5563-A

MERCURY-VAPOR THYRATRON

NEGATIVE-CONTROL TRIODE TYPE

Supersedes Type 5563

GENERAL DATA

Electrical:

Filament, Coated:

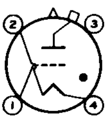
	Min.	*Av.*	*Max.*	
Voltage	4.75	5	5.25	volts
Current at 5 volts	–	10	11	amp

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:°		
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

° 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--In-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.

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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.

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▲ 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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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□ 10600▲	6300 4700	1.6 1.8		10 8.5	
Fig. 2 Full-Wave Single-Phase In-Phase Operation	7000□ 5300▲	6300 4700	3.2 3.6		20 17	
Fig. 3 Series Single-Phase In-Phase Operation	14000□ 10600▲	12700 9500	3.2 3.6		40 34	
Fig. 4 Half-Wave Three-Phase In-Phase Operation	8100□ 6100▲	9500 7100	4.8 5.4		45 38	
Fig. 5 Parallel Three-Phase Quadrature Operation	8100□ 6100▲	9500 7100	15.0 15.0		143 106	
Fig. 6 Series Three-Phase Quadrature Operation	8100□ 6100▲	19000 14200	7.5 7.5		143 106	
			Resistive Load	*Inductive Load*	*Resistive Load*	*Inductive Load*
Fig. 7 Half-Wave Four-Phase Quadrature Operation	7000□ 5300	9000 6700	10.0 10.0	10.0 10.0	90 67	90 67
			Resistive Load	*Inductive Load*	*Resistive Load*	*Inductive Load*
Fig. 8 Half-Wave Six-Phase Quadrature Operation	7000□ 5300▲	9500 7100	11.0 11.0	11.5 11.5	105 78	110 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.

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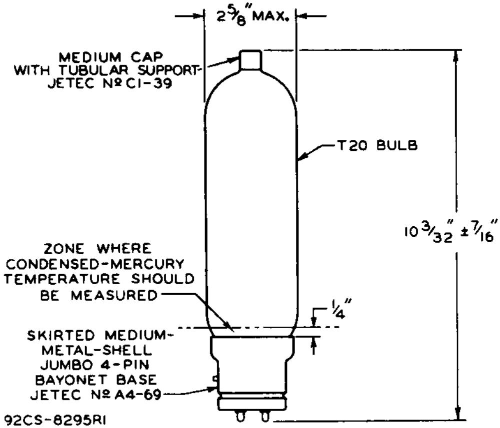

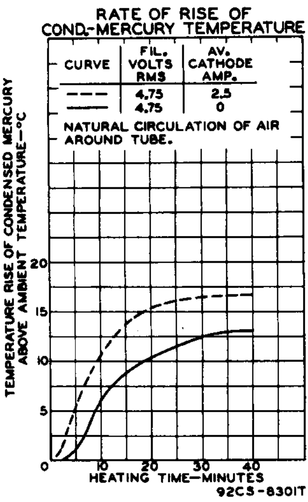

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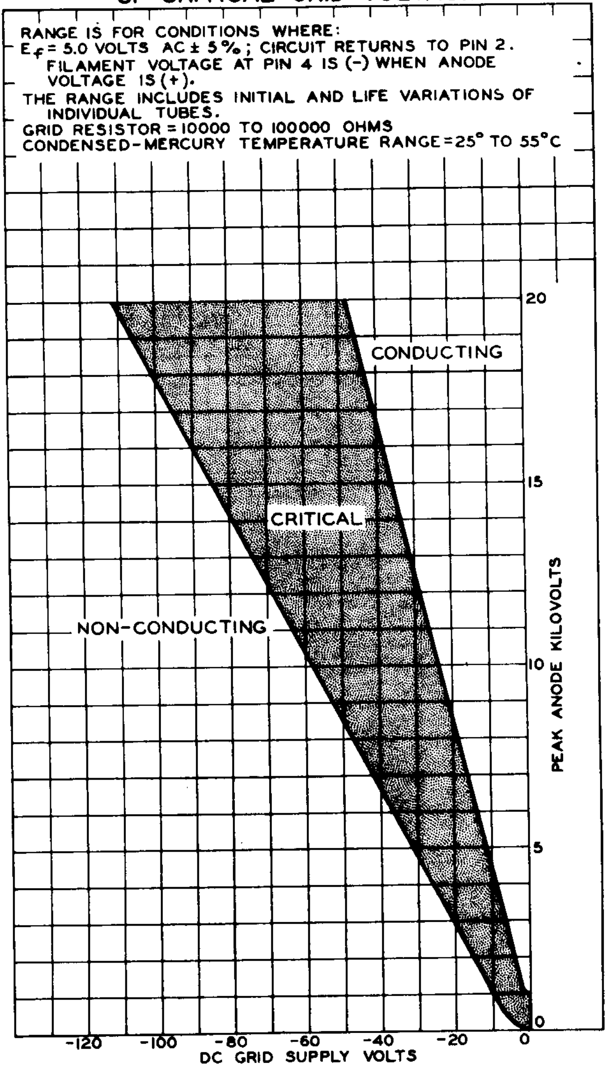
OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE



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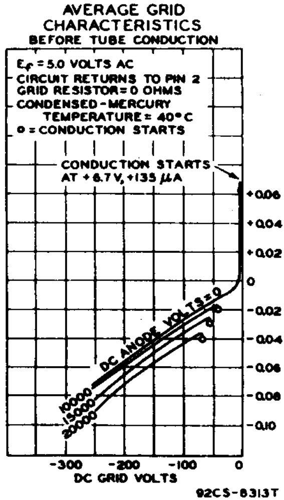
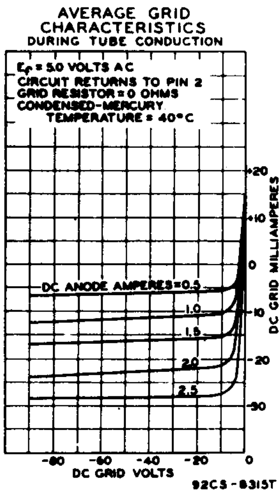
CHARACTERISTIC CURVES





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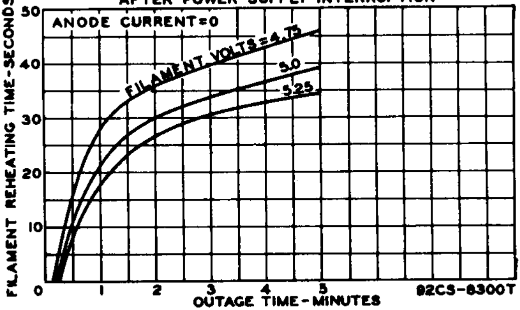
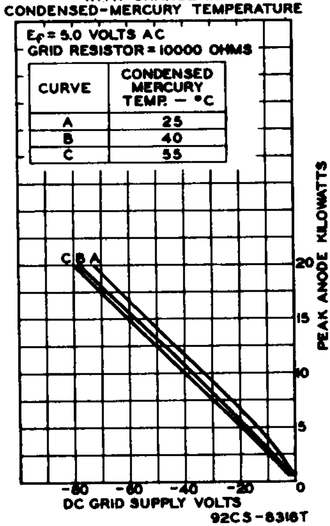
CHARACTERISTIC CURVES

FILAMENT REHEATING TIME AFTER POWER SUPPLY INTERRUPTION



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



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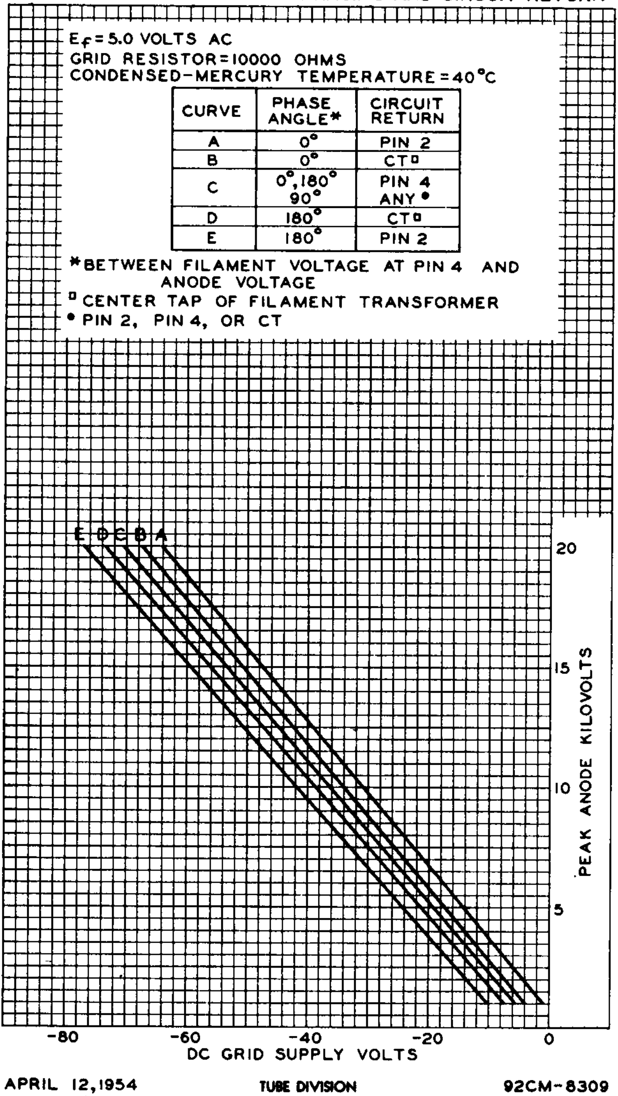
SHIFT OF AVERAGE CONTROL CHARACTERISTICS WITH CHANGE IN FILAMENT PHASING AND CIRCUIT RETURN

