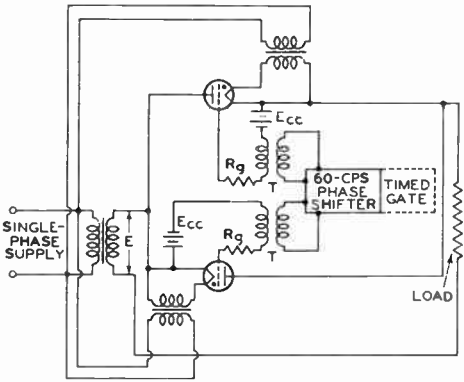

FIG. 1 SINGLE-PHASE INVERSE-PARALLEL

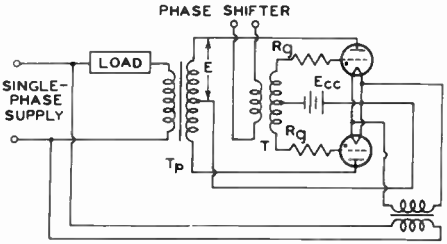

FIG. 2 FULL-WAVE SINGLE-PHASE REFLECTED IMPEDANCE

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XENON THYRATRON

DC Voltage Control

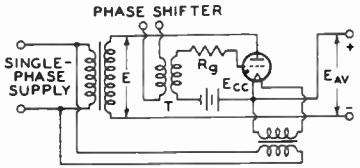

FIG.3 HALF-WAVE SINGLE-PHASE

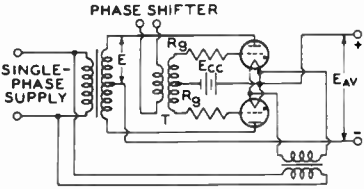

FIG.4 FULL-WAVE SINGLE-PHASE

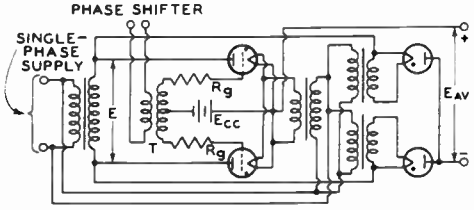

FIG. 5 SERIES SINGLE-PHASE

NOTES

E_{cc} = GRID-BIAS SUPPLY VOLTAGE
R_g = GRID CIRCUIT RESISTANCE
T = PEAKING TRANSFORMER
IN FIG. 5, THE RECTIFIER TUBES MAY BE USED AS DIODES. THE 7086 IS USED AS A DIODE BY CONNECTING THE GRID TO FILAMENT TERMINAL FS.

92CL-9438

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RCA

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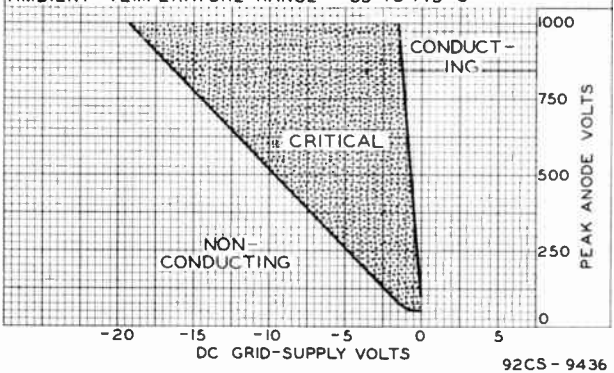
OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

RANGE IS FOR CONDITIONS WHERE:
E_f = 2.5 VOLTS AC ±5%. CIRCUIT RETURNS TO FILAMENT TERMINAL FS. FILAMENT VOLTAGE AT TERMINAL F IN PHASE WITH ANODE VOLTAGE (WITH RESPECT TO VOLTAGE AT FS).
THE RANGE INCLUDES INITIAL AND LIFE VARIATIONS OF INDIVIDUAL TUBES.
GRID RESISTOR = 0 TO 100000 OHMS
AMBIENT-TEMPERATURE RANGE = −55° TO +75° C

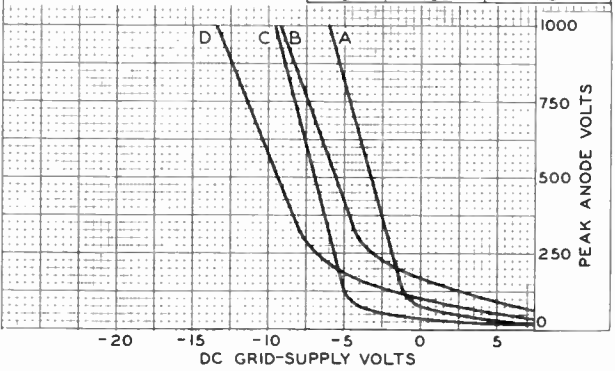


92CS-9436

SHIFT OF TYPICAL CONTROL CHARACTERISTICS WITH CHANGE IN FILAMENT PHASING AND CIRCUIT RETURN

E_f = 2.5 VOLTS AC
GRID RESISTOR=10000 OHMS
* BETWEEN FILAMENT VOLTAGE AT TERMINAL F AND ANODE VOLTAGE (WITH RESPECT TO VOLTAGE AT FS).

CURVE	PHASE ANGLE *	CIRCUIT RETURN TO FIL. TERM.
A	0°	FS
B	180°	F
C	0°	F
D	180°	FS



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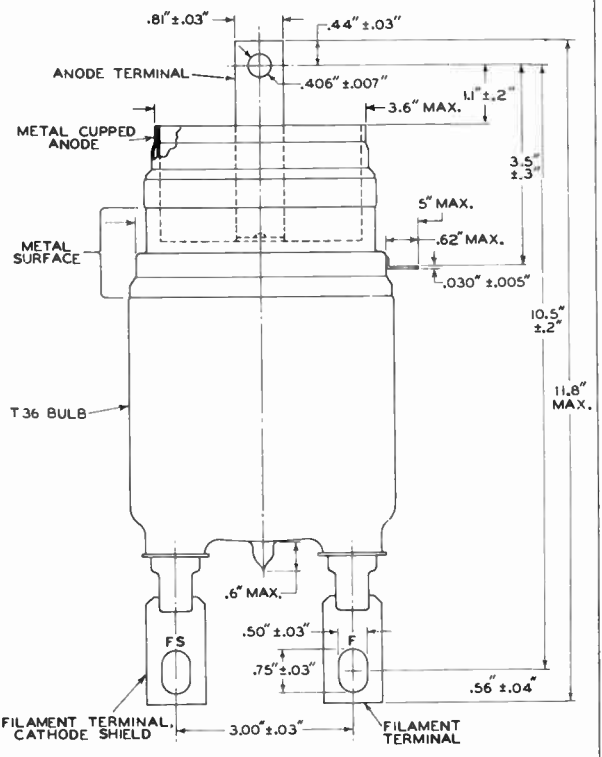
XENON THYRATRON



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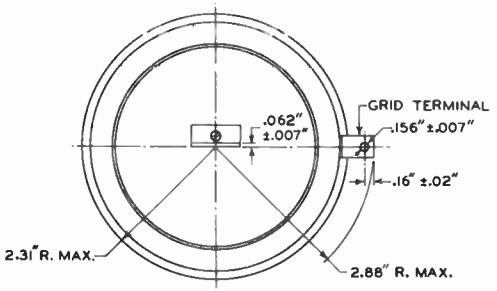
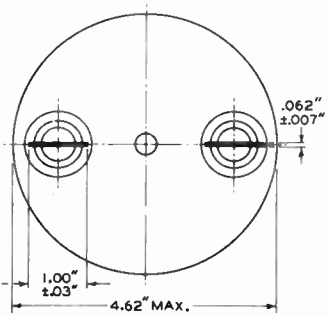
XENON THYRATRON



TOP VIEW



BOTTOM VIEW

92CJ-9424

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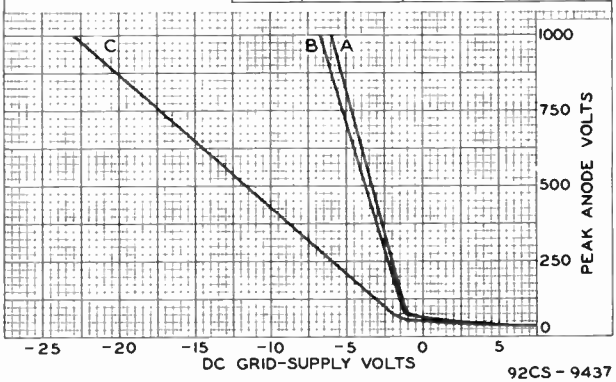
SHIFT OF CONTROL CHARACTERISTICS
WITH CHANGE IN GRID-RESISTOR VALUE

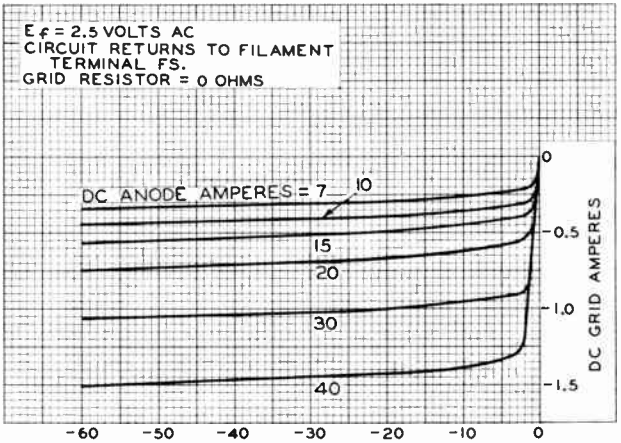
E_f = 2.5 VOLTS AC
*BETWEEN FILAMENT VOLTAGE AT TERMINAL F AND ANODE VOLTAGE (WITH RESPECT TO VOLTAGE AT FS).

CURVE	GRID RESISTOR MEGOHMS	CIRCUIT RETURN TO FIL. TERM.	PHASE ANGLE *
A	0.01	FS	0
B	0.1	FS	0
C	1	FS	0



92CS-9437

TYPICAL GRID CHARACTERISTICS
DURING TUBE CONDUCTION



92CS-9425

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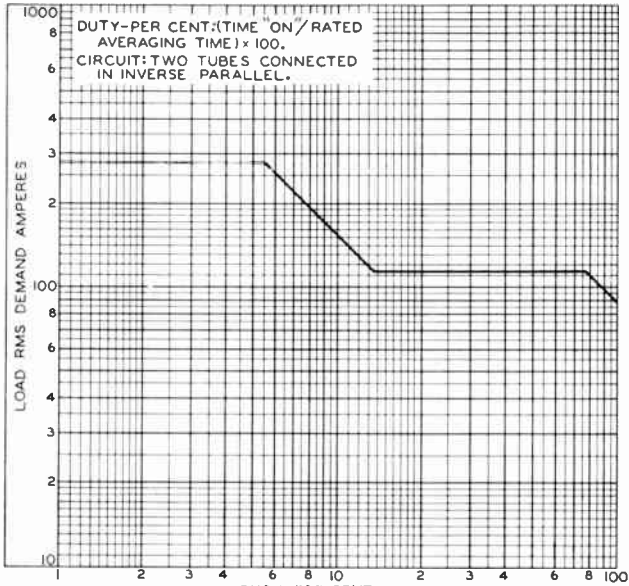
CURRENT DEMAND CHARACTERISTIC
AC VOLTAGE CONTROL SERVICE



92CS-9435

C3J/5632

XENON THYRATRON

NEGATIVE-CONTROL TRIODE TYPE

GENERAL DATA

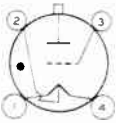
Electrical:

	Min.	Av.	Max.	
Filament, Coated:				
Mid-tapped:				
Voltage between pins 1 and 4	2.4	2.5	2.6	volts
Current at 2.5 volts		9	11	amp
Minimum heating time prior to tube conduction		30		sec
Direct Interelectrode Capacitances (Approx.):				
Grid to anode		2		μμf
Grid to cathode		11		μμf
Maximum Deionization Time		1000		μsec
Maximum Critical Grid Current		10		μamp
Anode Voltage Drop:				
Average, at beginning of life		10		volts
Maximum, at end of life		15		volts
Maximum Commutation Factor†, averaged over first 250 volts of inverse anode voltage rise			0.6	amp/μsec
Grid Control Ratio (Approx.):				
For conditions: 1000-ohm grid resistor, circuit returns to filament mid-tap, dc anode voltage, and dc grid voltage		10		

Mechanical:

Mounting Position	Any
Maximum Overall Length	3-1/4"
Maximum Diameter	2-3/4"
Weight (Approx.)	7 oz
Cap	Medium Bayonet (EIA S-24)
Bulb	T-9
Base	Modified Medium Shell Diode (EIA D-11-88) with Bayonet (EIA S-24)
Basing Designation for BOTTOM VIEW	5F

Pin 1 – Filament
Pin 2 – Filament
Mid-tap & Circuit Returns
Pin 3 – Anode
Pin 4 – Grid
Cap – Cathode



GRID-CONTROLLED RECTIFIER SERVICE

Maximum Ratings, *Absolute Values:*

PEAK ANODE VOLTAGE:		
Forward	650 max.	volts
Inverse	1300 max.	volts

† Defined as the product of the rate of current rise in amperes per microsecond and the factor for calculation of the peak inverse anode voltage rise in volts per microsecond of time duration of the current pulse.

