



5563-A

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# 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:<sup>o</sup>

Grid to anode . . . . .	4	$\mu\text{f}$
Grid to cathode . . . . .	16	$\mu\text{f}$
Ionization Time (Approx.) . . . . .	10	$\mu\text{sec}$
Deionization Time (Approx.) . . . . .	1000	$\mu\text{sec}$

Maximum Critical Grid Current for instantaneous anode volts = 20000 . . . . .

50  $\mu\text{a}$

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
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### 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 Connec-  
 tion  
 Pin 4 - Filament  
 Cap - Anode

<sup>o</sup> without external shield.

← Indicates a change.



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### 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 <sup>▲</sup> , during tube conduction . . . . .	-10 max.	-10 max.	volts

#### ANODE CURRENT:

Peak . . . . .	10 max.	6.4 max.	amp
Average <sup>●●</sup> . . . . .	1.8 max.	1.6 max.	amp
Fault, for duration of 0.1 second maximum . . . . .	70 max.	70 max.	amp

#### GRID CURRENT:

Average positive <sup>●●</sup> . . . . .	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
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\* 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.



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# MERCURY-VAPOR THYRATRON

## CONTROL SERVICE--Quadrature Operation<sup>oo</sup>

### 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

<b>PEAK ANODE VOLTAGE:</b>			
Forward . . . . .	15000 max.	20000 max.	volts
Inverse . . . . .	15000 max.	20000 max.	volts
<b>GRID VOLTAGE:</b>			
Peak or DC, before tube conduction . . . . .	-500 max.	-500 max.	volts
Average <sup>▲</sup> , during tube conduction . . . . .	-10 max.	-10 max.	volts
<b>ANODE CURRENT:</b>			
Peak . . . . .	11.5 max.	11.5 max.	amp
Average <sup>●●</sup> . . . . .	2.5 max.	2.5 max.	amp
Fault, for duration of 0.1 second maximum . . . . .	70 max.	70 max.	amp ←
<b>GRID CURRENT:</b>			
Average positive <sup>●●</sup> . . . . .	100 max.	100 max.	ma ←
Peak positive with anode negative . . . . .	5 max.	5 max.	ma
<b>Maximum Circuit Values:</b>			
Grid-Circuit Resistance . . . . .	0.1 max.	0.1 max.	megohm

## HIGH-SPEED LOAD-CIRCUIT PROTECTION SERVICE<sup>♠</sup>

### Maximum Ratings, Absolute Values:

Operating Condensed-Mercury-	
Temperature Range	
40 to 55 °C	40 to 50 °C

<b>PEAK ANODE VOLTAGE:</b>			
Forward . . . . .	15000 max.	20000 max.	volts
Inverse . . . . .	15000 max.	20000 max.	volts
<b>GRID VOLTAGE:</b>			
Peak or DC, before tube conduction . . . . .	-500 max.	-500 max.	volts
Average <sup>▲</sup> , during tube conduction . . . . .	-10 max.	-10 max.	volts
<b>ANODE CURRENT:</b>			
Peak . . . . .	100 max.	100 max.	amp
Average <sup>□</sup> . . . . .	70 max.	70 max.	amp
Average <sup>§</sup> . . . . .	1.05 max.	1.05 max.	amp
<b>Maximum Circuit Values:</b>			
Grid-Circuit Resistance . . . . .	0.1 max.	0.1 max.	megohm

▲, ●●, ○○, ♠, □, §: See next page.

← Indicates a change.