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



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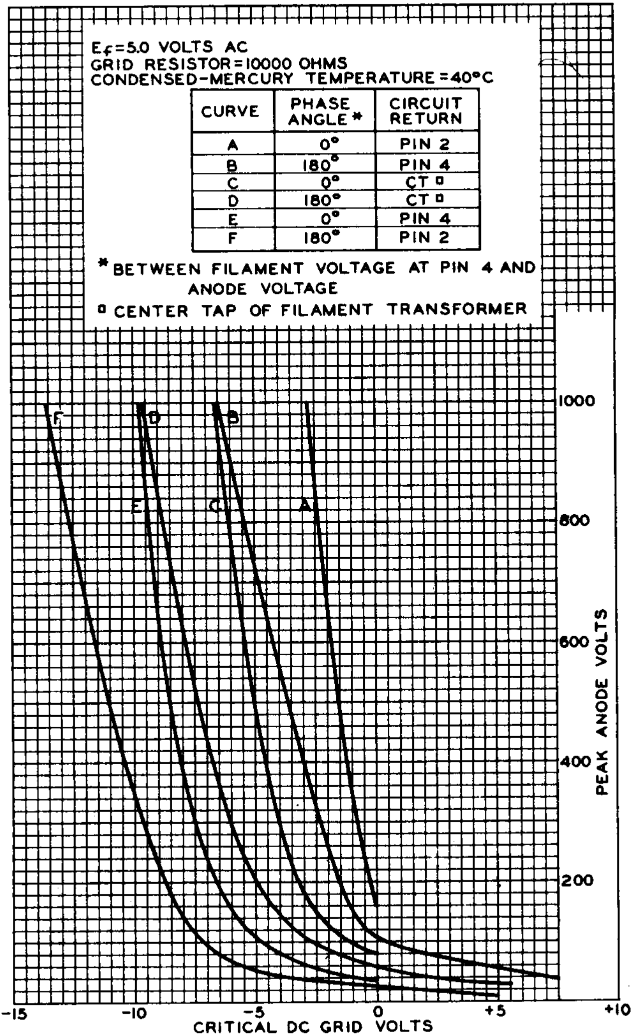
SHIFT OF AVERAGE CONTROL CHARACTERISTICS WITH CHANGE IN FILAMENT PHASING AND CIRCUIT RETURN AT LOW ANODE VOLTAGES



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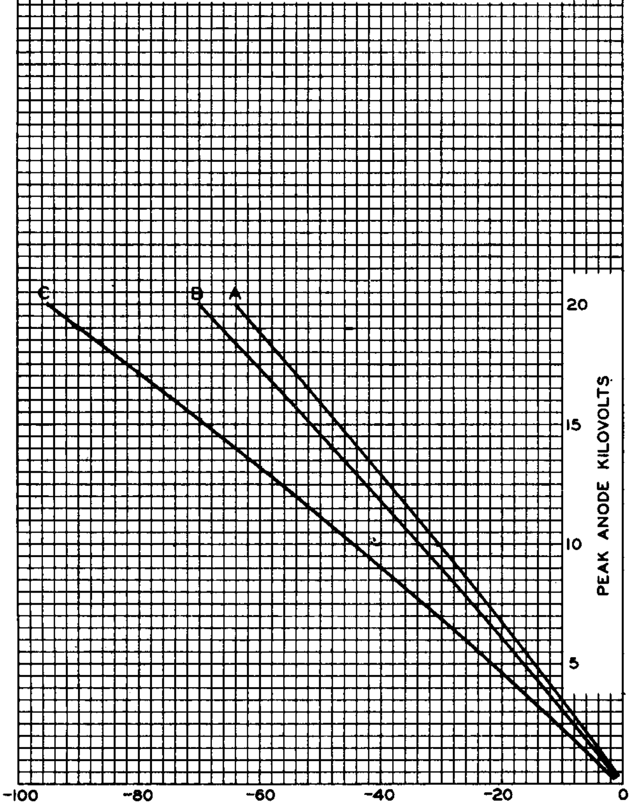
SHIFT OF AVERAGE CONTROL CHARACTERISTICS WITH CHANGE IN GRID-RESISTOR VALUE

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



APRIL. 12, 1954

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