TUBE DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

C3J/5632

XENON THYRATRON

GRID VOLTAGE:			
Peak, before tube conduction. . . .		−100 max.	volts
ANODE CURRENT:			
Peak.		30 max.	amp
Average•.		2.5 max.	amp
Overload:			
Rating I*, for duration of . .	0.37 sec. . .	30 max.	amp
	0.50 sec. . .	22.5 max.	amp
	1 sec. . .	11.25 max.	amp
	2 sec. . .	5.63 max.	amp
	3 sec. . .	3.75 max.	amp
	4 sec. . .	2.82 max.	amp
Rating II**, for duration of . .	3 sec. . .	3.75 max.	amp
	4 sec. . .	3.40 max.	amp
	4.5 sec. . .	3.30 max.	amp
Fault, for duration of 0.1 second maximum		300 max.	amp
AMBIENT-TEMPERATURE RANGE		−55 to +75	°C

• Averaged over any period of 4.5 seconds.

* Averaged over duration of overload occurring no more than once in any period of 4.5 seconds.

** Averaged over duration of overload occurring no more than once in any period of 30 seconds.

OPERATING CONSIDERATIONS

Circuit returns should be connected to filament mid-tap (pin 2).

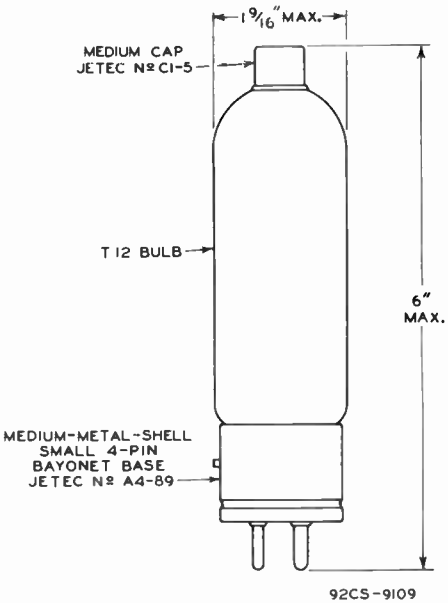
The *anode* of the C3J/5632 may show a red color when the tube is operated at full load.

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.

TUBE DIVISION
RADIO CORPORATION OF AMERICA HARRISON NEW JERSEY

C3J/5632

XENON THYRATRON



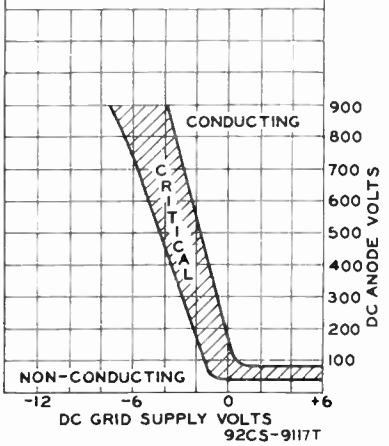
TUBE DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

C3J/5632

XENON THYRATRON

OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

RANGE IS FOR CONDITIONS WHERE: E_f = 2.5 VOLTS ± 5%; CIRCUIT RETURNS AND PIN 2 CONNECTED TO FILAMENT TRANSFORMER CENTER-TAP. THE RANGE INCLUDES INITIAL AND LIFE VARIATIONS OF INDIVIDUAL TUBES. GRID RESISTOR = 0 TO 10000 OHMS. AMBIENT-TEMPERATURE RANGE = −55 TO 75°C.



TUBE DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

C3J-A/5684

XENON THYRATRON

NEGATIVE-CONTROL TRIODE TYPE

GENERAL DATA

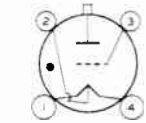
Electrical:

	Min.	Av.	Max.	
Filament, Coated and Mid-tapped:				
Voltage between pins 1 and 4	2.4	2.5	2.6	ac or dc volts
Current at 2.5 volts	7	9	11	amp
Minimum heating time prior to tube conduction			30	sec
Direct Interelectrode Capacitances (Approx.):				
Grid to anode			2	$\mu\mu f$
Grid to cathode			14	$\mu\mu f$
Maximum Deionization Time			1000	μsec
Maximum Critical Grid Current			10	μamp
Anode Voltage Drop:				
Average, at beginning of life			10	volts
Maximum, at end of life			14	volts
Maximum Commutation Factor♦, averaged over first 350 volts of inverse anode voltage rise			0.66	$va/\mu s^2$
Grid Control Ratio (Approx.): For conditions: 10000-ohm grid resistor, circuit returns to filament mid-tap, dc anode voltage, and dc grid voltage			200	

Mechanical:

Mounting Position	Any
Maximum Overall Length	5"
Maximum Diameter	1-9/16"
Weight (Approx.)	3 oz
Cap	Medium (JETEC No.C1-5)
Bulb	T-12
Base	Medium-Metal-Shell Small 4-Pin with Bayonet (JETEC No.A4-89)
Basing Designation for BOTTOM VIEW	4CF

Pin 1 – Filament
Pin 2 – Filament Mid-Tap & Circuit Returns



Pin 3 – Grid
Pin 4 – Filament Cap – Anode

GRID-CONTROLLED RECTIFIER SERVICE

Maximum Ratings, *Absolute Values:*

PEAK ANODE VOLTAGE:		
Forward	1000 max.	volts
Inverse	1250 max.	volts

♦ Defined as the product of the rate of current decay in amperes per microsecond just before conduction ceases and the rate of inverse voltage rise in volts per microsecond following current conduction.

TUBE DIVISION
RADIO CORPORATION OF AMERICA HARRISON NEW JERSEY

C3J-A/5684

XENON THYRATRON

GRID VOLTAGE:			
Peak, before tube conduction		−100 max.	volts
ANODE CURRENT:			
Peak		30 max.	amp
Average•		2.5 max.	amp
Overload:			
Rating I*, for duration of	0.37 sec.	30 max.	amp
	0.50 sec.	22.5 max.	amp
	1 sec.	11.25 max.	amp
	2 sec.	5.63 max.	amp
	3 sec.	3.75 max.	amp
	4 sec.	2.82 max.	amp
Rating II**, for duration of	3 sec.	3.75 max.	amp
	4 sec.	3.40 max.	amp
	4.5 sec.	3.30 max.	amp
Fault, for duration of 0.1 second maximum		300 max.	amp
AMBIENT-TEMPERATURE RANGE		−55 to +75	°C

• Averaged over any period of 4.5 seconds.

* Averaged over duration of overload occurring no more than once in any period of 4.5 seconds.

** Averaged over duration of overload occurring no more than once in any period of 30 seconds.

OPERATING CONSIDERATIONS

Circuit returns should be connected to filament mid-tap (pin 2).

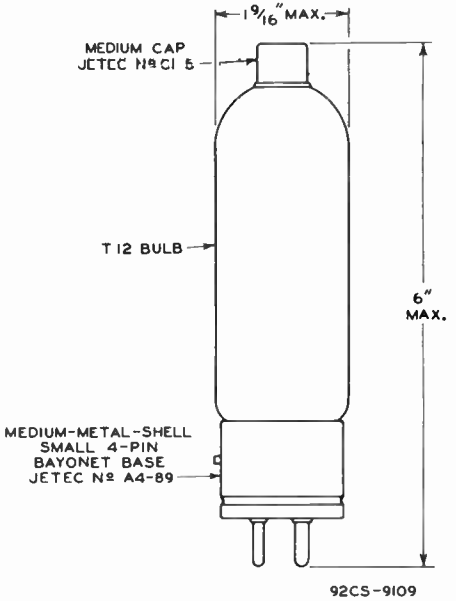
The *anode* of the C3J-A/5684 may show a red color when the tube is operated at full load.

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.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

C3J-A/5684

XENON THYRATRON



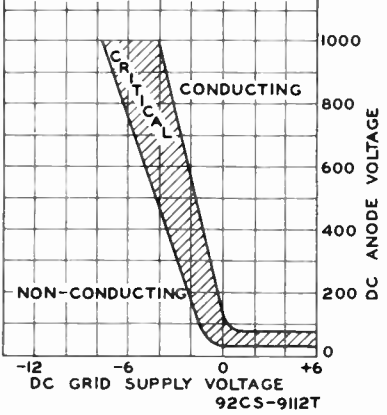
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

C3J-A/5684

XENON THYRATRON

OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

RANGE IS FOR CONDITIONS WHERE: E_f=2.5 VOLTS ± 5%; CIRCUIT RETURNS AND PIN 2 CONNECTED TO FILAMENT TRANSFORMER CENTER-TAP.
THE RANGE INCLUDES INITIAL AND LIFE VARIATIONS OF INDIVIDUAL TUBES.
GRID RESISTOR=0 TO 10000 OHMS.
AMBIENT-TEMPERATURE RANGE=-55 TO 75°C.



TUBE DIVISION

RADIO CORPORATION OF AMERICA HARRISON N.J. JERSEY

Xenon Thyratron

NEGATIVE-CONTROL TRIODE TYPE

GENERAL DATA

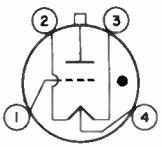
Electrical:

	Min.	Av.	Max.	
Filament, Coated and Mid-Tapped:				
Voltage (AC or DC) between pins 2 and 3	2.4	2.5	2.6	volts
Current	7	9	11	amp
Minimum heating time prior to tube conduction		30		sec
Direct Interelectrode Capacitances (Approx.):				
Grid to anode		2		μμf
Ionization Time (Approx.)		10		μsec
Deionization Time (Approx.)		1000		μsec
Maximum Critical Grid Current		10		μa
Anode Voltage Drop at peak anode amperes = 10		10		volts
Maximum Commutation Factor[a] averaged over first 350 volts of inverse anode-voltage rise		0.66		va/μsec²

Mechanical:

Operating Position	Any
Maximum Overall Length	6-3/4"
Maximum Seated Length	6"
Maximum Diameter	2-3/16"
Weight (Approx.)	3 oz
Cap	Medium (JEDEC No.C1-5)
Base	Special Metal Shell

Terminal Diagram:



Pin 1 – Grid
Pin 2 – Filament
Pin 3 – Filament
Pin 4 – Filament Tap & Circuit Returns
Cap – Anode

GRID-CONTROLLED-RECTIFIER SERVICE

Maximum and Minimum Ratings, *Absolute-Maximum Values:*

For anode supply frequency of 60 cps

PEAK ANODE VOLTAGE:		
Forward	900 max.	volts
Inverse	1250 max.	volts
PEAK NEGATIVE GRID VOLTAGE:		
Before tube conduction	100 max.	volts
During tube conduction	10 max.	volts

ANODE CURRENT:		
Peak	30 max.	amp
Average[b]	2.5 max.	amp
Fault	300 max.	amp
AMBIENT-TEMPERATURE RANGE during operation	-55 to +75	°C

[a] Defined as the product of the rate of current decay in amperes per microsecond just before conduction ceases and the rate of inverse-voltage rise in volts per microsecond following current conduction.