## 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.



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MERCURY-VAPOR THYRATRON

For Circuit Figures, see Front of this Section

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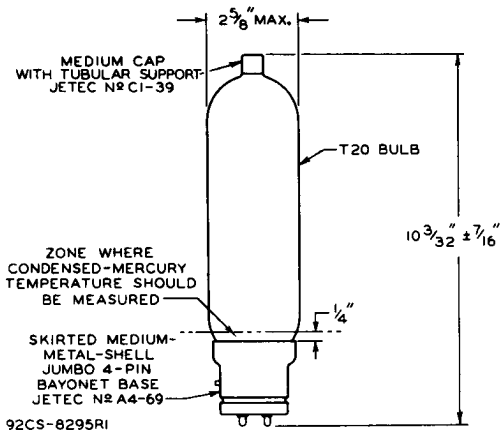
CIRCUIT	MAX. TRANS. SEC. VOLTS (RMS) E	APPROX. DC OUTPUT VOLTS TO FILTER $E_{av}$	MAX. DC OUTPUT AMPERES $I_{av}$	MAX. DC OUTPUT KW TO FILTER $P_{dc}$		
Fig. 1 Half-Wave Single-Phase In-Phase Operation	14000 <sup>□</sup> 10600 <sup>▲</sup>	6300 4700	1.6 1.8	10 8.5		
Fig. 2 Full-Wave Single-Phase In-Phase Operation	7000 <sup>□</sup> 5300 <sup>▲</sup>	6300 4700	3.2 3.6	20 17		
Fig. 3 Series Single-Phase In-Phase Operation	14000 <sup>□</sup> 10600 <sup>▲</sup>	12700 9500	3.2 3.6	40 34		
Fig. 4 Half-Wave Three-Phase In-Phase Operation	8100 <sup>□</sup> 6100 <sup>▲</sup>	9500 7100	4.8 5.4	45 38		
Fig. 5 Parallel Three-Phase Quadrature Operation	8100 <sup>□</sup> 6100 <sup>▲</sup>	9500 7100	15.0 15.0	143 106		
Fig. 6 Series Three-Phase Quadrature Operation	8100 <sup>□</sup> 6100 <sup>▲</sup>	19000 14200	7.5 7.5	143 106		
Fig. 7 Half-Wave Four-Phase Quadrature Operation	7000 <sup>□</sup> 5300	9000 6700	Resis- tive Load 10.0 10.0	Induc- tive Load 10.0 10.0	Resis- tive Load 90 67	Induc- tive Load 90 67
Fig. 8 Half-Wave Six-Phase Quadrature Operation	7000 <sup>□</sup> 5300 <sup>▲</sup>	9500 7100	Resis- tive Load 11.0 11.0	Induc- tive Load 11.5 11.5	Resis- tive Load 105 78	Induc- tive Load 110 81
<sup>□</sup> For maximum peak inverse anode voltage of 20000 volts, and condensed-mercury-temperature range of 25 to 50 °C. <sup>▲</sup> For maximum peak inverse anode voltage of 15000 volts, and condensed-mercury-temperature range of 25 to 55 °C.						

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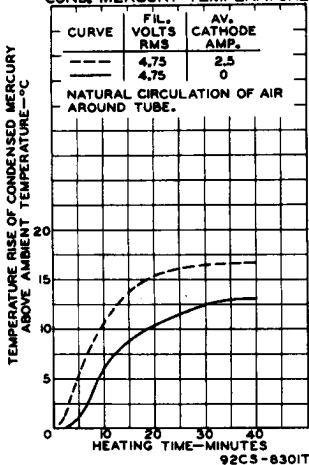