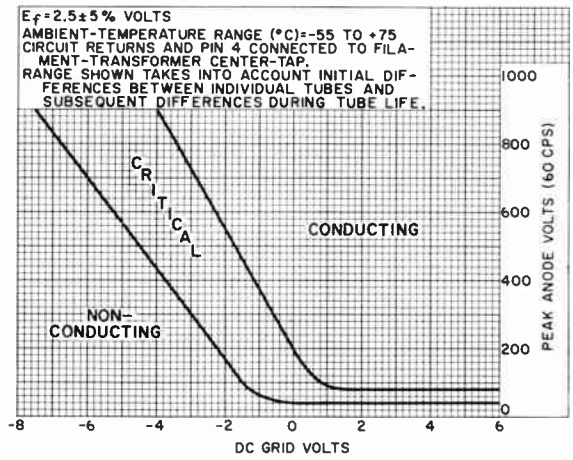
[b] Averaged over any period of 4.5 seconds.

OPERATING CONSIDERATIONS

Circuit returns should be connected to filament mid-tap (Pin 4).

Sufficient *anode-circuit resistance*, including the tube load, must be used under any conditions of operation to prevent exceeding the maximum current ratings of the tube.

OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE



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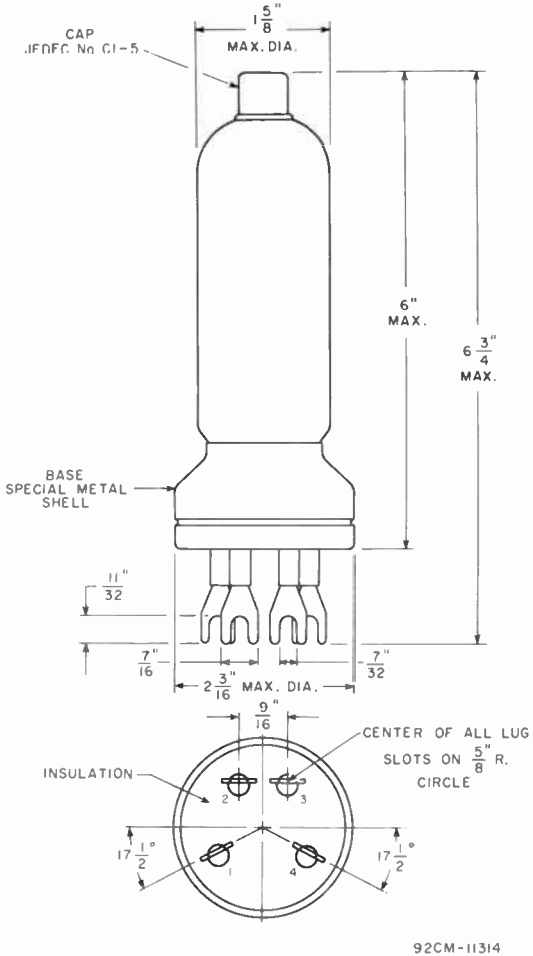


C6J/5C21

XENON THYRATRON

NEGATIVE-CONTROL TRIODE TYPE

GENERAL DATA

Electrical:

	Min.	Av.	Max.	
Filament, Cathode:				
Voltage	5.7	6.3	6.9	volts
Current at 6.3 volts	19	21	23	amp
Minimum heating time prior to tube conduction			60	sec
Direct Interelectrode Capacitances:				
Grid to anode			4	μμf
Grid to cathode			5	μμf
Maximum Deionization Time			100	μsec
Maximum Critical Grid Current			10	μamp
Anode Voltage Drop:				
Average, at beginning of life			9	volts
Maximum, at end of life			12	volts
Maximum Commutation Factor♦:				
Average over first 350 volts of inverse anode voltage rise			0.66	va/μs²
Grid Control Ratio (Average):				
For conditions: 10000-ohm grid resistor, circuit returns to filament transformer center-tap, filament pin 2 negative with respect to filament pin 3 when anode is positive, dc anode voltage, and dc grid voltage			210	

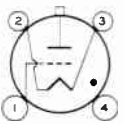
Mechanical:

Mounting Position	Vertical, base down
Maximum Overall Length	9-1/2"
Maximum Diameter	2-1/32"
Weight (Approx.)	7 oz
Cap	Medium (JETEC No. C1-5)
Bulb	T-16
Base	Medium-Metal-Shell Super-Jumbo 4-Pin (JETEC No. A4-81)
Basing Designation for BOTTOM VIEW	4BZ

Pin 1 – Grid

Pin 2 – Filament

Pin 3 – Filament



Pin 4 – No Connection

Cap – Anode

GRID-CONTROLLED RECTIFIER SERVICE

Maximum Ratings, *Absolute Values:*

PEAK ANODE VOLTAGE:

Forward	750 max.	volts
Inverse	1250 max.	volts

♦: See next page.

C6J/5C21

XENON THYRATRON

GRID VOLTAGE:		
Peak, before tube conduction	−100 max.	volts
ANODE CURRENT:		
Peak	77 max.	amp
Average♦	6.4 max.	amp
Overload:		
Rating I*, for duration of 0.5 sec.	77 max.	amp
Rating I*, for duration of 1 sec.	38.5 max.	amp
Rating I*, for duration of 2 sec.	19.2 max.	amp
Rating I*, for duration of 3 sec.	12.8 max.	amp
Rating I*, for duration of 4 sec.	9.6 max.	amp
Rating I*, for duration of 5 sec.	7.7 max.	amp
Rating II**, for duration of 3 sec.	12.8 max.	amp
Rating II**, for duration of 4 sec.	11.2 max.	amp
Rating II**, for duration of 5 sec.	10.3 max.	amp
Rating II**, for duration of 6 sec.	9.6 max.	amp
Fault, for duration of 0.1 second maximum	770 max.	amp
AMBIENT-TEMPERATURE RANGE	−55 to +75	°C

♦ Defined as the product of the rate of current decay in amperes per microsecond just before conduction ceases and the rate of inverse voltage rise in volts per microsecond following current conduction.

● Averaged over any period of 6 seconds.

* Averaged over duration of overload occurring no more than once in any period of 6 seconds.

** Averaged over duration of overload occurring no more than once in any period of 30 seconds.

OPERATING CONSIDERATIONS

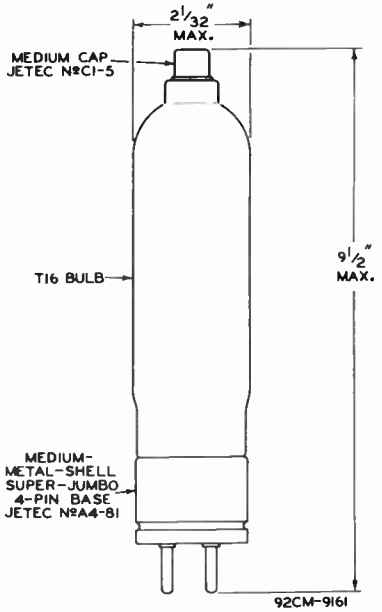
The *anode* of the C6J/5C21 will show a red color when the tube is operated at full load.

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.

TUBE DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

C6J/5C21

XENON THYRATRON

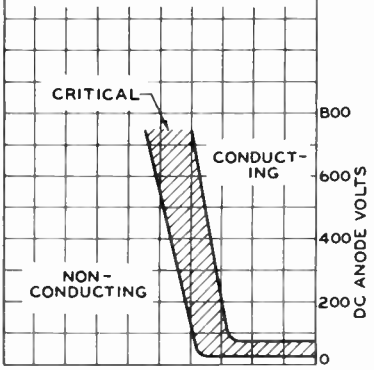


C6J/5C21

XENON THYRATRON

OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

RANGE IS FOR CONDITIONS WHERE: E_f = 2.5 VOLTS ± 5%; CIRCUIT RETURNS TO CENTER-TAP OF FILAMENT TRANSFORMER. FILAMENT VOLTAGE AT PIN 2 IS (-) WHEN ANODE VOLTAGE IS (+). THE RANGE INCLUDES INITIAL AND LIFE VARIATIONS OF INDIVIDUAL TUBES. GRID RESISTOR = 0 TO 10000 OHMS. AMBIENT TEMPERATURE = -55 TO +75°C.



92CS-9121T

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

C6J-A/5685

XENON THYRATRON

NEGATIVE-CONTROL TRIODE TYPE

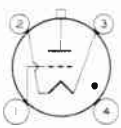
GENERAL DATA

Electrical:

	Min.	Av.	Max.	
Filament, Coated:				
Voltage	2.4	2.5	2.6	ac or dc volts
Current at 2.5 volts	19	21	23	amp
Minimum heating time prior to tube conduction			60	sec
Direct Interelectrode Capacitances (Approx.):				
Grid to anode			4	μμf
Grid to cathode			21	μμf
Maximum Deionization Time			1000	μsec
Maximum Critical Grid Current			10	μamp
Anode Voltage Drop:				
Average, at beginning of life			9	volts
Maximum, at end of life			12	volts
Maximum Commutation Factor♦, averaged over first 350 volts of inverse anode voltage rise			0.66	$v+/\mu s^2$
Grid Control Ratio (Approx.): For conditions: 10000-ohm grid resistor, circuit returns to filament transformer center-tap, filament pin 2 negative with respect to filament pin 3 when anode is positive, dc anode voltage, and dc grid voltage			210	

Mechanical:

Mounting Position	Vertical, base down
Maximum Overall Length	3-1/2"
Maximum Diameter	2-1/32"
Weight (Approx.)	7 oz
Cap	Medium (JETEC No.C1-5)
Bulb	T-16
Base	Medium-Metal-Shell Super-Jumbo 4-Pin (JETEC No.A4-81)
Baring Designation for BOTTOM VIEW	4BZ



Pin 1 – Grid

Pin 2 – Filament

Pin 3 – Filament

Pin 4 – No Connection

Cap – Anode

GRID-CONTROLLED RECTIFIER SERVICE

Maximum Ratings, *Absolute Values:*

PEAK ANODE VOLTAGE:	
Forward	1000 max. volts
Inverse	1250 max. volts

♦: See next page.

C6J-A/5685

XENON THYRATRON

GRID VOLTAGE:			
Peak, before tube conduction		-100 max.	volts
ANODE CURRENT:			
Peak		77 max.	amp
Average•		6.4 max.	amp
Overload:			
Rating I*, for duration of	0.5 sec	77 max.	amp
	1 sec	38.5 max.	amp
	2 sec	19.2 max.	amp
	3 sec	12.8 max.	amp
	4 sec	9.6 max.	amp
	5 sec	7.7 max.	amp
Rating II**, for duration of	3 sec	12.8 max.	amp
	4 sec	11.2 max.	amp
	5 sec	10.3 max.	amp
	6 sec	9.6 max.	amp
Fault, for duration of 0.1 second maximum		770 max.	amp
AMBIENT-TEMPERATURE RANGE		-55 to +75	°C

♦ Defined as the product of the rate of current decay in amperes per microsecond just before conduction ceases and the rate of inverse voltage rise in volts per microsecond following current conduction.

• Averaged over any period of 6 seconds.

* Averaged over duration of overload occurring no more than once in any period of 6 seconds.

** Averaged over duration of overload occurring no more than once in any period of 30 seconds.

OPERATING CONSIDERATIONS

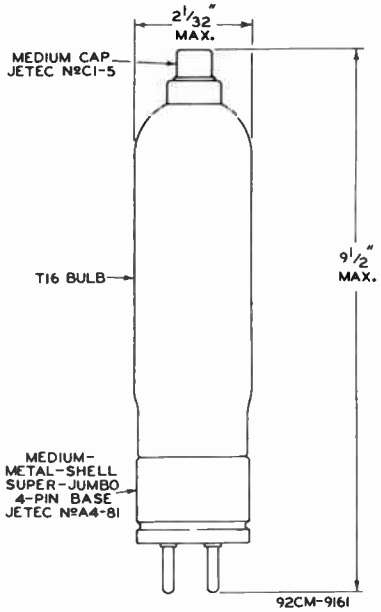
The *anode* of the C6J-A/5685 will show a red color when the tube is operated at full load.

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.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

C6J-A/5685

XENON THYRATRON



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

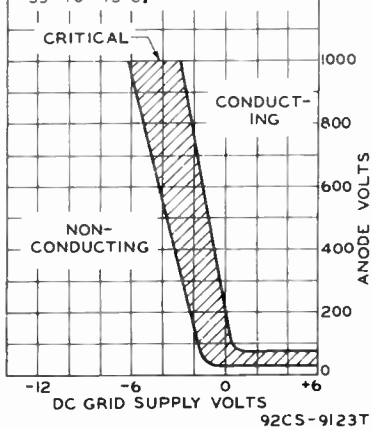
RCA

C6J-A/5685

XENON THYRATRON

OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

RANGE IS FOR CONDITIONS WHERE: E_f = 2.5 VOLTS ± 5%; CIRCUIT RETURNS TO CENTER-TAP OF FILAMENT TRANSFORMER. FILAMENT VOLTAGE AT PIN 2 IS (-) WHEN ANODE VOLTAGE IS (+). THE RANGE INCLUDES INITIAL AND LIFE VARIATIONS OF INDIVIDUAL TUBES. GRID RESISTOR = 0 TO 10000 OHMS. AMBIENT TEMPERATURE = -55 TO +75°C.



92CS-9123T

C16J/5665

XENON THYRATRON

NEGATIVE-CONTROL TRIODE TYPE

GENERAL DATA

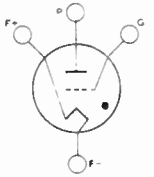
Electrical:

	Min.	Av.	Max.	
Filament, Coated:				
Voltage	2.4	2.5	2.6	ac or dc volts
Current at 2.5 volts	28	31	34	amp
Minimum heating time prior to tube conduction			60	sec
Direct Interelectrode Capacitance (Approx.):				
Grid to anode			8	$\mu\mu f$
Grid to cathode			29	$\mu\mu f$
Maximum Deionization Time			1000	μ sec
Maximum Critical Grid Current			10	μamp
Anode Voltage Drop:				
Average, at beginning of life			11	volts
Maximum, at end of life			14	volts
Maximum Commutation Factor†, average over first 330 volts of inverse anode voltage rise			0.66	$v/\mu s^2$
Grid Control Ratio (Approx.): For conditions: 10000-ohm grid resistor, circuit returns to filament transformer center-tap, filament lead F− negative with respect to filament lead F+ during conduction period, dc anode voltage and dc grid voltage			270	

Mechanical:

Mounting Position . . . . . Vertical, base down
Tube and Base Bracket Dimensions . . . *See Dimensional Outline*
Weight (Approx.) . . . . . 14 oz
Bulb T-20
Terminal Connections . . . . . *See Dimensional Outline*

BOTTOM VIEW



F−—Filament Lead

F+—Filament Lead

G—Grid Lead

P—Anode Lead (On envelope opposite bracket)

GRID-CONTROLLED RECTIFIER SERVICE

Maximum Ratings, *Absolute Values:*

PEAK ANODE VOLTAGE:			
Forward	1000 max.	1000 max.	volts
Inverse	1250 max.	1250 max.	volts

† Defined as the product of the rate of current decay in amperes per microsecond just before conduction ceases and the rate of inverse voltage rise in volts per microsecond following current conduction.

TUBE DIVISION
RADIO CORPORATION OF AMERICA HARRISON NEW JERSEY

C16J/5665

XENON THYRATRON

GRID VOLTAGE:			
Peak, before tube conduction	−100 max.	−100 max.	volts
ANODE CURRENT:			
Peak	160 max.	100 max.	amp
Average•	16 max.	16 max.	amp
Overload:			
Rating I•, for duration of.. 1 sec.	72 max.	81 max.	amp
2 sec.	36 max.	40.5 max.	amp
3 sec.	24 max.	27 max.	amp
3.5 sec.	21 max.	22.8 max.	amp
4 sec.	18 max.	20.3 max.	amp
Rating II••, for duration of.. 3 sec.	24 max.	—	amp
3.5 sec.	23 max.	22.8 max.	amp
4 sec.	22 max.	22.5 max.	amp
4.5 sec.	21.3 max.	22 max.	amp
Fault, for duration of 0.1 second maximum	1000 max.	1000 max.	amp
AMBIENT-TEMPERATURE RANGE	−55 to +75	−55 to +75	°C

• Averaged over any period of 4.5 seconds.

• Averaged over duration of overload occurring no more than once in any period of 4.5 seconds.

•• Averaged over duration of overload occurring no more than once in any period of 30 seconds.

OPERATING CONSIDERATIONS

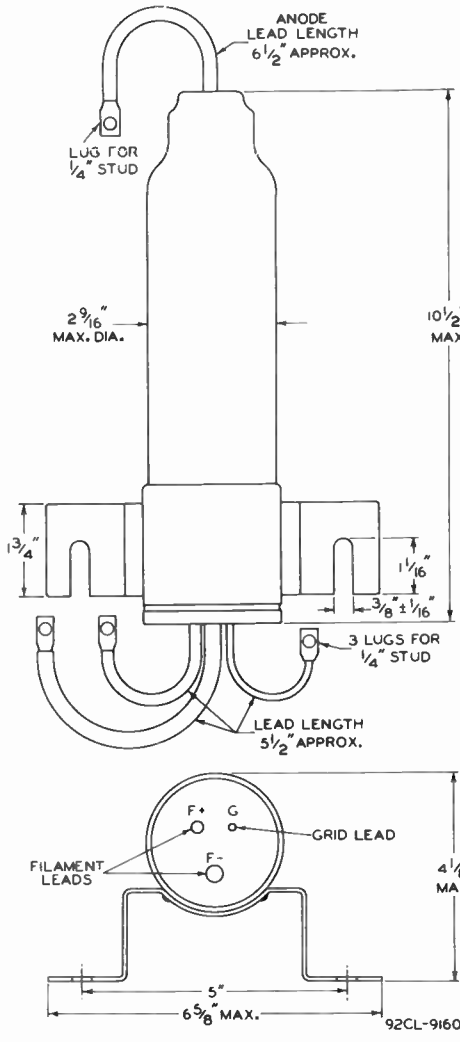
The *anode* of the C16J/5665 will show a red color when the tube is operated at full load.

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.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

C16J/5665

XENON THYRATRON



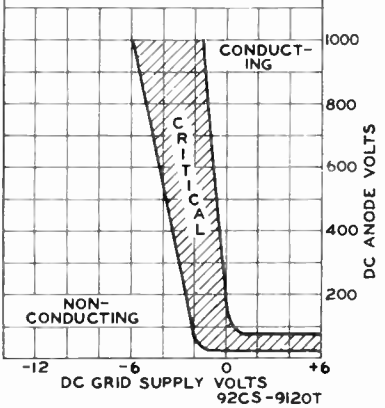
TUBE DIVISION
RADIO CORPORATION OF AMERICA HARRISON NEW JERSEY

C16J/5665

XENON THYRATRON

OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

RANGE IS FOR CONDITIONS WHERE: E_f = 2.5 VOLTS ± 5%; CIRCUIT RETURNS TO FILAMENT TRANSFORMER CENTER-TAP; FILAMENT LEAD F- NEGATIVE WITH RESPECT TO FILAMENT LEAD F+ DURING CONDUCTION PERIOD. THE RANGE INCLUDES INITIAL AND LIFE VARIATIONS OF INDIVIDUAL TUBES. GRID RESISTOR = 0 TO 10000 OHMS. AMBIENT TEMPERATURE RANGE -55 TO +75°C.



TUBE DIVISION
RADIO CORPORATION OF AMERICA HARRISON NEW JERSEY

2K56
KLYSTRON

SINGLE-RESONATOR, REFLEX TYPE

Frequency: 3840 to 4460 Mc.

GENERAL DATA

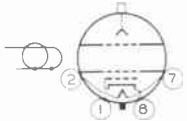
Electrical:

Heater, for Unipotential Cathode:		
Voltage	6.3 ± 0.5	ac or dc volts
Current	0.44	amp
Frequency Range	3840 to 4460	Mc

Mechanical:

Mounting Position	Any
Dimensions, Terminal Connections, and Mechanical Tuning Mechanism	See Outline Drawing
Resonant Cavity	Integral Part of Tube
Envelope	Metal
Cap	Miniature with Wafer
Base	Small-Wafer Octal 4-Pin with Pin No.4 replaced by Coaxial Output Line

BOTTOM VIEW



Pin 1 – Shell, Resonator

Pin 2 – Heater

Pin 7 – Heater

Pin 8 – Cathode

Cap – Reflector Terminal

NOTE: COAXIAL OUTPUT LINE PASSES THROUGH VACANT PIN POSITION NO.4

CW OSCILLATOR – Class C

Maximum Ratings, *Absolute Values*:

DC RESONATOR VOLTAGE	330 max.	volts
DC REFLECTOR VOLTAGE:		
Positive Value	0 max.	volts
Negative Value	400 max.	volts
DC RESONATOR CURRENT	37 max.	ma
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode.	50 max.	volts
Heater positive with respect to cathode.	50 max.	volts
AMBIENT TEMPERATURE OF SHELL	110 max.	°C
TEMPERATURE OF COAXIAL OUTPUT LINE	90 max.	°C

Typical Operation □ at 4150 Mc in Mode "A" with 1" x 2" Wave Guide

DC Resonator Voltage	300	volts
DC Reflector Voltage Range▲	−85 to −150	volts
DC Resonator Current	25	ma
DC Reflector Current	less than 7	μa

(continued on next page)

□, ▲: See next page.

2K56
KLYSTRON

Half-Power Electronic-Tuning Frequency Change■	35	Mc
Power Output	90	mw

▲ Adjusted for maximum power output at the given operating frequency.

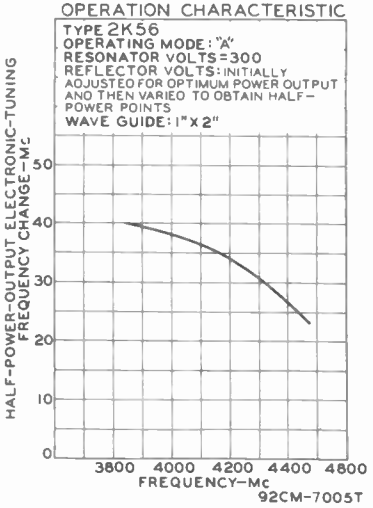
■ Change in frequency between the two half-power points when the reflector voltage is varied above and below the point of maximum power output corresponding to the given frequency.

□ The coaxial output line is coupled to the specified wave guide through the wide-band coaxial coupling unit shown on the following pages.