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## MERCURY-VAPOR THYRATRON



RATE OF RISE OF COND.-MERCURY TEMPERATURE

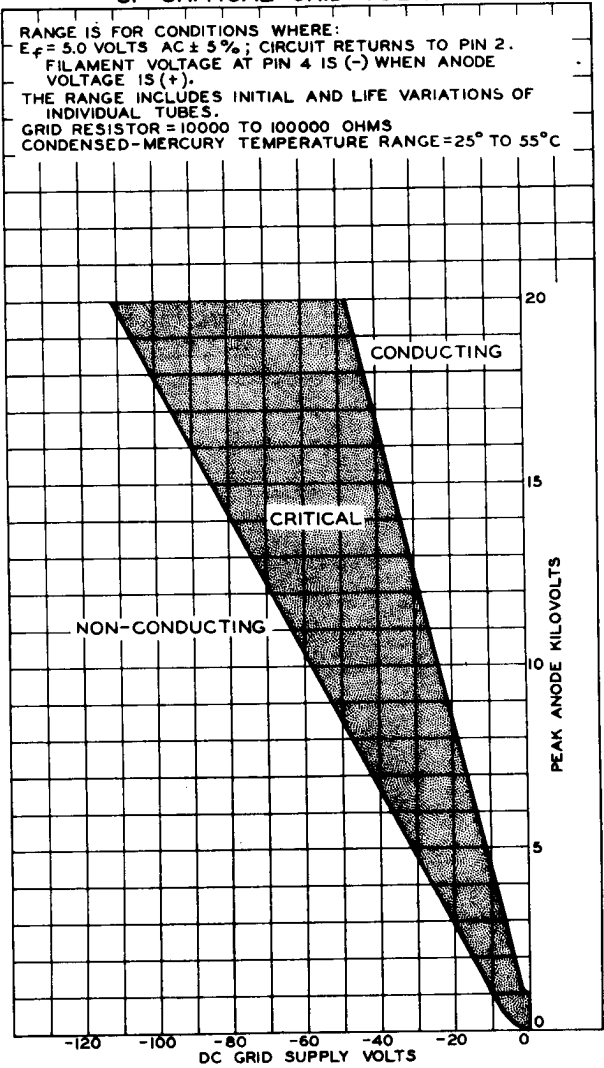




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# 5563-A OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

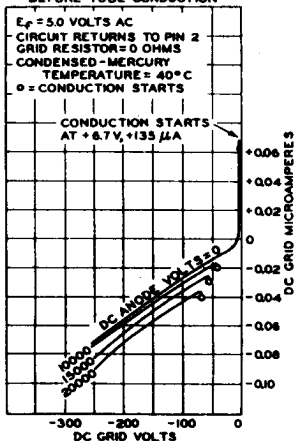
RANGE IS FOR CONDITIONS WHERE:  
 $E_f = 5.0$  VOLTS AC  $\pm 5\%$ ; CIRCUIT RETURNS TO PIN 2.  
FILAMENT VOLTAGE AT PIN 4 IS (-) WHEN ANODE VOLTAGE IS (+).  
THE RANGE INCLUDES INITIAL AND LIFE VARIATIONS OF INDIVIDUAL TUBES.  
GRID RESISTOR = 10000 TO 100000 OHMS  
CONDENSED-MERCURY TEMPERATURE RANGE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



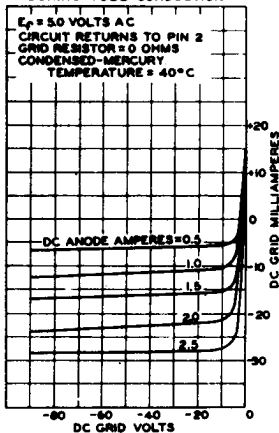


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## CHARACTERISTIC CURVES

 AVERAGE GRID  
 CHARACTERISTICS  
 BEFORE TUBE CONDUCTION


92CS-8313T

 AVERAGE GRID  
 CHARACTERISTICS  
 DURING TUBE CONDUCTION


92CS-8315T

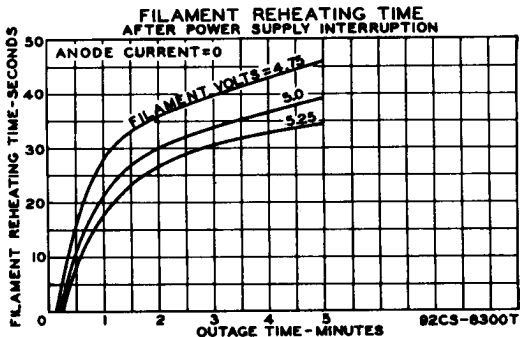




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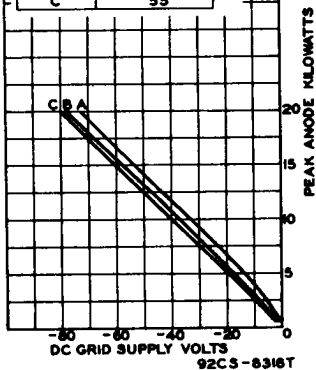
## CHARACTERISTIC CURVES