INSTALLATION and OPERATING NOTES for the 2K56 are the same as those shown for the 2K26, except that consideration should be given to the different coupling unit and wave guide required for the 2K56.

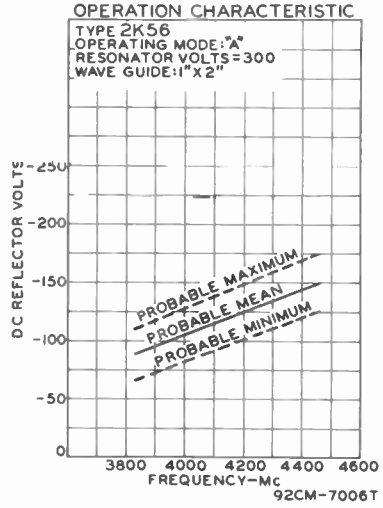
OUTLINE DIMENSIONS for Type 2K56 are the same as those for Type 2K26

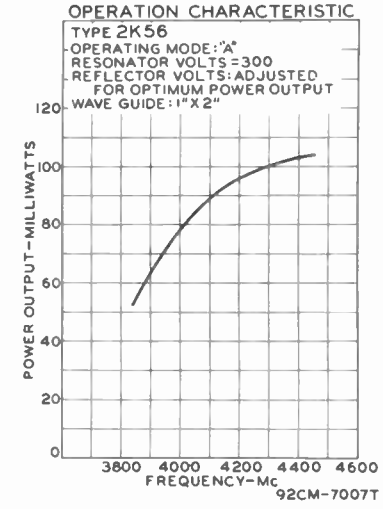
OPERATION CHARACTERISTIC



RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

2K56
KLYSTRON



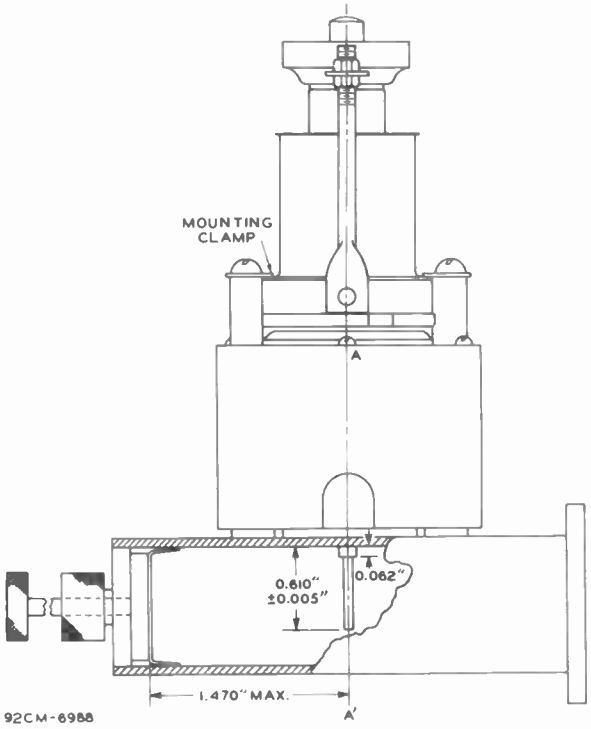


2K56

2K56
KLYSTRON

COUPLING ARRANGEMENT

RCA-2K56 Coupled to a 1" x 2" Wave Guide Through a Coaxial Transducer Coupling Circuit.

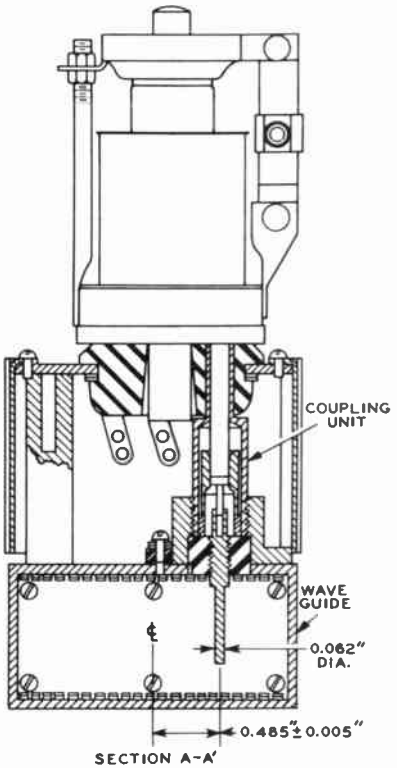


TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

2K56

KLYSTRON

COUPLING ARRANGEMENT (Cont'd)



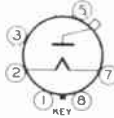
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
CE-6988VB

2V3-G

HALF-WAVE HIGH-VACUUM RECTIFIER

FOR USE WITH CATHODE-RAY TUBES

Filament	Tungsten	
Voltage *	2.5	a-c volts
Current	5	amp.
Maximum Overall Length		4-15/32"
Maximum Diameter		1-9/16"
Bulb		ST-12
Cap		Skirted Miniature - Style A
Base		Small Shell Octal 6-Pin
Pin 1 - No Connection		Pin 7 - Filament
Pin 2 - Filament		Pin 8 - No Connection
Pin 3 - No Connection		Cap - Plate
Pin 5 - No Connection		
Mounting Position		Vertical Only

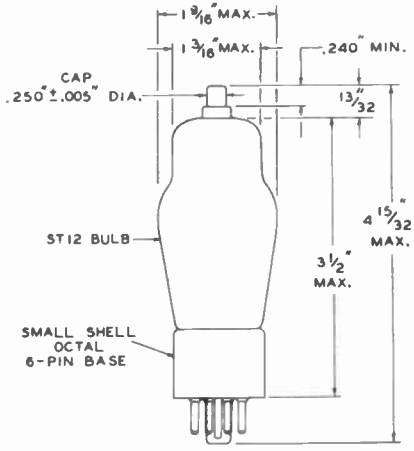


BOTTOM VIEW

MAXIMUM RATINGS

Peak Inverse Voltage	16500 max. volts
Peak Plate Current	12 max. ma.
Average Plate Current	2 max. ma.

* In equipment designed for an average line voltage of 117 volts, the 2V3-G can be operated at line voltages up to 125 volts or as low as 105 volts without serious effect on tube performance and life.

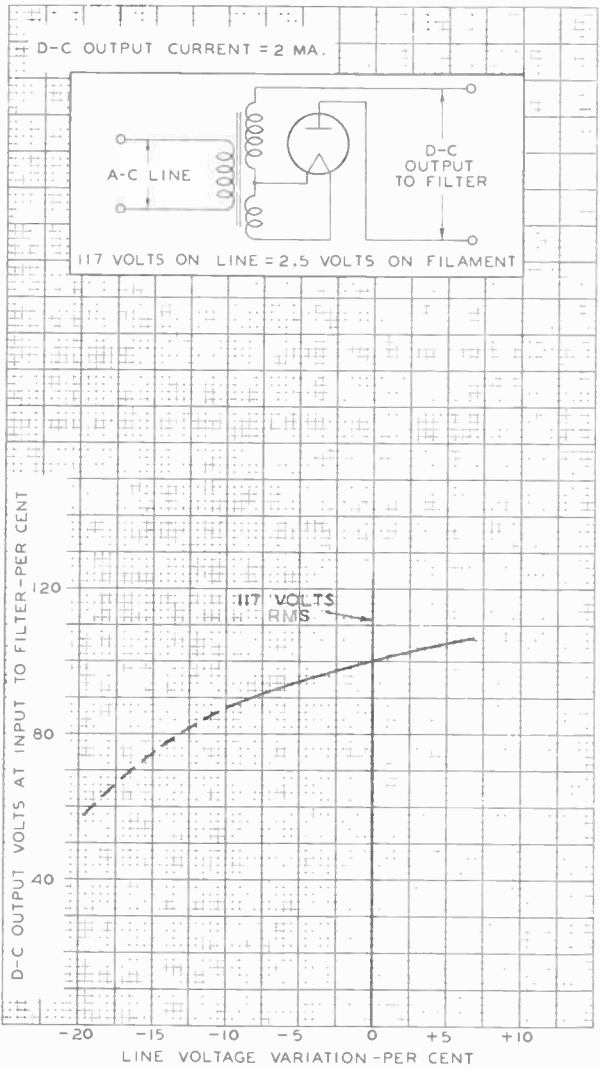


92C-8005 RI

2V3-G

2V3-G

TYPICAL REGULATION CHARACTERISTIC



4B26/2000

HALF-WAVE GAS RECTIFIER

HOT-CATHODE TYPE

Filament	Thoriated Tungsten	
Voltage	2.2	a-c volts
Current	18	amp.
Overall Length		6-5/8" ± 3/8"
Maximum Diameter		3-1/4"
Bulb		GT-25
End Terminal		*See Outline Drawing*
Base		Mogul Screw
Mounting Position		Any

Maximum Ratings Are Absolute Values

RECTIFIER

Peak Inverse Anode Voltage:		
In Single-Phase, Half-Wave Circuit	375 max.	volts
In Single-Phase, Full-Wave Circuit	250 max.	volts
In Polyphase Circuit	250 max.	volts
Peak Anode Current	36 max.	amp.
D-C Output Current	6 max.	amp.
Characteristics:		
Instantaneous Starting Anode Voltage*	13 approx.	volts
Tube Voltage Drop	8 approx.	volts

* To insure starting throughout tube life, an anode-supply voltage of not less than 20 volts (rms) is recommended. The actual design value above this minimum will depend on the nature of the load on the tube in any particular application.

If the output of the 4B26/2000 is filtered, the filter should be of the choke-input type.

Suitable circuits for use with the 4B26/2000 are the same as those shown for Type 872-A/872.

← Indicates a change.

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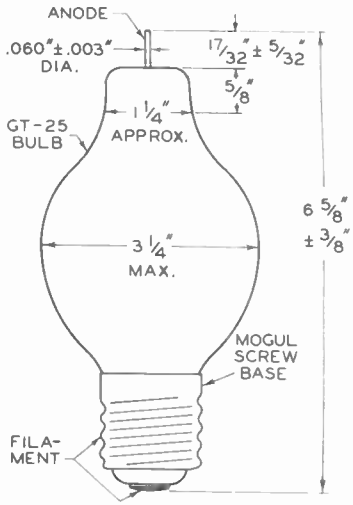
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

4B26

HALF-WAVE GAS-RECTIFIER



92CM-6147R1

◄ Indicates a change.

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LIGHTHOUSE DIODE

GENERAL DATA

Electrical:

Heater for Unipotential Cathode:
- Voltage . . . . . 6.3 ± 5% . . . . ac or dc volts
- Current . . . . . 0.75 . . . . . amp.

Direct Interelectrode Capacitance (Approx.):
- Plate to Cathode . . . . 2.70 . . . . . μμf

Mechanical:

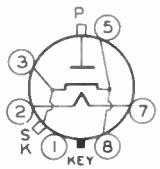
Operating Position . . . . . Any

Mounting . . . . . Tube should be supported by its metal shell and not by its base or other terminals

Dimensions and Terminals . . . . . See Outline Drawing

Base . . . . . Small H-Wafer Octal 6-Pin

BOTTOM VIEW



Pin 1 – Internal Con. Do Not Use
Pin 2 – Heater
Pin 3 – Cathode
Pin 5 – Cathode
Pin 7 – Heater
Pin 8 – Cathode

Shell (S) – Cathode, RF Terminal
Disc – Plate Terminal

HALF-WAVE RECTIFIER

Maximum Ratings, *Design-Center Values*:

PEAK INVERSE PLATE VOLTAGE	200 max.	volts
PEAK PLATE CURRENT	180 max.	ma.
AVERAGE PLATE CURRENT	27 max.	ma.
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode. .	90 max.	volts
Heater positive with respect to cathode. .	90 max.	volts
PLATE-SEAL TEMPERATURE*	150 max.	°C

* Under extremely high ambient temperature, the plate-seal temperature must never exceed 200°C.

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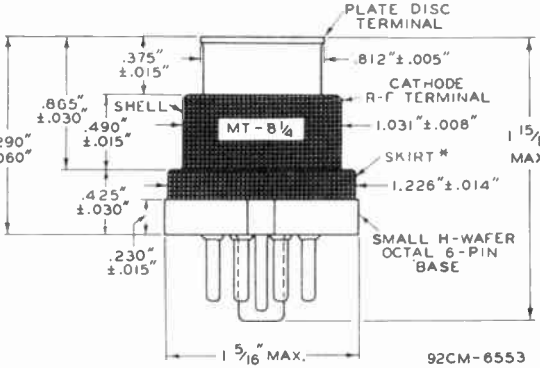
559

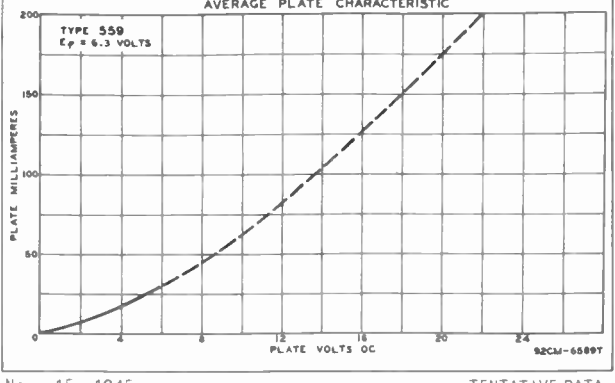
LIGHTHOUSE DIODE



MAXIMUM ECCENTRICITY OF ℄ (AXIS) OF THE FOLLOWING ITEMS WITH RESPECT TO ℄ OF SHELL AS REFERENCE IS:

PLATE DISC TERMINAL: 0.020"
SKIRT: 0.035"

*NOT TO BE USED FOR RF CONTACT IN NEW EQUIPMENT DESIGNS.



Nov. 15, 1945

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RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

TENTATIVE DATA

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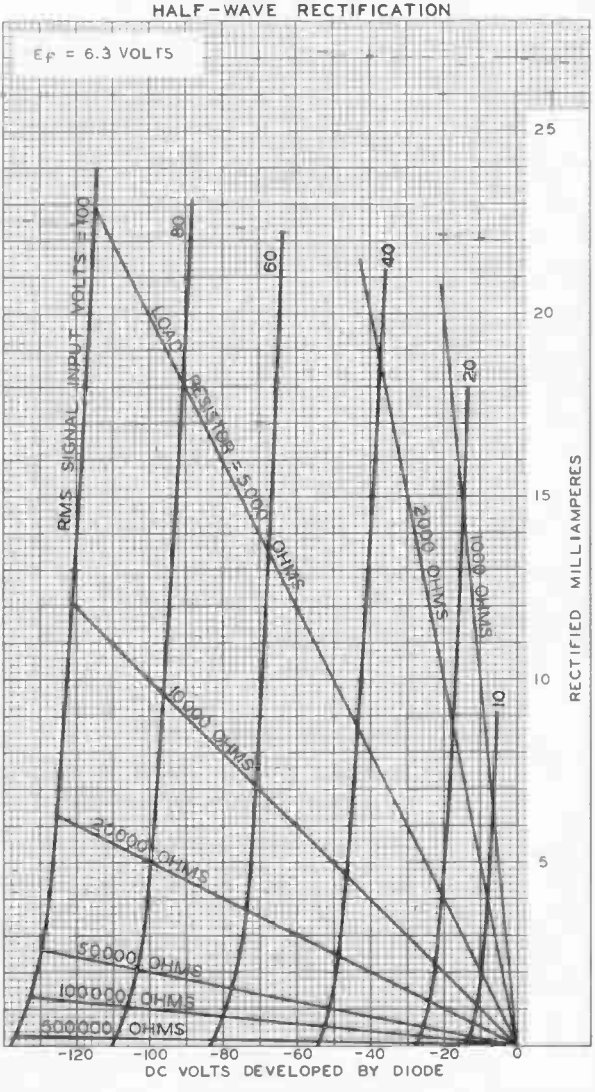
AVERAGE CHARACTERISTICS

HALF-WAVE RECTIFICATION



864

AMPLIFIER

LOW MICROPHONIC DESIGN

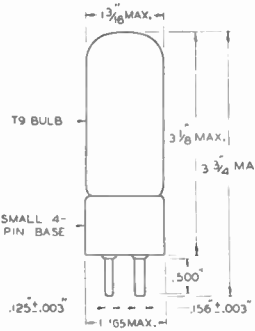
Filament	Coated	
Voltage	1.1	d-c volts
Current	0.25	amp.
Direct Interelectrode Capacitances:		
Grid to Plate	5.3	μμf
Grid to Filament	3.3	μμf
Plate to Filament	2.1	μμf
Maximum Overall Length		3-3/4"
Maximum Diameter		1-3/16"
Bulb		T-9
Base		Small 4-Pin

AMPLIFIER - Class A

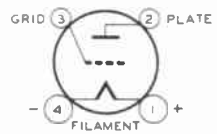
Operating Conditions and Characteristics:

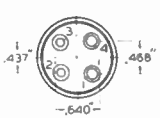
Filament Voltage	1.1	1.1	d-c volts
Plate Voltage	90	135 max.	volts
Grid Voltage	-4.5	-9	volts
Amplification Factor	8.2	8.2	
Plate Resistance	13500	12700	ohms
Mutual Conductance	610	645	μmhos
Plate Current	2.9	3.5	ma.

If a grid-coupling resistor is used, its maximum value should not exceed 2.0 megohms.



TUBE SYMBOL & TOP VIEW OF SOCKET CONNECTIONS





BOTTOM VIEW OF BASE

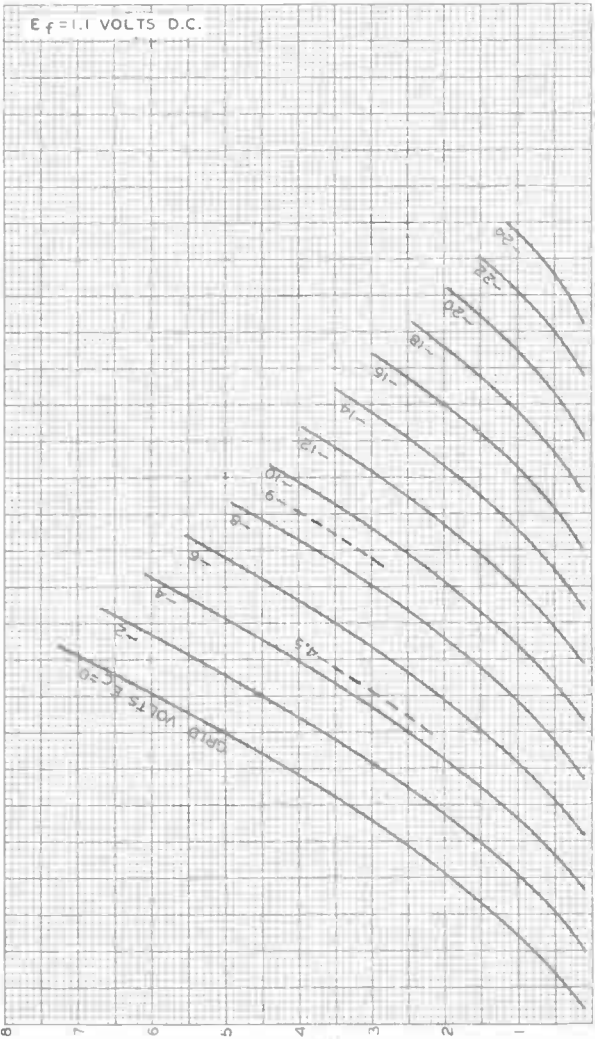
92C-451R3

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY INC

RCA

864

AVERAGE PLATE CHARACTERISTICS



874

VOLTAGE REGULATOR

GLOW DISCHARGE

Cathode	Cold	
Maximum Overall Length		5-3/8"
Maximum Seated Height		4-3/4" ◄
Maximum Diameter		2-1/16"
Bulb		ST-16 ◄
Base		Medium 4-Pin Bayonet
Pin 1 – Cathode		Pin 3 – Anode
Pin 2 – Jumper*		Pin 4 – Jumper*
Mounting Position		Any

BOTTOM VIEW (4S)

Maximum and Minimum Ratings Are Absolute Values

REGULATOR SERVICE

D-C Anode Supply Voltage*	130 min.	volts ◄
D-C Operating Current (Continuous)	50 max.	ma.
	10 min.	ma.
Ambient Temperature Range	-55 to +90	°C ◄
Characteristics:		
D-C Starting Voltage (Approx.)	115	volts
D-C Operating Voltage (Approx.)	90	volts
D-C Operating Current (Continuous)	10 to 50	ma.
Regulation (10 to 50 ma.)	7	volts

● With suitable socket connections, jumper within base acts as switch to open power-supply circuit when voltage regulator tube is removed from socket.

* Not less than indicated supply voltages should be provided to insure "starting" throughout tube life.

Sufficient resistance must always be used in series with this type to limit the current through the tube to 50 milliamperes under continuous (steady state) operating conditions. During the interval of 5 to 10 seconds which may be required for the regulated tubes in associated equipment to warm up and draw plate current, a maximum current of 100 milliamperes is permissible provided each such starting period is followed by a steady-state operating period of at least several minutes. Unless this precaution is observed, tube performance will be impaired. ◄

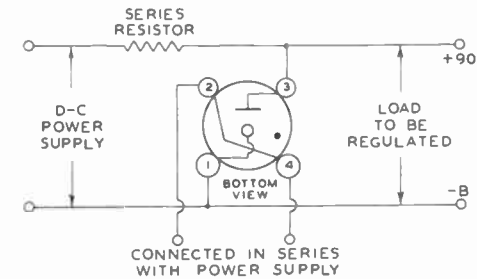
In voltage-regulator tubes of the glow-discharge type, regulation is somewhat dependent on past operating conditions. For example, the regulation value of a tube operated for a protracted period at 10 milliamperes and then changed to 35 milliamperes, may be somewhat different from the value that will be obtained after a long period of operation at 50 milliamperes. Likewise, the regulation value may change somewhat after a long idle period.

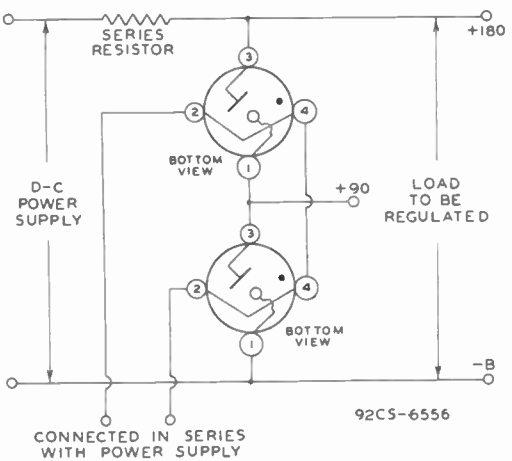
◄ Indicates a change.

874

VOLTAGE REGULATOR

TYPICAL CIRCUIT CONNECTIONS





RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

878

HALF-WAVE HIGH-VACUUM RECTIFIER

FOR USE WITH CATHODE-RAY TUBES

Filament	Tungsten	
Voltage	2.5	a-c volts
Current	5.0	amp.
Overall Length		7" to 7-5/8"
Maximum Diameter		1-13/16"
Bulb		T-14
Cap		Medium Metal Skirted
Base		Medium 4-Pin

Operating Conditions:

Filament Voltage	2.5	a-c volts
A-C Plate Voltage (RMS)	7100 max.	volts
Peak Inverse Voltage	20000 max.	volts
D-C Output Current (Continuous).	5 max.	ma.