SHIFT OF AVERAGE  
CONTROL CHARACTERISTIC  
WITH CHANGE IN  
CONDENSED-MERCURY TEMPERATURE

$E_f = 5.0$  VOLTS AC  
GRID RESISTOR = 10000 OHMS

CURVE	CONDENSED MERCURY TEMP. - °C
A	25
B	40
C	55



JAN. 3, 1955

TUBE DIVISION  
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

CE-8300T  
-8316T

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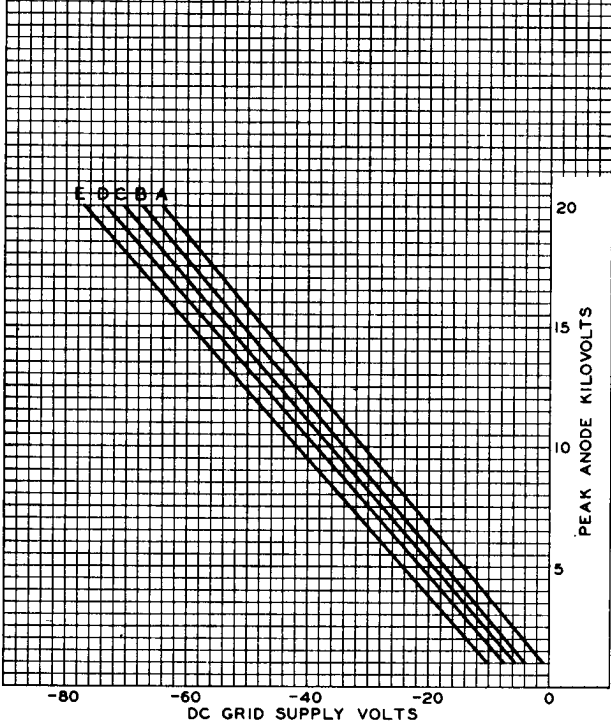
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SHIFT OF AVERAGE CONTROL CHARACTERISTICS  
WITH CHANGE IN FILAMENT PHASING AND CIRCUIT RETURN

$E_f = 5.0$  VOLTS AC  
GRID RESISTOR = 10000 OHMS  
CONDENSED-MERCURY TEMPERATURE =  $40^\circ\text{C}$

CURVE	PHASE ANGLE*	CIRCUIT RETURN
A	$0^\circ$	PIN 2
B	$0^\circ$	CT <sup>□</sup>
C	$0^\circ, 180^\circ$ $90^\circ$	PIN 4 ANY <sup>•</sup>
D	$180^\circ$	CT <sup>□</sup>
E	$180^\circ$	PIN 2

\* BETWEEN FILAMENT VOLTAGE AT PIN 4 AND ANODE VOLTAGE  
<sup>□</sup> CENTER TAP OF FILAMENT TRANSFORMER  
<sup>•</sup> PIN 2, PIN 4, OR CT





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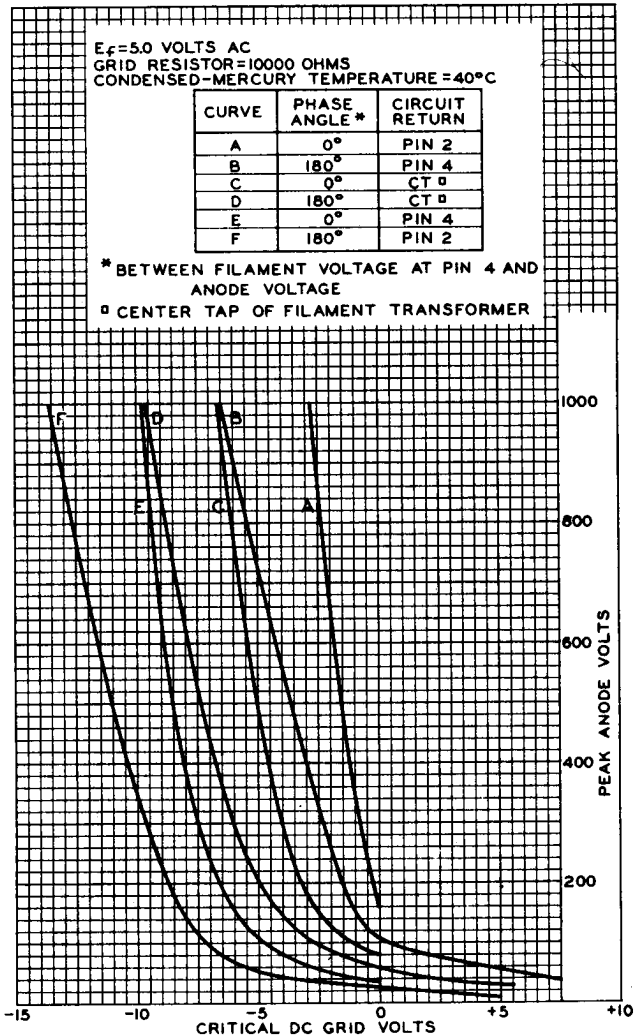
# 5563-A SHIFT OF AVERAGE CONTROL CHARACTERISTICS WITH CHANGE IN FILAMENT PHASING AND CIRCUIT RETURN AT LOW ANODE VOLTAGES

$E_f = 5.0$  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



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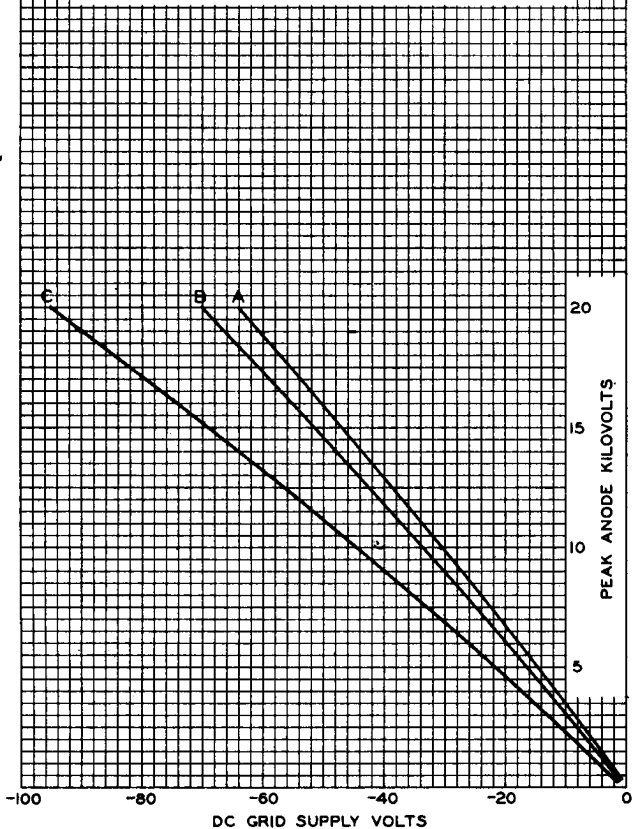
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### SHIFT OF AVERAGE CONTROL CHARACTERISTICS WITH CHANGE IN GRID-RESISTOR VALUE

$E_f = 5.0$  VOLTS AC  
CONDENSED-MERCURY TEMPERATURE =  $40^\circ\text{C}$

CURVE	GRID RESISTOR MEGOHMS	CIRCUIT RETURN	PHASE ANGLE*
A	0.01	PIN 2	$180^\circ$
B	0.1	PIN 2	$180^\circ$
C	1	PIN 2	$180^\circ$

\*BETWEEN FILAMENT VOLTAGE AT PIN 4 AND ANODE VOLTAGE



APRIL 12, 1954

TUBE DIVISION  
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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