The 878 is for use in suitable rectifying devices to supply the d-c voltage requirements of cathode-ray tubes.

It is important that the filament transformer secondary be insulated to withstand the maximum peak inverse voltage encountered in the installation.

The *maximum peak plate current* of the 878 is limited by the available emission from the filament. In normal operation, the peak current is practically independent of the size of input filter condenser and is approximately 20 milliamperes.

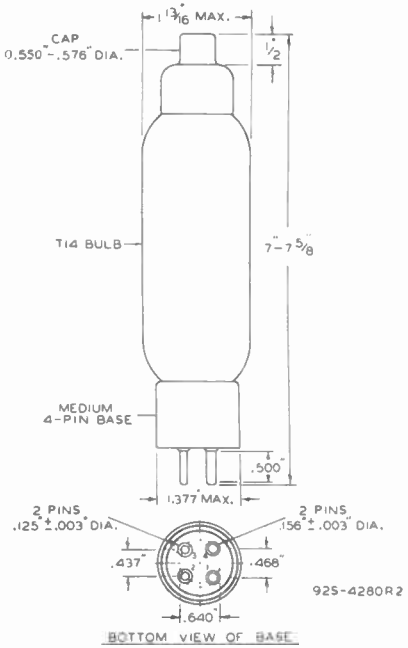
Filter requirements are ordinarily met by the use of a 0.5 to 2.0 μf condenser shunted across the bleeder circuit. The shunt condenser should have a rating sufficient to withstand the instantaneous peak value of the a-c input voltage. If this filtering is inadequate for a definite application, a two-section filter is recommended.

In a *voltage-doubler circuit*, two 878's may be operated to deliver approximately twice the voltage obtainable from a half-wave rectifier circuit for the same a-c input voltage. However, a separate filament-supply winding is required for each tube.

878

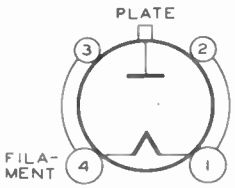
878

HALF-WAVE HIGH-VACUUM RECTIFIER



BOTTOM VIEW OF BASE

TUBE SYMBOL & TOP VIEW
OF
SOCKET CONNECTIONS



JAN. 15, 1936

DATA

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY INC

1603

TRIPLE-GRID DETECTOR AMPLIFIER

For applications critical as to microphonics, noise, and hum

Heater ■	Coated Unipotential Cathode	
Voltage	6.3	a-c or d-c volts
Current	0.3	amp.
Direct Interelectrode Capacitances: ▲		
Triode Connection (Approx.) - Grids #2 & #3 tied to plate		
Grid to Plate	2.0	μμf
Grid to Cathode	3.0	μμf
Plate to Cathode	10.5	μμf
Pentode Connection		
Grid to Plate	0.007 max. ○	μμf
Input	4.6	μμf
Output	6.1	μμf
Overall Length	4-11/16" to 4-13/16"	
Seated Height	4-1/16" to 4-5/16"	
Maximum Diameter	1-9/16"	
Bulb	ST-12	
Cap	Small Metal	
Base	Small 6-Pin	
Pin 1 - Heater	Pin 5 - Cathode	
Pin 2 - Plate	Pin 6 - Heater	
Pin 3 - Screen	Cap - Grid	
Pin 4 - Suppressor		
Mounting Position		Any

BOTTOM VIEW

SINGLE-TUBE AMPLIFIER

Plate Voltage	250 max.	volts
Screen Voltage	180 max.	volts

Typical Operation and Characteristics - Class A_1 Amplifier:

	Pentode Connection			*Triode Connection*		
Plate	100	250	250	180	250	volts
Screen	100	100	180	-	-	volts
Grid	-3	-3	-3	-5.3	-8	volts
Suppressor	Tied to cath. at socket					
Amp. Fact.	-	-	-	20●	20●	
Plate Res.	1.0	□	0.9	0.011	0.0105	megohm
Transcond.	1185	1225	2000	1800	1900	μmhos
Grid Bias #	-7	-7	-	-	-	volts
Plate Cur.	2	2	8.3	5.3	6.5	ma.
Screen Cur.	0.5	0.5	2.1	-	-	ma.

□ Greater than 1.5. ● Approx. # Approx., for cath. cur. cut-off.

PUSH-PULL AMPLIFIER - Triode Connection

Typical Operation - Class A_1 Amplifier:
Unless otherwise specified, values are for 2 tubes

Plate	90	volts
Grid	-2.5	volts
Cathode Resistor	625	ohms
Plate Current	4.0	ma.
Load Res. (plate to plate)	10000	ohms
Power Output	40	mw

DETECTOR

Typical Operation as Biased Detector:

Plate Supply◇	100	100	250	250	volts
Screen	12	30	50	100	volts
Grid	-1.16	-1.83	-1.95	-4.3	volts
Cathode Res.	18000	10000	3000	10000	ohms
Suppressor	Connected to cathode at socket				
Cath. Cur. (no sig.)	0.063	0.183	0.65	0.43	ma.
Plate Resistor	1.00	0.25	0.25	0.50	megohm
Blocking Condenser	0.01	0.01	0.03	0.03	μf
Grid Resistor *	1.00	0.50	0.25	0.25	megohm
R-F Signal (RMS)**	1.05	1.60	1.18	1.37	volts

■ In circuits where the cathode is not directly connected to the heater, the potential difference between heater and cathode should be kept as low as possible.
▲ The internal shield in the dome of the 1603 is connected to the cathode within the tube.
○ with close-fitting shield connected to cathode.
◇ Voltage at plate will be "Plate Supply" voltage minus voltage drop in plate resistor caused by plate current.
* For the following amplifier tube.
** See next page.

←Indicates a change.

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY INC

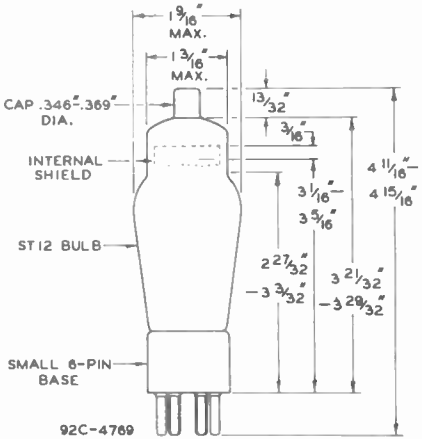
1603

TRIPLE-GRID DETECTOR AMPLIFIER

(continued from preceding page)

** With these signal values modulated 20%, the voltage output under each set of conditions is 17 peak volts at the grid of the following amplifier. This value is sufficient to insure full audio output from a 42 (for 6.3-volt operation) or a 2A5 (for 2.5-volt operation) under 250-volt plate conditions.

For Curves, refer to Types 6J7 and 57. For additional Data, refer to RESISTANCE-COUPLED AMPLIFIER CHART.



RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY INC

1644

TWIN-PENTODE POWER AMPLIFIER

For applications critical as to matching of the pentode units

Maximum Ratings,
Characteristics, Curves,
Dimensions, and Socket Connections
for Type 1644
are the same as those for Type 12L8-GT.

1654
HALF-WAVE VACUUM RECTIFIER

MINIATURE TYPE

GENERAL DATA

Electrical:

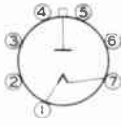
Filament, Coated:		
Voltage	1.4	ac or dc volts
Current	0.05	amp
Direct Interelectrode Capacitance (Approx.):[o]		
Plate to Filament	1.4	μμf

[o] With no external shield.

Mechanical:

Mounting Position	Any
Maximum Overall Length	2-7/16"
Maximum Seated Length	2-3/16"
Maximum Diameter	3/4"
Bulb	T-5-1/2
Base	Small-Button Miniature 7-Pin
Basing Designation for BOTTOM VIEW	2Z

Pin 1 – Filament –
Pin 2 – Internal Con. Do Not Use
Pin 3 – Internal Con. Do Not Use
Pin 4 – No Connection
Pin 5 – No Connection



Pin 6 – Internal Con. Do Not Use
Pin 7 – Filament + Bulb Terminal } Plate

HALF-WAVE RECTIFIER

Maximum Ratings, *Design-Center Values*:[•]

PEAK INVERSE PLATE VOLTAGE	4300 max.	volts ←
PEAK PLATE CURRENT[■]	6 max.	ma
AVERAGE PLATE CURRENT	1 max.	ma

Typical Operation:

AC Plate-Supply Voltage	1500	volts ←
Filter-Input Capacitor	0.025	μf
Total Effective Plate-Supply Impedance	150000	ohms ←
DC Output Current	1	ma
DC Output Voltage (At Input to Filter)[*]	1230	volts ←

Circuit Values: ←

A plate-supply impedance of 150000 ohms is required in order that the "hot-switching" current will not exceed the permissible value of 15 ma. under conditions of normal line-voltage fluctuation. For plate-supply voltages lower than 1500 volts, the plate-supply impedance may be decreased provided the resultant peak-current rating of 6 ma. and the "hot-switching" current of 15 ma. are not exceeded.

•,■,*: See next page.
← Indicates a change.

1654

1654
HALF-WAVE VACUUM RECTIFIER

- These ratings apply to the 1654 when it is operated from a power supply having a frequency up to 500 cycles per second. If a contemplated application involves higher supply frequencies, please write, stating the proposed operating frequency, to Commercial Engineering, RCA, Harrison, N. J., as to the required reduction in ratings.
- → A peak value of 15 ma. for 0.1 second is permitted under conditions of "hot-switching", i.e., switching the plate circuit "on" while the filament is hot.
- Values are approximate. → Indicates a change.

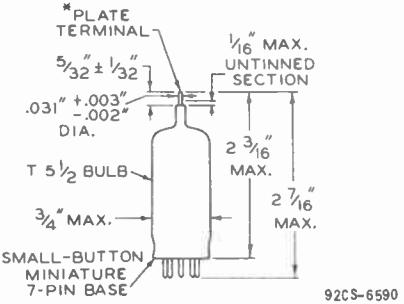
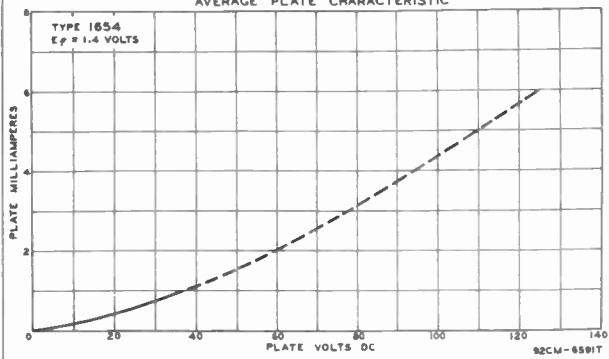


*PLATE TERMINAL AT TIP MAY BE ECCENTRIC WITH RESPECT TO BASE AXIS BY 1/8" MAX.

AVERAGE PLATE CHARACTERISTIC



RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

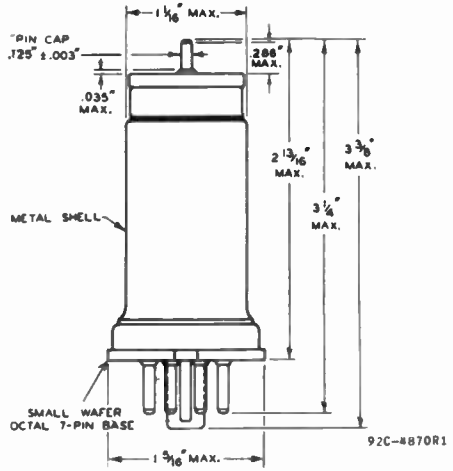
1851

TELEVISION AMPLIFIER PENTODE

Heater ▲	Coated Unipotential Cathode	
Voltage	6.3	a-c or d-c volts
Current	0.45	amp.
Direct Interelectrode Capacitances: °		
Grid to Plate	0.02 max.	μμf
Input	11.5	μμf
Output	5.2	μμf
Maximum Overall Length		3-3/8"
Maximum Diameter		1-5/16"
Bulb		Metal Shell, MT-8
Cap		Pin Cap
Base		Small Wafer Octal 7-Pin

° With shell connected to cathode.

For additional data and curves, refer to Type 1852. The 1851 and 1852 are identical electrically except for capacitances.



BOTTOM VIEW OF SOCKET CONNECTIONS

G_1 = GRID
G_2 = SCREEN
G_3 = SUPPRESSOR
H = HEATER
K = CATHODE
P = PLATE
S = SHELL

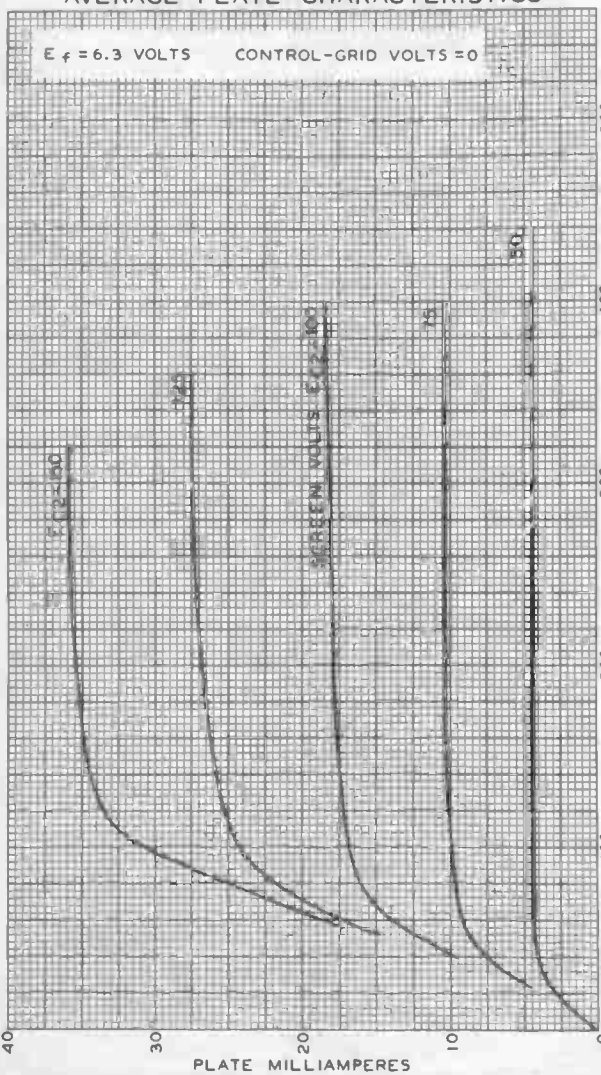
MOUNTING POSITION

VERTICAL: Base up or down.
HORIZONTAL: Permissible with Pins #2 & #7 in vertical plane.

1851

1851

AVERAGE PLATE CHARACTERISTICS



FEB. 14, 1938

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC.

92C-4877

1945
VACUUM-GAUGE TUBE

HYDROGEN-SENSITIVE, IONIZATION TYPE

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage	6.3 ± 10%	ac or dc volts
Current	0.75	amp

Mechanical:

Mounting Position	Any
Maximum Overall Length	6-3/8"
Maximum Diameter	1-5/16"
Tubulation	See Outline Drawing
Bulb	Metal Shell MT8G
Base	Small-Wafer Octal 8-Pin

BOTTOM VIEW

Pin 1 – Cathode
Pin 2 – Heater
Pin 3 – Ion Collector
Pin 4 – Cathode
Pin 5 – Plate, Shell DO NOT USE FOR GETTER CONNECTION

Pin 6 – Cathode
Pin 7 – Heater
Pin 8 – Getter

Shell – Plate, Getter Connection to Hexagonal Section of Tubulation

LEAK DETECTOR

Maximum Ratings, *Absolute Values*:

PLATE VOLTAGE	300 max.	volts
ION-COLLECTOR VOLTAGE	-30 max.	volts
	-15 min.	volts
PLATE CURRENT	50 max.	ma.
PLATE DISSIPATION	7 max.	watts
PEAK HEATER-CATHODE VOLTAGE	0 max.	volts

Typical Operation:

Plate Voltage	185	volts
Minimum Plate-Supply Voltage	250	volts
Ion-Collector Voltage	-22.5	volts
Plate Current	32	ma.
Ion-Collector Current	Less than 0.5*	μamp
Plate Dissipation	6	watts

* With no hydrogen in the gauge. When hydrogen from minute leaks enters the gauge tube, the ion-collector current may increase by less than 1%. In order to obtain a definite reading of such small changes in ion-collector current, it is necessary to use an amplifier capable of amplifying dc currents of the order of 0.005 μamp.

The metal shell of the 1945 contains an indirectly-heated cathode, an ion-collector and a plate made of palladium. The palladium plate located across the inner end of the tubulation serves, when cold, as a vacuum-tight barrier to the vacuum system. This construction permits the metal enclosure to be exhausted to a much better vacuum than

1945
VACUUM-GAUGE TUBE

(continued from preceding page)

normally exists in a vacuum system. However, when heated, the palladium plate serves as a permeable membrane which permits any hydrogen in the vacuum system to which the 1945 is connected to flow into the tube.

Practical application of the 1945 to locating a leak consists simply of connecting it to the vacuum system and of probing the system with a jet of gas containing a high percentage of hydrogen. If a leak is present, hydrogen enters the vacuum system at the point of leakage, passes through the hot palladium plate, and produces an increase in current to the ion-collector.

Because of its high vacuum, the 1945 can detect far smaller leaks than are detectable using conventional ionization gauges operating at the same pressure as the vacuum system. Actually, an increase in hydrogen pressure of less than 10^{-7} mm of mercury (10^{-4} microns) can be detected by the 1945.

The 1945 can be connected to a hard-glass, soft-glass, or metal vacuum system.

Connection to a hard-glass system may readily be made by breaking off the tip of the glass tubulation (see Outline Drawing), and sealing the (Corning Code 772 Nonex) tubulation to the glass system.

Connection to a soft-glass system requires a graded seal between the hard-glass tubulation of the 1945 and the soft glass of the system.

Connection to a metal system requires that the glass tubulation first be removed by pinching the glass with pliers at a point close to the Kovar seal. Then, the 1945 can be connected to a metal system by a straight pipe coupling which is necessary for clearance of the metal exhaust tubulation. Always apply the wrench to the hexagonal section and never to the metal shell. After the coupling has been tightened, it should be coated with Glyptal to insure that the joint is vacuum tight.

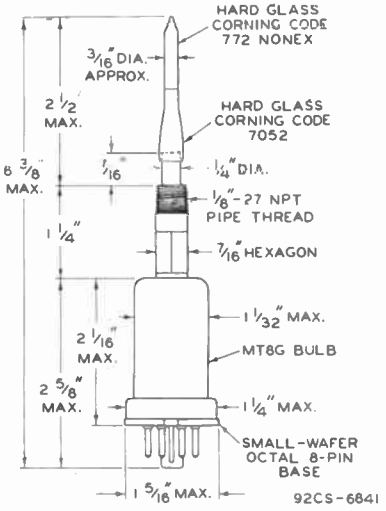
Suitable support should be provided for the 1945. In a glass system, it should be supported by a suitable clamp encircling the metal shell. The clamp should be lined with an asbestos pad so that the clamp does not place a strain on the welds. In a metal system, the 1945 can usually be supported by the pipe coupling.

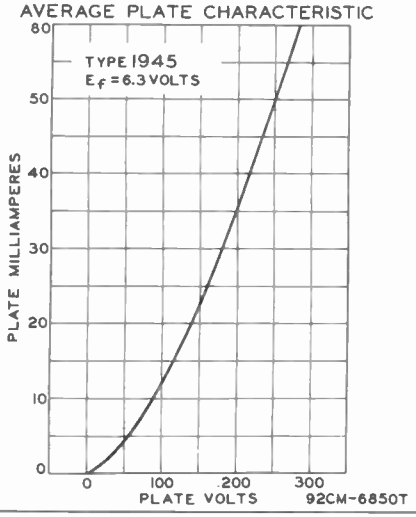
For safety reasons, it is advisable to have the metal shell of the 1945 at ground potential (positive polarity).

RCA

1945

VACUUM-GAUGE TUBE





5794

FIXED-TUNED OSCILLATOR TRIODE

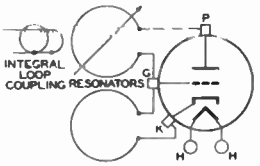
"PENCIL TYPE" WITH INTEGRAL RESONATORS
For radiosonde service at 1680 Mc

The 5794 is the same as the 6562 except for the following items:

Mechanical:

Dimensions . . . . . *See Dimensional Outline*
Terminal Connections *(See Dimensional Outline):*

H – Heater
K – Cathode



G – Grid
P – Plate

OPERATING CONSIDERATIONS

The *flexible heater leads* of the 5794 are usually soldered to the circuit elements. Soldering of these connections should not be made closer than 3/4" from the end of the tube. If this precaution is not followed, the heat of the soldering operation may crack the glass seals of the leads and damage the tube. Under no circumstances should any of the electrodes be soldered to the circuit elements. Connections to the electrodes should be made by spring contact only.

The 5794 should be supported by a suitable clamp around the metal shell either above or below the frequency-adjustment screw. It is essential, however, that the pressure exerted on the shell by the clamp be held to a minimum because excessive pressure can distort the reasonators and result in a change of frequency.

The *plate and cathode connections* should have flexible leads which will accommodate variations in the relative positions of the plate and cathode terminals in individual tubes.

The 5794 may be mechanically tuned by adjustment of the frequency-adjustment screw located on the metal shell of the tube. A clockwise rotation of the frequency-adjustment screw will decrease the frequency, while a counterclockwise rotation will increase the frequency. The range of adjustment provided by the screw is ±12 megacycles.

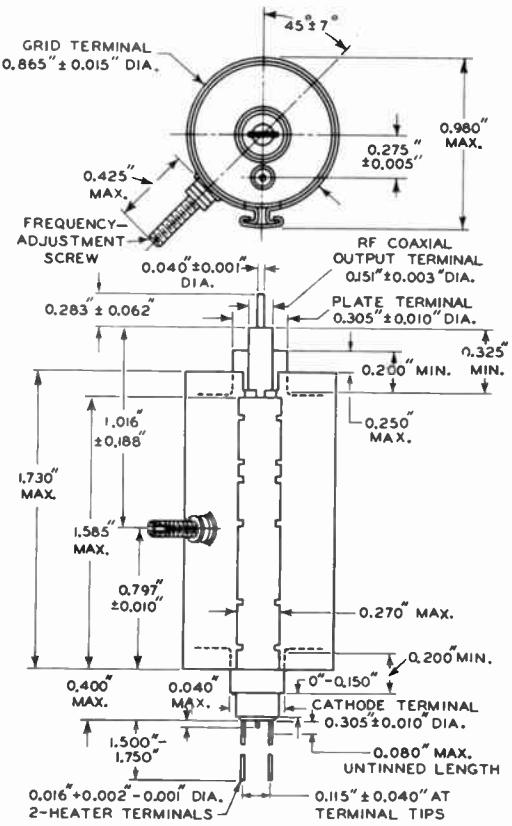
← Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

5794

FIXED-TUNED OSCILLATOR TRIODE



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY