Full-Wave Gas Rectifier

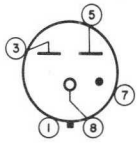
IONICALLY HEATED CATHODE TYPE

The OZ_4-G is the same as the OZ_4 except for the following items:

Mechanical:

Operating Position	Any
Maximum Overall Length	2-5/8"
Maximum Seated Length	2-1/16"
Maximum Diameter	1-1/16"
Bulb	T7
Base	Dwarf-Shell Octal 5-Pin (JEDEC Group 1, No.B5-45)
Basing Designation for BOTTOM VIEW	4R

Pin 1 - No Connection
Pin 3 - Plate No.2
Pin 5 - Plate No.1



Pin 7 - No Connection
Pin 8 - Cathode

RCA

1AD5

SHARP-CUTOFF PENTODE

SUBMINIATURE TYPE

GENERAL DATA

Electrical:

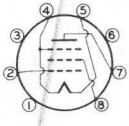
Filament, Coated:			
Voltage	1.25		dc volts
Current	0.04		amp
Direct Interelectrode Capacitances:[o]			
Grid No.1 to Plate	0.010	max.	μμf
Input	1.8		μμf
Output	2.8		μμf

[o] With no 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)	1.200 ± 0.060"
Maximum Diameter	0.4"
Bulb	T-3
Base	Small-Button Sub-minar 8-Pin

BOTTOM VIEW



Pin 1 - No Connection
Pin 2 - Grid No.1
Pin 3 - No Connection
Pin 4 - Filament (-), Grid No.3
Pin 5 - Filament (+)
Pin 6 - No Connection
Pin 7 - Plate
Pin 8 - Grid No.2

AMPLIFIER - Class A_1

Maximum Ratings, *Design-Center Values*:

PLATE VOLTAGE	67.5 max.	volts
GRID-No.2 (SCREEN) VOLTAGE	67.5 max.	volts
TOTAL CATHODE CURRENT	4.0 max.	ma

Typical Operation and Characteristics:

Plate Voltage	30	45	67.5	volts
Grid-No.2 Voltage	30	45	67.5	volts
Grid-No.1 (Control-Grid) Voltage	0	0	0	volts
Plate Resistance (Approx.)	0.7	0.7	0.7	megohm
Transconductance	430	580	735	μmhos
Grid-No.1 Bias (Approx.) for plate current of 10 μamp	-3	-4	-6	volts
Plate Current	0.45	0.9	1.85	ma
Grid-No.2 Current	0.16	0.35	0.75	ma

RCA

1AD5

AVERAGE PLATE CHARACTERISTICS

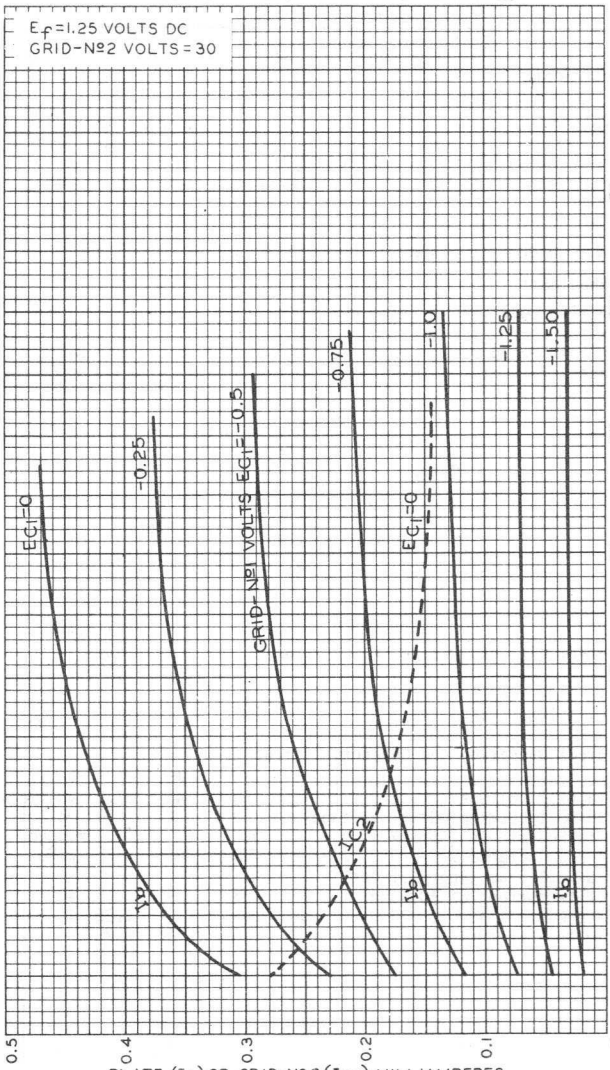


PLATE (I_b) OR GRID-№2 (I_{C_2}) MILLIAMPERES

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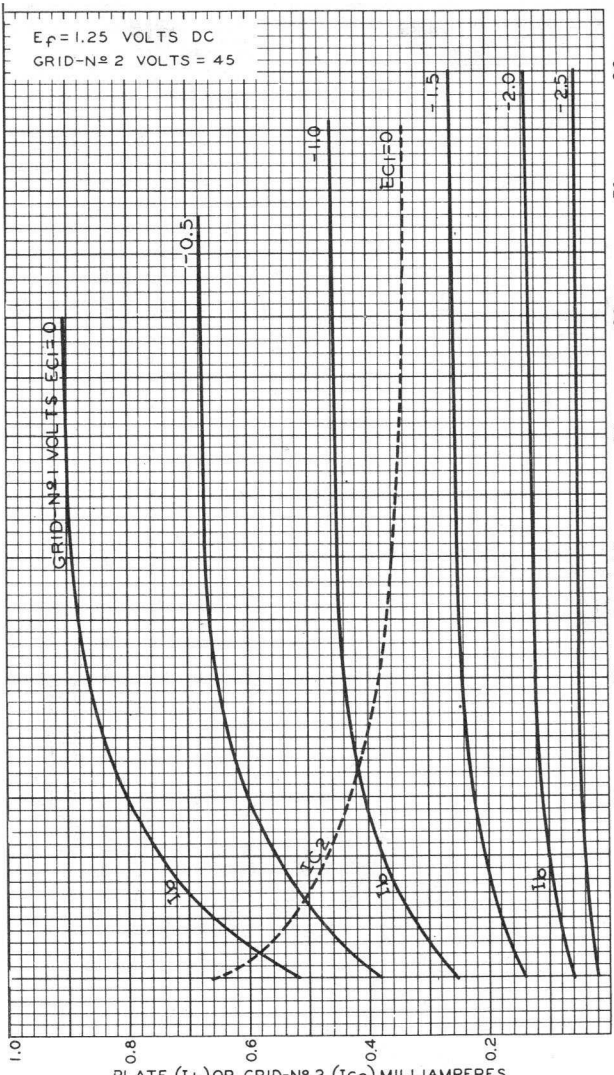
RCA

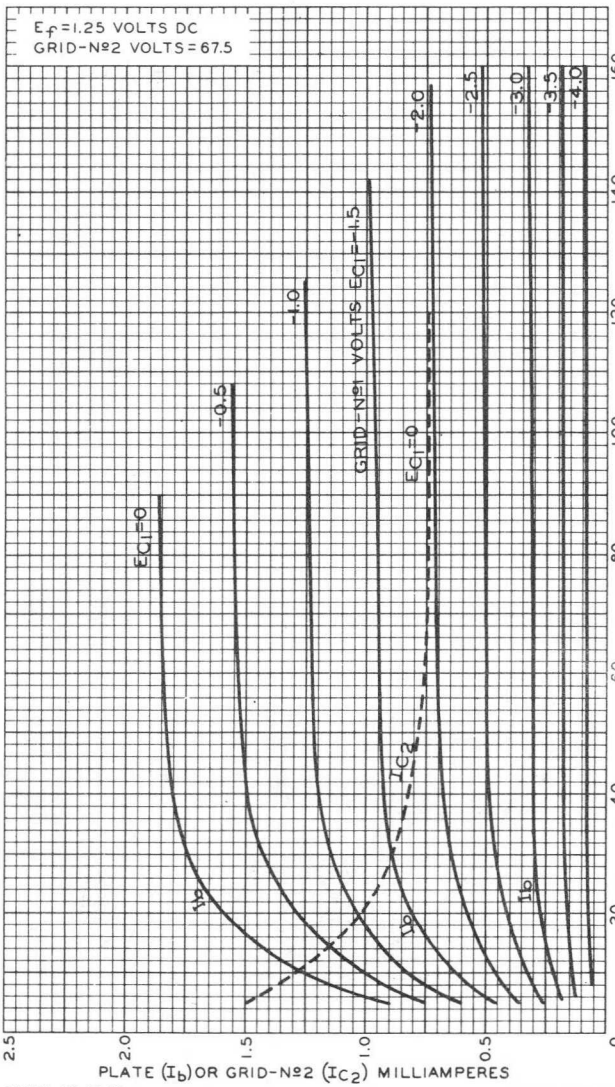
1AD5

AVERAGE PLATE CHARACTERISTICS



1AD5

AVERAGE PLATE CHARACTERISTICS



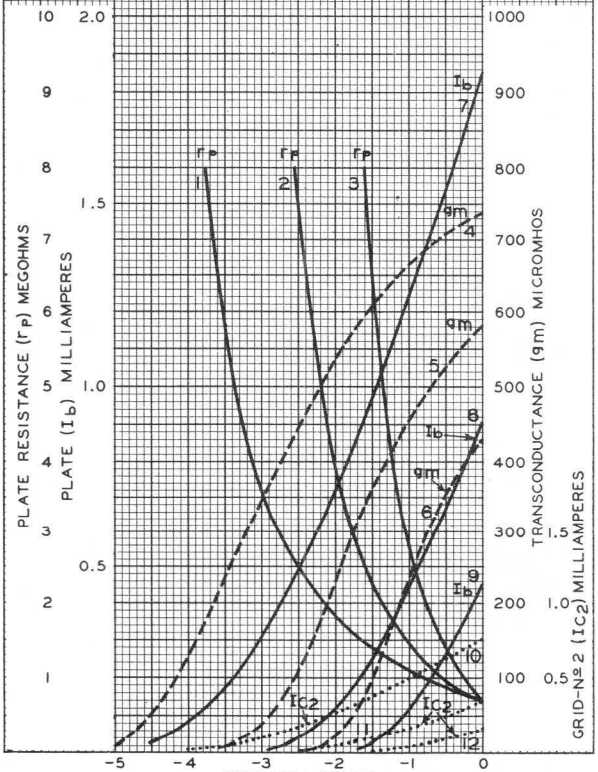
RCA

1AD5

AVERAGE CHARACTERISTICS

E_f = 1.25 VOLTS DC

CURVE	PLATE VOLTS	GRID-№2 VOLTS
1, 2, 3 } r_p	67.5 45 30	67.5 45 30
4, 5, 6 } g_m	67.5 45 30	67.5 45 30
7, 8, 9 } I_b	67.5 45 30	67.5 45 30
10, 11, 12 } I_{c_2}	67.5 45 30	67.5 45 30



Replaced by 1G3GT/1B3-GT

RCA

IB3-GT

IB3-GT/8016

HALF-WAVE VACUUM RECTIFIER

Supersedes Type 8016

GENERAL DATA

Electrical:

Filament, Coated:		
Voltage	1.25*	ac volts
Current	0.2	amp
Direct Interelectrode Capacitance (Approx.):●		
Plate to Filament	1.5	μμf

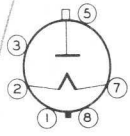
* The filament voltage must never exceed 1.5 volts, even momentarily.

● With no external shield.

Mechanical:

Mounting Position	Any
Overall Length	3-7/8" ± 3/16"
Seated Length	3-5/16" ± 3/16"
Maximum Diameter	1-9/32" ←
Bulb	T-9
Cap	Small
Base	Intermediate-Shell Octal 6-Pin ←
Basing Designation for BOTTOM VIEW	3C

Pin 1 – See NOTE
Pin 2 – Filament
Pin 3 – Same as Pin 1
Pin 5 – Same as Pin 1



Pin 7 – Filament, Internal Shield
Pin 8 – Same as Pin 1
Cap – Plate

NOTE: May be connected to pin 7; otherwise, do not use.

HALF-WAVE RECTIFIER

Maximum Ratings, *Design-Center Values*:

PEAK INVERSE PLATE VOLTAGE	30000 max.	volts ←
PEAK PLATE CURRENT	17 max.	ma
AVERAGE PLATE CURRENT	2 max.	ma
FREQUENCY OF SUPPLY VOLTAGE	300 max.	kc

OPERATING NOTES

When the *filament* is to be operated on rf, it is recommended that the filament be connected first to a dc or low-frequency ac supply of 1.25 volts. The color temperature of the filament corresponding to this voltage may then be checked visually by observing in a darkened room the reflection of the incandescent filament upon the upper surface of the internal shield. A visual comparison of this color temperature with that obtained with the filament operated from an rf voltage provides a convenient means for adjusting the amount of rf excitation to produce 1.25 volts (RMS) at the filament terminals.

The *voltages* employed in some television receivers and other high-voltage equipment are sufficiently high that high-voltage rectifier tubes may produce soft x-rays which can constitute a health hazard, unless such tubes are adequately shielded. Relatively simple shielding should prove adequate, but the need for this precaution should be considered in equipment design.

← Indicates a change.

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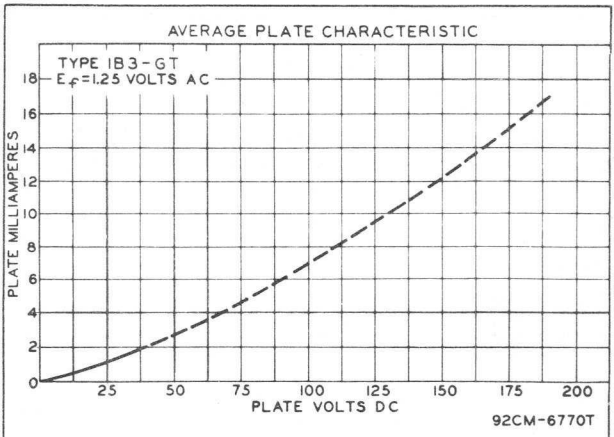
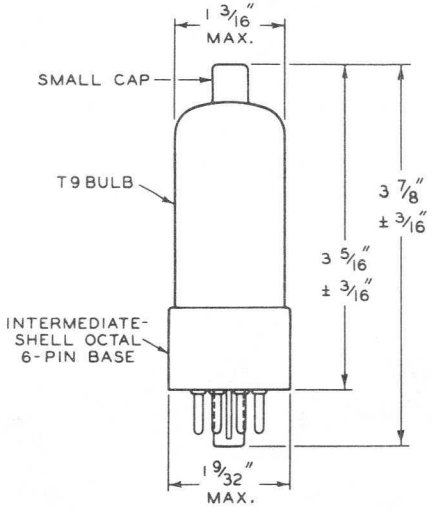
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

1B3-GT

HALF-WAVE VACUUM RECTIFIER





1E8

PENTAGRID CONVERTER

SUBMINIATURE TYPE

GENERAL DATA

Electrical:

Filament, Coated:		
Voltage	1.25	dc volts
Current	0.04	amp
Direct interelectrode Capacitances:[o]		
Grid No.3 to All Other Electrodes (RF Input).	6	μμf
Plate to All Other Electrodes (Mixer Input)	5	μμf
Grid No.1 to All Other Electrodes (Osc.Input)	2.4	μμf
Grid No.3 to Plate	0.4 max.	μμf
Grid No.3 to Grid No.1	0.2 max.	μμf

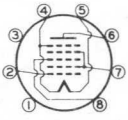
[o] with no external shield.

Mechanical:

Mounting Position	Any
Maximum Overall Length	1-3/4"
Maximum Seated Length	1-1/2"
Length, Base Seat to Bulb Top (excluding tip)	1.200" ± 0.060"
Maximum Diameter	0.4"
Bulb	T-3
Base	Small-Button Sub-minar 8-Pin

BOTTOM VIEW

Pin 1 - Internal Connection-Do Not Use
Pin 2 - Grid No.1
Pin 3 - No Connection



Pin 4 - Filament (-), Grid No.5
Pin 5 - Filament (+)
Pin 6 - Plate
Pin 7 - Grid No.2, Grid No.4
Pin 8 - Grid No.3

CONVERTER

Maximum Ratings, *Design-Center Values*:

PLATE VOLTAGE	67.5 max.	volts
GRIDS-No.2 & No.4 (SCREEN) VOLTAGE	45 max.	volts
GRIDS-No.2 & No.4 SUPPLY VOLTAGE	67.5 max.	volts
TOTAL CATHODE CURRENT	4.0 max.	ma

Characteristics — *Separate Excitation*:#

Plate Voltage	30	45	67.5	volts
Grids-No.2 & No.4 Supply Voltage	30	45	67.5	volts
Grids-No.2 & No.4 Resistor	10000	15000	20000	ohms

The characteristics shown under separate excitation approximate those obtained in a self-excited oscillator operating with zero bias.

1E8

PENTAGRID CONVERTER

Grid-No.3 (Control-Grid) Voltage	0	0	0	volts
Grid-No.1 (Oscillator-Grid) Resistor	0.1	0.1	0.1	megohm
Plate Resistance (Approx.)	0.3	0.4	0.4	megohm
Conversion Transconductance	115	140	150	μmhos
Grid-No.3 Voltage (Approx.) for conversion transconductance of 5 μmhos	-7	-8	-9	volts
Plate Current	0.3	0.6	1.0	ma
Grids-No.2 & No.4 Current	0.8	1.1	1.5	ma
Grid-No.1 Current	30	50	70	μamp
Total Cathode Current	1.1	1.7	2.5	ma

NOTE: The transconductance between grid No.1 and grids No.2 & No.4 connected to plate (not oscillating) is approximately 730 micromhos under the following conditions: Signal applied to grid No.1 at zero bias; grids No.2 & No.4 and plate at 30 volts; and grid No.3 grounded. Under the same conditions, the total cathode current is 3 milliamperes and the amplification factor is 3.9.

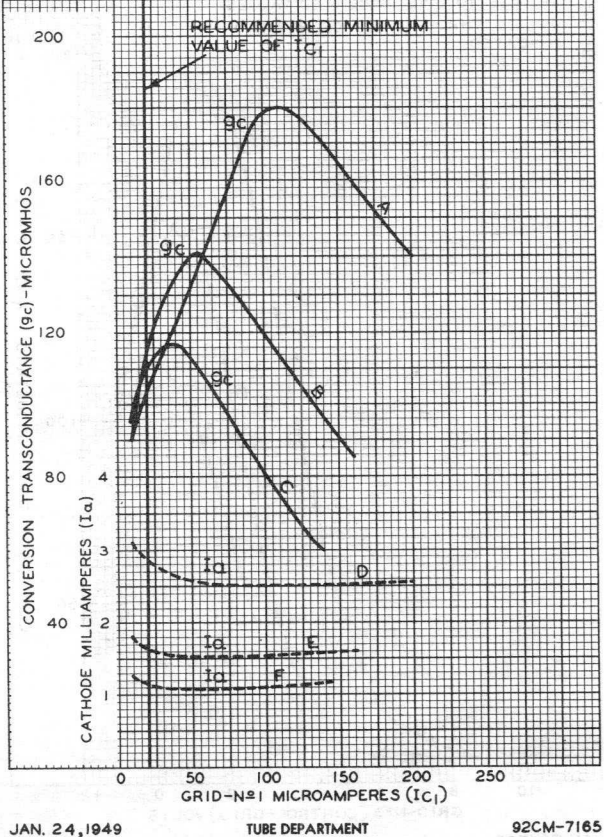
1E8

OPERATION CHARACTERISTICS
WITH SEPARATE OSCILLATOR EXCITATION

E_f = 1.25 VOLTS DC

CURVE	PLATE VOLTS	GRIDS Nº 2 & Nº 4 SUPPLY VOLTS[D]	GRIDS Nº 2 & Nº 4 SERIES RESISTOR OHMS	GRID-Nº 1 RESISTOR MEGOHMS
A,D	67.5	67.5	20000	0.1
B,E	45	45	15000	0.1
C,F	30	30	10000	0.1

[D] APPLIED THROUGH SERIES RESISTOR OF VALUE INDICATED



RCA

1E8

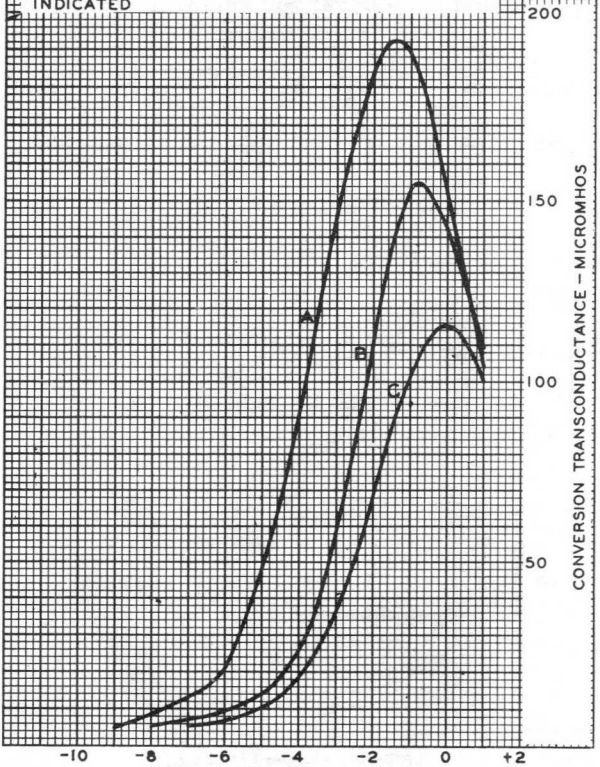
OPERATION CHARACTERISTICS
WITH SEPARATE OSCILLATOR EXCITATION

E_f=1.25 VOLTS D C

CURVE	PLATE VOLTS	GRIDS №2 & №4 SUPPLY VOLTS□	GRIDS №2 & №4 SERIES RESISTOR OHMS	GRID-№1 RESISTOR MEGOHMS	GRID-№1 CURRENT μAMP*
A	30	30	10000	0.1	30
B	45	45	15000	0.1	50
C	67.5	67.5	20000	0.1	70

*OBTAINED BY ADJUSTMENT OF OSCILLATOR GRID VOLTAGE TO GIVE INDICATED VALUES

□APPLIED THROUGH SERIES RESISTOR OF VALUE INDICATED



1N2-A

Half-Wave Vacuum Rectifier

GENERAL DATA

Electrical:

Filament, Coated:

	Min.	Av.	Max.	
Voltage (AC)	1.05	1.25	1.45	volts
Current at 1.25 volts	–	0.2	–	amp

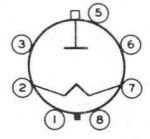
Direct Interelectrode Capacitance (Approx.):▲

Plate to filament & internal shield	1.4	μμf

Mechanical:

Operating Position	Any
Maximum Overall Length	3.562"
Seated Length	2.624" to 3.000"
Diameter	1.438" to 1.562"
Bulb	T12
Cap	Small with Tubular Support (JEDEC No.C1-34)
Base	Short Medium-Shell Octal 7-Pin with External Barriers, Style B (JEDEC Group 1, No.B7-227)
Basing Designation for BOTTOM VIEW	3C

Pin 1 – Limited Connection●
Pin 2 – Filament
Pin 3 – Same as Pin 1
Pin 5 – Same as Pin 1



Pin 6 – No Connection
Pin 7 – Filament, Internal Shield
Pin 8 – Same as Pin 1
Cap – Plate

PULSED-RECTIFIER SERVICE

Maximum Ratings, *Design-Maximum Values:*

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

INVERSE PLATE VOLTAGE:			
Total dc and peak♦	28000	max.	volts
DC	24000	max.	volts
PEAK PLATE CURRENT	50	max.	ma
AVERAGE PLATE CURRENT	0.5	max.	ma

Characteristics:

Plate Current for plate volts = 100	7↓	ma

▲ Without external shield.

● See *Operating Considerations.*

★ 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.

↓ Instantaneous test value.

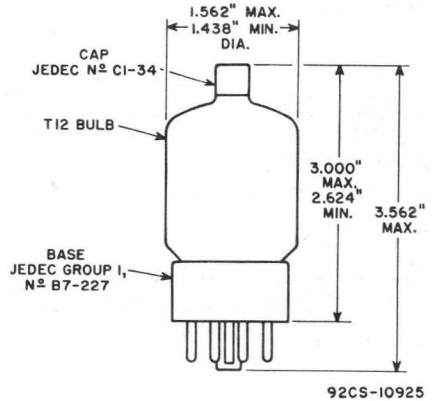
OPERATING CONSIDERATIONS

Socket Connections. Socket terminals 1,3,4,5,6, and 8 may be connected to socket terminal 7 or to a corona shield which is connected to socket terminal 7. Socket terminals 4 and 6 may be used as tie points for components at or near filament potential.

Measurement of Filament Voltage. To measure the filament voltage when the filament is at a high dc potential with respect to ground, it is recommended that a simple method utilizing visual comparison of the filament temperature be used. The color temperature of the filament, operating from a pulse-or-rf-power source, may be checked by observing in a darkened room the reflection of the incandescent filament upon the surface of the internal shield. A visual comparison of this color temperature with that obtained when the filament of another 1N2-A is operated from a dc or low-frequency ac supply of 1.25 volts, provides a convenient means for adjusting the amount of excitation to produce 1.25 volts (rms) at the filament terminals.

The high voltages at which the 1N2-A is operated are very dangerous. Great care should be taken in the design of apparatus to prevent the operator from coming in contact with these high voltages. Particular care against fatal shock should be taken in the measurement of filament voltage. Under all circumstances, circuit parts which may be at high potentials should be enclosed or adequately insulated.

X-rays. The voltages employed in some television receivers and other high-voltage equipment are sufficiently high that high-voltage rectifier tubes may produce *X-rays* which can constitute a health hazard unless such tubes are adequately shielded. Relatively simple shielding should prove adequate, but the need for this precaution should be considered in equipment design.



92CS-10925

1P39

VACUUM PHOTOTUBE

WITH S-4 RESPONSE

For applications critical as to leakage under high-humidity conditions

The 1P39 is like the 929, except that the 1P39 has a maximum dark current of 0.005 μa at 250 volts, and has a nonhygroscopic base which insures a value of resistance between anode and cathode pins about 10 times higher than conventional bases under adverse service conditions of high humidity. ←

←Indicates a change.

1P40

GAS PHOTOTUBE

WITH S-1 RESPONSE

For applications critical as to leakage under high-humidity conditions

The 1P40 is like the 930, except that the 1P40 has a maximum dark current of 0.005 μa at 90 volts, and has a nonhygroscopic base which insures a value of resistance between anode and cathode pins about 10 times higher than conventional bases under adverse service conditions of high humidity. ←

←Indicates a change.

RCA

2B7

TWIN DIODE—REMOTE-CUTOFF PENTODE

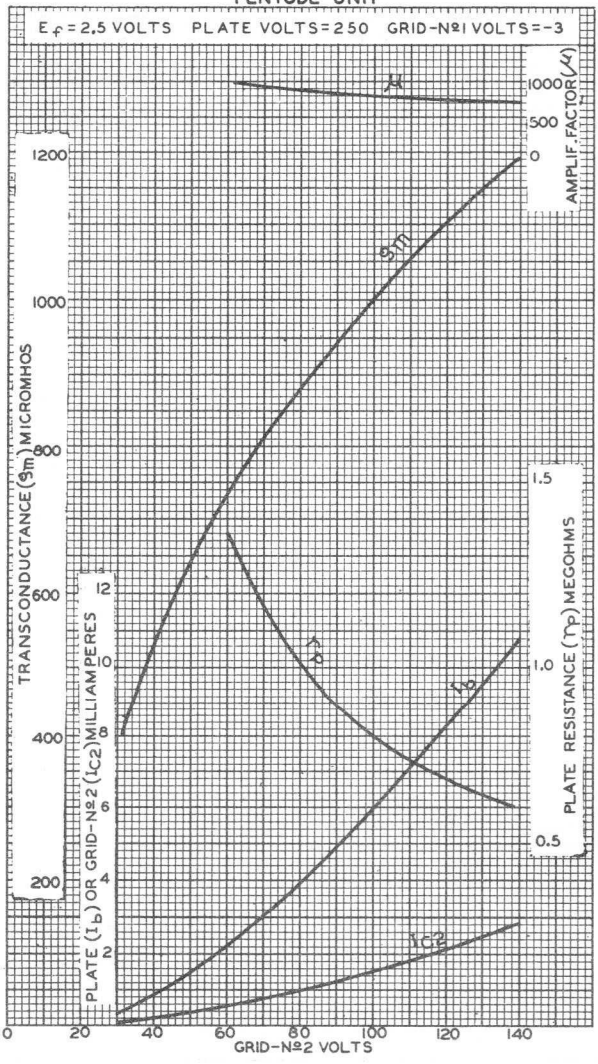
Heater, for Unipotential Cathode:		
Voltage	2.5	ac or dc volts
Current	0.8	amp

The 2B7 is the same as the 6B7 except for heater rating.

2B7

RCA

2B7
AVERAGE CHARACTERISTICS
PENTODE UNIT



FEB. 6, 1933

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-5254

2BN4
MEDIUM-MU TRIODE

7-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

The 2BN4 is the same as the 6BN4 except for the following items:

Heater, for Unipotential Cathode:		
Voltage	2.3	ac or dc volts
Current	0.6	amp
Warm-up time (Average)*	11	sec

2CY5
SHARP-CUTOFF TETRODE

7-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

The 2CY5 is the same as the 6CY5 except for the following items:

Heater, for Unipotential Cathode:		
Voltage	2.4	ac or dc volts
Current	0.6	amp
Warm-up time (Average)*	11	sec

* *For definition of heater warm-up time and method of determining it, see sheet HEATER WARM-UP TIME MEASUREMENT at front of this Section.*

2C39A

Power Triode

FORCED-AIR COOLED

Particularly suitable for cathode-drive circuits

GENERAL DATA

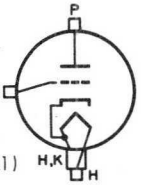
Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)[a]	6.3	volts
Current	1.0	amp
Heating time	1	minute
Amplification Factor	100	
Transconductance, for plate current of 70 ma. and plate voltage of 600 volts.	24000	μmhos
Direct Interelectrode Capacitances (Approx.):		
Grid to plate	2.0	μμf
Grid to cathode	6.6	μμf
Plate to cathode	0.035 max.	μμf

Mechanical:

Terminal Connections *(See Dimensional Outline)*:

BOTTOM VIEW



G – GRID TERMINAL (Adjacent to Cathode & Heater Terminal)

H – HEATER TERMINALS (Cylinder within Cathode Terminal & Cathode Terminal)

K – CATHODE TERMINAL (Outside Cylinder on End Opposite Radiator)

P – PLATE TERMINAL (Between Plate Flange & Glass Section)

Operating Position	Any
Maximum Overall Length	2-3/4"
Diameter	1-1/4" ± 1/64"
Weight (Approx.)	2 oz
Radiator	Integral part of tube
Mounting	Special

Thermal:

Air Flow:

Through Radiator—Adequate air flow should be delivered by a blower during the application of any voltages. Cooling must be sufficient to limit the radiator temperature to the specified maximum value.

To Plate, Grid, Cathode, and Heater Seals—A sufficient quantity of air should be delivered to these seals to prevent their temperature from exceeding the specified maximum value.

Incoming-Air Temperature	45 max.	°C

◄ Indicates a change.

Radiator Temperature (Measured on core adjacent to plate seal)	175	max.	°C
Seal Temperature (Plate, grid, cathode, and heater)	175	max.	°C

PLATE-MODULATED RF POWER AMPLIFIER — Class C Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1

Maximum CCS[b] Ratings, *Absolute-Maximum Values:*

DC PLATE VOLTAGE	600[c]	max.	volts
GRID VOLTAGE:			
DC	−150	max.	volts
→ Peak negative RF	400	max.	volts
Peak positive RF	30	max.	volts
DC GRID CURRENT	50	max.	ma
DC CATHODE CURRENT	100	max.	ma
GRID INPUT	2	max.	watts
PLATE DISSIPATION	70	max.	watts

RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy

Maximum CCS[b] Ratings, *Absolute-Maximum Values:*

DC PLATE VOLTAGE	1000	max.	volts
GRID VOLTAGE:			
DC	−150	max.	volts
→ Peak negative RF	400	max.	volts
Peak positive RF	30	max.	volts
DC GRID CURRENT	50	max.	ma
DC CATHODE CURRENT	125	max.	ma
GRID INPUT	2	max.	watts
PLATE DISSIPATION	100	max.	watts

[a] Because the cathode is subjected to considerable back bombardment as the frequency is increased with resultant increase in temperature, the heater voltage should be reduced depending on operating conditions and frequency to prevent overheating the cathode and resultant short life. For most applications where liberal cooling of the seals is provided, reduction of heater voltage to the values shown in the following table is suggested.

Frequency Mc	*Heater Voltage Volts*
→ up to 300	6.3
→ 300 to 1000	6.0
1000 to 1500	5.5
1500 to 2000	5.0
2000 and above	4.5

Permitted tolerance on the heater-voltage values in the above table is ± 10%. However, for long tube life, it is recommended that the tolerance be held to ± 5%.

When long life in continuous service is desired, the 2C39A should always be put in operation with full rated heater voltage (6.3 volts) which should then be reduced to the lowest value that will give the desired output.

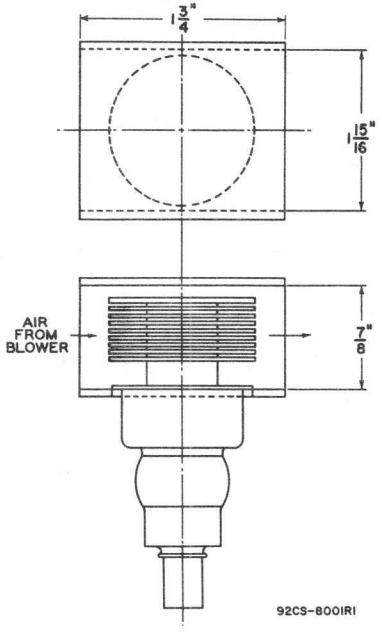
[b] Continuous Commercial Service.

[c] For less than 100% modulation, it is permissible to use a higher dc plate voltage provided the sum of the peak positive modulating voltage and the dc plate voltage does not exceed 1200 volts.

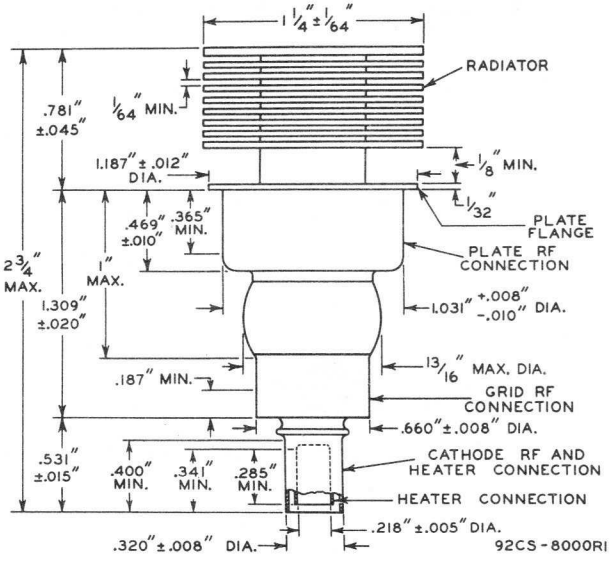
[d] Key-down conditions per tube without amplitude modulation. Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

→ Indicates a change.

RECOMMENDED COWLING FOR DIRECTING AIR FLOW THROUGH RADIATOR OF TYPE 2C39A



2C39A


1 1/4" ± 1/64"
RADIATOR
.781" ±.045"
1/64" MIN.
1.187" ± .012" DIA.
1/8" MIN.
1/32"
PLATE FLANGE
.469" ±.010"
.365" MIN.
PLATE RF CONNECTION
2 3/4" MAX.
1" MAX.
1.309" ±.020"
1.031" +.008" -.010" DIA.
.187" MIN.
13/16" MAX. DIA.
GRID RF CONNECTION
.660" ±.008" DIA.
.531" ±.015"
.400" MIN.
.341" MIN.
.285" MIN.
CATHODE RF AND HEATER CONNECTION
HEATER CONNECTION
.218" ±.005" DIA.
.320" ±.008" DIA.
92CS-8000RI

Power Triode

LIGHTHOUSE TYPE

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 0.3	volts
Current at heater volts = 6.3	0.750	amp
Direct Interelectrode Capacitances:[a]		
Grid to plate	1.3	μμf
Grid to cathode	2.2	μμf
Plate to cathode	0.03 max.	μμf
Cathode rf terminal to cathode	100	μμf

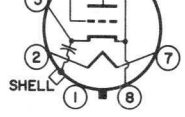
Characteristics, Class A_1 Amplifier:

Plate Supply Voltage	250	volts
Cathode Resistor	200	ohms
Amplification Factor	36	
Transconductance	4850	μmhos
Plate Current	17	ma

Mechanical:

Operating Position	Any
Maximum Overall Length	2-9/16"
Maximum Seated Length	1.973"
Maximum Diameter	1.312"
Weight (Approx.)	1.2 oz
Base	Small H-Wafer 6-Pin (JEDEC Group 1, No.B6-108)
Basing Designation for BOTTOM VIEW	6BY

Pin 1 - Do Not Use
Pin 2 - Heater
Pin 3 - Cathode
Pin 5 - Cathode
Pin 7 - Heater
Pin 8 - Cathode



Shell - Cathode RF Terminal
Center Disc-Grid Terminal
Post & End Disc-Plate Terminal

Thermal:

Cooling	Convection and Conduction	
Seal Temperature	175 max.	°C

RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy

Maximum CCS[b] Ratings, *Absolute-Maximum Values:*

For frequencies up to 3370 Mc

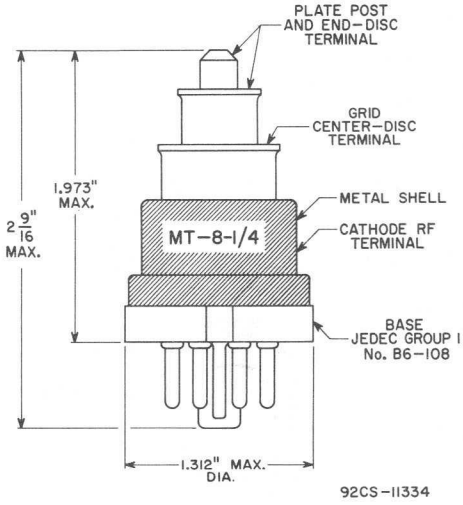
DC PLATE VOLTAGE	500 max.	volts
DC GRID VOLTAGE:		
Negative-bias value	50 max.	volts

← Indicates a change.

2C40

DC PLATE CURRENT	25 max.	ma
DC GRID CURRENT	8 max.	ma
PLATE DISSIPATION	6.5 max.	watts
PEAK HEATER–CATHODE VOLTAGE:		
Heater negative with respect to cathode	90 max.	volts
Heater positive with respect to cathode	90 max.	volts
PEAK CATHODE–SHELL VOLTAGE:		
Shell negative with respect to cathode	90 max.	volts
Shell positive with respect to cathode	90 max.	volts

[a] Without external shield.
[b] Continuous Commercial Service.



2C40A

Power Triode

LIGHTHOUSE TYPE

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 0.3	volts
Current at heater volts = 6.3	0.750	amp
Cathode Heating Time	See *Operating Considerations*	
Direct Interelectrode Capacitances (Approx.):[a]		
Grid to plate	1.3	μμf
Grid to cathode	2.2	μμf
Plate to cathode	0.03	μμf
Cathode rf terminal to cathode	100	μμf

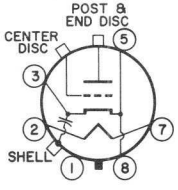
Characteristics, Class A_1 Amplifier:

Plate Supply Voltage	250	volts
Cathode Resistor	200	ohms
Amplification Factor	35	
Transconductance	5100	μmhos
Plate Current	17	ma

Mechanical:

Operating Position	Any
Maximum Overall Length	2-9/16"
Maximum Seated Length	1.973"
Maximum Diameter	1.312"
Weight (Approx.)	1.2 oz
Base	Small H-Wafer 6-Pin (JEDEC Group 1, No.B6-108)
Basing Designation for BOTTOM VIEW	6BY

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



Shell – Cathode RF Terminal
Center Disc – Grid Terminal
Post & End Disc – Plate Terminal

Thermal:

Cooling	Convection and Conduction
Seal Temperature	175 max. °C

← Indicates a change.

PLATE-PULSED OSCILLATOR

Maximum CCS[b] Ratings, *Absolute-Maximum Values:*

For frequencies up to 3370 Mc, maximum duty factor of plate pulse = 0.002[c], and maximum pulse duration of 1.5 microseconds

PEAK POSITIVE-PULSE PLATE SUPPLY VOLTAGE	1400 max.	volts
NEGATIVE GRID VOLTAGE:		
Average during plate pulse	100 max.	volts
PLATE CURRENT:		
Average[c]	3 max.	ma
Average during plate pulse	2 max.	amp
GRID CURRENT:		
Average[c]	1.5 max.	ma
Average during plate pulse	1 max.	amp
PLATE DISSIPATION[c]	4 max.	watts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	90 max.	volts
Heater positive with respect to cathode	90 max.	volts
PEAK CATHODE-SHELL VOLTAGE:		
Shell negative with respect to cathode	90 max.	volts
Shell positive with respect to cathode	90 max.	volts

[a] Without external shield.
[b] Continuous Commercial Service.
[c] In any 500-microsecond interval.

RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy

Maximum CCS[b] Ratings, *Absolute-Maximum Values:*

For frequencies up to 3370 Mc

DC PLATE VOLTAGE	500 max.	volts
DC GRID VOLTAGE:		
Negative-bias value	50 max.	volts
DC PLATE CURRENT	25 max.	ma
DC GRID CURRENT	8 max.	ma
PLATE DISSIPATION	6.5 max.	watts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	90 max.	volts
Heater positive with respect to cathode	90 max.	volts
PEAK CATHODE-SHELL VOLTAGE:		
Shell negative with respect to cathode	90 max.	volts
Shell positive with respect to cathode	90 max.	volts

OPERATING CONSIDERATIONS

In *Plate-Pulsed Oscillator Service,* the plate voltage must not be applied until a minimum of 1 minute after the application of the heater voltage.

In *RF Power Amplifier & Oscillator — Class C Telegraphy Service,* the plate voltage and the heater voltage may be applied simultaneously.

→ Indicates a change.

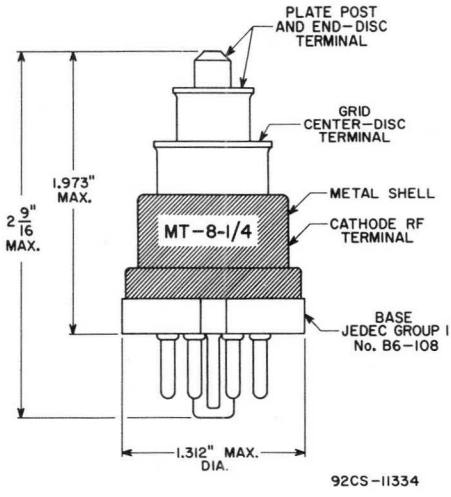


PLATE POST
AND END-DISC
TERMINAL
GRID
CENTER-DISC
TERMINAL
1.973"
MAX.
2 9/16"
MAX.
METAL SHELL
MT-8-1/4
CATHODE RF
TERMINAL
BASE
JEDEC GROUP I
No. B6-108
1.312" MAX.
DIA.
92CS-11334

2C43

Power Triode

LIGHTHOUSE TYPE

GENERAL DATA

Electrical:

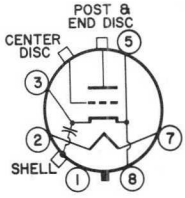
Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 0.3	volts
Current at heater volts = 6.3	0.900	amp
Cathode Heating Time	See *Operating Considerations*	
Direct Interelectrode Capacitances:[a]		
Grid to plate	1.8	μμf
Grid to cathode	3.0	μμf
Plate to cathode	0.04 max.	μμf
Cathode rf terminal to cathode	100	μμf

Characteristics, Class A1 Amplifier:

Plate Supply Voltage	250	volts
Cathode Resistor	100	ohms
Amplification Factor	50	
Transconductance	8100	μmhos
Plate Current	21	ma

Mechanical:

Operating Position	Any
Maximum Overall Length	2.6875"
Maximum Seated Length	2.078"
Maximum Diameter	1.312"
Weight (Approx.)	1 oz
Base	Small H-Wafer 6-Pin (JEDEC Group 1, No.B6-108)
Basing Designation for BOTTOM VIEW	6BY



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

Shell – Cathode RF Terminal
Center Disc – Grid Terminal
Post & End Disc – Plate Terminal

Thermal:

Cooling	Convection and Conduction	
Seal Temperature	175 max.	°C

RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy

Maximum CCS[b] Ratings, *Absolute-Maximum Values:*

For frequencies up to 1500 Mc

DC PLATE VOLTAGE	500 max.	volts
DC PLATE CURRENT	40 max.	ma

← Indicates a change.

DC CATHODE CURRENT.	55 max.	ma
PLATE DISSIPATION	12 max.	watts
PEAK HEATER–CATHODE VOLTAGE:		
Heater negative with respect to cathode .	90 max.	volts
Heater positive with respect to cathode .	90 max.	volts
PEAK CATHODE–SHELL VOLTAGE:		
Shell negative with respect to cathode. .	90 max.	volts
Shell positive with respect to cathode. .	90 max.	volts

→ **PLATE-PULSED OSCILLATOR**

Maximum CCS[b] Ratings, *Absolute-Maximum Values:*

For frequencies up to 3370 Mc, maximum duty factor of plate pulse = 0.006, and maximum pulse duration of 10 microseconds

PEAK POSITIVE-PULSE PLATE SUPPLY VOLTAGE. .	3500 max.	volts
PLATE CURRENT:		
Average during plate pulse.	2.75 max.	amp
CATHODE CURRENT:		
Average during plate pulse.	4 max.	amp
PLATE DISSIPATION	12 max.	watts
PEAK HEATER–CATHODE VOLTAGE:		
Heater negative with respect to cathode .	90 max.	volts
Heater positive with respect to cathode .	90 max.	volts
PEAK CATHODE–SHELL VOLTAGE:		
Shell negative with respect to cathode. .	90 max.	volts
Shell positive with respect to cathode. .	90 max.	volts

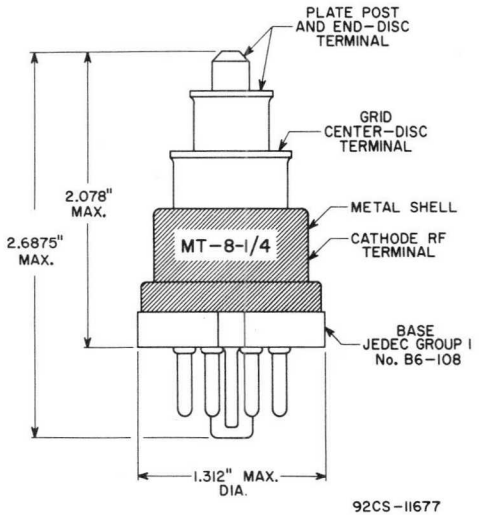
[a] Without external shield.
[b] Continuous Commercial Service.

→ Indicates a change.

OPERATING CONSIDERATIONS

In *Plate-Pulsed Oscillator Service*, the plate voltage must not be applied until a minimum of 1 minute after the application of the heater voltage.

In *RF Power Amplifier & Oscillator — Class C Telegraphy Service*, the plate voltage and the heater voltage may be applied simultaneously.



← Indicates a change.

Beam Power Tube

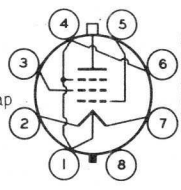
GENERAL DATA

Electrical:

Filament, Coated:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at filament volts = 6.3	0.65	amp
Heating time	Less than 2 seconds	
Transconductance, for plate volts = 500, grid-No.2 volts = 200, and plate ma. = 16	3200	μmhos
Mu-Factor, Grid No.2 to Grid No.1 for plate volts and grid-No.2 volts = 200, and plate ma. = 16	7.5	
Direct Interelectrode Capacitances:[a]		
Grid No.1 to plate	0.11 max.	μμf
Grid No.1 to filament tap & grid No.3 & internal shield, and grid No.2	8.5	μμf
Plate to filament tap & grid No.3 & internal shield, and base sleeve	6.5	μμf

Mechanical: ←

Operating Position	Vertical, or horizontal with plane of pins 3 and 7 vertical
Maximum Overall Length	3-21/32"
Seated Length	2-15/16" ± 5/32"
Maximum Diameter	1-5/16"
Weight (Approx.)	1.3 oz
Bulb	T9
Cap	Small (JEDEC No.C1-1)
Base	Small-Micanol-Wafer Octal 8-Pin with "640" Sleeve (JEDEC Group 1, No.B8-44)
Basing Designation for BOTTOM VIEW	7CL



Pin 1 – Grid No.3, Internal Shield, Filament Tap
Pin 2 – Filament
Pin 3 – Grid No.2
Pin 4 – Same as Pin 1
Pin 5 – Grid No.1
Pin 6 – Same as Pin 1
Pin 7 – Filament
Pin 8 – Base Sleeve
Cap – Plate

Thermal:

Bulb Temperature (At hottest point on bulb surface)	210 max.	°C

AF POWER AMPLIFIER & MODULATOR — Class A_1[b]

Maximum Ratings, *Absolute-Maximum Values:*

	CCS[c]	
DC PLATE VOLTAGE	300 max.	volts

←Indicates a change.

	CCS[c]	
DC GRID-No.2 VOLTAGE	200 max.	volts
GRID-No.2 INPUT	2.5 max.	watts
PLATE DISSIPATION	10 max.	watts
Typical Operation:		
DC Plate Voltage	250	volts
DC Grid-No.2 Voltage	160	volts
DC Grid-No.1 Voltage[d]	−8	volts
Peak AF Grid-No.1 Voltage	8	volts
Zero-Signal DC Plate Current	35	ma
Max.-Signal DC Plate Current	40	ma
Zero-Signal DC Grid-No.2 Current	2.6	ma
Max.-Signal DC Grid-No.2 Current	6.8	ma
Load Resistance	6000	ohms
Total Harmonic Distortion	10	%
Power Output	3.9	watts
→ **Maximum Circuit Values:**		
Grid-No.1-Circuit Resistance:[e]		
With fixed bias	0.1 max.	megohm
With cathode bias	0.5 max.	megohm

AF POWER AMPLIFIER & MODULATOR — Class AB_2[f]

Maximum Ratings, *Absolute-Maximum Values:*

	CCS[c]	ICAS[g]	
DC PLATE VOLTAGE	400 max.	500 max.	volts
DC GRID-No.2 VOLTAGE	200 max.	200 max.	volts
MAX.-SIGNAL DC PLATE CURRENT[h]	75 max.	75 max.	ma
MAX.-SIGNAL PLATE INPUT[h]	30 max.	37.5 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT[h]	2.5 max.	2.5 max.	watts
PLATE DISSIPATION[h]	10 max.	13.5 max.	watts

Typical Operation:

Values are for 2 tubes

DC Plate Voltage	400	500	volts
DC Grid-No.2 Voltage	125	125	volts
DC Grid-No.1 Voltage[d]	−15	−15	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage	82	82	volts
Zero-Signal DC Plate Current	18	20	ma
Max.-Signal DC Plate Current	150	150	ma
Zero-Signal DC Grid-No.2 Current	0.6	0.6	ma
Max.-Signal DC Grid-No.2 Current	26	28	ma
Effective Load Resistance (Plate-to-plate)	7000	9000	ohms
Max.-Signal Driving Power (Approx.)[j]	0.43	0.46	watt
Max.-Signal Power Output (Approx.)	42	54	watts

→ Indicates a change.

Maximum Circuit Values (CCS or ICAS Conditions): ←

Grid-No.1-Circuit Resistance[k]	30000 max.	ohms

PLATE-MODULATED RF POWER AMPLIFIER — Class C Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1

Maximum Ratings, *Absolute-Maximum Values:*

	CCS[c]	*ICAS*[g]	
DC PLATE VOLTAGE.	400 max.	500 max.	volts
DC GRID-No.2 VOLTAGE.	200 max.	200 max.	volts
DC GRID-No.1 VOLTAGE.	−175 max.	−175 max.	volts
DC PLATE CURRENT.	60 max.	70 max.	ma
DC GRID-No.1 CURRENT.	3.5 max.	3.5 max.	ma
PLATE INPUT	20 max.	27 max.	watts
GRID-No.2 INPUT	1.7 max.	2.3 max.	watts
PLATE DISSIPATION	6.7 max.	9 max.	watts

Typical Operation:

DC Plate Voltage.	400	500	volts
DC Grid-No.2 Voltage[m]	180	180	volts
From a series resistor of . .	27500	40000	ohms
DC Grid-No.1 Voltage[d,n]	−45	−45	volts
From a grid resistor of . . .	18000	18000	ohms
Peak RF Grid-No.1 Voltage . . .	61	62	volts
DC Plate Current.	50	54	ma
DC Grid-No.2 Current.	8	8	ma
DC Grid-No.1 Current (Approx.).	2.5	2.5	ma
Driving Power (Approx.)	0.15	0.16	watt
Power Output (Approx.).	13.5	18	watts

Maximum Circuit Values (CCS or ICAS Conditions): ←

Grid-No.1-Circuit Resistance[k]	30000 max.	ohms

RF POWER AMPLIFIER AND OSCILLATOR — Class C Telegraphy[p] ←
and
RF POWER AMPLIFIER — Class C FM Telephony

Maximum Ratings, *Absolute-Maximum Values:*

	CCS[c]	*ICAS*[g]	
DC PLATE VOLTAGE.	500 max.	600 max.	volts
DC GRID-No.2 VOLTAGE.	200 max.	200 max.	volts
DC GRID-No.1 VOLTAGE.	−175 max.	−175 max.	volts
DC PLATE CURRENT.	75 max.	85 max.	ma
DC GRID-No.1 CURRENT.	3.5 max.	3.5 max.	ma
PLATE INPUT	30 max.	40 max.	watts
GRID-No.2 INPUT	2.5 max.	2.5 max.	watts
PLATE DISSIPATION	10 max.	13.5 max.	watts

← Indicates a change.

2E24

Typical Operation up to 125 Mc:

	CCS[c]		ICAS[g]	
DC Plate Voltage	400	500	600	volts
DC Grid-No.2 Voltage[g]	200	190	195	volts
From a series resistor of	20000	29000	40500	ohms
DC Grid-No.1 Voltage[d,k,q]	-45	-45	-50	volts
From a grid resistor of	15000	15000	16700	ohms
Peak RF Grid-No.1 Voltage	62	65	71	volts
DC Plate Current	75	60	66	ma
DC Grid-No.2 Current	10	10.5	10	ma
DC Grid-No.1 Current (Approx.)	3	3	3	ma
Driving Power (Approx.)	0.19	0.2	0.21	watt
Power Output (Approx.)	20	20	27	watts

Typical Operation up to 160 Mc:

DC Plate Voltage	-		350	volts
DC Grid-No.2 Voltage[q]	-		170	volts
From a series resistor of	-		18000	ohms
DC Grid-No.1 Voltage[d,k,r]	-		-50	volts
From a grid resistor of	-		16500	ohms
Peak RF Grid-No.1 Voltage	-		70	volts
DC Plate Current	-		85	ma
DC Grid-No.2 Current	-		10	ma
DC Grid-No.1 Current (Approx.)	-		3	ma
Driving Power (Approx.)	-		2	watts
Power Output (Approx.)	-		16.5	watts

Maximum Circuit Values (CCS or ICAS Conditions):

Grid-No.1-Circuit Resistance[k] . . . . . 30000 max. ohms

[a] Without external shield and with base sleeve connected to ground.

[b] Subscript 1 indicates that grid-No.1 current does not flow during any part of the input cycle.

[c] Continuous Commercial Service.

[d] With ac on filament.

[e] The type of input-coupling network used should not introduce too much resistance in the grid-No.1 circuit. Transformer or impedance coupling devices are recommended. When grid No.1 is operated in the negative region with fixed bias, the dc grid-No.1-circuit resistance should not exceed 100,000 ohms. For higher values of dc grid-No.1-circuit resistance, cathode bias is required. Under no circumstances should the total dc grid-No.1-circuit resistance exceed 0.5 megohm.

[f] Subscript 2 indicates that grid-No.1 current flows during some part of the input cycle.

[g] Intermittent Commercial & Amateur Service.

[h] Averaged over any audio-frequency cycle of sine-wave form.

[j] Driver stage should be capable of supplying the specified driving power at low distortion to the No.1 grids of the AB_2 stage. The effective resistance per grid-No.1 circuit of the AB_2 stage should be held at low value.

[k] When grid No.1 is driven positive and the 2E24 is operated at maximum ratings, the total dc grid-No.1-circuit resistance should not exceed 30,000 ohms. If additional bias is required, it must be supplied by a cathode resistor or fixed supply. For operation at less than maximum ratings, the dc grid-No.1-circuit resistance may be as high as 100,000 ohms.

[m] Obtained preferably from a separate source modulated with the plate supply, or from the modulated plate supply through series resistor of the value shown.

[n] Obtained from grid-No.1 resistor or from a combination of grid-No.1 resistor with either fixed supply or cathode resistor.

[p] Key-down conditions per tube without amplitude modulation. Amplitude modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

[q] Obtained preferably from a separate source, or from the plate-supply voltage with a voltage divider, or through a series resistor of the value shown. The grid-No.2 voltage must not exceed 600 volts under key-up conditions.

[r] Obtained from fixed supply, by grid-No.1 resistor, by cathode resistor, or by combination methods.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Filament Current.	1	0.59	0.71	amp
Grid No.1-Plate Capacitance . .	2	–	0.11	μμf
Input Capacitance	2	7.0	10.0	μμf
Output Capacitance.	2	4.9	8.1	μμf
Plate Current	1,3	24	46	ma
Grid-No.2 Current	1,3	–	5	ma
Grid-No.1 Current	1,4	–	-5	μa
Useful Power Output	1,5	18	–	watts

Note 1: With 6.3 volts ac on filament.

Note 2: Without external shield. Base pin No.8 grounded.

Note 3: With dc plate voltage of 200 volts, dc grid-No.2 voltage of 135 volts, and dc grid-No.1 voltage of -5 volts.

Note 4: With dc plate voltage of 500 volts, dc grid-No.2 voltage of 200 volts, and dc grid-No.1 voltage adjusted to give dc plate current of 20 ma.

Note 5: With dc plate voltage of 500 volts, dc grid-No.2 voltage of 200 volts, grid-No.1 resistor of 0.015 megohm ± 10%, dc plate current of 60 ma., dc grid-No.1 current of 2.5 to 3.5 ma., and frequency of 15 Mc.

OUTLINE DIMENSIONS
for the 2E24 are the same as those for the 2E26

OPERATING NOTES

The 2E24 is intended for use in mobile and emergency-communications equipment. Its filament combines sturdiness and efficiency with quick heating and provides wide latitude in operating-voltage range. Although designed for intermittent operation, the filament will give reasonable life when it is operated continuously. In continuous-service applications where extremely long life is desired, it is recommended that the heater-cathode type 2E26 be used.

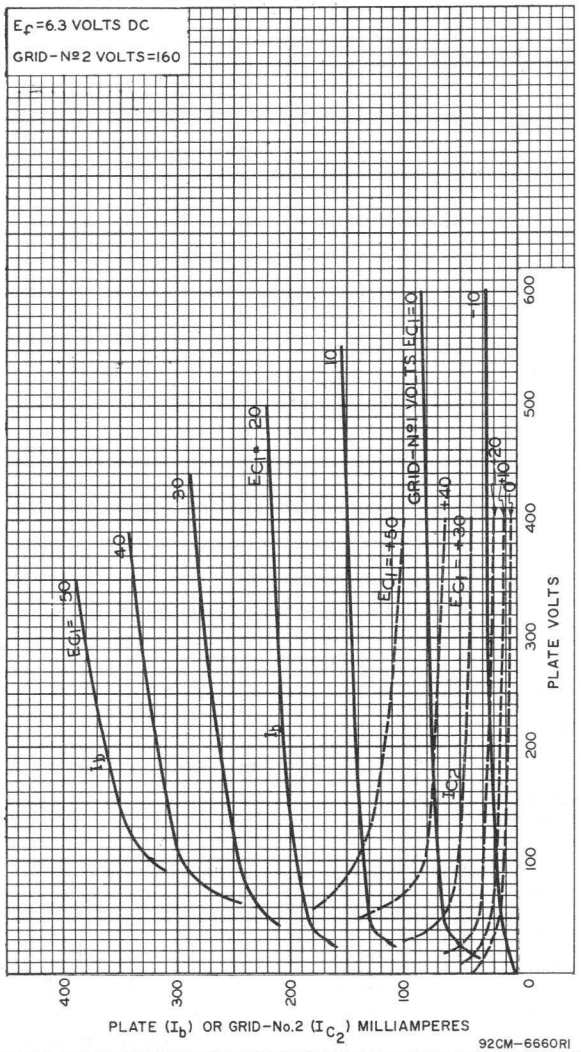
MAXIMUM RATINGS vs OPERATING FREQUENCY

FREQUENCY	125	150	160	175	Mc
MAXIMUM-PERMISSIBLE PERCENTAGE OF MAXIMUM-RATED PLATE VOLTAGE OR PLATE INPUT:					
Class C plate-modulated telephony	100	83	75	68	%
Class C telegraphy	100	83	75	68	%

← Indicates a change.

2E24

AVERAGE PLATE CHARACTERISTICS

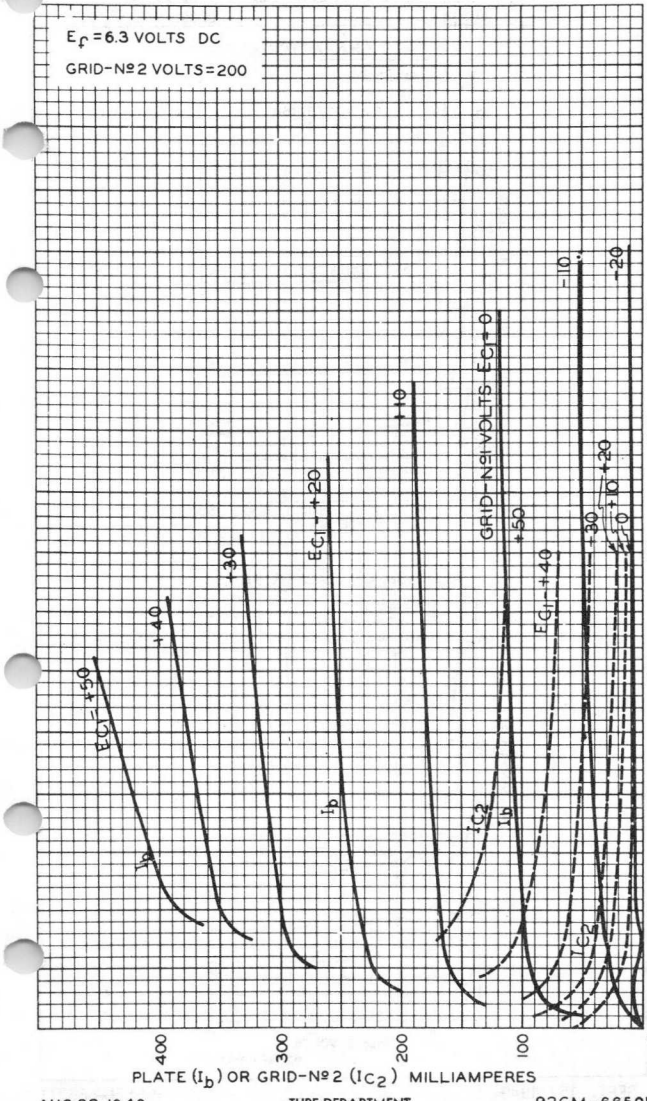


92CM-6660RI

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.

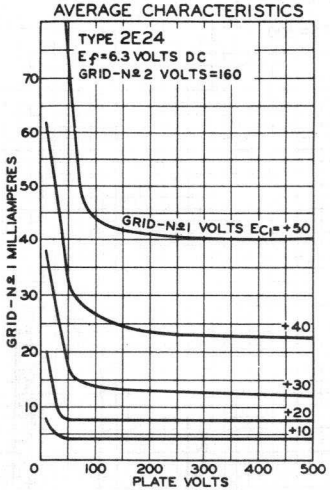
2E24

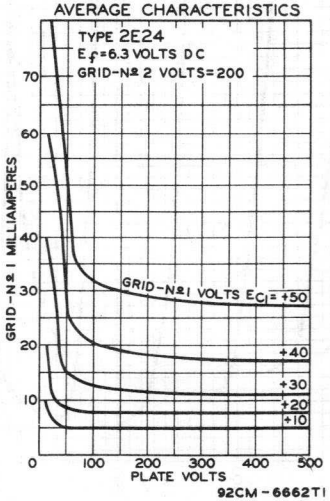
AVERAGE PLATE CHARACTERISTICS



2E24

2E24
VHF BEAM POWER AMPLIFIER





2E26

BEAM POWER TUBE

Useful with full input up to 125 Mc and with reduced input up to 175 Mc

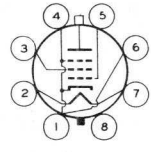
GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current	0.8	amp
Transconductance, for plate volts = 500, grid-No.2 volts = 200, and plate ma. = 20	3500	μmhos
Mu-Factor, Grid No.2 to Grid No.1, for plate volts = 200, grid-No.2 volts = 200, and plate ma. = 20	6.5	
Direct Interelectrode Capacitances:		
Grid No.1 to plate	0.2 max.	μμf
Grid No.1 to cathode & grid No.3 & internal shield, grid No.2, base sleeve, and heater	13	μμf ←
Plate to cathode & grid No.3 & internal shield, grid No.2, base sleeve, and heater	7	μμf

Mechanical:

Operating Position	Any
Maximum Overall Length	3-21/32"
Seated Length	2-15/16" ± 5/32"
Maximum Diameter	1-5/16"
Bulb	T9
Cap	Small (JEDEC No.C1-1)
Base	Small-Micanal-Wafer Octal 8-Pin with "640" Sleeve (JEDEC Group 1, No.B8-44)
Basing Designation for BOTTOM VIEW	7CK ←



Pin 1 – Cathode, Grid No.3, Internal Shield
Pin 2 – Heater
Pin 3 – Grid No.2
Pin 4 – Same as Pin 1
Pin 5 – Grid No.1
Pin 6 – Same as Pin 1
Pin 7 – Heater
Pin 8 – Base Sleeve
Cap – Plate

Bulb Temperature (At hottest point)	210 max.	°C
Weight (Approx.)	1.4	oz

AF POWER AMPLIFIER & MODULATOR — Class AB_1†

Maximum Ratings, *Absolute-Maximum Values:*

	CCS●	*ICAS*●●	
DC PLATE VOLTAGE	600 max.	750 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	250 max.	250 max.	volts

← Indicates a change.

2E26

BEAM POWER TUBE

	CCS●	ICAS●●	
MAX.-SIGNAL DC PLATE CURRENT**. .	75 max.	75 max.	ma
MAX.-SIGNAL PLATE INPUT**	30 max.	37.5 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT** . .	2.5 max.	2.5 max.	watts
PLATE DISSIPATION	10 max.	12.5 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode.	100 max.	100 max.	volts
Heater positive with respect to cathode.	100 max.	100 max.	volts

Typical Operation:

Values are for 2 tubes

	CCS●	ICAS●●	
DC Plate Voltage.	500	700	volts
DC Grid-No.2 Voltage▲⊕.	250	235	volts
DC Grid-No.1 (Control-Grid) Voltage:			
From fixed-bias source. . . .	-40	-40	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage.	70	72	volts
Zero-Signal DC Plate Current. . .	13	12	ma
Max.-Signal DC Plate Current. . .	120	110	ma
Max.-Signal DC Grid-No.2 Current.	10	10	ma
Effective Load Resistance (Plate to plate).	8650	14100	ohms
Max.-Signal Driving Power (Approx.)	0	0	watts
Max.-Signal Power Output (Approx.)	40	50	watts

Maximum Circuit Values (CCS or ICAS Conditions):

Grid-No.1-Circuit Resistance:○○

With fixed bias	30000 max. ohms
With cathode bias	Not recommended

AF POWER AMPLIFIER & MODULATOR — Class AB_2#

Maximum Ratings, *Absolute-Maximum Values:*

	CCS●	ICAS●●	
DC PLATE VOLTAGE.	600 max.	750 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	250 max.	250 max.	volts
MAX.-SIGNAL DC PLATE CURRENT**. .	75 max.	75 max.	ma
MAX.-SIGNAL PLATE INPUT**	30 max.	37.5 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT** . .	2.5 max.	2.5 max.	watts
PLATE DISSIPATION	10 max.	12.5 max.	watts

→Indicates a change.

2E26

BEAM POWER TUBE

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

Typical Operation:

Values are for 2 tubes

	CCS●	ICAS●●	
DC Plate Voltage.	400	500	volts
DC Grid-No.2 Voltage▲#.	125	125	volts
DC Grid-No.1 (Control-Grid) Voltage:			
From fixed-bias source.	-15	-15	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage	60	60	volts
Zero-Signal DC Plate Current	20	22	ma
Max.-Signal DC Plate Current	150	150	ma
Max.-Signal DC Grid-No.2 Current.	32	32	ma
Effective Load Resistance (Plate to plate).	6200	8000	ohms
Max.-Signal Driving Power (Approx.)★.	0.36	0.36	watt
Max.-Signal Power Output (Approx.).	42	54	watts

Maximum Circuit Values (CCS or ICAS Conditions):

Grid-No.1-Circuit Resistance:★		
With fixed bias	30000 max.	ohms
With cathode bias	Not recommended	

PLATE-MODULATED RF POWER AMPLIFIER — Class C Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1

Maximum Ratings, *Absolute-Maximum Values:*

	CCS●	ICAS●●	IMS○	
DC PLATE VOLTAGE. . .	400 max.	500 max.	600 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE . . .	200 max.	200 max.	200 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-175 max.	-175 max.	-175 max.	volts
DC PLATE CURRENT. . .	60 max.	70 max.	70 max.	ma

2E26

2E26

BEAM POWER TUBE

	CCS●	ICAS●●	IMS○	
DC GRID-No.1 CURRENT.	3.5 max.	3.5 max.	3.5 max.	ma
PLATE INPUT	20 max.	27 max.	37 max.	watts
GRID-No.2 INPUT . . .	1.7 max.	2.3 max.	2.5 max.	watts
PLATE DISSIPATION . .	6.7 max.	9 max.	12 max.	watts
PEAK HEATER-CATHODE VOLTAGE:				
Heater negative with respect to cathode	100 max.	100 max.	100 max.	volts
Heater positive with respect to cathode	100 max.	100 max.	100 max.	volts
Typical Operation:				
DC Plate Voltage. . .	400	500	600	volts
DC Grid-No.2 Voltage◆.	160	180	200	volts
From a series resistor of . . .	32000	35500	40000	ohms
DC Grid-No.1 Voltage⊕.	-50	-50	-50	volts
From a grid resistor of . . .	20000	20000	20000	ohms
Peak RF Grid-No.1 Voltage	60	60	60	volts
DC Plate Current. . .	50	54	60	ma
DC Grid-No.2 Current.	7.5	9	10	ma
DC Grid-No.1 Current (Approx.)	2.5	2.5	2.5	ma
Driving Power (Approx.)	0.15	0.15	0.15	watt
Power Output (Approx.)	13.5	18	24	watts

Maximum Circuit Values (CCS, ICAS, or IMS Conditions):

Grid-No.1-Circuit Resistance† . . . . . 30000 max. ohms

RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy□
and
RF POWER AMPLIFIER — Class C FM Telephony

Maximum Ratings, *Absolute-Maximum Values:*

	CCS●	ICAS●●	IMS○	
DC PLATE VOLTAGE. . .	500 max.	600 max.	700 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	200 max.	200 max.	200 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-175 max.	-175 max.	-175 max.	volts

2E26

BEAM POWER TUBE

	CCS[•]	ICAS[••]	IMS[◊]	
DC PLATE CURRENT . . .	75 max.	85 max.	85 max.	ma
DC GRID-No.1 CURRENT .	3.5 max.	3.5 max.	3.5 max.	ma
PLATE INPUT.	30 max.	40 max.	55 max.	watts
GRID-No.2 INPUT. . . .	2.5 max.	2.5 max.	2.5 max.	watts
PLATE DISSIPATION. . .	10 max.	13.5 max.	18.5 max.	watts
PEAK HEATER-CATHODE VOLTAGE:				
Heater negative with respect to cathode.	100 max.	100 max.	100 max.	volts
Heater positive with respect to cathode.	100 max.	100 max.	100 max.	volts

Typical CCS[•] Operation:

	Up to 125 Mc		*At 160 Mc*	
DC Plate Voltage . . .	400	500	300	volts
DC Grid-No.2 Voltage[⊕⊕].	190	185	170	volts
From a series resistor of. . . .	19000	28500	21500	ohms
DC Grid-No.1 Voltage[■].	-30	-40	-75	volts
From a grid-No.1 resistor of. . . .	10000	13500	30000	ohms
Peak RF Grid-No.1 Voltage.	41	50	85	volts
DC Plate Current . . .	75	60	75	ma
DC Grid-No.2 Current .	11	11	6	ma
DC Grid-No.1 Current (Approx.).	3	3	2.5	ma
Driving Power (Approx.).	0.12	0.15	1.5	watts
Power Output (Approx.).	20	20	13	watts

Typical ICAS[••] Operation:

	Up to 125 Mc	*At 160 Mc*	
DC Plate Voltage	600	350	volts
DC Grid-No.2 Voltage[⊕⊕] .	185	200	volts
From a series resistor of.	41500	21500	ohms
DC Grid-No.1 Voltage[■]. .	-45	-90	volts
From a grid-No.1 resistor of.	15000	30000	ohms
Peak RF Grid-No.1 Voltage.	57	105	volts
DC Plate Current	66	85	ma
DC Grid-No.2 Current . .	10	7	ma
DC Grid-No.1 Current (Approx.).	3	3	ma

2E26

BEAM POWER TUBE

	Up to 125 Mc	*At 160 Mc*	
Driving Power (Approx.). . .	0.17	2	watts
Power Output (Approx.) . . .	27	16.5	watts

Typical IMS◇ Operation:

	Up to 125 Mc	
DC Plate Voltage	650	volts
DC Grid-No.2 Voltage●●	200	volts
From a series resistor of.	45000	ohms
DC Grid-No.1 Voltage■.	−49	volts
From a grid-No.1 resistor of . . .	16300	ohms
Peak RF Grid-No.1 Voltage.	68	volts
DC Plate Current	84	ma
DC Grid-No.2 Current	10	ma
DC Grid-No.1 Current (Approx.) . . .	3	ma
Driving Power (Approx.).	0.2	watt
Power Output (Approx.)	36	watts

Maximum Circuit Values (CCS, or ICAS, or IMS Conditions):

Grid-No.1-Circuit Resistance‡. . . .	30000 max.	ohms

◇ Without external shield.

† Subscript 1 indicates that grid-No.1 current does not flow during any part of the input cycle.

● Continuous Commercial Service.

●● Intermittent Commercial and Amateur Service.

** Averaged over any audio-frequency cycle of sine-wave form.

▲ Preferably obtained from a separate source or from the plate voltage supply with a voltage divider.

⊕ In applications requiring the use of grid-No.2 voltages above 135 volts, provision should be made for the adjustment of grid-No.1 bias for each tube separately. The necessity for this adjustment at the lower grid-No.2 voltages depends on the distortion requirements and on whether the plate-dissipation rating is exceeded at zero-signal plate current.

∞ The resistance introduced into the grid-No.1 circuit by the input coupling should be held to a low value. In no case should it exceed the specified maximum value. Transformer- or impedance-coupling devices are recommended.

Subscript 2 indicates that grid-No.1 current flows during some part of the input cycle.

★ Driver stage should be capable of supplying the specified driving power at low distortion to the No.1 grids of the AB_2 stage. To minimize distortion, the effective resistance per grid-No.1 circuit of the AB_2 stage should be held at a low value. For this purpose, the use of transformer coupling is recommended.

○ Intermittent Mobile Service.

■ Obtained preferably from a separate source modulated along with the plate supply, or from the modulated plate supply through a series resistor.

⊕ Obtained from grid-No.1 resistor or from a combination of grid-No.1 resistor with either fixed supply or cathode resistor.

‡ When grid-No.1 is driven positive and the 2E26 is operated at maximum ratings, the total dc grid-No.1-circuit resistance should not exceed the specified value of 30,000 ohms. If this value is insufficient to provide adequate bias, the additional required bias must be supplied by a cathode resistor or fixed supply. For operation at less than maximum ratings, the dc grid-No.1-circuit resistance may be as high as 0.1 megohm.

2E26
BEAM POWER TUBE

□ Key-down conditions per tube without amplitude modulation. Amplitude modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

⊕⊕ Obtained preferably from a separate source, or from the plate supply voltage with a voltage divider, or through a series resistor. A series grid-No.2 resistor should be used only when the 2E26 is used in a circuit which is not keyed. Grid-No.2 voltage must not exceed 600 volts under key-up conditions.

■ Obtained from fixed supply, by grid-No.1 resistor, by cathode resistor, or by combination methods.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Heater Current	1	0.74	0.86	amp
Direct Interelectrode Capacitances:				
Grid No.1 to plate	2	–	0.2	μμf
Grid No.1 to cathode & grid No.3 & internal shield, grid No.2, base sleeve, and heater	2	11.6	14	μμf
Plate to cathode & grid No.3 & internal shield, grid No.2, base sleeve, and heater	2	6.4	8	μμf
Plate Current	3	23	47	ma
Grid-No.2 Current	3	–	4	ma
Useful Power Output	4	18	–	watts

Note 1: With heater volts = 6.3 ac.

Note 2: Without external shield.

Note 3: With heater volts = 6.3 ac, dc plate volts = 200, dc grid-No.2 volts = 135, and dc grid-No.1 volts = −10.

Note 4: In a single-tube self-excited oscillator circuit, and with heater volts = 6.3 ac, dc plate volts = 500, dc grid-No.2 volts = 200, grid-No.1 resistor (megohms) = 0.015 ± 10%, dc plate ma. = 60 maximum, dc grid-No.1 ma. = 1.8 to 2.2, and frequency (Mc) = 15.

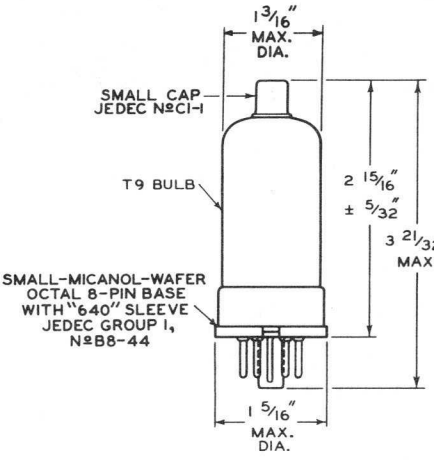
MAXIMUM RATINGS vs OPERATING FREQUENCY

FREQUENCY	125	150	160	175	Mc
MAXIMUM-PERMISSIBLE PERCENTAGE OF MAXIMUM-RATED PLATE VOLTAGE OR PLATE INPUT:					
Class C plate-modulated telephony	100	83	75	68	%
Class C telegraphy	100	83	75	68	%

← Indicates a change.

2E26

BEAM POWER TUBE



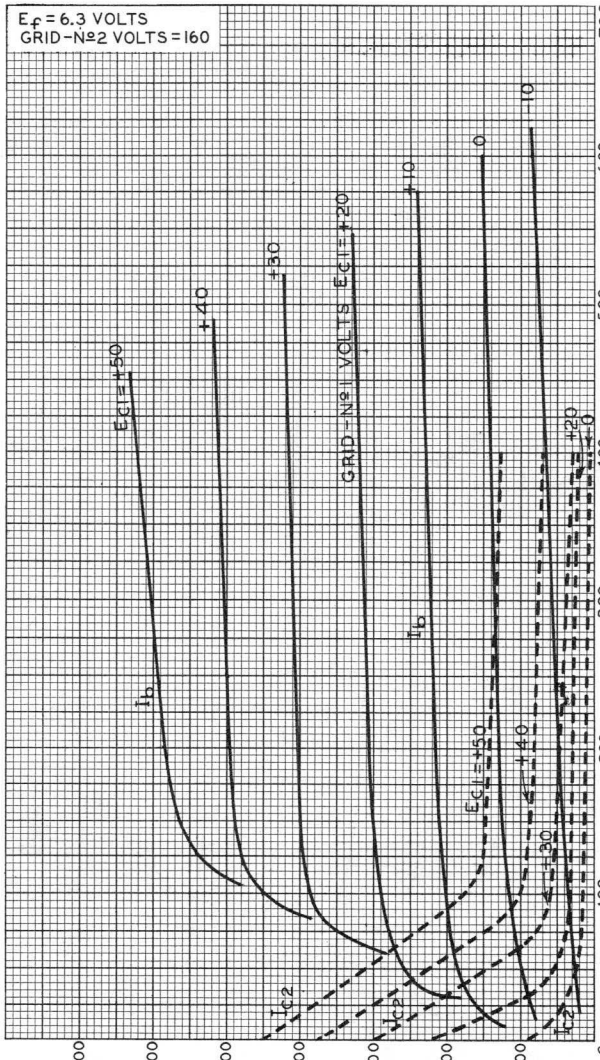
92CS-6607R3

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

RCA

2E26

AVERAGE CHARACTERISTICS



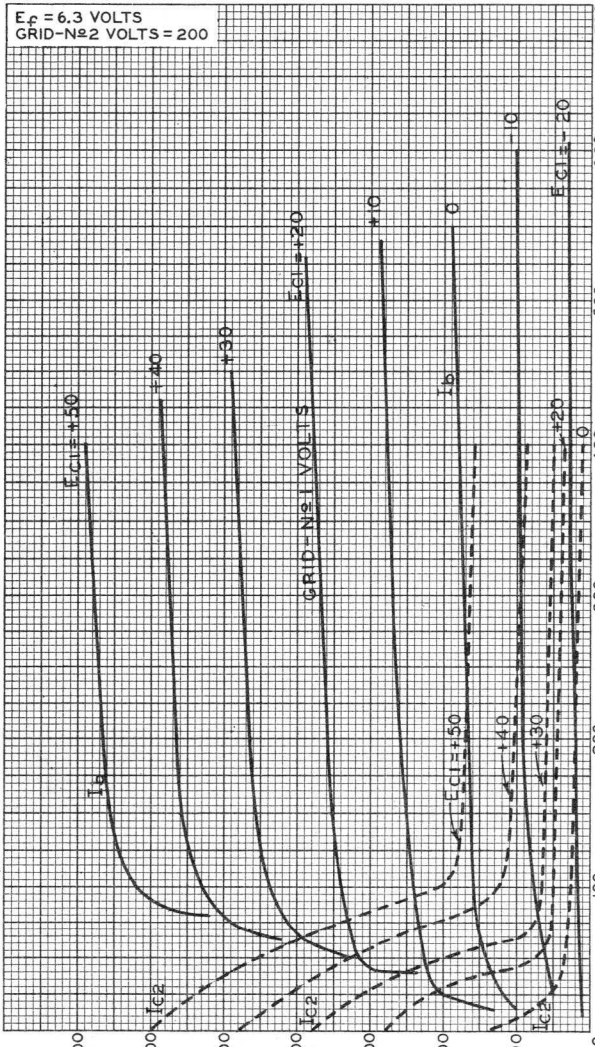
ELECTRON TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6631

2E26

AVERAGE CHARACTERISTICS



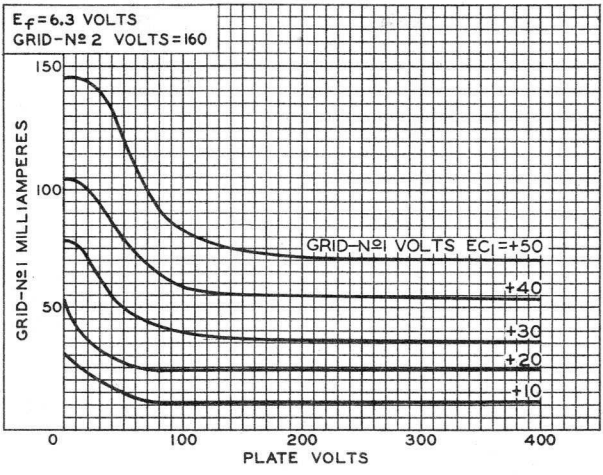
ELECTRON TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

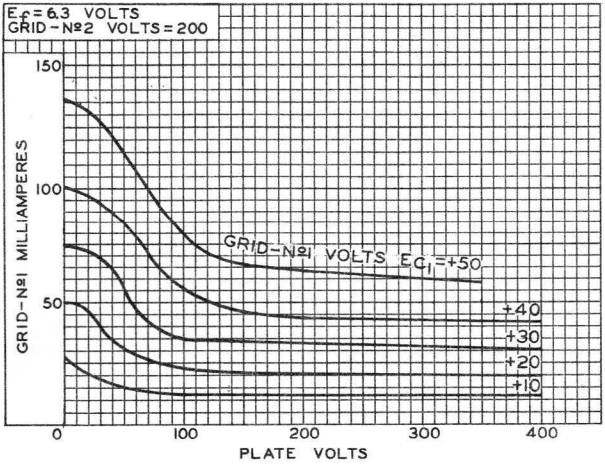
92CM-6630

2E26

TYPICAL CHARACTERISTICS



92CS-6628



92CS-6629

2N2873

Transistor

GERMANIUM P-N-P DIFFUSED-DOT TYPE

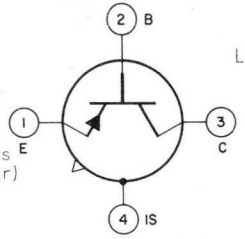
For Amplifier, Mixer, and Oscillator Applications in the Frequency Range of 10 to 300 Mc

GENERAL DATA

Mechanical:

Dimensions. . . . . .Similar to TO-1 outline but has 4 leads on a lead circle diameter of 0.100" and lead 4 has a min. length of 1.3". (See *Outline TO-1* in General Section)

Terminal Diagram: BOTTOM VIEW



Lead 1 – Emitter
Lead 2 – Base
Lead 3 – Collector (Red dot on case indicates collector)

Lead 4 – Internal Shield, Case

Index is an indentation on bottom of case between emitter and shield leads

RADIO-FREQUENCY SERVICE

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

COLLECTOR-TO-BASE VOLTAGE:			
With emitter open	V_{CBO}	-35 max.	volts
With emitter-to-base reverse bias dc volts = -0.3. . . .	V_{CBV}	-35 max.	volts
EMITTER-TO-BASE VOLTAGE:			
With collector open	V_{EBO}	-0.3 max.	volt
COLLECTOR CURRENT	I_C	-10 max.	ma
EMITTER CURRENT	I_E	10 max.	ma
TRANSISTOR DISSIPATION:	P_T		
At free-air temperatures:			
From -65° to 25° C.		115 max.	mw
Above 25° C		*Derate linearly 1.55 mw/°C*	
TEMPERATURE:			
Operating Range (Junction). .	T_{opr}	-65 to 100	°C
Storage Range	T_{stg}	-65 to 100	°C
Lead:[a]			
For 10 seconds maximum. . .	T_L	225 max.	°C

2N2873

ELECTRICAL CHARACTERISTICS

Free-air temperature = 25° C

		Min.	Typ.	Max.	
DC Collector-to-Base Breakdown Voltage for emitter-to-base reverse bias dc volts = -0.3, dc collector ma. = -0.05. . .	BV_{CBV}	-35	-	-	volts
DC Collector-Cutoff Current for dc collector-to-base volts = -12, emitter current = 0	I_{CBO}	-	-	-12	μa
DC Emitter-Cutoff Current for dc emitter-to-base volts = -0.3, collector current = 0	I_{EBO}	-		-12	μa
Collector-to-Base Feedback Capacitance for dc collector-to-base volts = -12, collector current = 0, frequency (Mc) = 1, lead 4 grounded.	C_{cb}	-	0.45	0.65	pf
Small-Signal Short-Circuit Forward-Current Transfer Ratio for dc collector-to-emitter volts = -6, dc collector ma. = -1 . .	h_{fe}	40	125	300	
Gain-Bandwidth Product for dc collector-to-emitter volts = -15, dc collector ma. = -2.5.	f_T	300	375	-	Mc
Collector-to-Base Time Constant for dc collector-to-base volts = -15, dc collector ma. = -2.5, frequency (Mc) = 31.9, lead 4 grounded	r_b, C_c	-	8	20	psec
Noise Figure for dc collector-to-emitter volts = -15, dc collector ma. = -2.5, source resistance (ohms) = 50, frequency (Mc) = 200. . .	NF	-	5.5	8	db

Typical Operation:

In a common-emitter, base input radio-frequency-amplifier circuit at a signal frequency of 175 Mc, and a free-air temperature of 25° C

DC Collector-to-Emitter Voltage . . .	-12	volts
DC Emitter Current.	2.5	ma

Input Resistance (AC output short-circuited).	75	ohms
Output Resistance (AC input short-circuited).	7000	ohms
Input Capacitance (AC output short-circuited)	5	pf
Output Capacitance (AC input short-circuited).	1.3	pf
Collector-to-Base Feedback Capacitance. . . .	0.45	pf
Transconductance.	33000	μmhos
Maximum Available Gain[b]	21.6	db
Maximum Usable Gain:		
In a fixed neutralized circuit.	16.8	db
In an unneutralized circuit	12.7	db
Noise Figure (50 ohms source impedance) . . .	5	db

[a] Measured along lead at distances not less than 1/32" from seating plane.
[b] Measured in a matched, unilateralized circuit or calculated from:

$$MAG = \frac{|gm|^2 R_i R_o}{4}$$

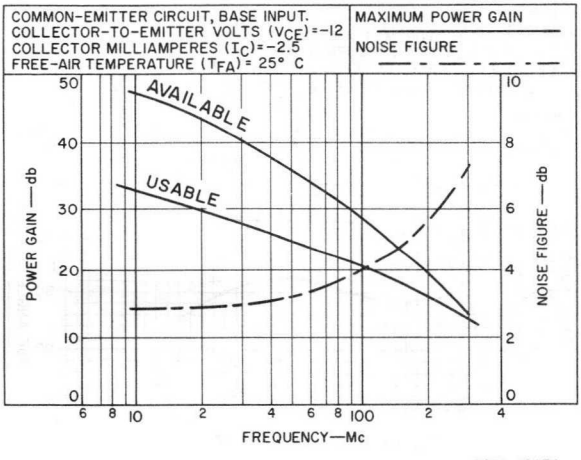
where: gm = transconductance R_i = Input Resistance
R_o = Output Resistance

OPERATING CONSIDERATIONS

This transistor should not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

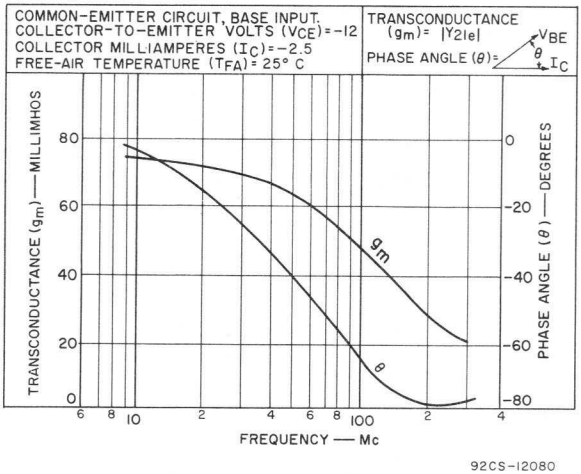
The *flexible leads* of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the seating plane provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the seals of the leads and damage the transistor.

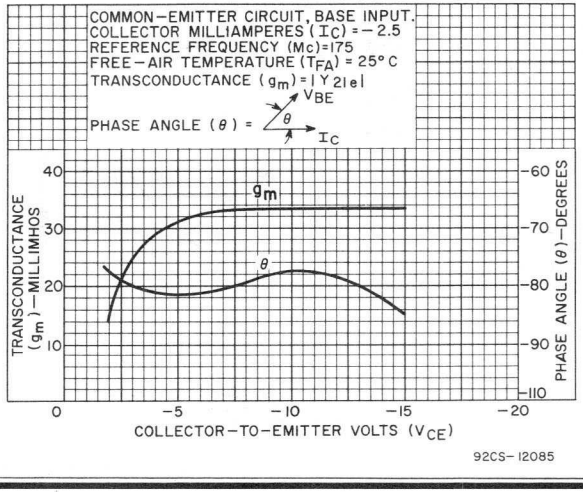
TYPICAL GAIN AND NOISE CHARACTERISTICS



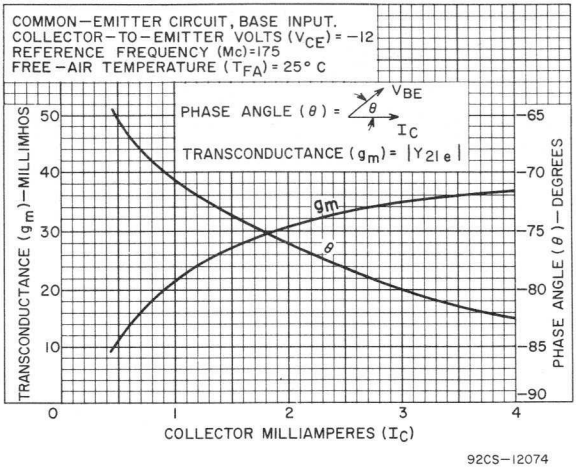
92CS-12078

TYPICAL TRANSCONDUCTANCE CHARACTERISTICS



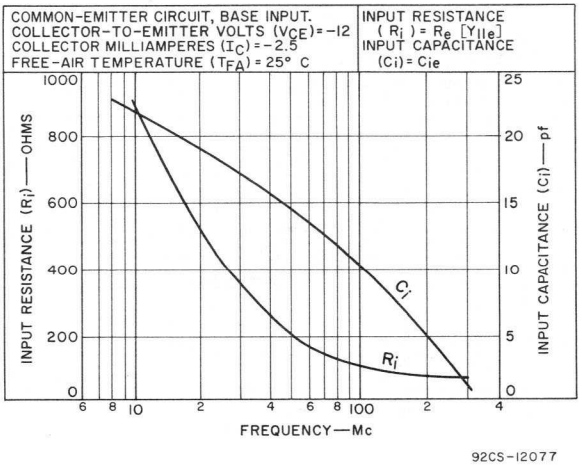


TYPICAL TRANSCONDUCTANCE CHARACTERISTICS



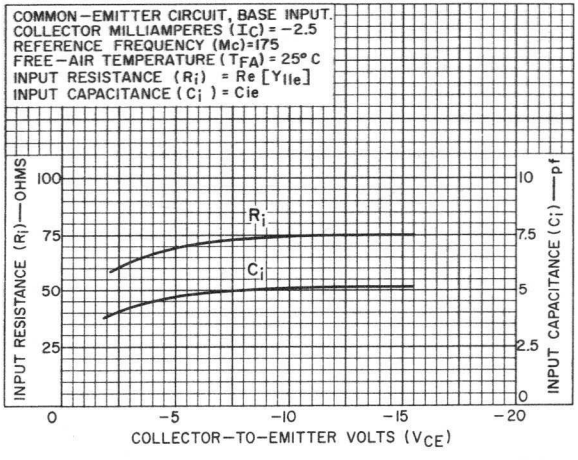
92CS-12074

TYPICAL INPUT CHARACTERISTICS

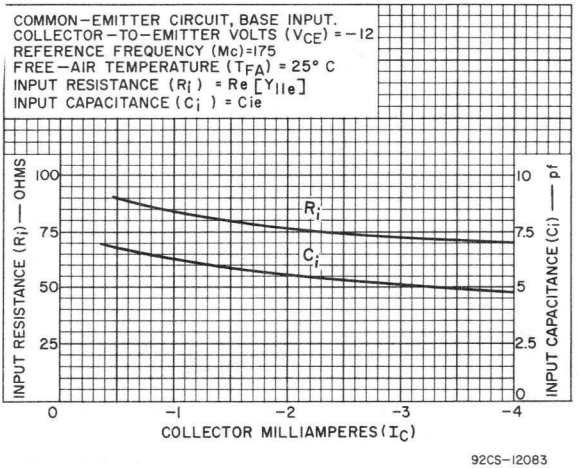


92CS-12077

TYPICAL INPUT CHARACTERISTICS

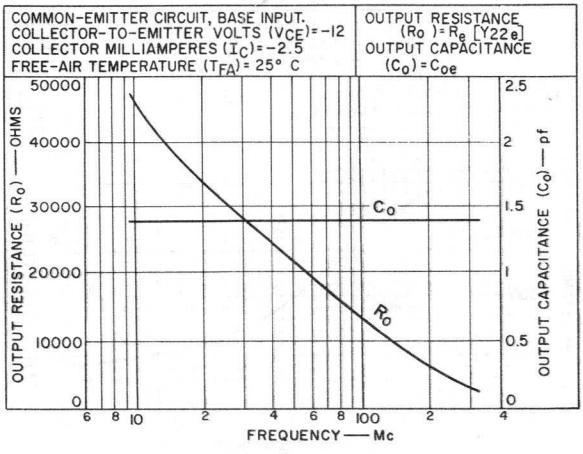


92CS–12086

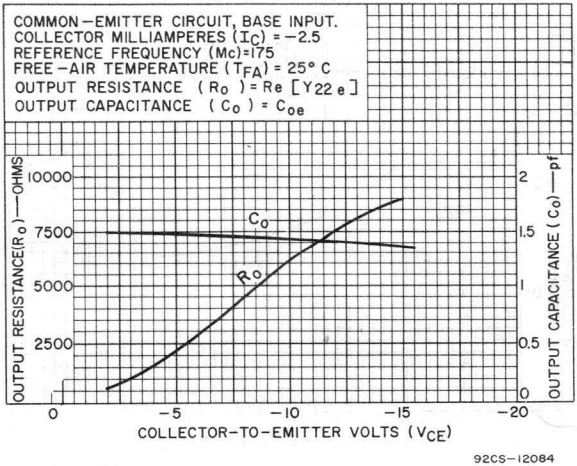


92CS–12083

TYPICAL OUTPUT CHARACTERISTICS



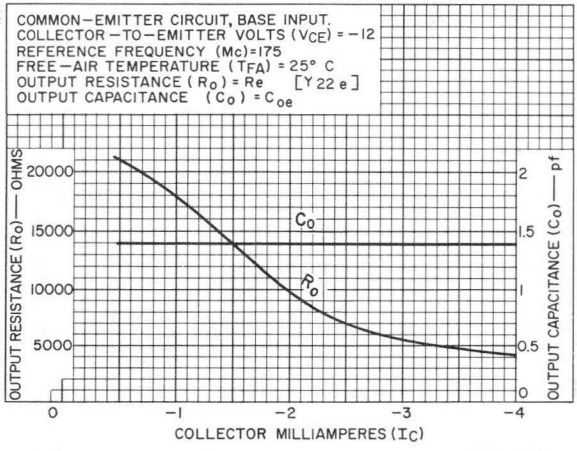
92CS-12079



92CS-12084

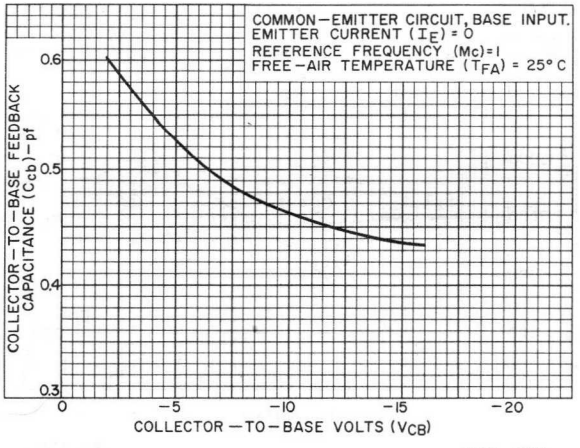
2N2873

TYPICAL OUTPUT CHARACTERISTICS



92CS-12082

TYPICAL FEEDBACK CAPACITANCE CHARACTERISTIC



92CS-12081

RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

3AF4-A
MEDIUM-MU TRIODE

7-PIN MINIATURE TYPE

Intended for use in UHF TV equipment having series heater-string arrangement

The 3AF4-A is the same as the 6AF4-A except for the following items:

Heater, for Unipotential Cathode:		
Voltage	3.15	ac or dc volts
Current	0.45	amp
Warm-up time (Average)*	11	sec

3AL5
TWIN DIODE

7-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

The 3AL5 is the same as the 6AL5 except for the following items:

Heater, for Unipotential Cathodes:		
Voltage	3.15	ac or dc volts
Current	0.6	amp
Warm-up time (Average)*	11	sec

3AU6
SHARP-CUTOFF PENTODE

7-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

The 3AU6 is the same as the 6AU6 except for the following items:

Heater, for Unipotential Cathode:		
Voltage	3.15	ac or dc volts
Current	0.6	amp
Warm-up time (Average)*	11	sec
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	200 max.	volts
Heater positive with respect to cathode	200▲ max.	volts

** For definition of heater warm-up time and method of determining it, see sheet HEATER WARM-UP TIME MEASUREMENT at front of this Section.*

▲ The dc component must not exceed 100 volts.

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

3AV6
TWIN DIODE—HIGH-MU TRIODE

7-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

The 3AV6 is the same as the 6AV6 except for the following items:

Heater, for Unipotential Cathode:		
Voltage	3.15	ac or dc volts
Current	0.6	amp
Warm-up time (Average)	11	sec
For definition of heater warm-up time and method of determining it, see sheet HEATER WARM-UP TIME MEASUREMENT at front of this Section.		
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	200 max.	volts
Heater positive with respect to cathode	200▲ max.	volts

▲ The dc component must not exceed 100 volts.

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

Half-Wave Vacuum Rectifier

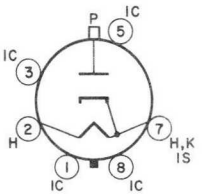
Electrical:

	Min.	Av.	Max.	
Heater Characteristics and Ratings:				
Voltage (AC or DC)	2.65	3.15	3.65	volts
Current at heater volts = 3.15	-	0.220	-	amp
Direct Interelectrode Capacitance (Approx.):[a]				
P to (K+IS+H)	-	1.5	-	pf

Mechanical:

Operating Position . . . . . Any
Type of Cathode . . . . . Coated Unipotential
Maximum Overall Length . . . . . 3.625"
Seated Length . . . . . 3.000" to 3.250"
Diameter . . . . . 1.062" to 1.188"
Dimensional Outline . . . . . See *General Section*
Bulb T9
Cap . . . . . Small (JEDEC No. C1-1) or Small with Tubular Support (JEDEC No.C1-34)
Bases (Alternates):
Intermediate-Shell Octal:
6-Pin, Arrangement 1 (JEDEC Group 1, No.B6-8)
Short Intermediate Shell Octal with External Barriers:
6-Pin, Arrangement 1 (JEDEC Group 1, No.B-6-60)
Basing Designation for BOTTOM VIEW 8EZ

Pin 1 - Do Not Use
Pin 2 - Heater
Pin 3 - Do Not Use
Pin 5 - Do Not Use
Pin 7 - Heater, Cathode, Internal Shield
Pin 8 - Do Not Use
Cap - Plate



PULSED-RECTIFIER SERVICE

Maximum Ratings, *Design-Maximum Values:*

For operation in a 525-line, 30-frame system[b]

Peak Inverse Plate Voltage[c]	30000 max.	volts
Peak Plate Current	88 max.	ma
Average Plate Current	1.7 max.	ma

[a] Without external shield.

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

[c] This rating is applicable when the duration of the voltage pulse does 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 high voltages at which the 3AW3 is operated are very dangerous. Great care should be taken in the design of equipment to prevent the operator from coming in contact with these high voltages. Particular care against fatal shock should be taken in the measurement of heater voltage. Under all circumstances, circuit parts which may be at high potentials should be enclosed or adequately insulated.

X-radiation. The voltages employed in some television receivers and other high-voltage equipment are sufficiently high that high-voltage rectifier tubes may produce *X-radiation* which can constitute a health hazard unless such tubes are adequately shielded. Relatively simple shielding should prove adequate, but the need for this precaution should be considered in equipment design.

3B25

HALF-WAVE GAS RECTIFIER

GENERAL DATA

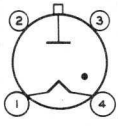
Electrical:

Filament, Coated:		
Voltage	2.5 ± 5%	ac volts
Current at 2.5 volts	5	amp
Minimum heating time at rated voltage	15	sec ←

Mechanical:

Operating Position	Any
Maximum Overall Length	6-5/16"
Seated Length	5-1/4" ± 7/16"
Maximum Diameter	2-1/16"
Weight (Approx.)	3 oz ←
Bulb	T16
Cap	Medium (JETEC No.C1-5) ←
Base	Medium-Shell Small 4-Pin with Bayonet (JETEC No.A4-10) ←
Basing Designation for BOTTOM VIEW	4P

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



Pin 4 – Filament, Cathode Shield
Cap – Anode

HALF-WAVE RECTIFIER

Maximum Ratings, *Absolute Values:*

For anode-supply frequencies up to 500 cps

PEAK INVERSE ANODE VOLTAGE	4500 max.	volts
ANODE CURRENT:		
Peak	2 max.	amp
Average*	0.5 max.	amp
Fault, for duration of 0.1 second maximum	20 max.	amp
AMBIENT-TEMPERATURE RANGE	-75 to +90	°C

CHARACTERISTICS RANGE VALUES# FOR EQUIPMENT DESIGN ←

	Note	*Min.*	*Max.*	
Filament Current	1	4.6	5.4	amp
Critical Anode Voltage	2	–	110	volts
Peak Tube Voltage Drop	3	–	14	volts

Note 1: With 2.5 volts rms on filament.

Note 2: With 2.38 volts rms on filament.

Note 3: With 2.5 volts rms on filament, peak anode current of 2 amperes provided by half-cycle pulse from a 60-cps sine wave and recurring approximately once a second. Tube drop is measured by an oscilloscope connected between anode and center-tap of filament transformer.

*, #: See next page.

← Indicates a change.

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

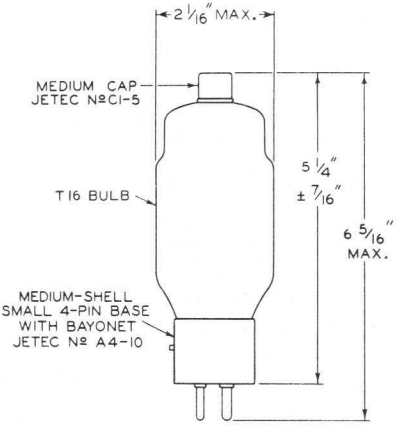
3B25

HALF-WAVE GAS RECTIFIER

* Averaged over any period of 30 seconds maximum.
\# Throughout tube life.

OPERATING CONSIDERATIONS

If the *anode return* of each tube is not connected to the center-tap of the filament-supply winding, the return should be made to that side of the filament to which the cathode shield is connected.



92CM-6555R3

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

3B25

HALF-WAVE GAS RECTIFIER

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 Pdc	
Fig. 1 **Half-Wave** **Single-Phase** In-Phase Operation	3100	1400	0.5		0.7	
Fig. 2 **Full-Wave** **Single-Phase** In-Phase Operation	1500	1400	1.0		1.4	
Fig. 3 **Series** **Single-Phase** In-Phase Operation	3100	2900	1.0		2.9	
Fig. 4 **Half-Wave** **Three-Phase** In-Phase Operation	1800	2200	1.5		3.3	
Fig. 5 **Parallel** **Three-Phase** Quadrature Operation	1800	2200	3.0		6.6	
Fig. 6 **Series** **Three-Phase** Quadrature Operation	1800	4300	1.5		6.4	
Fig. 7 **Half-Wave** **Four-Phase** Quadrature Operation	1500	2000	*Resistive Load* 1.8	*Inductive Load* 2.0	*Resistive Load* 3.6	*Inductive Load* 4.0
Fig. 8 **Half-Wave** **Six-Phase** Quadrature Operation	1500	2200	*Resistive Load* 1.9	*Inductive Load* 2.0	*Resistive Load* 4	*Inductive Load* 4.4

3BC5

Sharp-Cutoff Pentode

7-PIN MINIATURE TYPE

For Equipment Having Series Heater-String Arrangement

The 3BC5 is the same as the 6BC5 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	3.15	volts
Current	0.6 ± 6%	amp
Warm-up time (Average)	11	sec
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	200 max.	volts
Heater positive with respect to cathode	200▲ max.	volts

3BN4

Medium-Mu Triode

7-PIN MINIATURE TYPE

For Equipment Having Series Heater-String Arrangement

The 3BN4 is the same as the 6BN4 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	3	volts
Current	0.45 ± 6%	amp
Warm-up time (Average)	11	sec

3BN6

Beam Tube

7-PIN MINIATURE TYPE

For Equipment Having Series Heater-String Arrangement

The 3BN6 is the same as the 6BN6 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	3.15	volts
Current	0.6 ± 6%	amp
Warm-up time (Average)	11	sec

▲ The dc component must not exceed 100 volts.

3BU8

Sharp-Cutoff Twin Pentode

With Common Cathode, Grid No.1, and Grid No.2

9-PIN MINIATURE TYPE

For Equipment Having Series Heater-String Arrangement

The 3BU8 is the same as the 6BU8 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	3.15	volts
Current	0.6 ± 6%	amp
Warm-up time (Average)	11	sec

3BY6

Pentagrid Amplifier

7-PIN MINIATURE TYPE

For Equipment Having Series Heater-String Arrangement

The 3BY6 is the same as the 6BY6 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	3.15	volts
Current	0.6 ± 6%	amp
Warm-up time (Average)	11	sec

3BZ6

Semiremote-Cutoff Pentode

7-PIN MINIATURE TYPE

For Equipment Having Series Heater-String Arrangement

The 3BZ6 is the same as the 6BZ6 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	3.15	volts
Current	0.6 ± 6%	amp
Warm-up time (Average)	11	sec
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	300▲ max.	volts
Heater positive with respect to cathode	200● max.	volts

▲ The dc component must not exceed 200 volts.

● The dc component must not exceed 100 volts.

3CB6
SHARP-CUTOFF PENTODE

7-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

The 3CB6 is the same as the 6CB6-A except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	3.15	volts
Current	0.6 ± 6%	amp
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode.	300 max.	volts
Heater positive with respect to cathode.	200▲ max.	volts

3CF6
SHARP-CUTOFF PENTODE

7-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

The 3CF6 is the same as the 6CF6 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	3.15	volts
Current	0.6 ± 6%	amp
Warm-up time (Average)	11	sec
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode.	300 max.	volts
Heater positive with respect to cathode.	200▲ max.	volts

3CS6
PENTAGRID AMPLIFIER

7-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

The 3CS6 is the same as the 6CS6 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	3.15	volts
Current	0.6 ± 6%	amp
Warm-up time (Average)	11	sec

▲ The dc component must not exceed 100 volts.

3CY5

SHARP-CUTOFF TETRODE

7-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

The 3CY5 is the same as the 6CY5 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	2.9	volts
Current	0.45 ± 6%	amp
Warm-up time (Average)	11	sec

3DK6

SHARP-CUTOFF PENTODE

7-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

The 3DK6 is the same as the 6DK6 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	3.15	volts
Current	0.6 ± 6%	amp
Warm-up time (Average)	11	sec
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	300 max.	volts
Heater positive with respect to cathode	200▲ max.	volts

3DT6

SHARP-CUTOFF PENTODE

7-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

The 3DT6 is the same as the 6DT6 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	3.15	volts
Current	0.6 ± 6%	amp
Warm-up time (Average)	11	sec

▲ The dc component must not exceed 100 volts.

3CF6
SHARP-CUTOFF PENTODE

7-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

The 3CF6 is the same as the 6CF6 except for the following items:

Heater, for Unipotential Cathode:		
Voltage	3.15	ac or dc volts
Current	0.6	amp
Warm-up time (Average)*	11	sec
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	300 max.	volts
Heater positive with respect to cathode	200▲ max.	volts

3CS6
PENTAGRID AMPLIFIER

7-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

The 3CS6 is the same as the 6CS6 except for the following items:

Heater, for Unipotential Cathode:		
Voltage	3.15	ac or dc volts
Current	0.6	amp
Warm-up time (Average)*	11	sec

3DK6
SHARP-CUTOFF PENTODE

7-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

The 3DK6 is the same as the 6DK6 except for the following items:

Heater, for Unipotential Cathode:		
Voltage	3.15	ac or dc volts
Current	0.6 ± 6%	amp
Warm-up time (Average)*	11	sec
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	300 max.	volts
Heater positive with respect to cathode	200▲ max.	volts

* *For definition of heater warm-up time and method of determining it, see sheet HEATER WARM-UP TIME MEASUREMENT at front of this Section.*

▲ The dc component must not exceed 100 volts.

3DT6

SHARP-CUTOFF PENTODE

7-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

The 3DT6 is the same as the 6DT6 except for the following items:

Heater, for Unipotential Cathode:		
Voltage	3.15	ac or dc volts
Current	0.6	amp
Warm-up time (Average)	11	sec

For definition of heater warm-up time and method of determining it, see sheet HEATER WARM-UP TIME MEASUREMENT at front of this Section.

Sharp-Cutoff Pentode

With Two Independent Control Grids

7-PIN MINIATURE TYPE

For Equipment Having Series Heater-String Arrangement

The 3DT6-A is the same as the 6DT6-A except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	3.15	volts
Current	0.6 ± 6%	amp
Warm-up time (Average)	11	sec

3E22

PUSH-PULL H-F BEAM POWER AMPLIFIER

Unless otherwise specified, values are for both units

GENERAL DATA

Electrical:

Heaters, for Unipotential Cathodes.

	Series	Parallel	
Arrangement			
Voltage	12.6 ± 10%	6.3 ± 10%	ac or dc volts ←
Current	0.8	1.6	amp
Transconductance, for plate current of 25 ma	4000		μmhos
Grid-Screen Mu-Factor	6.5		

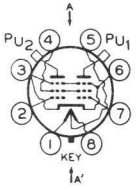
Direct Interelectrode Capacitances (Each Unit):*

Grid No.1 to Plate	0.22 max.	μμf
Input	14	μμf
Output	8.5	μμf

Mechanical:

Mounting Position	Vertical, base up or down; or Horizontal, plane of plates vertical
Overall Length	4-3/8" ± 3/16"
Seated Length	3-13/16" ± 3/16"
Maximum Diameter	2-3/8"
Bulb	T-16
Caps (Two)	Small
Base	Large Wafer Octal 8-Pin Micanol with Sleeve No.T253 ←
Basing Designation for BOTTOM VIEW	8BY

Pin 1 – Heater
Pin 2 – Grid No.1 of Unit No.2
Pin 3 – Cathode, Grid No.3, Internal Shield
Pin 4 – Grid No.2
Pin 5 – Heater Center-Tap



Pin 6 – Cathode, Grid No.3, Internal Shield ←
Pin 7 – Grid No.1 of Unit No.1 ←
Pin 8 – Heater
PU_1 – Plate of Unit No.1
PU_2 – Plate of Unit No.2

PLANE OF ELECTRODES OF EACH UNIT IS PARALLEL TO PLANE THROUGH AXIS OF TUBE AND AA'

PLATE-MODULATED PUSH-PULL RF POWER AMP. — Class C Telephony

Carrier conditions per tube for use with a maximum average modulation factor of 0.25

Maximum Ratings, *Absolute Values:*

	IMS	
DC PLATE VOLTAGE	560 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	225 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-175 max.	volts
DC PLATE CURRENT	160 max.	ma.
DC GRID-No.1 CURRENT	11 max.	ma.
PLATE INPUT	90 max.	watts

*, •, See next page. ← Indicates a change.

3E22

PUSH-PULL H-F BEAM POWER AMPLIFIER

GRID-No.2 INPUT	6 max.	watts
PLATE DISSIPATION	30 max.	watts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	100 max.	volts
Heater positive with respect to cathode	100 max.	volts

Typical Operation:

DC Plate Voltage	560	volts
DC Grid-No.2 Voltage□	200	volts
	18000	ohms
DC Grid-No.1 Voltage Δ	-50	volts
	7700	ohms
Peak RF Grid-No.1-to-Grid-No.1 Voltage	130	volts
DC Plate Current	160	ma.
DC Grid-No.2 Current	20	ma.
DC Grid-No.1 Current (Approx.)	6.5	ma.
Driving Power (Approx.)	0.4	watt
Power Output (Approx.)	67	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance§	30000 max.	ohms

PUSH-PULL RF POWER AMPLIFIER & OSCILLATOR – Class C Telegraphy

Key-down conditions per tube without modulation #

Maximum Ratings, *Absolute Values:*

	IMS●	
DC PLATE VOLTAGE	600 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	225 max.	volts
DC GRID-No.1 (CONTROL GRID) VOLTAGE	-175 max.	volts
DC PLATE CURRENT	175 max.	ma.
DC GRID-No.1 CURRENT	11 max.	ma.
PLATE INPUT	100 max.	watts
GRID-No.2 INPUT	6 max.	watts
PLATE DISSIPATION	35 max.	watts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	100 max.	volts
Heater positive with respect to cathode	100 max.	volts

Typical Operation:

DC Plate Voltage	600	volts
DC Grid-No.2 Voltage⊕	200	volts
	20000	ohms
DC Grid-No.1 Voltage ‡	-55	volts
	7850	ohms
	295	ohms
Peak RF Grid-No.1-to-Grid-No.1 Voltage	140	volts
DC Plate Current	160	ma.
DC Grid-No.2 Current	20	ma.
DC Grid-No.1 Current (Approx.)	7	ma.

*,●,□,Δ,#,⊕,‡,§: See next page.

3E22

PUSH-PULL H-F BEAM POWER AMPLIFIER

Driving Power (Approx.)	0.45	watt
Power Output (Approx.)	72	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance§	30000 max.	ohms

• Intermittent Mobile Service (IMS) is defined to include those applications, such as aircraft, where the transmitter design factors of minimum size, light weight, and exceedingly high power output for short intervals are the primary requirements, even though the average life expectancy of tubes used in such transmitters is reduced to about 100 hours.

Tube ratings for IMS service are established on the basis that the transmissions have maximum "on" periods of 15 seconds followed by "off" periods of at least 60 seconds, except that it is permissible to make equipment tests with maximum "on" periods of 5 minutes followed by off periods of at least 5 minutes provided the total "on" time of such periods does not exceed 10 hours during the life of any tube.

Although the use of tubes under IMS ratings involves great reduction in tube life, such use can be justified as economical practice in applications where high power is intermittently desired from small tubes.

* With no external shielding.

□ Obtained preferably from a separate source modulated with the plate supply or from the modulated plate-supply through a series resistor of the value shown.

Δ Obtained from grid-resistor of value shown or by partial self-bias methods.

※ Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of carrier conditions.

⊕ Obtained preferably from a separate source, or from the plate-voltage supply with a voltage divider, or through a series resistor of the value shown. The grid-No.2 voltage must not exceed 600 volts under key-up conditions.

‡ Obtained from fixed-supply, by grid resistor of value shown, or cathode resistor of value shown, respectively.

§ Any additional bias required must be supplied by a cathode resistor or a fixed supply.

OUTLINE DIMENSIONS AND CURVES for the 3E22 are the same as those for the 815.

Plate Current:			
Peak	5	10	amp
DC	0.010	0.010	amp
DC Grid-No.2 Current	0.0011	0.002	amp
DC Grid-No.1 Current	0.001	0.001	amp
Load Resistance	300	400	ohms

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Heater Current (Parallel connection)	1	2.00	2.50	amp
Heater Current (Series connection)	2	1.00	1.25	amp
Grid-No.1-to-Plate Capacitance (Each unit)	3	–	0.12	μμf
Input Capacitance (Each unit)	–	12.8	16.2	μμf
Output Capacitance (Each unit)	–	5.25	8.75	μμf
Plate Current (Each unit)	1,4	38	82	ma
Grid-No.1 Voltage	1,5	–	-55	volts
Grid-No.2 Current (Each unit)	1,4	–	10	ma
Peak Plate Current	1,6	9	–	amp

Note 1: With 6.3 volts on heater.

Note 2: With 12.6 volts on heater.

Note 3: With external shield having length of 3/4" and inside diameter of 2-3/8". Shield is placed around base end of tube and is connected to cathode.

Note 4: With dc plate voltage of 250 volts, dc grid-No.2 voltage of 175 volts, and dc grid-No.1 voltage of -11 volts. Grid No.1 of unit not under test is biased -100 volts with respect to its cathode.

Note 5: With units in parallel, dc plate voltage of 400 volts, dc grid-No.2 voltage of 225 volts, and dc grid-No.1 voltage adjusted to give dc plate current of 200 microamperes.

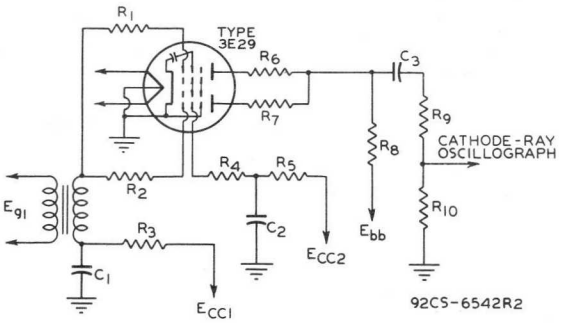
Note 6: With the units in parallel in the accompanying test circuit under the following conditions: rectangular-wave modulation applied to grid No.1; pulse duration of 1 microsecond approx; pulse repetition rate of 1500 cps approx; dc plate-supply voltage of 5000 volts; dc grid-No.2 voltage of 850 volts; dc grid-No.1 volts of -225 volts; peak positive grid-No.1 swing of 150 volts; and dc plate current of 15 ma. minimum obtained by adjusting the pulse repetition rate. ←

DIMENSIONAL OUTLINE
shown under Type 829B also applies to the 3E29

← Indicates a change.

3E29

TEST CIRCUIT



R1 R2: 20 ohms, 1 watt non-inductive
R3: 15000 ohms, 1 watt
R4: 25 ohms, 1 watt, non-inductive
R5: 10000 ohms, 1 watt
R6 R7: 10 ohms, 5 watts, non-inductive
R8: 10000 ohms, 50 watts
R9: 400 ± 5% ohms, 50 watts non-inductive
R10: 10 ± 1% ohms, 5 watts
C1: 0.1 μf, 600 v dc
C2: 0.1 μf, 1000 v dc
C3: 0.1 μf, 5000 v dc
Ecc1: Grid-No.1 Supply Voltage
Ecc2: Grid-No.2 Supply Voltage
Ebb: Plate Supply Voltage
Eg1: Signal Voltage

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3E29

TWIN-UNIT BEAM POWER TUBE

Unless Otherwise Specified, Values are on a Per Tube Basis

GENERAL DATA

Electrical:

Heater, for Unipotential Cathodes:

	Parallel	Series	
Arrangement			
Voltage (AC or DC)	6.3 +10% −5%	12.6 +10% −5%	volts
Current at 6.3 volts	2.25	–	amp
Current at 12.6 volts	–	1.125	amp

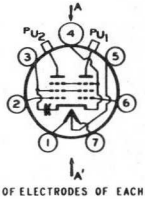
Transconductance (Each Unit): With plate volts = 250, grid-No.2 volts = 175, and plate ma. = 60	8500	μmhos
Mu-Factor, Grid No.2 to Grid No.1 (Each Unit): With plate volts = 225, grid-No.2 volts = 225, and plate ma. = 60	9	
Direct Interelectrode Capacitances (Each Unit):		
Grid No.1 to plate (with external shield□)	0.12 max.	μμf
Input	14	μμf
Output	7	μμf

Mechanical:

Mounting Position	Vertical, base up or down; Horizontal, plane of each plate vertical
Overall Length	4-1/8" ± 3/16"
Seated Length	3-11/16" ± 3/16"
Maximum Diameter	2-3/8"
Bulb	T-16
Bulb Terminals (Two)	See Dimensional Outline
Weight (Approx.)	3.5 oz.
Base	Medium Molded-Flare Septar 7-Pin (JETEC No.E7-2)

BOTTOM VIEW

Pin 1 – Heater
Pin 2 – Grid No.1 of Unit No.2
Pin 3 – Grid No.2 of Both Units
Pin 4 – Cathode, Grid No.3 of Both Units
Pin 5 – Heater Center-Tap



Pin 6 – Grid No.1 of Unit No.1
Pin 7 – Heater

PU_1 – Plate Terminal of Unit No.1
PU_2 – Plate Terminal of Unit No.2

PLANE OF ELECTRODES OF EACH UNIT IS PARALLEL TO PLANE THROUGH AXIS OF TUBE AND AA'

□: See next page.

←Indicates a change

RCA

3E29

TWIN-UNIT BEAM POWER TUBE

→ **MODULATOR—Rectangular-Wave Modulation**

Values are for Units in Parallel

Maximum CCS● Ratings, *Absolute Values:*

For Duty Factor between 0.0001 and 1.0 and Maximum Averaging Time of 1200 μsec in Any Interval*

DC PLATE SUPPLY VOLTAGE▲	5000 max.	volts
INSTANTANEOUS PLATE VOLTAGE	5750 max.	volts
DC GRID-No.2 (SCREEN) SUPPLY VOLTAGE▲	850 max.	volts
DC GRID-No.1 (CONTROL-GRID) SUPPLY VOLTAGE▲	-225 max.	volts
INSTANTANEOUS GRID-No.1 VOLTAGE	-600 max.	volts
PEAK POSITIVE GRID-No.1 VOLTAGE	250 max.	volts
PEAK PLATE CURRENT	See Rating Chart	
PEAK GRID-No.2 CURRENT	3.5 max.	amp
PEAK GRID-No.1 CURRENT	4 max.	amp
PLATE INPUT	85 max.	watts
GRID-No.2 INPUT	3 max.	watts
GRID-No.1 INPUT	1 max.	watt
PLATE DISSIPATION#	15 max.	watts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	100 max.	volts
Heater positive with respect to cathode	100 max.	volts

Typical Operation with Rectangular-Wave Shapes in Accompanying Test Circuit:

With Duty Factor of*	*0.002*	*0.001*	
DC Plate Supply Voltage	2000	5000	volts
DC Grid-No.2 Supply Voltage	650	850	volts
DC Grid-No.1 Supply Voltage	-175	-200	volts
Peak Positive Grid-No.1 Voltage	50	150	volts

□ Having length of 3/4" and inside diameter of 2-3/8". Shield is placed around base end of tube and is connected to cathode.

● Continuous Commercial Service.

▲ For tube protection, it is essential that sufficient dc resistance be used in the plate supply circuit, the grid-No.2 supply circuit, and the grid-No.1 supply circuit so that the short-circuit current is limited to 0.5 ampere in each circuit.

* *Duty Factor* for the 3E29 is defined as the "on" time in microseconds divided by 1200 microseconds.

"On" Time is defined as the sum of the durations of all the individual pulses which occur during any 1200-microsecond interval.

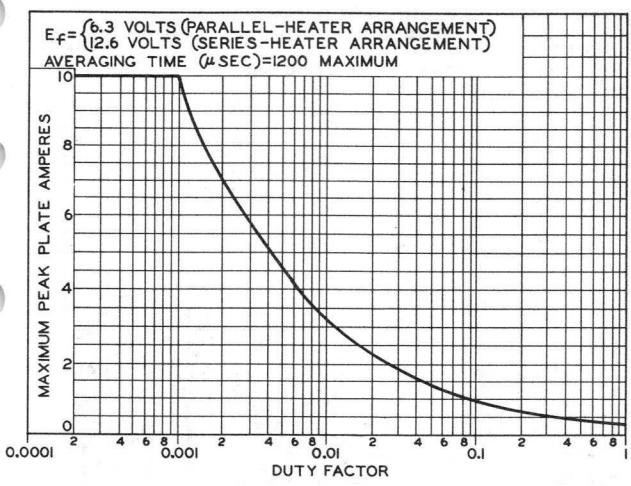
Pulse Duration is defined as the time interval between the two points on the pulse at which the instantaneous value is 70% of the peak value. The peak value is defined as the maximum value of a smooth curve through the average of the fluctuations over the top portion of the pulse.

Averaged over any interval not exceeding 1200 microseconds. Care should be used in determining the plate dissipation. A calculated value based on rectangular pulses can be considerably in error when the actual pulses have a finite rise and fall time. Plate dissipation should preferably be determined by measuring the bulb temperature under actual operating conditions; then, with the tube in the same socket and under the same ambient-temperature conditions, apply to the tube sufficient dc input to obtain the same bulb temperature. This value of dc input is a measure of the plate dissipation.

→ Indicates a change

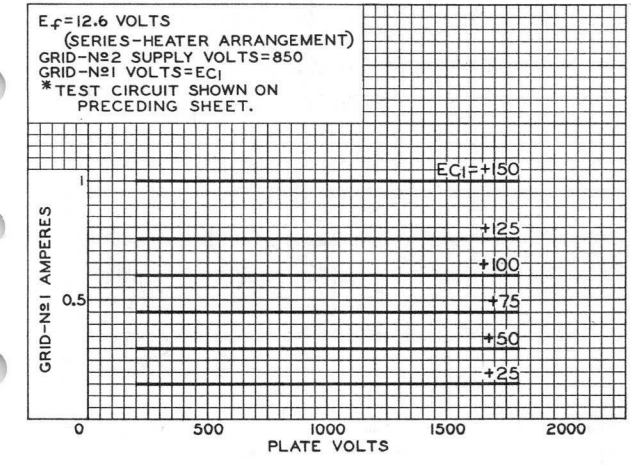
3E29

RATING CHART



92CS-7927RI

AVERAGE CHARACTERISTICS
UNITS IN PARALLEL IN TEST CIRCUIT *

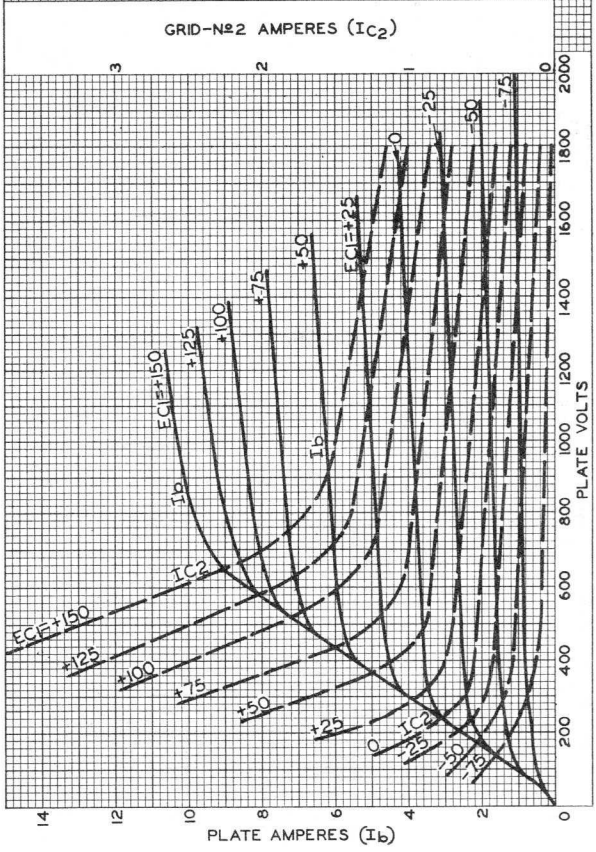


92CS-10389

3E29

AVERAGE CHARACTERISTICS
UNITS IN PARALLEL IN TEST CIRCUIT*

E_f=12.6 VOLTS (SERIES-HEATER ARRANGEMENT)
GRID-№2 SUPPLY VOLTS=850
GRID-№1 VOLTS=E_{C1}
*TEST CIRCUIT SHOWN ON PRECEDING SHEET.



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3MP1

OSCILLOGRAPH TUBE

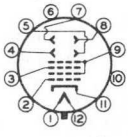
ELECTROSTATIC FOCUS — ELECTROSTATIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:		
Voltage	6.3	ac or dc volts
Current	0.6	amp
Direct Interelectrode Capacitances (Approx.):		
Cathode to All Other Electrodes	2.2	
Grid No.1 to All Other Electrodes	10.3	μμf
DJ_1 to DJ_2	1.3	μμf
DJ_3 to DJ_4	1.2	μμf
DJ_1 to All Other Electrodes Except DJ_2	4.4	μμf
DJ_2 to All Other Electrodes Except DJ_1	5.6	μμf
DJ_3 to All Other Electrodes Except DJ_4	5.0	μμf
DJ_4 to All Other Electrodes Except DJ_3	4.5	μμf
Phosphor (For Curves, see front of this Section)		No.1
Fluorescence		Green
Persistence		Medium
Focusing Method		Electrostatic
Deflection Method		Electrostatic
Overall Length		8" ± 1/4"
Greatest Diameter of Bulb		3" ± 1/16"
Minimum Useful Screen Diameter		2-3/4"
Mounting Position		Any
Base		Small-Shell Duodecal 12-Pin
Basing Designation for Bottom View		12F

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Anode No.1
Pin 4 – Deflecting Electrode DJ_3
Pin 5 – Deflecting Electrode DJ_4
Pin 6 – No Connection
Pin 7 – Deflecting Electrode DJ_1
Pin 8 – Deflecting Electrode DJ_2
Pin 9 – Anode No.2, Grid No.2
Pin 10 – No Connection
Pin 11 – Cathode
Pin 12 – Heater



DJ_1 and DJ_2 are nearer the screen
DJ_3 and DJ_4 are nearer the base

With DJ_1 positive with respect to DJ_2, the spot is deflected toward pin 4. With DJ_3 positive with respect to DJ_4, the spot is deflected toward pin 1.

The plane through the tube axis and pin 4 may vary from the trace produced by DJ_1 and DJ_2 by an angular tolerance (measured about the tube axis) of 10°.

Maximum Ratings, *Design-Center Values*:

ANODE-No.2• VOLTAGE# . . . . . 2500 max. volts

• Anode No.2 and grid No.2 which are connected together within tube, are referred to herein as anode No.2.

The product of anode-No.2 voltage and average anode-No.2 current should be limited to 6 watts.

3MP1

3MP1

OSCILLOGRAPH TUBE

ANODE-No.1 VOLTAGE	1000 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value.	200 max.	volts
Positive bias value.	0 max.	volts
Positive peak value.	2 max.	volts
PEAK VOLTAGE BETWEEN ANODE No.2 AND ANY DEFLECTING ELECTRODE. . .	500 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode.	125 max.	volts
Heater positive with respect to cathode.	125 max.	volts

Equipment Design Ranges:

For any anode-No.2 voltage (Eb_2) between recommended minimum and 2500 volts*

Anode-No.1 Voltage . . .	20% to 35% of Eb_2	volts
Max. Grid-No.1 Voltage for Visual Cutoff .	6.3% of Eb_2	volts
Anode-No.1 Cur. for any Operating Condition. .	-15 to +10 . .	microamperes
Deflection Factors:		
DJ_1 & DJ_2	115 to 145	v dc/in./kv of Eb_2
DJ_3 & DJ_4	110 to 140	v dc/in./kv of Eb_2

Examples of Use of Design Ranges:

For anode-No.2 voltage of	*1000*	*2000*	*volts*
Anode-No.1 Voltage . . .	200-350	400-700	volts
Max. Grid-No.1 Voltage for Visual Cutoff .	-63	-126	volts
Deflection Factors:			
DJ_1 & DJ_2	115-145	230-290	volts dc/in.
DJ_3 & DJ_4	110-140	220-280	volts dc/in.

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
Resistance in Any Deflecting-Electrode Circuit□	5.0 max.	megohms

* Brilliance and definition decrease with decreasing anode-No.2 voltage. Recommended minimum for the 3MP1 in general service is 1000 volts but a value as low as 500 volts may be used under conditions of low-velocity deflection and low ambient-light levels.

□ It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

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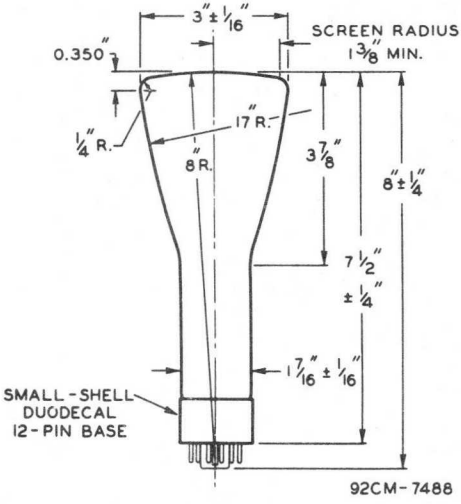
3MP1

OSCILLOGRAPH TUBE



4-125A/4D21

Beam Power Tube

FORCED-AIR COOLED ABOVE 30 Mc

For use at frequencies up to 240 Mc

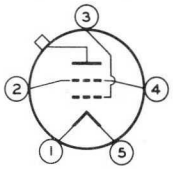
GENERAL DATA

Electrical:

Filament, Thoriated Tungsten:		
Voltage (AC or DC)	5.0 ± 5%	volts
Current at filament volts = 5.0	6.5	amp
Transconductance, for plate volts = 2500, grid-No.2 volts = 400, and plate ma. = 50.	2500	μmhos
Mu-Factor, Grid No.2 to Grid No.1	5.9	
Direct Interelectrode Capacitances:[a]		
Grid No.1 to plate	0.05 max.	μμf
Grid No.1 to filament, grid No.2, and base shell	11.0	μμf
Plate to filament, grid No.2, and base shell	3.2	μμf

Mechanical:

Operating Position	Vertical, base down or up
Maximum Overall Length	5-11/16"
Seated Length	4-11/16" ± 1/4"
Maximum Diameter	2-7/8"
Weight (Approx.)	6.5 oz
Cap	Skirted Small (JEDEC No.C1-22)
Base	Special Metal-Shell Giant 5-Pin
Basing Designation for BOTTOM VIEW	5BK



Pin 1 - Filament
Pin 2 - Grid No.2
Pin 3 - Grid No.1
Pin 4 - Grid No.2
Pin 5 - Filament
Cap - Plate

Thermal:

Forced-Air Cooling:

Through base toward bulb . . . . . 5 cfm

The specified air flow from a small fan or centrifugal blower should be applied simultaneously with filament power.

To bulb and plate seal:

Continuous service: At frequencies below 30 Mc, relatively slow movement of air past the bulb is sufficient to prevent exceeding the specified plate-seal temperature of 170° C. At frequencies above 30 Mc, special attention should be given to adequate cooling of bulb and plate seal. A small stream of air directed toward the upper part of the bulb will generally provide sufficient cooling.

← Indicates a change.

Intermittent service ("On" period does not exceed 5 minutes and is followed by "off" period of the same or greater duration): In this service, a plate-seal temperature as high as 220°C is permissible. At frequencies below 30 Mc and for ambient temperatures below 30° C, forced-air cooling of the bulb and plate seal is not usually required, provided a heat-radiating plate connector is used, and free circulation of air is provided. At frequencies above 30 Mc, special attention should be given to adequate cooling to prevent exceeding the specified plate-seal temperature.

Plate-Seal Temperature (Measured on top of plate cap):		
Continuous service.	170 max.	°C
Intermittent service (As defined above) .	220 max.	°C

Components:

Socket. . . E.F. Johnson Co. Socket No. 122-275, or equivalent
Heat-Radiating Plate Connector. . . Eimac HR-6, or equivalent

AF POWER AMPLIFIER & MODULATOR — Class AB_1[b]

Maximum CCS[c] Ratings, *Absolute-Maximum Values:*

DC PLATE VOLTAGE.	3000 max.	volts
DC GRID-No. 2 VOLTAGE.	600 max.	volts
MAX.-SIGNAL DC PLATE CURRENT[d]	225 max.	ma
GRID-No. 2 INPUT[d].	20 max.	watts
PLATE DISSIPATION[d].	125 max.	watts

→ **AF POWER AMPLIFIER & MODULATOR — Class AB_2[e]**

Maximum Ratings, *Absolute-Maximum Values:*

	CCS[c]	*ICAS*[f]	
DC PLATE VOLTAGE.	3000 max.	3200 max.	volts
DC GRID-No. 2 VOLTAGE.	400 max.	400 max.	volts
MAX.-SIGNAL DC PLATE CURRENT[d] . .	225 max.	250 max.	ma
GRID-No. 2 INPUT[d].	20 max.	20 max.	watts
PLATE DISSIPATION[d].	125 max.	125 max.	watts

→ **PLATE MODULATED RF POWER AMPLIFIER — Class C Telephony**

Carrier conditions per tube for use with a maximum modulation factor of 1

Maximum Ratings, *Absolute-Maximum Values:*

	CCS[c]	*ICAS*[f]	
	Up to 120 Mc	*Up to 30 Mc*	
DC PLATE VOLTAGE.	2500 max.	3200 max.	volts
DC GRID-No. 2 VOLTAGE. . . .	400 max.	400 max.	volts
DC GRID-No. 1 VOLTAGE. . . .	-500 max.	-500 max.	volts
DC PLATE CURRENT.	200 max.	200 max.	ma
GRID-No. 2 INPUT	20 max.	20 max.	watts
GRID-No. 1 INPUT	5 max.	5 max.	watts
PLATE DISSIPATION	85 max.	100 max.	watts

→ Indicates a change.

RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy[g]
and
RF POWER AMPLIFIER — Class C FM Telephony

Maximum Ratings, *Absolute-Maximum Values:*

	CCS[c] *Up to 120 Mc*	*ICAS*[f] *Up to 30 Mc*	
DC PLATE VOLTAGE	3000 max.	4000 max.	volts
DC GRID-No.2 VOLTAGE	400 max.	400 max.	volts
DC GRID-No.1 VOLTAGE	-500 max.	-500 max.	volts
DC PLATE CURRENT	225 max.	225 max.	ma
GRID-No.2 INPUT	20 max.	20 max.	watts
GRID-No.1 INPUT	5 max.	5 max.	watts
PLATE DISSIPATION	125 max.	125 max.	watts

[a] Without external shield.

[b] Subscript 1 indicates that grid-No.1 current does not flow during any part of the input cycle.

[c] Continuous Commercial Service.

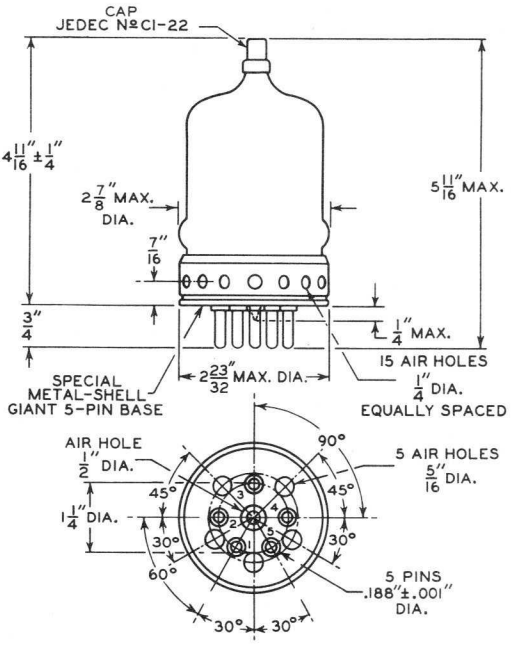
[d] Averaged over any audio-frequency cycle of sine-wave form.

[e] Subscript 2 indicates that grid-No.1 current flows during some part of the input cycle.

[f] Intermittent Commercial and Amatuer Service.

[g] Key-down conditions per tube without amplitude modulation. Amplitude modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

4-125A/4D21



92CS-6764R2

4-250A/5D22

Beam Power Tube

FORCED-AIR COOLED

GENERAL DATA

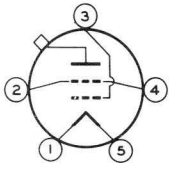
Electrical:

Filament, Thoriated Tungsten:		
Voltage (AC or DC)	5.0 ± 5%	volts
Current at filament volts = 5.0	14.5	amp
Transconductance, for plate volts = 2500, grid-No.2 volts = 500, and plate ma. = 100	4000	μmhos
Mu-Factor, Grid No.2 to Grid No.1	5.1	
Direct Interelectrode Capacitances:[a]		
Grid No.1 to plate	0.12 max.	μμf
Grid No.1 to filament, grid No.2, and base shell	13.0	μμf
Plate to filament, grid No.2, and base shell	4.6	μμf

Mechanical:

Operating Position	Vertical, base down or up
Maximum Overall Length	6-3/8"
Seated Length	5-3/8" ± 1/4"
Maximum Diameter	3-9/16"
Weight (Approx.)	8 oz
Cap	Skirted Small (JEDEC No.C1-22)
Base[b]	Special Metal-Shell Giant 5-Pin
Basing Designation for BOTTOM VIEW	5BK

Pin 1 - Filament
Pin 2 - Grid No.2
Pin 3 - Grid No.1



Pin 4 - Grid No.2
Pin 5 - Filament
Cap - Plate

Thermal:

Forced-Air Cooling:

Upward through base toward bulb:

Base-cooling air flow from a small fan or centrifugal blower should be applied simultaneously with filament power. In continuous service at frequencies below 30 Mc, 2 cfm at a static pressure of 0.1 inch of water are required through the base; at frequencies above 30 Mc, 5 cfm at a static pressure of 0.2 inch of water are required. In intermittent service, regardless of the operating frequency, an air flow of 5 cfm through the base must be maintained.

→ Indicates a change.

To bulb and plate seal:

Continuous Service: At frequencies below 30 Mc, relatively slow movement of air past the bulb is sufficient to prevent exceeding the specified plate-seal temperature of 170° C. At frequencies above 30 Mc, special attention should be given to adequate cooling of bulb and plate seal. A small stream of air directed toward the upper part of the bulb will generally provide sufficient cooling.

Plate-Seal Temperature (Measured on top of plate cap):

Continuous service	170 max.	°C

Components:

Socket. . . E.F. Johnson Co. Socket No.122-275, or equivalent
Heat-Radiating Plate Connector. . . Eimac HR-6, or equivalent

AF POWER AMPLIFIER & MODULATOR — Class AB_1[c]

Maximum CCS[d] Ratings, *Absolute-Maximum Values:*

DC PLATE VOLTAGE	4000 max.	volts
DC GRID-No.2 VOLTAGE	600 max.	volts
MAX.-SIGNAL DC PLATE CURRENT[e]	350 max.	ma
GRID-No.2 INPUT[e]	35 max.	watts
GRID-No.1 INPUT[e]	10 max.	watts
PLATE DISSIPATION[e]	250 max.	watts

AF POWER AMPLIFIER & MODULATOR — Class AB_2[f]

Maximum CCS[d] Ratings, *Absolute-Maximum Values:*

DC PLATE VOLTAGE	4000 max.	volts
DC GRID-No.2 VOLTAGE	600 max.	volts
MAX.-SIGNAL DC PLATE CURRENT[e]	350 max.	ma
GRID-No.2 INPUT[e]	35 max.	watts
GRID-No.1 INPUT[e]	10 max.	watts
PLATE DISSIPATION[e]	250 max.	watts

PLATE-MODULATED RF POWER AMPLIFIER — Class C Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1

Maximum CCS[d] Ratings, *Absolute-Maximum Values:*

	Up to 75 Mc	
DC PLATE VOLTAGE	3200 max.	volts
DC GRID-No.2 VOLTAGE	600 max.	volts
DC GRID-No.1 VOLTAGE	-500 max.	volts
DC PLATE CURRENT	275 max.	ma
GRID-No.2 INPUT	35 max.	watts
GRID-No.1 INPUT	10 max.	watts
PLATE DISSIPATION	165 max.	watts

→Indicates a change.

RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy[g]
and
RF POWER AMPLIFIER — Class C FM Telephony

Maximum CCS[d] Ratings, *Absolute Maximum Values:*

	Up to 75 Mc	
DC PLATE VOLTAGE	4000 max.	volts
DC GRID-No.2 VOLTAGE	600 max.	volts
DC GRID-No.1 VOLTAGE	-500 max.	volts
DC PLATE CURRENT	350 max.	ma
GRID-No.2 INPUT	35 max.	watts
GRID-No.1 INPUT	10 max.	watts
PLATE DISSIPATION	250 max.	watts

[a] Without external shield.

[b] Metal base shell should be grounded by means of suitable spring fingers.

[c] Subscript 1 indicates that grid-No.1 current does not flow during any part of input cycle.

[d] Continuous Commercial Service.

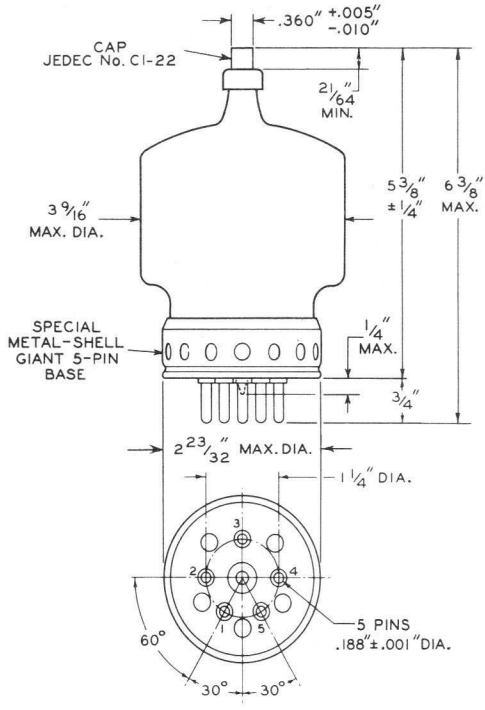
[e] Averaged over any audio-frequency cycle of sine-wave form.

[f] Subscript 2 indicates that grid-No.1 current flows during some part of input cycle.

[g] Key-down conditions per tube without amplitude modulation. Amplitude modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

← Indicates a change.

4-250A/5D22


.360" +.005" -.010"
CAP
JEDEC No. C1-22
2 1/64" MIN.
5 3/8" ± 1/4"
6 3/8" MAX.
3 9/16" MAX. DIA.
SPECIAL METAL-SHELL GIANT 5-PIN BASE
1/4" MAX.
3/4"
2 23/32" MAX. DIA.
1 1/4" DIA.
5 PINS .188" ± .001" DIA.
60°
30°
30°
92CS-7075R2

4C33
POWER TRIODE

FORCED-AIR COOLED

Intended especially for pulsed operation

GENERAL DATA

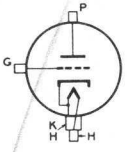
Electrical:

Heater, for Unipotential Cathode:		
Voltage	5.0	ac or dc volts
Current	9.1	amp
Starting Current: The heater current must never exceed 16 amperes, even momentarily.		
Minimum Cathode Heating Time	2	minutes
Amplification Factor	25	
Direct Interelectrode Capacitances (Approx.):[o]		
Grid to Plate	13	μμf
Grid to Cathode	34	μμf
Plate to Cathode	0.7	μμf

[o] With no external shield.

Mechanical:

Terminal Connections:



H - Heater
G - Grid Terminal (Flange)
K - Cathode
P - Plate Terminal (Radiator)

Mounting Position	Vertical, with radiator up or down
Overall Length	4-25/32" ± 3/32"
Greatest Diameter	2.056" ± 0.006"
Radiator	Integral Part of Tube
Air Flow:	
Through Radiator (for max. rated dissipation)	18 min. cfm

The specified air flow at a static pressure of 0.48 inch of water should be delivered through the radiator toward the bulb before and during application of any voltages.

Radiator Temperature (Measured on the core at end away from incoming air)	180 max.	°C
Grid-Flange Temperature	140 max.	°C
Glass Temperature	165 max.	°C

PLATE - PULSED OSCILLATOR—Class C

Maximum Ratings, *Absolute Values:*

For operating frequencies up to 625 Mc

PEAK PLATE PULSE SUPPLY VOLTAGE	13000 max.	volts
PEAK GRID-BIAS VOLTAGE	-2000 max.	volts
PEAK PLATE CURRENT FROM PULSE SUPPLY	30 max.	amp
PEAK RECTIFIED GRID CURRENT	4 max.	amp
DC PLATE CURRENT	0.030 max.	amp
DC GRID CURRENT	0.004 max.	amp
PEAK PLATE INPUT	390000 max.	watts
PLATE DISSIPATION	250 max.	watts
PULSE LENGTH	5 max.	μsec

4C33

4C33

POWER TRIODE

Typical Operation as Self-Excited Plate-Pulsed Oscillator at 600 Mc

Rectangular Pulse Shape

Peak Plate Pulse Supply Voltage	9000	volts
Peak Plate Current from Pulse Supply	27	amp
Peak Rectified Grid Current	3	amp
Peak Power Output	130000	watts
Duty Factor	0.001	
Cathode Resistor *	10	ohms
Pulse Repetition Frequency	200	cps

Maximum Circuit Values:

Grid-Circuit Resistance	200 max.	ohms

* It is recommended that the entire bias be obtained from a cathode resistor. In certain applications, partial grid-resistor bias may be used provided the grid-circuit resistance does not exceed the indicated maximum value.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Heater Current	1	8.2	10.0	amp
Grid-Plate Capacitance	–	11.5	15.5	μμf
Grid-Cathode Capacitance	–	27	41	μμf
Plate-Cathode Capacitance	–	0.5	0.9	μμf
Power Output During Pulse	1,2	125000	–	watts

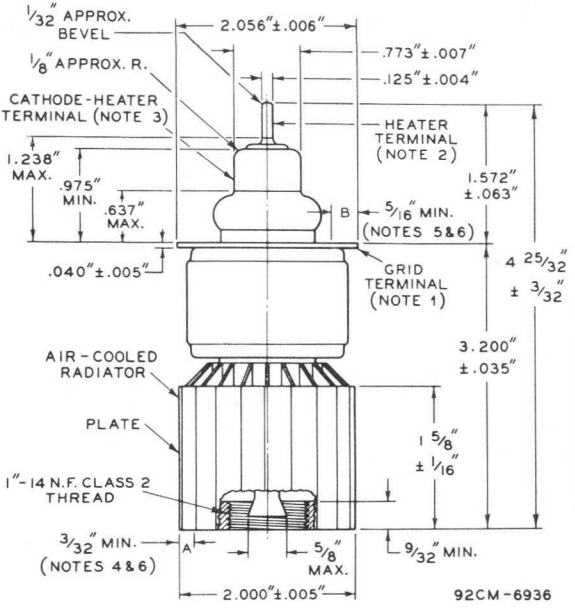
Note 1: With 5 volts on heater.

Note 2: With "dc plate voltage during pulse" of 9000 volts, cathode resistor of 10 ohms, pulse length of 5 microseconds, duty factor of 0.001, and frequency of 600 Mc.

RCA

4C33

POWER TRIODE



NOTE 1: MAXIMUM ECCENTRICITY OF ℄ (AXIS) OF GRID-TERMINAL FLANGE WITH RESPECT TO ℄ (AXIS) OF PLATE RADIATOR IS 0.040", MEASURED WITHIN 1/32" OF BOTTOM OF RADIATOR.

NOTE 2: MAXIMUM ECCENTRICITY OF ℄ (AXIS) OF HEATER TERMINAL WITH RESPECT TO ℄ (AXIS) OF CATHODE-HEATER TERMINAL IS 0.020".

NOTE 3: MAXIMUM ECCENTRICITY OF ℄ (AXIS) OF CATHODE-HEATER TERMINAL WITH RESPECT TO ℄ (AXIS) OF GRID-TERMINAL FLANGE IS 0.020".

NOTE 4: SURFACE OF ANNULAR AREA INDICATED BY "A" ON BOTTOM OF RADIATOR IS IN SAME PLANE WITHIN 0.005", AS DETERMINED BY GAUGE 1/16" WIDE AND 0.005" THICK. THIS GAUGE WILL NOT ENTER MORE THAN 1/16" WITH BOTTOM OF RADIATOR RESTING ON FLAT PLATE.

NOTE 5: SURFACE OF ANNULAR AREA INDICATED BY "B" ON GRID-TERMINAL FLANGE IS IN SAME PLANE WITHIN 0.008", AS DETERMINED BY GAUGE METHOD DESCRIBED IN NOTE 4.

NOTE 6: SURFACE OF ANNULAR AREA INDICATED BY "A" ON BOTTOM OF RADIATOR IS PARALLEL WITHIN 0.030" TO SURFACE OF ANNULAR AREA INDICATED BY "B" ON GRID-TERMINAL FLANGE.

4DE6

Sharp-Cutoff Pentode

7-PIN MINIATURE TYPE

For Equipment Having Series Heater-String Arrangement

The 4DT6 is the same as the 6DT6 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	4.2	volts
Current	0.45 ± 6%	amp
Warm-up time (Average)	11	sec

4DT6

Sharp-Cutoff Pentode

With Two Independent Control Grids

7-PIN MINIATURE TYPE

For Equipment Having Series Heater-String Arrangement

The 4DT6 is the same as the 6DT6 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	4.2	volts
Current	0.45 ± 6%	amp
Warm-up time (Average)	11	sec

4DT6-A

Sharp-Cutoff Pentode

With Two Independent Control Grids

7-PIN MINIATURE TYPE

For Equipment Having Series Heater-String Arrangement

The 4DT6-A is the same as the 6DT6-A except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	4.2	volts
Current	0.45 ± 6%	amp
Warm-up time (Average)	11	sec

4EW6

Sharp-Cutoff Pentode

7-PIN MINIATURE TYPE

For Equipment Having Series Heater-String Arrangement

The 4EW6 is the same as the 6EW6 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	4.2	volts
Current	0.6 ± 6%	amp
Warm-up time (Average)	11	sec

4E27/8001

TRANSMITTING BEAM POWER AMPLIFIER

GENERAL DATA

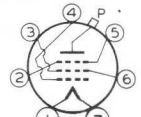
Electrical:

Filament, Thoriated Tungsten:		
Voltage	5.0	a-c or d-c volts
Current	7.5	amp.
Transconductance for plate current of 75 ma.	2800	μmhos
Direct Interelectrode Capacitances:		
Grid to Plate	0.06	μμf
Input	12	μμf
Output	6.5	μμf

Physical:

Overall Length	5-15/16" ± 1/4"
Seated Length	5-5/16" ± 1/4"
Maximum Diameter	2-11/16"
Mounting Position	Vertical Only: Base up or down
Bulb	T-21
Base	Medium Metal Shell Giant 7-Pin, Bayonet
Basing Designation for BOTTOM VIEW	7BM

Pin 1 - Filament
Pin 2 - Grid No.3
Pin 3 - Grid No.2
Pin 4 - Grid No.1
Pin 5 - Grid No.3
Pin 6 - Grid No.2



Pin 7 - Filament
Bulb, Terminal - Plate
Base, Shell - Internal Shield

A-F POWER AMPLIFIER & MODULATOR - Class A1

Maximum Ratings, *Absolute Values*:

D-C PLATE VOLTAGE	2000 max.	volts
D-C SCREEN VOLTAGE (Grid No.2)	750 max.	volts
D-C PLATE CURRENT	150 max.	ma.
D-C SCREEN CURRENT	40 max.	ma.
PLATE INPUT	75 max.	watts
SCREEN INPUT	30 max.	watts
PLATE DISSIPATION	75 max.	watts

Typical Operation:

D-C Plate Voltage	500	1000	volts
D-C Suppressor Voltage (Grid No.3)◊	60	0	volts
D-C Screen Voltage	500	300	volts
D-C Grid Voltage (Grid No.1)*#	-47	-27	volts
Peak A-F Grid Voltage	47	27	volts
D-C Plate Current	150	75	ma.
D-C Screen Current	10	5	ma.
Load Resistance	2600	12000	ohms
Power Output	30	34	approx. watts

*; #: See next page. ◊ : See end of tabulation. ← Indicates a change.

4E27

4E27

TRANSMITTING BEAM POWER AMPLIFIER

(continued from preceding page)

SUPPRESSOR-MODULATED R-F POWER AMPLIFIER – Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values*:

D-C PLATE VOLTAGE	2000 max.	volts
D-C SUPPRESSOR VOLTAGE (Grid No.3)	-500 max.	volts
→ D-C SCREEN VOLTAGE (Grid No.2)	600 max.	volts
D-C GRID VOLTAGE (Grid No.1)	-500 max.	volts
D-C PLATE CURRENT	100 max.	ma.
→ D-C GRID CURRENT	25 max.	ma.
PLATE INPUT	110 max.	watts
→ SCREEN INPUT	27 max.	watts
PLATE DISSIPATION	75 max.	watts

→ **Typical Operation:**

D-C Plate Voltage	1500	2000	volts
D-C Suppressor Voltage◊	-210	-300	volts
D-C Screen Voltage**	500	600	volts
	22000	30000	ohms
D-C Grid Voltage	-130	-130	volts
Peak A-F Suppressor Voltage	210	300	volts
Peak R-F Grid Voltage	195	150	volts
D-C Plate Current	70	55	ma.
D-C Screen Current	44	45	ma.
D-C Grid Current	8	3	approx. ma.
Driving Power°	1.4	0.4	approx. watts
Power Output	33	35	approx. watts

* For a-c filament supply.

◊ Obtained from fixed supply or by cathode resistor. The d-c resistance in the grid circuit should not exceed 50000 ohms with fixed bias, or 500000 ohms with cathode bias.

**Obtained preferably from plate-voltage supply through series resistor of value shown.

° At crest of a-f cycle with modulation factor of 1.0.

PLATE-MODULATED R-F POWER AMPLIFIER – Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values*:

→ D-C PLATE VOLTAGE	3000 max.	volts
→ D-C SCREEN VOLTAGE (Grid No.2)	600 max.	volts
D-C GRID VOLTAGE (Grid No.1)	-500 max.	volts
D-C PLATE CURRENT	135 max.	ma.
→ D-C SCREEN CURRENT	30 max.	ma.
D-C GRID CURRENT	25 max.	ma.
→ PLATE INPUT	250 max.	watts
→ SCREEN INPUT	18 max.	watts
PLATE DISSIPATION	65 max.	watts

← Indicates a change.

4E27

TRANSMITTING BEAM POWER AMPLIFIER

(continued from preceding page)

Typical Operation:

D-C Plate Voltage	1500	2500	volts
D-C Suppressor Voltage (Grid No.3)◇	60	60	volts
D-C Screen Voltage ##	600	600	volts
	82000	240000	ohms
D-C Grid Voltage***	-200	-200	volts
	145000	330000	ohms
	110000	250000	ohms
	310	450	ohms
Peak R-F Grid Voltage	255	220	volts
D-C Plate Current	135	100	ma.
D-C Screen Current	11	8	ma.
D-C Grid Current	1.4	0.6	approx. ma.
Driving Power	0.4	0.1	approx. watt
Power Output	145	200	approx. watts

Obtained preferably from modulated fixed supply. May also be obtained from modulated plate-voltage supply through series resistor of values shown.

***Obtained from fixed supply, grid resistor (145000,330000), or combination of cathode resistor (310,450) and grid resistor (110000,250000).

R-F POWER AMPLIFIER & OSCILLATOR - Class C Telegraphy

Key-down conditions per tube without modulation▲

Maximum Ratings, *Absolute Values*:

D-C PLATE VOLTAGE	4000 max.	volts
D-C SCREEN VOLTAGE (Grid No.2)	750 max.	volts
D-C GRID VOLTAGE (Grid No.1)	-500 max.	volts
D-C PLATE CURRENT	150 max.	ma.
D-C SCREEN CURRENT	30 max.	ma.
D-C GRID CURRENT	25 max.	ma.
PLATE INPUT	300 max.	watts
SCREEN INPUT	25 max.	watts
PLATE DISSIPATION	75 max.	watts

Typical Operation:

D-C Plate Voltage	2000	3000	volts
D-C Suppressor Voltage (Grid No.3)◇	0	60	volts
D-C Screen Voltage△	750	750	volts
	70000	280000	ohms
D-C Grid Voltage□	-200	-200	volts
	300000	---	ohms
	1200	1800	ohms
Peak R-F Grid Voltage	225	170	volts
D-C Plate Current	150	100	ma.
D-C Screen Current	18	8	ma.
D-C Grid Current	0.7	0	approx. ma.
Driving Power	0.2	0	approx. watt
Power Output	230	235	approx. watts

◇; ▲; △; □: See next page. ← Indicates a change.

4E27

TRANSMITTING BEAM POWER AMPLIFIER

(continued from preceding page)

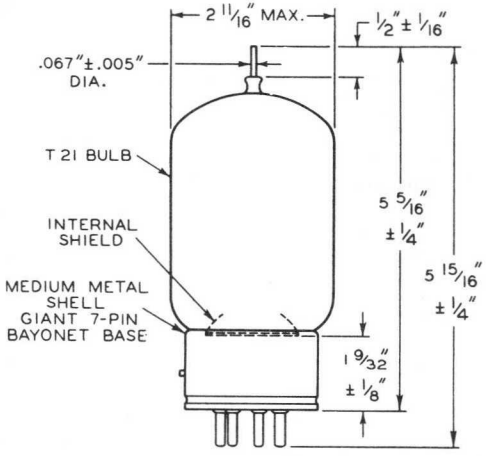
◇ Suppressor should be connected to the mid-point of filament circuit operated on a.c., or to the negative end of the filament operated on d.c.

▲ Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

△ Obtained from a separate source, or from the plate-voltage supply with a voltage divider, or through a series resistor of the value shown. Series screen resistor should be used only where 4E27 is employed as buffer amplifier and is not keyed. The screen voltage must not exceed 1500 volts under key-up conditions.

□ Obtained from fixed supply, grid resistor (300000), or cathode resistor (1200, 1800). When a preceding stage is keyed, sufficient fixed bias must be used to maintain the plate current at a low value when the key is up.

Data on operating frequencies for the 4E27/8001 are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY.



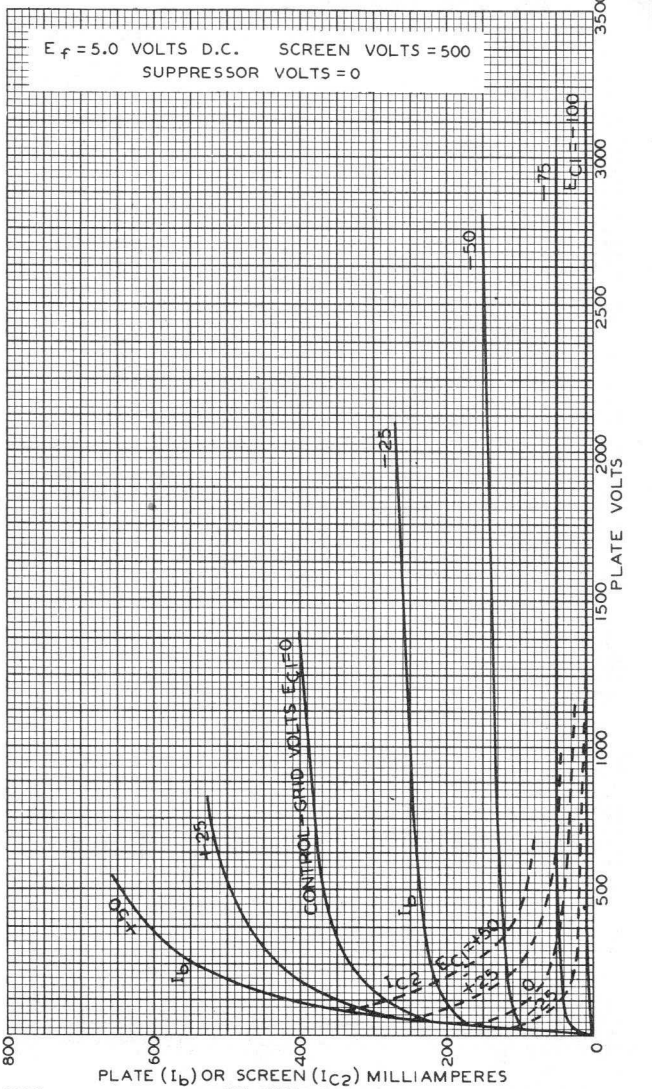
92CM-6260RI

← Indicates a change.

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

4E27

AVERAGE PLATE CHARACTERISTICS

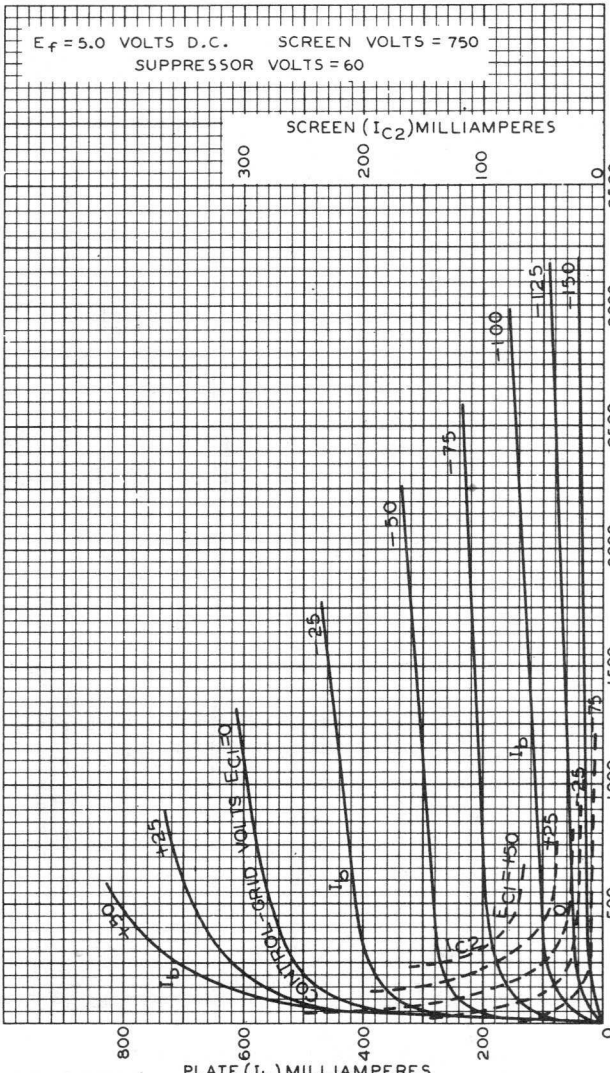


MAR. 26, 1945 RCA VICTOR DIVISION 92CM-6261RI
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

4E27

4E27

AVERAGE PLATE CHARACTERISTICS



JAN. 22, 1945

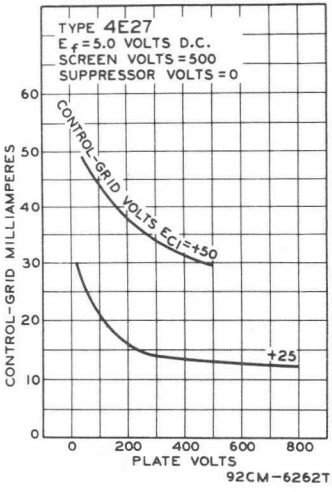
RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6259RI

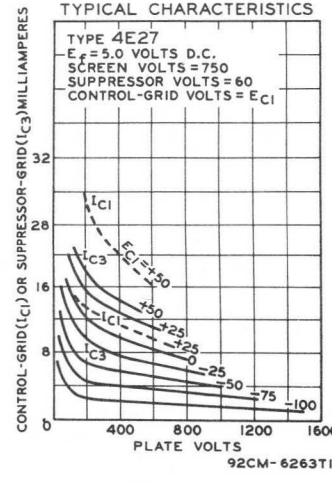
4E27

TRANSMITTING BEAM POWER AMPLIFIER

TYPICAL CHARACTERISTICS



TYPICAL CHARACTERISTICS



4E27A/5-125B
BEAM POWER TUBE

Full Input at Frequencies up to 75 Mc

GENERAL DATA

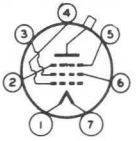
Electrical:

Filament, Thoriated Tungsten:		
Voltage	5.0	ac or dc volts
Current	7.5	amp
Transconductance (Approx.) For plate volts = 2500, grid-No.3 volts = 0, grid-No.2 volts = 500, and plate ma. = 50	2150	μmhos
Mu-Factor, Grid No.2 to Grid No.1	5	
Direct Interelectrode Capacitances:		
Grid No.1 to plate*	0.08	μμf
Input	10.5	μμf
Output	4.7	μμf

Mechanical:

Mounting Position	Vertical, base down or up ←
Maximum Overall Length	5-9/16" ←
Seated Length	5-3/8" ± 1/4"
Maximum Diameter	2-3/4"
Plate Terminal	See Dimensional Outline
Weight	6 ounces ←
Base	Ventilated Medium-Metal-Shell Giant 7-Pin
Basing Designation for BOTTOM VIEW	7BM

Pin 1 - Filament
Pin 2 - Grid No.3
Pin 3 - Grid No.2
Pin 4 - Grid No.1



Pin 5 - Grid No.3
Pin 6 - Grid No.2
Pin 7 - Filament
Bulb Terminal - Plate

Seal Temperature (Plate and stem)	225 max.	°C
Bulb Temperature (At hottest point)	250 max.	°C

Components:

Socket	Johnson No.122-237, or equivalent
Heat-Radiating Plate Connector (Supplied with tube)	Eimac HR-5

AF POWER AMPLIFIER & MODULATOR - Class AB_1† ←

Maximum CCS• Ratings, *Absolute Values:*

DC PLATE VOLTAGE	4000 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	750 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-500 max.	volts

† Subscript 1 indicates that grid-No.1 current does not flow during any part of the input cycle.

* With no external shielding and base shell connected to ground.

•: See next page.

←Indicates a change.

4E27A

4E27A

BEAM POWER TUBE

DC PLATE CURRENT*	200 max.	ma
PLATE DISSIPATION*	125 max.	watts
GRID-No.3 (SUPPRESSOR) DISSIPATION*	20 max.	watts
GRID-No.2 DISSIPATION*	20 max.	watts
GRID-No.1 DISSIPATION*	5 max.	watts

Typical Operation:

Values are for 2 tubes

DC Plate Voltage	1500	2000	2500	volts
DC Grid-No.3 Voltage	0	0	0	volts
DC Grid-No.2 Voltage	500	500	500	volts
DC Grid-No.1 (Control-Grid) Voltage◇	−70	−80	−85	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage	140	160	170	volts
Zero-Signal DC Plate Current	110	85	65	ma
Max.-Signal DC Plate Current	205	210	220	ma
Zero-Signal DC Grid-No.2 Current (Approx.)	0	0	0	ma
Max.-Signal DC Grid-No.2 Current (Approx.)	15	13	8	ma
Effective Load Resistance (Plate to plate)	13700	18000	20000	ohms
Max.-Signal Driving Power (Approx.)	0	0	0	watts
Max.-Signal Power Input	310	420	550	watts
Max.-Signal Power Output (Approx.)	200	250	300	watts

Maximum Circuit Values:

DC Resistance in Series with Grid No.1 of Each Tube	0.25 max.	megohm

AF POWER AMPLIFIER & MODULATOR – Class AB_2#

Maximum CCS● Ratings, *Absolute Values:*

DC PLATE VOLTAGE	4000 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	750 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	−500 max.	volts
DC PLATE CURRENT	200 max.	ma
PLATE DISSIPATION	125 max.	watts
GRID-No.3 (SUPPRESSOR) DISSIPATION	20 max.	watts
GRID-No.2 DISSIPATION	20 max.	watts
GRID-No.1 DISSIPATION	5 max.	watts

* Averaged over any audio-frequency cycle of sine-wave form.

\# Subscript 2 indicates that grid-No.1 current flows during some part of the input cycle.

●,◇: See next page. → indicates a change.

4E27A

BEAM POWER TUBE

Typical Operation:

Values are for 2 tubes

DC Plate Voltage	1500	2000	2500	volts
DC Grid-No.3 Voltage	60	0	0	volts
DC Grid-No.2 Voltage	500	500	500	volts
DC Grid-No.1 (Control-Grid) Voltage◇	-70	-80	-85	volts
Grid-No.1-to-Grid-No.1 Voltage	200	200	190	volts
Zero-Signal DC Plate Current	110	85	65	ma
Max.-Signal DC Plate Current	365	295	250	ma
Zero-Signal DC Grid-No.2 Current (Approx.)	0	0	0	ma
Max.-Signal DC Grid-No.2 Current (Approx.)	11	16	13	ma
Effective Load Resistance (Plate to plate)	7300	13000	20000	ohms
Max.-Signal Driving Power (Approx.)	0.5	0.3	0.2	watt
Max.-Signal Power Input	550	590	625	watts
Max.-Signal Power Output (Approx.)	300	350	400	watts

GRID No.3-MODULATED RF POWER AMPLIFIER—Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum CCS® Ratings, *Absolute Values:*

DC PLATE VOLTAGE	4000 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	750 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-500 max.	volts
DC PLATE CURRENT	200 max.	ma
PLATE DISSIPATION	125 max.	watts
GRID-No.3 (SUPPRESSOR) DISSIPATION	20 max.	watts
GRID-No.2 DISSIPATION	20 max.	watts
GRID-No.1 DISSIPATION	5 max.	watts

Typical Operation:

DC Plate Voltage	1500	2000	2500	volts
DC Grid-No.3 Voltage	-220	-260	-305	volts
Fixed DC Grid-No.2 Supply Voltage	610	645	650	volts
DC Grid-No.2 Voltage	400	400	400	volts
From a series grid-No.2 resistor of	5500	9100	10000	ohms
DC Grid-No.1 Voltage	-170	-180	-190	volts
Peak AF Grid-No.3 Voltage	220	260	305	volts
Peak RF Grid-No.1 Voltage	230	235	245	volts
DC Plate Current	59	59	59	ma

◇ Adjust to stated zero-signal dc plate current.

←Indicates a change.

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BEAM POWER TUBE

DC Grid-No.2 Current (Approx.) . .	38	27	25	ma
DC Grid-No.1 Current (Approx.) . .	6	5	5	ma
Driving Power (Approx.)	1.4	1.3	1.2	watts
Power Output (Approx.)	35	50	61	watts

PLATE-MODULATED RF POWER AMPLIFIER—Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum CCS● Ratings, *Absolute Values:*

DC PLATE VOLTAGE	3200 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	750 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE . . .	-500 max.	volts
DC PLATE CURRENT	160 max.	ma
PLATE DISSIPATION	85 max.	watts
GRID-No.3 (SUPPRESSOR) DISSIPATION . . .	20 max.	watts
GRID-No.2 DISSIPATION	20 max.	watts
GRID-No.1 DISSIPATION	5 max.	watts

→**Typical Operation with Grid No.3 Grounded and Grid-No.2 Volts = 500:**

DC Plate Voltage	1500	2000	2500	volts
DC Grid-No.2 Voltage	500	500	500	volts
DC Grid-No.1 Voltage	-195	-200	-205	volts
Peak AF Grid-No.2 Voltage	350	350	350	volts
Peak RF Grid-No.1 Voltage	265	270	275	volts
DC Plate Current	150	151	152	ma
DC Grid-No.2 Current (Approx.) . .	18	17	16	ma
DC Grid-No.1 Current (Approx.) . .	7	8	8	ma
Driving Power (Approx.)	2	2	2	watts
Power Output (Approx.)	153	220	295	watts

RF POWER AMPLIFIER & OSCILLATOR—Class C Telegraphy□ and RF POWER AMPLIFIER—Class C FM Telephony

Maximum CCS● Ratings, *Absolute Values:*

DC PLATE VOLTAGE	4000 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	750 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE . . .	-500 max.	volts
DC PLATE CURRENT	200 max.	ma
PLATE DISSIPATION.	125 max.	watts
GRID-No.3 (SUPPRESSOR) DISSIPATION	20 max.	watts
GRID-No.2 DISSIPATION.	20 max.	watts
GRID-No.1 DISSIPATION.	5 max.	watts

● Continuous Commercial Service.

□ Key-down conditions per tube without amplitude modulation. Amplitude modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

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

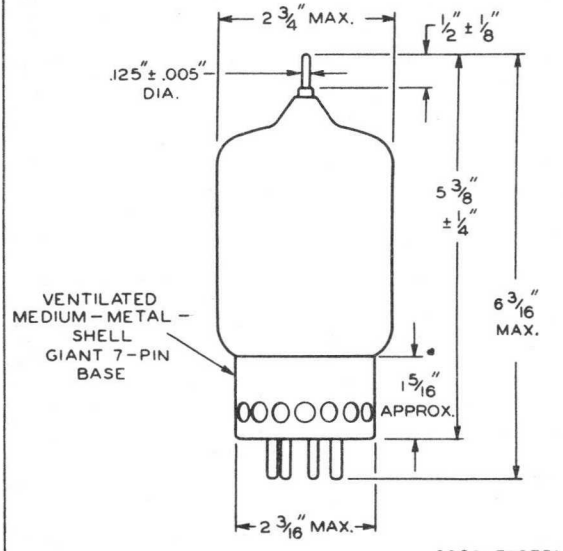
RCA

4E27A

BEAM POWER TUBE

Typical Operation with Grid No.3 Grounded and Grid-No.2 Volts = 500:				
DC Plate Voltage	1000	2000	3000	volts
DC Grid-No.2 Voltage	500	500	500	volts
DC Grid-No.1 Voltage	-120	-150	-200	volts
Peak RF Grid-No.1 Voltage	170	240	270	volts
DC Plate Current	145	200	167	ma
DC Grid-No.2 Current (Approx.)	17	23	12	ma
DC Grid-No.1 Current (Approx.)	6	11	7	ma
Driving Power (Approx.)	1	2.6	1.9	watts
Power Output (Approx.)	90	275	375	watts
Typical Operation with Grid No.3 Grounded and Grid-No.2 Volts = 750:				
DC Plate Voltage	1000	2000	3000	volts
DC Grid-No.2 Voltage	750	750	750	volts
DC Grid-No.1 Voltage	-170	-200	-250	volts
Peak RF Grid-No.1 Voltage	205	257	290	volts
DC Plate Current	160	200	167	ma
DC Grid-No.2 Current (Approx.)	21	22	9	ma
DC Grid-No.1 Current (Approx.)	3	6	3	ma
Driving Power (Approx.)	0.6	1.5	0.9	watts
Power Output (Approx.)	115	300	375	watts
Typical Operation with Grid-No.3 Volts = 60 and Grid-No.2 Volts = 500:				
DC Plate Voltage	1000	2000	3000	volts
DC Grid-No.3 Voltage	60	60	60	volts
DC Grid-No.2 Voltage	500	500	500	volts
DC Grid-No.1 Voltage	-120	-150	-200	volts
Peak RF Grid-No.1 Voltage	170	222	260	volts
DC Plate Current	167	200	167	ma
DC Grid-No.3 Current (Approx.)	6	4	3	ma
DC Grid-No.2 Current (Approx.)	11	11	5	ma
DC Grid-No.1 Current (Approx.)	6	8	6	ma
Driving Power (Approx.)	1	1.8	1.6	watts
Power Output (Approx.)	120	300	375	watts

4E27A
BEAM POWER TUBE



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RCA

4E27A

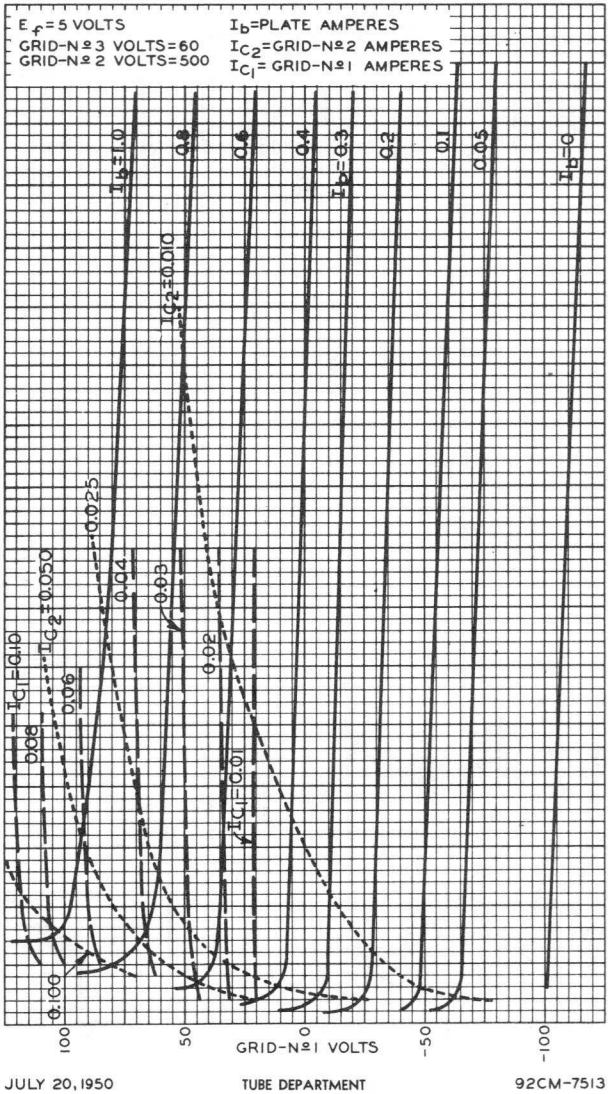
AVERAGE CONSTANT-CURRENT CHARACTERISTICS



RCA

4E27A

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



4X500A

Beam Power Tube

FORCED-AIR COOLED

GENERAL DATA

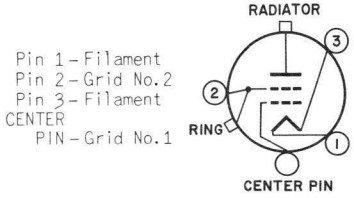
Electrical:

Filament, Thoriated Tungsten:			
Voltage (AC or DC)	5.0		volts
Current	12.2 to 13.7		amp
Transconductance, for plate volts = 2500, grid-No.2 volts = 500, and plate ma. = 200	5200		μmhos
Mu-Factor, Grid No.2 to Grid No.1	4.5 to 6.5		
Direct Interelectrode Capacitances:			
Grid No.1 to plate	0.1	max.	μμf
Grid No.1 to filament and grid No.2	10.5 to 14.4		μμf
Plate to filament and grid No.2	4.9 to 6.9		μμf

Mechanical:

Operating Position. . . . . Vertical, radiator up or down
Overall Length. . . . . 4-1/2" ± 1/4"
Maximum Diameter. . . . . 2-5/8"
Weight (Approx.). . . . . 1.7 lbs
Radiator. . . . . Integral part of tube
Terminal Diagram (See *Dimensional Outline*):

BOTTOM VIEW



Thermal:

Forced-Air Cooling:
Through base toward bulb. . . . . 20 min. cfm
The specified air flow at a pressure drop of 2.25 inches of water should be passed through the radiator using the recommended socket and should be started before the application of filament voltage.
Radiator-Core Temperature . . . . . 150 max. °C
Glass-Metal Seals Temperature . . . . . 150 max. °C

Components:

Socket. . . . . .Eimac SK900, or equivalent

← Indicates a change.

4X500A

RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy[a]
and
RF POWER AMPLIFIER — Class C FM Telephony

Maximum CCS[b] Ratings, *Absolute-Maximum Values:*

	Up to 120 Mc	
DC PLATE VOLTAGE	4000 max.	volts
DC GRID-No.2 VOLTAGE	500 max.	volts
DC GRID-No.1 VOLTAGE	-500 max.	volts
DC PLATE CURRENT	350 max.	ma
GRID-No.2 INPUT	30 max.	watts
GRID-No.1 INPUT	10 max.	watts
PLATE DISSIPATION	500 max.	watts

→ **RF POWER AMPLIFIER — Class B Television Service**

Synchronizing-level conditions per tube unless otherwise specified

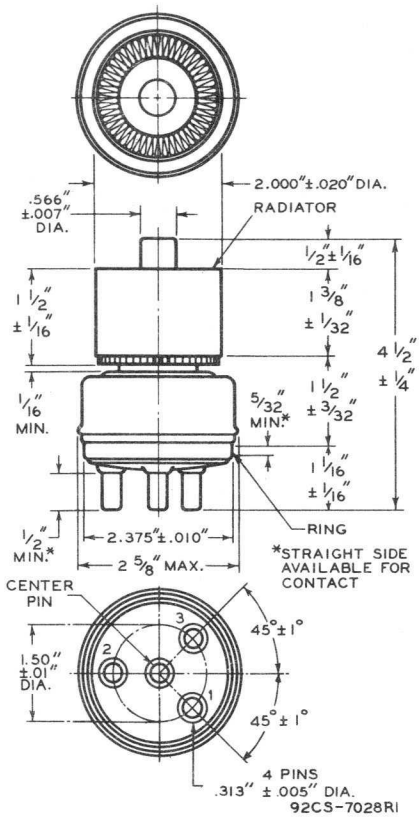
Maximum CCS[b] Ratings, *Absolute-Maximum Values:*

	Up to 220 Mc	
DC PLATE VOLTAGE	3000 max.	volts
DC GRID-No.2 VOLTAGE	500 max.	volts
DC GRID-No.1 VOLTAGE	-500 max.	volts
DC PLATE CURRENT	350 max.	ma
GRID-No.2 INPUT	30 max.	watts
GRID-No.1 INPUT	10 max.	watts
PLATE DISSIPATION	500 max.	watts

[a] Key-down conditions per tube without amplitude modulation. Amplitude modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

[b] Continuous Commercial Service.

→ Indicates a change.


2.000"±.020" DIA.
.566" ±.007" DIA.
RADIATOR
1/2"±1/16"
1 1/2" ±1/16"
1 3/8" ±1/32"
4 1/2" ±1/4"
1/16" MIN.
5/32" MIN.*
1 1/2" ±3/32"
1 1/16" ±1/16"
1/2" MIN.*
2.375"±.010"
2 5/8" MAX.
RING
*STRAIGHT SIDE AVAILABLE FOR CONTACT
CENTER PIN
1.50" ±.01" DIA.
45°±1°
45°±1°
4 PINS
.313" ±.005" DIA.
92CS-7028RI

5AS8
DIODE–SHARP-CUTOFF PENTODE

9-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

The 5AS8 is the same as the 6AS8 except for the following items:

Heater, for Unipotential Cathodes:		
Voltage	4.7	ac or dc volts
Current	0.6	amp
Warm-up time (Average)*	11	sec

5AT8
TRIODE-PENTODE CONVERTER

9-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

The 5AT8 is the same as the 6AT8 except for the following items:

Heater, for Unipotential Cathode:		
Voltage	4.7	ac or dc volts
Current	0.6	amp
Warm-up time (Average)*	11	sec
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	200 max.	volts
Heater positive with respect to cathode	200▲ max.	volts

* *For definition of heater warm-up time and method of determining it, see sheet HEATER WARM-UP TIME MEASUREMENT at front of this Section.*

▲ The dc component must not exceed 100 volts.

5AV8

MEDIUM-MU TRIODE – SHARP-CUTOFF PENTODE

9-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

The 5AV8 is the same as the 6AN8 except for the following items:

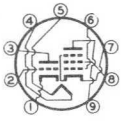
Heater, for Unipotential Cathodes:

Voltage	4.7	ac or dc volts
Current	0.6	amp
Warm-up time (Average)	11	sec

For definition of heater warm-up time and method of determining it, see sheet HEATER WARM-UP TIME MEASUREMENT at front of this Section.

Base. . . . . Small-Button Noval 9-Pin (JETEC No.E9-1)
Basing Designation for BOTTOM VIEW. 9DZ

Pin 1 – Triode Cathode
Pin 2 – Triode Grid
Pin 3 – Triode Plate
Pin 4 – Heater
Pin 5 – Heater
Pin 6 – Pentode Grid No.1



Pin 7 – Pentode Cathode, Pentode Grid No.3, Internal Shield
Pin 8 – Pentode Grid No.2
Pin 9 – Pentode Plate

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

Full-Wave Vacuum Rectifier

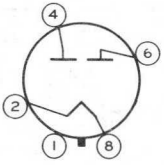
GENERAL DATA

Electrical:

Filament, Coated:		
Voltage (AC or DC)	5	volts
Current	3.7	amp

Mechanical:

Operating Position	Any
Maximum Overall Length	5-3/16"
Maximum Seated Length	4-5/8"
Diameter	1.438" to 1.562"
Bulb	T12
Base	Medium-Shell Octal 5-Pin, Arrangement 1 (JEDEC Group 1, No.B5-15)
Basing Designation for BOTTOM VIEW	5T



Pin 1 – No Connection
Pin 2 – Filament
Pin 4 – Plate No.2
Pin 6 – Plate No.1
Pin 8 – Filament

FULL-WAVE RECTIFIER

Maximum Ratings, *Design-Center Values:*

PEAK INVERSE PLATE VOLTAGE	1550 max.	volts
AC PLATE SUPPLY VOLTAGE PER PLATE (RMS, without load)	See *Rating Chart*	
STEADY-STATE PEAK PLATE CURRENT PER PLATE	750 max.	ma
TRANSIENT PEAK PLATE CURRENT PER PLATE for duration of 0.2 second maximum	4 max.	amp
DC OUTPUT CURRENT	See *Rating Chart*	

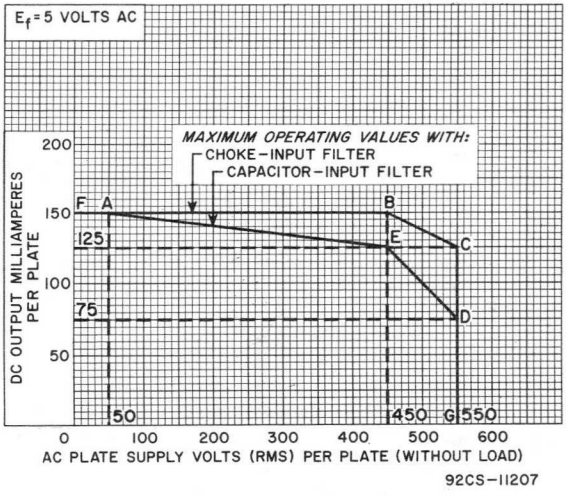
Typical Operation:

	With capacitor-input filter	*With choke-input filter*	
AC Plate-to-Plate Supply Voltage (RMS, without load)	900	1100	volts
Filter-Input Capacitor	10	–	μf
Filter-Input Choke	–	10	henrys
Total Effective Plate Supply Impedance Per Plate	153	–	ohms
DC Output Voltage at input to filter	422	440	volts
DC Output Current	250	250	ma

Characteristics:

Tube-Voltage Drop for plate ma. = 250 (Per plate)	46	volts

RATING CHART



5AYP4

VIEW-FINDER KINESCOPE

METAL-BACKED SCREEN

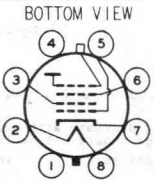
ELECTROSTATIC FOCUS MAGNETIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:		
Voltage	6.3	ac or dc volts
Current	0.6 ± 10%	amp
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes	6	μμf
Cathode to all other electrodes	5	μμf
External conductive coating to ultor•	750 max. 500 min.	μμf μμf
Faceplate, Spherical		Clear Glass
Phosphor (For Curves, see front of this Section)		P4-Sulfide Type, Metal-Backed
Fluorescence		White
Phosphorescence		White
Persistence		Short
Focusing Method		Electrostatic
Deflection Method		Magnetic
Deflection Angle (Approx.)		53°
Overall Length		11-9/16" ± 3/8"
Greatest Diameter of Bulb		4-15/16" ± 3/32"
Minimum Useful Screen Diameter		4-1/4"
Picture Size (Within minimum-useful-screen area)		3-3/8" x 2-1/2"
Weight (Approx.)		1 lb 6 oz
Mounting Position		Any
Ultor• Terminal		Recessed Small Ball Cap (JETEC No.J1-22)
Bulb		J-39-1/2
Base		Long Medium-Shell Octal 8-Pin (JETEC No.B8-65)

BOTTOM VIEW



Pin 1 – No Connection
Pin 2 – Heater
Pin 3 – Grid No.2
Pin 4 – No Connection
Pin 5 – Grid No.1
Pin 6 – Grid No.3
Pin 7 – Cathode
Pin 8 – Heater
Cap – Ultor (Grid No.4, Collector)

Maximum Ratings, *Design-Center Values*:

ULTOR VOLTAGE•	10000 max.	volts
GRID-No.3 VOLTAGE	1500 max.	volts
GRID-No.2 VOLTAGE	410 max.	volts

• The "ultor" in a cathode-ray tube is the electrode to which is applied the highest dc voltage for accelerating the electrons in the beam prior to its deflection. In the 5AYP4, the ultor function is performed by grid No.4. Since grid No.4 and collector are connected together within the 5AYP4, they are collectively referred to simply as "ultor" for convenience in presenting data and curves.

5AYP4

5AYP4

VIEW-FINDER KINESCOPE

GRID-No.1 VOLTAGE:		
Negative bias value.	125 max.	volts
Positive bias value.	0 max.	volts
Positive peak value.	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode.	180 max.	volts
Heater positive with respect to cathode.	180 max.	volts

Equipment Design Ranges:

For any ultor voltage (E_{c_4}) between 5000 and 10000 volts and grid-No.2 voltage (E_{c_2}) between 200 and 410 volts*

Grid-No.3 Voltage for Focus with Ultor Current of 100 μamp	9.8% to 14.1% of E_{c4}	volts
Grid-No.1 Voltage for Visual Extinction of Focused Raster	8.5% to 23.5% of E_{c_2}	volts
Max. Grid-No.3 Current** . .	*See Curves*	
Grid-No.2 Current.	−15 to +15	μamp
Field Strength of Adjustable Centering Magnet	0 to 8	gausses

Examples of Use of Design Ranges:

For ultor voltage of	*7000*	*10000*	*volts*
and grid-No.2 voltage of	*200*	*300*	*volts*
Grid-No.3 Voltage for Focus with Ultor Current of 100 μamp. . . .	680 to 990	980 to 1410	volts
Grid-No.1 Voltage for Visual Extinction of Focused Raster	−17 to −47	−25 to −71	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

* Brilliance and definition decrease with decreasing ultor voltage. In general, the ultor voltage should not be less than 5000 volts.

** Grid-No.3 current increases as the ultor voltage is decreased.

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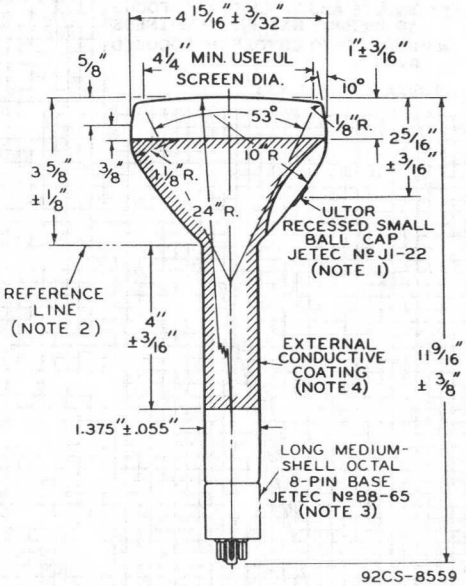
5AYP4

VIEW-FINDER KINESCOPE



NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 5 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ± 10°. ULTOR TERMINAL IS ON SAME SIDE OF TUBE AS PIN 5.

NOTE 2: REFERENCE LINE IS DETERMINED BY POSITION WHERE GAUGE 1.430" + 0.003" −0.000" I.D. AND 2" LONG WILL REST ON BULB CONE.

NOTE 3: CENTER LINE OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF THE BOTTOM OF THE BASE.

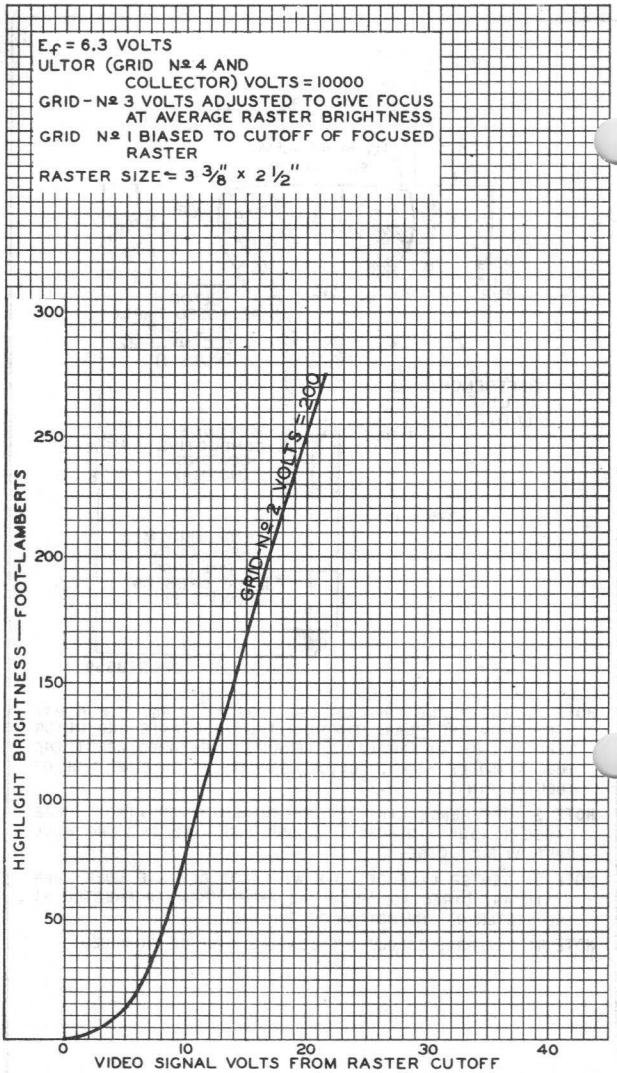
NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

5AYP4

AVERAGE GRID-DRIVE CHARACTERISTIC



5BE8

MEDIUM-MU TRIODE—SHARP-CUTOFF PENTODE

9-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

GENERAL DATA

Electrical:

Heater, for Unipotential Cathodes:		
Voltage (AC or DC)	4.7	volts
Current	0.6 ± 6%	amp
Warm-up time (Average)	11	sec
Direct Interelectrode Capacitances:[o]		
Triode Unit:		
Grid to plate	1.8	μμf
Grid to cathode & pentode grid No.3 & internal shield, and heater	2.8	μμf
Plate to cathode & pentode grid No.3 & internal shield, and heater	1.5	μμf
Pentode Unit:		
Grid No.1 to plate	0.04 max.	μμf
Grid No.1 to cathode, grid No.2, and heater	4.4	μμf
Plate to cathode, grid No.3 & triode cathode & internal shield, grid No.2, and heater	2.6	μμf
Plate to cathode, grid No.2, and heater	0.3	μμf
Triode grid to pentode plate	0.01	μμf
Pentode grid No.1 to triode plate	0.009	μμf
Triode plate to pentode plate	0.065	μμf

Characteristics, Class A_1 Amplifier:

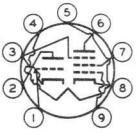
	Triode Unit	*Pentode Unit*	
Plate Supply Voltage	150	250	volts
Grid No.3	–	♦	
Grid-No.2 Supply Voltage	–	110	volts
Grid-No.1 Voltage	0	0	volts
Cathode Resistor	56	68	ohms
Amplification Factor	40	–	
Plate Resistance (Approx.)	0.005	0.4	megohm
Transconductance	8500	5200	μmhos
Plate Current	18	10	ma
Grid-No.2 Current	–	3.5	ma
Grid-No.1 Voltage (Approx.) for plate μa = 10	-12	-10	volts

5BE8
MEDIUM-MU TRIODE—SHARP-CUTOFF PENTODE

Mechanical:

Operating Position . . . . . Any
Maximum Overall Length . . . . . 2-3/16"
Maximum Seated Length . . . . . 1-15/16"
Length, Base Seat to Bulb Top (Excluding tip) . 1-9/16" ± 3/32"
Diameter . . . . . 0.750" to 0.875"
Dimensional Outline . . . . . *See General Section*
Bulb T6-1/2
Base . . . . . Small-Button Noval 9-Pin (JEDEC No.E9-1)
Basing Designation for BOTTOM VIEW 9EG

Pin 1 – Triode Grid
Pin 2 – Triode Plate
Pin 3 – Triode Cathode, Pentode Grid No.3, Internal Shield
Pin 4 – Heater
Pin 5 – Heater
Pin 6 – Pentode Plate
Pin 7 – Pentode Grid No.2
Pin 8 – Pentode Cathode
Pin 9 – Pentode Grid No.1



CONVERTER SERVICE

Maximum Ratings, *Design-Center Values:*

	Triode Unit as Osc.	*Pentode Unit as Mixer*	
PLATE VOLTAGE	300 max.	300 max.	volts
GRID-No.2 (SCREEN-GRID) SUPPLY VOLTAGE	–	300 max.	volts
GRID-No.2 VOLTAGE	–	*See Grid No.2 Input Rating Chart at front of Receiving Tube Section*	
GRID-No.1 (CONTROL-GRID) VOLTAGE:			
Positive-bias value	0 max.	0 max.	volts
GRID-No.2 INPUT:			
For grid-No.2 voltages up to 150 volts	–	0.5 max.	watt
For grid-No.2 voltages between 150 and 300 volts	–	*See Grid No.2 Input Rating Chart at front of Receiving Tube Section*	
PLATE DISSIPATION	2.5 max.	2.8 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	200 max.	200 max.	volts
Heater positive with respect to cathode	200▲ max.	200▲ max.	volts

5BE8
MEDIUM-MU TRIODE—SHARP-CUTOFF PENTODE

Maximum Circuit Values:

	Triode Unit	*Pentode Unit*	
Grid-No.1-Circuit Resistance:*			
For fixed-bias operation. . .	0.5 max.	0.25 max.	megohm
For cathode-bias operation. .	1 max.	1 max.	megohm

○ Without external shield.

♦ Internally connected to triode cathode.

▲ The dc component must not exceed 100 volts.

* If either unit is operated at maximum rated conditions, grid-No.1-circuit resistances for both units should not exceed the stated values.

5CG8

TRIODE-PENTODE CONVERTER

9-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

The 5CG8 is the same as the 6CG8 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	4.7	volts
Current	0.6 ± 6%	amp
Warm-up time (Average)	11	sec

5CL8-A

MEDIUM-MU TRIODE— SHARP-CUTOFF TETRODE

9-PIN MINIATURE TYPE

Intended for use as combined VHF oscillator and mixer tube in TV receivers having series heater-string arrangement

The 5CL8-A is the same as the 6CL8-A except for the following items:

Heater, for Unipotential Cathodes:		
Voltage (AC or DC)	4.7	volts
Current	0.6 ± 6%	amp

5CM8

HIGH-MU TRIODE— SHARP-CUTOFF PENTODE

9-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

The 5CM8 is the same as the 6CM8 except for the following items:

Heater, for Unipotential Cathodes:		
Voltage (AC or DC)	4.7	volts
Current	0.6 ± 6%	amp

5CQ8

MEDIUM-MU TRIODE—SHARP-CUTOFF TETRODE

9-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

The 5CQ8 is the same as the 6CQ8 except for the following items:

Heater, for Unipotential Cathodes:		
Voltage (AC or DC)	4.7	volts
Current	0.6 ± 6%	amp

5CZ5

BEAM POWER TUBE

9-PIN MINIATURE TYPE

For vertical-deflection-amplifier service in 110° systems having series heater-string arrangement

The 5CZ5 is the same as the 6CZ5 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	4.7	volts
Current	0.6 ± 6%	amp

5CG8

Medium-Mu Triode—Sharp-Cutoff Pentode

9-PIN MINIATURE TYPE

For Equipment Having Series Heater-String Arrangement

The 5CG8 is the same as the 6CG8-A except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	4.7	volts
Current	0.6 ± 6%	amp

5CL8-A

Medium-Mu Triode—Sharp-Cutoff Tetrode

9-PIN MINIATURE TYPE

For Equipment Having Series Heater-String Arrangement

The 5CL8-A is the same as the 6CL8-A except for the following items:

Heater, for Unipotential Cathodes:		
Voltage (AC or DC)	4.7	volts
Current	0.6 ± 6%	amp

5CM8

High-Mu Triode—Sharp-Cutoff Pentode

9-PIN MINIATURE TYPE

For Equipment Having Series Heater-String Arrangement

The 5CM8 is the same as the 6CM8 except for the following items:

Heater, for Unipotential Cathodes:		
Voltage (AC or DC)	4.7	volts
Current	0.6 ± 6%	amp

5CQ8

Medium-Mu Triode—
Sharp-Cutoff Tetrode

9-PIN MINIATURE TYPE

For Equipment Having Series Heater-String Arrangement

The 5CQ8 is the same as the 6CQ8 except for the following items:

Heater, for Unipotential Cathodes:		
Voltage (AC or DC)	4.7	volts
Current	0.6 ± 6%	amp

5CZ5

Beam Power Tube

9-PIN MINIATURE TYPE

For Equipment Having Series Heater-String Arrangement

The 5CZ5 is the same as the 6CZ5 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	4.7	volts
Current	0.6 ± 6%	amp

5EW6

Sharp-Cutoff Pentode

7-PIN MINIATURE TYPE

For Equipment Having Series Heater-String Arrangement

The 5EW6 is the same as the 6EW6 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	5.6	volts
Current	0.45 ± 6%	amp
Warm-up time (Average)	11	sec

5CP12

OSCILLOGRAPH TUBE

POST-DEFLECTION ACCELERATOR

ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

The 5CP12 is the same as the 5CP1-A except that it utilizes a medium-long-persistence screen which exhibits orange fluorescence and phosphorescence.

Because of its medium-long persistence, the 5CP12 is particularly useful where low- and medium-speed recurring phenomena are to be observed. However, it may also be used for observing low-and medium-speed, non-recurring phenomena but its efficiency is low. The persistence is such that the 5CP12 can be operated with scanning frequencies as low as 10 cycles per second without excessive flicker.

It will be noted that the phosphorescence decays exponentially with a time constant of about 120 milliseconds with the result that the low-level phosphorescence is of relatively short duration. Because of this characteristic, the 5CP12 provides high contrast between new and old information with change in target position. Therefore, the 5CP12 is suitable for short-range radar equipment involving medium-speed recurrent phenomena.

The P12 screen is more susceptible to burning than other phosphors. Therefore, the 5CP12 should be operated with the rated maximum anode-No.3 voltage and with the lowest anode-No.3 current which will give the desired brightness.

THE SPECTRAL-ENERGY EMISSION CHARACTERISTIC and the PERSISTENCE CHARACTERISTIC of the P12 Phosphor are shown at the front of this Section.

5FP4-A
VIEW-FINDER KINESCOPE

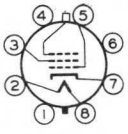
MAGNETIC FOCUS MAGNETIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:		
Voltage	6.3	ac or dc volts
Current	0.6	amp
Direct Interelectrode Capacitances:		
Grid No.1 to All Other Electrodes	8	μμf ←
Cathode to All Other Electrodes	5	μμf
Phosphor (For Curves, see front of this Section)	P4—Sulfide Type	
Fluorescence and Phosphorescence	White	
Persistence of Phosphorescence	Short	
Focusing Method	Magnetic	
Deflection Method	Magnetic	
Deflection Angle (Approx.)	53°	
Overall Length	11-1/8" ± 3/8"	
Greatest Diameter of Bulb	4-15/16" ± 3/32"	
Min. Useful Screen Diameter	4-1/4"	
Mounting Position	Any	
Cap	Recessed Small Ball (JETEC No.J1-22)	
Base	Long Medium-Shell Octal 8-Pin	

BOTTOM VIEW



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

Maximum Ratings, *Design-Center Values*: ←

ANODE VOLTAGE*	8000 max.	volts
GRID-No.2 VOLTAGE	410 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value	125 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	150 max.	volts
Heater positive with respect to cathode	150 max.	volts

Typical Operation: ←

Anode Voltage**	6000	volts
Grid-No.2 Voltage	250	volts
Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot	-25 to -70	volts

* The product of anode voltage and average anode current should be limited to 6 watts.

** Brilliance and definition decrease with decreasing anode voltage. In general, the anode voltage should not be less than 4000 volts.

← Indicates a change.

5FP4-A
VIEW-FINDER KINESCOPE

→ Focusing-Coil Current (DC, approx.) . . . 120 ± 15% ma

Maximum Circuit Values:

Grid-No.1-Circuit Resistance. . . . . 1.5 max. megohms

● For specimen focusing coil similar to JETEC Focusing Coil No. 106 positioned with air gap toward kinescope screen, and center line of air gap 3-1/4" from Reference Line (see Outline Drawing). The indicated current is for condition with combined grid-No.1 bias voltage and video-signal voltage adjusted to produce a highlight brightness of 10 foot-lamberts on a 3-7/8" x 2-7/8" picture area sharply focused at center of screen.

→ Indicates a change.

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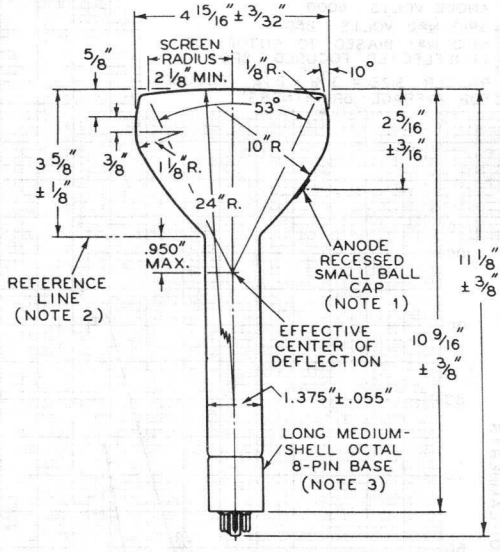
5FP4-A

VIEW-FINDER KINESCOPE



NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN No. 5 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ANODE TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ± 10°. ANODE TERMINAL IS ON SAME SIDE OF TUBE AS PIN No. 5.

NOTE 2: REFERENCE LINE IS DETERMINED BY POSITION WHERE GAUGE 1.430" + .003" −.000" I.D. AND 2" LONG WILL REST ON BULB CONE.

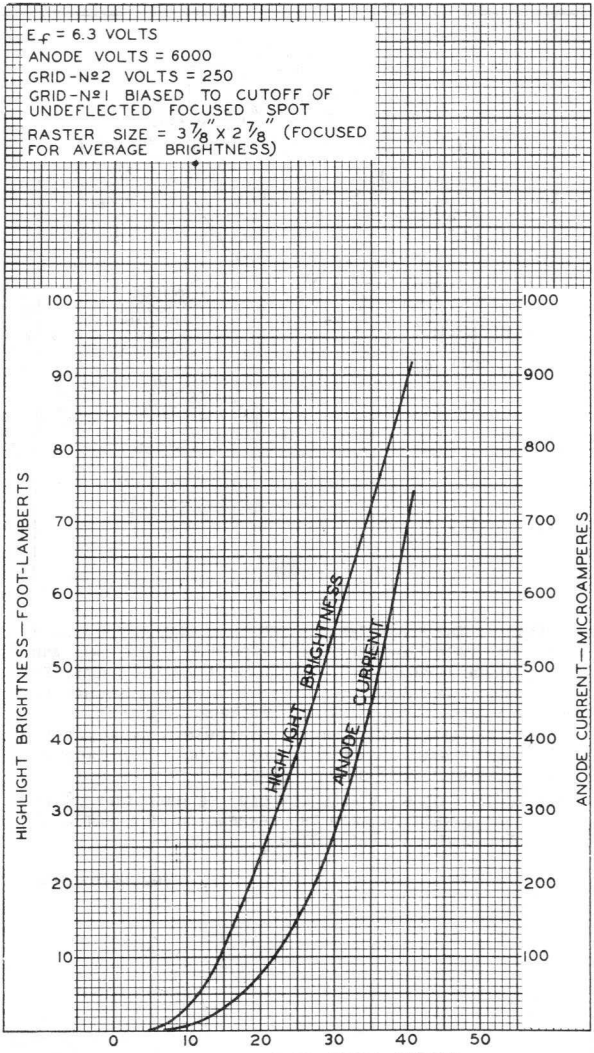
NOTE 3: ℄ OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF THE BOTTOM OF THE BASE.

92CM-6362R4

RCA

5FP4-A

AVERAGE GRID-DRIVE CHARACTERISTICS



5FP14-A

OSCILLOGRAPH TUBE

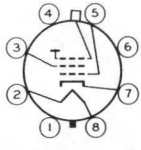
MAGNETIC FOCUS — MAGNETIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:	
Voltage	6.3 ac or dc volts
Current	0.6 ± 10% amp
Direct Interelectrode Capacitances (Approx.):	
Grid No.1 to all other electrodes	8 μμf
Cathode to all other electrodes	5 μμf
Faceplate, Spherical	Clear Glass
Phosphor (For curves, see front of this Section)	P14
Fluorescence	Purple
Phosphorescence	Orange
Persistence	Medium Long
Focusing Method	Magnetic
Deflection Method	Magnetic
Deflection Angle (Approx.)	53°
Overall Length	11-1/8" ± 3/8"
Greatest Diameter of Bulb	4-15/16" ± 3/32"
Minimum Useful Screen Diameter	4-1/4"
Weight (Approx.)	1 lb 2 oz
Mounting Position	Any
Cap	Recessed Small Ball (JETEC No.J1-22)
Bulb	J39-1/2
Base	Medium-Shell Octal 8-Pin (JETEC No.B8-11)
Basing Designation for BOTTOM VIEW	5AN

Pin 1 – No Connection
Pin 2 – Heater
Pin 3 – Grid No.2
Pin 4 – No Connection
Pin 5 – Grid No.1



Pin 6 – No Connection
Pin 7 – Cathode
Pin 8 – Heater
Cap – Ultor (Grid No.3, Collector)

Maximum Ratings, *Design-Center Values:*

ULTOR VOLTAGE	8000 max. volts
GRID-No.2 VOLTAGE	700 max. volts
GRID-No.1 VOLTAGE:	
Negative bias value	180 max. volts
Positive bias value*	0 max. volts
Positive peak value	2 max. volts
PEAK HEATER-CATHODE VOLTAGE:	
Heater negative with respect to cathode	125 max. volts
Heater positive with respect to cathode	125 max. volts

* At or near this rating, the effective resistance of the ultor supply should be adequate to limit the input power to 6 watts.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

5FP14-A

OSCILLOGRAPH TUBE

Equipment Design Ranges:

With any ultor voltage (E_{c_3}) between 4000[#] and 8000 volts and grid-No.2 voltage (E_{c_2}) between 150 and 700 volts

Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot	-10% to -28% of E_{c_2}	volts
Grid-No.2 Current	-15 to $+15$	μamp
Focusing-Coil Current (DC)[oo]	$\left[\sqrt{E_{c_3}/4000} \times 96\right] \pm 15\%$	ma
Spot Position[##]		

Examples of Use of Design Ranges:

With ultor voltage of	*4000*	*5000*	*volts*
and grid-No.2 voltage of	*250*	*250*	*volts*
Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot	-25 to -70	-25 to -70	volts
Focusing-Coil Current (DC)	96 ± 15%	107 ± 15%	ma

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

SPECIAL PERFORMANCE DATA

Line Width:

For Ultor Voltage of 4000 Volts	0.010 max.[▲]	inch
For Ultor Voltage of 5000 Volts	0.009 max.[▲]	inch

[#] Brilliance and definition decrease with decreasing ultor voltage. In general, the ultor voltage should not be less than 4000 volts.

[oo] For specimen focusing coil similar to JETEC Focusing Coil No.106 positioned with air gap toward faceplate and center line of air gap 2-3/4" from Reference Line *(See Dimensional Outline)* and ultor current of 200 microamperes.

[##] With the tube shielded from extraneous fields, the center of the undeflected, unfocused, low-intensity spot will fall within a circle having a 9-mm radius concentric with the center of the tube face.

[▲] With JETEC Deflecting Yoke No.120, or equivalent, and under the following conditions: heater voltage of 6.3 volts, ultor current of 200 microamperes, grid-No.2 voltage of 250 volts, and a 49-line raster. Raster width is adjusted to 11.4 cm and focusing-coil current is adjusted to give sharpest focus at center of tube face. Raster height is contracted until individual scanning lines are just barely distinguishable. *Line width* is expressed as the quotient of the contracted raster height measured at the center line of the tube face divided by the number of scanning lines (49).

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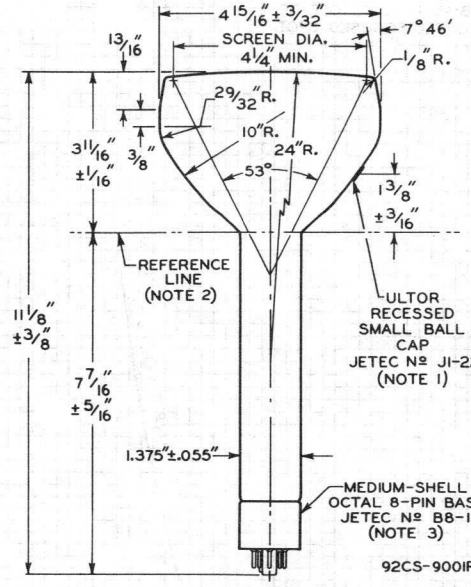
5FP14-A

OSCILLOGRAPH TUBE



NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 5 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ± 10°. ULTOR TERMINAL IS ON SAME SIDE OF TUBE AS PIN 5.

NOTE 2: REFERENCE LINE IS DETERMINED BY POSITION WHERE GAUGE 1.430" + .003" − .000" I.D. AND 2" LONG WILL REST ON BULB CONE.

NOTE 3: CENTER LINE OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF THE BOTTOM OF THE BASE.

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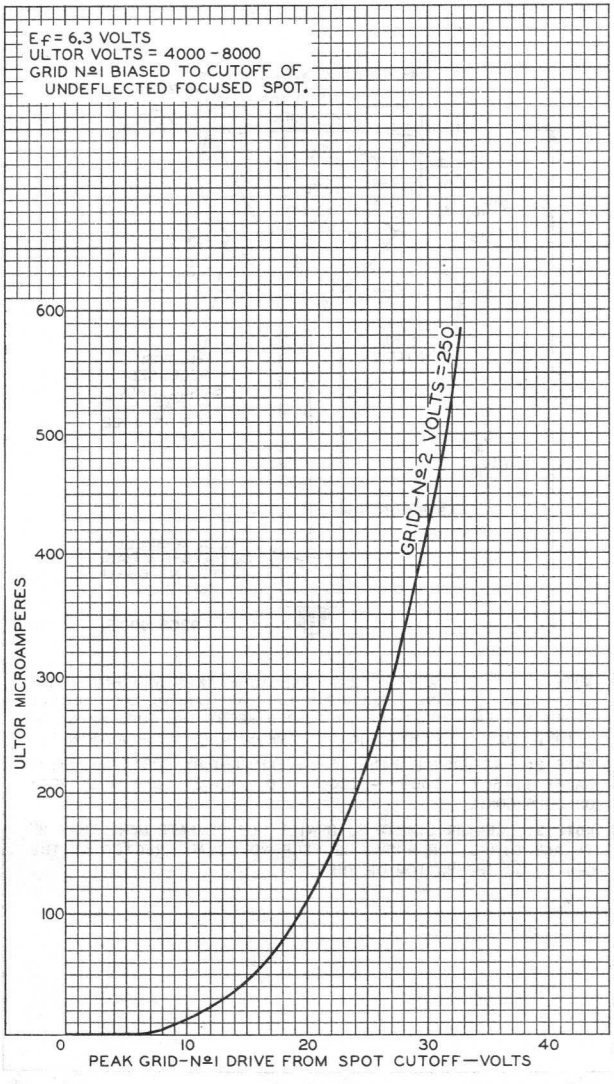
5FP14-A

AVERAGE GRID-DRIVE CHARACTERISTIC



5FP15-A

OSCILLOGRAPH TUBE

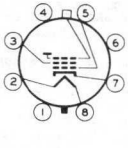
MAGNETIC FOCUS — MAGNETIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:	
Voltage	6.3 ac or dc volts
Current	0.6 ± 10% amp
Direct Interelectrode Capacitances (Approx.):	
Grid No.1 to all other electrodes	8 μμf
Cathode to all other electrodes	5 μμf
Faceplate, Spherical	Clear Glass
Phosphor (For Curves, see front of this Section)	P15
Fluorescence--	
Visible radiation	Blue-Green
Invisible radiation	Near-Ultraviolet
Phosphorescence--	
Persistence of visible radiation	Very Short
Persistence of invisible radiation	Extremely Short
Focusing Method	Magnetic
Deflection Method	Magnetic
Deflection Angle (Approx.)	53°
Tube Dimensions:	
Overall length	11-1/8" ± 3/8"
Greatest diameter of bulb	4-15/16" ± 3/32"
Minimum Useful Screen Diameter	4-1/4"
Weight (Approx.)	1 lb 2 oz
Mounting Position	Any
Cap	Recessed Small Ball (JETEC No.J1-22)
Bulb	J-39-1/2
Base	Medium-Shell Octal 8-Pin (JETEC No.B8-11)
Basing Designation for BOTTOM VIEW	5AN

Pin 1 – No Connection
Pin 2 – Heater
Pin 3 – Grid No.2
Pin 4 – No Connection
Pin 5 – Grid No.1



Pin 6 – No Connection
Pin 7 – Cathode
Pin 8 – Heater
Cap – Ultor (Grid No.3, Collector)

Maximum Ratings, *Design-Center Values:*

ULTOR VOLTAGE	8000 max. volts
GRID-No.2 VOLTAGE	700 max. volts
GRID-No.1 VOLTAGE:	
Negative bias value	180 max. volts
Positive bias value*	0 max. volts
Positive peak value	2 max. volts
PEAK HEATER-CATHODE VOLTAGE:	
Heater negative with respect to cathode	125 max. volts
Heater positive with respect to cathode	125 max. volts

* At or near this rating, the effective resistance of the ultor supply should be adequate to limit the ultor input power to 6 watts.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

5FP15-A

OSCILLOGRAPH TUBE

Equipment Design Ranges:

For any ultor voltage (E_{c3}) between 4000# and 8000 volts and grid-No.2 voltage (E_{c2}) between 150 and 700 volts

Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot	−10% to −28% of E_{c_2}	volts
Grid-No.2 Current	−15 to +15	μamp
Focusing-Coil Current (DC)^{oo}	$\left[\sqrt{E_{c3}/4000} \times 96\right]$ ± 15%	ma
Spot Position	##	

Examples of Use of Design Ranges:

For ultor voltage of	*4000*	*5000*	*volts*
and grid-No.2 voltage of	*250*	*250*	*volts*
Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot	−25 to −70	−25 to −70	volts
Focusing-Coil Current (DC)	82 to 110	91 to 123	ma

Maximum Circuit Values:

Grid-No.1-Circuit Resistance . . . . . 1.5 max. megohms

SPECIAL PERFORMANCE DATA

Line Width:

For Ultor Voltage of 4000 Volts	0.010 max.▲	inch
For Ultor Voltage of 5000 Volts	0.009 max.▲	inch

\# Brilliance and definition decrease with decreasing ultor voltage. In general, the ultor voltage should not be less than 4000 volts.

oo For specimen focusing coil similar to JETEC Focusing Coil No.106 positioned with air gap toward faceplate and center line of air gap 2-3/4" from Reference Line *(See Dimensional Outline)* and ultor current of 200 microamperes.

With the tube shielded from extraneous fields, the center of the undeflected, unfocused, low-intensity spot will fall within a circle having a 9-mm radius concentric with the center of the tube face.

▲ With JETEC Deflecting Yoke No.120, or equivalent, and under the following conditions: heater voltage of 6.3 volts, ultor current of 200 microamperes, grid-No.2 voltage of 250 volts, and a 49-line raster. Raster width is adjusted to 11.4 cm and focusing-coil current is adjusted to give sharpest focus at center of tube face. Raster height is contracted until individual scanning lines are just barely distinguishable. *Line width* is expressed as the quotient of the contracted raster height measured at the centerline of the tube face divided by the number of scanning lines (49).

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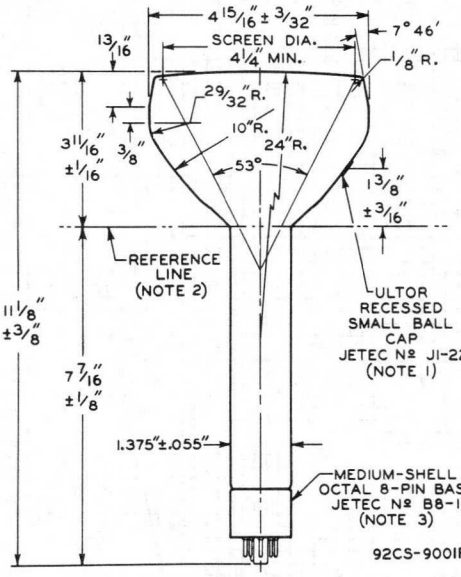
5FP15-A

OSCILLOGRAPH TUBE



NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 5 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ± 10°. ULTOR TERMINAL IS ON SAME SIDE OF TUBE AS PIN 5.

NOTE 2: REFERENCE LINE IS DETERMINED BY POSITION WHERE GAUGE 1.430" + .003" − .000" I.D. AND 2" LONG WILL REST ON BULB CONE.

NOTE 3: CENTER LINE OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF THE BOTTOM OF THE BASE.

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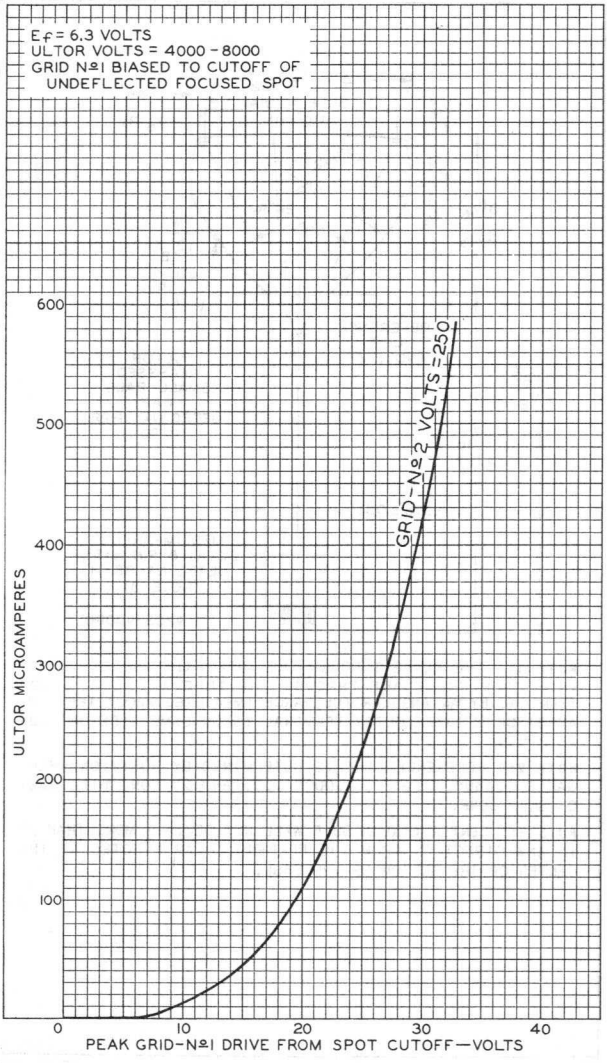
5FP15-A

5FP15-A

AVERAGE GRID-DRIVE CHARACTERISTIC



5R4-GY
FULL-WAVE VACUUM RECTIFIER

GENERAL DATA

Electrical:

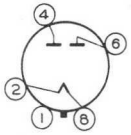
Filament, Coated:#

Voltage	5	ac or dc volts
Current	2	amp

Mechanical:

Mounting Position	Vertical, or Horizontal with pins 1 and 4 in vertical plane
Maximum Overall Length	5-5/16"
Maximum Seated Length	4-3/4"
Maximum Diameter	2-1/16"
Bulb	ST-16
Base	Medium-Shell Octal 5-Pin, Micanol
Basing Designation for BOTTOM VIEW	G-5T

Pin 1 – No Connection
Pin 2 – Filament
Pin 4 – Plate No.2



Pin 6 – Plate No.1
Pin 8 – Filament

FULL-WAVE RECTIFIER ←

Maximum Ratings, *Design-Center Values*:

	For Altitudes up to 40000 ft.		*For Altitudes up to 20000 ft.*	
PEAK INVERSE PLATE VOLT. (No Load)	2100 max.	2400 max.	2800 max.	volts
PEAK PLATE CURRENT PER PLATE	650 max.	650 max.	650 max.	ma
DC OUTPUT CURRENT:				
With capacitor input to filter	250 max.	175 max.	150 max.	ma
With choke input to filter	250 max.	250 max.○	175 max.●	ma

Typical Operation with Capacitor-Input Filter: ←

	For Altitudes up to 40000 ft.		*For Altitudes up to 20000 ft.*	
AC Plate-to-Plate Supply Voltage (RMS):				
Full Load	1400	1500	1800	volts
No Load	1500	1700	2000	volts
Filter Input Capacitor	4	4	4	μf

See curve for conditions necessitating delay in application of plate voltage until filament has reached operating temperature.

○, ●: See next Page.

← Indicates a change.

5R4-GY
FULL-WAVE VACUUM RECTIFIER

	For Altitudes up to 40000 ft.		*For Altitudes up to 20000 ft.*	
Total Effect. Plate-Supply Impedance per Plate▲. . .	125 . .	500 . .	575 . .	ohms
DC Output Current.	250 . .	150 . .	150 . .	ma
DC Output Volt. at Input to Filter:				
At Half Load . .	790* . .	900* . .	1060* . .	volts
At Full Load . .	700* . .	810* . .	950* . .	volts
Voltage Regulation, Half-Load to Full-Load Current . .	90* . .	90* . .	110* . .	volts

→ **Typical Operation with Choke-Input Filter:**

	For Altitudes up to 40000 ft.	*For Altitudes up to 20000 ft.*	
AC Plate-to-Plate Supply Voltage (RMS):			
Full Load.	1500	1900 . .	volts
No Load.	1700	2000 . .	volts
Filter Input Choke	5	10 . .	henries
DC Output Current.	250	175 . .	ma
DC Output Voltage at . . . . Input to Filter:			
At Half Load	590*	810* . .	volts
At Full Load	550*	750* . .	volts
Voltage Regulation, Half-Load to Full-Load Current	40*	60* . .	volts

○ For choke not less than 5 henries.

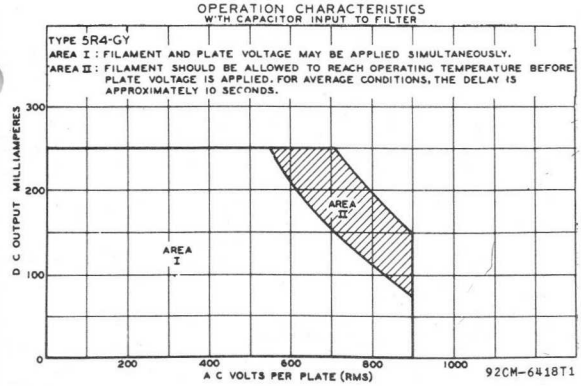
● For choke not less than 10 henries.

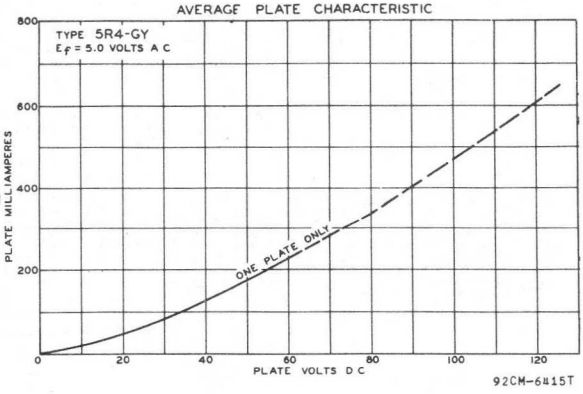
▲ Indicated values for conditions shown will limit peak plate current to max. rated value. When a filter-input capacitor larger than 4 μf is used, it may be necessary to use more plate-supply impedance than the value shown to limit the peak plate current to the rated value.

* Values are approximate.

→ Indicates a change.

5R4-GY
FULL-WAVE VACUUM RECTIFIER





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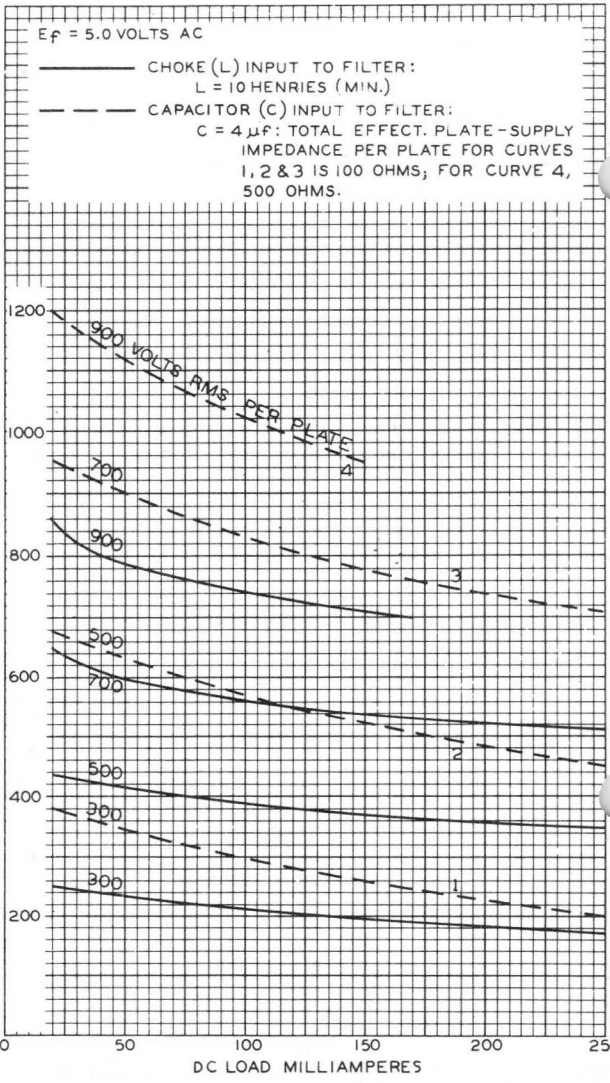
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

5R4-GY

5R4-GY

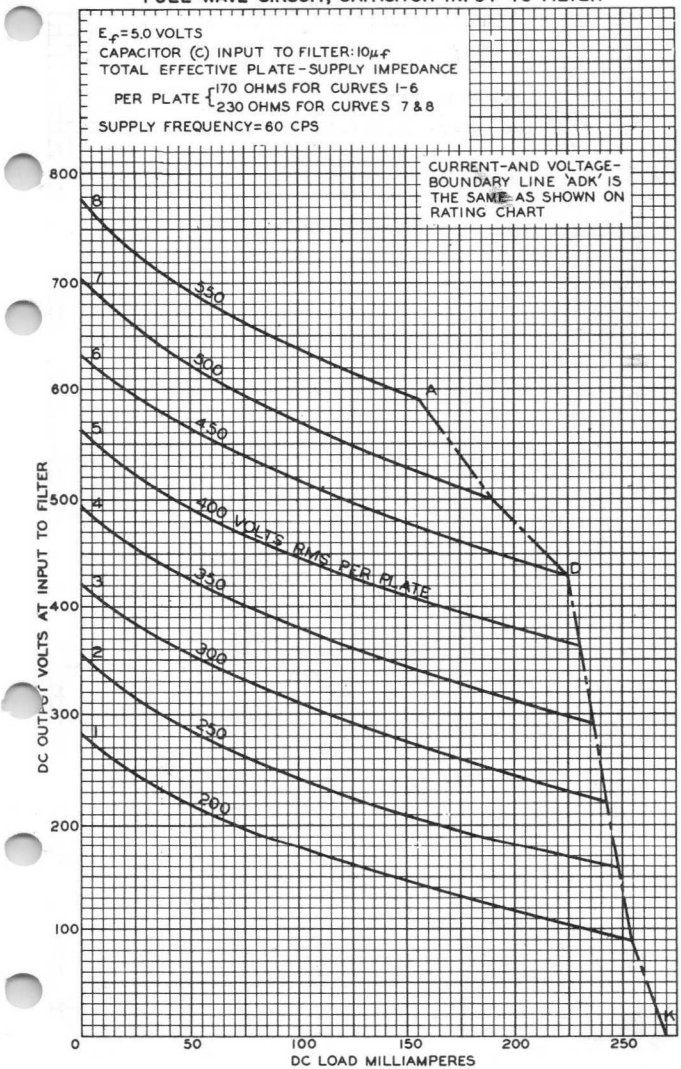
OPERATION CHARACTERISTICS



RCA

5U4-G

OPERATION CHARACTERISTICS
FULL-WAVE CIRCUIT, CAPACITOR INPUT TO FILTER



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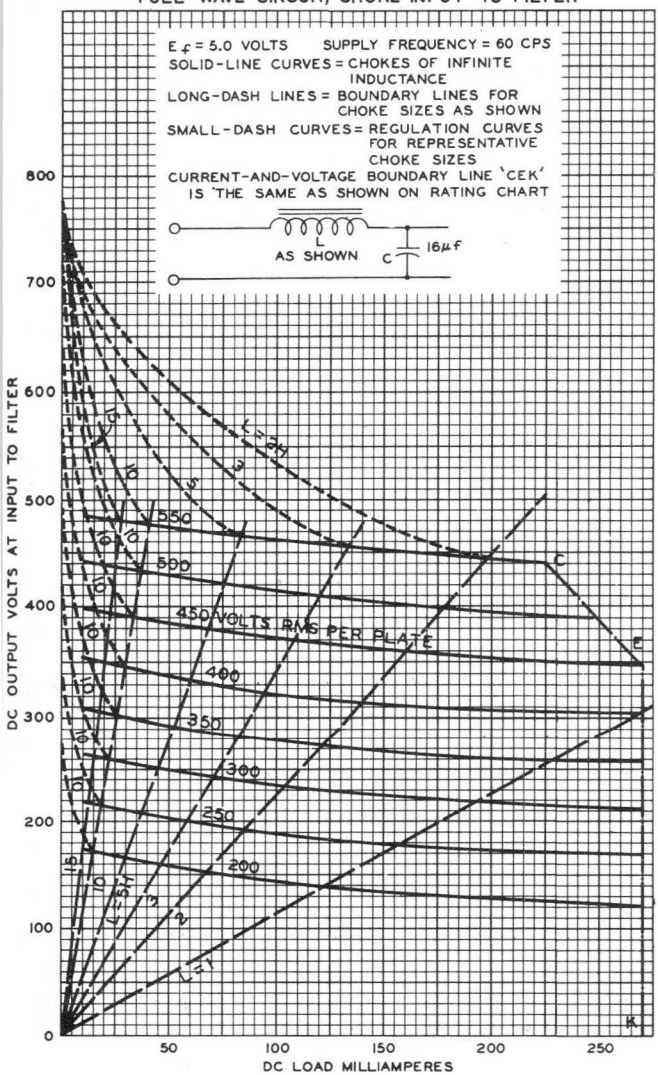
RCA

5U4-G

OPERATION CHARACTERISTICS
FULL-WAVE CIRCUIT, CHOKE INPUT TO FILTER



JULY 25, 1950

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7496

5U4-GB

FULL-WAVE VACUUM RECTIFIER

GENERAL DATA

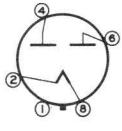
Electrical:

Filament, Coated:		
Voltage	5	ac volts
Current	3	amp

Mechanical:

Mounting Position	Vertical, base up or down, or Horizontal with pins 2 and 4 in vertical plane
Maximum Overall Length	4-3/4"
Maximum Seated Length	4-3/16"
Maximum Diameter	1-23/32"
Bulb	T-12
Base	Flared Medium-Shell Octal 5-Pin with External Barriers (JETEC No.B5-127) or Short Medium-Shell Octal 5-Pin with External Barriers (JETEC No.B5-121)
Basing Designation for BOTTOM VIEW	G-5T

Pin 1 - No Connection
Pin 2 - Filament
Pin 4 - Plate No.2



Pin 6 - Plate No.1
Pin 8 - Filament

FULL-WAVE RECTIFIER

Maximum Ratings, *Design-Center Values:*

PEAK INVERSE PLATE VOLTAGE	1550 max.	volts
PEAK PLATE CURRENT PER PLATE	1 max.	amp
AC PLATE SUPPLY VOLTAGE (RMS) PER PLATE	*See Rating Chart I*	
DC OUTPUT CURRENT PER PLATE	*See Rating Chart I*	
HOT-SWITCHING TRANSIENT PLATE CURRENT PER PLATE	*See Operating Considerations*	

Typical Operation with Capacitor-Input to Filter:

AC Plate-to-Plate Supply Voltage (RMS)	600	900	1100	volts
Filter-Input Capacitor▲	40	40	40	μf
Total Effective Plate-Supply Impedance Per Plate	21	67	97	ohms
DC Output Voltage at Input to Filter (Approx.):				
At full-load current of 300 ma	290	–	–	volts
275 ma	–	460	–	volts
162 ma	–	–	630	volts

▲ When capacitance values higher than 40 uf are used, the effective plate-supply impedance should be increased so that the maximum rating for peak plate current is not exceeded.

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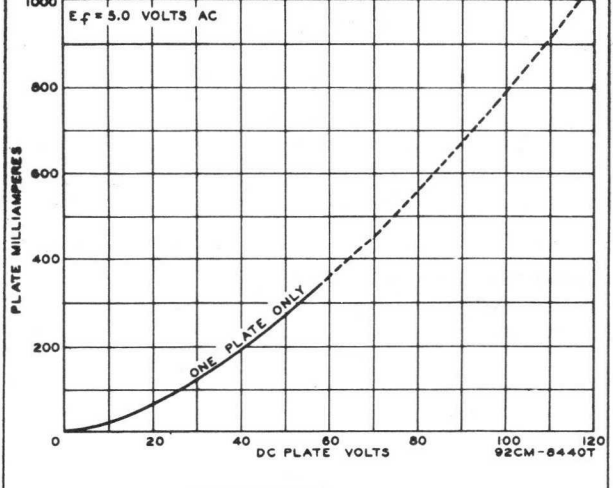
FULL-WAVE VACUUM RECTIFIER

DC Output Voltage at Input to Filter (Approx.):				
At half-load current of 150 ma .	335	–	–	volts
137.5 ma .	–	520	–	volts
81 ma .	–	–	680	volts
Voltage Regulation (Approx.):				
Half-load to full-load current .	45	60	50	volts

Typical Operation with Choke-Input to Filter:

AC Plate-to-Plate Supply Voltage (RMS)	900	1100	volts
Filter-Input Choke	10	10	henries
DC Output Voltage at Input to Filter (Approx.):			
At full-load current of 348 ma	340	–	volts
275 ma	–	440	volts
At half-load current of 174 ma	355	–	volts
137.5 ma	–	455	volts
Voltage Regulation (Approx.):			
Half-load to full-load current	15	15	volts

AVERAGE PLATE CHARACTERISTIC



OPERATING CONSIDERATIONS

Even occasional *hot-switching* with capacitor-input circuits permits the flow of plate current having magnitudes which can adversely affect tube life and reliability. If

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FULL-WAVE VACUUM RECTIFIER

capacitor-input circuits are to be used, it is essential that the tube be protected against the possible adverse effects of hot-switching. The tube can be protected by circuits, designed to incorporate sufficient plate-supply resistance, as determined from Rating Chart III, to limit the maximum peak current value per plate to 4.6 amperes during the initial cycles of hot-switching operation. For applications in which hot-switching is required, choke-input circuits are recommended. Such circuits limit the hot-switching current to a value no higher than that of the peak plate current.

RATING CHARTS AND OPERATION CHARACTERISTICS

Rating Chart I represents graphically the relationships between maximum ac voltage input and maximum dc output current derived from the fundamental ratings for conditions of capacitor-input and choke-input filters. This graphical presentation gives the equipment designer considerable latitude in choice of operating conditions.

Rating Chart II represents graphically the relationship between maximum rectification efficiency and maximum dc output current per plate for conditions of capacitor-input to filter.

A choice of operating values of dc output current per plate and rectification efficiency should be made such that they fall within the area of permissible operation to insure that the maximum peak plate current will not be exceeded. If the operating values chosen fall outside the permissible operating area, a different choice of parameters should be made. For a given value of ac voltage input and dc output current, it is possible to reduce the rectification efficiency by either increasing the plate-supply resistance per plate or by using a smaller value of input filter capacitor.

Rating Chart III represents graphically the relationships between minimum plate-supply resistance per plate and maximum ac plate-supply voltage per plate under no-load conditions of capacitor-input filter when occasional hot-switching is employed.

If occasional hot-switching is required with capacitor-input circuits, it is important to protect the tube and the circuits against the flow of plate currents having magnitude in excess of the maximum permissible hot-switching current of 4.6 amperes. To limit the hot-switching current, adequate series plate-supply resistance per plate is necessary. The minimum value of this resistance may be determined from Rating Chart III. If the transformer windings do not provide this minimum value of resistance, then additional dc series resistance is required. The value of this dc resistance, R_A, may be determined from the relationship shown in the legend for Rating Chart III.

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FULL-WAVE VACUUM RECTIFIER

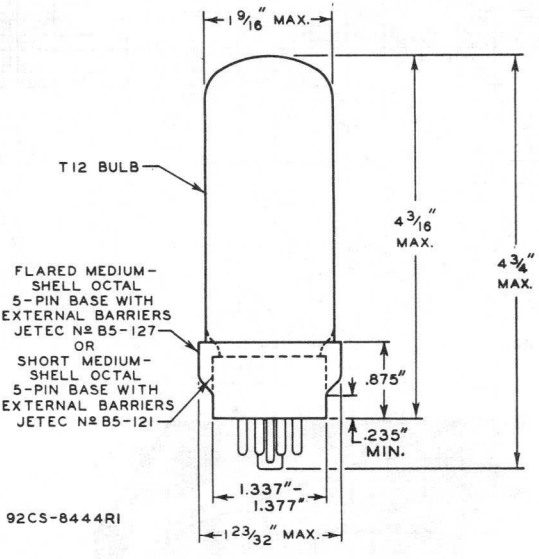
If appreciable series inductance is present in the plate supply, a value of series plate-supply resistance smaller than that indicated by the curve may be employed provided it is experimentally determined that the combined effect of inductance and plate-supply resistance used are adequate to limit the hot-switching current to the indicated maximum value.

The *Operation Characteristics for Full-Wave Circuit with Capacitor-Input to Filter* show the usual typical operating curves for a full-wave rectifier with capacitor-input filter. In addition, they show by means of the boundary line "AED" the limiting current and voltage relationships presented in Rating Chart I. A choice of operating values to the left of the boundary line should be made such that the operation of the tube at these values will insure that the maximum ratings will not be exceeded.

The *Operation Characteristics for Full-Wave Circuit with Choke-Input to Filter* show the usual typical operating curves for a full-wave rectifier with choke-input filter. They not only show by means of boundary line "ABC" the limiting current and voltage relationships presented in Rating Chart I, but also give information as to the effect of various sizes of chokes on regulation. The solid-line curves show the dc voltage outputs which would be obtained if the filter chokes had infinite inductance. The long-dash lines radiating from the zero position are boundary lines for various sizes of chokes as indicated. The intersection of one of these lines with a solid-line curve indicates the point on the curve at which the choke no longer behaves as though it had infinite inductance. To the left of the choke boundary line, the regulation curves depart from the solid-line curves as shown by the representative short-dash regulation curves. It will be noted that regulation improves with an increase in value of choke inductance, but for cost reasons, the value of inductance is usually held to the smallest value which will give the desired regulation over the operating current range. It is also to be noted that at the lower load currents, higher values of inductance are required to maintain good regulation. A choice of operating values to the left of the boundary line "ABC" should be made such that operation of the tube at these values will insure that the maximum ratings are not exceeded.

5U4-GB

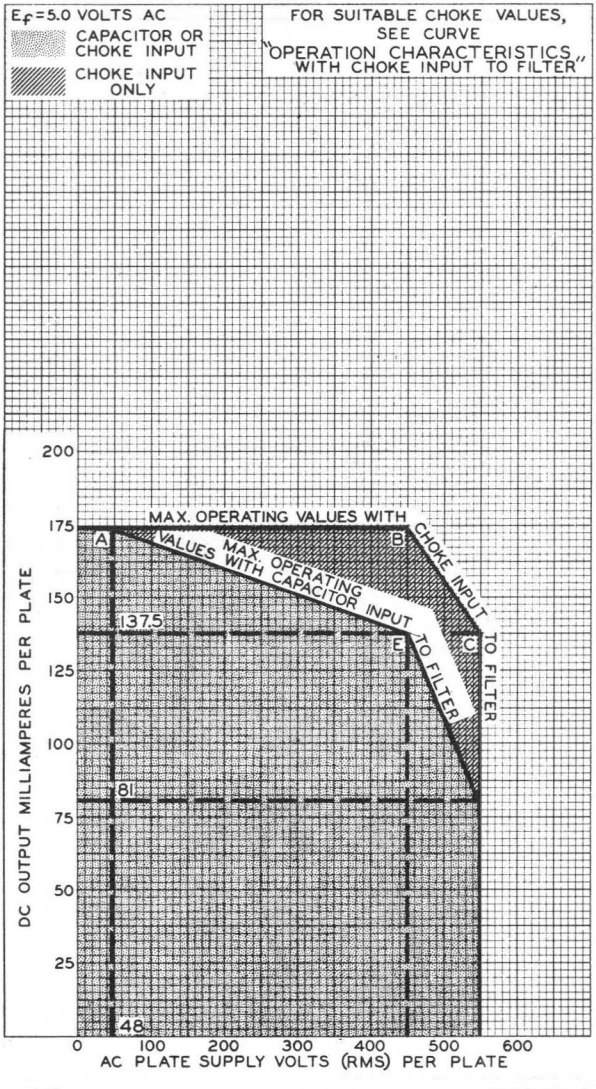
FULL-WAVE VACUUM RECTIFIER



RCA

5U4-GB

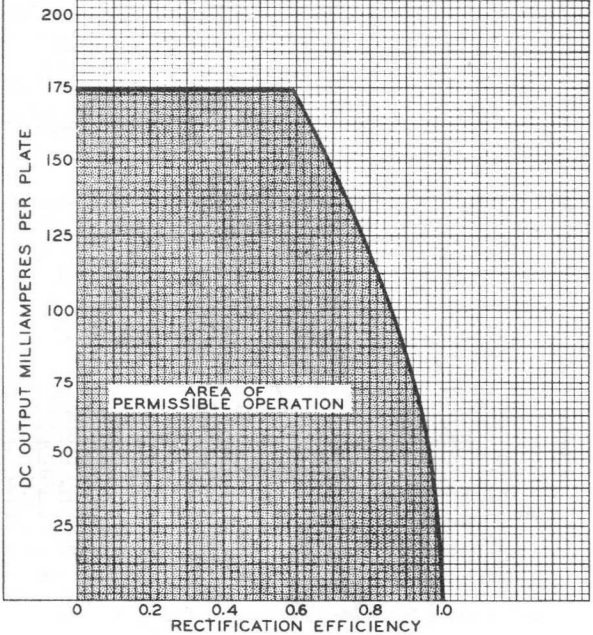
RATING CHART I



5U4-GB

RATING CHART II
CAPACITOR INPUT TO FILTER

E_f = 5.0 VOLTS AC
MAX. PEAK PLATE CURRENT PER PLATE = 1 AMP.
RECTIFICATION EFFICIENCY = $\frac{\overline{E}}{\sqrt{2}\,E_S}$
WHERE $\overline{E}$ = DC OUTPUT VOLTS AT INPUT TO FILTER
E_S = AC PLATE SUPPLY VOLTS (RMS) PER PLATE



RCA

5U4-GB

RATING CHART III
CAPACITOR INPUT TO FILTER

E_f = 5.0 VOLTS AC MAX. HOT-SWITCHING CUR. = 4.6 AMP.

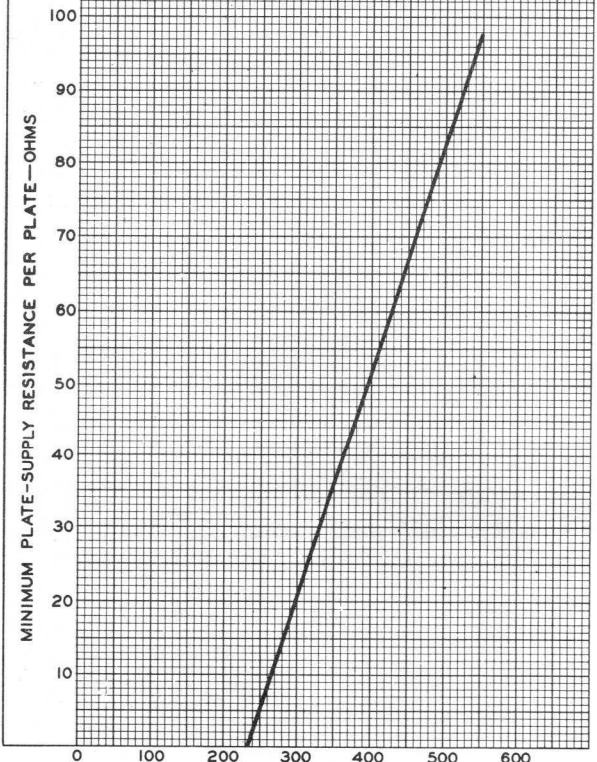
PLATE-SUPPLY RESISTANCE PER PLATE = $R_{SEC.} + N^2 R_{PRI.} + R_A$

WHERE $R_{SEC.}$ = DC RESISTANCE OF TRANSFORMER SECONDARY PER SECTION

$R_{PRI.}$ = DC RESISTANCE OF TRANSFORMER PRIMARY

R_A = DC RESISTANCE OF ADDED SERIES RESISTANCE PER PLATE

N = TRANSFORMER VOLTAGE STEP-UP RATIO PER SECTION



RCA

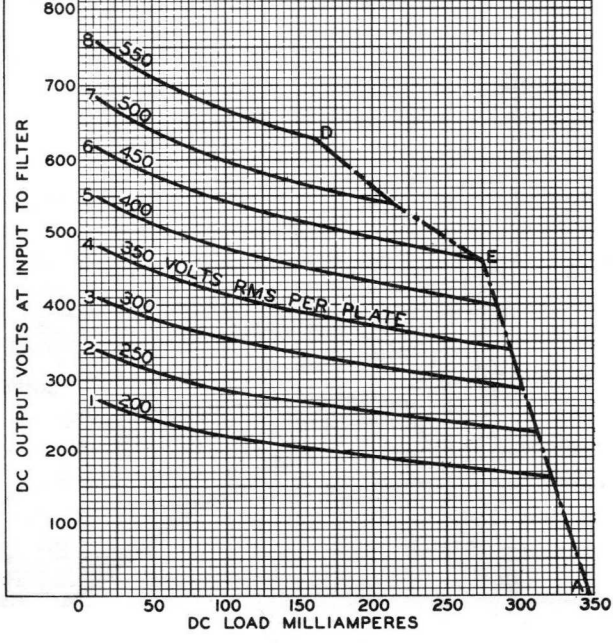
5U4-GB

OPERATION CHARACTERISTICS
FULL-WAVE CIRCUIT, CAPACITOR INPUT TO FILTER

E_f = 5.0 VOLTS AC
SUPPLY FREQUENCY = 60 CPS
CAPACITOR (C) INPUT TO FILTER: 40 μf
TOTAL EFFECTIVE PLATE-SUPPLY IMPEDANCE

PER PLATE	CURVE	1	2	3	4	5	6	7	8
	OHMS	11	11	20	36	52	67	82	97

CURRENT-AND VOLTAGE BOUNDARY LINE 'DEA' IS THE SAME AS SHOWN ON RATING CHART I



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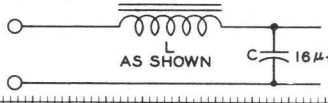
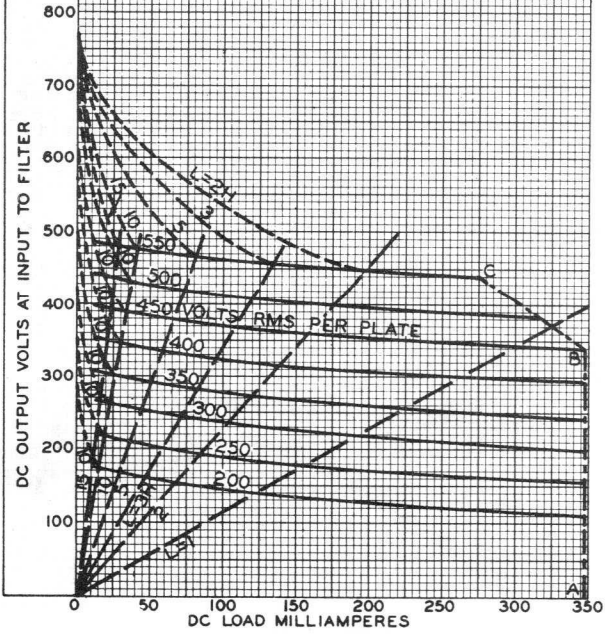
5U4-GB

OPERATION CHARACTERISTICS
FULL-WAVE CIRCUIT, CHOKE INPUT TO FILTER

E_f = 5.0 VOLTS AC SUPPLY FREQUENCY = 60 CPS
SOLID-LINE CURVES = CHOKES OF INFINITE INDUCTANCE
LONG-DASH LINES = BOUNDARY LINES FOR CHOKE SIZES AS SHOWN
SHORT-DASH CURVES = REGULATION CURVES FOR REPRESENTATIVE CHOKE SIZES
CURRENT-AND-VOLTAGE BOUNDARY LINE 'CBA' IS THE SAME AS SHOWN ON RATING CHART I





TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

5V3

FULL-WAVE VACUUM RECTIFIER

GENERAL DATA

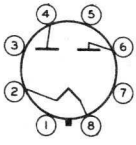
Electrical:

Filament, Coated:		
Voltage (AC or DC)	5	volts
Current	3.8	amp

Mechanical:

Operating Position	Vertical, or Horizontal with pins 2 and 4 in vertical plane
Maximum Overall Length	4-5/8"
Maximum Seated Length	4-1/16"
Diameter	1.438" to 1.562"
Bulb	T12
Base	Short Medium-Shell Octal 8-Pin with External Barriers, Style B (JEDEC Group 1, No.B8-118)
Basing Designation for BOTTOM VIEW	5T

Pin 1 – No Connection
Pin 2 – Filament
Pin 3 – Same as Pin 1
Pin 4 – Plate No.2



Pin 5 – Same as Pin 1
Pin 6 – Plate No.1
Pin 7 – Same as Pin 1
Pin 8 – Filament

FULL-WAVE RECTIFIER

Maximum Ratings, *Design-Center Values:*

For power-supply frequencies of 25 to 1000 cps

PEAK INVERSE PLATE VOLTAGE	1400 max.	volts
AC PLATE SUPPLY VOLTAGE PER PLATE (RMS) *(See Rating Chart I)*	500 max.	volts
STEADY-STATE PLATE CURRENT PER PLATE *(See Rating Chart II)*	1.2 max.	amp
TRANSIENT PEAK PLATE CURRENT PER PLATE *(See Rating Chart III)*	5.5 max.	amp
DC OUTPUT CURRENT	*See Rating Chart I*	

Typical Operation:

	With capacitor input to filter		*With choke input to filter*	
AC Plate-to-Plate Supply Voltage (RMS)▲	600	850	1000	volts
Filter-Input Capacitor	40	40	–	μf
Filter-Input Choke	–	–	10	henries
Total Effective Plate Supply Impedance Per Plate	24	56	–	ohms
DC Output Voltage at input to filter	285	430	385	volts
DC Output Current	380	350	350	ma

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

5V3

FULL-WAVE VACUUM RECTIFIER

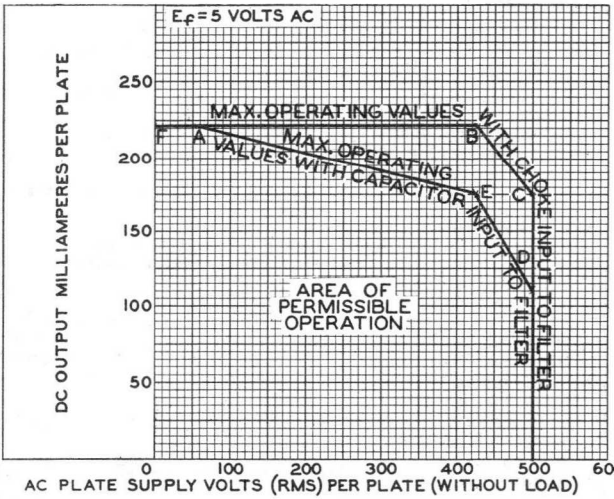
Characteristics:

Tube-Voltage Drop for plate ma. =350 (Per plate). 47 volts

▲ AC plate supply voltage is measured without load.

10-59 DATA

RATING CHART I



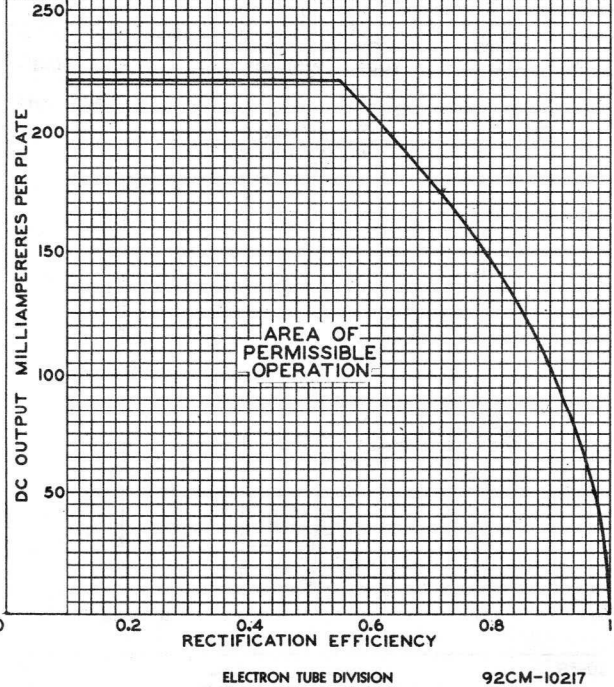
5V3

RATING CHART II
CAPACITOR INPUT TO FILTER

E_f = 5 VOLTS AC
STEADY-STATE PEAK PLATE CURRENT PER PLATE (AMPERES) = 1.2

RECTIFICATION EFFICIENCY = $\frac{\bar{E}}{\sqrt{2}\ E_S}$

WHERE $\bar{E}$ = DC OUTPUT VOLTS AT INPUT TO FILTER
E_S = AC PLATE SUPPLY VOLTS (RMS) PER PLATE (WITHOUT LOAD)

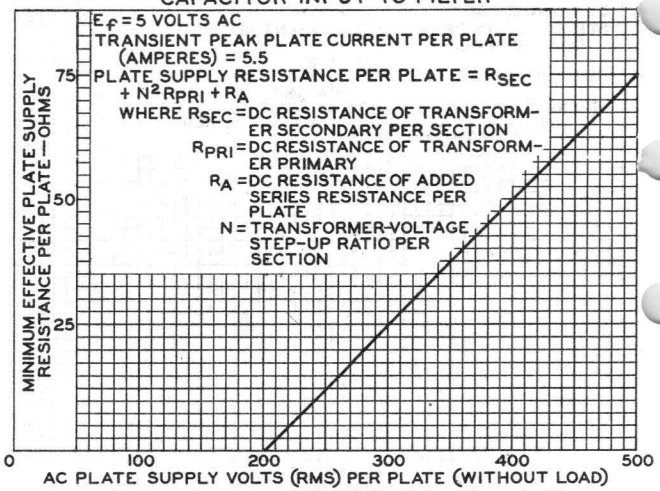


RCA

5V3

RATING CHART III

CAPACITOR INPUT TO FILTER



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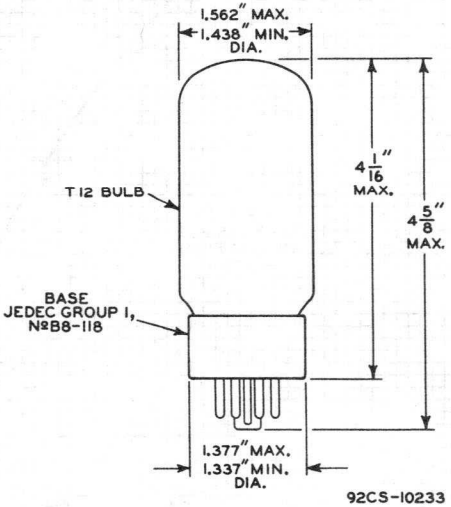


92CS-10233

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

5Y3-G, 5Y3-GT

FULL-WAVE VACUUM RECTIFIER

GENERAL DATA

Electrical:

Filament, Coated:

Voltage	5	ac volts
Current	2	amp

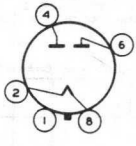
Mechanical:

Mounting Position . . . . 'Vertical, or Horizontal with pins 2 and 8 in horizontal plane

	5Y3-G	5Y3-GT
Maximum Overall Length	4-5/8"	3-3/8"
Maximum Seated Length	4-1/16"	2-13/16"
Maximum Diameter	1-13/16"	1-5/16"
Bulb	ST-14	T-9
Base	Med.-Shell Octal 5-Pin	Inter.-Shell Octal 5-Pin

Basing Designation for BOTTOM VIEW G-5T

Pin 1 – No Connection
Pin 2 – Filament
Pin 4 – Plate No.2
Pin 6 – Plate No.1
Pin 8 – Filament



FULL-WAVE RECTIFIER

Maximum Ratings, ***Design-Center Values****

PEAK INVERSE PLATE VOLTAGE	1400 max.	volts
PEAK PLATE CURRENT PER PLATE	400 max.	ma
AC PLATE SUPPLY VOLTAGE (RMS) PER PLATE	See Rating Chart	
DC OUTPUT CURRENT PER PLATE	See Rating Chart	
HOT-SWITCHING TRANSIENT PLATE CURRENT PER PLATE For duration of 0.2 second maximum	2.2 max.	amp

Typical Operation with Capacitor-Input Filter:

AC Plate-to-Plate Supply Voltage (RMS)	700	1000	volts
Filter-Input Capacitor	10	10	μf
Total Effect. Plate-Supply Impedance Per Plate	50	140	ohms
DC Output Voltage at Input to Filter (Approx.):			
At Half-Load Cur. of 62.5 ma.	390	–	volts
At Half-Load Cur. of 42 ma.	–	610	volts
At Full-Load Cur. of 125 ma.	350	–	volts
At Full-Load Cur. of 84 ma.	–	560	volts
Voltage Regulation, Half-Load to Full-Load Current (Approx.)	40	50	volts

5Y3-G, 5Y3-GT

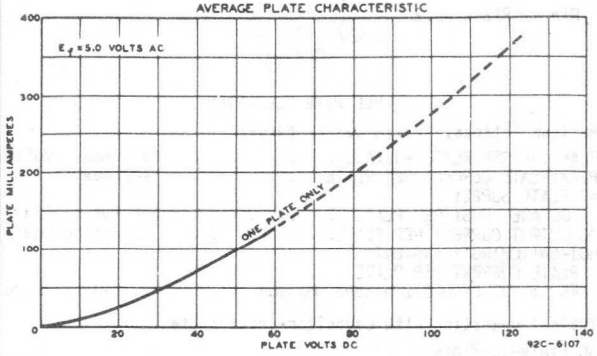
FULL-WAVE VACUUM RECTIFIER

Typical Operation with Choke-Input Filter:

AC Plate-to-Plate Supply Voltage (RMS)	700	1000	volts
Filter-Input Choke	10*	10**	henries
DC Output Voltage at Input to Filter (Approx.):			
At Half-Load Cur. of 75 ma.	270		volts
At Half-Load Cur. of 62.5 ma.	–	405	volts
At Full-Load Cur. of 150 ma.	245		volts
At Full-Load Cur. of 125 ma.	–	390	volts
Voltage Regulation, Half-Load to Full-Load Current (Approx.)	25	15	volts

* This value is adequate to maintain optimum regulation in the region to the right of line L=10H on curve OPERATION CHARACTERISTICS With Choke-Input to Filter, provided the load current is not less than 35 ma. For load currents less than 35 ma., a larger value of inductance is required for optimum regulation.

** This value is adequate to maintain optimum regulation in the region to the right of line L=10H on curve OPERATION CHARACTERISTICS With Choke-Input to Filter, provided the load current is not less than 50 ma. For load currents less than 50 ma., a larger value of inductance is required for optimum regulation.



RATING CHART AND OPERATION CHARACTERISTICS

The *Rating Chart* presents graphically the relationships between maximum ac voltage input and maximum dc output current derived from the fundamental ratings for conditions of capacitor-input and choke-input filters. This graphical presentation gives the equipment designer considerable latitude in choice of operating conditions.

The *Operation Characteristics for Full-Wave Circuit with Capacitor-Input Filter* show not only the typical operating curves for such a circuit, but also show by means of boundary lines "ADK" the limiting current and voltage relation-

5Y3-G, 5Y3-GT

FULL-WAVE VACUUM RECTIFIER

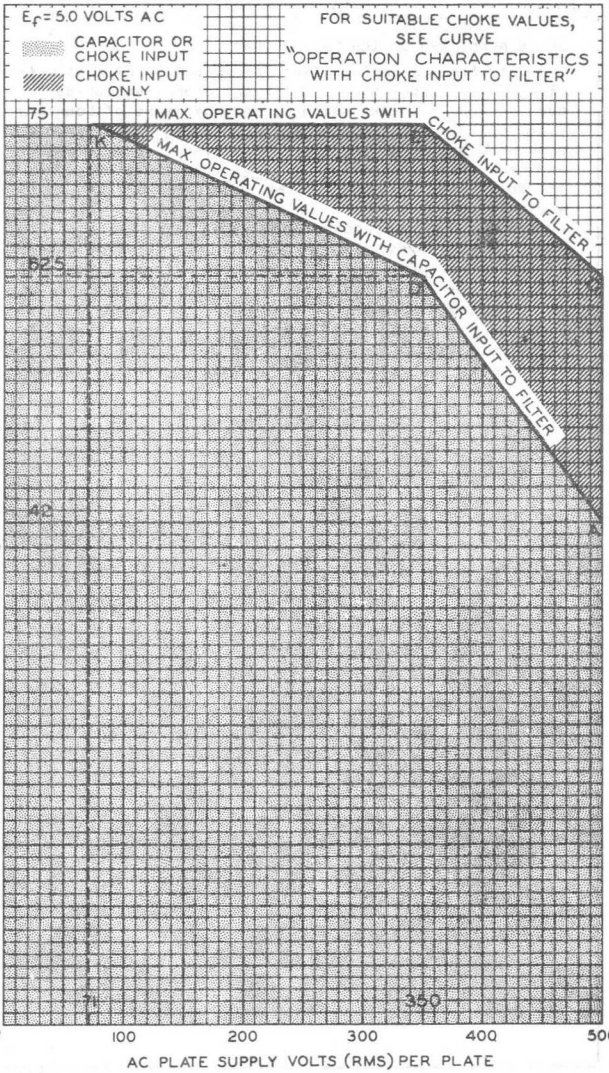
ships presented on the Rating Chart.

The *Operation Characteristics for Full-Wave Circuit with Choke-Input Filter* show the typical operating curves for such a circuit. They not only show by means of boundary line "CEK" the limiting current and voltage relationships presented on the *Rating Chart*, but also give information as to the effect on regulation of various sizes of chokes. The solid-line curves show the dc voltage outputs which would be obtained if the filter chokes had infinite inductance. The long-dash lines radiating from the zero position are boundary lines for various sizes of chokes as indicated. The intersection of one of these lines with a solid-line curve indicates the point on the curve at which the choke no longer behaves as though it had infinite inductance. To the left of the choke boundary line, the regulation curves depart from the solid-line curves as shown by the representative short-dash regulation curves.

5Y3-GT

5Y3-GT

RATING CHART



NOV. 1, 1949

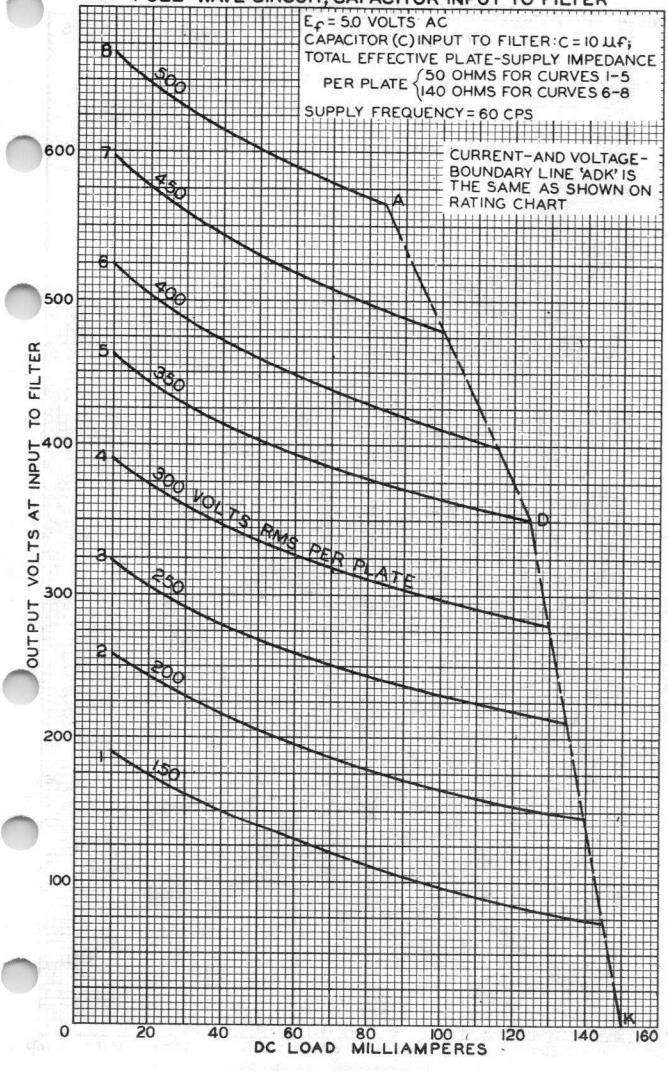
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7396

RCA

5Y3-GT

OPERATION CHARACTERISTICS
FULL-WAVE CIRCUIT, CAPACITOR INPUT TO FILTER

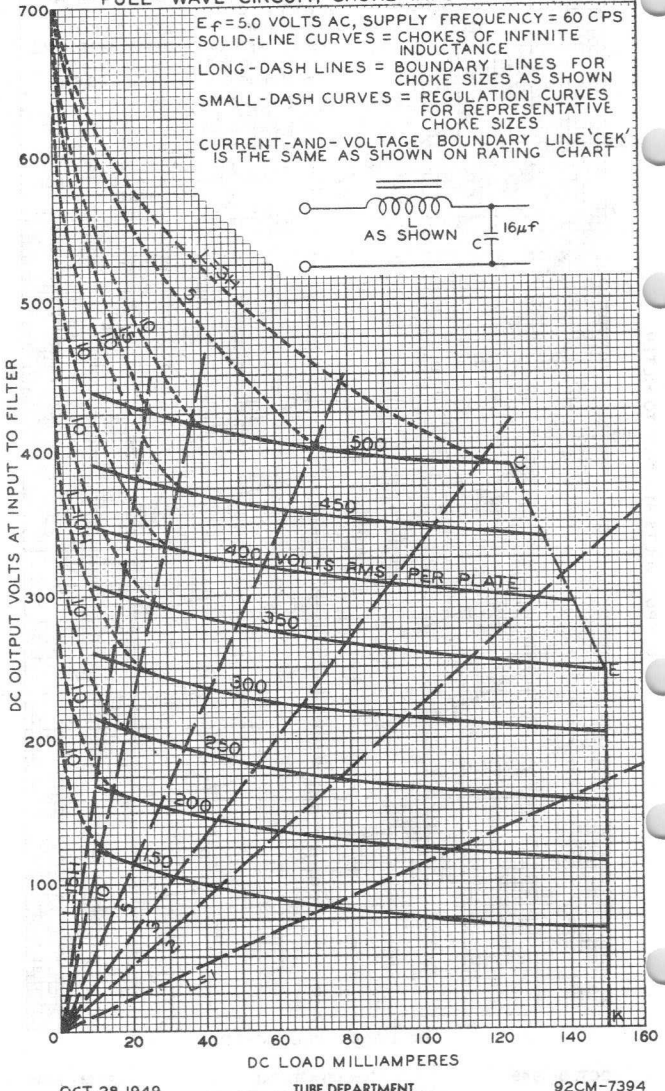


RCA

5Y3-GT

OPERATION CHARACTERISTICS

FULL-WAVE CIRCUIT, CHOKE INPUT TO FILTER



5Y4-G

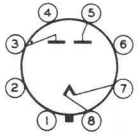
FULL-WAVE VACUUM RECTIFIER

The 5Y4-G is the same as the 5Y3-G except for the following items:

Mechanical:

Mounting Position . . . . . Vertical, base up or down, or Horizontal with pins 2 and 7 in horizontal plane
Base . . . . . Medium-Shell Octal 8-Pin (JETEC No.B8-11)
Basing Designation for BOTTOM VIEW. 5Q

Pin 1 – No Connection
Pin 2 – No Connection
Pin 3 – Plate No.2
Pin 4 – No Connection



Pin 5 – Plate No.1
Pin 6 – No Connection
Pin 7 – Filament
Pin 8 – Filament

5Y4-GT

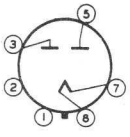
FULL-WAVE VACUUM RECTIFIER

The 5Y4-GT is the same as the 5Y3-GT except for the following items:

Mechanical:

Mounting Position . . . . . Vertical, base up or down, or Horizontal with pins 2 and 7 in horizontal plane
Base . . . . Intermediate-Shell Octal 6-Pin (JETEC No.B6-8), or Short Intermediate-Shell Octal 6-Pin (JETEC No.B6-48)
Basing Designation for BOTTOM VIEW 5Q

Pin 1 – No Connection
Pin 2 – No Connection



Pin 3 – Plate No.2
Pin 5 – Plate No.1
Pin 7 – Filament
Pin 8 – Filament

5Z3

5Z3

FULL-WAVE VACUUM RECTIFIER

The 5Z3 is the same as the 5U4-G except for the following items:

Mechanical:

Mounting Position. . . . . .Vertical, base up or down, or Horizontal with pins 1 and 4 in horizontal plane

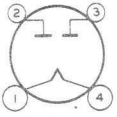
Maximum Overall Length . . . . . 5-3/8"

Base . . . . . Medium-Shell Small 4-Pin (JETEC No.A4-9)

Basing Designation for BOTTOM VIEW 4C

Pin 1 - Filament

Pin 2 - Plate No.2



Pin 3 - Plate No.1

Pin 4 - Filament

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6AF4-A

MEDIUM-MU TRIODE

MINIATURE TYPE

For UHF TV service

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:			
Voltage	6.3		ac or dc volts
Current	0.225		amp
Resonant Frequency (Approx.)	1000		Mc
Direct Interelectrode Capacitances (No external shield):			
Grid to Plate	1.9		μμf
Grid to Cathode and Heater	2.2		μμf
Plate to Cathode and Heater	0.45		μμf

Characteristics - Class A_1 Amplifier:

Plate Voltage	80	100	volts
Cathode-Bias Resistor	150	150	ohms
Amplification Factor	15	16	
Plate Resistance	2270	2130	ohms
Transconductance	6600	7500	μmhos
Plate Current	16	20	ma

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 (JETEC No.E7-1)
Basing Designation for BOTTOM VIEW	7DK

Pin 1 - Plate
Pin 2 - Grid
Pin 3 - Heater
Pin 4 - Heater



Pin 5 - Cathode
Pin 6 - Grid
Pin 7 - Plate

OSCILLATOR IN UHF TELEVISION RECEIVERS

Maximum Ratings, *Design-Center Values*:

DC PLATE VOLTAGE	150 max.	volts
DC GRID VOLTAGE	-50 max.	volts
DC GRID CURRENT	8 max.	ma
PLATE INPUT	2.5 max.	watts
PLATE DISSIPATION	2.25 max.	watts
DC CATHODE CURRENT	28 max.	ma
PEAK HEATER-CATHODE VOLTAGE:♦		
Heater negative with respect to cathode	50 max.	volts
Heater positive with respect to cathode	50▲max.	volts

▲,♦: See next page.

6AF4-A

MEDIUM-MU TRIODE

Typical Operation as Oscillator at 950 Mc:

DC Plate Voltage	100	volts
DC Grid Voltage	-4	volts
From a grid resistor of	10000	ohms
DC Plate Current	22	ma
DC Grid Current (Approx.)	400	μamp
Useful Power Output	160	mw

Maximum Circuit Values:

Grid-Circuit Resistance:

For fixed-bias operation	Not recommended
For cathode-bias operation	0.5 max. megohm

♦ It is recommended that the heater be kept at cathode potential to minimize the effects of variation in the heater-to-cathode capacitance between tubes.

▲ The dc component must not exceed 25 volts.

OPERATING CONSIDERATIONS

The *mounting arrangement* should insure that the tube is held secure by its socket. Unless this recommendation is followed, the generated frequency may change by as much as 10 megacycles per second. A conventional miniature tube shield and an external clamping arrangement are recommended.

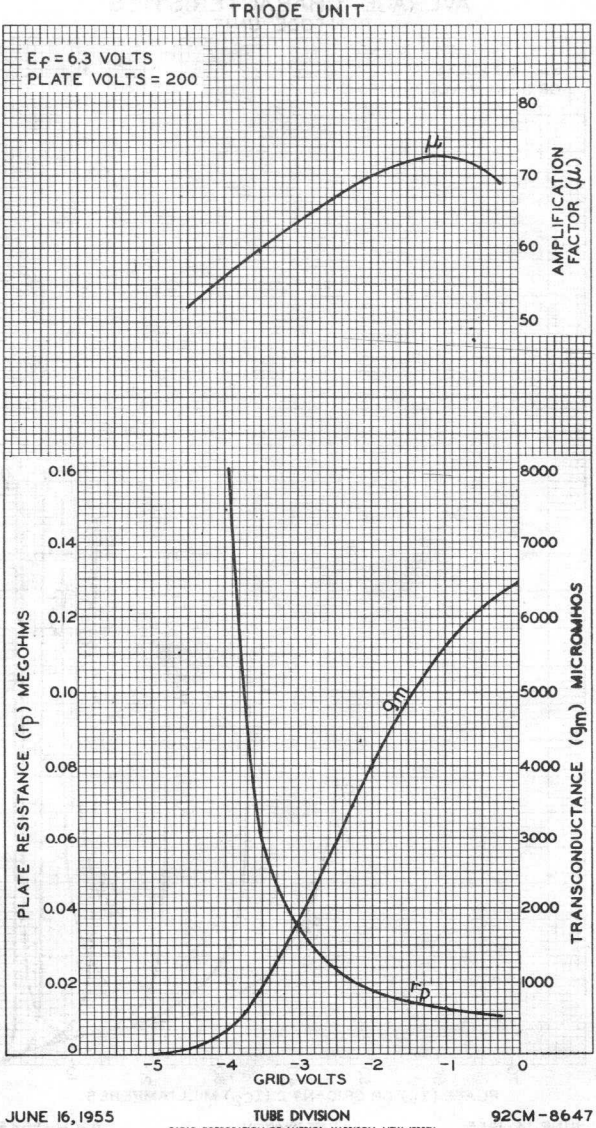
The *base pins* of the 6AF4-A fit the miniature 7-contact socket. The *socket* should be of the mica-filled, rubber, or ceramic type

RCA

6AW8

AVERAGE CHARACTERISTICS

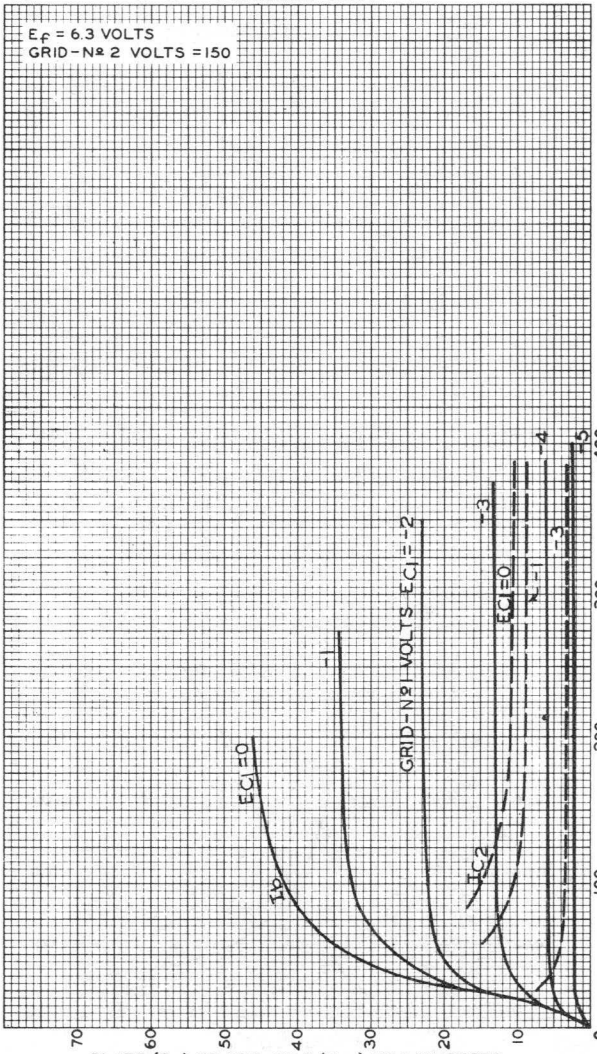
TRIODE UNIT



6AW8

6AW8

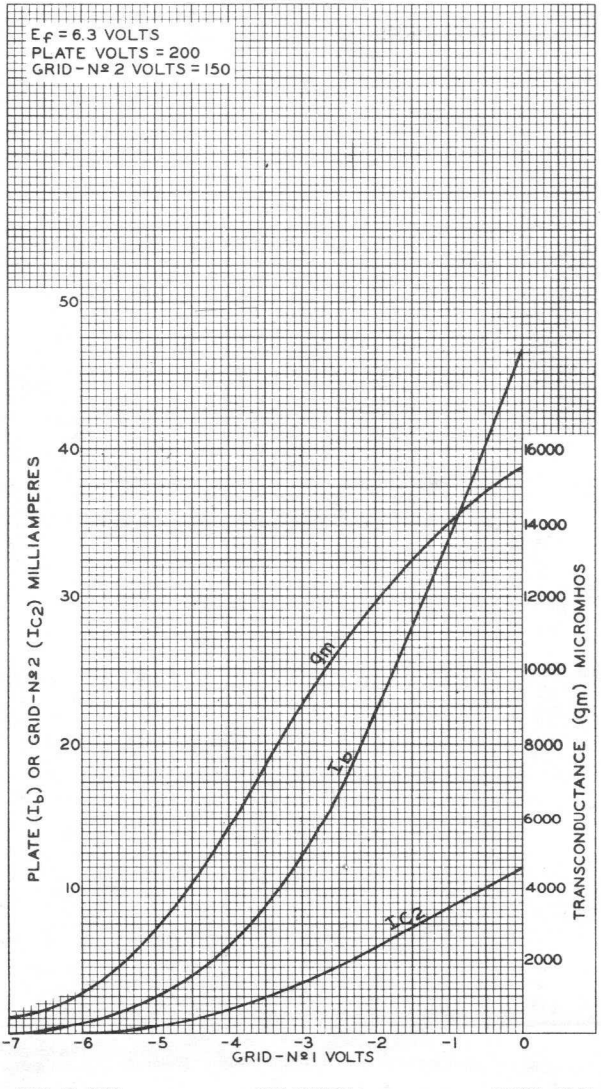
AVERAGE CHARACTERISTICS
PENTODE UNIT



RCA

6AW8

AVERAGE CHARACTERISTICS
PENTODE UNIT



Half-Wave Vacuum Rectifier

For Television Damper Service

GENERAL DATA

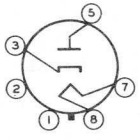
Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	1.2	amp
Direct Interelectrode Capacitances (Approx.):[a]		
Plate to cathode and heater	5	μμf
Cathode to plate and heater	8.5	μμf
Heater to cathode	4	μμf

Mechanical:

Operating Position	Any
Maximum Overall Length	3-5/16"
Maximum Seated Length	2-3/4"
Maximum Diameter	1-9/32"
Dimensional Outline	See *General Section*
Bulb	T9
Base	Intermediate-Shell Octal 5-Pin, Arrangement 2 (JEDEC Group 1, No.B5-82), Intermediate-Shell Octal 5-Pin with External Barriers, Arrangement 2 (JEDEC Group 1, No.B5-147), Short Intermediate-Shell Octal 5-Pin with External Barriers, Arrangement 2 (JEDEC Group 1, No.B5-85), or Short Intermediate-Shell Octal 6-Pin with External Barriers, Arrangement 1 (JEDEC Group 1, No.B6-60)
Basing Designation for BOTTOM VIEW	4CG

Pin 1[b] – Same as Pin 2
Pin 2 – Internal Connection—Do Not Use[c]



Pin 3 – Cathode
Pin 5 – Plate
Pin 7 – Heater
Pin 8 – Heater

DAMPER SERVICE

Maximum Ratings, *Design-Maximum Values:*

For operation in a 525-line, 30-frame system[d]

PEAK INVERSE PLATE VOLTAGE[e]	4400 max.	volts
PEAK PLATE CURRENT	825 max.	ma
DC PLATE CURRENT	137 max.	ma
PLATE DISSIPATION	5 max.	watts

← Indicates a change.

6AX4-GT

PEAK HEATER-CATHODE VOLTAGE:

Heater negative with respect to cathode.	4400[f] max.	volts
Heater positive with respect to cathode.	300[g] max.	volts

→Characteristics, Instantaneous Test Condition:

Tube Voltage Drop for plate ma. = 250. . .	32	volts

[a] Without external shield.

[b] On the 5-pin bases, pin 1 as well as pins 4 and 6 is omitted.

[c] Socket terminals 1, 2, 4 and 6 should not be used as tie points.

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

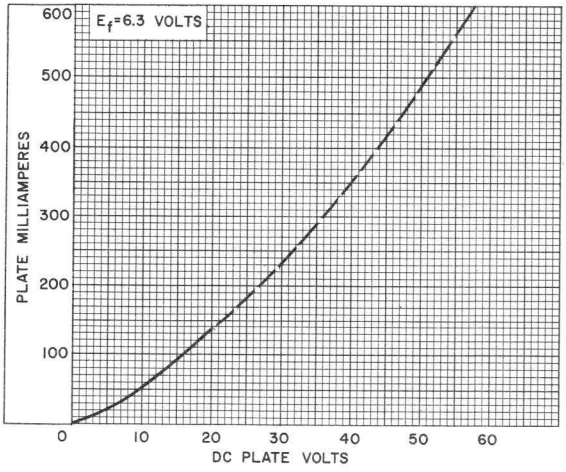
[e] This rating is applicable when the duty cycle of the voltage pulse does not exceed 15 per cent of one horizontal scanning cycle. In a 525-line, 30-frame system, 15 per cent of one horizontal scanning cycle is 10 microseconds.

[f] The dc component must not exceed 900 volts.

[g] The dc component must not exceed 100 volts.

→Indicates a change.

AVERAGE PLATE CHARACTERISTIC



92CS-7829

Twin Diode—High-Mu-Twin Triode

DUODECAR TYPE

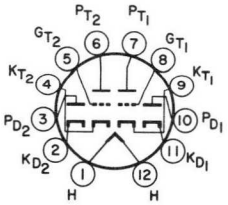
Electrical:

Heater Characteristics and Ratings:		
Voltage (AC or DC)	6.3 ± 0.6	volts
Current at heater volts = 6.3	0.690	amp
Peak heater-cathode voltage (Each unit):		
Heater negative with respect to cathode.	200 max.	volts
Heater positive with respect to cathode.	200[a] max.	volts
Direct Interelectrode Capacitances:[b]		
Each Diode Unit:		
P_D to (K_D,H)	2.0	pf
K_D to (P_D,H)	5.5	pf
Each Triode Unit:		
Grid to plate	2.2	pf
Input: G_T to (K_T,H)	2.0	pf
Output: P_T to (K_T,H)	0.22	pf
G_T to P_D	0.08 max.	pf
G_{T1} to G_{T2}	0.01 max.	pf
P_{T1} to P_{T2}	0.48	pf

Mechanical:

Operating Position	Any
Type of Cathodes	Coated Unipotential
Maximum Overall Length	1.875"
Seated Length	1.250" to 1.500"
Diameter	1.062" to 1.188"
Dimensional Outline	See *General Section*
Bulb	T9
Base	Small-Button Duodecar 12-Pin (JEDEC No.E12-70)
Basing Designation for BOTTOM VIEW	12DA

Pin 1 – Heater
Pin 2 – Cathode of Diode Unit No.2
Pin 3 – Plate of Diode Unit No.2
Pin 4 – Cathode of Triode Unit No.2
Pin 5 – Grid of Triode Unit No.2
Pin 6 – Plate of Triode Unit No.2
Pin 7 – Plate of Triode Unit No.1
Pin 8 – Grid of Triode Unit No.1
Pin 9 – Cathode of Triode Unit No.1
Pin 10 – Plate of Diode Unit No.1
Pin 11 – Cathode of Diode Unit No.1
Pin 12 – Heater



Characteristics, Class A_1 Amplifier (Each Triode Unit):

Plate Voltage	250	volts
Grid Voltage	-2.0	volts
Amplification Factor	100	
Plate Resistance (Approx.)	52700	ohms
Transconductance	1900	μmhos
Plate Current	1.2	ma

TRIODE UNITS — AMPLIFIER — Class A_1

Values are for Each Unit

Maximum Ratings, *Design-Maximum Values:*

Plate Voltage	330	volts
DC Grid Voltage:		
Negative	50	volts
Positive	0	volts
Plate Dissipation	1	watt

DIODE UNITS — Two

Values are for Each Unit

Maximum Ratings, *Design-Maximum Values:*

Plate Current	5 max.	ma

Characteristics, Instantaneous Value:

Plate Current for plate volts = 5	18	ma

[a] The dc component must not exceed 100 volts.
[b] without external shield.

6B7

TWIN DIODE—REMOTE-CUTOFF PENTODE

GENERAL DATA

Electrical:

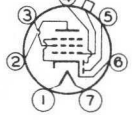
Heater, for Unipotential Cathode:		
Voltage	6.3	ac or dc volts
Current	0.3	amp
Direct Interelectrode Capacitances (Pentode Unit):		
Grid No.1 to Plate[o]	0.007 max.	μμf
Input	3.5	μμf
Output	9.5	μμf

[o] With external shield connected to cathode.

Mechanical:

Mounting Position	Any
Maximum Overall Length	4-17/32"
Seated Length	3-25/32" ± 1/8" ←
Maximum Diameter	1-9/16"
Bulb	ST-12
Cap	Small
Base	Small-Shell Small 7-Pin
Basing Designation for BOTTOM VIEW	7D

Pin 1 – Heater
Pin 2 – Pentode Plate
Pin 3 – Pentode Grid No.2
Pin 4 – Diode No.2 Plate



Pin 5 – Diode No.1 Plate
Pin 6 – Cathode, Pentode Grid No.3
Pin 7 – Heater
Cap – Pentode Grid No.1

PENTODE UNIT
AMPLIFIER – Class A_1

Maximum Ratings, *Design-Center Values*:

PLATE VOLTAGE	300 max.	volts
GRID-No.2 (SCREEN) VOLTAGE	125 max.	volts
GRID-No.2 SUPPLY VOLTAGE	300 max.	volts
GRID-No.1 (CONTROL-GRID) VOLTAGE:		
Positive bias value	0 max.	volts
PLATE DISSIPATION	2.25 max.	watts
GRID-No.2 DISSIPATION	0.3 max.	watt
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	90 max.	volts
Heater positive with respect to cathode	90 max.	volts

Characteristics:

Plate Voltage	100	180	250	250	volts
Grid-No.2 Voltage	100	75	100	125	volts
Grid-No.1 Voltage	-3	-3	-3	-3	volts
Plate Resistance (Approx.)	0.3	1.0	0.8	0.6	megohm
Transconductance	950	840	1000	1125	μmhos

(continued on next page)

←Indicates a change.

6B7

TWIN DIODE—REMOTE-CUTOFF PENTODE

Grid-No.1 Bias (Approx.) for Cathode-Current Cutoff . .	-17	-13	-17	-21	volts
Plate Current.	5.8	3.4	6	9	ma
Grid-No.2 Current.	1.7	0.9	1.5	2.3	ma

DIODE UNITS

Maximum Ratings, *Design-Center Values:*

→ PLATE CURRENT (For Each Diode) . . . . . 1.0 max. ma

Diode Considerations:

See front of this Section.

For additional data, refer to RESISTANCE-COUPLED AMPLIFIER CHARTS at the front of this Section.

The curve shown under type 2B7 also applies to the pentode unit of the 6B7.

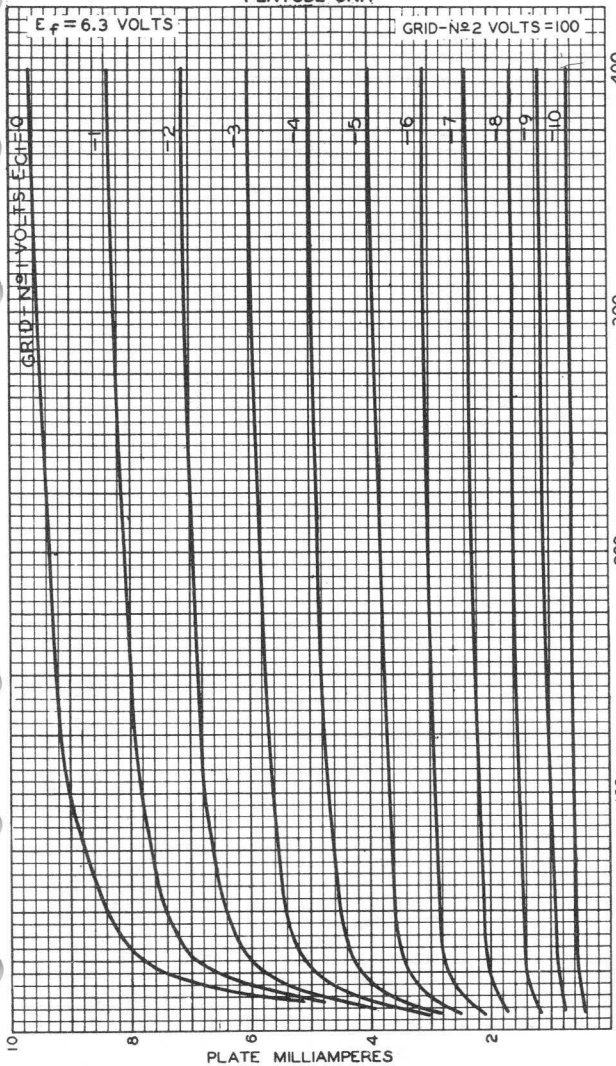
→ Indicates a change.

RCA

6B7

AVERAGE PLATE CHARACTERISTICS

PENTODE UNIT



FEB. 17, 1938

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-4880

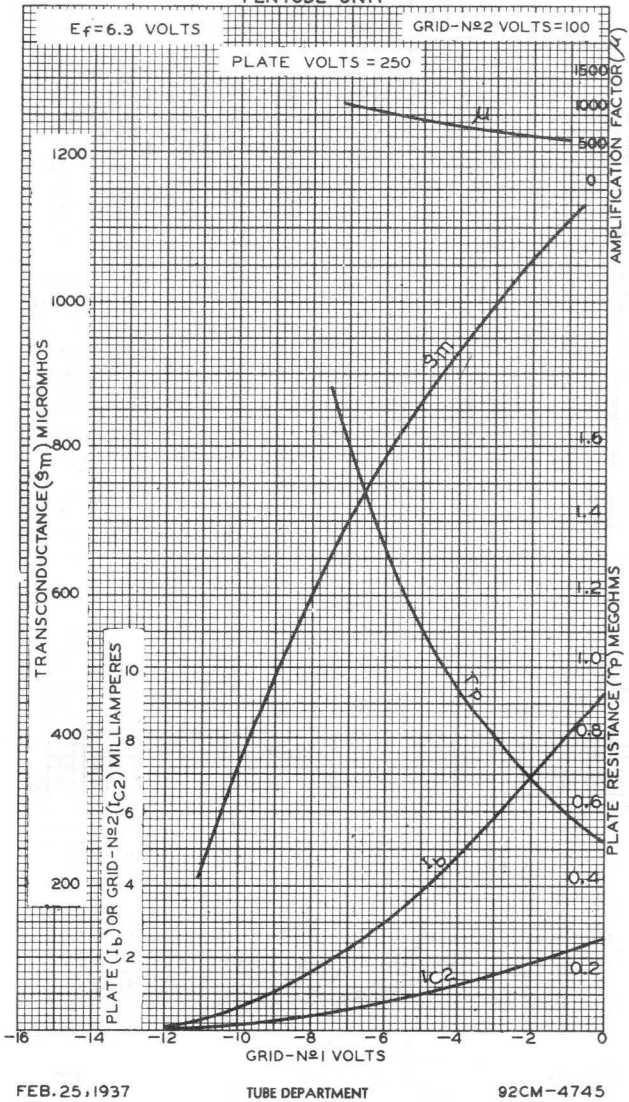
6B7

RCA

6B7

AVERAGE CHARACTERISTICS

PENTODE UNIT



FEB. 25, 1937

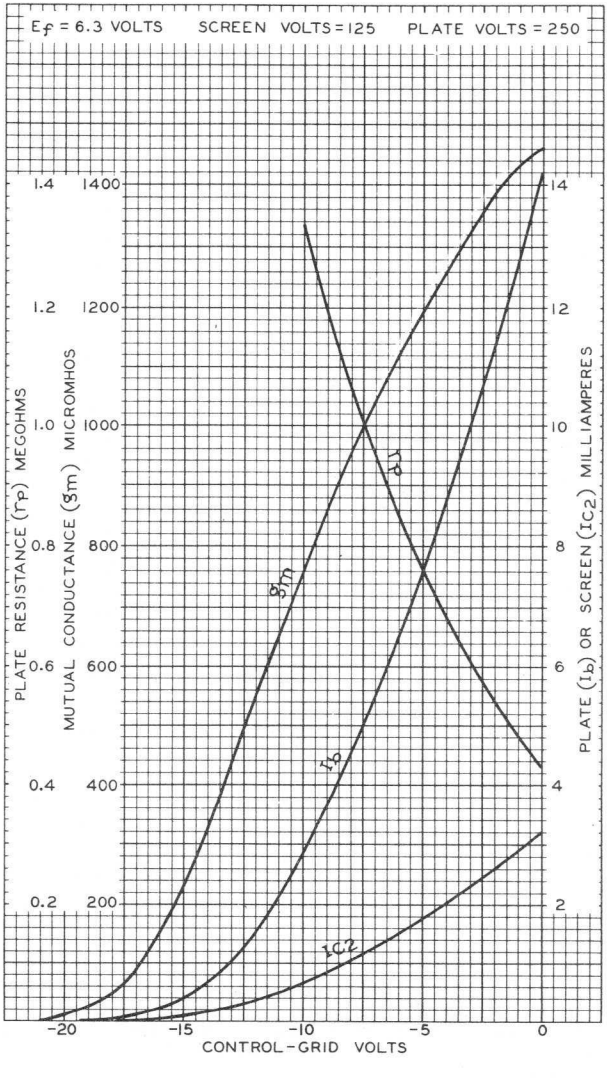
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-4745

RCA Cunningham Radiotron RADIO TUBES

RCA-6B8

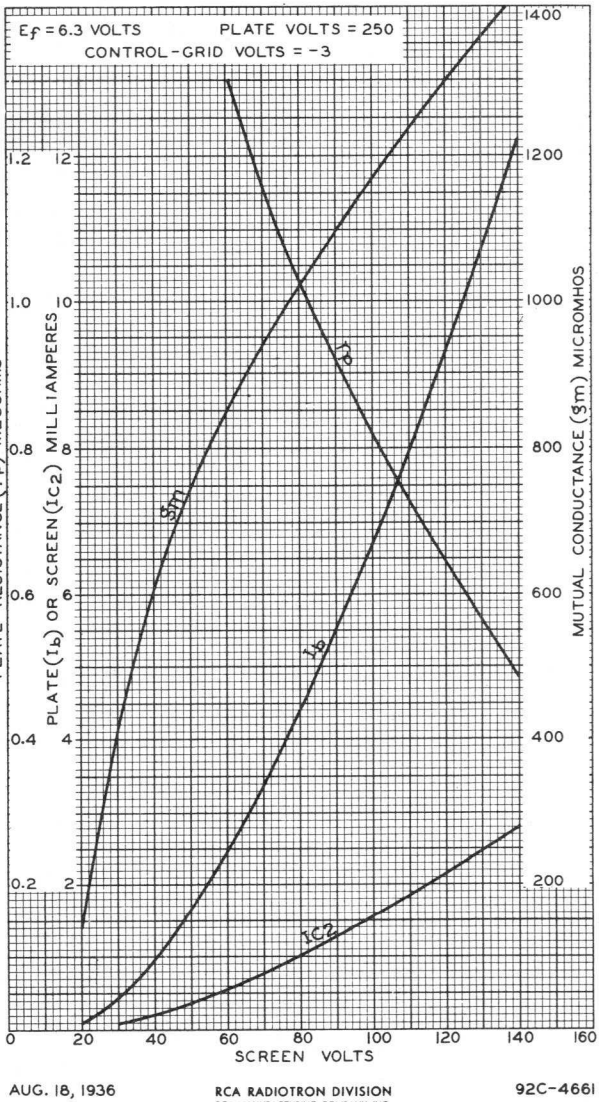
AVERAGE CHARACTERISTICS



RCA Cunningham Radiotron RADIO TUBES

RCA-6B8

AVERAGE CHARACTERISTICS



6BD4-A

SHARP-CUTOFF BEAM TRIODE

HIGH-VOLTAGE, LOW-CURRENT, REGULATOR TYPE

Supersedes Type 6BD4

GENERAL DATA

Electrical:

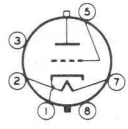
Heater, for Unipotential Cathode:		
Voltage	6.3	ac or dc volts
Current	0.6	amp
Direct Interelectrode Capacitances:		
Grid to Plate	1.0	μμf
Input	3.8	μμf
Output	0.04 max.	μμf
Amplification Factor	1650	

Mechanical:

Mounting Position	Any
Maximum Overall Length	5-1/8"
Seated Length	4-1/2" ± 1/8"
Maximum Diameter	1-23/32"
Weight (Approx.)	2.7 oz
Bulb	T-12
Cap	Small (JETEC No.C1-1)
Base	Short Jumbo-Shell Octal 6-Pin (JETEC No.B6-73)

BOTTOM VIEW

Pin 1 – Cathode
Pin 2 – Heater
Pin 3 – No Connection
Pin 5 – Grid



Pin 7 – Heater
Pin 8 – No Connection
Cap – Plate

VOLTAGE-CONTROL SERVICE

Maximum Ratings, *Design-Center Values:*

DC PLATE VOLTAGE	27000 max.	volts
UNREGULATED DC SUPPLY VOLTAGE	55000 max.	volts
GRID VOLTAGE:		
DC value	-125 max.	volts
Peak value	-550 max.	volts
DC PLATE CURRENT	1.5 max.	ma
PLATE DISSIPATION	25 max.	watts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	180 max.	volts
Heater positive with respect to cathode	180 max.	volts

Typical Operation As Shunt Voltage-Regulator Tube In Accompanying Circuit:

Unregulated Supply:			
DC voltage	29800	36300	volts
Equivalent resistance	8	8	megohms

6BD4-A

SHARP-CUTOFF BEAM TRIODE

Voltage Divider Values:			
R_1 (5 watts)	120	220	megohms
R_2 (2 watts)	1	1	megohm
R_3 (1/2 watt)	2	3	megohms
Reference Voltage Supply:			
DC value	500	500	volts
Equivalent resistance	1000	1000	ohms
Effective Grid-Plate Transconductance	138	116	μmhos
DC Plate Current:			
For load current of 0 ma	1055	1035	μamp
For load current of 1 ma	100	100	μamp
Regulated DC Output Voltage:			
For load current of 0 ma	20000	27000	volts
For load current of 1 ma	19700	26500	volts

Maximum Circuit Values:

Grid-Circuit Resistance:

With unregulated supply having an equivalent resistance of at least 8 megohms . . . . . 4 max. megohms

With unregulated supply having an equivalent resistance less than 8 megohms . . *See accompanying curve*

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Heater Current	1	0.54	0.66	amp
Grid Voltage (1)	1,2	-7	-	volts
Grid Voltage (2)	1,3	-	-40	volts
Grid-Voltage Change	1,4	-	9	volts

Note 1: With heater voltage of 6.3 volts ac or dc.

Note 2: With dc plate voltage of 30000 volts and dc plate current of 1 ma.

Note 3: With dc plate voltage of 30000 volts and dc plate current of 0.1 ma.

Note 4: Difference between grid voltage (1) and grid voltage (2).

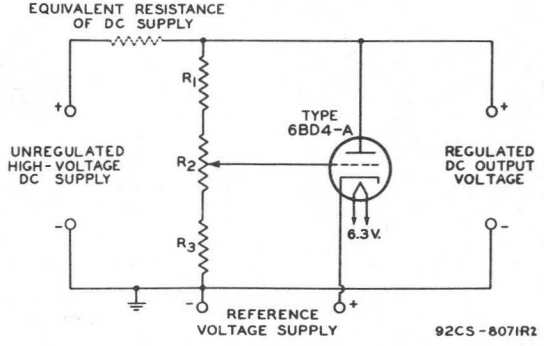
OPERATING NOTES

Operation of the 6BD4-A with a plate voltage above approximately 16000 volts (absolute value) results in the production of x-rays which can constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Relatively simple shielding should prove adequate, but the need for this precaution should be considered in equipment design.

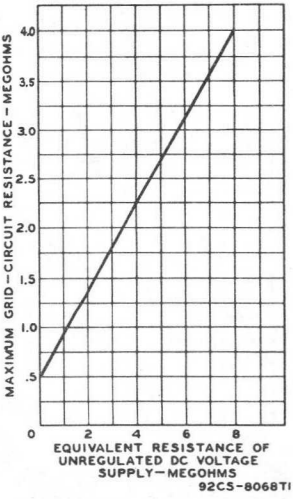
6BD4-A

SHARP-CUTOFF BEAM TRIODE

SHUNT VOLTAGE-REGULATOR CIRCUIT



Typical performance data for this basic circuit with certain characteristics of the unregulated dc supply and related voltage-divider values are given in the above tabulated data. Other combinations are feasible within the maximum ratings and the maximum circuit values for the 6BD4-A.



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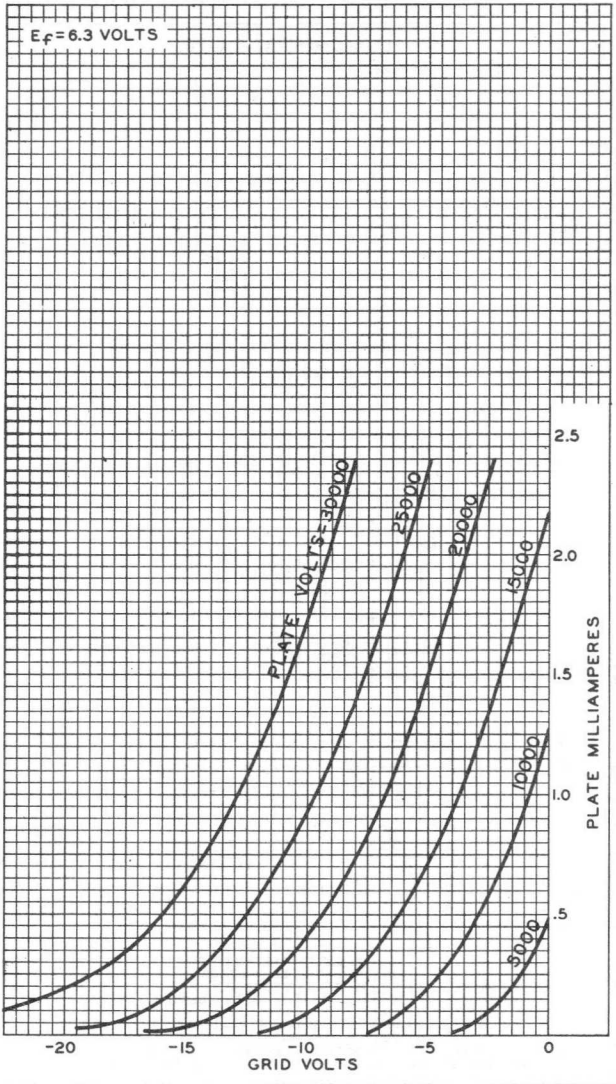
6BD4-A

AVERAGE TRANSFER CHARACTERISTICS



6BE6

PENTAGRID CONVERTER

MINIATURE TYPE

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:			
Voltage	6.3		ac or dc volts
Current	0.3		amp
Direct Interelectrode Capacitances:	*Without Shield*	*With Shield°*	
Grid No.3 to All Other Electrodes (RF Input)	7 max.	7 max.	μμf
Plate to All Other Electrodes (Mixer Input)	8	13	μμf
Grid No.1 to All Other Electrodes (Osc. Input)	5.5 max.	5.5 max.	μμf
Grid No.3 to Plate	0.30 max.	0.25 max.	μμf
Grid No.3 to Grid No.1	0.15 max.	0.15 max.	μμf
Grid No.1 to Plate	0.1 max.	0.05 max.	μμf
Grid No.1 to Cathode and Grid No.5	3	3	μμf
Cathode and Grid No.5 to All Other Electrodes Except Grid No.1	15	20	μμf

° JETEC No.316 connected to pin No.2.

Mechanical:

Mounting Position	Any
Maximum Overall Length	2-1/8"
Maximum Seated Length	1-7/8"
Length from 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 (JETEC No.E7-1)	
Basing Designation for BOTTOM VIEW	7CH

Pin 1 – Grid No.1
Pin 2 – Cathode, Grid No.5
Pin 3 – Heater
Pin 4 – Heater
Pin 5 – Plate
Pin 6 – Grid No.2, Grid No.4
Pin 7 – Grid No.3



CONVERTER

Maximum Ratings, *Design-Center Values:*

PLATE VOLTAGE	300 max.	volts
GRID-No.3 (CONTROL-GRID) VOLTAGE:		
Negative Bias Value	50 max.	volts
Positive Bias Value	0 max.	volts
GRIDS-No.2 & No.4 (SCREEN) VOLTAGE	100 max.	volts
GRIDS-No.2 & No.4 SUPPLY VOLTAGE	300 max.	volts

←Indicates a change

RCA

6BE6

PENTAGRID CONVERTER

TOTAL CATHODE CURRENT		14 max.	ma
PLATE DISSIPATION		1 max.	watt
GRIDS-No.2 & No.4 INPUT		1 max.	watt
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode		90 max.	volts
Heater positive with respect to cathode		90 max.	volts

→**Characteristics** - *Separate Excitation:**

Plate Voltage	100	250	volts
Grids-No.2 & No.4 Voltage	100	100	volts
Grid-No.3 Voltage	-1.5	-1.5	volts
Grid-No.1 (Oscillator Grid) Voltage (rms)	10	10	volts
Grid-No.1 Resistor	20000	20000	ohms
Plate Resistance (Approx.)	0.4	1	megohm
Conversion Transconductance	455	475	μmhos
Grid-No.3 Voltage (Approx.) for conversion transconductance of:			
10 μmhos	-30	-30	volts
100 μmhos	-6	-6	volts
Plate Current	2.6	2.9	ma
Grids-No.2 & No.4 Current	7	6.8	ma
Grid-No.1 Current	0.5	0.5	ma
Total Cathode Current	10.1	10.2	ma

NOTE: With grids-No.2 & No.4 and plate at 100 volts, grids-No.1 & No.3 at zero volts, and signal applied to grid No.1, the oscillator transconductance (not oscillating) is 7250 micromhos; the cathode current is 25 milliamperes; and the amplification factor is 20. Grid-No.1 voltage (approx.) for plate current of 10 microamperes is -11 volts.

* The characteristics shown with separate excitation correspond very closely with those obtained in a self-excited oscillator circuit operating with zero bias.

→ Indicates a change

6BK7-A

MEDIUM-MU TWIN TRIODE

9-PIN MINIATURE TYPE

GENERAL DATA

Electrical:

Heater, for Unipotential Cathodes:			
Voltage	6.3		ac or dc volts
Current	0.45		amp ←
Direct Interelectrode Capacitances:[o]	*Unit No.1*	*Unit No.2*	
Grid to plate	1.8	1.8	μμf
Grid to cathode, internal shield, and heater	3	3	μμf
Plate to cathode, internal shield, and heater	1	0.9	μμf
Heater to cathode	2.8	3	μμf
Plate to cathode	0.22	0.22	μμf
Cathode to grid, internal shield, and heater	6	6	μμf
Plate to grid, internal shield, and heater	2.4	2.4	μμf
Grid of unit No.1 to grid of unit No.2	0.004 max.		μμf
Plate of unit No.1 to plate of unit No.2	0.075 max.		μμf

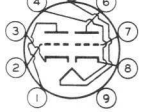
Characteristics, Class A_1 Amplifier (Each Unit):

Plate-Supply Voltage	150	volts
Cathode Resistor	56	ohms
Amplification Factor	43	
Plate Resistance (Approx.)	4600	ohms
Transconductance	9300	μmhos
Plate Current	18	ma
Grid Volts (Approx.) for plate current of 10 μamp	-11	volts

Mechanical:

Mounting Position	Any
Maximum Overall Length	2-3/16"
Maximum Seated Length	1-15/16"
Length, Base Seat to Bulb Top (Excluding tip)	1-9/16" ± 3/32" ←
Maximum Diameter	7/8"
Dimensional Outline	*See General Section*
Bulb	T6-1/2
Base	Small-Button Noval 9-Pin (JETEC No.E9-1)
Basing Designation for BOTTOM VIEW	9AJ

Pin 1 – Plate of Unit No.2
Pin 2 – Grid of Unit No.2
Pin 3 – Cathode of Unit No.2
Pin 4 – Heater
Pin 5 – Heater



Pin 6 – Plate of Unit No.1
Pin 7 – Grid of Unit No.1
Pin 8 – Cathode of Unit No.1
Pin 9 – Internal Shield

[o] Without external shield.

← Indicates a change.

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6BK7-A

MEDIUM-MU TWIN TRIODE

AMPLIFIER - Class A_1

Values are for Each Unit

Maximum Ratings, *Design-Center Values:*

PLATE VOLTAGE	300 max.	volts
GRID VOLTAGE:		
Negative bias value	50 max.	volts
PLATE DISSIPATION	2.7 max.	watts
→ PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	200■ max.	volts
Heater positive with respect to cathode	200▲ max.	volts

■ Under cutoff conditions in cascode-type circuits with direct-coupled drive, it is permissible for this voltage to be as high as 300 volts.

▲ The dc component must not exceed 100 volts.

→ Indicates a change.

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6BK7-B

MEDIUM-MU TWIN TRIODE

9-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

The 6BK7-B is the same as the 6BK7-A except for the following items:

Heater, for Unipotential Cathodes:

Voltage	6.3	ac or dc volts
Current	0.45	amp
Warm-up time (Average)	11	sec

For definition of heater warm-up time and method of determining it, see sheet HEATER WARM-UP TIME MEASUREMENT at front of this Section.

6BL4
HALF-WAVE VACUUM RECTIFIER

For Television Damper Service

GENERAL DATA

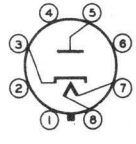
Electrical:

Heater, for Unipotential Cathode:		
Voltage	6.3	ac or dc volts
Current	3.0	amp
Direct Interelectrode Capacitances (Approx.):○		
Plate to heater and cathode	11.5	μμf
Cathode to heater and plate	16	μμf
Heater to cathode	5	μμf

Mechanical:

Mounting Position	Any
Maximum Overall Length	4-5/8"
Maximum Seated Length	4-1/16"
Maximum Diameter	1-23/32"
Bulb	T-12
Base	Short Jumbo-Shell Octal 8-Pin with External Barriers (JETEC No.B8-71)
Basing Designation for BOTTOM VIEW	8GB

Pin 1 – Internal Connection–Do Not Use
Pin 2 – Same As Pin 1
Pin 3 – Cathode



Pin 4 – Same as Pin 1
Pin 5 – Plate
Pin 6 – Same as Pin 1
Pin 7 – Heater
Pin 8 – Heater

DAMPER SERVICE

Maximum Ratings, *Design-Center Values Except as Noted:*

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

PEAK INVERSE PLATE VOLTAGE (Absolute value)#	4500●	max.	volts
PEAK PLATE CURRENT	1200	max.	ma
DC PLATE CURRENT	200	max.	ma
PLATE DISSIPATION	8	max.	ma
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode (Absolute value)	4500●▲	max.	volts
Heater positive with respect to cathode	300■	max.	volts

○ Without external shield.

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

This rating is applicable where the duty cycle of the voltage pulse does 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.

● Under no circumstances should this absolute value be exceeded.

▲ The dc component must not exceed 900 volts.

■ The dc component must not exceed 100 volts.

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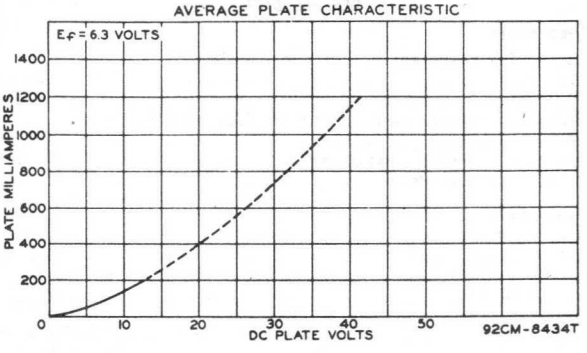
6BL4

HALF-WAVE VACUUM RECTIFIER



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6CB5

BEAM POWER TUBE

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:			
Voltage	6.3		ac or dc volts
Current	2.5		amp
Direct Interelectrode Capacitances (Approx.):°			
Grid No.1 to plate		0.8	μμf
Grid No.1 to cathode & grid No.3, grid No.2, and heater		24	μμf
Plate to cathode & grid No.3, grid No.2, and heater		10	μμf

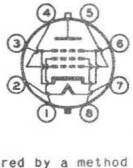
Characteristics, Class A_1 Amplifier:

Plate Voltage	75	175	volts
Grid-No.2 (Screen) Voltage	150	175	volts
Grid-No.1 (Control-Grid) Voltage	0	-30	volts
Mu-Factor, Grid No.2 to Grid No.1	-	3.8	
Plate Resistance (Approx.)	-	5000	ohms
Transconductance	-	8800	μmhos
Plate Current	460*	90	ma
Grid-No.2 Current	42*	6	ma
Grid-No.1 Voltage (Approx.) for plate current of 1 ma	-	-60	volts

Mechanical:

Mounting Position	Any
Maximum Overall Length	5-1/8"
Seated Length	4-7/16" ± 5/32"
Maximum Diameter	2-1/16"
Bulb	ST-16
Cap	Small (JETEC No.C1-1)
Base	Short Jumbo-Shell Octal 8-Pin with External Barriers (JETEC No.B8-71)
Basing Designation for BOTTOM VIEW	8GD

Pin 1 – Grid No.2
Pin 2 – Heater
Pin 3 – Cathode, Grid No.3
Pin 4 – Grid No.1
Pin 5 – Grid No.1



Pin 6 – Cathode, Grid No.3
Pin 7 – Heater
Pin 8 – Grid No.2
Cap – Plate

° Without external shield.

* These values can be measured by a method involving a recurrent wave form such that the plate dissipation and grid-No.2 input will be kept within ratings in order to prevent damage to the tube.

6CB5

6CB5
BEAM POWER TUBE

HORIZONTAL DEFLECTION AMPLIFIER

Maximum Ratings, *Design-Center Values Except as Noted:*

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

DC PLATE VOLTAGE	700	max.	volts
PEAK POSITIVE-PULSE PLATE VOLTAGE (Absolute Value)#	6800●	max.	volts
PEAK NEGATIVE-PULSE PLATE VOLTAGE	1500	max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	200	max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-50	max.	volts
PEAK NEGATIVE-PULSE GRID-No.1 VOLTAGE	200	max.	volts
DC PLATE CURRENT	200	max.	ma
GRID-No.2 INPUT	3.6	max.	watts
PLATE DISSIPATION†	23	max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	200	max.	volts
Heater positive with respect to cathode	200▲	max.	volts
BULB TEMPERATURE (At hottest point on bulb surface)	210	max.	°C

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	0.47	max.	megohm

□ 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.

● Under no circumstances should this absolute value be exceeded.

▲ The dc component must not exceed 100 volts.

† It is essential that the plate dissipation be limited in the event of loss of grid signal. For this purpose, some protective means such as a cathode resistor of suitable value be employed.

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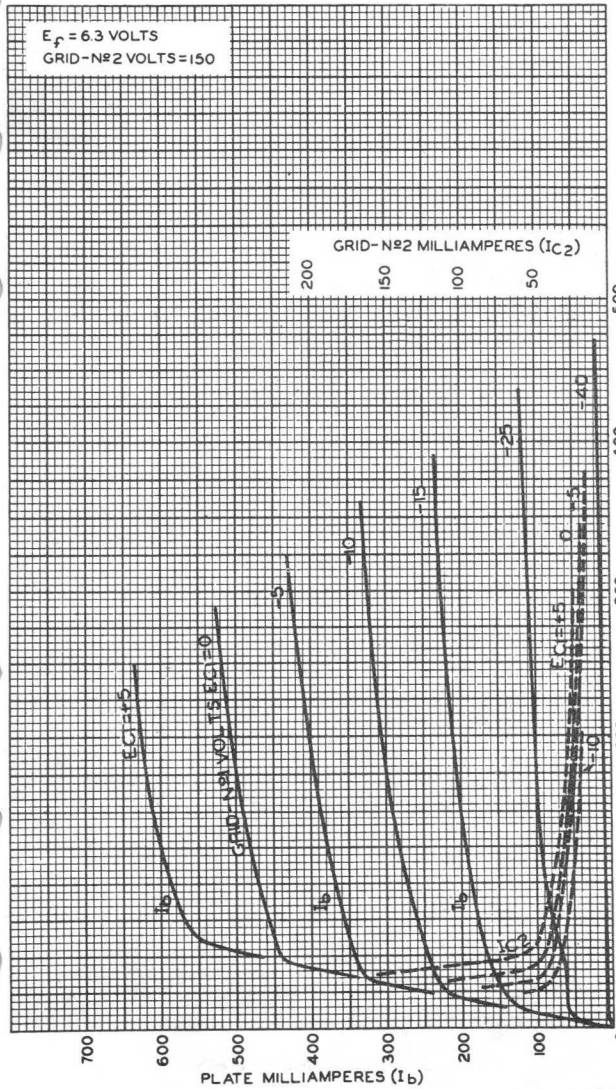
6CB5

AVERAGE PLATE CHARACTERISTICS



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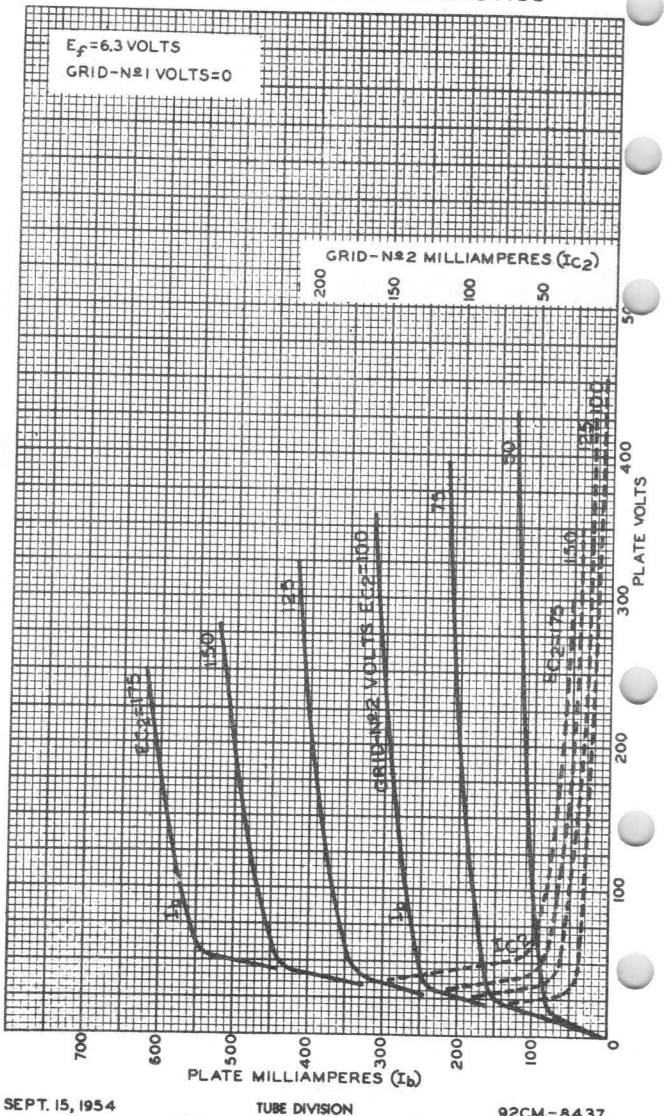
6CB5

AVERAGE PLATE CHARACTERISTICS



6CL8
MEDIUM-MU TRIODE—SHARP-CUTOFF TETRODE

9-PIN MINIATURE TYPE

Intended for use as VHF oscillator and mixer in TV receivers having series heater-string arrangement

GENERAL DATA

Electrical:

Heater, for Unipotential Cathodes:

Voltage	6.3	ac or dc volts
Current	0.45	amp
Warm-up time (Average)	11	sec

For definition of heater warm-up time and method of determining it, see sheet HEATER WARM-UP TIME MEASUREMENT at front of this Section.

Direct Interelectrode Capacitances:

	Without External Shield	*With External Shield°*	
Triode Unit:			
Grid to plate	1.8	1.8	μμf
Grid to cathode and heater	2.7	2.7	μμf
Plate to cathode and heater	0.4	1.2	μμf
Tetrode Unit:			
Grid No.1 to plate	0.028 max.	0.016 max.	μμf
Grid No.1 to cathode, grid No.2, and heater	5	5	μμf
Plate to cathode, grid No.2, and heater	2	3	μμf
Heater to cathode	2.5	2.5•	μμf

Characteristics, Class A_1 Amplifier:

	Triode Unit	*Tetrode Unit*	
Plate Voltage	125	125	volts
Grid-No.2 (Screen-Grid) Voltage	–	125	volts
Grid-No.1 (Control-Grid) Voltage	–	−1	volt
Cathode Resistor	56	–	ohms
Amplification Factor	40	–	
Plate Resistance (Approx.)	5000	100000	ohms
Transconductance	8000	5800	μmhos
Plate Current	15	12	ma
Grid-No.2 Current	–	4	ma
Grid-No.1 Voltage (Approx.) for plate μa. = 10	−9	−10	volts

Mechanical:

Operating Position	Any
Maximum Overall Length	2-3/16"
Maximum Seated Length	1-15/16"
Length, Base Seat to Bulb Top (Excluding tip)	1-9/16" ± 3/32"

°,•: See next page.

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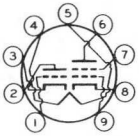
6CL8

MEDIUM-MU TRIODE—SHARP-CUTOFF TETRODE

Maximum Diameter	7/8"
Dimensional Outline	*See General Section*
Bulb	T6-1/2
Base	Small-Button Noval 9-Pin (JETEC No.E9-1)
Basing Designation for BOTTOM VIEW	9FX

Pin 1 – Triode Grid
Pin 2 – Triode Plate
Pin 3 – Triode Cathode
Pin 4 – Heater
Pin 5 – Heater
Pin 6 – Tetrode Plate
Pin 7 – Tetrode Grid No.2
Pin 8 – Tetrode Cathode
Pin 9 – Tetrode Grid No.1



CONVERTER SERVICE

Maximum Ratings, *Design-Center Values:*

	Triode Unit as Osc.	*Tetrode Unit as Mixer*	
PLATE VOLTAGE	300 max.	300 max.	volts
GRID-No.2 (SCREEN-GRID) SUPPLY VOLTAGE	–	300 max.	volts
GRID-No.2 VOLTAGE	–	*See Grid-No.2 Input Rating Chart at front of Receiving Tube Section*	
GRID-No.1 (CONTROL-GRID) VOLTAGE: Positive bias value	0 max.	0 max.	volts
GRID-No.2 INPUT: For grid-No.2 voltages up to 150 volts	–	0.5 max.	watt
For grid-No.2 voltages between 150 and 300 volts	–	*See Grid-No.2 Input Rating Chart at front of Receiving Tube Section*	
PLATE DISSIPATION	2.7 max.	2.8 max.	watts
PEAK HEATER-CATHODE VOLTAGE: Heater negative with respect to cathode	200 max.	200 max.	volts
Heater positive with respect to cathode	200▲ max.	200▲ max.	volts

Maximum Circuit Values:

	Triode Unit	*Tetrode Unit*	
Grid-No.1-Circuit Resistance: For fixed-bias operation	0.5 max.	0.25 max.	megohm
For cathode-bias operation	1 max.	1 max.	megohm

°,●,▲: See next page.

6CL8

MEDIUM-MU TRIODE—
SHARP-CUTOFF TETRODE

o With external shield JETEC No.315 connected to cathode of unit under test except as noted.

● With external shield JETEC No.315 connected to ground.

▲ The dc component must not exceed 100 volts.

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6CM7

MEDIUM-MU DUAL TRIODE

With Dissimiliar Units

9-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

GENERAL DATA

Electrical:

Heater, for Unipotential Cathodes:

Voltage	6.3	ac or dc volts
Current	0.6	amp
Warm-up time (Average)	11	sec

For definition of heater warm-up time and method of determining it, see sheet HEATER WARM-UP TIME MEASUREMENT at front of this Section.

Direct Interelectrode Capacitances (Approx.):[o]

	Unit No.1 Oscillator	*Unit No.2 Amplifier*	
Grid to plate	3.8	3	μμf
Grid to cathode and heater	2	3.5	μμf
Plate to cathode and heater	0.5	0.4	μμf

Characteristics, Class A_1 Amplifier:

	Unit No.1 Oscillator	*Unit No.2 Amplifier*	
Plate Voltage	200	250	volts
Grid Voltage	−7	−8	volts
Amplification Factor	20	18	
Plate Resistance (Approx.)	11000	4100	ohms
Transconductance	2000	4400	μmhos
Plate Current	5	20	ma
Plate Current for grid voltage of −10 volts	1	–	ma
Grid Voltage (Approx.) for plate current of 10 microamperes	−14	–	volts

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	7/8"
Dimensional Outline	*See General Section*
Bulb	T-6-1/2

[o] Without external shield.

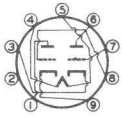
6CM7

6CM7

MEDIUM-MU DUAL TRIODE
With Dissimiliar Units

Base . . . . . Small-Button Noval 9-Pin (JETEC No. E9-1)
Basing Designation for BOTTOM VIEW 9ES

Pin 1 - Plate of Unit No. 2
Pin 2 - No Connection
Pin 3 - Cathode of Unit No. 1
Pin 4 - Heater
Pin 5 - Heater



Pin 6 - Plate of Unit No. 1
Pin 7 - Grid of Unit No. 1
Pin 8 - Grid of Unit No. 2
Pin 9 - Cathode of Unit No. 2

VERTICAL DEFLECTION OSCILLATOR

Values are for Unit No. 1

Maximum Ratings, *Design-Center Values:*

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

DC PLATE VOLTAGE	500 max.	volts
PEAK NEGATIVE-PULSE GRID VOLTAGE	200 max.	volts
CATHODE CURRENT:		
Peak	70 max.	ma
Average.	15 max.	ma
PLATE DISSIPATION.	1.25 max.	watts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode. .	200 max.	volts
Heater positive with respect to cathode. .	200▲max.	volts

Maximum Circuit Values:

Grid-Circuit Resistance:

For fixed-bias, grid-resistor bias, or cathode-bias operation	2.2 max.	megohms

VERTICAL DEFLECTION AMPLIFIER

Values are for Unit No. 2

Maximum Ratings, *Design-Center Values Except as Noted:*

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

DC PLATE VOLTAGE	500 max.	volts
PEAK POSITIVE-PULSE PLATE VOLTAGE# (Absolute maximum)	2200■max.	volts
PEAK NEGATIVE-PULSE GRID VOLTAGE	200 max.	volts
CATHODE CURRENT:		
Peak	70 max.	ma
Average.	20 max.	ma
PLATE DISSIPATION.	5.5 max.	watts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode. .	200 max.	volts
Heater positive with respect to cathode. .	200▲max.	volts

▲ The dc component must not exceed 100 volts.
□,#,■: See next page.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6CM7

MEDIUM-MU DUAL TRIODE
With Dissimiliar Units

Maximum Circuit Values:

Grid-Circuit Resistance:

For fixed-bias operation	1.0 max.	megohm
For cathode-bias operation	2.5 max.	megohms

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

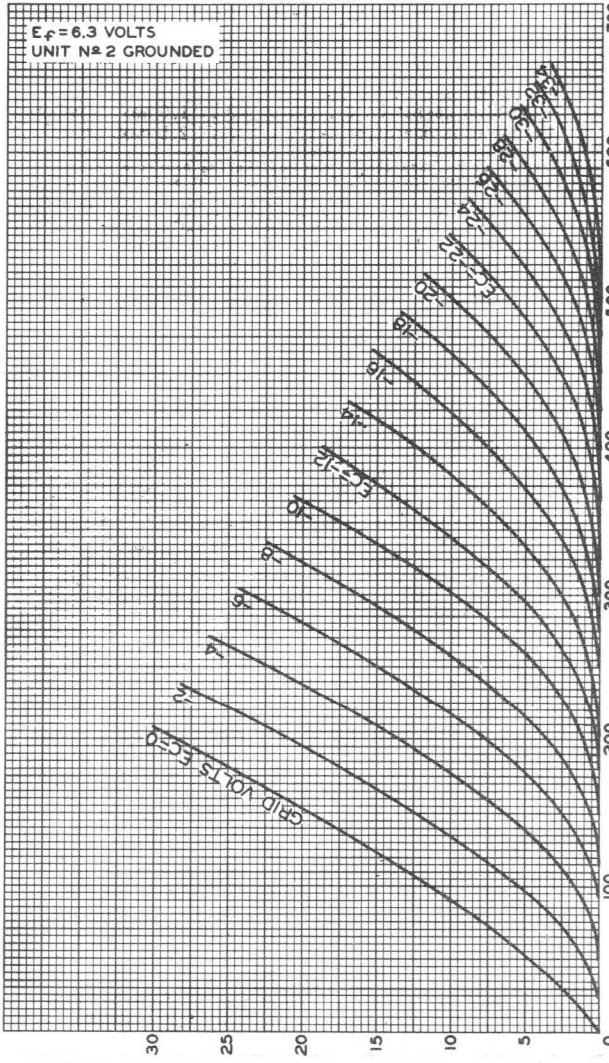
* This rating is applicable where the duration of the voltage pulse does not exceed 15 per cent of one vertical scanning cycle. In a 525-line, 30-frame system, 15 per cent of one vertical scanning cycle is 2.5 milliseconds.

■ Under no circumstances should this absolute value be exceeded.

6CM7

AVERAGE PLATE CHARACTERISTICS

UNIT Nº 1



MAY 17, 1955

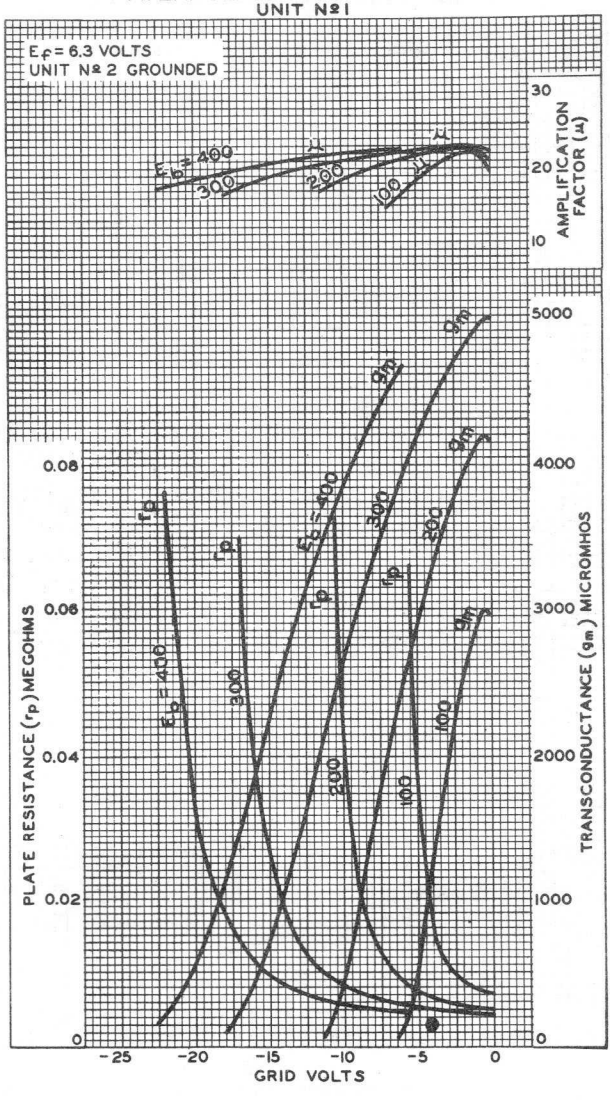
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8617

6CM7

AVERAGE CHARACTERISTICS

UNIT Nº 1

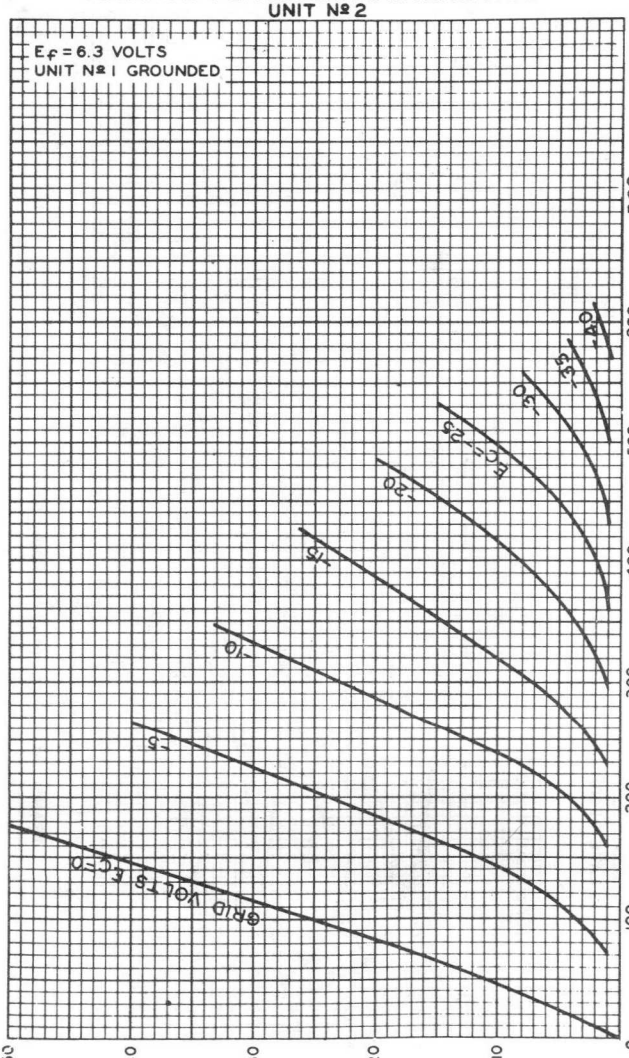


RCA

6CM7

AVERAGE PLATE CHARACTERISTICS

UNIT Nº 2



MAY 16, 1955

TUBE DIVISION

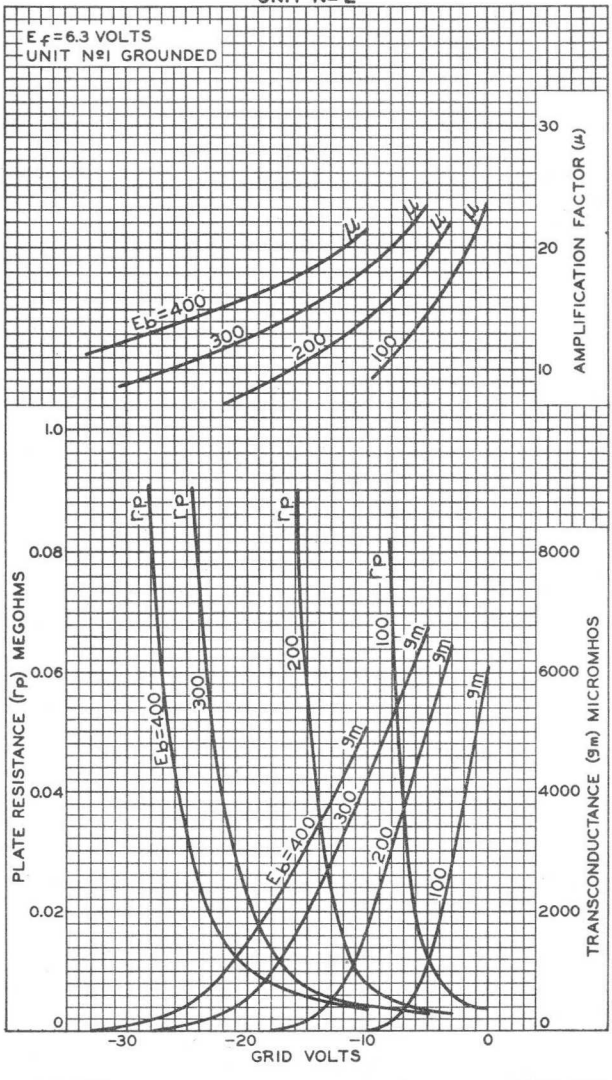
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8615

RCA

6CM7

AVERAGE CHARACTERISTICS
UNIT Nº 2



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6CN7

TWIN DIODE—HIGH-MU TRIODE

9-PIN MINIATURE TYPE

With heater having controlled warm-up time

GENERAL DATA

Electrical:

	Series	Parallel	
Heater, for Unipotential Cathodes:			
Heater arrangement			
Voltage (AC or DC)	6.3	3.15	volts
Current	0.3	0.6	amp
Warm-up time (Average)	–	11	sec
Direct Interelectrode Capacitances (Approx.):[o]			
Triode Unit:			
Grid to plate		1.8	μμf
Grid to cathode and heater		1.5	μμf
Plate to cathode and heater		0.5	μμf
Diode Units:			
Diode-No.1 plate to cathode of diodes No.1 and No.2 & internal shield, and heater		3.6	μμf
Diode-No.2 plate to cathode of diodes No.1 and No.2 & internal shield, and heater		3.6	μμf
Triode grid to either diode plate		0.006	μμf

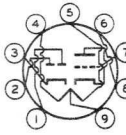
Characteristics, Class A_1 Amplifier (Triode Unit):

Plate Voltage	100	250	volts
Grid Voltage	-1	-3	volts
Amplification Factor	70	70	
Plate Resistance (Approx.)	54000	58000	ohms
Transconductance	1300	1200	μmhos
Plate Current	0.8	1	ma

Mechanical:

Operating Position	Any
Maximum Overall Length	2-3/16"
Maximum Seated Length	1-15/16"
Length, Base Seat to Bulb Top (Excluding tip)	1-9/16" ± 3/32"
Diameter	0.750" to 0.875" ←
Dimensional Outline	*See General Section*
Bulb	T6-1/2
Base	Small-Button Noval 9-Pin (JEDEC No.E9-1)
Basing Designation for BOTTOM VIEW	9EN

Pin 1 – Diode-No.2 Plate
Pin 2 – Diode-No.1 Plate
Pin 3 – Cathode of Diodes No.1 & No.2, Internal Shield



Pin 4 – Heater
Pin 5 – Heater
Pin 6 – Triode Cathode
Pin 7 – Triode Grid
Pin 8 – Triode Plate
Pin 9 – Heater Mid-Tap

← indicates a change.

6CN7

TWIN DIODE—HIGH-MU TRIODE

TRIODE UNIT — AMPLIFIER — Class A_1

Maximum Ratings, *Design-Center Values:*

PLATE VOLTAGE	300	max.	volts
GRID VOLTAGE:			
Positive-bias value	0	max.	volts
PLATE DISSIPATION	1	max.	watt
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	200	max.	volts
Heater positive with respect to cathode	200▲	max.	volts

Typical Operation as Resistance-Coupled Amplifier:

See RESISTANCE-COUPLED AMPLIFIER CHART No. 7 at front of this Section

DIODE UNITS — Two

Values are for Each Unit

Maximum Ratings, *Design-Center Values:*

PLATE CURRENT	5	max.	ma
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	200	max.	volts
Heater positive with respect to cathode	200▲	max.	volts

→ **Characteristics:**

Plate Current for plate volts = 5	20	ma

○ Without external shield.

▲ The dc component must not exceed 100 volts.

→ **Curves shown under Type 6T8-A also apply to the 6CN7**

→ Indicates a change.

6EA8

MEDIUM-MU TRIODE–SHARP-CUTOFF PENTODE

9-PIN MINIATURE TYPE

With heater having controlled warm-up time

GENERAL DATA

Electrical:

Heater, for Unipotential Cathodes:

Voltage	6.3	ac or dc volts
Current	0.45 ± 6%	amp
Warm-up time (Average)	11	sec

For definition of heater warm-up time and method of determining it, see sheet HEATER WARM-UP TIME MEASUREMENT at front of this Section.

Direct Interelectrode Capacitances:

	Without External Shield	*With External Shield°*	
Triode Unit:			
Grid to plate	1.7	1.7	μμf
Grid to cathode and heater	3	3.2	μμf
Plate to cathode and heater	0.3	1.1	μμf
Pentode Unit:			
Grid No.1 to plate	0.02 max.	0.01 max.	μμf
Grid No.1 to cathode & grid No.3 & internal shield, grid-No.2, and heater	5	5	μμf
Plate to cathode & grid No.3 & internal shield, grid No.2, and heater	2.6	3.4	μμf
Heater to cathode	3	3•	μμf

Characteristics, Class A_1 Amplifier:

	Triode Unit	*Pentode Unit*	
Plate-Supply Voltage	150	125	volts
Grid-No.2 Voltage	–	125	volts
Grid-No.1 Voltage	–	–1	volt
Cathode Resistor	56	–	ohms
Amplification Factor	40	–	
Plate Resistance (Approx.)	5000	80000	ohms
Transconductance	8500	6400	μmhos
Plate Current	18	12	ma
Grid-No.2 Current	–	4	ma
Grid-No.1 Voltage (Approx.) for plate μa = 10	–12	–9	volts

Mechanical:

Operating Position . . . . . Any

°,•: See next page.

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

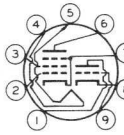
TENTATIVE DATA

6EA8

MEDIUM-MU TRIODE— SHARP-CUTOFF PENTODE

Maximum Overall Length	2-3/16"
Maximum Seated Length	1-15/16"
Length, Base Seat to Bulb Top (Excluding tip)	1-9/16" ± 3/32"
Diameter	0.750" to 0.875"
Dimensional Outline	*See General Section*
Bulb	T6-1/2
Base	Small-Button Noval 9-Pin (JEDEC No.E9-1)
Basing Designation for BOTTOM VIEW	9AE

Pin 1 – Triode Plate
Pin 2 – Pentode Grid No.1
Pin 3 – Pentode Grid No.2
Pin 4 – Heater
Pin 5 – Heater
Pin 6 – Pentode Plate



Pin 7 – Pentode Cathode, Pentode Grid No.3, Internal Shield
Pin 8 – Triode Cathode
Pin 9 – Triode Grid

CONVERTER SERVICE

Maximum Ratings, *Design-Maximum Values:*

	Triode Unit as Osc.	*Pentode Unit as Mixer*	
PLATE VOLTAGE	330 max.	330 max.	volts
GRID-No.2 (SCREEN-GRID) SUPPLY VOLTAGE	–	330 max.	volts
GRID-No.2 VOLTAGE	–	*See Grid-No.2 Input Rating Chart at front of Receiving Tube Section*	
GRID-No.1 (CONTROL-GRID) VOLTAGE: Positive-bias value	0 max.	0 max.	volts
GRID-No.2 INPUT: For grid-No.2 voltages up to 165 volts	–	0.55 max.	watt
For grid-No.2 voltages between 165 and 330 volts	–	*See Grid-No.2 Input Rating Chart at front of Receiving Tube Section*	
PLATE DISSIPATION	3 max.	3.1 max.	watts
PEAK HEATER-CATHODE VOLTAGE: Heater negative with respect to cathode	200 max.	200 max.	volts
Heater positive with respect to cathode	200▲ max.	200▲ max.	volts

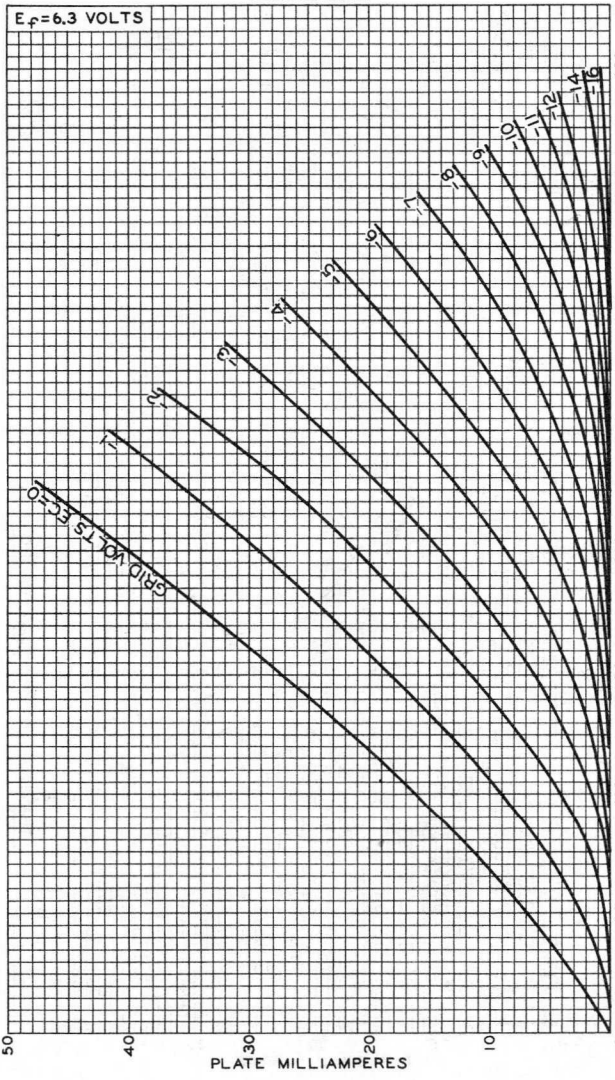
° With external shield JEDEC No.315 connected to cathode of unit under test except as noted.
● With external shield JEDEC No.315 connected to ground.
▲ The dc component must not exceed 100 volts.

RCA

6EA8

AVERAGE PLATE CHARACTERISTICS

TRIODE UNIT



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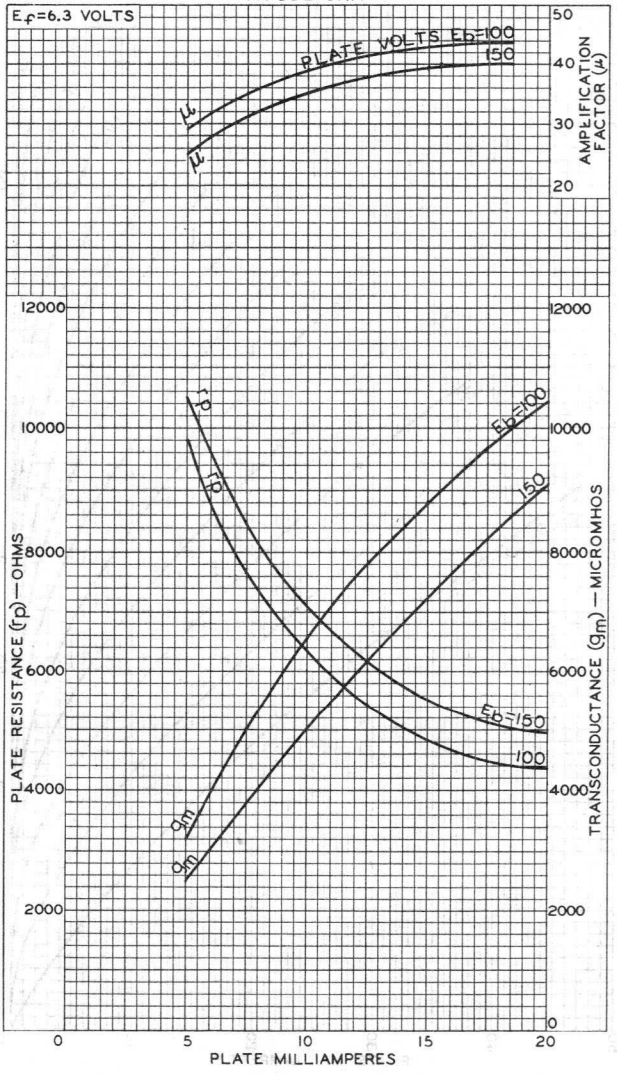
92CM-9866

RCA

6EA8

AVERAGE CHARACTERISTICS

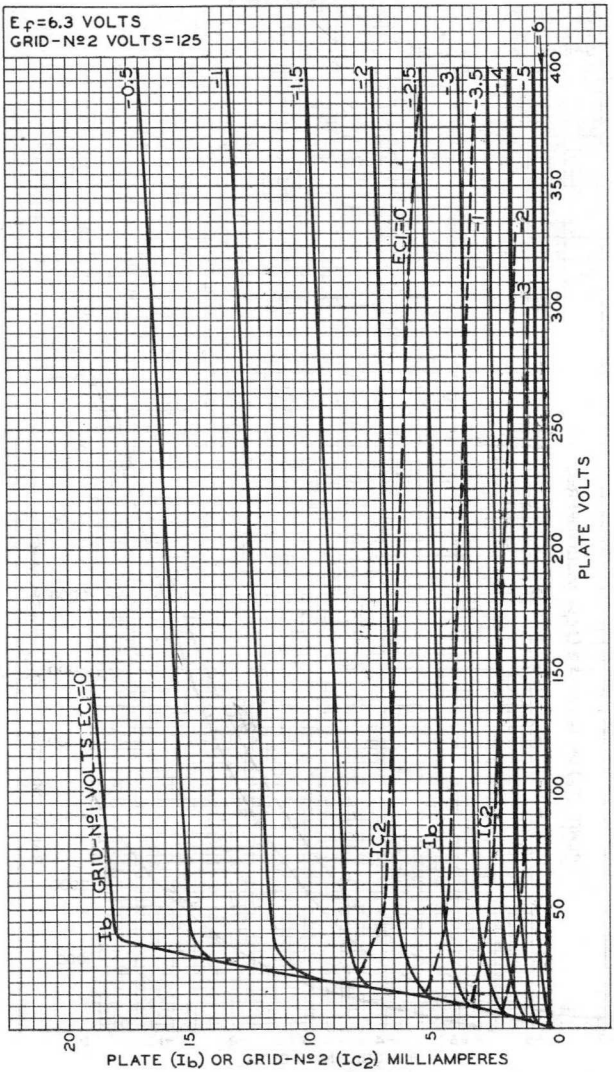
TRIODE UNIT



RCA

6EA8

AVERAGE CHARACTERISTICS
PENTODE UNIT



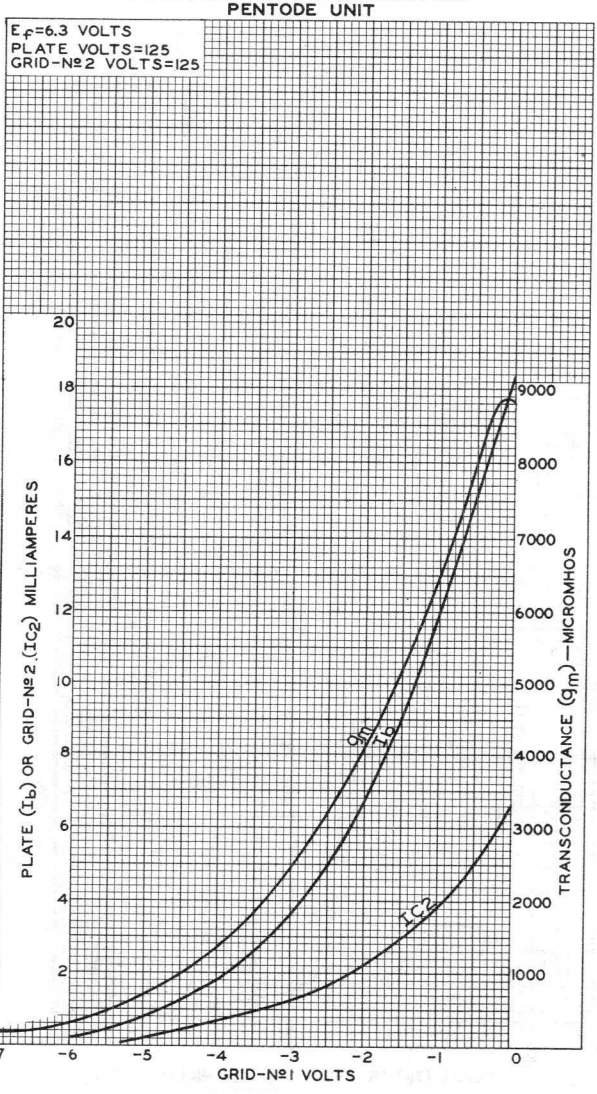
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9867

6EA8

AVERAGE CHARACTERISTICS

PENTODE UNIT



6EM5

BEAM POWER TUBE

9-PIN MINIATURE TYPE

For vertical-deflection-amplifier service in 110° systems

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:			
Voltage	6.3		ac or dc volts
Current	0.8		amp
Direct Interelectrode Capacitances:°			
Grid No.1 to plate		0.7 max.	μμf
Grid No.1 to cathode & grid No.3, grid No.2, and heater		10	μμf
Plate to cathode & grid No.3, grid No.2, and heater		5.1	μμf

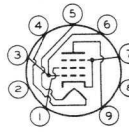
Characteristics, Class A_1 Amplifier:

Plate Voltage	60	250	volts
Grid-No.2 (Screen-Grid) Voltage	250	250	volts
Grid-No.1 (Control-Grid) Voltage	0	-18	volts
Mu Factor, Grid No.1 to Grid No.2	-	8.7	
Transconductance	-	5100	μmhos
Plate Current	180*	35	ma
Grid-No.2 Current	30*	3	ma
Grid-No.1 Voltage (Approx.) for plate ma. = 1	-	-37	volts

Mechanical:

Operating Position	Any
Maximum Overall Length	3-1/16"
Maximum Seated Length	2-13/16"
Length, Base Seat to Bulb Top (Excluding tip)	2-7/16" ± 3/32"
Diameter	0.750" to 0.850"
Dimensional Outline	*See General Section*
Bulb	T6-1/2
Base	Small-Button Noval 9-Pin (JETEC No.E9-1)
Basing Designation for BOTTOM VIEW	9HN

Pin 1 - Grid No.2
Pin 2 - No Connection
Pin 3 - Grid No.1
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Grid No.1



Pin 7 - Cathode, Grid No.3
Pin 8 - Internal Connection—Do Not Use
Pin 9 - Plate

VERTICAL-DEFLECTION AMPLIFIER

Maximum Ratings, *Design-Center Values Except as Noted:*

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

DC PLATE VOLTAGE	315 max.	volts
PEAK POSITIVE-PULSE PLATE VOLTAGE (Absolute maximum)#	2200■ max.	volts

°, *, □, #, ■: See next page.

6EM5

BEAM POWER TUBE

DC GRID-No.2 (SCREEN-GRID) VOLTAGE. . . .	285	max.	volts
PEAK NEGATIVE-PULSE GRID-No.1 (CONTROL-GRID) VOLTAGE.	250	max.	volts
PEAK CATHODE CURRENT.	210	max.	ma
DC CATHODE CURRENT.	60	max.	ma
GRID-No.2 INPUT	1.5	max.	watts
PLATE DISSIPATION	10	max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode.	200	max.	volts
Heater positive with respect to cathode.	200▲	max.	volts
BULB TEMPERATURE (At hottest point on bulb surface).	250	max.	°C

Maximum Circuit Values:

Grid-No.1-Circuit Resistance:			
For fixed-bias operation.	2.2	max.	megohms
For cathode-bias operation.	2.2	max.	megohms

° Without external shield.

* This value can be measured by a method involving a recurrent wave form such that the maximum ratings of the tube will not be exceeded.

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

\# This rating is applicable when the duration of the voltage pulse does not exceed 15 per cent of one vertical scanning cycle. In a 525-line, 30-frame system, 15 per cent of one vertical scanning cycle is 2.5 milliseconds.

■ Under no circumstances should this absolute value be exceeded.

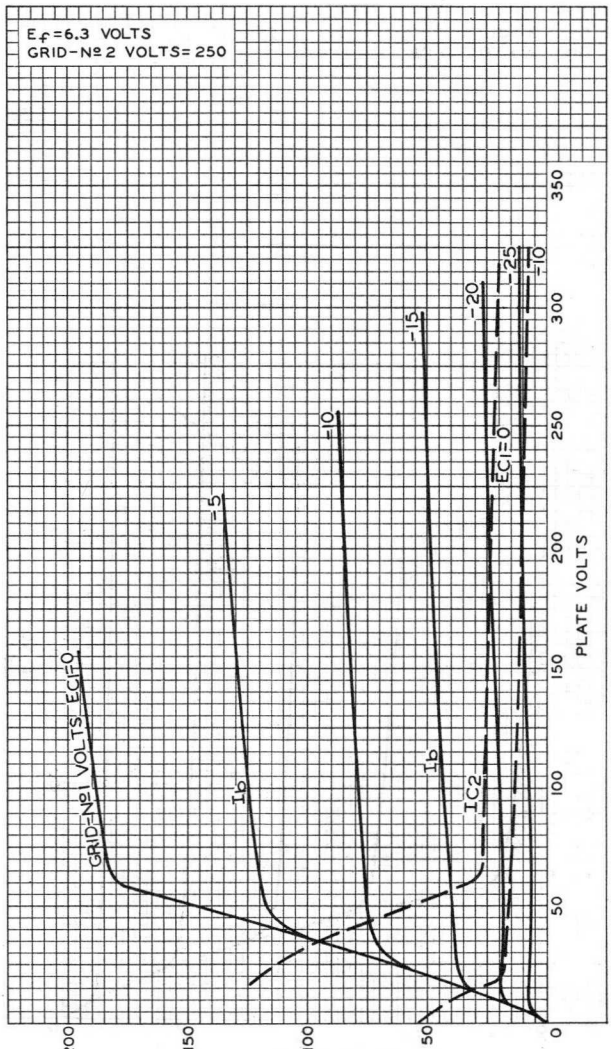
▲ The dc component must not exceed 100 volts.

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

TENTATIVE DATA

6EM5

AVERAGE CHARACTERISTICS



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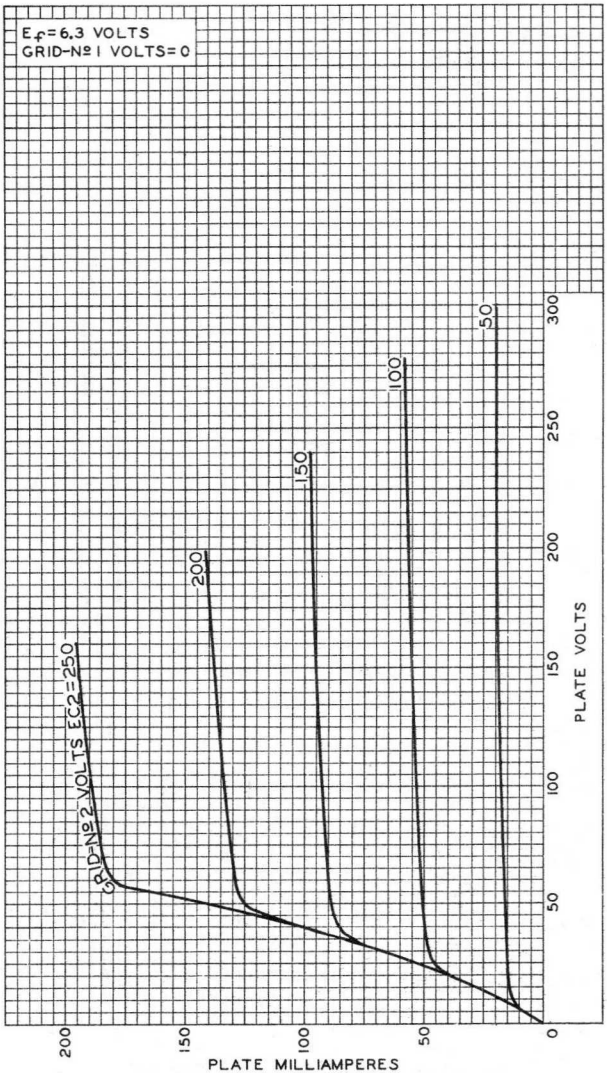
92CM-9797

6EM5

AVERAGE PLATE CHARACTERISTICS



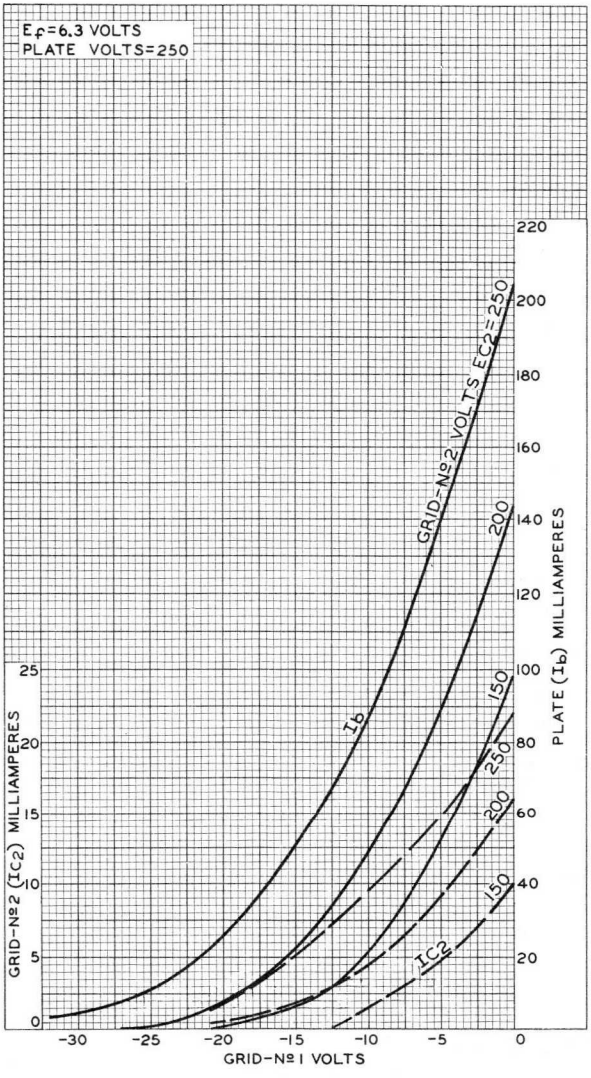
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9672

RCA

6EM5

AVERAGE CHARACTERISTICS



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

92CM-9673

6EM7

Dual Triode

With High-Mu Unit and Low-Mu Unit

GENERAL DATA

Electrical:

Heater, for Unipotential Cathodes:			
Voltage (AC or DC)	6.3 ± 10%		volts
Current at 6.3 volts	0.925		amp
Direct Interelectrode Capacitances (Approx.):▲			
	Unit No.1	*Unit No.2*	
Grid to plate	4.8	10	μμf
Grid to cathode and heater	2.2	7	μμf
Plate to cathode and heater	0.6	1.8	μμf

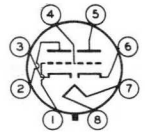
Characteristics, Class A_1 Amplifier:

	Unit No.1	*Unit No.2*	
Plate Voltage	250	150	volts
Grid Voltage	−3	−20	volts
Amplification Factor	68	5.4	
Plate Resistance (Approx.)	40000	750	ohms
Transconductance	1600	7200	μmhos
Plate Current	1.4	50	ma
Plate Current for plate volts = 60 and grid volts = 0	–	95	ma
Plate Current for grid volts = −28	–	10	ma
Grid Voltage (Approx.) for plate μa = 10	−5.5	–	volts
Grid Voltage (Approx.) for plate μa = 100	–	−45	volts

Mechanical:

Operating Position	Any
Maximum Overall Length	3"
Maximum Seated Length	2-7/16"
Maximum Diameter	1-9/32"
Bulb	T9
Base	Short Intermediate-Shell Octal 8-Pin with External Barriers (JEDEC Group 1, B8-58)
Basing Designation for BOTTOM VIEW	8BD

Pin 1 – Grid of Unit No.2
Pin 2 – Plate of Unit No.2
Pin 3 – Cathode of Unit No.2
Pin 4 – Grid of Unit No.1



Pin 5 – Plate of Unit No.1
Pin 6 – Cathode of Unit No.1
Pin 7 – Heater
Pin 8 – Heater

VERTICAL-DEFLECTION OSCILLATOR

Values are for Unit No.1

Maximum Ratings, *Design-Maximum Values:*

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

DC PLATE VOLTAGE	330 max.	volts

PEAK NEGATIVE-PULSE GRID VOLTAGE.	400	max.	volts
CATHODE CURRENT:			
Peak.	77	max.	ma
Average	22	max.	ma
PLATE DISSIPATION	1.5	max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode.	200	max.	volts
Heater positive with respect to cathode.	200★	max.	volts

Maximum Circuit Values:

Grid-Circuit Resistance:			
For grid-resistor-bias or cathode-bias operation.	2.2	max.	megohms

VERTICAL-DEFLECTION AMPLIFIER

Values are for Unit No.2

Maximum Ratings, *Design-Maximum Values:*

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

DC PLATE VOLTAGE.	330	max.	volts
PEAK POSITIVE-PULSE PLATE VOLTAGE♦. . . .	1500	max.	volts
PEAK NEGATIVE-PULSE GRID VOLTAGE.	250	max.	volts
CATHODE CURRENT:			
Peak.	175	max.	ma
Average	50	max.	ma
PLATE DISSIPATION	10	max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode.	200	max.	volts
Heater positive with respect to cathode.	200★	max.	volts

Maximum Circuit Values:

Grid-Circuit Resistance:			
For grid-resistor-bias or cathode-bias operation.	2.2	max.	megohms

▲ Without external shield.

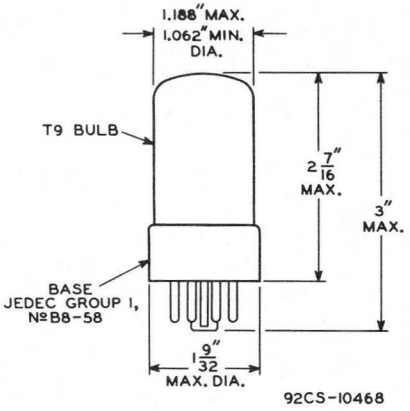
● As described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission.

★ The dc component must not exceed 100 volts.

♦ This rating is applicable where the duration of the voltage pulse does not exceed 15 per cent of one vertical scanning cycle. In a 525-line, 30-frame system, 15 per cent of one vertical scanning cycle is 2.5 milliseconds.

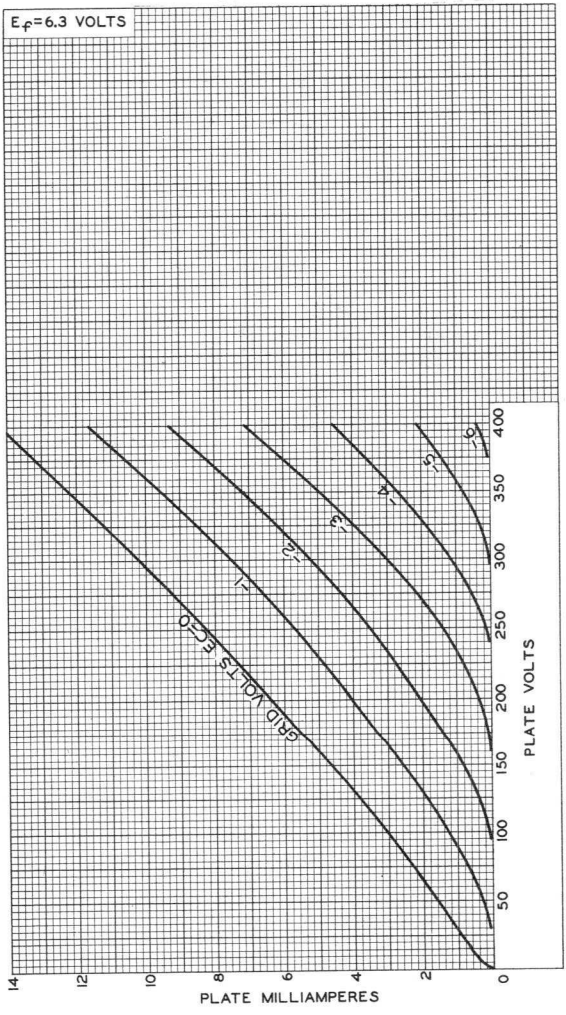
OPERATING CONSIDERATIONS

The *bulb* becomes hot during operation. To insure adequate cooling, therefore, it is essential that free circulation of air be provided.


1.188" MAX.
1.062" MIN.
DIA.
T9 BULB
2 7/16"
MAX.
3"
MAX.
BASE
JEDEC GROUP 1,
NO B8-58
1 9/32"
MAX. DIA.
92CS-10468

6EM7

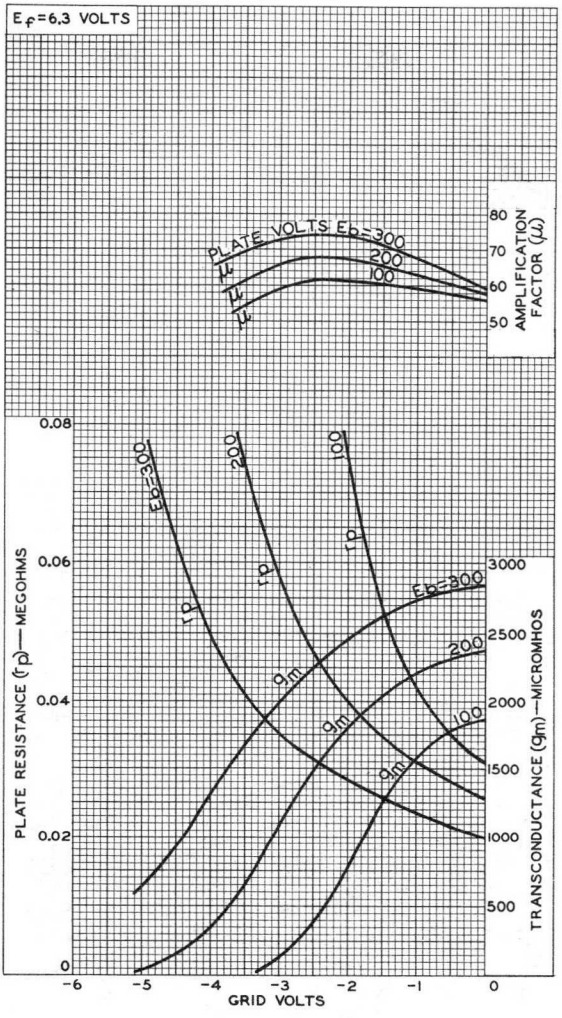
AVERAGE PLATE CHARACTERISTICS
Unit No. 1



92CM-9912

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.

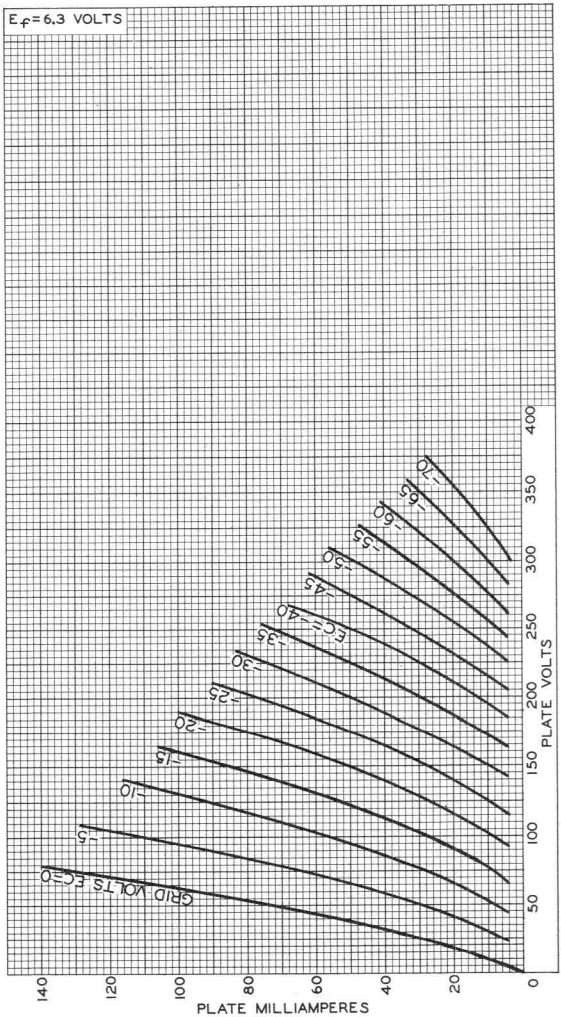
AVERAGE CHARACTERISTICS
Unit No. 1



92CM-9915

6EM7

AVERAGE PLATE CHARACTERISTICS
Unit No. 2



92CM-10466

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.

Medium-Mu Triode—Sharp-Cutoff Pentode

9-PIN MINIATURE TYPE

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Heater, for Unipotential Cathodes:		
Voltage (AC or DC)	6.3	volts
Current	0.45 ± 6%	amp
Warm-up time (Average)	11	sec

Direct Interelectrode Capacitances:

	Without External Shield	*With External Shield*[a]	
Triode Unit:			
Grid to plate	1.8	1.8	μμf
Grid to cathode, pentode cathode & pentode grid No.3 & internal shield, and heater	2.8	2.8	μμf
Plate to cathode, pentode cathode & pentode grid No.3 & internal shield, and heater	1.5	2	μμf
Pentode Unit:			
Grid No.1 to plate	0.02 max.	0.01 max.	μμf
Grid No.1 to cathode & grid No.3 & internal shield, grid No.2, and heater	5	5	μμf
Plate to cathode & grid No.3 & internal shield, grid No.2, and heater	2	3	μμf
Pentode plate to triode plate	0.15 max.	0.03 max.	μμf

Characteristics, Class A_1 Amplifier:

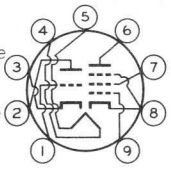
	Triode Unit	*Pentode Unit*	
Plate Voltage	125	125	volts
Grid-No.2 Voltage	–	125	volts
Grid-No.1 Voltage	-1	-1	volt
Amplification Factor	40	–	
Plate Resistance (Approx.)	5000	200000	ohms
Transconductance	8000	6500	μmhos
Plate Current	14	12	ma
Grid-No.2 Current	–	4	ma
Grid-No.1 Voltage (Approx.) for plate μa = 20	-9	-9	volts

6FV8

Mechanical:

Operating Position	Any
Maximum Overall Length	2-3/16"
Maximum Seated Length	1-15/16"
Length, Base Seat to Bulb Top (Excluding tip)	1-9/16" ± 3/32"
Diameter	0.750" to 0.875"
Dimensional Outline	See *General Section*
Bulb	T6-1/2
Base	Small-Button Noval 9-Pin (JEDEC No.E9-1)
Basing Designation for BOTTOM VIEW	9FA

Pin 1 – Triode Grid
Pin 2 – Triode Plate
Pin 3 – Triode Cathode
Pin 4 – Heater
Pin 5 – Heater
Pin 6 – Pentode Plate
Pin 7 – Pentode Grid No.2



Pin 8 – Pentode Cathode, Grid No.3, Internal Shield
Pin 9 – Pentode Grid No.1

AMPLIFIER — Class A$_1$

Pentode Unit

Maximum Ratings, *Design-Maximum Values:*

PLATE VOLTAGE	330 max.	volts
GRID-No.2 (SCREEN-GRID) SUPPLY VOLTAGE	330 max.	volts
GRID-No.2 VOLTAGE	See *Grid-No.2 Input Rating Chart* at front of Receiving Tube Section	
GRID-No.1 (CONTROL-GRID) VOLTAGE:		
Positive-bias value	0 max.	volts
GRID-No.2 INPUT:		
For grid-No.2 voltages up to 165 volts	0.55 max.	watt
For grid-No.2 voltages between 165 and 330 volts	See *Grid-No.2 Input Rating Chart* at front of Receiving Tube Section	
PLATE DISSIPATION	2.3 max.	watts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	200 max.	volts
Heater positive with respect to cathode	200[b] max.	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance:		
For fixed-bias operation	0.25 max.	megohm
For cathode-bias operation	1 max.	megohm

VERTICAL-DEFLECTION OSCILLATOR

Triode Unit

Maximum Ratings, *Design-Maximum Values:*

For operation in a 525-line, 30-frame system[c]

DC PLATE VOLTAGE	330	max.	volts
PEAK NEGATIVE-PULSE GRID VOLTAGE	250	max.	volts
CATHODE CURRENT:			
Peak	70	max.	ma
Average	20	max.	ma
PLATE DISSIPATION	2	max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	200	max.	volts
Heater positive with respect to cathode	200[b]	max.	volts

Maximum Circuit Values:

Grid-Circuit Resistance:			
For cathode-bias operation	3	max.	megohms

[a] With external shield JEDEC No.315 connected to pin 4.

[b] The dc component must not exceed 100 volts.

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

Medium-Mu Triode—Sharp-Cutoff Pentode

9-PIN MINIATURE TYPE

GENERAL DATA

Electrical:

Heater, for Unipotential Cathodes:			
Voltage (AC or DC)	6.3		volts
Current at 6.3 volts	0.45 ± 6%		amp
Warm-up time (Average)	11		sec
Direct Interelectrode Capacitances:	*Without External Shield*	*With External Shield*▲	
Triode Unit:			
Grid to plate	1.6	1.6	μμf
Grid to cathode, pentode grid No.3 & pentode cathode & internal shield, and heater	3.4	3.6	μμf
Plate to cathode, pentode grid No.3 & pentode cathode & internal shield, and heater	1.7	2.2	μμf
Heater to cathode	3	3●	μμf
Pentode Unit:			
Grid No.1 to plate	0.02 max.	0.015 max.	μμf
Grid No.1 to cathode & grid No.3 & internal shield, grid No.2, and heater	5.5	5.5	μμf
Plate to cathode & grid No.3 & internal shield, grid No.2, and heater	2.6	3.4	μμf
Heater to cathode & grid No.3 & internal shield	3	3●	μμf

Characteristics, Class A_1 Amplifier:

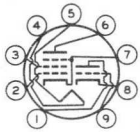
	Triode Unit	*Pentode Unit*	
Plate Voltage	125	125	volts
Grid-No.2 Voltage	–	125	volts
Grid-No.1 Voltage	−1	−1	volt
Amplification Factor	46	–	
Plate Resistance (Approx.)	5400	200000	ohms
Transconductance	8500	7500	μmhos
Plate Current	13.5	12	ma
Grid-No.2 Current	–	4	ma
Grid-No.1 Voltage (Approx.) for plate μa = 10	−8	−8	volts

6GH8

Mechanical:

Operating Position	Any
Maximum Overall Length	2-3/16"
Maximum Seated Length	1-15/16"
Length, Base Seat to Bulb Top (Excluding tip)	1-9/16" ± 3/32"
Diameter	0.750" to 0.875"
Dimensional Outline	See *General Section*
Bulb	T6-1/2
Base	Small-Button Noval 9-Pin (JEDEC No.E9-1)
Basing Designation for BOTTOM VIEW	9AE

Pin 1 – Triode Plate
Pin 2 – Pentode Grid No.1
Pin 3 – Pentode Grid No.2
Pin 4 – Heater
Pin 5 – Heater
Pin 6 – Pentode Plate



Pin 7 – Pentode Cathode, Pentode Grid No.3, Internal Shield
Pin 8 – Triode Cathode
Pin 9 – Triode Grid

HORIZONTAL-DEFLECTION OSCILLATOR

Maximum Ratings, *Design-Maximum Values:*

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

	Triode Unit	*Pentode Unit*	
PLATE VOLTAGE	330 max.	350 max.	volts
GRID-No.2 (SCREEN-GRID) SUPPLY VOLTAGE	–	330 max.	volts
GRID-No.2 VOLTAGE	–	*See Grid-No.2 Input Rating Chart at front of Receiving Tube Section*	
GRID-No.1 (CONTROL-GRID) VOLTAGE:			
Positive-bias value	0 max.	0 max.	volts
Peak-negative value	–	175 max.	volts
CATHODE CURRENT:			
Peak	–	300 max.	ma
Average	–	20 max.	ma
GRID-No.2 INPUT:			
For grid-No.2 voltages up to 165 volts	–	0.55 max.	watt
For grid-No.2 voltages between 165 and 330 volts	–	*See Grid-No.2 Input Rating Chart at front of Receiving Tube Section*	
PLATE DISSIPATION	2.5 max.	2.5 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	200 max.	200 max.	volts
Heater positive with respect to cathode	200♦ max.	200♦ max.	volts

Maximum Circuit Values:

	Triode Unit	*Pentode Unit*	
Grid-No.1-Circuit Resistance: For fixed-bias or cathode-bias operation.	2.2 max.	2.2 max.	megohms

▲ With external shield JEDEC No.315 connected to cathode of unit under test except as noted.

● With external shield JEDEC No.315 connected to ground.

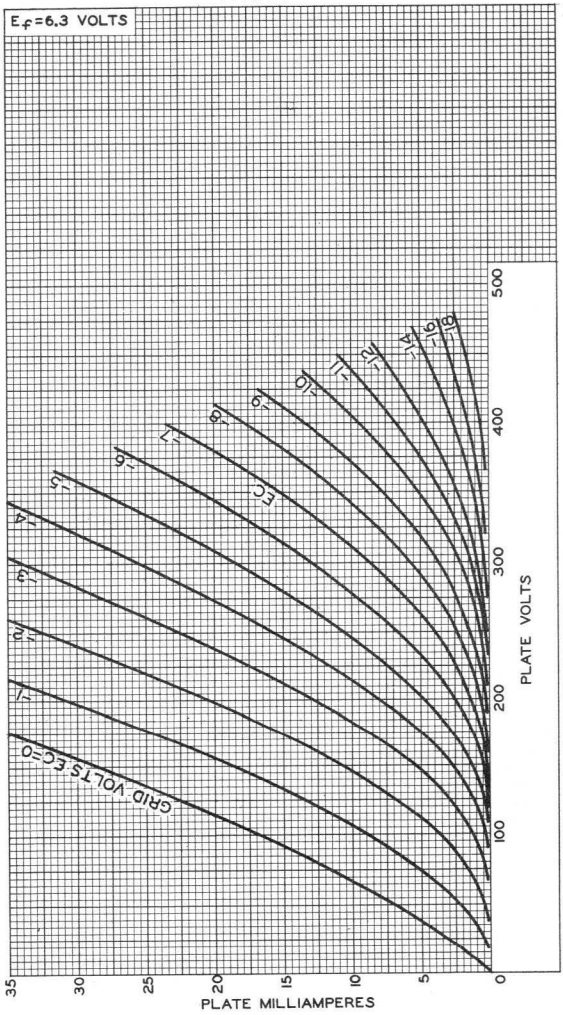
★ As described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission.

⧫ The dc component must not exceed 100 volts.

6GH8

AVERAGE PLATE CHARACTERISTICS

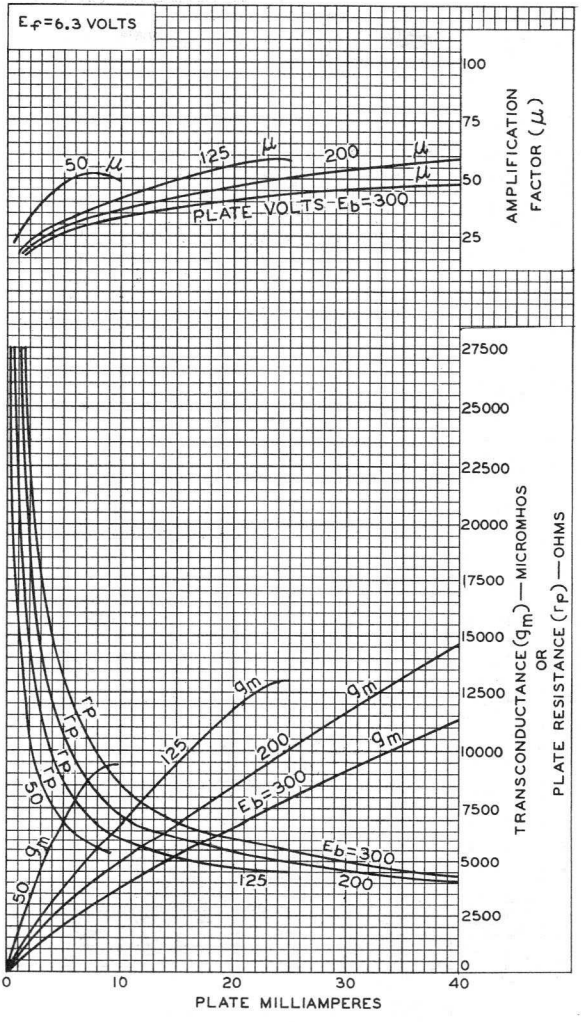
Triode Unit



92CM-10421RI

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.

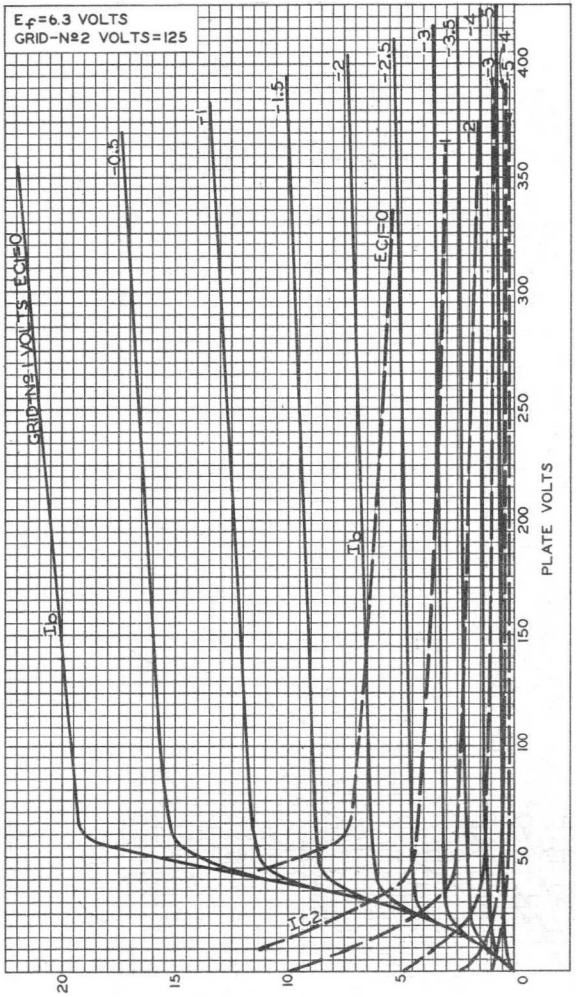
AVERAGE CHARACTERISTICS
Triode Unit



92CM-10428

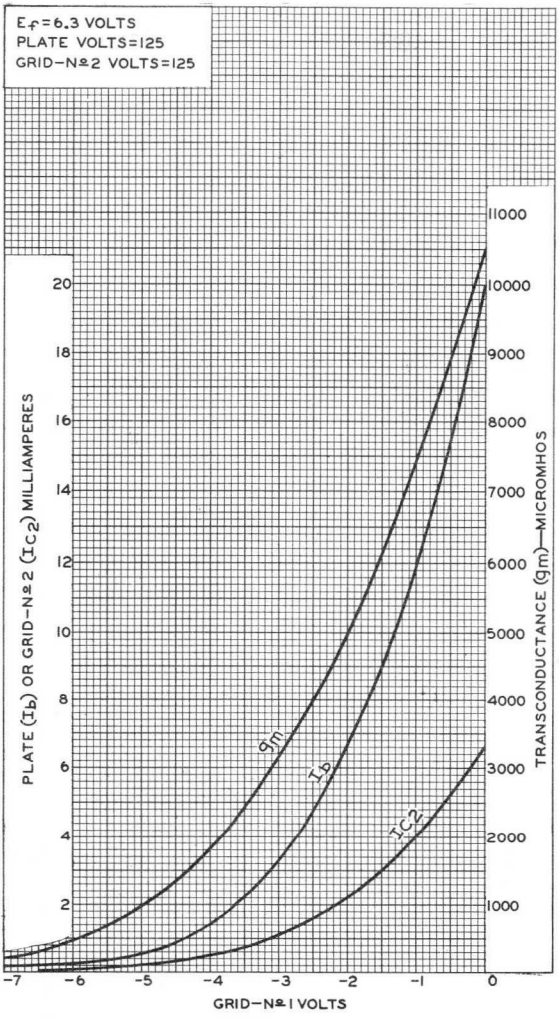
6GH8

AVERAGE CHARACTERISTICS
Pentode Unit

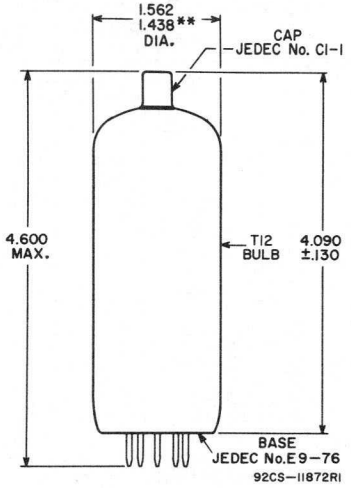


92CM-10436

AVERAGE CHARACTERISTICS
Pentode Unit



92CM-10417



ALL DIMENSIONS IN INCHES

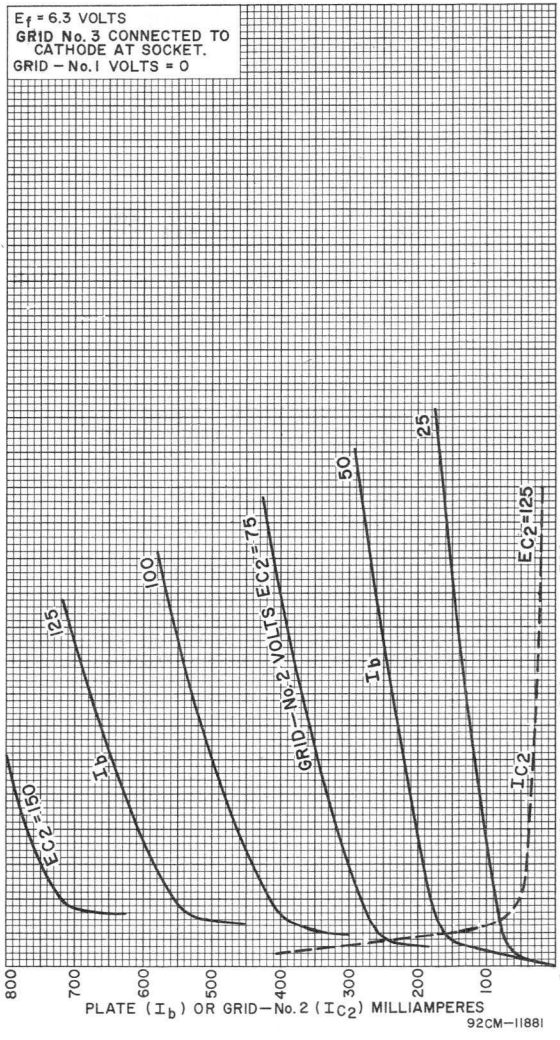
** APPLIES IN ZONE STARTING 0.375" FROM BASE SEAT.

OPERATING CONSIDERATIONS

In *horizontal-deflection amplifier service* a positive voltage may be applied to grid No.3 to minimize "snivets" interference which may occur in both uhf and vhf television receivers. A typical value for this voltage is 30 volts.

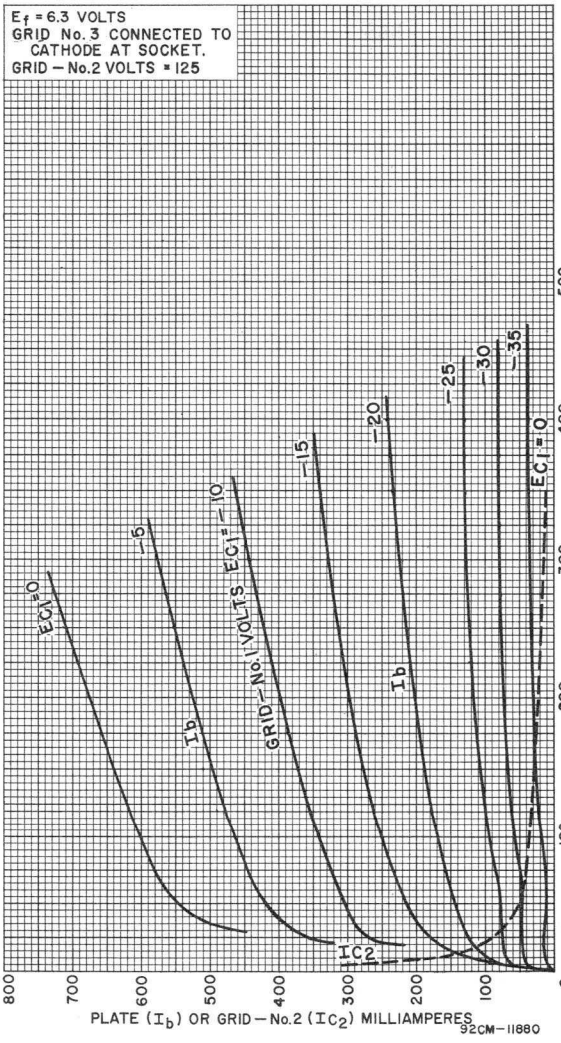
6JE6

AVERAGE CHARACTERISTICS



RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.

AVERAGE CHARACTERISTICS



Beam Power Tube

NOVAR TYPE

For Color-TV Horizontal-Deflection Amplifier Applications

GENERAL DATA

Electrical:

Heater Characteristics and Ratings:			
Voltage (AC or DC)	6.3 ± 0.6		volts
Current at heater volts = 6.3	2.500		amp
Peak heater-cathode voltage:			
Heater negative with respect to cathode	200	max.	volts
Heater positive with respect to cathode	200[a]	max.	volts
Direct Interelectrode Capacitances (Approx.):[b]			
Grid No.1 to plate	0.44		pf
Grid No.1 to cathode, grid No.3, grid No.2, and heater	21.0		pf
Plate to cathode, grid No.3, grid No.2, and heater	11.0		pf

Characteristics, Class A$_1$ Amplifier:

	Triode Connection	*Pentode Connection*		
Plate Voltage	125	70	175	volts
Grid No.3	*Connected to cathode at socket*			
Grid-No.2 Voltage	125	125	125	volts
Grid-No.1 Voltage	−25	0	−25	volts
Amplification Factor	3.3	–	–	
Plate Resistance (Approx.)	–	–	5500	ohms
Transconductance	–	–	10500	μmhos
Plate Current	–	580[c]	115	ma
Grid-No.2 Current	–	40[c]	5	ma
Grid-No.1 Voltage (Approx.) for plate ma. = 1	–	–	−55	volts

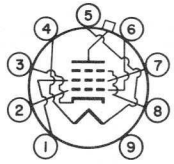
Mechanical:

Operating Position	Any
Type of Cathode	Coated Unipotential
Maximum Overall Length	4.600"
Seated Length	4.090" ± 0.130"
Diameter	1.438" to 1.562"
Bulb	T12
Cap	Small (JEDEC No.C1-1)
Socket	Cinch Mfg. Co. No.149 19 00 033, Industrial Electronic Hardware Corp. No.SO-0968-SL1, or equivalent

6JE6

Base. . . . . .Large Button Novar 9-Pin (JEDEC No.E9-76)
Basing Designation for BOTTOM VIEW. 9QL

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



Pin 6 - Grid No.1
Pin 7 - Grid No.2
Pin 8 - Grid No.3
Pin 9 - Do Not Use
Cap - Plate

HORIZONTAL-DEFLECTION AMPLIFIER

Maximum Ratings, *Design-Maximum Values:*

For operation in a 525-line, 30-frame system[d]

DC PLATE-SUPPLY VOLTAGE	990 max.	volts
PEAK POSITIVE-PULSE PLATE VOLTAGE[e]	7000 max.	volts
PEAK NEGATIVE-PULSE PLATE VOLTAGE	1100 max.	volts
DC GRID-No.3 VOLTAGE (See *Operating Considerations*)	75 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	190 max.	volts
PEAK NEGATIVE-PULSE GRID-No.1 (CONTROL-GRID) VOLTAGE	250 max.	volts
CATHODE CURRENT:		
Peak	1100 max.	ma
Average	315 max.	ma
GRID-No.2 INPUT	3.2 max.	watts
PLATE DISSIPATION[f]	24 max.	watts
BULB TEMPERATURE (At hottest point on bulb surface)	240 max.	°C

Maximum Circuit Values:

Grid-No.1-Circuit Resistance:		
For grid-resistor bias operation[f]	0.47 max.	megohm
For plate-pulsed operation (horizontal-deflection circuits only)	10 max.	megohms

[a] The dc component must not exceed 100 volts.

[b] Without external shield.

[c] This value can be measured by a method involving a recurrent wave form such that the plate dissipation, grid-No.2 input, and cathode current will be kept within ratings in order to prevent damage to the tube.

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

[e] This rating is applicable where the duration of the voltage pulse does 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.

[f] It is essential that the plate dissipation be limited in the event of loss of grid signal. For this purpose, some protective means such as a cathode resistor of suitable value should be employed.

Three-Unit Triode

With Medium-Mu Unit and Two High-Mu Units

DUODECAR TYPE

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Heater Characteristics and Ratings *(Design-Maximum Values):*			
Voltage (AC or DC)	6.3[a]	6.3 ± 0.6	volts
Current	0.600 ± 0.040	0.600[b]	amp
Warm-up time (Average)	11	–	sec
Peak heater-cathode voltage (Each unit):			
Heater negative with respect to cathode	200 max.		volts
Heater positive with respect to cathode	200[c] max.		volts

Direct Interelectrode Capacitances (Approx.):[d]

	Unit No.1	*Unit No.2*	*Unit No.3*	
Grid to plate	1.3	1.3	1.3	μμf
Grid to cathode, internal shield, and heater	1.9	1.8	1.8	μμf
Plate to cathode, internal shield, and heater	1.8	0.7	1.8	μμf

Characteristics, Class A_1 Amplifier:

	Unit No.1	*Units No. 2 or 3*	
Plate Voltage	250	250	volts
Grid Voltage	-8.5	-2	volts
Amplification Factor	17	100	
Plate Resistance (Approx.)	7700	62500	ohms
Transconductance	2200	1600	μmhos
Plate Current	10.5	1.2	ma
Grid Voltage (Approx.) for plate μa = 10	-24	–	volts

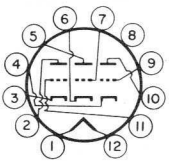
Mechanical:

Operating Position	Any
Type of Cathodes	Coated Unipotential
Maximum Overall Length	1.875"
Seated Length	1.250" to 1.500"
Diameter	1.062" to 1.188"
Bulb	T9
Base	Small-Button Duodecar 12-Pin (JEDEC No.E12-70)

6K11

Basing Designation for BOTTOM VIEW. 12BY

Pin 1 – Heater
Pin 2 – Plate of Unit No.3
Pin 3 – Cathode of Unit No.3
Pin 4 – Cathode of Unit No.1
Pin 5 – Plate of Unit No.2
Pin 6 – Cathode of Unit No.2



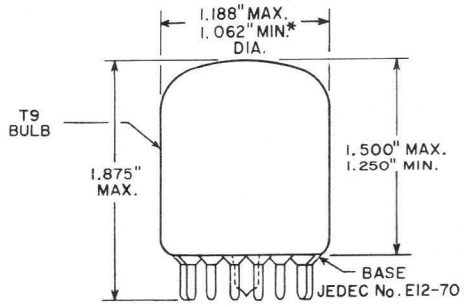
Pin 7 – Grid of Unit No.2
Pin 8 – Internal Shield
Pin 9 – Grid of Unit No.1
Pin 10 – Plate of Unit No.1
Pin 11 – Grid of Unit No.3
Pin 12 – Heater

AMPLIFIER — Class A_1

Maximum Ratings, *Design-Maximum Values:*

	Unit No.1	*Units No. 2 or 3*	
PLATE VOLTAGE	330 max.	330 max.	volts
GRID VOLTAGE:			
Negative-bias value	50 max.	50 max.	volts
Positive-bias value	0 max.	0 max.	volts
CATHODE CURRENT	20 max.	–	ma
PLATE DISSIPATION	2.75 max.	0.3 max.	watts

[a] At heater amperes = 0.600.
[b] At heater volts = 6.3.
[c] Without external shield.
[d] The dc component must not exceed 100 volts.



92CS-11485

* APPLIES IN ZONE STARTING 0.375" FROM BASE SEAT.

6L4

OSCILLATOR TRIODE

ACORN TYPE

GENERAL DATA

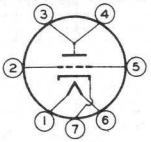
Electrical:

Heater, for Unipotential Cathode:		
Voltage	6.3	ac or dc volts
Current	0.225	amp
Direct Interelectrode Capacitances:*		
Grid to Plate	1.6	μμf
Grid to Cathode	1.8	μμf
Plate to Cathode	0.5	μμf

* With no external shield.

Mechanical:

Mounting Position	Any
Overall Length	1-7/32" ± 5/32"
Overall Diameter (Including radial pins)	1-3/32" ± 1/16"
Bulb	T-4-1/2
Base	Small Radial 7-Pin
Basing Designation for BOTTOM VIEW	7BR



Pin 1 – Heater
Pin 2 – Grid
Pin 3 – Plate
Pin 4 – Plate
Pin 5 – Grid
Pin 6 – Heater
Pin 7 – Cathode

AMPLIFIER – Class A_1

Maximum Ratings, *Design-Center Values*:

PLATE VOLTAGE	500 max.	volts
PLATE DISSIPATION	1.7 max.	watts
PLATE CURRENT	15 max.	ma
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	80 max.	volts
Heater positive with respect to cathode	80 max.	volts

Typical Operation and Characteristics:

Plate Voltage	80	volts
Cathode-Bias Resistor	150	ohms
Amplification Factor	28	
Plate Resistance	4400	ohms
Transconductance	6400	μmhos
Plate Current	9.5	ma

Maximum Circuit Values (for maximum rated conditions):

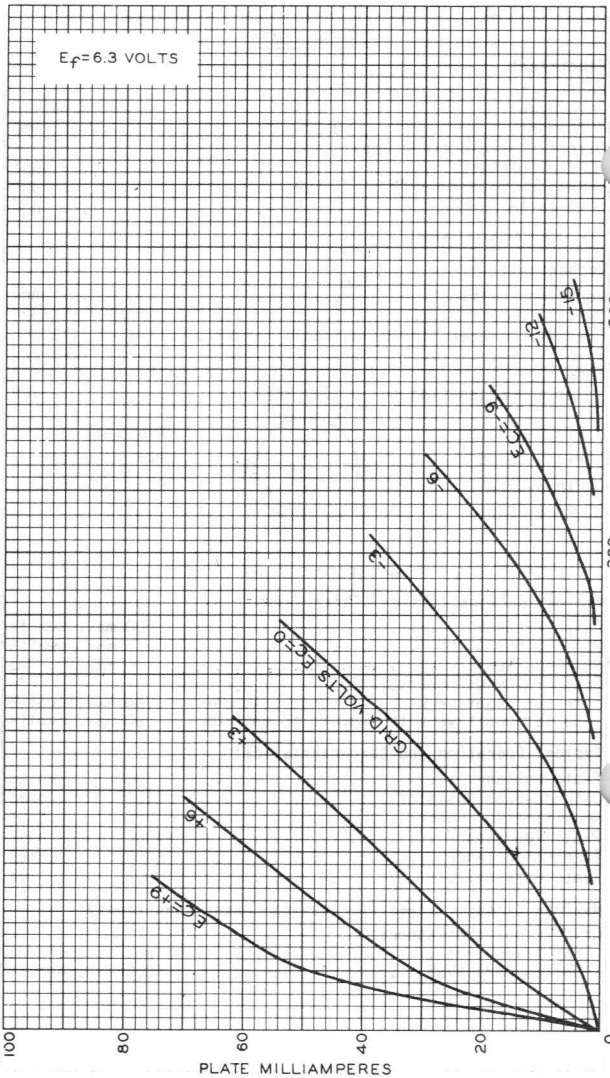
Grid-Circuit Resistance:	
For fixed bias	Not Recommended
For cathode bias	0.5 max. megohm

6L4

RCA

6L4

AVERAGE PLATE CHARACTERISTICS



MAR. 8, 1949

TUBE DEPARTMENT

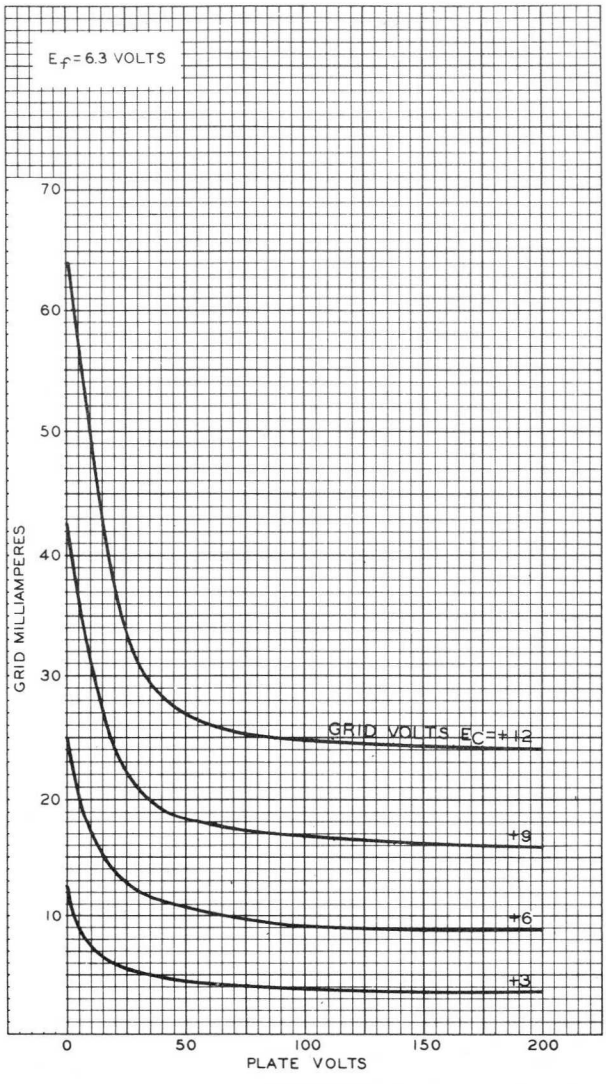
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7199

RCA

6L4

TYPICAL CHARACTERISTICS



6N6-G

DIRECT-COUPLED POWER AMPLIFIER

Heater *	Coated Unipotential Cathode	
Voltage	6.3	a-c or d-c volts
Current	0.8	amp.
Maximum Overall Length		4-11/16"
Maximum Diameter		1-13/16"
Bulb		ST-14
Base		Medium Shell Octal 7-Pin
Pin 1 - No Connection		Pin 5 - Input-Triode Grid
Pin 2 - Heater		
Pin 3 - Output-Triode Plate		Pin 7 - Heater
Pin 4 - Input-Triode Plate		Pin 8 - Cathode
Mounting Position	BOTTOM VIEW (G-7AU)	Any



AMPLIFIER - Class A_1

Operating Conditions and Characteristics:

Heater *	6.3	volts
Output-Triode Plate	300 max.	volts
Input-Triode Plate	300 max.	volts
Input-Triode Grid ▲	0	volts
Peak A-F Grid Voltage	21	volts
Amp. Fact.	58	
Plate Res.	24000	ohms
Transcond. ≠	2400	μmhos
Output-Triode Plate Cur.	42	ma.
Input-Triode Plate Cur.	9	ma.
Load Res. □	7000	ohms
Total Harmonic Distortion	5	%
Power Output	4	watts

* 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.

≠ Input grid to output plate.

▲ The input triode serves as a driver for the output triode and is directly coupled to it. No external bias supply is required, but the input-triode grid does not draw grid current because a bias voltage is set up automatically in the tube.

□ If two tubes are operated in push-pull, the plate-to-plate load resistance should be 10000 ohms.

6SZ7

DUPLEX-DIODE HIGH-MU TRIODE

SINGLE-ENDED METAL TYPE

GENERAL DATA

Electrical:

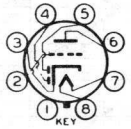
Heater, for Unipotential Cathode:		
Voltage	6.3	ac or dc volts
Current	0.15	amp.
Direct Interelectrode Capacitances—Triode Unit (Approx.):°		
Grid to Plate	1.1	μμf
Grid to Cathode	2.6	μμf
Plate to Cathode	2.8	μμf

° With shell connected to cathode.

Mechanical:

Mounting Position	Any
Maximum Overall Length	2-5/8"
Maximum Seated Length	2-1/16"
Maximum Diameter	1-5/16"
Bulb	MT-8G
Base	Small Wafer Octal 8-Pin
Basing Designation for BOTTOM VIEW	8Q

Pin 1 – Shell
Pin 2 – Triode Grid
Pin 3 – Cathode
Pin 4 – Diode Plate No.2



Pin 5 – Diode Plate No.1
Pin 6 – Triode Plate
Pin 7 – Heater
Pin 8 – Heater

TRIODE UNIT

Maximum Ratings, *Design-Center Values*:

PLATE VOLTAGE	300 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	90 max.	volts
Heater positive with respect to cathode	90 max.	volts

Characteristics - Class A_1 Amplifier:

Plate Voltage	100	250	volts
Grid Voltage	-1	-3	volts
Amplification Factor	70	70	
Plate Resistance (Approx.)	61000	58700	ohms
Transconductance	1150	1200	μmhos
Plate Current	0.8	1	ma.

Typical Operation — Resistance-Coupled Amplifier:

Same as type 6Q7 in RESISTANCE-COUPLED AMPLIFIER CHART

DIODE UNITS - Two

Consideration of these units, including typical circuits and diode curves is given at the front of this section. Diode biasing of the triode unit of the 6SZ7 is not suitable.

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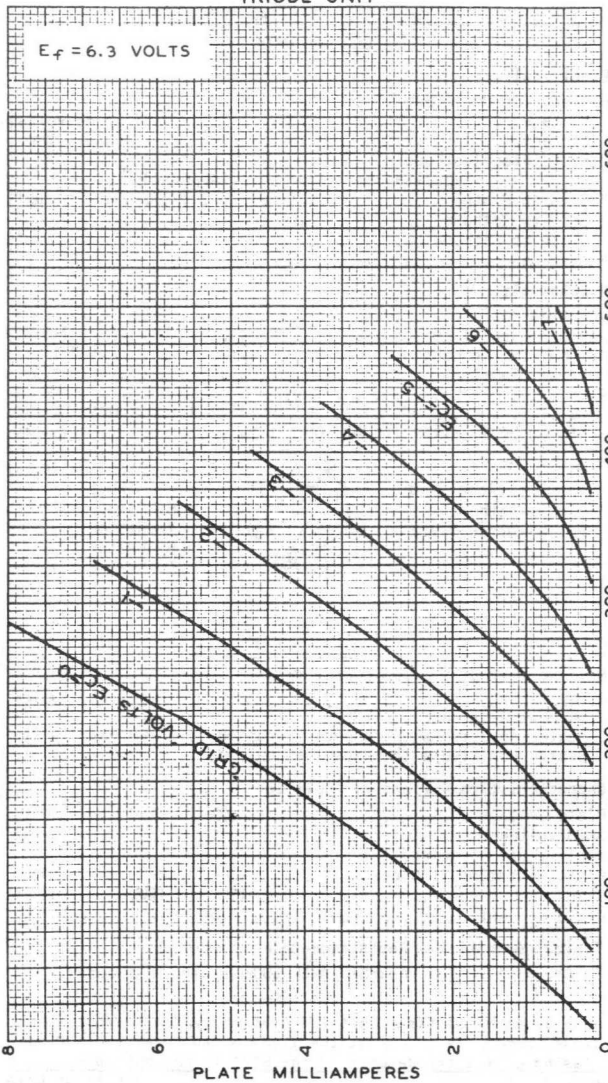
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6SZ7

6SZ7
AVERAGE PLATE CHARACTERISTICS
TRIODE UNIT



7AU7

MEDIUM-MU TWIN TRIODE

9-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

The 7AU7 is the same as the 12AU7 except for the following items:

Heater, for Unipotential Cathodes:

	Series	*Parallel*	
Heater arrangement			
Voltage	7.0	3.5	ac or dc volts
Current	0.3	0.6	amp
Warm-up time (Average)	-	11	sec

For definition of heater warm-up time and method of determining it, see sheet HEATER WARM-UP TIME MEASUREMENT at front of this Section.

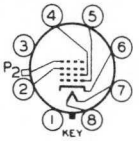
7CP1
OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS, MAGNETIC DEFLECTION

General:

Heater, for Unipotential Cathode:	
Voltage	6.3 ± 10% ac or dc volts
Current	0.6 amp
Direct Interelectrode Capacitances (Approx.):	
Grid No.1 to All Other Electrodes	8.0 µµf
Cathode to All Other Electrodes	6.5 µµf
Phosphor (For Curves, see front of this Section)	No.1
Fluorescence	Green
Persistence	Medium
Focusing Method	Electrostatic
Deflection Method	Magnetic
Solid Deflection Angle (Approx.)	57°
Overall Length	13-7/16" ±3/8"
Greatest Diameter of Bulb	7" ±1/8"
Minimum Useful Screen Diameter	6-1/2"
Cap	Recessed Small Ball
Mounting Position	Any
Base	Long Medium-Shell Octal 8-Pin
Basing Designation for BOTTOM VIEW	6AZ

Pin 1 – No Connection
Pin 2 – Anode No.1
Pin 3 – No Connection
Pin 4 – Grid No.2
Pin 5 – Grid No.1



Pin 6 – Cathode
Pin 7 – Heater
Pin 8 – Heater
Cap – Anode No.2

Maximum Ratings, *Design-Center Values*:

ANODE-No.2 VOLTAGE	8000 max.	volts
ANODE-No.1 VOLTAGE	2400 max.	volts
GRID-No.2 VOLTAGE	300 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value	125 max.	volts
Positive bias value	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	125 max.	volts

Typical Operation:

Anode-No.2 Voltage*	4000	7000	volts
Anode-No.1 Voltage for Focus at 75% of Grid-No.1 Voltage for Cutoff°	780	1365	volts
Grid-No.2 Voltage	250	250	volts
Grid-No.1 Voltage for Visual Cutoff**	-45	-45	volts

*, °, **: See next page.

RCA

7CP1

OSCILLOGRAPH TUBE

* Brilliance and definition decrease with decreasing anode-No.2 voltage. In general, the anode-No.2 voltage should not be less than 4000 volts.

o Individual tubes may require between −30% and +20% of the values shown with grid-No.1 voltages between zero and cutoff.

** Visual extinction of undeflected focused spot. Supply should be adjustable to ± 50% of indicated value.

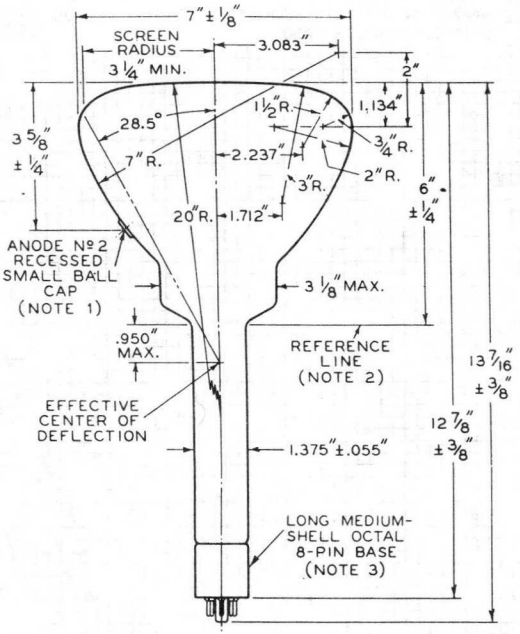
Maximum Circuit Values:

Grid-No.1-Circuit Resistance. . . . . 1.5 max. megohms

RCA

7CP1

OSCILLOGRAPH TUBE



NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN No. 2 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ANODE No. 2 TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF 10°. ANODE No. 2 TERMINAL IS ON SAME SIDE OF TUBE AS PIN No. 2.

NOTE 2: REFERENCE LINE IS DETERMINED BY POSITION WHERE GAUGE 1.430" + .003" − .000" I.D. AND 2" LONG WILL REST ON BULB CONE.

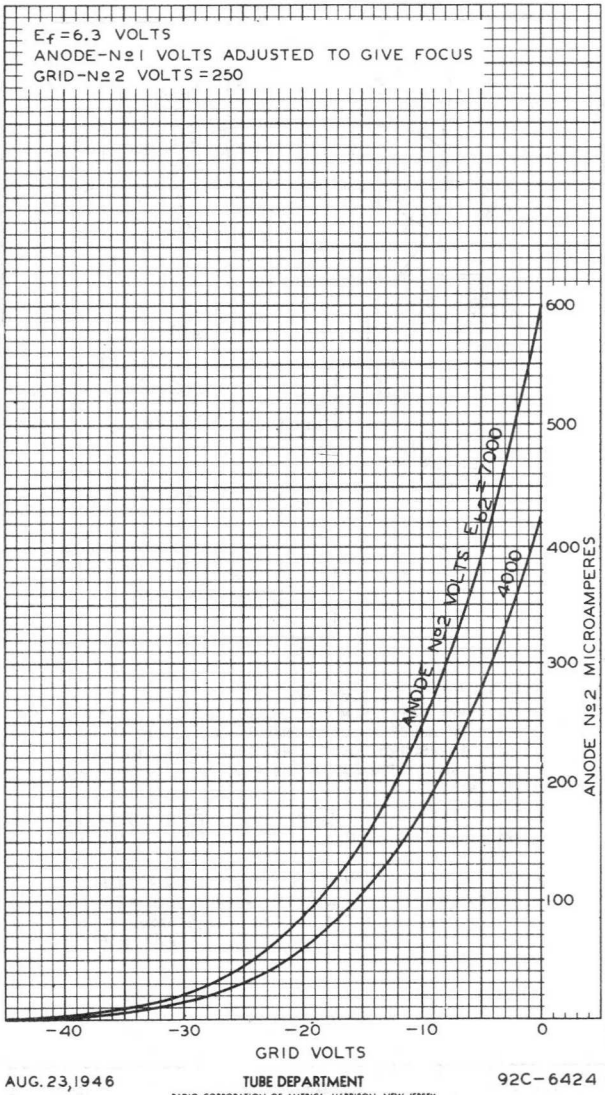
NOTE 3: ℄ OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF THE BOTTOM OF THE BASE.

92CM-6364R2

7CP1

7CP1

AVERAGE CHARACTERISTICS



AUG. 23, 1946

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92C-6424

7E6
TWIN DIODE—MEDIUM-MU TRIODE

GENERAL DATA

Electrical:

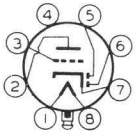
Heater, for Unipotential Cathode:		
Voltage	6.3□	ac or dc volts
Current	0.3□□	amp
Direct Interelectrode Capacitances:*		
Triode Unit:		
Grid to Plate	1.5	μμf
Grid to Cathode	3.0	μμf
Plate to Cathode	2.4	μμf
Diode-No.1 Plate to Grid.	0.01 max.	μμf
Diode-No.2 Plate to Grid.	0.04 max.	μμf

* With external shield connected to cathode.

Mechanical:

Mounting Position	Any
Maximum Overall Length.	2-25/32"
Maximum Seated Length	2-1/4"
Maximum Diameter.	1-3/16"
Bulb.	T-9
Base.	Lock-in 8-Pin
Basing Designation for BOTTOM VIEW	8W

Pin 1 - Heater
Pin 2 - Triode Plate
Pin 3 - Triode Grid
Pin 4 - Internal Connection —Do Not Use
Pin 5 - Diode-No.2 Plate



Pin 6 - Diode-No.1 Plate
Pin 7 - Cathode
Pin 8 - Heater
Plug - Base Shell

TRIODE UNIT
AMPLIFIER - Class A1

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

PLATE VOLTAGE	300 max.	volts
PLATE DISSIPATION	2.5 max.	watts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	90 max.	volts
Heater positive with respect to cathode	90 max.	volts

Typical Operation and Characteristics:

Plate Voltage	100	250	volts
Cathode-Bias Resistor	770	950	ohms
Amplification Factor.	16.5	16	
Plate Resistance	11000	8500	ohms

(continued on next page)

□ Nominal Voltage = 7.0 volts. □□ Nominal Current = 0.32 ampere.

←Indicates a change.

7E6
TWIN DIODE—MEDIUM-MU TRIODE

Transconductance	1500	1900	μmhos
Plate Current	3.9	9.5	ma

Maximum Circuit Values (for maximum circuit conditions):

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

DIODE UNITS – Two

Maximum Ratings, *Design-Center Values*:

PLATE CURRENT (Each Diode) . . . . . 1 max. ma

7MP14

OSCILLOGRAPH TUBE

MAGNETIC FOCUS MAGNETIC DEFLECTION

The 7MP14 is the same as the 7MP7 except that it utilizes a medimum-long-persistence, cascade (two-layer) screen which exhibits purple fluorescence of short persistence and orange phosphorescence which persists for a little over a minute under conditions of adequate excitation and ambient light.

Because of its medium-long-persistence, the 7MP14 is particularly useful where either low- and medium-speed non-recurring phenomena or high-speed recurring phenomena are to be observed. Furthermore, two or more phenomena can be observed simultaneously on the screen by means of a suitable switching arrangement.

The persistence is such that the 7MP14 without filter can be operated with scanning frequencies as low as 30 cycles per second without excessive flicker. When used with yellow filter, such as Wratten No.15 (G), the 7MP14 can be operated with much lower scanning frequencies.

In general, operation of the 7MP14 at an ultor voltage below 4000 volts will not give persistence of useable brightness.

THE SPECTRAL-ENERGY EMISSION CHARACTERISTIC
and the PERSISTENCE CHARACTERISTIC of
the P14 Phosphor are shown at the
front of this Section

7QP4

MONITOR KINESCOPE

MAGNETIC FOCUS — MAGNETIC DEFLECTION

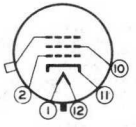
DATA

General:

Heater, for Unipotential Cathode:		
Voltage	6.3	ac or dc volts
Current	0.6	amp
Direct Interelectrode Capacitances (Approx.):		
Grid No.1 to All Other Electrodes	6	μμf
Cathode to All Other Electrodes	5	μμf
Phosphor (For Curves, See front of this Section)		No.4–Sulfide Type
Fluorescence		White
Phosphorescence		White
Persistence		Short
Focusing Method		Magnetic
Deflection Method		Magnetic
Deflection Angle (Approx.)		52°
Ion-Trap Gun		Requires External, Single-Field Magnet
Overall Length		12-7/8" ± 3/8"
Greatest Diameter of Bulb		7-3/16" ± 1/8"
Screen Diameter		6-1/4"
Mounting Position		Any
Cap		Recessed Small Cavity
Base		Small-Shell Duodecal 5-Pin

BOTTOM VIEW

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 10 – Grid No.2



Pin 11 – Cathode
Pin 12 – Heater
Cap – Anode

Maximum Ratings, *Design-Center Values*:

ANODE VOLTAGE*	10000 max.	volts
GRID-No.2 VOLTAGE	410 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value	125 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	410 max.	volts
After equipment warm-up period	150 max.	volts
Heater positive with respect to cathode	150 max.	volts

Typical Operation:

Anode Voltage**	8000	volts

* The product of anode voltage and average anode current should be limited to 6 watts.

** Brilliance and definition decrease with decreasing anode voltage. In general, the anode voltage should not be less than 6000 volts.

7QP4

MONITOR KINESCOPE

Grid-No.2 Voltage.	300	volts
Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot . .	-33 to -77	volts
Focusing-Coil Current (DC, approx.)# . . .	80	ma
Field Strength of Single-Field Ion-Trap Magnet°.	35	gausses

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

Minimum Circuit Values:

The power supply should be of the limited-energy type with inherent regulation to limit the continuous short-circuit current to 5 milliamperes. If the supply permits the instantaneous short-circuit current to exceed 1 ampere, or is capable of storing more than 250 microcoulombs, the effective resistance in circuit between indicated electrode and the output capacitor should be as follows:

Grid-No.1-Circuit Resistance	150 min.	ohms
Grid-No.2-Circuit Resistance	470 min.	ohms
Anode-Circuit Resistance	11000 min.	ohms

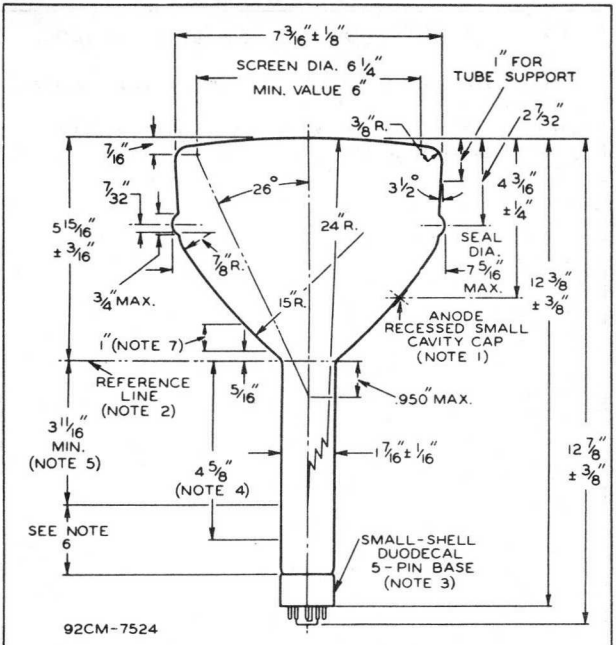
The resistors used should be capable of withstanding the applied voltage.

\# For specimen focusing coil similar to JETEC Focusing Coil No.109, positioned with air gap toward kinescope screen, and center line of air gap 3 inches from Reference Line (see *Outline Drawing*). The indicated current is for condition with combined grid-No.1 bias voltage and video-signal voltage adjusted to produce a highlight brightness of 40 foot-lamberts on a 5-3/8" x 4" picture area sharply focused at center of screen.

° Measured at center of field with General Electric Gauss Meter, Cat. No.409X51.

7QP4

MONITOR KINESCOPE



NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND VACANT PIN POSITION No.3 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ANODE TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF 10°. ANODE TERMINAL IS ON SAME SIDE AS VACANT PIN POSITION No.3.

NOTE 2: REFERENCE LINE IS DETERMINED BY POSITION WHERE HINGED GAUGE 1.500" + .003" – .000" I.D. AND 2" LONG WILL REST ON BULB CONE.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING DIAMETER OF 1-7/8".

NOTE 4: DISTANCE FROM REFERENCE LINE FOR LOCATING CENTER OF ION-TRAP MAGNETIC FIELD. DIRECTION OF FIELD OF THE ION-TRAP MAGNET SHOULD BE SUCH THAT NORTH POLE IS ADJACENT TO VACANT PIN POSITION No.8 AND SOUTH POLE TO PIN No.2.

RCA

7QP4

MONITOR KINESCOPE

NOTE 5: LOCATION OF DEFLECTING YOKE MUST BE WITHIN THIS SPACE.

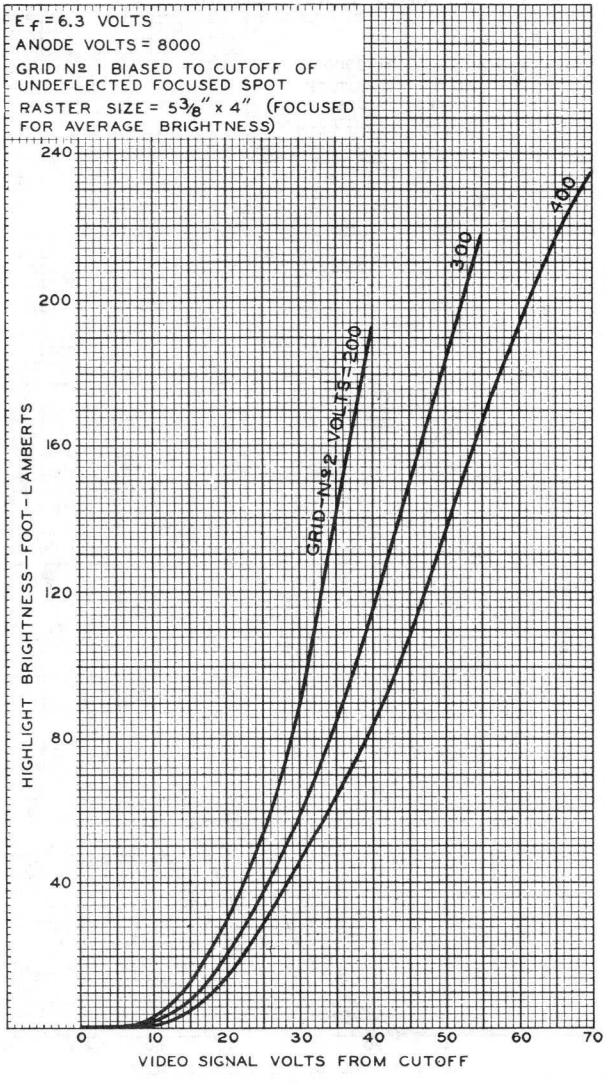
NOTE 6: KEEP THIS SPACE CLEAR FOR SINGLE-FIELD, ION-TRAP MAGNET.

NOTE 7: FOR TUBE SUPPORT WHICH MUST BE KEPT AT LEAST 2" AWAY FROM ANODE CAVITY CAP.

RCA

7QP4

AVERAGE GRID-DRIVE CHARACTERISTICS

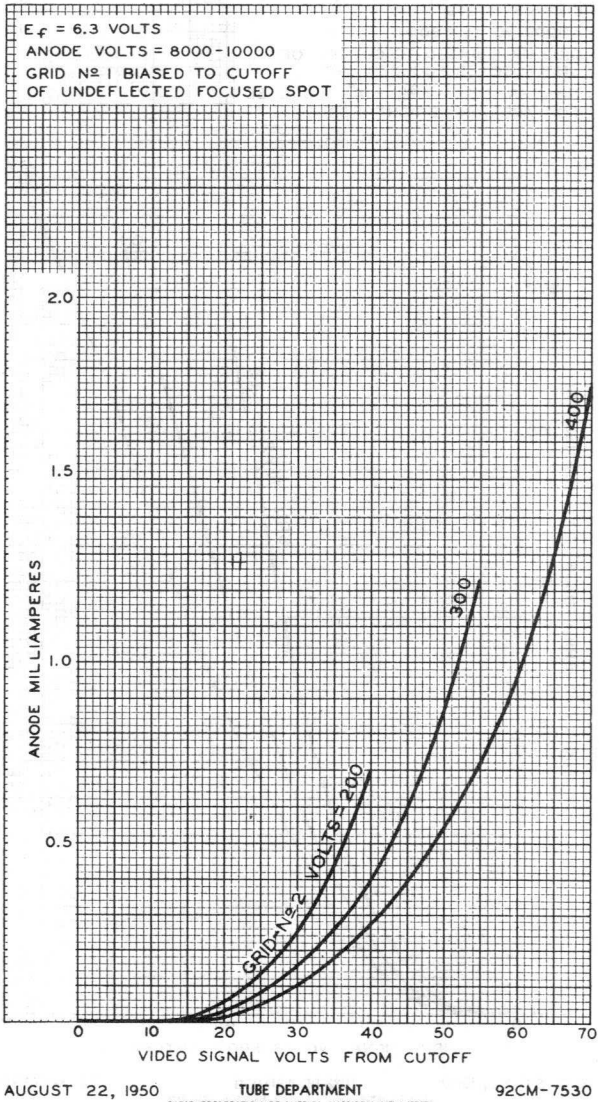


7QP4

RCA

7QP4

AVERAGE GRID-DRIVE CHARACTERISTICS



8AU8
MEDIUM-MU TRIODE— SHARP-CUTOFF PENTODE

9-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

The 8AU8 is the same as the 6AU8 except for the following items:

Heater, for Unipotential Cathodes:		
Voltage (AC or DC)	8.4	volts
Current	0.45	amp

8AW8-A
HIGH-MU TRIODE— SHARP-CUTOFF PENTODE

9-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

The 8AW8-A is the same as the 6AW8-A except for the following items:

Heater, for Unipotential Cathodes:		
Voltage (AC or DC)	8.4	volts
Current	0.45	amp

8BH8
MEDIUM-MU TRIODE— SHARP-CUTOFF PENTODE

9-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

The 8BH8 is the same as the 6BH8 except for the following items:

Heater, for Unipotential Cathodes:		
Voltage (AC or DC)	8.4	volts
Current	0.45	amp

8BN8
TWIN DIODE– HIGH-MU TRIODE

9-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

The 8BN8 is the same as the 6BN8 except for the following items:

Heater, for Unipotential Cathodes:		
Voltage (AC or DC)	8.4	volts
Current	0.45 ± 6%	amp

8BQ5
POWER PENTODE

9-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

The 8BQ5 is the same as the 6BQ5 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	8	volts
Current	0.6	amp
Warm-up time (Average)	11	sec

8CG7
MEDIUM-MU TWIN TRIODE

9-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

The 8CG7 is the same as the 6CG7 except for the following items:

Heater, for Unipotential Cathodes:		
Voltage (AC or DC)	8.4	volts
Current	0.45	amp

8CM7
MEDIUM-MU DUAL TRIODE
With Dissimilar Units

9-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

The 8CM7 is the same as the 6CM7 except for the following items:

Heater, for Unipotential Cathodes:		
Voltage (AC or DC)	8.4	volts
Current	0.45	amp

8CN7
TWIN DIODE—HIGH-MU TRIODE

9-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

The 8CN7 is the same as the 6CN7 except for the following items:

Heater, for Unipotential Cathodes:			
Heater arrangement	*Series*	*Parallel*	
Voltage (AC or DC)	8.4	4.2	volts
Current	0.225	0.45 ± 6%	amp

8CX8
MEDIUM-MU TRIODE— SHARP-CUTOFF TETRODE

9-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

The 8CX8 is the same as the 6CX8 except for the following items:

Heater, for Unipotential Cathodes:		
Voltage (AC or DC)	8	volts
Current	0.6 ± 6%	amp
Warm-up time (Average)	11	sec

RCA

8EB8

HIGH-MU TRIODE–SHARP-CUTOFF PENTODE

9-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

The 8EB8 is the same as the 6EB8 except for the following items:

Heater, for Unipotential Cathodes:		
Voltage (AC or DC)	8	volts
Current	0.6 ± 6%	amp
Warm-up time (Average)	11	sec

8EM5

BEAM POWER TUBE

9-PIN MINIATURE TYPE

For vertical-deflection-amplifier service in 110° systems having series heater-string arrangement

The 8EM5 is the same as the 6EM5 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	8.4	volts
Current	0.6	amp
Warm-up time (Average)	11	sec

8D21

PUSH-PULL POWER TETRODE

WATER AND FORCED-AIR COOLED

GENERAL DATA

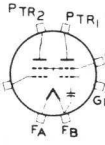
Electrical:

Filament, Thoria-Coated:

Voltage (AC or DC)	3.2 av., 3.4 max.	volts. See DATA 3 for operating instructions on conserving filament life. ←
Current, with 3.2 volts on filament. . .	125	amp
Starting Current	Must never exceed 220 amperes, even momentarily	
Cold Resistance.	0.0077	ohm
Minimum Heating Time	5	sec
Mu-Factor, Grid No.2 to Grid No.1 (Each Unit)	5	
Direct Interelectrode Capacitances (Each Unit):*		←
Grid No.1 to Plate	**	
Input.	25.5	μμf
Output	6.5	μμf
Internal Grid-No.2 Bypass Capacitor (Approx.). . .	200	μμf

Mechanical:

Terminal Connections:



F_A – Filament

F_B – Fil., Mounting Flange

G_{1TR_1} – Grid No.1 of Tetrode #1

G_{1TR_2} – Grid No.1 of Tetrode #2

G_2 – Grid No.2 of Tetrodes #1 & #2

P_{1TR_1} – Plate of Tetrode #1

P_{1TR_2} – Plate of Tetrode #2

Mounting Position. . . Plane of grid-No.1 leads horizontal and below horizontal plane of plate leads

Maximum Overall Length . . . . . 12-9/32"

Maximum Diameter . . . . . 5-3/4"

Air Cooling: ←

Forced-air cooling of the glass envelope is required. The air flow must start with application of plate voltage, and should be directed from a 2"-diameter nozzle at the plate end of the tube so as to cool the area between the plate seals as well as the sides of the glass envelope. The air flow may be removed simultaneously with removal of plate voltage. Interlocking of the air flow with the power supplies is recommended to prevent the application of voltages to the tube without air cooling.

Air Flow	40 min.	cfm
Bulb and Seal Temperature.	150 max.	°C

Water Cooling: ←

Water cooling of the filament block, the No.1 grids, the No.2 grids, and the plates is required. The water flow must start before application of any voltages and preferably should continue for several seconds after removal of all voltages. Interlocking of the water flow through each of the electrodes with all power supplies is recommended to prevent tube damage in case of failure of adequate water flow.

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

8D21
PUSH-PULL POWER TETRODE

→Water Cooling (Continued):

Water Flow Required:			
Filament Block, Cooling pipes in series.	0.1 min.		gpm
No.1 Grids, Cooling pipes in series. .	0.1 min.		gpm
No.2 Grids	0.1 min.		gpm
Plate of Each Unit:			
With dissipation of 1.5 kw	0.3 min.		gpm
With dissipation of 2.25 kw	0.4 min.		gpm
With dissipation of 3 kw	0.5 min.		gpm
Water Flow Obtained with Pressure Drop of 60 psi:	*Min.*	*Max.*	
Filament Block, Cooling pipes in series	0.18	0.37	gpm
No.1 Grids, Cooling pipes in series.	0.18	0.35	gpm
No.2 Grids	0.18	0.38	gpm
Plate of Each Unit	0.55	1.00	gpm
Water Pressure		100 max.	psi
Minimum Recommended Value.		60	psi
Outlet Water Temperature		70 max.	°C

GRID-MODULATED PUSH-PULL RF POWER AMPLIFIER--

Class C Television Service

Synchronizing-Level Conditions unless otherwise noted;
Values are total for both units

Maximum CCS* Ratings, *Absolute Values:*		
DC PLATE VOLTAGE	6000 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE.	1000 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE--White Level. . .	-1000 max.	volts
→DC PLATE CURRENT(At Crest of Modulation)	2 max.	amp
PLATE INPUT.	10000 max.	watts
GRID-No.2 INPUT.	400 max.	watts
PLATE DISSIPATION.	6000 max.	watts
GRID-No.1 DISSIPATION.	50 max.	watts

Typical Operation in Television Service up to 216 Mc--Bandwidth of 6 Mc:			
DC Plate Voltage	5000	. .	volts
DC Grid-No.2 Voltage	800	. .	volts
DC Grid-No.1 Voltage:			
Synchronizing Level.	-220	. .	volts
→Pedestal Level	-400	. .	volts
→White Level.	-820	. .	volts
Peak RF Grid-No.1-to-Grid-No.1 Voltage .	1300	. .	volts
→DC Plate Current:			
Synchronizing Level.	1.9	. .	amp
Pedestal Level	1.45	. .	amp
DC Grid-No.2 Current:			
Pedestal Level	-0.025	. .	amp

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

DC Grid-No.1 Current:		
Synchronizing level	0.050	amp
Pedestal level	0.010	amp
Driving Power (Approx.)★	300 to 500	watts
Power Output:		
Synchronizing level	5300	watts
Pedestal level	3100	watts

PUSH-PULL RF POWER AMPLIFIER — Class C Telegraphy# or FM Telephony

Values are for both units

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

DC PLATE VOLTAGE	6000 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	1000 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-1000 max.	volts
DC PLATE CURRENT	2 max.	amp
PLATE INPUT	10000 max.	watts
GRID-No.2 INPUT	400 max.	watts
PLATE DISSIPATION	6000 max.	watts
GRID-No.1 DISSIPATION	50 max.	watts

Typical Operation in CW Service at 300 Mc:

DC Plate Voltage	6000	volts
DC Grid-No.2 Voltage	800	volts
DC Grid-No.1 Voltage▲	-275	volts
Peak RF Grid-No.1-to-Grid-No.1 Voltage	1350	volts
DC Plate Current	1.6	amp
DC Grid-No.2 Current	0.040	amp
DC Grid-No.1 Current (Approx.)	0.085	amp
Driving Power (Approx.)	500	watts
Power Output (Approx.)	6500	watts

Typical Operation in FM Service up to 216 Mc:

DC Plate Voltage	4500	volts
DC Grid-No.2 Voltage	700	volts
DC Grid-No.1 Voltage	-300	volts
Peak RF Grid-No.1-to-Grid-No.1 Voltage	1150	volts
DC Plate Current	1	amp
DC Grid-No.2 Current	0.050	amp
DC Grid-No.1 Current (Approx.)	0	amp
Driving Power (Approx.)	400	watts
Power Output (Approx.)	2500	watts

Maximum Circuit Values (CW or FM Service):

Grid-No.1-Circuit Resistance	6000 max.	ohms

*,**,●,★,▲,#,: See next page.

8D21

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

Values are for each unit, unless otherwise indicated

	Note	Min.	Max.	
Filament Current	1	110	140	amp
Input Capacitance	–	22.5	28.5	μμf
Output Capacitance	–	5.3	7.7	μμf
Plate Current	1,2	–	0.1	amp
Plate Current	1,3	3.0	5.0	amp
→ Plate Current Average of Both Units	1,3	3.35	–	amp
Peak Cathode Current	1,4	7	–	amp

Note 1: AC filament volts = 3.2.

Note 2: With dc plate voltage of 5000 volts; dc grid-No.2 voltage of 800 volts; and dc grid-No.1 voltage of -220 volts.

Note 3: With dc plate voltage of 1500 volts; dc grid-No.2 voltage of 800 volts; and dc grid-No.1 voltage of +500 volts.

Note 4: Designers should limit the maximum usable cathode current to this value.

*

** Without external shield.

→ Grid-No.1-to-plate capacitance is internally neutralized by the tube structure to within 0.03 μμf.

● Continuous Commercial Service.

★ Driving power is accounted for largely by circuit losses and is less at lower frequencies. In practical, grid-modulated circuit design with damping resistors, the indicated driving power, depending on frequency, is required to take care of losses in the damping resistors, the circuit losses, and the tube driving power.

▲ Obtained from combination of fixed bias and a grid-No.1 resistor of 2500 to 3000 ohms.

Key-down conditions per tube without amplitude modulation. Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

Data on operating frequencies for the 8D21 are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY.

→ Indicates a change.

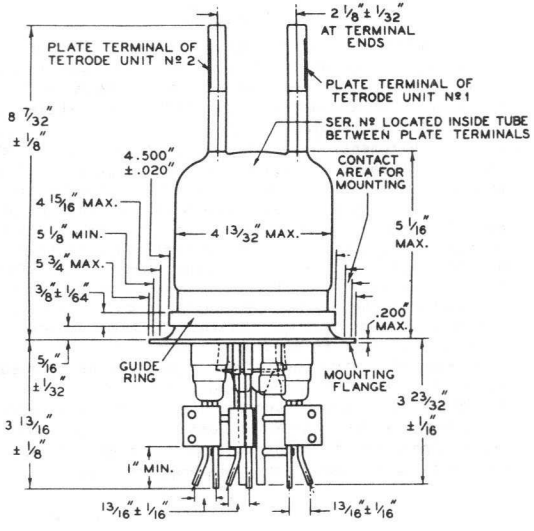
8D21

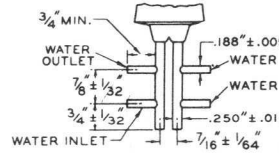
PUSH-PULL POWER TETRODE

OPERATING INSTRUCTIONS FOR CONSERVING FILAMENT LIFE

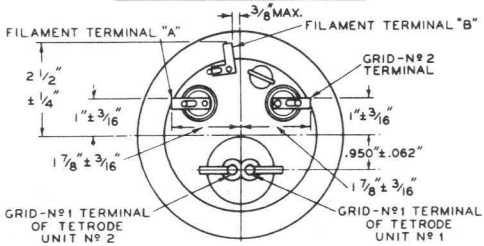
Filament life of the 8D21 can be conserved by operating its filament at the lowest voltage which will give the desired power output. Because the filament of this tube when operated at the tabulated value of 3.2 volts provides emission usually in excess of any requirements within ratings, it is recommended that the filament voltage be reduced below 3.2 volts to a value that will give adequate but not excessive emission for any particular application. The proper operating value may be found by reducing the filament voltage, with normal modulation applied to the transmitter, until a reduction in output is observed. The filament voltage must then be increased by an amount equivalent to the maximum percentage regulation of the filament-voltage supply, and then further increased by about 0.1 volt to allow for other variations. It is suggested that the adjustment procedure be carried out daily. However, if no significant changes in the operating voltage are found necessary, the adjustment procedure can be scheduled less frequently. Good regulation of the filament voltage is in general economically advantageous from the viewpoint of tube life.

8D21
PUSH-PULL POWER TETRODE



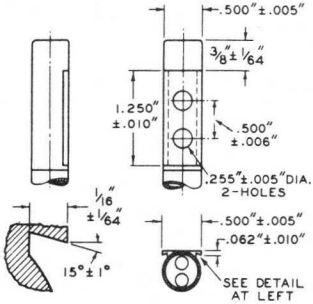


DETAIL OF GRID-Nº1 TERMINALS

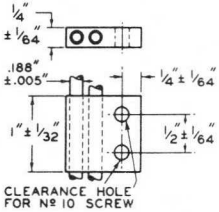


8D21
PUSH-PULL POWER TETRODE

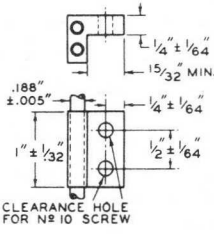
OUTLINE DETAILS



DETAIL OF PLATE TERMINALS



DETAIL OF FILAMENT
TERMINAL "A" AND
GRID-Nº2 TERMINAL

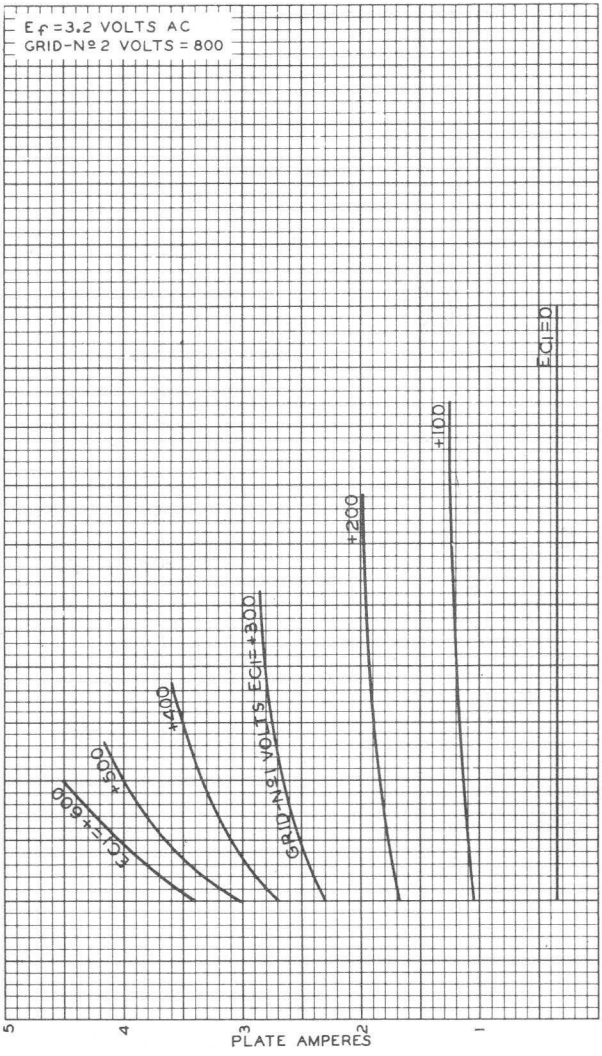


DETAIL OF FILAMENT
TERMINAL "B"

8D21

8D21

AVERAGE PLATE CHARACTERISTICS
FOR EACH UNIT



MAY 25, 1948

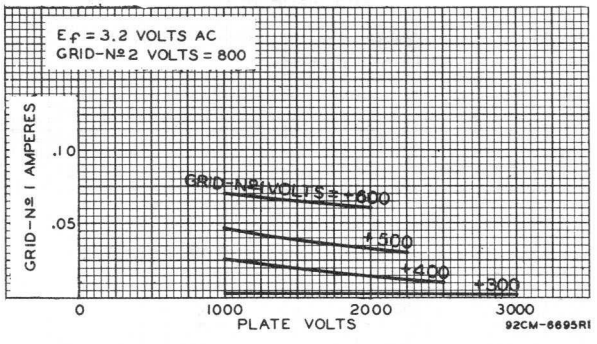
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6696RI

8D21

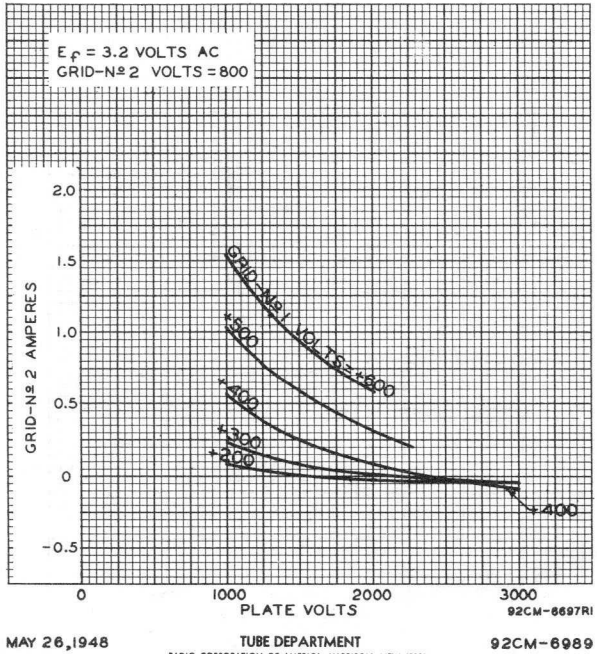
TYPICAL CHARACTERISTICS

FOR EACH UNIT



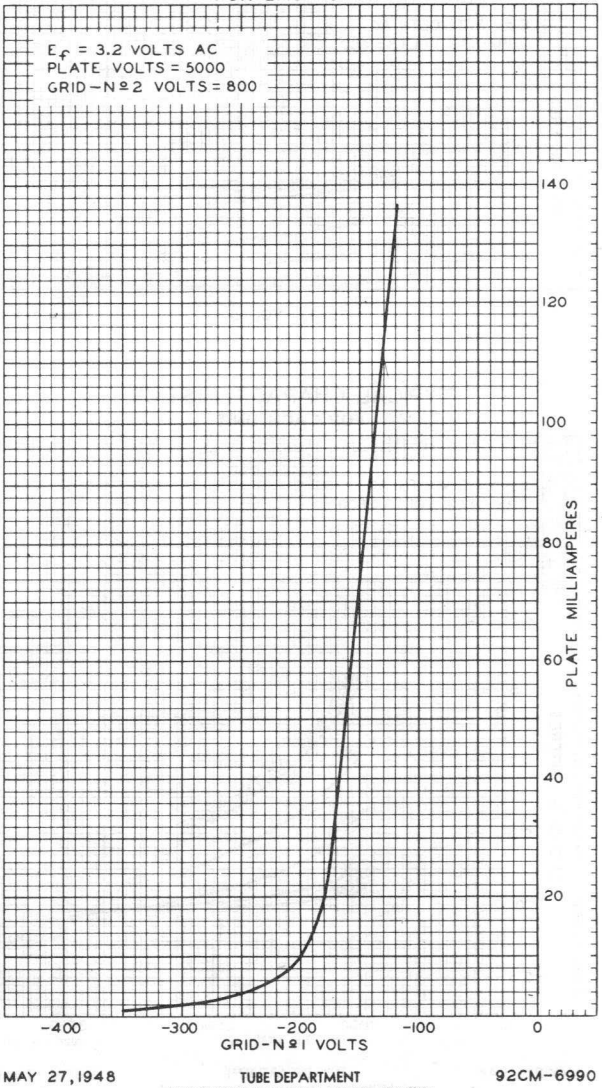
TYPICAL CHARACTERISTICS

FOR EACH UNIT



8D21

8D21
AVERAGE CHARACTERISTIC
FOR EACH UNIT



MAY 27, 1948

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6990

High-Mu Triode—
Sharp-Cutoff Pentode

9-PIN MINIATURE TYPE

For Equipment Having Series Heater-String Arrangement

The 8GN8 is the same as the 6GN8 except for the following items:

Heater, for Unipotential Cathodes:		
Voltage (AC or DC)	8	volts
Current	0.6 ± 6%	amp
Warm-up time (Average)	11	sec

Monitor Kinescope

NO ION-TRAP MAGNET REQUIRED

RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
WITH INTEGRAL PROTECTIVE WINDOW — 90° MAGNETIC DEFLECTION
LOW-VOLTAGE ELECTROSTATIC FOCUS

Electrical:

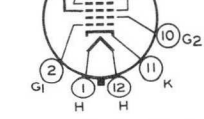
Direct Interelectrode Capacitances:		
Cathode to all other electrodes	5	pf
Grid No.1 to all other electrodes	6	pf
Heater Current at 6.3 volts	600 ±30	ma
Heater Warm-up Time (Average)	11	seconds
Electron Gun	Type Requiring No Ion-Trap Magnet	

Optical:

Phosphor (For Curves, see front of this Section)	P4—Sulfide Type, Aluminized
Faceplate and Integral Protective Window	Filterglass
Light transmission at center (Approx.)	60%

Mechanical:

Weight (Approx.)	3-1/4 lbs
Overall Length	9.94"±.19"
Neck Length	5.81"±.12"
Projected Area of Screen	36 sq.in.
External Conductive Coating	None
For Additional Information on Dimensions: See *Bulb J67-1/2A* sheets at front of this Section	
Integral Protective Window	FP67-1/2-800, or equivalent
Cap	Recessed Small Cavity (JEDEC No.J1-21)
Base . . Small-Shell Duodecal 6-Pin (JEDEC Group 4, No.B6-63) Basing Designation for BOTTOM VIEW	12M



Pin 1 – Heater
Pin 2 – Grid No.1
Pin 6 – Grid No.4
Pin 10 – Grid No.2
Pin 11 – Cathode
Pin 12 – Heater

Cap – Anode (Grid No.3, Grid No.5, Screen Collector)

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

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	22000 max.	volts
Grid-No.4 Voltage:		
Positive value	1100 max.	volts
Negative value	550 max.	volts
Grid-No.2 Voltage	550 max.	volts
	200 min.	volts

8QP4

Grid-No.1 Voltage:		
Negative peak value	220 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
Heater Voltage	6.9 max.	volts
	5.7 min.	volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC Voltage	200 max.	volts
DC Component	100 max.	volts

Typical Operating Conditions for Grid-Drive Service:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	16000	volts
Grid-No.4 Voltage[a]	200	volts
Grid-No.2 Voltage	300	volts
Grid-No.1 Voltage for visual extinction of focused raster	-28 to -72	volts

Maximum Circuit Value:

Grid-No.1 Circuit Resistance	1.5 max.	megohms

[a] The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between 0 and +400 volts.

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section

9AU7

MEDIUM-MU TWIN TRIODE

9-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

The 9AU7 is the same as the 12AU7 except for the following items:

Heater, for Unipotential Cathodes:	*Series*	*Parallel*	
Heater arrangement			
Voltage (AC or DC)	9.4	4.7	volts
Current	0.225	0.45	amp
Warm-up time (Average)	–	11	sec

Power Triode

WATER- AND FORCED-AIR COOLED

GENERAL DATA

Electrical:

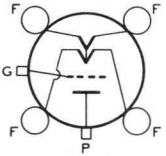
Filament, Multistrand Tungsten:
- Excitation . . . . . DC or Single Phase AC
- Voltage (AC or DC) . . . . . 19.5 volts
- Current . . . . . 415 amp
- Starting Current: The filament current should never exceed 750 amperes, even momentarily.
- Cold Resistance . . . . . 0.0042 ohm

Amplification Factor 40

Direct Interelectrode Capacitances (Approx.):
- Grid to plate . . . . . 53 pf
- Grid to filament . . . . . 103 pf
- Plate to filament . . . . . 1.2 pf

Mechanical:

Operating Position . . . . . Vertical, filament end up
Maximum Overall Length . . . . . 24-1/2"
Maximum Diameter . . . . . 9-1/2"
Weight (Approx.) . . . . . 26 lbs
Terminal Diagram (See *Dimensional Outline*):



F – Filament
G – Grid
P – Plate

DIAMETRICALLY OPPOSITE TERMINALS MUST BE CONNECTED TOGETHER

Thermal:

Water Flow . . . . . 15 to 20 gpm
The water flow must start before the application of any voltages and must continue for at least 2 minutes after the removal of all voltages.

Air Flow:
- To filament seals . . . . . 10 min. cfm
  The specified air flow directed by a nozzle of 1-1/4" diameter into the filament header is required before and during the application of any voltages to limit the temperature of the filament seals to the maximum value.
- To plate seal and bulb . . . . . 250 min. cfm
  The specified air flow at a pressure of 1.3 inches of water must be directed at and distributed uniformly around the plate seal and bulb to limit the temperature of each to its maximum value at the hottest point.

← Indicates a change.

Outlet Water Temperature	70 max.	°C
Bulb Temperature	180 max.	°C
Seal Temperature (Filament, grid, plate)	165 max.	°C

AF POWER AMPLIFIER & MODULATOR — Class B

Maximum CCS[a] Ratings, *Absolute-Maximum Values:*

DC PLATE VOLTAGE	15000 max.	volts
MAX.-SIGNAL DC PLATE CURRENT[b]	6 max.	amp
MAX.-SIGNAL PLATE INPUT[b]	90 max.	kw
PLATE DISSIPATION[b]	40 max.	kw

Typical Operation:

Unless otherwise specified, values are for 2 tubes

DC Plate Voltage	10200	14000	volts
DC Grid Voltage	-220	-300	volts
Peak AF Grid-to-Grid Voltage	850	1050	volts
Zero-Signal DC Plate Current	0.6	0.6	amp
Max.-Signal DC Plate Current	5.7	7.1	amp
Effective Load Resistance (Plate to plate)	3600	4000	ohms
Max.-Signal Driving Power (Approx.)[c]	110	150	watts
Max.-Signal Power Output (Approx.)	36	61	kw

PLATE-MODULATED RF POWER AMPLIFIER — Class C Telephony

Carrier conditions per tube for use with a maximum-modulation factor of 1

Maximum CCS[a] Ratings, *Absolute-Maximum Values:*

DC PLATE VOLTAGE	12500 max.	volts
DC GRID VOLTAGE	-2000 max.	volts
DC PLATE CURRENT	4 max.	amp
DC GRID CURRENT	1.5 max.	amp
PLATE INPUT	50 max.	kw
PLATE DISSIPATION	28 max.	kw

Typical Operation:

DC Plate Voltage	10200	12500	volts
DC Grid Voltage:[d]			
From a grid resistor of:			
2000 ohms	-1500	-	volts
2100 ohms	-	-1670	volts
Peak RF Grid Voltage	1960	2190	volts
DC Plate Current	3.1	3.5	amp
DC Grid Current (Approx.)[e]	0.75	0.79	amp
Driving Power (Approx.)[e]	1320	1570	watts
Power Output (Approx.)	27.5	38	kw

RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy[f]

Maximum CCS[a] Ratings, *Absolute-Maximum Values:*

DC PLATE VOLTAGE	17000 max.	volts
DC GRID VOLTAGE	-2000 max.	volts
DC PLATE CURRENT	9 max.	amp

DC GRID CURRENT	1.5 max.		amp
PLATE INPUT	150 max.		kw
PLATE DISSIPATION	40 max.		kw

Typical Operation:

DC Plate Voltage	14000	17000	volts
DC Grid Voltage:[g]			
From a grid resistor of:			
1800 ohms	-1500	–	volts
1780 ohms	–	-1600	volts
From a cathode resistor of:			
230 ohms	-1500	–	volts
180 ohms	–	-1600	volts
Peak RF Grid Voltage	2000	2200	volts
DC Plate Current	5.8	7.9	amp
DC Grid Current (Approx.)	0.83	0.9	amp
Driving Power (Approx.)	1500	1800	watts
Power Output (Approx.)	61	100	kw

[a] Continuous Commercial Service.

[b] Averaged over any audio-frequency cycle of sine-wave form.

[c] The driving stage should have good regulation and should be capable of supplying considerably more than the specified driving power.

[d] Obtained from a fixed supply, grid resistor, or a combination of both.

[e] Subject to wide variations as explained under TUBE RATINGS in General Section.

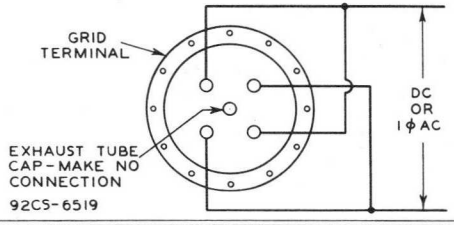
[f] Key-down conditions per tube without modulation. Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

[g] Obtained from a fixed supply, a cathode resistor, a grid resistor, or from a combination of a fixed supply and self-bias.

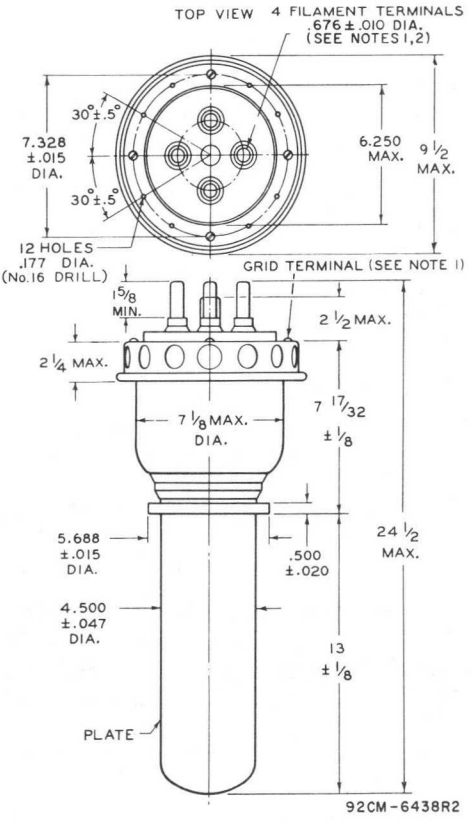
MAXIMUM RATINGS vs OPERATING FREQUENCY

OPERATING FREQUENCY Mc	MAXIMUM PERMISSIBLE PERCENTAGE OF MAXIMUM-RATED PLATE VOLTAGE & PLATE INPUT	
	TELEPHONY	TELEGRAPHY
	Class C Plate-Modulated	Class C Unmodulated
15	100	100
20	88	82
25	81	70

FILAMENT CONNECTIONS



9C21



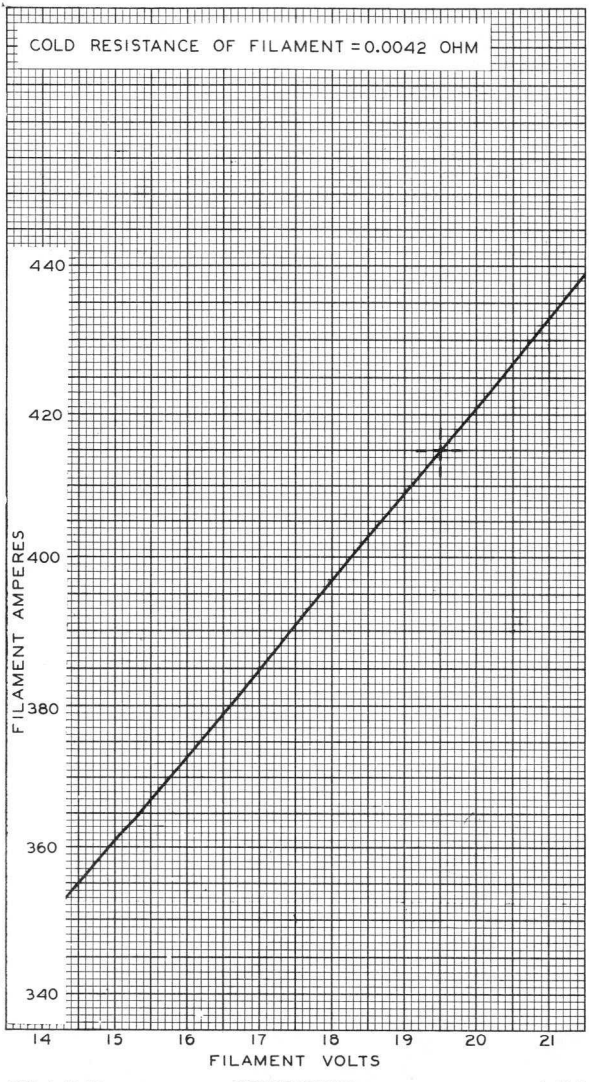
ALL DIMENSIONS IN INCHES

NOTE 1: FLEXIBLE CONNECTIONS ARE REQUIRED.

NOTE 2: FILAMENT-TERMINAL POSITIONS ARE HELD TO TOLERANCES SUCH THAT ENTIRE LENGTH OF TERMINALS WILL, WITHOUT UNDUE FORCE, PASS INTO AND DISENGAGE FROM FLAT-PLATE GAUGE HAVING A THICKNESS OF 1/8" AND FOUR HOLES WITH DIAMETERS OF 0.801" ± 0.001" ARRANGED AT ANGLES OF 90° ± 10' ON A CIRCLE HAVING DIAMETER OF 3.125" ± 0.001". GAUGE IS ALSO PROVIDED WITH A HOLE HAVING DIAMETER OF 1.250" ± 0.010" CONCENTRIC WITH THE FILAMENT-TERMINAL CIRCLE.

9C21

AVERAGE FILAMENT CHARACTERISTIC



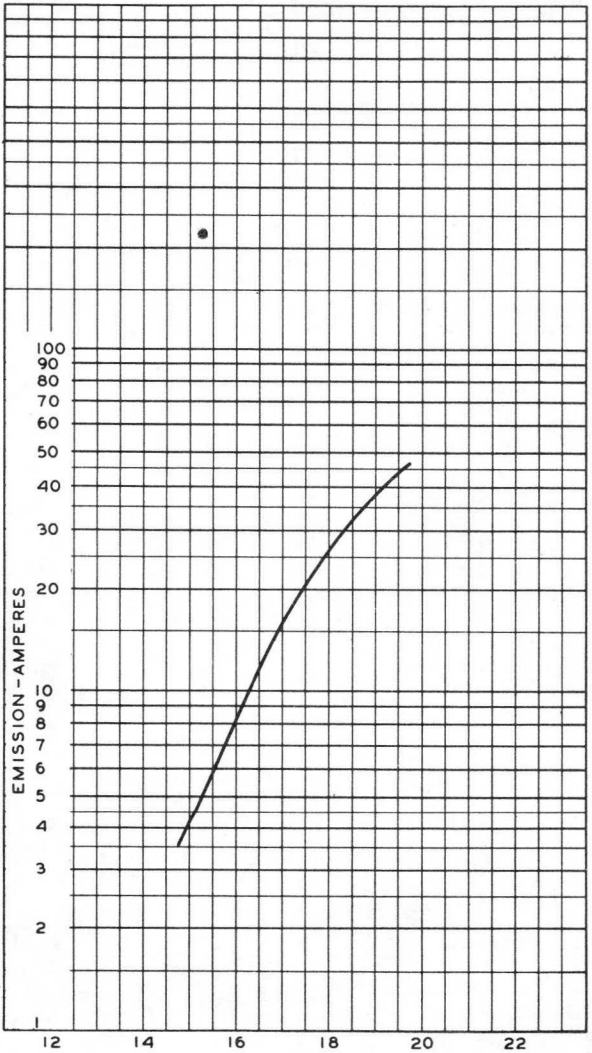
DEC. 1, 1943

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6457

9C21

AVERAGE FILAMENT-EMISSION CHARACTERISTIC

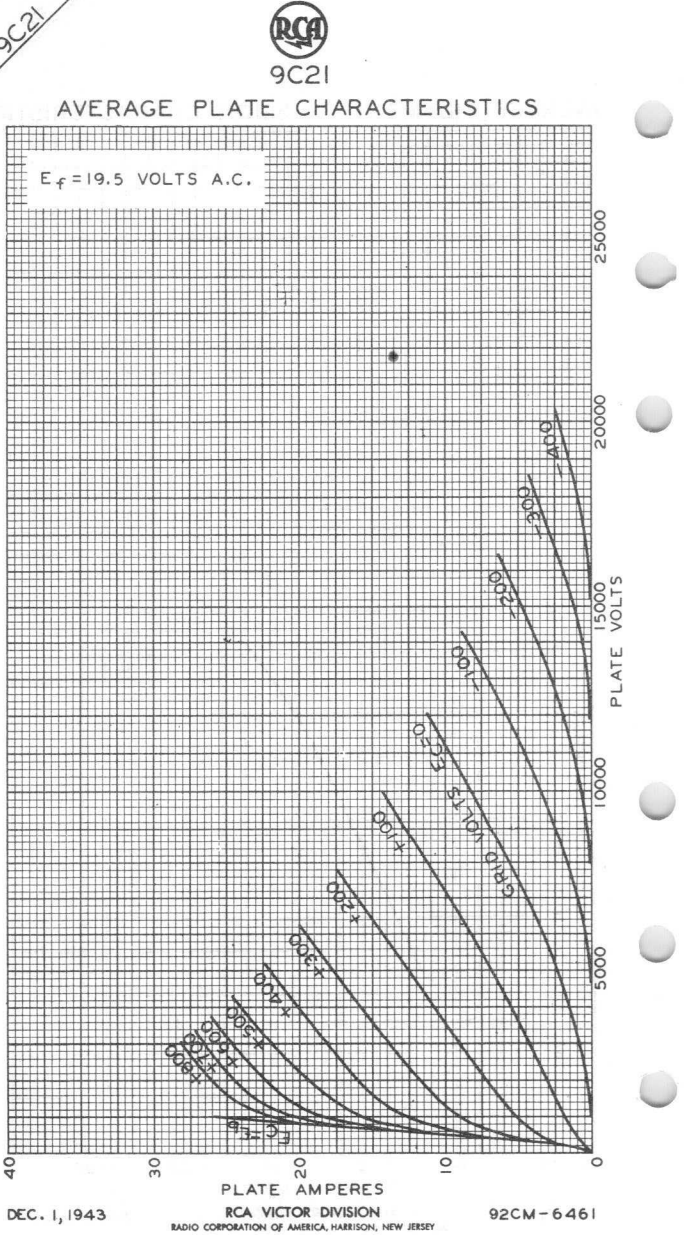


DEC. 1, 1943

RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

92CM-6458

9C21



DEC. 1, 1943

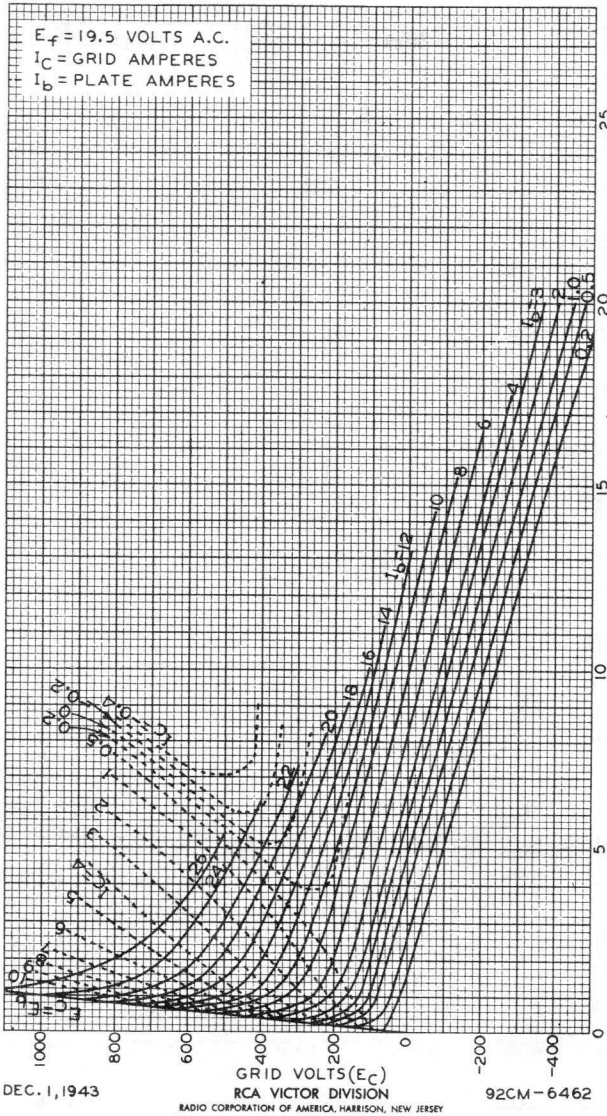
RCA VICTOR DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6461

9C21

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



DEC. 1, 1943

RCA VICTOR DIVISION

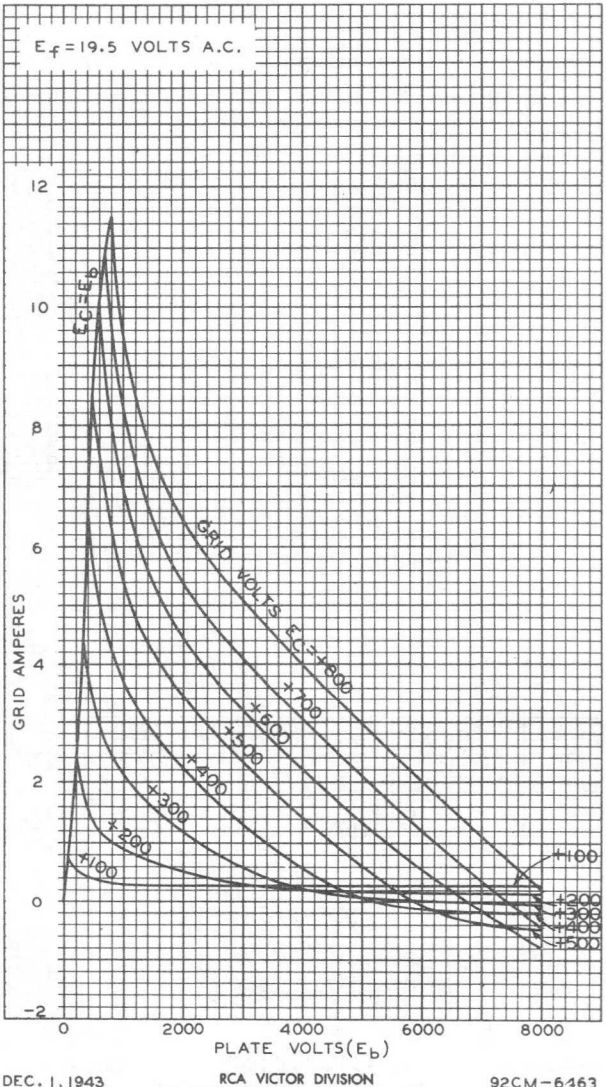
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6462

9C21

9C21

TYPICAL CHARACTERISTICS



DEC. 1, 1943

RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

92CM-6463

Power Triode

FORCED-AIR COOLED

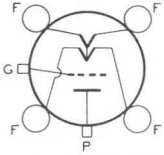
GENERAL DATA

Electrical:

Filament, Multistrand Tungsten:		
Excitation	DC or Single Phase AC	
Voltage (AC or DC)	19.5	volts
Current	415	amp
Starting Current: The filament current should never exceed 750 amperes, even momentarily.		
Cold Resistance	0.0042	ohm
Amplification Factor	41	
Direct Interelectrode Capacitances (Approx.):		
Grid to plate	50	pf
Grid to filament	100	pf
Plate to filament	2.2	pf

Mechanical:

Operating Position	Vertical, filament end up
Maximum Overall Length	25"
Maximum Diameter	17"
Weight (Approx.)	130 lbs ←
Radiator	Integral part of tube
Terminal Diagram (See *Dimensional Outline*):	



F – Filament
G – Grid

P – Plate

DIAMETRICALLY OPPOSITE TERMINALS MUST BE CONNECTED TOGETHER

Thermal:

Air Flow:		
Through radiator (For maximum ratings). The specified air flow at a pressure of 2.2 inches of water should be delivered by a blower vertically upward through the radiator before and during the application of any voltages.	1800 min.	cfm
To filament seals. The specified air flow directed by a nozzle of 1-1/4" diameter downward into the filament header is required before and during the application of any voltages in order to limit the temperature of the filament seals to the maximum value.	10 min.	cfm
Input Air Temperature (To radiator)	45 max.	°C
Radiator Temperature (Measured at core upper end, away from incoming air)	180 max.	°C
Seal Temperature (Filament, grid, plate)	165 max.	°C

← Indicates a change.

AF POWER AMPLIFIER & MODULATOR — Class B

Maximum CCS[a] Ratings, *Absolute Maximum Values:*

DC PLATE VOLTAGE	15000 max.	volts
MAX.-SIGNAL DC PLATE CURRENT[b]	6 max.	amp
MAX.-SIGNAL PLATE INPUT[b]	60 max.	kw
PLATE DISSIPATION[b]	20 max.	kw

Typical Operation:

Unless otherwise specified, values are for 2 tubes

DC Plate Voltage	10200	14000	volts
DC Grid Voltage	-220	-300	volts
Peak AF Grid-to-Grid Voltage	850	1050	volts
Zero-Signal DC Plate Current	0.6	0.6	amp
Max.-Signal DC Plate Current	5.7	7.1	amp
Effective Load Resistance (Plate to plate)	3600	4000	ohms
Max.-Signal Driving Power (Approx.)[c]	110	150	watts
Max.-Signal Power Output (Approx.)	36	61	kw

PLATE-MODULATED RF POWER AMPLIFIER — Class C Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1

Maximum CCS[a] Ratings, *Absolute Maximum Values:*

DC PLATE VOLTAGE	12500 max.	volts
DC GRID VOLTAGE	-2000 max.	volts
DC PLATE CURRENT	4 max.	amp
DC GRID CURRENT	1.5 max.	amp
PLATE INPUT	50 max.	kw
PLATE DISSIPATION	14 max.	kw

Typical Operation:

DC Plate Voltage	10200	12500	volts
DC Grid Voltage:[d]			
From a grid resistor of:			
2000 ohms	-1500	-	volts
2100 ohms	-	-1670	volts
Peak RF Grid Voltage	1960	2190	volts
DC Plate Current	3.1	3.5	amp
DC Grid Current (Approx.)[e]	0.75	0.79	amp
Tube Driving Power (Approx.)[e]	1320	1570	watts
Power Output (Approx.)	27.5	38	kw

RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy[f]

Maximum CCS[a] Ratings, *Absolute Maximum Values:*

DC PLATE VOLTAGE	17000 max.	volts
DC GRID VOLTAGE	-2000 max.	volts
DC PLATE CURRENT	8 max.	amp
DC GRID CURRENT	1.5 max.	amp
PLATE INPUT	100 max.	kw
PLATE DISSIPATION	20 max.	kw

Typical Operation:

DC Plate Voltage	14000	17000	volts
DC Grid Voltage:[g]			
From a grid resistor of:			
1800 ohms	−1500	–	volts
2000 ohms	–	−1600	volts
From a cathode resistor of:			
230 ohms	−1500	–	volts
275 ohms	–	−1600	volts
Peak RF Grid Voltage	2000	2050	volts
DC Plate Current	5.8	5	amp
DC Grid Current (Approx.)[e]	0.83	0.8	amp
Tube Driving Power (Approx.)[e]	1500	1450	watts
Power Output (Approx.)	61	65	kw

[a] Continuous commercial service.

[b] Averaged over any audio-frequency cycle of sine-wave form.

[c] The driving stage should have good regulation and should be capable of supplying considerable more than the specified driving power.

[d] Obtained from a fixed supply, grid resistor, or a combination of both.

[e] For effect of load resistance on grid current and driving power, refer to TUBE RATINGS--*Grid Current and Driving Power* in General Section.

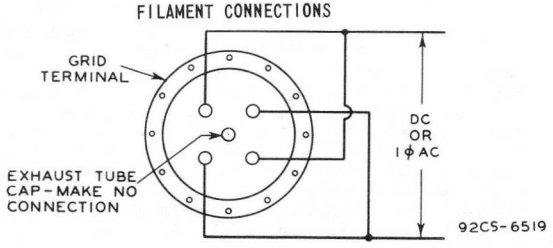
[f] Key-down conditions per tube without modulation. Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

[g] Obtained from a fixed supply, a cathode resistor, a grid resistor, or from a combination of a fixed supply and self-bias.

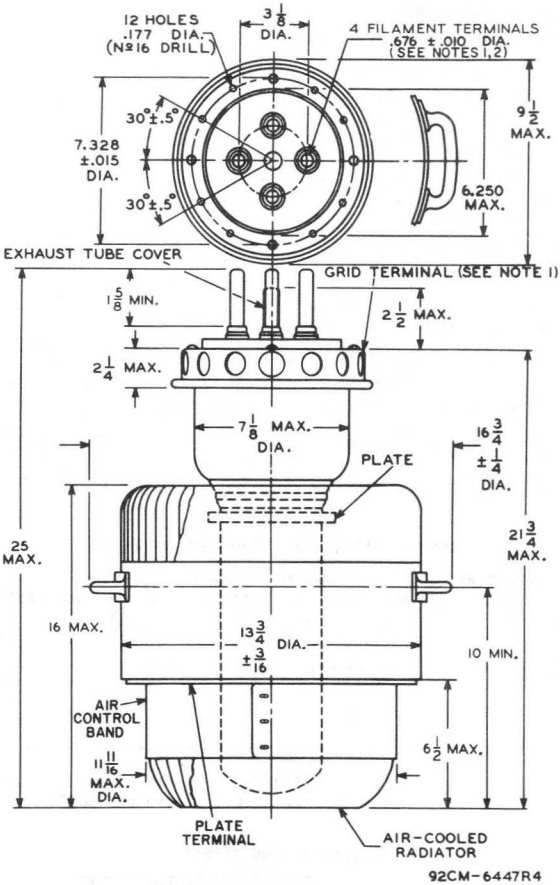
MAXIMUM RATINGS vs OPERATING FREQUENCY

OPERATING FREQUENCY Mc	MAXIMUM PERMISSIBLE PERCENTAGE OF MAXIMUM-RATED PLATE VOLTAGE & PLATE INPUT	
	TELEPHONY	TELEGRAPHY
	Class C Plate-Modulated	Class C Unmodulated
5	100	100
12	90	84
25	81	70

CURVES
Shown under Type 9C21 also apply to the 9C22



9C22



92CM-6447R4

ALL DIMENSIONS IN INCHES

NOTE 1: FLEXIBLE CONNECTIONS ARE REQUIRED.

NOTE 2: FILAMENT-TERMINAL POSITIONS ARE HELD TO TOLERANCES SUCH THAT ENTIRE LENGTH OF TERMINALS WILL, WITHOUT UNDUE FORCE, PASS INTO AND DISENGAGE FROM FLAT-PLATE GAUGE HAVING A THICKNESS OF 1/8" AND FOUR HOLES WITH DIAMETERS OF 0.801" ± 0.001" ARRANGED AT ANGLES OF 90° ± 10' ON A CIRCLE HAVING DIAMETER OF 3.125" ± 0.001". GAUGE IS ALSO PROVIDED WITH A HOLE HAVING DIAMETER OF 1.250" ± 0.010" CONCENTRIC WITH THE FILAMENT-TERMINAL CIRCLE.

10KP7

OSCILLOGRAPH TUBE

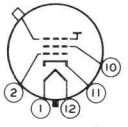
MAGNETIC FOCUS MAGNETIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:		
Voltage	6.3	ac or dc volts
Current	0.6 ± 10%	amp
Direct Interelectrode Capacitances (Approx.):		
Grid No.1 to all other electrodes	6	μμf
Cathode to all other electrodes	5	μμf
Faceplate		Filterglass
Light transmission (Approx.)		76% ←
Phosphor (For curves, see front of this Section)		P7
Fluorescence		Blue
Phosphorescence		Greenish-Yellow
Persistence		Long
Focusing Method		Magnetic
Deflection Method		Magnetic
Deflection Angle (Approx.)		50°
Tube Dimensions:		←
Overall length		17-5/8" ± 3/8"
Diameter:		
At faceplate		10-1/2" ± 1/16"
Maximum, at faceplate seal		10-5/8"
Minimum Useful Screen Diameter		9"
Weight (Approx.)		10 lbs
Operating Position		Any
Cap		Recessed Small Cavity (JETEC No.J1-21)
Bulb		J-84
Base		Small-Shell Duodecal 5-Pin (JETEC No.B5-57)
Basing Designation for BOTTOM VIEW		12D

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 10 – Grid No.2
Pin 11 – Cathode



Pin 12 – Heater
Cap – Ultor (Grid No.3, Collector)

Maximum Ratings, *Design-Center Values:*

ULTOR VOLTAGE	10000 max.	volts
GRID-No.2 VOLTAGE:		
Positive value (DC or Peak AC)	700 max.	volts
Negative value# (DC or Peak AC)	180 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value	180 max.	volts
Positive bias value▲	0 max.	volts
Positive peak value	2 max.	volts
PEAK GRID-No.1 DRIVE FROM CUTOFF	65 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	125 max.	volts

#,▲: See next page. ← Indicates a change.

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

RCA

10KP7

OSCILLOGRAPH TUBE

Equipment Design Ranges:

For any ultor voltage (E_{c3}) between 7000 and 10000 volts and grid-No.2 voltage (E_{c2}) between 150 and 700 volts*

Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot	-10.8% to -25.2% of E_{c2}	volts
Grid-No.2 Current	-15 to $+15$	μa
Focusing-Coil Current (DC)^{oo}	$\left[\sqrt{\frac{E_{c3}}{7000}} \times 99\right] \pm 15\%$	ma
Spot Position	##	

Examples of Use of Design Ranges:

For ultor voltage of and grid-No.2 voltage of	*7000* *250*	*9000* *250*	*volts* *volts*
Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot	-27 to -63	-27 to -63	volts
Focusing-Coil Current (DC)	99 ±15%	112 ± 15%	ma

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

\# This value has been specified to take care of applications where grid No.2 is modulated.

▲ At or near this rating, the effective resistance of the ultor supply should be adequate to limit the ultor input power to 6 watts.

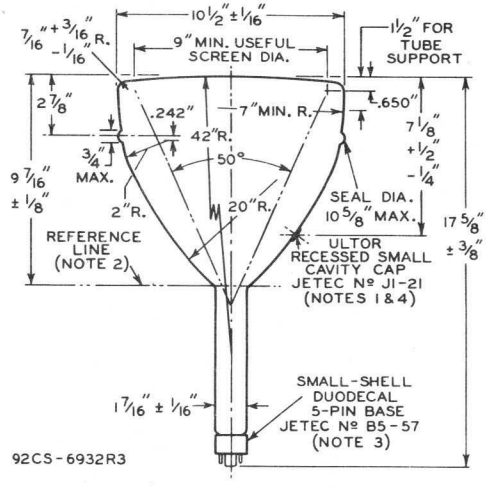
* Brilliance and definition decrease with decreasing ultor voltage. In general, the ultor voltage should not be less than 7000 volts.

oo For specimen focusing coil similar to JETEC Focusing Coil No.106 positioned with air gap toward faceplate and center line of air gap 3-1/4" from Reference Line *(See Dimensional Outline)* and ultor current of 200 microamperes.

\## The center of the undeflected, unfocused spot will fall within a circle having an 18-mm radius concentric with the center of the tube face.

10KP7

OSCILLOGRAPH TUBE



NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND VACANT PIN POSITION No.3 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ± 10°. ULTOR TERMINAL IS ON SAME SIDE AS VACANT PIN POSITION No.3.

NOTE 2: REFERENCE LINE IS DETERMINED BY POSITION WHERE REFERENCE-LINE GAUGE (JETEC No. 112) 1.500" + .003" – .000" I.D. AND 2" LONG WILL REST ON BULB CONE.

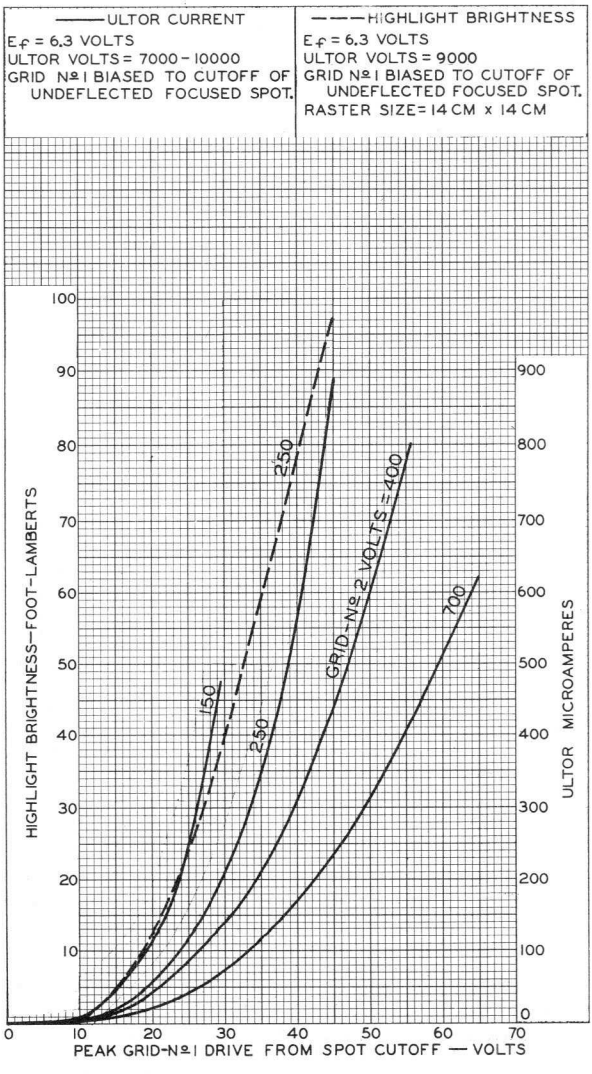
NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING DIAMETER OF 1-7/8".

NOTE 4: TUBE SUPPORT MUST BE KEPT AT LEAST 2" AWAY FROM ULTOR CAP.

RCA

10KP7

AVERAGE GRID-DRIVE CHARACTERISTICS



10-Y
POWER AMPLIFIER TRIODE

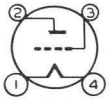
GENERAL DATA

Electrical:

Filament, Thoriated Tungsten:		
Voltage	7.5	ac or dc volts
Current	1.25	amp
Amplification Factor	8	
Direct Interelectrode Capacitances (Approx.):		
Grid to Plate	7	μμf
Grid to Filament	4	μμf
Plate to Filament	3	μμf

Mechanical:

Mounting Position	Vertical, base down
Maximum Overall Length	5-3/8"
Maximum Seated Length	4-3/4"
Maximum Diameter	2-1/16"
Bulb	ST-16
Base	Medium-Shell Small 4-Pin Micanol, Bayonet
Basing Designation for BOTTOM VIEW	4D



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

PLATE-MODULATED RF POWER AMPLIFIER – Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values*:

DC PLATE VOLTAGE	350 max.	volts
DC GRID VOLTAGE	-200 max.	volts
DC PLATE CURRENT	60 max.	ma.
DC GRID CURRENT	15 max.	ma.
PLATE INPUT	17.5 max.	watts
PLATE DISSIPATION	10 max.	watts

Typical Operation:

DC Plate Voltage	250	350	volts
DC Grid Voltage	-95	-135	volts
Peak RF Grid Voltage	195	235	volts
DC Plate Current	45	45	ma.
DC Grid Current (Approx.)□	15	15	ma.
Driving Power (Approx.)□	3	3.5	watts
Power Output (Approx.)	5.5	8	watts

□ Subject to wide variations as explained on sheet TUBE RATINGS in General Section.

10-Y

10-Y
POWER AMPLIFIER TRIODE

RF POWER AMPLIFIER & OSCILLATOR – Class C Telegraphy

Key-down conditions per tube without modulation[□□]

Maximum Ratings, *Absolute Values*:

DC PLATE VOLTAGE	450 max.	volts
DC GRID VOLTAGE	−200 max.	volts
DC PLATE CURRENT	60 max.	ma.
DC GRID CURRENT	15 max.	ma.
PLATE INPUT	27 max.	watts
PLATE DISSIPATION	15 max.	watts

Typical Operation:

DC Plate Voltage	350	450	volts
DC Grid Voltage	−90	−115	volts
Peak RF Grid Voltage	190	215	volts
DC Plate Current	55	55	ma.
DC Grid Current (Approx.)[□]	15	15	ma.
Driving Power (Approx.)[□]	3	3.3	watts
Power Output (Approx.)	9	13	watts

[□] Subject to wide variations as explained on sheet TUBE RATINGS in General Section.

[□□] Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

Data on operating frequencies for the 10-Y are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY

12AF6

REMOTE-CUTOFF PENTODE

7-PIN MINIATURE TYPE

For use in automobile radio receivers operating directly from 12-volt storage batteries

GENERAL DATA

Electrical:

Heater●, for Unipotential Cathode:
Voltage range. . . . 10.0 to 15.9 . . . . . dc volts
This voltage range is on an absolute basis. For longest life, it is recommended that the heater be operated within the voltage range of 11 to 14 volts.
Current (Approx.)
at 12.6 volts. . . 0.15 . . . . . amp

Direct Interelectrode Capacitances:○

Grid No.1 to plate	0.006 max.	μμf
Grid No.1 to cathode, grid No.3 & internal shield, grid No.2, and heater .	5.5	μμf
Plate to cathode, grid No.3 & internal shield, grid No.2, and heater.	4.8	μμf

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)
Basing Designation for BOTTOM VIEW 7BK

Pin 1 - Grid No.1
Pin 2 - Grid No.3, Internal Shield
Pin 3 - Heater



Pin 4 - Heater
Pin 5 - Plate
Pin 6 - Grid No.2
Pin 7 - Cathode

AMPLIFIER — Class A_1

Maximum Ratings, *Design-Center Values:*

PLATE VOLTAGE.	16 max.	volts
GRID-No.2 (SCREEN-GRID) VOLTAGE.	16 max.	volts
GRID-No.1 (CONTROL-GRID) VOLTAGE:		
Positive bias value.	0 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode. .	16 max.	volts
Heater positive with respect to cathode.	16 max.	volts

● ○: See next page.

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

TENTATIVE DATA

12AF6

REMOTE-CUTOFF PENTODE

Characteristics with 12.6 Volts on Heater:		
Plate Voltage	12.6	volts
Grid-No.3 (Supressor-Grid) Voltage	0	volts
Grid-No.2 Voltage	12.6	volts
Grid-No.1 Supply Voltage	0	volts
Grid-No.1 Resistor (Bypassed)	2.2	megohms
Plate Resistance (Approx.)	0.3	megohm
Transconductance	1250	μmhos
Plate Current	0.8	ma
Grid-No.2 Current	0.3	ma
Grid-No.1 Voltage (Approx.) for transconductance of 40 μmhos	-2.7	volts
Maximum Circuit Values:		
Grid-No.1-Circuit Resistance	2.2 max.	megohms

° Without external shield.

• Operation of heater in series with other heaters is not recommended.

OPERATING CONSIDERATIONS

The *maximum ratings* in the tabulated data for the 12AF6 are working design-center maximums established according to the standard design-center system of rating electron tubes. Tubes so rated will give satisfactory performance in storage-battery-operated equipment provided the following stipulations are observed:

In the case of storage-battery-with-charger supply or similar supplies, the normal battery-voltage fluctuation may be as much as 35 per cent or more. This fluctuation imposes severe operating conditions on tubes. Under these conditions, the equipment should be designed so that 90 per cent of the design-center maximum values of plate voltage, grid-No.2 voltage, plate dissipation, and grid-No.2 input is never exceeded for a battery-terminal potential of 13.2 volts. Although the operating voltages of the 12AF6 in this service will, at times, exceed the design-center maximum values, satisfactory performance with probable sacrifice in life will be obtained.

12AU7-A

MEDIUM-MU TWIN TRIODE

9-PIN MINIATURE TYPE

For applications critical as to microphonics

The 12AU7-A has the same *maximum ratings, characteristics, typical operation, mechanical data,* and *curves* as the 12AU7.

12DB5

BEAM POWER TUBE

9-PIN MINIATURE TYPE

Intended for use in equipment having series heater-string arrangement

GENERAL DATA

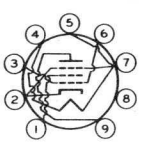
Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	12.6	volts
Current	0.6 ± 6%	amp
Warm-up time (Average)	11	sec
Direct Interelectrode Capacitances (Approx.):[o]		
Grid No.1 to plate	0.2	μμf
Grid No.1 to cathode & grid No.3, grid No.2, and heater	13	μμf
Plate to cathode & grid No.3, grid No.2, and heater	8	μμf

Mechanical:

Operating Position	Any
Maximum Overall Length	2-3/4"
Maximum Seated Length	2-1/2"
Length, Base Seat to Bulb Top (Excluding tip)	2-1/8" ± 3/32"
Diameter	0.750" to 0.875"
Bulb	T6-1/2
Base	Small-Button Noval 9-Pin (JEDEC No.E9-1)
Basing Designation for BOTTOM VIEW	9GR

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



Pin 7 - Cathode, Grid No.3
Pin 8 - Internal Connection — Do Not Use
Pin 9 - Plate

AMPLIFIER — Class A_1

Maximum Ratings, *Design-Center Values:*

PLATE VOLTAGE	300	max.	volts
GRID-No.2 (SCREEN-GRID) VOLTAGE	150	max.	volts
GRID-No.2 INPUT	1.25	max.	watts
PLATE DISSIPATION	10	max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	200	max.	volts
Heater positive with respect to cathode	200[▲]	max.	volts

Typical Operation and Characteristics:

Plate Supply Voltage	110	200	volts
Grid-No.2 Supply Voltage	110	125	volts
Grid-No.1 (Control-grid) Voltage	-7.5	-	volts
Cathode Resistor	-	180	ohms

12DB5

BEAM POWER TUBE

Peak AF Grid-No.1 Voltage	7.5	8.5	volts
Zero-Signal Plate Current	49	46	ma
Max.-Signal Plate Current	50	47	ma
Zero-Signal Grid-No.2 Current	4	2.2	ma
Max.-Signal Grid-No.2 Current	10	8.5	ma
Plate Resistance (Approx.)	13000	28000	ohms
Transconductance	8000	8000	μmhos
Load Resistance	2000	4000	ohms
Total Harmonic Distortion	10	10	%
Max.-Signal Power Output	2.1	3.8	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance:		
For fixed-bias operation	0.1 max.	megohm
For cathode-bias operation	2.2 max.	megohms

VERTICAL-DEFLECTION AMPLIFIER

Maximum Ratings, *Design-Center Values Except as Noted:*

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

DC PLATE VOLTAGE	300 max.	volts
PEAK POSITIVE-PULSE PLATE VOLTAGE (Absolute maximum)#	2000■ max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	150 max.	volts
PEAK NEGATIVE-PULSE GRID-No.1 (CONTROL-GRID) VOLTAGE	250 max.	volts
CATHODE CURRENT:		
Peak	200 max.	ma
Average	55 max.	ma
GRID-No.2 INPUT	1.25 max.	watts
PLATE DISSIPATION	10 max.	watts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	200 max.	volts
Heater positive with respect to cathode	200▲ max.	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance:		
For fixed-bias operation	0.1 max.	megohm
For cathode-bias operation	2.2 max.	megohms

○ Without external shield.

▲ The dc component must not exceed 100 volts.

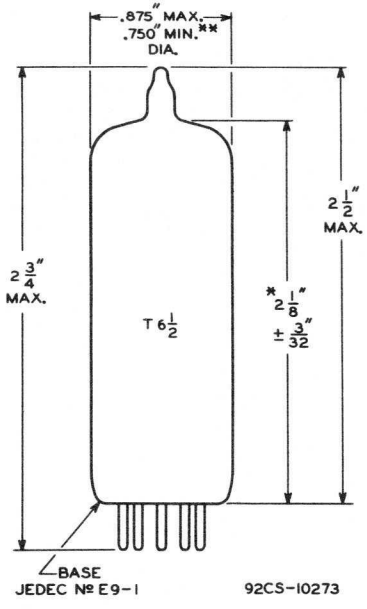
□ As described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission.

This rating is applicable where the duration of the voltage pulse does not exceed 15 per cent of one vertical scanning cycle. In a 525-line, 30-frame system, 15 per cent of one vertical scanning cycle is 2.5 milliseconds.

■ Under no circumstances should this absolute value be exceeded.

12DB5

BEAM POWER TUBE



* Measured from base seat to bulb-top line as determined by ring gauge of 7/16" inside diameter.

** Applies in zone starting 0.375" from seat.

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

12DP7-A
OSCILLOGRAPH TUBE

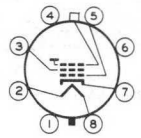
MAGNETIC FOCUS — MAGNETIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:		
Voltage	6.3	ac or dc volts
Current	0.6 ± 10%	amp
Direct Interelectrode Capacitances (Approx.):		
Grid No.1 to all other electrodes	9	μμf
Cathode to all other electrodes	6	μμf
Faceplate, Spherical		Filterglass ←
Light transmission (Approx.)		76%
Phosphor (For Curves, see front of this Section)		P7
Fluorescence		Blue
Persistence		Short
Phosphorescence		Greenish-Yellow
Persistence		Long
Focusing Method		Magnetic
Deflection Method		Magnetic
Deflection Angle (Approx.)		50°
Overall Length		19-5/8" ± 1/2"
Greatest Diameter of Bulb		12" ± 3/16"
Minimum Useful Screen Diameter		10"
Weight (Approx.)		8 lbs
Mounting Position		Any
Cap		Medium (JETEC No.C1-5)
Bulb		J96
Base	Long Medium-Shell Octal 8-Pin (JETEC No.B8-65), or Long Medium-Shell Octal 5-Pin (JETEC No.B5-80)	←
Basing Designation for BOTTOM VIEW		5AN

Pin 1 – No Connection
Pin 2 – Heater
Pin 3 – Grid No.2
Pin 4 – No Connection
Pin 5 – Grid No.1



Pin 6 – No Connection
Pin 7 – Cathode
Pin 8 – Heater
Cap – Ultor (Grid No.3, Collector)

Maximum Ratings, *Design-Center Values:*

ULTOR VOLTAGE	10000 max.	volts
GRID-No.2 VOLTAGE:		
Positive value (DC or Peak AC)	700 max.	volts
Negative value (DC or Peak AC)	180 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value	180 max.	volts
Positive bias value▲	0 max.	volts
Positive peak value	2 max.	volts

▲ At or near this rating, the effective resistance of the ultor supply should be adequate to limit the ultor input power to 6 watts.

← Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

12DP7-A

OSCILLOGRAPH TUBE

PEAK GRID-No.1 DRIVE FROM CUTOFF	65 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode .	125 max.	volts
Heater positive with respect to cathode .	125 max.	volts

Equipment Design Ranges:

For any ultor voltage (E_{c_3}) between 4000 and 10000 volts and grid-No.2 voltage (E_{c_2}) between 150 and 750 volts*

Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot	-10% to -28% of E_{c_2}	volts
Grid-No.2 Current.	-15 to +15	μamp
Focusing-Coil Current (DC)^{oo} .	$\left[\sqrt{\frac{E_{c_3}}{4000}} \times 88.5\right] \pm 15\%$	ma
Spot Position.	##	

Examples of Use of Design Ranges:

For ultor voltage of	*4000*	*7000*	*volts*
and grid-No.2 voltage of	*250*	*250*	*volts*
Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot	-25 to -70	-25 to -70	volts
Focusing-Coil Current (DC) .	75 to 102	99 to 135	ma

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

* Brilliance and definition decrease with decreasing ultor voltage. In general, the ultor voltage should not be less than 4000 volts.

oo For specimen focusing coil similar to JETEC Focusing Coil No.106 positioned with air gap toward faceplate and center line of air gap 4-1/8" from Reference Line *(See Dimensional Outline)* and ultor current of 200 microamperes.

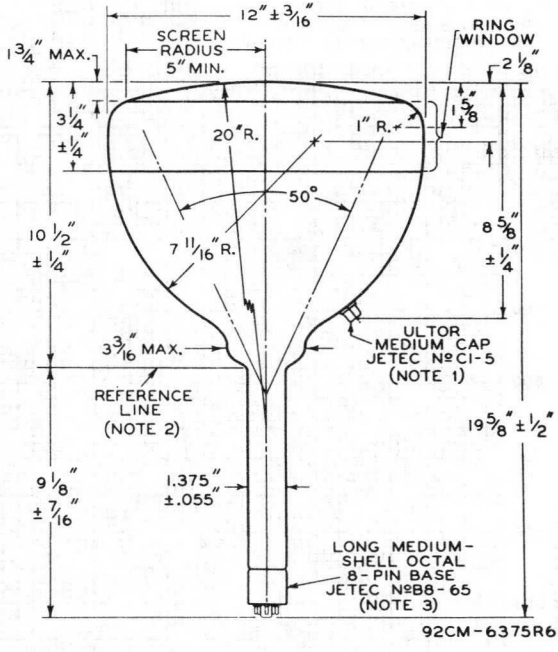
The center of the undeflected, unfocused spot will fall within a circle having a 20-mm radius concentric with the center of the tube face.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

12DP7-A

OSCILLOGRAPH TUBE



NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN No.5 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ± 10°. ULTOR TERMINAL IS ON SAME SIDE OF TUBE AS PIN No.5.

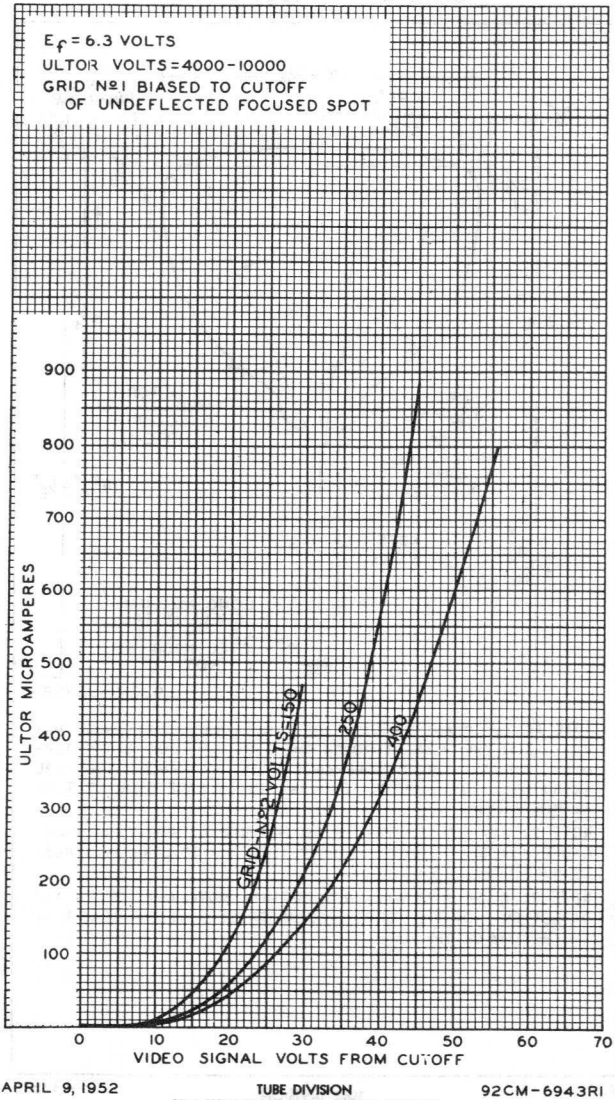
NOTE 2: REFERENCE LINE IS DETERMINED BY POSITION WHERE GAUGE 1.430" + .003" - .000" I.D. and 2" LONG WILL REST ON BULB CONE.

NOTE 3: ℄ OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF THE BOTTOM OF THE BASE.

RCA

12DP7-A

AVERAGE GRID-DRIVE CHARACTERISTICS



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

Diode—
Medium-Mu Triode—
Remote-Cutoff Pentode

9-PIN MINIATURE TYPE

For Automobile Radio Receivers Operating Directly from 6-Cell Storage Batteries

GENERAL DATA

Electrical:

Heater, for Unipotential Cathodes:		
Voltage range (DC)	10 to 15.9	volts
For longest life, it is recommended that the heater be operated within the voltage range of 11 to 14 volts.		
Current (Approx.) at 12.6 volts	0.32	amp
Direct Interelectrode Capacitances:[a]		
Triode Unit:		
Grid to plate	1.7	μμf
Grid to cathode and heater	2.6	μμf
Plate to cathode and heater	2	μμf
Pentode Unit:		
Grid No.1 to plate	0.015 max.	μμf
Grid No.1 to cathode & grid No.3 & internal shield, grid No.2, and heater	8.5	μμf
Plate to cathode & grid No.3 & internal shield, grid No.2, and heater	5.5	μμf
Pentode grid No.1 to triode grid	0.012 max.	μμf
Pentode grid No.1 to diode plate	0.004 max.	μμf
Triode grid to diode plate	0.17 max.	μμf
Triode plate to diode plate	0.8	μμf

Characteristics, Class A_1 Amplifier:

With heater voltage of 12.6 volts

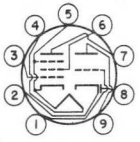
	Triode Unit	*Pentode Unit*	
Plate Voltage	12.6	12.6	volts
Grid-No.2 Voltage	–	12.6	volts
Grid-No.1 Voltage developed across a 2.2-megohm grid-No.1 resistor	-0.6	-0.8	volt
Amplification Factor	10	–	
Plate Resistance (Approx.)	–	0.4	megohm
Transconductance	1200	2700	μmhos
Plate Current	1	1.9	ma
Grid-No.2 Current	–	0.7	ma
Grid-No.1 Voltage (Approx.) for transconductance (μmhos) = 30	–	-2.8	volts
Grid Voltage (Approx.) for plate μa = 10	-3.5	–	volts

12FR8

Mechanical:

Operating Position	Any
Maximum Overall Length	2-7/16"
Maximum Seated Length	2-3/16"
Length, Base Seat to Bulb Top (Excluding tip)	1-13/16" ± 3/32"
Diameter	0.750" to 0.875"
Bulb	T6-1/2
Base	Small-Button Noval 9-Pin (JEDEC No.E9-1)
Basing Designation for BOTTOM VIEW	9KU

Pin 1 – Triode Grid
Pin 2 – Triode and Diode Cathode
Pin 3 – Pentode Grid No.1
Pin 4 – Heater
Pin 5 – Pentode Grid No.3, Cathode, Internal Shield, Heater



Pin 6 – Pentode Grid No.2
Pin 7 – Pentode Plate
Pin 8 – Diode Plate
Pin 9 – Triode Plate

AMPLIFIER — Class A_1

Maximum Ratings, *Design-Center Values:*

	Triode Unit	*Pentode Unit*	
PLATE VOLTAGE	16 max.	16 max.	volts
GRID-No.2 (SCREEN-GRID) SUPPLY VOLTAGE	–	16 max.	volts
GRID-No.2 VOLTAGE	–	16 max.	volts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	16 max.	–	volts
Heater positive with respect to cathode	16 max.	–	volts

Maximum Circuit Values:

	Triode Unit	*Pentode Unit*	
Grid-No.1-Circuit Resistance	10 max.	10 max.	megohms

DIODE UNIT

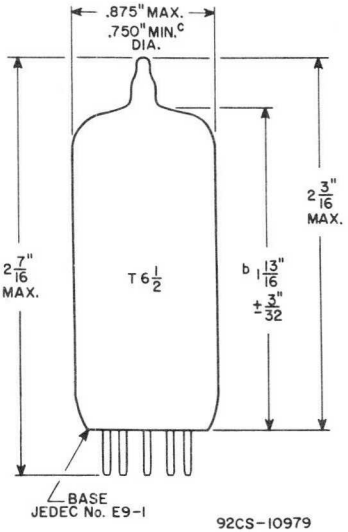
Maximum Ratings, *Design-Center Values:*

PLATE CURRENT	5 max.	ma

Characteristics, Instantaneous Test Condition:

Plate Current for plate volts = 10	2	ma

[a] Without external shield.



[b] MEASURED FROM BASE SEAT TO BULB-TOP LINE AS DETERMINED BY RING GAUGE OF 7/16" INSIDE DIAMETER.

[c] APPLIES IN ZONE STARTING 0.375" FROM SEAT.

Medium-Mu Triode—Pentagrid Converter

9-PIN MINIATURE TYPE

For Automobile Radio Receivers Operating Directly from 6-Cell Storage Batteries

GENERAL DATA

Electrical:

Heater, for Unipotential Cathodes:		
Voltage range (DC)	10 to 15.9	volts
For longest life, it is recommended that the heater be operated within the voltage range of 11 to 14 volts.		
Current (Approx.) at 12.6 volts	0.27	volts
Direct Interelectrode Capacitances:[a]		
Triode Unit:		
Grid to plate	1.3	μμf
Grid to cathode & heater	2.2	μμf
Plate to cathode & heater	0.25	μμf
Heptode Unit:		
Grid No.3 to plate	0.28 max.	μμf
Grid No.3 to grid No.1	0.12 max.	μμf
Grid No.3 to cathode & grid No.5 & internal shield, plate, grids No.2 & No.4, grid No.1, and heater (RF input)	6	μμf
Plate to cathode & grid No.5 & internal shield, grids No.2 & No.4, grid No.1, and heater (Mixer output)	5	μμf
Grid No.1 to cathode & grid No.5 & internal shield, grid No.3, grids No.2 & No.4, and heater (Oscillator input)	5	μμf
Grid No.1 to cathode & grid No.5 & internal shield	3	μμf
Cathode & grid No.5 & internal shield to plate, grids No.2 & No.4, grid No. 3, and heater (Oscillator output)	17	μμf
Grid No.1 to plate	0.16 max.	μμf
Triode grid to heptode grid No.3	0.01 max.	μμf
Triode plate to heptode grid No.3	0.18 max.	μμf
Triode plate to heptode plate	0.2 max.	μμf

Characteristics, Class A_1 Amplifier (Triode Unit):

With heater voltage of 12.6 volts

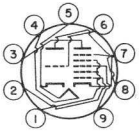
Plate Voltage	12.6	volts
Grid Voltage developed across a 2.2-megohm grid resistor	-0.8	volt
Amplification Factor	10	
Plate Resistance (Approx.)	7150	ohms
Transconductance	1400	μmhos
Plate Current	1.3	ma
Grid Voltage (Approx.) for plate μa = 10.	-3.2	volts

12FX8

Mechanical:

Operating Position	Any
Maximum Overall Length	2-7/16"
Maximum Seated Length	2-3/16"
Length, Base Seat to Bulb Top (Excluding tip)	1-13/16" ± 3/32"
Diameter	0.750" to 0.875"
Bulb	T6-1/2
Base	Small-Button Noval 9-Pin (JEDEC No.E9-1)
Basing Designation for BOTTOM VIEW	9KV

Pin 1 – Heptode Grid No.2, Grid No.4
Pin 2 – Heptode Grid No.1
Pin 3 – Heptode Plate
Pin 4 – Heater
Pin 5 – Heater, Triode Cathode



Pin 6 – Triode Grid
Pin 7 – Heptode Grid No.5, Cathode, Internal Shield
Pin 8 – Triode Plate
Pin 9 – Heptode Grid No.3

HEPTODE UNIT — CONVERTER

Maximum Ratings, *Design-Center Values:*

PLATE VOLTAGE	16 max.	volts
GRID-No.3 (CONTROL-GRID) VOLTAGE:		
Negative-bias value	16 max.	volts
Positive-bias value	0 max.	volts
GRIDS-No.2 & No.4 (SCREEN-GRID) VOLTAGE	16 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	16 max.	volts
Heater positive with respect to cathode	16 max.	volts

Typical Operation and Characteristics:

With self-excitation and heater voltage of 12.6 volts

Plate Voltage	12.6	volts
Grid-No.3 Voltage developed across a 2.2-megohm grid-No.3 resistor	-0.5	volt
Grids-No.2 & No.4 Voltage	12.6	volts
RMS Grid-No.1 (Oscillator-Grid) Voltage	1.6	volts
Grid-No.1 Resistor	33000	ohms
Plate Resistance (Approx.)	0.5	megohm
Conversion Transconductance	300	μmhos
Grid-No.3 Voltage (Approx.) for conversion transconductance (μmhos) = 10	-3	volts
Plate Current	290	μa
Grids-No.2 & No.4 Current	1.25	ma

Oscillator Characteristics (Not Oscillating):

With grids No.2 & No.4 connected to plate and with heater voltage of 12.6 volts

Plate and Grids-No.2 & No.4 Voltage	12.6	volts
Grid-No.3 Voltage	0	volts
Grid-No.1 Voltage	0	volts

Amplification Factor between grid No.1 and grids No.2 & No.4 connected to plate.	9	
Transconductance between grid No.1 and grids No.2 & No.4 connected to plate . .	3600	μmhos
Cathode Current.	4.4	ma
Grid-No.1 Voltage (Approx.) for plate μa = 10.	−4.5	volts

Maximum Circuit Values:

Grid-No.3-Circuit Resistance	10 max.	megohms

TRIODE UNIT — AMPLIFIER — Class A_1

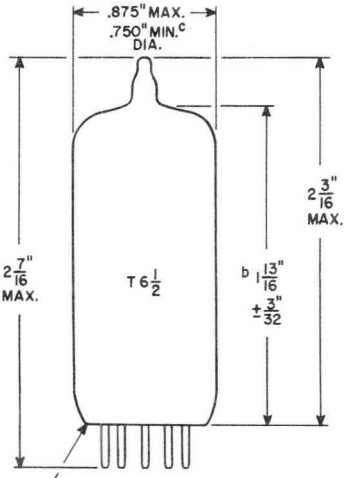
Maximum Ratings, *Design-Center Values:*

PLATE VOLTAGE.	16 max.	volts

Maximum Circuit Values:

Grid-Circuit Resistance.	10 max.	megohms

[a] Without external shield.



[b] Measured from base seat to bulb-top line as determined by ring gauge of 7/16" inside diameter.

[c] Applies in zone starting 0.375" from seat.

12SK7
REMOTE-CUTOFF PENTODE

The 12SK7 is the same as the 6SK7 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	12.6	volts
Current	0.15	amp

12SK7-GT
REMOTE-CUTOFF PENTODE

The 12SK7-GT is the same as the 6SK7-GT except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	12.6	volts
Current	0.15	amp

12SL7-GT
HIGH-MU TWIN TRIODE

The 12SL7-GT is the same as the 6SL7-GT except for the following items:

Heater, for Unipotential Cathodes:		
Voltage (AC or DC)	12.6	volts
Current	0.15	amp

12SN7-GT
MEDIUM-MU TWIN TRIODE

The 12SN7-GT is the same as the 6SN7-GT except for the following items:

Heater, for Unipotential Cathodes:		
Voltage (AC or DC)	12.6	volts
Current	0.3	amp

12SQ7
TWIN DIODE—HIGH-MU TRIODE

The 12SQ7 is the same as the 6SQ7 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	12.6	volts
Current	0.15	amp

12SQ7-GT
TWIN DIODE—HIGH-MU TRIODE

The 12SQ7-GT is the same as the 6SQ7-GT except for the follow- items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	12.6	volts
Current	0.15	amp

12SR7
TWIN DIODE—MEDIUM-MU TRIODE

The 12SR7 is the same as the 6SR7 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	12.6	volts
Current	0.15	amp

13DE7

Dual Triode

With Medium-Mu Unit and Low-Mu Unit

9-PIN MINIATURE TYPE

For Equipment Having Series Heater-String Arrangement

The 13DE7 is the same as the 6DE7 except for the following items:

Heater, for Unipotential Cathodes:		
Voltage (AC or DC)	13	volts
Current	0.45 ± 6%	amp
Warm-up time (Average)	11	sec

13EM7

Dual Triode

With High-Mu Unit and Low-Mu Unit

For Equipment Having Series Heater-String Arrangement

The 13EM7 is the same as the 6EM7 except for the following items:

Heater, for Unipotential Cathodes:		
Voltage (AC or DC)	13	volts
Current	0.45 ± 6%	amp
Warm-up time (Average)	11	sec

17AX4-GT

Half-Wave Vacuum Rectifier

For Damper Service in TV Equipment
Having Series Heater-String Arrangement

The 17AX4-GT is the same as the 6AX4-GT except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	16.8	volts
Current	0.45 ± 6%	amp
Warm-up time (Average)	11	sec

17AX4-GTA

Half-Wave Vacuum Rectifier

For Damper Service in TV Equipment
Having Series Heater-String Arrangement

The 17AX4-GTA is the same as the 6AX4-GTB except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	16.8	volts
Current	0.45 ± 6%	amp
Warm-up time (Average)	11	sec

17BQ6-GTB

Beam Power Tube

For Equipment Having Series Heater-String Arrangement

The 17BQ6-GTB is the same as the 6BQ6-GTB/6CU6 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	16.8	volts
Current	0.45	amp
Warm-up time (Average)	11	sec

17D4

Half-Wave Vacuum Rectifier

For Damper Service in TV Equipment
Having Series Heater-String Arrangement

The 17D4 is the same as the 6DA4 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	16.8	volts
Current	0.45 ± 6%	amp
Warm-up time (Average)	11	sec

17DE4

Half-Wave Vacuum Rectifier

For Damper Service in TV Equipment
Having Series Heater-String Arrangement

The 17DE4 is the same as the 6DE4 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	17	volts
Current	0.6 ± 6%	amp
Warm-up time (Average)	11	sec

17DQ6-A

Beam Power Tube

For Equipment Having Series Heater-String Arrangement

The 17DQ6-A is the same as the 6DQ6-A except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	16.8	volts
Current	0.45 ± 6%	amp
Warm-up time (Average)	11	sec

RADIO CORPORATION OF AMERICA
Electron Tube Division Harrison, N. J.

17AX4GT

Half-Wave Vacuum Rectifier

For Damper Service in TV Equipment
Having Series Heater-String Arrangement

The 17AX4GT is the same as the 6AX4GT except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	16.8	volts
Current	0.45 ± 6%	amp
Warm-up time (Average)	11	sec

17AX4GTA

Half-Wave Vacuum Rectifier

For Damper Service in TV Equipment
Having Series Heater-String Arrangement

The 17AX4GTA is the same as the 6AX4GTB except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	16.8	volts
Current	0.45 ± 6%	amp
Warm-up time (Average)	11	sec

17BQ6GTB

Beam Power Tube

For Equipment Having Series Heater-String Arrangement

The 17BQ6GTB is the same as the 6BQ6GTB/6CU6 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	16.8	volts
Current	0.45	amp
Warm-up time (Average)	11	sec

17D4

Half-Wave Vacuum Rectifier

For Damper Service in TV Equipment
Having Series Heater-String Arrangement

The 17D4 is the same as the 6DA4 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	16.8	volts
Current	0.45 ± 6%	amp
Warm-up time (Average)	11	sec

17DE4

Half-Wave Vacuum Rectifier

For Damper Service in TV Equipment
Having Series Heater-String Arrangement

The 17DE4 is the same as the 6DE4 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	17	volts
Current	0.6 ± 6%	amp
Warm-up time (Average)	11	sec

17DM4

Half-Wave Vacuum Rectifier

For Damper Service in TV Equipment
Having Series Heater-String Arrangement

The 17DM4 is the same as the 6DM4 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	16.8	volts
Current	0.45 ± 6%	amp
Warm-up time (Average)	11	sec

RCA

17BWP4

PICTURE TUBE

RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — MAGNETIC DEFLECTION

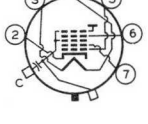
Intended for use in equipment having series heater-string arrangement

DATA

General:

Heater, for Unipotential Cathode:	
Voltage	6.3 ac or dc volts
Current	0.6 ± 5% amp
Warm-up time (Average)	11 sec
For definition of heater warm-up time and method of determining it, see sheet HEATER WARM-UP TIME MEASUREMENT at front of Receiving Tube Section.	
Capacitance between External Conductive Coating and Ultor	1500 max. μμf 1000 min. μμf
Faceplate, Spherical	Filterglass
Phosphor (For Curves, see front of this Section)	P4—Sulfide Type Aluminized
Deflection Angles (Approx.):	
Diagonal	110°
Horizontal	105°
Vertical	87°
Electron Gun	Type Requiring No Ion-Trap Magnet
Tube Dimensions:	
Overall length	12-5/16" ± 5/16"
Greatest width	15-5/8" ± 1/8"
Greatest height	12-3/4" ± 1/8"
Diagonal	16-9/16" ± 1/8"
Neck length	5-3/16" ± 3/16"
Radius of curvature of faceplate (External surface)	20-3/4"
Screen Dimensions (Minimum):	
Greatest width	14-3/4"
Greatest height	11-11/16"
Diagonal	15-3/4"
Projected area	155 sq. in.
Operating Position	Any
Cap	Recessed Small Cavity (JETEC No.J1-21)
Base	Special (JETEC No.B6-185)
Basing Designation for BOTTOM VIEW	7FA

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



Cap - Ultor (Grid No.3, Grid No.5, Collector)
C - External Conductive Coating

17BWP4

PICTURE TUBE

Maximum Ratings, *Design-Center Values:*		
ULTOR VOLTAGE	16000 max.	volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value	1000 max.	volts
Negative value	500 max.	volts
GRID-No.2 VOLTAGE	500 max.	volts
GRID-No.1 VOLTAGE:		
Negative-peak value	200 max.	volts
Negative-bias value	140 max.	volts
Positive-bias value	0 max.	volts
Positive-peak value	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	410 max.	volts
After equipment warm-up period	180 max.	volts
Heater positive with respect to cathode	180 max.	volts
Maximum Circuit Values:		
Grid-No.1-Circuit Resistance	1.5 max.	megohms

For X-ray shielding considerations, see sheet X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section

Remote-Cutoff Pentode

7-PIN MINIATURE TYPE

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	18	volts
Current	0.1 ± 6%	amp
Direct Interelectrode Capacitances:▲		
Grid No.1 to plate	0.0035 max.	μμf
Grid No.1 to cathode, grid No.3, grid No.2, and heater	5.5	μμf
Plate to cathode, grid No.3, grid No.2, and heater	5	μμf

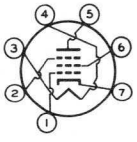
Characteristics, Class A_1 Amplifier:

Plate Supply Voltage	100	volts
Grid No.3	*Connected to cathode at socket*	
Grid-No.2 Supply Voltage	100	volts
Cathode Resistor	68	ohms
Plate Resistance (Approx.)	0.25	megohm
Transconductance	4400	μmhos
Plate Current	11	ma
Grid-No.2 Current	4.4	ma
Grid-No.1 Voltage (Approx.) for transconductance (μmhos) = 25	−20	volts

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"
Diameter	0.650" to 0.750"
Dimensional Outline	See *General Section*
Bulb	T5-1/2
Base	Small-Button Miniature 7-Pin (JEDEC No.E7-1)
Basing Designation for BOTTOM VIEW	7CC

Pin 1 – Grid No.1
Pin 2 – Grid No.3, Internal Shield
Pin 3 – Heater



Pin 4 – Heater
Pin 5 – Plate
Pin 6 – Grid No.2
Pin 7 – Cathode

AMPLIFIER — Class A_1

Maximum Ratings, *Design-Maximum Values:*

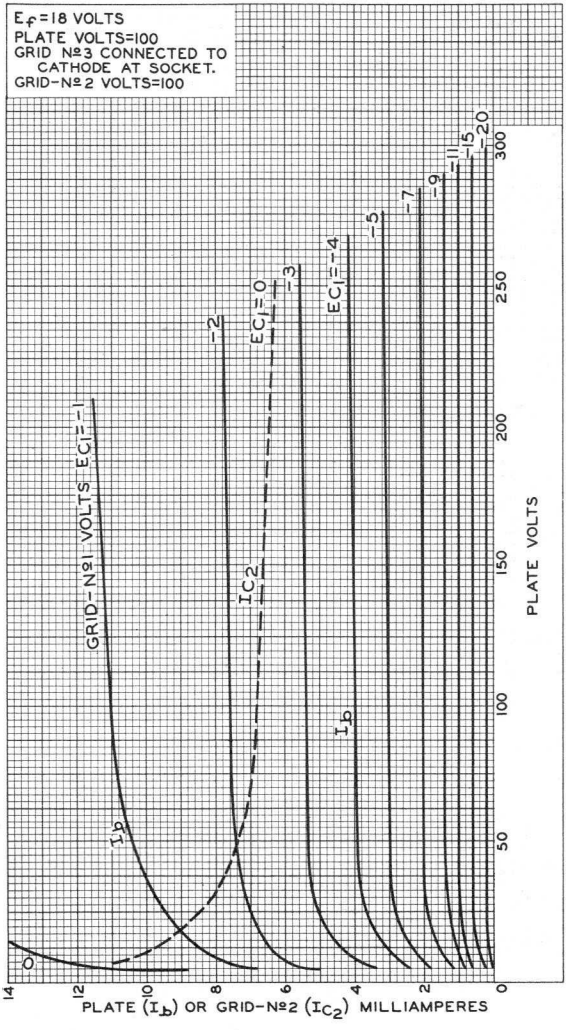
PLATE VOLTAGE	150 max.	volts
GRID No.3 (SUPPRESSOR GRID)	*Connected to cathode at socket*	
GRID-No.2 (SCREEN-GRID) SUPPLY VOLTAGE	150 max.	volts

← Indicates a change.

GRID-No.2 VOLTAGE	*See Grid-No.2 Input Rating Chart at front of Receiving Tube Section*	
GRID-No.2 INPUT:		
For grid-No.2 voltages up to 75 volts . .	0.6 max.	watt
For grid-No.2 voltages between 75 and 150 volts	*See Grid-No.2 Input Rating Chart at front of Receiving Tube Section*	
PLATE DISSIPATION	2.5 max.	watts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode .	100 max.	volts
Heater positive with respect to cathode .	100 max.	volts

▲ With external shield JEDEC No.316 connected to cathode.

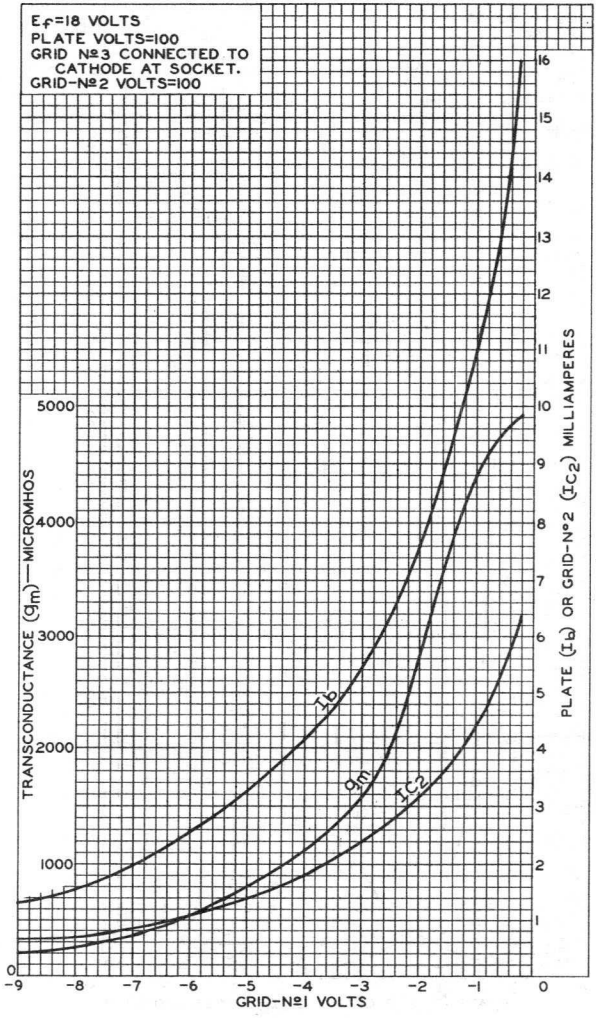
AVERAGE CHARACTERISTICS



92CM-10778

18FW6

AVERAGE CHARACTERISTICS



92CM-10776

18FX6

PENTAGRID CONVERTER

7-PIN MINIATURE TYPE

GENERAL DATA

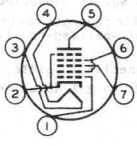
Electrical:

Heater, for Unipotential Cathode:			
Voltage (AC or DC)	18 ± 10%		volts
Current	0.1		amp
Direct Interelectrode Capacitances:	*Without External Shield*	*With External Shield*[o]	
Grid No.3 to all other electrodes (RF input)	7	7	μμf
Plate to all other electrodes (Mixer input)	8	13	μμf
Grid No.1 to all other electrodes (Oscillator input)	5.5	5.5	μμf
Grid No.3 to plate	0.30 max.	0.25 max.	μμf
Grid No.3 to grid No.1	0.15 max.	0.15 max.	μμf
Grid No.1 to plate	0.1	0.05	μμf
Grid No.1 to cathode & grid No.5	3	3	μμf
Cathode & grid No.5 to all other electrodes except grid No.1	15	20	μμf

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"
Diameter	0.650" to 0.750"
Dimensional Outline	*See General Section*
Bulb	T5-1/2
Base	Small-Button Miniature 7-Pin (JEDEC No.E7-1)
Basing Designation for BOTTOM VIEW	7CH

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



CONVERTER

Maximum Ratings, *Design-Maximum Values:*

PLATE VOLTAGE	150 max.	volts
GRIDS-No.2 & No.4 (SCREEN-GRIDS) SUPPLY VOLTAGE	150 max.	volts
GRIDS-No.2 & No.4 VOLTAGE	110 max.	volts
GRIDS-No.2 & No.4 INPUT	1.2 max.	watts
PLATE DISSIPATION	1 max.	watt

18FX6

PENTAGRID CONVERTER

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

Characteristics:

*With Separate Excitation**

Plate Voltage	100	volts
Grids-No.2 & No.4 Voltage	100	volts
Grid-No.3 Voltage	-1.5	volts
Grid-No.1 Resistor.	20000	ohms
Plate Resistance (Approx.).	0.4	megohm
Conversion Transconductance	480	μmhos
Plate Current	2.3	ma
Grids-No.2 & No.4 Current	6.2	ma
Grid-No.1 Current	0.5	ma
Total Cathode Current	9	ma
Grid-No.3 Voltage (Approx.) for conversion transconductance (μmhos) = 10.	-21	volts

Oscillator Characteristics (Not Oscillating):■

Plate & Grids-No.2 & No.4 Voltage . . .	100	volts
Grid-No.3 Voltage	0	volts
Grid-No.1 Voltage	0	volts
Amplification Factor†	22	
Oscillator Transconductance†.	7000	μmhos
Cathode Current	24	ma
Grid-No.1 Voltage (Approx.) for plate μa = 20	-9.2	volts

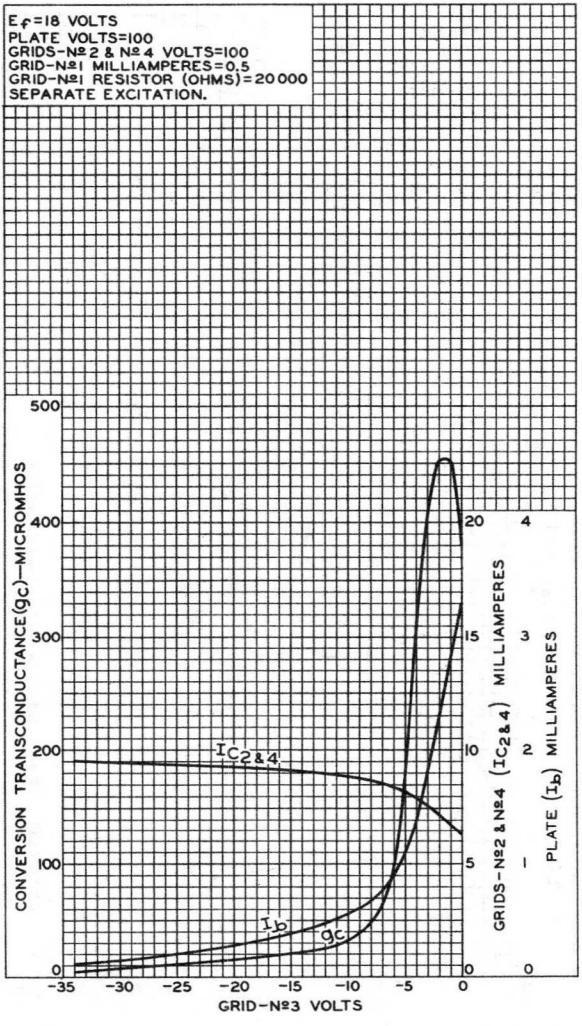
° With external shield JEDEC No.316 connected to cathode.

* The characteristics shown with separate excitation correspond very closely with those obtained in a self-excited-oscillator circuit operating with zero bias.

■ With grids No.2 & No.4 connected to plate.

† Between grid No.1 and grids No.2 & No.4 connected to plate.

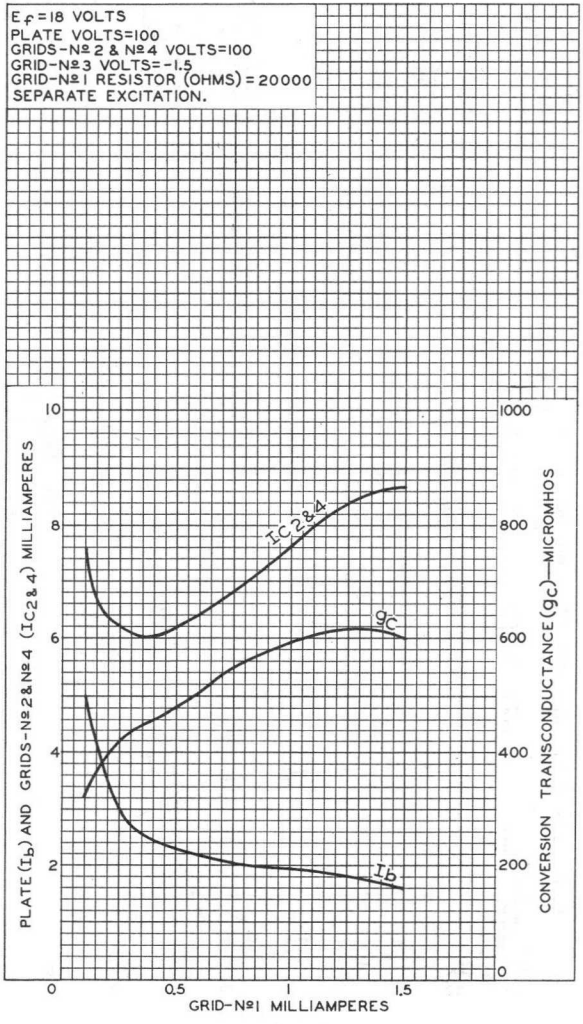
AVERAGE CHARACTERISTICS



92CM-10777

18FX6

AVERAGE CHARACTERISTICS



92CM-10782

18FY6

TWIN DIODE—HIGH-MU TRIODE

7-PIN MINIATURE TYPE

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:

Voltage (AC or DC)	18 ± 10%	volts
Current	0.1	amp

Direct Interelectrode Capacitances:

	Without External Shield	*With External Shield°*	
Triode grid to triode plate	1.8	1.8	μμf
Triode grid to cathode and heater	2.4	2.4	μμf
Triode plate to cathode and heater	0.22	2	μμf
Plate of diode unit No.2 to triode grid	0.2 max.	0.2 max.	μμf

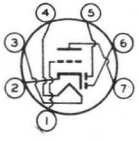
Characteristics, Class A_1 Amplifier (Triode Unit):

Plate Voltage	100	volts
Grid Voltage	−1	volt
Amplification Factor	100	
Plate Resistance (Approx.)	77000	ohms
Transconductance	1300	μmhos
Plate Current	0.6	ma

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"
Diameter	0.650" to 0.750"
Dimensional Outline	*See General Section*
Bulb	T5-1/2
Base	Small-Button Miniature 7-Pin (JEDEC No.E7-1)
Basing Designation for BOTTOM VIEW	7BT

Pin 1 – Grid of Triode Unit
Pin 2 – Cathode of Triode Unit and Diode Units No.1 and No.2
Pin 3 – Heater
Pin 4 – Heater



Pin 5 – Plate of Diode Unit No.2
Pin 6 – Plate of Diode Unit No.1
Pin 7 – Plate of Triode Unit

° With external shield JEDEC No.316 connected to cathode.

18FY6

TWIN DIODE—HIGH-MU TRIODE

TRIODE UNIT — AMPLIFIER — Class A_1

Maximum Ratings, *Design-Maximum Values:*

PLATE VOLTAGE	150 max.	volts
GRID VOLTAGE:		
Positive-bias value	0 max.	volts
PLATE DISSIPATION	0.5 max.	watt
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	100 max.	volts
Heater positive with respect to cathode	100 max.	volts

DIODE UNITS — Two

Maximum Ratings, *Design-Maximum Values:*

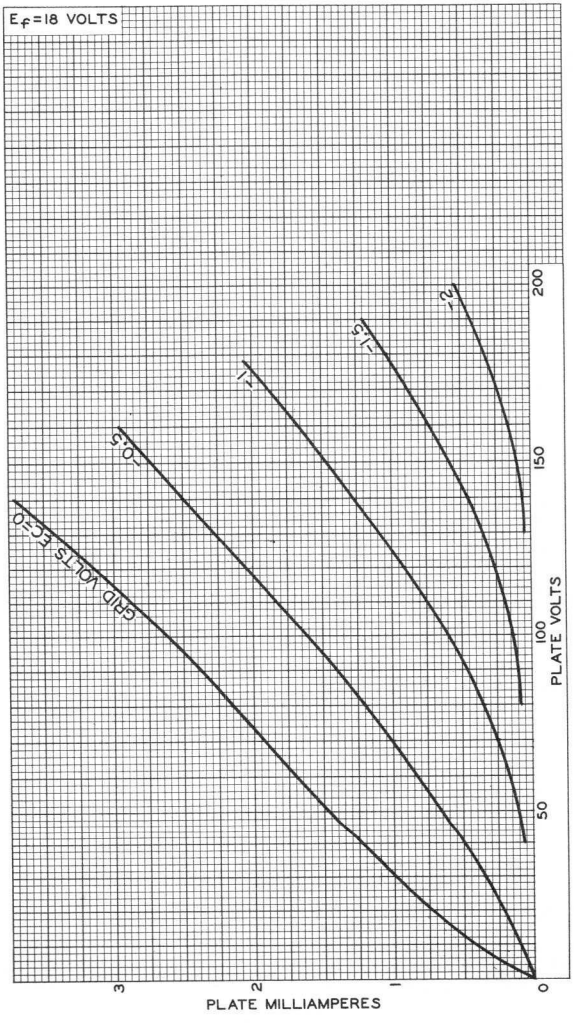
Values are for Each Unit

PLATE CURRENT	1 max.	ma

Characteristics:

Plate Current for plate volts = 10	2	ma

AVERAGE PLATE CHARACTERISTICS
Triode Unit



92CM-10775

19BFP4

Picture Tube

RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — 92° MAGNETIC DEFLECTION

GENERAL DATA

Electrical:

Heater Current at 6.3 volts	600 ± 5%	ma
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes	6	μμf
Cathode to all other electrodes	5	μμf
External conductive coating to ultor	2000 max. / 1500 min.	μμf
Electron Gun	Type Requiring No Ion-Trap Magnet	

Optical:

Faceplate	Filterglass
Light transmission (Approx.)	78%
Phosphor (For Curves, see front of this Section)	P4—Sulfide Type, Aluminized

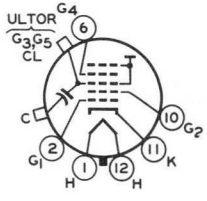
Mechanical:

Operating Position	Any
Weight (Approx.)	14-3/4 lbs
Overall Length	15-1/4" ± 3/8"
Neck Length	5-1/2" ± 3/16"
Projected Area of Screen	172 sq. in.
External Conductive Coating:	
Type	Regular Band
Contact area for grounding	Near Reference Line

For Additional Information on Coatings and Dimensions:
See *Picture-Tube Dimensional-Outlines* and *Bulb J149 B* sheets at the front of this section

Cap . . . . . Recessed Small Cavity (JEDEC No.J1-21)
Bases (Alternates):
Short Small-Shell Duodecal 6-Pin (JEDEC Group 4, No.B6-203)
Small-Shell Duodecal 6-Pin, Arrangement 1 (JEDEC Group 4, No.B6-63)
Basing Designation for BOTTOM VIEW 12L

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 6 – Grid No.4
Pin 10 – Grid No.2
Pin 11 – Cathode
Pin 12 – Heater



Cap – Ultor (Grid No.3, Grid No.5, Collector)
C – External Conductive Coating

19BFP4

Maximum Ratings, *Design-Maximum Values:*

ULTOR VOLTAGE	20000 max.	volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value	1100 max.	volts
Negative value	550 max.	volts
GRID-No.2 VOLTAGE	550 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value	154 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode	200 max.	volts

Typical Operating Conditions:

With ultor voltage of	*16000*	*volts*
and grid-No.2 voltage of	*400*	*volts*
Grid-No.4 Voltage for focus	0 to 400	volts
Grid-No.1 Voltage for visual extinction of focused raster	-36 to -94	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section

20EZ7

High-Mu Twin Triode

9-PIN MINIATURE TYPE

For High-Gain, Resistance-Coupled, Low-Level Audio-Amplifiers Operating at Low-Signal Levels, such as Preamplifiers for Low-Cost Stereophonic Phonographs

GENERAL DATA

Electrical:

Heater, for Unipotential Cathodes:			
Heater arrangement	*Series*	*Parallel*	
Voltage (AC or DC)	20	10 ± 10%	volts
Current	0.1 ± 6%	0.2	amp
Direct Interelectrode Capacitances (Approx.):▲	*Unit No.1*	*Unit No.2*	
Grid to plate	1.5	1.5	μμf
Grid to cathode and heater	1.6	1.6	μμf
Plate to cathode and heater	0.2	0.3	μμf

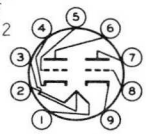
Characteristics, Class A_1 Amplifier (Each Unit):

Plate Voltage	100	250	volts
Grid Voltage	-1	-2	volts
Amplification Factor	100	100	
Plate Resistance (Approx.)	80000	62500	ohms
Transconductance	1250	1600	μmhos
Plate Current	0.5	1.2	ma

Mechanical:

Operating Position	Any
Maximum Overall Length	2-3/16"
Maximum Seated Length	1-15/16"
Length, Base Seat to Bulb Top (Excluding tip)	1-9/16" ± 3/32"
Diameter	0.750" to 0.875"
Dimensional Outline	See *General Section*
Bulb	T6-1/2
Base	Small-Button Noval 9-Pin (JEDEC No.E9-1)
Basing Designation for BOTTOM VIEW	9MJ

Pins 1 & 3 – Heater of Unit No.1
Pins 2 & 3 – Heater of Unit No.2
Pin 3 – Heater Tap
Pin 4 – Cathode of Unit No.2
Pin 5 – Grid of Unit No.2



Pin 6 – Plate of Unit No.2
Pin 7 – Plate of Unit No.1
Pin 8 – Grid of Unit No.1
Pin 9 – Cathode of Unit No.1

AMPLIFIER — Class A_1

Values are for Each Unit

Maximum Ratings, *Design-Maximum Values:*

PLATE VOLTAGE	330 max.	volts

20EZ7

GRID VOLTAGE:			
Negative-bias value	55	max.	volts
Positive-bias value	0	max.	volts
PLATE DISSIPATION	1.2	max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	200	max.	volts
Heater positive with respect to cathode	200●	max.	volts

Typical Operation as Resistance-Coupled Amplifier:

See *RESISTANCE-COUPLED-AMPLIFIER CHART No.25* at front of this Section

▲ Without external shield.

● The dc component must not exceed 100 volts.

21ALP4

PICTURE TUBE

RECTANGULAR GLASS TYPE

LOW-VOLTAGE ELECTROSTATIC FOCUS MAGNETIC DEFLECTION

The 21ALP4 is the same as the 21ALP4-B/21ALP4-A except that it utilizes a *non-aluminized phosphor* and has a *maximum ultor-voltage rating of 18,000 volts.*

21CYP22

COLOR PICTURE TUBE

THREE-GUN, GRADED-HOLE, SHADOW-MASK TYPE
ALUMINIZED TRICOLOR PHOSPHOR-DOT SCREEN
ALL-GLASS ENVELOPE — ELECTROSTATIC FOCUS
MAGNETIC CONVERGENCE — MAGNETIC DEFLECTION

DATA

General:

Electron Guns, Three with Axes Tilted Toward Tube Axis	Blue, Green, Red	
Heater, for Unipotential Cathode of Each Gun, Paralleled with Each of the Other Two Heaters within Tube:		
Voltage	6.3	ac or dc volts
Current	1.8 ± 10%	amp
Direct Interelectrode Capacitances (Approx.):		
Grid No.1 of any gun to all other electrodes except the No.1 grids of the other two guns	7	μμf
Cathode of blue gun + cathode of green gun + cathode of red gun to all other electrodes	16	μμf
Grid No.3 (Of each gun tied within tube to No.3 grids of other two guns) to all other electrodes	9	μμf
External conductive coating to grid No.6	2500 max. 2000 min.	μμf μμf
Faceplate, Spherical	Filterglass	
Light transmission (Approx.)	72%	
Screen, on Inner Surface of Faceplate:		
Type	Aluminized, Tricolor, Phosphor-Dot	
Phosphor (Three separate phosphors, collectively)	P22	
Fluorescence and phosphorescence of separate phosphors, respectively	Blue, Green, Red	
Persistence of group phosphorescence	Medium	
Dot arrangement	Triangular group consisting of blue dot, green dot, and red dot	
Spacing between centers of adjacent dot trios (Approx.)	0.029"	
Size (Minimum):		
Greatest width	19-1/4"	
Height	15-1/2"	
Projected area	261 sq. in.	
Focusing Method	Electrostatic	
Convergence Method	Magnetic	
Deflection Method	Magnetic	
Deflection Angles (Approx.):		
Horizontal	70°	
Vertical	55°	
Tube Dimensions:		
Overall length	25-1/32" ± 3/8"	
Diameter	20-13/16" ± 1/8"	
Weight (Approx.)	36-1/2 lbs	
Operating Position	Tube Axis Horizontal (Base pin 12 and V-grooved panel pad on top)	

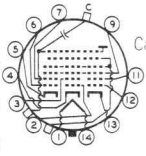
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

21CYP22

COLOR PICTURE TUBE

Caps (Two). . . . . .Recessed Small Cavity (JETEC No.J1-21)
Socket. . . . . Alden Nos.214NMINSC (Radial leads), 214NMINC (Axial leads), or equivalent
Base. . . . Small-Shell Neodiheptal 12-Pin (JETEC No.B12-131)
Basing Designation for BOTTOM VIEW. 14AL

Pin 1 - Heater
Pin 2 - Grid No.1 of Red Gun
Pin 3 - Grid No.2 of Red Gun
Pin 4 - Cathode of Red Gun
Pin 5 - Cathode of Green Gun
Pin 6 - Grid No.1 of Green Gun
Pin 7 - Grid No.2 of Green Gun
Pin 9 - Grid No.3
Pin 11 - Grid No.2 of Blue Gun
Pin 12 - Grid No.1 of Blue Gun



Pin 13 - Cathode of Blue Gun
Pin 14 - Heater
Cap Over Pin 1 - Ultor (Grid No.4, Grid No.5)
Cap♦ Over Pin 2 - Grid No.6, Collector, High-Voltage-Supply Terminal
C - External Conductive Coating

Maximum Ratings, *Design-Center Values:*

ULTOR-TO-CATHODE (Of each gun) VOLTAGE. . . 25000 max. volts

Between the Ultor Terminal and the High-Voltage-Supply Terminal *(See Dimensional Outline)*, it is necessary to connect a resistor of 50,000 ohms as described under *Limiting Circuit Values.* The high voltage must be connected to the High-Voltage-Supply Terminal--never directly to the Ultor Terminal.

GRID-No.3-TO-CATHODE (Of each gun) VOLTAGE.	6000 max.	volts
GRID-No.2-TO-CATHODE VOLTAGE (Each gun) . .	600 max.	volts
GRID-No.1-TO-CATHODE VOLTAGE (Each gun):		
Negative bias value	400 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE (Each gun):		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds.	410 max.	volts
After equipment warm-up period.	180 max.	volts
Heater positive with respect to cathode .	180 max.	volts

Equipment Design Ranges:

With ultor voltage (E_{c_4} $k_{each\ gun}$) between 20000# and 25000 volts

Grid-No.3 (Focusing Electrode)-to-Cathode (Of each gun) Voltage .	16.8% to 20% of E_{c_4} $k_{each\ gun}$	volts

♦,#: See next page.

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21CYP22

COLOR PICTURE TUBE

Grid-No.2-to-Cathode Voltage (Each gun) when circuit design utilizes grid-No.1-to-cathode voltage (E_{c_1k}) at fixed value for raster cutoff	*See Cutoff Design Chart*	
Grid-No.1-to-Cathode Voltage (Each gun) for Visual Extinction of Focused Raster when circuit design utilizes grid-No.2-to-cathode voltage (E_{c_2k}) at fixed value	*See Cutoff Design Chart*	
Variation in Raster Cutoff Between Guns in Any Tube	± 21% of average of highest and lowest cutoff values	
Grid-No.3 Current	-45 to +45	μa
Grid-No.2 Current (Each gun)	-5 to +5	μa
Percentage of Total Ultor Current Supplied by Each Gun: *To Produce White of 8500° K + 27 M.P.C.D. (I.C.I. Coordinates x = 0.287, y = 0.316):*		
Red gun	50	%
Blue gun	19	%
Green gun	31	%

Ratios of Cathode Currents: *To Produce White of 8500° K + 27 M.P.C.D. (I.C.I. Coordinates x = 0.287, y = 0.316):*	*Min.*	*Typical*	*Max.*	
Red cathode to green cathode	1	1.6	2	
Red cathode to blue cathode	1.5	2.7	4	
Maximum Raster Shift in Any Direction from Screen Center□		7/8		inch
Maximum Required Displacements of Beam Trios with Respect to Associated Phosphor-Dot Trios: Uniform in any direction over entire screen area			0.005"*	

♦ Connect high-voltage supply to this cap and also connect 50,000-ohm resistor between this cap and cap over pin 1 (Ultor cap).

Brilliance and definition decrease with decreasing ultor voltage. In general, the ultor voltage should not be less than 20,000 volts.

* If this displacement is accomplished by means of a purifying magnet located on the neck of the tube, the equivalent raster movement is about 3/4".

□: See next page.

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Localized around edge of screen—	
Tangential	0.002"
Radial	0.003"
Adjustment to be Provided by the Following Components:	
Lateral-Converging Magnet:⊕	
Maximum lateral shift of blue beam	±1/4"
Maximum lateral shift of red beam and green beam	±1/8" to ±3/8"
Average of maximum lateral shift of red beam and green beam	±7/32" to ±9/32"
Radial-Converging Magnet Assembly:⊕	
For static convergence including compensation for dc component of dynamic convergence (Each beam)	Shift of ±5/8"
For dynamic convergence†—	
Effected by magnetomotive force of parabolic and/or sawtooth waveshape synchronized with scanning.	
Horizontal:	
Blue pattern—	
Parabola amplitude to provide▲	Shift of 3/16" to 1/2"
Sawtooth amplitude to provide^{OO}	Shift of ±50% of the shift caused by parabola amplitude
Red pattern & green pattern—	
Parabola:	
Amplitude to provide▲	Shift of 1/16" to 5/16"
Ratio of red-pattern shift to green-pattern shift	2/3 to 3/2
Sawtooth:	
Amplitude to provide^{OO}	Shift of −60% to +60% of the shift caused by parabola amplitude
Difference between red-pattern shift and green-pattern shift ($Shift_R - Shift_G$)	−75% to +75%

□ Centering of the raster on the screen may be accomplished by passing direct current of the required value through each pair of deflecting coils to compensate for raster shift resulting from adjustments for optimum convergence and color purity.

⊕ Shift is the movement of the regions of dot/crosshatch-generator pattern indicated in notes (▲) and (^{OO}).

Ⓘ The direction of movement of the red and green beam is opposite to that of the blue beam.

† Indicated values apply when RCA test yoke is used with the 21CYP22.

▲, ^{OO}: See next page.

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RCA

21CYP22

COLOR PICTURE TUBE

Vertical:

Blue pattern--

Parabola amplitude to provide▲ . . . . . Shift of -1/8" to +1/16"

Sawtooth amplitude to provide○○ . . . . . Shift of -1/16" to +3/16"

Red pattern & green pattern--

Parabola:

Amplitude to provide▲ . . . . Shift of 1/8" to 5/16"

Ratio of red-pattern shift to green-pattern shift . . . . . 2/3 to 3/2

Sawtooth:

Amplitude to provide○○ . . Shift of -1/8" to +3/16"

Difference between red-pattern shift and green-pattern shift ($Shift_R - Shift_G$) . . . . . -100% to +100%

Examples of Use of Design Ranges:

For ultor voltage of	*20000*	*25000*	*volts*
Grid-No.3 (Focusing Electrode)-to-Cathode (Of each gun) Voltage. .	3360 to 4000	4200 to 5000	volts
Grid-No.2-to-Cathode Voltage (Each gun) when circuit design utilizes grid-No.1-to-cathode voltage of -70 volts for raster cutoff.	130 to 370	130 to 370	volts
Grid-No.1-to-Cathode Voltage (Each gun) for Visual Extinction of Focused Raster when circuit design utilizes grid-No.2-to-cathode voltage of 200 volts.	-45 to -100	-45 to -100	volts

Limiting Circuit Values:

High-Voltage Circuits:

In order to minimize the possibility of damage to the tube caused by a momentary internal arc, it is recommended that the *high-voltage power supply* and the *grid-No.3 power supply* be of the limited-energy type with inherent regulation to limit the continuous short-circuit current to 50

▲ The parabola amplitude is determined by the average value of the shifts at the extremities of the respective horizontal and vertical axes of the screen with convergence of the three beams maintained at the center of the screen. An increase in amplitude should move the blue beam toward the top of the screen; the red beam toward the lower left of the screen; and the green beam toward the lower right of the screen.

○○ The sawtooth amplitude is determined by the difference between the shifts at the extremities of the respective horizontal and vertical axes of the screen. Positive amplitude indicates that the shift at the right or bottom of the screen is greater than the shift at the left or top of the screen.

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COLOR PICTURE TUBE

milliamperes. In addition, to prevent cathode damage with resultant decrease in tube life, an external resistor having a value of 50,000 ohms must be connected between the two bulb terminals and the effective resistance between the grid-No.3 power-supply output capacitor and the grid-No.3 electrode should not be less than 50,000 ohms. These resistances should be capable of withstanding the maximum instantaneous currents and voltages in their respective circuits. It is to be noted that the high voltage must be connected only to the High-Voltage-Supply Terminal--*never directly to the Ultor Terminal*. A resistor of 50,000 ohms must be connected between the Ultor Terminal and the High-Voltage-Supply Terminal.

In equipment utilizing a well-regulated ultor power supply, the *grid-No.3-circuit resistance* should be limited to 7.5 megohms.

Low-Voltage Circuits:

Effective Grid-No.1-to-Cathode-Circuit Resistance (Each gun). . . . . 0.75 max. megohm

When the cathode of each gun is not connected directly to the heater, the grid-No.2-to-heater circuit, the grid-No.1-to-heater circuit, and the cathode-to-heater circuit should each have an impedance such that their respective power sources in combination will not supply an instantaneous or continuous short-circuit current of more than 300 milliamperes total. Such current limitation will prevent heater burnout in case of a momentary internal arc within the tube.

When the cathode is connected directly to the heater, the grid-No.2-to-heater circuit, and the grid-No.1-to-heater circuit should each have an impedance such that their respective power sources in combination will not supply an instantaneous or continuous short-circuit current of more than 300 milliamperes total. Such current limitation will prevent heater burnout in case of a momentary internal arc within the tube.

DEFINITIONS

Beam Trio. The red beam, green beam, and blue beam passing through a common hole in the shadow mask.

Register. Exact correspondence in position of the centers of beam trios with respect to the centers of the associated phosphor-dot trios.

Misregister. Lack of correspondence in position of the centers of the beam trios with respect to the centers of the center of the associated phosphor-dot trios.

Displacement. Shift of the position of the beams with respect to the phosphor dots.

GENERAL CONSIDERATIONS

X-Ray Warning. Because the 21CYP22 is designed to be operated at ultor voltages as high as 25 kilovolts (design-center maximum value), shielding of the 21CYP22 for X-ray radiation may be needed to protect against possible injury from prolonged exposure at close range.

21CYP22

COLOR PICTURE TUBE

Shatter-Proof Cover Over the Tube Face. Following conventional picture-tube practice, it is recommended that the cabinet be provided with a shatter-proof, glass cover over the face of the 21CYP22 to protect it from being struck accidentally and to protect against possible damage resulting from tube implosion under some abnormal condition. This safety cover can also provide X-ray protection when required.

High Voltages. The high voltages at which cathode-ray tubes are operated may be very dangerous. Great care should be taken in the design of apparatus to prevent the operator from coming in contact with the high voltages. Precautions include the enclosing of high-potential terminals and the use of interlocking switches to break the primary circuit of the power supply when access to the equipment is required.

REFERENCE-LINE AND NECK-FUNNEL-CONTOUR GAUGE for Type 21CYP22 is the same as that shown for Type 21AXP22-A

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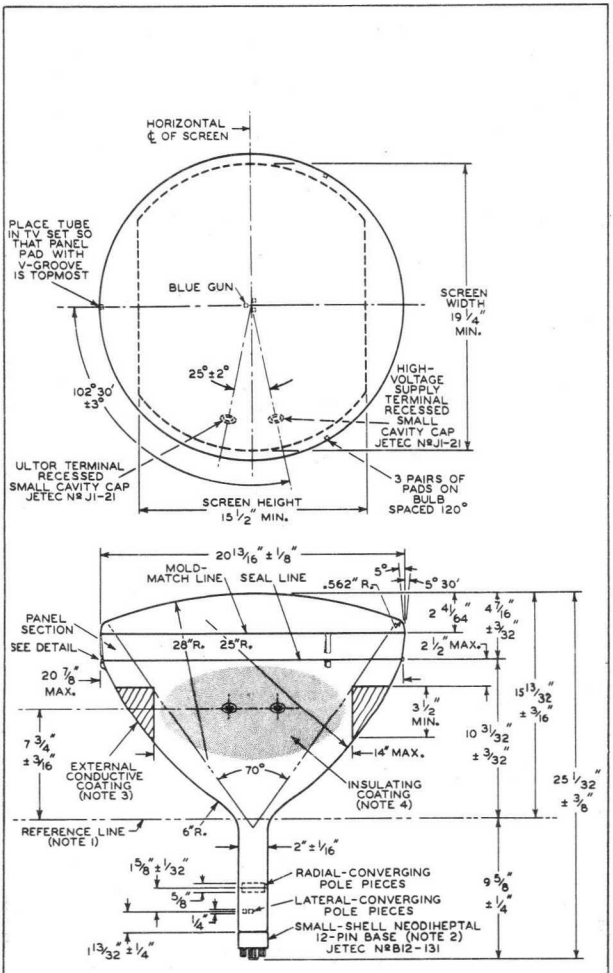
21CYP22

COLOR PICTURE TUBE



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ELECTRON TUBE DIVISION
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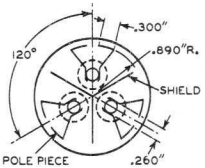
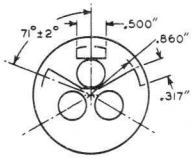
21CYP22

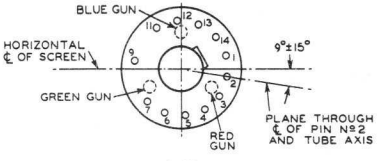
COLOR PICTURE TUBE



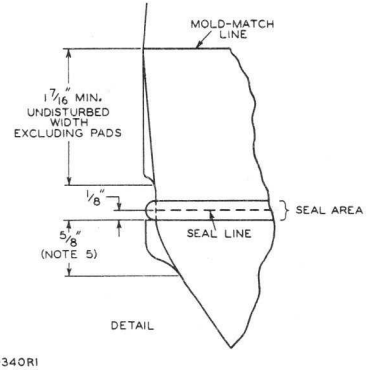
LOCATION OF RADIAL-CONVERGING POLE PIECES VIEWED FROM SCREEN END OF GUNS



LOCATION OF LATERAL-CONVERGING POLE PIECES WITH RESPECT TO GUNS



BASE
BOTTOM VIEW



DETAIL

92CL-9340R1

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21CYP22

COLOR PICTURE TUBE

NOTE 1: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE AND NECK-FUNNEL-CONTOUR GAUGE AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 2: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 3".

NOTE 3: THE DRAWING SHOWS THE MINIMUM SIZE AND LOCATION OF THE CONTACT BAND OF THE EXTERNAL CONDUCTIVE COATING. THE ACTUAL AREA OF THIS COATING WILL BE GREATER THAN THAT OF THE CONTACT BAND SO AS TO PROVIDE THE REQUIRED CAPACITANCE. EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

NOTE 4: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINT-LESS CLOTH.

NOTE 5: THE MAXIMUM EFFECTIVE WIDTH OF A FUNNEL PAD IS 5/8".

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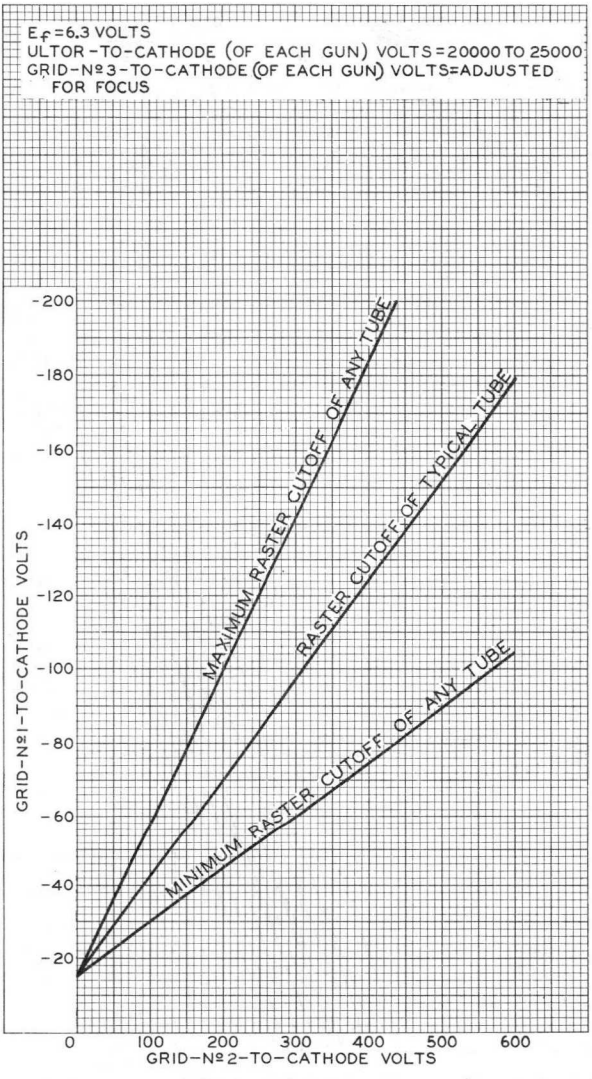
21CYP22

CUTOFF DESIGN CHART



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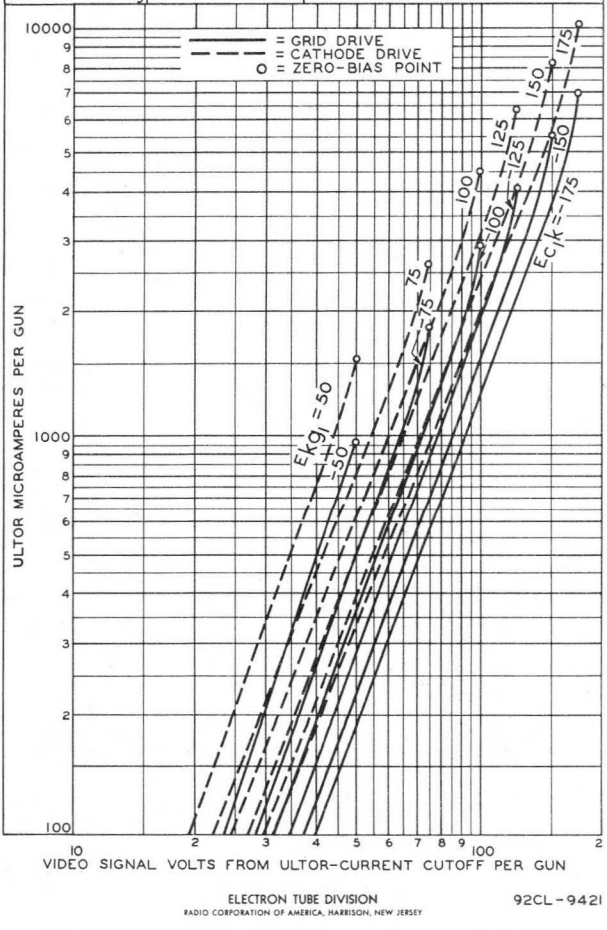
92CM-8565R1

RCA

21CYP22

TYPICAL DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE	GRID-DRIVE SERVICE
E_f = 6.3 VOLTS	E_f = 6.3 VOLTS
ULTOR-TO-GRID-№1 (OF EACH GUN) VOLTS = 20000 TO 25000	ULTOR-TO-CATHODE (OF EACH GUN) VOLTS = 20000 TO 25000
GRID-№3-TO-GRID-№1 (OF EACH GUN) VOLTS = ADJUSTED FOR FOCUS	GRID-№3-TO-CATHODE (OF EACH GUN) VOLTS = ADJUSTED FOR FOCUS
GRID-№2-TO-GRID-№1 VOLTS (EACH GUN) = ADJUSTED TO PROVIDE ULTOR-CURRENT CUT-OFF FOR DESIRED FIXED CATHODE-TO-GRID-№1 (EACH GUN) VOLTAGE (E_{kg_1})	GRID-№2-TO-CATHODE VOLTS (EACH GUN) = ADJUSTED TO PROVIDE ULTOR-CURRENT CUT-OFF FOR DESIRED FIXED GRID-№1-TO-CATHODE (EACH GUN) VOLTAGE (E_{c_1k}).



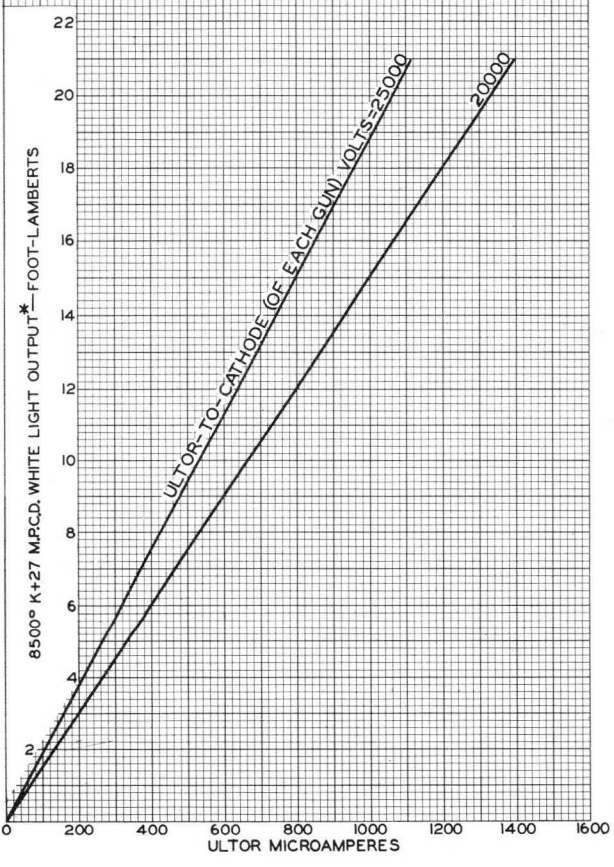
21CYP22

TYPICAL LIGHT-OUTPUT CHARACTERISTICS

E_f = 6.3 VOLTS
GRID-№ 3 - TO-CATHODE (OF EACH GUN) VOLTS = ADJUSTED FOR FOCUS
DRIVE OF EACH GUN IS ADJUSTED TO GIVE COMPOSITE ULTOR CURRENT TO PRODUCE 8500° K+27 M.P.C.D. WHITE LIGHT OUTPUT.
PERCENTAGE OF TOTAL ULTOR CURRENT SUPPLIED BY EACH GUN TO PRODUCE 8500° K+27 M.P.C.D. WHITE:

RED GUN:	50 %
BLUE GUN:	19 %
GREEN GUN:	31 %

RASTER SIZE: 19¼" x 14½" CENTERED ON TUBE FACE.
*MEASURED WITHIN 5"-DIAMETER AREA CENTERED ON TUBE FACE.



21DEP4

PICTURE TUBE

RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — MAGNETIC DEFLECTION

With heater having controlled warm-up time

The 21DEP4 is the same as the 21DEP4-A except that it has a maximum ultor-voltage rating of 18,000 volts.

Half-Wave Vacuum Rectifier

For TV Damper Service in Equipment Having Series Heater-String Arrangement

The 22DE4 is the same as the 6DE4 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	22.4	volts
Current	0.45 ± 6%	amp
Warm-up time (Average)	11	sec

23GJP4A

Picture Tube

PAN-O-PLY TYPE
110° MAGNETIC DEFLECTION

LOW-VOLTAGE ELECTROSTATIC FOCUS
CATHODE-DRIVE TYPE

ELECTRICAL

Direct Interelectrode Capacitances		
Cathode to all other electrodes	5	pF
Grid No.1 to all other electrodes	6	pF
External conductive coating to anode	1700 min—2500 max	pF
Heater Current at 6.3 V	450 ± 20	mA
Heater Warm-Up Time (Average)	11	s
Electron Gun	Type Requiring No Ion-Trap Magnet	

OPTICAL

Phosphor . . . . . P4—Sulfide Type, Aluminized
For curves, see front of this section

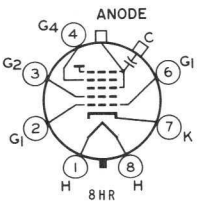
Faceplate . . . . . Filterglass
Light transmission at center (approx.) 42%

MECHANICAL

Weight (Approx.) . . . . . 28 lb
Overall Length . . . . . 14.250 ± .281 in
Neck Length . . . . . 4.500 ± .125 in
Projected Area of Screen . . . . . 282 sq in
External Conductive Coating[a]
Type . . . . . Regular-Band
Contact area for grounding . . . . . Near Reference Line
For Additional Information on Coatings Dimensions
See *Picture-Tube Dimensional-Outlines* and *Bulb J187K* sheets at front of this section
Cap . . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base . . . . . Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)

TERMINAL DIAGRAM (Bottom View)

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Grid No.2
Pin 4 – Grid No.4
Pin 6 – Grid No.1
Pin 7 – Cathode
Pin 8 – Heater
Cap – Anode (Grid No.3, Grid No.5, Screen, Collector)
C – External Conductive Coating



MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Voltages are positive with respect to grid No.1

Anode Voltage	11000 min—23000 max	V
Grid-No.4 Voltage		
Positive value	1250 max	V
Negative value	400 max	V
Grid-No.2 Voltage	40 min—70 max	V
Cathode Voltage		
Negative peak value	2 max	V
Negative bias value	0 max	V
Positive bias value	100 max	V
Positive peak value	150 max	V
Heater Voltage	5.7 min—6.9 max	V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode:		
During equipment warm-up period ≤ 15 s	450 max	V
After equipment warm-up period	300 max	V
Heater positive with respect to cathode		
Combined AC & DC voltage	200 max	V
DC component	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Voltages are positive with respect to grid No.1

Anode Voltage	18000	
Grid-No.4 Voltage	0 to 400	V
Grid-No.2 Voltage	50	V
Cathode Voltage	34 to 52	V
For visual extinction of focused raster		

MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance	1.5 max	MΩ

[a] Includes implosion protection hardware.

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this section

Picture Tube

RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — MAGNETIC DEFLECTION
LOW GRID-No.2 VOLTAGE — CATHODE-DRIVE TYPE

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Heater Current at 6.3 volts	600 ± 30	ma
Heater Warm-Up Time (Average)	11	seconds
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes	6	μμf
Cathode to all other electrodes	5	μμf
External conductive coating to ultor	2500 max. 1700 min.	μμf μμf
Focusing Method	Electrostatic	
Deflection Method	Magnetic	
Deflection Angles (Approx.):		
Diagonal	114°	
Horizontal	102°	
Vertical	84°	
Electron Gun	Type Requiring No Ion-Trap Magnet	

Optical:

Faceplate	Filterglass
Light transmission at center (Approx.)	78%
Phosphor (For curves, see front of this Section)	P4—Sulfide Type Aluminized
Fluorescence	White
Phosphorescence	White
Persistence	Medium Short

Mechanical:

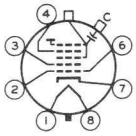
Tube Dimensions:			
Overall length	14-3/8" ± 5/16"		
Greatest width	20-1/2" + 1/16" − 1/8"		
Greatest height	16-1/2" ± 1/8"		
Diagonal	23-25/64" + 3/32" − 1/8"		
Neck length	5-1/8" ± 1/8"		
Curvature of faceplate (Radii):	*Center*	*Intermediate*	*Edge*
External surface	50"	—	36-3/4"
Internal surface	30"	48"	24"
Screen Dimensions (Minimum):			
Greatest width	19-1/4"		
Greatest height	15-1/8"		
Diagonal	22-5/16"		
Projected area	282 sq. in.		
Weight (Approx.)	24 lbs		
Operating Position	Any		
Cap	Recessed Small Cavity (JEDEC No.J1-21)		
Bulb	J187 (114°)		

23NP4

Base. . . . . Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)

Basing Designation for BOTTOM VIEW. 8HR

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Grid No.2
Pin 4 – Grid No.4
Pin 6 – Grid No.1
Pin 7 – Cathode
Pin 8 – Heater



Cap – Ultor (Grid No.3, Grid No.5, Collector)
C – External Conductive Coating

CATHODE-DRIVE▲ SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No.1

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

ULTOR-TO-GRID-No.1 VOLTAGE.	22000 max.	volts
	11000 min.	volts
GRID-No.4-TO-GRID-No.1 (FOCUSING) VOLTAGE:		
Positive value.	1250 max.	volts
Negative value.	400 max.	volts
GRID-No.2-TO-GRID-No.1 VOLTAGE.	70 max.	volts
	40 min.	volts
CATHODE-TO-GRID-No.1 VOLTAGE:		
Positive-peak value	220 max.	volts
Positive-bias value	154 max.	volts
Negative-bias value	0 max.	volts
Negative-peak value	2 max.	volts
HEATER VOLTAGE.	6.9 max.	volts
	5.7 min.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds.	450 max.	volts
After equipment warm-up period. . . .	200 max.	volts
Heater positive with respect to cathode .	200 max.	volts

Equipment Design Ranges:

With any ultor-to-grid-No.1 voltage ($E_{c_{5g_1}}$) between 11000 and 22000 volts and grid-No.2-to-grid-No.1 voltage ($E_{c_{2g_1}}$) between 44 and 70 volts

Grid-No.4-to-Grid-No.1 Voltage for focus●.	0 to 400	volts
Cathode-to-Grid-No.1 Voltage (Ek_{g_1}) for visual extinction of focused raster	*See Raster-Cutoff-Range Chart for Cathode-Drive Service*	
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black level): White-level value (Peak negative)	Same value as determined for Ek_{g_1} except video drive is a negative value	

Grid-No.4 Current	-25 to +25	μa
Grid-No.2 Current	-15 to +15	μa
Field Strength of Adjustable Centering Magnet★. . . .	0 to 8	gauss

Examples of Use of Design Ranges:

With ultor-to-grid-No.1 voltage of	*18000*	*volts*
and grid-No.2-to-grid-No.1 voltage of	*50*	*volts*
Grid-No.4-to-Grid-No.1 Voltage for focus●.	0 to 400	volts
Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster. . . .	34 to 49	volts
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black level): White-level value	-34 to -49	volts

Maximum Circuit Values:

Grid-No.1 Circuit Resistance.	1.5 max.	megohms

▲ Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid No.1 and the other electrodes.

● Individual tubes will have satisfactory focus at some value of grid-No.4-to-grid-No.1 voltage between 0 and 400 volts with the combined bias voltage and video-signal voltage adjusted to give an ultor current of 200 microamperes.

★ Distance from *Reference Line* for suitable PM centering magnet should not exceed 2-1/4". Excluding extraneous fields, the center of the undeflected focused spot will fall within a circle having a 7/16-inch radius concentric with the center of the tube face. It is to be noted that the earth's magnetic field can cause as much as 1/2-inch deflection of the spot from the center of the tube face.

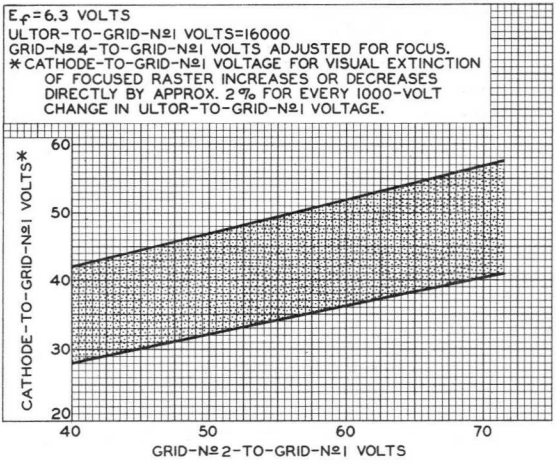
OPERATING CONSIDERATIONS

X-Ray Warning. When operated at ultor voltages up to 16 kilovolts, this picture tube does not produce any harmful X-ray radiation. However, because the rating of this type permits operation at voltages as high as 22 kilovolts (Design-maximum value), shielding of this picture tube for X-ray radiation may be needed to protect against possible injury from prolonged exposure at close range whenever the operating conditions involve voltage in excess of 16 kilovolts.

Shatter-Proof Cover Over the Tube Face. Following conventional picture-tube practice, it is recommended that the cabinet be provided with a shatter-proof, glass cover over the face of this picture tube to protect it from being struck accidentally and to protect it against possible damage resulting from tube implosion under some abnormal condition. This safety cover can also provide X-ray protection when required.

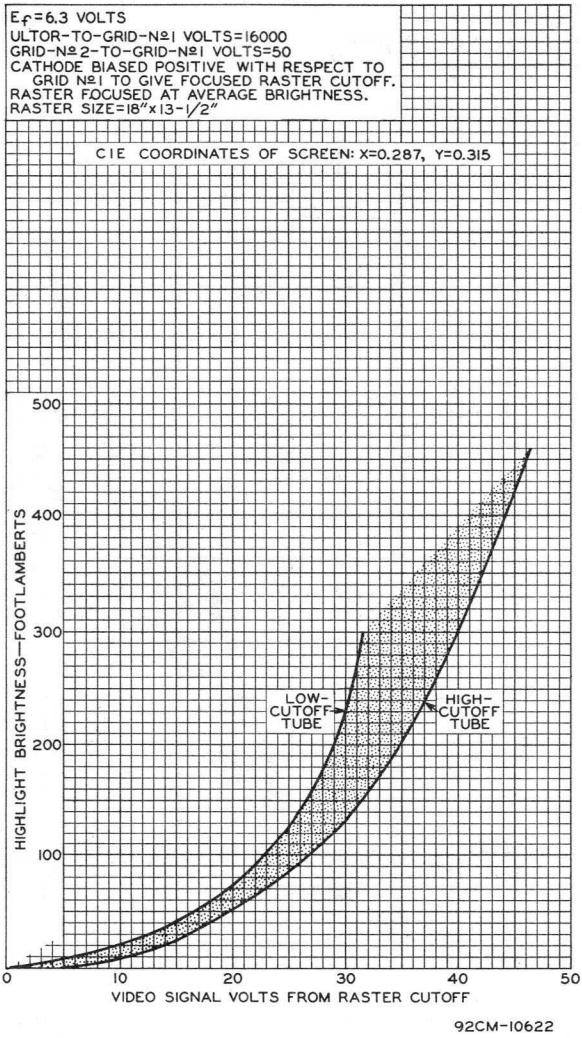
DIMENSIONAL OUTLINE and BULB-CONTOUR DIMENSIONS shown under Type 23MP4 also apply to the 23NP4

RASTER-CUTOFF-RANGE CHART
Cathode-Drive Service



92CS-10623

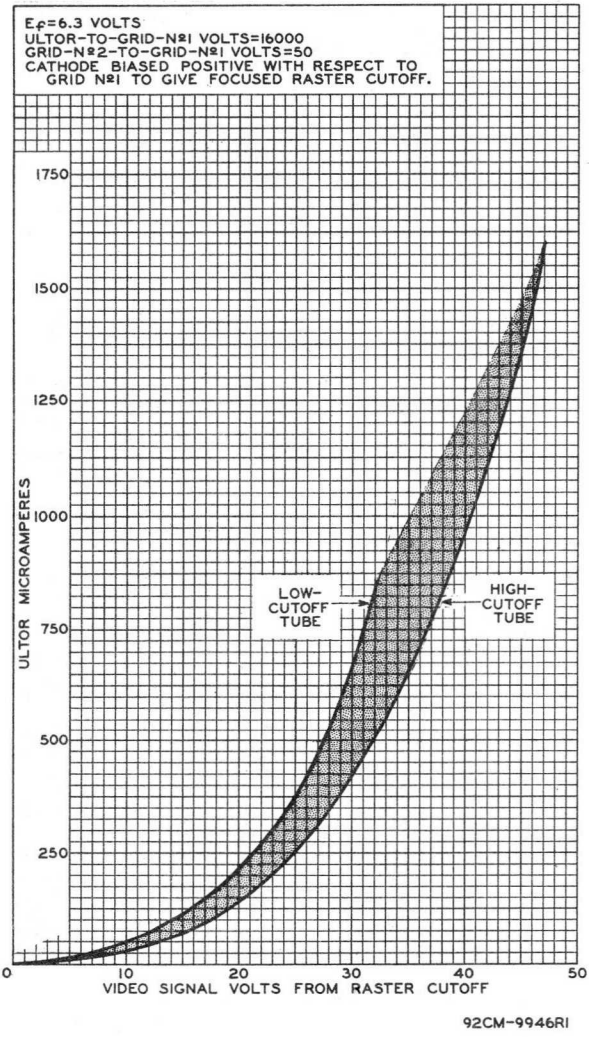
CATHODE-DRIVE CHARACTERISTICS



92CM-10622

23NP4

CATHODE-DRIVE CHARACTERISTICS



92CM-9946RI

25CD6-GA
BEAM POWER TUBE

Intended for use in equipment having series heater-string arrangement

The 25CD6-GA is the same as the 6CD6-G except for the following items:

Heater, for Unipotential Cathode:

Voltage	25	ac or dc volts
Current	0.6	amp
Warm-up time (Average)	11	sec

For definition of heater warm-up time and method of determining it, see sheet HEATER WARM-UP TIME MEASUREMENT at front of this Section.

PEAK HEATER-CATHODE VOLTAGE:

Heater negative with respect to cathode	200 max.	volts
Heater positive with respect to cathode	200▲max.	volts

▲ The dc component must not exceed 100 volts.

32ET5

POWER PENTODE

7-PIN MINIATURE TYPE

GENERAL DATA

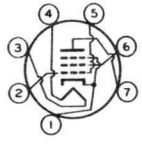
Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	32 ± 10%	volts
Current	0.1	amp
Direct Interelectrode Capacitances (Approx.):		
Grid No.1 to plate	0.6	μμf
Grid No.1 to cathode & grid No.3, grid No.2, and heater	12	μμf
Plate to cathode & grid No.3, grid No.2, and heater	6	μμf

Mechanical:

Operating 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"
Diameter	0.650" to 0.750"
Dimensional Outline	*See General Section*
Bulb	T5-1/2
Base	Small-Button Miniature 7-Pin (JEDEC No.E7-1)
Basing Designation for BOTTOM VIEW	7CV

Pin 1 - Cathode, Grid No.3
Pin 2 - Grid No.1
Pin 3 - Heater



Pin 4 - Heater
Pin 5 - Grid No.1
Pin 6 - Grid No.2
Pin 7 - Plate

AMPLIFIER — Class A_1

Maximum Ratings, *Design-Maximum Values:*

PLATE VOLTAGE	150	max.	volts
GRID-No.2 (SCREEN-GRID) VOLTAGE	130	max.	volts
GRID-No.2 INPUT	1.2	max.	watts
PLATE DISSIPATION	5.4	max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	200	max.	volts
Heater positive with respect to cathode	200▲	max.	volts

Typical Operation and Characteristics:

Plate Voltage	110	volts
Grid-No.2 Voltage	110	volts
Grid-No.1 Voltage	-7.5	volts
Peak AF Grid-No.1 Voltage	7.5	volts
Zero-Signal Plate Current	30	ma
Zero-Signal Grid-No.2 Current	2.8	ma
Plate Resistance (Approx.)	21500	ohms
Transconductance	5500	μmhos
Load Resistance	2800	ohms

32ET5

POWER PENTODE

Total Harmonic Distortion	10		%
Max.-Signal Power Output	1.2		watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance:			
For fixed-bias operation	0.1	max.	megohm
For cathode-bias operation	0.5	max.	megohm

o Without external shield.

▲ The dc component must not exceed 100 volts.

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MEDIUM-MU TRIODE

GENERAL DATA

Electrical:

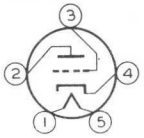
Heater, for Unipotential Cathode:		
Voltage	6.3	ac or dc volts
Current	0.3	amp
Direct Interelectrode Capacitances:[o]		
Grid to Plate	2.8	μμf
Grid to Cathode	3.5	μμf
Plate to Cathode	2.5	μμf

[o] With no external shield.

Mechanical:

Mounting Position	Any
Maximum Overall Length	4-3/16"
Seated Length	3-3/8" ± 3/16"
Maximum Diameter	1-9/16"
Bulb	ST-12
Base	Small-Shell Small 5-Pin
Basing Designation for BOTTOM VIEW	5A

Pin 1 – Heater
Pin 2 – Plate
Pin 3 – Grid



Pin 4 – Cathode
Pin 5 – Heater

AMPLIFIER – Class A_1

Maximum Ratings, *Design-Center Values*:

PLATE VOLTAGE	250 max.	volts
PLATE DISSIPATION	1.4 max.	watts ←
PEAK HEATER-CATHODE VOLTAGE:		←
Heater negative with respect to cathode	90 max.	volts
Heater positive with respect to cathode	90 max.	volts

Typical Operation and Characteristics:

Plate Voltage	100	250	volts
Grid Voltage	-5	-13.5	volts
Amplification Factor	13.8	13.8	
Plate Resistance	12000	9500	ohms
Transconductance	1150	1450	μmhos
Plate Current	2.5	5	ma

Maximum Circuit Values:

Grid-Circuit Resistance	1 max. megohm

← Indicates a change.

76
MEDIUM-MU TRIODE

DETECTOR

Maximum Ratings, *Design-Center Values*:

PLATE VOLTAGE		250 max.	volts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode.		90 max.	volts
Heater positive with respect to cathode.		90 max.	volts

Typical Operation as Biased Detector:

Plate Voltage	100	250	volts
Grid Voltage (Approx.)	-8	-20	volts
Plate Current	Adjust to 0.2 ma. with no input signal		
Cathode-Bias Resistor▲	30000 to 150000	30000 to 150000	ohms

Typical Operation as Grid-Resistor Detector:

Plate Voltage	45	volts
Grid	Return to cathode	
Grid Resistor	1 to 5	megohms
Grid Capacitor	250	μμf

▲ Not critical.

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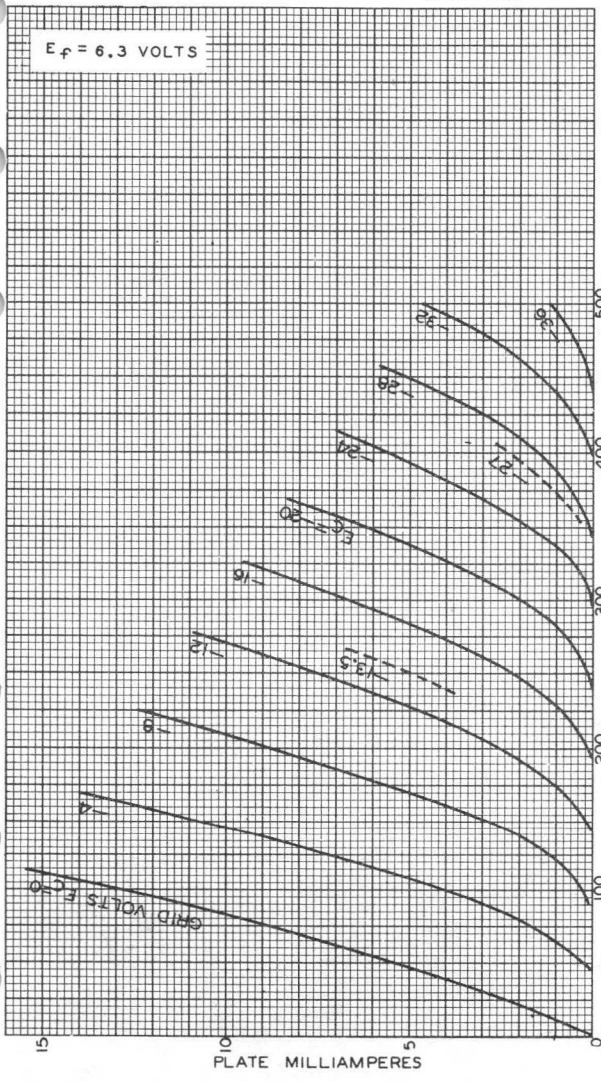
AVERAGE PLATE CHARACTERISTICS



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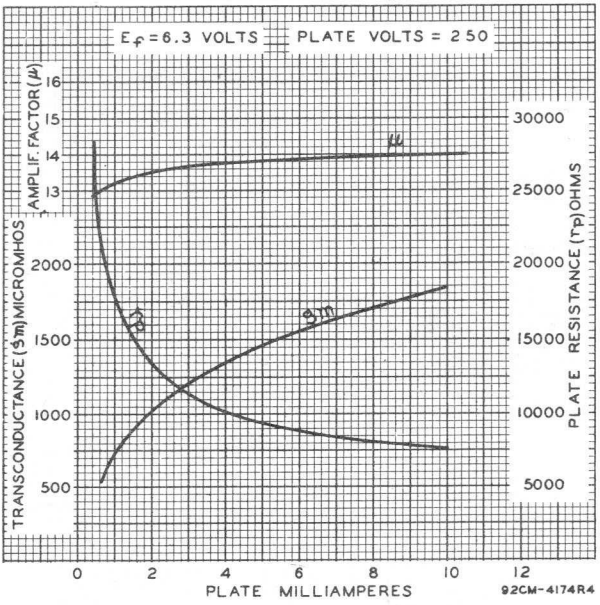
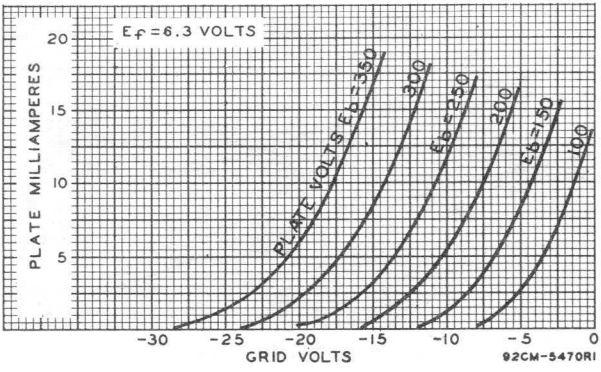
AVERAGE CHARACTERISTICS



AVERAGE CHARACTERISTICS



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TWIN DIODE—MEDIUM-MU TRIODE

GENERAL DATA

Electrical:

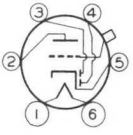
Heater, for Unipotential Cathode:		
Voltage	6.3	ac or dc volts
Current	0.3	amp
Direct Interelectrode Capacitances – Triode Unit:*		
Grid to Plate	1.5	μμf
Grid to Cathode	1.5	μμf
Plate to Cathode	4.3	μμf

* With no external shield.

Mechanical:

Mounting Position	Any
Maximum Overall Length	4-17/32"
Seated Length	3-25/32" ± 1/8"
Maximum Diameter	1-9/16"
Bulb	ST-12
Cap	Small
Base	Small-Shell Small 6-Pin
Basing Designation for BOTTOM VIEW	6G

Pin 1 – Heater
Pin 2 – Triode Plate
Pin 3 – Diode No.2 Plate



Pin 4 – Diode No.1 Plate
Pin 5 – Cathode
Pin 6 – Heater
Cap – Triode Grid

TRIODE UNIT
AMPLIFIER – Class A_1

Maximum Ratings, *Design-Center Values*:

PLATE VOLTAGE	250 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	90 max.	volts
Heater positive with respect to cathode	90 max.	volts

Typical Operation and Characteristics:

Plate Voltage	135	180	250	volts
Grid Voltage	-10.5	-13.5	-20	volts
Amplification Factor	8.3	8.3	8.3	
Plate Resistance	11000	8500	7500	ohms
Transconductance	750	975	1100	μmhos
Plate Current	3.7	6.0	8.0	ma
Load Resistance	25000	20000	20000	ohms
Power Output	75	160	350	mw

← Indicates a change.

(continued on next page)

85
TWIN DIODE—MEDIUM-MU TRIODE

DIODE UNITS – Two

Consideration of these units, including typical circuits and diode curves, is given at the front of this Section. Diode biasing of the triode unit of the 85 may be used only when at least 20000 ohms resistance is in the triode plate circuit.

For additional data, see RESISTANCE-COUPLED AMPLIFIER CHARTS at the front of this Section.

RCA

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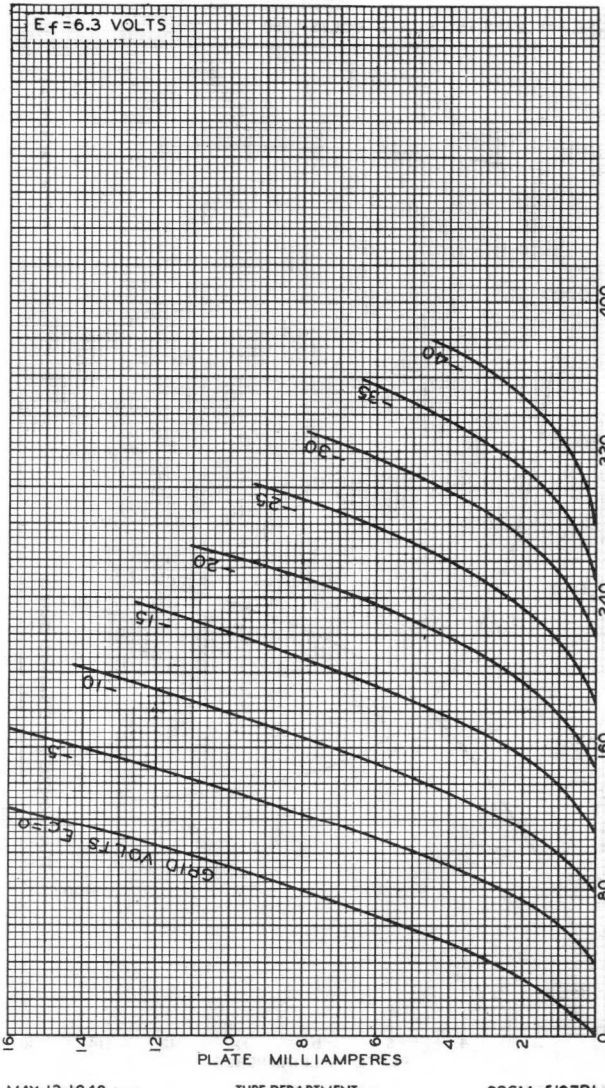
AVERAGE PLATE CHARACTERISTICS

TRIODE UNIT



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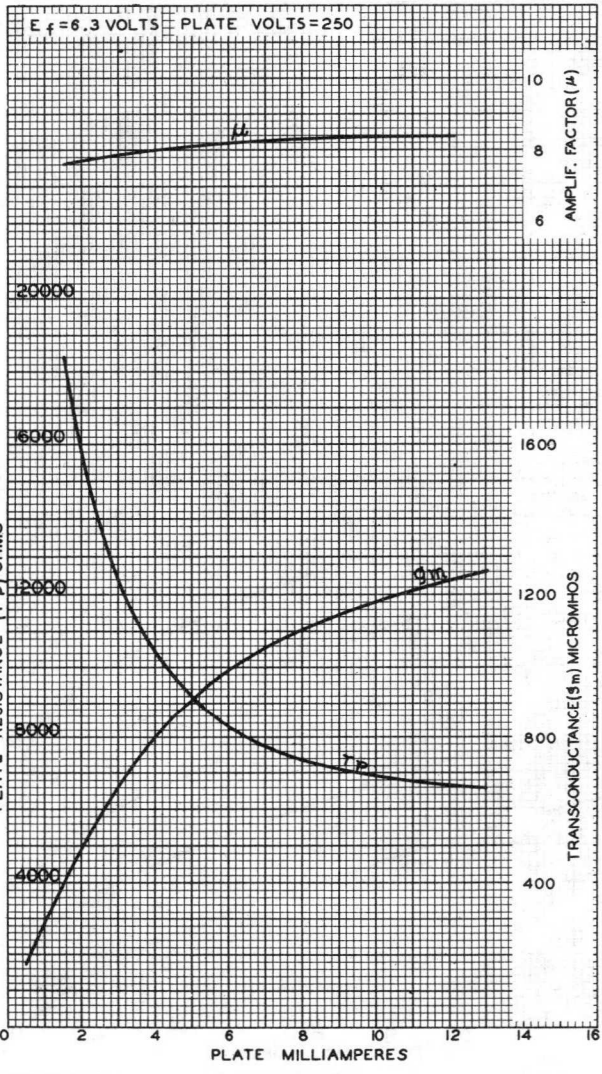
AVERAGE CHARACTERISTICS

TRIODE UNIT



MAY 14, 1948

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-4746RI

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THYRATRON

METAL MERCURY-VAPOR TETRODE

Electrical:

DATA

	Continuous Service		Welder-Control Service		
Heater, for Unipotential Cathode:					
Voltage*.	5.0	5.0	5.0	5.5	volts
Current	10.0	10.0	10.0	11.0	amp
Direct Interelectrode Capacitance (Approx.):					
Grid No.1 to Anode	0.07	0.07	0.07	0.07	μμf
Peak Voltage Drop . .	16	16	16	16	volts
Approx. Control Characteristics:					
Anode Voltage . . .	100	2000	100	2000	volts
Grid-No.1 Voltage .	+1.0	-14	+1.0	-14	volts
Grid-No.2 Voltage .	0	0	0	0	volts
Ionization Time(Approx.)	10	10	10	10	μsec
Deionization Time (Approx.)	1000	1000	1000	1000	μsec

Mechanical:

Mounting Position	Vertical, Radiator Down
Overall Rigid Length.	10-11/16" ± 1/16"
Greatest Radius	2-5/8"
Terminals	See Outline Drawing

Maximum Ratings, Absolute Values:

	Continuous Service	Welder-Control Service	
PEAK FORWARD ANODE VOLT. .	2000 max.	750 max.	volts
PEAK INVERSE ANODE VOLT. .	2000 max.	750 max.	volts
GRID-No.1 (CONT. GRID) VOLT.:			
Before Conduction	-1000 max.	-1000 max.	volts
During Conduction	-10 max.	-10 max.	volts
GRID-No.2 (SHL'D GRID) VOLT.:			
Before Conduction	-300 max.	-300 max.	volts
During Conduction	-5.0 max.	-5.0 max.	volts
INSTANTANEOUS ANODE CUR.:			
Below 25 Cycles	13.0 max.	13.0 max.	amp
25 Cycles and Higher. . .	40 max.	77 max.	amp
AVERAGE ANODE CURRENT** . .	6.4 max.	2.5 max.	amp
SURGE ANODE CURRENT for 0.1 sec. max.	400 max.	400 max.	amp
INSTANTANEOUS GRID-No.1 CUR.	1.0 max.	1.0 max.	amp
AVERAGE GRID-No.1 Cur.** .	0.25 max.	0.25 max.	amp
INSTANTANEOUS GRID-No.2 CUR.	2.0 max.	2.0 max.	amp
AVERAGE GRID-No.2 CUR.**. .	0.5 max.	0.5 max.	amp
COND.-MERCURY TEMP. RANGE▲	40 - 80	30 - 95	°C

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

** Averaged over any 15-second interval.

▲ Recommended condensed-mercury temperature 40°C.

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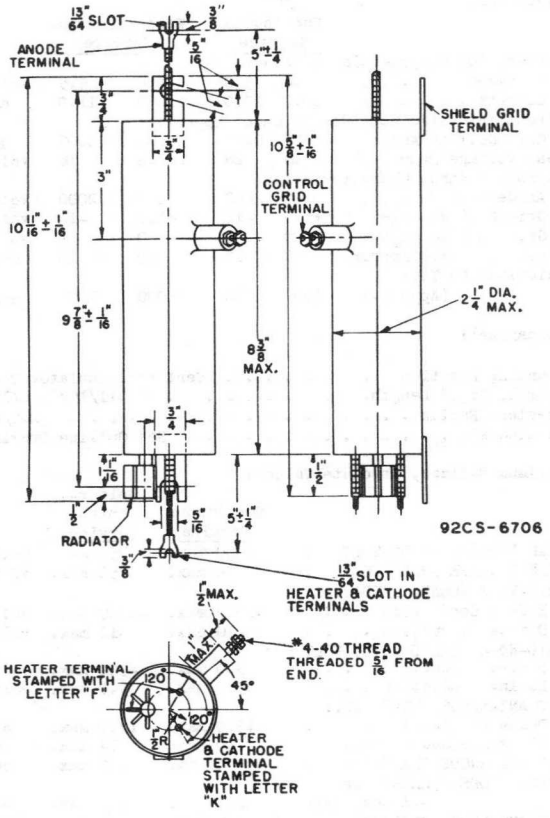
THYRATRON



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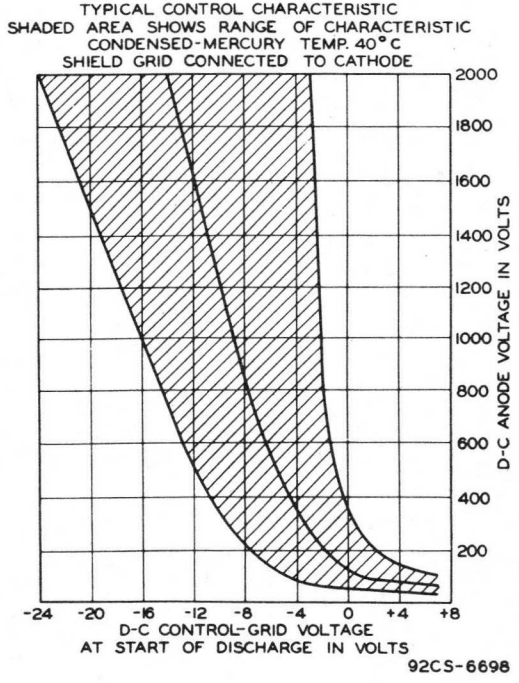
THYRATRON



207
POWER TRIODE
WATER COOLED

GENERAL DATA

Electrical:

Filament, Tungsten:

Voltage	22	ac or dc volts
Current	52	amp
Starting Current: The filament current must never exceed 100 amperes, even momentarily.		
Cold Resistance	0.03	ohm

NOTE: This tube can often be operated with reduced filament voltage as explained on sheet TYPES OF CATHODES in the General Section. ←

Amplification Factor . . . 20

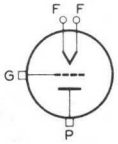
Direct Interelectrode Capacitances (Approx.):

Grid to Plate	27	μμf
Grid to Filament	18	μμf
Plate to Filament	2	μμf

Mechanical: ←

Terminal Connections:

F – Filament
G – Grid
Terminal



P – Water-Cooled Plate Terminal

Mounting Position	Vertical, Filament End Up	
Maximum Overall Length	20-1/4"	
Maximum Radius	6-1/2"	
Water Flow	3 to 8	gpm

The water flow must start before the application of any voltages and must continue for 2 minutes after the removal of all voltages.

Outlet Water Temperature	70 max.	°C
Water Pressure in Jacket	80 max.	psi

Components:

Water Jacket	RCA MI-7415
Gasket	RCA MI-7440

AF POWER AMPLIFIER & MODULATOR – Class B

Maximum CCS® Ratings, *Absolute Values*:

DC PLATE VOLTAGE	15000 max.	volts
MAX.-SIGNAL DC PLATE CURRENT*	2 max.	amp
MAX.-SIGNAL PLATE INPUT*	20 max.	kw
PLATE DISSIPATION*	7.5 max.	kw

Typical Operation:

Values are for 2 tubes

DC Plate Voltage	6000	10000	12500	volts
DC Grid Voltage†	-210	-410	-575	volts
Peak AF Grid-to-Grid Voltage	1520	2140	2300	volts
Zero-Signal DC Plate Current	0.5	0.5	0.4	amp
Max.-Signal DC Plate Current	2.5	3.2	2.8	amp

●,*,†: See next page.

← Indicates a change.

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POWER TRIODE

Effective Load Resistance (Plate-to-plate) . . .	4200	6400	10000	ohms
Max.-Signal Driving Power (Approx.) . . .	190	380	400	watts
Max.-Signal Power Output (Approx.) . . .	8	20	22.5	kw

* Averaged over any audio-frequency cycle of sine-wave form.

RF POWER AMPLIFIER – Class B Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

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

DC PLATE VOLTAGE	15000 max.	volts
DC PLATE CURRENT	1 max.	amp
PLATE INPUT.	15 max.	kw
PLATE DISSIPATION.	10 max.	kw

Typical Operation:

DC Plate Voltage	6000	10000	14000	volts
DC Grid Voltage†	−225	−440	−650	volts
Peak RF Grid Voltage	400	600	730	volts
DC Plate Current	0.62	0.93	1	amp
Driving Power (Approx.)▲ . . .	72	16	0	watts
Power Output (Approx.)	1	2.5	4	kw

PLATE-MODULATED RF POWER AMPLIFIER – Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

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

DC PLATE VOLTAGE	10000 max.	volts
DC GRID VOLTAGE.	−3000 max.	volts
DC PLATE CURRENT	1 max.	amp
DC GRID CURRENT.	0.2 max.	amp
PLATE INPUT.	10 max.	kw
PLATE DISSIPATION.	6.6 max.	kw

Typical Operation:

DC Plate Voltage	6000	8000	10000	volts
DC Grid Voltage●,#	−1200	−1600	−2000	volts
Peak RF Grid Voltage	1860	2300	2660	volts
DC Plate Current	0.76	0.78	0.75	amp
DC Grid Current (Approx.). . .	0.15	0.14	0.07	amp
Driving Power (Approx.). . . .	280	325	185	watts
Power Output (Approx.)	3.5	5	6	kw

† For dc filament supply.
▲ At crest of audio-frequency cycle with modulation factor of 1.0.
● Obtained by grid resistor or by partial self-bias methods.

●,#: See next page.

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POWER TRIODE

RF POWER AMPLIFIER & OSCILLATOR – Class C Telegraphy

Key-down conditions per tube without modulation[□□]

Maximum CCS[●] Ratings, *Absolute Values*:

DC PLATE VOLTAGE	15000 max.	volts
DC GRID VOLTAGE	−3000 max.	volts
DC PLATE CURRENT	2 max.	amp
DC GRID CURRENT	0.2 max.	amp
PLATE INPUT	30 max.	kw
PLATE DISSIPATION	10 max.	kw

Typical Operation:

DC Plate Voltage	8000	10000	12000	volts
DC Grid Voltage[▲▲#]	−1000	−1200	−1600	volts
Peak RF Grid Voltage	1730	2050	2650	volts
DC Plate Current	1.10	1.33	1.67	amp
DC Grid Current (Approx.)	0.17	0.12	0.09	amp
Driving Power (Approx.)	295	245	235	watts
Power Output (Approx.)	6.5	10	15	kw

● Continuous Commercial Service.

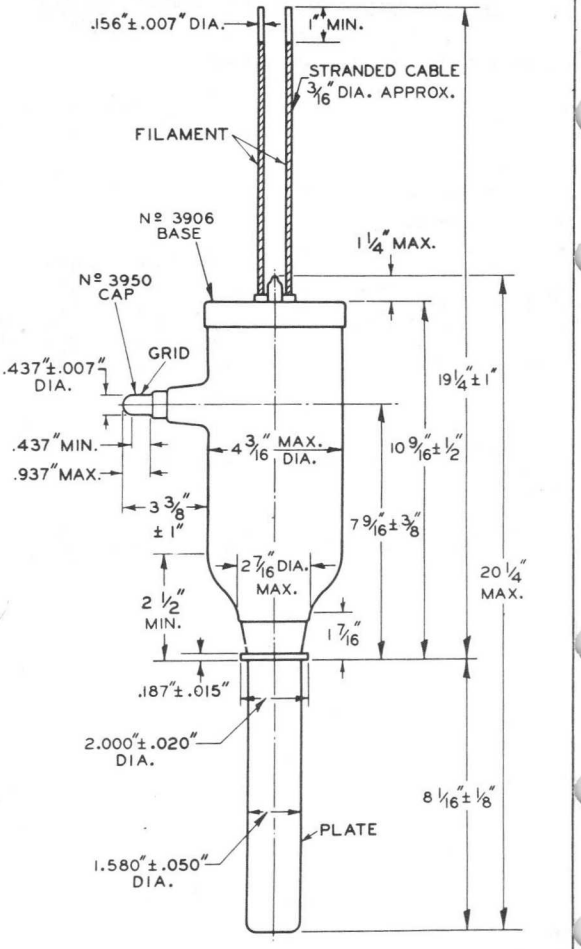
\# For ac filament supply.

□□ Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

▲▲ Obtained from fixed supply, by grid resistor, or by cathode resistor.

Data on operating frequencies for the 207 are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY.

207
POWER TRIODE



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POWER TRIODE

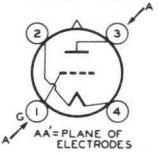
GENERAL DATA

Electrical:

Filament, Thoriated-Tungsten:			
Voltage	10		ac or dc volts
Current	3.25		amp
Amplification Factor	12		
Direct Interelectrode Capacitances:			
Grid to Plate	14		μμf
Grid to Filament	5.4		μμf
Plate to Filament	4.8		μμf

Mechanical:

Mounting Position	Vertical, base down; or Horizontal, with pins 1 and 3 in vertical plane
Maximum Overall Length	7-7/8"
Maximum Diameter	2-5/16"
Bulb	T-18
Base	Medium-Metal-Shell Jumbo 4-Pin, Bayonet
Basing Designation for BOTTOM VIEW	4AZ



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

AF POWER AMPLIFIER & MODULATOR—Class A_1

Maximum CCS• Ratings, *Absolute Values*:

DC PLATE VOLTAGE	1250 max.	volts
PLATE DISSIPATION	75 max.	watts

Typical Operation and Characteristics:

DC Plate Voltage	750	1000	1250	volts
DC Grid Voltage#	-46	-61	-80	volts
Peak AF Grid Voltage	41	56	75	volts
DC Plate Current	34	53	60	ma
Plate Resistance	4400	3800	3600	ohms
Transconductance	2750	3150	3300	μmhos
Load Resistance	8800	7600	9200	ohms
2nd Harmonic Distortion	5	5	5	%
Power Output	5.6	12	19.7	watts

AF POWER AMPLIFIER & MODULATOR—Class B

Maximum CCS• Ratings, *Absolute Values*:

DC PLATE VOLTAGE	1250 max.	volts

•,#: See next page. ←-Indicates a change.

RCA

211

POWER TRIODE

MAX.-SIGNAL DC PLATE CURRENT*	175 max.	ma
MAX.-SIGNAL PLATE INPUT*	220 max.	watts
PLATE DISSIPATION*	100 max.	watts

Typical Operation:

Values are for 2 tubes

DC Plate Voltage	1000	1250	volts
DC Grid Voltage#	-77	-100	volts
Peak AF Grid-to-Grid Voltage	380	410	volts
Zero-Signal DC Plate Current	20	20	ma
Max.-Signal DC Plate Current	320	320	ma
Effective Load Resistance (plate-to-plate)	6900	9000	ohms
Max.-Signal Driving Power (Approx.)	7.5	8	watts
Max.-Signal Power Output (Approx.)	200	260	watts

RF POWER AMPLIFIER—Class B Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum CCS® Ratings, *Absolute Values:*

DC PLATE VOLTAGE	1250 max.	volts
DC PLATE CURRENT	150 max.	ma
PLATE INPUT	150 max.	watts
PLATE DISSIPATION	100 max.	watts

Typical Operation:

DC Plate Voltage	1000	1250	volts
DC Grid Voltage#	-77	-100	volts
Peak RF Grid Voltage	125	125	volts
DC Plate Current	130	106	ma
DC Grid Current (Approx.)□	5	1	ma
Driving Power (Approx.)▲ □	10	7.5	watts
Power Output (Approx.)	40	42.5	watts

PLATE-MODULATED RF POWER AMPLIFIER—Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum CCS® Ratings, *Absolute Values:*

DC PLATE VOLTAGE	1000 max.	volts
DC GRID VOLTAGE	-400 max.	volts
DC PLATE CURRENT	175 max.	ma
DC GRID CURRENT	50 max.	ma
PLATE INPUT	175 max.	watts

* Averaged over any audio-frequency cycle of sine-wave form.

For ac filament supply.

▲ At crest of audio-frequency cycle with modulation factor of 1.0.

●,□: See next page.

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

211

POWER TRIODE

PLATE DISSIPATION		67 max.	watts

Typical Operation:

DC Plate Voltage	750	1000	volts
DC Grid Voltage	−200	−260	volts
Peak RF Grid Voltage	350	410	volts
DC Plate Current	150	150	ma
DC Grid Current (Approx.)□	35	35	ma
Driving Power (Approx.)□	12	14	watts
Power Output (Approx.)	65	100	watts

RF POWER AMPLIFIER & OSCILLATOR—Class C Telegraphy

Key-down conditions per tube without modulation□□

Maximum CCS• Ratings, *Absolute Values*:

DC PLATE VOLTAGE	1250 max.	volts
DC GRID VOLTAGE	−400 max.	volts
DC PLATE CURRENT	175 max.	ma
DC GRID CURRENT	50 max.	ma
PLATE INPUT	220 max.	watts
PLATE DISSIPATION	100 max.	watts

Typical Operation:

DC Plate Voltage	750	1000	1250	volts
DC Grid Voltage	−135	−175	−225	volts
Peak RF Grid Voltage	275	315	375	volts
DC Plate Current	150	150	150	ma
DC Grid Current (Approx.)□	18	18	18	ma
Driving Power (Approx.)□	5	6	7	watts
Power Output (Approx.)	65	100	130	watts

• Continuous Commercial service.

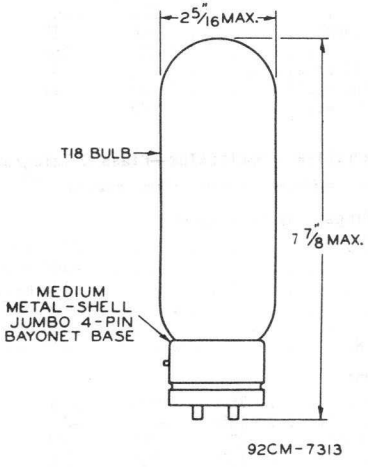
□ For effect of load resistance on grid current and driving power, refer to TUBE RATINGS—*Grid Current and Driving Power* in General Section.

□□ Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

Data on operating frequencies for the 211 are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY.

211

POWER TRIODE



TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

217-C

HALF-WAVE VACUUM RECTIFIER

NOT RECOMMENDED FOR NEW EQUIPMENT DESIGN

GENERAL DATA

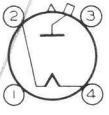
Electrical:

Filament, Thoriated Tungsten:		
Voltage	10.0	ac volts
Current	3.25	amp

Mechanical:

Mounting Position	Vertical only, base down
Overall Length	8-1/4" ± 1/4"
Seated Length	7-15/16" ± 1/4"
Maximum Diameter	2-5/16"
Bulb	T-18
Cap	Medium
Base	Medium-Metal-Shell Jumbo 4-Pin, Bayonet
Basing Designation for BOTTOM VIEW	2C

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



Pin 4 – Filament

Cap – Plate

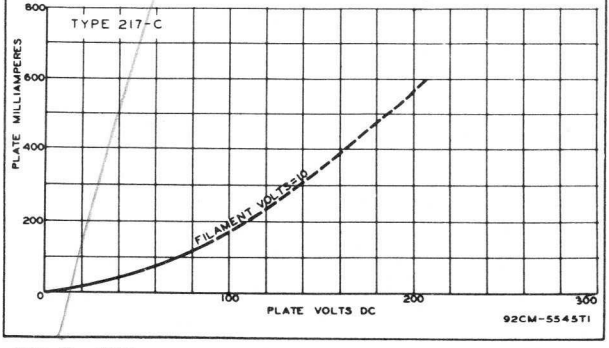
HALF-WAVE RECTIFIER

Maximum Ratings, *Absolute Values*:

PEAK INVERSE PLATE VOLTAGE	7500 max.	volts
PEAK PLATE CURRENT	0.6 max.	amp
AVERAGE PLATE CURRENT	0.15 max.	amp

OUTLINE DIMENSIONS for the 217-C are the same as those for Type 805.

AVERAGE PLATE CHARACTERISTIC



502-A
GAS THYRATRON

NEGATIVE-CONTROL TETRODE TYPE WITH METAL SHELL

GENERAL DATA

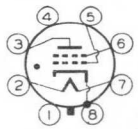
Electrical:

	Min.	Av.	Max.	
Heater, for Unipotential Cathode:				
Voltage	5.7	6.3	7	ac or dc volts
Current at 6.3 volts	–	0.6	0.66	amp
Cathode:				
Minimum heating time prior to tube conduction			10	sec
Direct Interelectrode Capacitances:				
Grid No.1 to anode			0.2	μμf
Grid No.1 to cathode & shell, grid No.2, and heater			2.5	μμf
Ionization Time (Approx.)			0.5	μsec
Deionization Time (Approx.):				
For conditions: dc anode ma = 100, grid-No.1-circuit resistor (ohms) = 1000, and dc grid-No.1 supply volts = -250			10	μsec
For conditions: dc anode ma = 100, grid-No.1-circuit resistor (ohms) = 1000, and dc grid-No.1 supply volts = -15			150	μsec
Maximum Critical Grid-No.1 Current:				
For conditions: anode volts (rms) = 460, and dc grid-No.1 volts adjusted to cutoff			2	μamp
Anode Voltage Drop			8	volts

Mechanical:

Mounting Position	Any
Maximum Overall Length	2-5/8"
Seated Length	1-31/32" ± 3/32"
Maximum Diameter	1-5/16"
Weight (Approx.)	2 oz
Bulb	Metal Shell MT8G
Base	Small-Wafer Octal 8-Pin (JETEC No.B8-21)

BOTTOM VIEW



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, Shell

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

← Indicates a change.

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502-A
GAS THYRATRON

GRID-No.2 (SHIELD-GRID) VOLTAGE:			
Peak, before tube conduction	-100 max.	-100 max.	volts
Average■, during tube conduction	-5 max.	-5 max.	volts
GRID-No.1 (CONTROL-GRID) VOLTAGE:			
Peak, before tube conduction	-250 max.	-250 max.	volts
Average■, during tube conduction	-10 max.	-10 max.	volts
CATHODE CURRENT:			
Peak	1.0 max.	1.0 max.	amp
Average●	0.2 max.	0.1 max.	amp
Fault, for duration of 0.1 second 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	-55 to +90	-55 to +90	°C

■ Averaged over 1 cycle.
● Averaged over any interval of 30 seconds maximum.

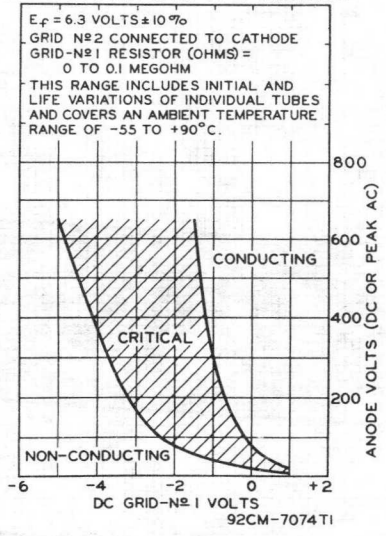
For Dimensional Outline, see GENERAL SECTION

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

502-A

GAS THYRATRON

OPERATIONAL RANGE
OF CRITICAL GRID-№1 VOLTAGE



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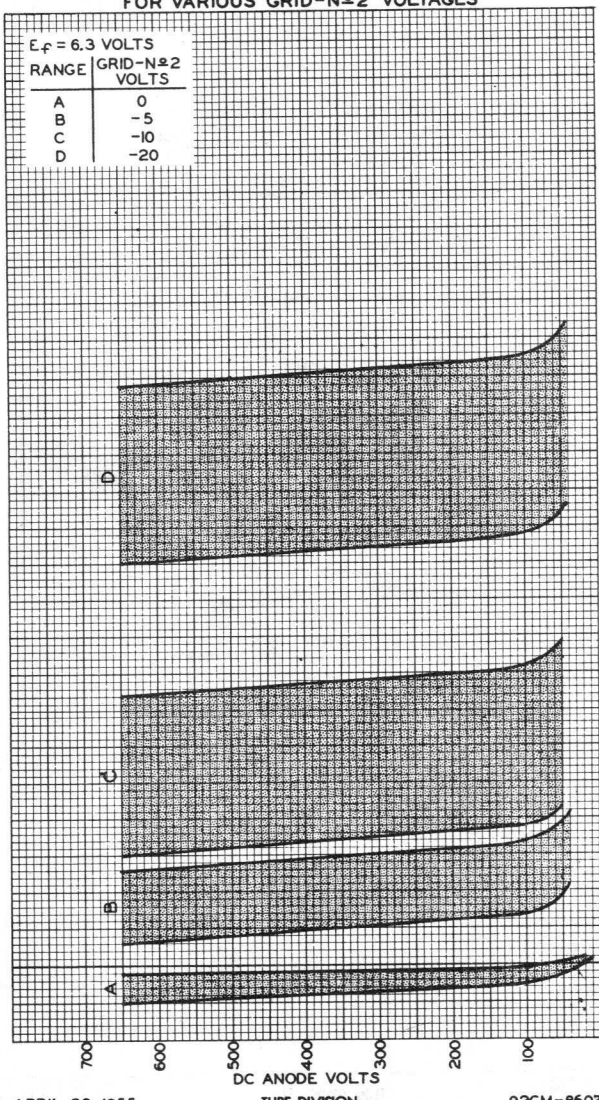
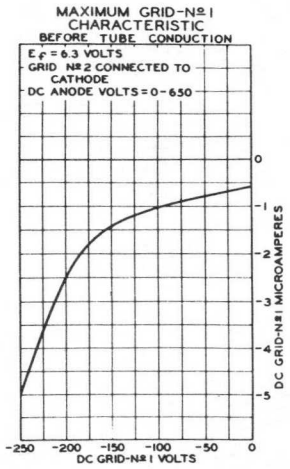
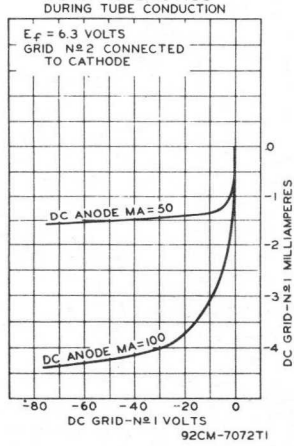
502-A
OPERATIONAL RANGES OF CRITICAL GRID-№1 VOLTAGE FOR VARIOUS GRID-№2 VOLTAGES



502-A

CHARACTERISTIC CURVES





579-B

HALF-WAVE HIGH-VACUUM RECTIFIER

DATA

Electrical:

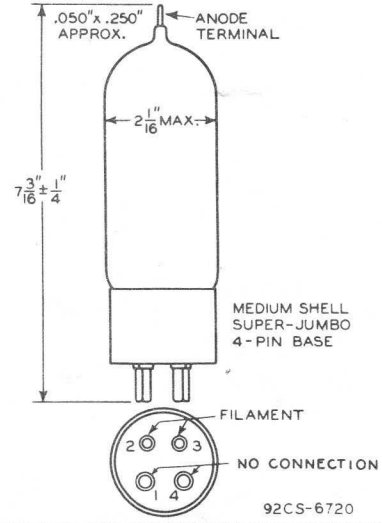
Filament, Thoriated Tungsten:		
Voltage	2.5 ± 5%	volts
Current	6	amp

Mechanical:

Mounting Position	Vertical
Overall Length	7-3/16" ± 1/4"
Maximum Diameter	2-1/16"
Bulb	T-16
Bulb Terminal	See Outline Drawing
Base	Medium Shell Super-Jumbo 4-Pin

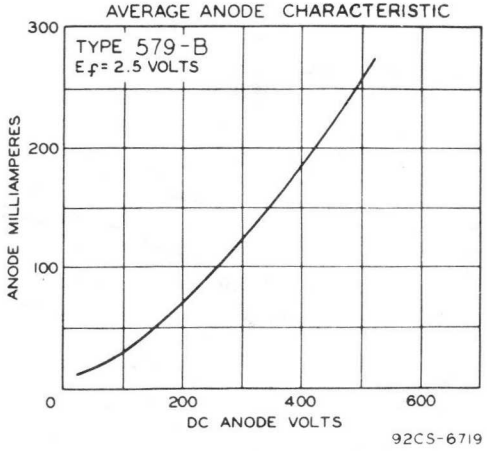
Maximum Ratings, Absolute Values:

PEAK INVERSE ANODE VOLTAGE	20000 max.	volts
PEAK ANODE CURRENT	270 max.	ma.
AVERAGE ANODE CURRENT	25 max.	ma.
AMBIENT AIR TEMPERATURE	50 max.	°C
BULB TEMPERATURE	75 max.	°C



579-B

HALF-WAVE HIGH-VACUUM RECTIFIER



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629

THYRATRON

GAS TRIODE

DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage*	2.5	volts
Current	2.6	amp
Direct Interelectrode Capacitances (Approx.):		
Grid to Anode	3.3	μμf
Grid to Cathode	3.3	μμf
Anode to Cathode	1.8	μμf
Peak Voltage Drop	15	volts
Control Characteristic	Negative	
Ionization Time (Approx.)	10	μseconds
Deionization Time (Approx.)	1000	μseconds

Mechanical:

Mounting Position	Any
Maximum Overall Length	4-1/4"
Maximum Seated Length	3-5/8"
Maximum Diameter	1-9/16"
Bulb	ST-12
Base	Small 5-Pin

Maximum Ratings, Absolute Values:

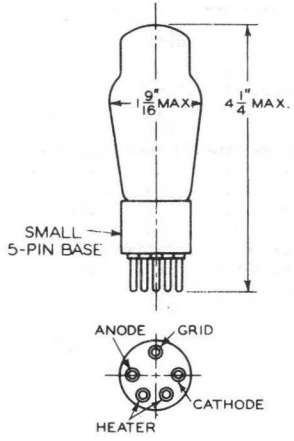
PEAK FORWARD ANODE VOLTAGE	350 max.	volts
PEAK INVERSE ANODE VOLTAGE	350 max.	volts
PEAK GRID VOLTAGE	-90 max.	volts
PEAK ANODE CURRENT	0.2 max.	amp
AVERAGE ANODE CURRENT**	0.04 max.	amp
SURGE ANODE CURRENT for 0.1 sec. max.	2.0 max.	amp
GRID CURRENT, Before Conduction	2.5 max.	μamp
PEAK GRID CURRENT	20 max.	ma.
AVERAGE GRID CURRENT**	0.4 max.	ma.
DC HEATER-CATHODE POTENTIAL RANGE	-45 to +5	volts
AMBIENT TEMPERATURE RANGE	-40 to +70	°C

* Heater voltage must be applied at least 30 seconds before start of tube conduction.

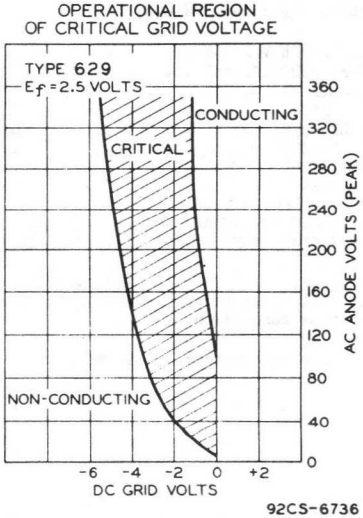
** Averaged over any 10-second interval.

629

THYRATRON



92CS-6737



92CS-6736

MAY 1, 1946

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

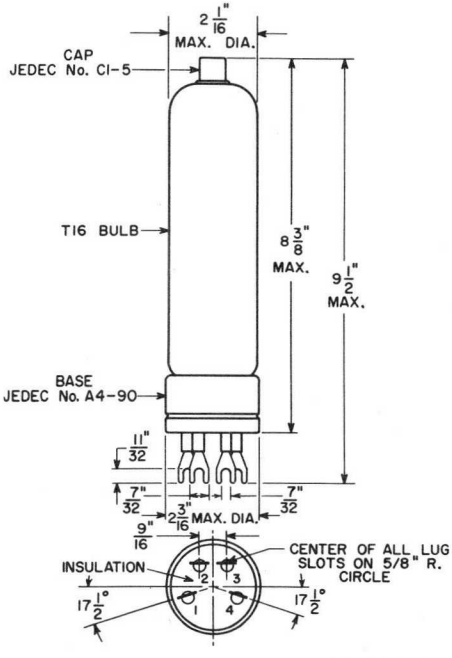
CE-6737-6736

Half-Wave Gas and Mercury-Vapor Rectifier

The 635L/7020 is the same as the 635/7019 except for the following items:

Mechanical:

Maximum Seated Length . . . . . 8-3/8"
Base. . . . . .Special Metal Shell (JEDEC No.A4-90)



92CS-11668

800

TRANSMITTING TRIODE

Filament	Thoriated Tungsten	
Voltage	7.5	a-c or d-c volts
Current	3.1	amp. ←
Amplification Factor	15	
Direct Interelectrode Capacitances:		
Grid to Plate	2.5	μμf
Grid to Filament	2.8	μμf
Plate to Filament	2.8	μμf
Overall Length		6-5/32" ± 7/32" ←
Seated Height		5-17/32" ± 7/32" ←
Maximum Diameter		2-11/16"
Bulb		S-21
Caps (two)		Small
Base		Medium 4-Pin, Bayonet
RCA Socket		Stock No. 9937 ←

Maximum Ratings Are Absolute Values

MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS

A-F POWER AMPLIFIER & MODULATOR - Class B

D-C Plate Voltage			1250 max.	volts
Max.-Signal D-C Plate Current*			115 max.	ma.
Max.-Signal Plate Input*			85 max.	watts
Plate Dissipation*			35 max.	watts
Typical Operation:				
Unless otherwise specified, values are for 2 tubes.				
D-C Plate Voltage	750	1000	1250	volts
D-C Grid Voltage**	-40	-55	-70	volts
Peak A-F Grid-to-Grid Volt.	320	300	300	volts
Zero-Signal D-C Plate Cur.	26	28	30	ma.
Max.-Signal D-C Plate Cur.	210	160	130	ma.
Load Resistance (per tube)	1600	3125	5250	ohms
Effective Load Resistance (plate to plate)	6400	12500	21000	ohms
Max.-Signal Driving Power	6.0	4.4	3.4	approx. watts
Max.-Signal Power Output	90	100	106	approx. watts

R-F POWER AMPLIFIER - Class B Telephony

Carrier conditions per tube for use with a max. modulation fact. of 1.0

D-C Plate Voltage			1250 max.	volts
D-C Plate Current			45 max.	ma.
Plate Input			50 max.	watts
Plate Dissipation			35 max.	watts
Typical Operation:				
D-C Plate Voltage	750	1000		volts
D-C Grid Voltage**	-40	-55		volts
Peak R-F Grid Voltage	160	170		volts
D-C Plate Current	45	42		ma.
D-C Grid Current †	2	2	approx.	ma.
Driving Power °†	3.6	3.3	approx.	watts
Power Output	10	14	approx.	watts

*, **, †, °: See next page. ← Indicates a change.

800

TRANSMITTING TRIODE

(continued from preceding page)

PLATE-MODULATED R-F POWER AMPLIFIER - Class C Telephony

Carrier conditions per tube for use with a max. modulation fact. of 1.0

D-C Plate Voltage			1000 max.	volts
D-C Grid Voltage			-400 max.	volts
D-C Plate Current			80 max.	ma.
D-C Grid Current			25 max.	ma.
Plate Input			80 max.	watts
Plate Dissipation			23 max.	watts
Typical Operation:				
D-C Plate Voltage	750	1000		volts
D-C Grid Voltage ††	-150	-200		volts
	10000	13300		ohms
Peak R-F Grid Voltage	275	325		volts
D-C Plate Current	70	70		ma.
D-C Grid Current †	15	15	approx.	ma.
Driving Power †	3	4	approx.	watts
Power Output	35	50	approx.	watts

R-F POWER AMPLIFIER & OSCILLATOR - Class C Telegraphy

*Key-down conditions per tube without modulation****

D-C Plate Voltage			1250 max.	volts
D-C Grid Voltage			-400 max.	volts
D-C Plate Current			80 max.	ma.
D-C Grid Current			25 max.	ma.
Plate Input			100 max.	watts
Plate Dissipation			35 max.	watts
Typical Operation:				
D-C Plate Voltage	750	1000	1250	volts
D-C Grid Voltage †††	-100	-135	-175	volts
	6700	9000	11700	ohms
	1200	1600	2100	ohms
Peak R-F Grid Voltage	225	260	300	volts
D-C Plate Current	70	70	70	ma.
D-C Grid Current †	15	15	15 approx.	ma.
Driving Power †	2	3	4 approx.	watts
Power Output	35	50	65 approx.	watts

* Averaged over any audio-frequency cycle of sine-wave form.

** For a-c filament supply.

*** Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

o At crest of a-f cycle with modulation factor of 1.0.

† Subject to wide variations as explained on sheet TUBE RATINGS in General Section.

†† Obtained from grid resistor of value shown or by combination methods.

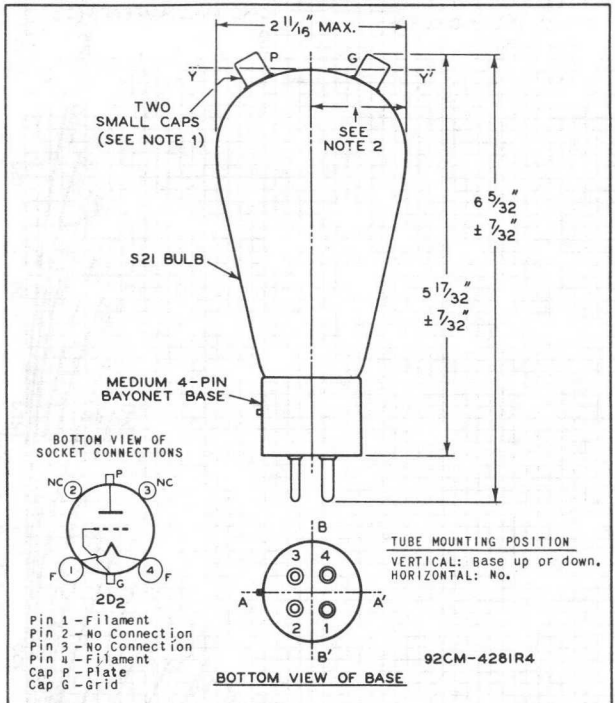
††† Obtained from a fixed supply, by grid resistor (6700, 9000, 11700) or by cathode resistor (1200, 1600, 2100).

Data on operating frequencies for the 800 are given on the sheet TRANS. TUBE RATINGS vs. FREQUENCY.

←Indicates a change.

800

TRANSMITTING TRIODE



AS USED BELOW, PLANES AA', BB', AND YY' HAVE THE FOLLOWING DEFINITIONS:

1. PLANE AA' IS PLANE THROUGH AXIS OF BASE AND POINT MIDWAY BETWEEN PINS NO.1 AND NO.4.
2. PLANE BB' IS PLANE THROUGH AXIS OF BASE AND PERPENDICULAR TO PLANE AA'.
3. PLANE YY' IS TANGENT TO TOP OF BULB AND PERPENDICULAR TO AXIS OF BASE.

NOTE 1 -- WITH ALL MEASUREMENTS MADE PARALLEL TO THE PLANE YY' AND AT OR ABOVE THE PLANE, THE TOP CAPS ARE POSITIONED SO THAT:

a. NO PORTION OF CONTACT SURFACE EXTENDS MORE THAN 1-11/32" FROM THE PLANE BB'.

b. NO PORTION OF CONTACT SURFACE IS NEARER THAN 1/2" TO THE PLANE BB'.

c. NO PORTION OF CONTACT SURFACE EXTENDS MORE THAN 1/2" FROM THE PLANE AA'.

NOTE 2 -- WHEN TUBE IS ROTATED ABOUT AXIS OF ITS BASE, THE MAXIMUM RADIAL DISTANCE BETWEEN ANY POINT ON THE BULB AND THE ROTATIONAL AXIS DOES NOT EXCEED 1-7/16".

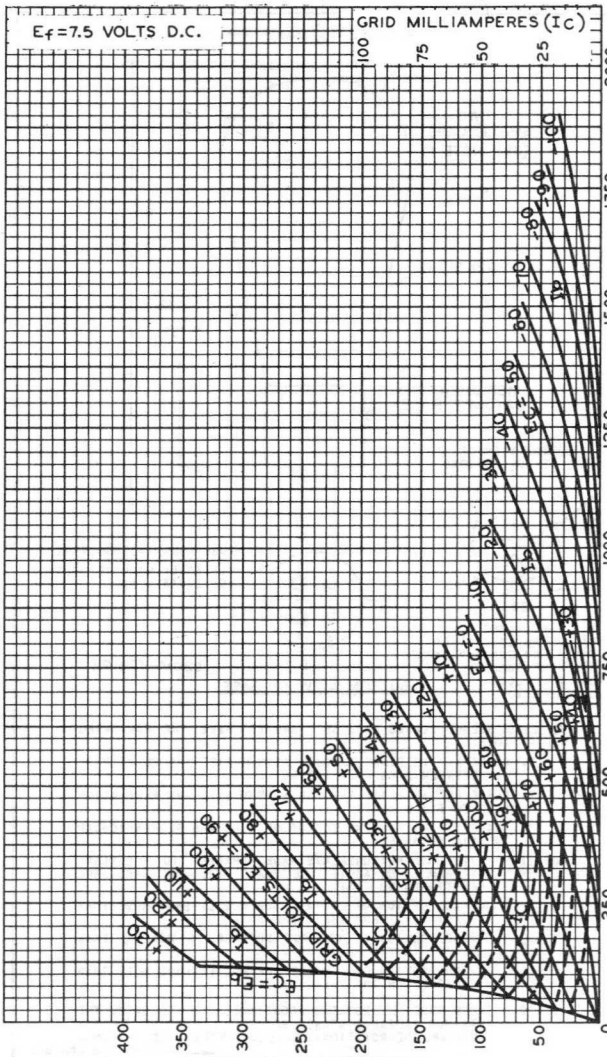
← Indicates a change.

800

RCA

800

AVERAGE PLATE CHARACTERISTICS



SEPT. 11, 1933

RCA VICTOR DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-5368

801-A/801
R-F POWER AMPLIFIER, A-F POWER AMPLIFIER, MODULATOR

Filament	Thoriated tungsten	
Voltage	7.5	a-c or d-c volts
Current	1.25	amp.
Amplification Factor	8	
Direct Interelectrode Capacitances:		
Grid to Plate	6.0	μμf
Grid to Filament	4.5	μμf
Filament to Plate	1.5	μμf
Maximum Overall Length		5-3/8"
Maximum Diameter		2-1/16"
Bulb		ST-16
Base	Medium 4-Pin "MICANOL", Bayonet	←
RCA Socket	Type UR-542-A	

MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS

A-F POWER AMPLIFIER & MODULATOR - Class A$_1$

D-C Plate Voltage			600 max.	volts
Plate Dissipation			20 max.	watts
Typical Operation:				
D-C Plate Voltage	425	500	600	volts
D-C Grid Voltage □△	-40	-45	-55	volts
Peak A-F Grid Voltage	35	40	50	volts
D-C Plate Current	18	24	30	ma.
Plate Resistance	5000	4600	4300	ohms
Transconductance	1600	1725	1840	μmhos
Load Resistance	10200	8000	7800	ohms
U.P.O. (5% second harmonic)	1.6	2.3	3.8	watts

□ The d-c resistance in the grid circuit should not exceed 0.5 megohm with cathode bias, or 0.1 megohm with fixed bias.

A-F POWER AMPLIFIER & MODULATOR - Class B

D-C Plate Voltage			600 max.	volts
Max.-Signal D-C Plate Current*			70 max.	ma.
Max.-Signal Plate Input*			42 max.	watts
Plate Dissipation*			20 max.	watts
Typical Operation:				
Unless otherwise specified, values are for 2 tubes				
D-C Plate Voltage	400	500	600	volts
D-C Grid Voltage △	-50	-60	-75	volts
Peak A-F Grid-to-Grid Voltage	270	290	320	volts
Zero-Signal D-C Plate Cur.	8	8	8	ma.
Max.-Signal D-C Plate Cur.	130	130	130	ma.
Load Resistance (per tube)	1500	2000	2500	ohms
Effective Load Resistance (plate to plate)	6000	8000	10000	ohms
Max.-Signal Driving Power	3	3	3	approx.watts
Max.-Signal Power Output	27	36	45	approx.watts

* Averaged over any audio-frequency cycle of sine-wave form.
△ With a-c filament supply.

←Indicates a change.

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RCA MANUFACTURING COMPANY, INC.

801-A
R-F POWER AMPLIFIER.
A-F POWER AMPLIFIER, MODULATOR

(continued from preceding page)

R-F POWER AMPLIFIER – Class B Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

D-C Plate Voltage		600 max.	volts
D-C Plate Current		50 max.	ma.
Plate Input		30 max.	watts
Plate Dissipation		20 max.	watts
Typical Operation:			
D-C Plate Voltage	500	600	volts
D-C Grid Voltage △	-60	-75	volts
Peak R-F Grid Voltage	85	90	volts
D-C Plate Current	45	45	ma.
D-C Grid Current**	0.2	0.2	approx.ma.
Driving Power** ○	2.2	2.3	approx.watts
Power Output	6	7.5	approx.watts

○ At crest of a-f cycle with modulation factor of 1.0

PLATE-MODULATED R-F POWER AMPLIFIER – Class C Telephony

Carrier conditions per tube for use with a max. modulation fact. of 1.0

D-C Plate Voltage		500 max.	volts
D-C Grid Voltage		-200 max.	volts
D-C Plate Current		60 max.	ma.
D-C Grid Current		15 max.	ma.
Plate Input		30 max.	watts
Plate Dissipation		13.5 max.	watts
Typical Operation:			
D-C Plate Voltage	400	500	volts
D-C Grid Voltage ▲△	-150	-190	volts
	10000	12700	ohms
Peak R-F Grid Voltage	260	300	volts
D-C Plate Current	55	55	ma.
D-C Grid Current**	15	15	approx.ma.
Driving Power**	4	4.5	approx.watts
Power Output	14	18	approx.watts

▲ obtained by grid resistor of value shown, or by combination of grid resistor with either fixed supply or suitably by-passed cathode resistor.

R-F POWER AMPLIFIER & OSCILLATOR – Class C Telegraphy

Key-down conditions per tube without modulation ◊

D-C Plate Voltage		600 max.	volts
D-C Grid Voltage		-200 max.	volts
D-C Plate Current		70 max.	ma.
D-C Grid Current		15 max.	ma.
Plate Input		42 max.	watts
Plate Dissipation		20 max.	watts
Typical Operation:			
D-C Plate Voltage	500	600	volts
D-C Grid Voltage ▽△	-125	-150	volts
	8300	10000	ohms
	1560	1875	ohms
Peak R-F Grid Voltage	235	260	volts

**, ◊, ▽, △: see next page.

← indicates a change.

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801-A
R-F POWER AMPLIFIER, A-F POWER AMPLIFIER, MODULATOR

(continued from preceding page)

D-C Plate Current	65	65	ma.
D-C Grid Current**	15	15	approx.ma.
Driving Power**	3.5	4	approx.watts
Power Output	20	25	approx.watts

▽ Obtained from fixed supply, by grid resistor (8300, 10000), or by cathode resistor (1560, 1875). When the 801-A is used in the final amplifier or a preceding stage of a transmitter designed for break-in operation and oscillator keying, a small amount of fixed bias must be used to maintain the plate current at a safe value. With plate voltage of 600 volts, a fixed bias of at least 50 volts should be used.

** Subject to wide variations as explained on sheet TRANS. TUBE RATINGS.

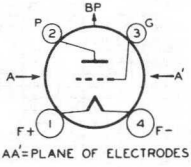
Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

△ With a-c filament supply.

For use of the 801 at the higher frequencies, refer to sheet TRANS. TUBE RATINGS vs FREQUENCY.

For OUTLINE DIMENSIONS, refer to sheet OUTLINES OF RECEIVING TUBES, drawing of ST-16 bulb with 4-pin base.

BOTTOM VIEW OF SOCKET CONNECTIONS

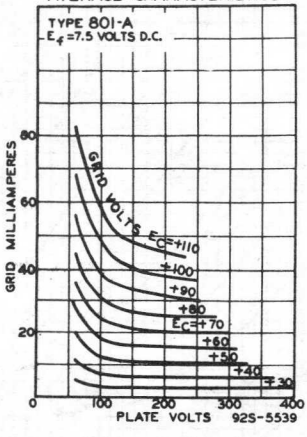


AA'=PLANE OF ELECTRODES

TUBE MOUNTING POSITION

VERTICAL: Base down.
HORIZONTAL: Plane of plate vertical (on edge).

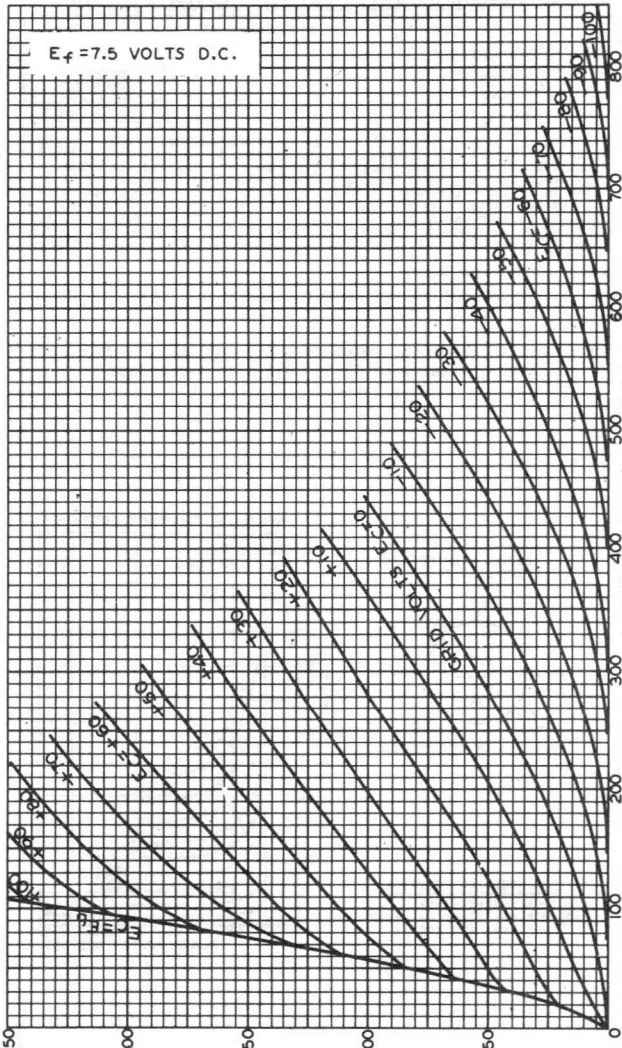
AVERAGE CHARACTERISTICS



RCA

801-A

AVERAGE PLATE CHARACTERISTICS



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925—5538

802

R-F POWER AMPLIFIER PENTODE

Heater ⊙	Coated Unipotential Cathode	
Voltage	6.3	a-c or d-c volts
Current	0.9	amp.
Transconductance for plate current of 20 ma.	2250	μmhos
Direct Interelectrode Capacitances:		
Grid to Plate (With external shielding)	0.15 max.	μμf
Input	12	μμf
Output	8.5	μμf
Maximum Overall Length		5-3/4"
Maximum Diameter		2-1/16"
Bulb		ST-16
Cap		Small Metal
Base		Medium 7-Pin Bayonet

MAXIMUM CCS and ICAS RATINGS with TYPICAL OPERATING CONDITIONS

CCS = Continuous Commercial Service
ICAS = Intermittent Commercial and Amateur Service

A-F POWER AMPLIFIER & MODULATOR - Class A

		CCS		ICAS	
D-C Plate Voltage		500 max.		600 max.	volts
D-C Screen Voltage (Grid #2)		250 max.		250 max.	volts
Plate Input		15 max.		18 max.	watts
Screen Input		3 max.		3 max.	watts
Typical Operation:					
D-C Plate Voltage	400	500	500	600	volts
Suppressor (Grid #3)	0*	0*	0*	40	volts
D-C Screen Voltage	250	175	225	250	volts
D-C Grid Volt. (Grid #1)□	-18	-10	-17	-18.5	volts
	450	325	530	490	ohms
Peak A-F Grid Volt.	18	10	17	18.5	volts
Internal Shield*	-	-	-	-	
D-C Plate Current	30	25	25	30	ma.
D-C Screen Current	10	6	7	8	ma.
Load Resistance	10000	18000	16000	13200	ohms
Total Har. Distortion	8	4	10	9	%
Power Output	5.5	4	6.5	7.6	watts

□ Obtained from fixed supply or by cathode resistor of value shown. The d-c resistance in the grid circuit should not exceed 10000 ohms with fixed bias, or 500000 ohms with cathode bias.
* Connected to cathode at socket.

R-F POWER AMPLIFIER - Class B Telephony

Carrier conditions per tube for use with a max. modulation fact. of 1.0

	CCS	ICAS	
D-C Plate Voltage	500 max.	600 max.	volts
D-C Suppressor Volt. (Grid #3)	200 max.	200 max.	volts
D-C Screen Voltage (Grid #2)	250 max.	250 max.	volts
D-C Plate Current	30 max.	30 max.	ma.
Plate Input	15 max.	18 max.	watts

⊙ In circuits where the cathode is not directly connected to the heater, the potential difference between them should not exceed 100 volts.

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R-F POWER AMPLIFIER PENTODE

(continued from preceding page)

	CCS		ICAS	
Suppressor Input	2 max.		2 max.	watts
Screen Input	4 max.		4 max.	watts
Plate Dissipation	10 max.		13 max.	watts
Typical Operation:				
D-C Plate Voltage	400	500	600	volts
Suppressor *★	–	–	–	
D-C Screen Voltage	150	200	225	volts
D-C Grid Voltage (Grid #1)	-22	-28	-30	volts
Peak R-F Grid Voltage	35	32	35	volts
Internal Shield *	–	–	–	
D-C Plate Current	25	25	30	ma.
D-C Screen Current	6.5	7	8	ma.
D-C Grid Cur. (Approx.)	1	0	0.5	ma.
Driving Power (Approx.) ○	0.5	0.18	0.18	watts
Power Output (Approx.)	2.75	3.5	5.3	watts

SUPPRESSOR-MODULATED R-F POWER AMPLIFIER - Class C Telephony

Carrier conditions per tube for use with a max. modulation fact. of 1.0

		CCS		ICAS	
D-C Plate Voltage		500 max.		600 max.	volts
D-C Screen Voltage (Grid #2)		200 max.		250 max.	volts
D-C Grid Voltage (Grid #1)		-200 max.		-200 max.	volts
D-C Plate Current		30 max.		30 max.	ma.
D-C Grid Current		7.5 max.		7.5 max.	ma.
Plate Input		15 max.		18 max.	watts
Screen Input		6 max.		6 max.	watts
Plate Dissipation		10 max.		13 max.	watts
Typical Operation:					
D-C Plate Voltage	400	500	500	600	volts
D-C Sup'r Volt. (Grid #3)	-40	-53	-45	-45	volts
D-C Screen Voltage △	8900	10700	10700	14500	volts
D-C Grid Voltage □	-85	-90	-90	-100	volts
	11000	18000	20000	20000	ohms
Peak A-F Sup'r Volt.	40	53	65	65	volts
Peak R-F Grid Volt.	125	125	125	125	volts
Internal Shield *	–	–	–	–	
D-C Plate Current	18	20	22	30	ma.
D-C Screen Current	28	28	28	24	ma.
D-C Grid Cur. (Approx.)	7.5	5	4.5	5	ma.
Driving Power (Approx.)	0.9	0.8	0.5	0.6	watts
Power Output (Approx.)	2	3	3.5	6.3	watts

△ Voltage taken from unmodulated plate-voltage supply through resistor of value shown.
□ From fixed supply or grid resistor of value shown.

GRID-MODULATED R-F POWER AMPLIFIER - Class C Telephony

Carrier conditions per tube for use with a max. modulation fact. of 1.0

	CCS		ICAS	
D-C Plate Voltage	500 max.		600 max.	volts

*, ★, ○: See next page.

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R-F POWER AMPLIFIER PENTODE

(continued from preceding page)

	CCS		ICAS	
D-C Suppressor Volt. (Grid #3)	200 max.		200 max.	volts
D-C Screen Voltage (Grid #2)	250 max.		250 max.	volts
D-C Grid Voltage (Grid #1)	-200 max.		-200 max.	volts
D-C Plate Current	30 max.		30 max.	ma.
Plate Input	15 max.		18 max.	watts
Suppressor Input	2 max.		2 max.	watts
Screen Input	4 max.		4 max.	watts
Plate Dissipation	10 max.		13 max.	watts
Typical Operation:				
D-C Plate Voltage	400	500	600	volts
Suppressor * ★	–	–	–	
D-C Screen Voltage	150	200	250	volts
D-C Grid Voltage	-105	-130	-130	volts
Peak A-F Grid Voltage	40	50	50	volts
Peak R-F Grid Voltage	125	145	145	volts
Internal Shield *	–	–	–	
D-C Plate Current	25	25	30	ma.
D-C Screen Current	7.5	8	8	ma.
D-C Grid Cur. (Approx.)	2	1	1	ma.
Driving Power (Approx.) o	1	0.8	0.8	watt
Power Output (Approx.)	3	4	6	watts

PLATE-MODULATED R-F POWER AMPLIFIER - Class C Telephony

Pentode Connection

Carrier conditions per tube for use with a max. modulation fact. of 1.0

	CCS	ICAS	
D-C Plate Voltage	400 max.	500 max.	volts
D-C Suppressor Volt. (Grid #3)	200 max.	200 max.	volts
D-C Screen Voltage (Grid #2)	200 max.	250 max.	volts
D-C Grid Voltage (Grid #1)	-200 max.	-200 max.	volts
D-C Plate Current	40 max.	40 max.	ma.
D-C Grid Current	7.5 max.	7.5 max.	ma.
Plate Input	16 max.	20 max.	watts
Suppressor Input	2 max.	2 max.	watts
Screen Input	4 max.	4 max.	watts
Plate Dissipation	6.7 max.	8 max.	watts
Typical Operation:			
D-C Plate Voltage	400	500	volts
D-C Suppressor Voltage	40	40	volts
D-C Screen Voltage ≠	195	245	volts
	11500	16300	ohms
D-C Grid Voltage ▲	-40	-40	volts
	27000	27000	ohms
Peak R-F Grid Voltage	55	55	volts

★ Applying a positive voltage of not more than 40 volts to the suppressor gives slightly increased output.
o At crest of a-f cycle with modulation factor of 1.0.
≠ From modulated fixed supply or modulated plate-voltage supply through resistor of value shown.
*, ▲: See next page.

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R-F POWER AMPLIFIER PENTODE

(continued from preceding page)

	CCS	ICAS	
Internal Shield *	–	–	
D-C Plate Current	35	40	ma.
D-C Screen Current	17	15	ma.
D-C Grid Cur. (Approx.)	1.5	1.5	ma.
Driving Power (Approx.)	0.1	0.1	watt
Power Output (Approx.)	8	12	watts

PLATE-MODULATED R-F POWER AMPLIFIER – Class C Telephony

Tetrode Connection - Grids #2 & #3 tied together

Carrier conditions per tube for use with a max. modulation fact. of 1.0

	CCS	ICAS	
D-C Plate Voltage	400 max.	500 max.	volts
D-C Screen Volt. (Grids #2 & #3)	200 max.	200 max.	volts
D-C Grid Voltage (Grid #1)	-200 max.	-200 max.	volts
D-C Plate Current	40 max.	40 max.	ma.
D-C Grid Current	7.5 max.	7.5 max.	ma.
Plate Input	16 max.	20 max.	watts
Screen Input	6 max.	6 max.	watts
Plate Dissipation	6.7 max.	8 max.	watts
Typical Operation:			
D-C Plate Voltage	400	500	volts
D-C Screen Voltage△	85	195	volts
	15000	18000	ohms
D-C Grid Voltage ▲	-120	-120	volts
	20000	20000	ohms
Peak R-F Grid Voltage	160	160	volts
Internal Shield *	–	–	
D-C Plate Current	35	40	ma.
D-C Screen Current	21	17	ma.
D-C Grid Current (Approx.)	6	6	ma.
Driving Power (Approx.)	0.9	0.9	watt
Power Output (Approx.)	8	12	watts

△ Preferably from unmodulated plate-voltage supply through resistor of value shown.
▲ Obtained by grid resistor of value shown or by partial self-bias methods.

R-F POWER AMPLIFIER & OSCILLATOR – Class C Telegraphy

Pentode Connection

*Key-down conditions per tube without modulation **

	CCS	ICAS	
D-C Plate Voltage	500 max.	600 max.	volts
D-C Suppressor Volt. (Grid #3)	200 max.	200 max.	volts
D-C Screen Volt. (Grid #2)	250 max.	250 max.	volts
D-C Grid Voltage (Grid #1)	-200 max.	-200 max.	volts
D-C Plate Current	60 max.	60 max.	ma.
D-C Grid Current	7.5 max.	7.5 max.	ma.
Plate Input	25 max.	33 max.	ma.
Suppressor Input	2 max.	2 max.	watts

* Connected to cathode at socket.

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC.

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R-F POWER AMPLIFIER PENTODE

(continued from preceding page)

		CCS		ICAS	
Screen Input		6 max.		6 max.	watts
Plate Dissipation		10 max.		13 max.	watts
Typical Operation:					
D-C Plate Voltage	400	500	500	600	volts
D-C Suppressor Volt.	0	0	40	40	volts
D-C Screen Volt. ♦	200	200	250	250	volts
	8000	13600	20800	22000	ohms
D-C Grid Volt. ¤	-100	-100	-100	-120	volts
	14000	17000	50000	42000	ohms
	1300	1370	1700	1620	ohms
Peak R-F Grid Volt.	155	155	155	165	volts
Internal Shield *	-	-	-	-	
D-C Plate Current	45	45	45	55	ma.
D-C Screen Current	25	22	12	16	ma.
D-C Grid Cur. (Approx.)	7	6	2	2.4	ma.
Driving Power (Approx.)	1.1	0.9	0.25	0.3	watt
Power Output (Approx.)	10	14	16	23	watts

R-F POWER AMPLIFIER & OSCILLATOR - Class C, Telegraphy

Tetrode Connection - Grids #2 & #3 tied together
Key-down conditions per tube without modulation#

		CCS		ICAS	
D-C Plate Voltage		500 max.		600 max.	volts
D-C Screen Volt. (Grids #2 & #3)		200 max.		200 max.	volts
D-C Grid Voltage (Grid #1)		-200 max.		-200 max.	volts
D-C Plate Current		60 max.		60 max.	ma.
D-C Grid Current		7.5 max.		7.5 max.	ma.
Plate Input		25 max.		33 max.	watts
Screen Input		6 max.		6 max.	watts
Plate Dissipation		10 max.		13 max.	watts
Typical Operation:					
D-C Plate Voltage	400	500		600	volts
D-C Screen Volt. ♦	100	100		150	volts
	20000	27000		30000	ohms
D-C Grid Volt. ■	-60	-60		-60	volts
	8600	10000		10000	ohms
	1000	1000		860	ohms
Peak R-F Grid Volt.	90	90		90	volts
Internal Shield *	-	-		-	
D-C Plate Current	45	45		55	ma.
D-C Screen Current	15	15		15	ma.
D-C Grid Cur. (Approx.)	7	6		6	ma.
Driving Power (Approx.)	0.7	0.5		0.5	watt
Power Output (Approx.)	10	12		23	watts

■ Obtained by grid resistor (8600, 10000). by cathode resistor (1000, 860), or from fixed supply.

♦ From fixed supply or plate-voltage supply through resistor of value shown. Under key-up conditions, max. screen voltage should not exceed 500 volts. Series screen resistor of value shown should not be used except where the 802 is employed as a buffer amplifier and is not keyed.

Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

* Connected to cathode at socket.

¤ See next page.

802

R-F POWER AMPLIFIER PENTODE

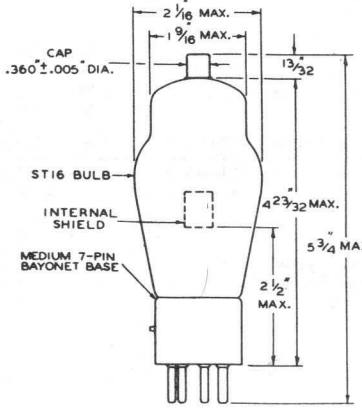
(continued from preceding page)

¤ Obtained from grid resistor (11000, 17000, 50000, 42000), by cathode resistor (1300, 1370, 1700, 1620) or from fixed supply.

HIGH-FREQUENCY OPERATION

Maximum permissible percentage of maximum rated plate voltage and plate input

FREQUENCY (Mc)		30	55	100
TELEPHONY	Class B	100	88	76
	Class C, Grid-Mod.	100	88	76
	Class C, Sup'r-Mod.	100	88	76
	Class C, Plate-Mod.	100	77	55
TELEGRAPHY - Class C		100	77	55



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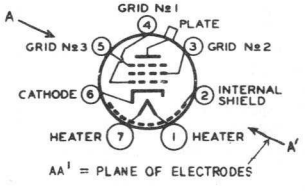
TOP VIEW OF SOCKET CONNECTIONS



AA' = PLANE OF ELECTRODES

TUBE MOUNTING POSITION
VERTICAL or HORIZONTAL

803

R-F POWER AMPLIFIER PENTODE

Filament	Thoriated Tungsten	
Voltage	10	a-c or d-c volts
Current	5	amp.
Transconductance for plate current of 62.5 ma.	4000	μmhos
Direct Interelectrode Capacitances:		
Grid to Plate (with external shielding)	0.15 max.	μμf
Input	17	μμf
Output	29	μμf
Overall Length		9-1/16" ± 3/16" ←
Seated Height		8-5/16" ± 3/16"
Maximum Diameter		2-9/16"
Bulb		T-20
Cap		Medium
Base		Medium Shell Giant 5-Pin Micanol, Bayonet ←
RCA Socket		Stock No.9927

Maximum Ratings Are Absolute Values

MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS

R-F POWER AMPLIFIER - Class B Telephony

Carrier conditions per tube for use with a max. modulation fact. of 1.0

D-C Plate Voltage			2000	max.	volts
D-C Suppressor Voltage (Grid #3)			500	max.	volts
D-C Screen Voltage (Grid #2)			600	max.	volts
D-C Plate Current			160	max.	ma.
Plate Input			180	max.	watts
Suppressor Input			10	max.	watts
Screen Input			20	max.	watts
Plate Dissipation			125	max.	watts
Typical Operation:					
D-C Plate Voltage	1250	1500	2000		volts
D-C Suppressor Voltage	40	40	40		volts
D-C Screen Voltage**	500	550	600		volts
D-C Grid Voltage (Grid #1)●○	-30	-35	-40		volts ←
Peak R-F Grid Voltage	90	70	55		volts
D-C Plate Current	130	110	80		ma.
D-C Screen Current	33	30	20		ma.
D-C Grid Current	8	5	3	approx.	ma.
Driving Power*	4.5	3.0	1.5	approx.	watts
Power Output	52	53	53	approx.	watts

* At crest of a-f cycle with modulation factor of 1.0.

○ For a-c filament supply.

● Obtained from a fixed supply or from suitably by-passed cathode resistor. ←

SUPPRESSOR-MODULATED R-F POWER AMPLIFIER - Class C Telephony

Carrier conditions per tube for use with a max. modulation fact. of 1.0

D-C Plate Voltage	2000	max.	volts
D-C Screen Voltage (Grid #2)	600	max.	volts
D-C Grid Voltage (Grid #1)	-500	max.	volts
D-C Plate Current	110	max.	ma.
D-C Grid Current	50	max.	ma.
Plate Input	180	max.	watts
Screen Input	30	max.	watts

← Indicates a change. **: See end of tabulation.

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R-F POWER AMPLIFIER PENTODE

(continued from preceding page)

Plate Dissipation			125 max.	watts
Typical Operation:				
D-C Plate Voltage	1250	1500	2000	volts
D-C Suppressor Voltage	−70	−90	−110	volts
D-C Screen Voltage△	13000	17000	35000	ohms
D-C Grid Voltage□	−110	−100	−100	volts
	5000	5000	7000	ohms
Peak A-F Suppressor Volt.	110	130	150	volts
Peak R-F Grid Voltage	200	190	170	volts
D-C Plate Current	100	100	80	ma.
D-C Screen Current	70	70	48	ma.
D-C Grid Current	22	20	15	approx.ma.
Driving Power	4	3.5	2.5	approx.watts
Power Output	40	50	53	approx.watts

△ Voltage taken from unmodulated plate-voltage supply through resistor.

□ From fixed supply, grid resistor (5000, 5000, 7000), or cathode resistor.

GRID-MODULATED R-F POWER AMPLIFIER – Class C Telephony

Carrier conditions per tube for use with a max. modulation fact. of 1.0

D-C Plate Voltage			2000 max.	volts
D-C Suppressor Voltage (Grid #3)			500 max.	volts
D-C Screen Voltage (Grid #2)			600 max.	volts
D-C Grid Voltage (Grid #1)			−500 max.	volts
D-C Plate Current			160 max.	ma.
Plate Input			180 max.	watts
Suppressor Input			10 max.	watts
Screen Input			20 max.	watts
Plate Dissipation			125 max.	watts
Typical Operation:				
D-C Plate Voltage	1250	1500	2000	volts
D-C Suppressor Voltage	40	40	40	volts
D-C Screen Voltage**	500	550	600	volts
D-C Grid Voltage	−100	−90	−80	volts
Peak R-F Grid Voltage	160	130	100	volts
Peak A-F Grid Voltage	75	65	50	volts
D-C Plate Current	130	110	80	ma.
D-C Screen Current	30	25	20	ma.
D-C Grid Current	8	6	4	approx.ma.
Driving Power*	4	3	2	approx.watts
Power Output	52	53	53	approx.watts

* At crest of a-f cycle with modulation factor of 1.0.

PLATE-MODULATED R-F POWER AMPLIFIER – Class C Telephony

Pentode Connection

Carrier conditions per tube for use with a max. modulation fact. of 1.0

D-C Plate Voltage	1600 max.	volts
D-C Suppressor Voltage (Grid #3)	500 max.	volts
D-C Screen Voltage (Grid #2)	500 max.	volts
D-C Grid Voltage (Grid #1)	−500 max.	volts
D-C Plate Current	160 max.	ma.
D-C Grid Current	50 max.	ma.

** See end of tabulation. ◄ Indicates a change.

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R-F POWER AMPLIFIER PENTODE

(continued from preceding page)

Plate Input		250 max.	watts
Suppressor Input		10 max.	watts
Screen Input		20 max.	watts
Plate Dissipation		85 max.	watts
Typical Operation:			
D-C Plate Voltage	1250	1600	volts
D-C Suppressor Voltage	100	100	volts
D-C Screen Voltage #	18000	27000	ohms
	350	400	volts
D-C Grid Voltage ▲	-80	-80	volts
	4000	4000	ohms
Peak R-F Grid Voltage	200	190	volts
D-C Plate Current	150	150	ma.
D-C Screen Current	50	45	ma.
D-C Grid Current	30	25	approx. ma.
Driving Power	6	5	approx. watts
Power Output	120	155	approx. watts

From modulated fixed supply or modulated plate-voltage supply through resistor.

PLATE-MODULATED R-F POWER AMPLIFIER – Class C Telephony

Tetrode Connection – Grids #2 & #3 tied together

Carrier conditions per tube for use with a max. modulation fact. of 1.0

D-C Plate Voltage		1600 max.	volts
D-C Screen Voltage (Grids #2 & #3)		500 max.	volts
D-C Grid Voltage (Grid #1)		-500 max.	volts
D-C Plate Current		160 max.	ma.
D-C Grid Current		50 max.	ma.
Plate Input		250 max.	watts
Screen Input		30 max.	watts
Plate Dissipation		85 max.	watts
Typical Operation:			
D-C Plate Voltage	1250	1600	volts
D-C Screen Voltage ##	15000	20000	ohms
	130	130	volts
D-C Grid Voltage ▲	-180	-180	volts
	4000	4000	ohms
Peak R-F Grid Voltage	305	320	volts
D-C Plate Current	150	150	ma.
D-C Screen Current	75	75	ma.
D-C Grid Current	45	45	approx. ma.
Driving Power	15	15	approx. watts
Power Output	125	155	approx. watts

Preferably from unmodulated plate-voltage supply through resistor.

▲ Obtained from grid resistor of value shown, or by partial self-bias methods.

R-F POWER AMPLIFIER & OSCILLATOR – Class C Telegraphy

Pentode Connection

Key-down conditions per tube without modulation§

D-C Plate Voltage	2000 max.	volts
D-C Suppressor Voltage (Grid #3)	500 max.	volts

§ See next page.

← Indicates a change.

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R-F POWER AMPLIFIER PENTODE

(continued from preceding page)

D-C Screen Voltage (Grid #2)			600 max.	volts
D-C Grid Voltage (Grid #1)			-500 max.	volts
D-C Plate Current			175 max.	ma.
D-C Grid Current			50 max.	ma.
Plate Input			350 max.	watts
Suppressor Input			10 max.	watts
Screen Input			30 max.	watts
Plate Dissipation			125 max.	watts
Typical Operation:				
D-C Plate Voltage	1250	1500	2000	volts
D-C Suppressor Voltage	40	40	40	volts
D-C Screen Voltage ♦	500	500	500	volts
D-C Grid Voltage ■	-90	-90	-90	volts
	415	415	415	ohms
	7500	7500	7500	ohms
Peak R-F Grid Voltage	175	175	175	volts
D-C Plate Current	160	160	160	ma.
D-C Screen Current	45	45	45	ma.
D-C Grid Current	12	12	12	approx. ma.
Driving Power	2	2	2	approx. watts
Power Output	130	160	210	approx. watts

■ obtained from fixed supply, cathode resistor (415), by grid resistor (7500), or by combination methods.

R-F POWER AMPLIFIER & OSCILLATOR - Class C Telegraphy

Tetrode Connection - Grids #2 & #3 tied together

Key-down conditions per tube without modulation§

D-C Plate Voltage			2000 max.	volts
D-C Screen Voltage (Grids #2 & #3)			600 max.	volts
D-C Grid Voltage (Grid #1)			-500 max.	volts
D-C Plate Current			175 max.	ma.
D-C Grid Current			50 max.	ma.
Plate Input			350 max.	watts
Screen Input			30 max.	watts
Plate Dissipation			125 max.	watts
Typical Operation:				
D-C Plate Voltage	1250	1500	2000	volts
D-C Screen Voltage ♦	150	150	150	volts
D-C Grid Voltage ⊕	-90	-90	-90	volts
	445	445	445	ohms
	3500	3500	3500	ohms
Peak R-F Grid Voltage	190	190	190	volts
D-C Plate Current	160	160	160	ma.
D-C Screen Current	15	15	15	ma.
D-C Grid Current	28	27	26	approx. ma.
Driving Power	4.6	4.4	4.4	approx. watts
Power Output	130	160	210	approx. watts

♦ Use of series resistor is not recommended.

⊕ obtained from fixed supply, cathode resistor (445), by grid resistor (3500), or by combination methods.

← Indicates a change. §, **: See next page.

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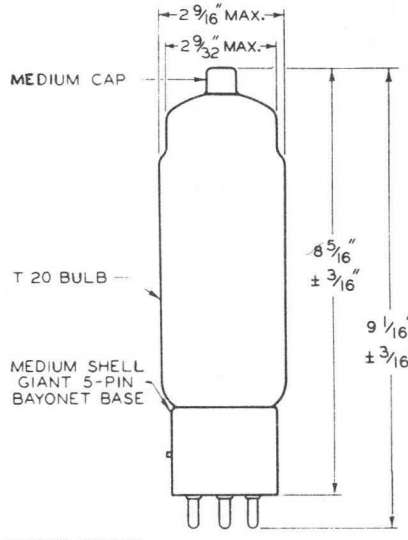
R-F POWER AMPLIFIER PENTODE

(continued from preceding page)

§ Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier condition.

** Preferably obtained from a separate source, or from the plate-voltage supply with a voltage divider.

Data on operating frequencies for the 803 are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY.

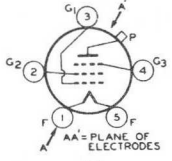


TUBE MOUNTING POSITION

VERTICAL: Base up or down.

92CM-4424R3

BOTTOM VIEW OF SOCKET CONNECTIONS



Pin 1 – Filament
Pin 2 – Grid No.2
Pin 3 – Grid No.1
Pin 4 – Grid No.3
Pin 5 – Filament
Cap – Plate

5J

◄ Indicates a change.

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R-F POWER AMPLIFIER PENTODE

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92CM-4519T2, 4426T1, & 4425T1

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R-F POWER AMPLIFIER PENTODE

Filament	Thoriated Tungsten	
Voltage	7.5	a-c or d-c volts
Current	3.0	amp.
Transconductance for plate current of 32 ma.	3250	μmhos
Direct Interelectrode Capacitances:		
Grid to Plate (with external shielding)	0.01 max.	μμf
Input	16	μμf
Output	14.5	μμf
Maximum Overall Length		7-3/4"
Maximum Diameter		2-1/16"
Bulb		T-16
Cap		Small Metal
Base		Medium 5-Pin, "Micanol"

MAXIMUM CCS and ICAS RATINGS with TYPICAL OPERATING CONDITIONS

CCS = Continuous Commercial Service
ICAS = Intermittent Commercial and Amateur Service

R-F POWER AMPLIFIER - Class B Telephony

Carrier conditions per tube for use with a max. modulation fact. of 1.0

		CCS		*ICAS*	
D-C Plate Voltage		1250 max.		1500 max.	volts
D-C Suppressor Volt. (Grid #3)		200 max.		200 max.	volts
D-C Screen Voltage (Grid #2)		300 max.		300 max.	volts
D-C Plate Current		50 max.		50 max.	ma.
Plate Input		60 max.		75 max.	watts
Suppressor Input		5 max.		5 max.	watts
Screen Input		10 max.		10 max.	watts
Plate Dissipation		40 max.		50 max.	watts
Typical Operation:					
Filament Volt.	7.5	7.5	7.5	7.5	a-c volts
D-C Plate Volt.	1000	1000	1250	1500	volts
D-C Suppressor Volt.	0	45	45	45	volts
D-C Screen Volt.	300	300	300	300	volts
D-C Grid Volt. (Grid #1)	-20	-20	-20	-26	volts
Peak R-F Grid Volt.	30	30	27	40	volts
D-C Plate Current	45	45	45	50	ma.
D-C Screen Current	12	11.5	11	12	ma.
D-C Grid Cur. (Approx.)	1	1	1	1.5	ma.
Driving Power (Approx.)[o]	0.35	0.3	0.25	0.5	watt
Power Output (Approx.)	11	12	16	28	watts

[o] At crest of a-f cycle with a modulation factor of 1.0.

SUPPRESSOR-MODULATED R-F POWER AMPLIFIER - Class C Telephony

Carrier conditions per tube for use with a max. modulation fact. of 1.0

	CCS	*ICAS*	
D-C Plate Voltage	1250 max.	1500 max.	volts
D-C Screen Volt. (Grid #2)	300 max.	300 max.	volts
D-C Grid Voltage (Grid #1)	-300 max.	-300 max.	volts
D-C Plate Current	50 max.	50 max.	ma.

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R-F POWER AMPLIFIER PENTODE

(continued from preceding page)

	CCS		ICAS		
D-C Grid Current	15 max.		15 max.		ma.
Plate Input	60 max.		75 max.		watts
Screen Input	15 max.		15 max.		watts
Plate Dissipation	40 max.		50 max.		watts
Typical Operation:					
Filament Voltage	7.5	7.5	7.5	a-c	volts
D-C Plate Voltage	1000	1250	1500		volts
D-C Sup'r Volt. (Grid #3)	-35	-50	-50		volts
D-C Screen Volt. ●	21000	27000	37500		ohms
D-C Grid Voltage □	-100	-100	-115		volts
	18200	14300	16400		ohms
Peak A-F Sup'r Volt.	60	70	75		volts
Peak R-F Grid Volt.	140	140	150		volts
D-C Plate Current	45	48	50		volts
D-C Screen Current	33.5	35.5	32		volts
D-C Grid Cur. (Approx.)	5.5	7	7		ma.
Driving Power (Approx.)	0.7	0.85	0.95		watts
Power Output (Approx.)	16	21	28		watts

● From unmodulated plate-voltage supply through resistor of value shown.
□ From fixed supply or grid resistor of value shown.

GRID-MODULATED R-F POWER AMPLIFIER - Class C Telephony

Carrier conditions per tube for use with a max. modulation fact. of 1.0

	CCS		ICAS		
D-C Plate Voltage	1250 max.		1500 max.		volts
D-C Suppressor Volt. (Grid #3)	200 max.		200 max.		volts
D-C Screen Voltage (Grid #2)	300 max.		300 max.		volts
D-C Grid Voltage (Grid #1)	-300 max.		-300 max.		volts
D-C Plate Current	50 max.		50 max.		ma.
Plate Input	60 max.		75 max.		watts
Suppressor Input	5 max.		5 max.		watts
Screen Input	10 max.		10 max.		watts
Plate Dissipation	40 max.		50 max.		watts
Typical Operation:					
Filament Voltage	7.5	7.5	7.5	a-c	volts
D-C Plate Voltage	1000	1000	1250	1500	volts
D-C Suppressor Volt.	0	45	45	45	volts
D-C Screen Volt.	300	300	300	300	volts
D-C Grid Volt.	-115	-115	-115	-130	volts
Peak R-F Grid Volt.	140	135	135	140	volts
Peak A-F Grid Volt.	35	35	35	40	volts
D-C Plate Current	45	45	45	50	ma.
D-C Screen Current	15	11	11	13.5	ma.
D-C Grid Cur. (Approx.)	2	2	2	3.7	ma.
Driving Power (Approx.) *	1.1	0.85	0.85	1.3	watts
Power Output (Approx.)	14	16	21	28	watts

* At crest of a-f cycle with a modulation factor of 1.0.

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R-F POWER AMPLIFIER PENTODE

(continued from preceding page)

PLATE-MODULATED R-F POWER AMPLIFIER - Class C Telephony

Pentode Connection

Carrier conditions per tube for use with a max. modulation fact. of 1.0

	CCS	ICAS	
D-C Plate Voltage	1000 max.	1250 max.	volts
D-C Suppressor Volt. (Grid #3)	200 max.	200 max.	volts
D-C Screen Voltage (Grid #2)	300 max.	300 max.	volts
D-C Grid Voltage (Grid #1)	-300 max.	-300 max.	volts
D-C Plate Current	80 max.	80 max.	ma.
D-C Grid Current	15 max.	15 max.	ma.
Plate Input	80 max.	100 max.	watts
Suppressor Input	5 max.	5 max.	watts
Screen Input	10 max.	10 max.	watts
Plate Dissipation	27 max.	35 max.	watts
Typical Operation:			
Filament Voltage	7.5	7.5 a-c	volts
D-C Plate Voltage	1000	1250	volts
D-C Suppressor Voltage	50	50	volts
D-C Screen Voltage oo	220	250	volts
	37000	50000	ohms
D-C Grid Voltage ▲	-90	-90	volts
	15000	15000	ohms
Peak R-F Grid Voltage	130	140	volts
D-C Plate Current	75	75	ma.
D-C Screen Current	21	20	ma.
D-C Grid Cur. (Approx.)	6	6	ma.
Driving Power (Approx.)	0.65	0.75	watt
Power Output (Approx.)	50	65	watts

oo From modulated fixed supply or modulated plate-voltage supply through resistor of value shown.

PLATE-MODULATED R-F POWER AMPLIFIER - Class C Telephony

Tetrode Connection - Grids #2 & #3 tied together

Carrier conditions per tube for use with a max. modulation fact. of 1.0

	CCS	ICAS	
D-C Plate Voltage	1000 max.	1250 max.	volts
D-C Screen Volt. (Grids #2 & #3)	200 max.	200 max.	volts
D-C Grid Voltage (Grid #1)	-300 max.	-300 max.	volts
D-C Plate Current	80 max.	80 max.	ma.
D-C Grid Current	15 max.	15 max.	ma.
Plate Input	80 max.	100 max.	watts
Screen Input	15 max.	15 max.	watts
Plate Dissipation	27 max.	35 max.	watts
Typical Operation:			
Filament Voltage	7.5	7.5 a-c	volts
D-C Plate Voltage	1000	1250	volts
D-C Screen Voltage #	155	170	volts
	30000	45000	ohms

Preferably from unmodulated plate-voltage supply through resistor of value shown.
▲ See next page.

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R-F POWER AMPLIFIER PENTODE

(continued from preceding page)

	CCS	ICAS	
D-C Grid Voltage▲	−80	−80	volts
	10000	10000	ohms
Peak R-F Grid Volt.	145	145	volts
D-C Plate Current	75	75	ma.
D-C Screen Current	28	24	ma.
D-C Grid Cur. (Approx.)	8	8	ma.
Driving Power (Approx.)	1.1	1.1	watts
Power Output (Approx.)	50	65	watts

R-F POWER AMPLIFIER & OSCILLATOR – Class C Telegraphy

Pentode Connection

Key-down conditions per tube without modulation##

	CCS			ICAS		
D-C Plate Voltage	1250 max.			1500 max.		volts
D-C Suppressor Volt. (Grid #3)	200 max.			200 max.		volts
D-C Screen Volt. (Grid #2)	300 max.			300 max.		volts
D-C Grid Voltage (Grid #1)	−300 max.			−300 max.		volts
D-C Plate Current	95 max.			100 max.		ma.
D-C Grid Current	15 max.			15 max.		ma.
Plate Input	120 max.			150 max.		watts
Suppressor Input	5 max.			5 max.		watts
Screen Input	15 max.			15 max.		watts
Plate Dissipation	40 max.			50 max.		watts
Typical Operation:						
Filament Voltage	7.5	7.5	7.5	7.5	a-c	volts
D-C Plate Voltage	1000	1250	1250	1500		volts
D-C Sup'r Voltage	45	0	45	45		volts
D-C Screen Volt.♦	300	300	300	300		volts
	24000	28800	35200	34000		ohms
D-C Grid Volt.■	−100	−100	−100	−100		volts
	14300	14300	14300	14300		ohms
Peak R-F Grid Volt.	150	145	150	180		volts
D-C Plate Current	92	80	92	100		ma.
D-C Screen Current	29	33	27	35		ma.
D-C Grid Cur. (Approx.)	7	7	7	7		ma.
Driving Power (Approx.)	0.95	0.9	0.95	1.95		watts
Power Output (Approx.)	60	64	80	110		watts

R-F POWER AMPLIFIER & OSCILLATOR – Class C Telegraphy

Tetrode Connection - Grids #2 & #3 tied together

Key-down conditions per tube without modulation##

	CCS	ICAS	
D-C Plate Voltage	1250 max.	1500 max.	volts
D-C Screen Volt. (Grids #2 & #3)	200 max.	200 max.	volts

▲ Obtained by grid resistor of value shown or by partial self-bias methods.

Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

♦, ■: See next page.

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R-F POWER AMPLIFIER PENTODE

(continued from preceding page)

	CCS	ICAS	
D-C Grid Volt (Grid #1)	-300 max.	-300 max.	volts
D-C Plate Current	95 max.	100 max.	ma.
D-C Grid Current	15 max.	15 max.	ma.
Plate Input	120 max.	150 max.	watts
Screen Input	15 max.	15 max.	watts
Plate Dissipation	40 max.	50 max.	watts
Typical Operation:			
Filament Voltage	7.5	7.5 a-c	volts
D-C Plate Voltage	1250	1500	volts
D-C Screen Voltage ♦	180	200	volts
	46700	43500	ohms
D-C Grid Voltage ■	-100	-100	volts
	-12500	7700	ohms
Peak R-F Grid Voltage	160	190	volts
D-C Plate Current	92	100	ma.
D-C Screen Current	23	30	ma.
D-C Grid Cur. (Approx.)	8	12	ma.
Driving Power (Approx.)	1.2	2.2	watts
Power Output (Approx.)	80	110	watts

♦ From fixed supply of value shown. Regulation of fixed supply should be adequate to limit the screen voltage, under key-up conditions, to 600 volts. Series screen resistor of value shown should not be used except where the 804 is employed as a buffer amplifier and is not keyed.

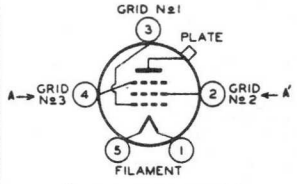
■ Obtained by grid resistor of value shown or by other self- or fixed-bias method.

For the 804 as a crystal-controlled oscillator, typical operating conditions are: d-c plate volts, 1250; d-c suppressor volts, 0; d-c screen volts, 300; grid resistor, 30000 ohms; d-c plate ma., 42; and d-c screen ma., 24.

HIGH-FREQUENCY OPERATION

Maximum permissible percentage of maximum rated plate voltage and plate input

FREQUENCY (Mc)		15	35	80
TELEPHONY	Class C	100	88	76
	Class C, Grid-Mod.	100	88	76
	Class C, Sup'r-Mod.	100	88	76
	Class C, Plate-Mod.	100	75	50
TELEGRAPHY - Class C		100	75	50



AA' = PLANE OF ELECTRODES

OUTLINE DIMENSIONS of the 804 are the same as those for the 814.

TUBE MOUNTING POSITION

VERTICAL: Base down.
HORIZONTAL: Plane of electrodes vertical.

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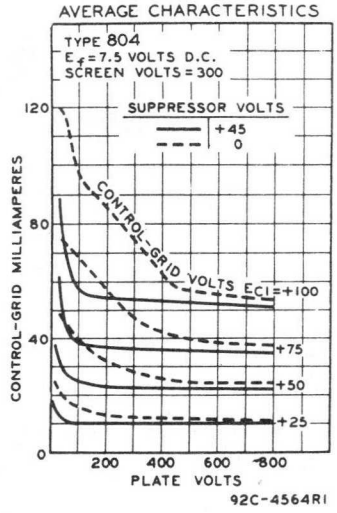
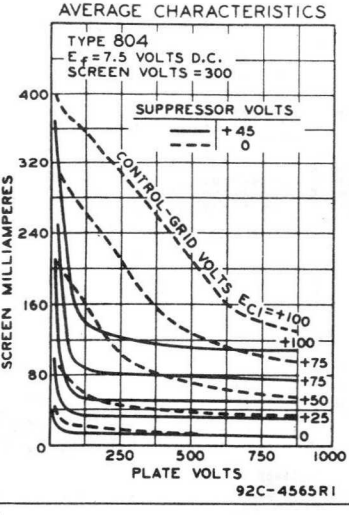
R-F POWER AMPLIFIER PENTODE





805

R-F POWER AMPLIFIER, OSCILLATOR, CLASS B MODULATOR

Filament	Thoriated Tungsten	
Voltage	10	a-c or d-c volts
Current	3.25	amp.
Direct Interelectrode Capacitances (approx.):		
Grid to Plate	6.5	μμf
Grid to Filament	8.5	μμf
Plate to Filament	10.5	μμf
Maximum Overall Length		8-1/2"
Maximum Diameter		2-5/16"
Bulb		T-18
Cap		Medium Metal
Base		Jumbo 4-Large Pin

MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS

A-F POWER AMPLIFIER & MODULATOR - Class B

D-C Plate Voltage		1500 max.	volts
Max-Signal D-C Plate Current *		210 max.	ma.
Max-Signal Plate Input *		315 max.	watts
Plate Dissipation *		125 max.	watts
Typical Operation - 2 tubes:			
Unless otherwise specified, values are for 2 tubes.			
Filament Voltage	10	10	a-c volts
D-C Plate Voltage	1250	1500	volts
D-C Grid Voltage	0	-16	volts
Peak A-F Grid-to-Grid Voltage	235	280	volts
Zero-Sig. D-C Plate Current	148	84	ma.
Max-Sig. D-C Plate Current	400	400	ma.
Load Resistance (per tube)	1675	2050	ohms
Effective Load Res.(plate to plate)	6700	8200	ohms
Max-Signal Driving Power	6	7	approx. watts
Max-Signal Power Output	300 ##	370#	approx. watts

* Averaged over any audio-frequency cycle.

With 4% harmonic distortion approx.

\# With 3% harmonic distortion approx.

R-F POWER AMPLIFIER - Class B Telephony

Carrier conditions per tube for use with a max. modulation fact. of 1.0

D-C Plate Voltage		1500 max.	volts
D-C Plate Current		150 max.	ma.
Plate Input		185 max.	watts
Plate Dissipation		125 max.	watts
Typical Operation:			
Filament Voltage	10	10	a-c volts
D-C Plate Voltage	1250	1500	volts
D-C Grid Voltage	0	-10	volts
Peak R-F Grid Voltage	75	70	volts
D-C Plate Current	135	115	ma.
D-C Grid Current **	15	15	approx. ma.
Driving Power ** o	11	7.5	approx. watts
Power Output	55	57.5	approx. watts

o At crest of a-f cycle with modulation factor of 1.0.

** See next page.

(continued on next page)

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R-F POWER AMPLIFIER, OSCILLATOR, CLASS B MODULATOR

(continued from preceding page)

PLATE-MODULATED R-F POWER AMPLIFIER - Class C Telephony

Carrier conditions per tube for use with a max. modulation fact. of 1.0

D-C Plate Voltage			1250 max.	volts
D-C Grid Voltage			-500 max.	volts
D-C Plate Current			175 max.	ma.
D-C Grid Current			70 max.	ma.
Plate Input			220 max.	watts
Plate Dissipation			85 max.	watts
Typical Operation:				
Filament Voltage	10	10	a-c	volts
D-C Plate Voltage	1000	1250		volts
D-C Grid Voltage	-155	-160		volts
Peak R-F Grid Voltage	295	300		volts
D-C Plate Current	160	160		ma.
D-C Grid Current **	60	60	approx.	ma.
Driving Power **	16	16	approx.	watts
Power Output	110	140	approx.	watts

R-F POWER AMPLIFIER & OSCILLATOR - Class C Telegraphy

Key-down conditions per tube without modulation ##

D-C Plate Voltage			1500 max.		volts
D-C Grid Voltage			-500 max.		volts
D-C Plate Current			210 max.		ma.
D-C Grid Current			70 max.		ma.
Plate Input			315 max.		watts
Plate Dissipation			125 max.		watts
Typical Operation:					
Filament Voltage	10	10	10	a-c	volts
D-C Plate Voltage	1000	1250	1500		volts
D-C Grid Voltage	-95	-100	-105		volts
Peak R-F Grid Voltage	225	230	235		volts
D-C Plate Current	200	200	200		ma.
D-C Grid Current **	40	40	40	approx.	ma.
Driving Power **	8.5	8.5	8.5	approx.	watts
Power Output	130	170	215	approx.	watts

** Subject to wide variations as explained on sheet TRANS. TUBE RATINGS.

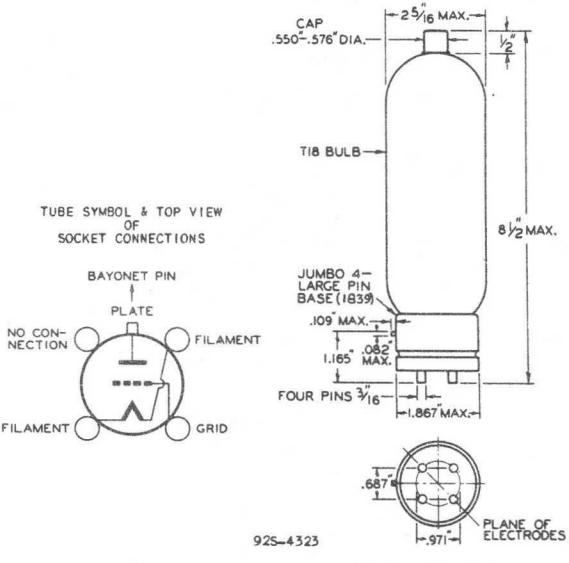
Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

For use of the 805 at the higher frequencies, refer to sheet TRANS. TUBE RATINGS vs FREQUENCY.

805

R-F POWER AMPLIFIER, OSCILLATOR, CLASS B MODULATOR

(continued from preceding page)



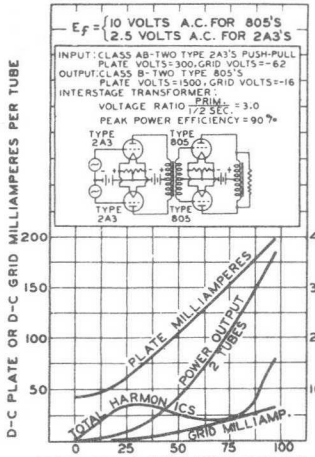
FOR PLATE FAMILY, REFER TO CURVE 92C-4404 UNDER TYPE 838.

← indicates a change

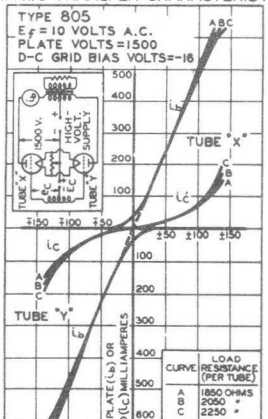
805

R-F POWER AMPLIFIER, OSCILLATOR CLASS B MODULATOR

OPERATION CHARACTERISTICS



DYNAMIC TRANSFER CHARACTERISTICS



APRIL 5, 1937

92C-4570R1 & 4571R1

806
R-F POWER AMPLIFIER, CLASS B MODULATOR

Filament	Thoriated Tungsten	
Voltage	5.0	a-c or d-c volts
Current	9.5	amp. ←
Amplification Factor	12.6	
Direct Interelectrode Capacitances:		←
Grid to Plate	4.0	μμf
Grid to Filament	5.5	μμf
Plate to Filament	0.4	μμf
Maximum Overall Length		10"
Maximum Diameter		3-13/16"
Bulb		GT-30
Cap (Top)		Skirted Medium
Cap (Side)		Saddle Medium
Base		Jumbo 4-Pin
RCA Socket		Stock No. 9936 ←

Cooling—Forced ventilation from fan directed at middle and upper portions of bulb is required for continuous key-down conditions in class C telegraph service and is recommended for other services at frequencies of 30 Mc or higher.

Maximum Ratings Are Absolute Values

MAXIMUM CCS and ICAS RATINGS with TYPICAL OPERATING CONDITIONS

CCS = Continuous Commercial Service
ICAS = Intermittent Commercial and Amateur Service

A-F POWER AMPLIFIER & MODULATOR - Class B

	CCS		ICAS	
D-C Plate Voltage	3000 max.		3300 max.	volts
Max.-Sig. D-C Plate Cur.[oo]	200 max.		250 max.	ma.
Max.-Sig. Plate Input[oo]	500 max.		825 max.	watts ←
Plate Dissipation[oo]	150 max.		225 max.	watts
Typical Operation:				
Unless otherwise specified, values are for 2 tubes				
D-C Plate Voltage	2000	3000	3300	volts
D-C Grid Voltage	-140	-230	-240	volts
Peak A-F Grid-to-Grid Volt.	660	770	930	volts
Zero-Sig. D-C Plate Cur.	80	50	80	ma.
Max.-Sig. D-C Plate Cur.	390	330	475	ma.
Load Res. (per tube)	4500	5200	4000	ohms
Effective Load Res. (plate to plate)	18000	20800	16000	ohms
Max.-Sig. Driving Power (Approx.)	19	15	35	watts
Max.-Sig. Power Output (Approx.)	535	700	1120	watts

[oo] Averaged over any audio-frequency cycle of sine-wave form.

R-F POWER AMPLIFIER - Class B Telephony

Carrier conditions per tube for use with a max. modulation fact. of 1.0

	CCS	ICAS	
D-C Plate Voltage	3000 max.	3300 max.	volts
D-C Plate Current	150 max.	150 max.	ma.
Plate Input	225 max.	338 max.	watts

← Indicates a change.

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R-F POWER AMPLIFIER, CLASS B MODULATOR

(continued from preceding page)

	CCS		ICAS	
Plate Dissipation	150 max.		225 max.	watts
Typical Operation:				
D-C Plate Voltage	2000	3000	3300	volts
D-C Grid Voltage	-150	-240	-280	volts
Peak R-F Grid Voltage	180	200	290	volts
D-C Plate Current	110	70	102	ma.
D-C Grid Cur. (Approx.)**	1	0	0	ma.
Driving Power (Approx.)** °	8	5	10.3	watts
Power Output (Approx.)	70	70	115	watts

° At crest of a-f cycle with modulation factor of 1.0.

PLATE-MODULATED R-F POWER AMPLIFIER - Class C Telephony

Carrier conditions per tube for use with a max. modulation fact. of 1.0

	CCS		ICAS	
D-C Plate Voltage	2500 max.		3000 max.	volts
D-C Grid Voltage	-1000 max.		-1000 max.	volts
D-C Plate Current	200 max.		200 max.	ma.
D-C Grid Current	50 max.		50 max.	ma.
Plate Input	500 max.		600 max.	watts
Plate Dissipation	110 max.		150 max.	watts
Typical Operation:				
D-C Plate Voltage	2000	2500	3000	volts
D-C Grid Voltage §	-500	-600	-670	volts
	12500	15000	25000	ohms
Peak R-F Grid Volt.	790	890	970	volts
D-C Plate Current	195	195	195	ma.
D-C Grid Cur. (Approx.)**	40	40	27	ma.
Driving Power (Approx.)**	28	32	24	watts
Power Output (Approx.)	300	390	460	watts

§ Obtained by grid resistor of value shown or by partial self-bias methods.

R-F POWER AMPLIFIER & OSCILLATOR - Class C Telegraphy□

Key-down conditions per tube without modulation##

	CCS		ICAS	
D-C Plate Voltage	3000 max.		3300 max.	volts
D-C Grid Voltage	-1000 max.		-1000 max.	volts
→ D-C Plate Current	200 max.		305 max.	ma.
D-C Grid Current	50 max.		50 max.	ma.
Plate Input	600 max.		1000 max.	watts
Plate Dissipation	150 max.		225 max.	watts
Typical Operation:				
D-C Plate Volt.	2000	2500 3000	3300	volts
D-C Grid Volt. ★	-400	-500 -600	-600	volts
	16000	20000 24000	15000	ohms
	1800	2300 2700	1730	ohms

□ See "Cooling" under this type.
** See next page.
Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.
→ Indicates a change.
★ Obtained by grid resistor (16000, 20000, 24000, 12800), by cathode resistor (1800, 2300, 2700, 1730), or from fixed-bias source.

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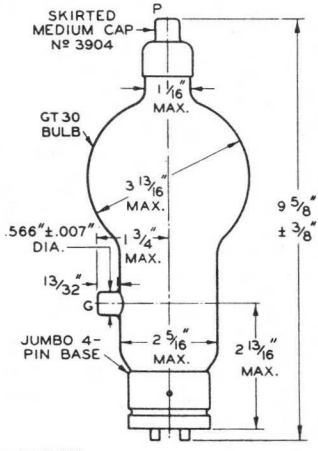
R-F POWER AMPLIFIER, CLASS B MODULATOR

(continued from preceding page)

	CCS			ICAS	
Peak R-F Grid Volt.	640	755	870	930	volts
D-C Plate Current	195	195	195	300	ma.
D-C Grid Cur. (Approx.)**	25	25	25	40	ma.
Driving Power (Approx.)**	15	17	20	34	watts
Power Output (Approx.)	280	370	450	780	watts

** Subject to wide variations as explained on sheet TUBE RATINGS in General Section.

Data on operating frequencies for the 806 are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY.

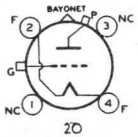


TUBE MOUNTING POSITION

VERTICAL: Base down.
HORIZONTAL: No.

92CM-4681R3

BOTTOM VIEW OF SOCKET CONNECTIONS



20

F - FILAMENT
G - GRID
NC - NO CONNECTION
P - PLATE

← Indicates a change.

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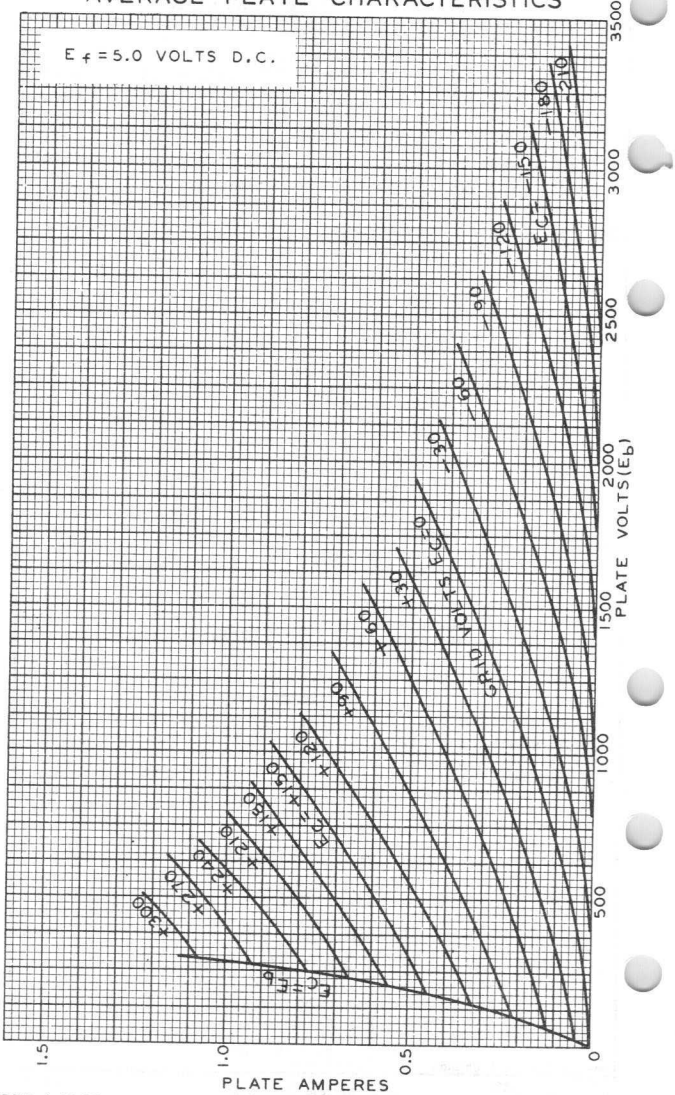
AVERAGE PLATE CHARACTERISTICS



DEC. 1, 1943

RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

92CM-4690

RCA

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BEAM POWER TUBE

Useful at Frequencies up to 125 Mc

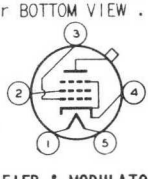
GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage	6.3 ± 0.6	ac or dc volts
Current	0.9	amp
Transconductance (Approx.) for plate volts = 250, grid-No.2 volts = 250, grid-No.1 volts = -14	6000	μmhos
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 250, grid-No.2 volts = 250, and grid-No.1 volts = -20	8	
Direct Interelectrode Capacitances:		
Grid No.1 to plate°	0.2 max.	μμf
Grid No.1 to cathode & grid No.3, grid No.2, and heater	12	μμf
Plate to cathode & grid No.3, grid No.2, and heater	7	μμf

Mechanical:

Mounting Position	Any
Maximum Overall Length	5-3/4"
Seated Length	4-31/32" ± 5/32"
Maximum Diameter	2-1/16"
Weight (Approx.)	3 oz
Bulb	ST-16
Cap	Small (JETEC No.C1-1)
Base . . . Medium-Micanol-Shell Small 5-Pin (JETEC No.A5-11)	
Basing Designation for BOTTOM VIEW	5AW



Pin 1 - Heater
Pin 2 - Grid No.2
Pin 3 - Grid No.1
Pin 4 - Cathode, Grid No.3
Pin 5 - Heater
Cap - Plate

AF POWER AMPLIFIER & MODULATOR - Class AB1♦

Triode Connection--Grid No.2 Connected to Plate

Maximum Ratings, *Absolute Values*:

	CCS●	ICAS●●	
DC PLATE VOLTAGE	400 max.	400 max.	volts
MAX.-SIGNAL DC PLATE CURRENT*	125 max.	125 max.	ma
MAX.-SIGNAL DC PLATE PLUS GRID-No.2 INPUT*	50 max.	50 max.	watts
PLATE DISSIPATION PLUS GRID-No.2 INPUT*	25 max.	30 max.	watts

° with external shield JETEC No.312.

♦, ●, ●●, *: See next page.

←Indicates a change.

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BEAM POWER TUBE

	CCS●	ICAS●●	
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	135 max.	135 max.	volts
Heater positive with respect to cathode	135 max.	135 max.	volts

Typical Operation:⊕	CCS●	ICAS●●	
Values are for 2 tubes			
DC Plate Voltage	400	400	volts
DC Grid-No.1 (Control-Grid) Voltage.	-45	-45	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage⊕⊕.	90	90	volts
→ Zero-Signal DC Plate Current .	64	64	ma
Max.-Signal DC Plate Current .	140	140	ma
Effective Load Resistance (Plate to Plate)	3000	3000	ohms
Max.-Signal Driving Power (Approx.).	0	0	watts
Max.-Signal Power Output (Approx.).	15	15	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance:○○

With fixed bias.	0.1 max.	megohm
With cathode bias.	0.5 max.	megohm

AF POWER AMPLIFIER & MODULATOR - Class AB_1◆

Maximum Ratings, *Absolute Values*:

	CCS●	ICAS●●	
DC PLATE VOLTAGE	600 max.	750 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE.	300 max.	300 max.	volts
MAX.-SIGNAL DC PLATE CURRENT*.	120 max.	120 max.	ma
MAX.-SIGNAL DC PLATE INPUT*. .	60 max.	90 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT* .	3.5 max.	3.5 max.	watts
PLATE DISSIPATION*	25 max.	30 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	135 max.	135 max.	volts
Heater positive with respect to cathode	135 max.	135 max.	volts

◆ Subscript 1 indicates that grid-No.1 current does not flow during any part of the input cycle.

⊕ In class AB_1 service, the normal design limitation is the requirement that grid-No.1 current should not flow. For this reason, the typical operating values shown for both CCS and ICAS conditions are the same.

⊕⊕ The driver stage should be capable of supplying the No.1 grids of the class AB_1 stage with the specified driving voltage at low distortion.

●, ●●, *, ○○: See next page. →Indicates a change.

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BEAM POWER TUBE

Typical Operation:	*CCS*●			*ICAS*●●	
	Values are for 2 tubes				
DC Plate Voltage	400	500	600	750	volts
DC Grid-No.2 Voltage** .	300	300	300	300	volts
DC Grid-No.1 (Control-Grid) Voltage:					
From fixed-bias source	-30	-32	-34	-35	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage. . .	60	64	68	70	volts
Zero-Signal DC Plate Current.	56	44	36	30	ma
Max.-Signal DC Plate Current.	143	141	139	139	ma
Zero-Signal DC Grid-No.2 Current. . .	2	1	0.6	0.5	ma
Max.-Signal DC Grid-No.2 Current. . .	16	15	15	16	ma
Effective Load Resistance (Plate to plate) . . .	6800	8200	10000	12000	ohms
Max.-Signal Driving Power (Approx.). . . .	0	0	0	0•	watts
Max.-Signal Power Output (Approx.) . . .	36	46	56	72	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance:○○

With fixed bias.	0.1 max. megohm
With cathode bias.	Not recommended

AF POWER AMPLIFIER & MODULATOR - Class AB_2#

Maximum Ratings, *Absolute Values*:

	CCS●	*ICAS*●●	
DC PLATE VOLTAGE	600 max.	750 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE.	300 max.	300 max.	volts
MAX.-SIGNAL DC PLATE CURRENT*.	120 max.	120 max.	ma
MAX.-SIGNAL PLATE INPUT* . . .	60 max.	90 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT* .	3.5 max.	3.5 max.	watts
PLATE DISSIPATION*	25 max.	30 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	135 max.	135 max.	volts
Heater positive with respect to cathode	135 max.	135 max.	volts

\# Subscript 2 indicates that the grid-No.1 current flows during some part of the input cycle.

* Averaged over any audio-frequency cycle of sine-wave form.

●, ●●, **, ○○: See next page.

←Indicates a change.

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BEAM POWER TUBE

Typical Operation:	CCS●			ICAS●●	
Values are for 2 tubes					
DC Plate Voltage	400	500	600	750	volts
DC Grid-No.2 Voltage**	300	300	300	300	volts
DC Grid-No.1 (Control-Grid) Voltage:					
From fixed-bias source	-28	-30	-32	-35	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage	80	86	90	96	volts
Zero-Signal DC Plate Current	72	60	48	30	ma
Max.-Signal DC Plate Current	240	240	200	240	ma
Zero-Signal DC Grid-No.2 Current	2	0.9	0.7	0.5	ma
Max.-Signal DC Grid-No.2 Current	20	20	18	20	ma
Effective Load Resistance (Plate to plate)	3700	4600	6900	7300	ohms
Max.-Signal Driving Power (Approx.)◆◆	0.2	0.2	0.1	0.2	watt
Max.-Signal Power Output (Approx.)▲	55	75	80	120	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance:○○

With fixed bias	30000 max.	ohms
With cathode bias	Not recommended	

RF POWER AMPLIFIER-Class B Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values*:

	CCS●	ICAS●●	
DC PLATE VOLTAGE	600 max.	750 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	300 max.	300 max.	volts
DC PLATE CURRENT	80 max.	90 max.	ma
PLATE INPUT	37.5 max.	45 max.	watts
GRID-No.2 INPUT	2.5 max.	2.5 max.	watts

** Preferably obtained from a separate source, or from the plate-voltage supply with a voltage divider.

◆◆ Driver stage should be capable of supplying the specified driving power at low distortion to the No.1 grids of the class AB_2 stage. The effective resistance per grid-No.1 circuit of the class AB_2 stage should be kept below 500 ohms and the effective impedance should not exceed 700 ohms at the highest response frequency.

▲ With zero-impedance driver and perfect regulation, plate-circuit distortion does not exceed 2%. In practice, the regulation of the plate-voltage, grid-No.2 voltage, and grid-No.1 voltage should not be greater than 5%, 5%, and 3%, respectively.

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

RCA

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BEAM POWER TUBE

				CCS●	ICAS●●	
PLATE DISSIPATION.				25 max.	30 max.	watts
PEAK HEATER-CATHODE VOLTAGE:						
Heater negative with respect to cathode				135 max.	135 max.	volts
Heater positive with respect to cathode				135 max.	135 max.	volts
Typical Operation:						
DC Plate Voltage	400	500	600	750		volts
DC Grid-No.2 Voltage . .	300	300	300	300		volts
DC Grid-No.1 (Control-Grid) Voltage♦	-40	-40	-40	-40		volts
Peak RF Grid-No.1 Voltage	40	38	36	35		volts
DC Plate Current	75	70	62.5	60		ma
DC Grid-No.2 Current . .	5	4	4	3		ma
DC Grid-No.1 Current (Approx.).	0	0	0	0		ma
Driving Power (Approx.)□	0.4	0.3	0.2	0.2		watt
Power Output (Approx.)	9	11	12.5	15		watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance∞ . . . . . 30000 max. ohms

PLATE-MODULATED RF POWER AMPLIFIER - Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values*:

	CCS●	ICAS●●	
DC PLATE VOLTAGE	475 max.	600 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE.	300 max.	300 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE.	-200 max.	-200 max.	volts
DC PLATE CURRENT	83 max.	100 max.	ma
DC GRID-No.1 CURRENT	5 max.	5 max.	ma
PLATE INPUT.	40 max.	60 max.	watts
GRID-No.2 INPUT.	2.5 max.	2.5 max.	watts
PLATE DISSIPATION.	16.5 max.	25 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	135 max.	135 max.	volts
Heater positive with respect to cathode	135 max.	135 max.	volts

♦ Use of a fixed supply or bypassed cathode resistor is recommended.

□ At crest of audio-frequency cycle with a modulation factor of 1.0.

∞ The type of input coupling network used should not introduce too much resistance in the grid-No.1 circuit. Transformer- or impedance-coupling devices are recommended.

●, ●●: See next page.

←Indicates a change.

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BEAM POWER TUBE

Typical Operation:	*CCS*●			*ICAS*●●	
DC Plate Voltage . . .	325	400	475	600	volts
DC Grid-No.2 Voltage▲▲	250	250	250	300	volts
From a series resistor of . . .	12500	25000	28000	37500	ohms
DC Grid-No.1 Voltage††	−75	−75	−85	−85	volts
From a grid-No.1 resistor of . . .	21400	21400	21200	21200	ohms
Peak RF Grid-No.1 Voltage	95	95	108	107	volts
DC Plate Current . . .	80	80	83	100	ma
DC Grid-No.2 Current .	6	6	8	8	ma
DC Grid-No.1 Current (Approx.)	3.5	3.5	4	4	ma
Driving Power (Approx.)	0.3	0.3	0.4	0.4	watt
Power Output (Approx.)	17	22	28	44	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance■ . . . . . 30000 max. ohms

RF POWER AMPLIFIER & OSCILLATOR-Class C Telegraphy■ and RF POWER AMPLIFIER-Class C FM Telephony

Maximum Ratings, *Absolute Values*:

	CCS●	*ICAS*●●	
DC PLATE VOLTAGE	600 max.	750 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE .	300 max.	300 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	−200 max.	−200 max.	volts
DC PLATE CURRENT	100 max.	100 max.	ma
DC GRID-No.1 CURRENT	5 max.	5 max.	ma
PLATE INPUT.	60 max.	75 max.	watts
GRID-No.2 INPUT.	3.5 max.	3.5 max.	watts
PLATE DISSIPATION.	25 max.	30 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	135 max.	135 max.	volts
Heater positive with respect to cathode	135 max.	135 max.	volts

▲▲ Obtained preferably from a separate source modulated along with the plate supply, or from the modulated plate supply through a series resistor as indicated.

†† Obtained from a grid-No.1 resistor as indicated, or from a combination of grid-No.1 resistor with either fixed supply or cathode resistor.

■ Key-down conditions per tube without amplitude modulation. Amplitude modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

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

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BEAM POWER TUBE

Typical Operation:	CCS●			ICAS●●	
DC Plate Voltage . . .	400	500	600	750	volts
DC Grid-No.2 Voltage■■	250	250	250	250	volts
From a series resistor of. . . .	19000	31000	44000	62000	ohms
DC Grid-No.1 Voltage□□	−45	−45	−45	−45	volts
From a grid-No.1 resistor of. . . .	11200	11200	11200	11200	ohms
From a cathode resistor of. . . .	400	400	400	400	ohms
Peak RF Grid-No.1 Voltage.	65	65	65	65	volts
DC Plate Current . . .	100	100	100	100	ma
DC Grid-No.2 Current .	8	8	8	8	ma
DC Grid-No.1 Current (Approx.).	4	4	4	4	ma
Driving Power (Approx.).	0.3	0.3	0.3	0.3	watt
Power Output (Approx.)	25	32	40	54	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance●. . . . . 30000 max. ohms

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Heater Current	1	0.81	0.99	amp
Direct Interelectrode Capacitances:				
Grid No.1 to plate	2	–	0.2	μμf
Grid No.1 to cathode & grid No.3, grid No.2, and heater	–	10	14	μμf
Plate to cathode & grid No.3, grid No.2, and heater	–	5.3	8.7	μμf
Plate Current (1).	1,3	24	48	ma
Plate Current (2).	1,4	–	0.5	ma
Grid-No.2 Current.	1,3	–	4	ma
Power Output	1,5	33	–	watts

Note 1: Heater voltage = 6.3 volts.

Note 2: With external shield JETEC No.312.

Note 3: With dc plate voltage of 600 volts, dc grid-No.2 voltage of 300 volts, and dc grid-No.1 voltage of −29 volts.

Note 4: With dc plate voltage of 600 volts, dc grid-No.2 voltage of 300 volts, and dc grid-No.1 voltage of −100 volts.

Note 5: With dc plate voltage of 600 volts, dc grid-No.2 voltage of 200 volts, dc plate current of 100 ma. max., grid-No.1 current of 5 to 7 ma., grid-No.1 resistor of 10000 ohms ± 10%, and a frequency of 15 MC.

●, ●●, ◆, ■, □□: See next page.

←Indicates a change.

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BEAM POWER TUBE

● Continuous Commercial Service.

●● Intermittent Commercial & Amateur Service.

● When grid No.1 is driven positive, the total dc grid-No.1-circuit resistance should not exceed 30000 ohms. If this value is insufficient to provide adequate bias, the additional required bias must be supplied by a cathode resistor or fixed supply.

■■ Obtained from a separate source, from the plate-voltage supply with a voltage divider, or through a series resistor as indicated. A series grid-No.2 resistor should be employed only when the 807 is used in a circuit which is not keyed. Grid-No.2 voltage must not exceed 400 volts under key-up conditions.

□□ Obtained from fixed supply, by grid-No.1 resistor as indicated, by cathode resistor as indicated, or by combination methods.

Data on Operating Frequencies for the 807 are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY.

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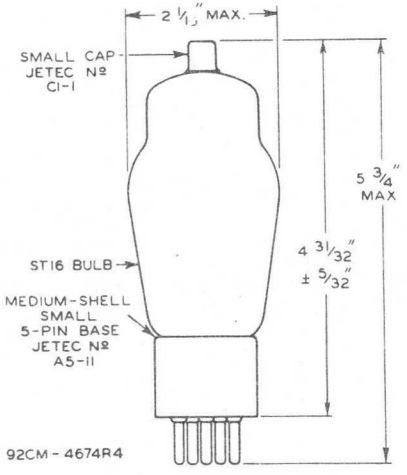
BEAM POWER TUBE



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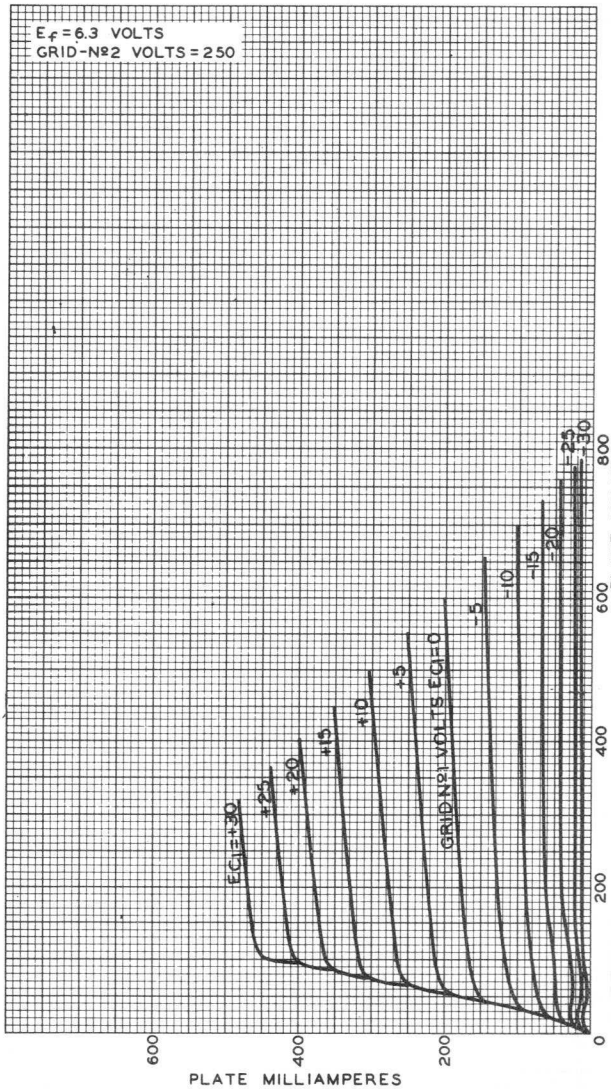
AVERAGE PLATE CHARACTERISTICS



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92CM-4676R3

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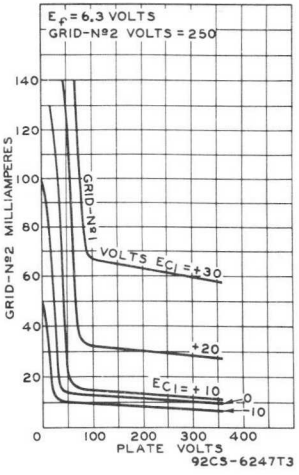
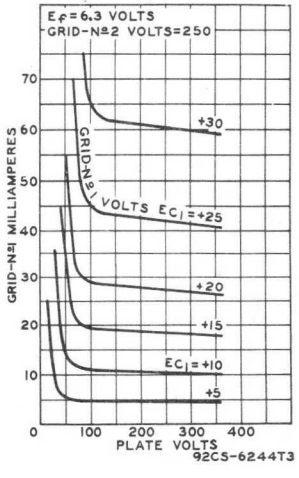
AVERAGE CHARACTERISTICS





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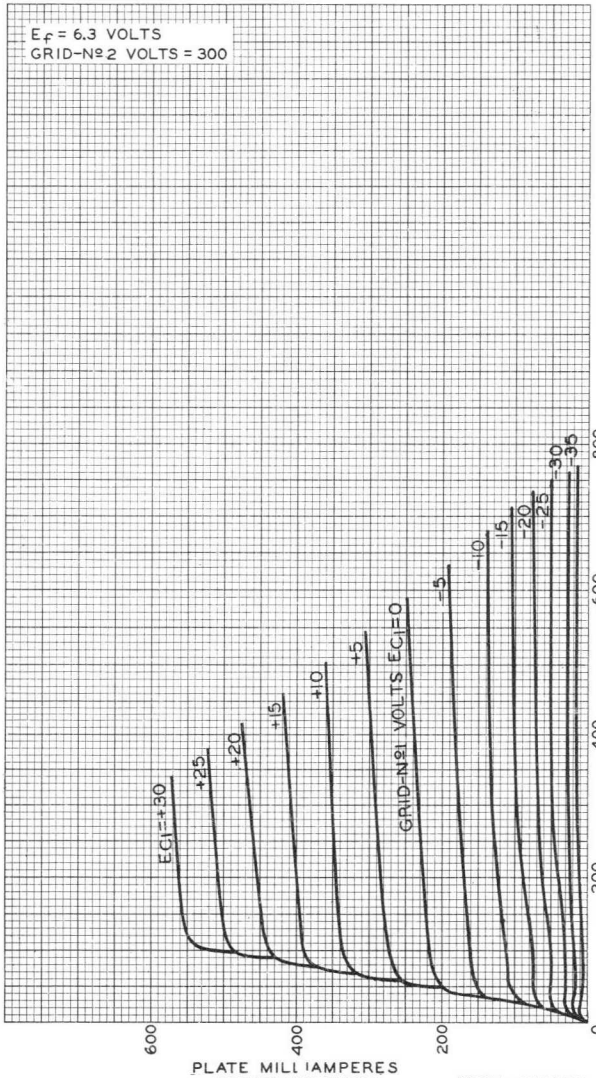
AVERAGE PLATE CHARACTERISTICS



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92CM-4682R3

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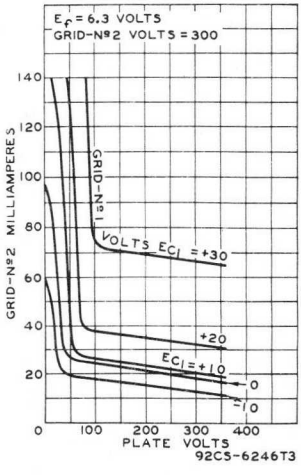
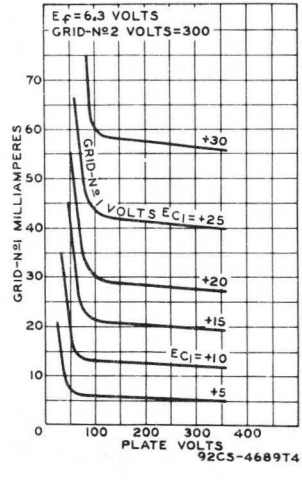
AVERAGE CHARACTERISTICS





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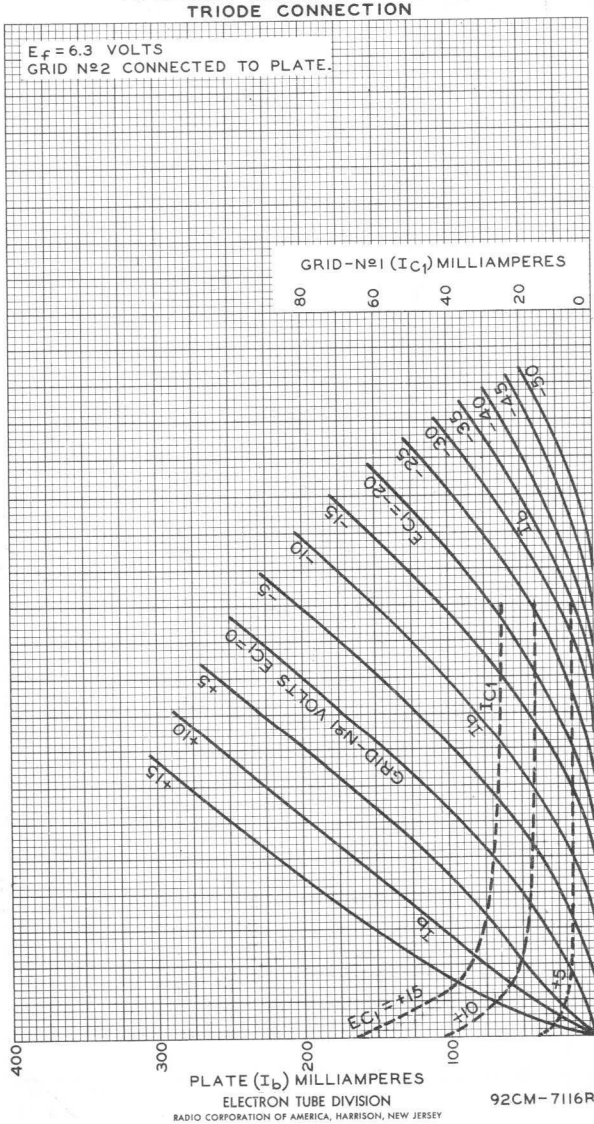
AVERAGE CHARACTERISTICS
TRIODE CONNECTION



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92CM-7116R1

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TRANSMITTING TRIODE

GENERAL DATA

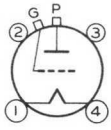
Electrical:

Filament, Thoriated Tungsten:		
Voltage	7.5	. . . ac or dc volts
Current	4.0	. . . . . amp
Amplification Factor	47	
Direct Interelectrode Capacitances:		
Grid to Plate	2.8	. . . . . μμf
Grid to Filament	5.3	. . . . . μμf
Plate to Filament	0.25	. . . . . μμf ←

Mechanical:

Mounting Position	Vertical only, Base down
Overall Length	5-7/8" ± 3/16"
Seated Length	5-1/4" ± 3/16"
Maximum Diameter	2-13/16"
Bulb	G-22
Cap (top)	Medium
Cap (side)	Small
Base	Medium-Shell Small 4-Pin, Bayonet
Basing Designation for BOTTOM VIEW	$2D_1$

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



Pin 4 – Filament
P – Plate (Top)
G – Grid (Side)

AF POWER AMPLIFIER & MODULATOR – Class B

Maximum Ratings, *Absolute Values*:

	CCS●	ICAS●●	
DC PLATE VOLTAGE	1500 max.	2000 max.	volts
MAX.-SIGNAL DC PLATE CUR.*	150 max.	150 max.	ma.
MAX.-SIGNAL PLATE INPUT*	150 max.	225 max.	watts
PLATE DISSIPATION*	50 max.	75 max.	watts

Typical Operation:

Values are for 2 tubes				
DC Plate Voltage	1250	1500	2000	volts
DC Grid Voltage#	-16.5	-22.5	-36	volts
Peak AF Grid-to-Grid Volt.	245	215	270	volts
Zero-Signal DC Plate Cur.	40	30	40	ma.
Max.-Signal DC Plate Cur.	230	190	220	ma.
Effective Load Resistance (plate-to-plate)	12700	18300	21400	ohms
Max.-Signal Driving Power (Approx.)	7.8	4.8	8.8	watts

← Indicates a change.

* Averaged over any audio-frequency cycle of sine-wave form.

●, ●●, #: See next page.

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TRANSMITTING TRIODE

Max.-Signal Power Output (Approx.). . . .	190	185	300 . .	watts

* *For ac filament supply.*

PLATE-MODULATED RF POWER AMPLIFIER – Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values:*

	CCS●	ICAS●●	
DC PLATE VOLTAGE.	1250 max.	1600 max.	volts
DC GRID VOLTAGE	-400 max.	-400 max.	volts
DC PLATE CURRENT.	125 max.	125 max.	ma.
DC GRID CURRENT	35 max.	40 max.	ma.
PLATE INPUT	135 max.	200 max.	watts
PLATE DISSIPATION	35 max.	50 max.	watts

Typical Operation:

DC Plate Voltage.	1000	1250	1600 . .	volts
DC Grid Voltage⊕.	-135	-150	-170 . .	volts
	3900	5000	4600 . .	ohms
Peak RF Grid Voltage. . .	270	270	300 . .	volts
DC Plate Current.	120	100	125 . .	ma.
DC Grid Current (Approx.)□	35	30	37 . .	ma.
Driving Power (Approx.)□.	9	7.5	10 . .	watts
Power Output (Approx.). .	90	95	150 . .	watts

⊕ Obtained by grid resistor of value shown or by partial self-bias methods.

RF POWER AMPLIFIER & OSCILLATOR – Class C Telegraphy

Key-down conditions per tube without modulation□□

Maximum Ratings, *Absolute Values:*

	CCS●	ICAS●●	
DC PLATE VOLTAGE.	1500 max.	2000 max.	volts
DC GRID VOLTAGE	-400 max.	-400 max.	volts
DC PLATE CURRENT.	150 max.	150 max.	ma.
DC GRID CURRENT	35 max.	40 max.	ma.
PLATE INPUT	200 max.	300 max.	watts
PLATE DISSIPATION	50 max.	75 max.	watts

Typical Operation:

DC Plate Voltage.	1250	1500	2000 . .	volts
DC Grid Voltage Δ	-150	-150	-150 . .	volts
	4300	4300	4200 . .	ohms
	880	940	800 . .	ohms
Peak RF Grid Voltage. . .	290	300	280 . .	volts
DC Plate Current.	135	125	150 . .	ma.
DC Grid Current (Approx.)□	35	35	36 . .	ma.
Driving Power (Approx.)□	9	9.5	9 . .	watts
Power Output (Approx.). .	125	140	225 . .	watts

←Indicates a change.

●, ●●, □, □□, Δ: See next page.

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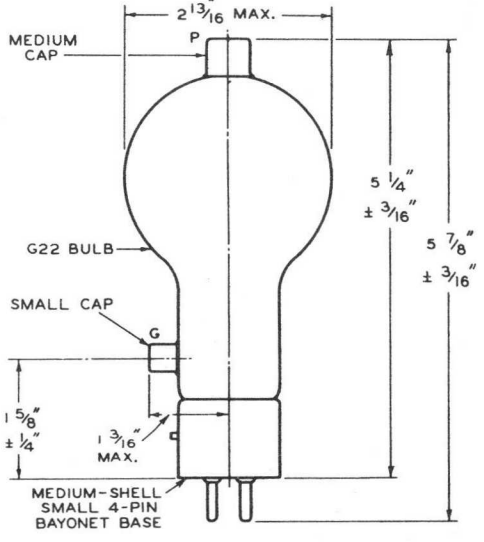
TRANSMITTING TRIODE

- ● Continuous Commercial Service.
- ●● Intermittent Commercial and Amateur Service.
- □ Subject to wide variations as explained on sheet TUBE RATINGS in General Section.
- □□ Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.
- Δ Obtained from fixed supply, by grid resistor (4300, 4300, 4200) or by cathode resistor (880, 940, 800).

NOTE: When the 808 is used in the final amplifier or a preceding stage of a transmitter designed for break-in operation and oscillator keying, a small amount of fixed-bias must be used to maintain plate current at a safe value. With a plate voltage of 2000 volts, a fixed bias of at least −30 volts should be used.

Data on operating frequencies for the 808 are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY



THE PLANE THROUGH THE TUBE AXIS AND CENTER OF GRID CAP MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND CENTER OF BAYONET PIN BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF 10°.

92CM-4677R3

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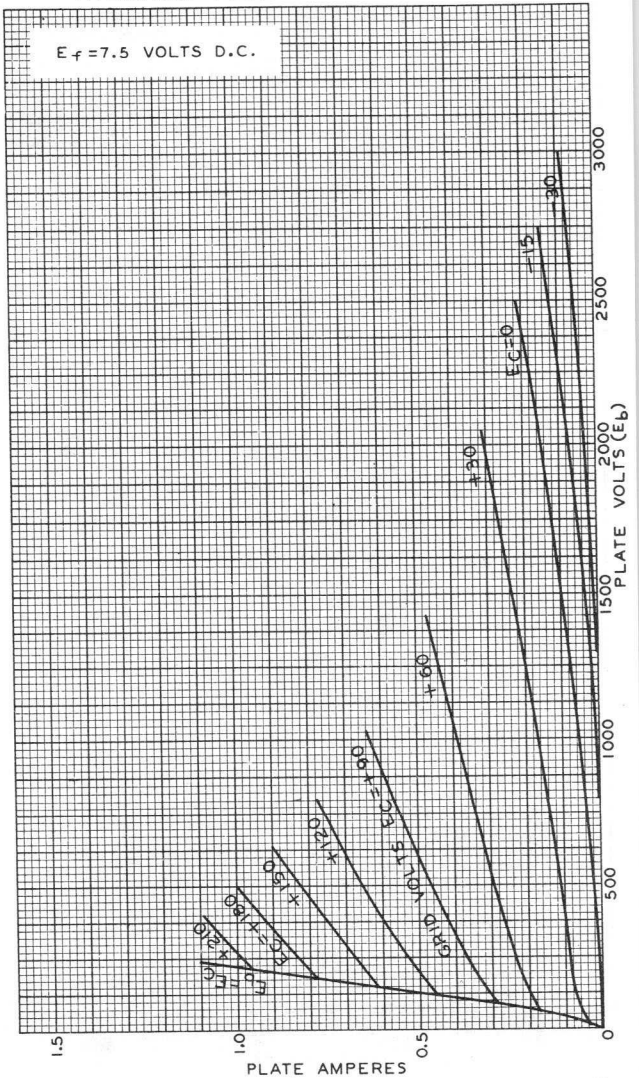
AVERAGE PLATE CHARACTERISTICS



OCT. 26, 1936

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-4678

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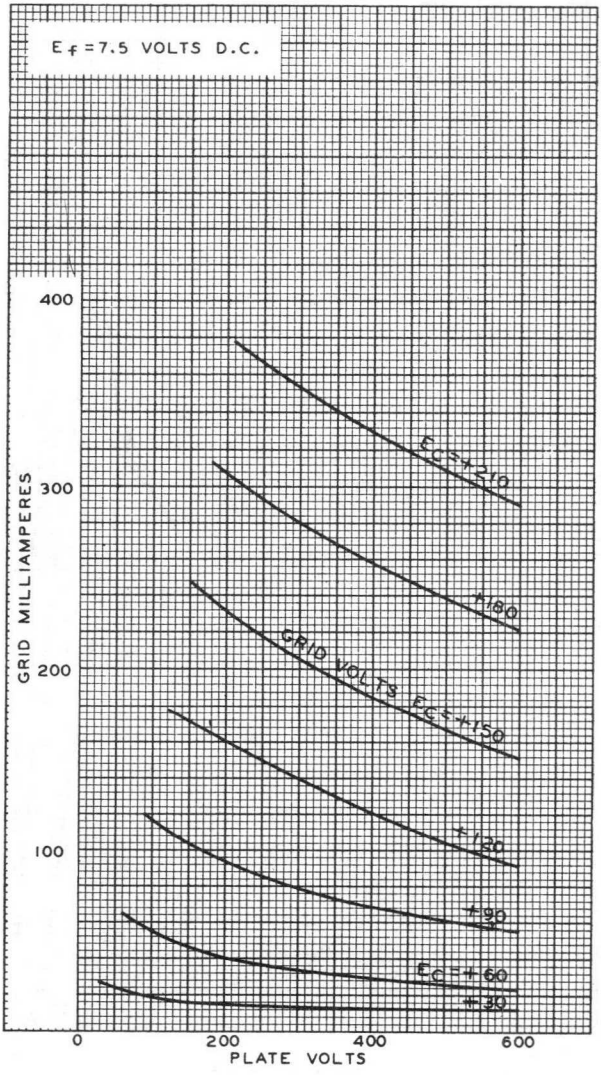
TYPICAL CHARACTERISTICS



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TRANSMITTING TRIODE

GENERAL DATA

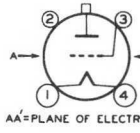
Electrical:

Filament, Thoriated Tungsten:		
Voltage	6.3	ac or dc volts
Current	2.5	amp
Amplification Factor	50	
Direct Interelectrode Capacitances:		
Grid to Plate	6.7	μμf
Grid to Filament	5.7	μμf
Plate to Filament	0.9	μμf

Mechanical:

Mounting Position	Vertical, base down; or Horizontal, pins 1 & 4 in vertical plane
Overall Length	6-13/32" ± 5/32"
Seated Length	5-25/32" ± 5/32"
Maximum Diameter	2-7/16"
Bulb	ST-19
Cap	Medium
Base	Medium-Shell Small 4-Pin Micanol, Bayonet
Basing Designation for BOTTOM VIEW	3G

Pin 1 – Filament
Pin 2 – No Connection



AA'=PLANE OF ELECTRODES

Pin 3 – Grid
Pin 4 – Filament
Cap – Plate

AF POWER AMPLIFIER & MODULATOR – Class B

Maximum Ratings, *Absolute Values*:

	CCS●	*ICAS*●●	
DC PLATE VOLTAGE	750 max.	1000 max.	volts
MAX.-SIGNAL DC PLATE CUR.*	125 max.	125 max.	ma. ←
MAX.-SIGNAL PLATE INPUT*	75 max.	100 max.	watts
PLATE DISSIPATION*	25 max.	30 max.	watts

Typical Operation: ←

Unless otherwise specified, values are for 2 tubes

DC Plate Voltage	750	700	1000 volts
DC Grid Voltage#	-4.5	0	-9 volts
Peak AF Grid-to-Grid Voltage	145	160	155 volts
Zero-Signal DC Plate Current	40	70	40 ma.
Max.-Signal DC Plate Current	200	250	200 ma.
Effective Load Resistance (plate-to-plate)	8400	6200	11600 ohms

*, ●, ●●, #: See next page. ← Indicates a change.

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TRANSMITTING TRIODE

Max.-Signal Driving Power (Approx.) . . .	2.5 . .	3.4	2.7	watts
Max.-Signal Power Output (Approx.) . . .	105 . .	120	145	watts

RF POWER AMPLIFIER – Class B Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values*:

	CCS●	*ICAS*●●	
DC PLATE VOLTAGE	750 max.	1000 max.	volts
DC PLATE CURRENT	50 max.	60 max.	ma.
PLATE INPUT.	37.5 max.	45 max.	watts
PLATE DISSIPATION.	25 max.	30 max.	watts

Typical Operation:

DC Plate Voltage	500	750	1000 . .	volts
DC Grid Voltage#	-5	-10	-30 . .	volts
Peak RF Grid Voltage . .	35	40	60 . .	volts
DC Plate Current	50	50	45 . .	ma.
DC Grid Current (Approx.)□	6	5	4 . .	ma.
Driving Power (Approx.)□▲	1.4	1.4	1.5 . .	watts
Power Output (Approx.) .	7.5	12.5	15 . .	watts

PLATE-MODULATED RF POWER AMPLIFIER – Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values*:

	CCS●	*ICAS*●●	
DC PLATE VOLTAGE	600 max.	750 max.	volts
DC GRID VOLTAGE.	-200 max.	-200 max.	volts
DC PLATE CURRENT	83 max.	100 max.	ma.
DC GRID CURRENT.	35 max.	35 max.	ma.
PLATE INPUT.	50 max.	75 max.	watts
PLATE DISSIPATION.	17.5 max.	25 max.	watts

Typical Operation:

DC Plate Voltage	500	600	750 . .	volts
DC Grid Voltage⊕	-60	-60	-60 . .	volts
	2000	2000	2000 . .	ohms
Peak RF Grid Voltage . .	135	135	150 . .	volts
DC Plate Current	83	83	100 . .	ma.
DC Grid Current (Approx.)□	32	32	32 . .	ma.
Driving Power (Approx.)□	3.2	3.2	4.3 . .	watts
Power Output (Approx.) .	30	38	55 . .	watts

* Averaged over any audio-frequency cycle of sine-wave form.

\# For ac filament supply.

⊕ Obtained by grid resistor of value shown or by partial self-bias methods.

●, ●●, □, ▲: See next page.

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TRANSMITTING TRIODE

RF POWER AMPLIFIER & OSCILLATOR – Class C Telegraphy

Key-down conditions per tube without modulation[□□]

Maximum Ratings, *Absolute Values*:

	CCS[●]	*ICAS*[●●]	
DC PLATE VOLTAGE	750 max.	1000 max.	volts
DC GRID VOLTAGE	−200 max.	−200 max.	volts
DC PLATE CURRENT	100 max.	100 max.	ma.
DC GRID CURRENT	35 max.	35 max.	ma.
PLATE INPUT	75 max.	100 max.	watts
PLATE DISSIPATION	25 max.	30 max.	watts

Typical Operation:

DC Plate Voltage	500	750	1000	volts
DC Grid Voltage[▲▲]	−50	−60	−75	volts
	2500	3000	3000	ohms
	420	500	600	ohms
Peak RF Grid Voltage	135	140	160	volts
DC Plate Current	100	100	100	ma.
DC Grid Current (Approx.)[□]	20	20	25	ma.
Driving Power (Approx.)[□]	2.5	2.5	3.8	watts
Power Output (Approx.)	35	55	75	watts

● Continuous Commercial Service.

●● Intermittent Commercial and Amateur Service.

□ Subject to wide variations as explained on sheet TUBE RATINGS in General Section.

▲ At crest of audio-frequency cycle of sine-wave form.

□□ Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

▲▲ Obtained from fixed supply, by grid resistor (2500, 3000, 3000) or by cathode resistor (420,500,600).

NOTE: When the 809 is used in the final amplifier or a preceding stage of a transmitter designed for break-in operation and oscillator keying, a small amount of fixed-bias must be used to maintain the plate current at a safe value. With a plate voltage of 1000 volts, a fixed bias of at least −10 volts should be used.

Data on operating frequencies for the 809 are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY

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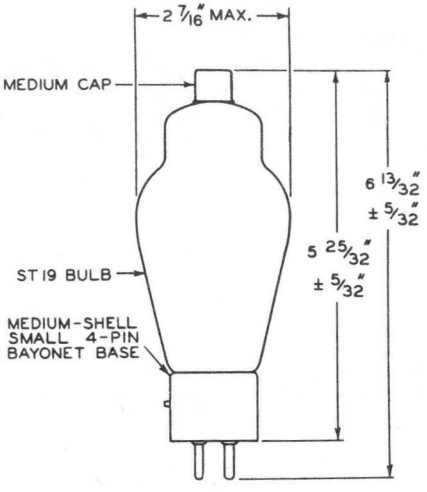
TRANSMITTING TRIODE



92CM-4835R1

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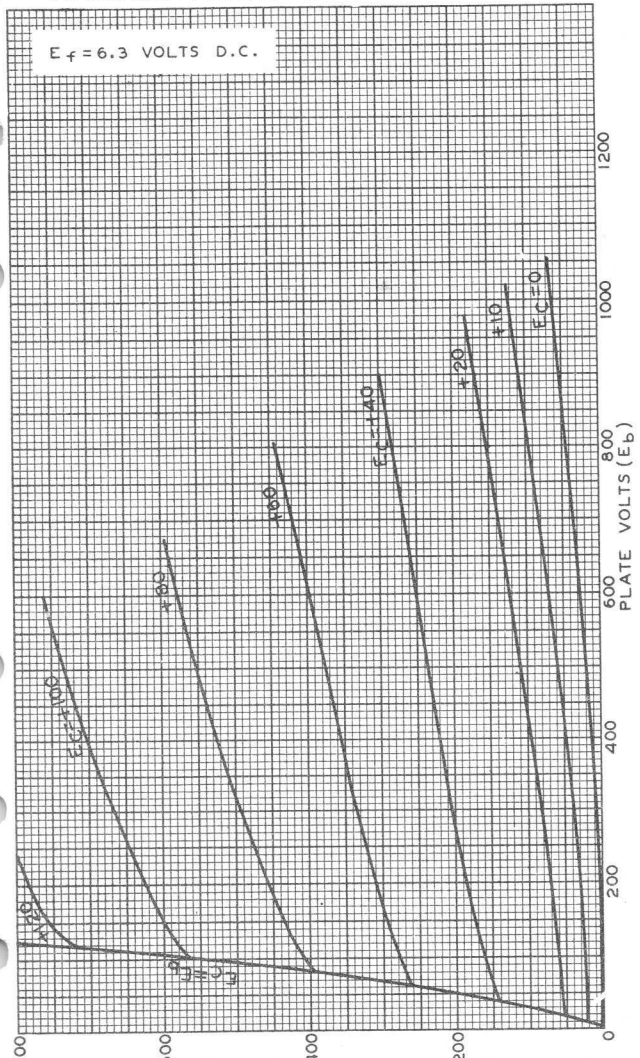
AVERAGE PLATE CHARACTERISTICS



OCT. 11, 1937

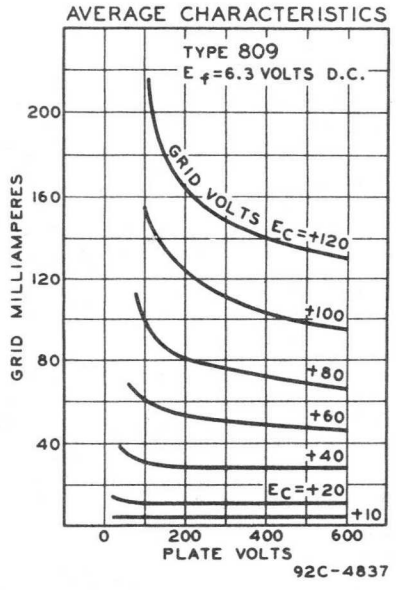
TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-4836

809

TRANSMITTING TRIODE



810

TRANSMITTING TRIODE

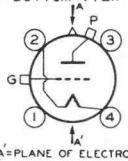
GENERAL DATA

Electrical:

Filament, Thoriated Tungsten:		
Voltage	10	ac or dc volts
Current	4.5	amp
Amplification Factor	36	
Direct Interelectrode Capacitances:		
Grid to Plate	4.8	μμf
Grid to Filament	8.7	μμf
Plate to Filament	12	μμf

Mechanical:

Mounting Position	Vertical, base down; or Horizontal, pins 1 & 2 in vertical plane
Overall Length	8-1/2" ± 1/4"
Seated Length	8-3/16" ± 1/4"
Maximum Radius	2-1/8" ± 1/8"
Bulb	T-20
Cap (top)	Skirted Medium
Cap (side)	Medium
Base	Medium Metal-Shell Jumbo 4-Pin, Bayonet
Basing Designation for BOTTOM VIEW	20_1



Pin 1 – No Connection
Pin 2 – Filament
Pin 3 – No Connection
Pin 4 – Filament
P – Plate (End Cap)
G – Grid (Side Cap)

AA'=PLANE OF ELECTRODES

AF POWER AMPLIFIER & MODULATOR – Class B

Maximum Ratings, *Absolute Values*:

	CCS●	ICAS●●	
DC PLATE VOLTAGE	2500 max.	2750 max.	volts
MAX.-SIGNAL DC PLATE CUR.*	250 max.	250 max.	ma.
MAX.-SIGNAL PLATE INPUT*	425 max.	510 max.	watts
PLATE DISSIPATION*	125 max.	175 max.	watts ←

Typical Operation:

Unless otherwise specified, values are for 2 tubes

DC Plate Voltage	2000	2250	volts
DC Grid Voltage#	-50	-60	volts
Peak AF Grid-to-Grid Voltage	345	380	volts
Zero-Signal DC Plate Current	60	70	ma.
Max.-Signal DC Plate Current	420	450	ma.
Effective Load Resistance (plate to plate)	11000	11600	ohms

* Averaged over any audio-frequency cycle of sine-wave form.
●, ●●, #: See next page. ← Indicates a change.

810

TRANSMITTING TRIODE

Max.-Signal Driving Power (Approx.) . .	10	. .	13	. . watts
Max.-Signal Power Output (Approx.) . .	590	. .	725	. . watts

RF POWER AMPLIFIER – Class B Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values*:

	CCS●	*ICAS*●●	
→ DC PLATE VOLTAGE	2000 max.	2500 max.	volts
DC PLATE CURRENT	185 max.	185 max.	ma.
PLATE INPUT.	185 max.	225 max.	watts
→ PLATE DISSIPATION.	125 max.	175 max.	watts

Typical Operation:

DC Plate Voltage	1500	2000	2250	. . volts
DC Grid Voltage#	−50	−65	−70	. . volts
Peak RF Grid Voltage . . .	110	100	100	. . volts
DC Plate Current	115	93	100	. . ma.
DC Grid Current (Approx.)□	2	2	2	. . ma.
Driving Power (Approx.)□▲	6	4	4	. . watts
Power Output (Approx.) . .	60	60	75	. . watts

PLATE-MODULATED RF POWER AMPLIFIER – Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values*:

	CCS●	*ICAS*●●	
→ DC PLATE VOLTAGE	1600 max.	2000 max.	volts
DC GRID VOLTAGE.	−500 max.	−500 max.	volts
DC PLATE CURRENT	210 max.	250 max.	ma.
→ DC GRID CURRENT.	70 max.	75 max.	ma.
→ PLATE INPUT.	335 max.	500 max.	watts
PLATE DISSIPATION.	85 max.	125 max.	watts

→ **Typical Operation:**

DC Plate Voltage	1250	1600	2000	. . volts
DC Grid Voltage⊕	−200	−200	−350	. . volts
	4000	4000	5000	. . ohms
Peak RF Grid Voltage . . .	370	370	550	. . volts
DC Plate Current	210	210	250	. . ma.
DC Grid Current (Approx.)□	50	50	70	. . ma.
Driving Power (Approx.)□ .	17	17	35	. . watts
Power Output (Approx.) . .	180	250	380	. . watts

For ac filament supply.

⊕ Obtained by grid resistor of value shown or by partial self-bias methods.

●, ●●, □, ▲: See next page.

← indicates a change.

810
TRANSMITTING TRIODE

RF POWER AMPLIFIER & OSCILLATOR – Class C Telegraphy

Key-down conditions per tube without modulation □□

Maximum Ratings, *Absolute Values*:

	CCS●	ICAS●●	
DC PLATE VOLTAGE	2000 max.	2500 max.	volts
DC GRID VOLTAGE	-500 max.	-500 max.	volts
DC PLATE CURRENT	250 max.	300 max.	ma.
DC GRID CURRENT	70 max.	75 max.	ma.
PLATE INPUT	500 max.	750 max.	watts
PLATE DISSIPATION	125 max.	175 max.	watts

Typical Operation:

DC Plate Voltage	1500	2000	2500	volts
DC Grid Voltage▲▲	-120	-160	-180	volts
	3000	4000	3000	ohms
	415	550	500	ohms
Peak RF Grid Voltage	280	330	350	volts
DC Plate Current	250	250	300	ma.
DC Grid Current (Approx.)□	40	40	60	ma.
Driving Power (Approx.)□	10	12	19	watts
Power Output (Approx.)	275	375	575	watts

● Continuous Commercial Service.

●● Intermittent Commercial and Amateur Service.

□ Subject to wide variations as explained on sheet TUBE RATINGS in General Section.

▲ At crest of audio-frequency cycle with modulation factor of 1.0.

□□ Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

▲▲ Obtained from fixed supply, by grid resistor (3000, 4000, 3000), or by cathode resistor (415, 550, 500).

NOTE: When the 810 is used in the final amplifier or a preceding stage of a transmitter designed for break-in operation and oscillator keying, a small amount of fixed-bias must be used to maintain the plate current at a safe value. With a plate voltage of 2500 volts, a fixed bias of at least -40 volts should be used.

Data on operating frequencies for the 810 are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY

← Indicates a change.

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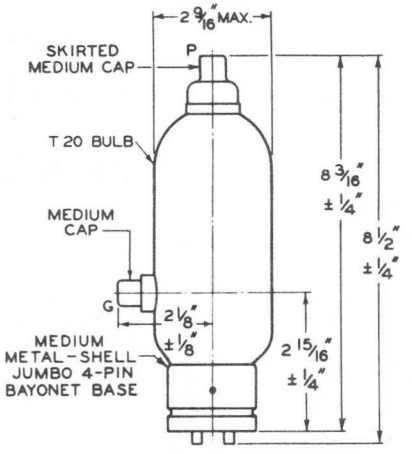
TRANSMITTING TRIODE



92CM-4965RI

RCA

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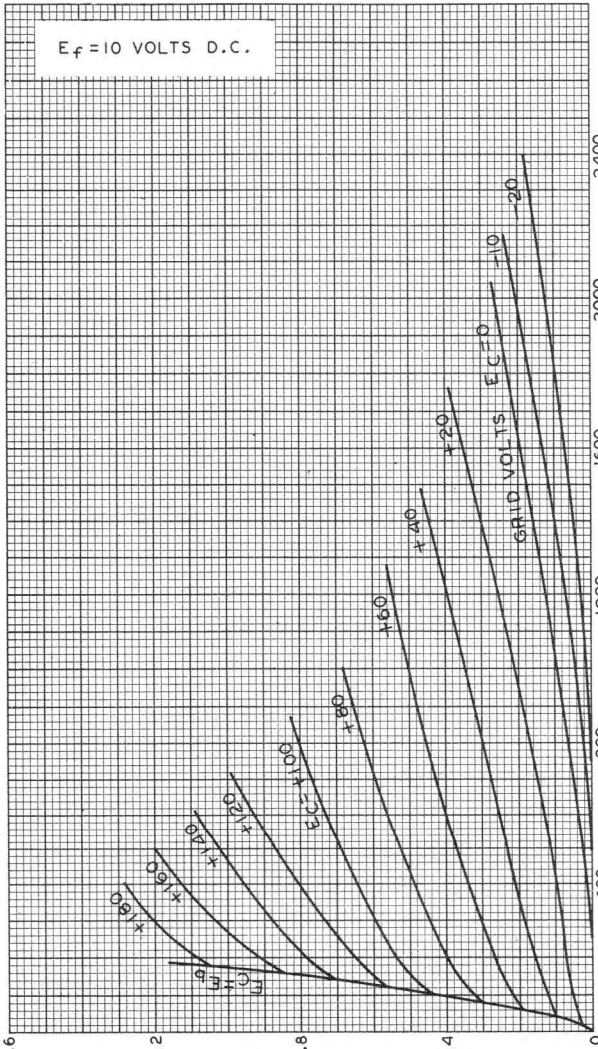
AVERAGE PLATE CHARACTERISTICS



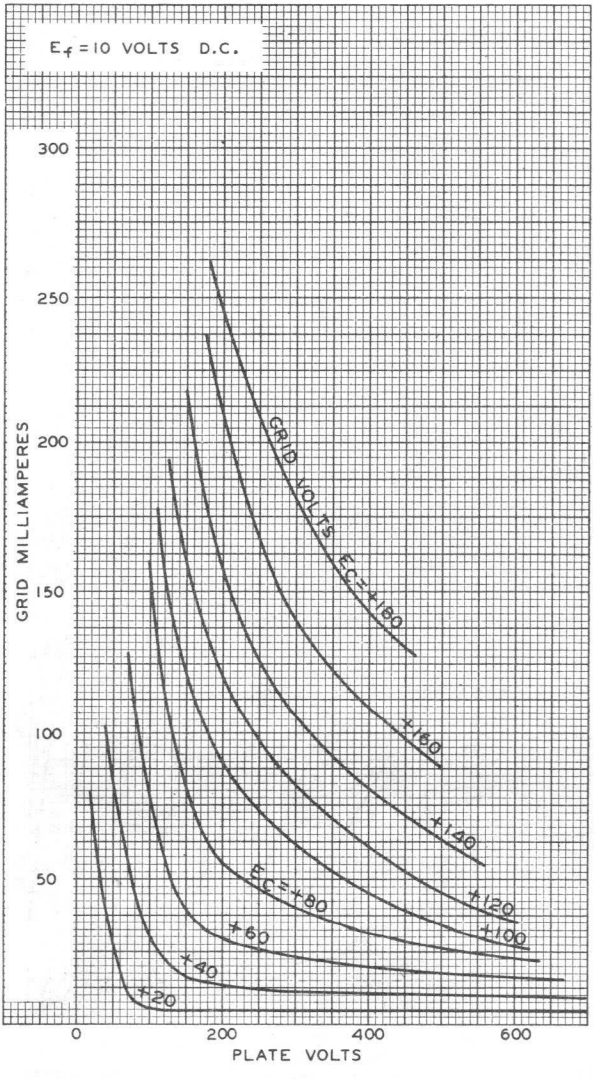
OCT. 13, 1938

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC.

92C—4981

810

TYPICAL CHARACTERISTICS



BEAM POWER TUBE

DATA

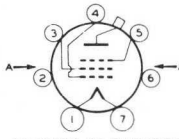
Electrical:

Filament, Thoriated Tungsten:		
Voltage	10.0 ± 5%	ac or dc volts
Current at 10.0 volts	5.0	amp
Transconductance (Approx.), for plate volts = 2000, grid-No.2 volts = 400, and plate current = 50 ma	3750	μmhos
Mu-Factor, grid No.2 to grid No.1, for plate volts = 2000, grid-No.2 volts = 400, and plate current = 50 ma	8.5	
Direct Interelectrode Capacitances:[o]		
Grid No.1 to plate	0.25 max.	μμf
Grid No.1 to filament, grid No.2, and grid No.3	16.3	μμf
Plate to filament, grid No.2, and grid No.3	14	μμf

Mechanical:

Mounting Position:	
Vertical	Base up or down
Horizontal	Pins 2 and 6 in vertical plane
Maximum Overall Length	7-1/2"
Seated Length	6-5/8" ± 1/4"
Maximum Diameter	2-9/16"
Weight (Approx.)	8 oz
Bulb	T-20
Cap	Medium (JETEC No.C1-5)
Base	Medium-Metal-Shell Giant 7-Pin with Bayonet (JETEC No.A7-17)
Basing Designation for BOTTOM VIEW	5BA

Pin 1 – Filament
Pin 2 – No Connection
Pin 3 – Grid No.2
Pin 4 – Grid No.1



Pin 5 – Grid No.3, Int. Shield
Pin 6 – No Connection
Pin 7 – Filament Cap – Plate

AA=PLANE OF ELECTRODES

AF POWER AMPLIFIER & MODULATOR - Class AB$_1$#

Maximum Ratings, *Absolute Values:*

	CCS●	ICAS●●	
DC PLATE VOLTAGE	2250 max.	2500 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	1100 max.	1100 max.	volts
MAX.-SIGNAL DC PLATE CURRENT*	180 max.	225 max.	ma
MAX.-SIGNAL PLATE INPUT*	360 max.	450 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT*	22 max.	22 max.	watts
PLATE DISSIPATION*	100 max.	125 max.	watts

[o] Without external shield and with base shell floating.

#, ●, ●●, *: See next page.

← Indicates a change.

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BEAM POWER TUBE

→ **Typical Operation:**	*CCS*●			*ICAS*●●	
Values are for 2 tubes					
DC Plate Voltage	1500	2000	2250	2500	volts
DC Grid-No.3 (Suppressor) Voltage†	0	0	0	0	volts
DC Grid-No.2 Voltage**	750	750	750	750	volts
DC Grid-No.1 (Control-Grid) Voltage:●					
From fixed-bias source	-85	-90	-95	-95	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage♦	160	160	170	180	volts
Zero-Signal DC Plate Current	50	50	50	50	ma
Max.-Signal DC Plate Current	305	265	255	290	ma
Zero-Signal DC Grid-No.2 Current	2	2	2	2	ma
Max.-Signal DC Grid-No.2 Current	45	43	53	54	ma
Effective Load Resistance (Plate to plate)	9300	16000	20000	19000	ohms
Max.-Signal Driving Power (Approx.)	0	0	0	0	watts
Max.-Signal Power Output (Approx.)	260	335	380	490	watts

→ **Maximum Circuit Values (CCS or ICAS):**

Grid-No.1-Circuit Resistance:#●

With fixed bias . . . . . 30000 max. ohms

With cathode bias . . . . . Not recommended

RF POWER AMPLIFIER - Class B Telephony

Carrier conditions per tube with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values*:

	CCS●	*ICAS*●●	
DC PLATE VOLTAGE	2000 max.	2250 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	400 max.	400 max.	volts
DC PLATE CURRENT	100 max.	125 max.	ma
PLATE INPUT	150 max.	200 max.	watts
GRID-No.2 INPUT	15 max.	20 max.	watts
PLATE DISSIPATION	100 max.	125 max.	watts

Subscript 1 indicates that grid-No.1 current does not flow during any part of the input cycle.

* Averaged over any audio-frequency cycle of sine-wave form.

** Preferably obtained from a separate source or from the plate-voltage supply with a voltage divider.

♦ The driver stage should be capable of supplying the No.1 grids of the class AB_1 stage with the specified driving voltage at low distortion.

●, ●●, †, ●, ##: See next page.

→ Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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BEAM POWER TUBE

Typical Operation:	*CCS*●		*ICAS*●●	
DC Plate Voltage	1500	2000	2250	volts
DC Grid-No.3 (Suppressor) Voltage†	0	0	0	volts
DC Grid-No.2 Voltage	400	400	400	volts
DC Grid-No.1 (Control-Grid) Voltage●♦	−60	−75	−60	volts
Peak RF Grid-No.1 Voltage	70	80	70	volts
DC Plate Current	100	75	85	ma
DC Grid-No.2 Current	4	3	3	ma
DC Grid-No.1 Current	★	★	★	ma
Driving Power□##	▲	▲	▲	watts
Power Output (Approx.)	50	50	70	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance	30000 max.	ohms

GRID-MODULATED RF POWER AMPLIFIER - Class C Telephony

Carrier conditions per tube with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values*:

	CCS●	*ICAS*●●	
DC PLATE VOLTAGE	2000 max.	2250 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	400 max.	400 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	−200 max.	−200 max.	volts
DC PLATE CURRENT	100 max.	125 max.	ma
PLATE INPUT	150 max.	200 max.	watts
GRID-No.2 INPUT	15 max.	20 max.	watts
PLATE DISSIPATION	100 max.	125 max.	watts

Typical Operation:

DC Plate Voltage	1500	2000	2250	volts
DC Grid-No.3 (Suppressor) Voltage†	0	0	0	volts
DC Grid-No.2 Voltage	400	400	400	volts
DC Grid-No.1 Voltage♦♦	−140	−120	−110	volts
Peak RF Grid-No.1 Voltage	145	120	135	volts
Peak AF Grid-No.1 Voltage	60	60	55	volts
DC Plate Current	70	75	85	ma
DC Grid-No.2 Current	3	3	2.5	ma
DC Grid-No.1 Current	★	★	★	ma
Driving Power##	□□	□□	□□	watts
Power Output (Approx.)	40	50	75	watts

The type of input coupling network used should not introduce too much resistance in the grid-No.1 circuit. Transformer or impedance coupling devices are recommended. When the 813 is operated in class AB_1 service, only fixed bias should be used.

♦ Use of a fixed supply or bypassed cathode resistor is recommended.

□ At crest of audio-frequency cycle with a modulation factor of 1.0.

▲ Never more than 2 watts.

●, ●●, †, ⊕, ★, ##, ♦♦, □□: See next page. ← indicates a change.

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BEAM POWER TUBE

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance:

With fixed bias	30000 max. ohms
With cathode bias	Not recommended

PLATE-MODULATED RF POWER AMPLIFIER - Class C Telephony

Carrier conditions per tube with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values:*

	CCS●	ICAS●●	
DC PLATE VOLTAGE	1600 max.	2000 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	400 max.	400 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-300 max.	-300 max.	volts
DC PLATE CURRENT	150 max.	200 max.	ma
DC GRID-No.1 CURRENT	25 max.	30 max.	ma
PLATE INPUT	240 max.	400 max.	watts
GRID-No.2 INPUT	15 max.	20 max.	watts
PLATE DISSIPATION	67 max.	100 max.	watts

Typical Operation:

DC Plate Voltage	1250	1600	2000	volts
DC Grid-No.3 (Suppressor) Voltage†	0	0	0	volts
DC Grid-No.2 Voltage▲▲	300	300	350	volts
From a series resistor of	27000	43000	41000	ohms
DC Grid-No.1 Voltage††	-160	-160	-175	volts
From a grid resistor of	12500	13500	11000	ohms
Peak RF Grid-No.1 Voltage	250	250	300	volts
DC Plate Current	150	150	200	ma
DC Grid-No.2 Current	35	30	40	ma
DC Grid-No.1 Current (Approx.)	13	12	16	ma
Driving Power (Approx.)■■	2.9	2.7	4.3	watts
Power Output (Approx.)	140	180	300	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance	30000 max. ohms

★ Usually negligible.

●● Obtained from fixed supply, or cathode resistor unbypassed for audio frequencies.

□□ RF driving power is never more than 2 watts. AF power is usually not more than 1 watt.

▲▲ Obtained from a separate source modulated along with the plate supply, or from the modulated plate supply through a series resistor of the value shown for each operating condition.

●, ●●, †, ⊕, ■■, ††: See next page. → Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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BEAM POWER TUBE

RF POWER AMPLIFIER & OSCILLATOR - Class C Telegraphy

Key-down conditions per tube without amplitude modulation■

Maximum Ratings, *Absolute Values:*

	CCS●	ICAS●●	
DC PLATE VOLTAGE	2000 max.	2250 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	400 max.	400 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-300 max.	-300 max.	volts
DC PLATE CURRENT	180 max.	225 max.	ma
DC GRID-No.1 CURRENT	25 max.	30 max.	ma
PLATE INPUT	360 max.	500 max.	watts
GRID-No.2 INPUT	22 max.	22 max.	watts
PLATE DISSIPATION	100 max.	125 max.	watts

Typical Operation:

DC Plate Voltage	1250	1500	2000	2250	volts
DC Grid-No.3 (Suppressor) Voltage†	0	0	0	0	volts
DC Grid-No.2 Voltage■■	300	300	400	400	volts
From a series resistor of	27000	40000	36000	46000	ohms
DC Grid-No.1 Voltage⊕††	-75	-90	-120	-155	volts
From a grid resistor of	6000	7500	12000	10000	ohms
From a cathode resistor of	330	400	520	565	ohms
Peak RF Grid-No.1 Voltage	160	175	205	275	volts
DC Plate Current	180	180	180	220	ma
DC Grid-No.2 Current	35	30	45	40	ma
DC Grid-No.1 Current (Approx.)	12	12	10	15	ma
Driving Power (Approx.)⊕⊕	1.7	1.9	1.9	4.0	watts
Power Output (Approx.)	170	210	275	375	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance . . . . . 30000 max. ohms

●● Intermittent Commercial and Amateur Service.

⊕ For ac filament supply.

†† Obtained from a grid-No.1 resistor, from cathode resistor, or from a combination of grid-No.1 resistor with either fixed supply or cathode resistor.

■ Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

■■ Obtained from a separate source, from the plate-voltage supply with a voltage divider, or through a series resistor of the value shown for each operating condition. A series grid-No.2 resistor should be used only when the 813 is used in a circuit which is not keyed. Grid-No.2 voltage must not exceed 800 volts under key-up conditions.

⊕⊕ If preceding stage is keyed, the grid-No.1 bias must be obtained partially from a fixed supply in order to limit the plate current and, therefore, the plate dissipation to a safe value.

●, †, ⊕⊕: See next page. ← Indicates a change.

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BEAM POWER TUBE

SELF-RECTIFYING OSCILLATOR or AMPLIFIER - Class C

Maximum CCS● Ratings, *Absolute Values*:

AC PLATE VOLTAGE (RMS)	2800 max.	volts
AC GRID-No.2 (SCREEN) VOLTAGE (RMS)	550 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	−100 max.	volts
DC PLATE CURRENT	95 max.	ma
DC GRID-No.1 CURRENT	10 max.	ma
PLATE INPUT★★	295 max.	watts
GRID-No.2 INPUT★★	22 max.	watts
PLATE DISSIPATION	100 max.	watts

Typical Operation:

AC Plate Voltage (RMS)	2800	volts
DC Grid-No.3 (Suppressor) Voltage†	0	volts
AC Grid-No.2 Voltage (RMS)○○	530	volts
DC Grid-No.1 Voltage◆◆	−37	volts
From a grid resistor of	37000	ohms
DC Plate Current	95	ma
DC Grid-No.2 Current	12	ma
DC Grid-No.1 Current (Approx.)	1	ma
Driving Power (Approx.)★★‡	1	watt
Output-Circuit Efficiency (Approx.)	75	per cent
Useful Power Output (Approx.)	170★	watts

→ **Maximum Circuit Values:**

Grid-No.1-Circuit Resistance	30000 max.	ohms

AMPLIFIER or OSCILLATOR - Class C

With Separate, Rectified, Unfiltered, Single-Phase, Full-Wave Plate and Grid-No.2 Supply

Maximum CCS● Ratings, *Absolute Values*:

DC PLATE VOLTAGE	1800 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	360 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	−200 max.	volts
DC PLATE CURRENT	190 max.	ma
DC GRID-No.1 CURRENT	22 max.	ma
PLATE INPUT‡‡	360 max.	watts
GRID-No.2 INPUT‡‡	22 max.	watts
PLATE DISSIPATION	100 max.	watts

● Continuous Commercial Service.

★★ Power input is 1.11 times the product of the ac voltage (rms) and the dc current.

‡ From a self-rectified driver.

○○ Obtained from a separate ac supply in phase with the plate supply or from a low-voltage tap on the plate transformer. Use of a grid-No.2 series voltage-dropping resistor is not recommended.

‡‡ Power input is 1.23 times the product of dc voltage and dc current.

†, ★★, ◆◆, ★: See next page. → Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

813

BEAM POWER TUBE

Typical Operation:

DC Plate Voltage	1800	volts
DC Grid-No.3 (Suppressor) Voltage†	0	volts
DC Grid-No.2 Voltage♣	250	volts
DC Grid-No.1 Voltage♦♦	−120	volts
From a grid resistor of	10000	ohms
DC Plate Current	160	ma
DC Grid-No.2 Current	37	ma
DC Grid-No.1 Current (Approx.)	12	ma
Driving Power (Approx.)⊕⊕	2	watts
Output-Circuit Efficiency (Approx.)	75	per cent
Useful Power Output (Approx.)	210⊿	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	30000 max.	ohms

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Filament Current	1	4.7	5.3	amp
Direct Interelectrode Capacitances:				
Grid No.1 to plate	2	–	0.25	μμf
Grid No.1 to filament, grid No.2, and grid No.3	2	13	19.6	μμf
Plate to filament, grid No.2, and grid No.3	2	10.5	17.5	μμf
Plate current (1)	1,3	35	65	ma
Plate current (2)	1,4	–	2	ma
Grid-No.2 current	1,3	–	4	ma
Useful power output	1,5	198	–	watts

Note 1: With 10 volts dc on filament.

Note 2: With no external shield and with base shell floating.

Note 3: With dc plate voltage of 2000 volts, grid No.3 connected to negative filament terminal, dc grid-No.2 voltage of 400 volts, and dc grid-No.1 voltage of −35 volts.

Note 4: With dc plate voltage of 2000 volts, grid No.3 connected to negative filament terminal, dc grid-No.2 voltage of 400 volts, and dc grid-No.1 voltage of −80 volts.

Note 5: In a self-excited oscillator with dc plate voltage of 2000 volts, grid No.3 connected to negative filament terminal, dc grid-No.2 voltage of 400 volts, dc grid-No.1 current of 9.6 to 14.4 ma, grid-No.1 resistor of 10000 ± 10% ohms, dc plate current of 180 ma, and frequency of 15 Mc.

† Grid No.3 should be connected to mid-tap on filament-transformer secondary winding or to negative end of filament operated on dc.

⊕⊕ Value shown for each operating condition is power required by grid No.1 and biasing device when the 813 is operated at frequency sufficiently low to avoid high-frequency losses. At moderate frequencies, the driver stage should be capable of providing about twice the tabulated value; at higher frequencies, the driver stage may have to supply 3 to 10 times the value shown.

♦♦, ⊿, ♣, ⊕⊕: See next page.

← Indicates a change.

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BEAM POWER TUBE

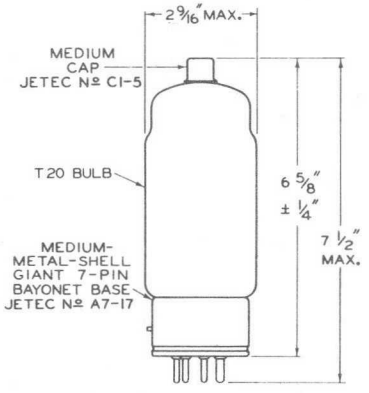
Obtained from a grid-No.1 resistor of the value shown or from a combination of grid-No.1 resistor and cathode resistor. Fixed-bias operation is not recommended. The bias resistors should not be by-passed for the plate and grid-No.2 voltage supply frequency.

This value of useful power is measured at load of output circuit having indicated efficiency.

Obtained from a separate, rectified, unfiltered, single-phase, full-wave supply in phase with the plate supply, or from the rectified, unfiltered, single-phase, full-wave supply by means of taps on the plate transformer.

From a driver with a rectified, unfiltered, single-phase, full-wave plate supply.

Data on operating frequencies for the 813 are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY



92CM-4963R3

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RCA

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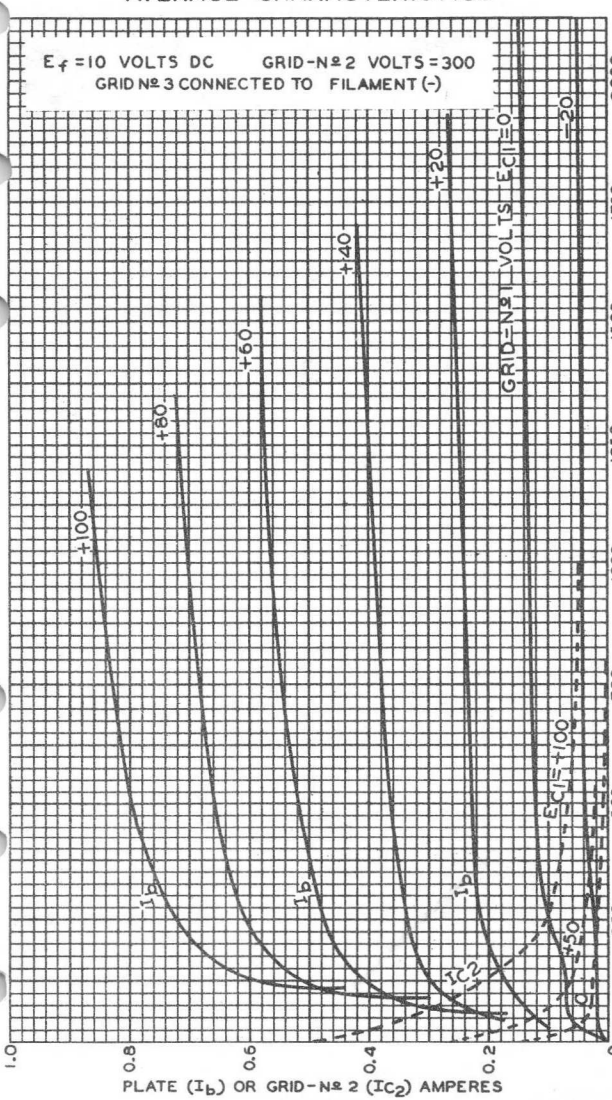
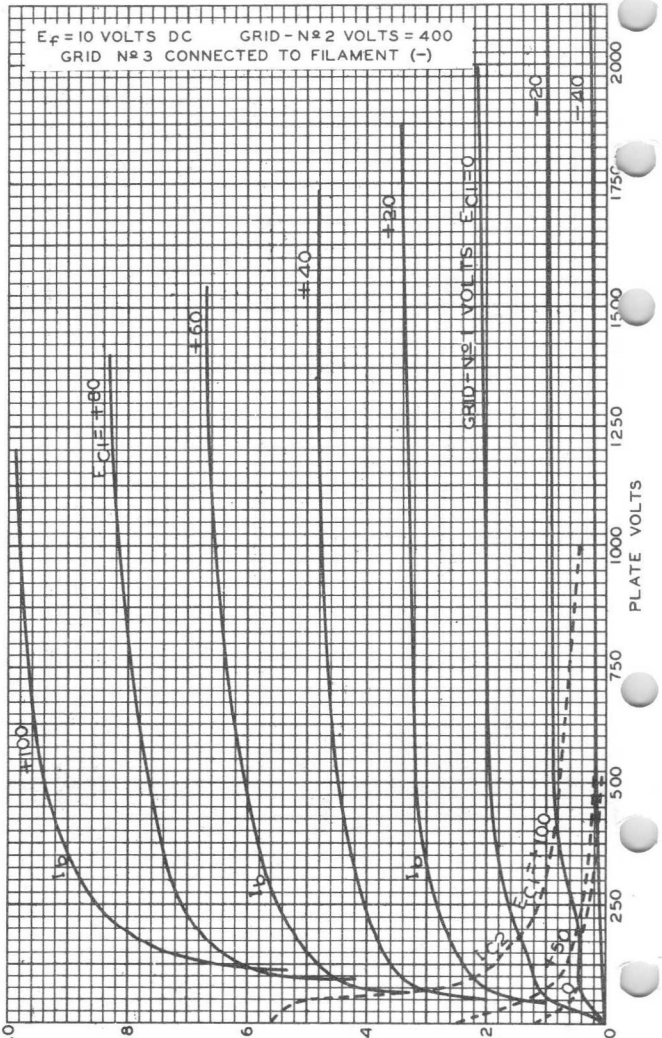
AVERAGE CHARACTERISTICS



RCA

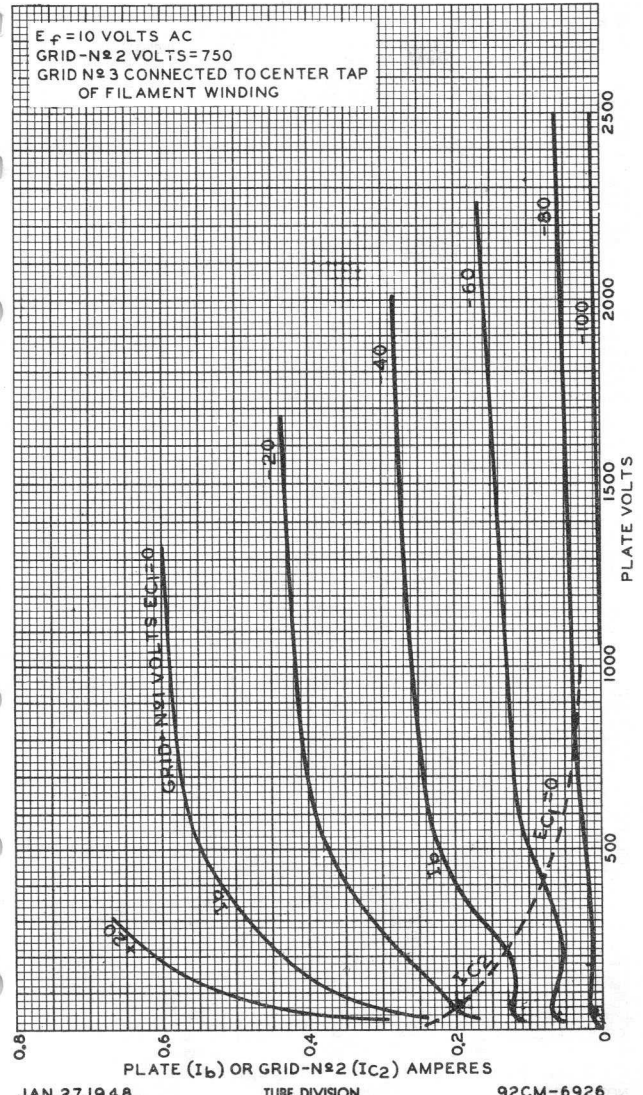
813

AVERAGE CHARACTERISTICS



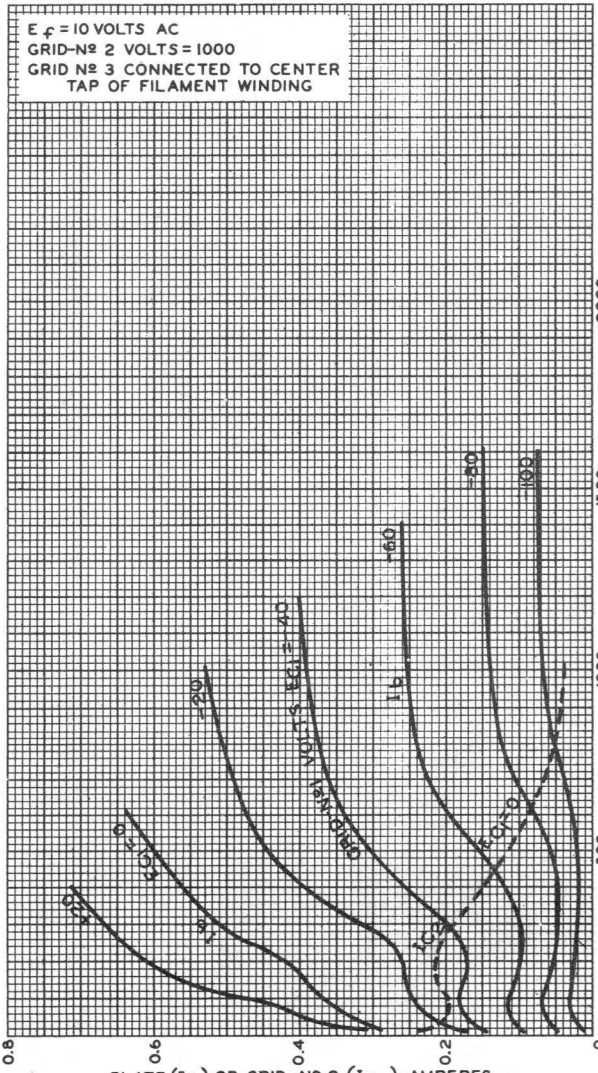
813

AVERAGE CHARACTERISTICS



813

AVERAGE CHARACTERISTICS



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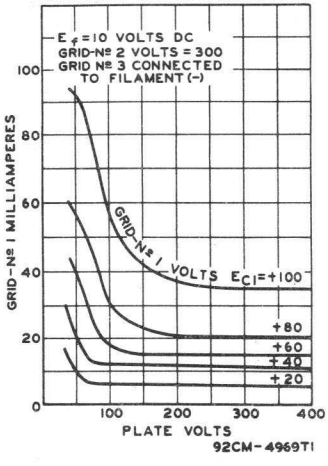
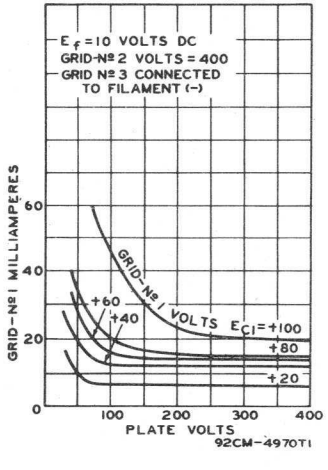
BEAM POWER TUBE

AVERAGE CHARACTERISTICS



AVERAGE CHARACTERISTICS



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TRANSMITTING BEAM POWER AMPLIFIER

GENERAL DATA

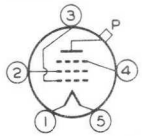
Electrical:

Filament, Thoriated Tungsten:		
Voltage	10 ± 0.5	ac or dc volts
Current	3.25	amp
Transconductance (Approx.) for plate current of 39 ma.	3300	μmhos
Direct Interelectrode Capacitances:°		
Grid No.1 to Plate	0.15 max.	μμf ←
Input	13.5	μμf
Output	13.5	μμf

° Without external shielding.

Mechanical:

Mounting Position	Vertical, base down; Horizontal, pins 2 & 4 in vertical plane
Overall Length	7-7/16" ± 1/4"
Seated Length	6-13/16" ± 1/4"
Maximum Diameter	2-1/16"
Bulb	T-16
Cap	Small
Base	Medium-Shell Small 5-Pin, Micanol
Basing Designation for BOTTOM VIEW	5J



Pin 1 – Filament
Pin 2 – Grid No.2
Pin 3 – Grid No.1
Pin 4 – Grid No.3
Pin 5 – Filament
Cap – Plate

RF POWER AMPLIFIER – Class B Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values*:

	CCS●	*ICAS*●●	
DC PLATE VOLTAGE	1250 max.	1500 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	400 max.	400 max.	volts ←
DC PLATE CURRENT	60 max.	60 max.	ma
PLATE INPUT	75 max.	90 max.	watts
GRID-No.2 INPUT	6.7 max.	6.7 max.	watts
PLATE DISSIPATION	50 max.	60 max.	watts

Typical Operation:

DC Plate Voltage	1000	1250	1500	volts
DC Grid-No.3 (Suppressor) Voltage†	0	0	0	volts
DC Grid-No.2 Voltage	200	200	250	volts
DC Grid-No.1 (Control-Grid) Voltage⊕	-28	-28	-35	volts

●, ●●, †, ⊕: See next page.

← Indicates a change.

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TRANSMITTING BEAM POWER AMPLIFIER

	CCS●		ICAS●●		
Peak RF Grid-No.1 Voltage. .	50	50	56	. .	volts
DC Plate Current	60	60	60	. .	ma
DC Grid-No.2 Current	1.3	1	1.5	. .	ma
DC Grid-No.1 Current (Approx.)* . . .	1.8	1.8	1.5	. .	ma
Driving Power (Approx.)□* .	0.65	0.65	0.85	. .	watt
Power Output (Approx.) . . .	20	25	30	. .	watts

GRID-MODULATED RF POWER AMPLIFIER – Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values:*

	CCS●	ICAS●●	
DC PLATE VOLTAGE	1250 max.	1500 max.	volts
→ DC GRID-No.2 (SCREEN) VOLTAGE.	400 max.	400 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE. . . .	-250 max.	-250 max.	volts
DC PLATE CURRENT	60 max.	60 max.	ma
PLATE INPUT.	75 max.	90 max.	watts
GRID-No.2 INPUT.	6.7 max.	6.7 max.	watts
PLATE DISSIPATION.	50 max.	60 max.	watts

Typical Operation:

DC Plate Voltage	1000	1250	1500	. .	volts
DC Grid-No.3 (Suppressor) Voltage†	0	0	0	. .	volts
DC Grid-No.2 Voltage	200	200	250	. .	volts
DC Grid-No.1 Voltage® . . .	-100	-100	-120	. .	volts
Peak RF Grid-No.1 Voltage. .	129	129	150	. .	volts
→ Peak AF Grid-No.1 Voltage. .	64	64	90	. .	volts
DC Plate Current	60	60	60	. .	ma
DC Grid-No.2 Current	2	1.4	3	. .	ma
DC Grid-No.1 Current (Approx.)*. . . .	3	2.8	2.5	. .	ma
Driving Power (Approx.)□* .	2.5	2.3	4.2	. .	watts
Power Output (Approx.) . . .	25	29	35	. .	watts

PLATE-MODULATED RF POWER AMPLIFIER – Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values:*

	CCS●	ICAS●●	
DC PLATE VOLTAGE	1000 max.	1250 max.	volts
→ DC GRID-No.2 (SCREEN) VOLTAGE.	400 max.	400 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-300 max.	-300 max.	volts

□ At crest of audio-frequency cycle with a modulation factor of 1.0.

●,●●,†,®,*: See next page. → Indicates a change.

TUBE DEPARTMENT
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TRANSMITTING BEAM POWER AMPLIFIER

	CCS●		ICAS●●		
DC PLATE CURRENT	120 max.		150 max.		ma
DC GRID-No.1 CURRENT	15 max.		15 max.		ma
PLATE INPUT	120 max.		180 max.		watts
GRID-No.2 INPUT	6.7 max.		6.7 max.		watts
PLATE DISSIPATION	34 max.		50 max.		watts
Typical Operation:					
DC Plate Voltage	900	1000	1250		volts
DC Grid-No.3 (Suppressor) Voltage†	0	0	0		volts
DC Grid-No.2 Voltage▲▲	300	300	300		volts
	40000	40000	48000		ohms
DC Grid-No.1 Voltage††⊕	−150	−150	−150		volts
	15000	15000	15000		ohms
Peak RF Grid-No.1 Voltage	215	222	222		volts
DC Plate Current	120	120	144		ma
DC Grid-No.2 Current	15	17.5	20		ma
DC Grid-No.1 Current (Approx.)*	10	10	10		ma
Driving Power (Approx.)*	2	2	2		watts ←
Power Output (Approx.)	76	87	130		watts

▲▲ Obtained preferably from modulated plate-voltage supply through resistor of value shown.

RF POWER AMPLIFIER & OSCILLATOR – Class C Telegraphy

Key-down conditions per tube without modulation■

Maximum Ratings, *Absolute Values*:

	CCS●	ICAS●●	
DC PLATE VOLTAGE	1250 max.	1500 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	400 max.	400 max.	volts ←
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	−300 max.	−300 max.	volts
DC PLATE CURRENT	150 max.	150 max.	ma
DC GRID-No.1 CURRENT	15 max.	15 max.	ma
PLATE INPUT	180 max.	225 max.	watts
GRID-No.2 INPUT	10 max.	10 max.	watts
PLATE DISSIPATION	50 max.	65 max.	watts
Typical Operation:			
DC Plate Voltage	1000	1250	1500	volts
DC Grid-No.3 (Suppressor) Voltage†	0	0	0	volts
DC Grid-No.2 Voltage■■⊕	300	300	300	volts
	40000	42000	50000	ohms
DC Grid-No.1 Voltage††⊕	−70	−80	−90	volts
	7000	8000	9000	ohms
	395	455	490	ohms
Peak RF Grid-No.1 Voltage	150	165	170	volts

●, ●●, †, ⊕, *, ††, ■, ■■, ⊕: see next page. ←Indicates a change.

RCA

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TRANSMITTING BEAM POWER AMPLIFIER

	CCS●		ICAS●●		
DC Plate Current	150	144	150	. .	ma
DC Grid-No.2 Current	17.5	22.5	24	. .	ma
DC Grid-No.1 Cur. (Approx.)*	10	10	10	. .	ma
Driving Power Approx.)*. . .	1.35	1.5	1.5	. .	watts
Power Output (Approx.) . . .	100	130	160	. .	watts

● Continuous Commercial Service.

●● Intermittent Commercial & Amateur Service.

† Connect grid No.3 to mid-point of filament operated on ac, or to the negative end of filament operated on dc.

* For effect of load resistance on grid current and driving power, refer to TUBE RATINGS—Grid Current and Driving Power in the General Section.

†† Obtained preferably from grid-No.1 resistor, although combination of either grid-No.1 resistor and cathode resistor or grid resistor and fixed supply may be used.

■ Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

■■ Obtained from a separate source, from the plate-voltage supply with a voltage divider, or through a series resistor (40000, 42000, 50000).

⊖ If preceding stage is keyed, partial fixed-bias is required.

⊕ For ac filament supply.

→ CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Filament Current	1	3.10	3.40	amp
Grid No.1-Plate Capacitance	–	–	0.15	μμf
Input Capacitance.	–	11.1	15.9	μμf
Output Capacitance	–	10.1	16.9	μμf
Plate Current.	1,2	30	48	ma
Grid-No.2 Current.	1,2	–	3.5	ma
Grid-No.1 Current.	1,3	22	52	ma
Power Output	1,4	120	–	watts

NOTE 1: DC filament volts = 10.0.

NOTE 2: With dc plate voltage of 1250 volts; dc grid-No.3 voltage of 0 volts; dc grid-No.2 voltage of 300 volts; and dc grid-No.1 voltage of −19 volts.

NOTE 3: With dc plate voltage of 175 volts; dc grid-No.3 voltage of 0 volts; dc grid-No.2 voltage of 175 volts; and dc grid-No.1 voltage of +65 volts.

NOTE 4: With dc plate voltage of 1250 volts; dc grid-No.3 voltage of 0 volts; dc grid-No.2 voltage of 300 volts; plate current of 150 ma., grid-No.1 current of 10 – 15 ma.; grid-No.1 resistor of 8000 ±10% ohms; and frequency of 15 Mc.

OUTLINE DIMENSIONS for Type 814 are the same as those for Type 828.

Data on operating frequencies for the 814 are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY.

→ Indicates a change.

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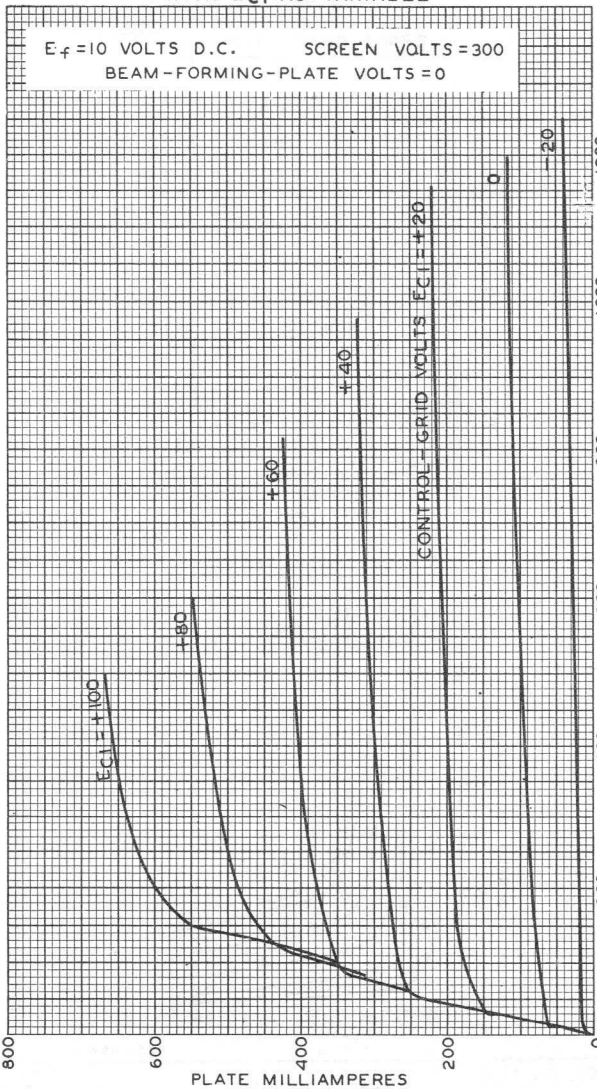
AVERAGE PLATE CHARACTERISTICS
WITH E_{C1} AS VARIABLE



NOV. 11, 1937

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC.

92C-4845

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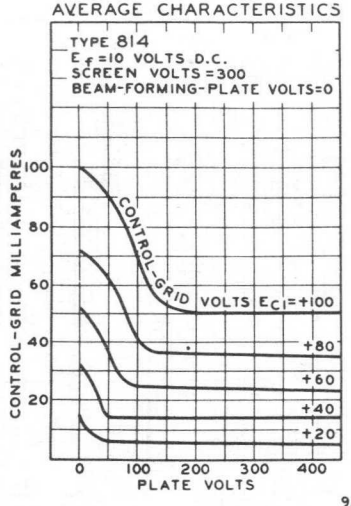
TRANSMITTING BEAM POWER AMPLIFIER



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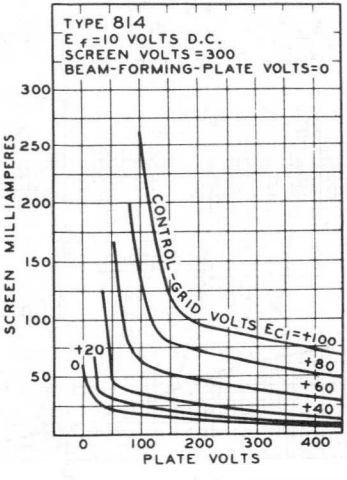

92C-4847

815

PUSH-PULL R-F BEAM POWER AMPLIFIER

Unless otherwise specified, values are for both units

Heater	Coated Unipotential Cathode▽		
Heater Arrangement	*Series*	*Parallel*	
Voltage †	12.6	6.3	a-c or d-c volts
Current	0.8	1.6	amp.
Transconductance, for plate current of 25 ma.	4000		μmhos
Grid-Screen Mu-Factor	6.5		
Direct Interelectrode Capacitances (each unit):			
Grid-Plate (with external shielding)		0.2 max.	μμf
Input		14	μμf
Output		8.5	μμf
Maximum Overall Length		4-9/16"	
Maximum Radius		1-3/16"	
Bulb		T-16	
Caps (two)		Small	
Base		Large Wafer Octal 8-Pin, Sleeve	
RCA Socket		Stock No. 9924	←

† Should not deviate more than ±10% from the rated value.

▽ In circuits where the cathode is not directly connected to the heater, the potential difference between heater and cathode should not exceed 100 volts.

Maximum Ratings Are Absolute Values

MAXIMUM CCS and ICAS RATINGS with TYPICAL OPERATING CONDITIONS

CCS = Continuous Commercial Service
ICAS = Intermittent Commercial and Amateur Service

A-F POWER AMPLIFIER & MODULATOR – Class AB_2#

	CCS	*ICAS*	
D-C Plate Voltage	400 max.	500 max.	volts
D-C Screen Voltage (Grid #2)	225 max.	225 max.	volts ←
Max.-Sig. D-C Plate Current*	150 max.	150 max.	ma.
Max.-Sig. Plate Input*	60 max.	75 max.	watts
Max.-Sig. Screen Input*	4.5 max.	4.5 max.	watts ←
Plate Dissipation*	20 max.	25 max.	watts
Typical Operation:			
D-C Plate Voltage	400	500	volts
D-C Screen Voltage**‡	125	125	volts
D-C Grid Voltage (Fixed bias, Grid #1)	-15	-15	volts
Peak A-F Grid-to-Grid Volt.	60	60	volts
Zero-Sig. D-C Plate Current	20	22	ma.
Max.-Sig. D-C Plate Current	150	150	ma.
Max.-Sig. D-C Screen Current	32	32	ma.
Load Resistance (Per plate)	1550	2000	ohms
Effective Load Resistance (Plate to plate)	6200	8000	ohms
Max.-Sig. Driving Power♦	0.36	0.36	approx. watt
Max.-Sig. Power Output	42	54	approx. watts

Subscript 2 indicates that grid current flows during some part of input cycle. ** ‡: See end of tabulation.

* Averaged over any audio-frequency cycle of sine-wave form.

♦ Driver stage should be capable of supplying the grids of the class AB_2 stage with the specified driving power at low distortion. The effective resistance per grid circuit of the class AB_2 stage should be kept below 500 ohms and the effective impedance at the highest desired response frequency should not exceed 700 ohms. ← Indicates a change.

815

PUSH-PULL R-F BEAM POWER AMPLIFIER

(continued from preceding page)

PUSH-PULL R-F POWER AMPLIFIER – Class B Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

	CCS		ICAS		
D-C Plate Voltage	400	max.	500	max.	volts
→ D-C Screen Voltage (Grid #2)	225	max.	225	max.	volts
D-C Plate Current	75	max.	75	max.	ma.
Plate Input	30	max.	37.5	max.	watts
→ Screen Input	4.0	max.	4.0	max.	watts
Plate Dissipation	20	max.	25	max.	watts
Typical Operation:					
D-C Plate Voltage	400		500		volts
D-C Screen Voltage** ‡	125		125		volts
D-C Grid Voltage (Grid #1) ■	−25		−25		volts
Peak R-F Grid-to-Grid Volt.	50		50		volts
D-C Plate Current	75		75		ma.
D-C Screen Current	4		3		ma.
D-C Grid Current	Negligible				ma.
Driving Power°	0.8		0.7	approx.	watt
Power Output	10.5		13	approx.	watts

GRID-MODULATED PUSH-PULL R-F POWER AMP. – Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

	CCS		ICAS		
D-C Plate Voltage	400	max.	500	max.	volts
→ D-C Screen Voltage (Grid #2)	225	max.	225	max.	volts
D-C Grid Voltage (Grid #1)	−175	max.	−175	max.	volts
D-C Plate Current	75	max.	75	max.	ma.
Plate Input	30	max.	37.5	max.	watts
→ Screen Input	4.0	max.	4.0	max.	watts
Plate Dissipation	20	max.	25	max.	watts
Typical Operation:					
D-C Plate Voltage	400		500		volts
D-C Screen Voltage ‡**	125		125		volts
D-C Grid Voltage ■	−40		−40		volts
Peak R-F Grid-to-Grid Volt.	80		80		volts
Peak A-F Grid Voltage	19		17		volts
D-C Plate Current	75		75		ma.
D-C Screen Current	3		3		ma.
D-C Grid Current	0.4		0.4	approx.	ma.
Driving Power°	0.32		0.28	approx.	watt
Power Output	10.5		13	approx.	watts

° At crest of audio-frequency cycle with modulation factor of 1.0.
■ Obtained preferably from a fixed supply.

PLATE-MODULATED PUSH-PULL R-F POWER AMP. – Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

	CCS		ICAS		
D-C Plate Voltage	325	max.	400	max.	volts
→ D-C Screen Voltage (Grid #2)	225	max.	225	max.	volts
D-C Grid Voltage (Grid #1)	−175	max.	−175	max.	volts
D-C Plate Current	125	max.	150	max.	ma.

** ‡: See end of tabulation.

← Indicates a change.

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PUSH-PULL R-F BEAM POWER AMPLIFIER

(continued from preceding page)

	CCS	ICAS	
D-C Grid Current	7 max.	7 max.	ma. ←
Plate Input	40 max.	60 max.	watts
Screen Input	4.0 max.	4.0 max.	watts ←
Plate Dissipation	13.5 max.	20 max.	watts
Typical Operation:			
D-C Plate Voltage	325	400	volts
D-C Screen Voltage□ ‡	165	175	volts
	10000	15000	ohms
D-C Grid Voltage § ⊕	-45	-45	volts
	11250	15000	ohms
Peak R-F Grid-to-Grid Volt.	112	116	volts
D-C Plate Current	123	150	ma.
D-C Screen Current	16	15	ma.
D-C Grid Current	4	3 approx.	ma.
Driving Power	0.2	0.16 approx.	watt
Power Output	30	45 approx.	watts

□ Preferably obtained from a separate source modulated with the plate supply, or obtained from the modulated plate-supply through resistor of value shown.

§ Obtained from grid resistor of value shown (per tube) or by partial self-bias methods.

PUSH-PULL R-F POWER AMPLIFIER & OSCILLATOR-Class C Telegraphy

Key-down conditions per tube without modulation ‡‡

	CCS	ICAS	
D-C Plate Voltage	400 max.	500 max.	volts
D-C Screen Voltage (Grid #2)	225 max.	225 max.	volts ←
D-C Grid Voltage (Grid #1)	-175 max.	-175 max.	volts
D-C Plate Current	150 max.	150 max.	ma.
D-C Grid Current	7 max.	7 max.	ma. ←
Plate Input	60 max.	75 max.	watts
Screen Input	4.5 max.	4.5 max.	watts ←
Plate Dissipation	20 max.	25 max.	watts
Typical Operation:			
D-C Plate Voltage	400	500	volts
D-C Screen Voltage▲ ‡	145	200	volts
	15000	17500	ohms
D-C Grid Voltage⊡ ⊕	-45	-45	volts
	10000	13000	ohms
	260	265	ohms
Peak R-F Grid-to-Grid Volt.	116	112	volts
D-C Plate Current	150	150	ma.
D-C Screen Current	17	17	ma.
D-C Grid Current	4.5	3.5 approx.	ma.
Driving Power	0.23	0.18 approx.	watt
Power Output	44	56 approx.	watts

‡‡ Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

‡: See next page.

▲ Obtained from a separate source, or from the plate-voltage supply with a voltage divider, or through a series resistor of the value shown. The screen voltage must not exceed 600 volts under key-up conditions.

⊡ Obtained from fixed supply, by grid resistor (10000, 13000), or cathode resistor (260, 265).

⊕ The grid-circuit resistance should never exceed 15000 ohms (total) per tube, or 30000 ohms per unit. Any additional bias required must be supplied by a cathode resistor or a fixed supply. ← Indicates a change.

815

PUSH-PULL R-F BEAM POWER AMPLIFIER

(continued from preceding page)

** Preferably obtained from a separate source, or from the plate-voltage supply with a voltage divider.

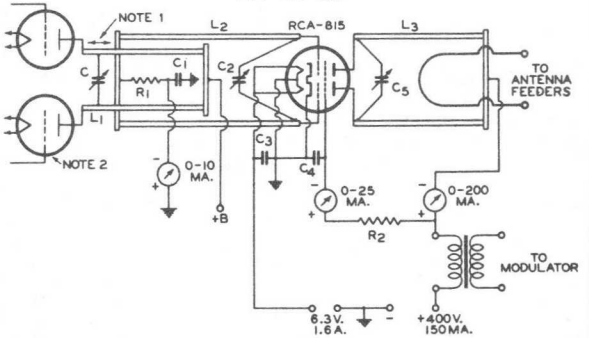
‡ In applications requiring the use of screen voltages above 135 volts, provision should be made for the adjustment of control-grid bias for each unit separately. The necessity for this adjustment at the lower screen voltages depends on the distortion requirements and on whether the plate-dissipation rating is exceeded at zero-signal plate current.

Data on operating frequencies for the 815 are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY.

Shielding and by-passing considerations for the 815 are similar to those given under Type 832-A.

ULTRA-HIGH-FREQUENCY PLATE-MODULATED PUSH-PULL R-F POWER AMPLIFIER

112-116 Mc



C — See L_1

C_1 C_3 C_4 — 1" x 1½" copper sheet insulated from chassis by mica sheet 0.002" thick, or 0.0005-μf "postage stamp" mica condensers soldered to chassis with shortest practicable leads.

C_2 C_5 — Copper discs, 1/16" x 1½". Solder discs to 10-32 brass screws 1" long. Drill and tap grid and plate lines for 10-32 screws.

R_1 — 15000 ohms, 0.5 watt

R_2 — 15000 ohms, 25 watts, adjustable.

L_1 — ¼" dia. copper tubing. Length of tubing and capacitance of C depend upon driver tubes employed.

L_2 — ¼" dia. copper tubing, 12½" long and spaced approx. 7/8" between centers.

L_3 — ¼" dia. copper tubing, 13" long and spaced approx. 7/8" between centers.

NOTES

(1) The r-f driver stage should be able to deliver about one watt of useful r-f power, in order to insure ample grid excitation for the 815.

(2) Adjust coupling between L_1 and L_2 and tuning of C and C_2 for recommended d-c grid current of the 815.

(3) L_1 and L_3 should be effectively shielded from L_2 by a metal chassis, or by a vertical metal baffle plate used to mount the 815.

(4) Adjust coupling of "hairpin" antenna coil to L_3 so that the amplifier is properly loaded.

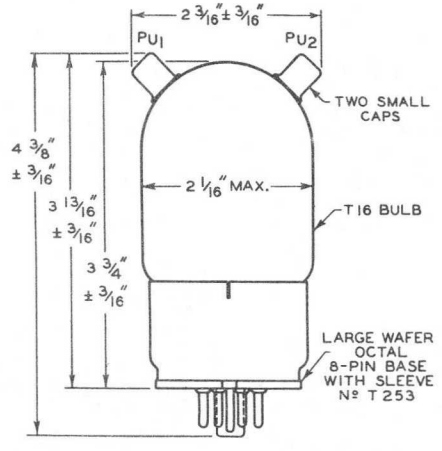
(5) A small lumped inductance can be substituted for the amplifier grid lines, if desired. Such a grid coil is preferably tuned by varying its inductance rather than by means of a variable condenser.

The license extended to the purchaser of tubes appears in the License Notice accompanying them. Information contained herein is furnished without assuming any obligations.

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

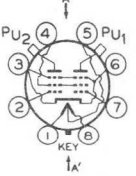
815

PUSH-PULL R-F BEAM POWER AMPLIFIER



BOTTOM VIEW OF SOCKET CONNECTIONS

Pin 1 – Heater
Pin 2 – Grid No.1 of Unit No.2
Pin 3 – Cathode, Internal Shield
Pin 4 – Grid No.2
Pin 5 – Heater Center-Tap



Pin 6 – Cathode, Internal Shield
Pin 7 – Grid No.1 of Unit No.1
Pin 8 – Heater
P_{U1} & P_{U2} – Plate Terminals of Units No.1 & No.2, respectively

PLANE OF ELECTRODES OF EACH UNIT IS PARALLEL TO PLANE THROUGH AXIS OF TUBE AND AA'

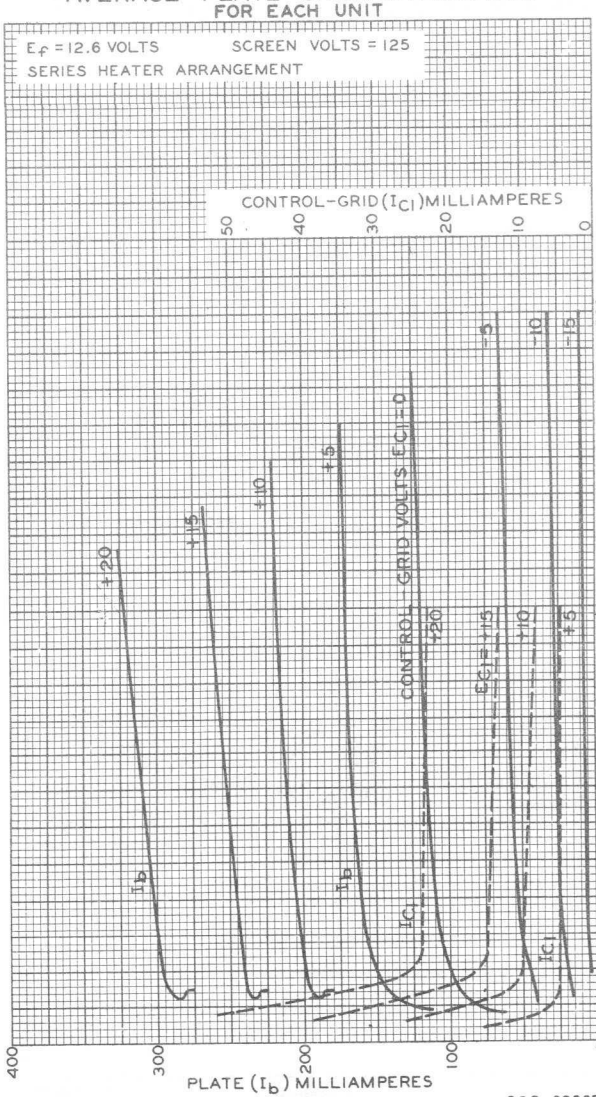
TUBE MOUNTING POSITION

Any

815

815

AVERAGE PLATE CHARACTERISTICS FOR EACH UNIT



SEPT. 17, 1943

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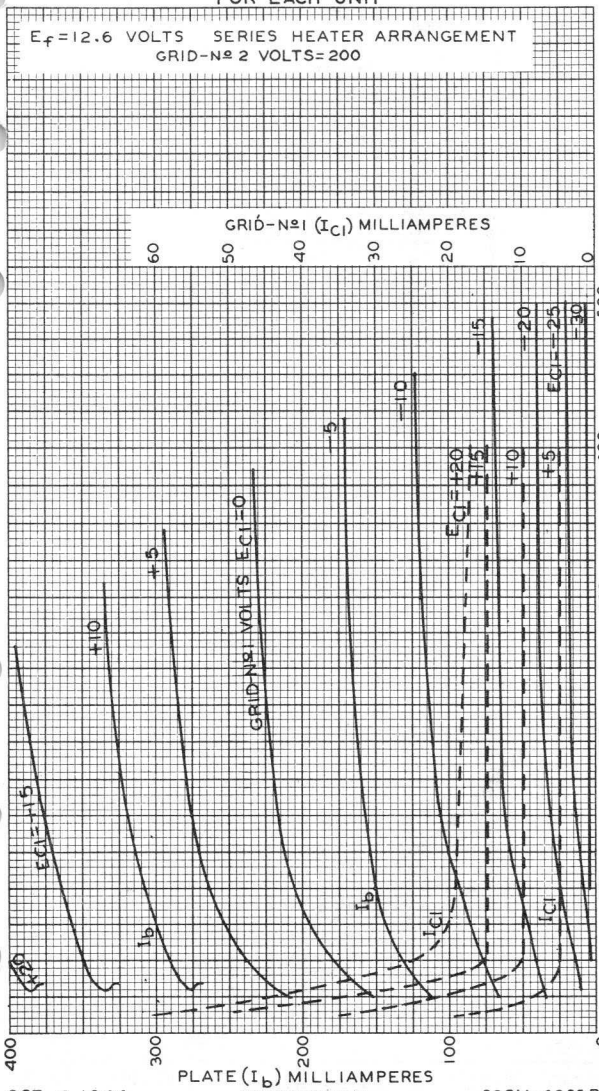
92C-6206RI

RCA

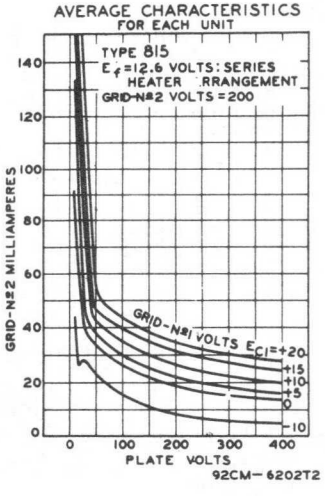
815
AVERAGE PLATE CHARACTERISTICS
FOR EACH UNIT

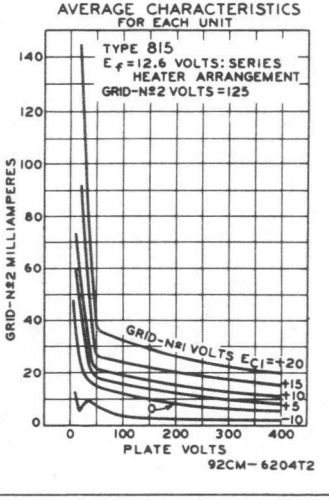


TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

815

PUSH-PULL R-F BEAM POWER AMPLIFIER





827-R

BEAM POWER TUBE

FORCED-AIR COOLED

Useful with full input up to 110 Mc

GENERAL DATA

Electrical:

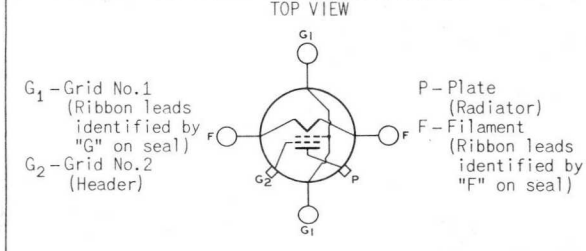
Filament, Thoriated Tungsten:		
Voltage	7.5 ± 0.4	ac or dc volts ←
Current at 7.5 volts	25	amp
Starting current: The filament current must never exceed 50 amperes, even momentarily		
Cold resistance	0.033	ohm
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 2000, grid-No.2 volts = 1100, and plate ma. = 350	16	←
Direct Interelectrode Capacitances:		←
Grid No.1 to plate (With external shield)♦	0.19	μμf
Grid No.1 to filament and grid No.2	18.5	μμf
Plate to filament and grid No.2	11	μμf

Mechanical:

Operating Position	Vertical, filament end up
Maximum Overall Length (Excluding flexible leads)	6-3/8"
Maximum Diameter	4-11/16"
Weight (Approx.)	4-1/2 lbs
Radiator	Integral part of tube

Terminal Connections *(See Dimensional Outline)*:

TOP VIEW



Air Flow:

Through Radiator--The specified flow of incoming air at a maximum temperature of 45° C for various plate dissipations, as indicated in the following tabulation, should be delivered by a blower through the radiator before and during the application of any voltages. Filament power, plate power, and air flow may be removed simultaneously.

♦: See next page. ← Indicates a change.

827-R

BEAM POWER TUBE

Percentage of maximum-rated plate dissipation for each class of service	100	80	%
Minimum air flow	65	45	cfm
Static pressure	0.2	0.1	in. of water
To Header, Grid-No.1 Seals, and Filament Seals		10 min.	cfm

The specified air flow from a 1"-diameter nozzle should be directed into the header and onto the grid-No.1 seals and filament seals before and during the application of any voltages in order to limit the temperature of the filament and the grid-No.1 seals to their maximum value.

Incoming-Air Temperature	45 max.	°C
Radiator Temperature (Measured on the core at end away from incoming air)	150 max.	°C
Bulb Temperature (At hottest part)	150 max.	°C
Seal Temperature, Filament and Grid No.1	175 max.	°C

RF POWER AMPLIFIER — Class B Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1

Maximum CCS● Ratings, *Absolute Values:*

DC PLATE VOLTAGE	3500 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	1000 max.	volts
DC PLATE CURRENT	400 max.	ma
PLATE INPUT	1200 max.	watts
GRID-No.2 INPUT	100 max.	watts
PLATE DISSIPATION	800 max.	watts

Typical Operation:

DC Plate Voltage	3000	3500	volts
DC Grid-No.2 Voltage	800	800	volts
DC Grid-No.1 (Control-Grid) Voltage*	-75	-75	volts
Peak RF Grid-No.1 Voltage	165	150	volts
DC Plate Current	320	340	ma
DC Grid-No.2 Current	10	12	ma
DC Grid-No.1 Current (Approx.)	30	25	ma
Driving Power (Approx.)■	50	38	watts
Power Output (Approx.)	350	400	watts

♦,●,#,■: See next page.

827-R

BEAM POWER TUBE

GRID-MODULATED RF POWER AMPLIFIER — Class C Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1

Maximum CCS● Ratings, *Absolute Values:*

DC PLATE VOLTAGE	3500 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	1000 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	−500 max.	volts
DC PLATE CURRENT	400 max.	ma
PLATE INPUT	1200 max.	watts
GRID-No.2 INPUT	100 max.	watts
PLATE DISSIPATION	800 max.	watts

Typical Operation:

DC Plate Voltage	3000	3500	volts
DC Grid-No.2 Voltage	800	800	volts
DC Grid-No.1 Voltage	−300	−300	volts
Peak RF Grid-No.1 Voltage	410	410	volts
Peak AF Grid-No.1 Voltage	235	260	volts
DC Plate Current	333	320	ma
DC Grid-No.2 Current	15	13	ma
DC Grid-No.1 Current (Approx.)	45	40	ma
Driving Power (Approx.)■	82	74	watts
Power Output (Approx.)	350	400	watts

PLATE-MODULATED RF POWER AMPLIFIER — Class C Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1

Maximum CCS● Ratings, *Absolute Values:*

DC PLATE VOLTAGE	3000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	800 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	−500 max.	volts
DC PLATE CURRENT	400 max.	ma
DC GRID-No.1 CURRENT	125 max.	ma
PLATE INPUT	1200 max.	watts
GRID-No.2 INPUT	100 max.	watts
PLATE DISSIPATION	550 max.	watts

Typical Operation:

DC Plate Voltage	2500	3000	volts
DC Grid-No.2 Voltage*	700	750	volts
DC Grid-No.1 Voltage▲	−350	−325	volts
Peak RF Grid-No.1 Voltage	640	600	volts
DC Plate Current	400	400	ma
DC Grid-No.2 Current	140	125	ma
DC Grid-No.1 Current (Approx.)	125	125	ma
Driving Power (Approx.)	72	68	watts
Power Output (Approx.)	670	825	watts

♦,●,#,■,*,▲: See next page.

827-R

RCA

827-R

BEAM POWER TUBE

RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy†
and
RF POWER AMPLIFIER — Class C FM Telephony

Maximum CCS● Ratings, *Absolute Values:*

DC PLATE VOLTAGE	3500 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	1000 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-500 max.	volts
DC PLATE CURRENT	500 max.	ma
DC GRID-No.1 CURRENT	150 max.	ma
PLATE INPUT	1500 max.	watts
GRID-No.2 INPUT	150 max.	watts
PLATE DISSIPATION	800 max.	watts

Typical Operation:

DC Plate Voltage	3000	3500	volts
DC Grid-No.2 Voltage⊕	900	700	volts
DC Grid-No.1 Voltage□	-350	-300	volts
Peak RF Grid-No.1 Voltage	590	520	volts
DC Plate Current	500	428	ma
DC Grid-No.2 Current	165	185	ma
DC Grid-No.1 Current (Approx.)	125	100	ma
Driving Power (Approx.)	66	50	watts
Power Output (Approx.)	1000	1050	watts

♦ With external, flat metal shield 10" by 12" having a 3-inch-diameter hole whose center is located on major axis 5" from one of the 10" sides. Shield is located in plane of the grid-No.2 terminal, perpendicular to the tube axis, and is connected to grid No.2.

● Continuous Commercial Service.

Grid-No.1 voltage is given with respect to midpoint of filament operated on ac. If dc is used, each stated value of grid-No.1 voltage should be decreased by one-half the filament voltage and the circuit returns made to the negative end of the filament.

■ At crest of audio-frequency cycle with modulation factor of 1.

* Obtained preferably from fixed supply modulated simultaneously with the plate voltage. Series voltage-dropping resistor connected to modulated plate-voltage supply may also be used.

▲ Obtained by grid-No.1 resistor or by combination of grid-No.1 resistor with either fixed supply or cathode resistor.

† Key-down conditions per tube without amplitude modulation. Amplitude modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

⊕ Obtained preferably from fixed supply or voltage divider. Grid-No.2 voltage must not exceed twice the maximum grid-No.2-voltage rating under key-up conditions.

□ Obtained from fixed supply, cathode resistor, or grid-No.1 resistor. If a preceding stage is keyed, sufficient bias must be applied to maintain plate current at a low value under key-up conditions.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Filament Current	1	23.1	26.9	amp

→ Indicates a change.

827-R

BEAM POWER TUBE

	Note	Min.	Max.	
Direct Interelectrode Capacitances:				
Grid No.1 to plate	2	0.16	0.22	μμf
Grid No.1 to filament and grid No.2.	–	14.5	22.5	μμf
Plate to filament and grid No.2.	–	7.5	14.5	μμf
Mu-Factor, Grid No.2 to Grid No.1.	1,3	13.9	18.1	
Plate Current.	1,4	200	340	ma
Plate-Current Cutoff	1,5	-55	-95	volts
Grid-No.2 Current.	1,4	–	23	ma
Power Output	1,6	900	–	watts

Note 1: With 7.5 volts ac on filament.

Note 2: With external, flat metal shield 10" by 12" having a 3-inch-diameter hole whose center is located on major axis 5" from one of the 10" sides. Shield is located in plane of the grid-No.2 terminal, perpendicular to the tube axis, and is connected to grid No.2.

Note 3: With dc plate volts = 2000, dc grid-No.2 volts = 1100, and dc grid-No.1 voltage adjusted to give dc plate current of 350 ma.

Note 4: With dc plate volts = 3000, dc grid-No.2 volts = 1000, and dc grid-No.1 volts = -20.

Note 5: With dc plate volts = 3000, dc grid-No.2 volts = 1000, and dc grid-No.1 voltage adjusted to give dc plate current of 10 ma.

Note 6: In self-excited oscillator circuit, and with dc plate volts = 3500, dc grid-No.2 volts = 900, dc plate ma. = 430, dc grid-No.1 ma. = 80 to 120, grid-No.1 resistor (ohms) = 5000, and frequency (Mc) = 8.

OPERATING CONSIDERATIONS

The *mounting* for the 827-R requires a clamp support for the radiator (plate connection), a connector for the grid-No.2 terminal, a connector for the grid-No.1 leads tied together, and two connectors for the filament leads. The tube should be supported in a vertical position with the grid-No.1 and filament leads up. If the 827-R is subjected to considerable vibration in service, it is advisable to support the mounting by means of a spring suspension. The installation of all wires and connections must be made so that they will not be close to or touch the glass parts. This precaution is necessary to prevent almost certain puncture of the glass.

Connections to the grid-No.1 and filament leads must have some degree of flexibility in order not to put strain on the glass-to-metal seals. Particular caution must be exercised in making connection to the grid-No.2 terminal (header) in order to avoid placing strain on the seal between the header and the glass bulb. It is suggested that the connector for the grid-No.2 terminal consist of a flat yoke having spring contacts which will engage the inside and the outside of the rim of the header with firm but moderate pressure. Do not

← Indicates a change.

827-R

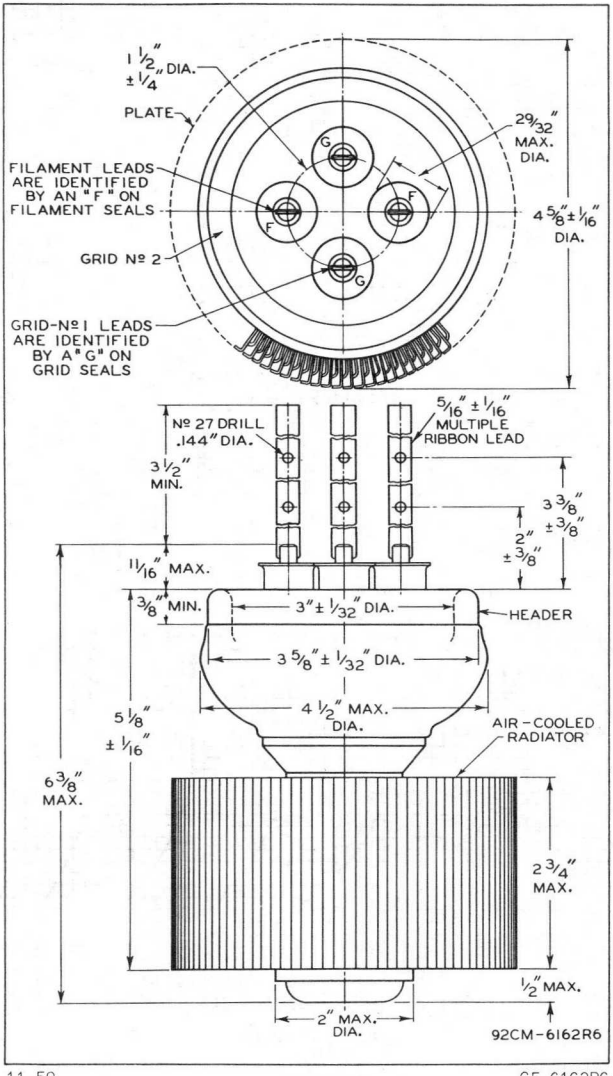
BEAM POWER TUBE

use any form of clamp on the header as it will crack the glass-to-metal seal. The support for the yoke must not place any pressure on the seal. None of the connectors should be used to support circuits parts.

Cooling of the 827-R is accomplished by passing a stream of clean air through the radiator toward the filament end, and by directing another stream of air into the entrant metal header and around the grid-No.1 and filament seals. A suitable air filter is required in the air supply for the radiator.

827-R

BEAM POWER TUBE



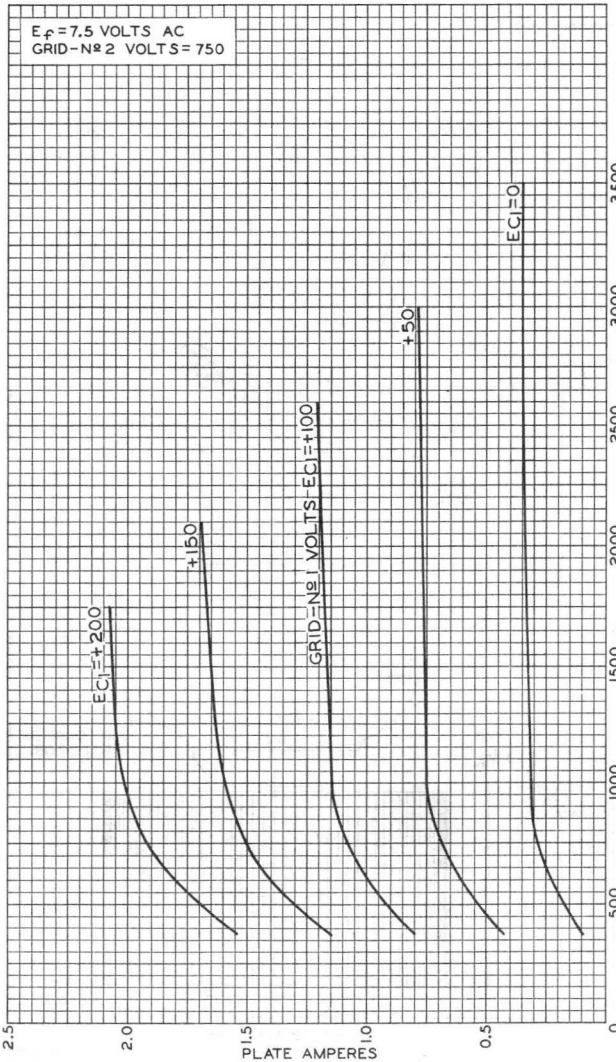
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

827-R

RCA

827-R

TYPICAL PLATE CHARACTERISTICS



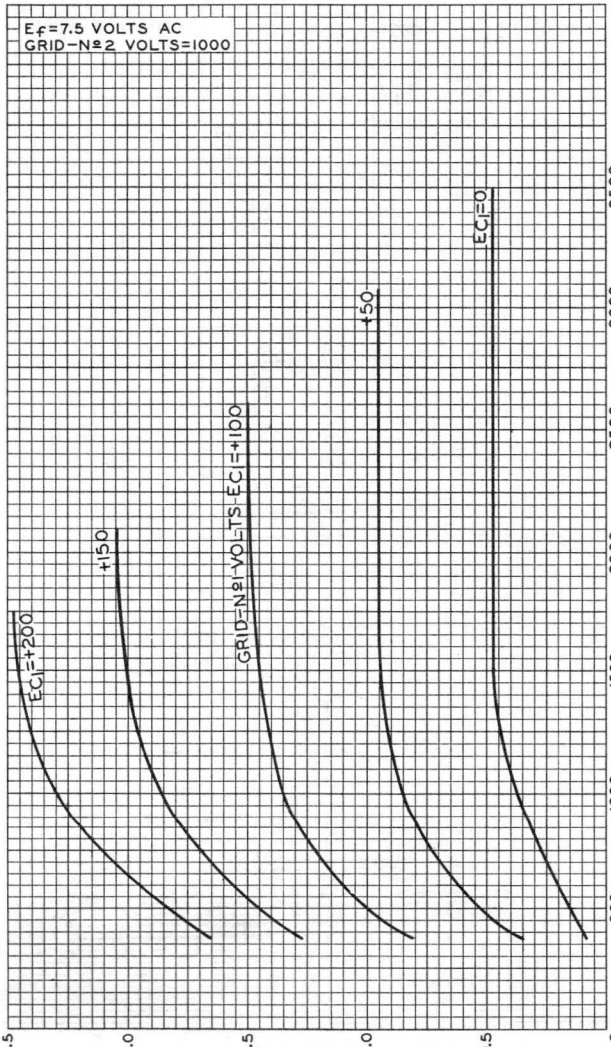
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6167R1

827-R

827-R

TYPICAL PLATE CHARACTERISTICS



ELECTRON TUBE DIVISION

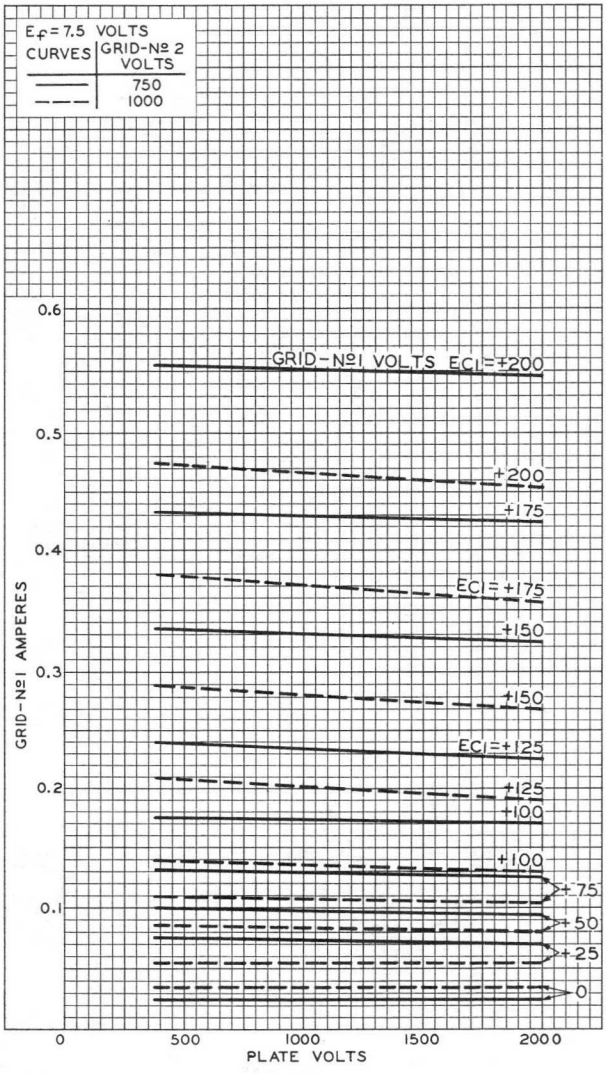
92CM-6166RI

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

827-R

827-R

TYPICAL CHARACTERISTICS



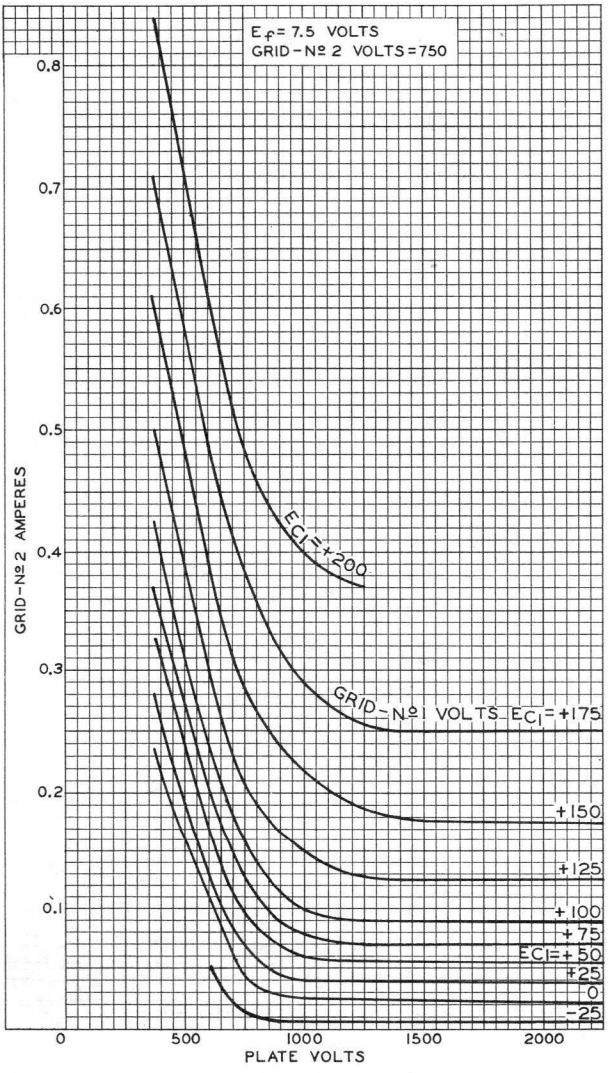
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6169RI

RCA

827-R

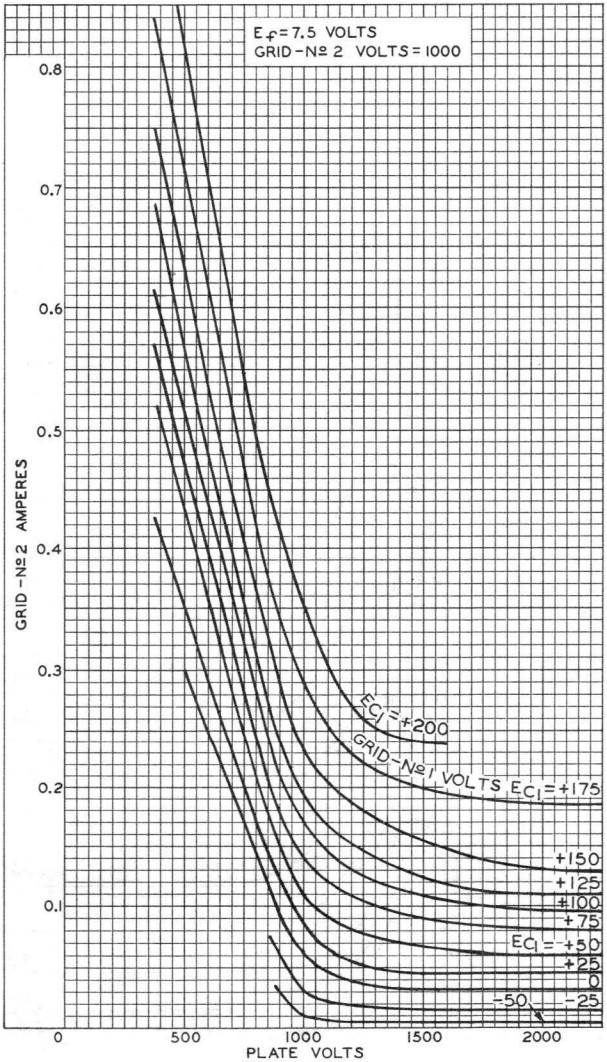
TYPICAL CHARACTERISTICS



827-R

827-R

TYPICAL CHARACTERISTICS



ELECTRON TUBE DIVISION
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92CM-9556

828
TRANSMITTING BEAM POWER AMPLIFIER

GENERAL DATA

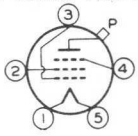
Electrical:

Filament, Thoriated Tungsten:		
Voltage	10 ± 0.5	ac or dc volts
Current	3.25	amp
Transconductance (Approx.) for plate current of 43 ma.	2700	μmhos ←
Direct Interelectrode Capacitances:		
Grid No.1 to Plate	0.07 max.	μμf ←
Input	12	μμf
Output	14	μμf

Mechanical:

Mounting Position	Vertical, base down; or Horizontal, pins 2 & 4 in vertical plane.
Overall Length	7-7/16" ± 1/4"
Seated Length	6-13/16" ± 1/4"
Maximum Diameter	2-1/16"
Bulb	T-16
Cap	Small
Base	Medium-Shell Small 5-Pin, Micanol
Basing Designation for BOTTOM VIEW	5J

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



Pin 4 – Grid No.3
Pin 5 – Filament
Cap – Plate

AF POWER AMPLIFIER & MODULATOR – Class AB_1*

Maximum Ratings, *Absolute Values*:

	CCS●	ICAS●●	
DC PLATE VOLTAGE	1750 max.	2000 max.	volts
DC GRID-No.3 (SUPPRESSOR) VOLT.	100 max.	100 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	750 max.	750 max.	volts
MAX.-SIG. DC PLATE CURRENT*	150 max.	150 max.	ma
MAX.-SIG. PLATE INPUT*	225 max.	270 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT*	16 max.	23 max.	watts
PLATE DISSIPATION*	70 max.	80 max.	watts

Typical Operation:

Values are for 2 tubes

DC Plate Voltage	1750	2000	volts ←
DC Grid-No.3 Voltage	60	60	volts
DC Grid-No.2 Voltage†	750	750	volts

* Suscript 1 indicates that grid-No.1 current does not flow during any part of the input cycle.

* Averaged over any audio-frequency cycle of sine-wave form.

† Zero-signal grid-No.2 voltage must not exceed 775 volts.

●, ●●: See next page.

← Indicates a change.

828

TRANSMITTING BEAM POWER AMPLIFIER

	CCS●	ICAS●●	
DC Grid-No.1 (Control-Grid) Voltage♦	-120	-120	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage	240	240	volts
Zero-Signal DC Plate Current	50	50	ma
Max.-Signal DC Plate Current	248	270	ma
DC Grid-No.3 Current	9	9	ma
Zero-Signal DC Grid-No.2 Current	4	2	ma
Max.-Signal DC Grid-No.2 Current	43	60	ma
Effective Load Resistance (Plate-to-plate)	16200	18500	ohms
Max.-Signal Driving Power (Approx.)♦	0	0	watts
Max.-Signal Power Output (Approx.)	300**	385	watts

♦ Driver stage should be capable of supplying the specified driving power at low distortion to the No.1 grids of the class AB_1 stage. The effective resistance per grid-No.1 circuit of the class AB_1 stage should be held at a low value.

** Distortion only 1% with 20 db of feedback to grid of driver.

RF POWER AMPLIFIER - Class B Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values:*

	CCS●	ICAS●●	
DC PLATE VOLTAGE	1250 max.	1500 max.	volts
DC GRID-No.3 (SUPPRESSOR) VOLT.	100 max.	100 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	400 max.	400 max.	volts
DC PLATE CURRENT	100 max.	100 max.	ma
PLATE INPUT	105 max.	120 max.	watts
GRID-No.3 INPUT	5 max.	5 max.	watts
GRID-No.2 INPUT	11 max.	11 max.	watts
PLATE DISSIPATION	70 max.	80 max.	watts

Typical Operation:

DC Plate Voltage	1250	1500	volts
DC Grid-No.3 Voltage	75	75	volts
DC Grid-No.2 Voltage	400	400	volts
DC Grid-No.1 (Control-Grid) Voltage●♦	-50	-50	volts
Peak RF Grid-No.1 Voltage	52	50	volts
DC Plate Current	84	80	ma
DC Grid-No.3 Current	4	4	ma
DC Grid-No.2 Current	5	5	ma
DC Grid-No.1 Cur. (Approx.)	0.3	0.2	ma

●, ●●, ♦: See next page.

828
TRANSMITTING BEAM POWER AMPLIFIER

	CCS●	ICAS●●	
Driving Power (Approx.)□ . . .	0.5 . .	0.4 . .	watt
Power Output (Approx.)	36 . .	41 . .	watts

● obtained from a source of good regulation or from suitably bypassed cathode resistor.

GRID-MODULATED RF POWER AMPLIFIER – Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values*:

	CCS●	ICAS●●	
DC PLATE VOLTAGE	1250 max.	1500 max.	volts
DC GRID-No.3 (SUPPRESSOR) VOLT.	100 max.	100 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE.	400 max.	400 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE. . . .	-300 max.	-300 max.	volts
DC PLATE CURRENT	100 max.	100 max.	ma
PLATE INPUT.	105 max.	120 max.	watts
GRID-No.3 INPUT.	5 max.	5 max.	watts
GRID-No.2 INPUT.	11 max.	11 max.	watts
PLATE DISSIPATION.	70 max.	80 max.	watts

Typical Operation:

DC Plate Voltage	1250 . .	1500 . .	volts
DC Grid-No.3 Voltage	75 . .	75 . .	volts
DC Grid-No.2 Voltage	400 . .	400 . .	volts
DC Grid-No.1 Voltage**● . . .	-150 . .	-150 . .	volts
Peak RF Grid-No.1 Voltage. . .	165 . .	165 . .	volts
Peak AF Grid-No.1 Voltage. . .	94 . .	94 . .	volts
DC Plate Current	84 . .	80 . .	ma
DC Grid-No.3 Current	4 . .	3.5 . .	ma
DC Grid-No.2 Current	5 . .	4 . .	ma
DC Grid-No.1 Cur. (Approx.). .	1.6 . .	1.3 . .	ma
RF Driving Power (Approx.)□ □□	2.5 . .	2.5 . .	watts
Power Output (Approx.)	36 . .	41 . .	watts

** Fixed supply or cathode-resistor bias, unbypassed for audio-frequencies, is recommended.

□ At crest of audio-frequency cycle with a modulation factor of 1.0.

□□ AF driving power is generally never more than 2 watts.

PLATE-MODULATED RF POWER AMPLIFIER – Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximur Ratings, *Absolute Values*:

	CCS●	ICAS●●	
DC PLATE VOLTAGE	1000 max.	1250 max.	volts
DC GRID-No.3 (SUPPRESSOR) VOLT.	100 max.	100 max.	volts

●, ●●, ●: See next page.

828
TRANSMITTING BEAM POWER AMPLIFIER

	CCS●	ICAS●●	
DC GRID-No.2 (SCREEN) VOLTAGE.	400 max.	400 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE. . . .	-300 max.	-300 max.	volts
DC PLATE CURRENT	135 max.	160 max.	ma
DC GRID-No.1 CURRENT	15 max.	15 max.	ma
PLATE INPUT.	135 max.	200 max.	watts
GRID-No.3 INPUT.	5 max.	5 max.	watts
GRID-No.2 INPUT.	11 max.	11 max.	watts
PLATE DISSIPATION	47 max.	70 max.	watts
Typical Operation:			
DC Plate Voltage	1000 . .	1250 . .	volts
DC Grid-No.3 Voltage	75 . .	75 . .	volts
DC Grid-No.2 Voltage▲▲	400 . .	400 . .	volts
	26000 . .	30000 . .	ohms
DC Grid-No.1 Voltage††● . . .	-140 . .	-140 . .	volts
	14000 . .	11700 . .	ohms
Peak RF Grid-No.1 Voltage. . .	230 . .	250 . .	volts
DC Plate Current	135 . .	160 . .	ma
DC Grid-No.3 Current	13 . .	15 . .	ma
DC Grid-No.2 Current	23 . .	28 . .	ma
DC Grid-No.1 Current (Approx.)	10 . .	12 . .	ma
Driving Power (Approx.) . . .	2.1 . .	2.7 . .	watts
Power Output (Approx.)	100 . .	150 . .	watts

▲▲ obtained preferably from a separate source modulated with the plate supply, or from the modulated plate-supply through a series resistor of the value shown.

†† obtained from a grid resistor of value shown or from a combination of grid resistor with either fixed supply or cathode resistor.

RF POWER AMPLIFIER & OSCILLATOR - Class C Telegraphy

Key-down conditions per tube without modulation■

Maximum Ratings, *Absolute Values*:

	CCS●	ICAS●●	
DC PLATE VOLTAGE.	1250 max.	1500 max.	volts
DC GRID-No.3 (SUPPRESSOR) VOLT.	100 max.	100 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	400 max.	400 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE . . .	-300 max.	-300 max.	volts
DC PLATE CURRENT.	160 max.	180 max.	ma
DC GRID-No.1 CURRENT.	15 max.	15 max.	ma
PLATE INPUT	200 max.	270 max.	watts
GRID-No.3 INPUT	5 max.	5 max.	watts
GRID-No.2 INPUT	16 max.	16 max.	watts
PLATE DISSIPATION	70 max.	80 max.	watts

●, ●●, ●, ■: See next page.

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

828

TRANSMITTING BEAM POWER AMPLIFIER

Typical Operation:

	CCS●	ICAS●●	
DC Plate Voltage	1250	1500	volts
DC Grid-No.3 Voltage	75	75	volts
DC Grid-No.2 Voltage■■	400	400	volts
	24300	39300	ohms
DC Grid-No.1 Voltage●#❋	−95	−100	volts
	7900	8300	ohms
	415	430	ohms
Peak RF Grid-No.1 Voltage	195	205	volts
DC Plate Current	160	180	ma
DC Grid-No.3 Current	22	14	ma
DC Grid-No.2 Current	35	28	ma
DC Grid-No.1 Cur. (Approx.)	12	12	ma
Driving Power (Approx.)	2.1	2.2	watts
Power Output (Approx.)	150	200	watts

■ Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

■■ Obtained from a separate source, from the plate-voltage supply with a voltage divider, or through a series resistor of value shown. Series grid-No.2 resistor should be used only when the 828 is used as a buffer amplifier and is not keyed. Grid-No.2 voltage must not exceed 800 volts under key-up conditions.

\# Obtained from fixed supply, by grid resistor (7900, 8300) or cathode resistor (415, 430).

❋ If preceding stage is keyed, partial fixed-bias is required.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Filament Current	1	3.10	3.40	amp
Grid No.1-Plate Capacitance	–	–	0.07	μμf
Input Capacitance	–	9.9	14.1	μμf
Output Capacitance	–	10.5	17.5	μμf
Plate Current	1,2	30	56	ma
Grid-No.2 Current	1,2	–	7	ma
Grid-No.1 Current	1,3	21	49	ma
Plate Current	1,4	–	10	ma
Power Output	1,5	180	–	watts

Note 1: DC filament volts = 10.0.

Note 2: With dc plate voltage of 1750 volts; dc grid-No.3 voltage of 0 volts; dc grid-No.2 voltage of 300 volts; dc grid-No.1 voltage of −25 volts.

Note 3: With dc plate voltage of 200 volts; dc grid-No.3 voltage of 200 volts; dc grid-No.2 voltage of 200 volts; and dc grid-No.1 voltage of +75 volts.

Note 4: With dc plate voltage of 1750 volts; dc grid-No.3 voltage of −180 volts; dc grid-No.2 voltage of 300 volts; and dc grid-No.1 voltage of −25 volts.

Note 5: With dc plate voltage of 1750 volts; dc grid-No.3 voltage of 100 volts; dc grid-No.2 voltage of 300 volts; plate current of 150 ma; grid-No.1 current of 10 − 15 ma.; grid-No.1 resistor of 10000 ± 10% ohms and frequency of 15 Mc.

●, ●●, ❋: See next page.

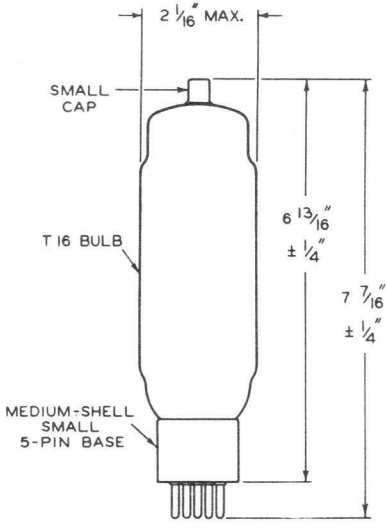
828

828

TRANSMITTING BEAM POWER AMPLIFIER

Continuous Commercial Service.
Intermittent Commercial & Amateur Service.
For ac filament supply.

Data on operating frequencies for the 828 are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY.

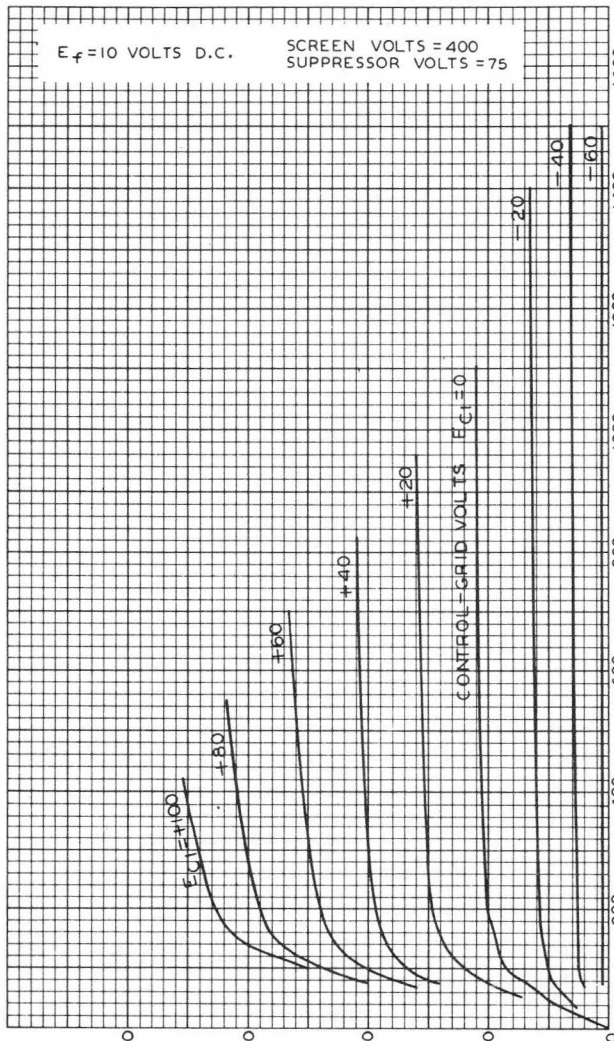


92CM-4547R3

RCA

828

AVERAGE PLATE CHARACTERISTICS



SEPT. 28, 1939

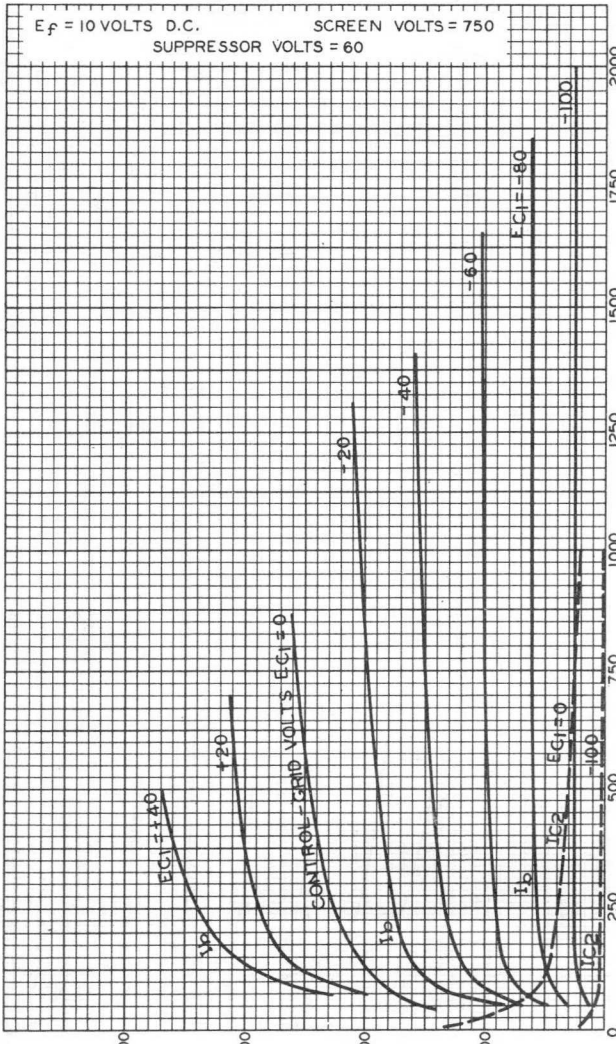
RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC.

92CM-6080

RCA

828

AVERAGE PLATE CHARACTERISTICS



SEPT. 14, 1939

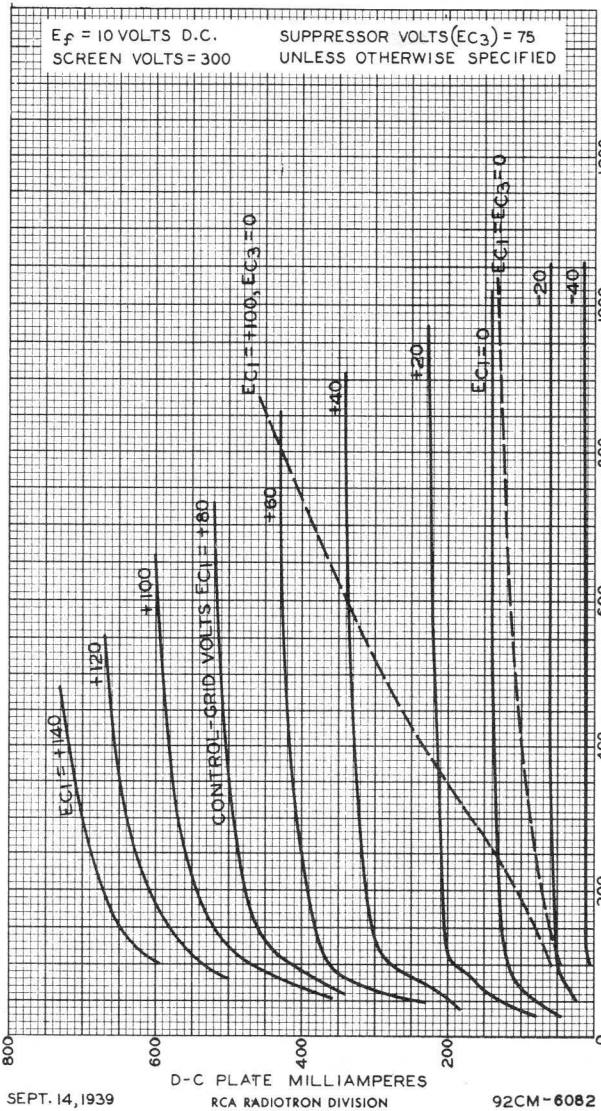
RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC.

92CM-6081

RCA

828

AVERAGE PLATE CHARACTERISTICS



SEPT. 14, 1939

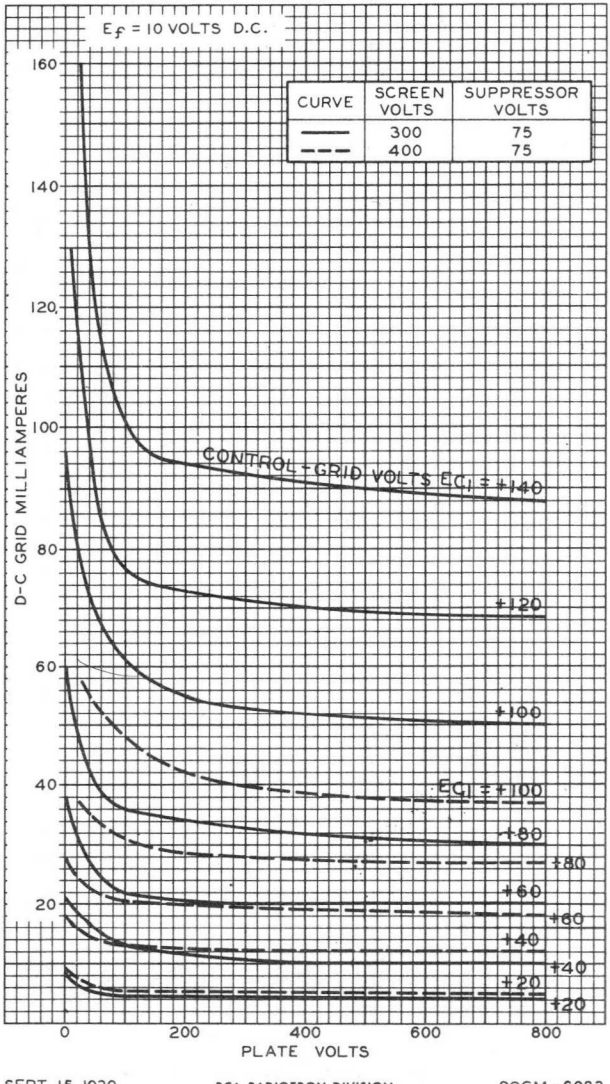
RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC.

92CM-6082

828

828

TYPICAL CHARACTERISTICS



SEPT. 15, 1939

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC.

92CM-6083

Twin Beam Power Tube

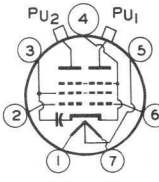
GENERAL DATA

Electrical:

	Series	*Parallel*	
Heater, for Unipotential Cathode:			
Heater Arrangement			
Voltage (AC or DC)	12.6 ± 10%	6.3 ± 10%	volts
Current	1.125	2.250	amp
Transconductance (Each unit) for dc plate volts = 250, dc grid No.2 volts = 175, and dc plate ma. = 60.		8500	μmhos
Mu-Factor, Grid No.2 to Grid No.1 (Each unit) for dc plate volts & dc grid No.2 volts = 225, and dc plate ma. = 60.		9	
Direct Interelectrode Capacitances (Each unit):			
Grid-No.1 to plate[a]		0.12 max.	pf
Grid No.1 to cathode & grid No.3, grid No.2, and heater		14.5	pf
Plate to cathode & grid No.3, grid No.2, and heater		7.0	pf
Grid-No.2-to-Cathode Capacitance including internal grid-No.2 bypass capacitor (Approx.)		65	pf

Mechanical:

Operating Position	Vertical, base up or down; Horizontal, plane of each plate vertical
Overall Length	4-1/8" ± 3/16"
Seated Length	3-11/16" ± 3/16"
Maximum Diameter	2-3/8"
Bulb	T16
Bulb Terminals	See *Dimensional Outline*
Base	Medium Molded-Flare Septar 7-Pin (JEDEC No. 7-2)
Basing Designation for BOTTOM VIEW	7BP



Pin 1 - Heater
Pin 2 - Grid No.1 of Unit No.2
Pin 3 - Grid No.2
Pin 4 - Cathode, Grid No.3
Pin 5 - Heater Center-Tap
Pin 6 - Grid No.1 of Unit No.1
Pin 7 - Heater
P_{U_1} - Plate of Unit No.1
P_{U_2} - Plate of Unit No.2

AF POWER AMPLIFIER & MODULATOR — Class AB_1[b]

Values are on a per-tube basis

Maximum CCS[c] Ratings, *Absolute-Maximum Values:*

DC PLATE VOLTAGE	750 max. volts

← Indicates a change.

DC GRID-No.2 VOLTAGE	225 max.	volts
MAX.-SIGNAL DC PLATE CURRENT[d]	250 max.	ma
MAX.-SIGNAL PLATE INPUT[d]	100 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT[d]	7 max.	watts
PLATE DISSIPATION[d]	30 max.	watts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	100 max.	volts
Heater positive with respect to cathode	100 max.	volts
BULB TEMPERATURE (At hottest point on bulb surface)	235 max.	°C

Typical Operation:

DC Plate Voltage	600	volts
DC Grid-No.2 Voltage[e]	200	volts
DC Grid-No.1 Voltage[f]	-18	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage	36	volts
Zero-Signal DC Plate Current	40	ma
Max.-Signal DC Plate Current	110	ma
Zero-Signal DC Grid-No.2 Current	6	ma
Max.-Signal DC Grid-No.2 Current	26	ma
Effective Load Resistance (Plate-to-plate)	13750	ohms
Max.-Signal Driving Power (Approx.)	0	watts
Max.-Signal Power Output (Approx.)	44	watts

→ PLATE-MODULATED PUSH-PULL RF POWER AMPLIFIER--Class C Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1. Values are on a per tube basis.

Natural Cooling

Maximum Ratings, *Absolute-Maximum Values:*

	CCS	*ICAS*[g]	
DC PLATE VOLTAGE	600 max.	600 max.	volts
DC GRID-No.2 VOLTAGE	225 max.	225 max.	volts
DC GRID-No.1 VOLTAGE	-175 max.	-175 max.	volts
DC PLATE CURRENT	212 max.	212 max.	ma
DC GRID-No.1 CURRENT	15 max.	15 max.	ma
PLATE INPUT	67.5 max.	90 max.	watts
GRID-No.2 INPUT	7 max.	7 max.	watts
PLATE DISSIPATION	21 max.	28 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	100 max.	100 max.	volts
Heater positive with respect to cathode	100 max.	100 max.	volts
BULB TEMPERATURE (At hottest point on bulb surface)	235 max.	235 max.	°C

Typical Operation with Natural Cooling:

DC Plate Voltage	600	425	600	volts

→ Indicates a change.

	CCS	ICAS		
DC Grid-No.2 Voltage:[h]				
From a grid-No.2 series resistor of:				
32000 ohms	190	–	–	volts
11000 ohms	–	200	–	volts
25000 ohms	–	–	200	volts
DC Grid-No.1 Voltage:[j]				
From a grid-No.1 resistor of:				
15000 ohms	-60	–	–	volts
43000 ohms	–	-60	–	volts
8600 ohms	–	–	-60	volts
Peak RF Grid-No.1-to-Grid-No.1 Voltage	138	160	144	volts
DC Plate Current	112	212	150	ma
DC Grid-No.2 Current	13	21	16	ma
DC Grid-No.1 Current (Approx.)	4	14	7	ma
Driving Power (Approx.)	0.3	1	0.5	watt
Power Output (Approx.)	50	63	70	watts

Forced-Air Cooling

Maximum Ratings, *Absolute-Maximum Values:*

	CCS	ICAS	
DC PLATE VOLTAGE	600 max.	600 max.	volts
DC GRID-No.2 VOLTAGE	225 max.	250 max.	volts
DC GRID-No.1 VOLTAGE	-175 max.	-175 max.	volts
DC PLATE CURRENT	212 max.	240 max.	ma
DC GRID-No.1 CURRENT	15 max.	20 max.	ma
PLATE INPUT	90 max.	120 max.	watts
GRID-No.2 INPUT	7 max.	8 max.[k]	watts
PLATE DISSIPATION	28 max.	40 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	100 max.	100 max.	volts
Heater positive with respect to cathode	100 max.	100 max.	volts
BULB TEMPERATURE (At hottest point on bulb surface)	235 max.	235 max.	°C

Typical Operation with Forced-Air Cooling:

DC Plate Voltage	425	600	600	volts
DC Grid-No.2 Voltage:[h]				
From a grid-No.2 series resistor of:				
11000 ohms	200	–	–	volts
25000 ohms	–	200	–	volts
20000 ohms	–	–	200	volts
DC Grid-No.1 Voltage:[j]				
From a grid-No.1 resistor of:				
4300 ohms	-60	–	–	volts
8600 ohms	–	-60	–	volts
5400 ohms	–	–	-70	volts
Peak RF Grid-No.1-to-Grid-No.1 Voltage	160	144	180	volts

	CCS		ICAS	
DC Plate Current	212	150	200	ma
DC Grid-No.2 Current	21	16	20	ma
DC Grid-No.1 Current (Approx.)	14	7	13	ma
Driving Power (Approx.)	1	0.5	1.1	watts
Power Output (Approx.)	63	70	90	watts

PUSH-PULL RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy[m]
and
PUSH-PULL RF POWER AMPLIFIER — Class C FM Telephony

Values are on a per-tube basis unless otherwise specified

Natural Cooling

Maximum Ratings, *Absolute-Maximum Values:*

	CCS	ICAS	
DC PLATE VOLTAGE	750 max.	750 max.	volts
DC GRID-No.2 VOLTAGE	225 max.	225 max.	volts
DC GRID-No.1 VOLTAGE	-175 max.	-175 max.	volts
DC PLATE CURRENT	240 max.	240 max.	ma
DC GRID-No.1 CURRENT	15 max.	15 max.	ma
PLATE INPUT	90 max.	120 max.	watts
GRID-No.2 INPUT	7 max.	7 max.	watts
PLATE DISSIPATION	30 max.	40 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	100 max.	100 max.	volts
Heater positive with respect to cathode	100 max.	100 max.	volts
BULB TEMPERATURE (At hottest point on bulb surface)	265 max.	265 max.	°C

Typical Operation with Natural Cooling:

DC Plate Voltage	750	500 750	volts
DC Grid-No.2 Voltage:[n]			
From a grid-No.2 series resistor of:			
40000 ohms	190	- -	volts
13000 ohms	-	200 -	volts
32000 ohms	-	- 200	volts
DC Grid-No.1 Voltage:[p]			
From a grid-No.1 resistor of:			
12500 ohms	-50	- -	volts
3000 ohms	-	-45 -	volts
7200 ohms	-	- -50	volts
From a cathode resistor of:			
360 ohms	-50	- -	volts
170 ohms	-	-45 -	volts
270 ohms	-	- -50	volts
Peak RF Grid-No.1-to-Grid-No.1 Voltage	116	128 124	volts
DC Plate Current	120	230 160	ma
DC Grid-No.2 Current	14	23 17	ma
DC Grid-No.1 Current (Approx.)	4	15 7	ma

Driving Power (Approx.). . . .	0.3	0.9	0.4	watt
Power Output (Approx.)	70	83	90	watts

Forced-Air Cooling

Maximum Ratings, *Absolute-Maximum Values:*

	CCS	*ICAS*	
DC PLATE VOLTAGE	750 max.	750 max.	volts
DC GRID-No.2 VOLTAGE	225 max.	250 max.	volts
DC GRID-No.1 VOLTAGE	-175 max.	-175 max.	volts
DC PLATE CURRENT	240 max.	240 max.	ma
DC GRID-No.1 CURRENT	15 max.	20 max.	ma
PLATE INPUT.	120 max.	150 max.	watts
GRID-No.2 INPUT.	7 max.	8 max.	watts
PLATE DISSIPATION.	40 max.	45 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	100 max.	100 max.	volts
Heater positive with respect to cathode	100 max.	100 max.	volts
BULB TEMPERATURE (At hottest point on bulb surface) . . .	235 max.	235 max.	°C

Typical Operation with Forced-Air Cooling:

DC Plate Voltage	500	750	750	volts
DC Grid-No.2 Voltage:[n]				
From a grid-No.2 series resistor of:				
13000 ohms	200	–	–	volts
32000 ohms	–	200	–	volts
27500 ohms	–	–	200	volts
DC Grid-No.1 Voltage:[p]				
From a grid-No.1 resistor of:				
3000 ohms.	-45	–	–	volts
7200 ohms.	–	-50	–	volts
4200 ohms.	–	–	-50	volts
From a cathode resistor of:				
170 ohms	-45	–	–	volts
270 ohms	–	-50	–	volts
200 ohms	–	–	-50	volts
Peak RF Grid-No.1-to-Grid-No.1 Voltage	128	124	134	volts
DC Plate Current	230	160	200	ma
DC Grid-No.2 Current	23	17	20	ma
DC Grid-No.1 Current (Approx.).	15	7	12	ma
Driving Power (Approx.). . . .	0.9	0.4	0.8	watt
Power Output (Approx.)	83	90	115	watts

[a] With external shield up to flange seal.

[b] Subscript 1 indicates that grid-No.1 current does not flow during any part of the input cycle.

[c] Continuous Commercial Service.

[d] Averaged over any audio-frequency cycle of sine-wave form.

[e] Obtained preferably from a separate source or from the plate-voltage supply with a voltage divider.

f The type of input-coupling network used should not introduce too much resistance in the grid-No.1 circuit. Transformer or impedance coupling devices are recommended. When grid No.1 is operated in the negative region with fixed bias, the dc grid-No.1-circuit resistance should not exceed 100000 ohms. Cathode bias is not recommended.

g Intermittent Commercial and Amateur Service.

h Obtained preferably from a separate source modulated with the plate supply, or from the modulated plate supply through a series resistor.

j Obtained from grid-No.1 resistor or from a combination of grid-No.1 resistor with either fixed supply or cathode resistor.

k In ICAS applications at frequencies less than 20 Mc where duty factor does not exceed 0.2, maximum "on" period does not exceed 30 seconds, and average modulation factor does not exceed 0.25, maximum grid-No.2 input of 12 watts is permitted.

m Key-down conditions per tube without amplitude modulation. Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

n Obtained preferably from a separate source, or from the plate supply voltage with a voltage divider, or through a series resistor. A series grid-No.2 resistor should be used only when the 829B is used in a circuit which is not keyed. Grid-No.2 voltage must not exceed 600 volts under key-up conditions.

p Obtained from fixed supply, by grid No.1 resistor, by cathode resistor, or by combination methods.

SHIELDING AND BYPASSING

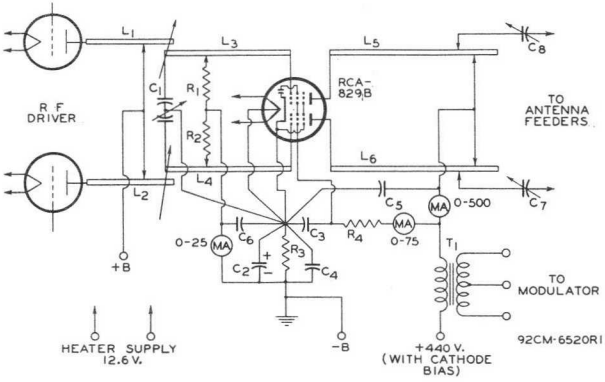
Shielding of the 829B in an rf amplifier is required for stable operation. A convenient method of shielding is to mount the tube with one end through a hole in a metal plate so that the edge of the hole is close to the internal shield of the tube. Due to the importance, at the very-high frequencies, of obtaining the shortest leads possible, rf bypassing must be accomplished close to the tube terminals. Ribbon leads acting as plates of the bypass capacitors are effective. All circuit returns should be made to the common cathode connection. RF chokes may be advisable in the voltage-supply leads.

MAXIMUM RATINGS vs OPERATING FREQUENCY

OPERATING FREQUENCY Mc	MAXIMUM PERMISSIBLE PERCENTAGE OF MAXIMUM-RATED PLATE VOLTAGE & PLATE INPUT	
	TELEPHONY	TELEGRAPHY
	Class C Plate-Modulated	Class C Unmodulated
200	100	100
250	89	89

VHF PLATE-MODULATED PUSH-PULL RF POWER AMPLIFIER

(OPERATING FREQUENCY APPROX. 200 Mc)



C_1 = 1.2 to 10 pf per section

C_2 = 25 μf, 200 Volts

C_3 C_4 C_5 C_6 = 500 pf, Mica

C_7 C_8 = 3 to 35 pf

R_1 R_2 = 7500 to 15000 Ohms, 1 Watt

R_3 = 60 Ohms, 10 Watts

R_4 = 6400 Ohms, 15 Watts

T_1 = Modulation Transformer

L_1 L_2 = Dimensions dependent on type of driver tube; Approx. same as L_5 L_6

L_3 L_4 = 1/4" Dia. copper tubing, approx. 10" long and spaced approx. 7/8" between centers.

L_5 L_6 = 3/8" Dia. copper tubing, approx. 7" long and spaced approx. 7/8" between centers.

NOTE 1: Adjust coupling of L_1L_2 and L_3L_4 for optimum grid excitation.

NOTE 2: Grid resistors should be adjusted on L_3L_4 at voltage node.

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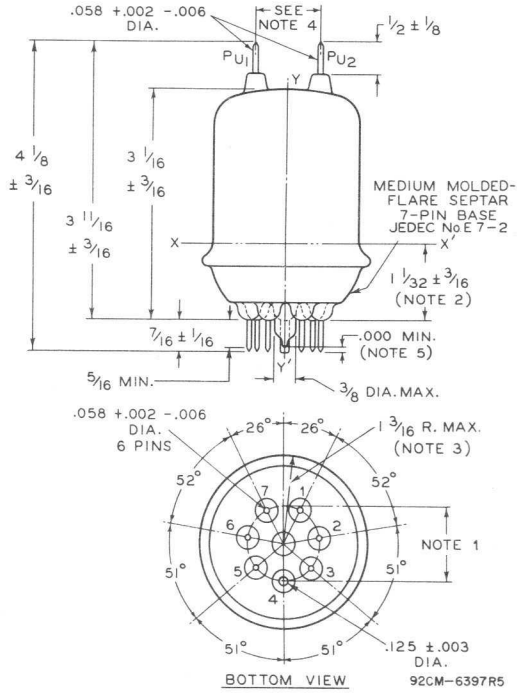
829B



ALL DIMENSIONS IN INCHES

THE REFERENCE AXIS YY' IS DEFINED AS THE AXIS OF THE BASE-PIN GAUGE DESCRIBED IN NOTE 1.

NOTE 1: ANGULAR VARIATIONS BETWEEN PINS AND VARIATION IN PIN-CIRCLE DIAMETER ARE HELD TO TOLERANCES SUCH THAT PINS WILL ENTER TO A DISTANCE OF 0.375" A FLAT-PLATE BASE-PIN GAUGE HAVING SIX HOLES 0.0800" ± 0.005" AND ONE HOLE 0.1450" ± 0.0005" ARRANGED ON A 1.0000" ± 0.0005" CIRCLE AT SPECIFIED ANGLES WITH TOLERANCE OF ±5' FOR EACH ANGLE. GAUGE IS ALSO PROVIDED WITH A HOLE 0.500" ± 0.010" CONCENTRIC WITH PIN CIRCLE WHOSE CENTER IS ON THE AXIS YY'.

NOTE 2: A FLAT-PLATE FLANGE GAUGE WITH HOLE 2.063" +0.003" -0.000" IS LOWERED OVER TUBE SEATED IN BASE-PIN GAUGE SO THAT THE HOLE AXIS IS COINCIDENT WITH AXIS YY' WITHIN 0.150", AND SO THAT THE BOTTOM SURFACE OF THE FLANGE GAUGE IS PARALLEL TO THE TOP SURFACE OF THE BASE-PIN GAUGE, AND UNTIL THE FLANGE GAUGE RESTS ON THE TUBE-FLANGE SEAL AT POSITION XX'. THE PERPENDICULAR DISTANCE BETWEEN THE TWO

GAUGES WILL BE AS SHOWN.

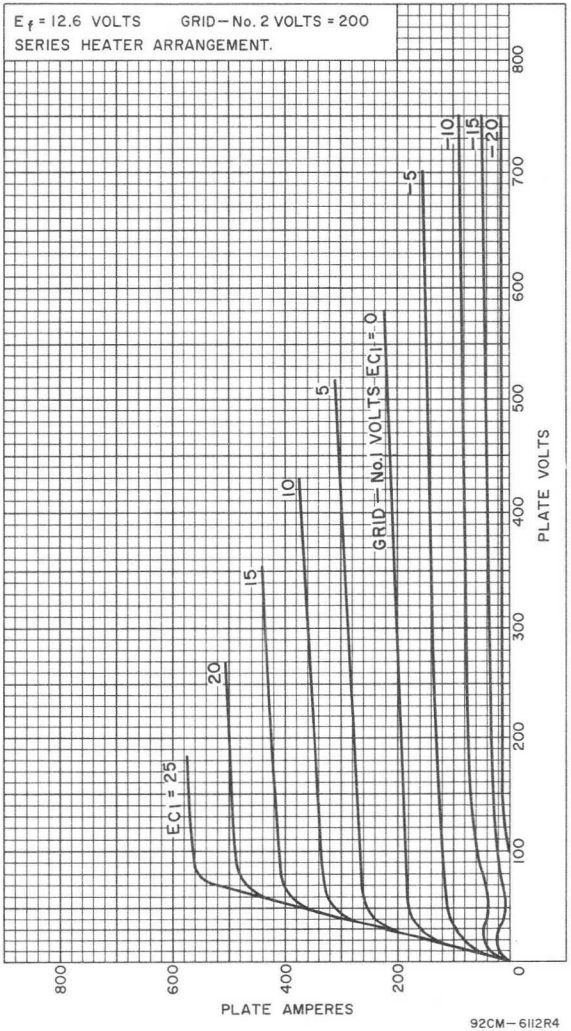
NOTE 3: MINIMUM DIAMETER OF TUBE-SEAL FLANGE WILL BE SUCH THAT A RING GAUGE HAVING INSIDE DIAMETER OF 2.125" − 0.000" + 0.003" AND THICKNESS OF 0.125" ± 0.010" WILL NOT PASS THE FLANGE WHEN TRIED AT ANY ANGLE.

NOTE 4: THE PLATE LEADS WILL ENTER A FLAT-PLATE PLATE-LEAD GAUGE HAVING MINIMUM THICKNESS OF 0.375" AND HAVING TWO HOLES 0.1200" ± 0.0005" WHOSE CENTERS ARE LOCATED AT A DISTANCE OF 0.424" ± 0.001" FROM THE AXIS YY' AND WHOSE AXES ARE PARALLEL TO YY'. THE PLANE THROUGH THESE AXES WILL BE 90° ± 5' FROM THE PLANE THROUGH YY' AND PIN No.4.

NOTE 5: EXHAUST TIP WILL NOT EXTEND BEYOND THE PLANE WHICH PASSES THROUGH THE ENDS OF THE THREE LONGEST PINS.

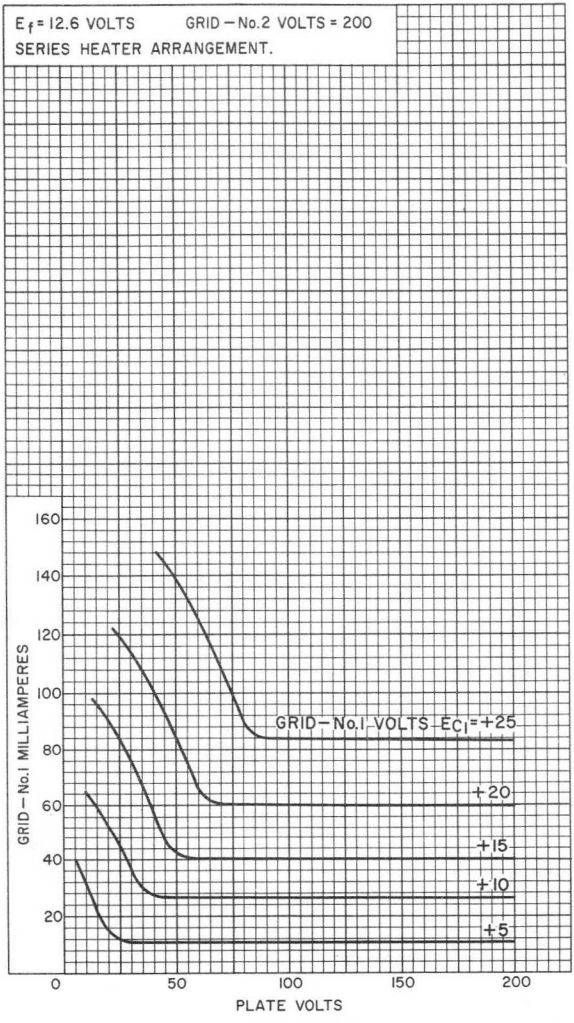
829B

TYPICAL CHARACTERISTICS
For Each Unit



92CM—6112R4

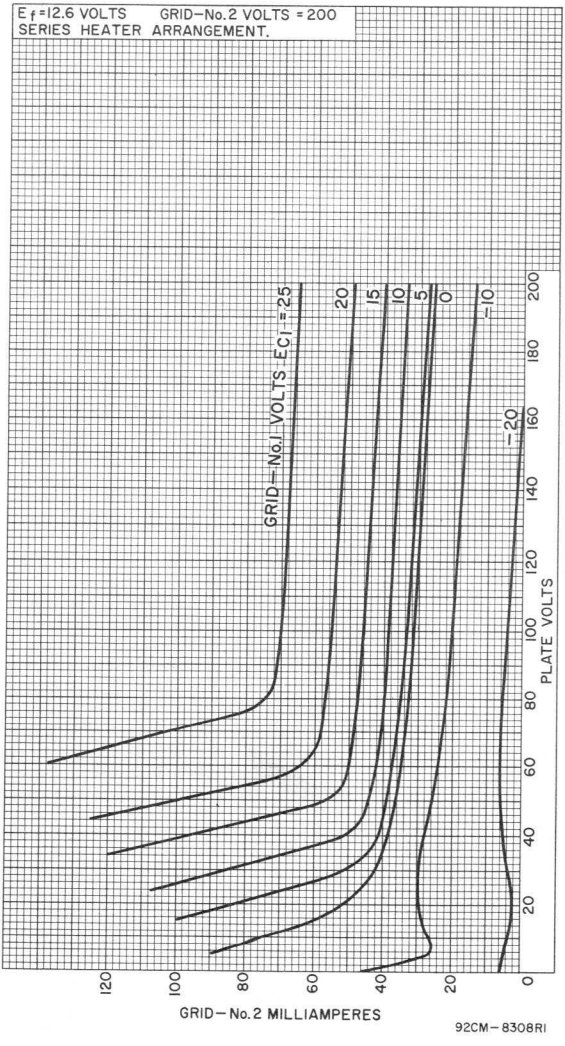
TYPICAL CHARACTERISTICS
For Each Unit



92CM—6114R4

829B

TYPICAL CHARACTERISTICS
For Each Unit



92CM-8308RI

830-B

R-F POWER AMPLIFIER, OSCILLATOR, CLASS B MODULATOR

Filament	Thoriated Tungsten	
Voltage	10	a-c or d-c volts
Current	2	amp.
Amplification Factor	25	
Direct Interelectrode Capacitances (approx.):		
Grid to Plate	11	μμf
Grid to Filament	5	μμf
Plate to Filament	1.8	μμf
Maximum Overall Length		6-11/16"
Maximum Diameter		2-1/16"
Cap		Small Metal
Base		Medium 4-Pin Bayonet

MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS

A-F POWER AMPLIFIER & MODULATOR - Class B

D-C Plate Voltage		1000 max.	volts
Max-Signal D-C Plate Current*		150 max.	ma.
Max-Signal Plate Input*		150 max.	watts
Plate Dissipation*		60 max.	watts
Typical Operation - 2 tubes:			
Unless otherwise specified, values are for 2 tubes.			
Filament Voltage	10	10	a-c volts
D-C Plate Voltage	800	1000	volts
D-C Grid Voltage	-27	-35	volts
Peak A-F Grid-to-Grid Voltage	250	270	volts
Zero-Signal D-C Plate Current	20	20	ma.
Max-Signal D-C Plate Current	280	280	ma.
Load Resistance (per tube)	1500	1900	ohms
Effective Load Res. (plate to plate)	6000	7600	ohms
Max-Signal Driving Power	5	6	approx. watts
Max-Signal Power Output	135	175	approx. watts

R-F POWER AMPLIFIER - Class B Telephony

Carrier conditions per tube for use with a max. modulation fact. of 1.0

D-C Plate Voltage		1000 max.	volts
D-C Plate Current		100 max.	ma.
Plate Input		90 max.	watts
Plate Dissipation		60 max.	watts
Typical Operation:			
Filament Voltage	10	10	a-c volts
D-C Plate Voltage	800	1000	volts
D-C Grid Voltage	-27	-35	volts
Peak R-F Grid Voltage	85	85	volts
D-C Plate Current	95	85	ma.
D-C Grid Current**	7	6	approx. ma.
Driving Power** °	9	6	approx. watts
Power Output	23	26	approx. watts

*, **, ° See next page.

(continued on next page)

830-B
R-F POWER AMPLIFIER, OSCILLATOR CLASS B MODULATOR

(continued from preceding page)

PLATE-MODULATED R-F POWER AMPLIFIER - Class C Telephony

Carrier conditions per tube for use with a max. modulation fact. of 1.0

D-C Plate Voltage			800 max.	volts
D-C Grid Voltage			-300 max.	volts
D-C Plate Current			100 max.	ma.
D-C Grid Current			30 max.	ma.
Plate Input			80 max.	watts
Plate Dissipation			40 max.	watts
Typical Operation:				
Filament Voltage		10	10 a-c	volts
D-C Plate Voltage		600	800	volts
D-C Grid Voltage		-140	-150	volts
Peak R-F Grid Voltage		255	265	volts
D-C Plate Current		95	95	ma.
D-C Grid Current **		30	20 approx.	ma.
Driving Power **		7	5 approx.	watts
Power Output		38	50 approx.	watts

R-F POWER AMPLIFIER & OSCILLATOR - Class C Telegraphy

Key-down conditions per tube without modulation ##

D-C Plate Voltage			1000 max.		volts
D-C Grid Voltage			-300 max.		volts
D-C Plate Current			150 max.		ma.
D-C Grid Current			30 max.		ma.
Plate Input			150 max.		watts
Plate Dissipation			60 max.		watts
Typical Operation:					
Filament Voltage	10	10	10	a-c	volts
D-C Plate Voltage	600	800	1000		volts
D-C Grid Voltage	-95	-105	-110		volts
Peak R-F Grid Voltage	235	245	250		volts
D-C Plate Current	140	140	140		ma.
D-C Grid Current **	30	30	30	approx.	ma.
Driving Power **	7	7	7	approx.	watts
Power Output	45	70	90	approx.	watts

* Averaged over any audio-frequency cycle.

** Subject to wide variations as explained on sheet TRANS. TUBE RATINGS.

° At crest of a-f cycle with modulation factor of 1.0.

Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

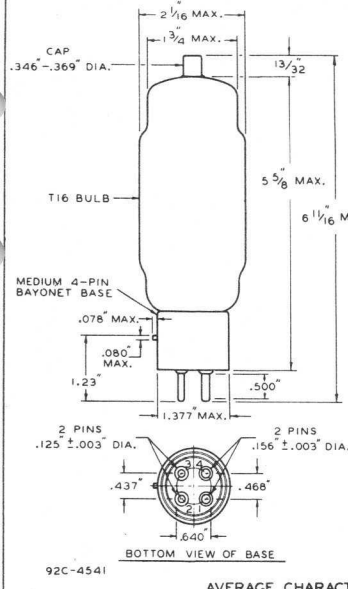
For operation of the 830-B at the higher frequencies, refer to sheet TRANS. TUBE RATINGS vs FREQUENCY.

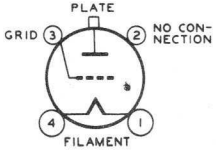
(continued on next page)

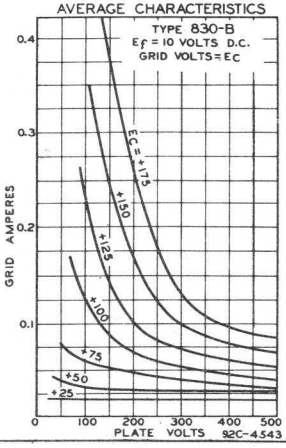
830-B

R-F POWER AMPLIFIER, OSCILLATOR, CLASS B MODULATOR

(continued from preceding page)

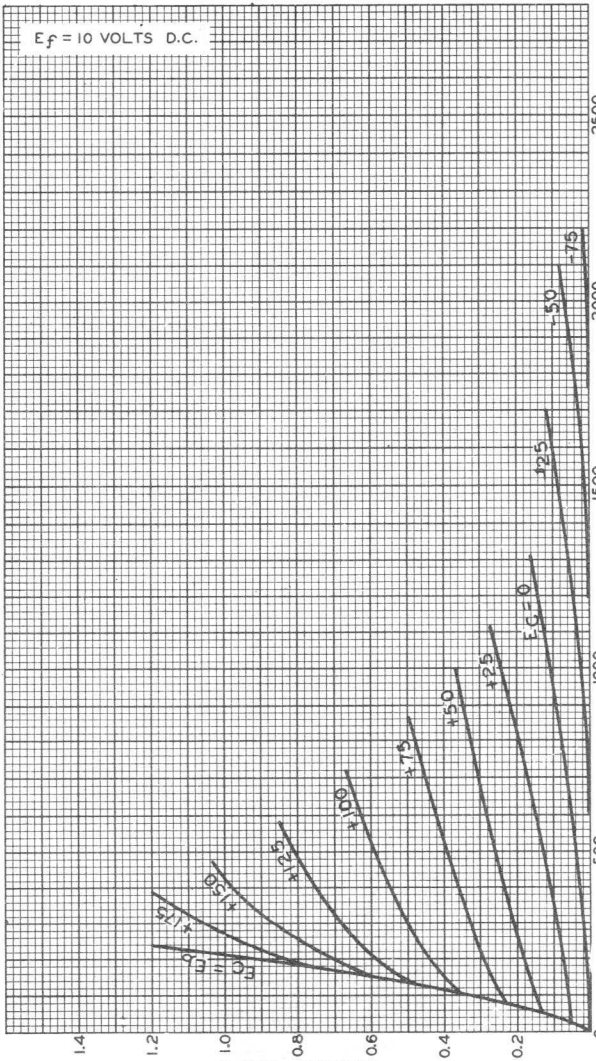






830-B

AVERAGE PLATE CHARACTERISTICS



JAN. 17, 1936

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC.

92C-4542

832-A

PUSH-PULL RF BEAM POWER AMPLIFIER

UNLESS OTHERWISE SPECIFIED, VALUES ARE ON A PER-TUBE BASIS

GENERAL DATA

Electrical:

Heater, for Unipotential Cathodes:

Heater Arrangement	*Series*	*Parallel*	
Voltage	12.6 ± 10%	6.3 ± 10%	ac or dc volts
Current	0.8	1.6	amp

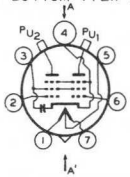
Transconductance (Approx., each unit) For grid-No.2 volts = 135 and plate ma. = 30	3500	μmhos
Mu-Factor, Grid No.2 to Grid No.1 (Approx., each unit) For grid-No.2 volts = 250 and plate ma. = 30	6.5	
Direct Interelectrode Capacitances (Each Unit):		
Grid-No.1 to Plate[o]	0.07 max.	μμf
Input	8.0	μμf
Output	3.8	μμf
Grid-No.2-to-Cathode Capacitance including internal grid-No.2 bypass capacitor (Approx.)	65	μμf

[o] With external shield in plane of seal flange.

Mechanical:

Mounting Position	Any
Overall Length	3-3/16" ± 1/8"
Seated Length	2-3/4" ± 1/8"
Maximum Diameter	See Outline Drawing
Bulb Terminals	See Outline Drawing
Base	Medium Molded-Flare Septar 7-Pin (JETEC No.E7-2)
Basing Designation for BOTTOM VIEW	7BP

Pin 1 - Heater
Pin 2 - Grid No.1 of Unit No.2
Pin 3 - Grid No.2
Pin 4 - Cathode, Grid No.3
Pin 5 - Heater Center-Tap



Pin 6 - Grid No.1 of Unit No.1
Pin 7 - Heater
PU1 - Plate of Unit No.1
PU2 - Plate of Unit No.2

PLANE OF ELECTRODES OF EACH UNIT IS PARALLEL TO PLANE THROUGH AXIS OF TUBE AND AA'

Bulb Temperature (At hottest point)	200 max.	°C ←

PLATE-MODULATED PUSH-PULL RF POWER AMP. - Class C Telephony

Carrier conditions per tube for use with a max.modulation factor of 1.0

Maximum Ratings, *Absolute Values*: ←

	CCS●	*ICAS*●●	
DC PLATE VOLTAGE	600 max.	600 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	250 max.	250 max.	volts

●, ●●: See next page. ← Indicates a change.

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PUSH-PULL RF BEAM POWER AMPLIFIER

	CCS●	*ICAS*●●	
DC GRID-No.1 (CONTROL-GRID) VOLTAGE. .	−175 max.	−175 max.	volts
DC PLATE CURRENT.	75 max.	95 max.	ma
DC GRID-No.1 CURRENT. . . .	6 max.	6 max.	ma
PLATE INPUT	22 max.	36 max.	watts
GRID-No.2 INPUT	3.4 max.	5 max.	watts
PLATE DISSIPATION	10 max.	15 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode.	100 max.	100 max.	volts
Heater positive with respect to cathode.	100 max.	100 max.	volts

→ **Typical Operation**

DC Plate Voltage.	425	600	600	volts
DC Grid-No.2 Voltage# . . .	200	200	200	volts
From series resistor of .	14000	25000	20000	ohms
DC Grid-No.1 Voltage▲▲ . .	−60	−65	−70	volts
From grid resistor of . .	25000	25000	23000	ohms
Peak RF Grid-No.1-to-Grid-No.1 Voltage .	140	150	160	volts
DC Plate Current.	52	36	60	ma
DC Grid-No.2 Current. . . .	16	16	20	ma
DC Grid-No.1 Cur. (Approx.)	2.4	2.6	3.0	ma
Driving Power (Approx.) . .	0.15	0.18	0.21	watt
Power Output (Approx.). . .	16	17	26	watts

PUSH-PULL RF POWER AMPLIFIER & OSCILLATOR-Class C Telegraphy

Key-down conditions per tube without modulation□□

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

	CCS●	*ICAS*●●	
DC PLATE VOLTAGE.	750 max.	750 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	250 max.	250 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE. .	−175 max.	−175 max.	volts
DC PLATE CURRENT.	90 max.	115 max.	ma
DC GRID-No.1 CURRENT. . . .	6 max.	6 max.	ma
PLATE INPUT	36 max.	50 max.	watts
GRID-No.2 INPUT	5 max.	5 max.	watts
PLATE DISSIPATION	15 max.	20 max.	watts

\# Obtained from a separate source modulated with the plate supply, or from the modulated plate supply through a series resistor of the value shown.

▲▲ Obtained from a grid resistor of value shown (per tube) or by partial self-bias methods.

□□ Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

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

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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PUSH-PULL RF BEAM POWER AMPLIFIER

	CCS●		ICAS●●		
PEAK HEATER-CATHODE VOLTAGE:					
Heater negative with respect to cathode . .	100 max.		100 max.		volts
Heater positive with respect to cathode . .	100 max.		100 max.		volts
Typical Operation:					←
DC Plate Voltage	500	750	750		volts
DC Grid-No.2 Voltage**. . .	200	200	200		volts
From series resistor of. .	21000	37000	25000		ohms
DC Grid-No.1 Voltage●. . . .	-65	-65	-50		volts
From grid resistor of. . .	25000	23000	12500		ohms
From cathode resistor of .	730	1000	550		ohms
Peak RF Grid-No.1-to-Grid-No.1 Voltage . .	150	150	130		volts
DC Plate Current	72	48	65		ma
DC Grid-No.2 Current	14	15	22		ma
DC Grid-No.1 Current (Approx.)	2.6	2.8	4.0		ma
Driving Power (Approx.). . .	0.18	0.19	0.24		watt
Power Output (Approx.) . . .	26	26	35		watts

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN ←

	Note	Min.	Max.	
Heater Current (Each section).	1	0.76	0.84	amp
Grid No.1—Plate Capacitance (Each unit).	2	–	0.07	μμf
Input (Each unit).	–	6.6	9.4	μμf
Output (Each unit)	–	2.8	4.8	μμf
Plate Current (Each unit). . .	3	18	42	ma
Grid-No.2 Current (Each unit).	3	0.1	5.5	ma
Positive Grid-No.1 Current (Each unit).	4	8	52	ma
Useful Power Output (Per tube)	5	14	–	watts

Note 1: With 6.3 volts on heater section under test.

Note 2: With external shield in plane of seal flange.

Note 3: With 6.3 volts on heater sections in parallel, dc plate voltage of 250 volts on unit under test, dc grid-No.2 voltage of 135 volts, dc grid-No.1 voltage of -10 volts on unit under test, and dc grid-No.1 voltage of -100 volts on unit not under test.

Note 4: With 6.3 volts on heater sections in parallel, dc plate voltage of 90 volts on unit under test, dc grid-No.2 voltage of 90 volts, dc grid-No.1 voltage of +20 volts on unit under test, and dc grid-No.1 voltage of -100 volts on unit not under test.

Note 5: In a push-pull self-excited oscillator circuit with 11 volts on heater sections in series, dc plate voltage of 400 volts on each unit, max. dc grid-No.2 voltage of 250 volts, total dc plate current of 90 ma., total dc grid-No.1 current of 2 to 6 ma., grid-No.1 resistor of 8000 to 18000 ohms, and frequency of 200 megacycles per second.

●, ●●, ⊕, ⊕⊕: See next page. ← Indicates a change.

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PUSH-PULL RF BEAM POWER AMPLIFIER

- Continuous Commercial Service.
- ●● Intermittent Commercial and Amateur Service.
- ⊕ The grid-circuit resistance should never exceed 25000 ohms (total) per tube; or 50000 ohms per unit. Any additional bias required must be supplied by a cathode resistor or a fixed supply.
- ★★ Obtained from a separate source, or from the plate-voltage supply with a voltage divider, or through a series resistor of value shown. The grid-No.2 voltage must not exceed 600 volts under key-up conditions.

Data on operating frequencies for the 832-A are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY

OPERATING NOTES

Shielding of the 832-A in an rf amplifier is required for stable operation. A convenient method of shielding is to mount the tube with one end through a hole in a metal plate so that the edge of the hole is close to the internal shield of the tube. Due to the importance, at the ultra-high frequencies, of obtaining the shortest leads possible, rf bypassing must be accomplished close to the tube terminals. Ribbon leads acting as plates of the bypassing capacitors are effective. All circuit returns should be made to the common cathode connection. Rf chokes may be advisable in the voltage-supply leads.

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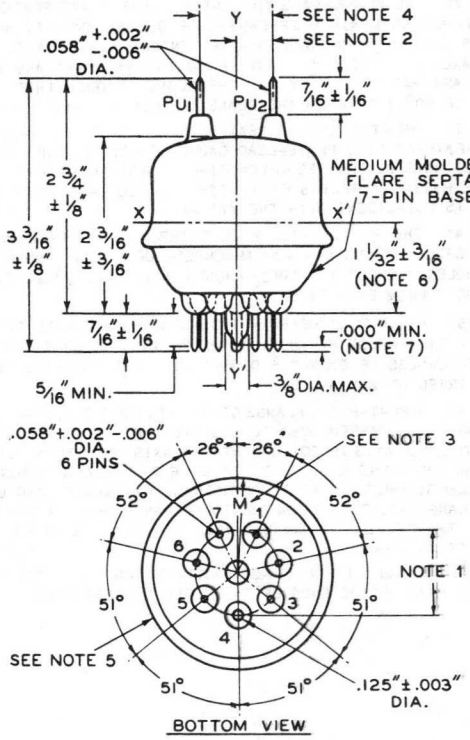
PUSH-PULL RF BEAM POWER AMPLIFIER



THE REFERENCE AXIS YY' IS DEFINED AS THE AXIS OF THE BASE-PIN GAUGE DESCRIBED IN NOTE 1

92CM-6374R3

NOTE 1: ANGULAR VARIATIONS BETWEEN PINS AND VARIATION IN PIN-CIRCLE DIAMETER ARE HELD TO TOLERANCES SUCH THAT PINS WILL ENTER TO A DISTANCE OF 0.375" A FLAT-PLATE BASE-PIN GAUGE HAVING SIX HOLES 0.0800" ± 0.0005" AND ONE HOLE 0.1450" ± 0.0005" ARRANGED ON A 1.0000" ± 0.0005" CIRCLE AT SPECIFIED ANGLES WITH TOLERANCE OF ± 5' FOR EACH ANGLE. GAUGE IS ALSO PROVIDED WITH A HOLE 0.500" ± 0.010" CONCENTRIC WITH PIN CIRCLE WHOSE CENTER IS ON THE AXIS YY'.

RCA

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PUSH-PULL RF BEAM POWER AMPLIFIER

NOTE 2: THE PLATE LEADS WILL ENTER A FLAT-PLATE PLATE-LEAD GAUGE HAVING MINIMUM THICKNESS OF 0.375" AND HAVING TWO HOLES 0.2000" ± 0.0005" WHOSE CENTERS ARE LOCATED AT A DISTANCE OF 0.424" ± 0.001" FROM THE AXIS YY' AND WHOSE AXES ARE PARALLEL TO YY'. THE PLANE THROUGH THESE AXES WILL BE 90° ± 5' FROM THE PLANE THROUGH YY' AND PIN No.4.

NOTE 3: WHEN THE TUBE IS SEATED IN THE BASE-PIN GAUGE AND CONSTRAINED BY THE PLATE-LEAD GAUGE OF NOTE 2, THE MAXIMUM RADIUS 'M' IS DETERMINED BY LOWERING OVER THE TUBE A CYLINDER GAUGE HAVING A RADIUS OF 1.156" + 0.000" - 0.003" WHOSE AXIS IS COINCIDENT WITH THE YY' AXIS.

NOTE 4: THE PLATE LEADS WILL ENTER A FLAT-PLATE PLATE-LEAD GAUGE HAVING MINIMUM THICKNESS OF 0.375" AND HAVING TWO HOLES 0.2000" ± 0.0005" WHOSE CENTERS ARE SPACED 0.848" ± 0.001" FROM EACH OTHER.

NOTE 5: MINIMUM DIAMETER OF TUBE-SEAL FLANGE WILL BE SUCH THAT A RING GAUGE HAVING I.D. OF 2.125" - 0.000" + 0.003" AND THICKNESS OF 0.125" ± 0.010" WILL NOT PASS THE FLANGE WHEN TRIED AT ANY ANGLE.

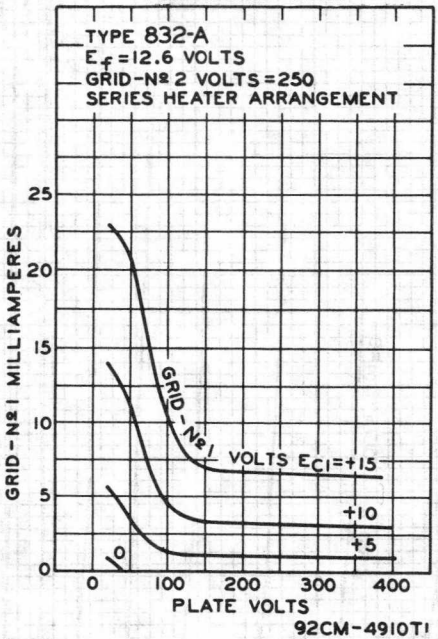
NOTE 6: A FLAT-PLATE FLANGE GAUGE WITH HOLE 2.063" - 0.000" + 0.003" IS LOWERED OVER TUBE SEATED IN BASE-PIN GAUGE SO THAT THE HOLE AXIS IS COINCIDENT WITH AXIS YY' WITHIN 0.150", AND SO THAT THE BOTTOM SURFACE OF THE FLANGE GAUGE IS PARALLEL TO THE TOP SURFACE OF THE BASE-PIN GAUGE, AND UNTIL THE FLANGE GAUGE RESTS ON THE TUBE-FLANGE SEAL AT POSITION XX'. THE PERPENDICULAR DISTANCE BETWEEN THE TWO GAUGES WILL BE AS SHOWN.

NOTE 7: EXHAUST TIP WILL NOT EXTEND BEYOND THE PLANE WHICH PASSES THROUGH THE ENDS OF THE THREE LONGEST PINS.

832-A

PUSH-PULL RF BEAM POWER AMPLIFIER

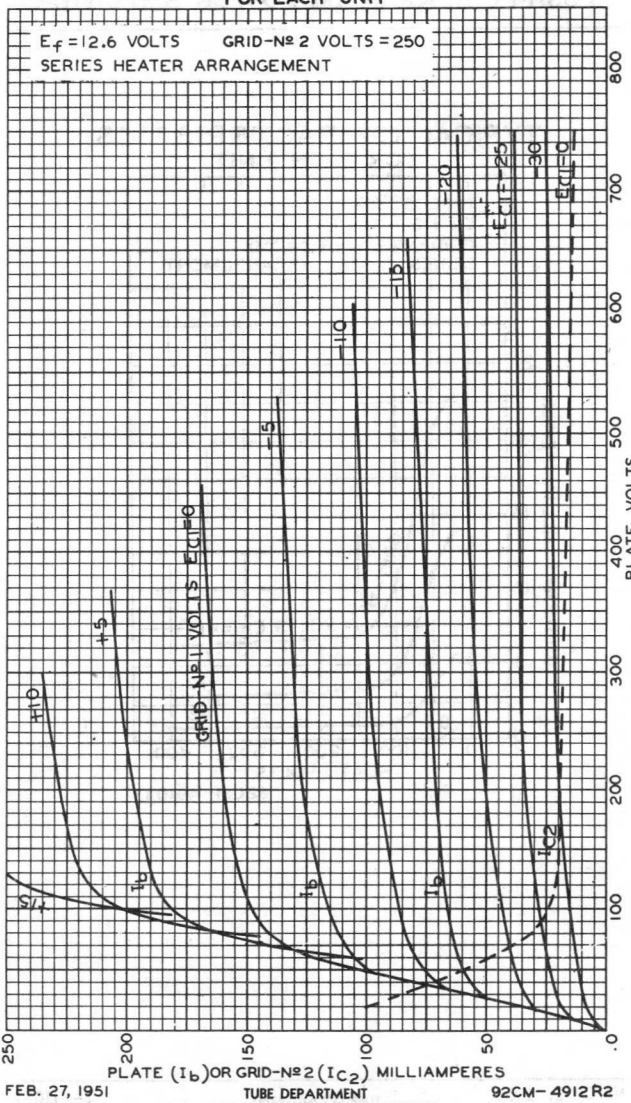
TYPICAL CHARACTERISTICS
FOR EACH UNIT



RCA

832-A

AVERAGE PLATE CHARACTERISTICS
FOR EACH UNIT



FEB. 27, 1951

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-4912R2

834

R-F POWER AMPLIFIER

Filament	Thoriated Tungsten	
Voltage	7.5	a-c or d-c volts
Current	3.1	amp. ←
Amplification Factor	10.5	
Direct Interelectrode Capacitances:		
Grid to Plate	2.6	μμf
Grid to Filament	2.2	μμf
Plate to Filament	0.6	μμf
Maximum Overall Length		6-7/8"
Maximum Diameter		2-11/16"
Bulb		S-21
Base		Medium 4-Pin, Bayonet
RCA Socket (Type UR-542A)		Stock No.9919

Cooling- Forced air from fan directed at middle and upper portions of bulb is recommended for all classes of service above 60 Mc.

Maximum Ratings Are Absolute Values

MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS

R-F POWER AMPLIFIER - Class B Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

D-C Plate Voltage			1250	max.	volts
D-C Plate Current			100	max.	ma.
Plate Input			75	max.	watts
Plate Dissipation			50	max.	watts
Typical Operation:					
D-C Plate Voltage	750	1000	1250		volts
D-C Grid Voltage #	-70	-90	-115		volts
Peak R-F Grid Voltage	90	100	115		volts
D-C Plate Current	50	50	50		ma.
D-C Grid Current **	1.0	0.5	0	approx.	ma.
Driving Power o **	3.3	3.1	3.0	approx.	watts
Power Output	11	16	20	approx.	watts

PLATE-MODULATED R-F POWER AMPLIFIER - Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

D-C Plate Voltage			1000	max.	volts
D-C Grid Voltage			-400	max.	volts
D-C Plate Current			100	max.	ma.
D-C Grid Current			20	max.	ma.
Plate Input			100	max.	watts
Plate Dissipation			35	max.	watts
Typical Operation:					
D-C Plate Voltage	750	1000			volts
D-C Grid Voltage *	14500	17700			ohms
	-290	-310			volts
Peak R-F Grid Voltage	415	435			volts
D-C Plate Current	90	90			ma.
D-C Grid Current **	20	17.5	approx.		ma.
Driving Power **	7.5	6.5	approx.		watts
Power Output	42	58	approx.		watts

* Obtained by grid-leak resistor or by partial self-bias methods.
o At crest of a-f cycle with modulation factor of 1.0.
**, #: See next page. ← Indicates a change.

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RCA MANUFACTURING COMPANY, INC.

834

R-F POWER AMPLIFIER

(continued from preceding page)

R-F POWER AMPLIFIER & OSCILLATOR – Class C Telegraphy

Key-down conditions per tube without modulation##

D-C Plate Voltage			1250	max.	volts
D-C Grid Voltage			-400	max.	volts
D-C Plate Current			100	max.	ma.
D-C Grid Current			20	max.	ma.
Plate Input			125	max.	watts
Plate Dissipation			50	max.	watts
Typical Operation:					
D-C Plate Voltage	750	1000	1250		volts
D-C Grid Voltage †	-175	-200	-225		volts
	8750	11400	15000		ohms
	1600	1850	2150		ohms
Peak R-F Grid Voltage	300	325	350		volts
D-C Plate Current	90	90	90		ma.
D-C Grid Current **	20	17.5	15	approx.	ma.
Driving Power **	5.5	5.0	4.5	approx.	watts
Power Output	42	58	75	approx.	watts

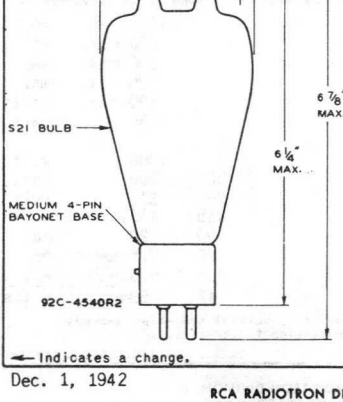
\# For a-c filament supply. If d.c. is used, the stated voltage values should be decreased by approx. one-half of the rated filament voltage.

† Obtained from fixed supply, by grid resistor (8750, 11400, 15000), or cathode resistor (1600, 1850, 2150).

Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

** Subject to wide variations as explained on sheet TRANS. TUBE RATINGS.

Data on operating frequencies for the 834 are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY. See also "Cooling" under this type.

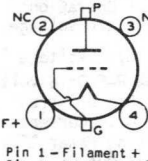


NOTE: Connections to tips P and G should be made by means of radiating connectors to which flexible circuit leads should be clamped.

TUBE MOUNTING POSITION

VERTICAL: Base down.
HORIZONTAL: No.

BOTTOM VIEW OF SOCKET CONNECTIONS



Pin 1 – Filament +
Pin 2 – No Connection
Pin 3 – No Connection
Pin 4 – Filament –
P – Plate
G – Grid

← Indicates a change.

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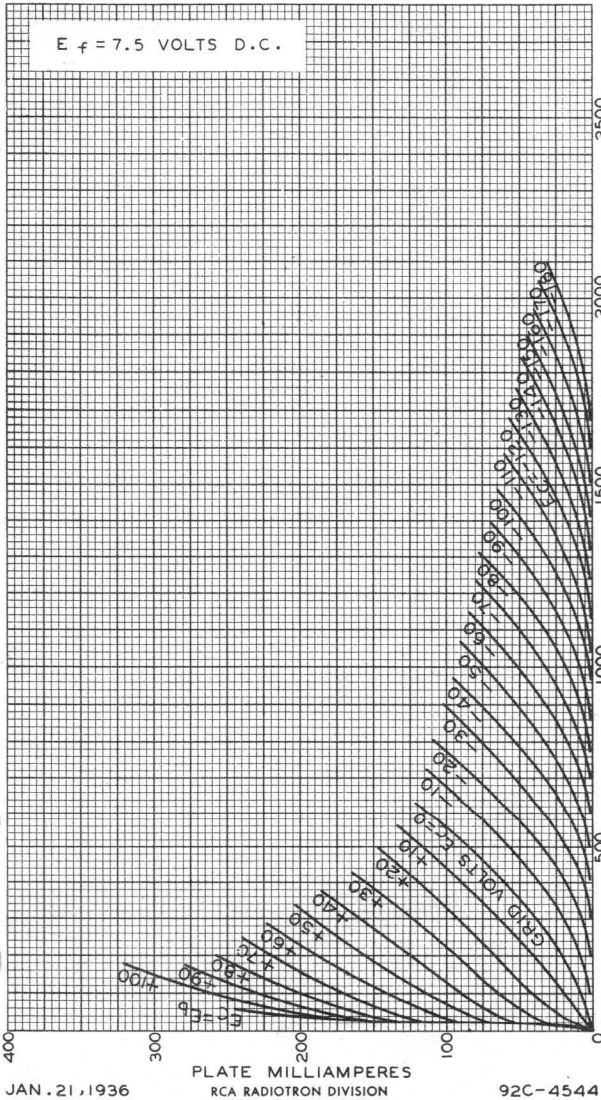
834

AVERAGE PLATE CHARACTERISTICS



JAN. 21, 1936

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC.

92C-4544

837

R-F POWER AMPLIFIER PENTODE

Heater °	Coated Unipotential Cathode	
Voltage □	12.6	a-c or d-c volts ←
Current	0.7	amp.
Transconductance for plate current of 24 ma.	3400	μmhos
Direct Interelectrode Capacitances:		
Grid to Plate (with external shielding)	0.20 max.	μμf
Input	16	μμf
Output	10	μμf
Maximum Overall Length		5-7/8"
Maximum Diameter		2-1/16"
Bulb		ST-16
Cap		Small Metal
Base		Medium 7-Pin Ceramic, Bayonet

MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS

R-F POWER AMPLIFIER - Class B Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

D-C Plate Voltage			500 max.	volts
D-C Suppressor Voltage (Grid #3)			200 max.	volts
D-C Screen Voltage (Grid #2)			200 max.	volts
D-C Plate Current			40 max.	ma.
Plate Input			16 max.	watts
Suppressor Input			5 max.	watts
Screen Input			5 max.	watts
Plate Dissipation			12 max.	watts
Typical Operation:				
D-C Plate Voltage	400	500	500	volts
D-C Suppressor Voltage	0	0	40	volts
D-C Screen Voltage	200	200	200	volts
D-C Grid Voltage (Grid #1)	-25	-25	-25	volts
Peak R-F Grid Voltage	28	25	24	volts
Internal Shield	connected to cathode at socket			
D-C Plate Current	35	30	30	ma.
D-C Screen Current	10	15	12	ma.
D-C Grid Current	1	0	0	approx.ma.
Driving Power *	0.4	0.2	0.1	approx.watt
Power Output	4	5	5.5	approx.watts

* At crest of a-f cycle with modulation factor of 1.0.

SUPPRESSOR-MODULATED R-F POWER AMPLIFIER - Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

D-C Plate Voltage	500 max.	volts
D-C Screen Voltage (Grid #2)	200 max.	volts
D-C Grid Voltage (Grid #1)	-200 max.	volts
D-C Plate Current	40 max.	ma.
D-C Grid Current	8 max.	ma.
Plate Input	16 max.	watts
Screen Input	8 max.	watts
Plate Dissipation	12 max.	watts

□ Should not deviate more than ±10% from rated value.
° See NOTE on DATA 3 page.
← Indicates a change.

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R-F POWER AMPLIFIER PENTODE

(continued from preceding page)

Typical Operation:				
D-C Plate Voltage	400	500		volts
D-C Suppressor Voltage (Grid #3)	-55	-65		volts
D-C Screen Voltage△	6500	14000		ohms
→ D-C Grid Voltage□§	-20	-20		volts
	2500	5700		ohms
Peak A-F Suppressor Voltage	55	65		volts
Peak R-F Grid Voltage	45	32		volts
Internal Shield	Connected to cathode at socket			
D-C Plate Current	35	30		ma.
D-C Screen Current	37	23		ma.
D-C Grid Current	8	3.5	approx.	ma.
Driving Power	0.4	0.1	approx.	watt
Power Output	4	5	approx.	watts

△ Voltage taken from unmodulated plate-voltage supply through resistor.

□ From fixed supply or grid-leak resistor.

GRID-MODULATED R-F POWER AMPLIFIER - Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

D-C Plate Voltage			500 max.	volts
D-C Suppressor Voltage (Grid #3)			200 max.	volts
D-C Screen Voltage (Grid #2)			200 max.	volts
D-C Grid Voltage (Grid #1)			-200 max.	volts
D-C Plate Current			40 max.	ma.
Plate Input			16 max.	watts
Suppressor Input			5 max.	watts
Screen Input			5 max.	watts
Plate Dissipation			12 max.	watts
Typical Operation:				
D-C Plate Voltage	400	500	500	volts
D-C Suppressor Voltage	0	0	40	volts
D-C Screen Voltage	200	200	200	volts
→ D-C Grid Voltage§	-50	-45	-43	volts
Peak R-F Grid Voltage	58	48	44	volts
Peak A-F Grid Voltage	25	20	18	volts
Internal Shield	Connected to cathode at socket			
D-C Plate Current	35	30	30	ma.
D-C Screen Current	9	7	6	ma.
D-C Grid Current	1	0	0 approx.	ma.
Driving Power *	0.5	0.2	0.15 approx.	watt
Power Output	4	5	5.5 approx.	watts

* At crest of a-f cycle with modulation factor of 1.0

PLATE-MODULATED R-F POWER AMPLIFIER - Class C Telephony

Pentode Connection

Carrier conditions per tube for use with a max. modulation factor of 1.0

D-C Plate Voltage	400 max.	volts
D-C Suppressor Voltage (Grid #3)	200 max.	volts
D-C Screen Voltage (Grid #2)	200 max.	volts
D-C Grid Voltage (Grid #1)	-200 max.	volts
D-C Plate Current	50 max.	ma.

§ See end of tabulation.

← Indicates a change.

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R-F POWER AMPLIFIER PENTODE

(continued from preceding page)

D-C Grid Current		8 max.	ma.
Plate Input		20 max.	watts
Screen Input		5 max.	watts
Suppressor Input		5 max.	watts
Plate Dissipation		8 max.	watts
Typical Operation:			
D-C Plate Voltage		400	volts
D-C Suppressor Voltage		40	volts
D-C Screen Voltage #		13000	ohms
		140	volts
D-C Grid Voltage▲ §		-40	volts ←
		8000	ohms
Peak R-F Grid Voltage		60	volts
Internal Shield	Connected to cathode at socket		
D-C Plate Current		45	ma.
D-C Screen Current		20	ma.
D-C Grid Current		5	approx. ma.
Driving Power		0.3	approx. watt
Power Output		11	approx. watts

From modulated fixed supply or modulated plate-voltage supply through resistor.

PLATE-MODULATED R-F POWER AMPLIFIER - Class C Telephony

Tetrode Connection - Grids #2 & #3 tied together

Carrier conditions per tube for use with a max. modulation factor of 1.0

D-C Plate Voltage		400 max.	volts
D-C Screen Voltage (Grids #2 & #3)		200 max.	volts
D-C Grid Voltage (Grid #1)		-200 max.	volts
D-C Plate Current		50 max.	ma.
D-C Grid Current		8 max.	ma.
Plate Input		20 max.	watts
Screen Input		7.5 max.	watts
Plate Dissipation		8 max.	watts
Typical Operation:			
D-C Plate Voltage		400	volts
D-C Screen Voltage ##		10000	ohms
		100	volts
D-C Grid Voltage▲ §		-70	volts ←
		10000	ohms
Peak R-F Grid Voltage		100	volts
Internal Shield	Connected to cathode at socket		
D-C Plate Current		45	ma.
D-C Screen Current		30	ma.
D-C Grid Current		7	approx. ma.
Driving Power		0.7	approx. watt
Power Output		11	approx. watts

Preferably from unmodulated plate-voltage supply through resistor.

▲ Obtained by grid-leak resistor or by partial self-bias methods.

§ See end of tabulation.

← Indicates a change.

837

R-F POWER AMPLIFIER PENTODE

(continued from preceding page)

R-F POWER AMPLIFIER & OSCILLATOR – Class C Telegraphy

Pentode Connection

Key-down conditions per tube without modulation °°

D-C Plate Voltage			500 max.	volts
D-C Suppressor Voltage (Grid #3)			200 max.	volts
D-C Screen Voltage (Grid #2)			200 max.	volts
D-C Grid Voltage (Grid #1)			-200 max.	volts
D-C Plate Current			80 max.	ma.
D-C Grid Current			8 max.	ma.
Plate Input			32 max.	watts
Suppressor Input			5 max.	watts
Screen Input			8 max.	watts
Plate Dissipation			12 max.	watts
Typical Operation:				
D-C Plate Voltage	400	500	500	volts
D-C Suppressor Voltage	0	0	40	volts
D-C Screen Voltage♦	200	200	200	volts
	6300	10000	20000	ohms
D-C Grid Voltage■ §	-40	-85	-75	volts
	5000	10600	18700	ohms
Peak R-F Grid Voltage	70	120	100	volts
Internal Shield	Connected to cathode at socket			
D-C Plate Current	70	60	60	ma.
D-C Screen Current	32	30	15	ma.
D-C Grid Current	8	8	4	approx.ma.
Driving Power	0.5	0.8	0.4	approx.watt
Power Output	16	20	22	approx.watts

R-F POWER AMPLIFIER & OSCILLATOR – Class C Telegraphy

Tetrode Connection – Grids #2 & #3 tied together

Key-down conditions per tube without modulation °°

D-C Plate Voltage			500 max.	volts
D-C Screen Voltage (Grids #2 & #3)			200 max.	volts
D-C Grid Voltage (Grid #1)			-200 max.	volts
D-C Plate Current			80 max.	ma.
D-C Grid Current			8 max.	ma.
Plate Input			32 max.	watts
Screen Input			8 max.	watts
Plate Dissipation			12 max.	watts
Typical Operation:				
D-C Plate Voltage	400	500		volts
D-C Screen Voltage ♦	11600	28000		ohms
	110	80		volts
D-C Grid Voltage ■ §	8700	8700		ohms
	-70	-70		volts
Peak R-F Grid Voltage	115	110		volts
Internal Shield	Connected to cathode at socket			

°° Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

♦ ■ See next page. § See end of tabulation.

← Indicates a change.

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RCA MANUFACTURING COMPANY, INC.

837

R-F POWER AMPLIFIER PENTODE

(continued from preceding page)

D-C Plate Current	70	60	ma.
D-C Screen Current	25	15	ma.
D-C Grid Current	8	8	approx.ma.
Driving Power	0.75	0.7	approx.watt
Power Output	18	20	approx.watts

♦ Obtained from fixed supply or plate-voltage supply through resistor.

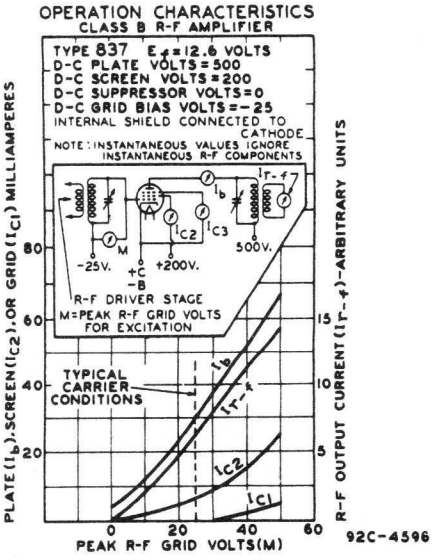
■ Obtained by grid-leak resistor or other self- or fixed-bias method.

§ Maximum total effective grid circuit resistance should not exceed 25000 ohms.

NOTE: In circuits where the cathode is not directly connected to the heater, the potential difference between them should not exceed 100 volts.

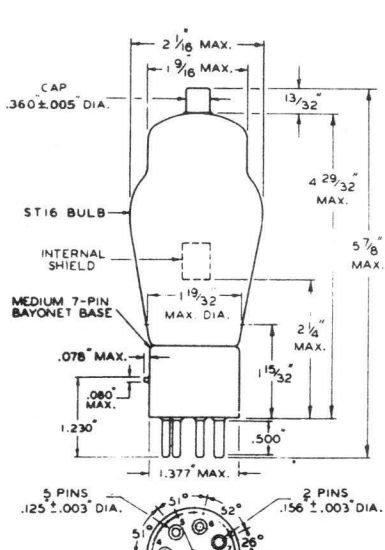
The 837, as a crystal-controlled oscillator with either pentode or tetrode connection, may be operated under the conditions shown for class C telegraph services. Because the internal shielding in this tube is unusually effective, it generally is necessary to introduce external feedback in those circuits which depend on the control-grid-to-plate capacity for oscillation.

For use of the 837 at the higher frequencies, refer to sheet TRANS. TUBE RATINGS vs FREQUENCY.



837

R-F POWER AMPLIFIER PENTODE



92C-4832

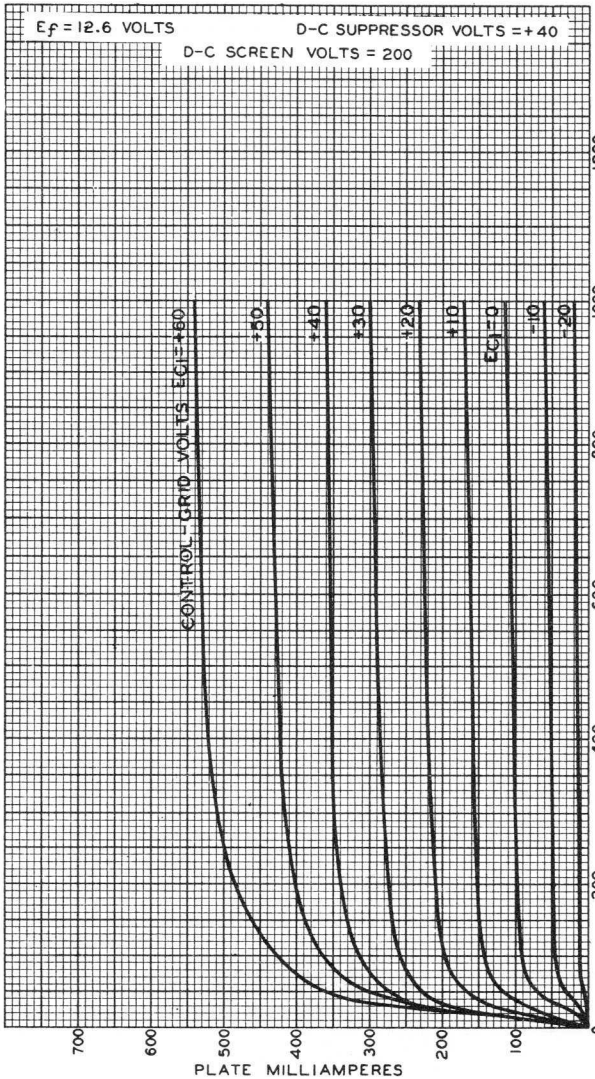
TOP VIEW OF
SOCKET CONNECTIONS



TUBE MOUNTING POSITION
VERTICAL OR HORIZONTAL

837

AVERAGE PLATE CHARACTERISTICS



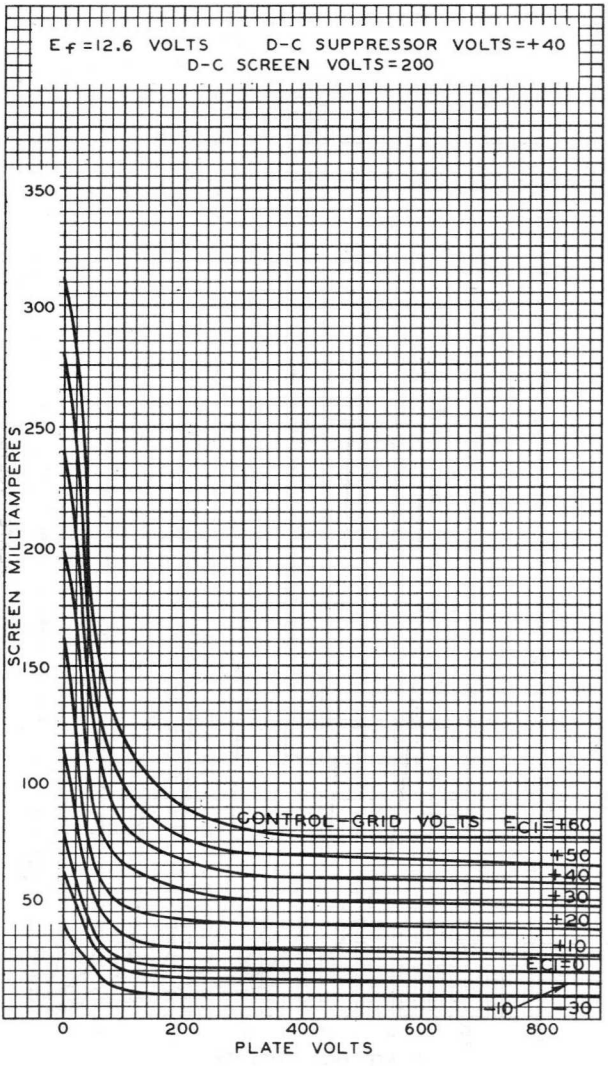
MAR. 27, 1936

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC.

92C-4586

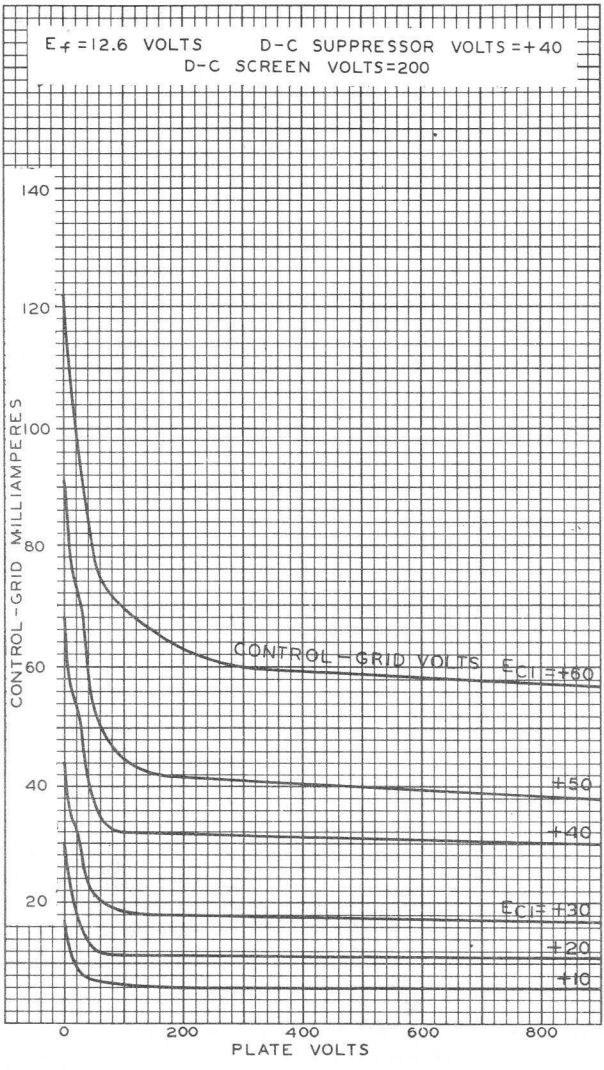
837

AVERAGE CHARACTERISTICS



837

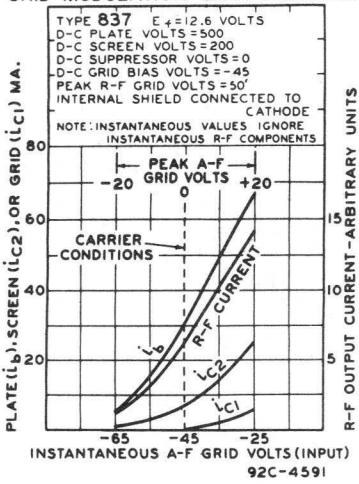
AVERAGE CHARACTERISTICS



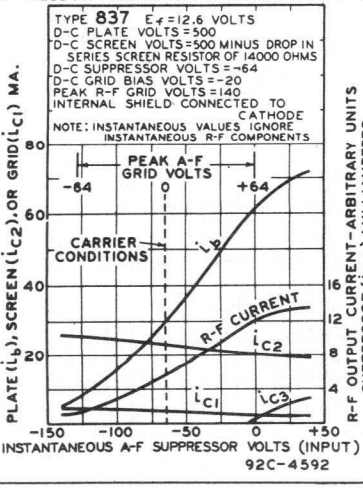
837

R-F POWER AMPLIFIER PENTODE

GRID MODULATION CHARACTERISTICS



SUPPRESSOR MODULATION CHARACTERISTICS



841

R-F POWER AMPLIFIER, OSCILLATOR, A-F VOLTAGE AMPLIFIER

Filament	Thoriated Tungsten	
Voltage	7.5	a-c or d-c volts
Current	1.25	amp.
Amplification Factor	30	
Direct Interelectrode Capacitances:		
Grid to Plate	7	μμf
Grid to Filament	4	μμf
Plate to Filament	3	μμf
Maximum Overall Length		5-5/8"
Maximum Diameter		2-3/16"
Bulb		S-17
Base		Medium 4-Pin Bayonet

MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS

A-F VOLTAGE AMPLIFIER (Resistance-coupled)-Class A

D-C Plate Voltage		425 max.	volts
D-C Plate-Supply Voltage*		1250 max.	volts
Plate Dissipation		12 max.	watts
Typical Operation and Characteristics:			
Filament Voltage	7.5	7.5	d-c volts
D-C Plate-Supply Voltage*	425	1000	volts
D-C Grid Voltage	-6	-9	volts
Peak A-F Grid Voltage	6	9	volts
D-C Plate Current	0.7	2.2	ma.
Plate Resistance	63000	40000	ohms
Transconductance	450	750	μmhos
Load Resistance	250000	250000	ohms
Voltage Output (5% second harmonic)	126	225	volts

* Voltage effective at plate is less than the plate-supply voltage by an amount equal to the voltage drop in the load resistance caused by the plate current.

A-F POWER AMPLIFIER & MODULATOR - Class B

D-C Plate Voltage		425 max.	volts
Max-Signal D-C Plate Current*		60 max.	ma.
Max-Signal Plate Input*		25 max.	watts
Plate Dissipation*		15 max.	watts
Typical Operation - 2 tubes:			
Unless otherwise specified, values are for 2 tubes.			
Filament Voltage	7.5	7.5	d-c volts ←
D-C Plate Voltage	350	425	volts
D-C Grid Voltage	-5	-5	volts
Peak A-F Grid-to-Grid Voltage	176	180	volts
Zero-Signal D-C Plate Cur.	7	13	ma.
Max-Signal D-C Plate Cur.	114	120	ma.
Load Resistance (per tube)	1300	1750	ohms
Effective Load Res. (plate to plate)	5200	7000	ohms
Max-Signal Driving Power	3.2	3.6	approx. watts
Max-Signal Power Output	21	28	approx. watts

* Averaged over any audio frequency cycle of sine-wave form. ←

← Indicates a change

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RCA MANUFACTURING COMPANY, INC.

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R-F POWER AMPLIFIER, OSCILLATOR, A-F VOLTAGE AMPLIFIER

(continued from preceding page)

R-F POWER AMPLIFIER - Class B Telephony

Carrier conditions per tube for use with a max. modulation fact. of 1.0

D-C Plate Voltage		450 max.	volts
D-C Plate Current		50 max.	ma.
R-F Grid Current		4 max.	amp.
Plate Input		22.5 max.	watts
Plate Dissipation		15 max.	watts
Typical Operation:			
Filament Voltage	7.5	7.5 a-c	volts
D-C Plate Voltage	350	450	volts
D-C Grid Voltage	-12	-15	volts
Peak R-F Grid Voltage	60	60	volts
D-C Plate Current	45	45	ma.
D-C Grid Current**	4	4	approx. ma
Driving Power** °	3.5	3.5	approx. watts
Power Output	4.25	6	approx. watts

→ ° At crest of a-f cycle with modulation factor of 1.0.

PLATE-MODULATED R-F POWER AMPLIFIER - Class C Telephony

Carrier conditions per tube for use with a max. modulation fact. of 1.0

D-C Plate Voltage		350 max.	volts
→ D-C Grid Voltage		-200 max.	volts
D-C Plate Current		60 max.	ma.
D-C Grid Current		20 max.	ma.
R-F Grid Current		4 max.	amp.
Plate Input		21 max.	watts
Plate Dissipation		10 max.	watts
Typical Operation:			
Filament	7.5	7.5 a-c	volts
D-C Plate Voltage	250	350	volts
D-C Grid Voltage	-40	-47	volts
Peak R-F Grid Voltage	125	130	volts
D-C Plate Current	50	50	ma.
D-C Grid Current**	15	15	approx. ma.
Driving Power**	2	2	approx. watts
Power Output	7	11	approx. watts

R-F POWER AMPLIFIER & MODULATOR - Class C Telegraphy

Key-down conditions per tube without modulation ##

D-C Plate Voltage		450 max.	volts
→ D-C Grid Voltage		-200 max.	volts
D-C Plate Current		60 max.	ma.
D-C Grid Current		20 max.	ma.
R-F Grid Current		5 max.	amp.
Plate Input		27 max.	watts
Plate Dissipation		15 max.	watts
Typical Operation:			
Filament Voltage	7.5	7.5 a-c	volts
D-C Plate Voltage	350	450	volts
D-C Grid Voltage	-30	-34	volts
Peak R-F Grid Voltage	115	120	volts
D-C Plate Current	50	50	ma.

##, ** See next page

← Indicates a change

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC.

841
R-F POWER AMPLIFIER
A-F VOLTAGE AMPLIFIER

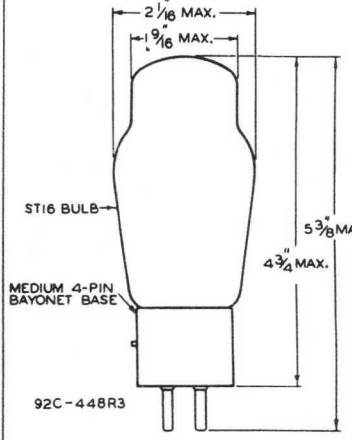
(continued from preceding page)

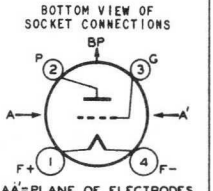
D-C Grid Current**	15	15	approx.ma.
Driving Power**	1.8	1.8	approx.watts
Power Output	11	15	approx.watts

Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

** Subject to wide variations as explained on sheet TRANS.TUBE RATINGS.

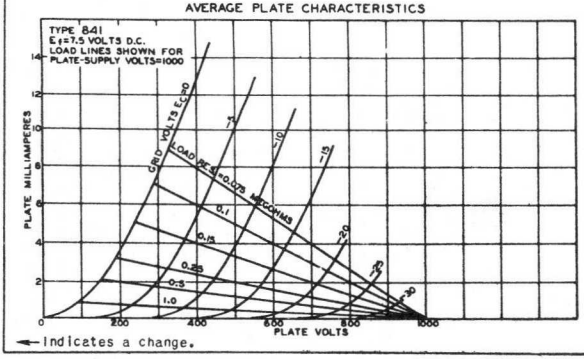
For the use of the 841 at the higher frequencies refer to sheet TRANS. TUBE RATINGS vs FREQUENCY.





TUBE MOUNTING POSITION

VERTICAL: Base down
HORIZONTAL: Plate in vertical plane (on edge)



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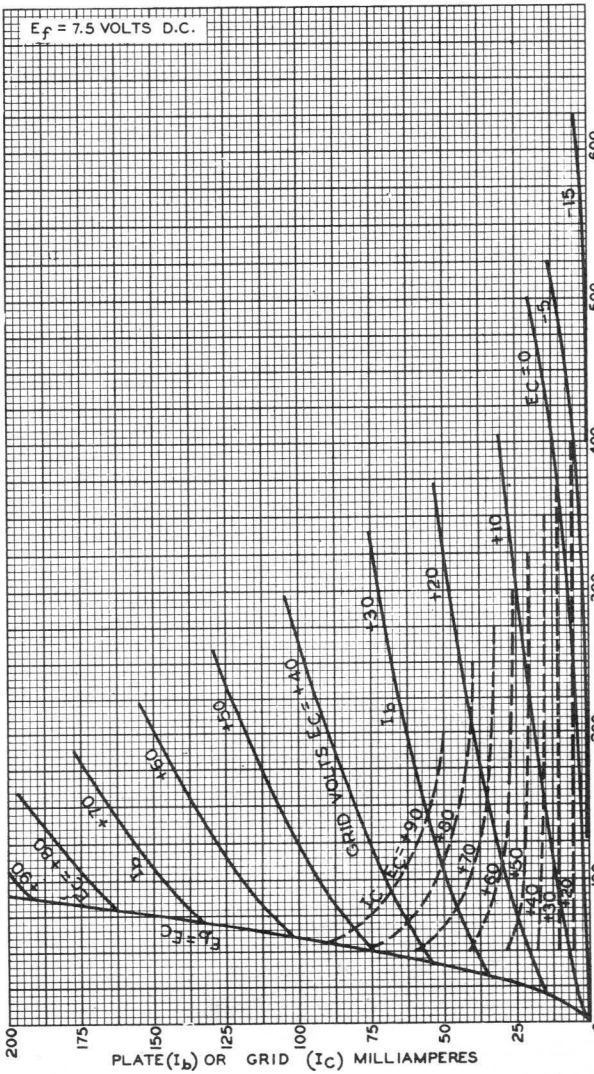
841

841

AVERAGE PLATE CHARACTERISTICS



FEB. 12, 1934

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

92S-5454

845

MODULATOR, A-F POWER AMPLIFIER

Filament	Thoriated Tungsten	
Voltage	10	a-c or d-c volts
Current	3.25	amp.
Amplification Factor	5.3	
Direct Interelectrode Capacitances:		
Grid to Plate	13.5	μμf
Grid to Filament	6	μμf
Plate to Filament	6.5	μμf
Maximum Overall Length		7-7/8"
Maximum Diameter		2-5/16"
Bulb		T-18
Base		Jumbo 4-Large Pin
RCA Socket		Type UT-541 ←

MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS

A-F POWER AMPLIFIER & MODULATOR - Class A_1

D-C Plate Voltage			1250 max.	volts
Plate Dissipation			100 max.	watts ←
Typical Operation:				←
D-C Plate Voltage	750	1000	1250	volts
D-C Grid Voltage*	-98	-145	-195	volts
Peak A-F Grid Voltage	93	140	190	volts
D-C Plate Current	95	90	80	ma.
Transconductance	3100	3100	3100	μmhos
Plate Resistance	1700	1700	1700	ohms
Load Resistance	3400	6000	11000	ohms
U.P.O. (5% second harmonic)	15	24	30	watts

NOTE: In cases where the input circuit to the 845 is resistance coupled, the resistance in the grid circuit should not exceed 0.5 megohm when cathode bias is used. Without cathode bias, the d-c resistance in the grid-coupling circuit should not exceed 0.1 megohm.

A-F POWER AMPLIFIER & MODULATOR - Class AB_1 ←

D-C Plate Voltage			1250 max.	volts
D-C Grid Voltage			-400 max.	volts
D-C Plate Current			120 max.	ma.
Plate Input			150 max.	watts
Plate Dissipation			100 max.	watts
Typical Operation:				
Unless otherwise specified, values are for 2 tubes				
D-C Plate Voltage	1000	1250		volts
D-C Grid Voltage*	-175	-225		volts
Peak A-F Grid-to-Grid Voltage	340	440		volts
Zero-Signal D-C Plate Current	40	40		ma.
Max.-Signal D-C Plate Current	230	240		ma.
Load Resistance (per tube)	1150	1650		ohms
Effective Load Res. (plate to plate)	4600	6600		ohms
Max.-Signal Power Output	75	115		approx. watts

* With a-c filament supply.

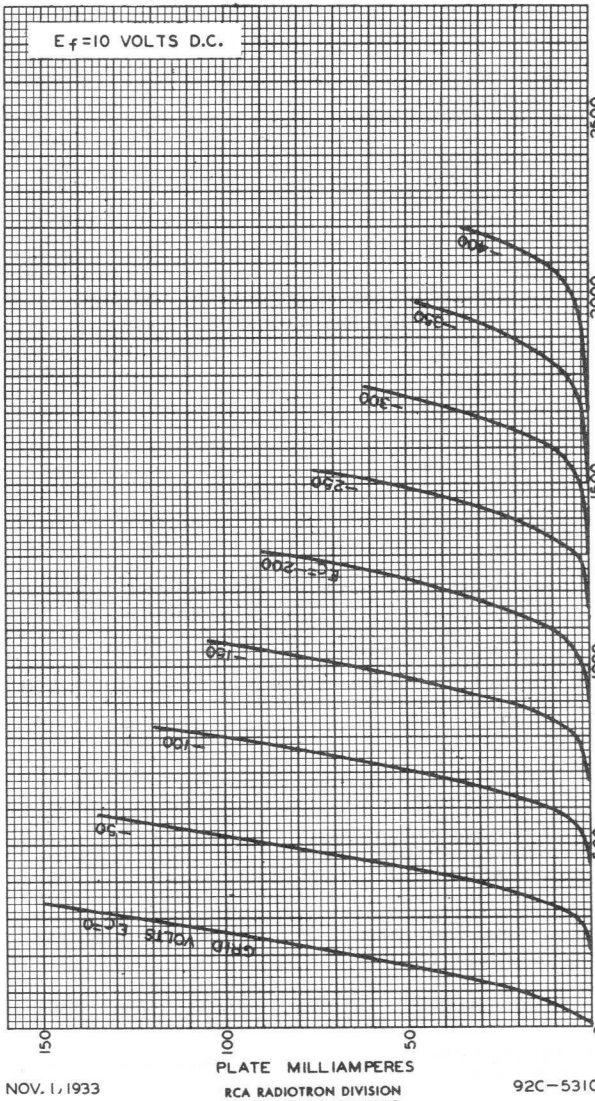
OUTLINE DIMENSIONS, TUBE SYMBOL, and SOCKET CONNECTIONS for the 845 are the same as for the 211.

← Indicates a change.

845

845

AVERAGE PLATE CHARACTERISTICS



NOV. 1, 1933

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC.

92C-5310

860

POWER TETRODE

GENERAL DATA

Electrical:

Filament, Thoriated Tungsten:

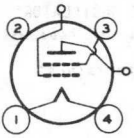
Voltage	10	ac or dc volts
Current	3.25	amp
Transconductance, for plate current of 16 ma	1100	μmhos
Direct Interelectrode Capacitances:		
Grid to Plate	0.08 max.*	μμf
Input	7.75	μμf
Output	7.5	μμf

* With external shielding.

Mechanical:

Mounting Position	Vertical, base down
Maximum Overall Length	8-3/4"
Maximum Radius	4-1/4"
Bulb	GT-30, with arm
Base	Medium-Metal-Shell Small 4-Pin, Bayonet
Basing Designation for BOTTOM VIEW	3F

Pin 1 – Filament
Pin 2 – No Connection
Pin 3 – Screen
Pin 4 – Filament



Top Lead– Grid
Side Lead– Plate

RF POWER AMPLIFIER - Class B Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values*:

D-C Plate Voltage		3000 max.	volts
D-C Screen Voltage		500 max.	volts
D-C Plate Current		85 max.	ma.
Plate Input		150 max.	watts
Screen Input		10 max.	watts
Plate Dissipation		100 max.	watts
Typical Operation:			
D-C Plate Voltage	2000	3000	volts
D-C Screen Voltage □	300	300	volts
D-C Grid Voltage	-50	-50	volts
D-C Plate Current	60	43	ma.
Power Output	30	40	approx. watts

PLATE-MODULATED RF POWER AMPLIFIER - Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values*:

D-C Plate Voltage	2000 max.	volts

□ Use of series screen resistor is not recommended.

RCA

860

POWER TETRODE

D-C Screen Voltage			500	max.	volts
D-C Grid Voltage			-800	max.	volts
D-C Plate Current			85	max.	ma.
D-C Grid Current			40	max.	ma.
Plate Input			170	max.	watts
Screen Input			6.7	max.	watts
Plate Dissipation			67	max.	watts
Typical Operation:					
D-C Plate Voltage	1500	1800	2000		volts
D-C Screen Voltage ▲	60000	80000	100000		ohms
	300	300	220		volts
D-C Grid Voltage ¶	7500	7500	5300		ohms
	-225	-225	-200		volts
Peak R-F Grid Voltage	-	-	500		volts
D-C Plate Current	70	67	85		ma.
D-C Screen Current	-	-	25		ma.
D-C Grid Current **	30	30	38	approx.	ma.
Driving Power **	15	15	17	approx.	watts
Power Output	45	60	105	approx.	watts

RF POWER AMPLIFIER & OSCILLATOR - Class C Telegraphy

Key-down conditions per tube without modulation‡

Maximum Ratings, *Absolute Values*:

D-C Plate Voltage			3000	max.	volts
D-C Screen Voltage			500	max.	volts
D-C Grid Voltage			-800	max.	volts
D-C Plate Current			150	max.	ma.
D-C Grid Current			40	max.	ma.
Plate Input			300	max.	watts
Screen Input			10	max.	watts
Plate Dissipation			100	max.	watts
Typical Operation:					
D-C Plate Voltage	1500	2000	2500	3000	volts
D-C Screen Voltage □	300	300	300	300	volts
D-C Grid Voltage ●	10000	10000	10000	10000	ohms
	-150	-150	-150	-150	volts
D-C Plate Current	90	90	90	85	ma.
D-C Grid Current **	15	15	15	15	approx. ma.
Driving Power **	7	7	7	7	approx. watts
Power Output	60	100	135	165	approx. watts

▲ Obtained from modulated plate-voltage supply through resistor or from modulated fixed supply.

¶ Obtained by grid-leak resistor or by partial self-bias methods.

‡ Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

** Subject to wide variations as explained on sheet TRANS. TUBE RATINGS.

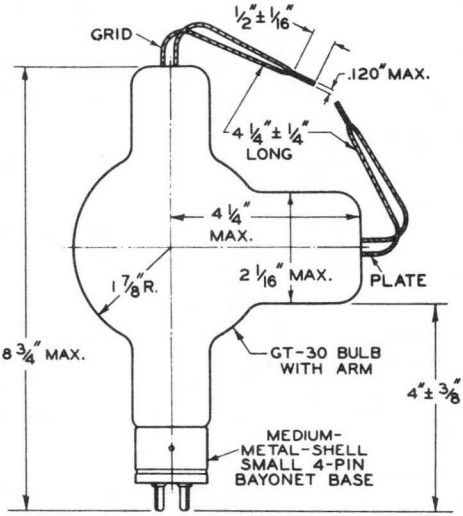
□ Use of series resistor is not recommended.

● Obtained by grid-leak resistor or other self- or fixed-bias method.

860

POWER TETRODE

For use of the 860 at the higher frequencies, refer to sheet TRANS. TUBE RATINGS vs FREQUENCY.



92CM-4318R4

862-A

TRANSMITTING TRIODE

WATER & FORCED-AIR COOLED

GENERAL DATA

Electrical:

Filament: Tungsten

Voltage	33	a-c or d-c volts
Current	207	amp.

Starting – The current should never exceed 400 amperes, even momentarily.

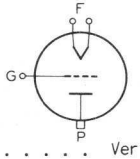
Amplification Factor. . . . 45

Direct Interelectrode Capacitances (Approx.):

Grid to Plate	70	μμf
Grid to Filament	53	μμf
Plate to Filament	4.5	μμf

Physical:

Terminal Legend:
F – Stranded Filament Terminal
G – Ribbon Grid Terminal
P – Water-cooled Plate Terminal



Mounting Position . . . . . Vertical only, glass end up
Maximum Overall Length. . . . . 60-3/8"
Greatest Radius . . . . . 10"
Base (with nozzle for air-cooling of filament seal) No.3908
Water Jacket (with nozzle for air-cooling of bulb) Type UT-1289-A
Gasket. . . . . RCA Stock No.17879

Cooling – *Water flow* of 15 to 25 gallons per minute must start before application of any voltages and continue for at least 10 minutes after removal of all voltages. Water temperature must not exceed 70°C at socket outlet under any conditions of operation. *Air flow* of 15 cubic feet per minute in bulb nozzle and 3 cubic feet per minute in filament-seal nozzle is required before the application of any voltages and must continue for at least 10 minutes after removal of voltages to limit the glass temperature to 150°C at the hottest part.

This tube can often be operated at reduced filament voltage as explained on sheet TYPES OF CATHODES in General Section.

A-F POWER AMPLIFIER & MODULATOR – Class B

Maximum Ratings, *Absolute Values*:

D-C PLATE VOLTAGE	15000 max.	volts
MAX.-SIGNAL D-C PLATE CURRENT*	7.5 max.	amp.
MAX.-SIGNAL PLATE INPUT*	100 max.	kw
PLATE DISSIPATION*	50 max.	kw

Typical Operation:

Unless otherwise specified, values are for 2 tubes

D-C Plate Voltage	12000	volts
D-C Grid Voltage°	0	volts
Peak A-F Grid-to-Grid Voltage	2000	volts
Zero-Signal D-C Plate Current	3	amp.
Max.-Signal D-C Plate Current	13	amp.
Effective Load Res. (plate to plate)	1800	ohms
Max.-Signal Driving Power	450 approx.	watts
Max.-Signal Power Output	90 approx.	kw

* Averaged over any audio-frequency cycle of sine-wave form.
° For a-c filament supply.

862-A

TRANSMITTING TRIODE

(continued from preceding page)

R-F POWER AMPLIFIER – Class B Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values*:

D-C PLATE VOLTAGE	20000 max.	volts
D-C PLATE CURRENT	5 max.	amp.
PLATE INPUT	100 max.	kw
PLATE DISSIPATION	75 max.	kw

Typical Operation:

D-C Plate Voltage	12000	15000	18000	volts
D-C Grid Voltage°	-100	-150	-200	volts
Peak R-F Grid Voltage	500	625	750	volts
D-C Plate Current	2.8	3.5	4.2	amp.
Driving Power #,**	0.5	0.75	1.1	approx. kw
Power Output	11	17.5	25	approx. kw

** At crest of a-f cycle with modulation factor of 1.0.
° For a-c filament supply.

PLATE MODULATED R-F POWER AMPLIFIER – Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values*:

D-C PLATE VOLTAGE	12000 max.	volts
D-C GRID VOLTAGE	-3000 max.	volts
D-C PLATE CURRENT	5 max.	amp.
D-C GRID CURRENT	1.25 max.	amp.
PLATE INPUT	60 max.	kw
PLATE DISSIPATION	50 max.	kw

Typical Operation:

D-C Plate Voltage	8000	10000	12000	volts
D-C Grid Voltage	-700	-750	-800	volts
Peak R-F Grid Voltage	1700	1850	2000	volts
D-C Plate Current	4	4.5	5	amp.
D-C Grid Current #	1	1	1	approx. amp.
Driving Power #	1.7	1.85	2	approx. kw
Power Output	24	34	45	approx. kw

R-F POWER AMPLIFIER & OSCILLATOR – Class C Telegraphy

Key-down conditions per tube without modulation **

Maximum Ratings, *Absolute Values*:

D-C PLATE VOLTAGE	20000 max.	volts
D-C GRID VOLTAGE	-3000 max.	volts
D-C PLATE CURRENT	10 max.	amp.
D-C GRID CURRENT	1 max.	amp.
PLATE INPUT	200 max.	kw
PLATE DISSIPATION	100 max.	kw

#, ##: See next page.

862-A

TRANSMITTING TRIODE

(continued from preceding page)

Typical Operation:

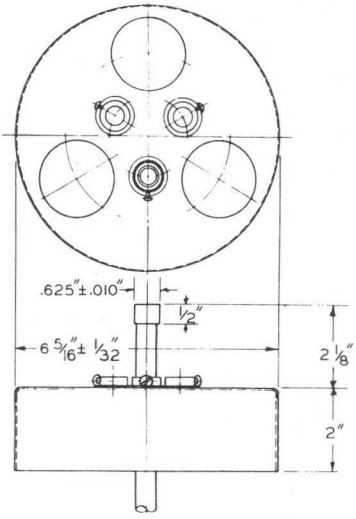
D-C Plate Voltage	12000	15000	18000	
D-C Grid Voltage.	-800	-900	-1000	. . . volts
Peak R-F Grid Voltage . .	2050	2300	2550	. . . volts
D-C Plate Current	6.25	7.5	8.33	. . . volts
D-C Grid Current #	0.8	0.85	0.9	approx. amp.
Driving Power #	1.6	2	2.4	approx. kw
Power Output.	50	75	100	approx. kw

Subject to wide variations as explained on sheet TUBE RATINGS in General Section.

Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

Data on operating frequencies for the 862-A are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY.

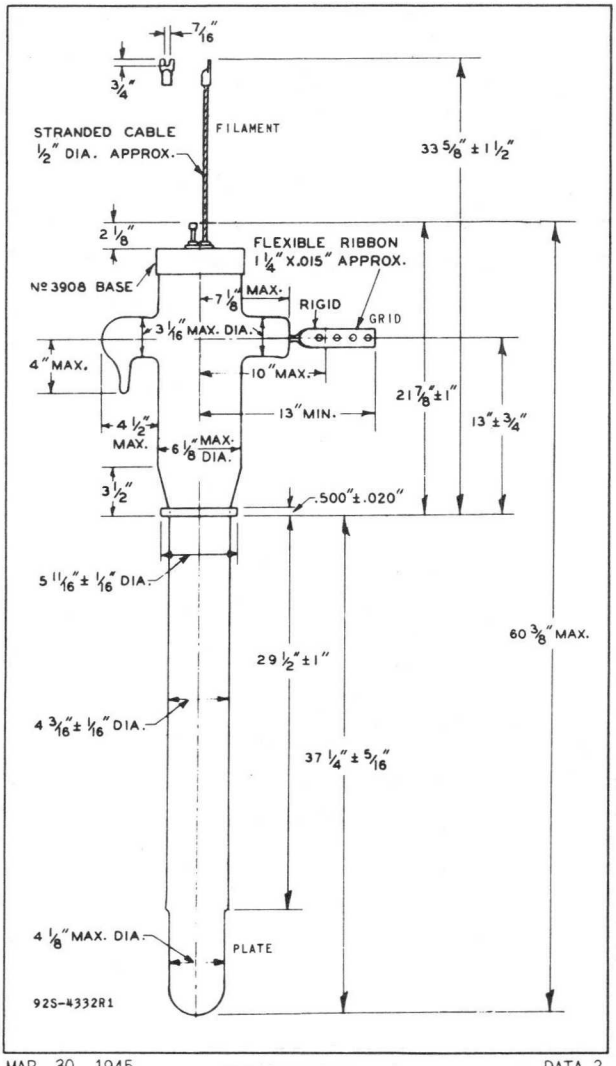
Nº 3908 BASE OUTLINE



92CS-6577

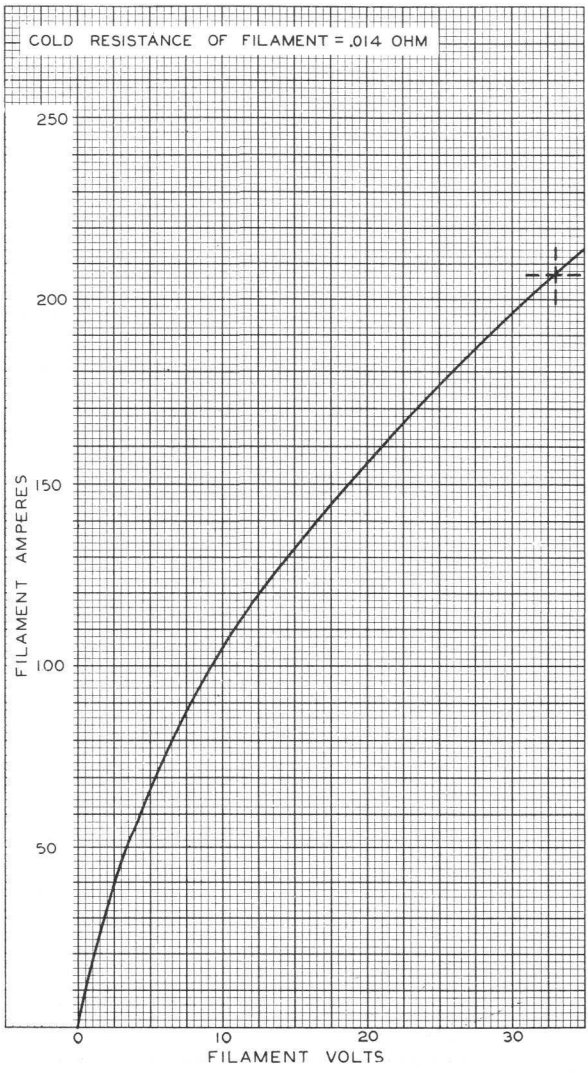
862-A

TRANSMITTING TRIODE



862-A

AVERAGE FILAMENT CHARACTERISTIC



862-A

862-A

TRANSMITTING TRIODE

ADDITIONAL CURVES
FOR THE 862-A ARE THE SAME AS
THOSE FOR TYPE 898-A

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.

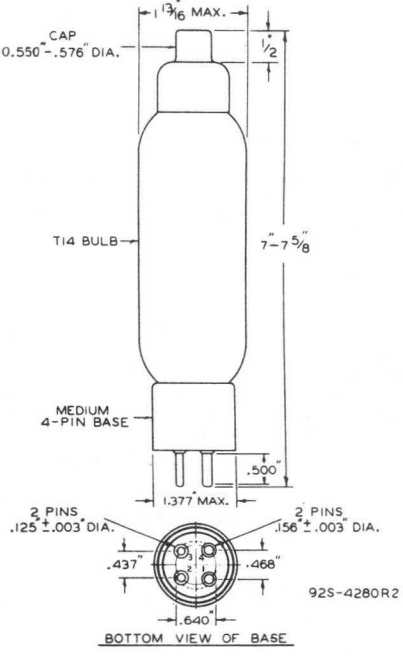
Filter requirements are ordinarily met by the use of a 0.5 to 2.0 μf condenser shunted across the bleeder circuit. The shunt condenser should have a rating sufficient to withstand the instantaneous peak value of the a-c input voltage. If this filtering is inadequate for a definite application, a two-section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

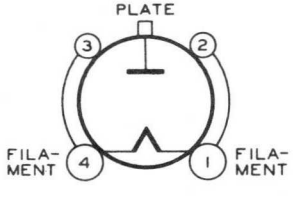
878

878

HALF-WAVE HIGH-VACUUM RECTIFIER



TUBE SYMBOL & TOP VIEW
OF
SOCKET CONNECTIONS



RCA
880

POWER TRIODE

WATER & FORCED-AIR COOLED

GENERAL DATA

Electrical:

Filament, Tungsten:

Voltage	12.6	ac or dc volts
Current	320	amp
Starting Current: The filament current should never exceed 480 amperes, even momentarily.		
Cold Resistance	0.003	ohm ←

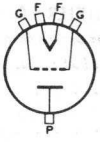
This tube can often be operated with reduced filament voltage, as explained on sheet TYPES OF CATHODES in General Section.

Amplification Factor	20	
Direct Interelectrode Capacitances:		
Grid to Plate	24	μμf ←
Grid to Filament	35	μμf
Plate to Filament	2	μμf

Mechanical:

Terminal Connections:

F – Filament
G – Grid
P – Water-Cooled Plate



Grid terminals are spaced diametrically wider than filament terminals.

Mounting Position	Vertical, Glass End Up	
Maximum Overall Length	11-1/2"	
Maximum Diameter	7"	
Water Flow	12 to 20	gpm

The specified water flow must start before application of any voltages, and may be removed simultaneously with the filament and plate power.

Air Flow	20 min.	cfm

The specified air flow should be directed vertically from a 3"-diameter nozzle onto the top portion of the bulb before and during the application of any voltages.

Water Pressure in Jacket	80 max.	psi
Outlet Water Temperature	70 max.	°C
Bulb Temperature	180 max.	°C
Seal Temperature (Filament, grid, plate)	165 max.	°C

Components: ←

Water Jacket	RCA MI-19461
Jacket Wrench	RCA MI-19436
Gasket	RCA MI-7441
Terminal-Post Chuck Connector (4 required)	RCA MI-19466
Chuck Wrench (2 required)	RCA MI-19424

AF POWER AMPLIFIER & MODULATOR-Class B

Maximum CCS• Ratings, *Absolute Values*:

DC PLATE VOLTAGE	10500 max.	volts

•,*: See next page. ←Indicates a change.

RCA

880

POWER TRIODE

MAX.-SIGNAL DC PLATE CURRENT*		5 max.	amp
MAX.-SIGNAL PLATE INPUT*		40 max.	kw
PLATE DISSIPATION*		15 max.	kw

→ **TYPICAL OPERATION:**

Values are for 2 tubes

DC Plate Voltage	7500	10000	volts
DC Grid Voltage	-340	-450	volts
Peak AF Grid-to-Grid Voltage	1450	1680	volts
Zero-Signal DC Plate Current	1	1	amp
Max.-Signal DC Plate Current	6.7	7	amp
Effective Load Resistance (Plate-to-plate)	2300	3100	ohms
Max.-Signal Driving Power (Approx.)#	490	540	watts
Max.-Signal Power Output (Approx.)	31.5	46	kw

RF POWER AMPLIFIER - Class B Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum CCS● Ratings, *Absolute Values*:

DC PLATE VOLTAGE	10500 max.	volts
DC PLATE CURRENT	4 max.	amp
PLATE INPUT	32 max.	kw
PLATE DISSIPATION	20 max.	kw

→ **Typical Operation:**

DC Plate Voltage	7500	10000	volts
DC Grid Voltage	-340	-460	volts
Peak RF Grid Voltage	570	595	volts
DC Plate Current	3.3	2.75	amp
DC Grid Current (Approx.)□	0.013	0.009	amp
Driving Power (Approx.)■□	1250	900	watts
Power Output (Approx.)	8	9	kw

PLATE-MODULATED RF POWER AMPLIFIER - Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum CCS● Ratings, *Absolute Values*:

DC PLATE VOLTAGE	10500 max.	volts
DC GRID VOLTAGE	-1200 max.	volts
DC PLATE CURRENT	3.6 max.	amp
→ DC GRID CURRENT	0.8 max.	amp
PLATE INPUT	36 max.	kw
PLATE DISSIPATION	12 max.	kw

* Averaged over any audio-frequency cycle of sine-wave form.

\# The driving stage should have good regulation and should be capable of supplying considerably more than the specified driving power.

■ At crest of audio-frequency cycle with modulation factor of 1.0.

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

RCA
880

POWER TRIODE

Typical Operation:

DC Plate Voltage	7500	10000	volts
DC Grid Voltage⊕	−1000	−1200	volts
Peak RF Grid Voltage	1560	1840	volts
DC Plate Current	3	3.6	amp
DC Grid Current (Approx.)□	0.57	0.64	amp
Driving Power (Approx.)□	850	1100	watts
Power Output (Approx.)	16	27	kw

RF POWER AMPLIFIER & OSCILLATOR - Class C Telegraphy

Key-down conditions per tube without modulation□□

Maximum CCS● Ratings, *Absolute Values*:

	1.5 to 25 Mc	*Below 1.5 Mc*	
DC PLATE VOLTAGE	10500 max.	15000 max.	volts
DC GRID VOLTAGE	−1200 max.	−1600 max.	volts
DC PLATE CURRENT	6 max.	4.5 max.	amp
DC GRID CURRENT	0.8 max.	1 max.	amp
PLATE INPUT	60 max.	67.5 max.	kw
PLATE DISSIPATION	20 max.	20 max.	kw

Typical Operation:

DC Plate Voltage	7500	10000	10000	volts
DC Grid Voltage▲	−600	−800	−1000	volts
Peak RF Grid Voltage	1250	1460	1830	volts
DC Plate Current	4.8	4.5	6	amp
DC Grid Current (Approx.)□	0.79	0.78	0.8	amp
Driving Power (Approx.)□	920	1000	1500	watts
Power Output (Approx.)	24	33	40	kw

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Filament Current	1	300	330	amp
Amplification Factor	1,2	17	23	
Grid-Plate Capacitance	–	21	27	μμf
Grid-Filament Capacitance	–	28.8	41.2	μμf
Plate-Filament Capacitance	–	1	3	μμf
Plate Voltage	1,3	6500	8100	volts
Plate Voltage	1,4	2800	3600	volts

● Continuous Commercial Service.

□□ Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

□ For effect of load resistance on grid current and driving power, refer to TUBE RATINGS—*Grid Current and Driving Power* in the General Section.

⊕ Obtained by grid resistor, or by partial self-bias methods.

▲ Obtained from cathode resistor, grid resistor, or by partial self-bias methods.

← Indicates a change.

880

RCA

880

POWER TRIODE

	Note	Min.	Max.	
Grid Voltage	1,5	-460	-690	volts
Grid Voltage	1,6	-	1300	volts
Grid Current	1,6	-	10	amp
Peak Cathode Current	1,7	35	-	amp
Power Output	1,8	28	-	kw

Note 1: With 12.6 volts ac on filament.

Note 2: With dc grid voltage of -100 volts, and plate voltage adjusted to give dc plate current of 2 amp.

Note 3: With dc grid voltage of -200 volts, and plate voltage adjusted to give dc plate current of 2 amp.

Note 4: With dc grid voltage of 0 volts, and plate voltage adjusted to give dc plate current of 2 amp.

Note 5: With dc plate voltage of 10000 volts, and dc grid voltage adjusted to give dc plate current of 20 ma.

Note 6: With dc plate voltage of 2000 volts, and instantaneous grid voltage adjusted to give instantaneous plate current of 25 amp.

Note 7: Represents the maximum usable cathode current (plate current and grid current) for the tube under any condition of operation.

Note 8: With dc plate voltage of 10000 volts, dc plate current of 4.5 amp., dc grid current of 0.8 amp., dc grid voltage of -1000 volts, and frequency of 25 Mc.

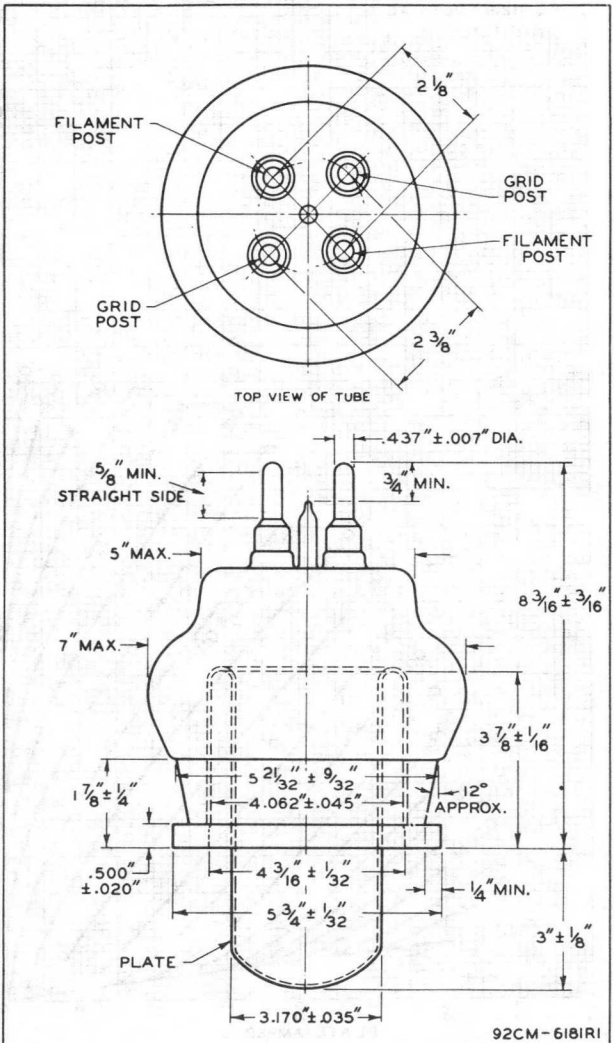
Data on operating frequencies for the 880 are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

880

POWER TRIODE



880

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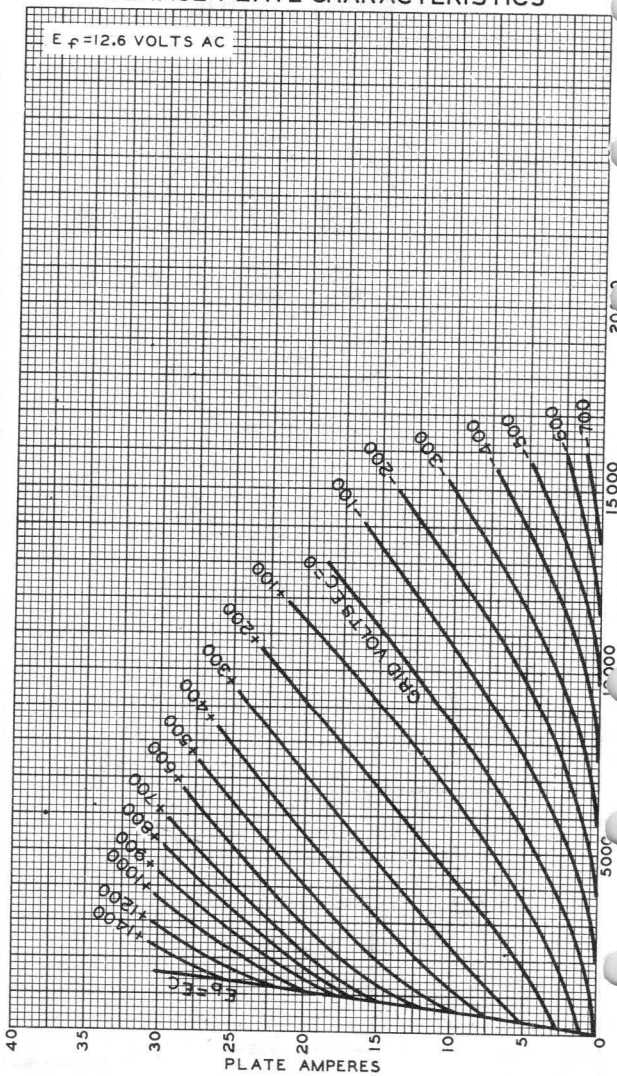
880

AVERAGE PLATE CHARACTERISTICS



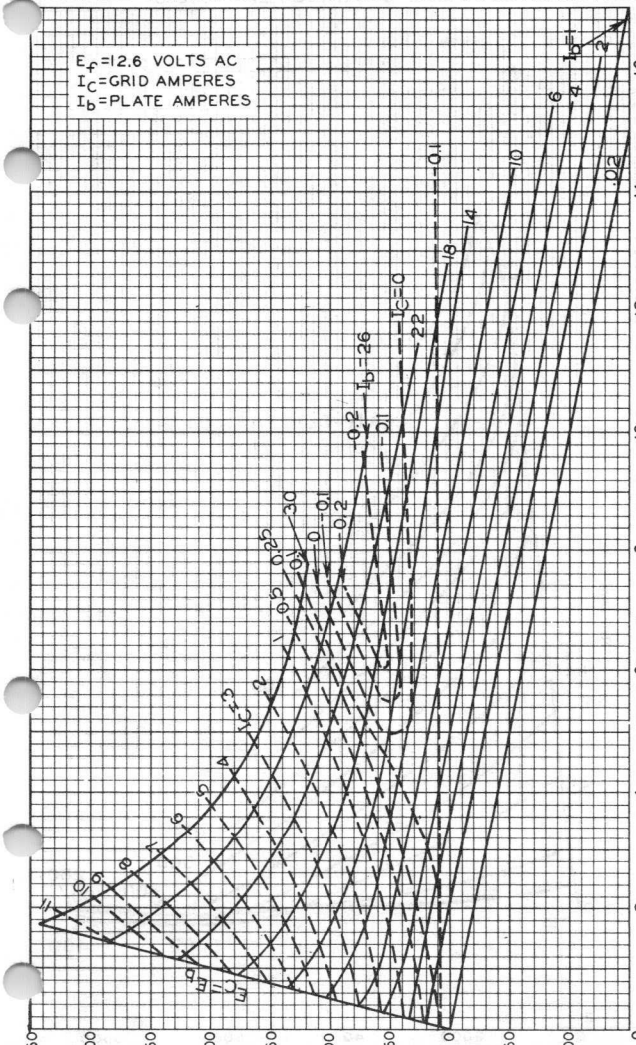
JAN.29,1948

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6927

880

AVERAGE CONSTANT-CURRENT CHARACTERISTICS

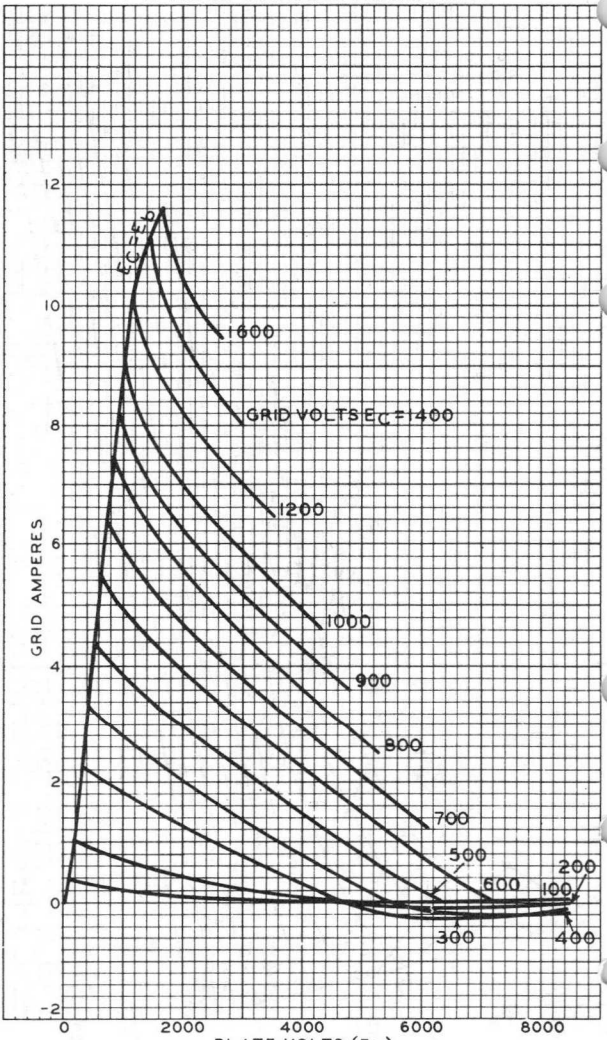


FEB.8,1950
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CM-6178RI

RCA

880

TYPICAL CHARACTERISTICS



JAN. 21, 1948

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6923

889-A

TRANSMITTING TRIODE

WATER & FORCED-AIR COOLED

Supersedes Type 889

GENERAL DATA

Electrical:

Filament, Tungsten:

Voltage	11	volts
Current	125	amp

Starting Current: The filament current must never exceed 187 amperes, even momentarily.

Amplification Factor	21	
Direct Interelectrode Capacitances (Approx.):		
Grid to Plate	17.5	μμf
Grid to Filament	23.3	μμf
Plate to Filament	2.7	μμf

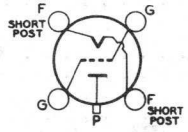
Mechanical:

Terminal Connections:

F – Filament (Short Terminals)

G – Grid (Long Terminals)

TOP VIEW



P – Water-Cooled Plate Terminal

Mounting Position	Vertical only, glass end up
Overall Length	10-7/16" ± 1/4"
Maximum Diameter	3-5/8"
Water Jacket	Type UT-4000

Water Flow: 3 to 6 gallons per minute must start before application of any voltages, and must continue for at least 5 minutes after removal of all voltages. Water temperature at jacket outlet must not exceed 70°C under any conditions of operation.

Air Flow: 15 cu.ft. per minute through a 3-inch diameter nozzle must be directed downward toward grid and plate seals before and during the application of any voltages to limit temperature of glass at hottest point to 150°C.

This tube can often be operated at reduced filament voltage, as explained on sheet TYPES OF CATHODES in General Section.

AF POWER AMPLIFIER & MODULATOR – Class B

Maximum Ratings, *Absolute Values*:

DC PLATE VOLTAGE	8500 max.	volts
MAX.-SIGNAL DC PLATE CURRENT*	2 max.	amp
MAX.-SIGNAL PLATE INPUT*	12 max.	kw
PLATE DISSIPATION*	5 max.	kw

Typical Operation:

Unless otherwise specified, values are for two tubes

DC Plate Voltage	5000	6000	7500	volts
DC Grid Voltage●	-180	-230	-300	volts
Peak AF Grid-to-Grid Volt.	1460	1680	1700	volts

* Averaged over any audio-frequency cycle of sine-wave form.

●: See next page.

889-A

TRANSMITTING TRIODE

Zero-Signal DC Plate Cur. . .	0.4	0.4	0.4	. . amp
Max.-Signal DC Plate Cur. . .	3.2	3.6	3.2	. . amp
Effective Load Resistance (plate-to-plate).	2520	3680	5000	. . ohms
Max.-Signal Driving Power (Approx.)	170	180	150	. . watts
Max.-Signal Power Output (Approx.)	8.8	12	15	. . kw

RF POWER AMPLIFIER - Class B Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values*:

DC PLATE VOLTAGE.	8500 max.	volts
DC PLATE CURRENT.	1.0 max.	amp
PLATE INPUT	7.5 max.	kw
PLATE DISSIPATION	5.0 max.	kw

Typical Operation:

DC Plate Voltage.	6000	7500	. . volts
DC Grid Voltage●.	-250	-300	. . volts
Peak RF Grid Voltage.	920	1000	. . volts
DC Plate Current.	0.9	0.9	. . amp
Driving Power (Approx.)**#.	95	80	. . watts
Power Output (Approx.).	1.5	2	. . kw

PLATE-MODULATED RF POWER AMPLIFIER - Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values*:

DC PLATE VOLTAGE.	6000 max.	volts
DC GRID VOLTAGE	-1000 max.	volts
DC PLATE CURRENT.	1.0 max.	amp
DC GRID CURRENT	0.25 max.	amp
PLATE INPUT	6.0 max.	kw
PLATE DISSIPATION	3.0 max.	kw

Typical Operation:

DC Plate Voltage.	5000	6000	. . volts
DC Grid Voltage	-800	-900	. . volts
Peak RF Grid Voltage.	1300	1420	. . volts
DC Plate Current.	0.9	1.0	. . amp
DC Grid Current (Approx.)#.	0.12	0.1	. . amp
Driving Power (Approx.)#.	155	140	. . watts
Power Output (Approx.).	2.75	4	. . kw

RF POWER AMPLIFIER & OSCILLATOR - Class C Telegraphy

Key-down conditions per tube without modulation##

Maximum Ratings, *Absolute Values*:

DC PLATE VOLTAGE.	8500 max.	volts
DC GRID VOLTAGE	-1000 max.	volts

●, **, #, ##: See next page.

889-A

TRANSMITTING TRIODE

DC PLATE CURRENT			2.0 max.	amp
DC GRID CURRENT			0.25 max.	amp
PLATE INPUT			16 max.	kw
PLATE DISSIPATION			5 max.	kw
Typical Operation:				
DC Plate Voltage	5000	6000	7500	volts
DC Grid Voltage	-500	-600	-800	volts
Peak RF Grid Voltage	1200	1460	1830	volts
DC Plate Current	1.5	1.8	2.0	amp
DC Grid Current (Approx.)#	0.19	0.21	0.24	amp
Driving Power (Approx.)#	220	290	400	watts
Power Output (Approx.)	5	7	10	kw

● With ac filament excitation.

** At crest of audio-frequency cycle with modulation factor of 1.0.

Subject to wide variations as explained on sheet TUBE RATINGS in General Section.

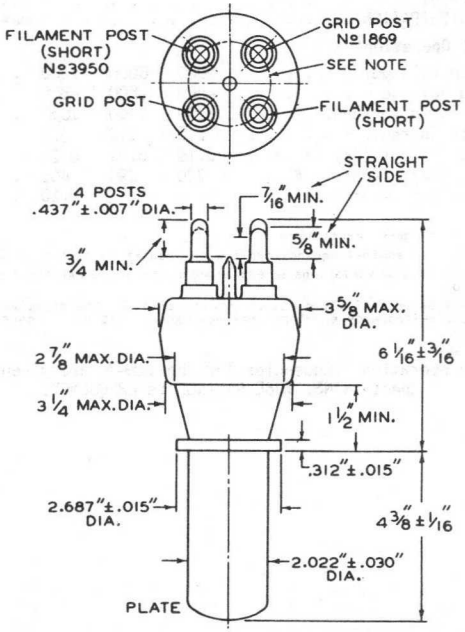
Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

Data on operating frequencies for the 889-A are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY.

RCA

889-A

TRANSMITTING TRIODE

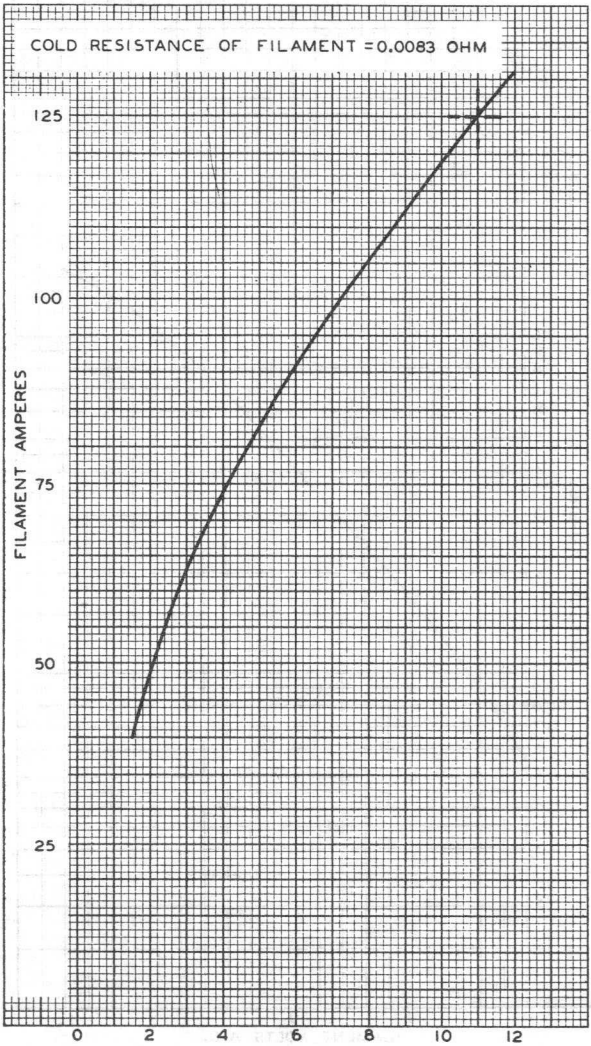


NOTE: THE TUBE BASE SHALL BE CAPABLE OF ENTERING TO A DISTANCE OF 5/8" IN A FLAT-PLATE GAUGE HAVING FOUR HOLES .536"±.001" DIAMETER ARRANGED ON A CIRCLE OF 2.125"±.001" DIAMETER AT ANGLES OF 90°±10'.

92CM-6039R2

889-A

AVERAGE FILAMENT CHARACTERISTIC



MAY 22, 1939

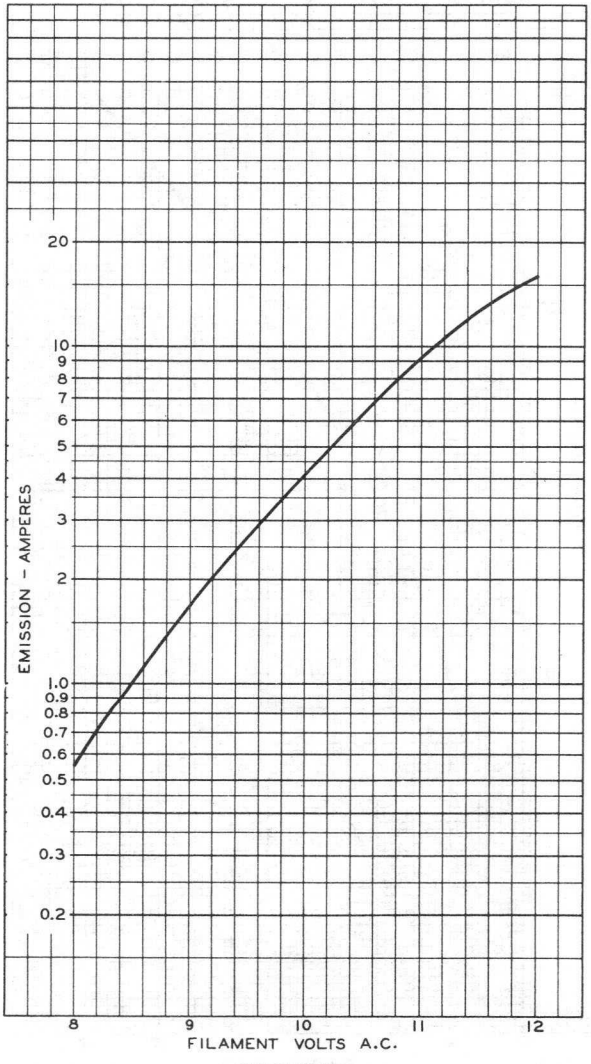
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92C-6086

RCA

889-A

AVERAGE FILAMENT-EMISSION CHARACTERISTIC



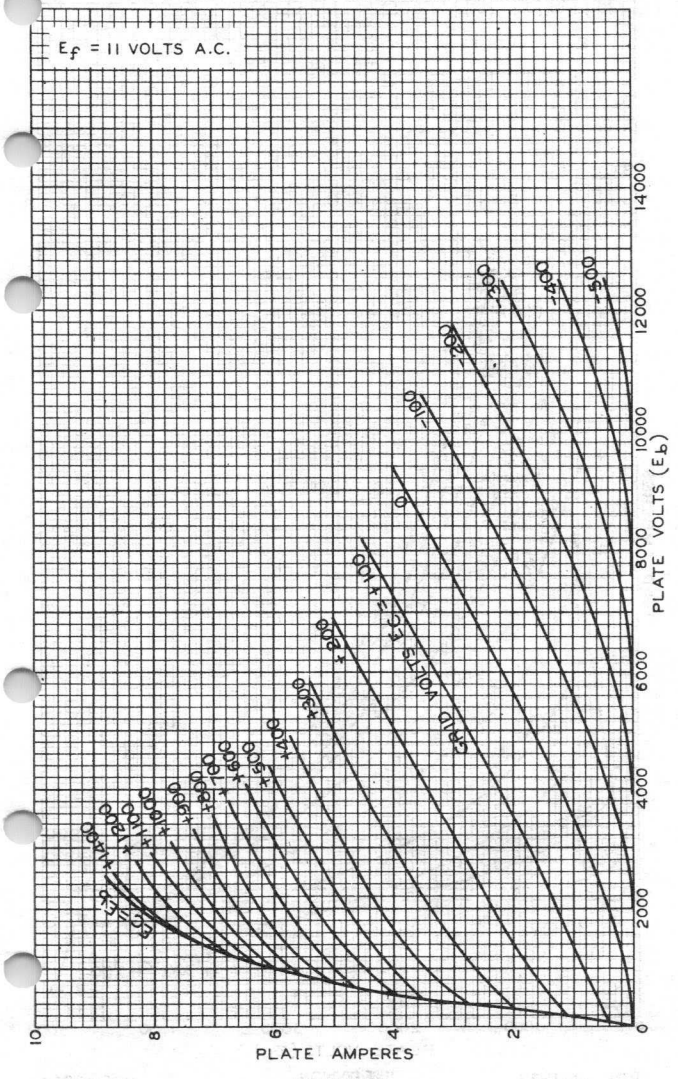
JUNE 10, 1940

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92C-6174

889-A

AVERAGE PLATE CHARACTERISTICS

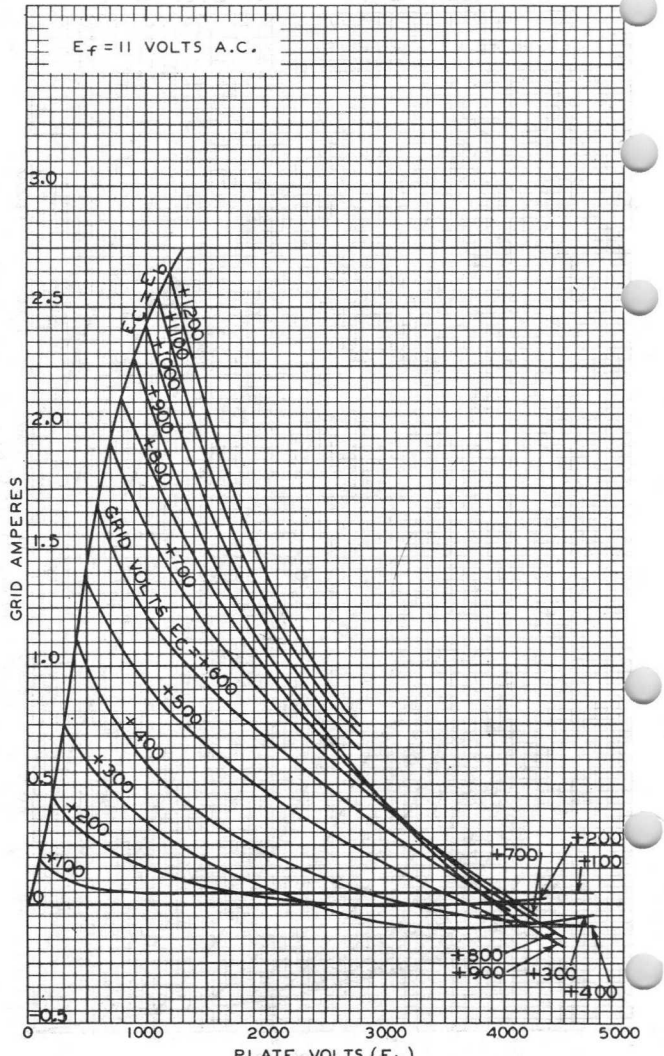


889-A

RCA

889-A

TYPICAL CHARACTERISTICS



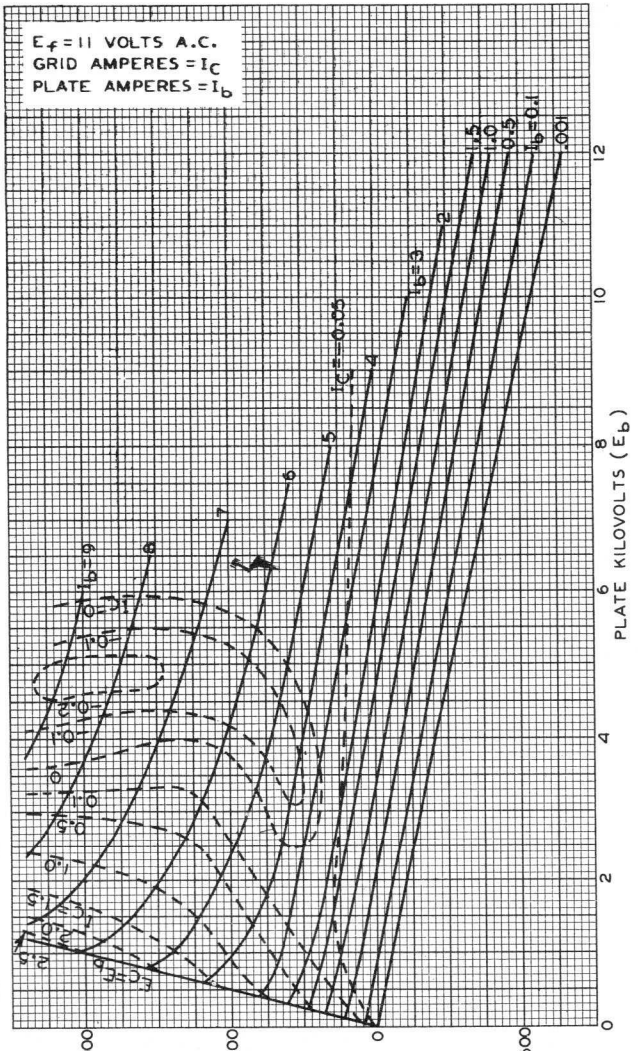
JUNE 15, 1939

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92C-6064

889-A

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



MAY 22, 1939

TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92C-6088

889R-A

TRANSMITTING TRIODE

FORCED-AIR COOLED

Supersedes Type 889-R

GENERAL DATA

Electrical:

Filament, Tungsten:

Voltage	11	volts
Current	125	amp

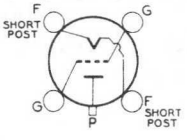
Starting Current: The filament current must never exceed 187 amperes, even momentarily.

Amplification Factor	21	
Direct Interelectrode Capacitances (Approx.):		
Grid to Plate	18.5	μμf
Grid to Filament	23.3	μμf
Plate to Filament	3.0	μμf

Mechanical:

Terminal Connections:

F – Filament (Short Terminals)
G – Grid (Long Terminals)



P – Water-Cooled Plate Terminal

Mounting Position	Vertical only, glass end up
Overall Length	11-1/2" ± 3/8"
Radiator Clamp Diameter	10-7/8" ± 1/8"
Radiator	Integral part of tube

Air Flow:

	For Plate Dissipation of 3.3 KW	4.0 KW	5.0 KW	
Through Radiator	325 min.	390 min.	500 min.	cfm
At Pressure of	0.38 min.	0.5 min.	0.7 min.in. of water	

The specified air flow should be delivered by a blower vertically upward through the radiator before and during the application of any voltages.

To Grid and Filament Seals . . . . . 15 . . . cfm

The specified air flow must be directed vertically downward from a 3-inch diameter nozzle upon the grid and filament seals before and during the application of any voltages in order to limit the temperature of the glass at the hottest part to the maximum specified value.

Bulb Temperature	150 max.	°C
Input Air Temperature (to Radiator)	50 max.	°C
Radiator Temperature	180 max.	°C

This tube can often be operated with reduced filament voltage, as explained on sheet TYPES OF CATHODES in General Section.

AF POWER AMPLIFIER & MODULATOR – Class B

Maximum Ratings, *Absolute Values:*

DC PLATE VOLTAGE	8500 max.	volts
MAX.-SIGNAL DC PLATE CURRENT*	2.0 max.	amp
MAX.-SIGNAL PLATE INPUT*	12 max.	kw
PLATE DISSIPATION*	5.0 max.	kw

* Averaged over any audio-frequency cycle of sine-wave form.

889R-A

TRANSMITTING TRIODE

Typical Operation:

Unless otherwise specified, values are for two tubes

DC Plate Voltage	5000	6000	7500	volts
DC Grid Voltage●	-180	-230	-300	volts
Peak AF Grid-to-Grid Volt.	1460	1680	1700	volts
Zero-Signal DC Plate Cur.	0.4	0.4	0.4	amp
Max.-Signal DC Plate Cur.	3.2	3.6	3.2	amp
Effective Load Resistance (plate-to-plate)	2520	3680	5000	ohms
Max.-Signal Driving Power (Approx.)	170	180	150	watts
Max.-Signal Power Output (Approx.)	8.8	12	15	kw

RF POWER AMPLIFIER – Class B Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values*:

DC PLATE VOLTAGE	8500 max.	volts
DC PLATE CURRENT	1.0 max.	amp
PLATE INPUT	7.5 max.	watts
PLATE DISSIPATION	5.0 max.	watts

Typical Operation:

DC Plate Voltage	6000	7500	volts
DC Grid Voltage	-250	-300	volts
Peak RF Grid Voltage	920	1000	volts
DC Plate Current	0.9	0.9	amp
Driving Power (Approx.)**#	95	80	watts
Power Output (Approx.)	1.5	2	kw

PLATE-MODULATED RF POWER AMPLIFIER – Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values*:

DC PLATE VOLTAGE	6000 max.	volts
DC GRID VOLTAGE●	-1000 max.	volts
DC PLATE CURRENT	1.0 max.	amp
DC GRID CURRENT	0.25 max.	amp
PLATE INPUT	6 max.	kw
PLATE DISSIPATION	3 max.	kw

Typical Operation:

DC Plate Voltage	5000	6000	volts
DC Grid Voltage	-800	-900	volts
Peak RF Grid Voltage	1300	1420	volts
DC Plate Current	0.9	1.0	amp
DC Grid Current (Approx.)#	0.12	0.1	amp

●, **, #: See next page.

889R-A

TRANSMITTING TRIODE

Driving Power (Approx.)#.	155	140	. .	watts
Power Output (Approx.).	2.75	4	. .	kw

RF POWER AMPLIFIER & OSCILLATOR – Class C Telegraphy

*Key-down conditions per tube without modulation***

Maximum Ratings, *Absolute Values*:

DC PLATE VOLTAGE.	8500 max.	volts	
DC GRID VOLTAGE●.	-1000 max.	volts	
DC PLATE CURRENT.	2.0 max.	amp	
DC GRID CURRENT	0.25 max.	amp	
PLATE INPUT	16 max.	kw	
PLATE DISSIPATION	5 max.	kw	

Typical Operation:

DC Plate Voltage.	5000	6000	7500	. .	volts
DC Grid Voltage	-500	-600	-800	. .	volts
Peak RF Grid Voltage. . . .	1240	1460	1830	. .	volts
DC Plate Current.	1.5	1.8	2.0	. .	amp
DC Grid Current (Approx.)#. .	0.19	0.21	0.24	. .	amp
Driving Power (Approx.)#. . .	220	290	400	. .	watts
Power Output (Approx.). . . .	5	7	10	. .	kw

● With ac filament excitation.

** At crest of audio-frequency cycle with modulation factor of 1.0.

Subject to wide variations as explained on sheet TUBE RATINGS in General Section.

Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

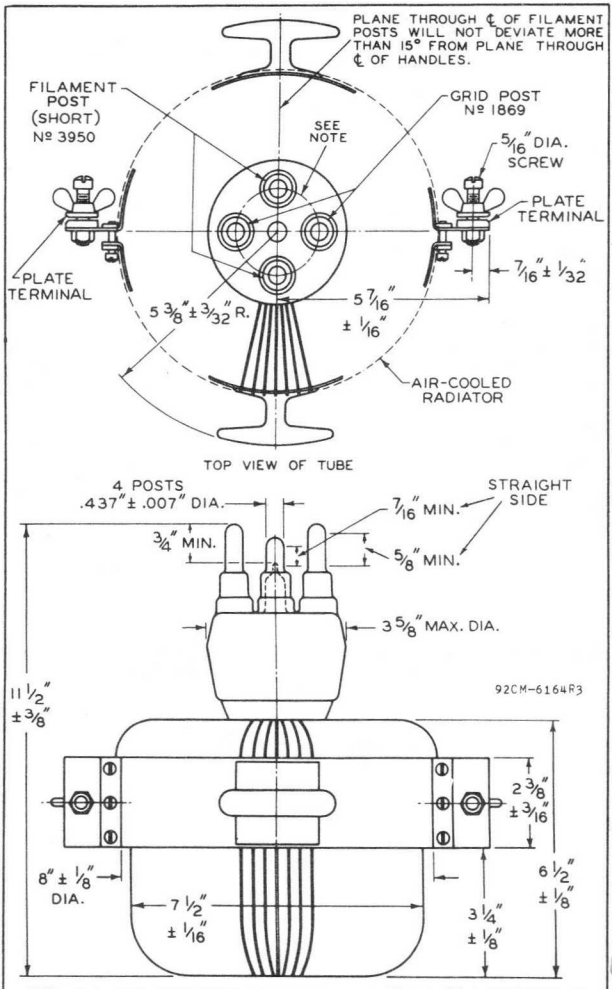
Data on operating frequencies for the 889R-A are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY.

CURVES
FOR THE 889R-A ARE THE SAME
AS THOSE FOR TYPE 889-A

RCA

889R-A

TRANSMITTING TRIODE



NOTE: THE TUBE BASE SHALL BE CAPABLE OF ENTERING TO A DISTANCE OF 5/8" IN A FLAT-PLATE GAUGE HAVING FOUR HOLES .536" ± .001" DIAMETER ARRANGED ON A CIRCLE OF 2.125" ± .001" DIAMETER AT ANGLES OF 90° ± 10'.

RCA

891

POWER TRIODE

WATER COOLED

GENERAL DATA

Electrical:

Filament, Tungsten: Two-Section Type

Excitation . . . . . Single- or Two-Phase AC, or DC

See FILAMENT CONNECTIONS and EXCITATION CIRCUITS. When a single-phase or dc supply is used, do not connect the two filament sections in parallel. Doing so will overheat common filament lead (large terminal) and damage tube.

Voltage per Section. . .	11	volts
Current.	60	amp
Starting Current:	The filament current should never exceed 120 amperes, even momentarily.	
Cold Resistance.	0.031	ohm ←

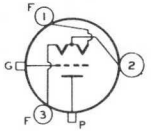
NOTE: This tube can often be operated with reduced filament voltage as explained on sheet TYPES OF CATHODES in the General Section.

Amplification Factor . . .	8.5	←
Direct Interelectrode Capacitances (Approx.):		
Grid to Plate.	27	μμf
Grid to Filament	19	μμf ←
Plate to Filament. . . .	2	μμf

Mechanical:

Terminal Connections:

Term. 1 – Filament
Term. 2 – Junction of Filament Sections, Base Shell



Term. 3 – Filament
G – Grid (Side Arm)
P – Water-Cooled Plate Terminal

Mounting Position.	Vertical, Filament End Up	
Maximum Overall Length	20-7/8"	←
Maximum Radius	6-1/2"	
Water Flow	3 to 8	gpm

The specified water flow must start before the application of any voltages, and may be removed simultaneously with the removal of all voltages. The pressure in the jacket must not exceed 80 lbs per square inch. ←

Outlet Water Temperature	70 max.	°C
Bulb Temperature	150 max.	°C ←

Components: ←

Water Jacket (Includes one gasket)	RCA MI-7415
Gasket (For Spare)	RCA MI-7440
Filament Connector (2 required).	RCA MI-7422-A
Filament-Section Junction Connector.	RCA MI-7432
Filament Terminal Block.	RCA MI-19422-7
Grid Connector	RCA MI-7422-A
Mounting Insulator	RCA MI-7424

AF POWER AMPLIFIER & MODULATOR – Class B

Maximum CCS• Ratings, *Absolute Values*:

DC PLATE VOLTAGE	15000 max.	volts

• See next page.

← Indicates a change.

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POWER TRIODE

MAX.-SIGNAL DC PLATE CURRENT*	2.0 max.		amp
MAX.-SIGNAL PLATE INPUT*	20000 max.		watts
PLATE DISSIPATION*	5000 max.		watts

→ **Typical Operation:**

Values are for 2 tubes

DC Plate Voltage	6000	10000	12500	volts
DC Grid Voltage	-630	-1100	-1450	volts
Peak AF Grid-to-Grid Volt.	2060	3060	3760	volts
Zero-Sig. DC Plate Current	0.5	0.5	0.4	amp
Max.-Sig. DC Plate Current	2.5	2.4	2.5	amp
Effective Load Resistance (Plate to plate)	5000	10000	12000	ohms
Max.-Signal Driving Power (Approx.)#	110	225	245	watts
Max.-Signal Power Output (Approx.)	8000	16000	22000	watts

RF POWER AMPLIFIER & OSCILLATOR—Class C Telegraphy

Key-down conditions per tube without amplitude modulation##

Maximum CCS• Ratings, *Absolute Values:*

DC PLATE VOLTAGE	12000 max. volts
DC GRID VOLTAGE	-3000 max. volts
DC PLATE CURRENT	2 max. amp
DC GRID CURRENT	0.15 max. amp
PLATE INPUT	18000 max. watts
PLATE DISSIPATION	6000 max. watts

→ **Typical Operation:**

DC Plate Voltage	8000	10000	volts
DC Grid Voltage	-1800	-2000	volts
From a grid resistor of	20000	14300	ohms
From a cathode resistor of	1450	1360	ohms
Peak RF Grid Voltage	2400	2700	volts
DC Plate Current	1.15	1.33	amp
DC Grid Current (Approx.)°	0.09	0.14	amp
Driving Power (Approx.)°	215	375	watts
Power Output (Approx.)	6500	10000	watts

• Continuous Commercial Service.

* Averaged over any audio-frequency cycle of sine-wave form.

\# The driving stage should have good regulation and should be capable of supplying considerably more than the required driving power.

\#\# Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

° For effect of load resistance on grid current and driving power, refer to TUBE RATINGS—*Grid Current and Driving Power* in the General Section.

→ Indicates a change.

RCA

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POWER TRIODE

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Filament Current	1	57	62	amp
Amplification Factor	1,2	7.6	9.4	
Grid-Plate Capacitance	-	24	31	μμf
Grid-Filament Capacitance	-	15	23	μμf
Plate-Filament Capacitance	-	1	3	μμf
Plate Voltage	1,3	1600	2200	volts
Plate Voltage	1,4	9500	11500	volts
Grid Voltage	1,5	-1500	-1850	volts
Grid Voltage	1,6	-	875	volts
Peak Cathode Current	7	9	-	amp
Grid Current	1,6	-	1.5	amp
Useful Power Output	1,8	12000	-	watts

Note 1: With 22 volts ac on filament connected for single-phase operation.

Note 2: With dc grid voltage of -500 volts and dc plate voltage adjusted to give dc plate current of 0.75 amp.

Note 3: With dc grid voltage of 0 volts, and dc plate voltage adjusted to give dc plate current of 0.75 amp.

Note 4: With dc grid voltage of -1000 volts, and dc plate voltage adjusted to give dc plate current of 0.75 amp.

Note 5: With dc plate voltage of 12000 volts, and dc grid voltage adjusted to give dc plate current of 20 ma.

Note 6: With dc plate voltage of 1500 volts, and instantaneous grid voltage adjusted to give instantaneous plate current of 6.0 amp.

Note 7: Represents the maximum usable cathode current (plate current and grid current) for the tube under any condition of operation.

Note 8: With dc plate voltage of 12000 volts, dc plate current of 1.5 amp., dc grid current of 0.10 amp., grid resistor of 19000 ± 10% ohms, and frequency of 1.5 megacycles/second.

Data on operating frequencies for the 891 are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY

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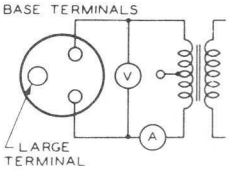
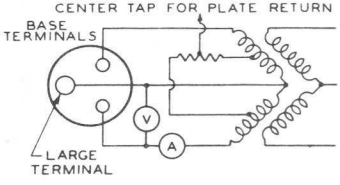
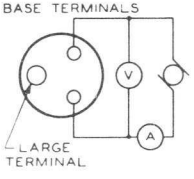
FILAMENT CONNECTIONS AND EXCITATION CIRCUITS

WITH SINGLE-PHASE A-C EXCITATION	 V = 22 VOLTS A = 60 AMPERES
WITH TWO-PHASE (QUARTER PHASE) A-C EXCITATION	 V = 11 VOLTS A = 60 AMPERES
WITH D-C EXCITATION	 V = 22 VOLTS A = 60 AMPERES

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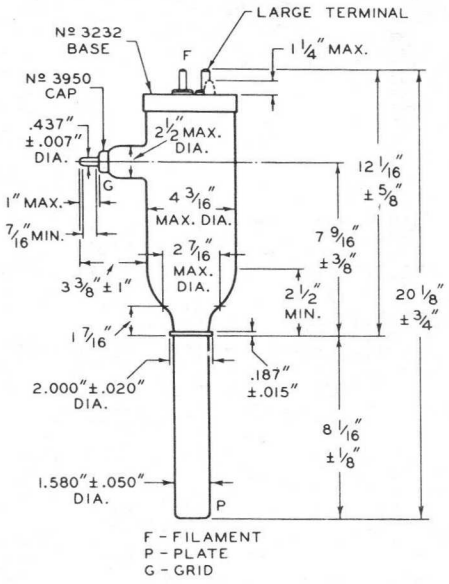
POWER TRIODE



92CM-4627R4

RCA

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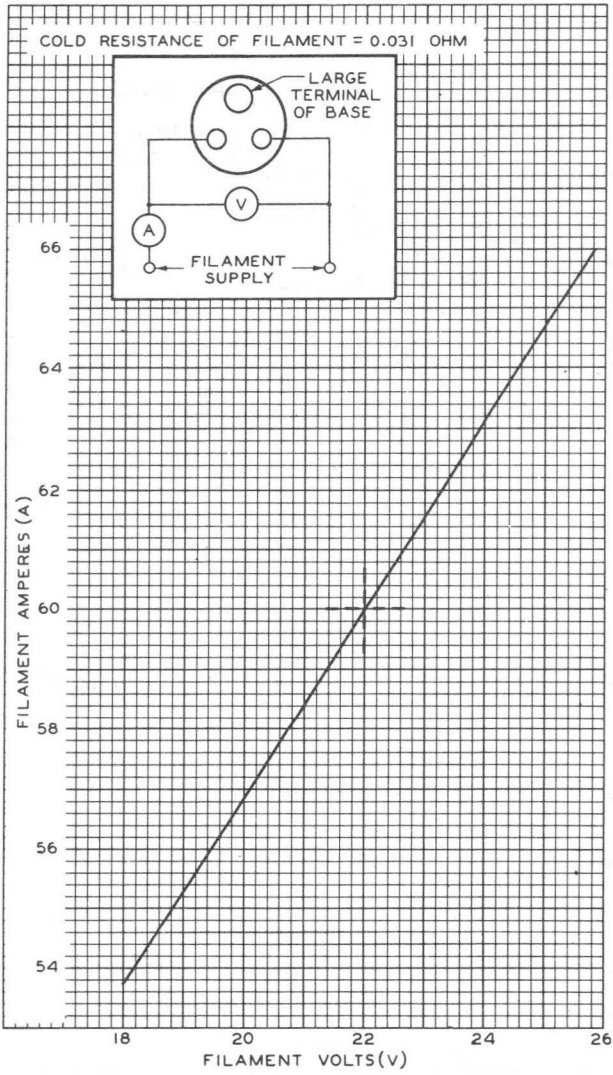
AVERAGE FILAMENT CHARACTERISTIC



RCA

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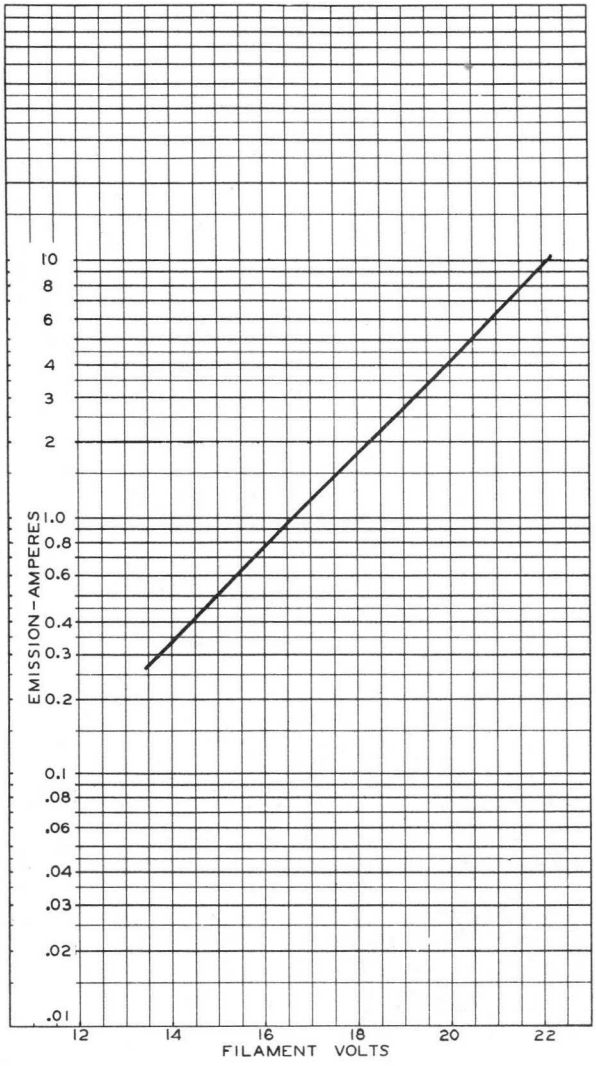
AVERAGE FILAMENT-EMISSION CHARACTERISTIC



RCA

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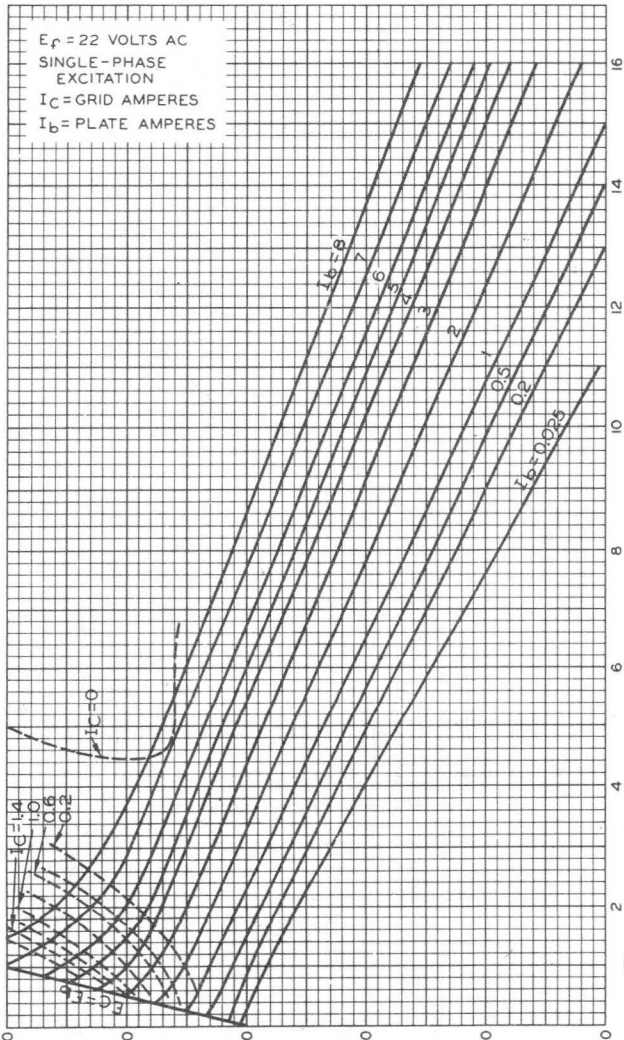
AVERAGE CONSTANT-CURRENT CHARACTERISTICS



DEC. 13, 1949

92CM-6134RI

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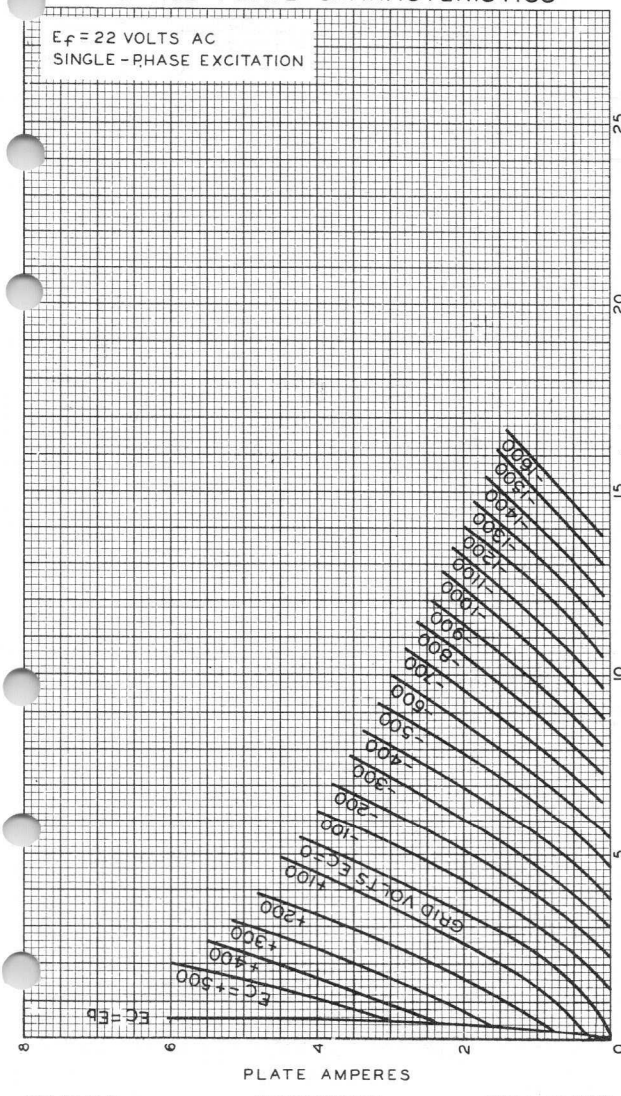
AVERAGE PLATE CHARACTERISTICS



RCA

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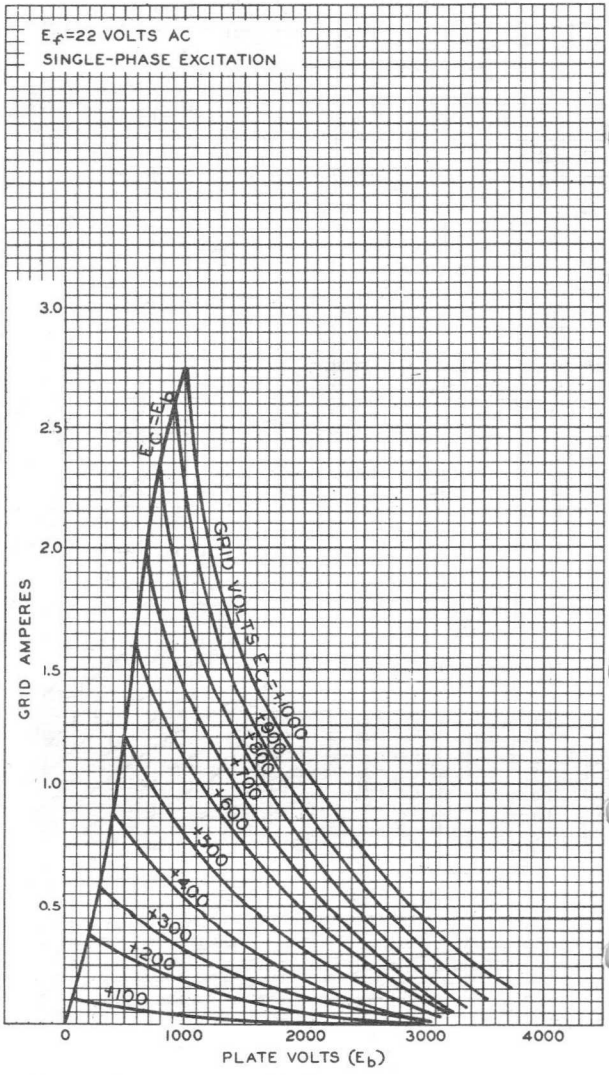
TYPICAL GRID CHARACTERISTICS



TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

891-R

POWER TRIODE

FORCED-AIR COOLED

GENERAL DATA

Electrical:

Filament, Tungsten: Two-Section Type

Excitation . . . . . Single- or Two-Phase AC, or DC

See FILAMENT CONNECTIONS and EXCITATION CIRCUITS under Type 891. When a single-phase or dc supply is used, do not connect the two filament sections in parallel. Doing so will overheat common filament lead (large terminal) and damage tube.

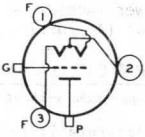
Voltage per Section. . .	11	. . . . .	volts
Current.	60	. . . . .	amp
Starting Current:	The filament current should never exceed 120 amperes, even momentarily.		
Cold Resistance.	0.031	. . . . .	ohm ←

NOTE: This tube can often be operated with reduced filament voltage as explained on sheet TYPES OF CATHODES in the General Section.

Amplification Factor . . .	8.5		←
Direct Interelectrode Capacitances (Approx.):			←
Grid to Plate.	28	. . . . .	μμf
Grid to Filament	19	. . . . .	μμf
Plate to Filament. . . .	2.5	. . . . .	μμf

Mechanical:

Terminal Connections:



Term. 1 - Filament
Term. 2 - Junction of Filament Sections, Base Shell
Term. 3 - Filament
G - Grid (Side Arm)
P - Radiator-Cooled Plate Terminal

Mounting Position.	Vertical, Filament End Up
Maximum Overall Length	22"
Maximum Radius	6-1/2"
Radiator	Integral Part of Tube
Air Flow:	←

Through Radiator - The specified air flow for various values of plate dissipation as indicated below should be delivered by a blower before and during the application of any voltages. Filament power, plate power, and air may be removed simultaneously.

Plate Dissipation	2400	3200	4000	. . . watts
Air Flow	300	380	450	. . . cfm
Static Pressure.	0.20	0.36	0.5	inches of water

Incoming Air Temperature	45 max.	°C
Radiator Temperature (Measured in thermometer well).	180 max.	°C
Bulb Temperature	150 max.	°C ←

Components:

←

Air Jacket	RCA MI-19422-A
Air Manifold	RCA MI-27017-A
Bracelet (For canvas boot)	RCA MI-27016-A

← Indicates a change.

891-R
POWER TRIODE

Filament Connector (2 required)	RCA MI-7422-A
Filament-Section Junction Connector	RCA MI-7432
Filament Terminal Block	RCA MI-19422-7
Grid Connector	RCA MI-7422-A

AF POWER AMPLIFIER & MODULATOR – Class B

Maximum CCS• Ratings, ***Absolute Values:***

DC PLATE VOLTAGE	10000 max.	volts
MAX.-SIGNAL DC PLATE CURRENT*	2 max.	amp
MAX.-SIGNAL PLATE INPUT*	10500 max.	watts
PLATE DISSIPATION*	3500 max.	watts

→ **Typical Operation:**

Values are for 2 tubes

DC Plate Voltage	6000	8000	volts
DC Grid Voltage	-630	-860	volts
Peak AF Grid-to-Grid Voltage	2060	2260	volts
Zero-Signal DC Plate Current	0.5	0.5	amp
Max.-Signal DC Plate Current	2.5	2.1	amp
Effective Load Resistance (Plate to plate)	5000	8000	ohms
Max.-Signal Driving Power (Approx.)#	110	50	watts
Max.-Signal Power Output (Approx.)	8000	10000	watts

RF POWER AMPLIFIER & OSCILLATOR – Class C Telegraphy

Key-down conditions per tube without amplitude modulation##

Maximum CCS• Ratings, ***Absolute Values:***

DC PLATE VOLTAGE	10000 max.	volts
DC GRID VOLTAGE	-3000 max.	volts
DC PLATE CURRENT	2 max.	amp
DC GRID CURRENT	0.15 max.	amp
PLATE INPUT	15000 max.	watts
PLATE DISSIPATION	4000 max.	watts

→ **Typical Operation:**

DC Plate Voltage	8000	10000	volts
DC Grid Voltage	-1800	-2000	volts
From a grid resistor of	20000	14300	ohms
From a cathode resistor of	1460	1360	ohms
Peak RF Grid Voltage	2400	2700	volts
DC Plate Current	1.14	1.33	amp

• Continuous Commercial Service.

* Averaged over any audio-frequency cycle of sine-wave form.

\# The driving stage should have good regulation and should be capable of supplying considerably more than the required driving power.

\## Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

→ Indicates a change.

891-R

POWER TRIODE

DC Grid Current (Approx.)°	0.09	0.14	amp
Driving Power (Approx.)°	215	375	watts
Power Output (Approx.)	6500	10000	watts

° For effect of load resistance on grid current and driving power, refer to TUBE RATINGS—*Grid Current and Driving Power* in the General Section.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Filament Current	1	57	62	amp
Amplification Factor	1,2	7.6	9.4	
Grid-Plate Capacitance	–	25	32	μμf
Grid-Filament Capacitance. . . .	–	15	23	μμf
Plate-Filament Capacitance . . .	–	1.5	3.5	μμf
Plate Voltage.	1,3	1200	1750	volts
Plate Voltage.	1,4	8800	10800	volts
Grid Voltage	1,5	-1500	-1850	volts
Grid Voltage	1,6	–	875	volts
Peak Cathode Current	7	9	–	amp
Grid Current	1,6	–	1.5	amp
Useful Power Output.	1,8	10000	–	watts

Note 1: With 22 volts ac on filament connected for single-phase operation.

Note 2: With dc grid voltage of -500 volts and dc plate voltage adjusted to give dc plate current of 0.45 amp.

Note 3: With dc grid voltage of 0 volts, and dc plate voltage adjusted to give dc plate current of 0.45 amp.

Note 4: With dc grid voltage of -1000 volts, and dc plate voltage adjusted to give dc plate current of 0.45 amp.

Note 5: With dc plate voltage of 12000 volts, and dc grid voltage adjusted to give dc plate current of 20 ma.

Note 6: With dc plate voltage of 1500 volts, and instantaneous grid voltage adjusted to give instantaneous plate current of 6.0 amp.

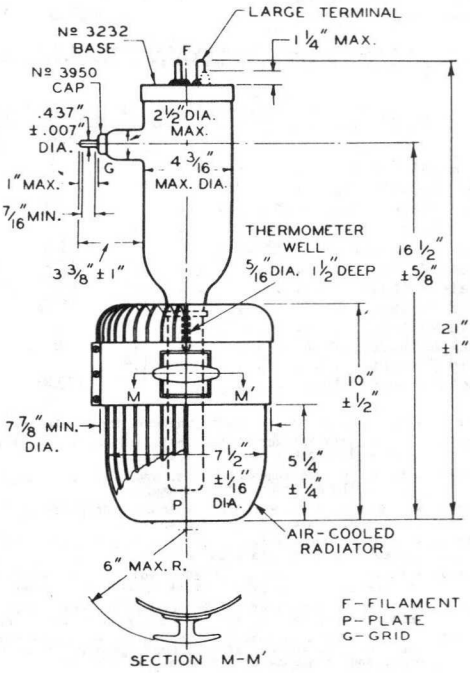
Note 7: Represents the maximum usable cathode current (plate current and grid current) for the tube under any condition of operation.

Note 8: With dc plate voltage of 10000 volts, dc plate current of 1.4 amp., dc grid current of 0.10 amp., grid resistor of 19000 ± 10% ohms, and frequency of 1.5 megacycles/second.

Data on operating frequencies for the 891-R are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY

Average Filament-Emission Characteristic Curve,
Average Filament Characteristic Curve,
and
Average Characteristic Curves
are the same as shown for Type 891

891-R
POWER TRIODE



TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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POWER TRIODE

WATER COOLED

GENERAL DATA

Electrical:

Filament, Tungsten: Two-Section Type

Excitation . . . . . Single- or Two-Phase AC, or DC

See FILAMENT CONNECTIONS and EXCITATION CIRCUITS under Type 891. When a single-phase or dc supply is used, do not connect the two filament sections, in parallel. Doing so will overheat common filament lead (large terminal) and damage tube.

Voltage per Section. . .	11	volts
Current.	60.	amp
Starting Current:	The filament current should never exceed 120 amperes, even momentarily.	
Cold Resistance.	0.031	ohm ←

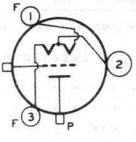
NOTE: This tube can often be operated with reduced filament voltage as explained on sheet TYPES OF CATHODES in the General Section.

Amplification Factor . . .	50	
Direct Interelectrode Capacitances (Approx.):		←
Grid to Plate.	30	μμf
Grid to Filament	20	μμf
Plate to Filament. . . .	1.5	μμf

Mechanical:

Terminal Connections:

Term. 1 - Filament
Term. 2 - Junction of Filament Sections, Base Shell



Term. 3 - Filament
G - Grid (Side Arm)
P - Water-Cooled Plate Terminal

Mounting Position	Vertical, Filament End Up	
Maximum Overall Length.	20-7/8"	←
Maximum Radius.	6-1/2"	
Water Flow.	3 to 8	gpm

The specified water flow must start before the application of any voltages, and may be removed simultaneously with the removal of all voltages. The pressure in the jacket must not exceed 80 lbs per square inch. ←

Outlet Water Temperature.	70 max.	°C
Bulb Temperature.	150 max.	°C ←

Components: ←

Water Jacket (Includes one gasket).	RCA MI-7415
Gasket (For spare).	RCA MI-7440
Filament Connector (2 required)	RCA MI-7422-A
Filament-Section Junction Connector	RCA MI-7432
Filament Terminal Block	RCA MI-19422-7
Grid Connector.	RCA MI-7422-A
Mounting Insulator.	RCA MI-7424

← Indicates a change.

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POWER TRIODE

AF POWER AMPLIFIER & MODULATOR – Class B

Maximum CCS● Ratings, *Absolute Values*:

DC PLATE VOLTAGE	15000 max.	volts
MAX.–SIGNAL DC PLATE CURRENT*	2.0 max.	amp
MAX.–SIGNAL PLATE INPUT*	20000 max.	watts
PLATE DISSIPATION*	7500 max.	watts

→ **Typical Operation:**

Values are for 2 tubes

DC Plate Voltage	6000	10000	12500	volts
DC Grid Voltage†	0	−90	−170	volts
Peak AF Grid-to-Grid Voltage	1000	1380	1370	volts
Zero-Signal DC Plate Current	0.5	0.5	0.4	amp
Max.-Signal DC Plate Current	2.6	3.3	2.8	amp
Effective Load Resistance (Plate to plate)	4200	6400	10000	ohms
Max.-Signal Driving Power (Approx.)#	135	240	160	watts
Max.-Signal Power Output (Approx.)	8000	20000	22000	watts

RF POWER AMPLIFIER – Class B Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1.0

Maximum CCS● Ratings, *Absolute Values*:

DC PLATE VOLTAGE	15000 max.	volts
DC PLATE CURRENT	1.0 max.	amp
PLATE INPUT	15000 max.	watts
PLATE DISSIPATION	10000 max.	watts

→ **Typical Operation:**

DC Plate Voltage	6000	10000	14000	volts
DC Grid Voltage†	0	−100	−190	volts
Peak RF Grid Voltage	230	370	440	volts
DC Plate Current	0.64	0.77	0.82	amp
DC Grid Current (Approx.)○	0.03	0.06	0.03	amp
Driving Power (Approx.)▲○	77	133	106	watts
Power Output (Approx.)	1000	2500	4000	watts

PLATE-MODULATED RF POWER AMPLIFIER – Class C Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1.0

Maximum CCS● Ratings, *Absolute Values*:

DC PLATE VOLTAGE	10000 max.	volts

* Averaged over any audio-frequency cycle of sine-wave form.

† With ac on filament.

\# The driving stage should have good regulation and should be capable of supplying considerably more than the required driving power.

▲ At the crest of audio-frequency cycle with modulation factor of 1.0.

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

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POWER TRIODE

DC GRID VOLTAGE			−3000 max.	volts
DC PLATE CURRENT			1.0 max.	amp
DC GRID CURRENT			0.3 max.	amp ←
PLATE INPUT			10000 max.	watts
PLATE DISSIPATION			6600 max.	watts
Typical Operation:				←
DC Plate Voltage	6000	8000	10000	volts
DC Grid Voltage	−1000	−1300	−1600	volts
From a grid resistor of	3570	5420	6960	ohms
Peak RF Grid Voltage	1650	1950	2250	volts
DC Plate Current	0.83	0.82	0.78	amp
DC Grid Current (Approx.)°	0.28	0.24	0.23	amp
Driving Power (Approx.)°	420	430	460	watts
Power Output (Approx.)	3500	5000	6000	watts

RF POWER AMPLIFIER & OSCILLATOR – Class C Telegraphy

Key-down conditions per tube without amplitude modulation##

Maximum CCS• Ratings, *Absolute Values:*

DC PLATE VOLTAGE			15000 max.	volts
DC GRID VOLTAGE			−3000 max.	volts
DC PLATE CURRENT			2.0 max.	amp
DC GRID CURRENT			0.4 max.	amp ←
PLATE INPUT			30000 max.	watts
PLATE DISSIPATION			10000 max.	watts
Typical Operation:				←
DC Plate Voltage	8000	10000	12000	volts
DC Grid Voltage	−1000	−1300	−1600	volts
From a grid resistor of	4540	5420	6960	ohms
From a cathode resistor of	720	790	900	ohms
Peak RF Grid Voltage	1700	2150	2550	volts
DC Plate Current	1.17	1.4	1.55	amp
DC Grid Current (Approx.)°	0.22	0.24	0.23	amp
Driving Power (Approx.)°	330	495	565	watts
Power Output (Approx.)	6500	10000	14000	watts

• Continuous Commercial Service.

Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

° For effect of load resistance on grid current and driving power, refer to TUBE RATINGS—*Grid Current and Driving Power* in the General Section.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Filament Current	1	57	62	amp
Amplification Factor	1,2	42.5	57.5	
Grid-Plate Capacitance	–	27	33	μμf
Grid-Filament Capacitance	–	15	24	μμf
Plate-Filament Capacitance	–	0.5	2.5	μμf

← Indicates a change.

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POWER TRIODE

	Note	Min.	Max.	
Plate Voltage.	1,3	7500	11000	volts
Plate Voltage.	1,4	12000	16500	volts
Grid Voltage	1,5	-240	-400	volts
Grid Voltage	1,6	-	925	volts
Peak Cathode Current	7	9	-	amp
Grid Current	1,6	-	1.75	amp
Useful Power Output.	1,8	20000	-	watts

Note 1: With 22 volts ac on filament connected for single-phase operation.

Note 2: With dc grid voltage of -50 volts and dc plate voltage adjusted to give dc plate current of 0.75 amp.

Note 3: With dc grid voltage of 0 volts, and dc plate voltage adjusted to give dc plate current of 0.75 amp.

Note 4: With dc grid voltage of -100 volts, and dc plate voltage adjusted to give dc plate current of 0.75 amp.

Note 5: With dc plate voltage of 15000 volts, and dc grid voltage adjusted to give dc plate current of 20 ma.

Note 6: With dc plate voltage of 1500 volts, and instantaneous grid voltage adjusted to give instantaneous plate current of 6.0 amp.

Note 7: Represents the maximum usable cathode current (plate current and grid current) for the tube under any condition of operation.

Note 8: With dc plate voltage of 15000 volts, dc plate current of 2.0 amp., dc grid current of 0.25 amp., grid resistor of 5000 ± 10% ohms, and frequency of 1.5 megacycles/second.

Data on operating frequencies for the 892 are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY

Outline Drawing for the 892 is the same as shown for Type 891

Average Filament-Emission Characteristic Curve
and
Average Filament Characteristic Curve
are the same as shown for Type 891

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RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

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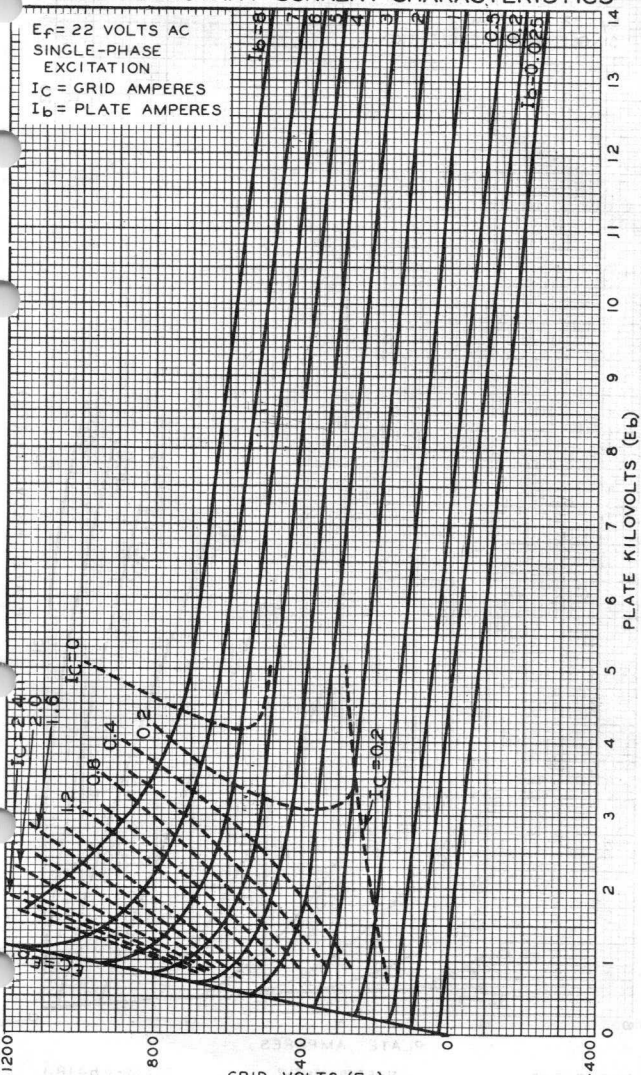
AVERAGE CONSTANT-CURRENT CHARACTERISTICS



MARCH 18, 1949

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6136R1

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RCA

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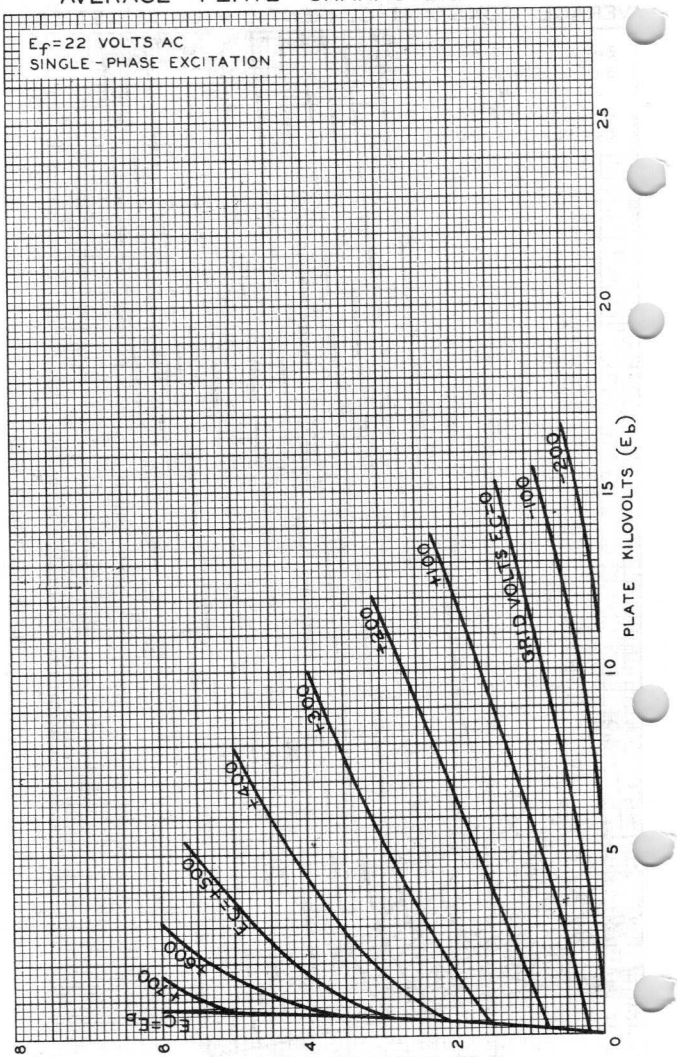
AVERAGE PLATE CHARACTERISTICS



MAR. 17, 1949

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-4641R3

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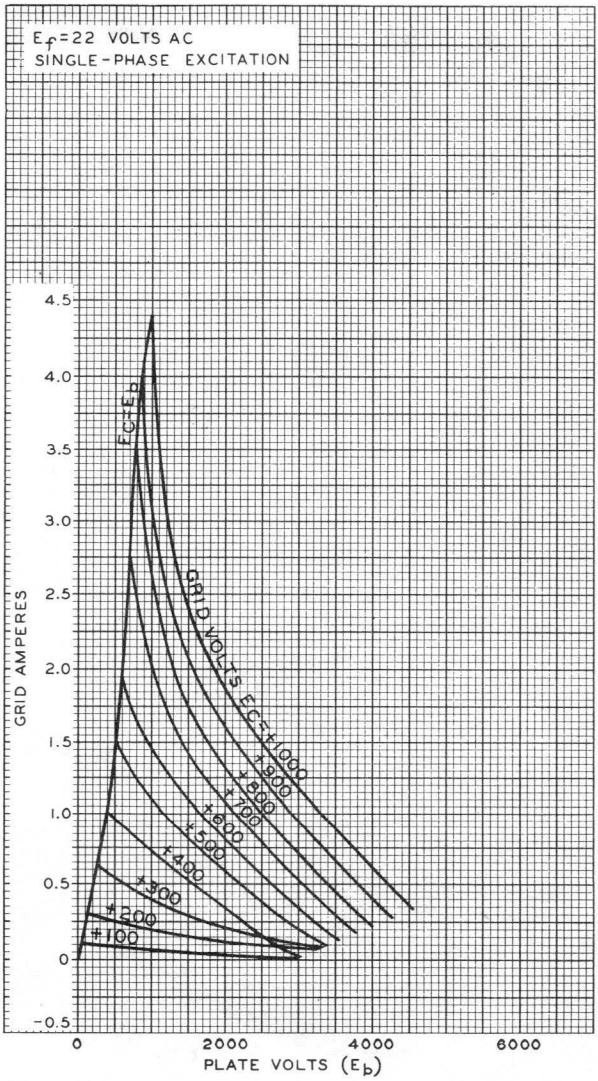
TYPICAL GRID CHARACTERISTICS



892-R

POWER TRIODE

FORCED-AIR COOLED

GENERAL DATA

Electrical:

Filament, Tungsten: Two-Section Type

Excitation . . . . . Single- or Two-Phase AC, or DC

See FILAMENT CONNECTIONS and EXCITATION CIRCUITS under Type 891. When a single-phase or dc supply is used, do not connect the two filament sections in parallel. Doing so will overheat common filament lead (large terminal) and damage tube.

Voltage per Section. . .	11	volts
Current.	60	amp
Starting Current:	The filament current should never exceed 120 amperes, even momentarily.	
Cold Resistance.	0.031	ohm ←

NOTE: This tube can often be operated with reduced filament voltage as explained on sheet TYPES OF CATHODES in the General Section.

Amplification Factor . . . 50

Direct Interelectrode Capacitances (Approx.): ←

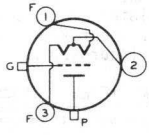
Grid to Plate.	31	μμf
Grid to Filament	20	μμf
Plate to Filament. . . .	2	μμf

Mechanical:

Terminal Connections:

Term. 1 - Filament

Term. 2 - Junction of Filament Sections, Base Shell



Term. 3 - Filament

G - Grid (Side Arm)

P - Radiator-Cooled Plate Terminal

Mounting Position.	Vertical, Filament End Up
Maximum Overall Length	22"
Maximum Radius	6-1/2"
Radiator	Integral Part of Tube

Air Flow: ←

Through Radiator - The specified air flow for various values of plate dissipation as indicated below should be delivered by a blower before and during the application of any voltages. Filament power, plate power, and air may be removed simultaneously.

Plate Dissipation	2400	3200	4000	watts
Air Flow	300	380	450	cfm
Static Pressure. .	0.20	0.36	0.5	inches of water

Incoming Air Temperature	45 max.	°C
Radiator Temperature (Measured in thermometer well). . . .	180 max.	°C
Bulb Temperature	150 max.	°C ←

Components: ←

Air Jacket . . . . . RCA MI-19422-A

← Indicates a change.

892-R

892-R

POWER TRIODE

Air Manifold	RCA MI-27017-A
Bracelet (For canvas boot)	RCA MI-27016-A
Filament Connector (2 required)	RCA MI-7422-A
Filament-Section Junction Connector	RCA MI-7432
Filament Terminal Block	RCA MI-19422-7
Grid Connector	RCA MI-7422-A

AF POWER AMPLIFIER & MODULATOR - Class B

Maximum CCS• Ratings, *Absolute Values:*

DC PLATE VOLTAGE	12500 max.	volts
MAX.-SIGNAL DC PLATE CURRENT*	2.0 max.	amp
MAX.-SIGNAL PLATE INPUT*	12000 max.	watts
PLATE DISSIPATION*	4000 max.	watts

Typical Operation:

Values are for 2 tubes

DC Plate Voltage	6000	8000	volts
DC Grid Voltage†	0	-60	volts
Peak AF Grid-to-Grid Voltage	1200	1000	volts
Zero-Signal DC Plate Current	0.5	0.5	amp
→ Max.-Signal DC Plate Current	2.6	2.3	amp
Effective Load Resistance (Plate to plate)	4200	6800	ohms
→ Max.-Sig. Driving Power (Approx.)#	135	84	watts
Max.-Sig. Power Output (Approx.)	8000	10500	watts

RF POWER AMPLIFIER - Class B Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1.0

Maximum CCS• Ratings, *Absolute Values:*

DC PLATE VOLTAGE	12500 max.	volts
DC PLATE CURRENT	1.0 max.	amp
PLATE INPUT	6000 max.	watts
PLATE DISSIPATION	4000 max.	watts

→ **Typical Operation:**

DC Plate Voltage	6000	8000	volts
DC Grid Voltage†	0	-60	volts
Peak RF Grid Voltage	230	320	volts
DC Plate Current	0.64	0.67	amp
DC Grid Current (Approx.)°	0.03	0.04	amp
Driving Power (Approx.)▲°	77	150	watts
Power Output (Approx.)	1000	1800	watts

* Averaged over any audio-frequency cycle of sine wave form.

† With ac on filament.

\# The driving stage should have good regulation and should be capable of supplying considerably more than the required driving power.

▲ At crest of audio-frequency cycle with modulation factor of 1.0.

•,°: See next page.

→ Indicates a change.

892-R

POWER TRIODE

PLATE-MODULATED RF POWER AMPLIFIER - Class C Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1.0

Maximum CCS• Ratings, *Absolute Values*:

DC PLATE VOLTAGE	10000 max.	volts
DC GRID VOLTAGE	-3000 max.	volts
DC PLATE CURRENT	1.0 max.	amp
DC GRID CURRENT	0.3 max.	amp ←
PLATE INPUT	10000 max.	watts
PLATE DISSIPATION	2500 max.	watts

Typical Operation: ←

DC Plate Voltage	6000	8000	volts
DC Grid Voltage	-1000	-1300	volts
From a grid resistor of	3570	5420	ohms
Peak RF Grid Voltage	1650	1950	volts
DC Plate Current	0.83	0.82	amp
DC Grid Current (Approx.)°	0.28	0.24	amp
Driving Power (Approx.)°	420	430	watts
Power Output (Approx.)	3500	5000	watts

RF POWER AMPLIFIER & OSCILLATOR - Class C Telegraphy

Key-down conditions per tube without amplitude modulation##

Maximum CCS• Ratings, *Absolute Values*:

DC PLATE VOLTAGE	12500 max.	volts
DC GRID VOLTAGE	-3000 max.	volts
DC PLATE CURRENT	2.0 max.	amp
DC GRID CURRENT	0.4 max.	amp ←
PLATE INPUT	18000 max.	watts
PLATE DISSIPATION	4000 max.	watts

Typical Operation: ←

DC Plate Voltage	8000	10000	volts
DC Grid Voltage	-1000	-1300	volts
From a grid resistor of	4540	5420	ohms
From a cathode resistor of	720	790	ohms
Peak RF Grid Voltage	1700	2150	volts
DC Plate Current	1.17	1.40	amp
DC Grid Current (Approx.)°	0.22	0.24	amp
Driving Power (Approx.)°	330	495	watts
Power Output (Approx.)	6500	10000	watts

• Continuous Commercial Service.

Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

° For effect of load resistance on grid current and driving power, refer to TUBE RATINGS--*Grid Current and Driving Power* in the General Section.

← Indicates a change.

892-R

892-R

POWER TRIODE

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Filament Current	1	57	62	amp
Amplification Factor	1,2	42.5	57.5	
Grid-Plate Capacitance	-	28	34	μμf
Grid-Filament Capacitance	-	15	24	μμf
Plate-Filament Capacitance	-	1.0	3.0	μμf
Plate Voltage	1,3	5000	7400	volts
Plate Voltage	1,4	9200	13200	volts
Grid Voltage	1,5	-240	-400	volts
Grid Voltage	1,6	-	925	volts
Peak Cathode Current	7	9	-	amp
Grid Current	1,6	-	1.75	amp
Useful Power Output	1,8	10000	-	watts

Note 1: With 22 volts ac on filament connected for single-phase operation.

Note 2: With dc grid voltage of -50 volts and dc plate voltage adjusted to give dc plate current of 0.42 amp.

Note 3: With dc grid voltage of 0 volts, and dc plate voltage adjusted to give dc plate current of 0.42 amp.

Note 4: With dc grid voltage of -100 volts, and dc plate voltage adjusted to give dc plate current of 0.42 amp.

Note 5: With dc plate voltage of 15000 volts, and dc grid voltage adjusted to give dc plate current of 20 ma.

Note 6: With dc plate voltage of 1500 volts, and instantaneous grid voltage adjusted to give instantaneous plate current of 6.0 amp.

Note 7: Represents the maximum usable cathode current (plate current and grid current) for the tube under any condition of operation.

Note 8: With dc plate voltage of 10000 volts, dc plate current of 1.4 amp., dc grid current of 0.25 amp., grid resistor of 5000 ± 10% ohms, and frequency of 1.5 megacycles/second.

Data on operating frequencies for the 892-R are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY

Outline Drawing for the 892-R is the same as shown for Type 891-R

Average Filament-Emission Characteristic Curve
and
Average Filament Characteristic Curve
are the same as shown for Type 891

Average Characteristics Curves
are the same as shown for Type 892

893-A

TRANSMITTING TRIODE

WATER & FORCED-AIR COOLED

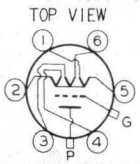
GENERAL DATA

Electrical:

Filament: Tungsten, Three-Section Type
Excitation . . 1φAC, 3φAC, 6φAC, or DC
Voltage per strand . . . . 10 . . . . . volts
Current per terminal . . . 61 . . . . . amp.
(See FILAMENT CONNECTIONS AND EXCITATION CIRCUITS under this type)
Starting – The current per terminal must never exceed 120 amperes, even momentarily.
Amplification Factor 36
Direct Interelectrode Capacitances (Approx.):
Grid to Plate. . . . . 33 . . . . . μμf
Grid to Filament . . . . . 48 . . . . . μμf
Plate to Filament. . . . . 3.2 . . . . . μμf

Physical:

Terminal Connections:
Term.1 – Fil. No.3
Term.2 – Fil. No.2
Term.3 – Fil. No.1
Term.4 – Fil. No.2
Term.5 – Fil. No.3
Term.6 – Fil. No.1



G – Grid Cap Terminal

P – Water-cooled Plate Terminal

TERMINAL NO5 IS ABOVE GRID ARM

Mounting Position. . . . . Vertical only, glass end up
Overall Length . . . . . 25-5/8" ± 1-1/8"
Greatest Radius. . . . . 6" ± 3/8"
Cap. No.3935
Base (with nozzle for air-cooling of filament seal) No.6628
Water Jacket . . . . . Type UT-1290-A
Gasket . . . . . RCA Stock No.17880
Cooling – *Water flow* of 8 to 15 gallons per minute must start before application of any voltages and continue for at least 2 minutes after removal of voltages. Water temperature must not exceed 70°C under any conditions of operation.
Air flow of 2 cubic feet per minute in nozzle of filament base before application of any voltages is required to limit temperature of filament seal to 150°C.

This tube can often be operated at reduced filament voltage as explained on sheet TYPES OF CATHODES in General Section.

A-F POWER AMPLIFIER & MODULATOR – Class B

Maximum Ratings, *Absolute Values*:

D-C PLATE VOLTAGE.	20000 max.	. volts
MAX.-SIGNAL D-C PLATE CURRENT*	4 max.	. amp.
MAX.-SIGNAL PLATE INPUT*	60 max.	. . kw
PLATE DISSIPATION*	20 max.	. . kw

Typical Operation:

Unless otherwise specified, values are for 2 tubes

D-C Plate Voltage.	12000	15000	18000	. . . volts

* Averaged over any audio-frequency cycle of sine-wave form.

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

893-A

TRANSMITTING TRIODE

(continued from preceding page)

D-C Grid Voltage	-260	-350	-450	volts
Peak A-F Grid-to-Grid Voltage	1480	1560	1720	volts
Zero-Sig. D-C Plate Cur.	0.8	0.8	0.8	amp.
Max.-Sig. D-C Plate Cur.	7.0	6.0	5.5	amp.
Effective Load Res. (plate-to-plate)	4000	6000	8000	ohms
Max.-Signal Driving Power	220	190	140	approx. watts
Max.-Signal Power Output	52	60	70	approx. kw

R-F POWER AMPLIFIER - Class B Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values:*

D-C PLATE VOLTAGE	20000 max.	volts
D-C PLATE CURRENT	2 max.	amp.
PLATE INPUT	32 max.	kw
PLATE DISSIPATION	20 max.	kw

Typical Operation:

D-C Plate Voltage	12000	15000	15000	volts
D-C Grid Voltage	-250	-340	-340	volts
Peak R-F Grid Voltage	350	395	450	volts
D-C Plate Current	1.5	1.5	2.0	amp.
Driving Power #**	130	150	200	approx. watts
Power Output #	6	7.5	10	approx. kw

**At crest of a-f cycle with modulation factor of 1.0.

PLATE-MODULATED R-F POWER AMPLIFIER - Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values:*

D-C PLATE VOLTAGE	12000 max.	volts
D-C GRID VOLTAGE	-3000 max.	volts
D-C PLATE CURRENT	2 max.	amp.
D-C GRID CURRENT	0.4 max.	amp.
PLATE INPUT	24 max.	kw
PLATE DISSIPATION	12 max.	kw

Typical Operation:

D-C Plate Voltage	10000	10000	12000	volts
D-C Grid Voltage	-800	-800	-1000	volts
Peak R-F Grid Voltage	1200	1280	1500	volts
D-C Plate Current	1.5	2.0	2.0	amp.
D-C Grid Current #	0.10	0.16	0.14	approx. amp.
Driving Power #	120	210	210	approx. watts
Power Output	11	15	18	approx. kw

#: See next page.

893-A

TRANSMITTING TRIODE

(continued from preceding page)

R-F POWER AMPLIFIER & OSCILLATOR – Class C Telegraphy

Key-down conditions per tube without modulation ##

Maximum Ratings, *Absolute Values*:

D-C PLATE VOLTAGE	20000 max.	volts
D-C GRID VOLTAGE	-3000 max.	volts
D-C PLATE CURRENT	4 max.	amp.
D-C GRID CURRENT	0.4 max.	amp.
PLATE INPUT	70 max.	kw
PLATE DISSIPATION	20 max.	kw

Typical Operation:

D-C Plate Voltage	12000	15000	18000	volts
D-C Grid Voltage	-800	-900	-1000	volts
Peak R-F Grid Voltage	1430	1520	1630	volts
D-C Plate Current	3.5	3.6	3.6	amp.
D-C Grid Current #	0.26	0.25	0.21	approx. amp.
Driving Power #	360	370	340	approx. watts
Power Output	30	40	50	approx. kw

Subject to wide variations as explained on sheet TUBE RATINGS in General Section.

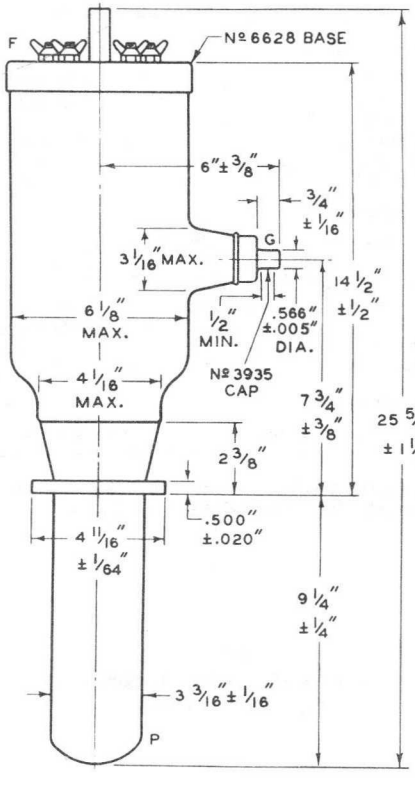
Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

Data on operating frequencies for the 893-A are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY.

CURVES
FOR THE 893-A ARE THE SAME AS
THOSE FOR TYPE 893A-R

893-A

TRANSMITTING TRIODE

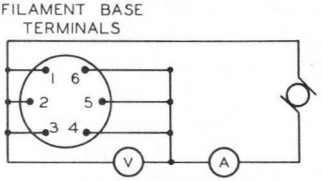
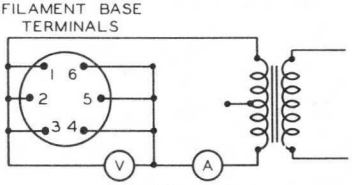
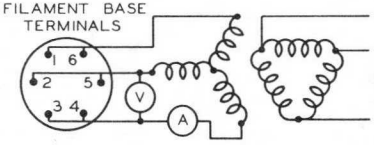
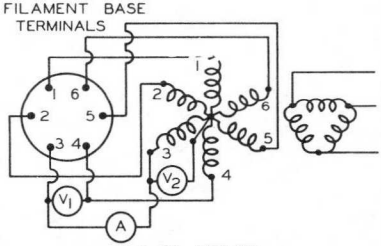


FOR CONNECTIONS OF FILAMENT TERMINALS SEE DRAWING FILAMENT CONNECTIONS AND EXCITATION CIRCUITS

F = FILAMENT
P = PLATE
G = GRID

893-A

FILAMENT CONNECTIONS AND EXCITATION CIRCUITS

D-C FILAMENT EXCITATION	 V = 20 VOLTS A = 183 AMP.
SINGLE-PHASE A-C FILAMENT EXCITATION	 V = 20 VOLTS A = 183 AMP.
THREE-PHASE A-C FILAMENT EXCITATION	 V = 17.3 VOLTS A = 122 AMP.
SIX-PHASE A-C FILAMENT EXCITATION NOTE: TERMINALS MUST BE CONNECTED IN CORRECT PHASE RELATION AS SHOWN	 V1 = 10 VOLTS V2 = 10 VOLTS A = 61 AMP.

893A-R

TRANSMITTING TRIODE
FORCED-AIR COOLED

GENERAL DATA

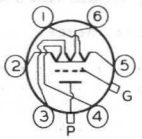
Electrical:

Filament: Tungsten, Three-Section Type
Excitation . . 1φAC, 3φAC, 6φAC, or DC
Voltage per strand . . . . 10 . . . . . volts
Current per terminal . . . 61 . . . . . amp.
(See FILAMENT CONNECTIONS AND EXCITATION CIRCUITS under type 893-A)
Starting – The current per terminal must never exceed 120 amperes, even momentarily.
Amplification Factor 36
Direct Interelectrode Capacitances (Approx.):
Grid to Plate. . . . . 34 . . . . . μμf
Grid to Filament . . . . . 48 . . . . . μμf
Plate to Filament. . . . . 3.5 . . . . . μμf

Physical:

Terminal Connections:
Term.1 – Fil. No.3
Term.2 – Fil. No.2
Term.3 – Fil. No.1
Term.4 – Fil. No.2
Term.5 – Fil. No.3
Term.6 – Fil. No.1

TOP VIEW



G – Grid Cap Terminal

P – Radiator-cooled Plate Terminal

TERMINAL NO.5 IS ABOVE GRID ARM

Mounting Position. . . . . Vertical only, glass end up
Overall Length . . . . . 26-7/8" ± 1-1/8"
Greatest Radius. . . . . 8-13/16"
Cap. No.3935
Base (with nozzle for air-cooling of filament seal) No.6628
Radiator . . . . . Integral part of tube
Cooling – A vertical air flow of at least 1800 cu. ft./min. should be delivered by a blower to the cooling radiator. An air flow of about 2 cu. ft./min. should be supplied to the air nozzle in the filament base. Cooling must be adequate to limit the glass temperature to not more than 150°C at the hottest part. Air flow must start before the application of any voltages. The incoming air temperature must not exceed 45°C.

This tube can often be operated with reduced filament voltage as explained on sheet TYPES OF CATHODES in General Section.

A-F POWER AMPLIFIER & MODULATOR – Class B

Maximum Ratings, *Absolute Values*:

D-C PLATE VOLTAGE	20000 max.	volts
MAX.-SIGNAL D-C PLATE CURRENT*	4 max.	amp.
MAX.-SIGNAL PLATE INPUT*	60 max.	kw
PLATE DISSIPATION*	20 max.	kw
RADIATOR TEMPERATURE▲	180 max.	°C

* Averaged over any audio-frequency cycle of sine-wave form.
▲ : See next page.

893A-R

TRANSMITTING TRIODE

(continued from preceding page)

Typical Operation:

Unless otherwise specified, values are for 2 tubes

D-C Plate Voltage	12000	15000	18000	volts
D-C Grid Voltage	-260	-350	-450	volts
Peak A-F Grid-to-Grid Voltage	1480	1560	1720	volts
Zero-Sig. D-C Plate Cur.	0.8	0.8	0.8	amp.
Max.-Sig. D-C Plate Cur.	7.0	6.0	5.5	amp.
Effective Load Res. (plate-to-plate)	4000	6000	8000	ohms
Max.-Sig. Driving Power	220	190	140	approx. watts
Max.-Sig. Power Output	52	60	70	approx. kw

R-F POWER AMPLIFIER - Class B Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values*:

D-C PLATE VOLTAGE	20000 max.	volts
D-C PLATE CURRENT	2 max.	amp.
PLATE INPUT	32 max.	kw
PLATE DISSIPATION	20 max.	kw
RADIATOR TEMPERATURE▲	180 max.	°C

Typical Operation:

D-C Plate Voltage	12000	15000	15000	volts
D-C Grid Voltage	-250	-340	-340	volts
Peak R-F Grid Voltage	350	395	450	volts
D-C Plate Current	1.5	1.5	2.0	amp.
Driving Power #**	130	150	200	approx. watts
Power Output #	6	7.5	10	approx. kw

** At crest of a-f cycle with modulation factor of 1.0.

PLATE-MODULATED R-F POWER AMPLIFIER - Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values*:

D-C PLATE VOLTAGE	12000 max.	volts
D-C GRID VOLTAGE	-3000 max.	volts
D-C PLATE CURRENT	2 max.	amp.
D-C GRID CURRENT	0.4 max.	amp.
PLATE INPUT	24 max.	kw
PLATE DISSIPATION	12 max.	kw
RADIATOR TEMPERATURE▲	180 max.	°C

Typical Operation:

D-C Plate Voltage	10000	10000	12000	volts
D-C Grid Voltage	-800	-800	-1000	volts

▲, #: See next page.

TRANSMITTING TRIODE

(continued from preceding page)

Peak R-F Grid Voltage . .	1200	1280	1500	. . . volts
D-C Plate Current	1.5	2.0	2.0	. . . amp.
D-C Grid Current #	0.10	0.16	0.14	approx. amp.
Driving Power #	120	210	210	approx. watts
Power Output.	11	15	18	approx. kw

R-F POWER AMPLIFIER & OSCILLATOR – Class C Telegraphy

Key-down conditions per tube without modulation##

Maximum Ratings, *Absolute Values:*

D-C PLATE VOLTAGE	20000 max.	. volts
D-C GRID VOLTAGE.	-3000 max.	. volts
D-C PLATE CURRENT	4 max.	. amp.
D-C GRID CURRENT.	0.4 max.	. amp.
PLATE INPUT	70 max.	. . kw
PLATE DISSIPATION	20 max.	. . kw
RADIATOR TEMPERATURE▲	180 max.	. . °C

Typical Operation:

D-C Plate Voltage	12000	15000	18000	. . . volts
D-C Grid Voltage.	-800	-900	-1000	. . . volts
Peak R-F Grid Voltage . .	1430	1520	1630	. . . volts
D-C Plate Current	3.5	3.6	3.6	. . . amp.
D-C Grid Current #	0.26	0.25	0.21	approx. amp.
Driving Power #	360	370	340	approx. watts
Power Output.	30	40	50	approx. kw

\# Subject to wide variations as explained on sheet TUBE RATINGS in General Section.

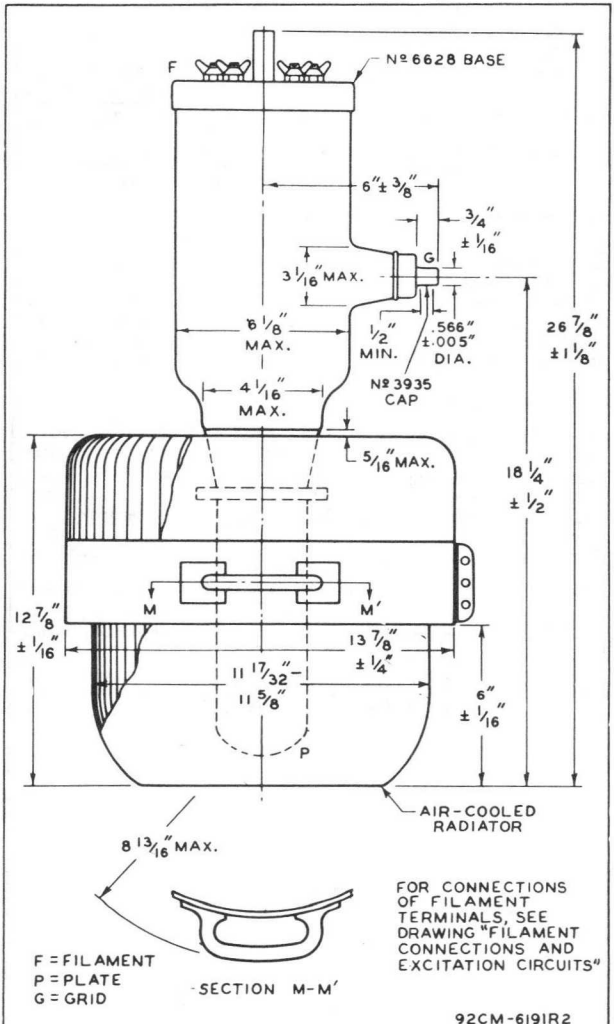
Modulation essentially negative may be used if the positive peak of the audio frequency envelope does not exceed 115% of the carrier conditions.

▲ Measured in thermometer well.

Data on operating frequencies for the 893A-R are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY.

893A-R

TRANSMITTING TRIODE



RCA

893A-R

AVERAGE FILAMENT CHARACTERISTIC

COLD RESISTANCE OF FILAMENT BETWEEN ANY TERMINAL AND NEUTRAL = 0.014 OHM

FILAMENT VOLTS A.C. – ANY TERMINAL TO NEUTRAL

0 2 4 6 8 10 12

FILAMENT AMPERES PER TERMINAL

10 20 30 40 50 60 70

FEB. 9, 1945

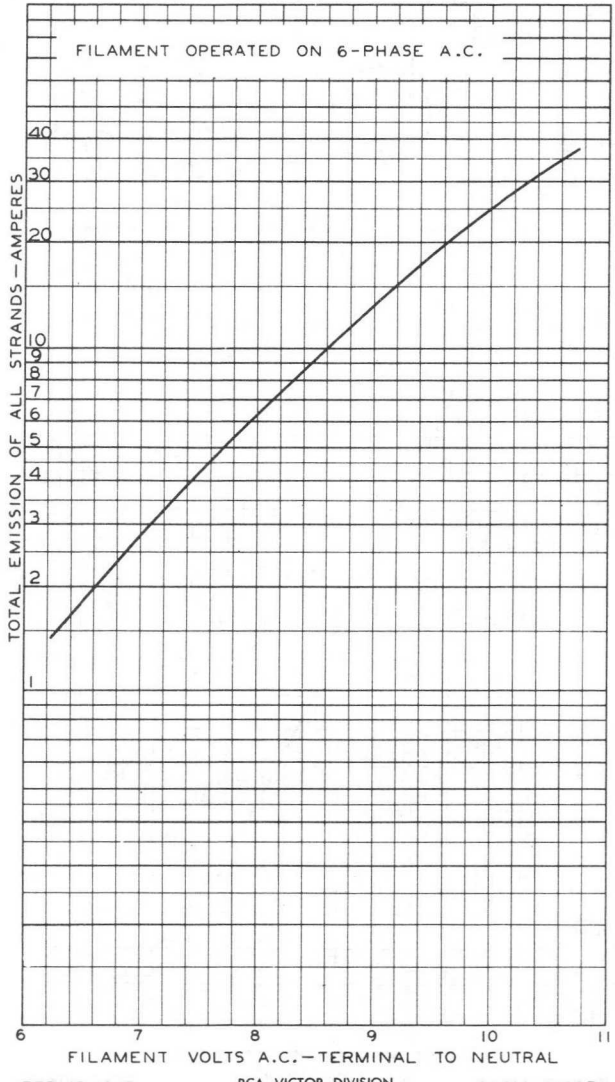
RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6022R2

RCA

893A-R

AVERAGE FILAMENT-EMISSION CHARACTERISTIC



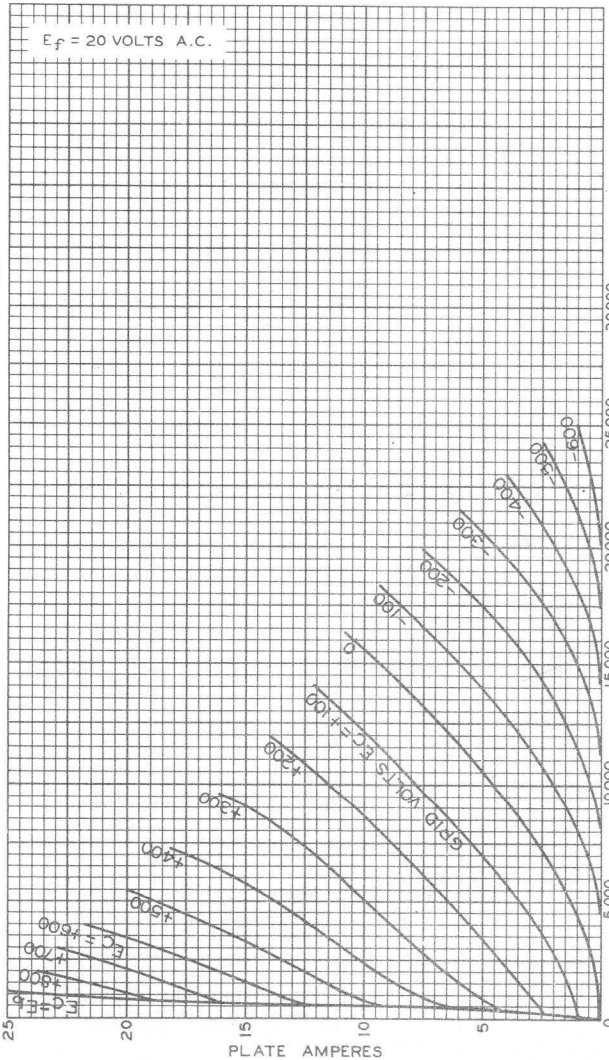
FEB. 10, 1945

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

92CM-6185R1

893A-R

AVERAGE PLATE CHARACTERISTICS

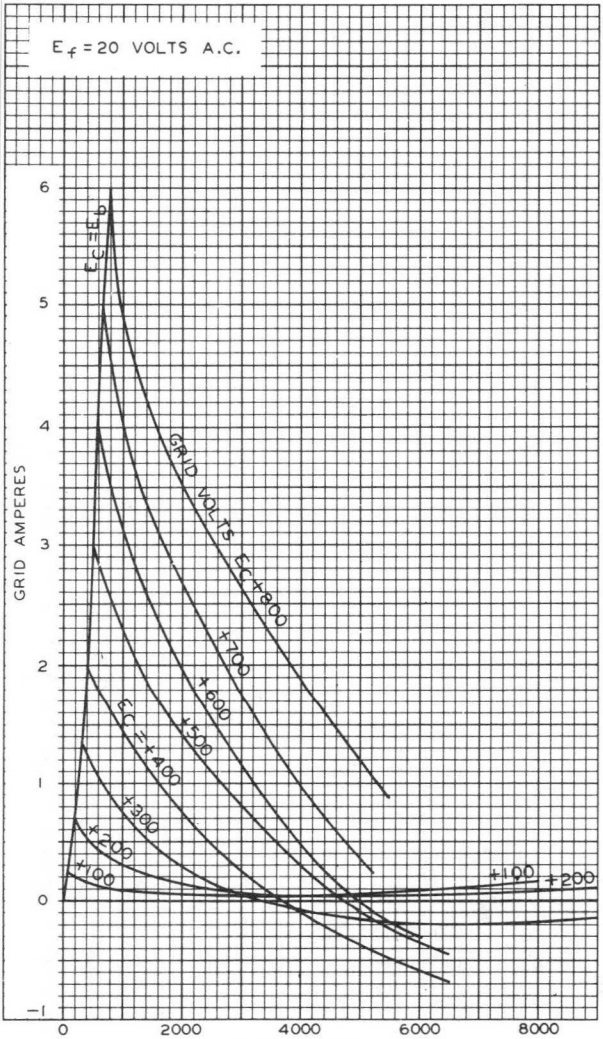


RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

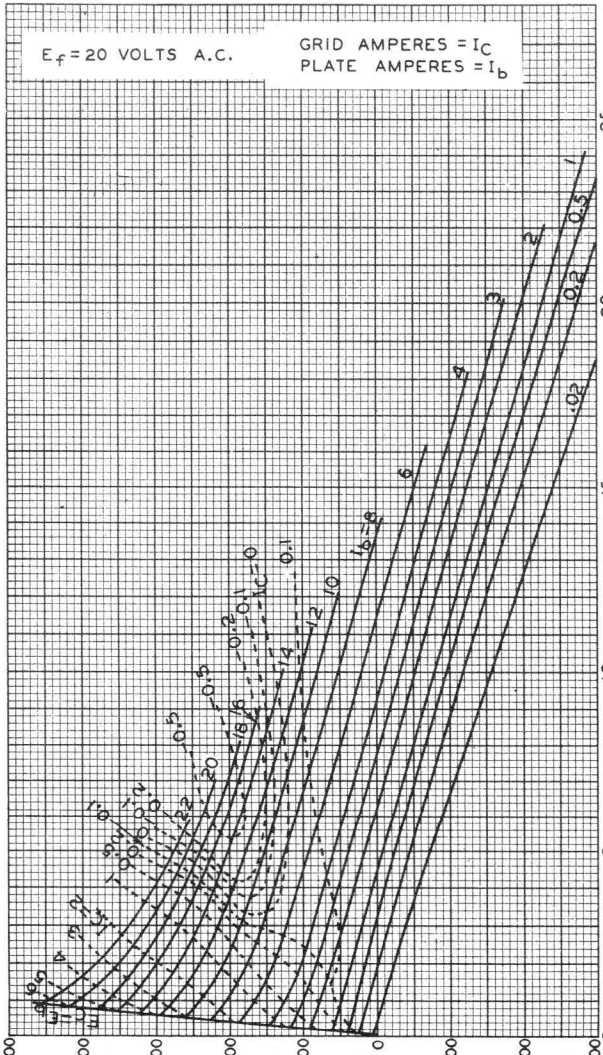
RCA

893A-R

TYPICAL CHARACTERISTICS



AVERAGE CONSTANT-CURRENT CHARACTERISTICS



FEB. 10. 1945

RCA VICTOR DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6187R1

898-A

TRANSMITTING TRIODE
WATER & FORCED-AIR COOLED

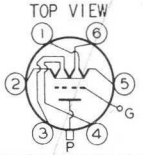
GENERAL DATA

Electrical:

Filament: Tungsten, Three-Section Type
Excitation . . . . 1φAC, 3φAC, or DC
Voltage per section. . . 33 . . . . . volts
Current per section. . . 70 . . . . . amp.
(See FILAMENT CONNECTIONS AND EXCITATION CIRCUITS under this type)
Starting – The current per section should never exceed 105 amperes, even momentarily.
Amplification Factor . . . 45
Direct Interelectrode Capacitances (Approx.):
Grid to Plate. . . . . 62 . . . . . μμf
Grid to Filament . . . . 52 . . . . . μμf
Plate to Filament. . . . 4.2 . . . . . μμf

Mechanical:

Terminal Connections:
Term.1 – Fil. No.3
Term.2 – Fil. No.2
Term.3 – Fil. No.1
Term.4 – Fil. No.2
Term.5 – Fil. No.3
Term.6 – Fil. No.1



G – Ribbon Grid Terminal

P – Water-cooled Plate Terminal

TERMINAL NO5 IS ABOVE GRID ARM

Mounting Position. . . . . Vertical only, glass end up
Maximum Overall Length . . . . . 60-3/8"
Greatest Radius. . . . . 10"
Base (with nozzle for air-cooling of filament seal) No.6628
Water Jacket (with nozzle for air-cooling of bulb) UT-1289-A
Gasket . . . . . RCA Stock No.17879
Cooling – *Water flow* of 15 to 25 gallons per minute must start before application of any voltages and continue for at least 10 minutes after removal of all voltages. Water temperature must not exceed 70°C at jacket outlet under any conditions of operation.
Air flow of 15 cubic feet per minute in bulb nozzle and 3 cubic feet per minute in filament-seal nozzle is required before the application of any voltages and must continue for at least 10 minutes after removal of voltages to limit the glass temperature to 150°C at the hottest part. The incoming air temperature must not exceed 50°C.

This tube can often be operated with reduced filament voltage as explained on sheet TYPES OF CATHODES in General Section.

A-F POWER AMPLIFIER & MODULATOR – Class B

Maximum Ratings, *Absolute Values*:

D-C PLATE VOLTAGE	15000 max.	volts
MAX.-SIGNAL D-C PLATE CURRENT*	7.5 max.	amp.
MAX.-SIGNAL PLATE INPUT*	100 max.	kw
PLATE DISSIPATION*	50 max.	kw

* Averaged over any audio-frequency cycle of sine-wave form.

898-A

TRANSMITTING TRIODE

(continued from preceding page)

Typical Operation:

Unless otherwise specified, values are for 2 tubes

D-C Plate Voltage	12000	volts
D-C Grid Voltage●	-100	volts
Peak A-F Grid-to-Grid Voltage	2200	volts
Zero-Sig. D-C Plate Current	2	amp.
Max.-Sig. D-C Plate Current	13	amp.
Effective Load Res. (plate-to-plate)	2000	ohms
Max.-Sig. Driving Power	6	approx. kw
Max.-Sig. Power Output	90	approx. kw

R-F POWER AMPLIFIER - Class B Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values*:

D-C PLATE VOLTAGE	20000 max.	volts
D-C PLATE CURRENT	5 max.	amp.
PLATE INPUT	100 max.	kw
PLATE DISSIPATION	75 max.	kw

Typical Operation:

D-C Plate Voltage	12000	15000	18000	volts
D-C Grid Voltage●	-100	-175	-250	volts
Peak R-F Grid Voltage	525	650	775	volts
D-C Plate Current	2.8	3.5	4.2	amp.
Driving Power #**	0.5	0.75	1.1	approx. kw
Power Output	11	17.5	25	approx. kw

PLATE-MODULATED R-F POWER AMPLIFIER - Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values*:

D-C PLATE VOLTAGE	12000 max.	volts
D-C GRID VOLTAGE	-3000 max.	volts
D-C PLATE CURRENT	5 max.	amp.
D-C GRID CURRENT	1.25 max.	amp.
PLATE INPUT	60 max.	kw
PLATE DISSIPATION	50 max.	kw

Typical Operation:

D-C Plate Voltage	12000	volts
D-C Grid Voltage	-800	volts
Peak R-F Grid Voltage	2000	volts
D-C Plate Current	5	amp.
D-C Grid Current #	1	approx. amp.
Driving Power #	2	approx. kw
Power Output	45	approx. kw

●; **; #; See next page.

898-A

TRANSMITTING TRIODE

(continued from preceding page)

R-F POWER AMPLIFIER & OSCILLATOR - Class C Telegraphy

*Key-down conditions per tube without modulation***

Maximum Ratings, *Absolute Values*:

D-C PLATE VOLTAGE	20000 max.	volts
D-C GRID VOLTAGE	-3000 max.	volts
D-C PLATE CURRENT	10 max.	amp.
D-C GRID CURRENT	1 max.	amp.
PLATE INPUT	200 max.	kw
PLATE DISSIPATION	100 max.	kw

Typical Operation:

D-C Plate Voltage	12000	15000	18000	volts
D-C Grid Voltage	-800	-900	-1000	volts
Peak R-F Grid Voltage	2050	2300	2550	volts
D-C Plate Current	6.25	7.5	8.33	amp.
D-C Grid Current #	0.8	0.85	0.9	approx. amp.
Driving Power #	1.6	2.0	2.4	approx. kw
Power Output	50	75	100	approx. kw

● With a-c filament excitation.

** At crest of a-f cycle with modulation factor of 1.0.

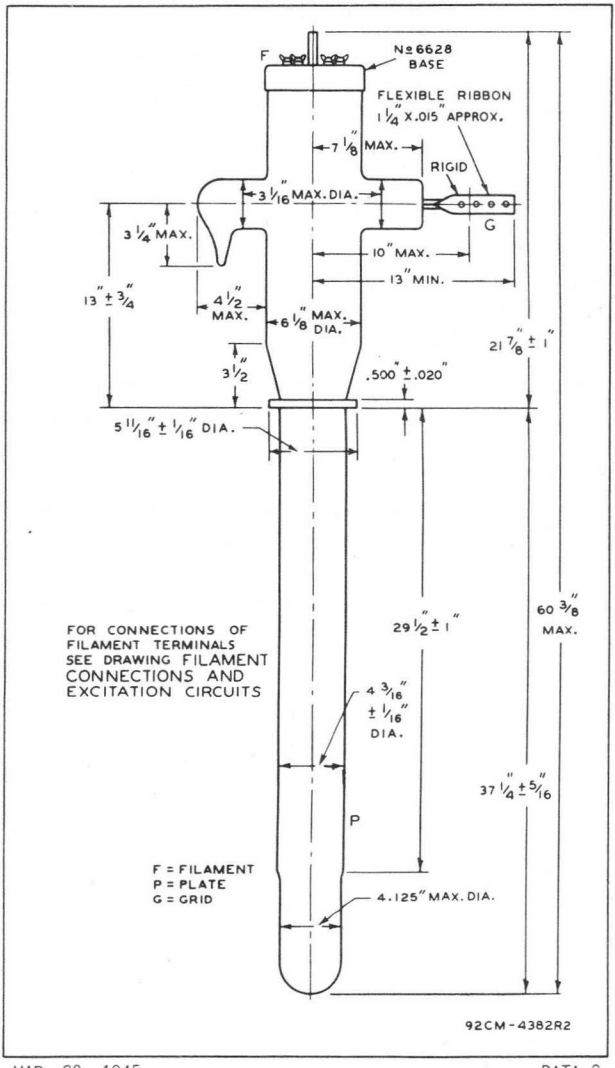
Subject to wide variations as explained on sheet TUBE RATINGS in General Section.

Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

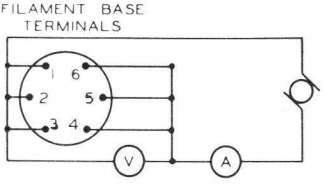
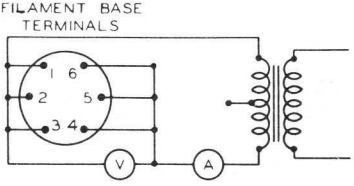
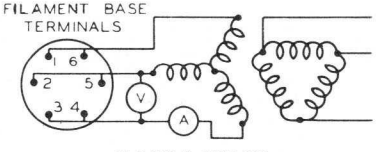
Data on operating frequencies for the 898-A are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY.

898-A

TRANSMITTING TRIODE



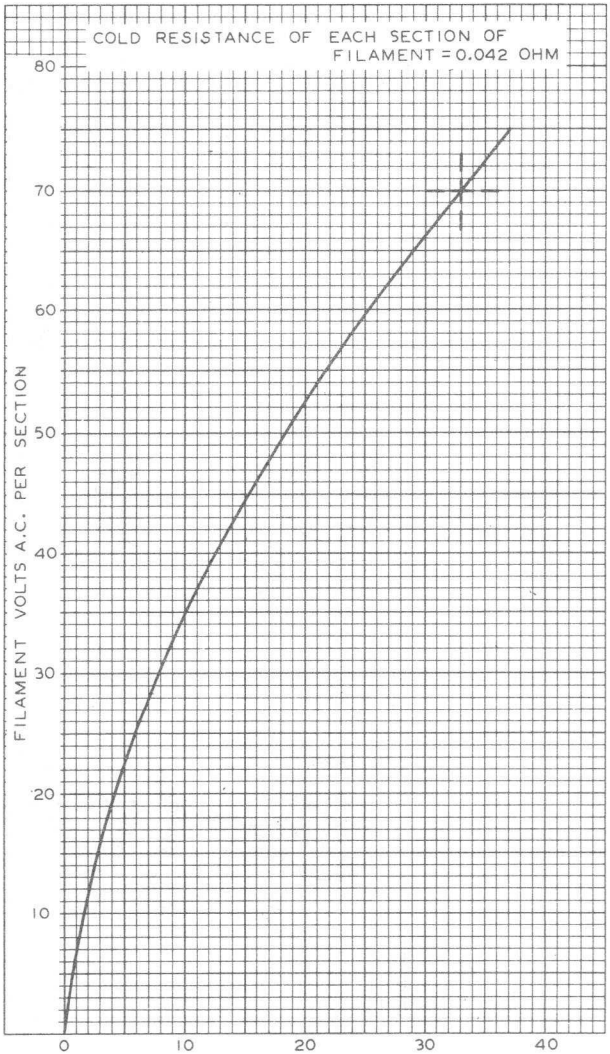
FILAMENT CONNECTIONS AND EXCITATION CIRCUITS

D-C FILAMENT EXCITATION	 V = 33 VOLTS A = 210 AMP.
SINGLE-PHASE A-C FILAMENT EXCITATION	 V = 33 VOLTS A = 210 AMP.
THREE-PHASE A-C FILAMENT EXCITATION	 V = 28.6 VOLTS A = 140 AMP.

898-A

898-A

AVERAGE FILAMENT CHARACTERISTIC

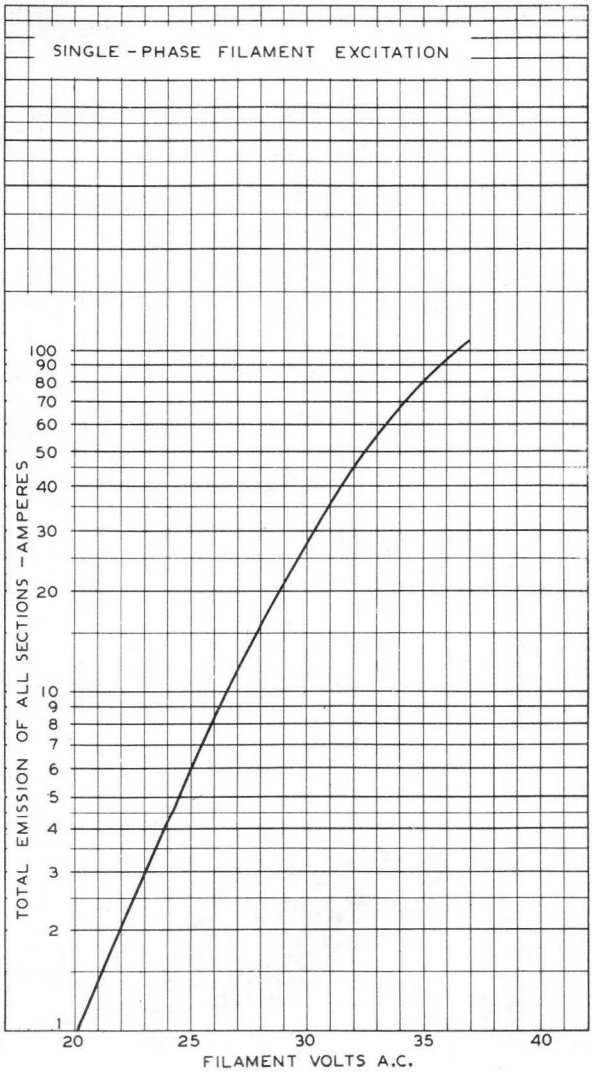


FEB. 3, 1945

RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

92CM-4389R2

AVERAGE FILAMENT-EMISSION CHARACTERISTIC



FEB. 8, 1945

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

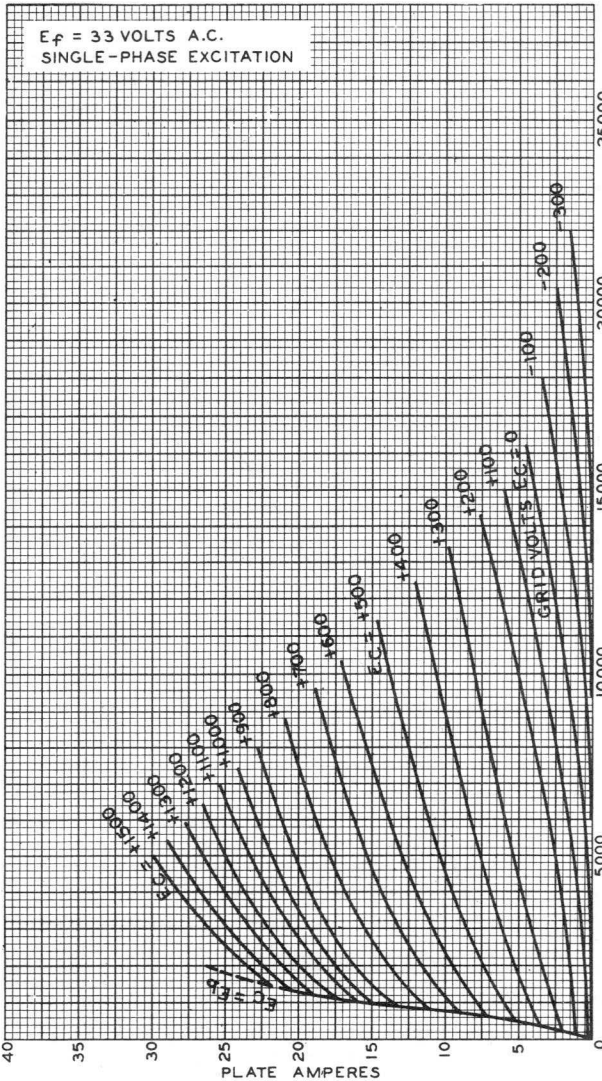
92CM-4390R3

898-A

RCA

898-A

AVERAGE PLATE CHARACTERISTICS



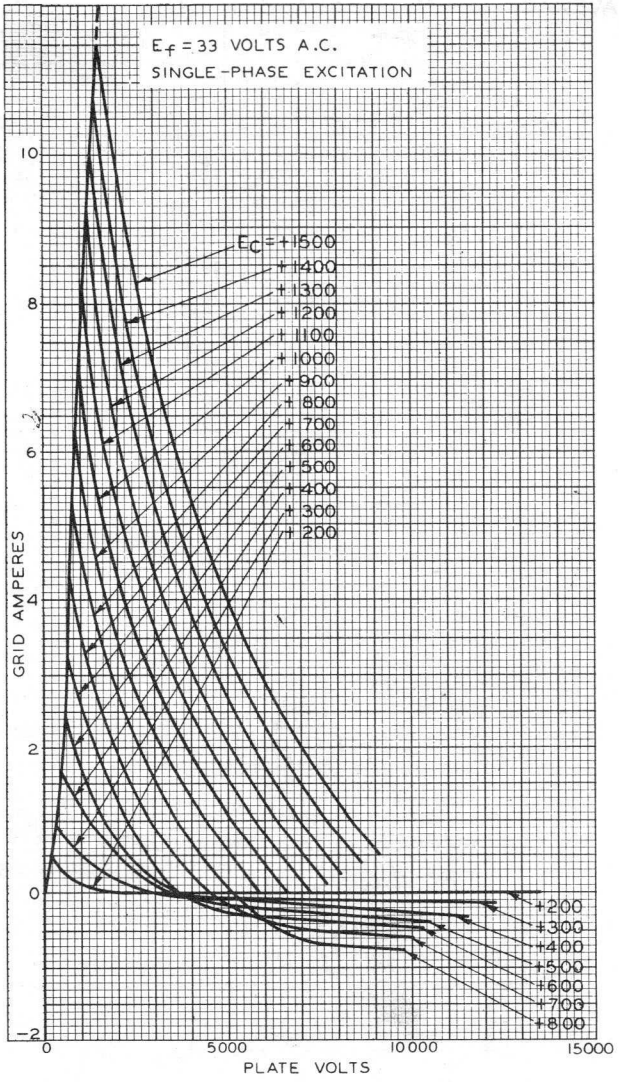
FEB. 7, 1945

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

92CM-4383R2

898-A

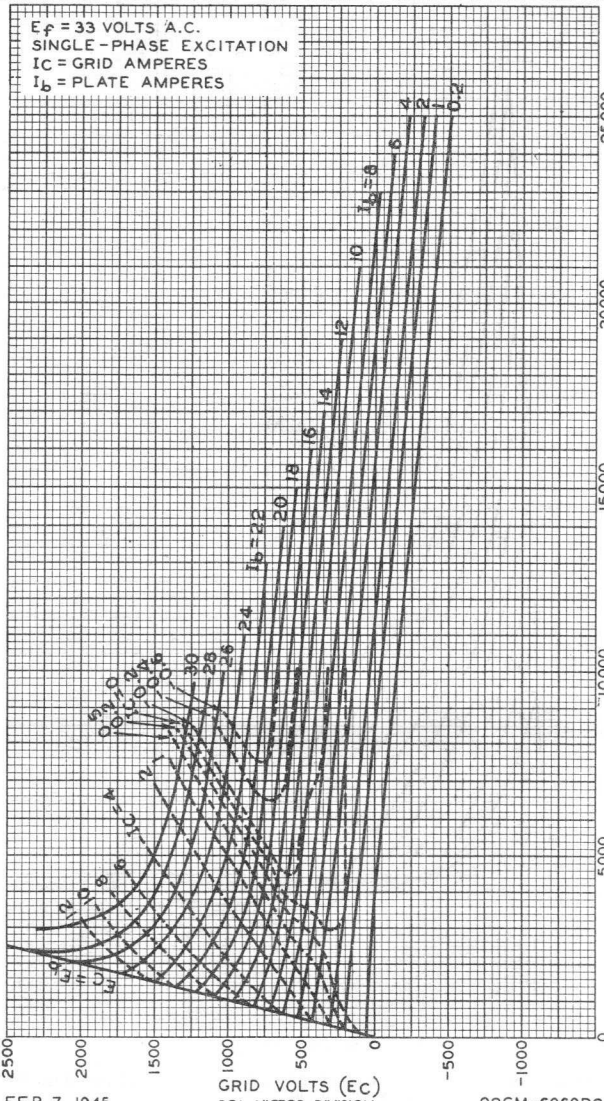
TYPICAL CHARACTERISTICS



898-A

898-A

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



FEB. 7, 1945

RCA VICTOR DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6069R2

912

HIGH-VACUUM CATHODE-RAY TUBE

HIGH-INTENSITY ELECTROSTATIC-DEFLECTION TYPE
WITH 5" MEDIUM-PERSISTENCE SCREEN FOR OSCILLOGRAPHIC USE

Heater	Coated Unipotential Cathode	
Voltage	2.5	a-c or d-c volts
Current	2.1	amp.
Fluorescent Screen:		
Material		Phosphor No.1
Pattern Color		Greenish
Direct Interelectrode Capacitances:		
Grid to all other electrodes		14 max. μμf
DJ_1 to DJ_2		3 max. μμf
DJ_3 to DJ_4		1.5 max. μμf
Overall Length		16-1/2" ± 3/8"
Maximum Diameter		5-1/4" + 1/16" - 3/32"
Bulb		J-42
Caps:		
Anode No.2		Medium Metal
Deflecting Electrodes (Four)		Small Metal
Base		Medium 5-Pin Micanol ←

BOTTOM VIEW



Pin 1 - Heater
Pin 2 - Grid No.2
Pin 3 - Anode No.1
Pin 4 - Grid No.1
Pin 5 - Heater, Cathode
Single Medium Cap - Anode No.2
Cap Over Pin 3 } { Deflecting Electrode DJ_1

Cap Over Pins 1 & 5 } { Deflecting Electrode DJ_2
Cap Over Pin 2 } { Deflecting Electrode DJ_3
Cap Over Pin 4 } { Deflecting Electrode DJ_4

MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS

Maximum Ratings Are Based on a Line-Voltage Design Center of 117 Volts

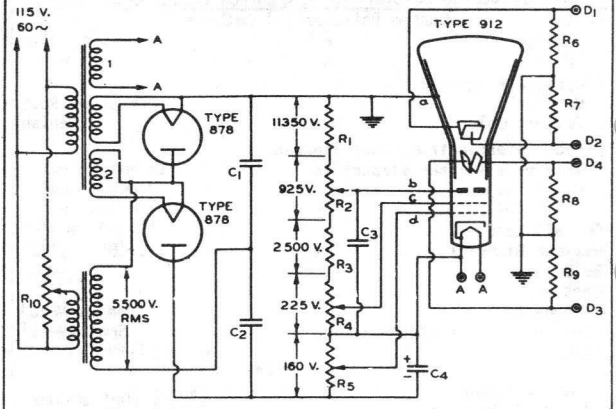
High-Voltage Electrode (Anode #2) Voltage			15000 max.	volts
Focusing Electrode (Anode #1) Voltage			4500 max.	volts
Accelerating Electrode (Grid #2) Voltage			250 max.	volts
Control Electrode (Grid #1) Voltage			Never positive	
Grid Voltage for Current Cut-off *			-125 approx.	volts
Peak Voltage Between Anode #2 and any deflecting electrode			7000 max.	volts
Typical Operation:				
Heater Voltage	2.5	2.5	2.5	volts
Anode #2 Voltage	5000	10000	15000	volts
Anode #1 Voltage	1000	2000	3000	approx. volts
Grid #2 Voltage	250	250	250	volts
Grid #1 Voltage	Adjusted to give suitable luminous spot			
Deflection Sensitivity:				
DJ_1 to DJ_2	0.083	0.041	0.028	mm/volt d.c.
DJ_3 to DJ_4	0.102	0.051	0.034	mm/volt d.c.

* With maximum voltages on Anode #1 and Grid #2.

← Indicates a change.

912

TYPICAL OSCILLOGRAPH CIRCUIT USING THE 912 WITH VOLTAGE-DOUBLING POWER SUPPLY



C_1, C_2 = 0.5 μf, 10000 V.
C_3 = 1.0 μf, 5000 V.
C_4 = 16 μf, 200 V.
→ R_1 = 2.5 MEGOHMS, 75-WATT
R_2 = 0.2 MEGOHM, 10-WATT
R_3 = 0.55 MEGOHM, 20-WATT
R_4 = 50000 OHMS, 2-WATT
R_5 = 35000 OHMS, 2-WATT
R_6, R_7, R_8, R_9 = 2 TO 5 MEGOHMS
R_{10} = 100 OHMS, 600-WATT
a = ANODE Nº 2
b = ANODE Nº 1
c = GRID Nº 2
d = GRID Nº 1

NOTE: AS THE TOTAL VOLTAGE ACROSS THE BLEEDER IS REDUCED BY MEANS OF R_{10}, THE ELECTRODE VOLTAGES ARE REDUCED IN CORRECT PROPORTION, EXCEPT FOR GRID NO.2 VOLTAGE; THIS MAY HAVE TO BE READJUSTED BY THE USE OF DIFFERENT VALUES FOR R_3 AND R_4. THEIR TOTAL RESISTANCE BEING KEPT THE SAME. CONDENSERS C_3 AND C_4 CAN BE OMITTED IF GRID-VOLTAGE SWITCHING (FOR HIGH-SPEED PHOTOGRAPHY) IS NOT CONTEMPLATED. FILAMENT WINDINGS NOS. 1 and 2 SHOULD BE INSULATED FOR 20000 VOLTS.

The license extended to the purchaser of tubes appears in the License Notice accompanying them. Information contained herein is furnished without assuming any obligations.

92C-4621R1

FLUORESCENT-SCREEN CHARACTERISTICS

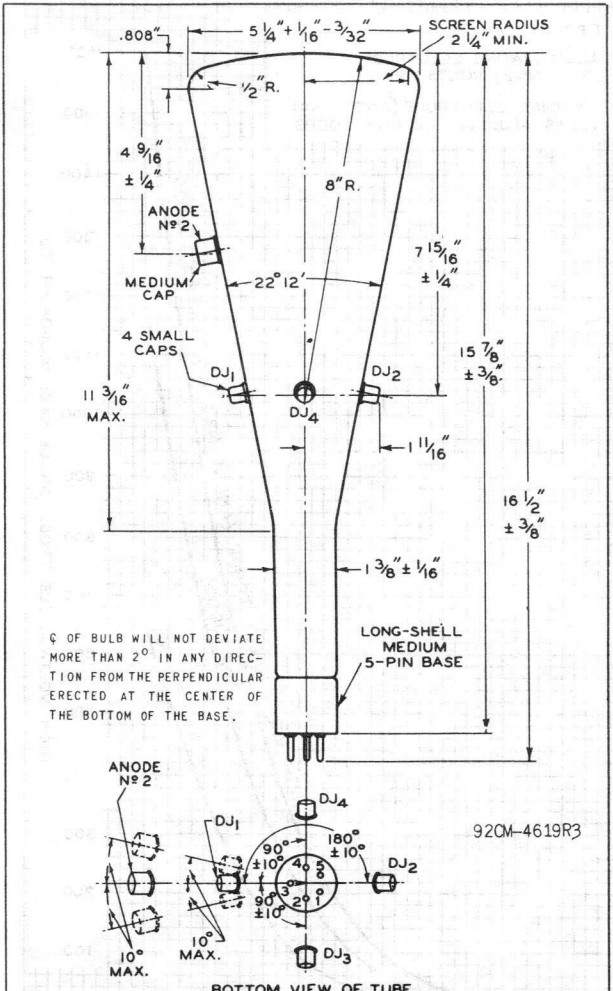
CURVES SHOWING THE AVERAGE CHARACTERISTICS, SPECTRAL ENERGY CHARACTERISTIC, AND PERSISTENCE CHARACTERISTIC OF PHOSPHOR No.1 ARE SHOWN AT THE BEGINNING OF THIS SECTION.

→ Indicates a change.

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

912

HIGH-VACUUM CATHODE-RAY TUBE



BOTTOM VIEW OF TUBE

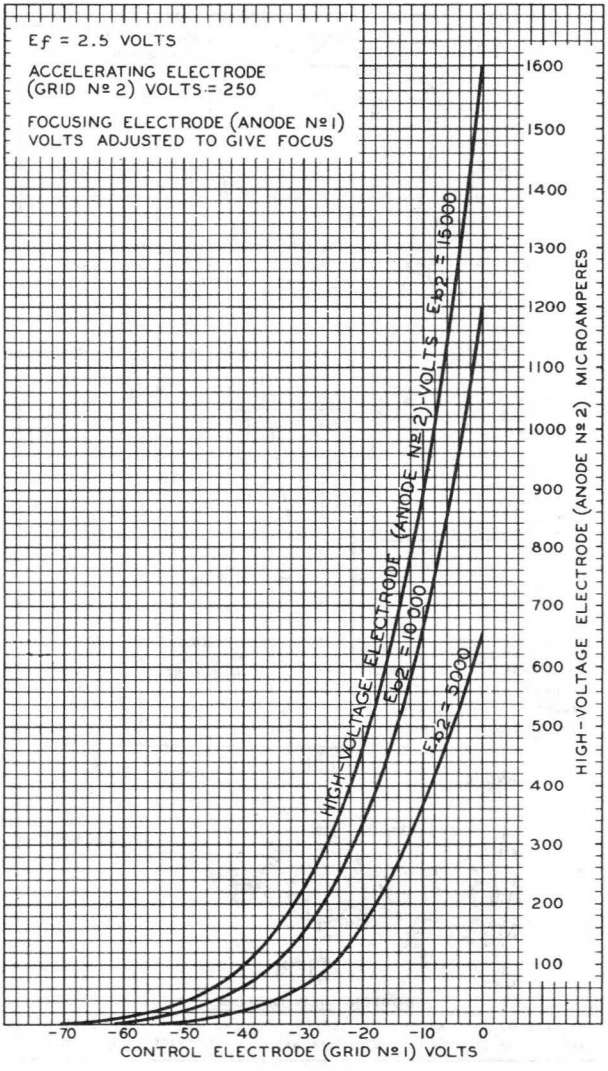
DJ_1 AND DJ_2 ARE NEARER THE SCREEN; DJ_3 AND DJ_4 ARE NEARER THE BASE. ANGLE BETWEEN $DJ_1 - DJ_2$ TRACE AND $DJ_3 - DJ_4$ TRACE IS $90° \pm 6°$.

912

RCA

912

AVERAGE CHARACTERISTICS



914-A

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

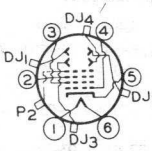
DATA

General:

Heater, for Unipotential Cathode:		
Voltage	2.5	ac or dc volts
Current	2.1	amp
Direct Interelectrode Capacitances (Approx.):		
Grid No.1 to All Other Electrodes	10.5	μμf
DJ_1 to DJ_2	2.0	μμf
DJ_3 to DJ_4	1.0	μμf
Phosphor (For Curves, see front of this Section)		No.1
Fluorescence		Green
Persistence		Medium
Focusing Method		Electrostatic
Deflection Method		Electrostatic
Overall Length		20-1/16" ± 3/8"
Greatest Diameter of Bulb		9-1/4" ± 1/8"
Minimum Useful Screen Diameter		8-1/4"
Mounting Position		Any
Caps:		
Anode No.2		Medium
Deflecting Electrodes (Four)		Small
Base		Long Medium-Shell Small 6-Pin

BOTTOM VIEW

Pin 1 – Heater
Pin 2 – Anode No.1
Pin 3 – Grid No.2
Pin 4 – Grid No.1
Pin 5 – Cathode
Pin 6 – Heater
Single Medium Cap – Anode No.2
Cap over Pin 2 } { Deflecting Electrode DJ_1



Cap over Pin 5 } { Deflecting Electrode DJ_2
Cap over Pins 1 & 6 } { Deflecting Electrode DJ_3
Cap over Pins 3 & 4 } { Deflecting Electrode DJ_4

DJ_1 and DJ_2 are nearer the screen
DJ_3 and DJ_4 are nearer the base

With DJ_1 positive with respect to DJ_2 the spot is deflected toward pin 2. With DJ_3 positive with respect to DJ_4, the spot is deflected toward pins 1 and 6.

The angle between the trace produced by DJ_1 and DJ_2 and its intersection with the plane through the tube axis and pin 2 does not exceed 10°.

The angle between the trace produced by DJ_3 and DJ_4 and the trace produced by DJ_1 and DJ_2 is 90° ± 6°.

Maximum Ratings, *Design-Center Values*:

ANODE-No.2 VOLTAGE°	7000 max. volts
ANODE-No.1 VOLTAGE	1900 max. volts

° The product of anode-No.2 voltage and average anode-No.2 current should never exceed 6 watts.

914-A

RCA

914-A

OSCILLOGRAPH TUBE

GRID No.2 VOLTAGE.	300 max.	volts
→ GRID No.1 VOLTAGE:		
Negative bias value.	125 max.	volts
Positive bias value.	0 max.	volts
Positive peak value.	2 max.	volts
PEAK VOLTAGE BETWEEN ANODE No.2 AND ANY DEFLECTING ELECTRODE	3000 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode. .	125 max.	volts
Heater positive with respect to cathode. .	125 max.	volts

→ **Equipment Design Ranges:**

*For any anode-No.2 voltage (E_{b_2}) between 1500 and 7000 volts**

Anode-No.1 Voltage. . .	15% to 26% of E_{b_2}	volts
Grid-No.2 Voltage . . .	250	volts
Max. Grid-No.1 Voltage for Visual Cutoff.	30% of E_{b_2}	volts
Max. Anode-No.1 Current Range.	-15 to + 10	μamp
Deflection Factors:		
DJ_1 to DJ_2.	38 to 54	v dc/in./kv of E_{b_2}
DJ_3 to DJ_4.	30 to 44	v dc/in./kv of E_{b_2}

→ **Examples of Use of Design Ranges:**

For Anode-No.2 Volt. of	*1500*	*2500*	*5000*	*7000*	*volts*
Anode-No.1 Voltage. .	225-390	375-650	750-1300	1050-1800	volts
Grid-No.2 Voltage . .	250	250	250	250	volts
Max. Grid-No.1 Volt. for Visual Cutoff	-75	-75	-75	-75	volts
Deflection Factors:					
DJ_1 to DJ_2.	57-81	93-135	190-270	266-378	v dc/in
DJ_3 to DJ_4.	45-66	75-110	150-220	210-308	v dc/in

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
Resistance in Any Deflecting-Electrode Circuit□ . .	5 max.	megohms

→ **Minimum Circuit Values:**

The power supply should be of the limited-energy type with inherent regulation to limit the continuous short-circuit current to 5 milliamperes. If the supply permits the instantaneous short-circuit current to exceed 1 ampere, or is capable of storing more than 250 microcoulombs, the effective resistance in circuit between indicated electrode and the output

* Brilliance and definition decrease with decreasing anode-No.2 voltage. In general, anode-No.2 voltage should not be less than 1500 volts.

□ It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

→ Indicates a change.

914-A

OSCILLOGRAPH TUBE

capacitor should be as follows:

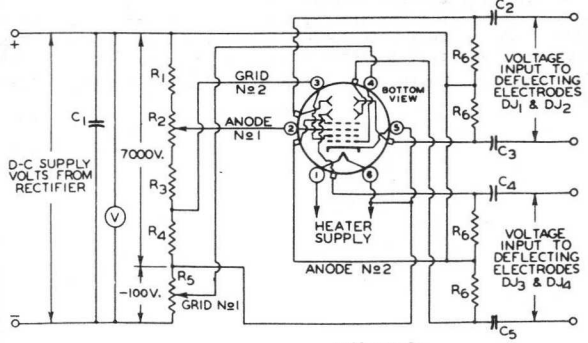
Grid-No.1-Circuit Resistance.	150 min.	ohms
Grid-No.2-Circuit Resistance.	330 min.	ohms
Anode-No.1-Circuit Resistance	2000 min.	ohms
Anode-No.2-Circuit Resistance	8200 min.	ohms

The resistors should be capable of withstanding the applied voltages.

914-A

OSCILLOGRAPH TUBE

TYPICAL OSCILLOGRAPH CIRCUIT



92CS-4754R3

C_1 = FILTER CAPACITOR 0.5 to 2.0 μf
C_2, C_3, C_4, C_5 = SEE NOTE
$R_1 + R_2 + R_3 + R_4 + R_5$ = BLEEDER POTENTIOMETER
R_1 = 2.5 MEGOHMS
R_2 = 0.5 MEGOHM
R_3 = 0.375 MEGOHM
R_4 = 0.125 MEGOHM
R_5 = 0.050 MEGOHM
R_6 = SEE □ ON BACK OF DATA 1
V = VOLTMETER

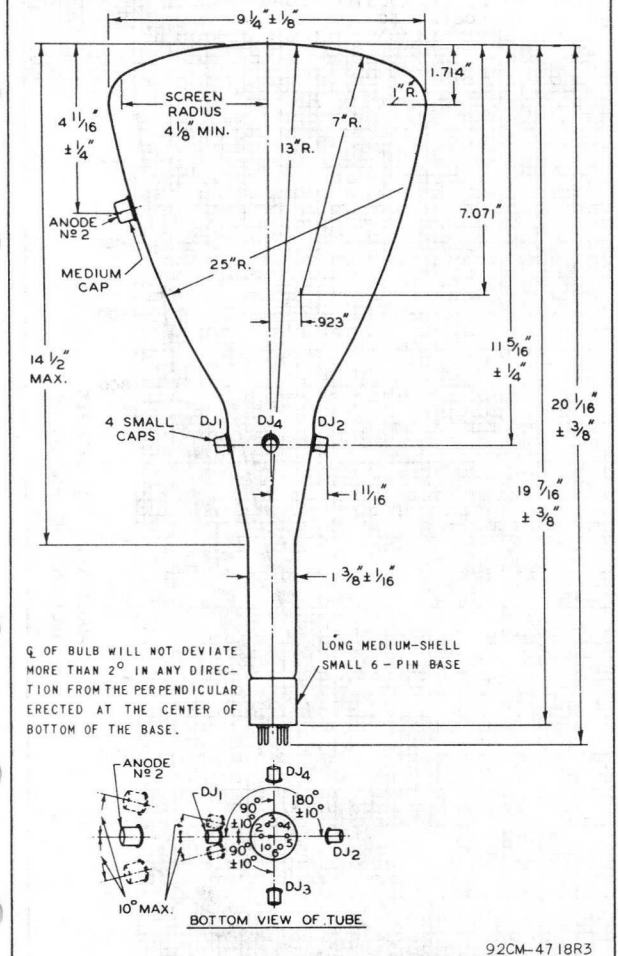
NOTE: When the cathode or the negative end of the cathode-ray high-voltage supply is grounded, blocking capacitors C_2, C_3, C_4, and C_5 should have a high voltage rating. When anode No.2 is grounded, C_2, C_3, C_4, and C_5 may be low-voltage capacitors.

For dc amplifier service, the deflecting electrodes should be coupled direct to the output of the amplifier by omitting the blocking capacitors. In addition, it will usually be preferable to remove the associated deflecting-electrode resistor in order to minimize the loading effect of the resistor on the dc amplifier. With the resistor removed, it is essential, in order to minimize spot defocusing, that anode No.2 be returned to some point in the dc amplifier circuit such that the potential difference between anode No.2 and the average voltage across the deflecting electrodes will be as low as possible.

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

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

914-A
OSCILLOGRAPH TUBE



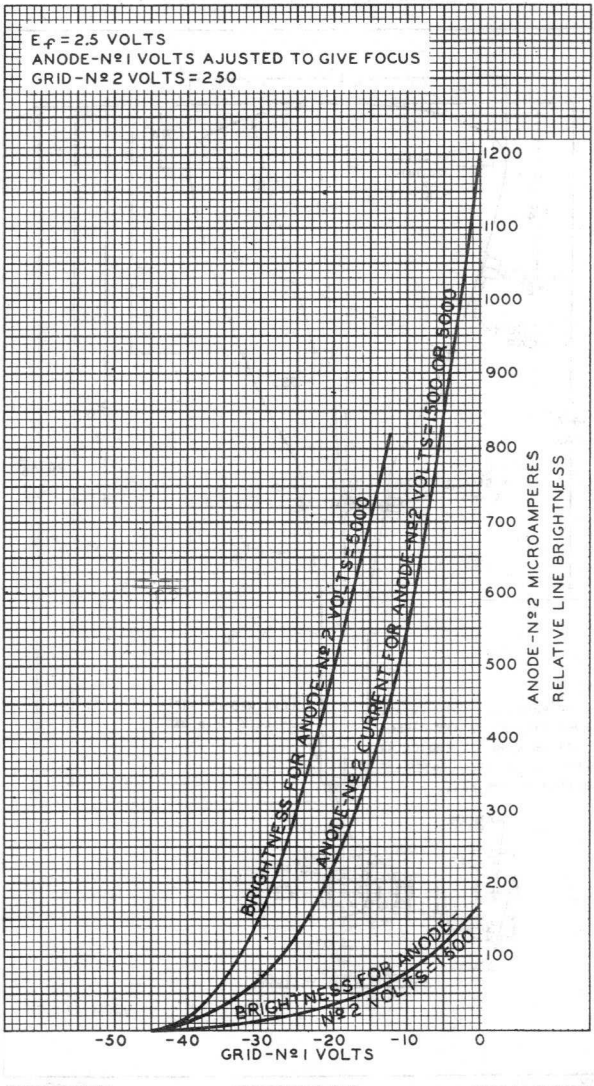
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

914-A

RCA

914-A

AVERAGE CHARACTERISTICS



Gas Phototube

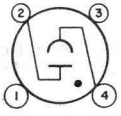
NON-DIRECTIONAL TYPE HAVING S-1 RESPONSE

DATA

General:

Spectral Response	S-1
Wavelength of Maximum Response	8000 ± 1000 angstroms
Cathode:	
Shape	Cylindrical Mesh
Minimum length	13/16"
Minimum diameter	5/8"
Direct Interelectrode Capacitance (Approx.)	3 μμf
Maximum Overall Length	3-9/16"
Maximum Seated Length	2-15/16"
Seated Length to Center of Cathode	1-31/32" ± 3/32"
Maximum Diameter	1-3/16"
Operating Position	Any
Weight (Approx.)	1 oz ←
Bulb	T9
Socket	Amphenol No.77-MIP-4-T, or equivalent ←
Base	Small-Shell Small 4-Pin (JEDEC No.A4-5) ←
Basing Designation for BOTTOM VIEW	2K

Pin 1 – No Connection
Pin 2 – Anode



Pin 3 – No Connection
Pin 4 – Photocathode

Maximum Ratings, *Absolute-maximum Values:* ←

	Rating I	*Rating II*	
ANODE-SUPPLY VOLTAGE (DC or Peak AC)	70 max.	90 max.	volts
AVERAGE CATHODE-CURRENT DENSITY[b]	60 max.	30 max.	μa/sq. in.
AVERAGE CATHODE CURRENT[b]	6 max.	3 max.	μa
AMBIENT TEMPERATURE	100 max.	100 max.	°C

Characteristics: ←

With an anode-supply voltage of 90 volts unless otherwise specified

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at 8000 angstroms	–	0.0061	–	amp/watt
Luminous:[c]				
At 0 cps	40	65	100	μa/lumen
At 5000 cps	–	56	–	μa/lumen
At 10000 cps	–	50	–	μa/lumen
Gas Amplification Factor[d]	–	–	10	
Anode Dark Current at 25° C.	–	–	0.1	μa

← Indicates a change.

Minimum Circuit Values:

With an anode-supply voltage of	*70 or less*	*90*	*volts*
DC Load Resistance:			
For dc currents above 3 μa.	0.1 min.	–	megohm
For dc currents below 3 μa.	0 min.	–	megohms
For dc currents above 2 μa.	–	2.5 min.	megohms
For dc currents below 2 μa.	–	0.1 min.	megohm

[a] On plane perpendicular to indicated direction of incident radiation.

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

[c] For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K. A dc anode supply voltage of 90 volts and a 1-megohm load resistor are used. For the 0-cycle measurement, a light input of 0.1 lumen is used. For the 5000- and 10,000-cycle measurements, the light input is varied sinusoidally about a mean value of 0.015 lumen from zero to a maximum of twice the mean value.

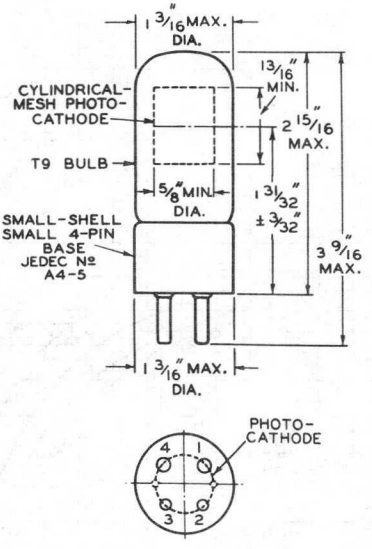
[d] The ratio of luminous sensitivity at an anode supply voltage of 90 volts to luminous sensitivity at an anode supply voltage of 25 volts. In each case, sensitivity is obtained under conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K, the light input is 0.1 lumen, and the load resistor has a value of 1 megohm.

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-1 RESPONSE

and

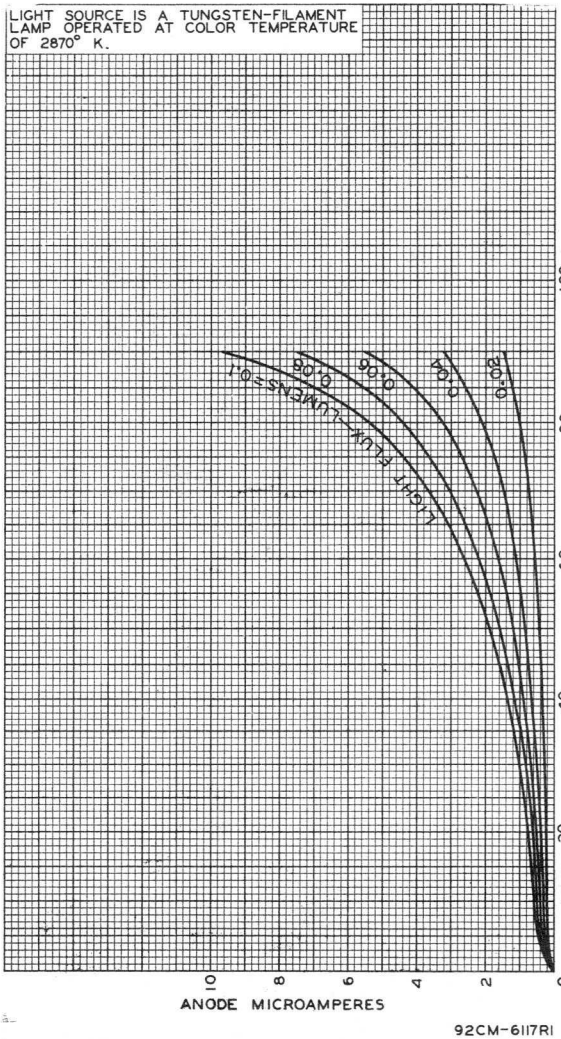
FREQUENCY-RESPONSE CHARACTERISTICS OF GAS PHOTOTUBES

are shown at the front of this section


1 3/16" MAX. DIA.
13/16" MIN.
CYLINDRICAL-MESH PHOTO-CATHODE
2 15/16" MAX.
T9 BULB
5/8" MIN. DIA.
1 31/32" ± 3/32"
SMALL-SHELL SMALL 4-PIN BASE JEDEC No. A4-5
3 9/16" MAX.
1 3/16" MAX. DIA.
PHOTO-CATHODE
4
1
3
2

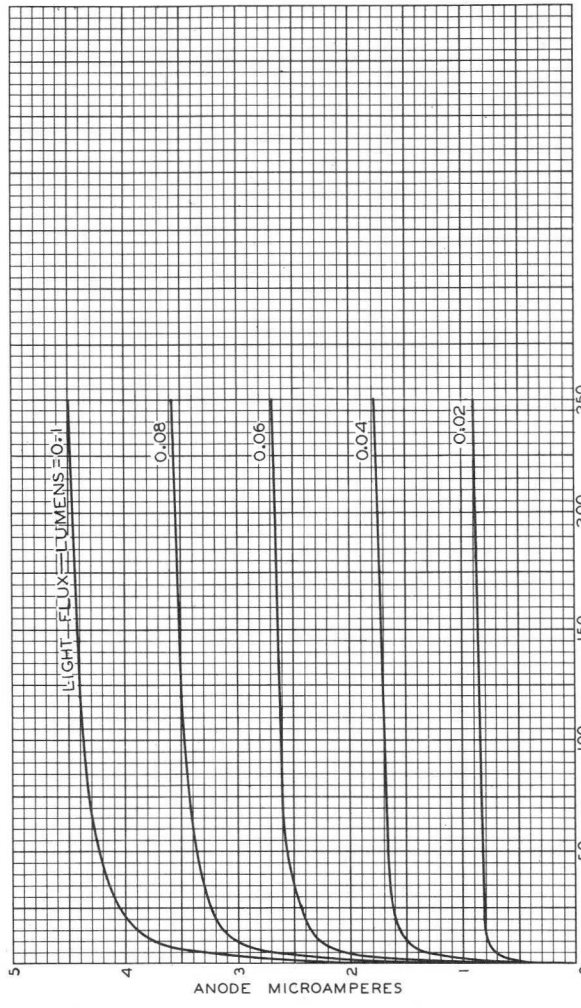
92CM-6111R3

AVERAGE ANODE CHARACTERISTICS



92CM-6117RI

AVERAGE ANODE CHARACTERISTICS



92CM-6151RI

Ignitron

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

For Intermittent-Power-Rectifier and Resistance-Welding-Control Applications

GENERAL DATA

Electrical:

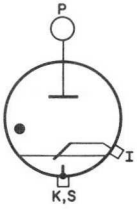
Cathode Excitation	Cyclic	
Cathode-Spot Starting	By Ignitor	
Minimum Requirements for Cathode Excitation:[a]		
Peak ignitor voltage required to fire	200	volts
Peak ignitor current required to fire	30	amp
Starting time at required ignitor voltage or current	100	μsec
Peak Tube Voltage Drop at peak anode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

Mechanical:

Operating Position	Vertical, flexible lead up
Maximum Overall Length:	
Including flexible lead	23-13/16"
Excluding flexible lead	13"
Maximum Radius (Including water connections)	2-7/8"
Weight (Approx.)	4.5 lbs

Terminal Diagram:

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



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

Thermal:

Cooling:		
Type	Water	
Minimum inlet-water temperature	0	°C
Maximum cooling-system temperature (Measured at thermostat mount):		
For Intermittent-Power-Rectifier Service	45	°C
For Resistance-Welding-Control Service at rms anode supply volts =		
600	45	°C
500	50	°C
250	55	°C

Typical cooling requirements for Resistance-Welding-Control Service at rms anode supply volts = 500:

Inlet Water Temperature (°C)	*Required Water Flow (gpm)*	*Pressure Drop (psi)*
With 100% load:		
15	1/4	0.4
30	1/2	0.75
40	1-1/2	3
With 50% load:		
15	1/16	0.1
30	1/8	0.2
40	1/4	0.4

Water-temperature rise with 100% load at flow of 1 gpm . . . . . 2 °C

Temperature Rise (Approx.), inlet water to thermostat, with 100% load at flow of 1 gpm . . . . . 4 °C

INTERMITTENT POWER-RECTIFIER SERVICE

Maximum Ratings, *Absolute-Maximum Values:*

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

PEAK ANODE VOLTAGE:				
Forward	500 max.	1200 max.	1500 max.	volts
Inverse	500 max.	1200 max.	1500 max.	volts
ANODE CURRENT:[b]				
Peak	700 max.	600 max.	480 max.	amp
Corresponding average . . .	–	5 max.	4 max.	amp
Average	40 max.	22.5 max.	18 max.	amp
Corresponding peak	–	135 max.	108 max.	amp
AVERAGING TIME . . .	6 max.	10 max.	10 max.	sec
RATIO OF AVERAGE ANODE CURRENT TO PEAK ANODE CURRENT for maximum averaging time (seconds) = 0.2	–	0.166 max.	0.166 max.	
RATIO OF PEAK FAULT ANODE CURRENT TO PEAK ANODE CURRENT.	12.5 max.	12.5 max.	12.5 max.	
FAULT-ANODE-CURRENT DURATION	0.15 max.	0.15 max.	0.15 max.	sec

RESISTANCE-WELDING-CONTROL SERVICE

Maximum Ratings, *Absolute-Maximum Values:*

For two tubes in inverse parallel circuit, zero phase-control angle, frequencies from 25 to 60 cps, and rms supply voltages from 250 to 600 volts

DEMAND	600 max.	kva
Corresponding average anode current (Per tube)	30.2 max.	amp
AVERAGE ANODE CURRENT (Per Tube)[c]	56 max.	amp
Corresponding demand	200 max.	kva
AVERAGING TIME at rms supply volts =		
600[c]	11.25 max.	sec
250[c]	27 max.	sec
RMS ANODE CURRENT (Per Tube)[c]	See *Rating Chart*	
PEAK FAULT ANODE CURRENT (Per Tube)	Limited to 280% of maximum RMS Anode Current	

IGNITOR

Maximum Ratings, *Absolute-Maximum Values:*

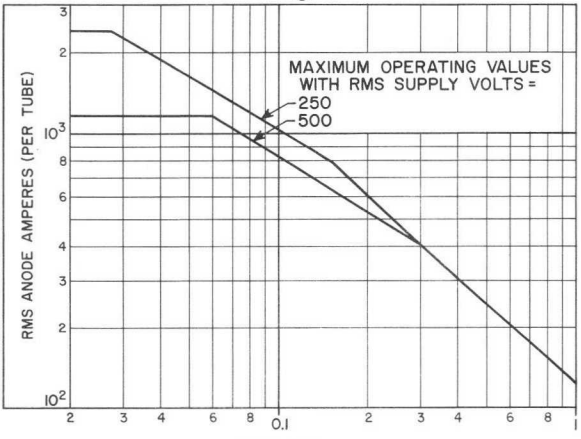
PEAK IGNITOR VOLTAGE:		
Positive	Equal to anode volts	
Negative	5 max.	volts
IGNITOR CURRENT:		
Peak	100 max.	amp
Average	1 max.	amp
RMS	10 max.	amp
AVERAGING TIME	5 max.	sec

[a] Ignition will occur if either the minimum peak ignitor voltage is applied or the minimum peak ignitor current flows for the minimum starting time.

[b] With the use of log-log graph paper, straight-line interpolation between tabulated points may be used to determine intermediate maximum ratings for Peak Anode Current and Average Anode Current.

[c] With the use of log-log graph paper, straight-line interpolation between tabulated points may be used to determine intermediate maximum ratings for RMS Anode Current and Average Anode Current or Averaging Time and RMS Supply Voltage.

ANODE-CURRENT RATING CHART
Resistance-Welding-Control Service



92CS-11700

Ignitron

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

For Intermittent-Power-Rectifier and Resistance-Welding-Control Applications

GENERAL DATA

Electrical:

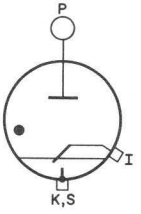
Cathode Excitation		Cyclic
Cathode-Spot Starting		By Ignitor
Minimum Requirements for Cathode Excitation:[a]		
Peak ignitor voltage required to fire	200	volts
Peak ignitor current required to fire	30	amp
Starting time at required ignitor voltage or current	100	μsec
Peak Tube Voltage Drop at peak anode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

Mechanical:

Operating Position	Vertical, flexible lead up
Maximum Overall Length (Including flexible lead)	26-9/16"
Maximum Radius (Including water connections)	3-5/8"
Weight (Approx.)	10 lbs

Terminal Diagram:

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



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

Thermal:

Cooling:

Type		Water
Minimum inlet-water temperature	0	°C
Maximum cooling-system temperature (Measured at thermostat mount):		
For Intermittent-Power-Rectifier Service	45	°C
For Resistance-Welding-Control Service at rms anode supply volts =		
600	45	°C
500	50	°C
250	55	°C

Typical cooling requirements for Resistance-Welding-Control Service at rms anode supply volts = 500:

Inlet Water Temperature (°C)	*Required Water Flow (gpm)*	*Pressure Drop (psi)*
With 100% load:		
15	3/8	0.6
30	1/2	0.9
40	1-1/4	4
With 50% load:		
15	1/8	0.2
30	1/4	0.4
40	1/2	0.9

Water-temperature rise with 100% load at flow of 1 gpm	5	°C
Temperature Rise (Approx.), inlet water to thermostat, with 100% load at flow of 1 gpm	4	°C

INTERMITTENT POWER-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
ANODE CURRENT:		
Peak	1600 max.	amp
Average	100 max.	amp
AVERAGING TIME	6 max.	sec
PEAK FAULT ANODE CURRENT	6000 max.	amp
FAULT-ANODE-CURRENT DURATION	0.15 max.	sec

RESISTANCE-WELDING-CONTROL SERVICE

Maximum Ratings, *Absolute-Maximum Values:*

For two tubes in inverse parallel circuit, zero phase-control angle, frequencies from 25 to 60 cps, and rms supply voltages from 250 to 600 volts

DEMAND	1200 max.	kva
Corresponding average anode current (Per tube)	75.6 max.	amp
AVERAGE ANODE CURRENT (Per Tube)[b]	140 max.	amp
Corresponding demand	400 max.	kva
AVERAGING TIME at rms supply volts =		
600[b]	8.75 max.	sec
250[b]	21 max.	sec

RMS ANODE CURRENT (Per Tube)[b] . . . . . .See *Rating Chart*
PEAK FAULT ANODE CURRENT (Per Tube) . . . . . Limited to 280% of maximum RMS Anode Current

IGNITOR

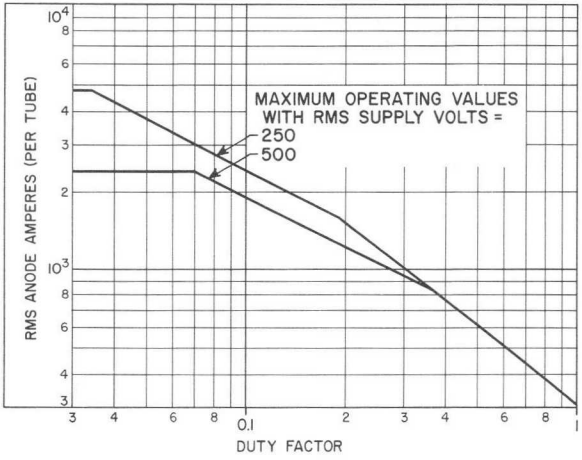
Maximum Ratings, *Absolute-Maximum Values:*

PEAK IGNITOR VOLTAGE:		
Positive. . . . . .Equal to anode		volts
Negative.	5 max.	volts
IGNITOR CURRENT:		
Peak.	100 max.	amp
Average	1 max.	amp
RMS	10 max.	amp
AVERAGING TIME.	5 max.	sec

[a] Ignition will occur if either the minimum peak ignitor voltage is applied or the minimum peak ignitor current flows for the minimum starting time.

[b] With the use of log-log graph paper, straight-line interpolation between tabulated points may be used to determine intermediate maximum ratings for RMS Anode Current and Average Anode Current or Averaging Time and RMS Supply Voltage.

ANODE-CURRENT RATING CHART
Resistance-Welding-Control Service

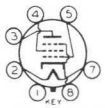


92CS-11699

1613

R-F POWER AMPLIFIER PENTODE

Heater	Coated Unipotential Cathode	
Voltage	6.3	a-c or d-c volts
Current	0.7	amp.
Transconductance for plate current of 31 ma.	2500	μmhos
Direct Interelectrode Capacitances:⊙		
Grid to Plate	0.26	μμf
Input	6.5	μμf
Output	13.5	μμf
Maximum Overall Length		3-1/4"
Maximum Seated Height		2-11/16" ←
Maximum Diameter		1-5/16"
Bulb		Metal Shell, MT-8
Base		Small Wafer Octal 7-Pin
Pin 1 - Shell		Pin 5 - Grid
Pin 2 - Heater		Pin 7 - Heater
Pin 3 - Plate		Pin 8 - Cathode, Suppressor
Pin 4 - Screen		
Mounting Position		Any



BOTTOM VIEW (7S)

Maximum Ratings Are Absolute Values

MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS

PLATE-MODULATED R-F POWER AMPLIFIER - Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

D-C Plate Voltage	275 máx.	volts
D-C Screen Voltage	275 max.	volts
D-C Grid Voltage	-100 max.	volts
D-C Plate Current	50 max.	ma.
D-C Grid Current	5 max.	ma.
Plate Input	11.5 max.	watts
Screen Input	2 max.	watts
Plate Dissipation	7 max.	watts
D-C Heater-Cathode Potential	100 max.	volts
Typical Operation:		
D-C Plate Voltage	275	volts
D-C Screen Voltage△	200	volts
	7500	ohms
D-C Grid Voltage□	-35	volts
	12500	ohms
Peak R-F Grid Voltage	65	volts
D-C Plate Current	42	ma.
D-C Screen Current	10	ma.
D-C Grid Current	2.8 approx.	ma.
Driving Power	0.16 approx.	watt
Power Output	6 approx.	watts

□ Obtained by grid resistor or by partial self-bias methods.
△ Preferably obtained from a separate source modulated with the plate supply, or obtained from the modulated plate-voltage supply through resistor of value shown.
⊙ With shell connected to cathode.

← Indicates a change.

1613

R-F POWER AMPLIFIER PENTODE

(continued from preceding page)

R-F POWER AMPLIFIER & OSCILLATOR – Class C Telegraphy

Key-down conditions per tube without modulation #

D-C Plate Voltage	350 max.	volts
D-C Screen Voltage	275 max.	volts
D-C Grid Voltage	-100 max.	volts
D-C Plate Current	50 max.	ma.
D-C Grid Current	5 max.	ma.
Plate Input	17.5 max.	watts
Screen Input	2.5 max.	watts
Plate Dissipation	10 max.	watts
D-C Heater-Cathode Potential	100 max.	volts
Typical Operation:		
D-C Plate Voltage	350	volts
D-C Screen Voltage■	200	volts
	15000	ohms
D-C Grid Voltage▲	-35	volts
	10000	ohms
Peak R-F Grid Voltage	70	volts
D-C Plate Current	50	ma.
D-C Screen Current	10	ma.
D-C Grid Current	3.5 approx.	ma.
Driving Power	0.22 approx.	watt
Power Output	9 approx.	watts

Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.
▲ Obtained by grid resistor or other self- or fixed-bias method.
■ Obtained from a separate source, or from the plate-voltage supply with a voltage divider, or through a series resistor of the value shown.

Data on operating frequencies for the 1613 are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY.

→ Indicates a change.

1614
TRANSMITTING BEAM POWER AMPLIFIER

GENERAL DATA

Electrical:

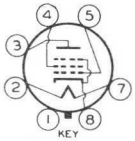
Heater, for Unipotential Cathode:		
Voltage	6.3	ac or dc volts
Current	0.9	amp
Transconductance: for plate current of 72 ma.	6050	μmhos
Direct Interelectrode Capacitances:[o]		
Grid-No.1 to Plate	0.4 max.	μμf
Input	10	μμf
Output	12	μμf

[o] With shell connected to cathode.

Mechanical:

Mounting Position	Any
Maximum Overall Length	4-5/16"
Maximum Seated Length	3-3/4"
Maximum Diameter	1-9/16" ± 1/16"
Bulb	MT-10A
Base	Small-Wafer Octal 7-Pin
Basing Designation for BOTTOM VIEW	7AC

Pin 1 - Shell
Pin 2 - Heater
Pin 3 - Plate
Pin 4 - Grid No.2



Pin 5 - Grid No.1
Pin 7 - Heater
Pin 8 - Cathode, Grid No.3

AF POWER AMPLIFIER & MODULATOR - Class AB_1[#]

Maximum Ratings, *Absolute Values:*

	CCS[●]	*ICAS*[●●]	
DC PLATE VOLTAGE	375 max.	550 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	300 max.	400 max.	volts
DC PLATE CURRENT	110 max.	110 max.	ma.
PLATE INPUT	40 max.	60 max.	watts
GRID-No.2 DISSIPATION	3.5 max.	3.5 max.	watts
PLATE DISSIPATION	21 max.	25 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	200 max.	200 max.	volts
Heater positive with respect to cathode	200 max.	200 max.	volts

Typical Operation:
Unless otherwise specified, values are for 2 tubes

DC Plate Voltage	360	530	volts
DC Grid-No.2 Voltage	270	340	volts

#, ●, ●●: See next page.

← Indicates a change.

1614
TRANSMITTING BEAM POWER AMPLIFIER

DC Grid-No.1 (Control-Grid) Voltage	-22.5		-36	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage	45		72	volts
Zero-Signal DC Plate Current	88		60	ma.
Max.-Signal DC Plate Current	132		160	ma.
Max.-Signal DC Grid-No.2 Current	15		20	ma.
Effective Load Resistance (plate-to-plate)	6600		7200	ohms
Total Harmonic Distortion	2		2.5	%
Max.-Signal Power Output	26.5		50	watts

PLATE-MODULATED RF POWER AMPLIFIER - Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values*:

	CCS●	*ICAS*●●	
DC PLATE VOLTAGE	325 max.	375 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	300 max.	300 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-125 max.	-125 max.	volts
DC PLATE CURRENT	70 max.	95 max.	ma.
DC GRID-No.1 Current	5 max.	5 max.	ma.
PLATE INPUT	23 max.	35 max.	watts
GRID-No.2 INPUT	2.5 max.	2.5 max.	watts
PLATE DISSIPATION	14 max.	21 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	200 max.	200 max.	volts
Heater positive with respect to cathode	200 max.	200 max.	volts

Typical Operation:

DC Plate Voltage	325	375	volts
DC Grid-No.2 Voltage▲	245	250	volts
	10000	18000	ohms
DC Grid-No.1 Voltage□	-40	-50	volts
	20000	25000	ohms
Peak RF Grid-No.1 Voltage	51	80	volts
DC Plate Current	70	93	ma.
DC Grid-No.2 Current	8	7	ma.
DC Grid-No.1 Current (Approx.)	2	2	ma.
Driving Power (Approx.)	0.1	0.15	watts
Power Output (Approx.)	15	24.5	watts

▲ Obtained preferably from a separate source modulated with the plate supply, or from the modulated plate-supply through a series resistor of the value shown.

□ Subscript 1 indicates that grid-current does not flow during any part of input cycle.

●, ●●, □: See next page.

→ indicates a change.

1614
TRANSMITTING BEAM POWER AMPLIFIER

PLATE-MODULATED RF POWER AMPLIFIER – Class C Telephony

Triode Connection – Grid No. 2 Connected to Plate

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values:*

	CCS●	ICAS●●	
DC PLATE VOLTAGE	325 max.	375 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	−125 max.	−125 max.	volts
DC PLATE CURRENT	70 max.	95 max.	ma.
DC GRID-No.1 CURRENT	10 max.	10 max.	ma.
PLATE INPUT	23 max.	35 max.	watts
PLATE DISSIPATION	14 max.	21 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	200 max.	200 max.	volts
Heater positive with respect to cathode	200 max.	200 max.	volts

Typical Operation:

DC Plate Voltage	325	375	volts
DC Grid-No.1 Voltage□	−85	−90	volts
	21000	15000	ohms
Peak RF Grid-No.1 Voltage	102	135	volts
DC Plate Current	65	90	ma.
DC Grid-No.1 Current (Approx.)	4	6	ma.
Driving Power (Approx.)	0.4	0.8	watts
Power Output (Approx.)	11.5	21	watts

□ obtained from grid resistor of value shown or by partial self-bias methods.

RF AMPLIFIER & OSCILLATOR – Class C Telegraphy

Key-down conditions per tube without modulation□□

Maximum Ratings, *Absolute Values:*

	CCS●	ICAS●●	
DC PLATE VOLTAGE	375 max.	450 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	300 max.	300 max.	volts
DC GRID-No.1 (CONTROL GRID) VOLTAGE	−125 max.	−125 max.	volts
DC PLATE CURRENT	110 max.	110 max.	ma.
DC GRID-No.1 CURRENT	5 max.	5 max.	ma.
PLATE INPUT	35 max.	45 max.	watts
GRID-No.2 INPUT	3.5 max.	3.5 max.	watts
PLATE DISSIPATION	21 max.	25 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	200 max.	200 max.	volts
Heater positive with respect to cathode	200 max.	200 max.	volts

●, ●●, □□ : See next page. ← indicates a change.

1614

TRANSMITTING BEAM POWER AMPLIFIER

→ **Typical Operation:**

DC Plate Voltage	375	450	volts
DC Grid-No.2 Voltage⊕	250	250	volts
	12500	25000	ohms
DC Grid-No.1 Voltage⊕⊕	−40	−45	volts
	20000	22500	ohms
	425	410	ohms
Peak RF Grid-No.1 Voltage	51	73	volts
DC Plate Current	80	100	ma.
DC Grid-No.2 Current	10	8	ma.
DC Grid-No.1 Current(Approx.)	2	2	ma.
Driving Power (Approx.)	0.1	0.15	watts
Power Output (Approx.)	21	31	watts

● Continuous Commercial Service.

●● Intermittent Commercial and Amateur Service.

🕮 Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of carrier conditions.

⊕ Obtained from a separate source, or from the plate-voltage supply with a voltage divider, or through a series resistor of the value shown.

⊕⊕ Obtained from fixed supply, by grid resistor (20000, 22500), by cathode resistor (425, 410) or by combination methods.

Data on operating frequencies for the 1614 are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY

CURVES under type 807 apply to the 1614 within its maximum ratings

← Indicates a change.

TRANSMITTING BEAM POWER AMPLIFIER

Filament	Coated	
Voltage	2.5	a-c or d-c volts
Current	2.0	amp.
Transconductance for plate current of 50 ma.	4500 approx.	μmhos
Direct Interelectrode Capacitances:⊙		
Grid to Plate	0.29	μμf
Input	9.6	μμf
Output	12.5	μμf
Maximum Overall Length		4-5/16"
Maximum Diameter		1-9/16"±1/16" ←
Bulb		Metal Shell, MT-10
Base		Small Wafer Octal 7-Pin

Maximum Ratings Are Absolute Values

MAXIMUM CCS RATINGS and TYPICAL OPERATING CONDITIONS

CCS = Continuous Commercial Service

SINGLE-TUBE AMPLIFIER - Class A_1

D-C Plate Voltage	400 max.	volts
D-C Screen Voltage (Grid #2)	300 max.	volts
Screen Input	3.5 max.	watts
Plate Dissipation	15 max.	watts
Typical Operation:		
D-C Plate Voltage	300	volts
D-C Suppressor Voltage (Grid #3)**	0	volts
D-C Screen Voltage	250	volts
D-C Grid Voltage (Grid #1) ## °	-10	volts
Peak A-F Grid Voltage	10	volts
Zero-Sig. D-C Plate Current	44	ma.
Max.-Sig. D-C Plate Current	46	ma.
Zero-Sig. D-C Screen Current	4	ma.
Max.-Sig. D-C Screen Current	6	ma.
Load Resistance	8800	ohms
Total Harmonic Distortion	7	%
Max.-Sig. Power Output	3 approx.	watts

The total effective grid-circuit resistance should not exceed 50000 ohms.

PUSH-PULL AMPLIFIER - Class AB_1

D-C Plate Voltage	400 max.	volts
D-C Screen Voltage (Grid #2)	300 max.	volts
Screen Input *	3.5 max.	watts
Plate Dissipation *	15 max.	watts
Typical Operation with Fixed Bias:		
Unless otherwise specified, values are for 2 tubes		
D-C Plate Voltage	400	volts
D-C Suppressor Voltage (Grid #3) **	0	volts
D-C Screen Voltage	300	volts
D-C Grid Voltage (Grid #1) † °	-20	volts
Peak A-F Grid-to-Grid Voltage	40	volts
Zero-Sig. D-C Plate Current	52	ma.

°, *, **, †, ⊙: See end of tabulation. ← Indicates a change.

1619

TRANSMITTING BEAM POWER AMPLIFIER

(continued from preceding page)

Max.-Sig. D-C Plate Current	80	ma.
Zero-Sig. D-C Screen Current	3.5	ma.
Max.-Sig. D-C Screen Current	10	ma.
Load Resistance (per tube)	3500	ohms
Effective Load Res. (plate to plate)	14000	ohms
Total Harmonic Distortion	3	%
Max.-Sig. Power Output	17.5 approx.	watts

PUSH-PULL AMPLIFIER - Class AB_2

D-C Plate Voltage	400 max.	volts
D-C Screen Voltage (Grid #2)	300 max.	volts
Max.-Sig. D-C Plate Current *	75 max.	ma.
Max.-Sig. Plate Input *	30 max.	watts
Screen Input *	3.5 max.	watts
Plate Dissipation *	15 max.	watts
Typical Operation with Fixed Bias:		
Unless otherwise specified, values are for 2 tubes		
D-C Plate Voltage	400	volts
D-C Suppressor (Grid #3) **	0	volts
D-C Screen Voltage	300	volts
D-C Grid Voltage (Grid #1) ○	-16.5	volts
Peak A-F Grid-to-Grid Voltage □	77	volts
Zero-Sig. D-C Plate Current	75	ma.
Max.-Sig. D-C Plate Current	150	ma.
Zero-Sig. D-C Screen Current	6.5	ma.
Max.-Sig. D-C Screen Current	11.5	ma.
Load Resistance (per tube)	1500	ohms
Effective Load Res. (plate to plate)	6000	ohms
Peak Grid Input Power ○○	0.4	watt
Total Harmonic Distortion	2.5	%
Max.-Sig. Power Output ◇	36 approx.	watts

◇ With zero-impedance driver and perfect regulation, plate-circuit distortion does not exceed 2%. In practice, plate-voltage regulation, screen voltage regulation and grid-bias regulation should not be greater than 5%, 5%, and 3% respectively.

□ The driver stage should be capable of supplying the grids of the class AB_2 stage with the specified peak grid voltage at low distortion. The effective resistance per grid circuit should not exceed 500 ohms and the effective impedance at the highest desired response frequency should not exceed 700 ohms.

GRID-MODULATED R-F POWER AMPLIFIER - Class C Telephony

Carrier condition per tube for use with a max. modulation fact. of 1.0		
D-C Plate Voltage	400 max.	volts
D-C Screen Voltage (Grid #2)	300 max.	volts
D-C Grid Voltage (Grid #1)	-125 max.	volts
D-C Plate Current	37.5 max.	ma.
Plate Input	15 max.	watts
Screen Input	2.5 max.	watts
Plate Dissipation	15 max.	watts
Typical Operation:		
D-C Plate Voltage	400	volts

*, **, ○, ○○: See end of tabulation.

1619

TRANSMITTING BEAM POWER AMPLIFIER

(continued from preceding page)

D-C Suppressor (Grid #3) **	0	volts
D-C Screen Voltage	250	volts
D-C Grid Voltage † •	−50	volts
	1500	ohms
Peak R-F Grid Voltage	58	volts
Peak A-F Grid Voltage	30	volts
D-C Plate Current	31	ma.
D-C Screen Current	1.5	ma.
D-C Grid Current	1.2	approx.ma.
Driving Power ∞	0.25	approx.watt
Power Output	3.8	approx.watts

PLATE-MODULATED R-F POWER AMPLIFIER – Class C Telephony

Carrier conditions per tube for use with a max. modulation fact. of 1.0

D-C Plate Voltage	325 max.	volts
D-C Screen Voltage (Grid #2)	300 max.	volts
D-C Grid Voltage (Grid #1)	−125 max.	volts
D-C Plate Current	62 max.	ma.
D-C Grid Current	5 max.	ma.
Plate Input	20 max.	watts
Screen Input	2.5 max.	watts
Plate Dissipation	10 max.	watts
Typical Operation:		
D-C Plate Voltage	325	volts
D-C Suppressor (Grid #3) **	0	volts
D-C Screen Voltage ♦	285	volts
	5000	ohms
D-C Grid Voltage † □	−50	volts
	18000	ohms
Peak R-F Grid Voltage	70	volts
D-C Plate Current	62	ma.
D-C Screen Current	7.5	ma.
D-C Grid Current	2.8	approx.ma.
Driving Power	0.18	approx.watt
Power Output	13	approx.watts

♦ Preferably obtained from a separate source modulated with the plate supply, or obtained from the modulated plate-voltage supply through resistor of value shown.

□ Obtained by grid resistor of value shown or by partial self-bias methods.

R-F POWER AMPLIFIER & OSCILLATOR – Class C Telegraphy

Key-down conditions per tube without modulation ■

D-C Plate Voltage	400 max.	volts
D-C Screen Voltage (Grid #2)	300 max.	volts
D-C Grid Voltage (Grid #1)	−125 max.	volts
D-C Plate Current	75 max.	ma.
D-C Grid Current	5 max.	ma.
Plate Input	30 max.	watts
Screen Input	3.5 max.	watts
Plate Dissipation	15 max.	watts

**, ∞, †, •: See end of tabulation.

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TRANSMITTING BEAM POWER AMPLIFIER

(continued from preceding page)

Typical Operation:

D-C Plate Voltage	400	volts
D-C Suppressor (Grid #3)**	0	volts
D-C Screen Voltage §	300	volts
	9500	ohms
D-C Grid Voltage † *	-55	volts
	11000	ohms
Peak R-F Grid Voltage	80	volts
D-C Plate Current	75	ma.
D-C Screen Current	10.5	ma.
D-C Grid Current	.5	approx.ma.
Driving Power	0.36	approx.watt
Power Output	19.5	approx.watts

■ Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

o For a-c filament supply. If d.c. is used, the stated voltages should be decreased by 1.75 volts.

† The total effective grid-circuit resistance should not exceed 25000 ohms.

* Averaged over any audio-frequency cycle of sine-wave form.

** Grid No. 3 should be connected to the mid-point of filament operated on a.c., or to negative end of filament when d-c filament supply is used.

∞ At crest of a-f cycle with a modulation factor of 1.0.

● Obtained from fixed supply or by cathode resistor of value shown.

§ Obtained from a separate source, or from the plate-voltage supply with a voltage divider, or through a series resistor of the value shown.

→ The screen voltage must not exceed 600 volts under key-up conditions.

★ Obtained from fixed supply, by grid resistor (11000), or by combination methods. When a preceding stage is keyed, sufficient fixed bias must be used to maintain the plate current at a low value when the key is up.

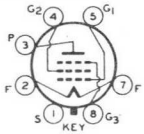
⊖ With shell connected to cathode.

Data on operating frequencies for the 1619 are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY.

TUBE MOUNTING POSITION

VERTICAL: Base up or down.
HORIZONTAL: No.

BOTTOM VIEW OF SOCKET CONNECTIONS

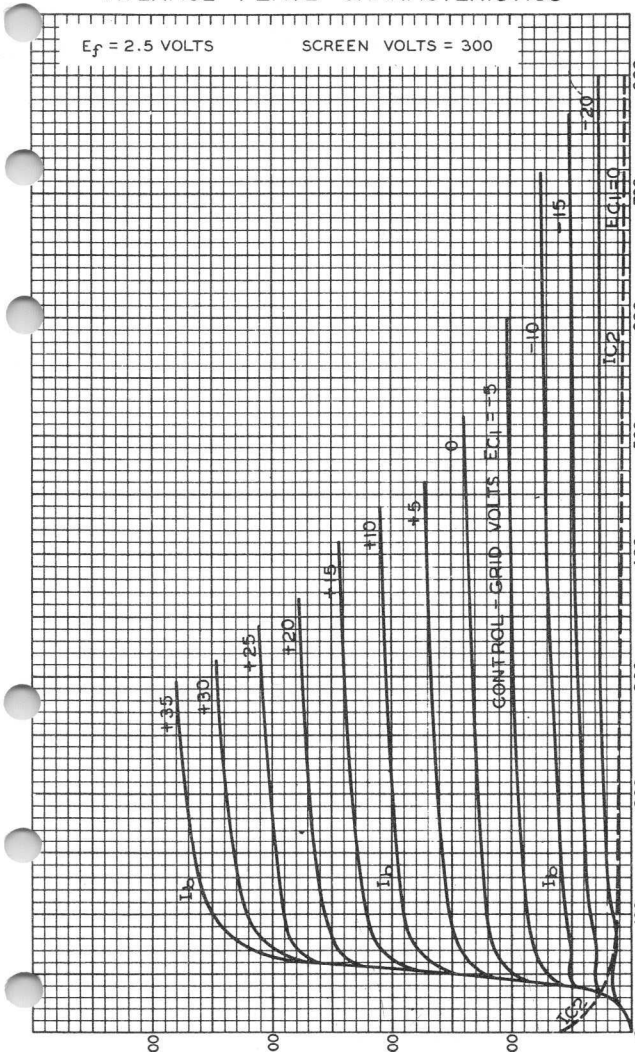


Pin 1 - Shell
Pin 2 - Filament
Pin 3 - Plate
Pin 4 - Grid No. 2
Pin 5 - Grid No. 1
Pin 7 - Filament
Pin 8 - Grid No. 3

→ Indicates a change.

1619

AVERAGE PLATE CHARACTERISTICS



JUNE 15, 1938

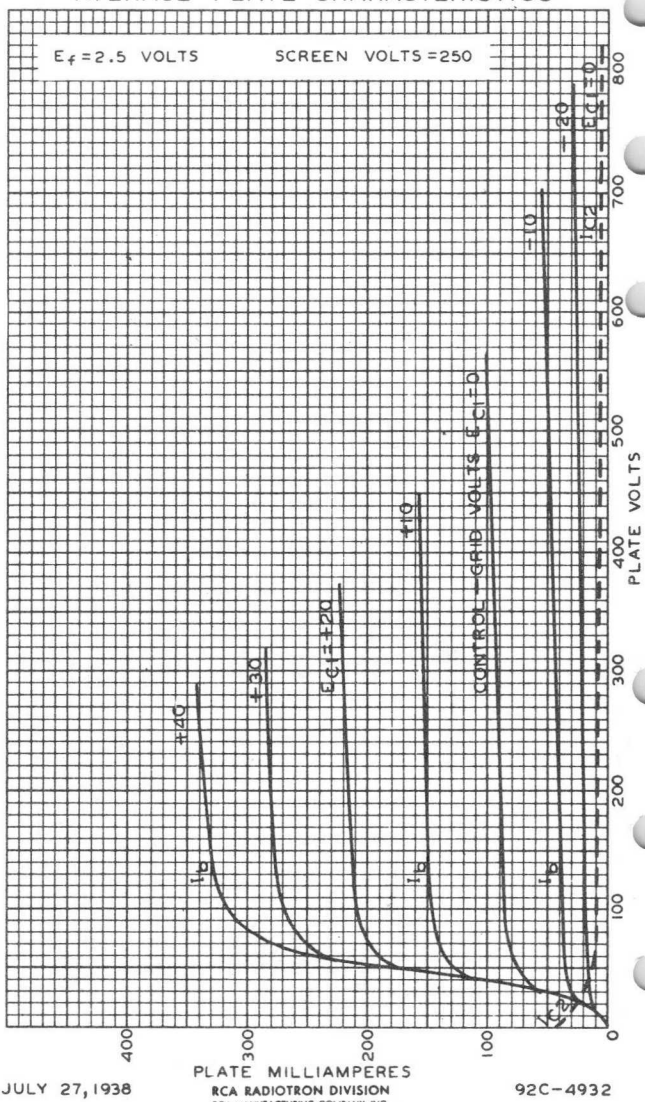
RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC.

92C-4931

1619

1619

AVERAGE PLATE CHARACTERISTICS



JULY 27, 1938

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC.

92C-4932

1623

R-F POWER AMPLIFIER, CLASS B MODULATOR

Filament	Thoriated Tungsten	
Voltage	6.3	a-c or d-c volts
Current	2.5	amp.
Amplification Factor	20	
Direct Interelectrode Capacitances:		
Grid to Plate	6.7	μμf
Grid to Filament	5.7	μμf
Plate to Filament	0.9	μμf
Maximum Overall Length		6-9/16"
Maximum Diameter		2-7/16"
Bulb		ST-19
Cap		Medium Metal
Base		Medium 4-Pin Ceramic, Bayonet
RCA Socket		Type UR-542-A

MAXIMUM CCS and ICAS RATINGS with TYPICAL OPERATING CONDITIONS

CCS = Continuous Commercial Service
ICAS = Intermittent Commercial and Amateur Service

A-F POWER AMPLIFIER & MODULATOR - Class B

	CCS		ICAS	
D-C Plate Voltage	750 max.		1000 max.	volts
Max.-Signal D-C Plate Current*	100 max.		100 max.	ma.
Max.-Signal Plate Input*	75 max.		100 max.	watts
Plate Dissipation*	25 max.		30 max.	watts
Typical Operation:	*Unless otherwise specified, values are for 2 tubes*			
D-C Plate Voltage	500	750	1000	volts
D-C Grid Voltage □	-10	-25	-40	volts
Peak A-F Grid-to-Grid Volt.	170	200	230	volts
Zero-Sig. D-C Plate Cur.	40	35	30	ma.
Max.-Sig. D-C Plate Cur.	200	200	200	ma.
Load Res. (Per tube)	1300	2100	3000	ohms
Effective Load Res. (plate to plate)	5200	8400	12000	ohms
Max.-Sig. Driving Power (Approx.)	3.5	4	4.2	watts
Max.-Sig. Power Output (Approx.)	60	100	145	watts

* Averaged over any audio-frequency cycle of sine-wave form.

R-F POWER AMPLIFIER - Class B Telephony

Carrier Conditions per tube for use with a max. modulation fact. of 1.0

	CCS		ICAS	
D-C Plate Voltage	750 max.		1000 max.	volts
D-C Plate Current	50 max.		50 max.	ma.
Plate Input	37.5 max.		45 max.	watts
Plate Dissipation	25 max.		30 max.	watts
Typical Operation:				
D-C Plate Voltage	500	750	1000	volts
D-C Grid Voltage □	-25	-40	-50	volts
Peak R-F Grid Voltage	50	60	62	volts
D-C Plate Current	50	50	45	ma.

□ With a-c filament supply.

1623

R-F POWER AMPLIFIER, CLASS B MODULATOR

(continued from preceding page)

	CCS		ICAS	
D-C Grid Current (Approx.)**	2	1.5	0.5	ma.
Driving Power (Approx.)**°	1.8	1.4	1.7	watts
Power Output (Approx.)	7.5	12.5	16	watts

° At crest of a-f cycle with modulation factor of 1.0

PLATE-MODULATED R-F POWER AMPLIFIER – Class C Telephony

Carrier conditions per tube for use with a max. modulation fact. of 1.0

	CCS		ICAS	
D-C Plate Voltage	600 max.		750 max.	volts
D-C Grid Voltage	-200 max.		-200 max.	volts
D-C Plate Current	83 max.		100 max.	ma.
D-C Grid Current	25 max.		25 max.	ma.
Plate Input	50 max.		75 max.	watts
Plate Dissipation	17.5 max.		25 max.	watts
Typical Operation:				
D-C Plate Voltage	500	600	750	volts
D-C Grid Voltage § □	-125	-125	-125	volts
	5000	5000	6250	ohms
Peak R-F Grid Voltage	200	200	215	volts
D-C Plate Current	83	83	100	ma.
D-C Grid Current (Approx.)**	25	25	20	ma.
Driving Power (Approx.)**	5	5	4	watts
Power Output (Approx.)	30	38	55	watts

§ Obtained by grid resistor of value shown or by partial self-bias methods.

R-F POWER AMPLIFIER & OSCILLATOR – Class C Telegraphy

Key-down conditions per tube without modulation#

	CCS		ICAS	
D-C Plate Voltage	750 max.		1000 max.	volts
D-C Grid Voltage	-200 max.		-200 max.	volts
D-C Plate Current	100 max.		100 max.	ma.
D-C Grid Current	25 max.		25 max.	ma.
Plate Input	75 max.		100 max.	watts
Plate Dissipation	25 max.		30 max.	watts
Typical Operation:				
D-C Plate Voltage	500	750	1000	volts
D-C Grid Voltage * □	-70	-85	-90	volts
	4100	5000	4500	ohms
	600	730	750	ohms
Peak R-F Grid Voltage	140	160	172	volts
D-C Plate Current	100	100	100	ma.
D-C Grid Current (Approx.)**	17	17	20	ma.
Driving Power (Approx.)**	2.2	2.5	3.1	watts
Power Output (Approx.)	33	55	75	watts

* Obtained by grid resistor (4100, 5500, 4500), by cathode resistor (600, 730, 750) or from fixed-bias source. When the 1623 is used in the final amplifier or a preceding stage of a transmitter designed for break-in operation and oscillator keying, a small amount of fixed bias must be used to maintain the plate current at a safe value. With plate voltage of 1000 volts, a fixed bias of at least -35 volts should be used.

\# Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

** Subject to wide variations as explained on sheet TRANS. TUBE RATINGS.

□ With a-c filament supply.

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC.

1623

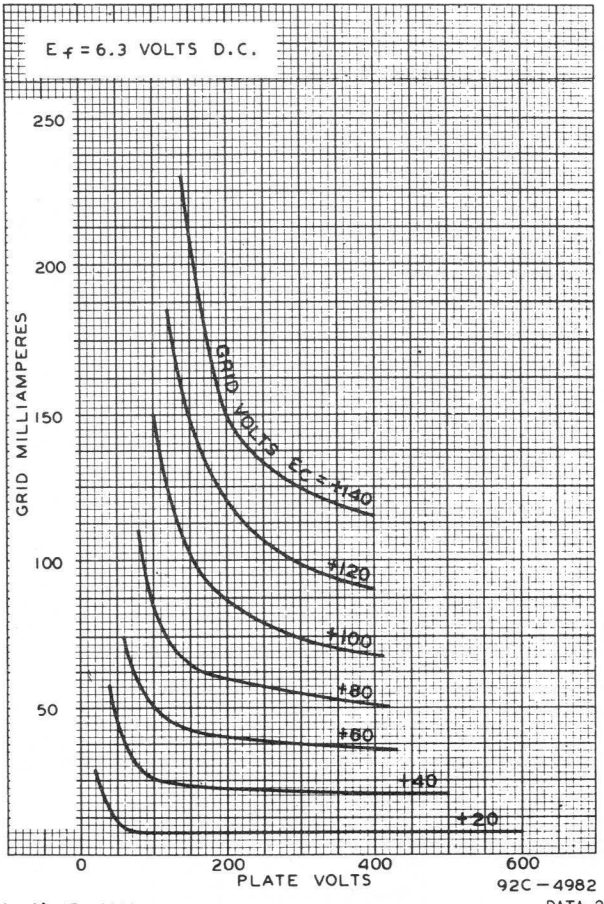
R-F POWER AMPLIFIER, CLASS B MODULATOR

(continued from preceding page)

Data on operating frequencies for the 1623 are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY.

OUTLINE DIMENSIONS, TUBE SYMBOL, and SOCKET CONNECTIONS for the 1623 are the same as for the 809.

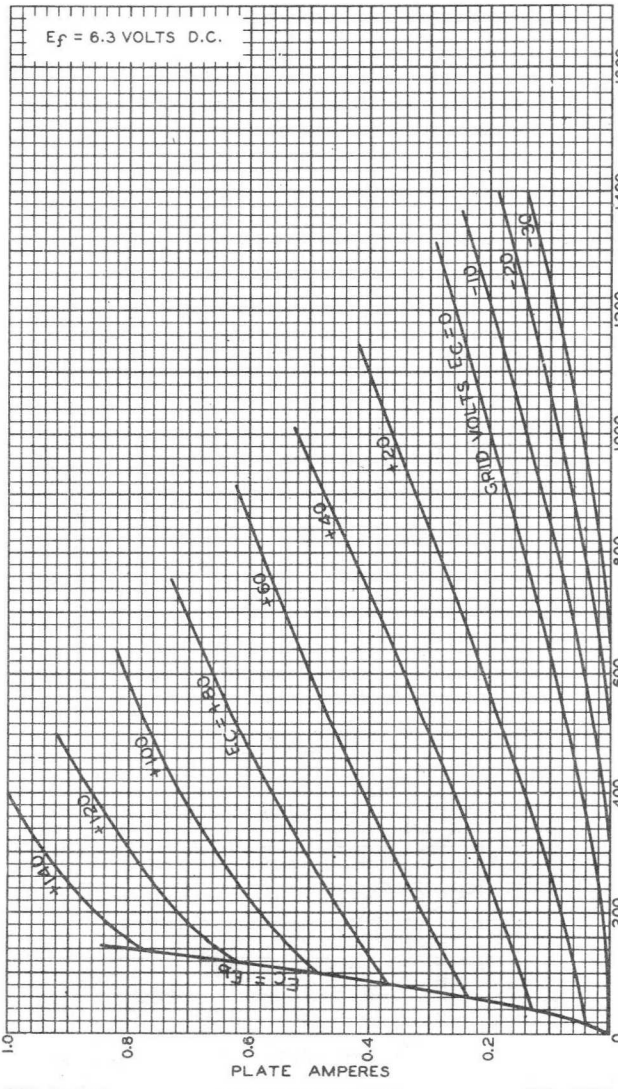
TYPICAL CHARACTERISTICS



1623

1623

AVERAGE PLATE CHARACTERISTICS



OCT. 10, 1938

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC.

92C-4980

RCA

1624

TRANSMITTING BEAM POWER AMPLIFIER

Filament	Coated		
Voltage	2.5	a-c or d-c	volts
Current	2.0		amp.
Transconductance for plate current of 50 ma.	4000 approx.		μmhos
Direct Interelectrode Capacitances:			
Grid to Plate	0.25 max.⊙		μμf
Input	11		μμf
Output	7.5		μμf
Maximum Overall Length			5-3/4"
Maximum Diameter			2-1/16"
Bulb			ST-16
Cap			Small Metal
Base			Medium 5-Pin
RCA Socket			Stock No.9920

Maximum Ratings Are Absolute Values

MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS

PUSH-PULL AMPLIFIER - Class AB_2 ††

D-C Plate Voltage	600 max.	volts
D-C Screen Voltage (Grid #2)	300 max.	volts
Max.-Sig. D-C Plate Current *	90 max.	ma.
Max.-Sig. Plate Input *	54 max.	watts
Screen Input *	3.5 max.	watts
Plate Dissipation *	25 max.	watts

Typical Operation (Fixed bias):

Unless otherwise specified, values are for 2 tubes

D-C Plate Voltage	400	600	volts
D-C Screen Voltage	300	300	volts
D-C Grid Voltage (Grid #1) □ o	-16.5	-25	volts
Peak A-F Grid-to-Grid Voltage	77	106	volts
Zero-Sig. D-C Plate Current	75	42	ma.
Max.-Sig. D-C Plate Current	150	180	ma.
Zero-Sig. D-C Screen Current	6.5	5	ma.
Max.-Sig. D-C Screen Current	11.5	15	ma.
Load Resistance (per tube)	1500	1870	ohms
Effective Load Res. (plate to plate)	6000	7500	ohms
Peak Grid Input Power	0.4	1.2	watts
Max.-Sig. Power Output **	36	72	approx.watts

* Averaged over any audio-frequency cycle of sine-wave form.

o For a-c filament supply, if d.c. is used, the stated voltages should be decreased by 1.75 volts.

□ Driver stage should be capable of supplying the grids of the class AB_2 stage with the specified peak grid voltage at low distortion. The effective resistance per grid circuit should be kept below 500 ohms and the effective impedance at the highest desired response frequency should not exceed 700 ohms.

** With zero-impedance driver and perfect regulation, plate-circuit distortion does not exceed 2%. In practice, plate-voltage regulation, screen-voltage regulation, and grid-bias regulation should not be greater than 5%, 5%, and 3%, respectively.

⊙ With external shielding.

†† See end of tabulation.

GRID-MODULATED R-F POWER AMPLIFIER - Class C Telephony

Carrier conditions per tube for use with a max. modulation fact. of 1.0

D-C Plate Voltage		600 max.	volts
D-C Screen Voltage (Grid #2)		300 max.	volts
D-C Grid Voltage (Grid #1)		-200 max.	volts
D-C Plate Current		75 max.	ma.
Plate Input		37.5 max.	watts
Screen Input		2.5 max.	watts
Plate Dissipation		25 max.	watts
Typical Operation:			
D-C Plate Voltage	400	600	volts
D-C Screen Voltage #	250	300	volts
D-C Grid Voltage +	-50	-60	volts
Peak R-F Grid Voltage	58	58	volts
Peak A-F Grid Voltage	30	30	volts
D-C Plate Current	31	40	ma.
D-C Screen Current	1.5	2.5	ma.

\# Obtained from a fixed supply or from a separate source.

\+ See end of tabulation.

→ Indicates a change

1624

TRANSMITTING BEAM POWER AMPLIFIER

(continued from preceding page)

D-C Grid Current	1.2	0	approx. ma.
Driving Power oo	0.25	0.4	approx. watt
Power Output	3.8	8	approx. watts

oo At crest of audio-frequency cycle with modulation factor of 1.0.

PLATE-MODULATED R-F POWER AMPLIFIER - Class C Telephony

Carrier conditions per tube for use with a max. modulation fact. of 1.0

D-C Plate Voltage		500 max.	volts
D-C Screen Voltage (Grid #2)		300 max.	volts
D-C Grid Voltage (Grid #1)		-200 max.	volts
D-C Plate Current		75 max.	ma.
D-C Grid Current		5 max.	ma.
Plate Input		37.5 max.	watts
Screen Input		2.5 max.	watts
Plate Dissipation		16.5 max.	watts
Typical Operation:			
D-C Plate Voltage □	325	500	volts
D-C Screen Voltage	285	275	volts
D-C Grid Voltage ★ +	-50	-50	volts
	18000	15000	ohms
Peak R-F Grid Voltage	70	80	volts
D-C Plate Current	62	75	ma.
D-C Screen Current	7.5	9	ma.
D-C Grid Current	2.8	3.3	approx. ma.
Driving Power	0.18	0.25	approx. watt
Power Output	13	24	approx. watts

□ Obtained preferably from a modulated fixed supply.

★ Obtained by grid resistor of value shown or by suitable combination of grid resistor with either fixed supply or cathode resistor.

R-F POWER AMPLIFIER & OSCILLATOR - Class C Telegraphy

Key-down conditions per tube without modulation ##

D-C Plate Voltage		600 ax.	volts
D-C Screen Voltage (Grid #2)		300 max.	volts
D-C Grid Voltage (Grid #1)		-200 max.	volts
D-C Plate Current		90 max.	ma.
D-C Grid Current		5 max.	ma.
Plate Input		54 max.	watts
Screen Input		3.5 max.	watts
Plate Dissipation		25 max.	watts
Typical Operation:			
D-C Plate Voltage	400	600	volts
D-C Screen Voltage ●	300	300	volts
D-C Grid Voltage ◇ +	-55	-60	volts
	11000 ⊕	12000 ⊕	ohms
	610 ⊕	570 ⊕	ohms
Peak R-F Grid Voltage	80	95	volts
D-C Plate Current	75	90	ma.
D-C Screen Current	10.5	10	ma.
D-C Grid Current	5	5	approx. ma.
Driving Power	0.36	0.43	approx. watt
Power Output	19.5	35	approx. watts

● Obtained preferably from a fixed supply of value shown.

◇ Obtained by grid leak(⊕) or cathode resistor (⊕) of values shown, fixed supply, or by combination methods.

Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

+ The total effective grid-circuit resistance should not exceed 25000 ohms.

†† Subscript (2) indicates that grid current flows during a part of input cycle.

← Indicates a change

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

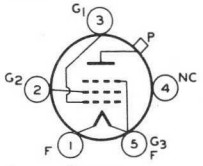
1624

TRANSMITTING BEAM POWER AMPLIFIER

OUTLINE DIMENSIONS for the 1624 are the same as those for the 807. For CURVES, refer to Type 1619.

Data on operating frequencies for the 1624 are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY. ←

BOTTOM VIEW OF
SOCKET CONNECTIONS



Pin 1 – Filament
Pin 2 – Grid No.2
Pin 3 – Grid No.1
Pin 4 – No Connection
Pin 5 – Filament –, Grid No.3
Cap – Plate

MOUNTING POSITION

VERTICAL: Base up or down.
HORIZONTAL: No.

← Indicates a change.

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

1625

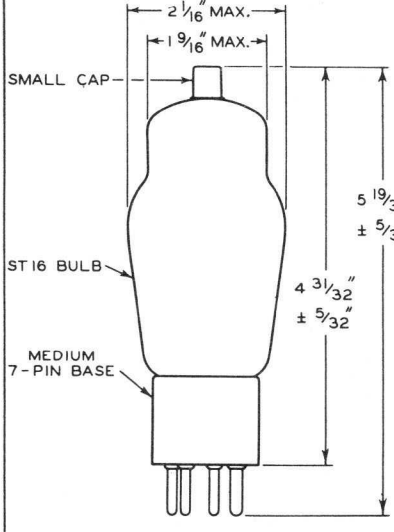
TRANSMITTING BEAM POWER AMPLIFIER

Heater	Coated Unipotential Cathode	
Voltage	12.6 (±10%)	a-c or d-c volts
Current	0.45	amp.
Transconductance for plate cur. of 72 ma.	6000 approx.	μmhos
Grid-Screen Mu-Factor	8	
Direct Interelectrode Capacitances:		
Grid to Plate (With external shielding)	0.2 max.	μμf
Input	11	μμf
Output	7	μμf
Overall Length	5-19/32" ± 5/32"	←
Seated Height	4-31/32" ± 5/32"	←
Maximum Diameter	2-1/16"	
Bulb	ST-16	
Cap	Small	
Base	Medium 7-Pin, Micanol	

Maximum Ratings Are Absolute Values

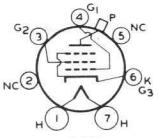
MAXIMUM CCS and ICAS RATINGS with TYPICAL OPERATING CONDITIONS

These are the same as those for Type 807 except that maximum d-c heater-cathode potential is 135 volts. Curves under the 807 also apply to the 1625.



TUBE MOUNTING POSITION
Any

BOTTOM VIEW OF SOCKET CONNECTIONS



5AZ

Pin 1 - Heater
Pin 2 - No Connection
Pin 3 - Grid No.2
Pin 4 - Grid No.1
Pin 5 - No Connection
Pin 6 - Cathode, Grid No.3
Pin 7 - Heater
Cap - Plate

← Indicates a change.

1626

TRANSMITTING TRIODE

For oscillator applications requiring unusually stable characteristics

Heater°	Coated Unipotential Cathode	
Voltage	12.6	a-c or d-c volts
Current	0.25	amp.
Amplification Factor	5	
Direct Interelectrode Capacitances:		
Grid to Plate	4.4	μμf
Grid to Cathode	3.2	μμf
Plate to Cathode	3.4	μμf
Maximum Overall Length		4-1/8"
Maximum Seated Height		3-9/16"
Maximum Diameter		1-9/16"
Bulb		ST-12
Base	Small Shell Octal 8-Pin, MICANOL*	

MAXIMUM CCS RATINGS and TYPICAL OPERATING CONDITIONS

CCS = Continuous Commercial Service

R-F POWER AMPLIFIER & OSCILLATOR - Class C Telegraphy

Key-down conditions per tube without modulation ##

D-C Plate Voltage	250 max.	volts
D-C Grid Voltage	-150 max.	volts
D-C Plate Current	25 max.	ma.
D-C Grid Current	8 max.	ma.
Plate Input	6.25 max.	watts
Plate Dissipation	5 max.	watts
Typical Operation:		
D-C Plate Voltage	250	volts
D-C Grid Voltage*	-70	volts
	14000	ohms
	2300	ohms
Peak R-F Grid Voltage	105	volts
D-C Plate Current	25	ma.
D-C Grid Current**	5 approx.	ma.
Driving Power**	0.5 approx.	watt
Power Output	4 approx.	watts

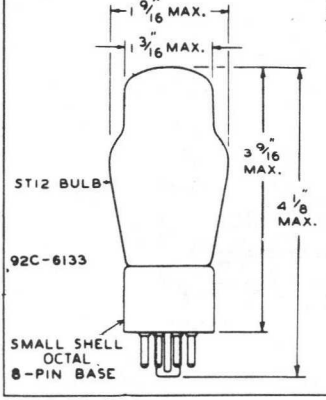
° In circuits where the cathode is not directly connected to the heater, the potential difference between heater and cathode should be kept as low as possible.

Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

* Obtained from fixed supply (-70), by grid resistor (14000), or cathode resistor (233), or by combination methods. When the 1626 is used in the final amplifier or a preceding stage of a transmitter designed for break-in operation and oscillator keying, a small amount of fixed bias must be used to maintain the plate current at a low value. With plate volts of 250, a fixed bias of at least -35 volts must be used.

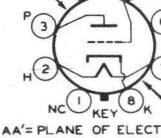
** Subject to wide variations as explained on sheet TRANS. TUBE RATINGS.

* Registered trademark.



Data on operating frequencies for the 1626 are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY.

BOTTOM VIEW OF SOCKET CONNECTIONS



AA' = PLANE OF ELECTRODES

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

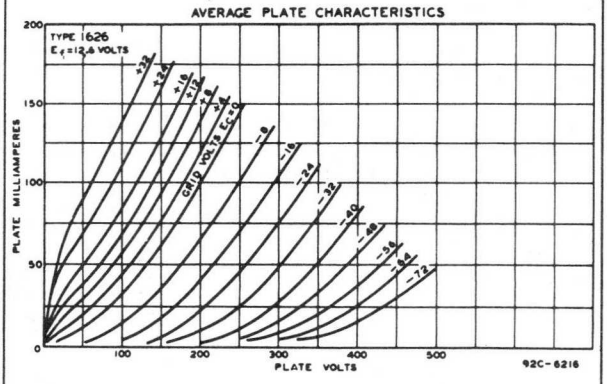
TUBE MOUNTING POSITION

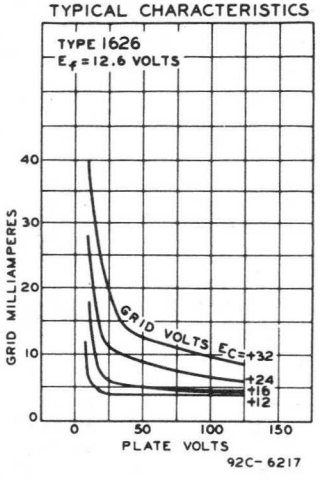
VERTICAL or HORIZONTAL

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC.

1626

1626
TRANSMITTING TRIODE





RCA

1850-A

ICONOSCOPE

FOR PICKUP FROM MOTION-PICTURE FILM OR SLIDES

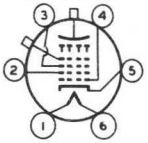
DATA

General:

Heater, for Unipotential Cathode:		
Voltage	6.3 ± 10%	ac or dc volts
Current	0.6	amp
Direct Interelectrode Capacitances (Approx.):		
Grid No.1 to All Other Electrodes	6.5	μμf
Signal Electrode to Grid No.4[o]	10	μμf
Mosaic, Photosensitive:		
Response		See Curve
Useful Size of Rectangular Image (4 x 3 Aspect Ratio)	5.75" max. diagonal	←
Focusing Method		Electrostatic
Deflection Method		Magnetic
Deflection Angle (Approx.)		55° ←
Max. Width of Mounted Tube		8-1/8"
Height of Mounted Tube		10-3/16" ± 3/4"
Depth of Mounted Tube		12-13/16" ± 3/4"
Mounting Position		Mosaic in vertical plane
Minimum Deflecting-Coil Inside Diameter		1-1/2" ←
Maximum Deflecting-Coil Length		2-1/4" ←
Caps (Two)		Medium (JETEC No.C1-5)
Base		Long Medium-Shell Small 6-Pin

BOTTOM VIEW

Pin 1 – Heater
Pin 2 – Grid No.2
Pin 3 – Grid No.3
Pin 4 – Grid No.1
Pin 5 – Cathode
Pin 6 – Heater



Caps { See Outline Drawing
S_J – Signal Electrode
G_4 – Grid No.4 (Collector)

DIRECTION OF LIGHT IS NORMAL TO MOSAIC

Maximum Ratings, *Absolute Values*:

AVERAGE MOSAIC ILLUMINATION•	50	max.	ft-c ←
OPERATING TEMPERATURE OF BULB AT LARGE END OF TUBE	40	max.	°C ←
SIGNAL-ELECTRODE VOLTAGE	1200	max.	volts
GRID-No.4 (COLLECTOR) VOLTAGE	1200	max.	volts
GRID-No.3 VOLTAGE	450	max.	volts
GRID-No.2 VOLTAGE	1200	max.	volts
GRID-No.1 VOLTAGE:			
Negative bias value	125	max.	volts
Positive bias value	0	max.	volts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	125	max.	volts
Heater positive with respect to cathode	10	max.	volts
GRID-No.4 CURRENT	0.5	max.	μamp

[o] With external shield.

• Averaged over any interval of 1 sec. max.

← Indicates a change.

1850-A
ICONOSCOPE

Typical Operation and Characteristics:

Signal-Electrode Voltage	1000	volts
Grid-No.4 Voltage	1000	volts
Grid-No.3 Voltage (Beam Focus)— 24% to 36% of Grid-No.4 Voltage	240 to 360	volts
Grid-No.2 Voltage	1000	volts
→ Max. Grid-No.1 Voltage for Pattern Cutoff— 7% of Grid-No.4 Voltage	−70	volts
→ Grid-No.4 Current (With no illumination on mosaic)*	0.1 to 0.2	μamp
External Load Resistance	0.1	megohm
→ Illumination on Mosaic:		
Steady Highlight Value for Slides	4 to 6	ft-c
Average Pulsed Highlight Value for Motion-Picture Film	10 to 20	ft-c
→ Ratio of Peak-to-Peak Highlight Video-Signal Current to RMS Noise Current (Approx.)	100	
→ Minimum Peak-to-Peak Blanking Voltage	20	volts
→ Deflecting-Coil Current (Approx.):**		
Horizontal (Peak to peak)	600	ma
Vertical (Peak to peak)	140	ma

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.0 max.	megohm

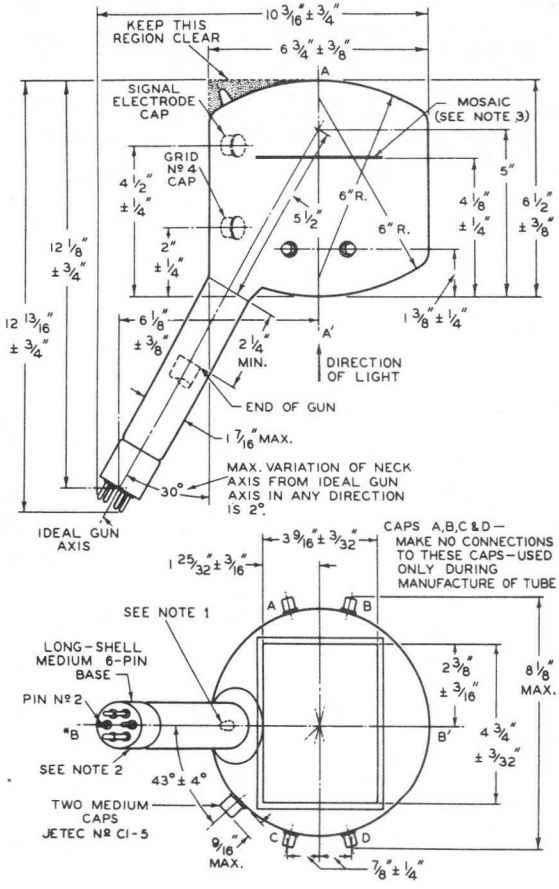
* Allowance should be made for leakage currents.

** For RCA Deflecting Yoke No.201D76.

→ Indicates a change.

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

1850-A
ICONOSCOPE



* BB' IS THE PLANE THROUGH THE BULB AXIS AA' AND THE IDEAL GUN AXIS.

← Indicates a change.

1850-A

ICONOSCOPE

NOTE 1: VARIATION OF TIP CENTER FROM PLANE BB' IS 1/2".

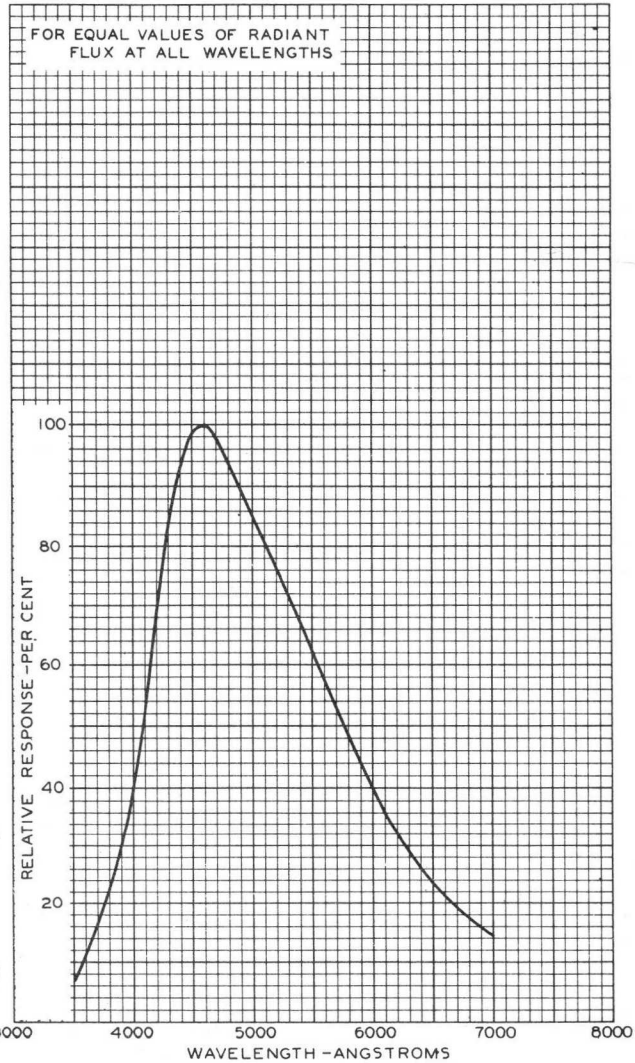
NOTE 2: MAXIMUM ROTATION OF LINE THROUGH PINS 2 AND 5 ABOUT IDEAL GUN AXIS IS ± 10°, MEASURED FROM PLANE BB'.

NOTE 3: DEVIATION OF PLANE OF MOSAIC FROM PLANE PERPENDICULAR TO THE BULB AXIS AA' IS 2.5° MAX. ROTATION OF MOSAIC ABOUT THE BULB AXIS AA' WITH RESPECT TO A LINE OF INTERSECTION FORMED BY MOSAIC PLANE AND PLANE BB' IS 2.5° MAX.

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

1850-A

SPECTRAL SENSITIVITY CHARACTERISTIC



JUNE 18, 1951

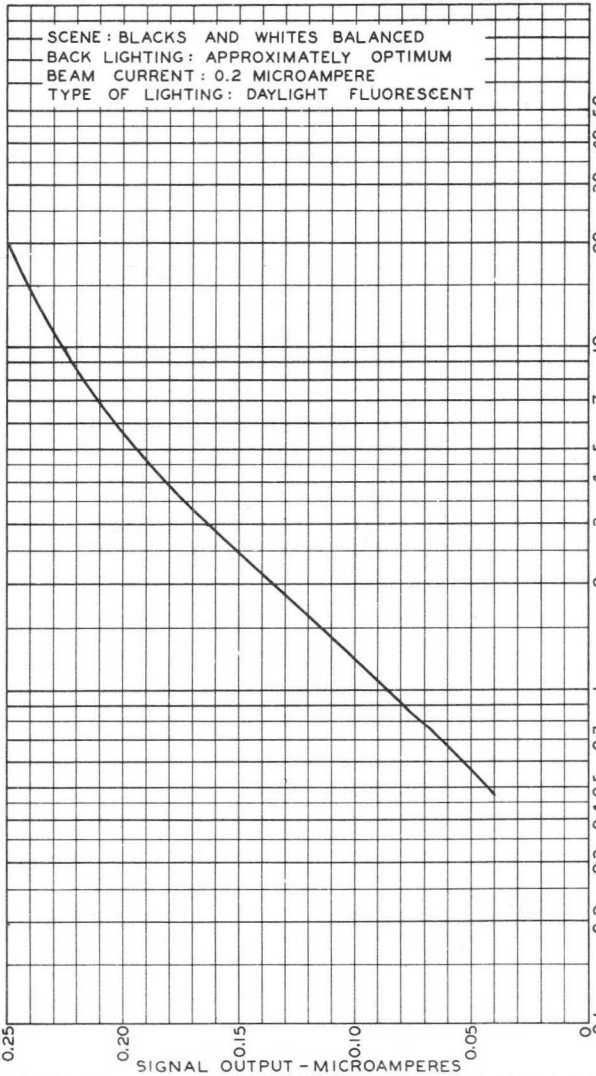
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6404RI

1850-A

1850-A

TYPICAL SIGNAL-OUTPUT CHARACTERISTIC



JAN. 2, 1951

TUBE DEPARTMENT

92CM-6581RI

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

1945

1945
VACUUM-GAUGE TUBE

HYDROGEN-SENSITIVE, IONIZATION TYPE

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:

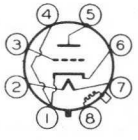
Voltage	6.3 ± 10%	ac or dc volts
Current	0.75	amp

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.

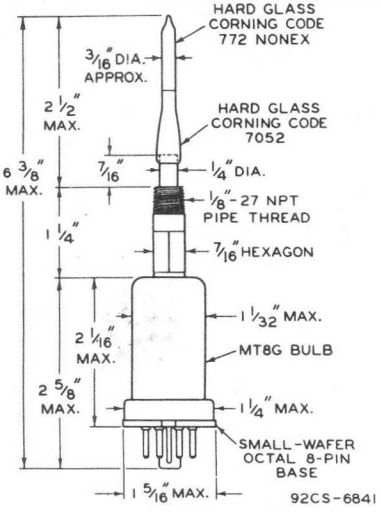
Suitable support should be provided for the 1945. In a glass system, it should be supported by a suitable clamp encircling the metal shell. The clamp should be lined with an asbestos pad so that the clamp does not place a strain on the welds. In a metal system, the 1945 can usually be supported by the pipe coupling.

For safety reasons, it is advisable to have the metal shell of the 1945 at ground potential (positive polarity).

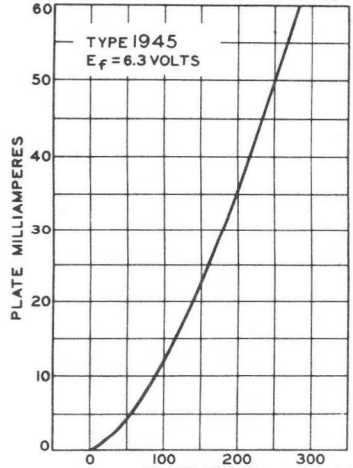
RCA

1945

VACUUM-GAUGE TUBE



AVERAGE PLATE CHARACTERISTIC



1950

VACUUM-GAUGE TUBE

SOFT-GLASS BULB, IONIZATION TYPE

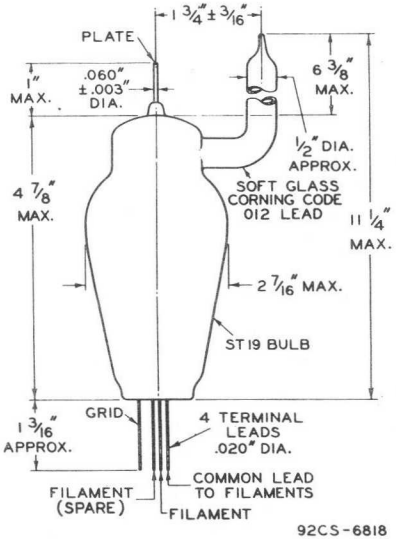
DATA

General:

Filament, Tungsten:*	
Voltage (Approx.)	5 ac or dc volts
Current (Approx.)	3.5 amp
Maximum Tube Length (Including tubulation)	11-1/4"
Maximum Tube Radius	2-3/16"
Maximum Bulb Length	4-7/8"
Maximum Bulb Diameter	2-7/16"
Bulb	ST-19
Tubulation	1/2" Diameter Soft Glass, Corning Code 012 Lead
Operating Position	Vertical, with tubulation up or down; Horizontal with stem press in vertical plane
Terminal Arrangement	See Outline Drawing

* The 1950 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.

Maximum Ratings, Typical Degassing Conditions, Typical Operation, Calibration and Terminal Lead Connections for the 1950 are the same as for the 1949.



2048A

Vidicon

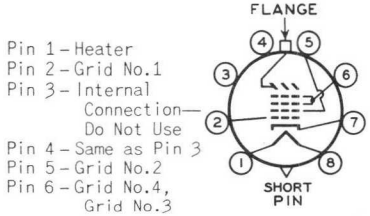
LOW-POWER (0.6-WATT) HEATER 600-TO-900-LINE RESOLUTION

For Use Under Severe Shock and Vibration, High Humidity, and at Altitudes up to 50,000 Feet

DATA

General:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.095	amp
Direct Interelectrode Capacitance:[a]		
Target to all other electrodes	3	μμf
Spectral Response	See *Curve*	
Photoconductive Layer:		
Maximum useful diagonal of rectangular image (4 x 3 aspect ratio)	0.62"	
Orientation of quality rectangle—Proper orientation is obtained when the horizontal scan is essentially parallel to the plane passing through the tube axis and short index pin.		
Focusing Method	Magnetic	
Deflection Method	Magnetic	
Overall Length	5.154" ± 0.06"	
Greatest Diameter (Excluding target-flange contact)	1.125" ± 0.010"	
Weight (Approx.)	2 oz	
Operating Position	Any	
Bulb	T8	
Socket	Cinch No.54A18088[b], or equivalent	
Base	Small-Button Ditetrar 8-Pin (JEDEC No.E8-11)	
Basing Designation for BOTTOM VIEW	8HM	



Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Internal Connection—Do Not Use
Pin 4 – Same as Pin 3
Pin 5 – Grid No.2
Pin 6 – Grid No.4, Grid No.3
Pin 7 – Cathode
Pin 8 – Heater
Flange – Target
Short Pin – Same as Pin 3

DIRECTION OF LIGHT: INTO FACE END OF TUBE

Maximum Ratings, *Absolute-Maximum Values:*

For altitudes up to 50,000 feet and scanned area of 1/2" x 3/8"

GRID-No.3 & GRID-No.4 VOLTAGE	750 max.	volts
GRID-No.2 VOLTAGE	750 max.	volts

GRID-No.1 VOLTAGE:		
Negative-bias value	300 max.	volts
Positive-bias value	0 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	10 max.	volts
TARGET VOLTAGE	100 max.	volts
DARK CURRENT	0.25 max.	μa
PEAK TARGET CURRENT[c]	0.55 max.	μa
FACEPLATE:		
Illumination	1000 max.	fc
Temperature	71 max.	°C

Typical Operation:

For scanned area of 1/2" x 3/8" and faceplate temperature of 30° to 35° C

Grid-No.4 (Decelerator) & Grid-No.3 (Beam-Focus-Electrode[d]) Voltage	250[e] to 300	volts
Grid-No.2 (Accelerator) Voltage	300	volts
Grid-No.1 Voltage for picture cutoff[f]	-45 to -100	volts
Average "Gamma" of Transfer Characteristic for signal-output current between 0.02 μa and 0.2 μa	0.57	
Visual Equivalent Signal-to-Noise Ratio (Approx.)[g]	300:1	
Lag (Per cent of initial value of signal-output current 1/20 second after illumination is removed) for initial signal-output current of 0.2 μa, dark current of 0.02 μa:		
Typical	15	%
Maximum	20	%
Minimum Peak-to-Peak Blanking Voltage:		
When applied to grid No.1	75	volts
When applied to cathode	20	volts
Field Strength at center of focusing coil (Approx.)	40	gausses
Field Strength of Adjustable Alignment Coil[h]	0 to 4	gausses

Maximum-sensitivity operation—0.1 footcandle on faceplate

Faceplate Illumination (Highlight)	0.1	fc
Target Voltage[j,k]	35 to 70	volts
Dark Current[m]	0.2	μa
Signal-Output Current:[n]		
Typical	0.14	μa

Intermediate-sensitivity operation—0.5 footcandle on faceplate

Faceplate Illumination (Highlight)	0.5	fc
Target Voltage[j,k]	30 to 60	volts
Dark Current[m]	0.1	μa
Signal-Output Current:[n]		
Typical	0.27	μa

Average-sensitivity operation—1 footcandle on faceplate

Faceplate Illumination (Highlight)	1	fc
Target Voltage[j,k]	20 to 40	volts
Dark Current[m]	0.02	μa
Signal-Output Current:[n]		
Typical	0.2	μa
Minimum	0.15	μa

[a] This capacitance, which effectively is the output impedance of the 2048A, is increased when the tube is mounted in the deflecting-yoke and focusing-coil assembly. The resistive component of the output impedance is in order of 100 megohms.

[b] Cinch Manufacturing Corporation, 1026 South Homan Avenue, Chicago 24, Illinois.

[c] Video amplifiers must be designed properly to handle target currents of this magnitude to avoid amplifier overload or picture distortion.

[d] Beam focus is obtained by combined effect of grid-No.3 voltage which should be adjustable over indicated range, and a focusing coil having and average field strength of 40 gausses.

[e] Definition, focus uniformity, and picture quality decrease with decreasing grid-No.4 and grid-No.3 voltage. In general, grid No.4 and grid No.3 should be operated above 250 volts.

[f] With no blanking voltage on grid No.1.

[g] Measured with high-gain, low-noise, cascode-input-type amplifier having bandwidth of 5 Mc and a peak signal-output current of 0.35 microampere. Because the noise in such a system is predominately of the high-frequency type, the visual equivalent signal-to-noise ratio is taken as the ratio of the highlight video-signal current to rms noise current, multiplied by a factor of 3.

[h] The alignment coil should be located on the tube so that its center is at a distance of 3-11/16 inches from the face of the tube, and be positioned so that its axis is coincident with the axis of the tube, the deflecting yoke, and the focusing coil.

[j] Indicated range for each type of service serves only to illustrate the operating target-voltage range normally encountered.

[k] The target voltage for each 2048A must be adjusted to that value which gives the desired operating dark current.

[m] The deflecting circuits must provide extremely linear scanning for good black-level reproduction. Dark-current signal is proportional to the scanning velocity. Any change in scanning velocity produces a black-level error in direct proportion to the change in scanning velocity.

[n] Defined as the component of the highlight target current after the dark-current component has been subtracted.

SPECIAL PERFORMANCE DATA

In connection with the following tests, sample 2048A's will maintain resolution as determined with a RETMA Resolution Chart, or equivalent.

Vibration Tests:

These tests are performed under conditions for *Average-Sensitivity Operation* on a sample lot of tubes from each production run. Tubes and their associated components[p] are vibrated on apparatus providing dynamic conditions similar to those described in MIL-E-5272B[r], paragraph 4.7.1.

Resonance. Tubes and associated components[p] are vibrated (per the method of MIL-E-5272B[r], paragraph 4.7.1) for 1 hour at +25° C, for 15 minutes at 0° C, and for 15 minutes at +55° C.

Cycling. Tubes and associated components[p] are vibrated (per the method of MIL-E-5272B[r], paragraph 4.7.1.2 pertaining

to specimen without vibration isolators) for 1 hour at +25° C, for 15 minutes at 0° C, and for 15 minutes at +55° C.

Temperature-Pressure (Altitude) Tests:

Tubes and associated components[p] are subjected (per the method of MIL-E-5400[s], paragraph 3.2.20, 3.2.20.1, and 3.2.20.1.1) to the separate and combined effects of varying temperature 0° to +55° C and varying barometric pressure 30 to 3.4 inches of mercury. The pressures correspond to sea level and to an altitude of 50,000 feet, respectively.

Shock Tests:

These tests are performed with no voltages applied and on a sample lot of tubes from each production run. Tubes and their associated components[p] are subjected in these tests (per MIL-E-5400[s], paragraph 3.2.21.2.1) to 18 impact shocks of 15 g consisting of 3 shocks in opposite directions along each of three mutually perpendicular axes of the tube. Each shock impulse has a duration of 11 ± 1 milliseconds with a maximum impact acceleration occurring at approximately 5.5 milliseconds. Tube mounting accessories assure the rigid fastening of the tube to the shock-test apparatus.

Temperature-Humidity Tests:

These tests are performed with no voltages applied to the 2048A. The 2048A and associated components[p] are subjected (per the method of MIL-E-5400[s], paragraph 3.2.20.2B) to relative humidities up to and including 95 per cent at temperatures up to and including +50° C.

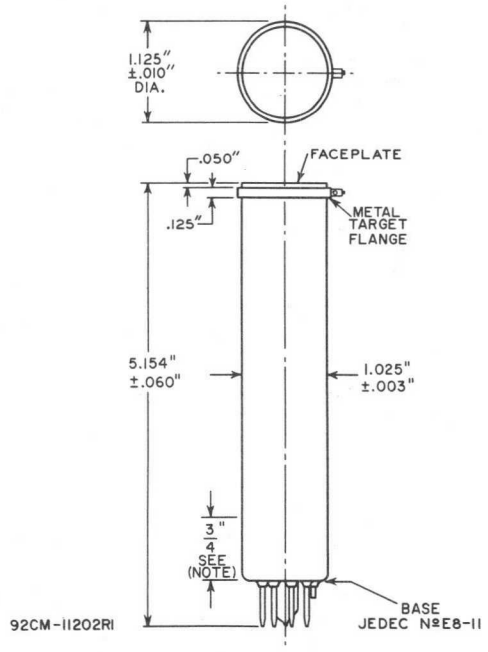
[p] Tube socket such as Cinch No.54A18088 and RCA Assembly No.8447880, or equivalent, which consists of the deflecting coils, focusing coil, alignment coil, shield, and target connector. This assembly is available from RCA Defense Electronic Products, Equipment Maintenance and Support, Building 7-5, Camden, New Jersey.

[r] 5 June 1957, Procedure I of Military Specifications.

[s] 1 January 1956.

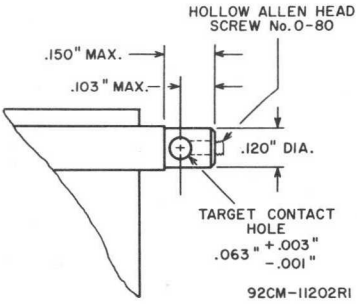
OPERATING CONSIDERATIONS

Support for the 2048A should be provided such that, under vibration and shock, the tube will not be displaced with respect to the focusing, deflecting, and alignment fields. Suitable support is provided for the tube and its socket in the RCA Deflection Assembly 8447880, or equivalent. Orientation of the 2048A in its support should be such that the horizontal scan is essentially parallel to the plane passing through the tube axis and short index pin.

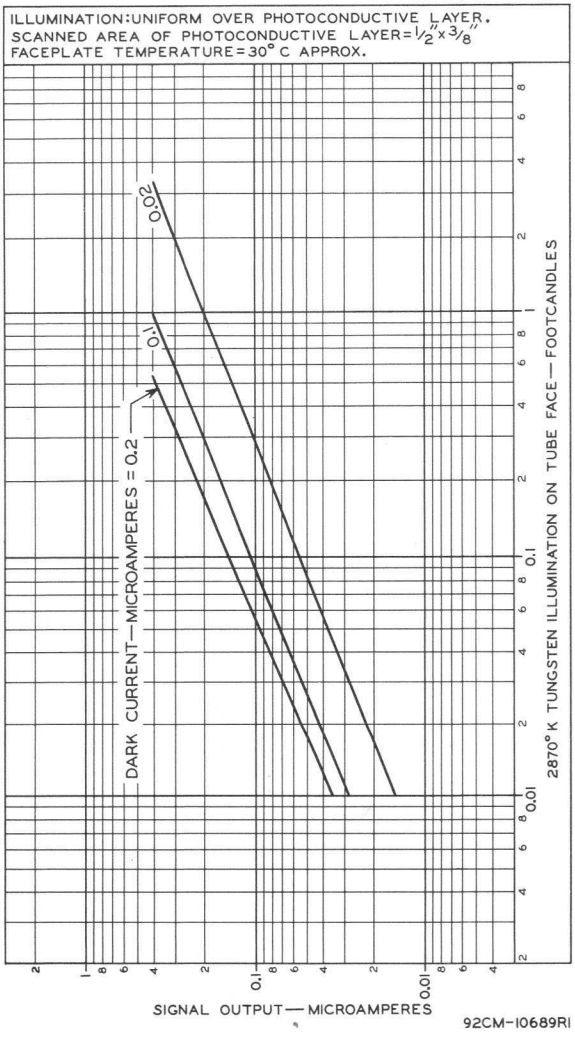


NOTE: WITHIN THIS DISTANCE, DIAMETER OF BULB IS 1.025" + 0.010" - 0.030".

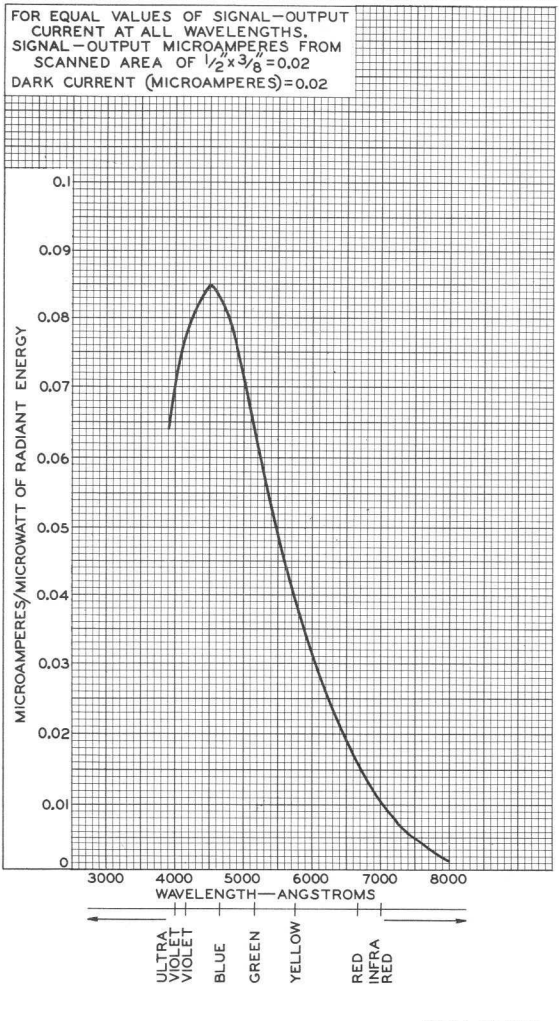
DETAIL OF TARGET-FLANGE CONTACT



TYPICAL LIGHT-TRANSFER CHARACTERISTICS



TYPICAL SPECTRAL-SENSITIVITY CHARACTERISTIC



92CM-10698RI

Display-Storage Tube

"RUGGEDIZED" TYPE
ONE WRITING GUN
ONE VIEWING GUN

5" - DIAMETER BULB
308" - DIAMETER DISPLAY
INTEGRAL MAGNETIC SHIELD

For Military and Commercial Information-Handling Displays Where Tube May Be Subjected to Severe Environmental Conditions

DATA

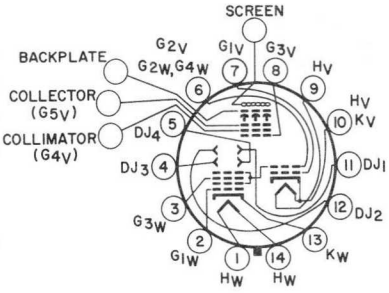
General:

	Writing Section	*Viewing Section*	
Heater, for Unipotential Cathode:			
Voltage (AC or DC)	6.3 ± 5%	6.3 ± 5%	volts
Current at 6.3 volts	0.6	0.6	amp
Cathode Heating Time (Minimum) before other electrode voltages are applied	–	60	sec
Direct Interelectrode Capacitances:			
Grid No.1 to all other electrodes	6.5	11	pf
Cathode to all other electrodes	5.5	8	pf
Backplate to all other electrodes	116		pf
Deflecting electrode DJ1 to deflecting electrode DJ2	1.9		pf
Deflecting electrode DJ3 to deflecting electrode DJ4	2		pf
DJ1 to all other electrodes	6		pf
DJ2 to all other electrodes	7		pf
DJ3 to all other electrodes	5		pf
DJ4 to all other electrodes	4.8		pf

Focusing Method . . . . . Electrostatic
Deflection Method . . . . . Electrostatic
Deflecting-Electrode Arrangement . . . . . See *Dimensional Outline*
Phosphor . . . . . P20, Aluminized
Minimum Useful Viewing Diameter[a] . . . . . 3.8"
Maximum Overall Length (Excluding encapsulated screen lead) . . . . . 13.64"
Maximum Seated Length . . . . . 12.89"
Maximum Diameter (Excluding encapsulated screen lead) . . . . . 5.562"
Operating Position . . . . . Any
Weight (Approx.) . . . . . 5-1/2 lbs
Base . . . . . Medium-Shell Diheptal 14-Pin (JEDEC Group 5, No.B14-38)

2053

BOTTOM VIEW



Pin 1 – Heater of the writing gun
Pin 2 – Grid No.1 of the writing gun
Pin 3 – Grid No.3 of the writing gun
Pin 4 – Deflecting electrode DJ3 of the writing gun
Pin 5 – Deflecting electrode DJ4 of the writing gun
Pin 6 – Grid No.2 of the viewing gun, Grid No.2 and Grid No.4 of the writing gun
Pin 7 – Grid No.1 of the viewing gun
Pin 8 – Grid No.3 of the viewing gun
Pin 9 – Heater of the viewing gun
Pin 10 – Heater and cathode of the viewing gun
Pin 11 – Deflecting electrode DJ1 of the writing gun
Pin 12 – Deflecting electrode DJ2 of the writing gun
Pin 13 – Cathode of the writing gun
Pin 14 – Heater of the writing gun

Leads:
At tube base—
Collector (Grid No.5 of viewing gun)—red wire
Collimator (Grid No.4 of viewing gun)—green wire
Backplate—violet wire
Encapsulated Lead: Screen Connector

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

All voltages are shown with respect to the cathode of the viewing gun unless otherwise specified.

	Minimum	*Maximum*	
Screen Voltage:			
Peak	0	11000	volts
DC	0	10500	volts
Backplate Voltage:			
Peak	0	15	volts
DC	-30	10	volts
Collector (Viewing-Grid-No.5) Voltage	130	170	volts

	Minimum	*Maximum*	
Collimator (Viewing-Grid No.4) Voltage	0	100	volts
Viewing-Grid-No.3 Voltage	10	50	volts
Viewing-Grid-No.2, Writing-Grid-No.4, and Writing-Grid-No.2 Voltage[b]	115	135	volts
Viewing-Grid-No.1 Voltage	-200	0	volts
Viewing-Gun Heater-to-Cathode Voltage	-125	125	volts
Magnetic-Shield Voltage[q]	-200	200	volts
Writing-Grid-No.4, Writing-Grid-No.2-to-any Deflecting Electrode Voltage[b]	-500	500	volts
Writing-Grid-No.3 Voltage[c]	0	1200	volts
Writing-Grid-No.1 Voltage[c]	-200	e	volts
Writing-Gun Cathode Voltage	-2750	145	volts
Writing-Gun Heater-to-Cathode Voltage	-125	125	volts
Series Current-Limiting Resistor (Unbypassed) in Screen Circuit.	1	-	megohm
Series Current-Limiting Resistor (Unbypassed) in Collector (Viewing-Grid-No.5) Circuit	0.005	-	megohm

Recommended Operating Values:

All voltages are shown with respect to the cathode of the viewing gun unless otherwise specified.

Screen Voltage	10000	volts
Backplate Voltage	2	volts
Collector (Viewing-Grid-No.5) Voltage	150	volts
Collimator (Viewing-Grid-No.4) Voltage[e]	20 to 90	volts
Viewing-Grid-No.3 Voltage[e]	10 to 40	volts
Viewing-Grid-No.2 Voltage[b]	125	volts
Viewing-Grid-No.1 Voltage[e]	-60 to 0	volts
Viewing-Gun Cathode	At ground potential	
Magnetic Shield[f]	At ground potential	
Writing-Grid-No.3 Voltage[g]	-1650 to -1250	volts
Writing-Grid-No.1 Voltage	d,h	volts
Writing-Gun Cathode	-2000	volts
Average Deflecting Plate Voltage.	112	volts
Circuit Values:		
Grid-No.1 Circuit Resistance (either gun)	1 max.	megohm
Resistance in any Deflecting Electrode Circuit[j]	0.01 max.	megohm
Backplate-Circuit Resistance.	0.005 max.	megohm
Series Current-Limiting Resistor (Unbypassed) in Screen Circuit.	1	megohm
Series Current-Limiting Resistor (Unbypassed) in Collector (Viewing Grid-No.5) Circuit	0.005	megohm

Performance Data and Characteristics:

	Min.	*Typ.*	*Max.*	
Useful Viewing Diameter[a]	3.8	–	–	inches
Luminance (Brightness)[k]	1000	1900	–	footlamberts
Viewing Duration[m]	20	–	–	seconds
Erasing Time[m]	8	–	50	milliseconds
Undeflected Spot Position[n]	–	–	10	millimeters
Deflection Factors:				
DJ1 & DJ2	72	81	90	volts/inch
DJ3 & DJ4	70	82	90	volts/inch

Environmental Tests:

The 2053 is designed to withstand the following environmental tests:

Vibration parallel to each of the three orthogonal axes and as specified in the schedule below. Two concurrent survey cycles each having a duration of 15 minutes are taken for each axis. The frequency is first changed from 5 to 54 and back to 5 cycles per second and then from 54 to 500 and back to 54 cycles per second. The frequencies of all resonant points are noted.

Double Amplitude in inches	Acceleration in g's	Frequency in cps	Sweep Duration in minutes (Approx.)
0.080	–	5 to 54	7.5
0.080	–	54 to 5	7.5
–	8	54 to 80	1.5
–	2	80 to 500	6.0
–	2	500 to 80	6.0
–	8	80 to 54	1.5

Resonance for one minute at the resonant point determined in *Vibration* for which resonance is most severe. If no resonant points are observed in *Vibration*, the 2053 is vibrated for one minute at a frequency of 50 cycles per second.

Shock — Non-Destructive consisting of three impact shocks in both directions of the three orthogonal axes. Each impact shock has a peak acceleration of 15 g's and a time duration of 11 milliseconds.

Shock — Destructive consisting of three impact shocks in both directions of the three orthogonal axes. Each impact shock has a peak acceleration of 30 g's and a time duration of 11 milliseconds. Following this destructive shock test, the tube need not be operable and any degree of internal destruction is permissible. However, no destruction or cracking of the tube faceplate is permitted and all internal parts must remain within the magnetic shield.

Fatigue consisting of vibration for 32 hours in each of the three orthogonal axes. A vibration frequency of 25 cps is employed with an amplitude of 0.040" (total excursion 0.080"). Each tube is vibrated for a total of 96 hours.

a The minimum useful viewing area may not be concentric with respect to the tube face.

b Grids No.4 and No.2 of Writing Gun and grid No.2 of Viewing Gun are connected within the tube.

c Voltages are shown with respect to cathode of Writing Gun.

d The writing-gun grid No.1 should never be more positive than necessary to write the display to saturated brightness for a given scanning and drive condition. In no case should the writing-gun grid No.1 voltage have a value greater than zero with respect to the writing-gun cathode.

e Adjusted for brightest, most uniform, full-size pattern.

f The integral magnetic shield should be grounded to eliminate shock hazard.

g Adjusted for the smallest, most circular spot.

h The bias-voltage value for writing-beam cutoff is between -54 and -92 volts with respect to writing-gun cathode.

j Recommended value for minimum distortion because of viewing-beam collection by the deflecting plates. Where strict display accuracy and display uniformity are not required, the resistance value for any deflecting-electrode circuit may be as high as 0.1 megohm maximum. For optimum performance, it is recommended that the deflecting electrode-circuit impedances be approximately equal.

k Luminance (Brightness) is measured after the entire display is written to saturated brightness, the writing gun has been turned off, and with no erasing pulse applied.

m The time required for any 1.5-inch diameter area of the useful 3.8-inch diameter viewing area to spontaneously rise (with no writing or erasing) from zero brightness (viewing-beam cutoff) to 10% of saturated brightness.

n Apply a single pulse having an amplitude of 9 volts to the backplate. Erasing time is defined as the shortest duration of such a pulse that will completely erase a full 3.8-inch diameter area display.

p The undeflected spot position must fall within a circle having a 5/16-inch radius (maximum), 0.2-inch from the geometric center of the tube face, on the radius passing through the center of the screen terminal.

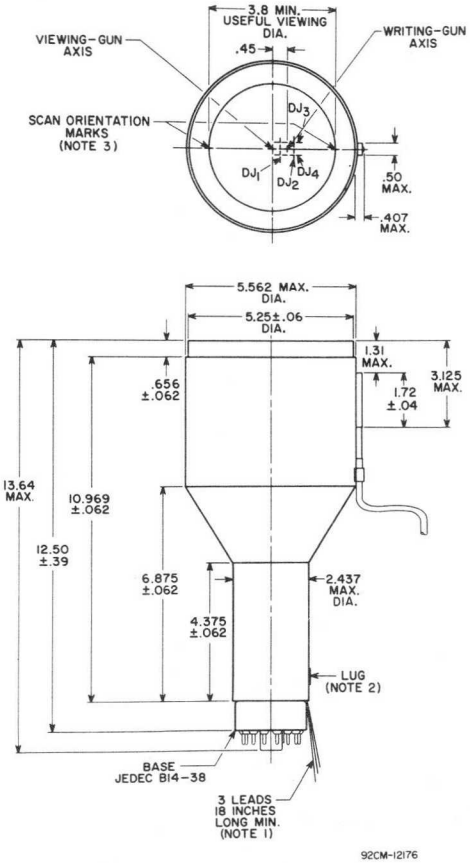
q The magnetic shield is normally connected to the viewing-gun cathode which is at ground potential.

OPERATING CONSIDERATIONS

To prevent possible damage to the tube, allow the viewing-gun beam current to reach normal operating value before turning on the writing-gun beam current, and keep the viewing beam on till the writing beam is turned off.

FOR ADDITIONAL INFORMATION ON THIS TYPE, WRITE FOR TECHNICAL BULLETIN AND PUBLICATION ICE-277, "RCA DISPLAY-STORAGE TUBES" AVAILABLE FROM:

Commercial Engineering
Electronic Components and Devices
Radio Corporation of America
Harrison, New Jersey



DIMENSIONS IN INCHES

NOTE 1: RED LEAD IS FOR CONNECTION TO COLLECTOR (VIEWING GRID No.5); GREEN LEAD IS FOR CONNECTION TO COLLIMATOR (VIEWING GRID No.4); VIOLET LEAD IS FOR CONNECTION TO BACKPLATE.

NOTE 2: SOLDER LUG FOR GROUNDING MAGNETIC SHIELD.

NOTE 3: SCAN ORIENTATION MARKS ARE PARALLEL TO TRACE PRODUCED BY DEFLECTING PLATES DJ1 AND DJ2.

Photomultiplier Tube

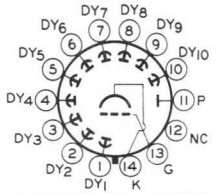
10-STAGE, HEAD-ON, FLAT-FACEPLATE TYPE HAVING VENETIAN-BLIND-TYPE DYNODE STRUCTURE, 2.59-INCH MINIMUM-DIAMETER, FLAT, CIRCULAR, SEMITRANSPARENT PHOTOCATHODE AND S-11 RESPONSE

For Use in Scintillation Counting Applications

The **2064** *is identical to type* **8054** *in all respects except that it is supplied with a medium-shell diheptal base attached to flexible leads to facilitate testing. After testing, the attached base should be removed prior to installing the* **2064** *in a given system.*

BASING DIAGRAM (Bottom View)
With Base Attached

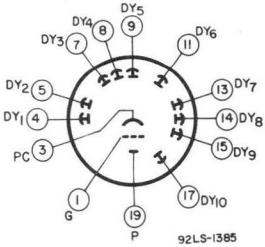
Pin 1 – Dynode No.1
Pin 2 – Dynode No.2
Pin 3 – Dynode No.3
Pin 4 – Dynode No.4
Pin 5 – Dynode No.5
Pin 6 – Dynode No.6
Pin 7 – Dynode No.7
Pin 8 – Dynode No.8
Pin 9 – Dynode No.9
Pin 10 – Dynode No.10
Pin 11 – Anode
Pin 12 – No Connection
Pin 13 – Focusing Electrode
Pin 14 – Photocathode



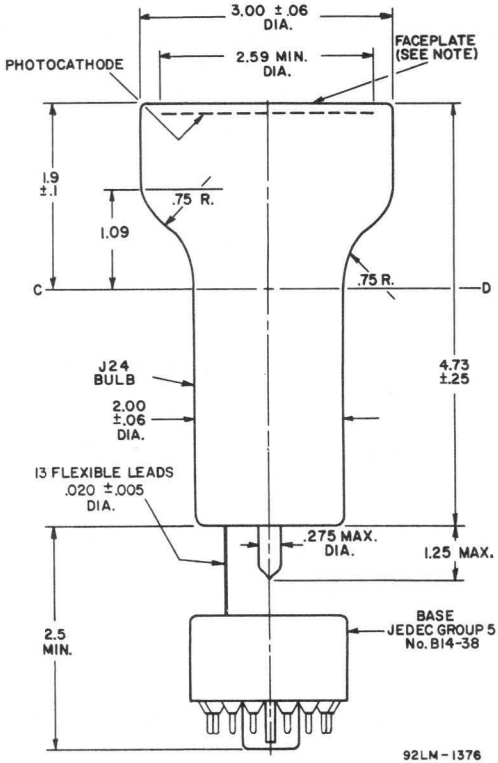
DIRECTION OF RADIATION:
INTO END OF BULB

TERMINAL CONNECTIONS (Bottom View)
With Base Removed

Lead 1 – Focusing Electrode
Lead 3 – Photocathode
Lead 4 – Dynode No.1
Lead 5 – Dynode No.2
Lead 7 – Dynode No.3
Lead 8 – Dynode No.4
Lead 9 – Dynode No.5
Lead 11 – Dynode No.6
Lead 13 – Dynode No.7
Lead 14 – Dynode No.8
Lead 15 – Dynode No.9
Lead 17 – Dynode No.10
Lead 19 – Anode



DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

Note: Within 2.59-inch diameter, deviation from flatness of external surface of faceplate will not exceed 0.010 inch from peak to valley.

Image Orthicon

MAGNETIC FOCUS **MAGNETIC DEFLECTION**

For Low-Light-Level Color Pickup. The 4401 is Unilaterally Interchangeable with Types 5820, 6474, and 7513.

DATA

General:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.6	amp
Direct Interelectrode Capacitance:		
Anode to all other electrodes	12	μμf
Spectral Response		S-10
Wavelength of Maximum Response	4500 ± 300	angstroms
Photocathode, Semitransparent:		
Rectangular image (4 x 3 aspect ratio):		
Useful size of	1.8" max.	diagonal

Note: The size of the optical image focused on the photocathode should be adjusted so that its maximum diagonal does not exceed the specified value. The corresponding electron image on the target should have a size such that the corners of the rectangle just touch the target ring.

Orientation of . . Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through center of faceplate and pin 7 of the shoulder base.

Focusing Method	Magnetic
Deflection Method	Magnetic
Overall Length	15.20" ± 0.25"
Greatest Diameter of Bulb	3.00" ± 0.06"
Minimum Deflecting-Coil Inside Diameter	2-3/8"
Deflecting-Coil Length	5"
Focusing-Coil Length	10"
Alignment-Coil Length	15/16"
Photocathode Distance Inside End of Focusing Coil	1/2"
Operating Position	See *Operating Considerations*
Weight (Approx.)	1 lb 6 oz
Shoulder Base	Keyed Jumbo Annular 7-Pin

BOTTOM VIEW▲

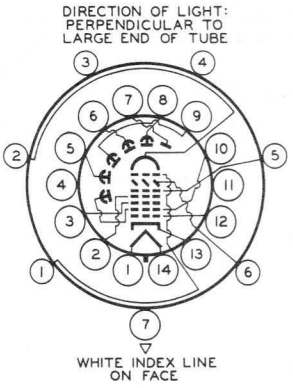
Pin 1 - Grid No.6
Pin 2 - Photocathode
Pin 3 - Internal Connection—Do Not Use
Pin 4 - Internal Connection—Do Not Use
Pin 5 - Grid No.5
Pin 6 - Target
Pin 7 - Internal Connection—Do Not Use

▲ See basing diagram on next page.

End Base. . . . . Small-Shell Diheptal 14-Pin
(JEDEC Group 5, No.B14-45)

BOTTOM VIEW

Pin 1 – Heater
Pin 2 – Grid No.4
Pin 3 – Grid No.3
Pin 4 – Internal Connection—Do Not Use
Pin 5 – Dynode No.2
Pin 6 – Dynode No.4
Pin 7 – Anode
Pin 8 – Dynode No.5
Pin 9 – Dynode No.3
Pin 10 – Dynode No.1, Grid No.2
Pin 11 – Internal Connection—Do Not Use
Pin 12 – Grid No.1
Pin 13 – Cathode
Pin 14 – Heater



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

PHOTOCATHODE:		
Voltage	-550 max.	volts
Illumination.	50 max.	fc
OPERATING TEMPERATURE:		
Of any part of bulb	50 max.	°C
Of bulb at large end of tube (Target section).	35 min.	°C
TEMPERATURE DIFFERENCE:		
Between target section and any part of bulb hotter than target section. . .	5 max.	°C
GRID-No.6 VOLTAGE	-550 max.	volts
TARGET VOLTAGE:		
Positive value.	10 max.	volts
Negative value.	10 max.	volts
GRID-No.5 VOLTAGE	150 max.	volts
GRID-No.4 VOLTAGE	300 max.	volts
GRID-No.3 VOLTAGE	400 max.	volts
GRID-No.2 & DYNODE-No.1 VOLTAGE	350 max.	volts
GRID-No.1 VOLTAGE:		
Negative-bias value	125 max.	volts
Positive-bias value	0 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode .	125 max.	volts
Heater positive with respect to cathode .	10 max.	volts
ANODE SUPPLY VOLTAGE●	1500 max.	volts
VOLTAGE PER MULTIPLIER STAGE.	500 max.	volts

Typical Operation and Characteristics:

Photocathode Voltage (Image Focus)	-400 to -540	volts
Grid-No.6 Voltage (Accelerator)— Approx. 75% of photocathode voltage	-300 to -405	volts
Target-Cutoff Voltage★	-3 to +1	volts
Grid-No.5 Voltage (Decelerator)	0 to 125	volts
Grid-No.4 Voltage (Beam Focus)	140 to 180	volts
Grid-No.3 Voltage♦	225 to 330	volts
Grid-No.2 & Dynode-No.1 Voltage	300	volts
Grid-No.1 Voltage for Picture Cutoff	-45 to -115	volts
Dynode-No.2 Voltage	600	volts
Dynode-No.3 Voltage	800	volts
Dynode-No.4 Voltage	1000	volts
Dynode-No.5 Voltage	1200	volts
Anode Voltage	1250	volts
Minimum Peak-to-Peak Blanking Voltage	5	volts
Field Strength at Center of Focusing Coil♦	75	gausses
Field Strength of Alignment Coil	0 to 3	gausses

Performance Data:

With conditions shown under Typical Operation and with picture highlights at the "knee" of the accompanying Basic-Light-Transfer-Characteristic Curve

	Min.	*Average*	*Max.*	
Cathode Radiant Sensitivity at 4500 angstroms	-	0.03	-	μa/μw
Anode Current (DC)	-	40	-	μa
Signal-Output Current (Peak-to-peak)	10.	25	50	μa
Ratio of Peak-to-Peak Highlight Video-Signal Current to RMS Noise Current for Bandwidth of 4.5 Mc	35:1	45:1	-	
Photocathode Illumination at 2870° K Required to Reach "Knee" of Light-Transfer Characteristic	-	0.007	0.01	fc
Peak-to-Peak Response to Square-Wave Test Pattern at 400 TV Lines per Picture Height (Per cent of large-area black to large-area white)♦	28	35	-	%

● Ratio of dynode voltages is shown under *Typical Operation*.

★ Normal setting of target voltage is +2 volts from target cutoff. The target supply voltage should be adjustable from -3 to +5 volts.

♦ Adjust to give the most uniformly shaded picture near maximum signal. Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

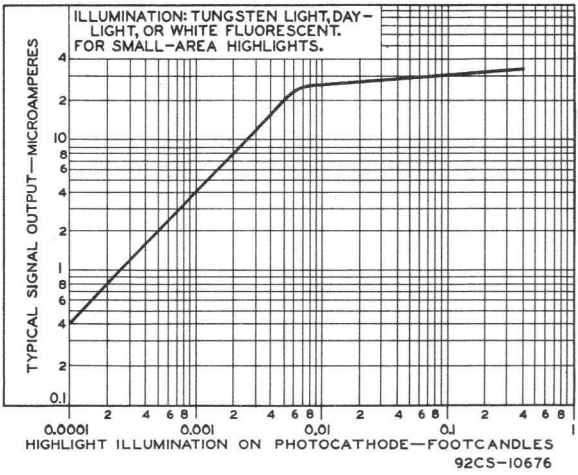
♦ Measured with amplifier having flat frequency response.

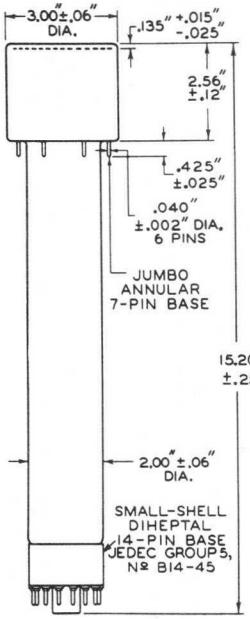
OPERATING CONSIDERATIONS

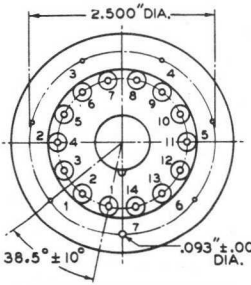
The *operating position* of the 4401 should preferably be such that any loose particles in the neck of the tube will not fall down and strike or become lodged on the target. Therefore, it is recommended that the tube never be operated in a vertical position with the Diheptal-base end up nor in any other position where the axis of the tube with base up makes an angle of less than 20° with the vertical.

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Photosensitive Device having S-10 Response
is shown at the front of this Section

BASIC LIGHT-TRANSFER CHARACTERISTIC

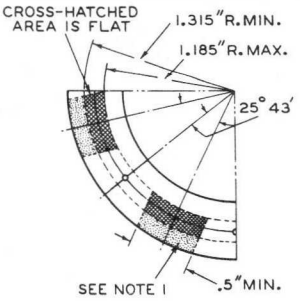






ENLARGED BOTTOM VIEW

DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE



NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.

ANNULAR-BASE GAUGE

ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAUGE WITH:

a. SIX HOLES HAVING DIAMETER OF 0.065" ± 0.001" AND ONE HOLE HAVING DIAMETER OF 0.150" ± 0.001". ALL HOLES HAVE DEPTH OF 0.265" ± 0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047". ALL HOLES ARE SPACED AT ANGLES OF 51°26' ± 5' ON CIRCLE DIAMETER OF 2.500" ± 0.001".

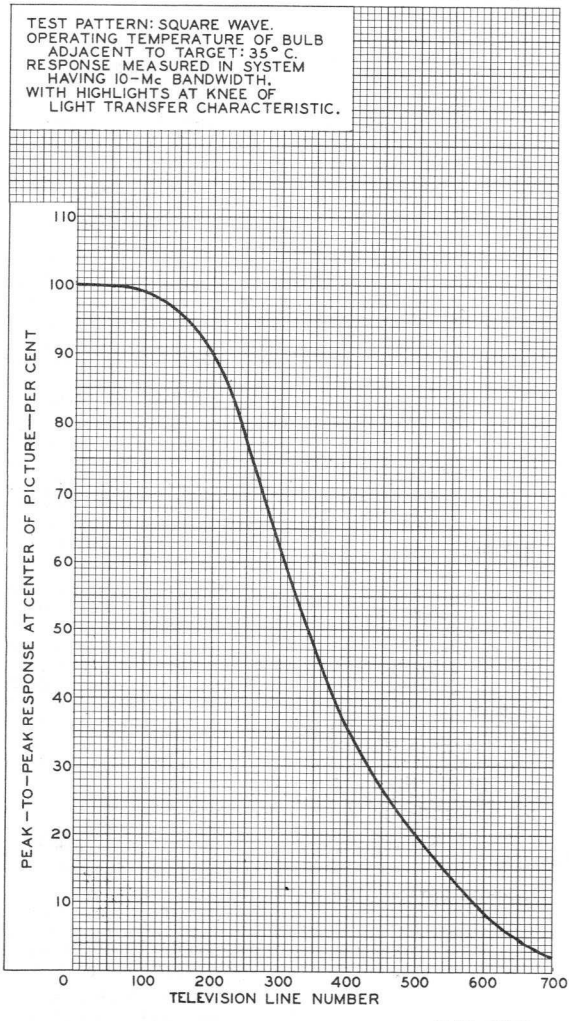
b. SEVEN STOPS HAVING HEIGHT OF 0.187" ± 0.001", CENTERED BETWEEN PIN HOLES TO BEAR AGAINST FLAT AREAS OF BASE.

c. RIM EXTENDING OUT A MINIMUM OF 0.125" FROM 2.812" DIAMETER AND HAVING HEIGHT OF 0.126" ± 0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200" ± 0.001".

92CM-8293R3

SQUARE-WAVE-RESPONSE CHARACTERISTIC



92CM-10675

Image Orthicon

MAGNETIC FOCUS S-10 RESPONSE MAGNETIC DEFLECTION

For Low-Light-Level Black-and-White Pickup

General:

Heater, for Unipotential Cathode:
- Voltage (AC or DC) . . . . . 6.3 ± 10% volts
- Current at 6.3 volts. . . . . 0.6 amp

Direct Interelectrode Capacitance:
- Anode to all other electrodes . . . . . 12 pf

Spectral Response S-10

Wavelength of Maximum Response. . . . . 4500 ± 300 angstroms

Photocathode, Semitransparent:
- Rectangular image (4 x 3 aspect ratio):
  - Useful size . . . . . 1.8" max. diagonal
    - Note: The size of the optical image focused on the photocathode should be adjusted so that its maximum diagonal does not exceed the specified value. The corresponding electron image on the target should have a size such that the corners of the rectangle just touch the target ring.
  - Orientation . . . . . Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through center of faceplate and pin 7 of the shoulder base.

Focusing Method . . . . . .Magnetic

Deflection Method . . . . . .Magnetic

Overall Length. . . . . 15.20" ± 0.25"

Greatest Diameter of Bulb . . . . . 3.00" ± 0.06"

Minimum Deflecting-Coil Inside Diameter . . . . . 2-3/8"

Deflecting-Coil Length. . . . . 5"

Focusing-Coil Length. . . . . 10"

Alignment-Coil Length . . . . . 15/16"

Photocathode Distance Inside End of Focusing Coil . . . 1/2"

Operating Position. . . . . .See *Operating Considerations*

Weight (Approx.). . . . . 1.4 lbs

Shoulder Base . . . . . Keyed Jumbo Annular 7-Pin

BOTTOM VIEW▲

Pin 1 - Grid No.6
Pin 2 - Photocathode
Pin 3 - Do Not Use
Pin 4 - Do Not Use
Pin 5 - Grid No.5
Pin 6 - Target
Pin 7 - Do Not Use

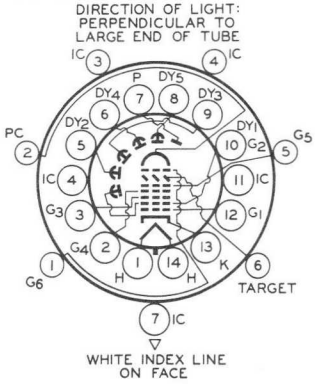
▲ See basing diagram on next page.

4401V1

End Base. . . . . Small-Shell Diheptal 14-Pin
(JEDEC Group 5, No.B14-45)

BOTTOM VIEW

Pin 1 - Heater
Pin 2 - Grid No.4
Pin 3 - Grid No.3
Pin 4 - Do Not Use
Pin 5 - Dynode No.2
Pin 6 - Dynode No.4
Pin 7 - Anode
Pin 8 - Dynode No.5
Pin 9 - Dynode No.3
Pin 10 - Dynode No.1, Grid No.2
Pin 11 - Do Not Use
Pin 12 - Grid No.1
Pin 13 - Cathode
Pin 14 - Heater



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

Photocathode:		
Voltage	-550 max.	volts
Illumination	50 max.	fc
Operating Temperature:		
Of any part of bulb	50 max.	°C
Of bulb at large end of tube (Target section)	35 min.	°C
Temperature Difference:		
Between target section any any part of bulb hotter than target section	5 max.	°C
Grid-No.6 Voltage	-550 max.	volts
Target Voltage:		
Positive value	10 max.	volts
Negative value	10 max.	volts
Grid-No.5 Voltage	150 max.	volts
Grid-No.4 Voltage	300 max.	volts
Grid-No.3 Voltage	400 max.	volts
Grid-No.2 & Dynode-No.1 Voltage	350 max.	volts
Grid-No.1 Voltage:		
Negative-bias value	125 max.	volts
Positive-bias value	0 max.	volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	10 max.	volts
Anode Supply Voltage[a]	1500 max.	volts
Voltage Per Multiplier Stage	500 max.	volts

Typical Operation and Characteristics:

Photocathode Voltage (Image Focus)	-400 to -540	volts
Grid-No.6 Voltage (Accelerator)— Approx. 75% of photocathode voltage	-300 to -405	volts
Target-Cutoff Voltage[b]	-3 to +1	volts
Grid-No.5 Voltage (Decelerator)	0 to 125	volts
Grid-No.4 Voltage (Beam Focus)	140 to 180	volts
Grid-No.3 Voltage[c]	225 to 330	volts
Grid-No.2 & Dynode-No.1 Voltage	300	volts
Grid-No.1 Voltage for Picture Cutoff	-45 to -115	volts
Dynode-No.2 Voltage	600	volts
Dynode-No.3 Voltage	800	volts
Dynode-No.4 Voltage	1000	volts
Dynode-No.5 Voltage	1200	volts
Anode Voltage	1250	volts
Minimum Peak-to-Peak Blanking Voltage	5	volts
Field Strength at Center of Focusing Coil[d]	75	gausses
Field Strength of Alignment Coil	0 to 3	gausses

Performance Data:

With conditions shown under Typical Operation and with picture highlights at the "knee" of the accompanying Basic-Light-Transfer-Characteristic Curve

	Min.	Typ.	Max.	
Cathode Radiant Sensitivity at 4500 angstroms	-	0.03	-	a/w
Anode Current (DC)	-	40	-	μa
Signal-Output Current (Peak-to-peak)	10	15	35	μa
Ratio of Peak-to-Peak Highlight Video-Signal Current to RMS Noise Current for Bandwidth of 4.5 Mc	35:1	40:1	-	
Photocathode Illumination at 2570°K Required to Reach "Knee" of Light-Transfer Characteristic	-	0.005	0.008	fc
Peak-to-Peak Response to Square-Wave Test Pattern at 400 TV Lines per Picture Height (Per cent of large-area black to large-area white)[e]	35	60	-	%

[a] Ratio of dynode voltages is shown under *Typical Operation*.

[b] Normal setting of target voltage is +2 volts from target cutoff. The target supply voltage should be adjustable from -3 to +5 volts.

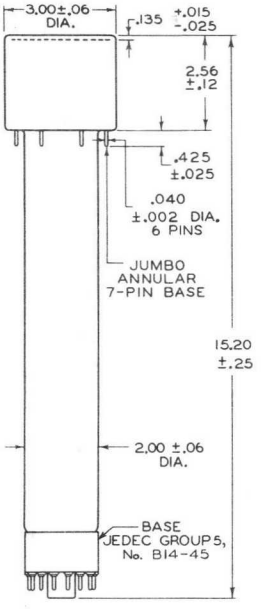
[c] Adjust to give the most uniformly shaded picture near maximum signal.

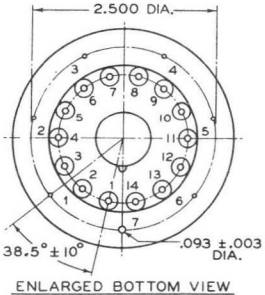
[d] Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

[e] Measured with amplifier having flat frequency response.

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-10 RESPONSE is shown at front of this Section

4401V1



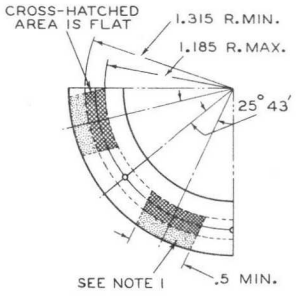


ENLARGED BOTTOM VIEW

DIMENSIONS IN INCHES

92CM-8293R3

DETAIL OF BOTTOM VIEW
OF JUMBO ANNULAR BASE



Note 1: Dotted area is flat or extends toward diheptal-base end of tube by 0.060" max.

ANNULAR-BASE GAUGE

Angular variations between pins as well as eccentricity of neck cylinder with respect to photocathode cylinder are held to tolerances such that pins and neck cylinder will fit flat-plate gauge with:

a. Six holes having diameter of 0.065" ± 0.001" and one hole having diameter of 0.150" ± 0.001". All holes have depth of 0.265" ± 0.001". The six 0.065" holes are enlarged by 45° taper to depth of 0.047". All holes are spaced at angles of 51°26 ± 5' on circles diameter of 2.500" ± 0.001".

b. Seven stops having height of 0.187" ± 0.001", centered between pin holes to bear against flat areas of base.

c. Rim extending out a minimum of 0.125" from 2.812" diameter and having height of 0.126" ± 0.001".

d. Neck-cylinder clearance hole having diameter of 2.200" ± 0.001".

4414/7611

Image Orthicon

MAGNETIC FOCUS — MAGNETIC DEFLECTION

HIGH SENSITIVITY

For Outdoor and Studio Pickup. The 4414/7611 is Unilaterally Interchangeable with Types 5820, 5820A, and 7611[a].

DATA

General:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.6	amp
Direct Interelectrode Capacitance:		
Anode to all other electrodes	12	pf
Spectral Response		S-10
Wavelength of Maximum Response	4500 ± 300	angstroms
Photocathode, Semitransparent:		
Rectangular image (4 x 3 aspect ratio):		
Useful size of	1.8" max.	diagonal

Note: The size of the optical image focused on the photocathode should be adjusted so that its maximum diagonal does not exceed the specified value. The corresponding electron image on the target should have a size such that the corners of the rectangle just touch the target ring.

Orientation of: Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through center of faceplate and pin 7 of the shoulder base.

Focusing Method	Magnetic
Deflection Method	Magnetic
Overall Length	15.20" ± 0.25"
Greatest Diameter of Bulb	3.00" ± 0.06"
Minimum Deflecting-Coil Inside Diameter	2-3/8"
Deflecting-Coil Length	5"
Focusing-Coil Length	10"
Alignment-Coil Length	15/16"
Photocathode Distance Inside End of Focusing Coil	1/2"

Operating Position: The tube should never be operated in a vertical position with the diheptal-base end up nor in any other position where the axis of the tube with the base up makes an angle of less than 20° with the vertical.

Weight (Approx.)	1 lb 6 oz
Shoulder Base	Keyed Jumbo Annular 7-Pin

BOTTOM VIEW▲

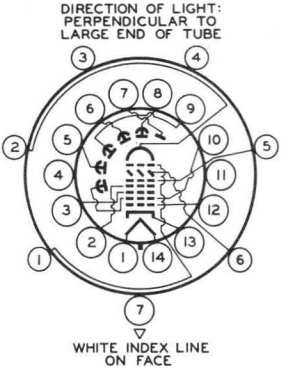
Pin 1 – Grid No.6
Pin 2 – Photocathode
Pin 3 – Do Not Use
Pin 4 – Do Not Use
Pin 5 – Grid No.5
Pin 6 – Target
Pin 7 – Do Not Use

▲See basing diagram on next page.

4414/7611

End Base. . . . . Small-Shell Diheptal 14-Pin
(JEDEC Group 5, No.B14-45)

BOTTOM VIEW



Pin 1 – Heater
Pin 2 – Grid No.4
Pin 3 – Grid No.3
Pin 4 – Do Not Use
Pin 5 – Dynode No.2
Pin 6 – Dynode No.4
Pin 7 – Anode
Pin 8 – Dynode No.5
Pin 9 – Dynode No.3
Pin 10 – Dynode No.1, Grid No.2
Pin 11 – Do Not Use
Pin 12 – Grid No.1
Pin 13 – Cathode
Pin 14 – Heater

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

PHOTOCATHODE:		
Voltage	−550 max.	volts
Illumination.	50 max.	fc
OPERATING TEMPERATURE:		
Of any part of bulb	50 max.	°C
Of bulb at large end of tube (Target section).	35 min.	°C
TEMPERATURE DIFFERENCE:		
Between target section and any part of bulb hotter than target section. . .	5 max.	°C
GRID-No.6 VOLTAGE	−550 max.	volts
TARGET VOLTAGE:		
Positive value.	10 max.	volts
Negative value.	10 max.	volts
GRID-No.5 VOLTAGE	150 max.	volts
GRID-No.4 VOLTAGE	300 max.	volts
GRID-No.3 VOLTAGE	400 max.	volts
GRID-No.2 & DYNODE-No.1 VOLTAGE	350 max.	volts
GRID-No.1 VOLTAGE:		
Negative-bias value	125 max.	volts
Positive-bias value	0 max.	volts
VOLTAGE PER MULTIPLIER STAGE.	350 max.	volts
ANODE SUPPLY VOLTAGE[b]	1350 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	10 max.	volts

Typical Operating Values:

Photocathode Voltage (Image Focus). . . .	−400 to −540	volts
Grid-No.6 Voltage (Accelerator)—		
Approx. 75% of photocathode voltage . .	−300 to −405	volts

Target Cutoff Voltage[c]	-3 to 1	volts
Grid-No.5 Voltage (Decelerator)	0 to 125	volts
Grid-No.4 Voltage (Beam Focus)	140 to 180	volts
Grid-No.3 Voltage[d]	225 to 330	volts
Grid-No.2 & Dynode-No.1 Voltage	300	volts
Grid-No.1 Voltage for Picture Cutoff	-45 to -115	volts
Dynode-No.2 Voltage	600	volts
Dynode-No.3 Voltage	800	volts
Dynode-No.4 Voltage	1000	volts
Dynode-No.5 Voltage	1200	volts
Anode Voltage	1250	volts
Minimum Peak-to-Peak Blanking Voltage	5	volts
Field Strength at Center of Focusing Coil[e]	75	gausses
Field Strength of Alignment Coil	0 to 3	gausses

Performance Data:[f]

With conditions shown under Typical Operating Values and with camera lens set to bring the picture highlights one stop above the "knee" of the accompanying Basic Light-Transfer-Characteristic Curve

	Min.	*Average*	*Max.*	
Cathode Radiant Sensitivity at 4500 angstroms	-	0.030	-	a/w
Luminous Sensitivity	30	60	-	μa/lm
Anode Current (DC)	-	30	-	μa
Signal-Output Current (Peak-to-Peak)	3	8	24	μa
Ratio of Peak-to-Peak Highlight Video-Signal Current to RMS Noise Current for Bandwidth of 4.5 Mc	35:1	-	-	
Photocathode Illumination at 2870° K Required to Bring Picture Highlights One Stop Above "Knee" of Light Transfer Characteristic	-	0.02	0.04	fc
Peak-to-Peak Response to Square-Wave Test Pattern at 400 TV Lines per Picture Height (Per cent of large-area black to large-area white)[g]	35	-	-	%
Uniformity:				
Ratio of Shading (Background) Signal to Highlight Signal	-	0.12	0.15	
Variation of Highlight Signal (Per cent of maximum highlight signal)[h]	-	20	25	%

[a] The 4414/7611 when operated within the temperature range of 35° to 45° C is unilaterally interchangeable with types 5820, 5820A, and 7611.

[b] Dynode-voltage values are shown under *Typical Operating Values*.

[c] Normal setting of target voltage is +2 volts from target cutoff. The target supply voltage should be adjustable from -3 to 5 volts.

[d] Adjust to give the most uniformly shaded picture near maximum signal.

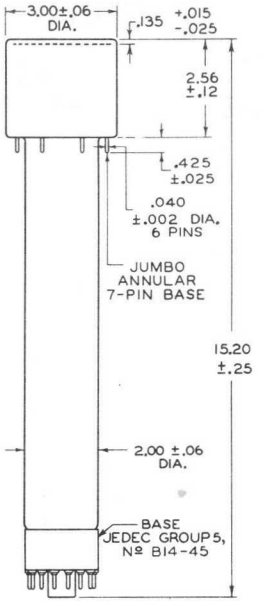
[e] Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

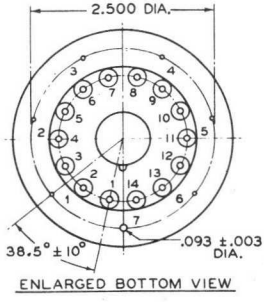
[f] With 4414/7611 operated in properly adjusted RCA TK-31 camera.

[g] Measured with amplifier having flat frequency response.

[h] Variation of response over scanned area.

SPECTRAL-SENSITIVITY CHARACTERISTIC
OF PHOTOSENSITIVE DEVICE HAVING S-10 RESPONSE
is shown at front of this Section

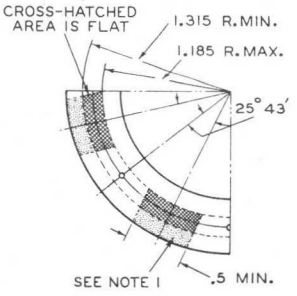




ENLARGED BOTTOM VIEW

ALL DIMENSIONS IN INCHES

DETAIL OF BOTTOM VIEW
OF JUMBO ANNULAR BASE



NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.

ANNULAR-BASE GAUGE

ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAUGE WITH:

a. SIX HOLES HAVING DIAMETER OF 0.065" ± 0.001" AND ONE HOLE HAVING DIAMETER OF 0.150" ± 0.001". ALL HOLES HAVE DEPTH OF 0.265" ± 0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047". ALL HOLES ARE SPACED AT ANGLES OF 51°26′ ± 5′ ON CIRCLE DIAMETER OF 2.500" ± 0.001".

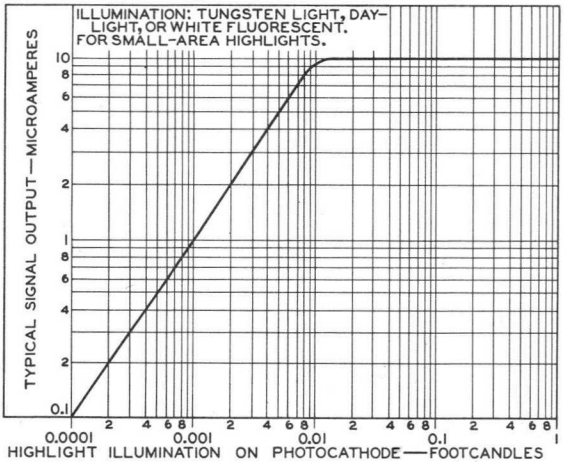
b. SEVEN STOPS HAVING HEIGHT OF 0.187" ± 0.001", CENTERED BETWEEN PIN HOLES TO BEAR AGAINST FLAT AREAS OF BASE.

c. RIM EXTENDING OUT A MINIMUM OF 0.125" FROM 2.812" DIAMETER AND HAVING HEIGHT OF 0.126" ± 0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200" ± 0.001".

92CM-8293R3

BASIC LIGHT-TRANSFER CHARACTERISTIC



4415, 4416

Image Orthicons

MAGNETIC FOCUS **MAGNETIC DEFLECTION**

For Color Pickup at Light Levels of Studios Equipped for Black-and-White Pickup. Two 4415's for the Red and Green Channels and One 4416 for the Blue Channel are Supplied as a Specially Selected Set having High Sensitivity for Simultaneous-Pickup Color TV Cameras.

DATA

General:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.6	amp
Direct Interelectrode Capacitance:		
Anode to all other electrodes	12	μμf
Maximum Target-to-Mesh Spacing	0.0008	inch
Photocathode, Semitransparent:		
Response:		
Type 4415	S10	
Type 4416	S11	
Wavelength of maximum response:		
Type 4415	4500 ± 300	angstroms
Type 4416	4400 ± 500	angstroms
Rectangular image (4 x 3 aspect ratio):		
Useful size of	1.8" max.	diagonal

Note: The size of the optical image focused on the photocathode should be adjusted so that its maximum diagonal does not exceed the specified value. The corresponding electron image on the target should have a size such that the corners of the rectangle just touch the target ring.

Orientation of. .Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through center of faceplate and pin 7 of the shoulder base. The horizontal and vertical scan should start at the corner of the raster nearest pin 6 of the shoulder base.

Focusing Method	.Magnetic
Deflection Method	.Magnetic
Overall Length	15.20" ± 0.25"
Greatest Diameter of Bulb	3.00" ± 0.06"
Minimum Deflecting-Coil Inside Diameter	2-3/8"
Deflecting-Coil Length	5"
Focusing-Coil Length	10"
Alignment Coil:	
Length	15/16"
Position on neck	.Centerline of coil located 8.5" from the flat area of the jumbo annular base
Photocathode Distance Inside End of Focusing Coil	1/2"
Operating Position	.See *Operating Considerations*
Weight (Approx.)	1 lb 6 oz

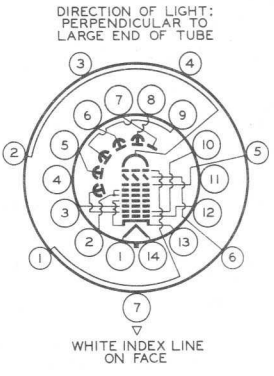
4415, 4416

Shoulder Base. . . . . .Keyed Jumbo Annular 7-Pin
BOTTOM VIEW

Pin 1 - Grid No.6
Pin 2 - Photocathode
Pin 3 - Internal Connection—Do Not Use
Pin 4 - Internal Connection—Do Not Use
Pin 5 - Grid No.5
Pin 6 - Target
Pin 7 - Internal Connection—Do Not Use

End Base . . . . . .Small-Shell Diheptal 14-Pin
(JEDEC Group 5, No.B14-45)
BOTTOM VIEW

Pin 1 - Heater
Pin 2 - Grid No.4, Field-Mesh Grid
Pin 3 - Grid No.3
Pin 4 - Internal Connection—Do Not Use
Pin 5 - Dynode No.2
Pin 6 - Dynode No.4
Pin 7 - Anode
Pin 8 - Dynode No.5
Pin 9 - Dynode No.3
Pin 10 - Dynode No.1, Grid No.2
Pin 11 - Internal Connection—Do Not Use
Pin 12 - Grid No.1
Pin 13 - Cathode, Suppressor Grid
Pin 14 - Heater



NOTE: In the tube symbol, the suppressor grid connected to the cathode, and the field-mesh grid connected to grid No.4, are intentionally without numbers to avoid upsetting industry practice of associating functional camera control knobs with specific grid numbers. For example, beam-focus control is generally associated with knob identified as G_4 (grid No.4).

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

PHOTOCATHODE:		
Voltage.	-550 max.	volts
Illumination	50 max.	fc
OPERATING TEMPERATURE:		
Of any part of bulb.	50 max.	°C
Of bulb at large end of tube (Image section).	35 min.	°C
TEMPERATURE DIFFERENCE:		
Between image section and any part of bulb hotter than image section. . .	5 max.	°C
GRID-No.6 VOLTAGE.	-550 max.	volts
TARGET VOLTAGE:		
Positive value	10 max.	volts
Negative value	10 max.	volts
GRID-No.5 VOLTAGE.	150 max.	volts
GRID-No.4 VOLTAGE.	300 max.	volts
GRID-No.3 VOLTAGE.	400 max.	volts

GRID-No.2 & DYNODE-No.1 VOLTAGE.	350 max.	volts
GRID-No.1 VOLTAGE:		
Negative-bias value.	125 max.	volts
Positive-bias value.	0 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode.	125 max.	volts
Heater positive with respect to cathode.	10 max.	volts
ANODE-SUPPLY VOLTAGE[a].	1350 max.	volts
VOLTAGE PER MULTIPLIER STAGE	350 max.	volts

Typical Operating Values:

Photocathode Voltage (Image focus)[b]. . .	−400 to −540	volts
Grid-No.6 Voltage (Accelerator)—		
Approx. 65% of photocathode voltage. .	−260 to −350	volts
Target-Cutoff Voltage[c]	−3 to +1	volts
Grid-No.5 Voltage (Decelerator).	0 to 125	volts
Grid-No.4 Voltage (Beam focus)[b].	140 to 180	volts
Grid-No.3 Voltage[d]	225 to 330	volts
Grid-No.2 & Dynode-No.1 Voltage.	300	volts
Grid-No.1 Voltage for picture cutoff . .	−45 to −115	volts
Dynode-No.2 Voltage.	600	volts
Dynode-No.3 Voltage.	800	volts
Dynode-No.4 Voltage.	1000	volts
Dynode-No.5 Voltage.	1200	volts
Anode Voltage.	1250	volts
Target-Temperature Range	35 to 45	°C
Minimum Peak-to-Peak Blanking Voltage. .	5	volts
Field Strength at Center of Focusing Coil[e].	75	gausses
Field Strength of Alignment Coil (Approx.)	0 to 3	gausses

Performance Data:

With conditions shown under Typical Operating Values and with picture highlights at the "knee" of the light-transfer characteristic

	Min.	*Average*	*Max.*	
Type 4415:				
Cathode Radiant Sensitivity at 4500 angstroms.	–	0.028	–	μa/μw
Signal-Output Current (Peak-to-Peak)	4	–	30	μa
Ratio of Peak-to-Peak Highlight Video-Signal Current to RMS Noise Current for Bandwidth of 4.5 Mc. .	30:1	37:1	–	
Type 4416:				
Cathode Radiant Sensitivity at 4400 angstroms.	–	0.04	–	μa/μw
Signal-Output Current (Peak-to-Peak)	4	–	30	μa
Ratio of Peak-to-Peak High-light Video-Signal Current to RMS Noise Current for Bandwidth of 4.5 Mc.	30:1	37:1	–	

[a] Ratio of dynode voltages is shown under *Typical Operating Values.*

[b] Within this range, the actual focusing-voltage value will not differ by more than 2% from that for any other tube when all other operating conditions are held constant, i.e., when different tubes are operated in the same camera with the same deflecting yoke, with fixed focusing-field current, with grid-No.6 voltage at a fixed percentage of the photocathode voltage, and with all other voltages held constant.

[c] Normal setting of target voltage is +2 volts from target cutoff. The target supply voltage should be adjustable from −3 to +5 volts.

[d] Adjust to give the most uniformly shaded picture near maximum signal.

[e] Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

OPERATING CONSIDERATIONS

The *operating position* of these types should preferably be such that any loose particles in the neck of the tubes will not fall down and strike or become lodged on the target. Therefore, it is recommended that these tubes never be operated in a vertical position with the Diheptal-base end up nor in any other position where the axis of the tubes with base up makes an angle of less than 20° with the vertical.

PERFORMANCE CHARACTERISTICS

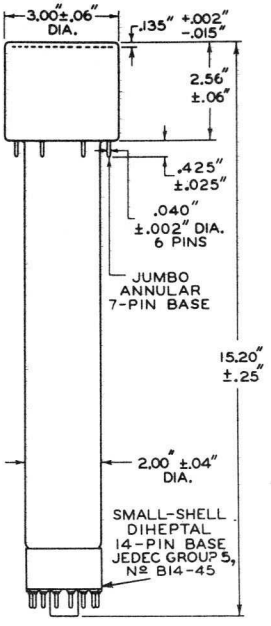
Because of the high sensitivity of the 4416 in the blue channel, cameras employing the 4415-4416 set will have greatly increased overall sensitivity. Color reproduction will also be excellent. With a lens opening of f/8, the set is capable of producing high-quality color pictures when scenes illuminated by incandescent light provide scene-luminance levels of approximately 100 footlamberts.

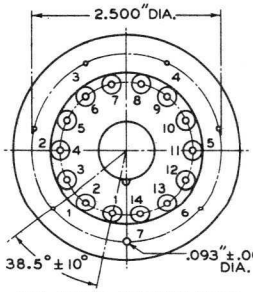
INSTALLATION PRECAUTION

The 4416 has S-11 response and is specifically intended for use in the blue channel. Its sensitivity to blue light is nearly twice that of the 4415's. However, its low green response and negligible red response restrict its use to this channel only. Either of the 4415's, which have the panchromatic S-10 response, may be used in the green or red channels. Improved performance is obtained, however, if the most sensitive of the 4415's is placed in the least sensitive of these two channels.

If a replacement tube is desired for any given set of tubes, reference should be made in the replacement order to the serial numbers of the remaining tubes in the set.

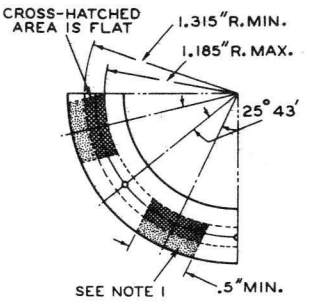
SPECTRAL-SENSITIVITY CHARACTERISTICS OF PHOTOSENSITIVE DEVICES HAVING S-10 OR S-11 RESPONSE
are shown at front of this Section





ENLARGED BOTTOM VIEW

DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE



NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.

ANNULAR-BASE GAUGE

ANNULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAUGE WITH:

a. SIX HOLES HAVING DIAMETER OF 0.065" ± 0.001" AND ONE HOLE HAVING DIAMETER OF 0.150" ± 0.001". ALL HOLES HAVE DEPTH OF 0.265"±0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047". ALL HOLES ARE SPACED AT ANGLES OF 51°26' ± 5' ON CIRCLE DIAMETER OF 2.500" ± 0.001".

b. SEVEN STOPS HAVING HEIGHT OF 0.187" ± 0.001", CENTERED BETWEEN PIN HOLES, TO BEAR AGAINST FLAT AREAS OF BASE.

c. RIM EXTENDING OUT A MINIMUM OF 0.125" FROM 2.812" DIAMETER AND HAVING HEIGHT OF 0.126" ± 0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200" ± 0.001".

92CM-10154R1

Image-Intensifier Orthicon

COMBINED IMAGE-CONVERTER & IMAGE ORTHICON SECTIONS
THIN FILM SEMICONDUCTIVE TARGET

For Extremely Low-Light Level Television Cameras

GENERAL

Maximum Overall Length	22.44 in
Greatest Diameter	5.016 in
Operating Position . . . The tube should never be operated in a vertical position with the diheptal-base end up nor in any other position where the axis of the tube with the base up makes an angle of less than 20° with the vertical.	
Weight (Approx.)	4 lbs 14 oz

Image-Converter Section

Spectral Response	S-20
Wavelength of Maximum Response	4200 ± 500 angstroms
First Photocathode, Semitransparent	
Useful size of	2 inches max diagonal
Focusing Method	Electrostatic

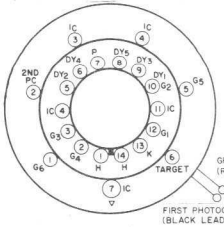
Image-Orthicon Section

Heater, for Unipotential Cathode	
Voltage (AC or DC)	6.3 ± 10% V
Current at 6.3 V	0.6 A
Direct Interelectrode Capacitance	
Anode to all other electrodes	12 pF
Focusing Method	Magnetic
Deflection Method	Magnetic
Socket	Cinch Part No.3M14,[a] or equivalent
Minimum Deflection-Coil Inside Diameter	2-3/8 in
Deflecting Coil . . . . Cleveland Electronics,	Part No.0Y-1,[b] or equivalent
Deflection-Coil Length	5 in
Focusing Coil . . . . . Cleveland Electronics,	Part No.0F-2,[b] or equivalent
Focusing-Coil Length	10 in
Alignment Coil . . . . Cleveland Electronics,	Part No.0A-3,[b] or equivalent
Alignment-Coil Length	15/16 in

TERMINAL DIAGRAM (Bottom View) ←

Shoulder Base: Keyed
Jumbo Annular 7-Pin

Pin 1 – Grid No.6
Pin 2 – Second Photocathode
Pin 3 – Do Not Use
Pin 4 – Do Not Use
Pin 5 – Grid No.5
Pin 6 – Target
Pin 7 – Do Not Use



Direction of Light: Perpendicular to Large End of Tube

← Indicates a change.

Image-Converter Section

Two leads fitted with Alden Part No.8111M, or equivalent.

Black Lead—First photocathode
Red Lead—Grid No. 7 (Focusing Electrode)

Image-Orthicon Section

End Base: Small-Shell Diheptal 14-Pin (JEDEC No.B14-45)

Pin 1 – Heater	Pin 8 – Dynode No.5
Pin 2 – Grid No.4	Pin 9 – Dynode No.3
Pin 3 – Grid No.3	Pin 10 – Dynode No.1, Grid No.2
Pin 4 – Do Not Use	Pin 11 – Do Not Use
Pin 5 – Dynode No.2	Pin 12 – Grid No.1
Pin 6 – Dynode No.4	Pin 13 – Cathode
Pin 7 – Anode	Pin 14 – Heater

ABSOLUTE-MAXIMUM RATINGS

Maximum Continuous Operating Photocathode Illumination.	1×10^{-6}	fc
Storage-Temperature Range.	0 to 50	°C

Image-Converter Section

First Photocathode Voltage[d].	-15000	V
Grid-No.7 Voltage.	1800	V
With respect to First Photocathode		

Image-Orthicon Section

Second Photocathode Voltage.	-550	V
Grid-No.6 Voltage.	-550	V
Target Voltage		
Positive Value	10	V
Negative Value	10	V
Grid-No.5 Voltage.	150	V
Grid-No.4 Voltage.	300	V
Grid-No.3 Voltage.	400	V
Grid-No.2 & Dynode-No.1 Voltage.	350	V
Grid-No.1 Voltage		
Negative bias value.	125	V
Positive bias value.	0	V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode.	125	V
Heater positive with respect to cathode.	10	V
Anode-Supply Voltage[e].	1350	V
Voltage Per Multiplier Stage	350	V
Operating Temperature [f]		
Of any part of bulb.	35	°C
At 3"-diameter end of tube (target section)	25 min	°C
Temperature Difference		
Between target section and any part hotter than image-orthicon target section . .	5	°C

TYPICAL OPERATING VALUES

Image-Converter Section

First Photocathode Voltage[d].	-10000 to -15000 V
Grid-No.7 (Focusing Electrode) Voltage .	89% to 93% of First Photocathode Voltage

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Image-Orthicon Section

Second Photocathode Voltage	-400 to -540	V
Grid-No.6 Voltage (Approx. 75% of Second Photocathode Voltage)	-300 to -405	V
Target-Cutoff Voltage[g]	-3 to +1	V
Grid-No.5 Voltage (Decelerator)	0 to 125	V
Grid-No.4 Voltage (Beam Focus)	160 to 220	V
Grid-No.3 Voltage[h]	225 to 330	V
Grid-No.2 & Dynode-No.1 Voltage	300	V
Grid-No.1 Voltage for Picture Cutoff	-45 to -115	V
Dynode-No.2 Voltage	600	V
Dynode-No.3 Voltage	800	V
Dynode-No.4 Voltage	1000	V
Dynode-No.5 Voltage	1200	V
Anode Voltage	1250	V
Target-Temperature Range	35 to 45	°C
Minimum Peak-to-Peak Blanking Voltage	5	V
Field Strength at Center of Focusing Coil[j]	75	G
Field Strength of Alignment Coil	0 to 3	G

[a] Made by Cinch Manufacturing Co., 1026 South Homan Ave., Chicago 24, Illinois.

[b] Made by Cleveland Electronics Inc., 1974 East 61st Street, Cleveland, Ohio.

[c] Image-Converter Section Electrode Lead

[d] An optimum value of image-converter-section supply voltage is supplied with each individual 4470.

[e] Dynode voltage values are shown under *Typical Operating Values*.

[f] The operating temperature may be 50° C max. within a distance of 7" from the diheptal base end of the tube.

[g] Normal setting of target voltage is +2 V from target cutoff. The target supply voltage should be adjustable from -3 to +5 V.

[h] Adjust to give the most uniformly shaded picture near maximum signal.

[j] Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with indicator located outside of and at the image end of the focusing coil.

OPERATING CONSIDERATIONS

Signal current produced in the 4470 is directly proportional to the incident light level. Noise, on the other hand, is proportional to the square root of scanning-beam current. Therefore, maximum signal-to-noise ratio is obtained only when that value of beam current necessary to just discharge the scene highlights is employed. The maximum ratio of signal-to-noise attainable from the 4470 approaches the signal-to-noise ratio of the photoelectron image of the first photocathode. This ratio is low, however, due to the small number of quanta available at the very low light levels at which the 4470 is operated and also because the quantum efficiency of the photocathode is less than unity.

When the 4470 is used in image-orthicon cameras, the following instructions and camera modifications should be followed:

1. The camera should be of good electrical and mechanical design.

2. A high-voltage source must be provided to supply the necessary voltage for the image-converter section of the 4470. The

positive terminal of this voltage supply should be grounded and the negative terminal of the supply should be adjustable from -10kV to -15kV for optimum operation of the tube. This high-voltage supply should be connected to a voltage-divider network, such as that shown under *Typical Image-Converter Section Voltage-Divider Arrangement*, to obtain the proper photocathode and grid-No.7 voltages.

3. A spherical corrective lens system should be employed with the first photocathode (image-converter section) to minimize "pin cushioning" effects. The photocathode radius of curvature is 4 inches. The faceplate glass is 0.045 inch thick.

4. The video signal should be passed through a 2 megacycle low-pass filter to obtain optimum signal-to-noise ratio at threshold light levels.

5. Support for the image-converter section of the 4470 must be provided. Such support may be provided by any convenient method that does not introduce undue pressure to the "potting" material and thereby reduces its voltage-isolation properties. In addition, the mounting arrangement should not introduce torsion or forces that are perpendicular to the major axis of the tube. Any tube retaining plug or lens housing placed at the image-converter section (front end) of tube should be made of high-grade insulating material.

6. The 4470 should be operated with the key pin of the base in the direction of vertical scanning.

SET-UP PROCEDURE

The set-up procedure described below should be followed carefully to obtain optimum performance from the 4470. Care must be exercised at all times to prevent the inadvertent exposure of the 4470 to direct illumination from the sun or other bright light sources. The maximum first photocathode illumination level should not exceed 1×10^{-6} footcandle.

The 4470 should be inserted in its socket with all camera voltages in the "off" position. Before applying the heater voltage make sure that no light is incident on the photocathode, i.e., make sure that all camera doors and light shields are closed and that the camera lens is capped. Allow the 4470 to warm up for 2 minutes with only heater voltage applied.

Carefully check the camera lens system for the proper combination of neutral-density filter and lens aperture that limits the illumination on the first photocathode to 1×10^{-6} footcandle from a test chart or set-up scene. Now, uncap the lens after the lens system has been so adjusted. Apply the specified image-converter voltage to that section. NOTE: A specified voltage which assures proper image-converter section operation is supplied with each individual 4470.

Turn on scanning and image-orthicon-section voltage as indicated under *Typical Operating Values* making certain that the image-orthicon beam control (grid No.1) is adjusted to its most negative position and that the target-voltage control is adjusted to -3 volts, or its most negative position. The deflecting circuits must be adjusted for maximum output to assure overscanning of the target.

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Next, slowly adjust the beam control (grid No.1) until noise or a rough-textured picture of dynode No.1 appears on the monitor. Cap the camera lens. Then adjust the beam control (grid No.1) and beam-focus control (grid No.4) so that the small white dynode spot appears on the monitor.

Then adjust the alignment-coil current so that the small white dynode spot does not move when the beam-focus control (grid No.4) is varied, but simply goes in and out of focus. During alignment of the beam, and also during operation of the tube, always keep the beam current as low as possible to give the best picture quality and to prevent excessive noise.

After the tube has warmed up for 1/4 hour, uncap the lens and point the camera at the test pattern or test scene, again making sure the light level on the first photocathode is between 1×10^{-7} and 1×10^{-6} footcandle. The target voltage is then increased until the test pattern is just discernible on the monitor. This value of target voltage is known as the "target-cutoff voltage". The target voltage should then be raised exactly 2 volts above the cutoff-voltage value, and the beam current control adjusted to give just sufficient beam current to discharge the highlights.

Then adjust the lens to produce best optical focus and the voltage on the second (image orthicon) photocathode as well as the voltage on grids No.4 and No.7 to produce the sharpest picture.

At this point, attention should be given to the grid-No.5 and grid-No.3 voltage controls. Grid No.5 is used to control the landing of the beam on the target and consequently the uniformity of signal output. The grid-No.5 voltage control should be adjusted to produce a picture that has most uniform shading from center to edge with the lens iris adjusted to permit operation at the highest light level involved in the application. The value of grid-No.5 voltage should be as high as possible consistent with uniform shading. Grid No.3 facilitates a more complete collection by dynode No.2 of the secondaries from dynode No.1. The grid-No.3 voltage control should be adjusted to produce the maximum signal output and uniformity.

Now with a test pattern consisting of a straight line centered on the face of the 4470 adjust the voltage on grid No.6 along with the voltage on the second photocathode to produce a sharply focused straight line on the monitor. Improper adjustment of the grid-No.6 voltage control will result in the straight-line pattern being reproduced with a slight S-shape.

Scanning may be adjusted until the target just fills the monitor picture.

The above adjustments constitute a rough setup of the 4470. Final adjustments necessary for the 4470 to produce the best possible picture include realignment of the beam with the lens capped. Beam alignment is necessary after each change of the grid-No.5 voltage control and sometimes after each adjustment of the grid-No.3 voltage control.

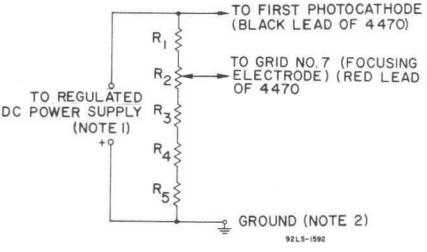
With the camera operating at the desired illumination level, the beam current should be slowly decreased by adjusting the grid-No.1 voltage control to the point where the beam is just sufficient to discharge the highlights of the picture. Each change of scene illumination should be accompanied by appropriate changes in the beam current and amplifier gain to obtain the best contrast and signal-to-noise ratio for each new scene condition.

For stand-by operation, adjust scanning for over-scan, cap camera lens, turn off image-converter voltage, and keep the beam and target voltage on.

To turn the 4470 off, put the camera in the standby operation described above, then adjust the target voltage to -3 volts, or its most negative position, turn the beam control (grid No.1) to its most negative position and immediately thereafter turn off all other image-orthicon voltages. To turn tube on again, repeat the set-up procedure.

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-20 RESPONSE is shown at front of this section

TYPICAL IMAGE-CONVERTER SECTION VOLTAGE-DIVIDER ARRANGEMENT



R_1, R_3: 5 megohms, 2 watts, RPC HBMW, or equivalent.
R_2: 5-megohm potentiometer, 2 watts, Clarostat Series 51, or equivalent.
R_4, R_5: 30 megohms, 2 watts, RPC HBMW, or equivalent.

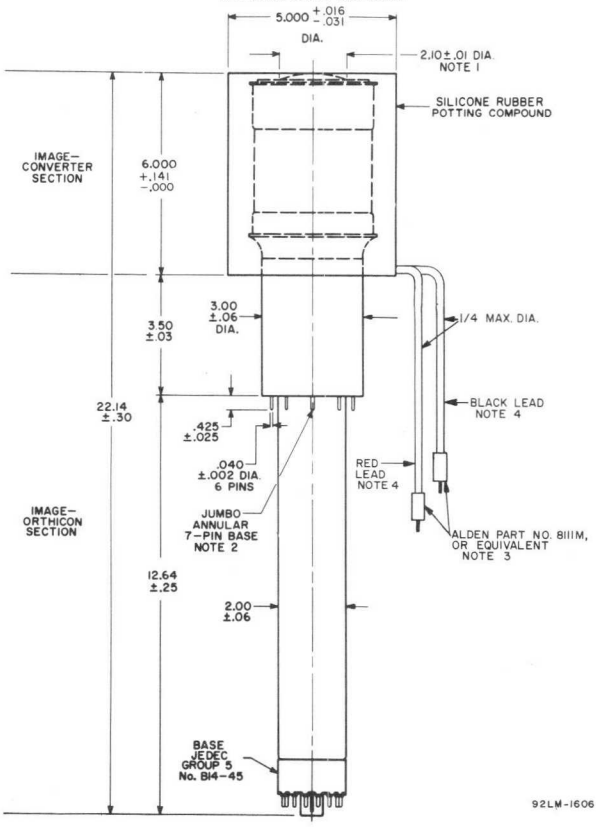
Note 1: Adjustable between approximately 10 kV and 15 kV.

Note 2: The positive high voltage lead should also be connected to the camera power supply ground.

Note 3: All components of this voltage-divider network must be isolated from ground. The control shaft of the focusing-electrode potentiometer (R_2) must be of insulating material and protrude through the wall of the housing through a grounding bushing. The compartment in which this voltage-divider network is housed should be filled with LTV-602 clear potting compound, or equivalent. This voltage-divider network packaged in suitable housing with high-voltage leads and connectors, is available from RCA as Dev. Part No.C21054.

RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

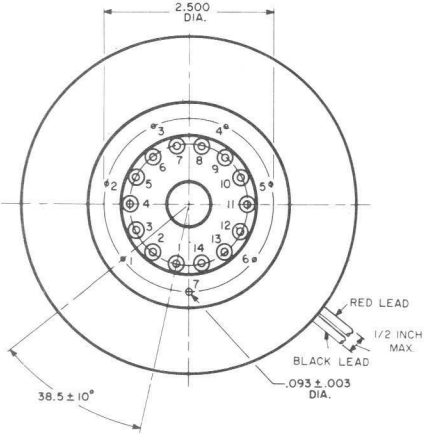
Note 1: The window area of the first photocathode is concentric with the image-converter section cylinder, and the image-orthicon section cylinders within 0.100" of the major axis of the tube.

Note 2: The index of the annular base and the key of the diheptal base are aligned within ± 7° with reference to the annular index pin.

Note 3: Alden Products Company, 9140 North Main Street, Brockton 64, Mass.

Note 4: Lead length is 28 ± 1/4" from potting to end plug.

ENLARGED-BOTTOM VIEW

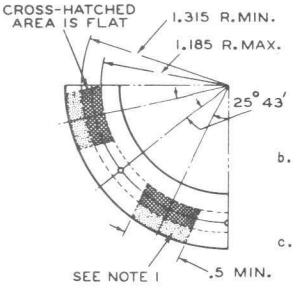


DIMENSIONS IN INCHES

ANNULAR-BASE GAUGE

Angular variations between pins as well as eccentricity of neck cylinder with respect to photocathode cylinder are held to tolerances such that pins and neck cylinder will fit flat-plate gauge with:

Detail of Bottom View of Jumbo Annular Base



DIMENSIONS IN INCHES

Note 1: Dotted area is flat or extends toward diheptal-base end of tube by 0.060" max.

a. Six holes having diameter of 0.065" ± 0.001" and one hole having diameter of 0.150" ± 0.001". All holes have depth of 0.265" ± 0.001". The six 0.065" holes are enlarged by 45° taper to depth of 0.047". All holes are spaced at angles of 51°26' ± 5' on circle diameter of 2.500" ± 0.001".

b. Seven stops having height of 0.187" ± 0.001", centered between pin holes, to bear against flat areas of base.

c. Rim extending out a minimum of 0.125" from 2.812" diameter and having height of 0.126" ± 0.001".

d. Neck-cylinder clearance hole having diameter of 2.200" ± 0.001".

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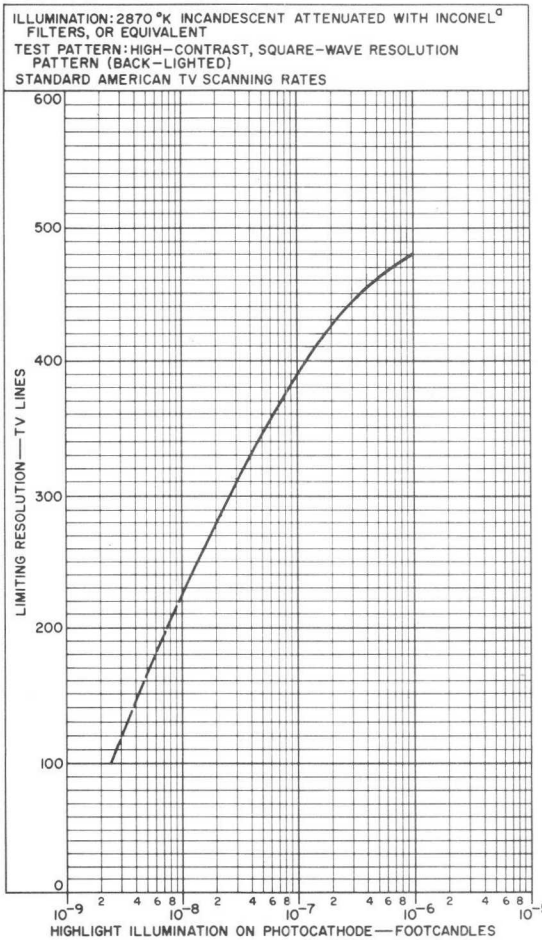
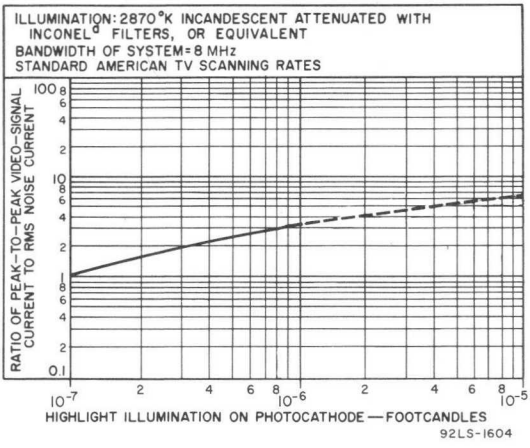
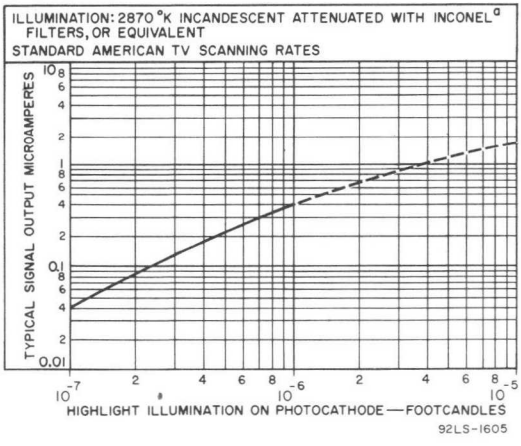
Typical Limiting Resolution Characteristic



Typical Signal-To-Noise Characteristic



Typical Light Transfer Characteristic



RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

4478

Vidicon

Magnetic Focus 1"-Diameter Magnetic Deflection
For Non-Critical Industrial and Consumer Product Closed-Circuit TV

The 4478 is the same as the 7735B except for the following items:

TYPICAL OPERATION AND PERFORMANCE DATA

Low-Voltage Operation		
Grid-No.1 Voltage for Picture Cutoff[a]	−45 to −110	V
Lag – Per Cent of Initial Value of Signal-Output Current 1/20 Second After Illumination is Removed:[b]		
Maximum Value	30	%
Limiting Resolution:		
At center of picture—Typical value	650	TV lines

AVERAGE SENSITIVITY OPERATION

Faceplate Illumination (Highlight)	1	fc
Target Voltage[c,d]	10 to 70	V
Dark Current[e]	0.02	μA
Minimum Signal-Output Current[f]	0.12	μA

[a] With no blanking voltage on grid No.1.

[b] For initial signal-output current of 0.3 microampere and a dark current of 0.02 microampere.

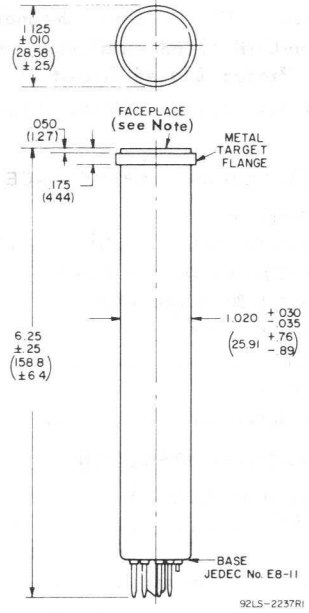
[c] The target voltage for each tube must be adjusted to that value which gives the desired operating signal current.

[d] Indicated range serves only to illustrate the operating target-voltage range normally encountered.

[e] The deflecting circuits must provide extremely linear scanning for good black-level reproduction. Dark-current signal is proportional to the scanning velocity. Any change in scanning velocity produces a black-level error in direct proportion to the change in scanning velocity.

[f] Defined as the component of the highlight target current after the dark-current component has been subtracted.

DIMENSIONAL OUTLINE-Dimensions in Inches (mm)



NOTE:
Faceplate glass is Corning No.7056 having a thickness of 0.094" ±0.012".

SPURIOUS SIGNAL TEST

For scanned area of 1/2" x 3/8"

Equivalent Number of Raster Lines	Zone 1 Allowed Spots	Zone 2 Allowed Spots
over 6	0	0
6 but not including 4	0	2
4 but not including 1	3	4
1 or less	*	*

Minimum separation between any 2 spots greater than 1 raster line is limited to 16 raster lines.

*Spots of this size are allowed unless concentration causes a smudged appearance.

4478, 4488

Vidicons

MAGNETIC FOCUS — 1"-DIAMETER — MAGNETIC DEFLECTION

For Televising Live Scenes in Educational, Industrial, and Other Closed-Circuit TV Applications Where Broadcast-Quality Scene Reproduction is Not Essential

The 4478 and 4488 are the same as the 7735B except for the following items:

GENERAL

Photoconductive Layer (4478)
Maximum useful diagonal of rectangular image (4x3 aspect ratio)[a]

TYPICAL OPERATION AND PERFORMANCE DATA

	4478	4488	
Grid-No.1 Voltage for Picture Cutoff[b]	-45 to -110	-45 to -100	V
Limiting Resolution[c] **at Center of Picture**			
Typical value	700	700	TV lines
Minimum value	600	625	TV lines

Average-sensitivity operation— 1.0 footcandle on faceplate

	4478	4488	
Faceplate Illumination (Highlight)	1.0	1.0	fc
Target Voltage[d,e]	10 to 70	12 to 53	V
Dark Current[f]	0.035	0.030	μA
Signal-Output Current[g]			
Typical	0.265	0.270	μA
Minimum	0.240	0.250	μA

[a] Orientation of quality rectangle — Proper orientation is obtained when the horizontal scan is essentially parallel to the plane passing through the tube axis and short pin.

[b] With no blanking voltage on grid No.1.

[c] Amplitude response values will be correspondingly lower than those of type 7735B.

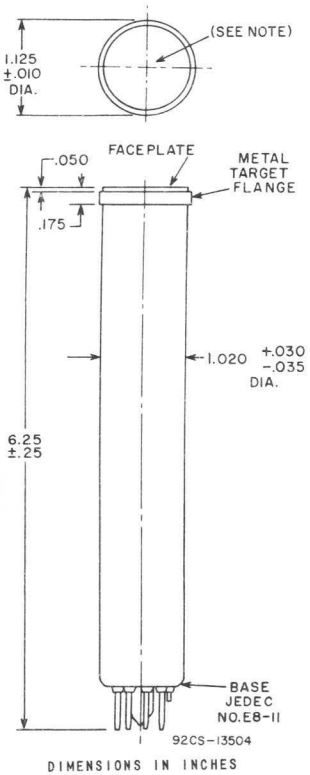
[d] The target voltage for each tube must be adjusted to that value which gives the desired operating signal current.

[e] Indicated range for each type of service serves only to illustrate the operating target-voltage range normally encountered.

[f] The deflecting circuits must provide extremely linear scanning for good black-level reproduction. Dark-current signal is proportional to the scanning velocity. Any change in scanning velocity produces a black-level error in direct proportion to the change in scanning velocity.

[g] Defined as the component of the highlight target current after the dark-current component has been subtracted.

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

Note: Type 4488 has portion of face masked similar to type 7735B.

SPURIOUS SIGNAL TEST

4478

For scanned area of 1/2" x 3/8"

Equivalent Number of Raster Lines	Zone 1 Allowed Spots	Zone 2 Allowed Spots
over 6	0	0
6 but not including 4	0	2
4 but not including 1	3	4
1 or less	footnote h	footnote h

4488

For scanned area of 1/2" x 3/8"

Equivalent Number of Raster Lines	Zone 1 Allowed Spots	Zone 2 Allowed Spots
over 4	0	0
4 but not including 3	0	1
3 but not including 1	2	3
1 or less	footnote h	footnote h

Minimum separation between any 2 spots greater than 1 raster line is limited to 16 raster lines.

h Spots of this size are allowed unless concentration causes a smudged appearance.

4620

Half-Wave Mercury-Vapor Rectifier

For High-Voltage, High-Current Rectifier Service with "Fault" Protection

The 4620 is the same as the 857-B except for a shield adjacent to the filament to protect the filament in the event of arc-back.

RADIO CORPORATION OF AMERICA
Electronic Components and Devices
Harrison, N. J.

DATA
2-64

Beam Power Tube

CERMOLOX®

CONDUCTION COOLED
FOR USE UNDER SEVERE
SHOCK AND VIBRATION

MATRIX-TYPE CATHODE
4500 WATTS PEAK POWER
OUTPUT AT 1215 Mc

The 4622 is the same as the 7649 except for the following items:

Mechanical:

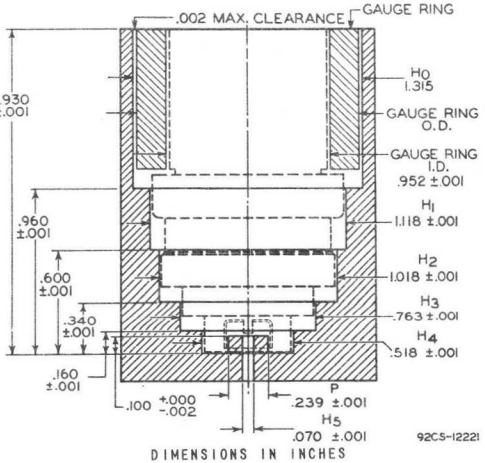
Socket:
For use at frequencies higher than 400 Mc. . . . . See *Mounting Arrangement*

Thermal:

Conduction-Cylinder Temperature. . . . . 250 max. °C
Seal Temperature (Plate, grid No.2, grid No.1, cathode, and heater). . . . . 250 max. °C
Cooling, Conduction:

The conduction cylinder must be thermally coupled to a constant-temperature device (heat sink—solid or liquid) to limit the conduction cylinder to the specified maximum value of 250° C. The plate, grid-No.2, grid-No.1, cathode, and heater terminals may also require coupling to the heat sink to limit their respective seal temperature to the specified maximum value of 250° C.

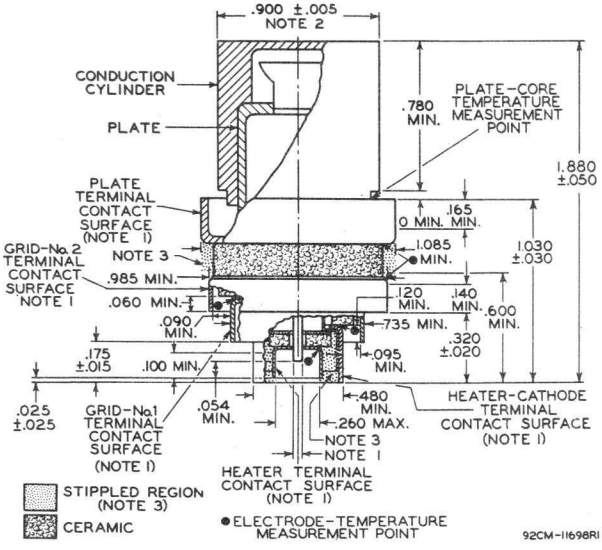
SKETCH G_1



DIMENSIONS IN INCHES

The axes of the cylindrical holes H_1 through H_5 and the axis of post P and coincident within 0.001".

The axes of the gauge ring I.D. and gauge ring O.D. are coincident within 0.001".



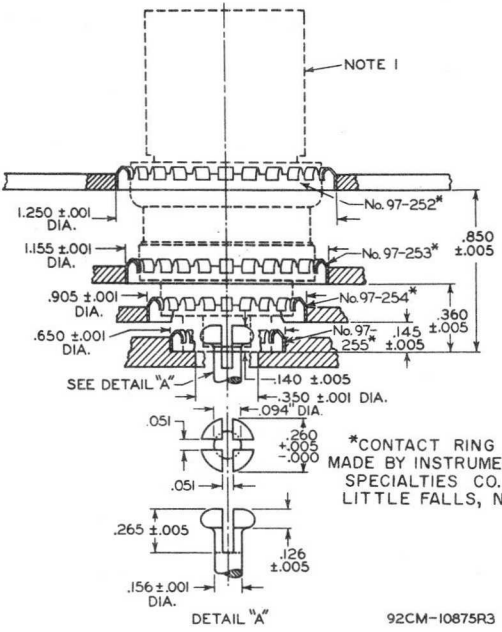
DIMENSIONS IN INCHES

Note 1: With the cylindrical surfaces of the plate terminal, grid-No.2 terminal, grid-No.1 terminal, heater-cathode terminal, and heater terminal clean, smooth, and free of burrs, the tube will enter a gauge as shown in sketch G_1. The tube is properly seated in the gauge when a 0.010" thickness gauge 1/8" wide will not enter between a heater-cathode terminal and the bottom surface of H_4. The gauge is provided with a slot to permit making measurement of seating of heater-cathode terminal on bottom of hole H_4.

Note 2: With the tube seated in gauge and with the conduction cylinder clean, smooth, and free of burrs, the gauge ring will slip over conduction cylinder as shown in sketch G_1.

Note 3: Keep all stippled regions clear. Do not allow contacts or circuit components to protrude into these annular volumes.

SUGGESTED MOUNTING ARRANGEMENT & LAYOUT OF ASSOCIATED CONTACTS

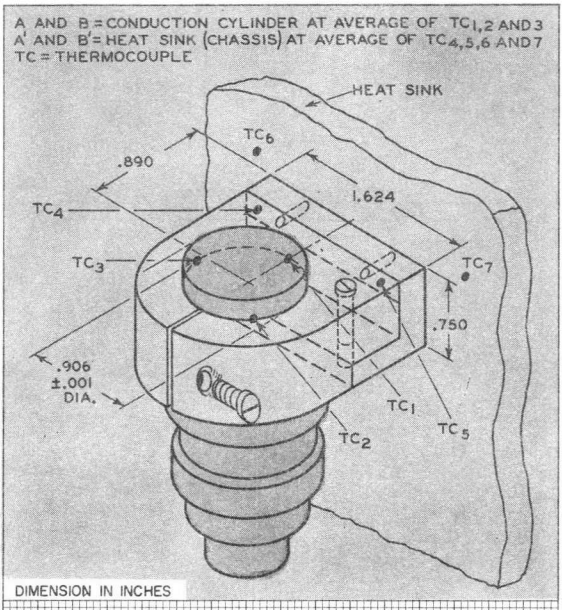


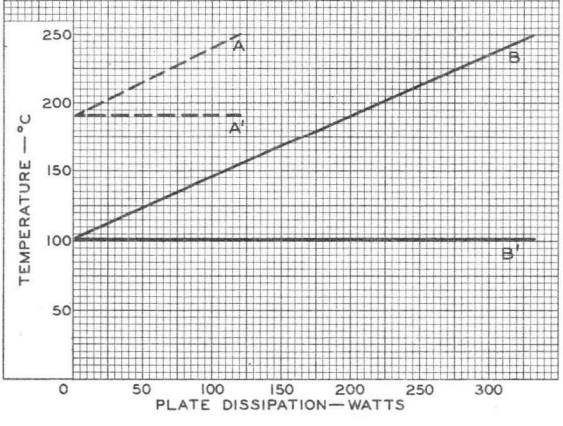
DIMENSIONS IN INCHES

Note 1: If a clamp is used, it must be adjustable in a plane normal to the major tube axis to compensate for variations in concentricity between the conduction cylinder and the contact terminals.

COOLING CHARACTERISTICS

Typical Clamp Conduction-Cooling System





92CM-10872

4654/5762

Power Triode

Forced-Air Cooled
VHF Grid-Drive or Cathode-Drive Operation

6350 Watts VHF TV Output at 216 MHz

7000 Watts CW Output at 30 MHz

ELECTRICAL

Filamentary Cathode, Thoriated-Tungsten Type:		
Voltage (ac or dc)	12.6 typical 13.2 max.	V V
Current:		
Typical value at 12.6 volts	29	A
Maximum value for starting, even momentarily	175	A
Cold Resistance	0.052	Ω
Minimum heating time	15	s
Amplification Factor	29	
Direct Interelectrode Capacitances:		
Grid to plate	21	pF
Grid to filament	19	pF
Plate to filament	0.5	pF

MECHANICAL

Operating Position	Vertical, either end up
Overall Length	(181.1 mm) 7.13 max. in
Greatest Diameter	(119.1 mm) 4.69 max. in
Terminal Connections	See Dimensional Outline
Radiator	Integral part of tube
Weight (Approx.)	(2.8 kg) 6-1/4 lb

THERMAL

Terminal Temperature (Plate, grid and filament)	250 max. °C
Plate-Core Temperature	250 max. °C
Envelope Temperature (at hottest point)	250 max. °C

AF POWER AMPLIFIER & MODULATOR – CLASS B[a]

Maximum CCS Ratings, *Absolute-Maximum Values:*

DC Plate Voltage	6200 max. V
Max.-Signal DC Plate Current	1.5 max. A
Max.-Signal Plate Input	8700 max. W
Plate Dissipation	5000 max. W

Typical Operation:

Values are for 2 tubes

DC Plate Voltage	4700	V
DC Grid Voltage	-200	V
Peak AF Grid-to-Grid Voltage	900	V
Zero-Signal DC Plate Current	0.3	A
Max.-Signal DC Plate Current	2.8	A
Effective Load Resistance (Plate to plate)	3640	Ω
Max.-Signal Driving Power (Approx.)	195	W
Max.-Signal Power Output (Approx.)	8800	W

GRID MODULATED RF POWER AMPLIFIER – CLASS C TELEVISION SERVICE[b]

Synchronizing-level conditions per tube unless otherwise specified. At frequency of 54 to 216 MHz.

Maximum CCS Ratings, *Absolute-Maximum Values:*

DC Plate Voltage	3700 max.	V
DC Grid Voltage (White level)	-800 max.	V
DC Plate Current	1.9 max.	A
DC Grid Current (Pedestal level)	0.225 max.	A
Plate Input	6500 max.	W
Plate Dissipation	5000 max.	W

Typical Operation in Cathode-Drive Circuit:

Bandwidth[c] of 8.5 MHz

DC Plate Voltage	3200	V
DC Grid Voltage:		
Synchronizing level	-110	V
Pedestal level	-220	V
White level	-520	V
Peak RF Grid Voltage	435	V
DC Plate Current:		
Synchronizing level	1.8	A
Pedestal level	1.25	A
DC Grid Current (Approx.):		
Synchronizing level	0.400	A
Pedestal level	0.130	A
Driving Power (Approx.):		
Synchronizing level	770	W
Power Output (Approx.):		
Synchronizing level	4000	W
Pedestal level	2300	W

RF POWER AMPLIFIER – CLASS B TELEVISION SERVICE[b]

Synchronizing-level conditions per tube unless otherwise specified. At frequency of 54 to 216 MHz.

Maximum CCS Ratings, *Absolute-Maximum Values:*

DC Plate Voltage	4500 max.	V
DC Plate Current	2.0 max.	A
DC Grid Current (Pedestal level)	0.325 max.	A
Plate Input	9000 max.	W
Plate Dissipation	5000 max.	W

Typical Operation in Cathode-Drive Circuit:

	Bandwidth[c] of 10 MHz	8.5 MHz	6.0 MHz	
DC Plate Voltage	3000	3200	4300	V
DC Grid Voltage	-105	-110	-150	V
Peak RF Grid Voltage:				
Synchronizing level	380	435	500	V
Pedestal level	290	310	355	V
DC Plate Current:				
Synchronizing level	1.8	1.8	2.0	A
Pedestal level	1.36	1.35	1.5	A
DC Grid Current:				
Synchronizing level	0.265	0.400	0.439	A
Pedestal level	0.115	0.130	0.118	A
Driving Power (Approx.):				
Synchronizing level	625	770	983	W
Power Output (Approx.):				
Synchronizing level	3150	4000	6350	W
Pedestal level	1800	2300	3590	W

PLATE MODULATED RF POWER AMPLIFIER – CLASS C TELEPHONY[b]

Carrier conditions per tube for use with a maximum modulation factor of 1.0. See Ratings vs. Frequency Chart.

Maximum CCS Ratings, *Absolute-Maximum Values:*

DC Plate Voltage	5000 max.	V
DC Grid Voltage	-1000 max.	V
DC Plate Current	1.0 max.	A
DC Grid Current	0.3 max.	A
Plate Input	5000 max.	W
Plate Dissipation	3300 max.	W

Typical Operation in Grid-Drive Circuit:

	Up to 30 MHz	At 110 MHz	
DC Plate Voltage	4700	4000	V

DC Grid Voltage	-400	-350	V
From a grid resistor of	1425	1460	Ω
Peak RF Grid Voltage[d]	675	600	V
DC Plate Current	0.96	0.93	A
DC Grid Current (Approx.)	0.28	0.24	A
Driving Power (Approx.)	170	130	W
Power Output (Approx.)	3700	2800	W

Typical Operation in Cathode-Drive Circuit:

DC Plate Voltage	4700	4000	V
DC Grid Voltage	-400	-350	V
From a grid resistor of	1425	1460	Ω
Peak RF Grid Voltage	675	600	V
DC Plate Current	0.96	0.93	A
DC Grid Current (Approx.)	0.28	0.24	A
Driving Power (Approx.)[e]	720	600	W
Power Output (Approx.)	4200	3200	W

RF POWER AMPLIFIER & OSC. – CLASS C TELEGRAPHY[b]
AND
RF POWER AMPLIFIER – CLASS C FM TELEPHONY[b]

See Ratings vs. Frequency Chart

Maximum CCS Ratings, *Absolute-Maximum Values:*

DC Plate Voltage	6200 max.	V
DC Grid Voltage	-1000 max.	V
DC Plate Current	1.4 max.	A
DC Grid Current	0.3 max.	A
Plate Input	8700 max.	W
Plate Dissipation	5000 max.	W

Typical Operation in Grid-Drive Circuit:

	Up to 30 MHz	
DC Plate Voltage	6000	V
DC Grid Voltage:		
From a fixed supply of	-550	V
From a grid resistor of	1900	Ω
From a cathode resistor of	360	Ω
Peak RF Grid Voltage	875	V
DC Plate Current	1.25	A
DC Grid Current (Approx.)	0.290	A
Driving Power (Approx.)	225	W
Power Output (Approx.)	6000	W

Typical Operation in Cathode-Drive Circuit:

	Up to 30 MHz	At 110 MHz	At 220 MHz	
DC Plate Voltage	6000	5000	4300	V

DC Grid Voltage:				
From a fixed supply of . .	-550	-340	-200	V
From a grid resistor of . .	1900	1225	807	Ω
From a cathode resistor of .	360	208	134	Ω
Peak RF Grid Voltage	875	625	432	V
DC Plate Current	1.25	1.35	1.25	A
DC Grid Current (Approx.). .	0.290	0.275	0.25	A
Driving Power (Approx.) . . .	1225	1000	542	W
Power Output (Approx.) . . .	7000	5500	4000	W

SELF-RECTIFYING OSCILLATOR OR AMPLIFIER – CLASS C[b]

See Ratings vs. Frequency Chart

Maximum CCS Ratings, *Absolute-Maximum Values:*

AC Plate Voltage (RMS)	7000 max.	V
DC Grid Voltage	-300 max.	V
DC Plate Current	0.635 max.	A
DC Grid Current	0.135 max.	A
Plate Input[f]	4900 max.	W
Plate Dissipation	5000 max.	W

Typical Operation:

AC Plate Voltage (RMS)	6600	V
DC Grid Voltage	-127	V
DC Plate Current	0.625	A
DC Grid Current (Approx.)	0.105	A
Driving Power (Approx.)[g]	60	W
Power Output (Approx.)	3350	W

AMPLIFIER OR OSCILLATOR – CLASS C[b]

With separate, rectified, unfiltered, single-phase, full-wave plate supply. See Ratings vs. Frequency Chart.

Maximum CCS Ratings, *Absolute-Maximum Values:*

DC Plate Voltage	5600 max.	V
DC Grid Voltage	-600 max.	V
DC Plate Current	1.25 max.	A
DC Grid Current	0.270 max.	A
Plate Input[h]	8600 max.	W
Plate Dissipation	5000 max.	W

Typical Operation:

DC Plate Voltage	5000	V
DC Grid Voltage	-260	V
DC Plate Current	1.2	A
DC Grid Current (Approx.)	0.260	A
Driving Power (Approx.)[i]	150	W
Power Output (Approx.)	5650	W

CHARACTERISTICS RANGE VALUES

	Note	Min.	Max.	
Filament Current	k	27	31	A
Amplification Factor	k,m	25	33	
Grid-Plate Capacitance	—	18.7	22.7	pF
Grid-Filament Capacitance	—	15.5	22.5	pF
Plate-Filament Capacitance	—	0.38	0.62	pF
Grid Voltage	k,n	-125	-190	V
Plate Voltage	k,p	1350	1750	V
Plate Voltage	k,r	2600	3400	V
Useful Power Output	k,s	3	—	kW

Footnotes (a) and (b) apply to the *RCA Transmitting Tube Operating Considerations* given at front of this section.

[a] See *Classes of Service – AF Power Amplifiers.*

[b] See *Classes of Service–RF Power Amplifiers or Oscillators.*

[c] Computed between -3 dB points in a single-tuned circuit and based on the tube output capacitance only.

[d] Driver modulated approximately 30%.

[e] Carrier power of driver modulated 100%.

[f] Plate input is 1.11 times the product of the ac voltage (rms) and the dc plate current.

[g] From a self-rectified driver.

[h] Plate input is 1.23 times the product of the dc plate voltage and the dc plate current.

[i] From a driver with a rectified, unfiltered, single-phase, full-wave plate supply.

[k] With 12.6 volts rms on filament.

[m] With dc grid voltage of -25 volts measured from center tap of filament supply, and dc plate voltage adjusted to give dc plate current of 0.5 ampere.

[n] With dc plate voltage of 4000 volts, and dc grid voltage adjusted to give dc plate current of 0.05 ampere.

[p] With dc grid voltage of 0 volts measured from center tap of filament supply, and dc plate voltage adjusted to give dc plate current of 0.5 ampere.

[r] With dc grid voltage of -50 volts measured from center tap of filament supply, and dc plate voltage adjusted to give dc plate current of 0.5 ampere.

[s] In a self-excited, coaxial, oscillator circuit and with dc plate voltage of 5000 volts, dc plate current of 1.1 amperes, grid resistor of 1500 ± 10% ohms, dc grid current of 0.250 to 0.300 ampere, and frequency of 110 MHz.

FORCED-AIR COOLING

Air Flow:

Through Radiator – Adequate air flow, to limit the plate-core temperature to 250° C, should be delivered by a blower through the radiator before and during the application of all voltages to the tube in accordance with "Typical Air-Cooling Characteristics".

To Grid and Filament Terminals – 10 min. cfm. The specified air flow from a one-inch dia. nozzle, or as obtained by deflectors, should be directed into the filament header before and during the application of any voltages in order to limit the temperature of the filament and grid terminals to 250° C.

During Standby Operation – Cooling air is required when only filament voltage is applied to the tube.

During Shutdown Operation – Air flow should continue for a few minutes after all electrode power is removed.

RATINGS VERSUS FREQUENCY

Frequency has a limiting effect on certain critical parameters. These parameters include: plate voltage, plate input, grid voltage, and grid current. The permissible percentage of maximum rated value for these parameters varies with frequency and service. The service falls into two categories: 1. Television Class B or C service, and 2. all other recommended service. All other recommended service includes:

Class C Telephony, Plate Modulated
Class C Telegraphy and FM Telephony
Class C Amplifier or Oscillator (self-rectifying)

Class C Amplifier or Oscillator (with separate rectified unfiltered plate supply)

PERMISSIBLE PERCENTAGE OF MAXIMUM RATED VALUES

Service	TV (B, C)	All Other Service			
Frequency	54 to 216	30	110	220	MHz
Plate Voltage	100	100	84	72	%
Plate Input	100	100	84	72	%
Grid Voltage	100	100	100	60	%
Grid Current	100	100	100	83	%

ELECTRICAL

Filament

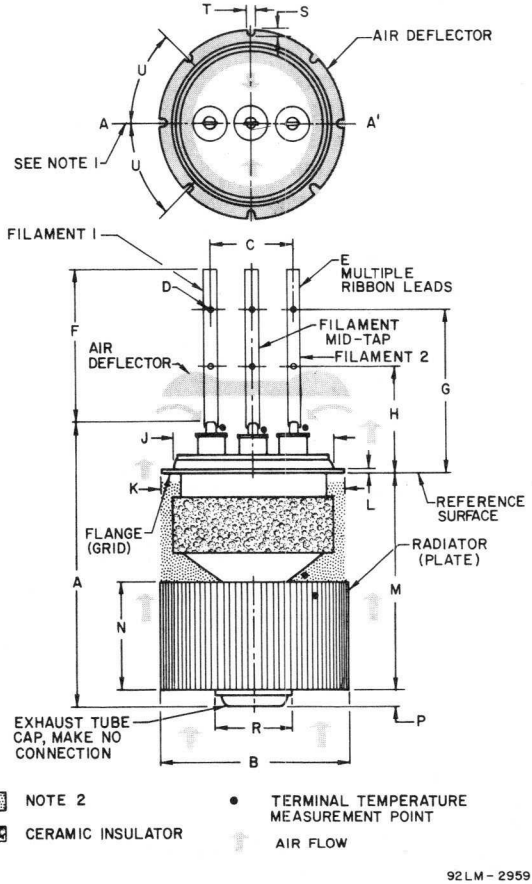
The filament is center-tapped in order to minimize the effect of filament lead inductance, and not to permit operation of the two sections in parallel. At the higher frequencies, all three filament leads should be connected in parallel by means of rf bypass capacitors. Any one of these three leads may then be used as the rf return to the filament.

MECHANICAL

Mounting

The tube requires a clamp support for the radiator (plate connection), a flexible connector for the grid-terminal flange, and three connectors for the filament leads. The tube should be supported in a vertical position with either end up or down. If the tube is subjected in service to considerable vibration, it is advisable to support the mounting by means of a spring suspension. The installation of all wires and connections must be made so that they will not intrude upon the stippled area.

DIMENSIONAL OUTLINE



92LM-2959

NOTES FOR DIMENSIONAL OUTLINE

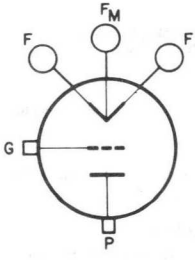
1. Plane of filament leads will not deviate more than $3\frac{1}{2}^{o}$ from plane passing through AA', normal to grid flange.
2. Keep all stippled regions clear. In general do not allow intrusions into these annular regions. If such intrusions are required contact RCA Power Tube Application Engineering, Lancaster, PA for instructions.

OUTLINE DIMENSIONS*

Dimension		Value	
A	7.12	(180.85)	Max.
B	4.62 ± .06	(117.4 ± 1.5)	
C	2.5	(63.5)	Max.
D Dia.	0.144	(3.658)	
E	0.31 ± .06	(7.9 ± 1.5)	
F	3.5	(88.9)	Min.
G	3.88 ± .38	(98.5 ± 9.7)	
H	2.50 ± .38	(63.5 ± 9.7)	
J Dia.	3.94	(100.08)	Max.
K Dia.	4.56 ± .03	(115.8 ± .8)	
L	0.062 ± .015	(1.58 ± .38)	
M	5.25 ± .12	(133.4 ± 3.1)	
N	2.75	(69.85)	Max.
P	0.5	(12.7)	Max.
R	2.0	(50.8)	Max.
S	0.210	(5.334)	
T	0.182	(4.623)	
U	45°	0.785 Radian	

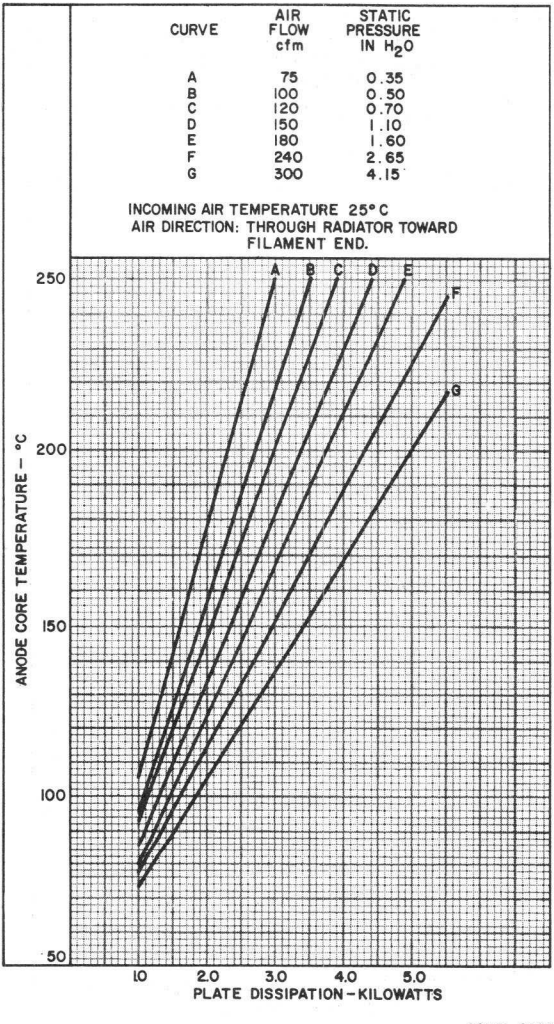
*Dimensions are in inches unless otherwise stated. Dimensions in parentheses are in millimeters.

TERMINAL DIAGRAM



F_1: filament 1
F_m: filament mid-tap
F_2: filament 2
G: grid-flange
P: plate-radiator

TYPICAL AIR-COOLING CHARACTERISTICS



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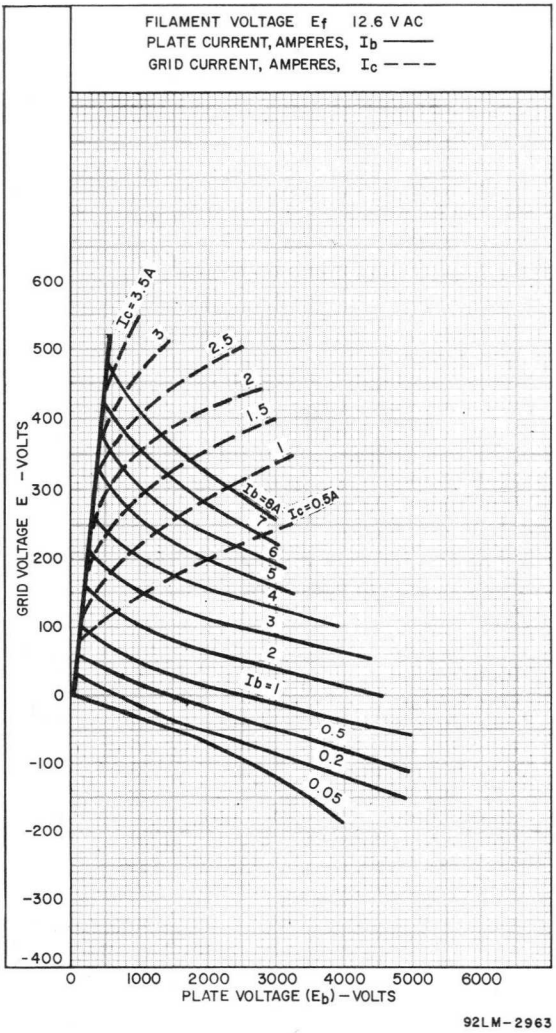
TYPICAL CONSTANT-CURRENT CHARACTERISTICS



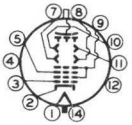
5527
ICONOSCOPE

ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

General:

Heater, for Unipotential Cathode:		
Voltage	6.3 ± 10%	ac or dc volts
Current	0.6	amp
Direct Interelectrode Capacitances (Approx.):▲		
Grid No.1 to All Other Electrodes	7.5	μμf
Signal Electrode to All Other Electrodes and External Shield	5	μμf
Focusing Method	Electrostatic	
Deflection Method	Electrostatic	
Image Size (4 x 3 aspect ratio)	1.4" Diagonal	
Overall Length	9" ± 1/4"	
Seated Length	8-1/4" ± 1/4"	
Maximum Diameter	2-1/4"	
Mounting Position	Any	
Cap	Recessed Small Cavity	
Base	Medium-Shell Diheptal 12-Pin	
Basing Designation for BOTTOM VIEW	14L	

Pin 1 – Heater
Pin 2 – Cathode
Pin 3 – Grid No.1
Pin 4 – Internal Connection – Do Not Use
Pin 5 – Grid No.3
Pin 7 – Deflecting Electrode DJ_3
Pin 8 – Deflecting Electrode DJ_4



DIRECTION OF LIGHT: INTO END OF BULB

Pin 9 – Anode No.2, Grid No.4
Pin 10 – Deflecting Electrode DJ_2
Pin 11 – Deflecting Electrode DJ_1
Pin 12 – Internal Connection – Do Not Use
Pin 14 – Heater
Cap – Signal Electrode

Maximum Ratings, *Design-Center Values*:

SIGNAL-ELECTRODE VOLTAGE	900 max.	volts
GRID-No.4 & GRID-No.2 VOLTAGE	900 max.	volts
GRID-No.3 VOLTAGE	450 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value	100 max.	volts
Positive bias value	0 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	10 max.	volts
AMBIENT TEMPERATURE	40 max.	°C
MOSAIC ILLUMINATION	50 max.	foot-candles

▲ With external shield.

5527

5527
ICONOSCOPE

Typical Operation:

Signal-Electrode Voltage	800	volts
Grid-No.4 & Grid-No.2 Voltage	800	volts
Grid-No.3 Voltage for Focus	125 to 250	volts
Grid-No.1 Voltage	Adjust for best picture	
Max. Grid-No.1 Voltage for Picture Cutoff	-75	volts
Max. Deflecting Voltages (Peak-to-Peak)*:		
DJ_1 & DJ_2 (Vertical)	120	volts
DJ_3 & DJ_4 (Horizontal)	100	volts
Min. Peak-to-Peak Blanking Voltage	30	volts
Signal-Output Current (Approx.)	0.025	μamp
Output Resistor (Approx.)	1.0	megohm

Maximum Circuit Values:

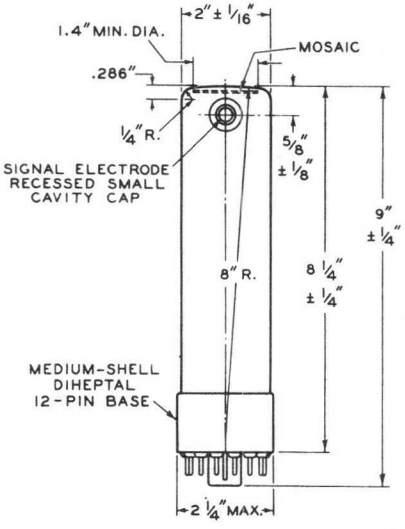
Grid-No.1-Circuit Resistance	1.0 max.	megohm
Resistance in any Deflecting-Electrode Circuit□	5.0 max.	megohms

* To scan picture of 1.4" diagonal (4 x 3 aspect ratio).

□ It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

The SPECTRAL SENSITIVITY CHARACTERISTIC curve for the 5527 is the same as that shown for Type 1850-A.

5527
ICONOSCOPE



℄ OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF BOTTOM OF THE BASE.

THE PLANE THROUGH THE TUBE AXIS AND BASE-PLUG KEY MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND SIGNAL ELECTRODE TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF 20°. SIGNAL ELECTRODE TERMINAL IS ON SAME SIDE AS BASE-PLUG KEY.

DJ1 AND DJ2 ARE NEARER THE MOSAIC; DJ3 AND DJ4 ARE NEARER THE BASE. WITH DJ1 POSITIVE WITH RESPECT TO DJ2, THE SPOT IS DEFLECTED TOWARD PIN 5. WITH DJ3 POSITIVE WITH RESPECT TO DJ4, THE SPOT IS DEFLECTED TOWARD PINS 1 AND 2. WITH DJ1 AND DJ2 USED FOR VERTICAL DEFLECTION, THE VERTICAL AXIS OF THE SCANNED AREA OF THE MOSAIC IS PARALLEL TO VERTICAL PLANE THROUGH PINS 5 AND 12 WITHIN ±15°. THE ANGLE BETWEEN THE SCANNING DIRECTION PRODUCED BY DJ3 AND DJ4 AND THE SCANNING DIRECTION PRODUCED BY DJ1 AND DJ2 IS 90° ± 3°.

92CS-6803

5553-B
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 13600 amperes.	36	volts
At peak anode current of 1115 amperes	17	volts

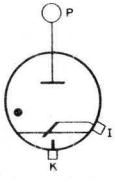
Mechanical:

Operating Position	Vertical, flexible lead up
Maximum Overall Length (Including flexible lead)	31-3/8"
Maximum Radius (Including water connections)	4-11/16"
Weight	21 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.	3	gpm
Maximum water-temperature rise.	9	°C
Maximum pressure drop	5.1	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	600 max.	600 max.	volts
Inverse	600 max.	600 max.	volts

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5553-B
IGNITRON

ANODE CURRENT:			
Peak	1140 max.	4000 max.	amp
Average (Averaged over any interval of 6.25 seconds maximum)	190 max.	54 max.	amp
Average (Averaged over any interval of 0.2 second maximum)	190 max.	666 max.	amp
Fault, for duration of 0.15 second maximum	50000 max.	50000 max.	amp

RATING II

PEAK ANODE VOLTAGE:			
Forward	1200 max.	1200 max.	volts
Inverse	1200 max.	1200 max.	volts
ANODE CURRENT:			
Peak	840 max.	3000 max.	amp
Average (Averaged over any interval of 6.25 seconds maximum)	140 max.	40 max.	amp
Average (Averaged over any interval of 0.2 second maximum)	140 max.	500 max.	amp
Fault, for duration of 0.15 second maximum	37500 max.	37500 max.	amp

RATING III

PEAK ANODE VOLTAGE:			
Forward	1500 max.	1500 max.	volts
Inverse	1500 max.	1500 max.	volts
ANODE CURRENT:			
Peak	672 max.	2400 max.	amp
Average (Averaged over any interval of 6.25 seconds maximum)	112 max.	32 max.	amp
Average (Averaged over any interval of 0.2 second maximum)	112 max.	400 max.	amp
Fault, for duration of 0.15 second maximum	30000 max.	30000 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

RCA

5553-B

IGNITRON

	Column 1*	Column 2*	
DEMAND POWER (During conduction)	800 max.	2400 max.	kva
DUTY●†	24.6 max.	4.4 max.	%
ANODE CURRENT (Per tube):			
Peak	4530 max.	13600 max.	amp
Demand (RMS, during conduction)#	3200 max.	9600 max.	amp
Average (Averaged over any interval of 11 seconds maximum)#	355 max.	192 max.	amp
Fault, for duration of 0.15 second maximum	27000 max.	27000 max.	amp

RATING I-B

	Column 1*	Column 2*	
SUPPLY VOLTAGE (RMS)	600 max.	600 max.	volts
DEMAND POWER (During conduction)	800 max.	2400 max.	kva
DUTY●†	59 max.	10.7 max.	%
ANODE CURRENT (Per tube):			
Peak	1890 max.	5660 max.	amp
Demand (RMS, during conduction)#	1330 max.	4000 max.	amp
Average (Averaged over any interval of 4.6 seconds maximum)#	355 max.	192 max.	amp
Fault, for duration of 0.15 second maximum	11200 max.	11200 max.	amp

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)	800 max.	2400 max.	kva
DUTY●†	12.2 max.	2.2 max.	%
ANODE CURRENT (Per tube):			
Peak	4530 max.	13600 max.	amp
Demand (RMS, during conduction)#	3200 max.	9600 max.	amp
Average (Averaged over any interval of 22.4 seconds maximum)#	175 max.	96 max.	amp
Fault, for duration of 0.15 second maximum	27000 max.	27000 max.	amp

⊕,●,†,*,#: See next page.

5553-B
IGNITRON

RATING II-B

	Column 1*	Column 2*	
SUPPLY VOLTAGE (RMS)	600 max.	600 max.	volts
DEMAND POWER (During conduction)	800 max.	2400 max.	kva
DUTY●†	29 max.	5.3 max.	%
ANODE CURRENT (Per tube):			
Peak	1890 max.	5660 max.	amp
Demand (RMS, during conduction)#	1330 max.	4000 max.	amp
Average (Averaged over any interval of 9.4 seconds maximum)#	175 max.	96 max.	amp
Fault, for duration of 0.15 second maximum	11200 max.	11200 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.

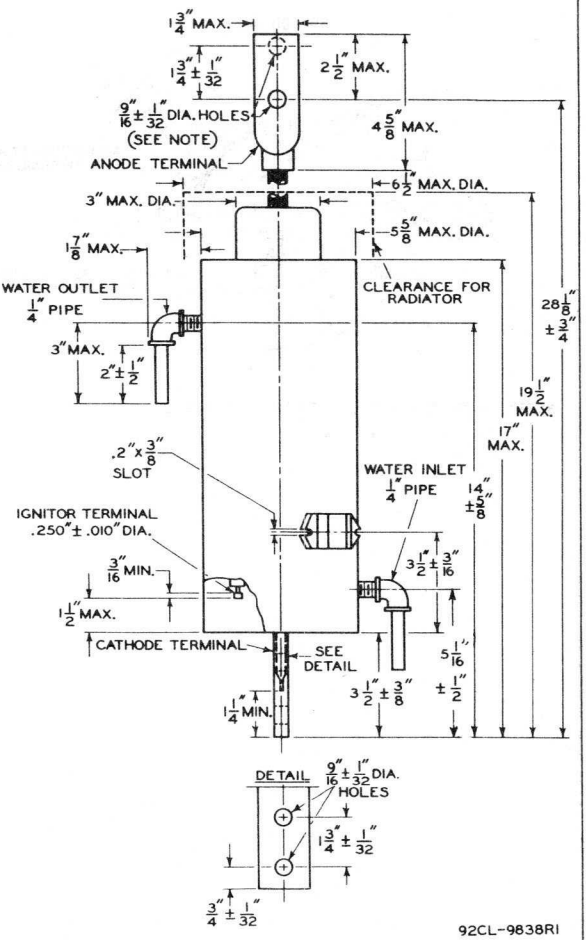
* Column 1 represents operation at maximum average anode current; Column 2 represents operation at maximum demand power.

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
for the 5553-B are the same as those shown for Type 5551-A

5553-B

IGNITRON



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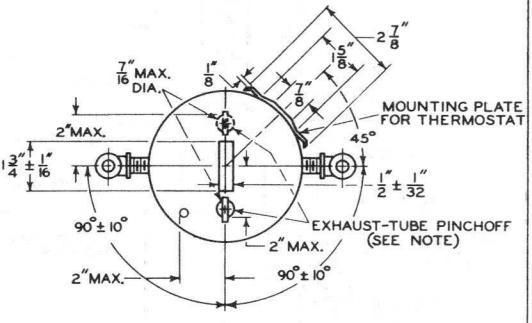
5553-B
IGNITRON

BOTTOM VIEW



NOTE: DASHED POSITION AT MANUFACTURER'S OPTION.

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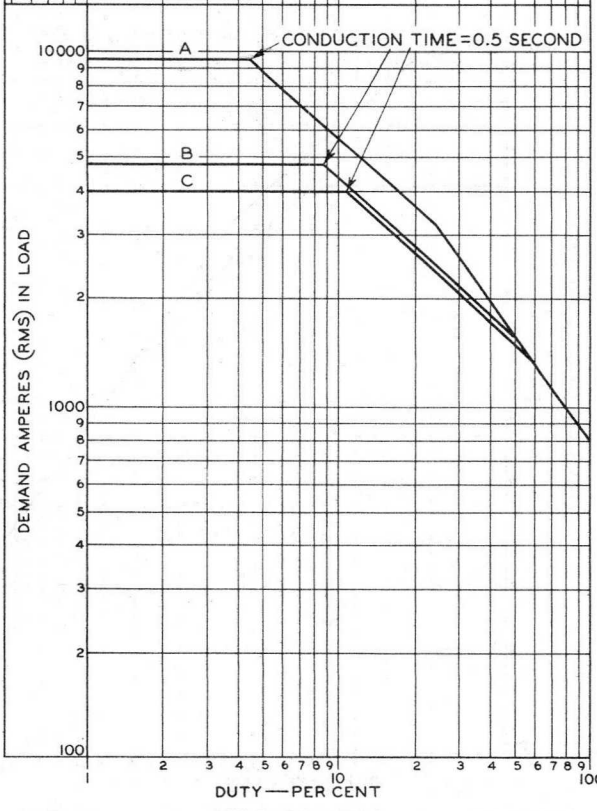
5553-B
RATING CHART
RESISTANCE-WELDING-CONTROL SERVICE

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

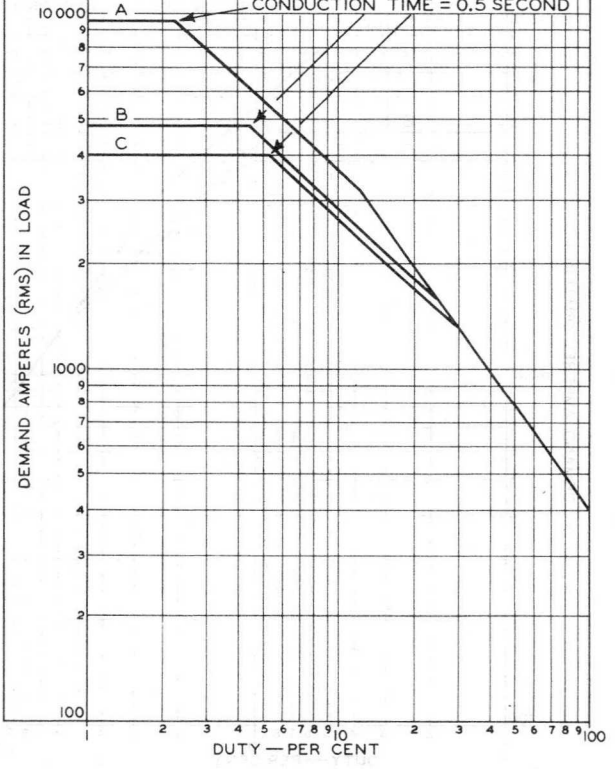
CURVE	RMS ANODE-SUPPLY VOLTS	MAXIMUM AVERAGING TIME—SECONDS
A	250	11
B	500	9.2
C	600	4.6



5553-B
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	22.4
B	500	18.8
C	600	9.4

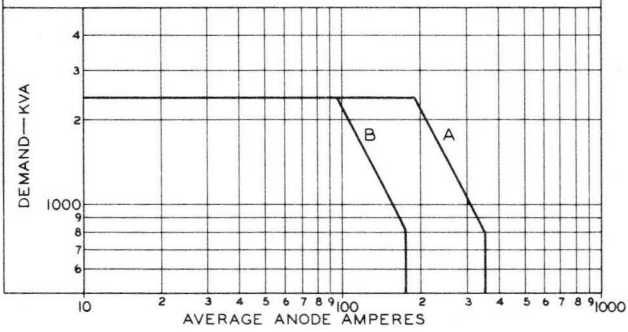


5553-B

RATING CHARTS

RESISTANCE-WELDING-CONTROL SERVICE

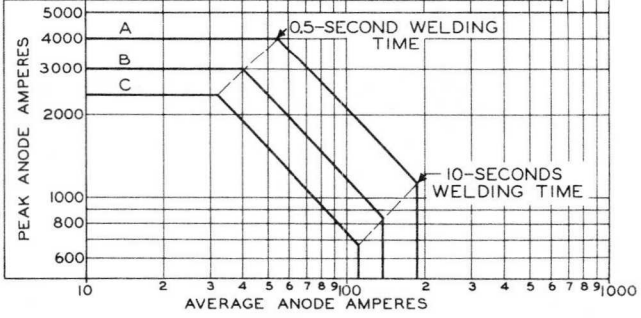
TWO TUBES CONNECTED IN INVERSE PARALLEL.
RMS ANODE-SUPPLY VOLTS = 250 TO 600
CURVE A: NO WATER-SAVING THERMOSTAT, OR WATER-SAVING THERMOSTAT SHUNTED BY AUXILIARY CONTACTOR.
CURVE B: WATER-SAVING THERMOSTAT WITHOUT AUXILIARY CONTACTOR.



92CS-9825

FREQUENCY-CHANGER WELDER SERVICE

CURVE	PEAK ANODE VOLTS FORWARD OR INVERSE	MAXIMUM AVERAGING TIME—SECONDS
A	600	6.25
B	1200	6.25
C	1500	6.25



92CS-9824

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5554
IGNITRON

DATA

General:

Cathode	Pool Type
Number of Ignitors•	2
Number of Main Anodes	1
Number of Auxiliary Anodes	1
Peak Voltage Drop:	
At 100 Amp. Peak-Anode Current	12.6 volts
At 300 Amp. Peak Anode Current	14.4 volts
At 600 Amp. Peak Anode Current	17.3 volts
Cooling:	
Type	Water
Typical Flow	1.5 to 3 gal./min.
Pressure Drop at Above Flow	2 to 5 lb./sq.in.
Temperature Rise at Lower Rate of Flow (150 Amp per Anode)	6°C
Mounting Position	Vertical, Flexible Lead Up
Maximum Rigid Length (Approx.)	17-1/2"
Diameter, Including Cooling Couplings	7-1/2" ± 1/8"

RECTIFIER SERVICE

For frequencies from 25 to 60 Cycles, Phase Retard = 0

Maximum Ratings, Absolute Values:

PEAK FORWARD ANODE VOLTAGE	900 max.	2100 max.	volts
PEAK INVERSE ANODE VOLTAGE	900 max.	2100 max.	volts
PEAK ANODE CURRENT	900 max.	600 max.	amp
AVERAGE CONTINUOUS ANODE CUR.	100 max.	75 max.	amp
2-HOUR AVERAGE ANODE CURRENT*	150 max.	112.5 max.	amp
1-MINUTE AVERAGE ANODE CUR.**	200 max.	150 max.	amp
SURGE ANODE CURRENT for 0.15 sec. max.	6000 max.	4500 max.	amp
OUTLET WATER TEMPERATURE	60 max.	45 max.	°C
INLET WATER TEMPERATURE	6 min.	6 min.	°C
WATER FLOW, AT CONTINUOUS AVERAGE ANODE CUR. RATING	1.5 min.	1.5 min.	gpm
WATER FLOW, AT NO LOAD#	0.5 min.	0.5 min.	gpm
PEAK INVERSE AUXILIARY ANODE VOLTAGE:			
With Anode Conducting	25 max.	25 max.	volts
With Anode Not Conducting	150 max.	150 max.	volts
AVERAGE AUXILIARY ANODE CUR.	5 max.	5 max.	amp
PEAK POSITIVE IGNITOR VOLTAGE	900 max.	2100 max.	volts
PEAK NEGATIVE IGNITOR VOLTAGE	5 max.		volts
PEAK IGNITOR CURRENT	100 max.		volts
AVERAGE IGNITOR CURRENT##	2 max.		volts
IGNITION TIME	100 max.		volts

GENERAL REQUIREMENTS for SELF-EXCITATION and SEPARATE EXCITATION are given on the next page

•, *, **, #, ##: See next page.

5554

5554

IGNITRON

AC WELDER-CONTROL SERVICE

Ratings for 2400 volts rms, 25 to 60 cycles

Maximum Ratings, Absolute Values:

DEMAND	1200 max.	kva
CORRESPONDING AVERAGE ANODE CURRENT.	75 max.	amp
AVERAGE ANODE CURRENT.	113 max.	amp
CORRESPONDING DEMAND	600 max.	kva
TIME OF AVERAGING ANODE CURRENT:		
At 2400 v RMS	1.5 max.	sec
SURGE ANODE CURRENT, for 0.15 sec. max.	3000 max.	amp
WATER FLOW	1.5 min.	gpm
OUTLET WATER TEMPERATURE	30 max.	°C
PEAK INVERSE AUXILIARY ANODE VOLTAGE:		
With Anode Conducting.	25 max.	volts
With Anode Not Conducting.	150 max.	volts
AVERAGE AUXILIARY ANODE CUR.	5 max.	amp
PEAK POSITIVE IGNITOR VOLTAGE.	2400 max.	volts
PEAK NEGATIVE IGNITOR VOLTAGE.	5 max.	volts
PEAK IGNITOR CURRENT	100 max.	amp
AVERAGE IGNITOR CURRENT##	2 max.	amp
IGNITION TIME.	100 max.	μsec

GENERAL REQUIREMENTS for SELF-EXCITATION and SEPARATE-EXCITATION are given below

SELF-EXCITATION (ANODE FIRING)

See Circuit 92CS-6722

PEAK IGNITOR VOLTAGE	150 min.	volts
PEAK IGNITOR CURRENT	40 min.	amp
Ignitor series resistance for anode firing at anode voltages of:		
600 volts or less.	4 . .	ohms
601 to 1000 volts (Approx.).	10 . .	ohms
1001 to 1500 volts (Approx.)	20 . .	ohms
1501 to 2000 volts (Approx.)	35 . .	ohms
2001 to 2400 volts (Approx.)	50 . .	ohms

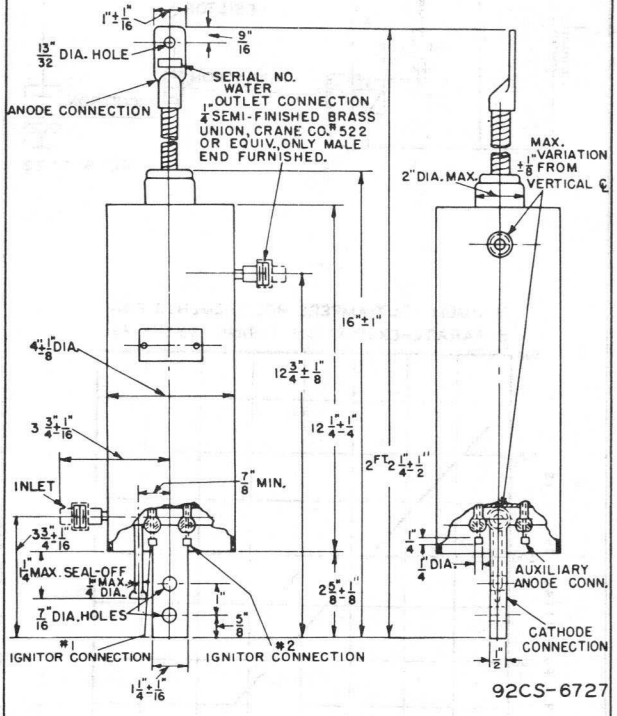
SEPARATE EXCITATION (CAPACITOR FIRING)

See Circuit 92CS-6722

Minimum volt-ampere requirements are shown on Curve 92CS-6723

• Use only one ignitor at a time.
* Averaged over any 2-minute interval.
** Averaged over any 1-minute interval.
# For systems in which the flow of water is controlled by the load.
Averaged over any 10-second interval.

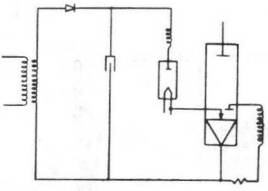
5554
IGNITRON



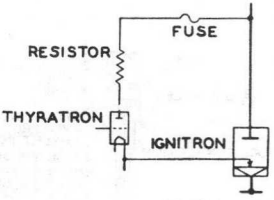
5554

5554
IGNITRON

ELEMENTARY CIRCUIT FOR CAPACITOR FIRING

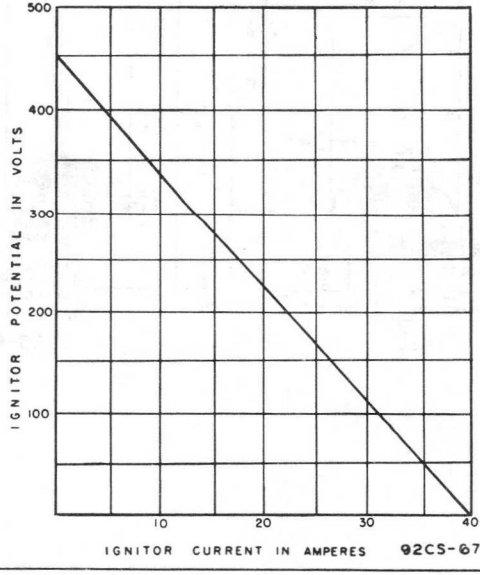


ELEMENTARY CIRCUIT FOR ANODE FIRING



92CS-6722

MINIMUM VOLT-AMPERE REQUIREMENTS FOR SEPARATE-EXCITATION FIRING SYSTEMS



92CS-6723

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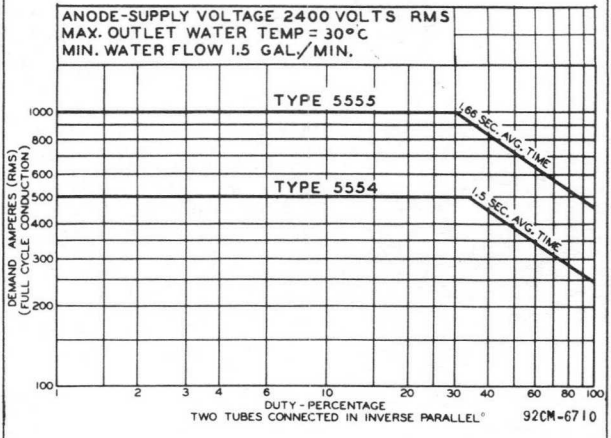
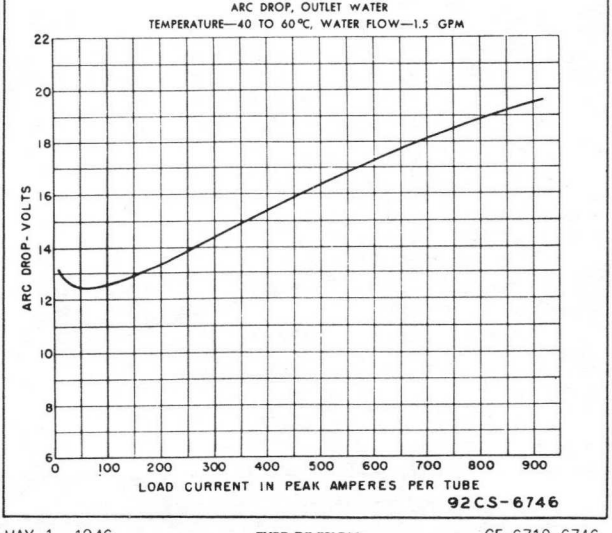
5554
IGNITRON

WELDER-CONTROL SERVICE





5556
POWER TRIODE

Useful at frequencies up to 30 Mc

GENERAL DATA

Electrical:

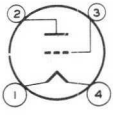
Filament, Thoriated Tungsten:		
Voltage	4.5	ac or dc volts
Current	1.1	amp
Amplification Factor, for plate volts = 350, grid volts = -20, and plate ma = 19	8.5	
Direct Interelectrode Capacitances:		
Grid to plate	6.7	μμf
Grid to filament	2.3	μμf
Plate to filament	2.2	μμf

Mechanical:

Mounting Position	Vertical, base down or up, or Horizontal with pins 1 and 4 in vertical plane
Maximum Overall Length	4-1/2" ←
Maximum Diameter	1-5/8" ←
Weight (Approx.)	2 oz ←
Base	Medium-Shell Small 4-Pin with Bayonet (JETEC No. A4-10) ←
Basing Designation for BOTTOM VIEW	4D ←

Pin 1 – Filament

Pin 2 – Plate



Pin 3 – Grid

Pin 4 – Filament

AF POWER AMPLIFIER & MODULATOR -- Class A

Maximum Ratings, *Absolute Values:*

DC PLATE VOLTAGE	350 max.	volts
PLATE DISSIPATION	7.5 max.	watts

Typical Operation:

DC Plate Voltage	350	volts
DC Grid Voltage●	-30	volts
Peak AF Grid Voltage (Approx.)	30	volts
DC Plate Current	9	ma
Plate Resistance (Approx.)	8700	ohms
Load Resistance	18000	ohms
Second Harmonic Distortion	5	%
Power Output	0.6	watt

RF POWER AMPLIFIER -- Class B Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values:*

DC PLATE VOLTAGE	350 max.	volts

●: See next page.

← Indicates a change.

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5556

POWER TRIODE

DC PLATE CURRENT	40 max.	ma
PLATE INPUT	14 max.	watts
PLATE DISSIPATION	10 max.	watts

Typical Operation:

DC Plate Voltage	350	volts
DC Grid Voltage●	−40	volts
Peak RF Grid Voltage	90	volts
DC Plate Current	32	ma
Driving Power (Approx.)*	0.1	watt
Power Output	2	watts

PLATE-MODULATED RF POWER AMPLIFIER -- Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values:*

DC PLATE VOLTAGE	350 max.	volts
DC GRID VOLTAGE	−150 max.	volts
DC PLATE CURRENT	40 max.	ma
DC GRID CURRENT	10 max.	ma
PLATE INPUT	14 max.	watts
PLATE DISSIPATION	7 max.	watts

Typical Operation:

DC Plate Voltage	300	volts
DC Grid Voltage●	−100	volts
Peak RF Grid Voltage (Approx.)	140	volts
DC Plate Current	30	ma
DC Grid Current (Approx.)	2	ma
Driving Power (Approx.)	0.3	watt
Power Output (Approx.)	4	watts

RF POWER AMPLIFIER & OSCILLATOR -- Class C Telegraphy□
and
RF POWER AMPLIFIER -- Class C FM Telephony

Maximum Ratings, *Absolute Values:*

DC PLATE VOLTAGE	350 max.	volts
DC GRID VOLTAGE	−150 max.	volts
DC PLATE CURRENT	40 max.	ma
DC GRID CURRENT	10 max.	ma
PLATE INPUT	14 max.	watts
PLATE DISSIPATION	10 max.	watts

Typical Operation:

DC Plate Voltage	350	volts
DC Grid Voltage●	−80	volts
Peak RF Grid Voltage	130	volts

● With dc filament excitation.

*, □: See next page.

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5556

POWER TRIODE

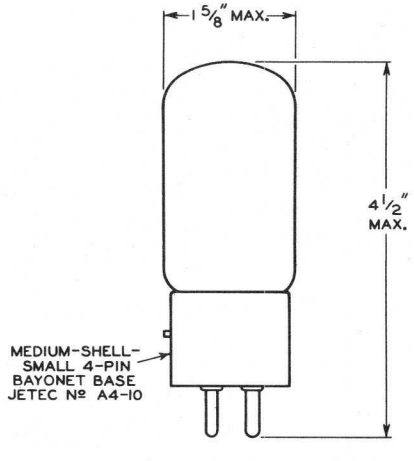
DC Plate Current	35	ma
DC Grid Current (Approx.)	2	ma
Driving Power (Approx.)	0.25	watt
Power Output (Approx.)	6	watts

At crest of af_t cycle with modulation factor of 1.

□ Key-down conditions per tube without amplitude modulation. Amplitude modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

MAXIMUM RATINGS vs OPERATING FREQUENCY

FREQUENCY	6	15	30	Mc
MAXIMUM PERMISSIBLE PERCENTAGE OF MAXIMUM RATED PLATE VOLTAGE AND PLATE INPUT:				
Class B Telephony	100	85	70	%
Class C Telephony	100	75	50	%
Class C Telegraphy	100	75	50	%

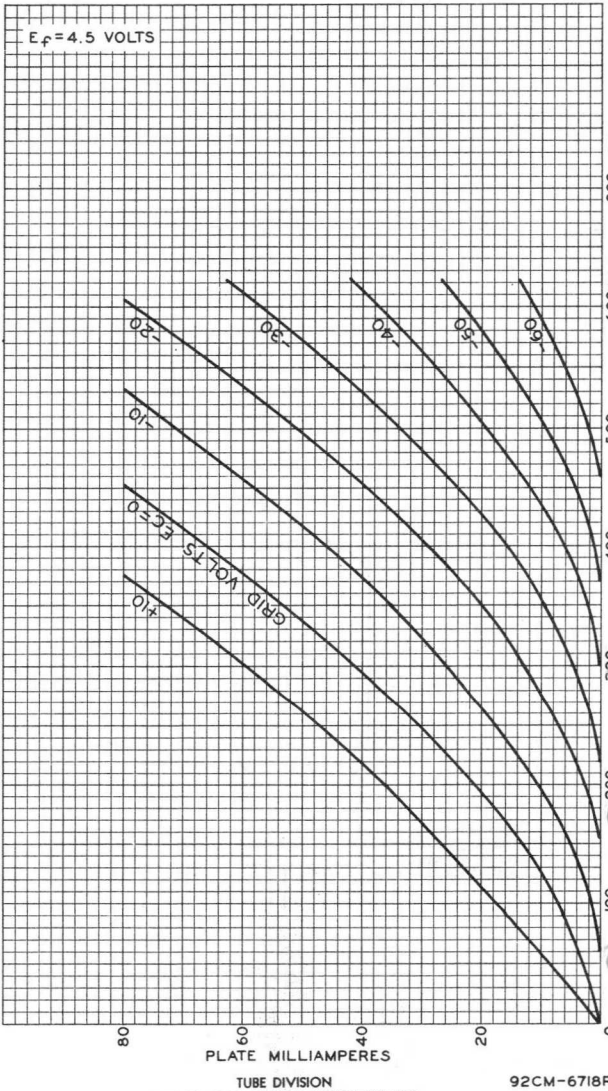


92CS-6717RI

5556

5556

AVERAGE PLATE CHARACTERISTICS



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6718RI

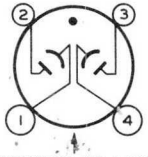
Gas Phototube

SIDE-ON, TWIN-UNIT TYPE HAVING S-4 RESPONSE

DATA

General:

Spectral Response. S-4
Wavelength of Maximum Response . . . . 4000 ± 500 angstroms
Cathode (Each):
  Shape. . . . . .Quarter-Cylindrical
  Minimum projected length[a]. . . . . 1-3/16"
  Minimum projected width[a] . . . . . 1/4"
Direct Interelectrode Capacitances (Approx.):
  Cathode to cathode[b]. . . . . 1.8 μμf
  Cathode to anode[c]. . . . . 1.6 μμf
  Anode to anode[d]. . . . . 0.4 μμf ←
Maximum Overall Length . . . . . 4"
Maximum Seated Length. . . . . 3-3/8"
Seated Length to Center of Cathode . . . . . 2-1/8" ± 3/32"
Maximum Diameter . . . . . 1-3/16"
Operating Position . . . . . .Any
Weight (Approx.) . . . . . 1.1 oz ←
Bulb T9
Socket . . . . . .Amphenol No.77-MIP-4-T, or equivalent ←
Base . . . . . .Small-Shell Small 4-Pin (JEDEC No.A4-5)
  Basing Designation for BOTTOM VIEW 4BG



Pin 1 – Photocathode of Unit No.2
Pin 2 – Anode of Unit No.2
Pin 3 – Anode of Unit No.1
Pin 4 – Photocathode of Unit No.1

DIRECTION OF LIGHT

Maximum Ratings, *Absolute-Maximum Values:* ←

Values are for Each Unit

	Rating I	*Rating II*	
ANODE-SUPPLY VOLTAGE (DC or Peak AC).	80 max.	100 max.	volts
AVERAGE CATHODE-CURRENT DENSITY[e]	20 max.	10 max.	μa/sq.in.
AVERAGE CATHODE CURRENT[e] . . .	4 max.	2 max.	μa
AMBIENT TEMPERATURE.	75 max.	75 max.	°C

← Indicates a change.

5584

Characteristics:

Values are for each unit with an anode-supply voltage of 90 volts unless otherwise specified

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4000 angstroms. .	–	0.12	–	amp/watt
Luminous:[f]				
At 0 cps.	80	120	175	μa/lumen
At 5000 cps	–	110	–	μa/lumen
At 10000 cps.	–	96	–	μa/lumen
Ratio of Luminous Sensitivities (Unit No.1 to Unit No.2). . .	0.5	1.15	2.0	
Gas Amplification Factor[g] . . .	–	–	5.5	
Anode Dark Current at 25° C . .	–	–	0.050	μa

Minimum Circuit Values:

Values are for Each Unit

With an anode-supply voltage of	*80 or less*	*100*	*volts*
DC Load Resistance:			
For dc currents above 3 μa. .	0.1 min.	–	megohm
For dc currents below 3 μa. .	0 min.	–	megohm
For dc currents above 1 μa. .	–	2.5 min.	megohms
For dc currents below 1 μa. .	–	0.1 min.	megohm

[a] On plane perpendicular to indicated direction of incident light.

[b] With anodes grounded.

[c] Each unit, with other unit grounded.

[d] With cathodes grounded.

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

[f] For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K. A dc anode supply of 90 volts and a 1-megohm load resistor are used. For the 0-cycle measurement, a light input of 0.04 lumen is used. For the 5000- and 10000-cycle measurements, the light input is varied sinusoidally about a mean value of 0.015 lumen from zero to a maximum of twice the mean value.

[g] The ratio of luminous sensitivity at an anode-supply voltage of 90 volts to luminous sensitivity at an anode-supply voltage of 25 volts. In each case, sensitivity is obtained under conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K, the light input is 0.04 lumen, and the load resistor has a value of 1 megohm.

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-4 RESPONSE

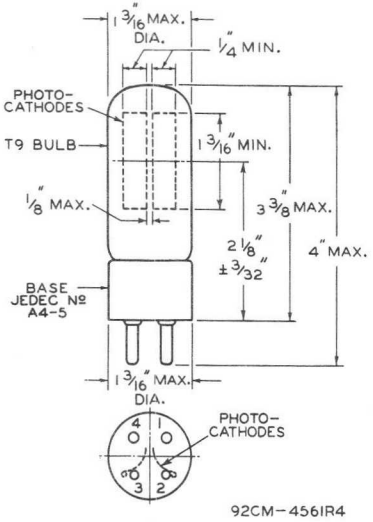
and

FREQUENCY-RESPONSE CHARACTERISTICS OF GAS PHOTOTUBES

are shown at the front of this section

AVERAGE-ANODE-CHARACTERISTICS CURVE shown under Type 5582 also applies to each unit of the 5584

→ Indicates a change.


1 3/16" MAX. DIA.
1/4" MIN.
PHOTO-CATHODES
T9 BULB
1 3/16" MIN.
1/8" MAX.
3 3/8" MAX.
2 1/8" ± 3/32"
4" MAX.
BASE JEDEC Nº A4-5
1 3/16" MAX. DIA.
PHOTO-CATHODES
4
1
3
2
92CM-456IR4

5592

POWER TRIODE

FORCED-AIR-COOLED, GROUNDED-GRID TYPE

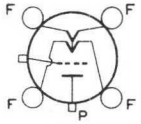
GENERAL DATA

Electrical:

Filament, Multistrand Tungsten:			
Excitation . . .	Single-Phase AC or DC		
Voltage.	11	. . . . .	ac or dc volts
Current.	412	. . . . .	amp
Starting Current:	The filament current must never exceed 750 amperes, even momentarily.		
Cold Resistance. . . .	0.0026	. . . . .	ohm
Amplification Factor . .	32		
Direct Interelectrode Capacitances (Approx.):			
Grid to Plate.	35	. . . . .	μμf
Grid to Filament . . .	76	. . . . .	μμf
Plate to Filament. . .	1.2	. . . . .	μμf

Mechanical:

Terminal Connections:



F – Filament Posts
G – Grid-Flange Terminal

P – Radiator-Cooled Plate Terminal

DIAMETRICALLY OPPOSITE TERMINALS MUST BE CONNECTED TOGETHER

Mounting Position	Vertical, Filament end up	
Maximum Overall Length	17-3/8"	
Maximum Diameter	14-1/4"	
Radiator	Integral part of tube	
Mounting	Special	
Air Flow:		
Through Radiator (for max. ratings). . .	1100 min.	cfm
The specified air flow at a pressure of 2.4 inches of water should be delivered by a blower vertically upward through the radiator. Air flow should be started before the application of any voltages.		
To Filament Seals.	200 min.	cfm
The specified air flow from a duct 8 square inches in area directed into the filament header before and during the application of any voltages, is required to limit the temperature of the header and filament seals to the maximum value.		
Input--Air Temperature (to radiator). . . .	45 max.	°C
Radiator Temperature (measured in thermometer well). .	180 max.	°C
Bulb Temperature	180 max.	°C
Seal Temperature (filament, grid, plate) .	165 max.	°C

RF POWER AMPLIFIER & OSCILLATOR – Class C Telegraphy

Key-down conditions per tube without amplitude modulation□

Maximum CCS● Ratings, *Absolute Values:*

DC PLATE VOLTAGE	11500 max.	volts
DC GRID VOLTAGE	-2000 max.	volts
DC PLATE CURRENT	4.5 max.	amp
DC GRID CURRENT	0.8 max.	amp

□, ●: See next page.

5592
POWER TRIODE

PLATE INPUT		50 max.	kw
PLATE DISSIPATION		17.5 max.	kw
Typical Operation in Grounded-Filament Circuit:			
DC Plate Voltage	7500	11000	volts
DC Grid Voltage■	-360	-820	volts
	600	1000	ohms
	75	200	ohms
Peak RF Grid Voltage	900	1450	volts
DC Plate Current	4.4	3.6	amp
DC Grid Current (Approx.)*	0.6	0.8	amp
Driving Power (Approx.)*	450	1000	watts
Power Output (Approx.)	20	30	kw
Typical Operation as Amplifier in Grounded-Grid Circuit at 108 Mc:▲			
DC Plate Voltage		7500	volts
DC Grid Voltage■		-1000	volts
		1650	ohms
		200	ohms
Peak RF Grid Voltage		1550	volts
DC Plate Current		4.4	amp
DC Grid Current (Approx.)*		0.6	amp
Driving Power (Approx.)		9000	watts
Power Output (Approx.)		27	kw

□ Modulation essentially negative may be used if positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

● Continuous Commercial Service.

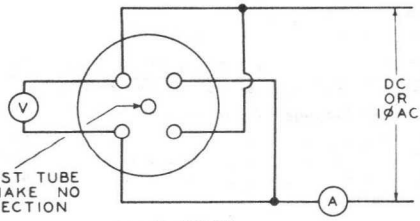
■ Obtained by grid-resistor (600, 1000), cathode-resistor (75, 200) or by partial self-bias methods.

* Subject to wide variations as explained on sheet TUBE RATINGS in General Section.

▲ For Class C Telegraphy or Class C FM Telephony.

Data on operating frequencies for the 5592 are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY.

FILAMENT CONNECTIONS

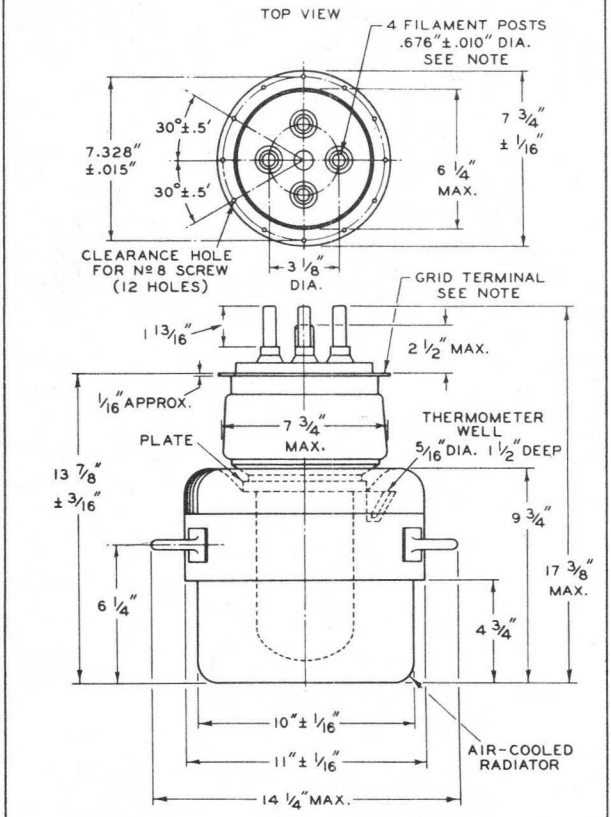


V= 11 VOLTS
A=412 AMP.

92CS-6828R1

5592

POWER TRIODE



NOTE: FLEXIBLE CONNECTIONS ARE REQUIRED.

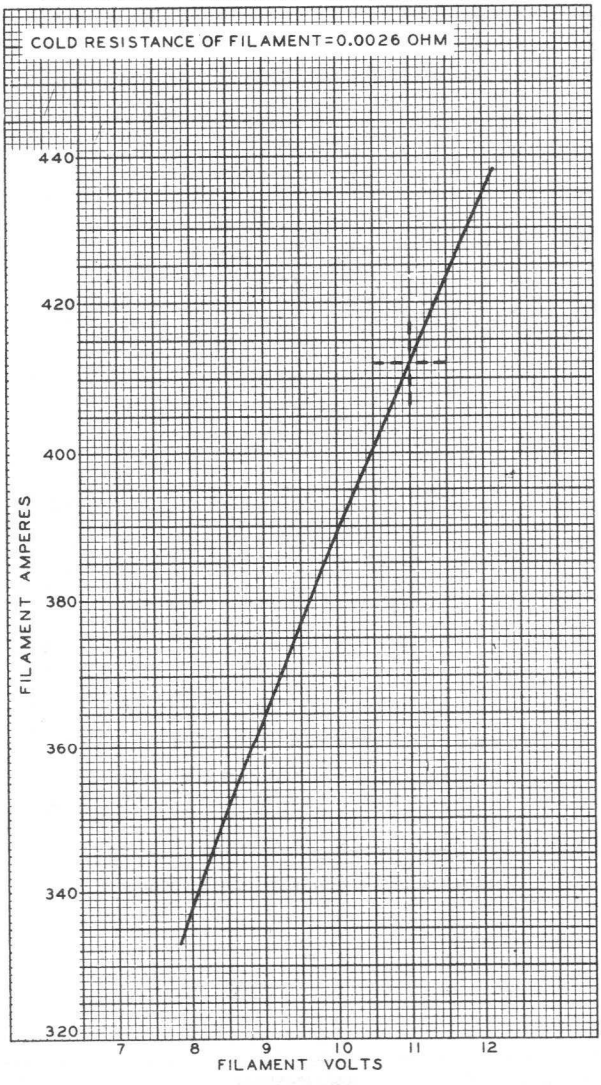
92CM-6827

5592

RCA

5592

AVERAGE FILAMENT CHARACTERISTIC



FEB. 7, 1947

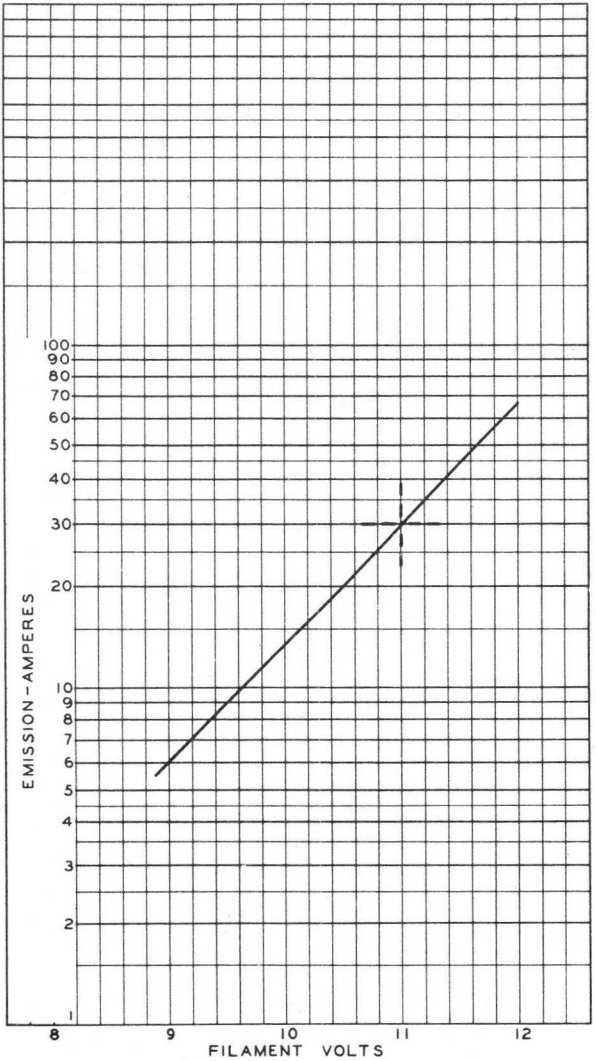
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6839

RCA

5592

AVERAGE FILAMENT-EMISSION CHARACTERISTIC



FEB. 6, 1947

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6838

RCA

5592

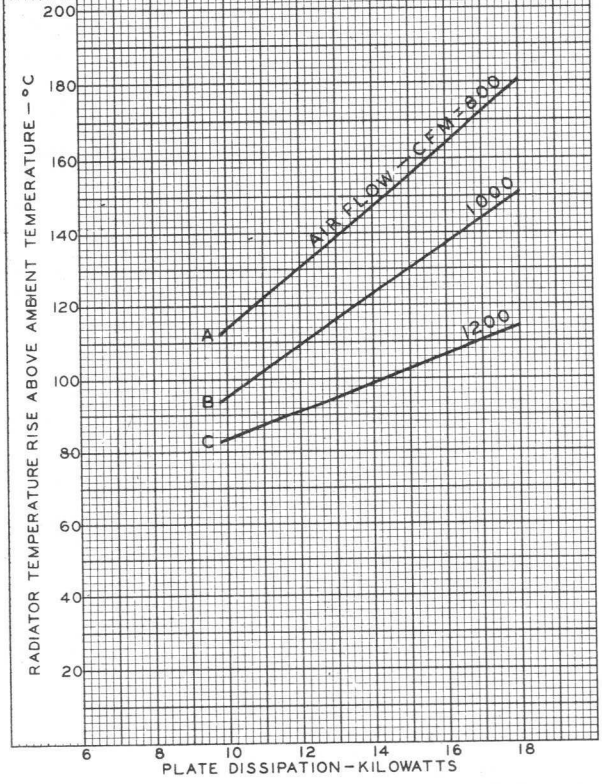
COOLING REQUIREMENTS

E_f = 11 VOLTS AC
MAXIMUM RADIATOR TEMPERATURE = 180°C

CURVE	PRESSURE DROP INCHES OF WATER
A	1.3
B	2.0
C	2.9

CURVES TAKEN ACCORDING TO NAFM* STANDARDS— BULLETIN Nº103

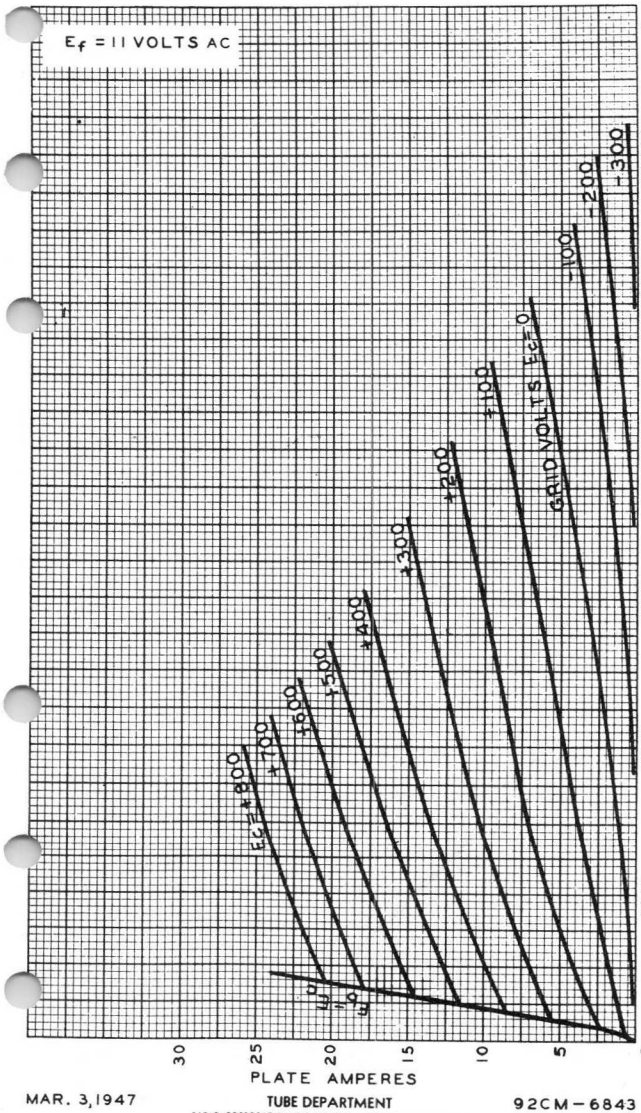
*NATIONAL ASSOCIATION OF FAN MFRS., GENERAL MOTORS BLDG., DETROIT, MICH.



RCA

5592

AVERAGE PLATE CHARACTERISTICS



MAR. 3, 1947

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

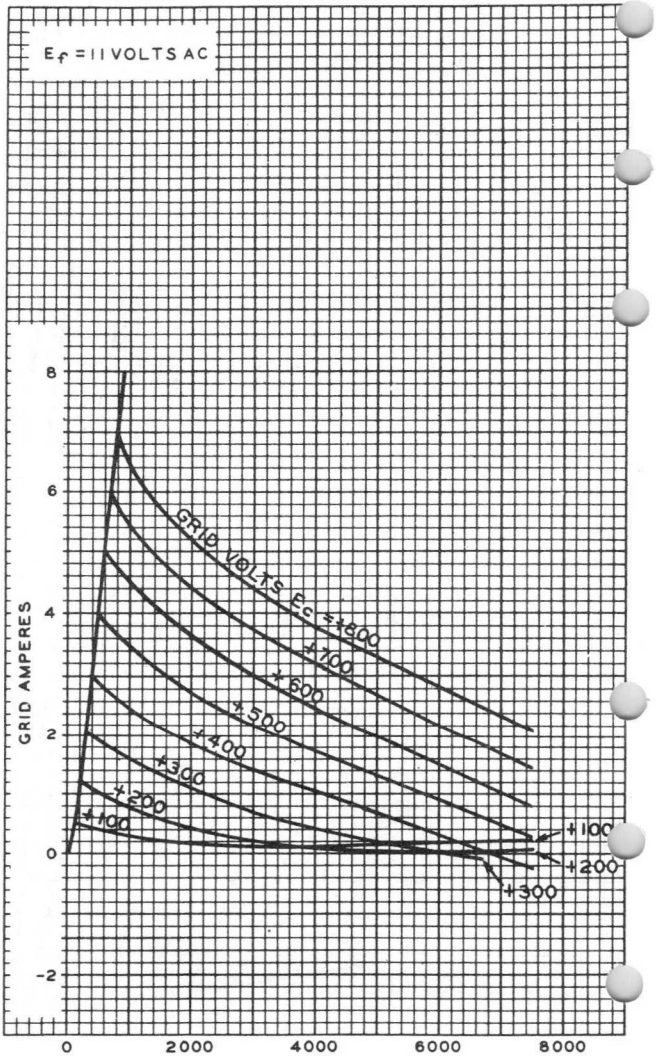
92CM-6843

5592

RCA

5592

TYPICAL GRID CHARACTERISTICS



MAR. 3, 1947

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6844

5604-A
POWER TRIODE

FORCED-AIR COOLED

GENERAL DATA

Electrical:

Filament, Multistrand Tungsten:

Voltage	11	ac or dc volts
Current	176	amp
Starting current:	The filament current must never exceed a value of 270 amperes, even momentarily.	
Cold resistance	0.0052	ohm

NOTE: This tube can often be operated with reduced filament voltage as explained on sheet TYPES OF CATHODES in the General Section.

Amplification Factor, for plate current = 1.25 amp and grid volts = -100 . . 20

Direct Interelectrode Capacitances:

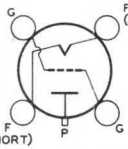
Grid to plate	24	μμf
Grid to filament	27	μμf
Plate to filament	1.25	μμf

Mechanical:

Terminal Connections: TOP VIEW

F - Filament

G - Grid



P - Plate (Either of two terminals on radiator band)

Mounting Position . . . . . Vertical, filament end up
Maximum Overall Length . . . . . 13-3/4"
Maximum Diameter (Including radiator handles) . . . . . 11"
Radiator . . . . . Integral part of tube
Air Flow:

Through Radiator--Typical flow values of incoming air at a temperature not exceeding 45°C for various plate dissipations, are indicated in the tabulation below. The air should be delivered by a blower vertically upward through the radiator during the application of any voltages. Under any condition, the air flow must be adequate to limit the temperature of the radiator to its specified maximum value. *See Cooling Requirements curves.*

Percentage of max. rated plate dissipation for each class of service	100	80	60	per cent
Air flow	650	460	310	cfm
Static pressure	2	1	0.45	in. of water

5604-A
POWER TRIODE

To Bulb and Seals--At frequencies below 15 Mc, adequate cooling of the bulb and seals is provided by the air flow through the radiator. At frequencies above 15 Mc, however, additional air flow directed onto the filament end of the tube should be supplied by a blower providing 50 cfm through a 3" nozzle in order to limit the temperature of the grid seals, filament seals, and bulb to 160°C.

Incoming-Air Temperature (To radiator)	45 max.	°C
Radiator Temperature (Measured on core at end adjacent to bulb)	230 max.	°C
Bulb Temperature	160 max.	°C
Seal Temperature (Filament, grid, and plate)	160 max.	°C
Weight (Approx.)	32	lbs

Fittings:

Air Jacket	RCA-211F1
Connector Wrench (2 required)	RCA-212F1
Grid or Filament Connector (4 required)	RCA-216F1
Bracelet	RCA-232F1
Air Manifold	RCA-234F1

AF POWER AMPLIFIER & MODULATOR--Class B

Maximum CCS• Ratings, *Absolute Values:*

DC PLATE VOLTAGE	12500 max.	volts
MAX.-SIGNAL DC PLATE CURRENT*	2.75 max.	amp
MAX.-SIGNAL PLATE INPUT*	32500 max.	watts
PLATE DISSIPATION*	10000 max.	watts

Typical Operation:

Values are for 2 tubes

DC Plate Voltage	8000	10000	12000	volts
DC Grid Voltage	-370	-480	-600	volts
Peak AF Grid-to-Grid Voltage	1620	2020	2380	volts
Zero-Signal DC Plate Current	0.4	0.5	0.6	amp
Max.-Signal DC Plate Current	2.6	3.7	4.5	amp
Effective Load Resistance (Plate to plate)	7200	6100	5900	ohms
Max.-Signal Driving Power (Approx.)	140	150	160	watts
Max.-Signal Power Output (Approx.)	14500	25000	36000	watts

* Averaged over any audio-frequency cycle of sine-wave form.

•: See next page.

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POWER TRIODE

RF POWER AMPLIFIER--Class B Telephony

Carrier conditions per tube with a max. modulation factor of 1.0

Maximum CCS● Ratings, *Absolute Values:*

DC PLATE VOLTAGE	12500 max.	volts
DC PLATE CURRENT	1.4 max.	amp
PLATE INPUT	16000 max.	watts
PLATE DISSIPATION	10000 max.	watts

Typical Operation:

DC Plate Voltage	8000	10000	12000	volts
DC Grid Voltage	-400	-500	-610	volts
Peak RF Grid Voltage	410	490	590	volts
DC Plate Current	0.6	0.8	1.0	amp
DC Grid Current (Approx.)	0	0	0	amp
Driving Power (Approx.)**	75	70	65	watts
Power Output (Approx.)	1700	2800	4400	watts

PLATE-MODULATED RF POWER AMPLIFIER--Class C Telephony

Carrier conditions per tube with a max. modulation factor of 1.0

Maximum CCS● Ratings, *Absolute Values:*

DC PLATE VOLTAGE	8000 max.	volts
DC GRID VOLTAGE	-2000 max.	volts
DC PLATE CURRENT	1.5 max.	amp
DC GRID CURRENT	0.45 max.	amp
PLATE INPUT	12000 max.	watts
PLATE DISSIPATION	6600 max.	watts

Typical Operation:

DC Plate Voltage	6000	8000	volts
DC Grid Voltage	-740	-1000	volts
Peak RF Grid Voltage	1140	1540	volts
DC Plate Current	0.7	1.1	amp
DC Grid Current (Approx.)	0.09	0.13	amp
Driving Power (Approx.)	100	200	watts
Power Output (Approx.)	3400	7100	watts

RF POWER AMPLIFIER & OSCILLATOR--Class C Telegraphy

Key-down conditions per tube without amplitude modulation□

Maximum CCS● Ratings, *Absolute Values:*

DC PLATE VOLTAGE	12500 max.	volts
DC GRID VOLTAGE	-2000 max.	volts

● Continuous Commercial Service.

**,□: See next page.

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POWER TRIODE

DC PLATE CURRENT			3 max.	amp
DC GRID CURRENT			0.45 max.	amp
PLATE INPUT			32500 max.	watts
PLATE DISSIPATION			10000 max.	watts
Typical Operation:				
DC Plate Voltage	8000	10000	12000	volts
DC Grid Voltage	-680	-870	-1170	volts
Peak RF Grid Voltage	1300	1620	2130	volts
DC Plate Current	1.5	2.0	2.5	amp
DC Grid Current (Approx.)	0.19	0.20	0.22	amp
Driving Power (Approx.)	250	320	470	watts
Power Output (Approx.)	9200	15000	22500	watts

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Filament Current	1	168	184	amp
Amplification Factor	1,2	17.5	22.5	
Grid-Plate Capacitance	-	21	27.5	μμf
Grid-Filament Capacitance	-	23	31	μμf
Plate-Filament Capacitance	-	-	2	μμf
DC Grid Voltage	1,3	-480	-600	volts
DC Plate Voltage (1)	1,4	3000	4000	volts
DC Plate Voltage (2)	1,5	6700	8300	volts
Peak Cathode Current	6	11.5	-	amp
Power Output	1,7	22.5	-	kw

Note 1: With 11 volts rms on filament.

Note 2: With dc grid voltage of -100 volts and dc plate current of 1.25 amperes.

Note 3: With dc plate voltage of 10000 volts, and dc plate current of 0.020 ampere.

Note 4: With dc grid voltage of 0 volts, and dc plate current of 1.25 amperes.

Note 5: With dc grid voltage of -200 volts, and dc plate current of 1.25 amperes.

Note 6: Designers should limit the maximum useable cathode current (plate current and grid current) to this value under any condition of operation.

Note 7: In amplifier or oscillator service at a frequency of 1.6 Mc, and with dc plate voltage of 12500 volts, dc plate current of 2.6 amperes, grid resistor of 6000 ± 10% ohms, and dc grid current of 0.225 ampere.

□ Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

MAXIMUM RATINGS vs OPERATING FREQUENCY

FREQUENCY	25	35	50	Mc
MAX. PERMISSIBLE PERCENTAGE OF MAX. RATED PLATE VOLTAGE AND PLATE INPUT:				
Class B Telephony	100	85	70	per cent
Class C Telephony	100	80	50	per cent
Class C Telegraphy	100	80	50	per cent

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RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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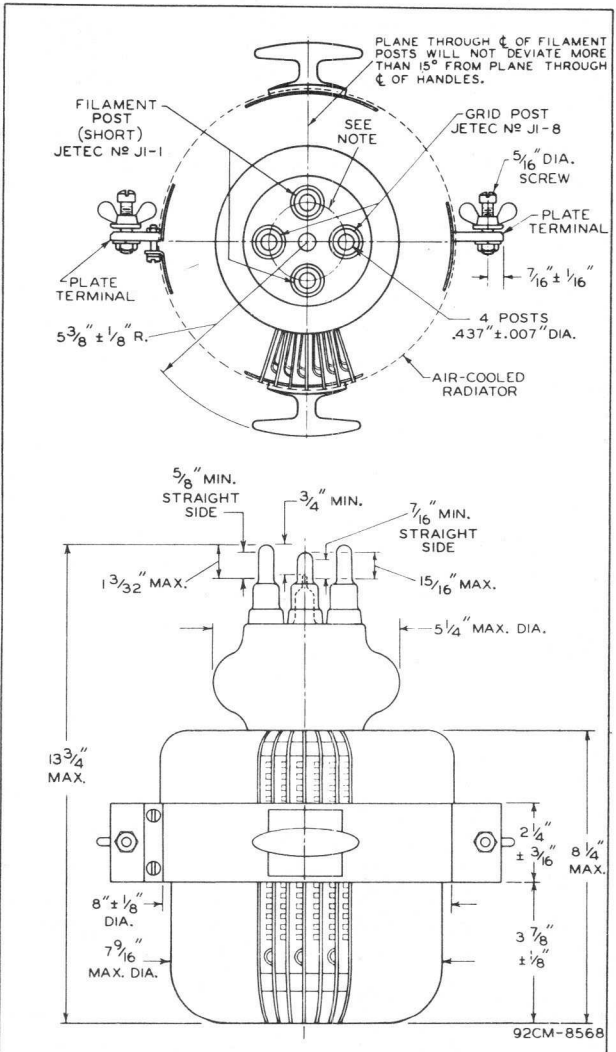
POWER TRIODE



5604-A
POWER TRIODE

NOTE: ANGULAR VARIATIONS BETWEEN POSTS AND VARIATION IN POST-CIRCLE DIAMETER ARE HELD TO TOLERANCES SUCH THAT THE ENTIRE STRAIGHT-SIDE LENGTH OF THE POSTS WILL ENTER A 5/8" THICK FLAT-PLATE GAUGE HAVING 4 HOLES 0.536" ± 0.001" DIAMETER ARRANGED ON A 2.125" ± 0.001" DIAMETER CIRCLE AT ANGLES OF 90° ± 10', AND HAVING A CENTER CLEARANCE HOLE WITH DIAMETER OF 1" APPROX.

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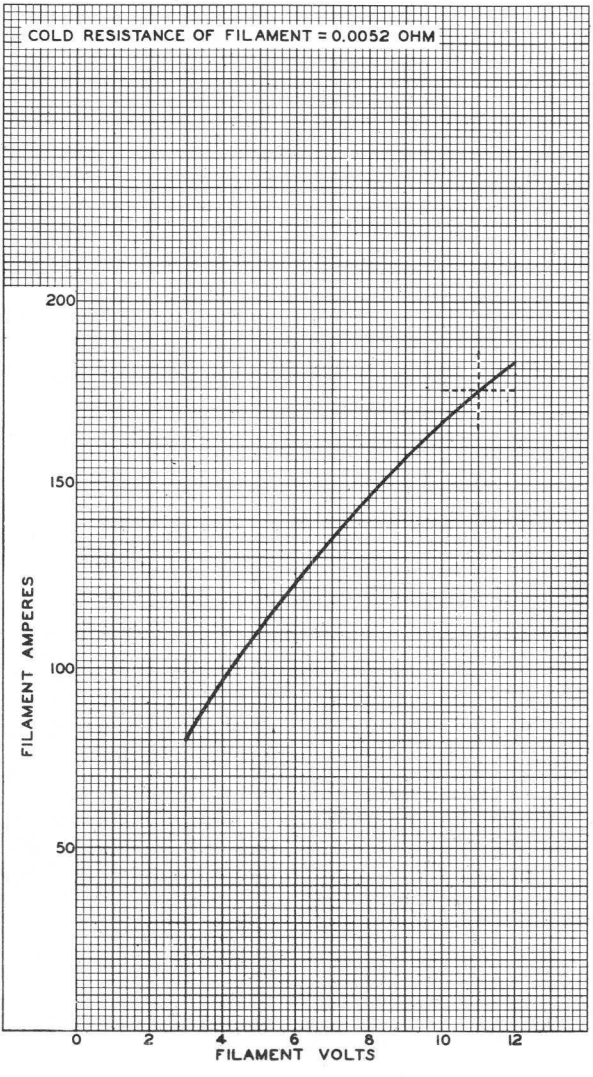
AVERAGE FILAMENT CHARACTERISTIC



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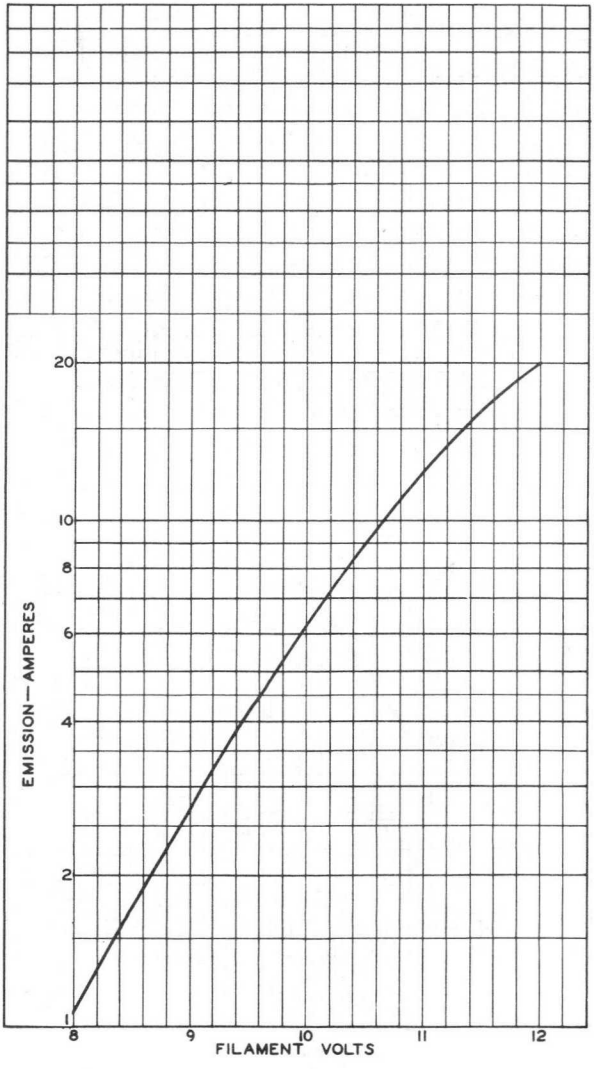
AVERAGE FILAMENT-EMISSION CHARACTERISTIC



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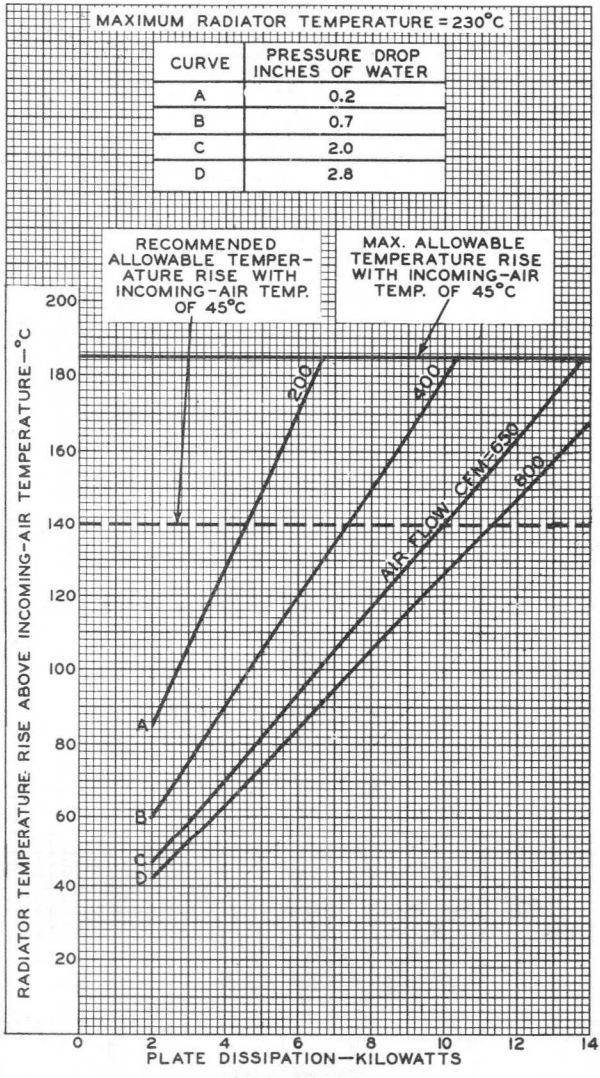
COOLING REQUIREMENTS



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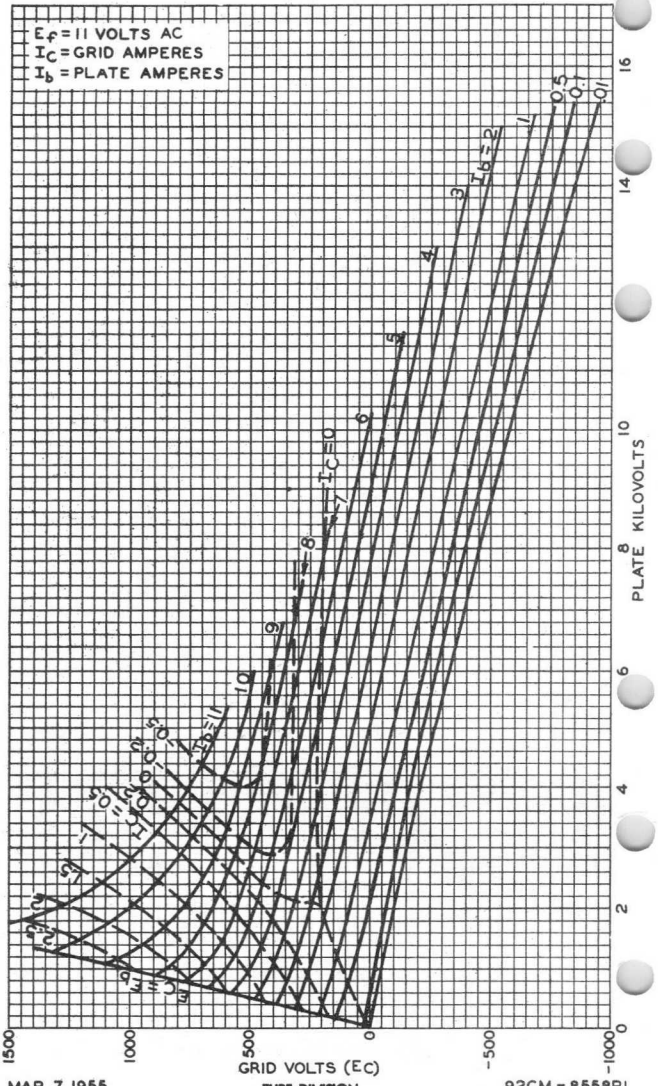
AVERAGE CONSTANT-CURRENT CHARACTERISTICS



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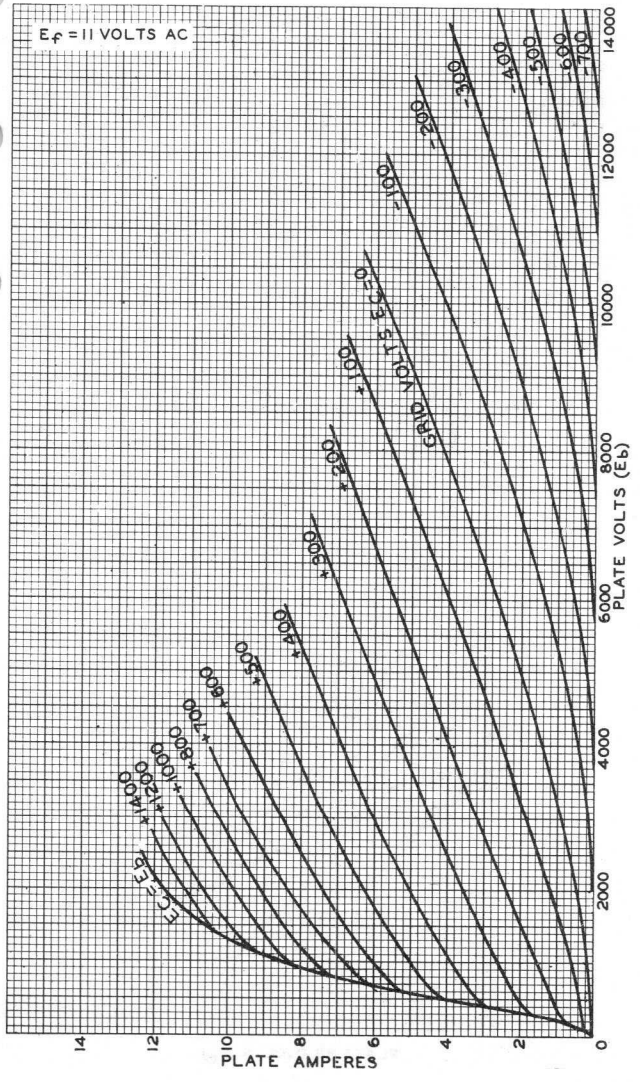
AVERAGE PLATE CHARACTERISTICS



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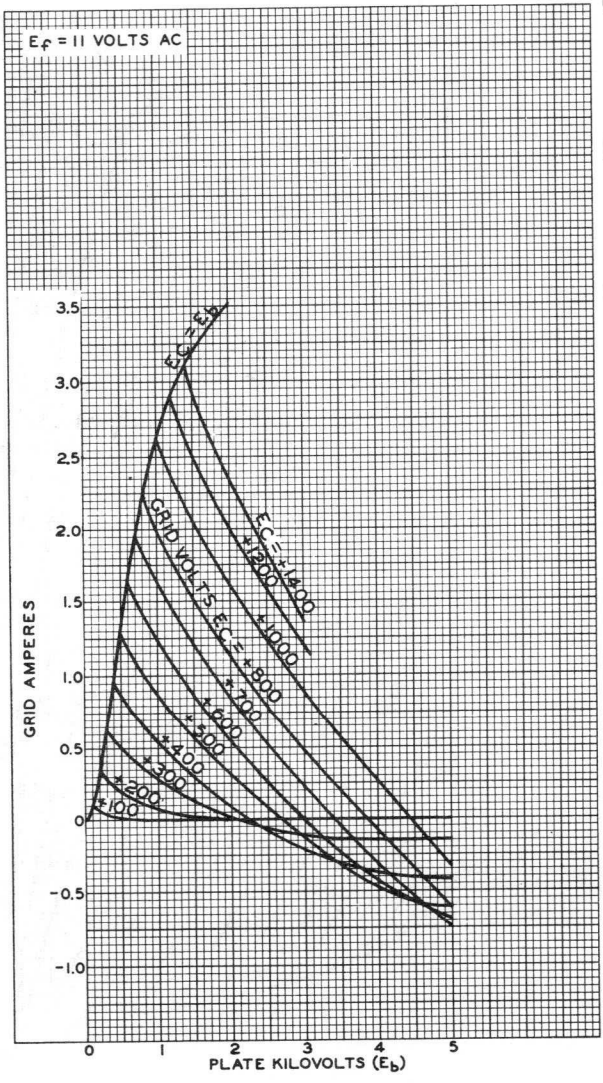
TYPICAL CHARACTERISTICS



5651

VOLTAGE-REFERENCE TUBE

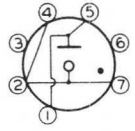
MINIATURE GLOW-DISCHARGE TYPE

DATA

General:

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

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:*

DC OPERATING CURRENT (Continuous)	3.5 max.	ma
AMBIENT TEMPERATURE RANGE	-55 to +90	°C

Characteristics and Operation Range Values:

	Min.	*Av.*	*Max.*	
DC Starting Voltage	–	107	115*	volts
DC Operating Voltage	82	87	92	volts
DC Operating Current	1.5	–	3.5	ma
Regulation (1.5 ma. to 3.5 ma.)	–	–	3	volts
Stability□	–	–	0.1	volt

Circuit Values:

Shunt Capacitor	–	–	0.02	μf
Series Resistor	See NOTE Below			

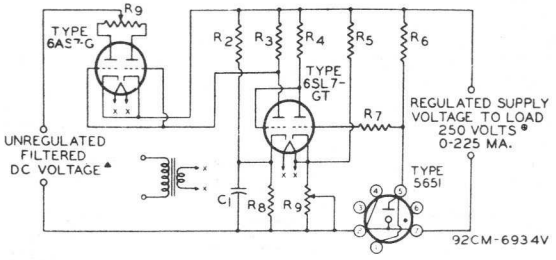
* A supply voltage of not less than this value should be provided to insure "starting" throughout tube life.

□ Defined as the maximum voltage fluctuation at any current level within the operating current range.

NOTE: A series resistor must always be used with the 5651. The resistance value must be chosen so that (1) the maximum current rating of 3.5 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.

5651
VOLTAGE-REFERENCE TUBE

SERIES TYPE OF STABILIZED VOLTAGE SUPPLY USING RCA-5651 AS VOLTAGE-REFERENCE TUBE



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, 0.5 watt
R_4 = 470000 ohms, 0.5 watt
R_5 = 12000 ohms, 2 watts
R_6 = 68000 ohms, 1 watt
R_7 = 1 megohm, 0.5 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.

⊕ 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 0.2 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. Socket connections for the 5651 are made so that removal of the 5651 from its socket opens the load.

RCA

5690

SPECIAL RED TUBE 5690

FULL-WAVE VACUUM RECTIFIER

Intended for critical industrial and aircraft applications where 10,000-hour life, extreme uniformity, rigid construction, and exceptional stability are paramount.

GENERAL DATA

Electrical:

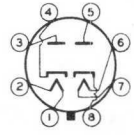
Heaters, Pure Tungsten, for Unipotential Cathodes:

Of Units 1 & 2 connected in	*Series*	*Parallel*	
Voltage	12.6 ± 5%*	6.3 ± 5%*	volts
Current	1.2	2.4	amp

Mechanical:

Mounting Position	Any
Maximum Overall Length	4-1/4"
Maximum Seated Length	3-11/16"
Maximum Diameter	1-23/32"
Bulb	T-12
Base	Short Jumbo-Shell Octal 8-Pin, Non Hygroscopic (JETEC No.B8-71)

BOTTOM VIEW



Pin 1: Heater of Unit No.2
Pin 2: Heater of Unit No.2
Pin 3: Plate of Unit No.2
Pin 4: Cathode of Unit No.2
Pin 5: Plate of Unit No.1
Pin 6: Heater of Unit No.1
Pin 7: Heater of Unit No.1
Pin 8: Cathode of Unit No.1

RECTIFIER

Maximum Ratings, *Absolute Values: For supply frequency of 60 cps*

	For Altitudes up to 40000 Feet	
PEAK INVERSE PLATE VOLTAGE	1120 max.	volts
PEAK VOLTAGE BETWEEN PLATE OF UNIT No.1 AND PLATE OF UNIT No.2	1120 max.	volts
PEAK PLATE CURRENT PER PLATE	375 max.	ma
AC PLATE SUPPLY VOLTAGE (RMS) PER PLATE	*See Rating Chart I*	
DC OUTPUT CURRENT PER PLATE	*See Rating Chart I*	

HOT-SWITCHING CURRENT:

Even occasional hot-switching with capacitor-input circuits permits the flow of plate currents having magnitudes which can adversely affect the life and reliability of tubes designed for life values in the order of 10000 hours. If capacitor-input circuits are to be used, protect the circuits against the possibility of hot-switching and do not exceed a maximum peak current value per plate of 3 amperes during the initial cycles of the hot-switching transient. If hot-switching is required in operation, the use of choke-input circuits is recommended for maximum reliability and for long life. Such circuits limit the hot-switching current to a value no higher than that of the peak plate current.

* May deviate ± 10 per cent from rated value provided such deviation occurs for less than 2 per cent of operating time.

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FULL-WAVE VACUUM RECTIFIER

PEAK HEATER-CATHODE VOLTAGE:●		
Heater negative with respect to cathode	400 max.	volts
Heater positive with respect to cathode	400 max.	volts
BULB TEMPERATURE	200 max.	°C

Typical Operation as Full-Wave Rectifier with Capacitor-Input Filter:

AC Plate-to-Plate Supply Voltage (RMS)	700	volts
Filter-Input Capacitor▲	10	μf
Effective Plate-Supply Resistance per Plate	350	ohms
DC Output Voltage at Input to Filter (Approx.):		
At half-load current of 55 ma	415	volts
At full-load current of 110 ma	355	volts
Voltage Regulation (Approx.):		
Half-load to full-load current	60	volts

Typical Operation as Full-Wave Rectifier with Choke-Input Filter:

AC Plate-to-Plate Supply Voltage (RMS)	700	volts
Filter Input Choke	10	henries
DC Output Voltage at Input to Filter (Approx.):		
At half-load current of 67.5 ma	305	volts
At full-load current of 135 ma	300	volts
Voltage Regulation (Approx.):		
Half-load to full-load current	5	volts

SPECIAL RATINGS & PERFORMANCE DATA

Shock Rating:

Impact Acceleration . . . . . 500 max. g

Tubes are held rigid in three different positions in a Navy Type, High Impact (flyweight) Shock Machine and are subjected to 500 g impact acceleration.

Fatigue Rating:

Vibrational Acceleration . . . . . 2.5 max. g

Tubes are rigidly mounted and subjected in each of three positions to 2.5 g vibrational acceleration at 25 cycles per second for 32 hours.

CHARACTERISTICS RANGE RALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Heater Current	1	2.30	2.50	amp

● For maximum reliability, it is recommended that the cathode of each unit be connected directly to the mid-point or one side of the heater winding.

▲ Higher values of capacitance than indicated may be used but the effective plate-supply resistance should be increased to prevent exceeding the maximum rating for peak plate current. *See Rating Chart II.*

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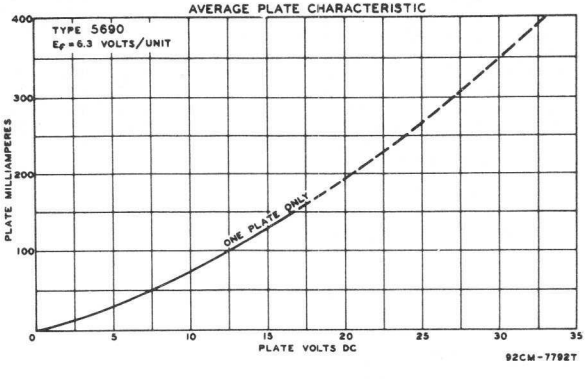
FULL-WAVE VACUUM RECTIFIER

	Note	Min.	Max.	
Heater-Cathode Current:				
Heater negative with respect to cathode . . .	1,2	–	30	μamp
Heater positive with respect to cathode . . .	1,2	–	30	μamp
Tube Voltage Drop	1,3	15	19	volts

Note 1: With 6.3 volts on heater of Unit No.1 connected in parallel with heater of Unit No.2.

Note 2: With 300 volts between heater and cathode.

Note 3: With dc voltage per plate adjusted to give dc plate current of 150 ma. per unit.



RATING CHARTS and OPERATION CHARACTERISTICS

Rating Chart I represents graphically the relationships between absolute maximum ac voltage input and absolute maximum dc output current derived from the fundamental ratings for conditions of capacitor-input and choke-input filters. This graphical presentation gives the equipment designer considerable latitude in choice of operating conditions.

Rating Chart II represents graphically the relationships between maximum rectification efficiency and absolute maximum dc output current per plate for conditions of capacitor input to filter.

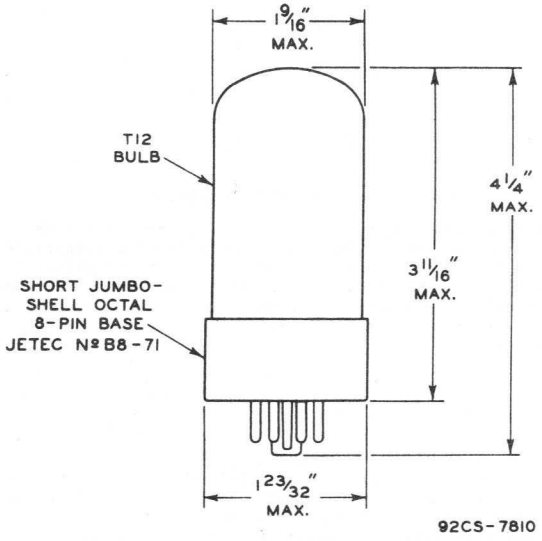
Rating Chart III represents graphically the relationships between minimum plate-supply resistance per plate and absolute maximum ac plate-supply voltage per plate under no-load conditions for conditions of capacitor input to filter when occasional hot-switching is employed.

5690

FULL-WAVE VACUUM RECTIFIER

The *Operation Characteristics for the 5690 in Full-Wave Circuit with 4μf, 10μf, and 20μf-Capacitor Input to Filter* show not only typical operating curves for different plate-supply voltages and different effective plate-supply resistances, but also by means of boundary line "AED" the limiting current and voltage relationships presented on *Rating Chart I.*

The *Operation Characteristics for the 5690 in Full-Wave Circuit with Choke Input to Filter* show not only typical operating curves for different plate-supply voltages but also by means of boundary line "ABC" the limiting current and voltage relationships presented on *Rating Chart I.* These curves also give information as to the effect of various sizes of chokes on regulation. The solid-line curves show the dc voltage outputs which would be obtained if the filter chokes had infinite inductance. The long-dash lines radiating from the zero position are boundary lines for various sizes of chokes as indicated. The intersection of one of these lines with a solid-line curve indicates the point on the curve at which the choke no longer behaves as though it had infinite inductance. To the left of the choke boundary line, the regulation curves depart from the solid-line curves as shown by the representative short-dash regulation curves.



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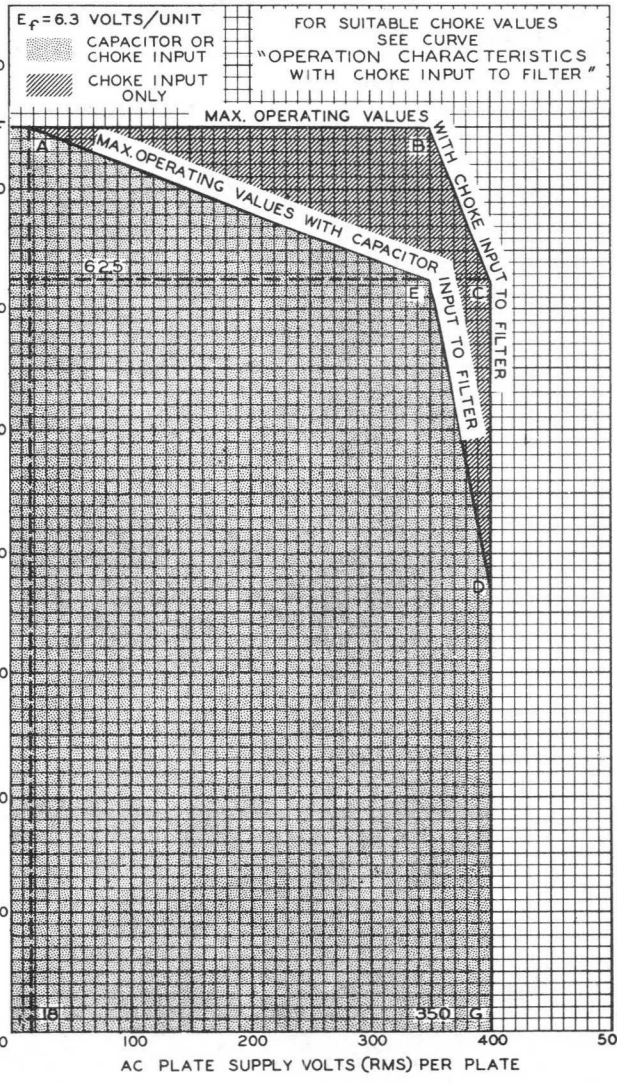
RATING CHART I



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RATING CHART II
CAPACITOR INPUT TO FILTER

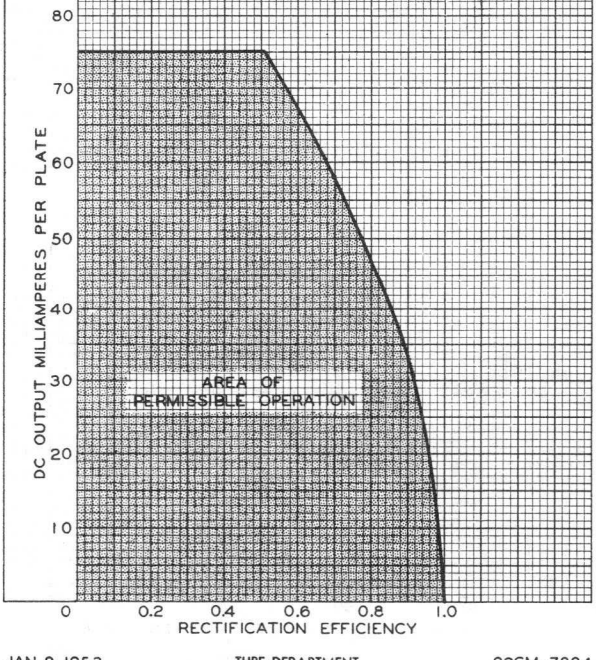
E_f = 6.3 VOLTS/UNIT

MAX. PEAK PLATE CURRENT PER PLATE = 375 MA

RECTIFICATION EFFICIENCY = $\frac{\bar{E}}{\sqrt{2}\ E_S}$

WHERE $\bar{E}$ = DC OUTPUT VOLTS AT INPUT TO FILTER

E_S = AC PLATE SUPPLY VOLTS (RMS) PER PLATE



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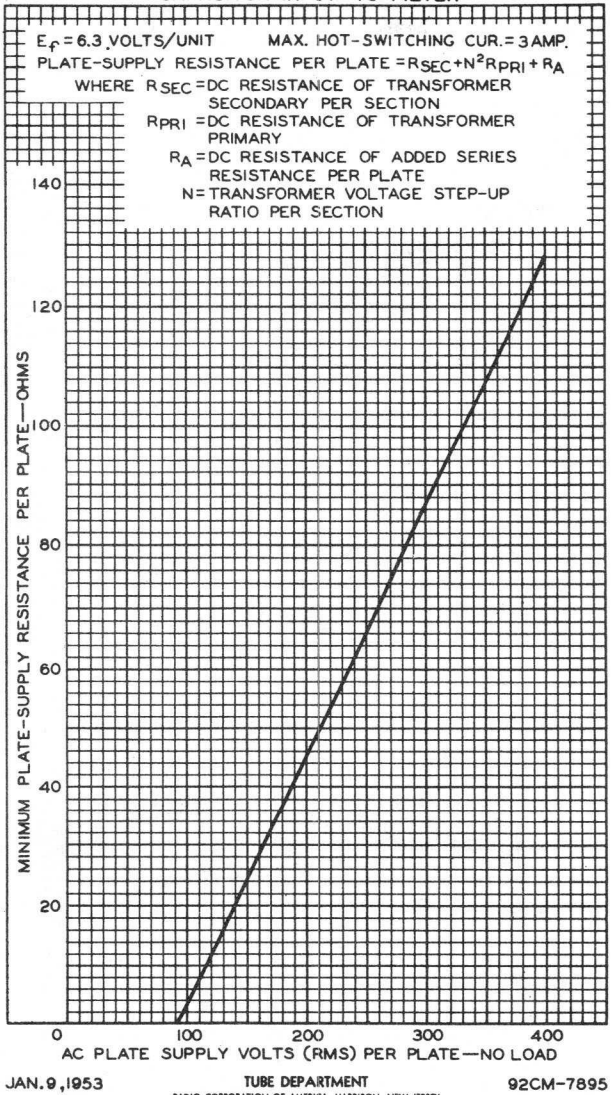
RATING CHART III

CAPACITOR INPUT TO FILTER



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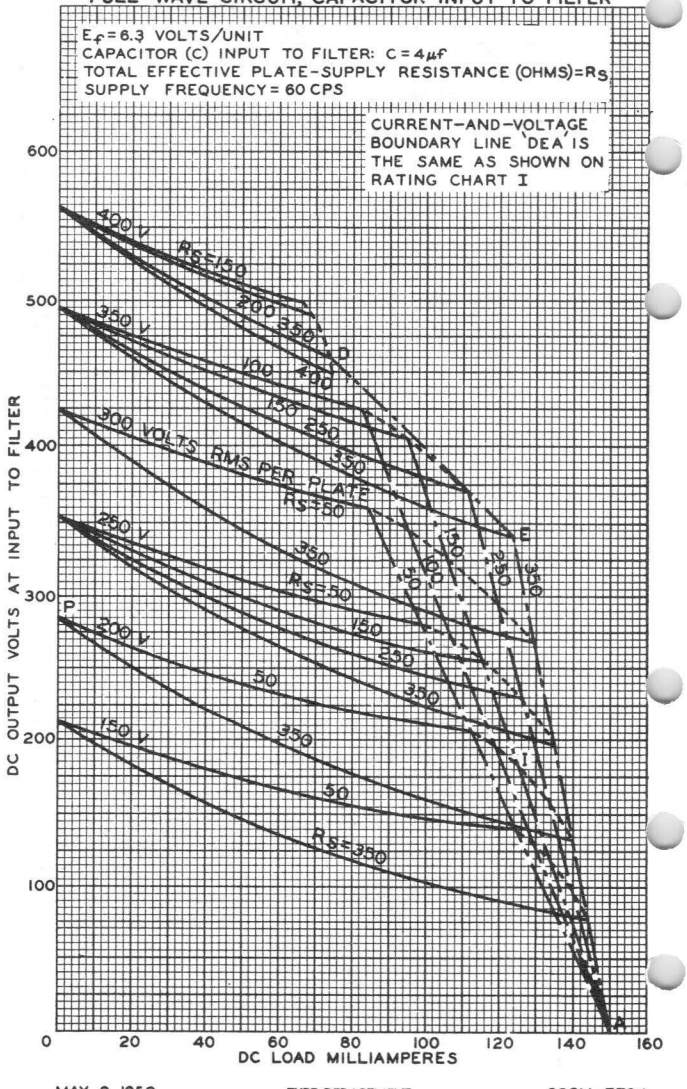
OPERATION CHARACTERISTICS

FULL-WAVE CIRCUIT, CAPACITOR INPUT TO FILTER

E_f = 6.3 VOLTS/UNIT
CAPACITOR (C) INPUT TO FILTER: C = 4 μf
TOTAL EFFECTIVE PLATE-SUPPLY RESISTANCE (OHMS) = R_S
SUPPLY FREQUENCY = 60 CPS

CURRENT-AND-VOLTAGE BOUNDARY LINE 'DEA' IS THE SAME AS SHOWN ON RATING CHART I



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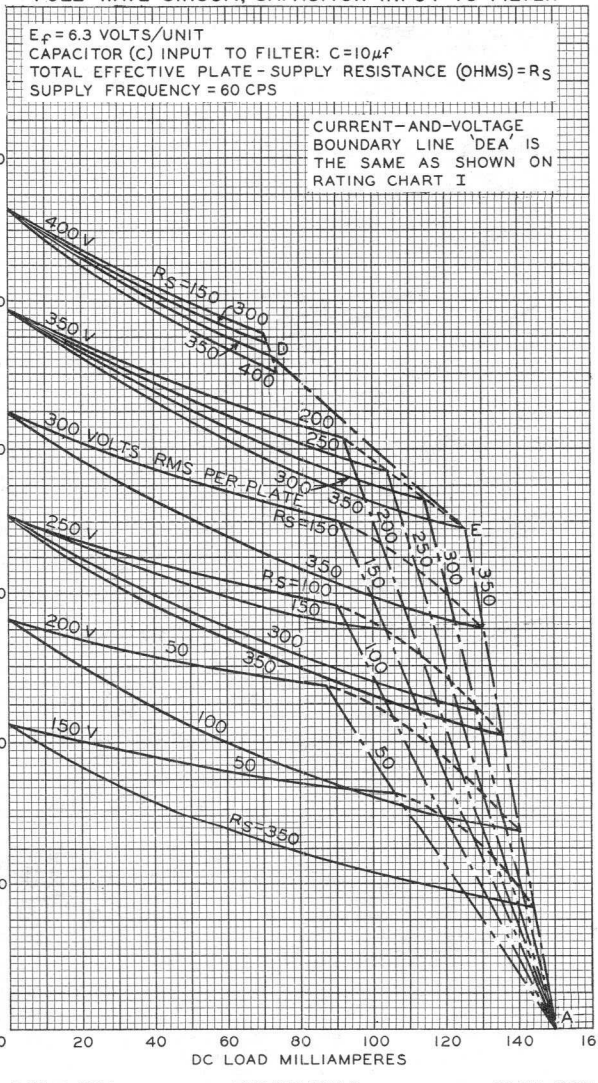
OPERATION CHARACTERISTICS

FULL-WAVE CIRCUIT, CAPACITOR INPUT TO FILTER



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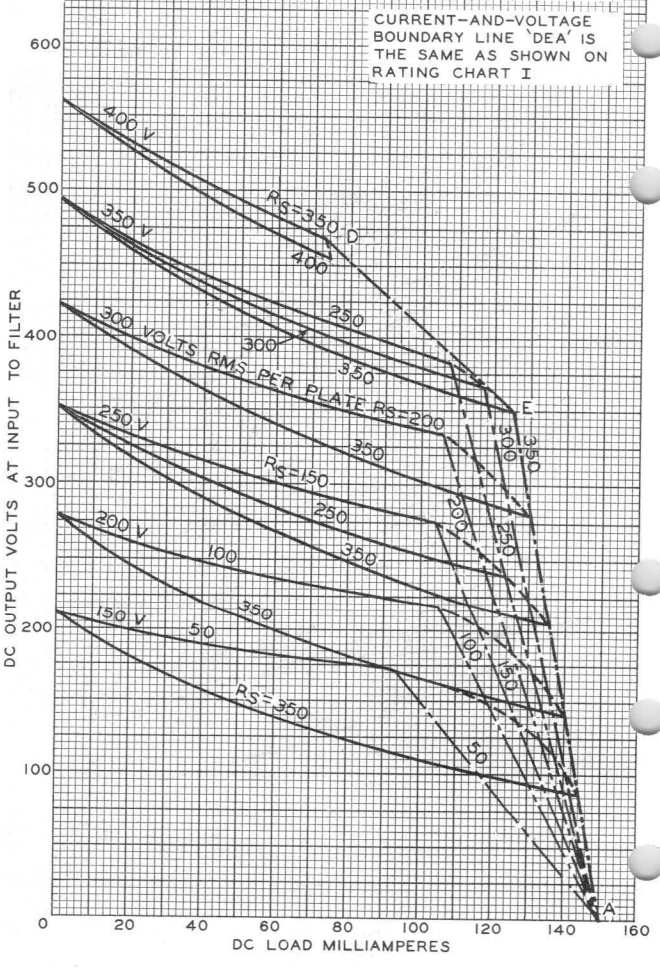
OPERATION CHARACTERISTICS

FULL-WAVE CIRCUIT, CAPACITOR INPUT TO FILTER

E_f = 6.3 VOLTS/UNIT
CAPACITOR (C) INPUT TO FILTER: C = 20 μf
TOTAL EFFECTIVE PLATE-SUPPLY RESISTANCE (OHMS)=R_S
SUPPLY FREQUENCY = 60 CPS

CURRENT-AND-VOLTAGE BOUNDARY LINE 'DEA' IS THE SAME AS SHOWN ON RATING CHART I



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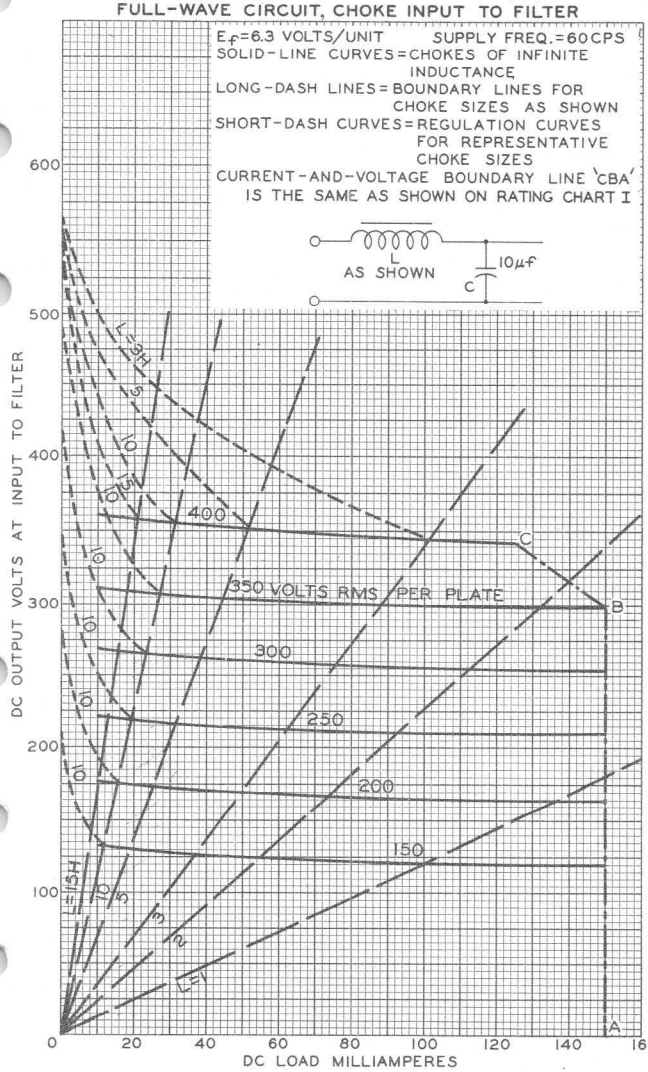
OPERATION CHARACTERISTICS

FULL-WAVE CIRCUIT, CHOKE INPUT TO FILTER



5713

POWER TRIODE

FORCED-AIR-COOLED, GROUNDED-GRID TYPE

GENERAL DATA

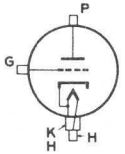
Electrical:

Heater, for Unipotential Cathode:		
Voltage	3.3 ± 0.2	ac or dc volts
Current	11.5	amp
Minimum Heating Time▲	2	minutes
Amplification Factor	25	
Direct Interelectrode Capacitances (Approx.):		
Grid to Plate	10.3	μμf
Grid to Cathode	26	μμf
Plate to Cathode	0.5	μμf

Mechanical:

Terminal Connections:

H: Heater
G: Grid Terminal (Flange)



K: Cathode
P: Plate Terminal (Radiator)

Mounting Position	Vertical, with radiator up or down
Overall Length	4-25/32" ± 3/32"
Greatest Diameter	2.056" ± 0.006"
Radiator	Integral Part of Tube

Air Flow:

Through Radiator — The specified air flow for various plate dissipations, as indicated in the tabulation below, should be delivered through the radiator toward the bulb before and during the application of any voltages.

Plate Dissipation	150	200	250	watts	
Air Flow	9	13	18	cfm	
Static Pressure	0.14	0.27	0.45	in. of water	

Incoming Air Temperature	45 max.	°C
Radiator Temperature (Measured on the core at end away from incoming air)	180 max.	°C
Glass Temperature	180 max.	°C
Grid-Terminal Temperature	140 max.	°C

RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy

Key-down conditions per tube without modulation

Maximum CCS● Ratings, *Absolute Values:*

DC PLATE VOLTAGE	1500 max.	volts
DC GRID VOLTAGE	−250 max.	volts
DC PLATE CURRENT	300 max.	ma
DC GRID CURRENT	50 max.	ma
PLATE INPUT	450 max.	watts
PLATE DISSIPATION	250 max.	watts

▲ With 3.3 volts on heater. This time may be shortened by increasing the heater voltage during the interval required for the cathode to reach normal operating temperature. Increasing the heater voltage to 4 volts reduces the heating time to 1 minute, while 5 volts reduces it to 40 seconds. After this heating interval, the heater voltage must be reduced to 3.3 volts.

● Continuous Commercial Service.

5713

5713
POWER TRIODE

Typical Operation in Grounded-Cathode Circuit:

DC Plate Voltage	1500	volts
DC Grid Voltage*	−175	volts
	510	ohms
Peak RF Grid Voltage	210	volts
DC Plate Current	300	ma
DC Grid Current (Approx.)	40	ma
Driving Power (Approx.)	8	watts
Power Output (Approx.)	290	watts

Typical Operation in Grounded-Grid Circuit at 220 Mc:

Same values as for Grounded-Cathode Circuit with the following exceptions:

Driving Power (Approx.)#	65	watts
Power Output (Approx.)	325	watts

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Heater Current	1	10.8	12.2	amp
Amplification Factor	1,2	19	29	
Grid-Plate Capacitance	–	9	11.6	μμf
Grid-Cathode Capacitance	–	23	29	μμf
Plate-Cathode Capacitance	–	0.39	0.65	μμf
Grid Voltage	1,3	–	−90	volts
Grid Voltage	1,4	−41	−70	volts
Peak Cathode Current	1,5	40	–	amp
Power Output	1,6	290	–	watts

Note 1: Heater volts = 3.3.

Note 2: With 1000 volts on plate, and plate ma. = 150.

Note 3: With 1500 volts on plate and plate ma. = 20.

Note 4: With 1500 volts on plate and plate ma. = 150.

Note 5: Represents maximum usable cathode current (plate current plus grid current) for tube, for any condition of operation.

Note 6: With 1500 volts on plate, plate ma. = 350, grid ma. = 50 to 60, grid resistor of 4000 ± 10% ohms, and frequency of 20 Mc.

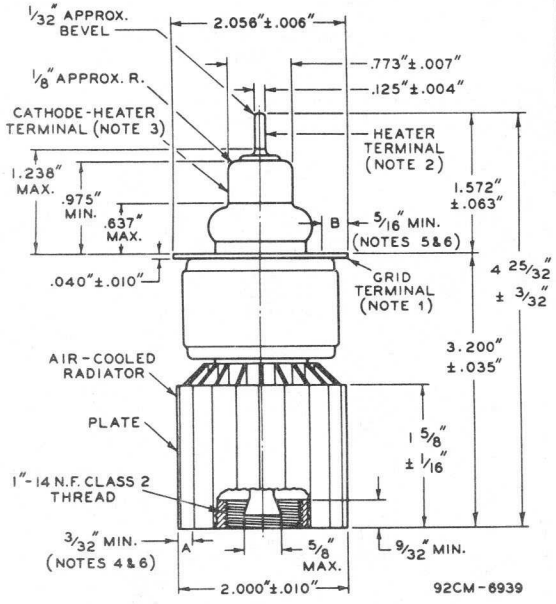
\# Required by tube and input circuit. A portion of this power appears in the load circuit.

* Obtained from fixed supply or from a cathode resistor of value shown.

Data on operating frequencies for the 5713 are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY.

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

5713
POWER TRIODE



NOTE 1: MAXIMUM ECCENTRICITY OF ℄ (AXIS) OF GRID-TERMINAL FLANGE WITH RESPECT TO ℄ (AXIS) OF PLATE RADIATOR IS 0.040", MEASURED WITHIN 1/32" OF BOTTOM OF RADIATOR.

NOTE 2: MAXIMUM ECCENTRICITY OF ℄ (AXIS) OF HEATER TERMINAL WITH RESPECT TO ℄ (AXIS) OF CATHODE-HEATER TERMINAL IS 0.020".

NOTE 3: MAXIMUM ECCENTRICITY OF ℄ (AXIS) OF CATHODE-HEATER TERMINAL WITH RESPECT TO ℄ (AXIS) OF GRID-TERMINAL FLANGE IS 0.020".

NOTE 4: SURFACE OF ANNULAR AREA INDICATED BY "A" ON BOTTOM OF RADIATOR IS IN SAME PLANE WITHIN 0.005", AS DETERMINED BY GAUGE 1/16" WIDE AND 0.005" THICK. THIS GAUGE WILL NOT ENTER MORE THAN 1/16" WITH BOTTOM OF RADIATOR RESTING ON FLAT PLATE.

NOTE 5: SURFACE OF ANNULAR AREA INDICATED BY "B" ON GRID-TERMINAL FLANGE IS IN SAME PLANE WITHIN 0.008", AS DETERMINED BY GAUGE METHOD DESCRIBED IN NOTE 4.

NOTE 6: SURFACE OF ANNULAR AREA INDICATED BY "A" ON BOTTOM OF RADIATOR IS PARALLEL WITHIN 0.030" TO SURFACE OF ANNULAR AREA INDICATED BY "B" ON GRID-TERMINAL FLANGE.

RCA

5713

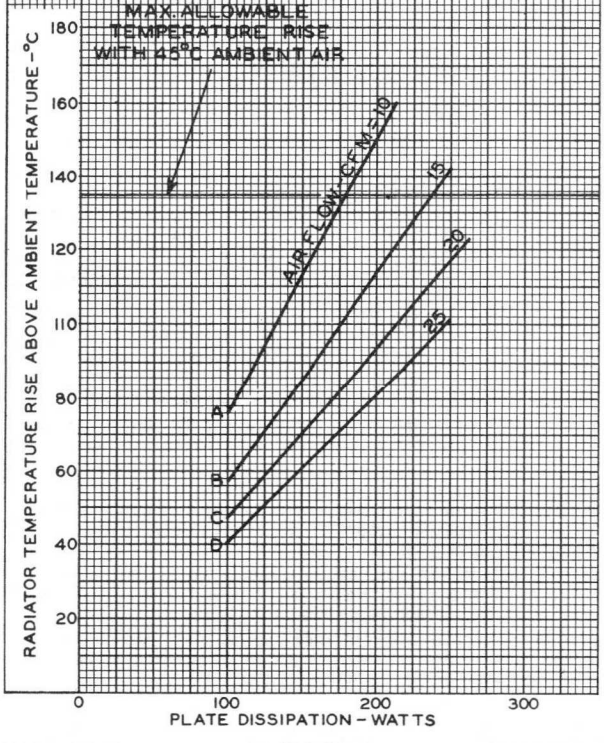
COOLING REQUIREMENTS

E_f = 3.3 VOLTS MAXIMUM RADIATOR TEMPERATURE = 180°C

CURVE	PRESSURE DROP INCHES OF WATER
A	0.17
B	0.33
C	0.55
D	0.82

CURVES TAKEN ACCORDING TO NAFM* STANDARDS - BULLETIN Nº 103

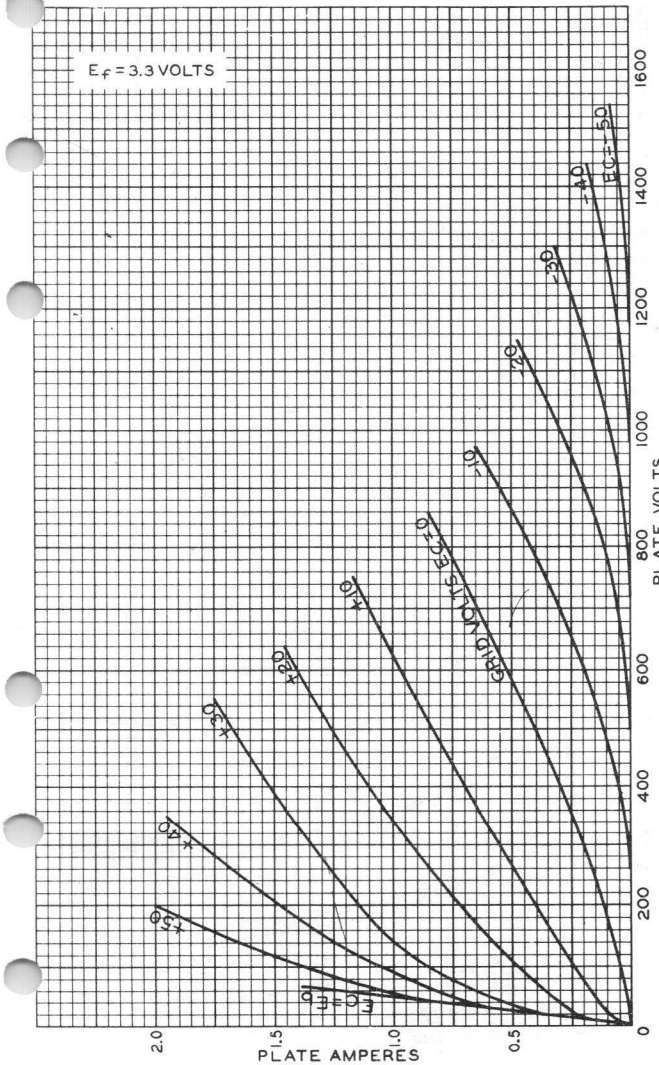
*NATIONAL ASSOCIATION OF FAN MFRS., GENERAL MOTORS BLDG., DETROIT, MICH.



RCA

5713

AVERAGE PLATE CHARACTERISTICS



MAR. 18, 1948

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6942

5713

RCA

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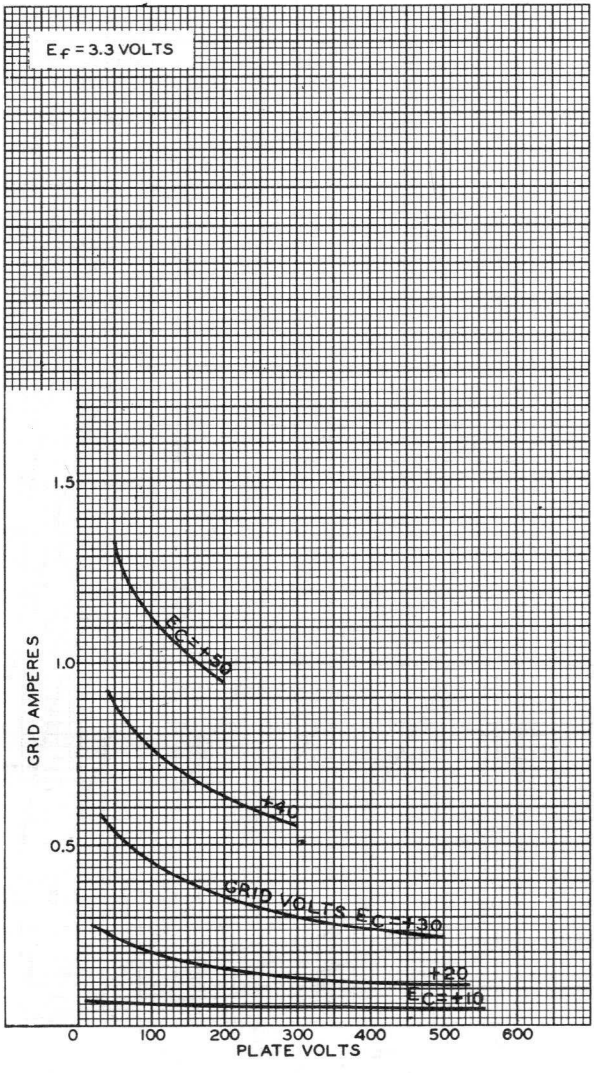
TYPICAL GRID CHARACTERISTICS



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*

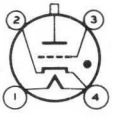
Direct Interelectrode Capacitances (Approx., without external shield):

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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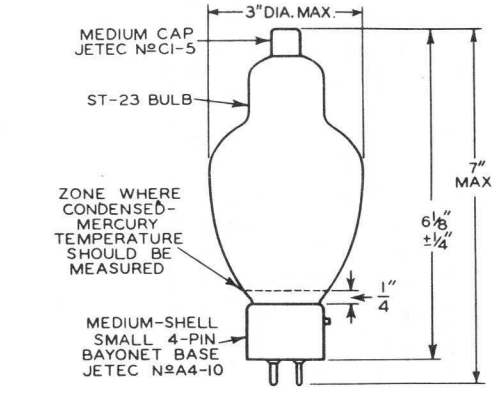
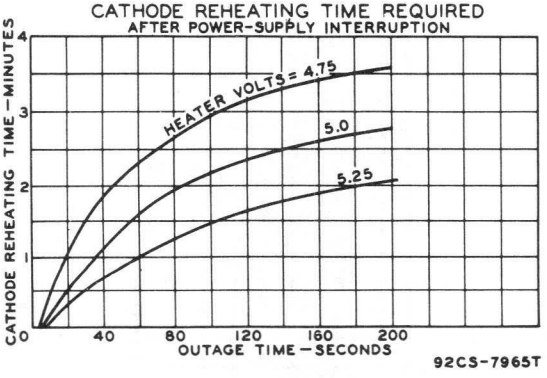
MERCURY-VAPOR THYRATRON





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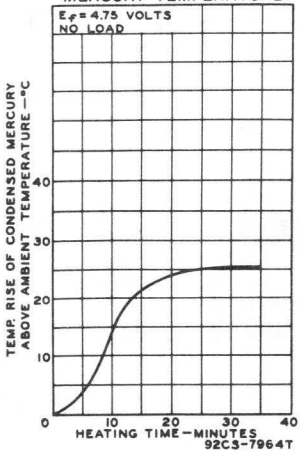
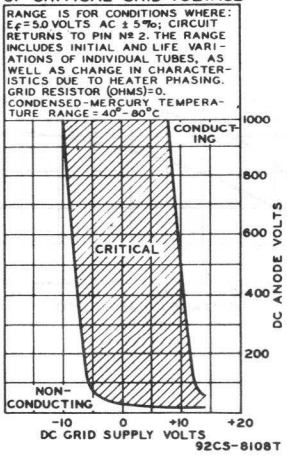
CHARACTERISTIC CURVES

RATE OF RISE OF COND.–MERCURY TEMPERATURE



OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE



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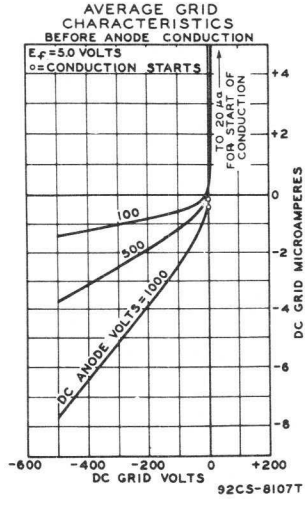
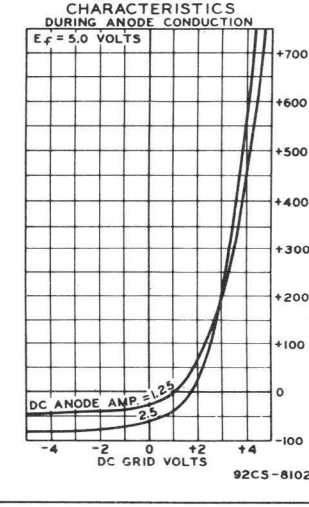
CHARACTERISTIC CURVES





5762A

Power Triode

THORIATED-TUNGSTEN FILAMENT COAXIAL-ELECTRODE STRUCTURE
FORCED-AIR COOLED 4 KW PLATE DISSIPATION
INTEGRAL RADIATOR

For VHF Service in Television and CW Applications at Frequencies up to 220 Mc. The 5762A is Unilaterally Interchangeable with the 5762/7C24.

GENERAL DATA

Electrical:

Filament, Thoriated Tungsten:		
Voltage (AC or DC)	12.6 ± 0.6	volts
Current at 12.6 volts	29	amperes
Starting current: The filament current must never exceed 175 amperes, even momentarily		
Cold resistance	0.052	ohm
Amplification Factor	29	
Direct Interelectrode Capacitances:		
Grid to plate	18	μμf
Grid to filament	19	μμf
Plate to filament	0.5	μμf

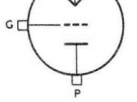
Mechanical:

Operating Position	Vertical, either end up
Maximum Overall Length (Excluding flexible leads)	7-1/8"
Maximum Diameter	4-11/16"
Radiator	Integral part of tube
Weight	6-1/4 lbs

Terminal Connections (See *Dimensional Outline*):

F – Filament

F_M – Filament Mid-Tap



G – Grid

P – Plate

Thermal:

Air Flow:

Through Radiator— The specified flow of incoming air at a temperature of 45° C for various plate dissipations, as indicated in the tabulation below, should be delivered by a blower through the radiator before and during the application of any voltages. Filament power, plate power, and air may be removed simultaneously.

Percentage of maximum rated plate dissipation for each class of service	100	80	60	per cent

Minimum air flow	300	214	125	cfm
Static pressure	2.9	1.47	0.58	in. of water

To Header and Filament Seals . . . . . 10 min. cfm

The specified air flow from a 1"-diameter nozzle should be directed into the filament header before and during the application of any voltages in order to limit the temperature of the filament seals and the grid seal to their maximum value.

Incoming Air Temperature	45 max.	°C
Radiator Temperature (Measured on the core at end away from incoming air)	180 max.	°C
Bulb Temperature (At hottest part)	180 max.	°C
Seal Temperature: Filament, grid, and plate	180 max.	°C

AF POWER AMPLIFIER & MODULATOR — Class B

Maximum CCS[a] Ratings, *Absolute-Maximum Values:*

DC PLATE VOLTAGE	6200 max.	volts
MAX.-SIGNAL DC PLATE CURRENT[b]	1.5 max.	amp
MAX.-SIGNAL PLATE INPUT[b]	8700 max.	watts
PLATE DISSIPATION[b]	4000 max.	watts

Typical Operation:

Values are for 2 tubes

DC Plate Voltage	4700	volts
DC Grid Voltage	−200	volts
Peak AF Grid-to-Grid Voltage	900	volts
Zero-Signal DC Plate Current	0.3	amp
Max.-Signal DC Plate Current	2.8	amp
Effective Load Resistance (Plate to plate)	3640	ohms
Max.-Signal Driving Power (Approx.)	195	watts
Max.-Signal Power Output (Approx.)	8800	watts

RF POWER AMPLIFIER — Class B Television Service

Synchronizing-level conditions per tube unless otherwise specified

Maximum CCS[a] Ratings, *Absolute-Maximum Values:*

	54 to 215 Mc	
DC PLATE VOLTAGE	4500 max.	volts
DC PLATE CURRENT	2.0 max.	amp
DC GRID CURRENT (Pedestal level)	0.325 max.	amp
PLATE INPUT	9000 max.	watts
PLATE DISSIPATION	4000 max.	watts

Typical Operation in Cathode-Drive Circuit:

Bandwidth[c] of	10	8.5	6	*Mc*
DC Plate Voltage	3000	3200	4300	volts
DC Grid Voltage	−105	−110	−150	volts

Peak RF Grid Voltage:				
Synchronizing level	380	435	500	volts
Pedestal level.	290	310	355	volts
DC Plate Current:				
Synchronizing level	1.8	1.8	2.0	amp
Pedestal level.	1.36	1.35	1.5	amp
DC Grid Current:				
Synchronizing level	0.265	0.400	0.439	amp
Pedestal level.	0.115	0.130	0.118	amp
Driving Power (Approx.):[d]				
Synchronizing level	625	770	983	watts
Power Output (Approx.):				
Synchronizing level	3150	4000	6350	watts
Pedestal level.	1800	2300	3590	watts

GRID-MODULATED RF POWER AMPLIFIER
Class C Television Service

Synchronizing-level conditions per tube unless otherwise specified

Maximum CCS[a] Ratings, *Absolute-Maximum Values:*

	54 to 216 Mc	
DC PLATE VOLTAGE.	3700 max.	volts
DC GRID VOLTAGE (White level)	-800 max.	volts
DC PLATE CURRENT.	1.9 max.	amp
DC GRID CURRENT (Pedestal level).	0.225 max.	amp
PLATE INPUT	6500 max.	watts
PLATE DISSIPATION	4000 max.	watts

Typical Operation in Cathode-Drive Circuit:

Bandwidth[c] of	*8.5*	*Mc*
DC Plate Voltage.	3200	volts
DC Grid Voltage:		
Synchronizing level	-110	volts
Pedestal level.	-220	volts
White level	-520	volts
Peak RF Grid Voltage.	435	volts
DC Plate Current:		
Synchronizing level	1.8	amp
Pedestal level.	1.25	amp
DC Grid Current (Approx.):		
Synchronizing level	0.400	amp
Pedestal level.	0.130	amp
Driving Power (Approx.):[d]		
Synchronizing level	770	watts
Power Output (Approx.):		
Synchronizing level	4000	watts
Pedestal level.	2300	watts

PLATE-MODULATED RF POWER AMPLIFIER — Class C Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1

Maximum CCS[a] Ratings, *Absolute-Maximum Values:*

	Up to 30 Mc[e]	
DC PLATE VOLTAGE	5000 max.	volts
DC GRID VOLTAGE	-1000 max.	volts
DC PLATE CURRENT	1.0 max.	amp
DC GRID CURRENT	0.3 max.	amp
PLATE INPUT	5000 max.	watts
PLATE DISSIPATION	2700 max.	watts

Typical Operation in Grid-Drive Circuit:

	Up to 30 Mc	*At 110 Mc*	
DC Plate Voltage	4700	4000	volts
DC Grid Voltage	-400	-350	volts
From a grid resistor of	1425	1460	ohms
Peak RF Grid Voltage[f]	675	600	volts
DC Plate Current	0.96	0.93	amp
DC Grid Current (Approx.)	0.28	0.24	amp
Driving Power (Approx.)	170	130	watts
Power Output (Approx.)	3700	2800	watts

Typical Operation in Cathode-Drive Circuit:

	Up to 30 Mc	*At 110 Mc*	
DC Plate Voltage	4700	4000	volts
DC Grid Voltage	-400	-350	volts
From a grid resistor of	1425	1460	ohms
Peak RF Grid Voltage	675	600	volts
DC Plate Current	0.96	0.93	amp
DC Grid Current (Approx.)	0.28	0.24	amp
Driving Power (Approx.)[g]	720	600	watts
Power Output (Approx.)	4200	3200	watts

RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy
and
RF POWER AMPLIFIER — Class C FM Telephony

Maximum CCS[a] Ratings, *Absolute-Maximum Values:*

	Up to 30 Mc[e]	
DC-PLATE VOLTAGE	6200 max.	volts
DC GRID VOLTAGE	-1000 max.	volts
DC PLATE CURRENT	1.4 max.	amp
DC GRID CURRENT	0.3 max.	amp
PLATE INPUT	8700 max.	watts
PLATE DISSIPATION	4000 max.	watts

Typical Operation in Grid-Drive Circuit:

	Up to 30 Mc	
DC Plate Voltage	6000	volts
DC Grid Voltage:		
From a fixed supply of	−550	volts
From a grid resistor of	1900	ohms
From a cathode resistor of	360	ohms
Peak RF Grid Voltage	875	volts
DC Plate Current	1.25	amp
DC Grid Current (Approx.)	0.290	amp
Driving Power (Approx.)	225	watts
Power Output (Approx.)	6000	watts

Typical Operation in Cathode-Drive Circuit:

	Up to 30 Mc	*At 110 Mc*	*At 220 Mc*	
DC Plate Voltage	6000	5000	4300	volts
DC Grid Voltage:				
From a fixed supply of	−550	−1000	−200	volts
From a grid resistor of	1900	4100	807	ohms
From a cathode resistor of	360	740	134	ohms
Peak RF Grid Voltage	875	1350	432	volts
DC Plate Current	1.25	1.1	1.25	amp
DC Grid Current (Approx.)	0.290	0.245	0.25	amp
Driving Power (Approx.)	1225	1680	542	watts
Power Output (Approx.)	7000	5500	4000	watts

SELF-RECTIFYING OSCILLATOR or AMPLIFIER — Class C

Maximum CCS[a] Ratings, *Absolute-Maximum Values:*

	Up to 30 Mc[e]	
AC PLATE VOLTAGE (RMS)	7000 max.	volts
DC GRID VOLTAGE	−300 max.	volts
DC PLATE CURRENT	0.635 max.	amp
DC GRID CURRENT	0.135 max.	amp
PLATE INPUT[h]	4900 max.	watts
PLATE DISSIPATION	4000 max.	watts

Typical Operation:

AC Plate Voltage (RMS)	6600	volts
DC Grid Voltage	−127	volts
DC Plate Current	0.625	amp
DC Grid Current (Approx.)	0.105	amp
Driving Power (Approx.)[j]	60	watts
Power Output (Approx.)	3350	watts

5762A

AMPLIFIER or OSCILLATOR — Class C

With separate, rectified, unfiltered, single-phase, full-wave plate supply

Maximum CCS[a] Ratings, *Absolute-Maximum Values:*

	Up to 30 Mc[e]	
DC PLATE VOLTAGE	5600 max.	volts
DC GRID VOLTAGE	−600 max.	volts
DC PLATE CURRENT	1.25 max.	amp
DC GRID CURRENT	0.270 max.	amp
PLATE INPUT[k]	8600 max.	watts
PLATE DISSIPATION	4000 max.	watts

Typical Operation:

DC Plate Voltage	5000	volts
DC Grid Voltage	−260	volts
DC Plate Current	1.2	amp
DC Grid Current (Approx.)	0.260	amp
Driving Power (Approx.)[m]	150	watts
Power Output (Approx.)	5650	watts

[a] Continuous Commercial Service.

[b] Averaged over any audio-frequency cycle of sine-wave form.

[c] Computed between half-power points in a single-tuned circuit and based on tube output capacitance only.

[d] The driver stage is required to supply tube losses and rf-circuit losses. It should be designed to provide an excess of power above the indicated values to take care of variations in line voltage, in components, in initial tube characteristics, and in tube characteristics during life.

[e] For operation at higher frequencies, see accompanying *Maximum-Ratings-vs-Operating-Frequency* Chart.

[f] Driver modulated approximately 30%.

[g] Carrier power of driver modulated 100%.

[h] Plate input is 1.11 times the product of the ac voltage (rms) and the dc plate current.

[j] From a self-rectified driver.

[k] Plate input is 1.23 times the product of the dc plate voltage and the dc plate current.

[m] From a driver with a rectified, unfiltered, single-phase, full-wave plate supply.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Filament Current	1	27	31	amp
Amplification Factor	1,2	25	33	
Direct Interelectrode Capacitances:				
Grid to plate	–	16.5	20.5	μμf
Grid to filament	–	15.5	22.5	μμf
Plate to filament	–	0.38	0.62	μμf
Grid Voltage	1,3	−125	−190	volts
Plate Voltage	1,4	1350	1750	volts
Plate Voltage	1,5	2600	3400	volts
Peak Cathode Current	6	10	–	amp
Useful Power Output	1,7	3	–	kw

Note 1: With 12.6 volts rms on filament.

Note 2: With dc grid voltage of −25 volts measured from center-tap of filament supply, and dc plate voltage adjusted to give dc plate current of 0.5 ampere.

Note 3: With dc plate voltage of 4000 volts, and dc grid voltage adjusted to give dc plate current of 0.05 ampere.

Note 4: With dc grid voltage of 0 volts measured from center-tap of filament supply, and dc plate voltage adjusted to give dc plate current of 0.5 ampere.

Note 5: With dc grid voltage of −50 volts measured from center-tap of filament supply, and dc plate voltage adjusted to give dc plate current of 0.5 ampere.

Note 6: Designers should limit the maximum useable cathode current (plate current and grid current) to this value under any condition of operation.

Note 7: In a self-excited, coaxial, oscillator circuit and with dc plate voltage of 5000 volts, dc plate current of 1.1 amperes, grid resistor of 1500 ± 10% ohms, dc grid current of 0.250 to 0.300 ampere, and frequency of 110 Mc.

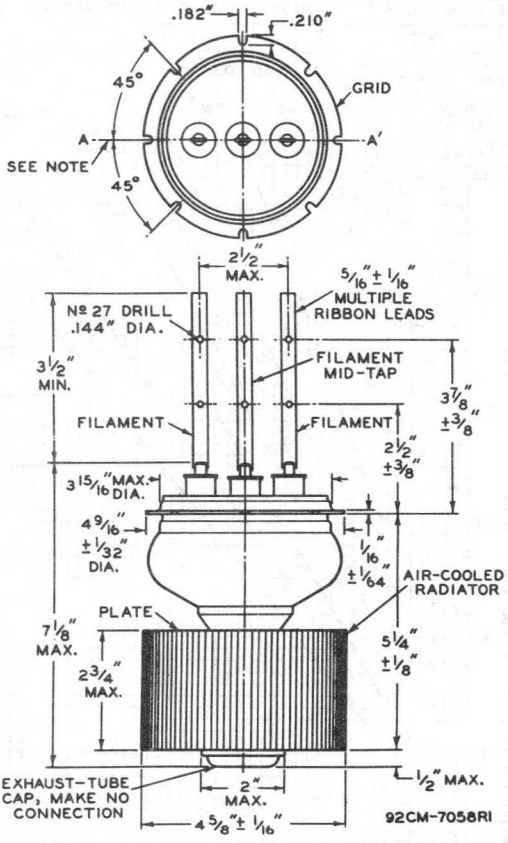
MAXIMUM RATINGS vs OPERATING FREQUENCY

FREQUENCY	30	110	220		Mc
MAXIMUM PERMISSIBLE PERCENTAGE OF MAXIMUM-RATED PLATE VOLTAGE AND PLATE INPUT:					
Class B Television	Full Ratings — 54 to 216 Mc				
Class C Television	Full Ratings — 54 to 216 Mc				
Class C Telephony, Plate-Modulated	100	84	72		%
Class C Telegraphy and FM Telephony	100	84	72		%
Class C Amplifier or Oscillator, Self-Rectifying	100	84	72		%
Class C Amplifier or Oscillator with Separate, Rectified, Unfiltered Plate Supply	100	84	72		%
MAXIMUM PERMISSIBLE PERCENTAGE OF MAXIMUM-RATED DC GRID VOLTAGE AND DC GRID CURRENT:					
Class B Television	Full Ratings — 54 to 216 Mc				
Class C Television	Full Ratings — 54 to 216 Mc				
			Voltage	*Current*	
Class C Telephony Plate-Modulated	100	100	60	83	%

FREQUENCY	30	110	220		Mc
			Voltage	*Current*	
Class C Telegraphy, and FM Telephony	100	100	60	83	%
Class C Amplifier or Oscillator, Self Rectifying	100	100	60	83	%
Class C Amplifier or Oscillator with Separate, Rectified, Unfiltered Plate Supply	100	100	60	83	%

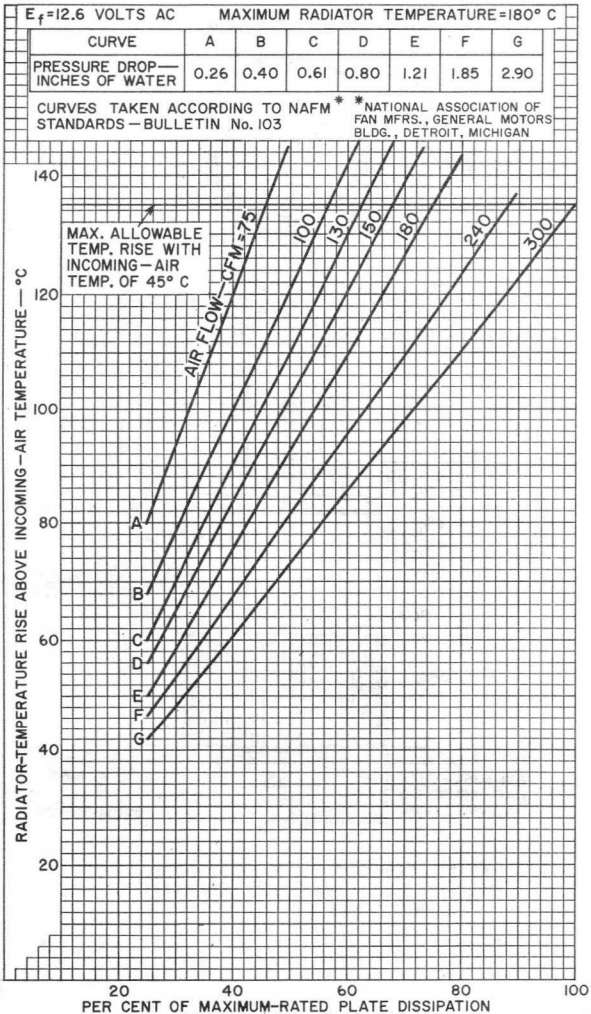
FOR ADDITIONAL INFORMATION ON THIS TYPE, WRITE FOR TECHNICAL BULLETIN AVAILABLE FROM:

Commercial Engineering
Electron Tube Division
RCA
Harrison, New Jersey



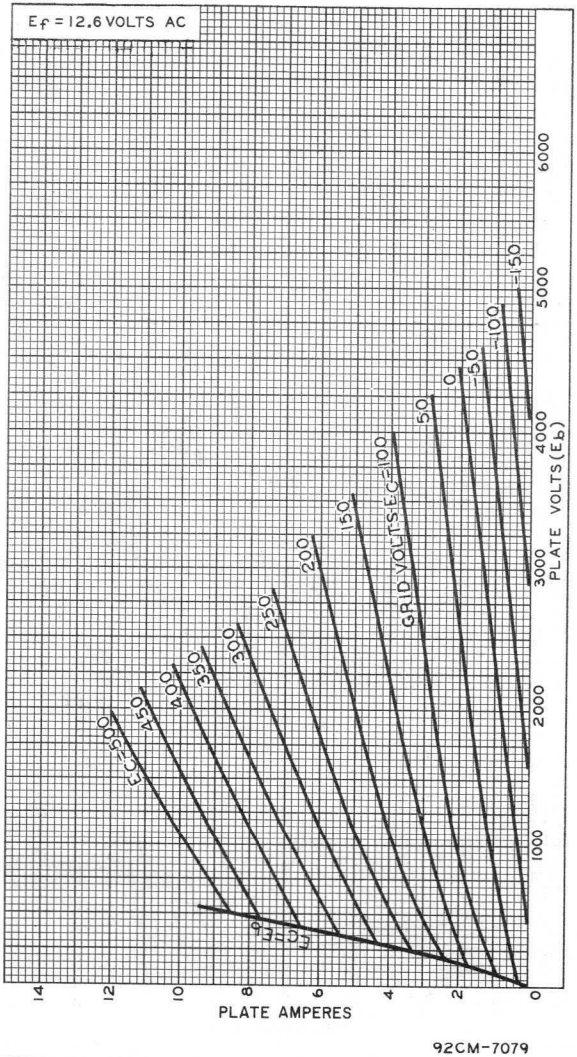
NOTE: PLANE OF FILAMENT LEADS WILL NOT DEVIATE MORE THAN 3-1/2° FROM PLANE PASSING THROUGH AA' NORMAL TO GRID FLANGE.

TYPICAL COOLING REQUIREMENTS



92CM-11091

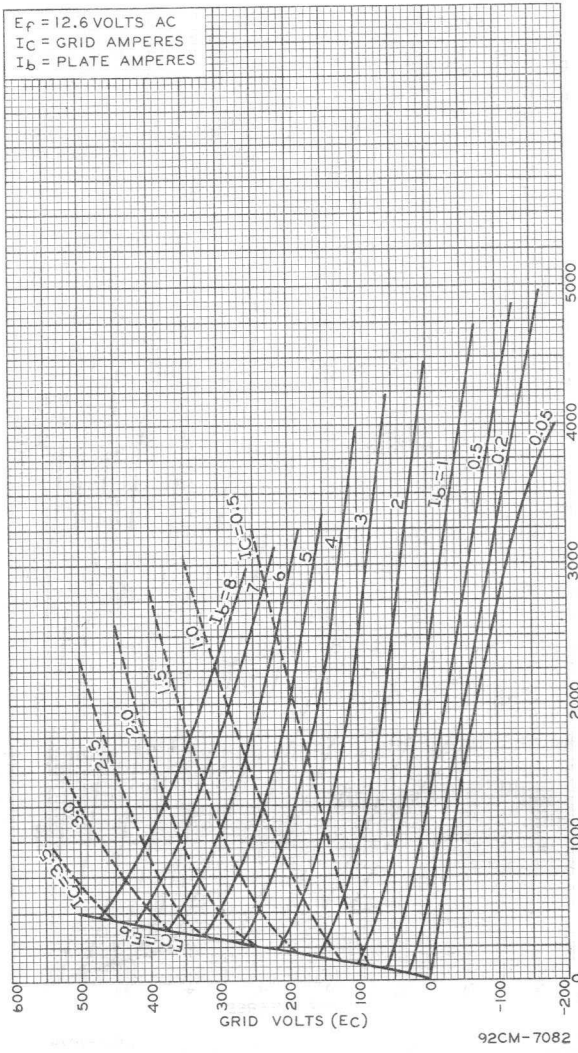
AVERAGE PLATE CHARACTERISTICS



92CM-7079

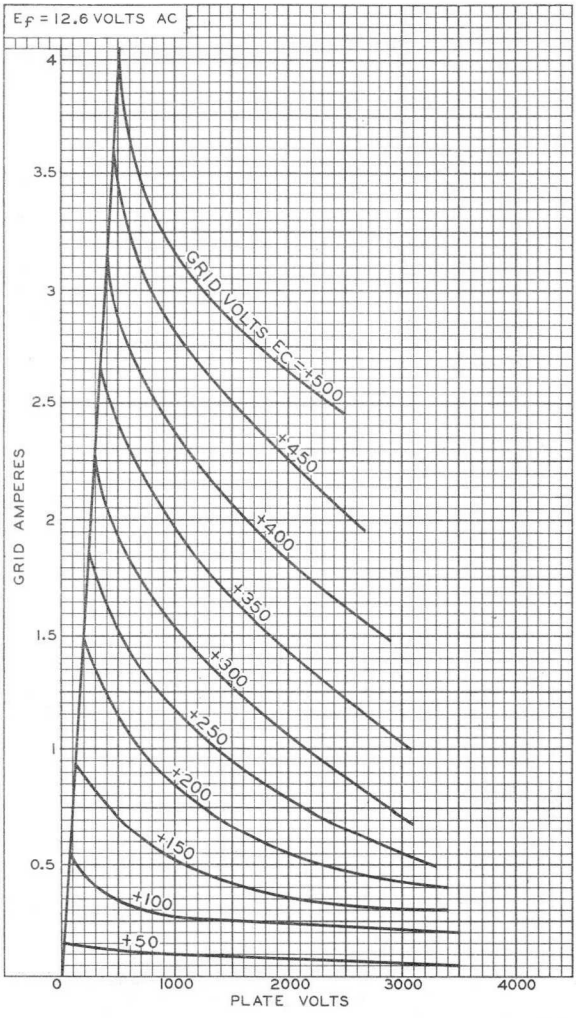
5762A

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



92CM-7082

TYPICAL CHARACTERISTICS



92CM-7081

5786
POWER TRIODE

FORCED-AIR COOLED

GENERAL DATA

Electrical:

Filament, Thoriated-Tungsten:

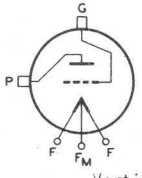
Voltage	11 ± 0.6	ac or dc volts
Current	12.5	amp
Starting current: The filament current must never exceed a value of 50 amperes, even momentarily.		
Cold resistance	0.13	ohm
Amplification Factor for grid-No.1 volts = −25 and plate ma. = 200	32	
Direct Interelectrode Capacitances:		
Grid to plate	5.3	μμf
Grid to filament	4.7	μμf
Plate to filament	3.8	μμf

Mechanical:

Terminal Connections:

F – Filament

F_M – Filament Mid-Tap



G – Grid Terminal (Opposite Filament Leads)

P – Radiator-Cooled Plate

Mounting Position	Vertical, grid end up or down	
Overall Length	9-3/8" ± 1/4"	
Maximum Diameter	2.895"	
Radiator	Integral part of tube	
Air Flow:		
To radiator and seals for maximum rated conditions	140 min.	cfm

Sufficient air must be delivered by a blower to the radiator and seals so that the maximum radiator and seal temperatures will not be exceeded. Air flow must start before the application of any voltages. Filament power, plate power, and air may be removed simultaneously.

Incoming Air Temperature	45 max.	°C
Radiator Temperature (Measured at core at sufficient number of places to insure that rating is not exceeded)	180 max.	°C
Seal Temperature:		
Grid and plate	165 max.	°C
Filament	220 max.	°C
Weight (Approx.)	1.6	lbs

AF POWER AMPLIFIER & MODULATOR - Class B

Maximum CCS• Ratings, *Absolute Values:*

DC PLATE VOLTAGE	4000 max.	volts
MAX.-SIGNAL DC PLATE CURRENT*	500 max.	ma
MAX.-SIGNAL PLATE INPUT*	1500 max.	watts
PLATE DISSIPATION*	600 max.	watts

•,*: See next page. ←Indicates a change

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POWER TRIODE

Typical Operation:

Values are for 2 tubes

DC Plate Voltage	3000	volts
DC Grid Voltage#	-95	volts
Peak AF Grid-to-Grid Voltage	470	volts
Zero-Signal DC Plate Current	75	ma
Max.-Signal DC Plate Current	800	ma
Effective Load Resistance (Plate-to-plate)	8600	ohms
Max.-Signal Driving Power (Approx.)	30	watts
Max.-Signal Power Output (Approx.)	1640	watts

* Averaged over any audio-frequency cycle of sine-wave form.

\# Grid voltage is given with respect to mid-point of filament operated on ac or dc.

PLATE-MODULATED RF POWER AMPLIFIER - Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum CCS® Ratings, *Absolute Values*:

DC PLATE VOLTAGE	2500 max.	volts
DC GRID VOLTAGE	-500 max.	volts
DC PLATE CURRENT	400 max.	ma
DC GRID CURRENT	150 max.	ma
PLATE INPUT	1000 max.	watts
PLATE DISSIPATION	400 max.	watts

Typical Operation:

DC Plate Voltage	2500	volts
DC Grid Voltage®	-350	volts
	2600	ohms
Peak RF Grid Voltage	620	volts
DC Plate Current	400	ma
DC Grid Current (Approx.)□	135	ma
Driving Power (Approx.)□	75	watts
Power Output (Approx.)	810	watts

RF POWER AMPLIFIER & OSCILLATOR - Class C Telegraphy

Key-down conditions per tube without amplitude modulation□□

Maximum CCS® Ratings, *Absolute Values*:

DC PLATE VOLTAGE	3000 max.	volts
DC GRID VOLTAGE	-500 max.	volts
DC PLATE CURRENT	500 max.	ma
DC GRID CURRENT	150 max.	ma
PLATE INPUT	1500 max.	watts
PLATE DISSIPATION	600 max.	watts

□□ Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

•, ••, □, ▪: See next page.

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POWER TRIODE

Typical Operation as RF Power Amplifier:

DC Plate Voltage	3000	volts
DC Grid Voltage▲▲	−200	volts
	2200	ohms
	330	ohms
Peak RF Grid Voltage	450	volts
DC Plate Current	500	ma
DC Grid Current (Approx.)□	90	ma
Driving Power (Approx.)□	36	watts
Power Output (Approx.)	1000	watts

Typical Operation as Oscillator at 160 Mc:

DC Plate Voltage	3000	volts
DC Grid Voltage†	−225	volts
	2000	ohms
	380	ohms
Peak RF Grid Voltage	475	volts
DC Plate Current	500	ma
DC Grid Current (Approx.)□	90	ma
Power Output (Approx.)	1000	watts
Useful Power Output (Approx.)— 85% circuit efficiency	850	watts

▲▲ Obtained from fixed supply, by grid resistor (2200) or by cathode resistor (330).

† Obtained from fixed supply, by grid resistor (2000) or by cathode resistor (380).

SELF-RECTIFYING OSCILLATOR or AMPLIFIER—Class C

Maximum CCS● Ratings, *Absolute Values*:

RMS PLATE VOLTAGE	4250 max.	volts
DC GRID VOLTAGE	−300 max.	volts
DC PLATE CURRENT	320 max.	ma
DC GRID CURRENT	85 max.	ma
PLATE INPUT	1500 max.	watts
PLATE DISSIPATION	600 max.	watts

Typical Operation:

RMS Plate Voltage	4250	volts
DC Grid Voltage⊕	−115	volts
	1500	ohms
DC Plate Current	320	ma
DC Grid Current□	77	ma
Driving Power (Approx.)■□	46	watts
Power Output (Approx.)	1050	watts

■ From a self-rectifying driver.

●, □, ⊕: See next page.

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POWER TRIODE

AMPLIFIER or OSCILLATOR—Class C

With Separate, Rectified, Unfiltered, Single-Phase, Full-Wave Plate Supply

Maximum CCS● Ratings, *Absolute Values*:

DC PLATE VOLTAGE	2700 max.	volts
DC GRID VOLTAGE	-300 max.	volts
DC PLATE CURRENT	450 max.	ma
DC GRID CURRENT	120 max.	ma
PLATE INPUT	1500 max.	watts
PLATE DISSIPATION	600 max.	watts

Typical Operation:

DC Plate Voltage	2700	volts
DC Grid Voltage⊕	-180	volts
	1530	ohms
DC Plate Current	450	ma
DC Grid Current (Approx.)□	118	ma
Driving Power (Approx.)▲□	57	watts
Power Output (Approx.)	1150	watts

● Continuous Commercial Service.

□ For effect of load resistance on grid current and driving power, refer to TUBE RATINGS—*Grid Current and Driving Power* in the General Section.

⊕ Obtained by grid resistor of value shown or by partial self-bias methods.

▲ From a driver with a rectified, unfiltered, single-phase, full-wave plate supply.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Filament Current	1	11.7	13.3	amp
Amplification Factor	1,2	27	33	
Grid-Plate Capacitance	-	4.8	5.8	μμf
Grid-Filament Capacitance	-	3.6	4.8	μμf
Plate-Filament Capacitance	-	2.8	4.0	μμf
Plate Voltage	1,3	1030	1350	volts
Plate Voltage	1,4	2400	3000	volts
Grid Voltage	1,5	-	-130	volts
Peak Cathode Current	1,6	6	-	amp
Useful Power Output	1,7	800	-	watts

Note 1: With 11 volts ac on filament

Note 2: With dc grid voltage of -25 volts, and plate voltage adjusted to give dc plate current of 200 ma.

Note 3: With dc grid voltage of 0 volts, and plate voltage adjusted to give dc plate current of 200 ma.

Note 4: With dc grid voltage of -50 volts, and plate voltage adjusted to give dc plate current of 200 ma.

Note 5: With dc plate voltage of 3000 volts, and grid voltage adjusted to give a dc plate current of 1 ma.

Note 6: Represents the maximum usable cathode current (plate current and grid current) for the tube under any condition of operation.

5786

POWER TRIODE

Note 7: With dc plate voltage of 3000 volts, dc plate current of 500 ma., dc grid current of 80 to 120 ma., grid resistor of 2000 ± 10% ohms, and frequency of 160 Mc.

Data on operating frequencies for the 5786 are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY.

OPERATING NOTES

The quantity of air necessary for adequate cooling of the 5786 will depend on the power input to the tube, as well as on the efficiency and frequency at which the tube is operated. When the 5786 is operated with full power input at the maximum rated frequency of 160 megacycles, and with the circuit adjusted for tube operation at the maximum plate-dissipation rating, sufficient cooling will be provided by a blower such as the Fasco No.50749. This blower is made by F.A. Smith Mfg. Co., Inc., Rochester 2, N.Y. It has an outlet area of approximately 6.25 square inches and is capable of supplying 140 cubic feet of air per minute, free delivery.

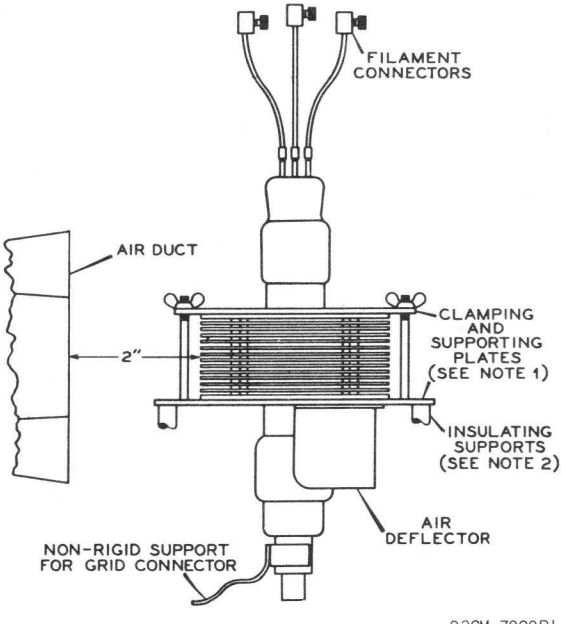
Provision must be made to direct part of the air from the blower to the filament and grid seals. For this purpose, a blower duct similar to that shown on the following sheet is suggested. Also sketched is a semi-circular air deflector which is useful in providing adequate cooling to the side of the grid seal away from the incoming air stream.

Depending on the type of application in which the 5786 is used, the required quantity of cooling air and the method employed for directing this air to the radiator and seals will vary considerably. It is recommended, therefore, that operating temperatures be measured in each application to make certain that maximum temperature ratings are not exceeded.

5786

POWER TRIODE

SUGGESTED MOUNTING



92CM-7080RI

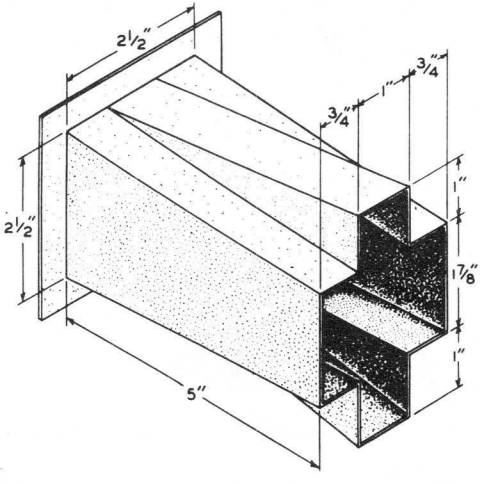
NOTE 1: SUPPORTING PLATE AND CLAMPING PLATE HAVE HOLES LARGE ENOUGH TO PERMIT PASSAGE OF THE GLASS BULBS OF THE TUBE.

NOTE 2: TWO OR MORE INSULATORS MAY BE USED. INSULATORS MUST BE PLACED SO AS TO NOT INTEREFERE WITH AIR FLOW ONTO GRID TERMINAL.

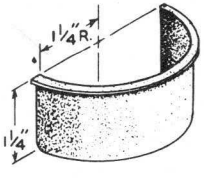
5786

POWER TRIODE

AIR DUCT



AIR DEFLECTOR

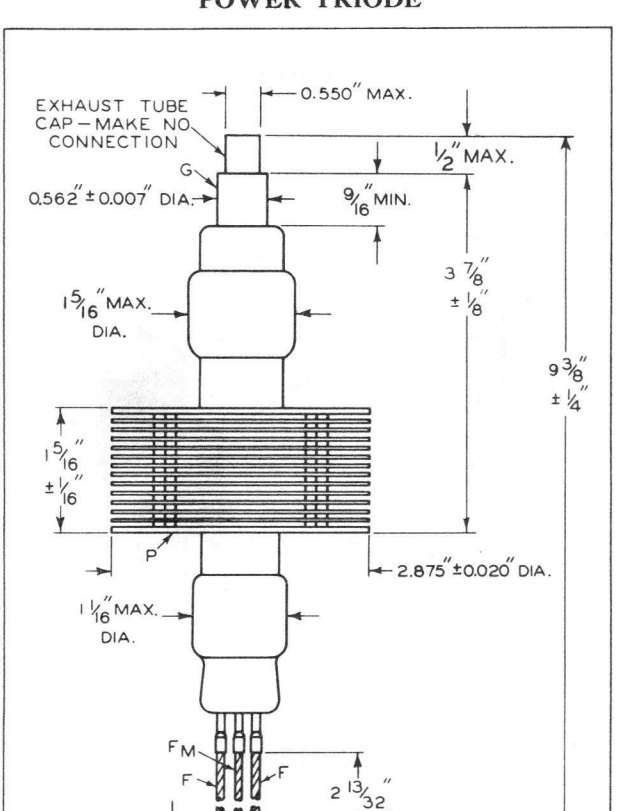


92CS-7117

RCA

5786

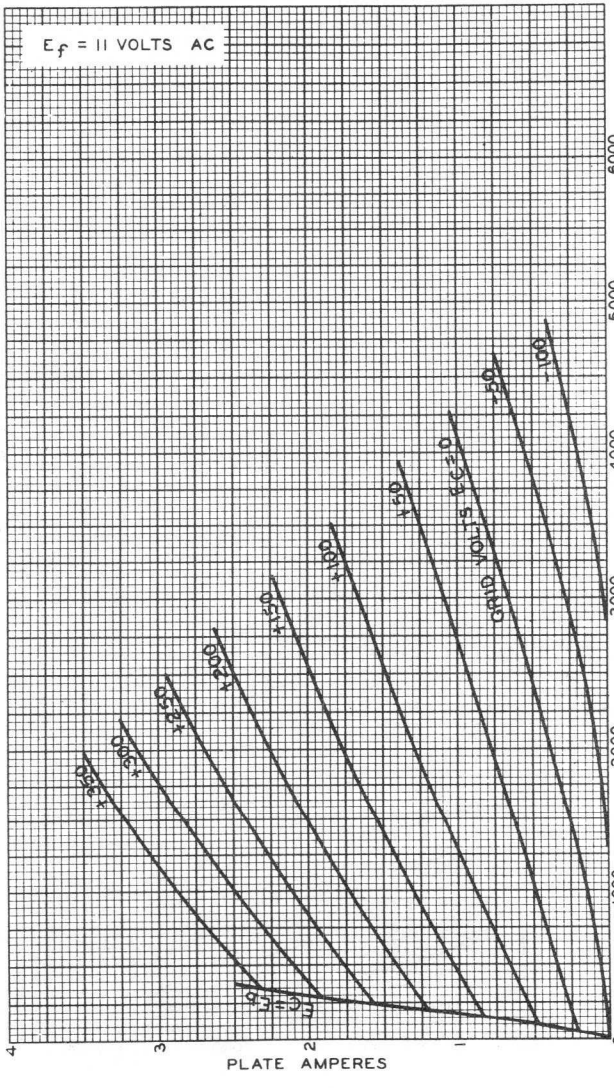
POWER TRIODE



RCA

5786

AVERAGE PLATE CHARACTERISTICS



MAY 10, 1948

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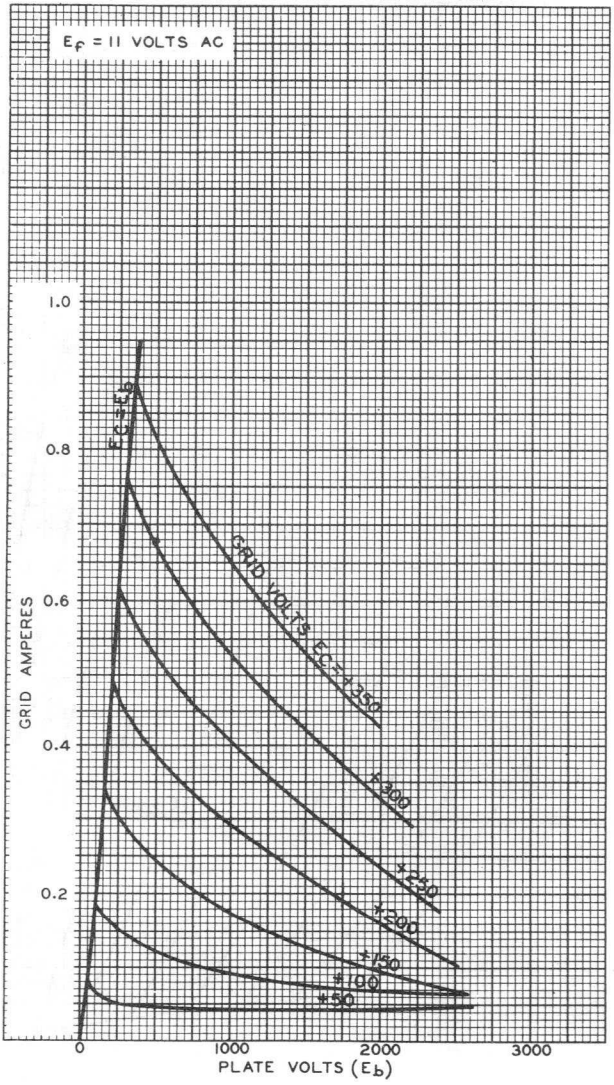
92CM-6593RI

RCA

5786

TYPICAL CHARACTERISTICS



5794

FIXED-TUNED OSCILLATOR TRIODE

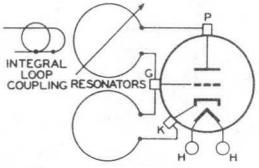
"PENCIL TYPE" WITH INTEGRAL RESONATORS
For radiosonde service at 1680 Mc

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.

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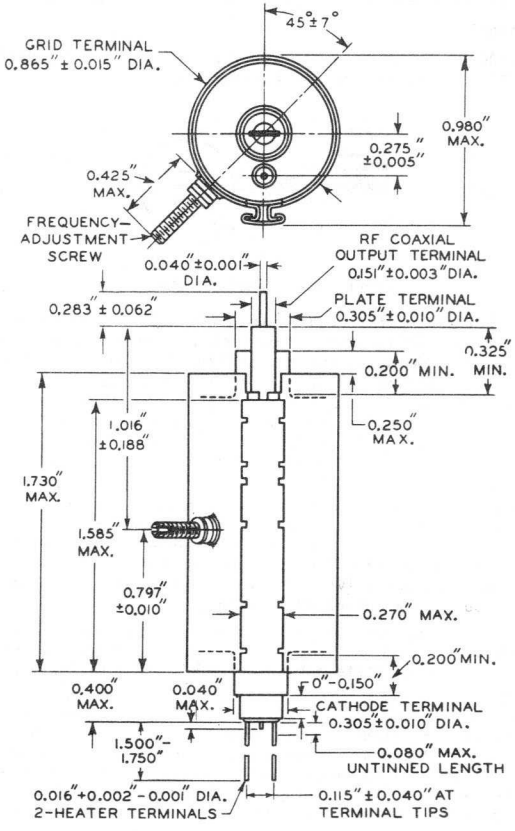
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

5794

FIXED-TUNED OSCILLATOR TRIODE



92CM-7140R4

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

5820

IMAGE ORTHICON

For outdoor and studio pickup

MAGNETIC FOCUS MAGNETIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:
Voltage. . . . . 6.3 ± 10% . . . . ac or dc volts
Current. . . . . 0.6 . . . . . .amp
Direct Interelectrode Capacitance:
Anode to all other electrodes. . . . . 12 μμf
Photocathode, Semitransparent:
Response . . . . . *See accompanying Spectral-Sensitivity-Characteristics curves*
Rectangular image (4 x 3 aspect ratio):
Useful size of . . . . . 1.8" max. diagonal ←
Note: The size of the optical image focused on the photocathode should be adjusted so that its maximum diagonal does not exceed the specified value. The corresponding electron image on the target should have a size such that the corners of the rectangle just touch the target ring.
Orientation of . . . . . Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through center of faceplate and pin 7 of the shoulder base.
Focusing Method. . . . . Magnetic
Deflection Method. . . . . Magnetic
Overall Length . . . . . 15.20" ± 0.25"
Greatest Diameter of Bulb. . . . . 3.00" ± 0.06"
Minimum Deflecting-Coil Inside Diameter. . . . . 2-3/8"
Deflecting-Coil Length . . . . . 5"
Focusing-Coil Length . . . . . 10"
Alignment-Coil Length. . . . . 15/16"
Photocathode Distance Inside End of Focusing Coil. . . . 1/2"
Operating Position . . . . . *See Operating Considerations* ←
Weight (Approx.) . . . . . 1 lb 6 oz ←
Shoulder Base. . . . . .Keyed Jumbo Annular 7-Pin

BOTTOM VIEW■

Pin 1 - Grid No.6	Pin 5 - Grid No.5
Pin 2 - Photocathode	
Pin 3 - Internal Connection—Do Not Use	Pin 6 - Target
Pin 4 - Internal Connection—Do Not Use	Pin 7 - Internal Connection—Do Not Use

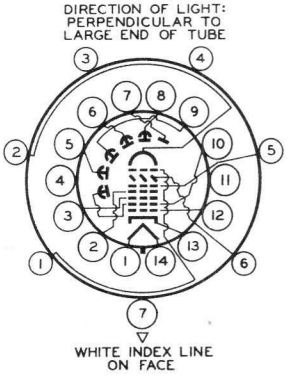
■ See basing diagram on next page. ← Indicates a change.

5820

IMAGE ORTHICON

End Base. . . . Small-Shell Diheptal 14-Pin (JETEC No.B14-45)
BOTTOM VIEW

Pin 1 – Heater
Pin 2 – Grid No.4
Pin 3 – Grid No.3
Pin 4 – Internal Connection—Do Not Use
Pin 5 – Dynode No.2
Pin 6 – Dynode No.4
Pin 7 – Anode
Pin 8 – Dynode No.5
Pin 9 – Dynode No.3
Pin 10 – Dynode No.1, Grid No.2
Pin 11 – Internal Connection—Do Not Use
Pin 12 – Grid No.1
Pin 13 – Cathode
Pin 14 – Heater



Maximum and Minimum Ratings, *Absolute Values:*

PHOTOCATHODE:		
Voltage	−550 max.	volts
Illumination	50 max.	ft-c
OPERATING TEMPERATURE:		
Of any part of bulb	50 max.	°C
Of bulb at large end of tube (Target section)	35 min.	°C
TEMPERATURE DIFFERENCE:		
Between target section and any part of bulb hotter than target section	5 max.	°C
GRID-No.6 VOLTAGE	−550 max.	volts
TARGET VOLTAGE:		
Positive value	10 max.	volts
Negative value	10 max.	volts
GRID-No.5 VOLTAGE	150 max.	volts
GRID-No.4 VOLTAGE	300 max.	volts
GRID-No.3 VOLTAGE	400 max.	volts
GRID-No.2 & DYNODE-No.1 VOLTAGE	350 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value	125 max.	volts
Positive bias value	0 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	10 max.	volts
ANODE-SUPPLY VOLTAGE*	1350 max.	volts
VOLTAGE PER MULTIPLIER STAGE	350 max.	volts

*: See next page.

5820

IMAGE ORTHICON

Typical Operation and Characteristics:

Photocathode Voltage (Image Focus)	−400 to −540	volts
Grid-No.6 Voltage (Accelerator)— Approx. 75% of photocathode voltage.	−300 to −405	volts
Target-Cutoff Voltage[o]	−3 to +1	volts
Grid-No.5 Voltage (Decelerator)	0 to 125	volts
Grid-No.4 Voltage (Beam Focus)	140 to 180	volts
Grid-No.3 Voltage[#]	225 to 330	volts
Grid-No.2 & Dynode-No.1 Voltage	300	volts
Grid-No.1 Voltage for picture cutoff	−45 to −115	volts
Dynode-No.2 Voltage	600	volts
Dynode-No.3 Voltage	800	volts
Dynode-No.4 Voltage	1000	volts
Dynode-No.5 Voltage	1200	volts
Anode Voltage	1250	volts
Anode Current (DC)	30	μa
Signal-Output Current (Peak to peak)	3 to 24	μa
Target-Temperature Range	35 to 45	°C
Ratio of Peak-to-Peak Highlight Video-Signal Current to RMS Noise Current (Approx.)	35	
Minimum Peak-to-Peak Blanking Voltage	5	volts
Field Strength at Center of Focusing Coil[▲]	75	gausses
Field Strength of Alignment Coil (Approx.)	0 to 3	gausses

* Ratio of dynode voltages is shown under *Typical Operation*.

[o] Normal setting of target voltage is +2 volts from target cutoff. The target-supply voltage should be adjustable from −3 to +5 volts.

[#] Adjust to give the most uniformly shaded picture near maximum signal.

[▲] Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

OPERATING CONSIDERATIONS

The *operating position* of the 5820 should preferably be such that any loose particles in the neck of the tube will not fall down and strike or become lodged on the target. Therefore, it is recommended that the tube never be operated in a vertical position with the Diheptal-base end up nor in any other position where the axis of the tube with base up makes an angle of less than 20° with the vertical.

When the equipment-design or operating conditions are such that the maximum temperature rating or maximum temperature difference as given under ***Maximum and Minimum Ratings*** will be exceeded, provision should be made to direct a blast of cooling air from the Diheptal-base end of the tube along the entire length of the bulb surface, i.e., through the space between the bulb surface and the surrounding deflecting-coil assembly and its extension. Any attempt to effect cooling

←Indicates a change.

5820

IMAGE ORTHICON

of the tube by circulating even a large amount of air around the focusing coil will do little good, but a small amount of air directly in contact with the bulb surface will effectively drop the bulb temperature. For this purpose, a small blower is satisfactory, but it should be run at low speed to prevent vibration of the 5820 and the associated amplifier equipment. Unless vibration is prevented, distortion of the picture may occur.

To keep the operating temperature of the large end of the tube from falling below 35° C, some form of controlled heating should be employed. Ordinarily, adequate heat will be supplied by the focusing coil, deflecting coils, and associated amplifier tubes so that the temperature can be controlled by the amount of cooling air directed along the bulb surface. If, in special cases, a target heater is required, it should fit between the focusing coil and the bulb near the shoulder of the tube, and be non-inductively wound.

→ *Resolution* in excess of 500 lines at the center of the picture can be produced by the 5820. The Square-Wave Response Characteristics curves show the center square-wave amplitude response versus television line number for the 5820 when it is operated with the highlights at the knee of the light-transfer characteristic and at one lens stop above the knee and at a temperature of 35° C. The values of response plotted on the curves are those obtained after optimum adjustments are made.

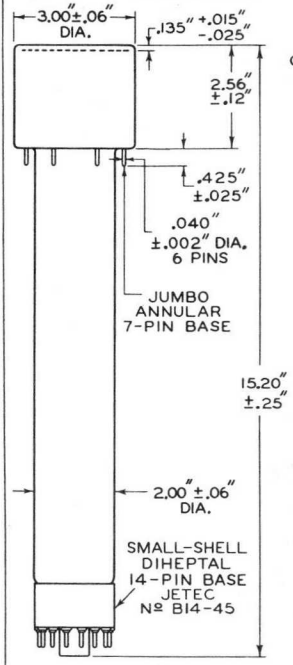
To utilize the resolution capability of the 5820 in the horizontal direction with the standard scanning rate of 525 lines, it is necessary to use a video amplifier having a bandwidth of at least 6 megacycles.

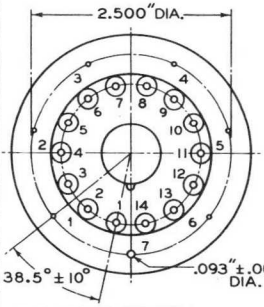
For very high illumination or for individual tubes with exceptionally high photocathode sensitivity, it may not be possible to stop the lens down far enough to reduce the high-light illumination on the photocathode to a value near the knee of the transfer characteristic. When such a condition is encountered, the use of a Wratten neutral filter selected to give the required reduction in illumination is recommended. Ordinarily, two filters--one having 10% transmission and the other 20%—will give sufficient choice. Such filters with lens-adapter rings can be obtained at a photographic-supply store.

→ Indicates a change.

5820

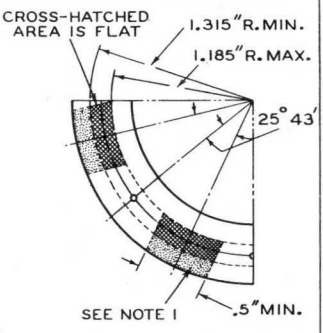
IMAGE ORTHICON





ENLARGED BOTTOM VIEW

DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE



NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.

ANNULAR-BASE GAUGE

ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAUGE WITH:

a. SIX HOLES HAVING DIAMETER OF 0.065" ± 0.001" AND ONE HOLE HAVING DIAMETER OF 0.150" ± 0.001". ALL HOLES HAVE DEPTH OF 0.265"±0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047". ALL HOLES ARE SPACED AT ANGLES OF 51°26' ± 5' ON CIRCLE DIAMETER OF 2.500" ± 0.001".

b. SEVEN STOPS HAVING HEIGHT OF 0.187" ± 0.001", CENTERED BETWEEN PIN HOLES, TO BEAR AGAINST FLAT AREAS OF BASE.

c. RIM EXTENDING OUT A MINIMUM OF 0.125" FROM 2.812" DIAMETER AND HAVING HEIGHT OF 0.126" ± 0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200" ± 0.001".

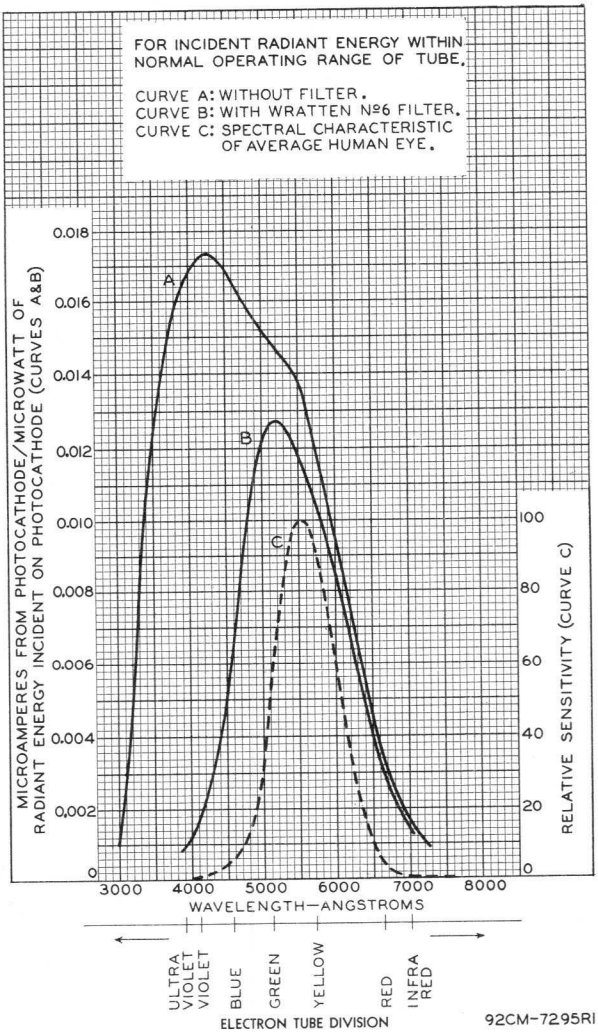
92CM-8293R3

5820

RCA

5820

SPECTRAL-SENSITIVITY CHARACTERISTICS



ELECTRON TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7295RI

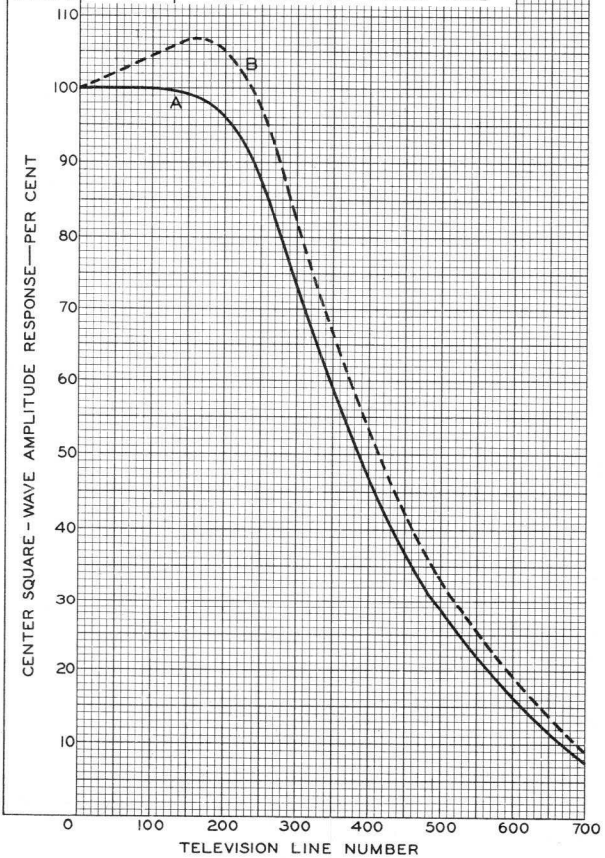
RCA

5820

SQUARE-WAVE RESPONSE CHARACTERISTICS

TEST PATTERN: SQUARE WAVE.
OPERATING TEMPERATURE OF BULB ADJACENT TO TARGET: 35° C.
RESPONSE MEASURED IN SYSTEM HAVING 10-Mc BANDWIDTH.

CURVE	HIGHLIGHTS IN RELATION TO LIGHT TRANSFER CHARACTERISTIC
A	AT KNEE
B	ONE LENS STOP ABOVE KNEE

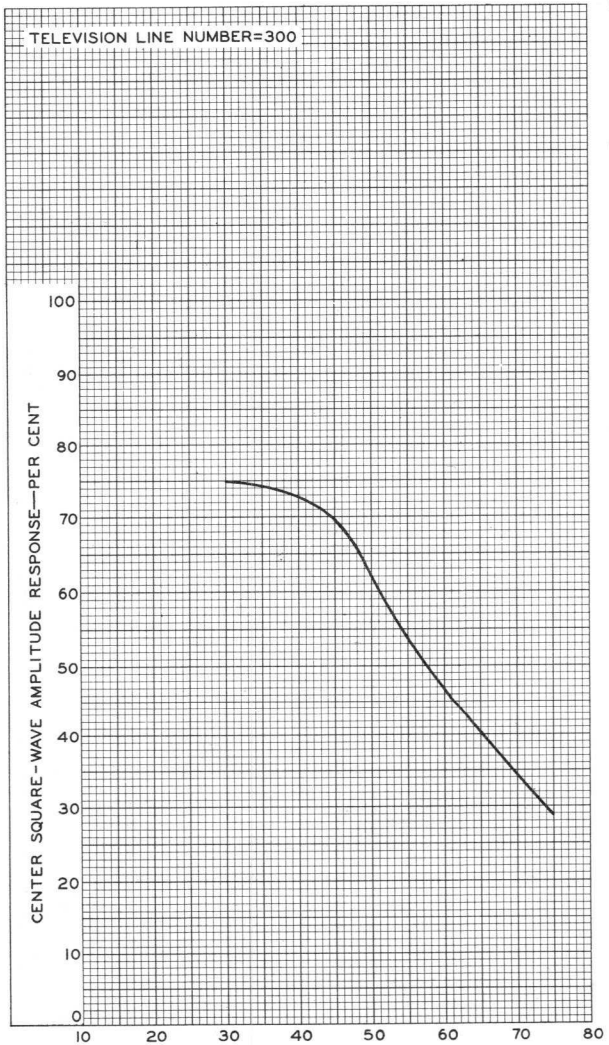


5820

RCA

5820

TEMPERATURE EFFECT ON SQUARE-WAVE RESPONSE

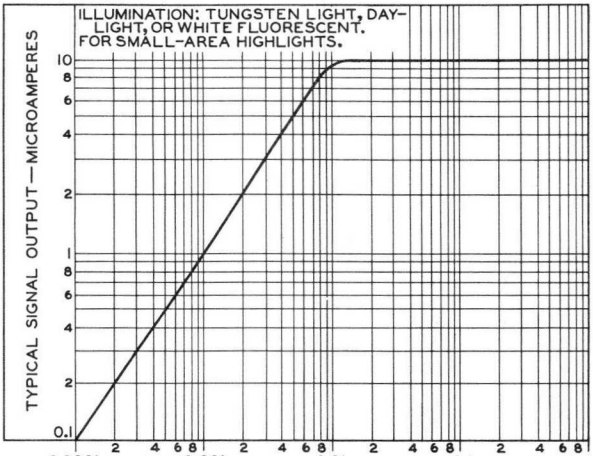


ELECTRON TUBE DIVISION 92CM-8272R1

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

5820

BASIC LIGHT-TRANSFER CHARACTERISTIC



92CS-7296R2

5822
IGNITRON

DATA

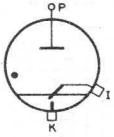
General:

Cathode, Ignitor Excited	Mercury-Pool Type	
Starting time at required ignitor voltage or current□	100	μsec
Anode Voltage Drop:		
At peak anode current of 1500 amperes	25	volts
Cooling:		
Type		water
Minimum Water Flow:		
At no load	0.5	gpm
At rated continuous average current	1.5	gpm
Maximum Pressure Drop:		
At 1.5 gpm	5	lb./sq.in.
Minimum Inlet-Water Temperature	10	°C
Maximum Outlet-Water Temperature	35	°C
Maximum Water-Temperature Rise	6	°C
Overall Rigid Length (Approx.)		14-1/2"
Maximum Diameter (Including water connections)		7-1/4"
Mounting Position	Vertical, flexible lead up	

Terminal Connections:

P – Anode Terminal (Flexible lead)

K – Cathode Terminal (Opposite the anode terminal)



I – Ignitor Terminal (Adjacent to the cathode terminal)

FREQUENCY-CHANGER RESISTANCE-WELDING SERVICE

For input-supply frequency from 50 to 60 cycles per second and minimum output frequency of 5 cycles per second

Maximum Ratings, *Absolute Values*:

	Rating I	*Rating II*	
PEAK ANODE VOLTAGE:			
Forward	1200 max.	1500 max.	volts
Inverse	1200 max.	1500 max.	volts
ANODE CURRENT:°			
Peak	1500 max.	1200 max.	amp
Corresponding Average*.	20 max.	16 max.	amp
Average*.	70 max.	56 max.	amp
Corresponding Peak.	420 max.	336 max.	amp
RATIO OF FAULT ANODE CURRENT TO PEAK ANODE CURRENT●.	12.5 max.	12.5 max.	

° Ratings are for zero phase-control angle. Straight-line interpolation on log-log paper is permissible between corresponding points.

* Averaged over any 6.25-second maximum interval.

● Duration of fault anode current should be limited to 0.15 second.

□: See next page.

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5822
IGNITRON

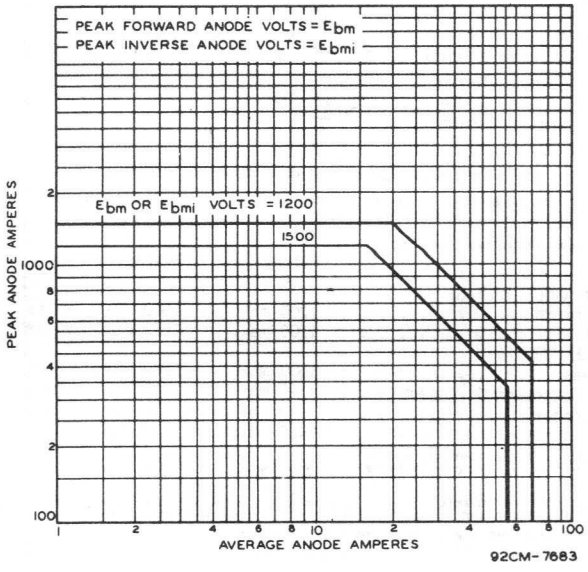
PEAK IGNITOR VOLTAGE:		
Positive□	Equal to anode	volts
	200 min.	volts
Negative	5 max.	volts
IGNITOR CURRENT:		
Peak□	100 max.	amp
	30 min.	amp
RMS.	10 max.	amp
Average■	1 max.	amp

□ Ignition will occur if either minimum peak positive ignitor potential is applied, or minimum peak ignitor current flows, for the indicated starting time (see Cathode).

■ Averaged over any 5-second maximum interval.

Outline Drawing for the 5822 is the same as shown for Type 5552

RATING CHART



TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON NEW JERSEY

5822-A

IGNITRON

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

For intermittent rectifier and frequency-changer welder service

GENERAL DATA

Electrical:

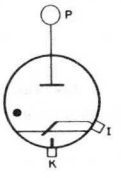
Cathode Excitation	Cyclic	
Cathode-Spot Starting	By Ignitor	
Minimum Requirements for Cathode Excitation:		
Peak ignitor voltage required to fire	200	volts
Peak ignitor current required to fire	30	amp
Starting time at required voltage or current	100	μsec
Tube Voltage Drop:		
At peak anode current of 1500 amperes	25	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	8.25 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	35	°C
Minimum water flow	1.5	gpm
Maximum water-temperature rise	6	°C
Maximum pressure drop	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	1200 max.	1200 max.	volts
Inverse	1200 max.	1200 max.	volts

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

5822-A
IGNITRON

ANODE CURRENT:			
Peak	420 max.	1500 max.	amp
Average (Averaged over any interval of 6.25 seconds maximum)	70 max.	20 max.	amp
Average (Averaged over any interval of 0.2 second maximum)	70 max.	250 max.	amp
Fault, for duration of 0.15 second maximum	18750 max.	18750 max.	amp

RATING II

PEAK ANODE VOLTAGE:			
Forward	1500 max.	1500 max.	volts
Inverse	1500 max.	1500 max.	volts
ANODE CURRENT:			
Peak	336 max.	1200 max.	amp
Average (Averaged over any interval of 6.25 seconds maximum)	56 max.	16 max.	amp
Average (Averaged over any interval of 0.2 second maximum)	56 max.	200 max.	amp
Fault, for duration of 0.15 second maximum	15000 max.	15000 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

OPERATING CONSIDERATIONS

The 5822-A is equipped with a mounting plate for mounting a thermostatic control 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.

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.

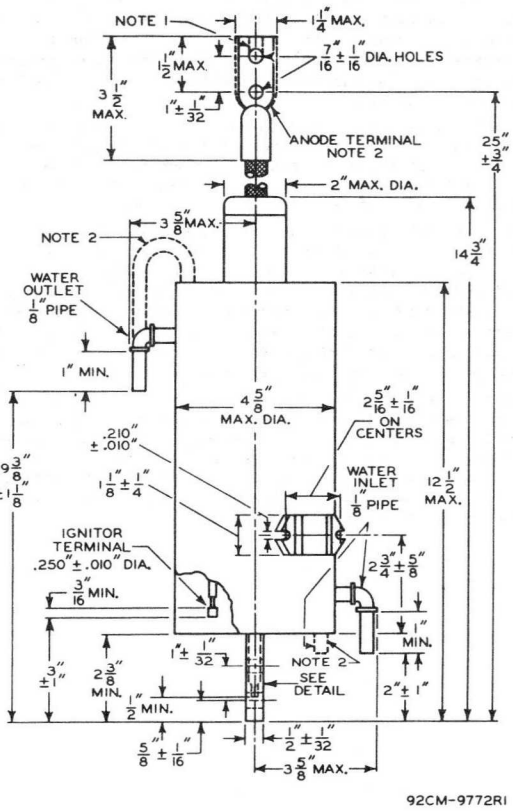
When a *protective thermostat* is used, it should be mounted on an ignitron from which the cooling water discharges into the drain. The protective thermostat is calibrated to open a set of normally closed contacts at a jacket temperature of approximately 52° C. The opening of these contacts causes a 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.

RCA

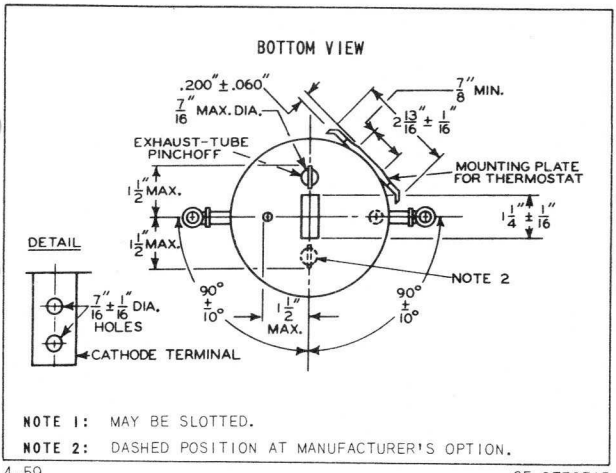
5822-A

IGNITRON



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

5822-A
IGNITRON



NOTE 1: MAY BE SLOTTED.

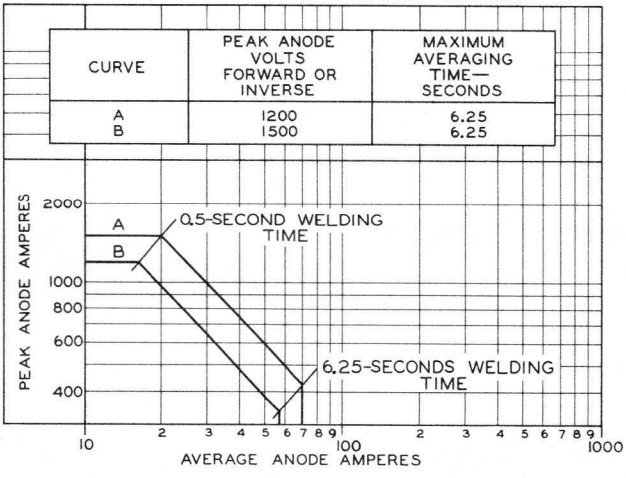
NOTE 2: DASHED POSITION AT MANUFACTURER'S OPTION.

4-59

CE-9772R1B

RATING CHART
FREQUENCY-CHANGER WELDER SERVICE

CURVE	PEAK ANODE VOLTS FORWARD OR INVERSE	MAXIMUM AVERAGING TIME— SECONDS
A	1200	6.25
B	1500	6.25



92CS-9821

Absolute

RCA

5890

5890

REMOTE-CUTOFF BEAM PENTODE

GENERAL DATA

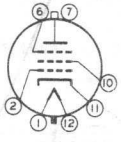
Electrical:

Heater, for Unipotential Cathode:			
Voltage	6.3	ac or dc	volts
Current	0.6		amp
Mu-Factor, Grid No.2 to Grid No.1	5		
Direct Interelectrode Capacitances:			
Grid No.1 to Plate	0.018		μμf
Input	7.5		μμf
Output	1.6		μμf

Mechanical:

Mounting Position	Any
Overall Length	6-1/2" ± 1/4"
Seated Length	6" ± 1/4"
Maximum Diameter	1-1/2"
Cap	Small
Base	Small-Shell Duodecal 7-Pin
Basing Designation for BOTTOM VIEW	12J

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 6 - Grid No.3
Pin 7 - Internal Con.- Do Not Use
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater
Cap - Plate



Bulb Temperature	220 max.	°C

VOLTAGE-CONTROL SERVICE

Maximum CCS• Ratings, *Absolute Values*:

DC PLATE VOLTAGE	30000 max.	volts
DC GRID-No.3 VOLTAGE	6600 max.	volts
DC GRID-No.2 VOLTAGE	450 max.	volts
DC GRID-No.1 VOLTAGE:		
Negative bias value	-200 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
MAX.-SIGNAL DC PLATE VOLTAGE	500 max.	volts
MAX.-SIGNAL GRID-No.3 INPUT	1 max.	watt
MAX.-SIGNAL GRID-No.2 INPUT	0.1 max.	watt
PLATE DISSIPATION	10 max.	watts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	165 max.	volts
Heater positive with respect to cathode	165 max.	volts

• See next page.

5890

REMOTE-CUTOFF BEAM PENTODE

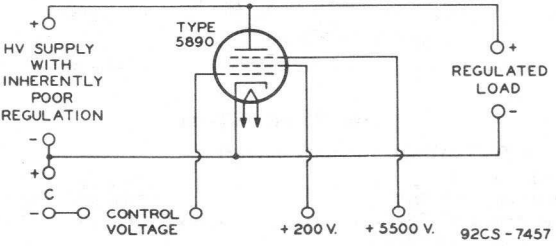
Typical Operation as Shunt Voltage-Regulator Tube in Accompanying Circuit			
DC Plate Voltage	20000	30000	volts
DC Grid-No.3 Voltage	5500	5500	volts
DC Grid-No.2 Voltage*	200	200	volts
DC Grid-No.1 Voltage**	-60	-60	volts
Peak Grid-No.1 Voltage	45	20	volts
Zero-Sig. DC Plate Cur.	0	0	μamp
Max.-Sig. DC Plate Cur.	500	60	μamp
Zero-Sig. DC Grid-No.3 Cur.	0	0	μamp
Max.-Sig. DC Grid-No.3 Cur.	0	0	μamp
Zero-Sig. DC Grid-No.2 Cur.	0	0	μamp
Max.-Sig. DC Grid-No.2 Cur.	0	0	μamp
Grid-No.1 Bias (Approx.) for plate current of 10 μamp.	-52	-52	volts
Grid-No.1—Plate Transconductance	11	3	μmhos

● Continuous Commercial Service.

* Subject to variation of ± 40% if grid-No.1 voltage is desired at indicated value.

** Subject to variation of ± 40% if grid-No.2 voltage is desired at indicated value.

Shunt Voltage-Regulator Circuit



NOTE: THE CONTROL VOLTAGE MAY BE TAKEN FROM THE LOAD CIRCUIT OR FROM A CIRCUIT SUPPLYING SIGNAL TO THE LOAD CIRCUIT, DEPENDING ON THE TYPE OF LOAD INVOLVED.

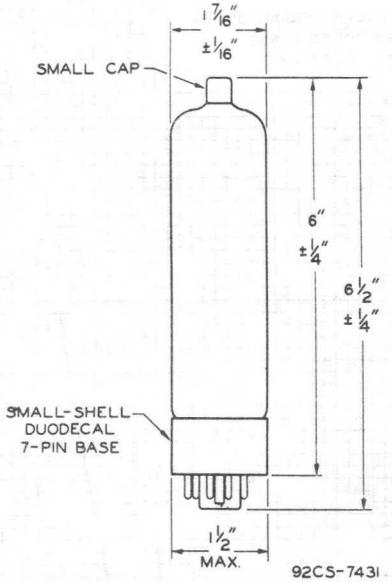
OPERATING NOTES

Operation of the 5890 with a plate voltage above approximately 16000 volts results in the production of soft x-rays which can constitute a health hazard on prolonged exposure unless the tube is adequately shielded. Relatively simple shielding should prove adequate, but the need for this precaution should be considered in equipment design.

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

5890

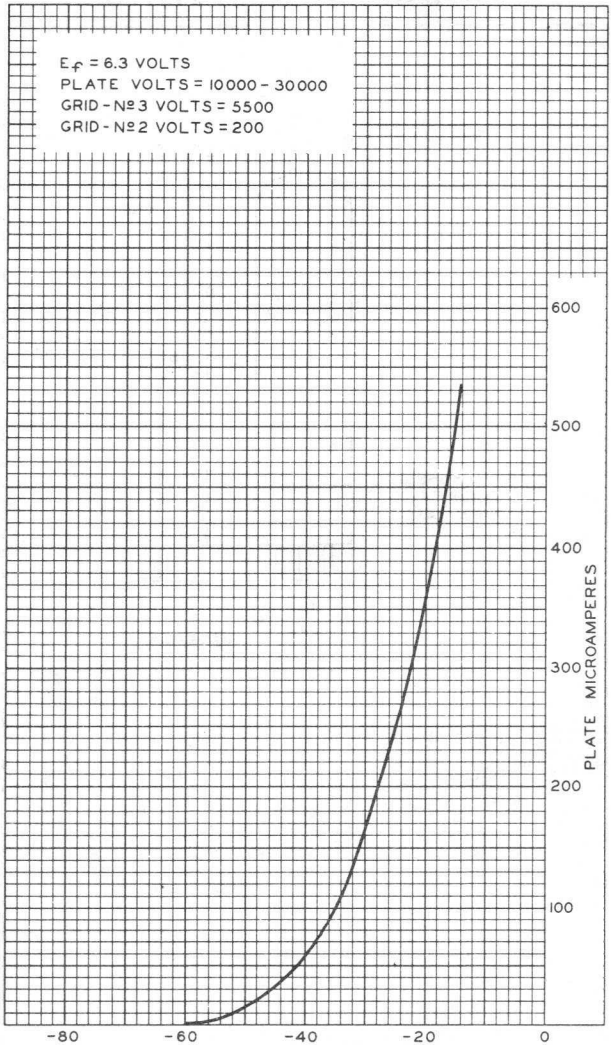
REMOTE-CUTOFF BEAM PENTODE



RCA

5890

AVERAGE CHARACTERISTIC



FEB. 9, 1950

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7445

RCA

5894

TWIN BEAM POWER TUBE

Useful at Frequencies up to 500 Mc

Unless Otherwise Specified, Values are on a Per-Tube Basis

GENERAL DATA

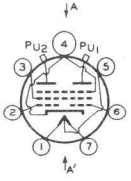
Electrical:

Heater for Unipotential Cathode:			
Heater arrangement	*Series*	*Parallel*	
Voltage	12.6 ± 10%	6.3 ± 10%	ac or dc volts
Current	0.9	1.8	amp
Mu-Factor, Grid No.2 to (Grid No.1 (Each Unit) for dc plate volts = 600, dc grid-No.2 volts = 250, and dc plate ma = 40		8.2	
Direct Interelectrode Capacitances (Each Unit):[o]			
Grid No.1 to plate		0.8 max.	μμf
Grid No.1 to cathode & grid No.3 & internal shield, grid No.2, and heater		11	μμf
Plate to cathode & grid No.3 & internal shield, grid No.2, and heater		3.4	μμf

Mechanical:

Mounting Position:	
Vertical	Base up or down
Horizontal	Plate terminals in horizontal plane
Maximum Overall Length	4-5/16"
Seated Length	3-11/16" ± 3/16"
Maximum Diameter	1-15/16"
Bulb	T-14
Bulb Terminals (Two)	*See Dimensional Outline*
Weight (Approx.)	2.3 oz
Base	Small-Wafer Septar 7-Pin (JETEC No.E7-21)

BOTTOM VIEW



Pin 1 – Heater
Pin 2 – Grid No.1 of Unit No.2
Pin 3 – Grid No.2
Pin 4 – Cathode, Grid No.3, Internal Shield
Pin 5 – Heater Mid-Tap
Pin 6 – Grid No.1 of Unit No.1
Pin 7 – Heater
PU_1 – Plate of Unit No.1
PU_2 – Plate of Unit No.2

PLANE OF ELECTRODES OF EACH UNIT IS PARALLEL TO PLANE THROUGH AXIS OF TUBE AND AA'

Plate-Seal Temperature	200 max.	°C

[o] Without external shield.

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TWIN BEAM POWER TUBE

Base-Seal Temperature.		180 max.	°C

Cooling: Free circulation of air around the tube is required. In addition, some forced-air cooling will generally be required to prevent exceeding the specified maximum bulb temperature.

AF POWER AMPLIFIER & MODULATOR - Class B

Maximum CCS● Ratings, *Absolute Values*:

DC PLATE VOLTAGE		600 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE.		250 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE. . . .		-175 max.	volts
MAX.-SIGNAL DC PLATE CURRENT*.		200 max.	ma
MAX.-SIGNAL PLATE INPUT*		120 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT*		7 max.	watts
PLATE DISSIPATION*		40 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode.		100 max.	volts
Heater positive with respect to cathode.		100 max.	volts

Typical CCS● Operation:

DC Plate Voltage	450	600	volts
DC Grid-No.2 Voltage▲.	250	250	volts
DC Grid-No.1 Voltage:			
From fixed-bias source	-23	-25	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage.	53	53	volts
DC Plate Current:			
Zero-signal value.	67	35	ma
Max.-signal value.	200	168	ma
DC Grid-No.2 Current:			
Zero-signal value.	8	4	ma
Max.-signal value.	26	27	ma
DC Grid-No.1 Current:			
Max.-signal value.	2.3	1.6	ma
Effective Load Resistance (Plate to plate)	4400	8000	ohms
Max.-Signal Driving Power (Approx.)♦	0.2	0.2	watt
Max.-Signal Power Output (Approx.)♦.	60	70	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance:▲		
With fixed bias.	50000 max.	ohms
With cathode bias.	Not recommended	

* Averaged over any audio-frequency cycle of sine-wave form.

▲ Preferably obtained from a separate source or from the plate-voltage supply with a voltage divider.

●, ♦: See next page.

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TWIN BEAM POWER TUBE

PLATE-MODULATED PUSH-PULL RF POWER AMPLIFIER - Class C Telephony

Carrier conditions per tube with a max. modulation factor of 1.0

Maximum CCS● Ratings, *Absolute Values*:

For max. plate voltage and max. plate input above 250 Mc, see Rating Chart I

DC PLATE VOLTAGE	450 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	250 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-175 max.	volts
DC PLATE CURRENT	160 max.	ma
DC GRID-No.1 CURRENT	10 max.	ma
PLATE INPUT	72 max.	watts
GRID-No.2 INPUT	4.5 max.	watts
PLATE DISSIPATION	27 max.	watts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	100 max.	volts
Heater positive with respect to cathode	100 max.	volts

Typical CCS● Operation:

	Up to 250 Mc	*At 470 Mc*	
DC Plate Voltage	450	380	volts
DC Grid-No.2 Voltage (Approx.)♦	250	250	volts
From an adjustable series resistor having a max. value of	20000	30000	ohms
DC Grid-No.1 Voltage★	-100	-60	volts
From a grid-No.1 resistor of	20000	15000	ohms
Peak RF Grid-No.1-to-Grid-No.1 Voltage	120	-	volts
DC Plate Current	150	160	ma
DC Grid-No.2 Current (Approx.)	16	8	ma
DC Grid-No.1 Current (Approx.)	5	4	ma

♦ Driver stage should be capable of supplying the specified driving power at low distortion to the No.1 grids of the class B stage. To minimize distortion, the effective resistance per grid-No.1 circuit of the class B stage should be held at a low value. For this purpose, the use of transformer coupling is recommended. In no case, however, should the total dc grid-No.1-circuit resistance exceed 50000 ohms.

♭ Obtained preferable from a separate source modulated along with the plate supply, or from the modulated plate supply through a series resistor. It is recommended that this resistor be adjustable to permit obtaining the desired operating plate current after initial tuning adjustments are completed.

★ Obtained from a grid-No.1 resistor of value shown or by partial self-bias method. A combination of grid-No.1 resistor and fixed supply has the advantage not only of protecting the tube from damage through loss of excitation but also of minimizing distortion by bias-supply compensation.

●: See next page.

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TWIN BEAM POWER TUBE

	Up to 250 Mc	*At 470 Mc*	
Driver Power			
Output (Approx.)	0.6	13	watts
Useful Power			
Output (Approx.)●●	50	35	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance‡.	50000 max.	ohms

PUSH-PULL RF POWER AMPLIFIER & OSCILLATOR - Class C Telegraphy□
and
PUSH-PULL RF POWER AMPLIFIER - Class C FM Telephony

Maximum CCS● Ratings, *Absolute Values*:

For max. plate voltage and max. plate input above 250 Mc, see Rating Chart II

DC PLATE VOLTAGE	600 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE.	250 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE.	-175 max.	volts
DC PLATE CURRENT	220 max.	ma
DC GRID-No.1 CURRENT	10 max.	ma
PLATE INPUT.	120 max.	watts
GRID-No.2 INPUT.	7 max.	watts
PLATE DISSIPATION.	40 max.	watts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode. .	100 max.	volts
Heater positive with respect to cathode. .	100 max.	volts

Typical CCS● Operation:

	Up to 250 Mc	*At 470 Mc*		
DC Plate Voltage	600	400	500	volts
DC Grid-No.2				
Voltage (Approx.)⊕ . . .	250	250	250	volts
From an adjustable series resistor having a max. value of.	33000	22000	47000	ohms
DC Grid-No.1 Voltage■. . . .	-80	-38	-60	volts
From a grid-No.1 resistor of.	39000	24000	30000	ohms
From cathode resistor of.	360	180	300	ohms
Peak RF Grid-No.1-to-Grid-No.1 Voltage.	200	–	–	volts
DC Plate Current	200	220	200	ma

□ Key-down conditions per tube without amplitude modulation. Amplitude modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

●, ●●, ‡, ⊕, ■: See next page.

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TWIN BEAM POWER TUBE

	Up to 250 Mc	*At 470 Mc*		
DC Grid-No.2 Current (Approx.)	16	12	8	ma
DC Grid-No.1 Current (Approx.)	2	3	4	ma
Driver Power Output (Approx.)	4	5	13	watts
Useful Power Output (Approx.)●●	85	43	55	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance‡	50000 max.	ohms

FREQUENCY TRIPLER - Class C

Maximum CCS● Ratings, *Absolute Values*:

For max. plate voltage and max. plate input above 250 Mc, see Rating Chart III

DC PLATE VOLTAGE	600 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	250 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-175 max.	volts
DC PLATE CURRENT	160 max.	ma
DC GRID-No.1 CURRENT	10 max.	ma
PLATE INPUT	80 max.	watts
GRID-No.2 INPUT	7 max.	watts
PLATE DISSIPATION	40 max.	watts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	100 max.	volts
Heater positive with respect to cathode	100 max.	volts

Typical CCS● Operation as Tripler:

	Up to 150 Mc		*To 225 Mc*	*To 462 Mc*		
DC Plate Voltage	400	500	400	400	400	volts
DC Grid-No.2 Voltage (Approx.)■	250	250	250	220	220	volts
From an adjustable series resistor having max. value of	16000	39000	20000	56000	56000	ohms

● Continuous Commercial Service.

■ Obtained preferably from a separate source, or from the plate-supply voltage with a voltage divider, or through a series resistor. A series grid-No.2 resistor should be used only when the 5894 is used in a circuit which is not keyed. It is recommended that this resistor be adjustable to permit obtaining the desired operating plate current after initial tuning adjustments are completed.

●●, ‡, ■: See next page.

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TWIN BEAM POWER TUBE

	Up to 150 Mc		*To 225 Mc*	*To 462 Mc*		
DC Grid-No.1 Voltage■	-150	-150	-150	-150	-175	volts
From a grid-No.1 resistor of. . .	30000	24000	50000	36000	36000	ohms
Peak RF Grid-No.1-to-Grid-No.1 Voltage.	360	360	360	–	–	volts
DC Plate Current . .	146	120	130	130	140	ma
DC Grid-No.2 Current (Approx.).	16	10	20	5	5	ma
DC Grid-No.1 Current (Approx.).	5	6	3	4	5	ma
Driver Power Output (Approx.).	0.9	1	0.5	4	8	watts
Useful Power Output (Approx.)●●. . . .	18	20	12	13	16	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance‡.	50000 max.	ohms

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Heater Current:				
Series connection	1	0.8	1	amp
Parallel connection	2	1.6	2	amp
Mu-Factor, Grid No.2 to Grid No.1 (Each Unit)	2,3	7	9.3	
Direct Interelectrode Capacitances (Each Unit):				
Grid No.1 to plate.	4	–	0.08	μμf
Grid No.1 to cathode & grid No.3 & internal shield, grid No.2, and heater.	4	9.4	11.6	μμf
Plate to cathode & grid No.3 & internal shield, grid No.2, and heater	4	2.6	3.7	μμf

Note 1: With 12.6 volts ac on heater.

Note 2: With 6.3 volts ac on heater.

Note 3: With dc plate voltage of 600 volts, dc grid-No.2 voltage of 250 volts, and dc plate current of 40 ma.

Note 4: Without external shield.

●● This value of useful power output is measured at load of output circuit.

‡ When grid No.1 is driven positive, the total dc grid-No.1-circuit resistance should not exceed the specified value of 50000 ohms. If this value is insufficient to provide adequate bias, the additional required bias must be supplied by a cathode resistor or fixed supply.

■ Obtained from a fixed supply, by grid-No.1 resistor, by cathode resistor, or by combination methods.

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RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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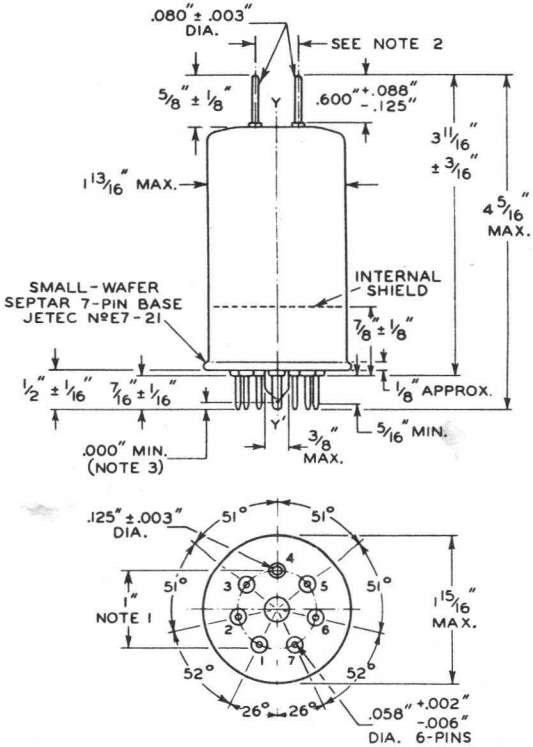
TWIN BEAM POWER TUBE

OPERATING CONSIDERATIONS

Shielding of the 5894 in rf service is required for stable operation. A convenient method of shielding is to mount the socket approximately 7/8" beneath a hole in the chassis plate so that when the 5894 is inserted in the socket, the internal shield (see *Dimensional Outline*) of the tube will be close to the edge of the hole and in the same plane as the chassis plate. This arrangement provides an effective shield to isolate the grid-No.1 circuits from the plate circuits.



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TWIN BEAM POWER TUBE

THE REFERENCE AXIS YY' IS DEFINED AS THE AXIS OF THE BASE-PIN GAUGE DESCRIBED IN NOTE 1.

NOTE 1: ANGULAR VARIATIONS BETWEEN PINS AND VARIATION IN PIN-CIRCLE DIAMETER ARE HELD TO TOLERANCES SUCH THAT PINS WILL ENTER TO A DISTANCE OF 3/8" A FLAT-PLATE BASE-PIN GAUGE HAVING SIX HOLES 0.0800" ± 0.0005" AND ONE HOLE 0.1450" ± 0.0005" ARRANGED ON A 1.0000" ± 0.0005" CIRCLE AT SPECIFIED ANGLES WITH TOLERANCE OF ± 5' FOR EACH ANGLE. GAUGE IS ALSO PROVIDED WITH A HOLE 0.500" ± 0.010" CONCENTRIC WITH PIN CIRCLE WHOSE CENTER IS ON THE AXIS YY'.

NOTE 2: THE PLATE LEADS WILL ENTER A FLAT-PLATE PLATE-LEAD GAUGE HAVING THICKNESS OF 3/8" AND HAVING TWO HOLES 0.1400" ± 0.0005" WHOSE CENTERS ARE LOCATED AT A DISTANCE OF 0.275" ± 0.001" FROM THE AXIS YY' AND WHOSE AXES ARE PARALLEL TO YY'. THE PLANE THROUGH THESE AXES WILL BE 90° ± 5' FROM THE PLANE THROUGH YY' AND PIN No.4.

NOTE 3: EXHAUST TIP WILL NOT EXTEND BEYOND THE PLANE WHICH PASSES THROUGH THE ENDS OF THE THREE LONGEST PINS.

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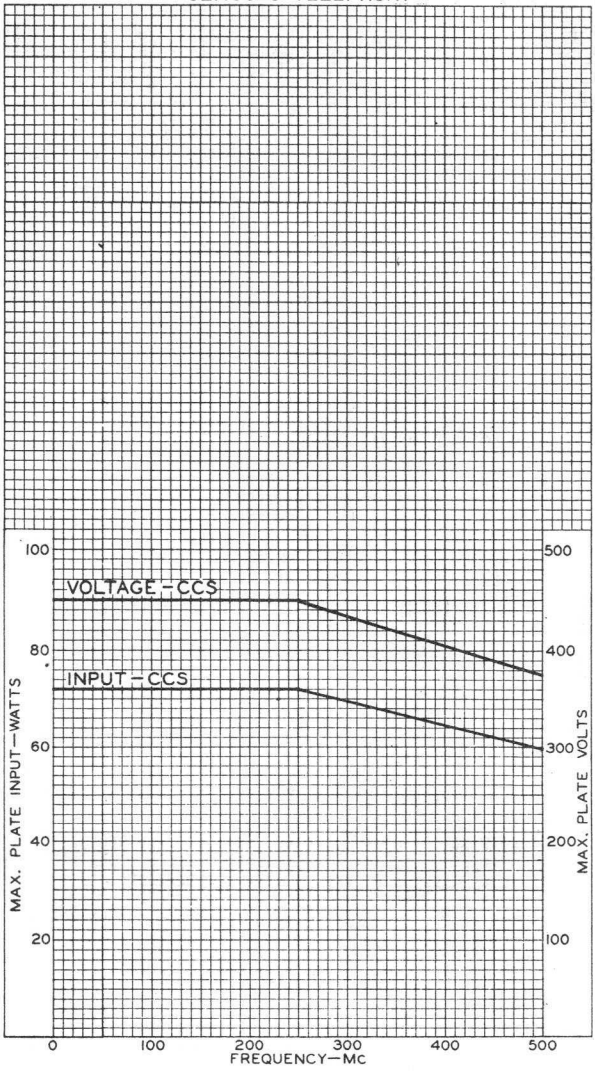
RATING CHART I
CLASS C TELEPHONY



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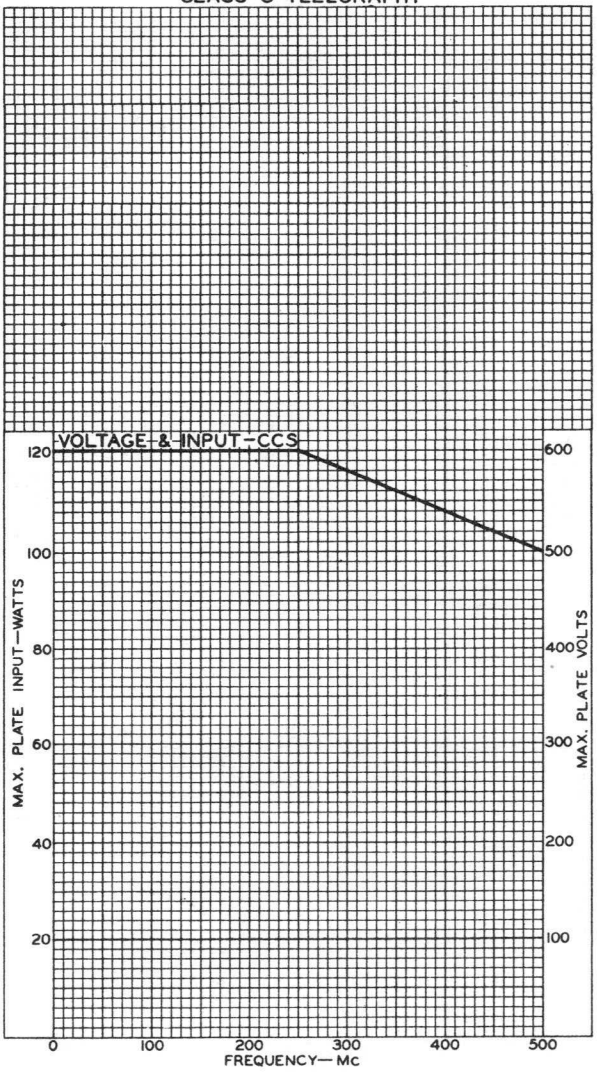
RATING CHART II
CLASS C TELEGRAPHY



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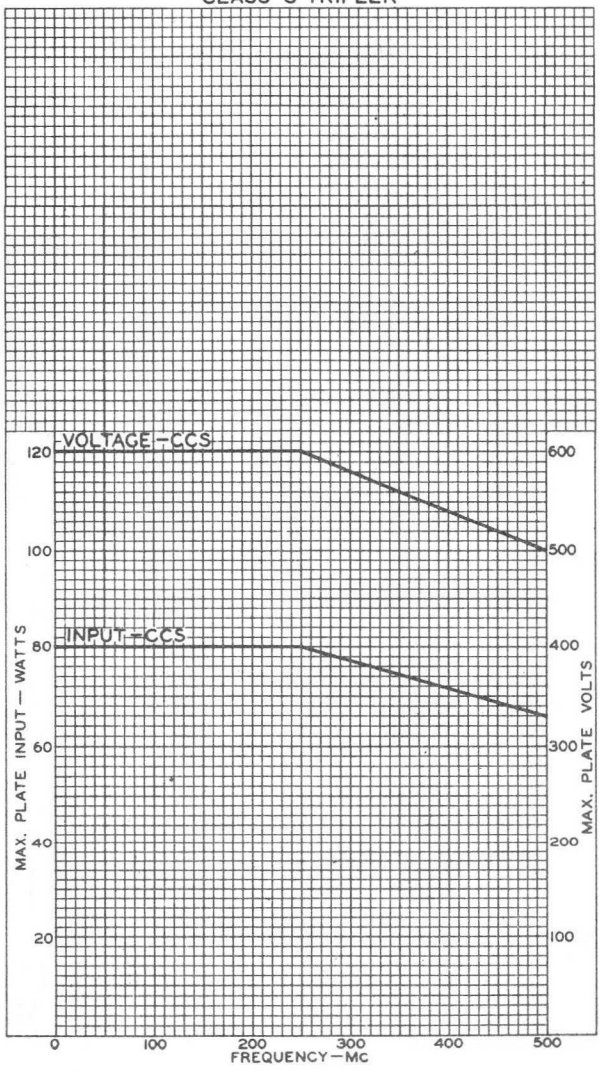
RATING CHART III
CLASS C TRIPLER



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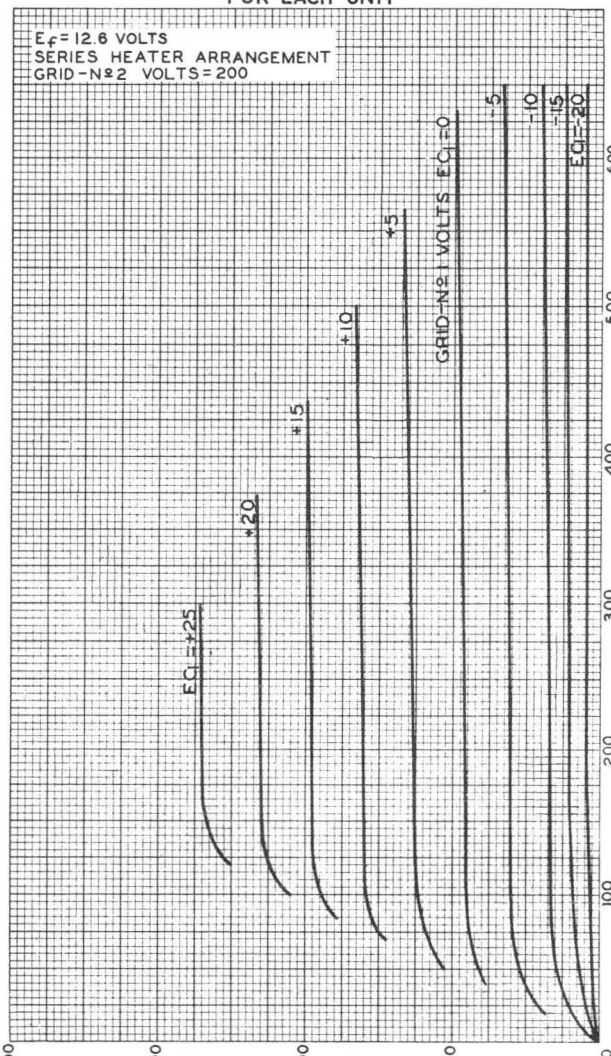
AVERAGE PLATE CHARACTERISTICS
FOR EACH UNIT



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92CM-8474

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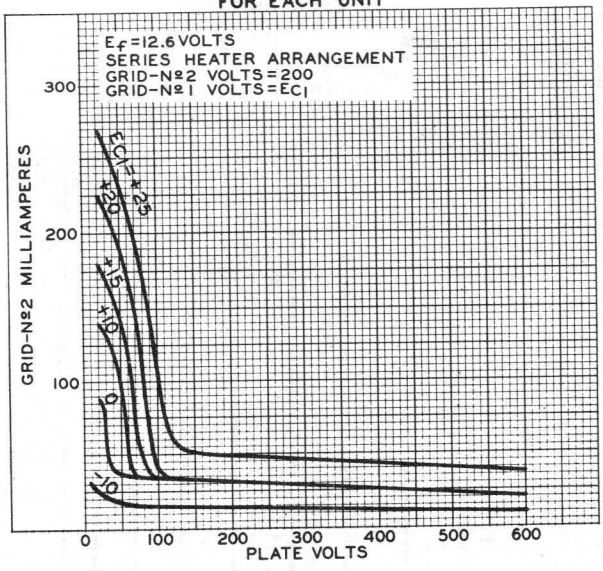
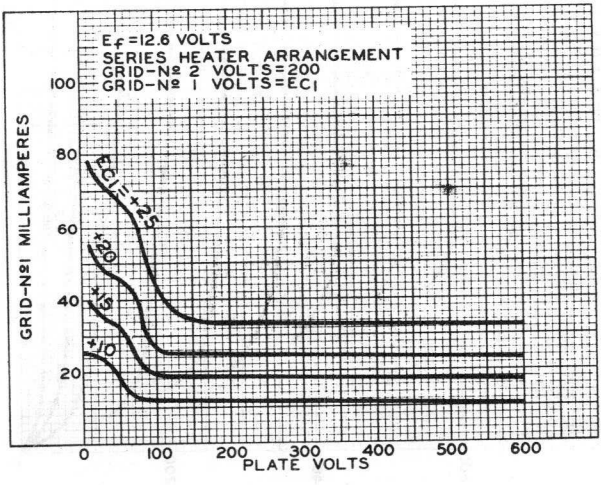
AVERAGE CHARACTERISTICS
FOR EACH UNIT





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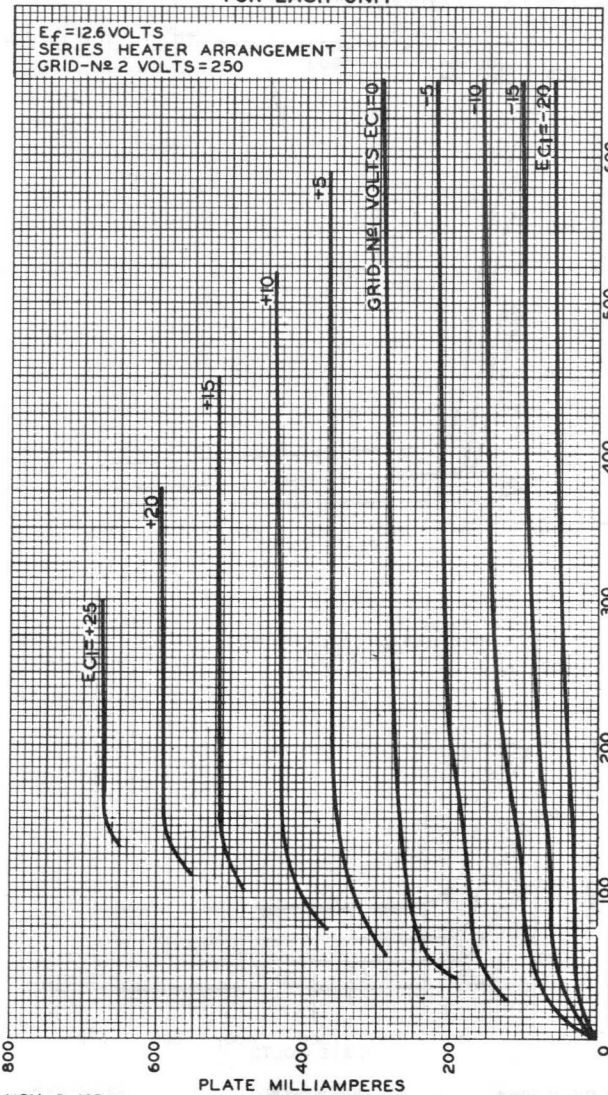
AVERAGE PLATE CHARACTERISTICS
FOR EACH UNIT



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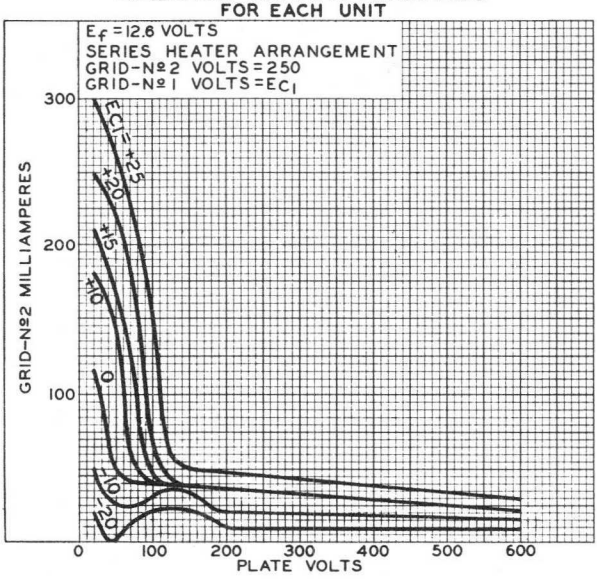
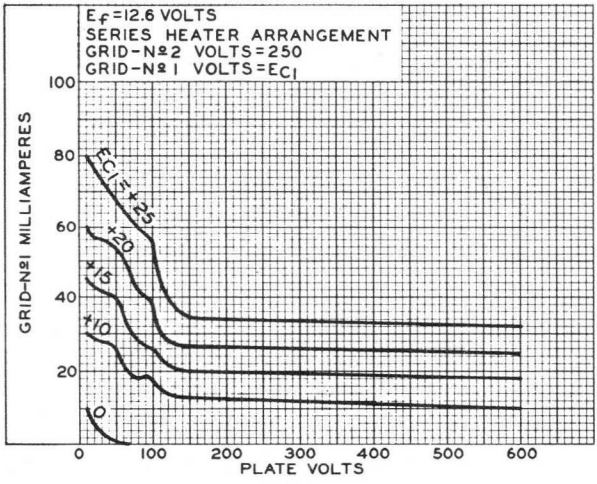
AVERAGE CHARACTERISTICS
FOR EACH UNIT





6032

IMAGE-CONVERTER TUBE

Paraxial Magnification Factor♦ .	0.5	0.5	
Sensitivity:			
Radiant, at 8000 angstroms . .	0.0038	0.0038	μa/μwatt
Infrared●	5	5	μa/lumen
Minimum Conversion Index†● . . .	8	10	
Minimum Resolution (In central area of photocathode)▲●. . . .	18	18	line-pairs per mm

* Grid No.2 serves the dual function of high-voltage electrode for accelerating the electron beam and of collector through which the electrons leave the tube after their energy has been transformed within the tube.

□ Referred to photocathode.

● Under the following conditions: 2870° K tungsten light source; light flux of 0.1 lumen incident on Corning No.2540 Infrared Filter (Melt 1613, 2.61-mm thick, or equivalent); irradiated area of photocathode is 3/4" in diameter.

† Ratio of light flux from fluorescent screen to the product of the light flux incident on the infrared filter multiplied by the filter factor.

▲ The resolution, both horizontally and vertically, in a 0.3"-diameter circle centered on the photocathode is determined with a pattern consisting of alternate black and white lines of equal width. Any two adjacent lines are designated as a "line-pair."

♦ Magnification is defined as the ratio of the distance from the tube axis of an image point on the fluorescent screen to the distance from the tube axis of an object point on the photocathode. Paraxial magnification is the magnification observed along the tube axis.

OPERATING CONSIDERATIONS

The curves giving the *spectral-energy emission characteristic* and the *persistence characteristics* of phosphor P20 are located in the front of the Cathode-Ray Tube Section. Only persistence-characteristic curve A applies to the 6032.

Subjecting the 6032 to intense incident-radiation levels may temporarily decrease the tube's sensitivity even though there is no voltage applied. The magnitude and duration of this decrease depend on the length of exposure. Permanent damage to the tube may result if it is exposed to radiant energy so great as to cause excessive heating of the photocathode.

The *sensitivity values* for the 6032 are *average* values. The average values are representative of this type when operated with low values of photocathode current. At high values of photocathode current, a drop in sensitivity below the values shown may be expected. The extent of the drop is affected by the nature and severity of the operating conditions to which the 6032 is subjected. After a period of idleness, the 6032 usually recovers a substantial percentage of such loss in sensitivity.

Support for the 6032 may be provided at the photocathode end by a cushioned arrangement and at the screen end by a suitable fixture which will exert adequate but not excessive pressure to hold the tube firmly against the cushioned arrangement.

6032

IMAGE-CONVERTER TUBE

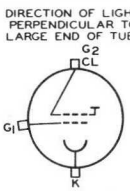
For use, in combination with suitable optical systems, in viewing a scene with infrared radiation

DATA

General:

Spectral Response	S-1
Wavelength of Maximum Response	8000 ± 1000 angstroms
Photocathode, Semitransparent:	
Shape	Circular
Minimum window area	1 sq. in.
Minimum window diameter	1-1/8"
Minimum quality-circle diameter within window	1"
Phosphor (For Curves, see front of Cathode-Ray Tube Section. *See also Operating Considerations*)	P20
Fluorescence	Yellow-Green
Phosphorescence	Yellow-Green
Persistence	Medium-Short
Fluorescent Screen:	
Shape	Circular
Minimum diameter	5/8"
Focusing Method	Electrostatic
Overall Length	4-15/32" ± 1/16"
Maximum Diameter	2-3/32" ± 1/32"
Weight (Approx.)	3.6 oz
Operating Position	Any

Terminal Connections *(See Dimensional Outline)*:



CL – Collector

G_2 – Grid No.2

G_1 – Grid No.1

K – Photocathode

Maximum Ratings, *Absolute Values:*

GRID-No.2* VOLTAGE (DC or Peak AC)□	20000 max.	volts
GRID-No.1 VOLTAGE□	2700 max.	volts
AVERAGE PHOTOCATHODE CURRENT (Continuous Operation)	1 max.	μa
AMBIENT TEMPERATURE	75 max.	°C

Characteristics:

Grid-No.2* Voltage	16000	20000	volts
Grid-No.1 (Focusing-Electrode) Voltage— 10.75% to 13.25% of grid-No.2 voltage	1720 to 2120	2150 to 2650	volts
Maximum Grid-No.1 Current	0.4	0.5	μa

*,□: See next page.

6032

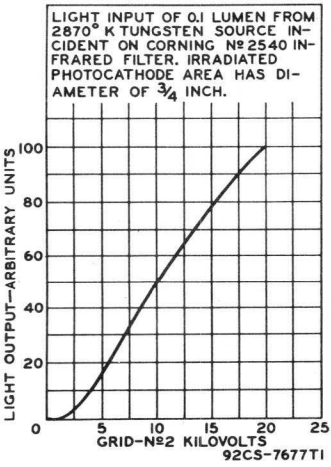
IMAGE-CONVERTER TUBE

Shielding of the 6032 is required to minimize the effects of extraneous fields on tube performance. If an iron or steel case is used, care should be taken in its construction to insure that the case is completely demagnetized. The shielding case may be designed, if desired, to include an annular end piece to position the tube properly in the optical system. The circular opening of the end piece should have a diameter less than 1-1/2" in order to bear on the rim of the tube face *(See Dimensional Outline)*.

Connections to the respective terminals of the tube, indicated on the *Dimensional Outline*, should not be soldered to the terminals. They should be made by flexible metal bands fastened firmly around the tube in the contact areas shown on the *Dimensional Outline*. The bands should be fastened only tight enough to insure good contact. If the bands are too tight, the metal-glass seals may be damaged.

The curve showing the Spectral-Sensitivity Characteristic of Phototube having S-1 Response located at the front of this Section also applies to the 6032

AVERAGE CHARACTERISTIC



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

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IMAGE-CONVERTER TUBE

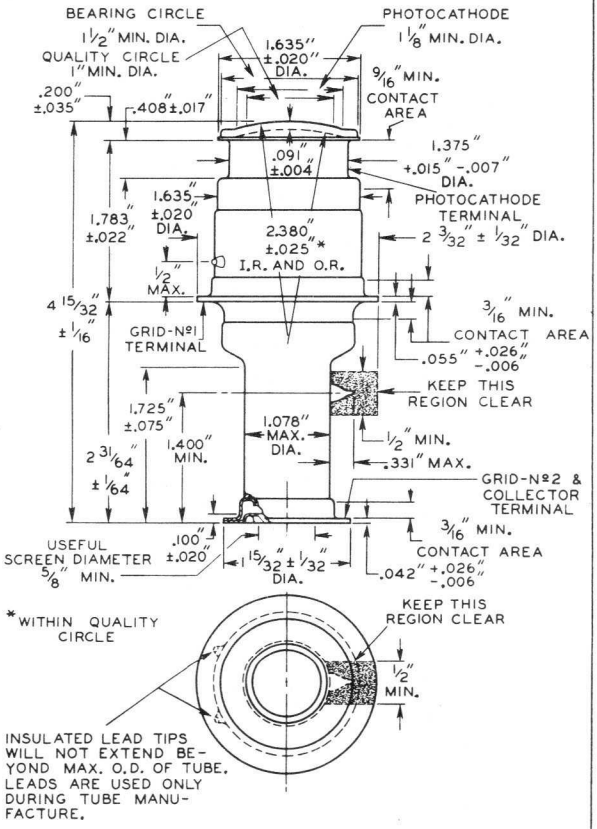

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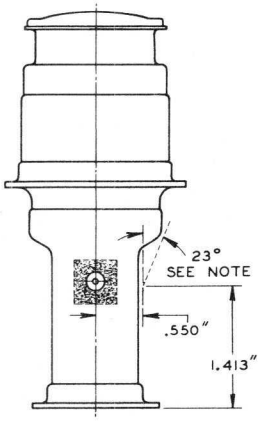
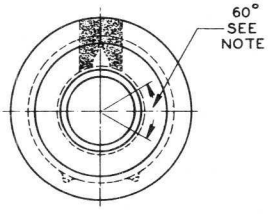
IMAGE-CONVERTER TUBE





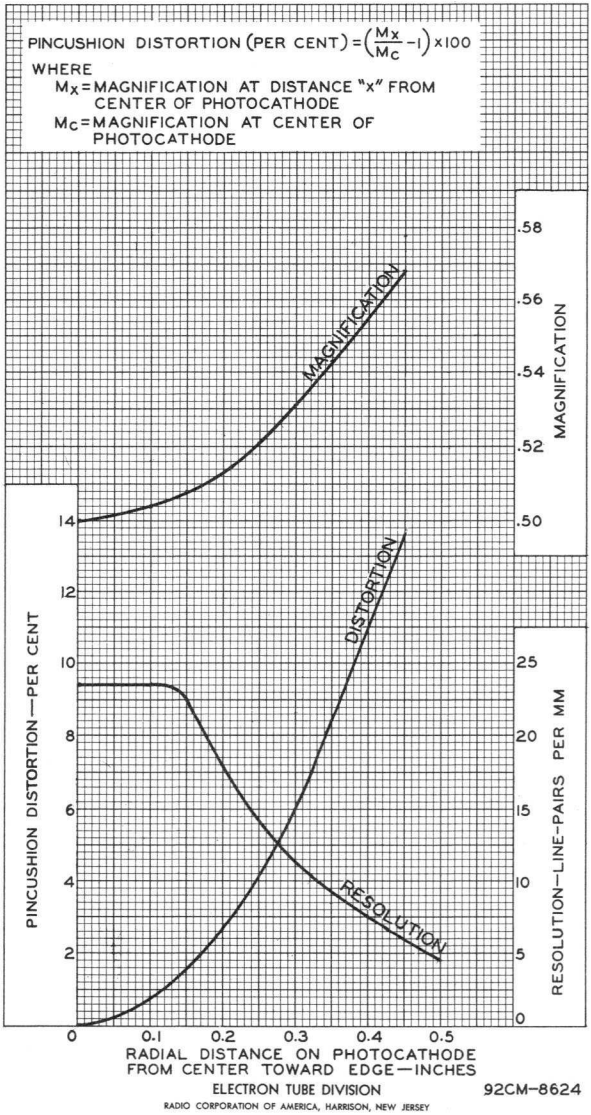
NOTE: THE CONTOUR OF THE FLARED GLASS NECK WILL BE WITHIN THE DOTTED LINE OVER A 60° SECTION AS SHOWN ON END VIEW.

92CL - 7617R2

RCA

6032

AVERAGE CHARACTERISTICS



ELECTRON TUBE DIVISION 92CM-8624

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6032-A

IMAGE-CONVERTER TUBE

For use, in combination with suitable optical systems, in viewing a scene with infrared radiation

The 6032-A is unilaterally interchangeable with the 6032.

The 6032-A is like the 6032 except that it is processed and tested to meet the following special-performance test:

Maximum luminous equivalent of infrared radiation for threshold visibility* . . 4.1×10^{-11} lumen

* Radiation from a tungsten lamp operating at a color temperature of 2870° K is passed through a Corning No.2540 Infrared Filter and focused to a point on the photocathode. The resulting image on the fluorescent screen is viewed by a dark-adapted eye through a 10-power ocular. The amount of infrared radiation for threshold visibility is determined by reducing the incident radiation until the image on the screen can just be discerned. The luminous equivalent of this amount of infrared radiation is the value of luminous flux from a 2870° K source which produces a response equal to that produced by the infrared radiation when both are measured with a receiver having S-1 spectral response.

6146

Beam Power Tube

HIGH POWER SENSITIVITY
90 WATTS CW INPUT (ICAS) UP TO 60 Mc
60 WATTS CW INPUT (ICAS) AT 175 Mc

GENERAL DATA

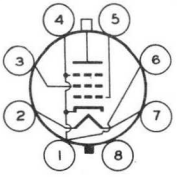
Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at heater volts = 6.3	1.25	amp
Transconductance, for plate volts = 200, grid-No.2 volts = 200, and plate ma. = 100	7000	μmhos
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 200, grid-No.2 volts = 200, and plate ma. = 100.	4.5	
Direct Interelectrode Capacitances:[a]		
Grid No.1 to plate	0.24 max.	pf
Grid No.1 to cathode & grid No.3 & internal shield, grid No.2, base sleeve, and heater	13.0	pf
Plate to cathode & grid No.3 & internal shield, grid No.2, base sleeve, and heater	8.5	pf

Mechanical:

Operating Position	Any
Maximum Overall Length	3-13/16"
Seated Length	3-1/8" ± 1/8"
Maximum Diameter	1-23/32"
Weight (Approx.)	2.3 oz
Bulb	T12
Cap	Small (JEDEC No.C1-1)
Bases (Alternates):	
Large-Wafer Octal with Sleeve: 8-Pin (JEDEC Group 1, No.B8-86)	
Large-Wafer with External Barriers and Sleeve: 8-Pin (JEDEC Group 1, No.B8-98)	
Basing Designation for BOTTOM VIEW	7CK

Pin 1 - Cathode, Grid No.3, Internal Shield
Pin 2 - Heater
Pin 3 - Grid No.2
Pin 4 - Same as Pin 1



Pin 5 - Grid No.1
Pin 6 - Same as Pin 1
Pin 7 - Heater
Pin 8 - Base Sleeve
Cap - Plate

← Indicates a change.

AF POWER AMPLIFIER & MODULATOR — Class AB_1[b]

Maximum Ratings, *Absolute-Maximum Values:*

	CCS[c]	*ICAS*[d]	
DC PLATE VOLTAGE	600 max.	750 max.	volts
DC GRID-No.2 VOLTAGE	250 max.	250 max.	volts
MAX.-SIGNAL DC PLATE CURRENT[e]	125 max.	135 max.	ma
MAX.-SIGNAL PLATE INPUT[e]	60 max.	85 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT[e]	3 max.	3 max.	watts
PLATE DISSIPATION[e]	20 max.	25 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	135 max.	135 max.	volts
Heater positive with respect to cathode	135 max.	135 max.	volts
BULB TEMPERATURE (At hottest point on bulb surface)	220 max.	220 max.	°C

Typical CCS Push-Pull Operation:

Values are for 2 tubes

DC Plate Voltage	400	500	600	volts
DC Grid-No.2 Voltage[f]	190	185	180	volts
DC Grid-No.1 Voltage:				
From fixed-bias source	−40	−40	−45	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage[g]	80	80	90	volts
Zero-Signal DC Plate Current	63	57	26	ma
Max.-Signal DC Plate Current	228	215	200	ma
Zero-Signal DC Grid-No.2 Current	2.5	2	1	ma
Max.-Signal DC Grid-No.2 Current	25	25	23	ma
Effective Load Resistance (Plate to plate)	4000	5500	7000	ohms
Max.-Signal Driving Power (Approx.)	0	0	0	watts
Max.-Signal Power Output (Approx.)	55	70	82	watts

Typical ICAS Push-Pull Operation:

Values are for 2 tubes

DC Plate Voltage	600	750	volts
DC Grid-No.2 Voltage[f]	200	195	volts
DC Grid-No.1 Voltage:			
From fixed-bias source	−50	−50	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage[g]	100	100	volts
Zero-Signal DC Plate Current	28	23	ma
Max.-Signal DC Plate Current	229	220	ma
Zero-Signal DC Grid-No.2 Current	1	1	ma
Max.-Signal DC Grid-No.2 Current	27	26	ma
Effective Load Resistance (Plate to plate)	6000	8000	ohms
Max.-Signal Driving Power (Approx.)	0	0	watts
Max.-Signal Power Output (Approx.)	95	120	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance under any condition:[h]	
With fixed bias	0.1 max. megohm
With cathode bias	Not recommended

AF POWER AMPLIFIER & MODULATOR — Class AB_1[b]

Triode Connection—Grid No.2 Connected to Plate

	CCS	ICAS	
Maximum Ratings, *Absolute-Maximum Values:*			
DC PLATE VOLTAGE	400 max.	400 max.	volts
MAX.-SIGNAL DC PLATE CURRENT[e]	90 max.	90 max.	ma
MAX.-SIGNAL PLATE INPUT[e]	35 max.	35 max.	watts
PLATE DISSIPATION[e]	20 max.	25 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	135 max.	135 max.	volts
Heater positive with respect to cathode	135 max.	135 max.	volts
BULB TEMPERATURE (At hottest point on bulb surface)	220 max.	220 max.	°C

Typical Push-Pull Operation:

	Values are for 2 tubes			
DC Plate Voltage	250	400	400	volts
DC Grid-No.1 Voltage	-50	-100	-100	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage[g]	100	200	200	volts
Zero-Signal DC Plate Current	120	40	40	ma
Max.-Signal DC Plate Current	125	100	100	ma
Effective Load Resistance (Plate-to-plate)	5000	8000	8000	ohms
Max.-Signal Driving Power (Approx.)	0	0	0	watts
Max.-Signal Power Output (Approx.)	10	22	22	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance under any condition:[h]	
With fixed bias	0.1 max. megohm
With cathode bias	0.5 max. megohm

AF POWER AMPLIFIER & MODULATOR — Class AB_2[j]

Maximum Ratings, *Absolute-Maximum Values:*

	CCS	ICAS	
DC PLATE VOLTAGE	600 max.	750 max.	volts
DC GRID-No.2 VOLTAGE	250 max.	250 max.	volts
MAX.-SIGNAL DC PLATE CURRENT[e]	125 max.	135 max.	ma
MAX.-SIGNAL PLATE INPUT[e]	62.5 max.	90 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT[e]	3 max.	3 max.	watts
PLATE DISSIPATION[e]	20 max.	25 max.	watts

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	CCS	ICAS		
PEAK HEATER-CATHODE VOLTAGE:				
Heater negative with respect to cathode.	135 max.	135 max.		volts
Heater positive with respect to cathode.	135 max.	135 max.		volts
BULB TEMPERATURE (At hottest point on bulb surface). . . .	220 max.	220 max.		°C

Typical CCS Push-Pull Operation:

Values are for 2 tubes

DC Plate Voltage.	400	500	600	volts
DC Grid-No.2 Voltage[f]	175	175	165	volts
DC Grid-No.1 Voltage:				
→ From fixed-bias source. . . .	-41	-44	-44	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage	95	102	97	volts
Zero-Signal DC Plate Current. .	33	27	22	ma
Max.-Signal DC Plate Current. .	232	242	207	ma
Zero-Signal DC Grid-No.2 Current	1.1	0.7	0.6	ma
Max.-Signal DC Grid-No.2 Current	18	18	17	ma
Max.-Signal DC Grid-No.1 Current	1.6	1.9	1.1	ma
Effective Load Resistance (Plate to plate).	3700	4600	6800	ohms
Max.-Signal Driving Power (Approx.)[k].	0.2	0.3	0.2	watt
Max.-Signal Power Output (Approx.)	62	83	90	watts

Typical ICAS Push-Pull Operation:

Values are for 2 tubes

DC Plate Voltage.	600	750	volts
DC Grid-No.2 Voltage[f]	190	165	volts
DC Grid-No.1 Voltage:			
From fixed-bias source.	-48	-46	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage. .	109	108	volts
Zero-Signal DC Plate Current.	28	22	ma
Max.-Signal DC Plate Current.	270	240	ma
Zero-Signal DC Grid-No.2 Current.	1.2	0.3	ma
Max.-Signal DC Grid-No.2 Current.	20	20	ma
Max.-Signal DC Grid-No.1 Current.	2	2.6	ma
Effective Load Resistance (Plate to plate).	5000	7400	ohms
→ Max.-Signal Driving Power (Approx.)[k]. . .	0.3	0.4	watt
Max.-Signal Power Output (Approx.). . . .	113	131	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance:[m]		
With fixed bias	30000 max.	ohms
With cathode bias	Not recommended	

→ Indicates a change.

PLATE-MODULATED RF POWER AMPLIFIER — Class C Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1 and at frequencies up to 60 Mc

	CCS	ICAS	
Maximum Ratings, *Absolute-Maximum Values:*			
For maximum plate voltage and maximum plate input above 60 Mc, see Rating Chart 1			
DC PLATE VOLTAGE	480 max.	600 max.	volts
DC GRID-No.2 VOLTAGE	250 max.	250 max.	volts
DC GRID-No.1 VOLTAGE	−150 max.	−150 max.	volts
DC PLATE CURRENT	117 max.	125 max.	ma
DC GRID-No.1 CURRENT	3.5 max.	4 max.	ma
PLATE INPUT	45 max.	67.5 max.	watts
GRID-No.2 INPUT	2 max.	2 max.	watts
PLATE DISSIPATION	13.3 max.	16.7 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	135 max.	135 max.	volts
Heater positive with respect to cathode	135 max.	135 max.	volts
BULB TEMPERATURE (At hottest point on bulb surface)	220 max.	220 max.	°C
Typical Operation:			
DC Plate Voltage	400	475	600	volts
DC Grid-No.2 Voltage:[n]				
From a grid-No.2 series resistor of:				
33000 ohms	150	–	–	volts
51000 ohms	–	135	–	volts
56000 ohms	–	–	150	volts
DC Grid-No.1 Voltage:[p]				
From a grid-No.1 resistor of 27000 ohms	−87	−77	−87	volts
Peak RF Grid-No.1 Voltage	107	95	107	volts
DC Plate Current	112	94	112	ma
DC Grid-No.2 Current	7.8	6.4	7.8	ma
DC Grid-No.1 Current (Approx.)	3.4	2.8	3.4	ma
Driving Power (Approx.)	0.4	0.3	0.4	watt
Power Output (Approx.)	32	34	52	watts
Maximum Circuit Values (CCS or ICAS):				
Grid-No.1-Circuit Resistance[q]	30000 max.			ohms

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RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy[r]
and
RF POWER AMPLIFIER — Class C FM Telephony

	CCS	ICAS	
Maximum Ratings, *Absolute-Maximum Values:*			
At frequencies up to 60 Mc. For maximum plate voltage and maximum plate input above 60 Mc, see Rating Chart II.			
DC PLATE VOLTAGE	600 max.	750 max.	volts
DC GRID-No.2 VOLTAGE	250 max.	250 max.	volts
DC GRID-No.1 VOLTAGE	-150 max.	-150 max.	volts
DC PLATE CURRENT	140 max.	150 max.	ma
DC GRID-No.1 CURRENT	3.5 max.	4 max.	ma
PLATE INPUT	67.5 max.	90 max.	watts
GRID-No.2 INPUT	3 max.	3 max.	watts
PLATE DISSIPATION	20 max.	25 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	135 max.	135 max.	volts
Heater positive with respect to cathode	135 max.	135 max.	volts
BULB TEMPERATURE (At hottest point on bulb surface)	220 max.	220 max.	°C

Typical Operation:

	As amplifier up to 60 Mc				
DC Plate Voltage	500	600	600	750	volts
DC Grid-No.2 Voltage:[s]					
From a grid-No.2 series resistor of:					
36000 ohms	170	–	–	–	volts
51000 ohms	–	150	–	–	volts
43000 ohms	–	–	180	–	volts
56000 ohms	–	–	–	160	volts
DC Grid-No.1 Voltage:[t]					
From a grid-No.1 resistor of:					
27000 ohms	-66	–	–	–	volts
20000 ohms	–	-58	–	-62	volts
24000 ohms	–	–	-71	–	volts
From cathode resistor of:					
430 ohms	–	–	-71	–	volts
470 ohms	-66	-58	–	-62	volts
Peak RF Grid-No.1 Voltage	84	73	91	79	volts
DC Plate Current	135	112	150	120	ma
DC Grid-No.2 Current	9	9	10	11	ma
DC Grid-No.1 Current (Approx.)	2.5	2.8	2.8	3.1	ma
Driving Power (Approx.)	0.2	0.2	0.3	0.2	watt
Power Output (Approx.)	48	52	66	70	watts

Typical Operation:

	As amplifier up to 175 Mc		
DC Plate Voltage	320	400	volts

DC Grid-No.2 Voltage:[s]			
From grid-No.2 series resistor of:			
13000 ohms.	180	–	volts
20000 ohms.	–	190	volts
DC Grid-No.1 Voltage:[t]			
From a grid-No.1 resistor of:			
27000 ohms.	-51	–	volts
24000 ohms.	–	-54	volts
From cathode resistor of			
330 ohms.	-51	-54	volts
Peak RF Grid-No.1 Voltage . . .	64	68	volts
DC Plate Current.	140	150	ma
DC Grid-No.2 Current.	10	10.4	ma
DC Grid-No.1 Current (Approx.).	2	2.2	ma
Driving Power (Approx.)	3	3	watts
Power Output (Approx.).	25	35	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1 Circuit Resistance[q]	30000 max.	ohms

[a] Without external shield.

[b] Subscript 1 indicates that grid-No.1 current does not flow during any part of the input cycle.

[c] Continuous Commercial Service.

[d] Intermittent Commercial and Amateur Service.

[e] Averaged over any audio-frequency cycle of sine-wave form.

[f] Obtained preferably from a separate source or from the plate-voltage supply with a voltage divider.

[g] The driver stage should be capable of supplying the No.1 grids of the class AB_1 stage with the specified driving voltage at low distortion.

[h] The type of input coupling network used should not introduce too much resistance in the grid-No.1 circuit. Transformer or impedance coupling devices are recommended.

[j] Subscript 2 indicates that grid-No.1 current flows during some part of the input cycle.

[k] Driver stage should be capable of supplying the specified driving power at low distortion to the No.1 grids of the AB_2 stage.

[m] To minimize distortion, the effective resistance per grid-No.1 circuit of the AB_2 stage should be held at a low value. For this purpose, the use of transformer coupling is recommended. In no case, however, should the total dc grid-No.1-circuit resistance exceed 30000 ohms when the 6146 is operated at maximum ratings. For operation at less than maximum ratings, the dc grid-No.1-circuit resistance may be as high as 100000 ohms.

[n] Obtained preferably from a separate source modulated with the plate supply, or from the modulated plate supply through a series resistor.

[p] Obtained from grid-No.1 resistor or from a combination of grid-No.1 resistor with either fixed supply or cathode resistor.

[q] When grid No.1 is driven positive and the 6146 is operated at maximum ratings, the total dc grid-No.1-circuit resistance should not exceed the specified value of 30000 ohms. If this value is insufficient to provide adequate bias, the additional required bias must be supplied by a cathode resistor or fixed supply. For operation at less than maximum ratings, the dc grid-No.1-circuit resistance may be as high as 100000 ohms.

[r] Key-down conditions per tube without amplitude modulation. Amplitude modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

[s] Obtained preferably from separate source, or from the plate-supply voltage with a voltage divider, or through a series resistor. A series grid-No.2 resistor should be used only when the 6146 is used in a cir-

cuit which is not keyed. Grid-No.2 voltage must not exceed 400 volts under key-up conditions.

† Obtained from fixed supply, by grid-No.1 resistor, by cathode resistor, or by combination methods.

CHARACTERISTICS RANGE VALUES

	Note	Min.	Max.	
Heater Current	1	1.175	1.325	amp
Direct Interelectrode Capacitances:				
Grid No.1 to plate	2	–	0.24	pf
Grid-No.1 to cathode & grid No.3 & internal shield, base sleeve, grid No.2, and heater	2	12.0	15.0	pf
Plate to cathode & grid No.3 & internal shield, base sleeve, grid No.2, and heater	2	7.3	9.5	pf
Plate Current	3	46	94	ma
Grid-No.2 Current	3	–	5.5	ma
Dynamic Grid-No.2 Current	4	3	21	ma
Useful Power Output	4	47	–	watts

Note 1: With 6.3 volts ac on heater.

Note 2: Without external shield.

Note 3: With rated ac heater voltage, dc plate volts = 300, dc grid-No.2 volts = 200, and dc grid-No.1 volts = −33.

Note 4: In a single-tube, self-excited oscillator circuit, and with rated ac heater voltage, dc plate volts = 600, dc grid-No.2 volts = 180, grid-No.1 resistor (ohms) = 30000 ± 10%, dc plate ma. = 100 to 112, dc grid-No.1 ma. = 2 to 2.5, and frequency (Mc) = 15.

MAXIMUM RATINGS vs OPERATING FREQUENCY

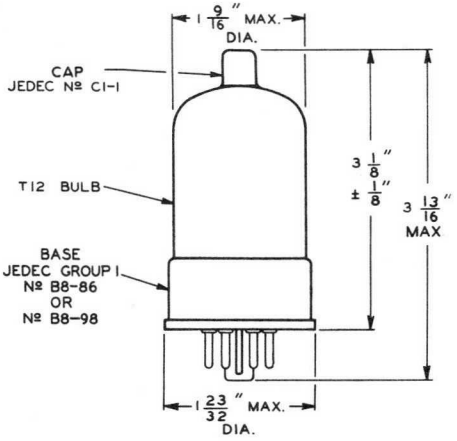
OPERATING FREQUENCY Mc	MAXIMUM PERMISSIBLE PERCENTAGE OF MAXIMUM-RATED PLATE VOLTAGE & PLATE INPUT			
	TELEPHONY		TELEGRAPHY	
	Class C Plate-Modulated		Class C Unmodulated	
	Voltage	*Input*	*Voltage*	*Input*
60	100	100	100	100
80	84	92	84	92
125	65	78	65	78
150	58	72	58	72
160	56	70	56	70
175	53	67	53	67

→ Indicates a change.

OPERATING CONSIDERATIONS

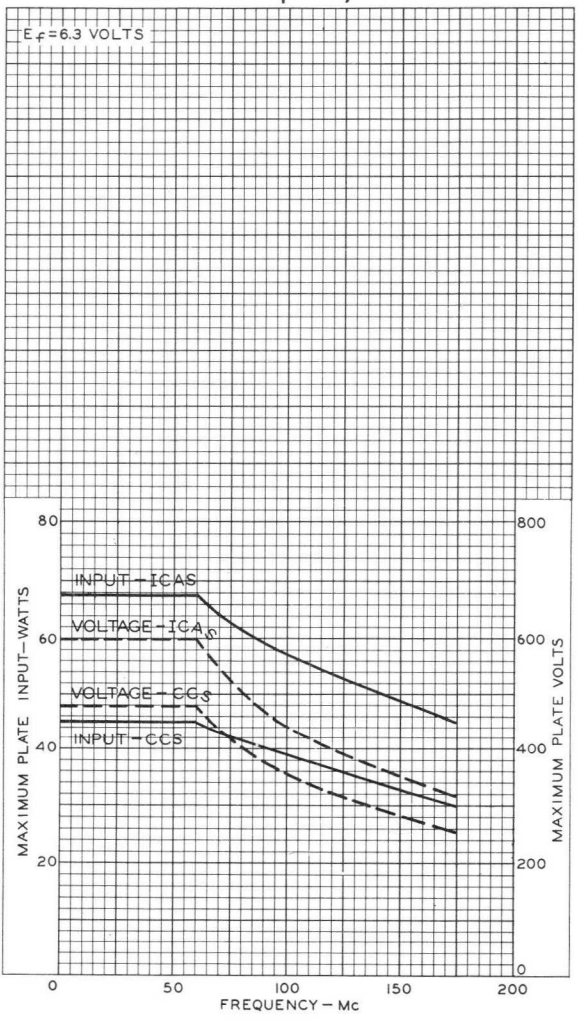
During standby periods in intermittent operation, it is recommended that the heater voltage be maintained at normal operating value when the period is less than 15 minutes, and that it be reduced to 80 per cent of normal when the period is between 15 minutes and 2 hours. For longer periods, the heater voltage should be turned off.

The maximum-rated plate and grid-No.2 voltages of this tube are extremely dangerous. Great care should be taken during the adjustment of circuits. The tube and its associated apparatus, especially all parts which may be at high potential above ground, should be housed in a protective enclosure. The protective housing should be designed with interlocks so that personnel can not possibly come in contact with any high-potential point in the electrical system. The interlock devices should function to break the primary circuit of the high-voltage supplies when any gate or door on the protective housing is opened, and should prevent the closing of the primary circuit until the door is again locked.



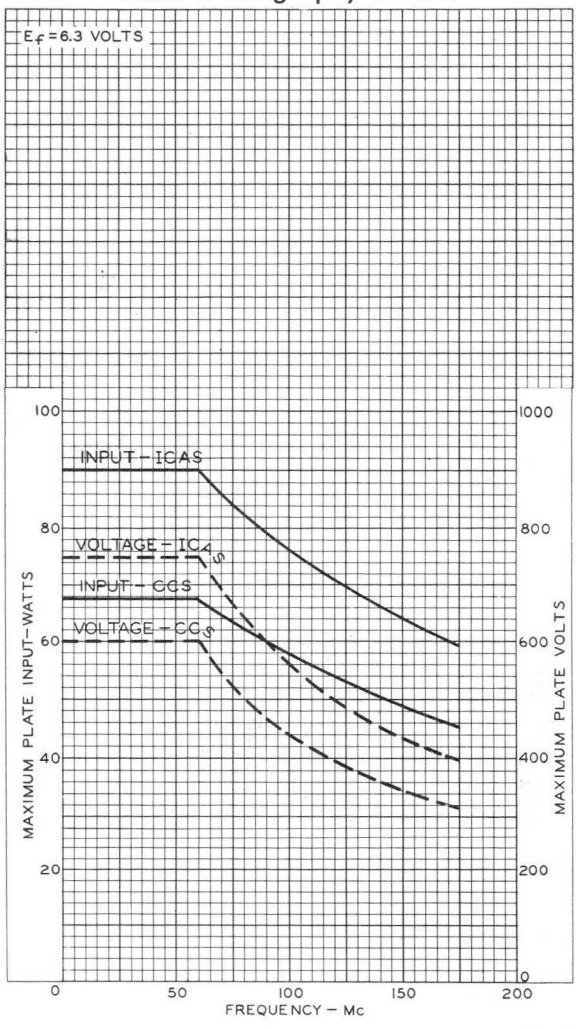
92CS-7700R4

RATING CHART I
Class C Telephony Service



92CM-7712RI

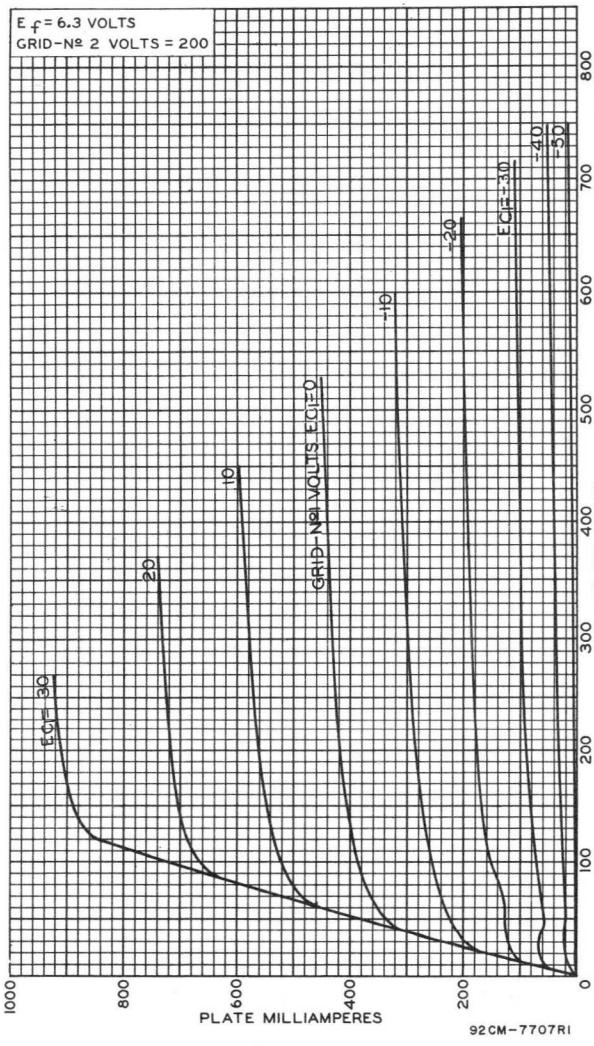
RATING CHART II
Class C Telegraphy Service



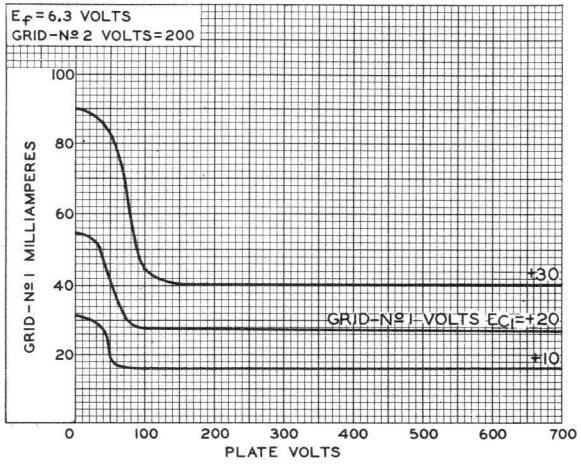
92CM-7709R1

6146

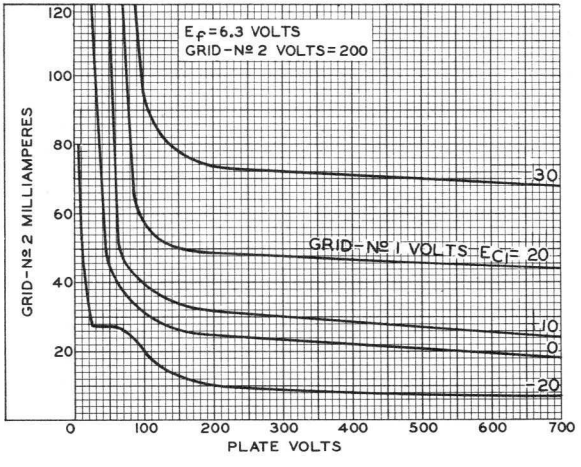
TYPICAL PLATE CHARACTERISTICS



TYPICAL CHARACTERISTICS



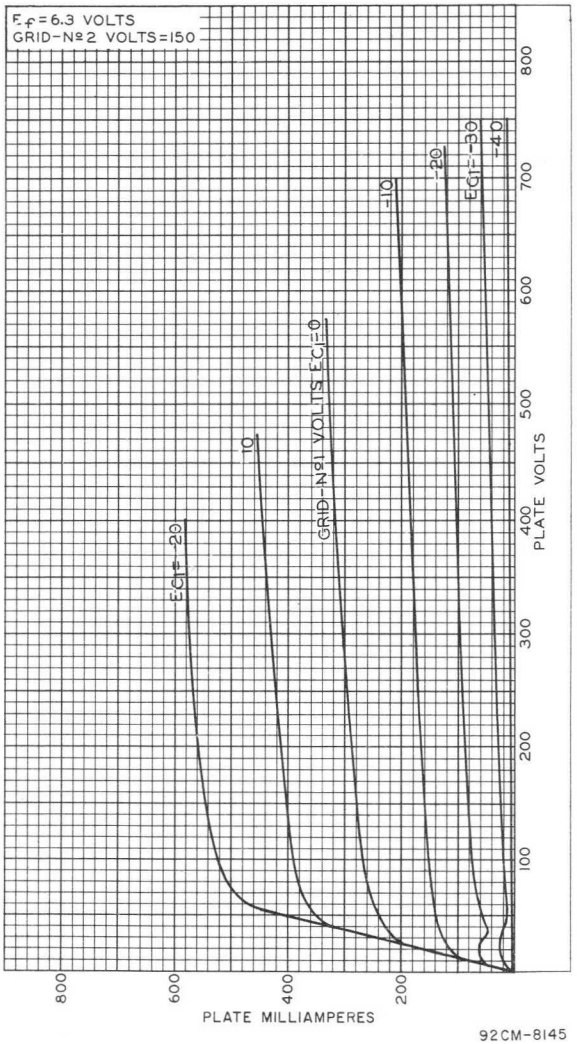
92CS-9617



92CS-9618

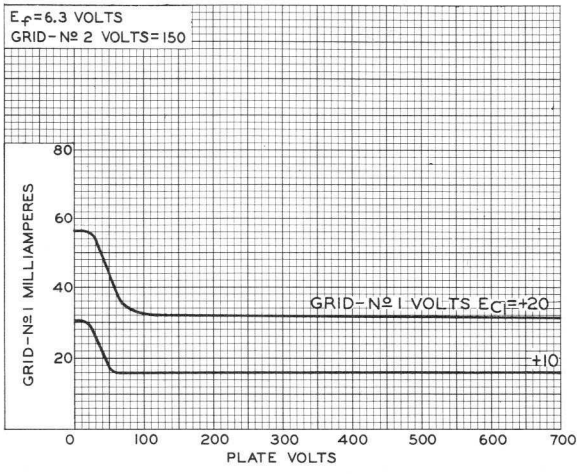
6146

TYPICAL PLATE CHARACTERISTICS

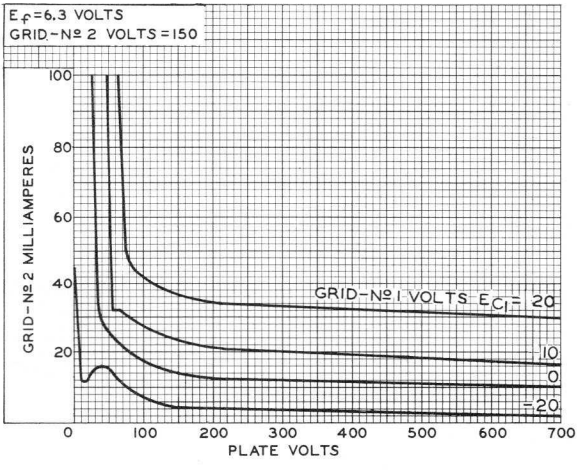


92CM-8145

TYPICAL CHARACTERISTICS



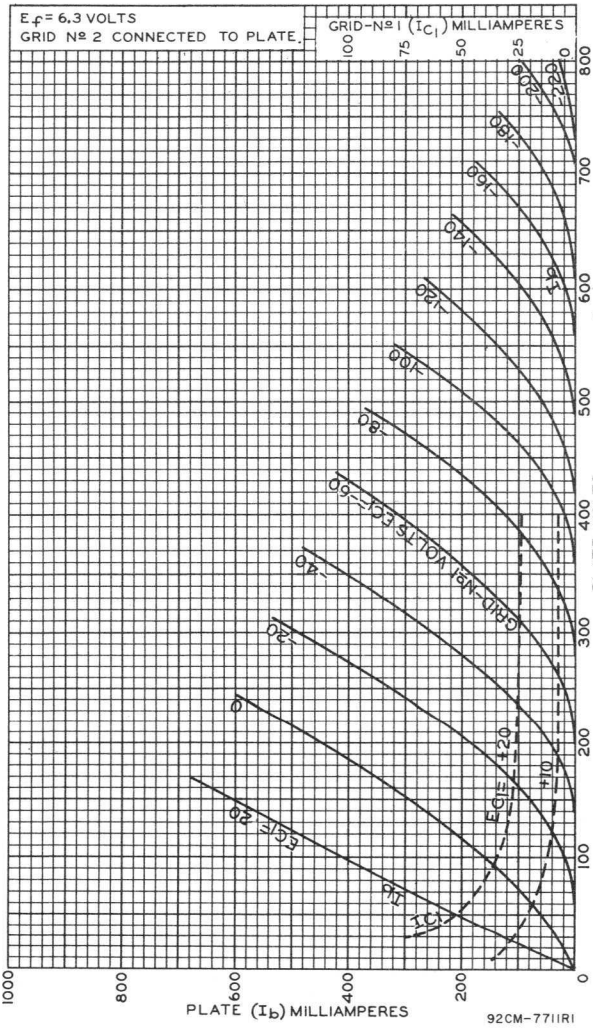
92CS-9619



92CS-9620

6146

TYPICAL CHARACTERISTICS
Triode Connection



6146A

Beam Power Tube

HIGH POWER SENSITIVITY
90 WATTS CW INPUT (ICAS)
UP TO 60 Mc
CONTROLLED ZERO-BIAS
PLATE CURRENT

RCA "DARK HEATER"
60 WATTS CW INPUT (ICAS)
AT 175 Mc
CONTROLLED POWER OUTPUT
AT REDUCED HEATER VOLTAGE

For RF Power Amplifier and Oscillator Service and as an AF Power Amplifier and Modulator in Both Mobile and Fixed Equipment. The 6146A is Unilaterally Interchangeable with the 6146.

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage (Ac or DC)[a]	6.3	volts
Current at heater volts = 6.3	1.25	amp
Transconductance, for plate volts = 200, grid-No.2 volts = 200, and plate ma. = 100	7000	μmhos
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 200, grid-No.2 volts = 200, and plate ma. = 100	4.5	
Direct Interelectrode Capacitances:[b]		
Grid No.1 to plate	0.24 max.	pf
Grid No.1 to cathode & grid No.3 & internal shield, grid No.2, base sleeve, and heater	13.0	pf
Plate to cathode & grid No.3 & internal shield, grid No.2, base sleeve, and heater	8.5	pf

Mechanical:

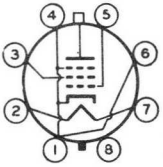
Operating Position	Any
Maximum Overall Length	3-13/16"
Seated Length	3-1/8" ± 1/8"
Maximum Diameter	1-23/32"
Weight (Approx.)	2.3 oz
Bulb	T12
Cap	Small (JEDEC No.C1-1)

Bases (Alternates):
- Large-Wafer Octal with Sleeve:
  8-Pin (JEDEC Group 1, No.B8-86)
- Large-Wafer Octal with External Barriers and Sleeve:
  8-Pin (JEDEC Group 1, No.B8-98)
- Small-Wafer Octal with Sleeve:
  8-Pin (JEDEC Group 1, No.B8-150)
- Small-Wafer Octal with External Barriers and Sleeve:
  8-Pin (JEDEC Group 1, No.B8-159)

6146A

Basing Designation for BOTTOM VIEW. 7CK

Pin 1 – Cathode, Grid No.3, Internal Shield
Pin 2 – Heater
Pin 3 – Grid No.2
Pin 4 – Same as Pin 1



Pin 5 – Grid No.1
Pin 6 – Same as Pin 1
Pin 7 – Heater
Pin 8 – Base Sleeve Cap – Plate

Bulb temperature (At hottest point on bulb surface). . . . . 220 max. °C

AF POWER AMPLIFIER & MODULATOR — Class AB_1[c]

Maximum Ratings, *Absolute-Maximum Values:*

	CCS[d]	*ICAS*[e]	
DC PLATE VOLTAGE.	600 max.	750 max.	volts
DC GRID-No.2 VOLTAGE.	250 max.	250 max.	volts
MAX.-SIGNAL DC PLATE CURRENT[f] .	125 max.	135 max.	ma
MAX.-SIGNAL PLATE INPUT[f]. . . .	60 max.	85 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT[f]. .	3 max.	3 max.	watts
PLATE DISSIPATION[f].	20 max.	25 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode.	135 max.	135 max.	volts
Heater positive with respect to cathode.	135 max.	135 max.	volts

Typical CCS Push-Pull Operation:

Values are for 2 tubes

DC Plate Voltage.	400	500	600	volts
DC Grid-No.2 Voltage[g]	190	185	180	volts
DC Grid-No.1 Voltage:				
From fixed-bias source. . . .	-40	-40	-45	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage[h].	80	80	90	volts
Zero-Signal DC Plate Current. .	63	57	26	ma
Max.-Signal DC Plate Current. .	228	215	200	ma
Zero-Signal DC Grid-No.2 Current	2.5	2	1	ma
Max.-Signal DC Grid-No.2 Current	25	25	23	ma
Effective Load Resistance (Plate to plate).	4000	5500	7000	ohms
Max.-Signal Driving Power (Approx.)	0	0	0	watts
Max.-Signal Power Output (Approx.)	55	70	82	watts

Typical ICAS Push-Pull Operation:

Values are for 2 tubes

DC Plate Voltage.	600	750	volts
DC Grid-No.2 Voltage[g]	200	195	volts

DC Grid-No.1 Voltage:			
From fixed-bias source.	-50	-50	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage[h].	100	100	volts
Zero-Signal DC Plate Current.	28	23	ma
Max.-Signal DC Plate Current.	229	220	ma
Zero-Signal DC Grid-No.2 Current. . .	1	1	ma
Max.-Signal DC Grid-No.2 Current. . .	27	26	ma
Effective Load Resistance (Plate to plate).	6000	8000	ohms
Max.-Signal Driving Power (Approx.) .	0	0	watts
Max.-Signal Power Output (Approx.). .	95	120	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance under any condition:[j]		
With fixed bias	0.1 max.	megohm
With cathode bias	Not recommended	

AF POWER AMPLIFIER & MODULATOR — Class AB_2[k]

Maximum Ratings, *Absolute-Maximum Values:*

	CCS	*ICAS*	
DC PLATE VOLTAGE.	600 max.	750 max.	volts
DC GRID-No.2 VOLTAGE.	250 max.	250 max.	volts
MAX.-SIGNAL DC PLATE CURRENT[f] .	125 max.	135 max.	ma
MAX.-SIGNAL PLATE INPUT[f]. . . .	62.5 max.	90 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT[f]. .	3 max.	3 max.	watts
PLATE DISSIPATION[f].	20 max.	25 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode.	135 max.	135 max.	volts
Heater positive with respect to cathode.	135 max.	135 max.	volts

Typical CCS Push-Pull Operation:

	Values are for 2 tubes			
DC Plate Voltage.	400	500	600	volts
DC Grid-No.2 Voltage[g]	175	175	165	volts
DC Grid-No.1 Voltage:				
From fixed-bias source. . . .	-41	-44	-44	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage	95	102	97	volts
Zero-Signal DC Plate Current. .	33	27	22	ma
Max.-Signal DC Plate Current. .	232	242	207	ma
Zero-Signal DC Grid-No.2 Current	1.1	0.7	0.6	ma
Max.-Signal DC Grid-No.2 Current	18	18	17	ma
Max.-Signal DC Grid-No.1 Current	1.6	1.9	1.1	ma
Effective Load Resistance (Plate to plate).	3700	4600	6800	ohms
Max.-Signal Driving Power (Approx.)[m].	0.2	0.3	0.2	watt

Max.-Signal Power Output (Approx.)	62	83	90 watts

Typical ICAS Push-Pull Operation:

Values are for 2 tubes

DC Plate Voltage	600	750	volts
DC Grid-No.2 Voltage[g]	190	165	volts
DC Grid-No.1 Voltage: From fixed-bias source	-48	-46	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage	109	108	volts
Zero-Signal DC Plate Current	28	22	ma
Max.-Signal DC Plate Current	270	240	ma
Zero-Signal DC Grid-No.2 Current	1.2	0.3	ma
Max.-Signal DC Grid-No.2 Current	20	20	ma
Max.-Signal DC Grid-No.1 Current	2	2.6	ma
Effective Load Resistance (Plate to plate)	5000	7400	ohms
Max.-Signal Driving Power (Approx.)[m]	0.3	0.4	watt
Max.-Signal Power Output (Approx.)	113	131	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance:[n]
- With fixed bias . . . . . 30000 max. ohms
- With cathode bias . . . . . Not recommended

LINEAR RF POWER AMPLIFIER — CLass AB_1
Single-Sideband Suppressed-Carrier Service

	CCS	ICAS	
Maximum Ratings, *Absolute-Maximum Values up to 60 Mc:*			
DC PLATE VOLTAGE	600 max.	750 max.	volts
DC GRID-No.2 VOLTAGE	250 max.	250 max.	volts
MAX.-SIGNAL DC PLATE CURRENT	125 max.	135 max.	ma
MAX.-SIGNAL PLATE INPUT	60 max.	85 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT	3 max.	3 max.	watts
PLATE DISSIPATION	20 max.	25 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	135 max.	135 max.	volts
Heater positive with respect to cathode	135 max.	135 max.	volts

Typical "Single-Tone" Operation:[p]

	At 60 Mc				
DC Plate Voltage	400	600	600	750	volts
DC Grid-No.2 Voltage[q]	190	180	200	195	volts
DC Grid-No.1 Voltage[r]	-40	-45	-50	-50	volts
Zero-Signal DC Plate Current	32	13	14	12	ma
Effective RF Load Resistance	2000	3500	3000	4000	ohms

	CCS		ICAS		
Max.-Signal DC Plate Current.	114	100	115	110	ma
Max.-Signal DC Grid-No.2 Current	12	11	14	13	ma
Max.-Signal Peak RF Grid-No.1 Voltage	40	45	50	50	volts
Max.-Signal Driving Power (Approx.)	0	0	0	0	watts
Max.-Signal Power Output (Approx.)	27	41	48	60	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance:[j]	
With fixed bias	30000 max. ohms
With cathode bias	Not recommended

PLATE-MODULATED RF POWER AMPLIFIER — Class C Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1 and at frequencies up to 60 Mc

	CCS	ICAS	
Maximum Ratings, *Absolute-Maximum Values:*			
For maximum plate voltage and maximum plate input above 60 Mc, see Rating Chart I			
DC PLATE VOLTAGE	480 max.	600 max.	volts
DC GRID-No.2 VOLTAGE	250 max.	250 max.	volts
DC GRID-No.1 VOLTAGE	-150 max.	-150 max.	volts
DC PLATE CURRENT	117 max.	125 max.	ma
DC GRID-No.1 CURRENT	3.5 max.	4 max.	ma
PLATE INPUT	45 max.	67.5 max.	watts
GRID-No.2 INPUT	2 max.	2 max.	watts
PLATE DISSIPATION	13.3 max.	16.7 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	135 max.	135 max.	volts
Heater positive with respect to cathode	135 max.	135 max.	volts
Typical Operation:			
DC Plate Voltage	400	475	600	volts
DC Grid-No.2 Voltage:[s]				
From a grid-No.2 series resistor of:				
33000 ohms	150	-	-	volts
51000 ohms	-	135	-	volts
56000 ohms	-	-	150	volts
DC Grid-No.1 Voltage:[t]				
From a grid-No.1 resistor of 27000 ohms	-87	-77	-87	volts
Peak RF Grid-No.1 Voltage	107	95	107	volts
DC Plate Current	112	94	112	ma
DC Grid-No.2 Current	7.8	6.4	7.8	ma
DC Grid-No.1 Current (Approx.)	3.4	2.8	3.4	ma

	CCS		ICAS		
Driving Power (Approx.)	0.4	0.3	0.4		watt
Power Output (Approx.).	32	34	52		watts

Maximum Circuit Value (CCS or ICAS):

Grid-No.1-Circuit Resistance[u] . . . . . 30000 max. ohms

RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy[v]
and
RF POWER AMPLIFIER — Class C FM Telephony

Maximum Ratings, *Absolute-Maximum Values:*

At frequencies up to 60 Mc. For maximum plate voltage and maximum plate input above 60 Mc, see Rating Chart II.

	CCS	ICAS	
DC PLATE VOLTAGE.	600 max.	750 max.	volts
DC GRID-No.2 VOLTAGE.	250 max.	250 max.	volts
DC GRID-No.1 VOLTAGE.	-150 max.	-150 max.	volts
DC PLATE CURRENT.	140 max.	150 max.	ma
DC GRID-No.1 CURRENT.	3.5 max.	4 max.	ma
PLATE INPUT	67.5 max.	90 max.	watts
GRID-No.2 INPUT	3 max.	3 max.	watts
PLATE DISSIPATION	20 max.	25 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode. . . .	135 max.	135 max.	volts
Heater positive with respect to cathode. . . .	135 max.	135 max.	volts

Typical Operation:

As amplifier up to 60 Mc

DC Plate Voltage.	500	600	600	750	volts
DC Grid-No.2 Voltage:[w]					
From a grid-No.2 series resistor of:					
36000 ohms.	170	–	–	–	volts
51000 ohms.	–	150	–	–	volts
43000 ohms.	–	–	180	–	volts
56000 ohms.	–	–	–	160	volts
DC Grid-No.1 Voltage:[x]					
From a grid-No.1 resistor of:					
27000 ohms.	-66	–	–	–	volts
20000 ohms.	–	-58	–	-62	volts
24000 ohms.	–	–	-71	–	volts
From cathode resistor of:					
430 ohms.	–	–	-71	–	volts
470 ohms.	-66	-58	–	-62	volts
Peak RF Grid-No.1 Voltage . .	84	73	91	79	volts
DC Plate Current.	135	112	150	120	ma
DC Grid-No.2 Current.	9	9	10	11	ma
DC Grid-No.1 Current (Approx.)	2.5	2.8	2.8	3.1	ma
Driving Power (Approx.) . . .	0.2	0.2	0.3	0.2	watt
Power Output (Approx.). . . .	48	52	66	70	watts

Typical Operation:

	CCS	ICAS	
As amplifier up to 175 Mc			
DC Plate Voltage	320	400	volts
DC Grid-No.2 Voltage:[w]			
From grid-No.2 series resistor of:			
13000 ohms	180	–	volts
20000 ohms	–	190	volts
DC Grid-No.1 Voltage:[x]			
From a grid-No.1 resistor of:			
27000 ohms	-51	–	volts
24000 ohms	–	-54	volts
From cathode resistor of			
330 ohms	-51	-54	volts
Peak RF Grid-No.1 Voltage	64	68	volts
DC Plate Current	140	150	ma
DC Grid-No.2 Current	10	10.4	ma
DC Grid-No.1 Current (Approx.)	2	2.2	ma
Driving Power (Approx.)	3	3	watts
Power Output (Approx.)	25	35	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1 Circuit Resistance[u]	30000 max.	ohms

[a] Heater voltage fluctuations will cause variations in power output. See *Test No.8* under *Characteristics Range Values*.

[b] Without external shield.

[c] Subscript 1 indicates that grid-No.1 current does not flow during any part of the input cycle.

[d] Continuous Commercial Service.

[e] Intermittent Commercial and Amateur Service.

[f] Averaged over any audio-frequency cycle of sine-wave form.

[g] Obtained preferably from a separate source or from the plate-voltage supply with a voltage divider.

[h] The driver stage should be capable of supplying the No.1 grids of the class AB_1 stage with the specified driving voltage at low distortion.

[j] The type of input coupling network used should not introduce too much resistance in the grid-No.1 circuit. Transformer or impedance coupling devices are recommended.

[k] Subscript 2 indicates that grid-No.1 current flows during some part of the input cycle.

[m] Driver stage should be capable of supplying the specified driving power at low distortion to the No.1 grids of the AB_2 stage.

[n] To minimize distortion, the effective resistance per grid-No.1 circuit of the AB_2 stage should be held at a low value. For this purpose, the use of transformer coupling is recommended. In no case, however, should the total dc grid-No.1-circuit resistance exceed 30000 ohms when the 6146A is operated at maximum ratings. For operation at less than maximum ratings, the dc grid-No.1-circuit resistance may be as high as 100000 ohms.

[p] "Single-Tone" operation refers to that class of amplifier service in which the grid No.1 input consists of a monofrequency rf signal having constant amplitude. This signal is produced in a single-sideband suppressed-carrier system when a single audio frequency of constant amplitude is applied to the input of the system.

[q] Obtained preferably from a separate, well regulated source.

[r] Obtained from a fixed supply.

[s] Obtained preferably from a separate source modulated with the plate supply, or from the modulated plate supply through a series resistor.

t Obtained from grid-No.1 resistor or from a combination of grid-No.1 resistor with either fixed supply or cathode resistor.

u When grid No.1 is driven positive ang the 6146A is operated at maximum ratings, the total dc grid-No.1-circuit resistance should not exceed the specified value of 30000 ohms. If this value is insufficient to provide adequate bias, the additional required bias must be supplied by a cathode resistor or fixed supply. For operation at less than maximum ratings, the dc grid-No.1-circuit resistance may be as high as 100000 ohms.

v Key-down conditions per tube without amplitude modulation. Amplitude modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

w Obtained preferably from separate source, or from the plate-supply voltage with a voltage divider, or through a series resistor. A series grid-No.2 resistor should be used only when the 6146A is used in a circuit which is not keyed. Grid-No.2 voltage must not exceed 400 volts under key-up conditions.

x Obtained from fixed supply, by grid-No.1 resistor, by cathode resistor, or by combination methods.

CHARACTERISTICS RANGE VALUES

Test No.	*Note*	*Min.*	*Max.*	
1. Heater Current	1	1.175	1.325	amp
2. Direct Interelectrode Capacitances:				
Grid No.1 to plate	2	–	0.24	pf
Grid-No.1 to cathode & grid No.3 & internal shield, base sleeve, grid No.2, and heater	2	12.0	15.0	pf
Plate to cathode & grid No.3 & internal shield, base sleeve, grid No.2, and heater	2	7.3	9.5	pf
3. Plate Current.	1,3	46	94	ma
4. Zero-Bias Plate Current. . .	1,4	330	–	ma
5. Grid-No.2 Current.	1,3	–	5.5	ma
6. Dynamic Grid-No.2 Current. .	1,5	3	21	ma
7. Useful Power Output I. . . .	1,5	47	–	watts
8. Useful Power Output II	See *Note 6*			

Note 1: With 6.3 volts ac on heater.

Note 2: Without external shield.

Note 3: With dc plate volts = 300, dc grid-No.2 volts = 200, and dc grid-No.1 volts = -33.

Note 4: With dc plate volts = 100, dc grid No.2 volts = 200, and dc grid No.1 volts = -100. Grid No.1 is square-wave pulsed at 1000 kc to zero volts. Limit value is peak-pulse current.

Note 5: In a single-tube, self-excited oscillator circuit, and with dc plate volts = 600, dc grid-No.2 volts = 180, grid-No.1 resistor (ohms) = 30000 ± 10%, dc plate ma. = 112, dc grid-No.1 ma. = 2 to 2.5, and frequency (Mc) = 15.

Note 6: With conditions in test No.7 reduce heater voltage to 5 volts. Useful power output shall be at least 90 per cent of that at heater volts = 6.3.

MAXIMUM RATINGS vs OPERATING FREQUENCY

OPERATING FREQUENCY Mc	MAXIMUM PERMISSIBLE PERCENTAGE OF MAXIMUM-RATED PLATE VOLTAGE & PLATE INPUT			
	TELEPHONY		TELEGRAPHY	
	Class C Plate-Modulated		Class C Unmodulated	
	Voltage	*Input*	*Voltage*	*Input*
60	100	100	100	100
80	84	92	84	92
125	65	78	65	78
150	58	72	58	72
160	56	70	56	70
175	53	67	53	67

OPERATING CONSIDERATIONS

The maximum bulb temperature of 220° C is a tube rating and is to be observed in the same manner as other ratings. The temperature may be measured with temperature-sensitive paint, such as Tempilaq. The latter is made by the Tempil Corporation, 132 W. 22nd Street, New York 11, N.Y.

To insure adequate cooling it is essential that free circulation of air be provided around the tube. In most cases, no additional air is required.

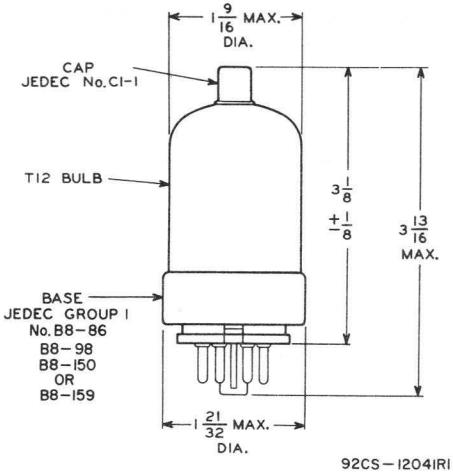
The plate shows no color when the 6146A is operated at full ratings under either CCS or ICAS conditions.

Connections to the plate should be made with a flexible lead to prevent any strain on the seal at the cap.

During standby periods in intermittent operation, it is recommended that the heater voltage be maintained at normal operating value when the period is less than 15 minutes, and that it be reduced to 80 per cent of normal when the period is between 15 minutes and 2 hours. For longer periods, the heater voltage should be turned off.

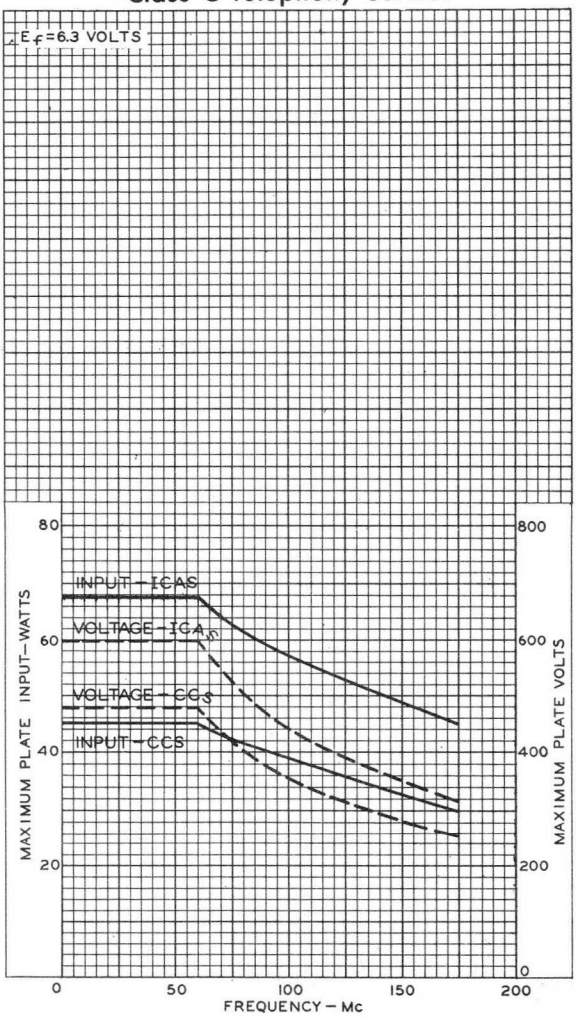
The maximum-rated plate and grid-No.2 voltages of this tube are extremely dangerous. Great care should be taken during the adjustment of circuits. The tube and its associated apparatus, especially all parts which may be at high potential above ground, should be housed in a protective enclosure. The protective housing should be designed with interlocks so that personnel can not possibly come in contact with any high-potential point in the electrical system. The interlock devices should function to break the primary circuit of the high-voltage supplies when any gate or door on the protective housing is opened, and should prevent the closing of the primary circuit until the door is again locked.

6146A



DIMENSIONS IN INCHES

RATING CHART I
Class C Telephony Service



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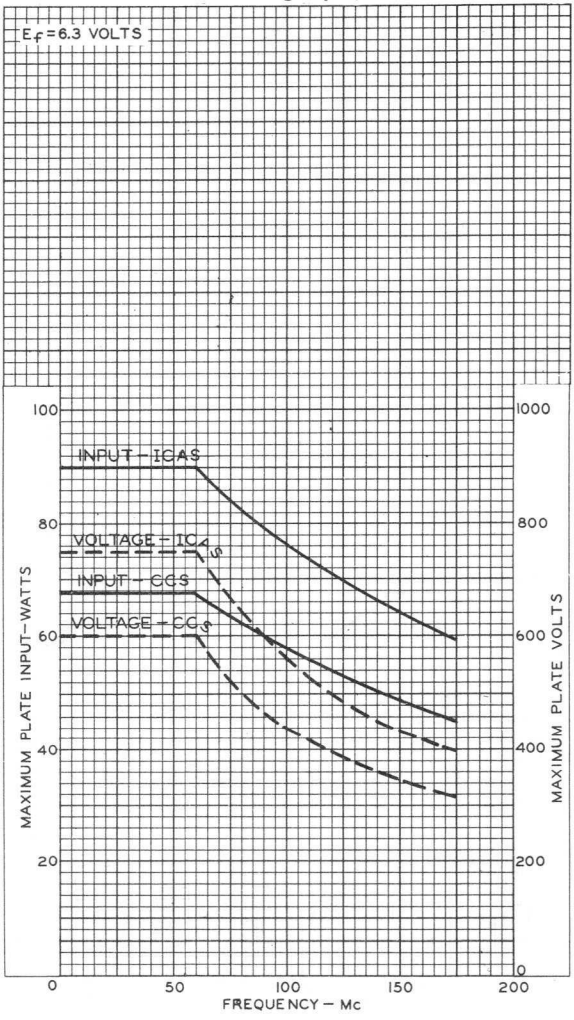
Class C Telegraphy Service



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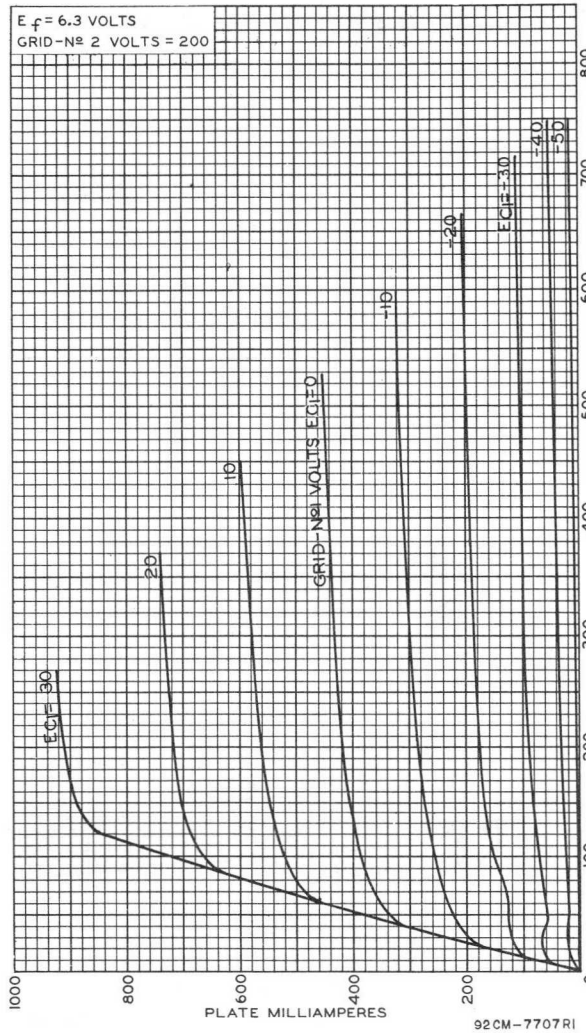
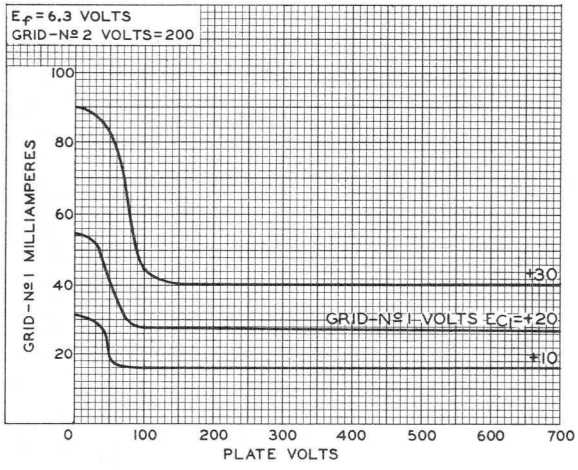
TYPICAL PLATE CHARACTERISTICS



TYPICAL CHARACTERISTICS



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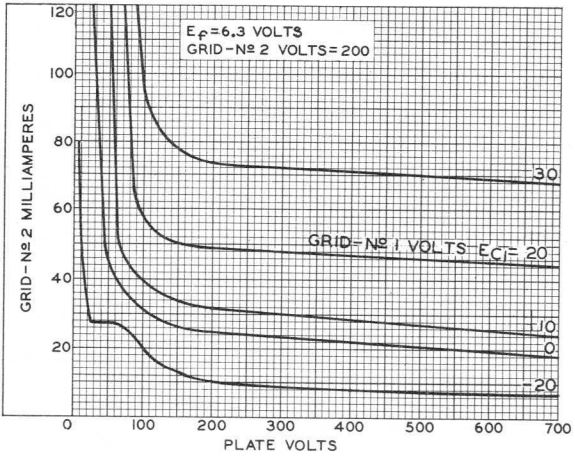
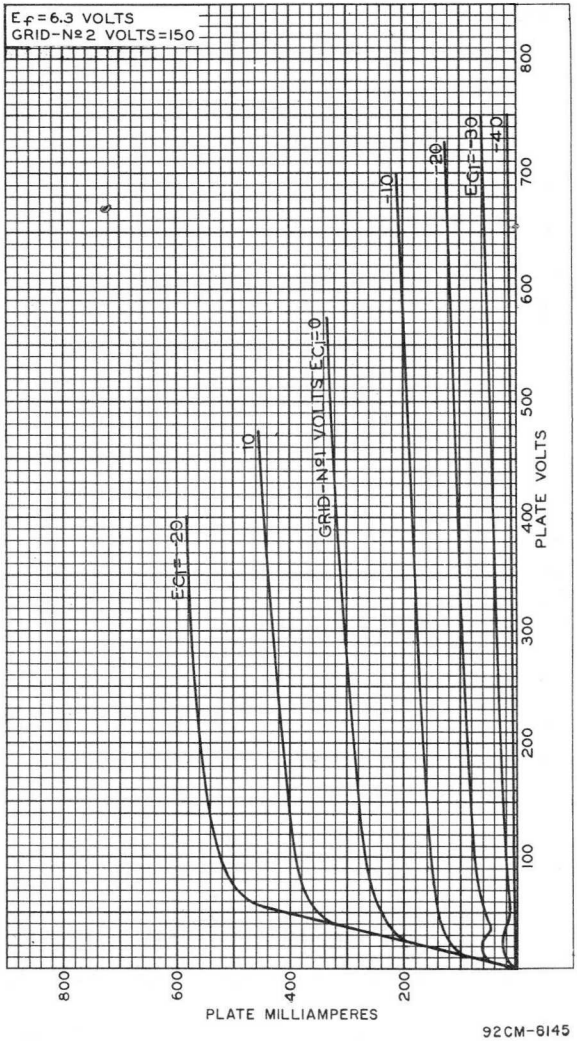
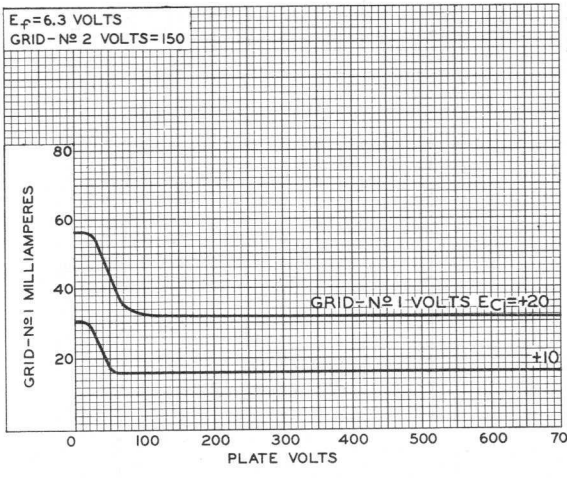


92CS-9618

TYPICAL PLATE CHARACTERISTICS



TYPICAL CHARACTERISTICS



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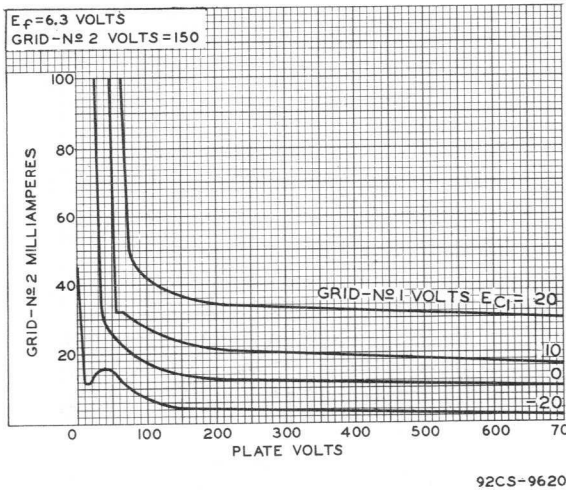


92CS-9620

6146W/7212

Beam Power Tube

90 WATTS CW INPUT (ICAS) UP TO 60 Mc

60 WATTS CW INPUT (ICAS) AT 175 Mc

For Use as an RF Power Amplifier and Oscillator as well as an AF Power Amplifier and Modulator Under Severe Shock and Vibration Conditions

GENERAL DATA

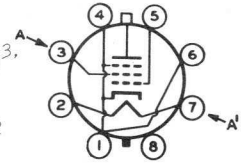
Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at heater volts = 6.3	1.25	amp
Transconductance, for plate volts = 200, grid-No.2 volts = 200, and plate ma. = 100	7000	μmhos
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 200, grid-No.2 volts = 200, and plate ma. = 100	4.5	
Direct Interelectrode Capacitances:[a]		
Grid No.1 to plate	0.24 max.	pf
Grid No.1 to cathode & grid No.3 & internal shield, grid No.2, base sleeve, and heater	13.0	pf
Plate to cathode & grid No.3 & internal shield, grid No.2, base sleeve, and heater	8.5	pf

Mechanical:

Operating Position	Any
Maximum Overall Length	3-13/16"
Seated Length	3-1/8" + 1/8"
Maximum Diameter	1-21/32"
Weight (Approx.)	2 oz
Bulb	T12
Cap	Small (JEDEC No.C1-1)
Socket	Standard Octal 8-Contact
Base	Small Micanol-Wafer Octal 8-Pin with "770" Sleeve (JEDEC Group 1, No.B8-150)
Basing Designation for BOTTOM VIEW	7CK

Pin 1 – Cathode, Grid No.3, Internal Shield
Pin 2 – Heater
Pin 3 – Grid No.2
Pin 4 – Same as Pin 1
Pin 5 – Grid No.1
Pin 6 – Same as Pin 1
Pin 7 – Heater
Pin 8 – Base Sleeve
Cap – Plate



AA' = PLANE OF ELECTRODES

AF POWER AMPLIFIER & MODULATOR — Class AB_1[b]

Maximum Ratings, *Absolute-Maximum Values:*

	CCS[c]	*ICAS*[d]	
DC PLATE VOLTAGE	600 max.	750 max.	volts
DC GRID-No.2 VOLTAGE	250 max.	250 max.	volts
MAX.-SIGNAL DC PLATE CURRENT[e]	125 max.	135 max.	ma
MAX.-SIGNAL PLATE INPUT[e]	60 max.	85 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT[e]	3 max.	3 max.	watts
PLATE DISSIPATION[e]	20 max.	25 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	135 max.	135 max.	volts
Heater positive with respect to cathode	135 max.	135 max.	volts
BULB TEMPERATURE (At hottest point on bulb surface)	220 max.	220 max.	°C

Typical CCS Push-Pull Operation:

Values are for 2 tubes

DC Plate Voltage	400	500	600	volts
DC Grid-No.2 Voltage[f]	190	185	180	volts
DC Grid-No.1 Voltage:				
From fixed-bias source	-40	-40	-45	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage[g]	80	80	90	volts
Zero-Signal DC Plate Current	63	57	26	ma
Max.-Signal DC Plate Current	228	215	200	ma
Zero-Signal DC Grid-No.2 Current	2.5	2	1	ma
Max.-Signal DC Grid-No.2 Current	25	25	23	ma
Effective Load Resistance (Plate to plate)	4000	5500	7000	ohms
Max.-Signal Driving Power (Approx.)	0	0	0	watts
Max.-Signal Power Output (Approx.)	55	70	82	watts

Typical ICAS Push-Pull Operation:

Values are for 2 tubes

DC Plate Voltage	600	750	volts
DC Grid-No.2 Voltage[f]	200	195	volts
DC Grid-No.1 Voltage:			
From fixed-bias source	-50	-50	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage[g]	100	100	volts
Zero-Signal DC Plate Current	28	23	ma
Max.-Signal DC Plate Current	229	220	ma
Zero-Signal DC Grid-No.2 Current	1	1	ma
Max.-Signal DC Grid-No.2 Current	27	26	ma
Effective Load Resistance (Plate to plate)	6000	8000	ohms
Max.-Signal Driving Power (Approx.)	0	0	watts
Max.-Signal Power Output (Approx.)	95	120	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance under any condition:[h,j]		
With fixed bias	0.1 max.	megohm
With cathode bias	Not recommended	

AF POWER AMPLIFIER & MODULATOR — Class AB_1[b]

Triode Connection—Grid No.2 Connected to Plate

Maximum Ratings, *Absolute-Maximum Values:*

	CCS	ICAS	
DC PLATE VOLTAGE	400 max.	400 max.	volts
MAX.-SIGNAL DC PLATE CURRENT[e]	90 max.	90 max.	ma
MAX.-SIGNAL PLATE INPUT[e]	35 max.	35 max.	watts
PLATE DISSIPATION[e]	20 max.	25 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	135 max.	135 max.	volts
Heater positive with respect to cathode	135 max.	135 max.	volts
BULB TEMPERATURE (At hottest point on bulb surface)	220 max.	220 max.	°C

Typical Push-Pull Operation:

Values are for 2 tubes

DC Plate Voltage	250	400	400	volts
DC Grid-No.1 Voltage	-50	-100	-100	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage[g]	100	200	200	volts
Zero-Signal DC Plate Current	120	40	40	ma
Max.-Signal DC Plate Current	125	100	100	ma
Effective Load Resistance (Plate-to-plate)	5000	8000	8000	ohms
Max.-Signal Driving Power (Approx.)	0	0	0	watts
Max.-Signal Power Output (Approx.)	10	22	22	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance under any condition:[h,k]		
With fixed bias	0.1 max.	megohm
With cathode bias	0.5 max.	megohm

AF POWER AMPLIFIER & MODULATOR — Class AB_2[m]

Maximum Ratings, *Absolute-Maximum Values:*

	CCS	ICAS	
DC PLATE VOLTAGE	600 max.	750 max.	volts
DC GRID-No.2 VOLTAGE	250 max.	250 max.	volts
MAX.-SIGNAL DC PLATE CURRENT[e]	125 max.	135 max.	ma
MAX.-SIGNAL PLATE INPUT[e]	62.5 max.	90 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT[e]	3 max.	3 max.	watts
PLATE DISSIPATION[e]	20 max.	25 max.	watts

	CCS	ICAS	
PEAK-HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode.	135 max.	135 max.	volts
Heater positive with respect to cathode.	135 max.	135 max.	volts
BULB TEMPERATURE (AT hottest point on bulb surface). . . .	220 max.	220 max.	°C

Typical CCS Push-Pull Operation:

Values are for 2 tubes

DC Plate Voltage.	400	500	600	volts
DC Grid-No.2 Voltage[f]	175	175	165	volts
DC Grid-No.1 Voltage:				
From fixed-bias source. . . .	-41	-44	-44	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage	95	102	97	volts
Zero-Signal DC Plate Current. .	33	27	22	ma
Max.-Signal DC Plate Current. .	232	242	207	ma
Zero-Signal DC Grid-No.2 Current	1.1	0.7	0.6	ma
Max.-Signal DC Grid-No.2 Current	18	18	17	ma
Max.-Signal DC Grid-No.1 Current	1.6	1.9	1.1	ma
Effective Load Resistance (Plate to plate).	3700	4600	6800	ohms
Max.-Signal Driving Power (Approx.)[n].	0.2	0.3	0.2	watt
Max.-Signal Power Output (Approx.)	62	83	90	watts

Typical ICAS Push-Pull Operation:

Values are for 2 tubes

DC Plate Voltage.	600	750	volts
DC Grid-No.2 Voltage[f]	190	165	volts
DC Grid-No.1 Voltage:			
From fixed-bias source.	-48	-46	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage.	109	108	volts
Zero-Signal DC Plate Current.	28	22	ma
Max.-Signal DC Plate Current.	270	240	ma
Zero-Signal DC Grid-No.2 Current. . . .	1.2	0.3	ma
Max.-Signal DC Grid-No.2 Current. . . .	20	20	ma
Max.-Signal DC Grid-No.1 Current. . . .	2	2.6	ma
Effective Load Resistance (Plate to plate).	5000	7400	ohms
Max.-Signal Driving Power (Approx.)[n]. .	0.3	0.4	watt
Max.-Signal Power Output (Approx.). . .	113	131	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance:[n]	
With fixed bias	30000 max. ohms
With cathode bias	Not recommended

PLATE-MODULATED RF POWER AMPLIFIER — Class C Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1

	CCS	ICAS	
Maximum Ratings, *Absolute-Maximum Values:*			
DC PLATE VOLTAGE	480 max.	600 max.	volts
DC GRID-No.2 VOLTAGE	250 max.	250 max.	volts
DC GRID-No.1 VOLTAGE	−150 max.	−150 max.	volts
DC PLATE CURRENT	117 max.	125 max.	ma
DC GRID-No.1 CURRENT	3.5 max.	4 max.	ma
PLATE INPUT	45 max.	67.5 max.	watts
GRID-No.2 INPUT	2 max.	2 max.	watts
PLATE DISSIPATION	13.3 max.	16.7 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	135 max.	135 max.	volts
Heater positive with respect to cathode	135 max.	135 max.	volts
BULB TEMPERATURE (At hottest point on bulb surface)	220 max.	220 max.	°C

Typical Operation:

At frequencies up to 60 Mc

DC Plate Voltage	400	475	600	volts
DC Grid-No.2 Voltage:[p]				
From a grid-No.2 series resistor of:				
33000 ohms	150	–	–	volts
51000 ohms	–	135	–	volts
56000 ohms	–	–	150	volts
DC Grid-No.1 Voltage:[q]				
From a grid-No.1 resistor of 27000 ohms	−87	−77	−87	volts
Peak RF Grid-No.1 Voltage	107	95	107	volts
DC Plate Current	112	94	112	ma
DC Grid-No.2 Current	7.8	6.4	7.8	ma
DC Grid-No.1 Current (Approx.)	3.4	2.8	3.4	ma
Driving Power (Approx.)	0.4	0.3	0.4	watt
Power Output (Approx.)	32	34	52	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance[r] . . . . . 30000 max. ohms

RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy[s] and RF POWER AMPLIFIER — Class C FM Telephony

	CCS	ICAS	
Maximum Ratings, *Absolute-Maximum Values:*			
DC PLATE VOLTAGE	600 max.	750 max.	volts
DC GRID-No.2 VOLTAGE	250 max.	250 max.	volts
DC GRID-No.1 VOLTAGE	−150 max.	−150 max.	volts
DC PLATE CURRENT	140 max.	150 max.	ma
DC GRID-No.1 CURRENT	3.5 max.	4 max.	ma

	CCS	ICAS	
PLATE INPUT	67.5 max.	90 max.	watts
GRID-No.2 INPUT	3 max.	3 max.	watts
PLATE DISSIPATION	20 max.	25 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	135 max.	135 max.	volts
Heater positive with respect to cathode	135 max.	135 max.	volts
BULB TEMPERATURE (At hottest point on bulb surface)	220 max.	220 max.	°C

Typical Operation:

As amplifier up to 60 Mc

DC Plate Voltage	500	600	600	750	volts
DC Grid-No.2 Voltage:[t]					
From a grid-No.2 series resistor of:					
36000 ohms	170	–	–	–	volts
51000 ohms	–	150	–	–	volts
43000 ohms	–	–	180	–	volts
56000 ohms	–	–	–	160	volts
DC Grid-No.1 Voltage:[u]					
From a grid-No.1 resistor of:					
27000 ohms	-66	–	–	–	volts
20000 ohms	–	-58	–	-62	volts
24000 ohms	–	–	-71	–	volts
From a cathode resistor of:					
430 ohms	–	–	-71	–	volts
470 ohms	-66	-58	–	-62	volts
Peak RF Grid-No.1 Voltage	84	73	91	79	volts
DC Plate Current	135	112	150	120	ma
DC Grid-No.2 Current	9	9	10	11	ma
DC Grid-No.1 Current (Approx.)	2.5	2.8	2.8	3.1	ma
Driving Power (Approx.)	0.2	0.2	0.3	0.2	watt
Power Output (Approx.)	48	52	66	70	watts

Typical Operation:

As amplifier up to 175 Mc

DC Plate Voltage	320	400	volts
DC Grid-No.2 Voltage[t]			
From grid-No.2 series resistor of:			
13000 ohms	180	–	volts
20000 ohms	–	190	volts
DC Grid-No.1 Voltage:[u]			
From a grid-No.1 resistor of:			
27000 ohms	-51	–	volts
24000 ohms	–	-54	volts
From a cathode resistor of:			
330 ohms	-51	-54	volts
Peak RF Grid-No.1 Voltage	64	68	volts
DC Plate Current	140	150	ma
DC Grid-No.2 Current	10	10.4	ma
DC Grid-No.1 Current (Approx.)	2	2.2	ma

Driving Power (Approx.)	3	3	watts
Power Output (Approx.).	25	35	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1 Circuit Resistance[r]	30000 max.	ohms

[a] Without external shield.

[b] Subscript 1 indicates that grid-No.1 current does not flow during any part of the input cycle.

[c] Continuous Commercial Service.

[d] Intermittent Commercial and Amateur Service.

[e] Averaged over any audio-frequency cycle of sine-wave form.

[f] Obtained preferably from a separate source or from the plate-voltage supply with a voltage divider.

[g] The driver stage should be capable of supplying the No.1 grids of the class AB_1 stage with the specified driving voltage at low distortion.

[h] The type of input coupling network used should not introduce too much resistance in the grid-No.1 circuit. Transformer or impedance coupling devices are recommended.

[j] When the 6146W/7212 is operated as a beam power tube in Class AB_1 service, only fixed bias should be used, and the dc grid-No.1-circuit resistance should never exceed the specified value of 0.1 megohm.

[k] When the 6146W/7212 is connected as a triode and its grid No.1 is operated with the fixed bias, the dc grid-No.1-circuit resistance should never exceed the specified value of 0.1 megohm. If higher values of grid-No.1-circuit resistance are desired, cathode bias must be employed. Under no circumstances should the dc grid-No.1-circuit resistance exceed the specified value of 0.5 megohm.

[m] Subscript 2 indicates that grid-No.2 current flows during some part of the input cycle.

[n] Driver stage should be capable of supplying the specified driving power at low distortion to the No.1 grids of the AB_2 stage. To minimize distortion, the effective resistance per grid-No.1 circuit of the AB_2 stage should be held at a low value. For this purpose, the use of transformer coupling is recommended. In no case, however, should the total dc grid-No.1-circuit resistance exceed 30000 ohms when the 6146W/7212 is operated at maximum ratings. For operation at less than maximum ratings, the dc grid-No.1-circuit resistance may be as high as 100000 ohms.

[p] Obtained preferably from a separate source modulated along with the plate supply, or from the modulated plate supply through a series resistor.

[q] Obtained from grid-No.1 resistor or from a combination of grid-No.1 resistor with either fixed supply or cathode resistor.

[r] When grid No.1 is driven positive and the 6146W/7212 is operated at maximum ratings, the total dc grid-No.1-circuit resistance should not exceed the specified value of 30000 ohms. If this value is insufficient to provide adequate bias, the additional required bias must be supplied by a cathode resistor or a fixed supply. For operation at less than maximum ratings, the dc grid-No.1-circuit resistance may be as high as 100000 ohms.

[s] Key-down conditions per tube without amplitude modulation. Amplitude modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

[t] Obtained preferably from separate source, or from the plate-supply voltage with a voltage divider, or through a series resistor. A series grid-No.2 resistor should be used only when the 6146W/7212 is used in a circuit which is not keyed. Grid-No.2 voltage must not exceed 400 volts under key-up conditions.

[u] Obtained from fixed supply, by grid-No.1 resistor, by cathode resistor, or by combination methods.

CHARACTERISTICS RANGE VALUES

	Note	Min.	Max.	
Heater Current	1	1.175	1.325	amp
Direct Interelectrode Capacitances:				
Grid No.1 to plate	2	–	0.24	pf
Grid No.1 to cathode & grid No.3 & internal shield, grid No.2, base sleeve and heater	2	12.0	15.0	pf
Plate to cathode & grid No.3 & internal shield, grid No.2, base sleeve, and heater	2	7.3	9.5	pf
Plate Current	3	46	94	ma
Grid-No.2 Current	3	–	5.5	ma
Heater-Cathode Leakage Current:				
Heater 100 volts negative with respect to cathode	1	–	100	μa
Heater 100 volts positive with respect to cathode	1	–	100	μa
Useful Power Output	4	47	–	watts
Mu-Factor, Grid No.1 to Grid No.2	5	3.6	5.4	

Note 1: With 6.3 volts ac on heater.

Note 2: Without external shield.

Note 3: With 6.3 volts ac on heater, dc plate volts = 300, dc grid-No.2 volts = 200, and dc grid-No.1 volts = -33.

Note 4: In a single-tube, self-excited oscillator circuit, and with 6.3 volts ac on heater, dc plate volts = 600, dc grid-No.2 volts = 180, grid-No.1 resistor (ohms) = 30,000 ± 10%, dc plate ma. = 100 to 112, dc grid-No.2 ma. = 23 maximum, dc grid-No.1 ma. = 2 to 2.5 and frequency (Mc) = 15.

Note 5: With 6.3 volts ac on heater, dc plate volts = 200, plate ma. = 100, and grid-No.2 volts = 200.

SPECIAL RATINGS & PERFORMANCE DATA

500-g Shock Rating:

This test is performed on a sample lot of tubes from each production run. Tubes are held rigid and are subjected in four different positions to an impact acceleration of 500 g. At the end of this test, tubes are required to meet the following limits:

Useful RF Power Output . . . . . 42 min. watts
For conditions shown under *Characteristics Range Values, Note 4.*

Heater-Cathode
Leakage Current . . . . .See *Characteristics Range Values*

The tubes must also meet the established limit for low-frequency vibration (See below).

Fatigue Rating:

This test is performed on a sample lot of tubes from each production run. Tubes are rigidly mounted and subjected to 2.5-g vibrational acceleration at 25 cycles per second for 32

hours in each of three positions. At the end of this test, tubes are required to meet the following limits:

Useful RF Power Output. . . . . 42 min. watts
For conditions shown under *Characteristics Range Values, Note 4.*

Heater-Cathode
Leakage Current . . . . .See *Characteristics Range Values*

The tubes must also meet the established limit for low-frequency vibration (See below).

Low-Frequency Vibration Performance:

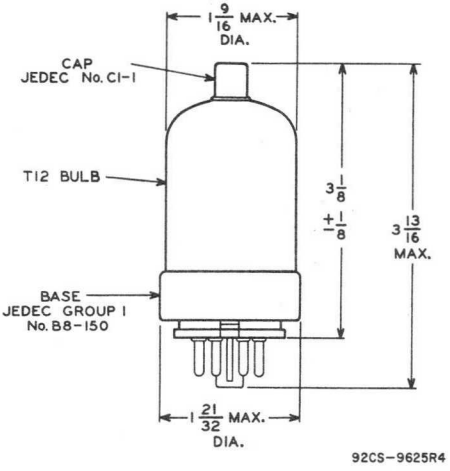
This test is performed on a sample lot of tubes from each production run under the following conditions: Heater volts = 6.3, plate-supply volts = 250, grid-No.2 volts = 200, grid-No.1 voltage varied to give a plate current of 10 milliamperes, plate load resistor (ohms) = 2000, and vibrating frequency of 25 cycles per second with a fixed amplitude of 0.040 inch (total excursion 0.080 inch). The rms output voltage across the plate load resistor as a result of vibration of the tube must not exceed 500 millivolts.

Variable-Frequency Vibration Performance (1):

This test is performed on a sample lot of tubes from each production run. Tubes are vibrated in each of 3 positions through frequency range of from 10 to 50 cycles per second and back to 10 cycles per second. The tubes are vibrated under the same conditions as specified for *Low-Frequency Vibration Performance.* During the test, the tubes will not show an rms output voltage across the plate load resistor in excess of 500 millivolts. At the end of this test, the tubes will not show tap or permanent interelectrode shorts or defects that cause the tubes to be inoperable.

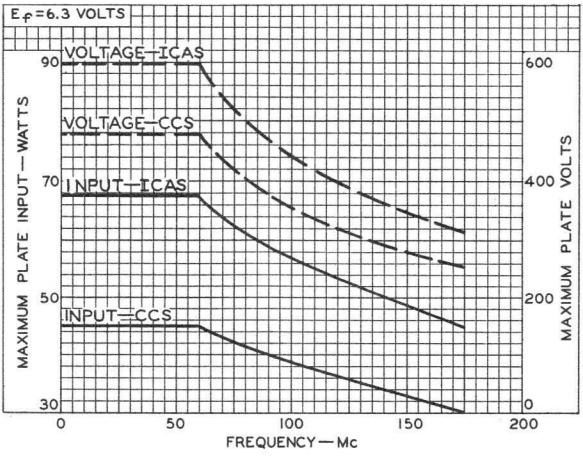
Variable-Frequency Vibration Performance (2):

This test is performed on a sample lot of tubes from each production run. Tubes are vibrated in each of 3 positions, perpendicular and parallel to major axis of the tube, and parallel to longitudinal axis of the tube, through the frequency range from 50 to 120 cycles per second at a fixed acceleration of 10 g under the same voltage, current and load conditions as specified for *Low-Frequency Vibration Performance.* During this test, the tubes will not show an rms output voltage across the plate load resistor in excess of 500 millivolts.



ALL DIMENSIONS IN INCHES

RATING CHART I
Class C Telephony Service



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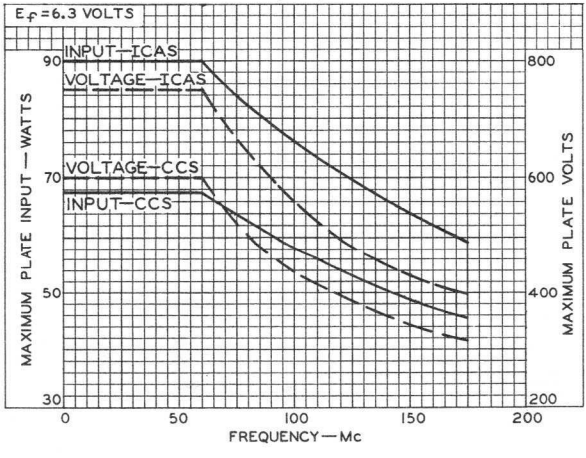
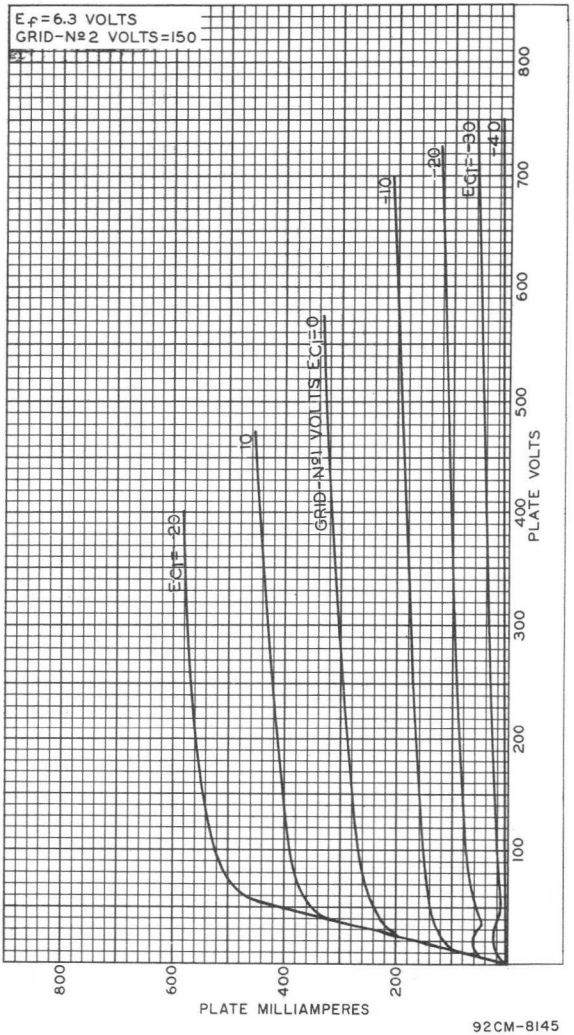
RATING CHART II
Class C Telegraphy Service



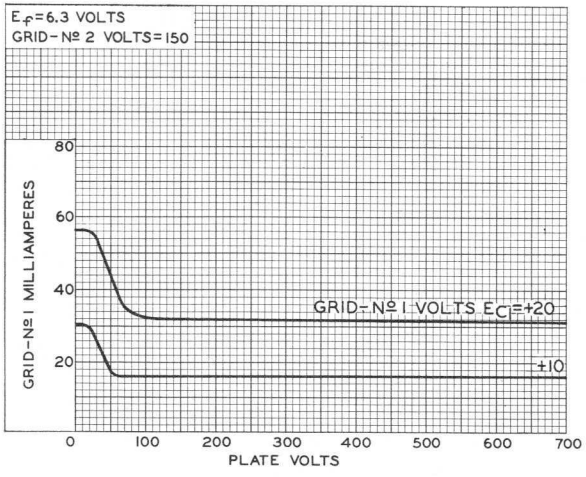
92CS-9615

TYPICAL PLATE CHARACTERISTICS



92CM-8145

TYPICAL CHARACTERISTICS



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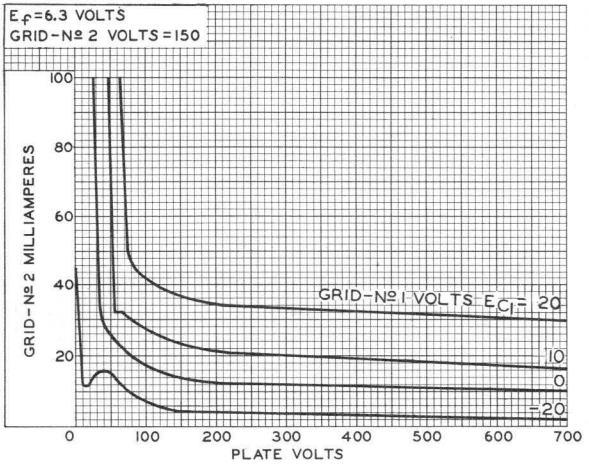
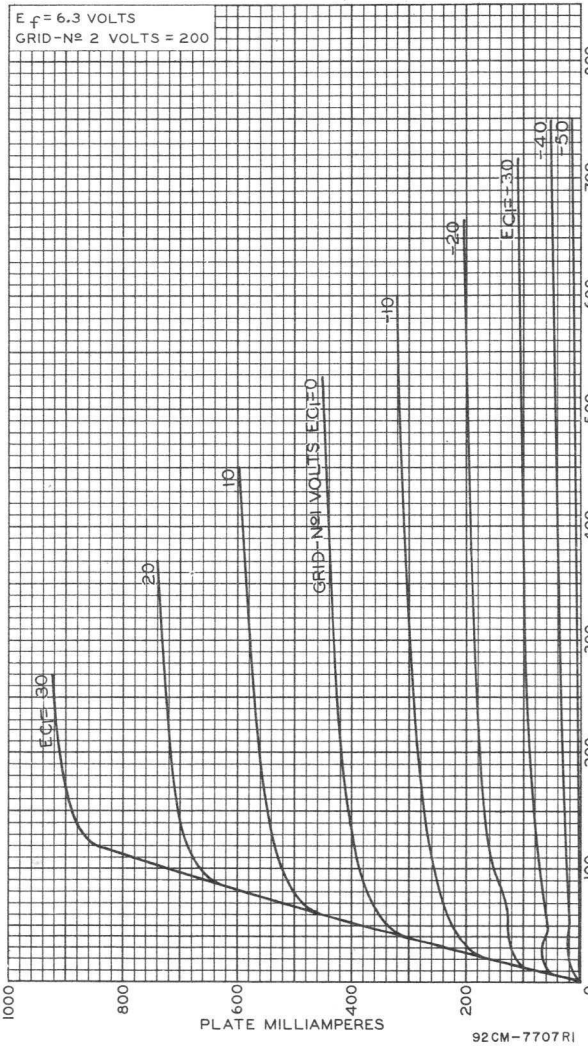


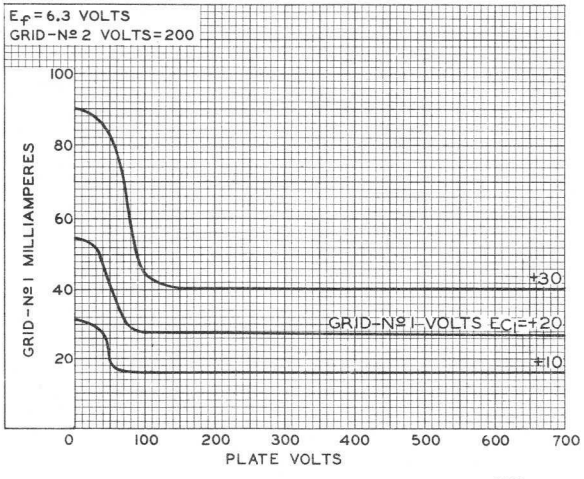
92CS-9620

TYPICAL PLATE CHARACTERISTICS



92CM-7707RI

TYPICAL CHARACTERISTICS



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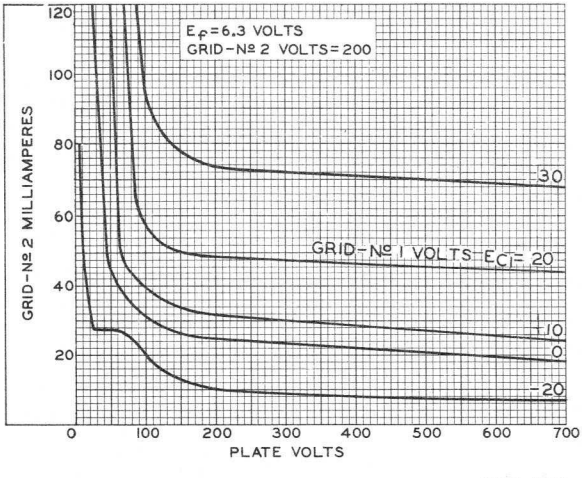
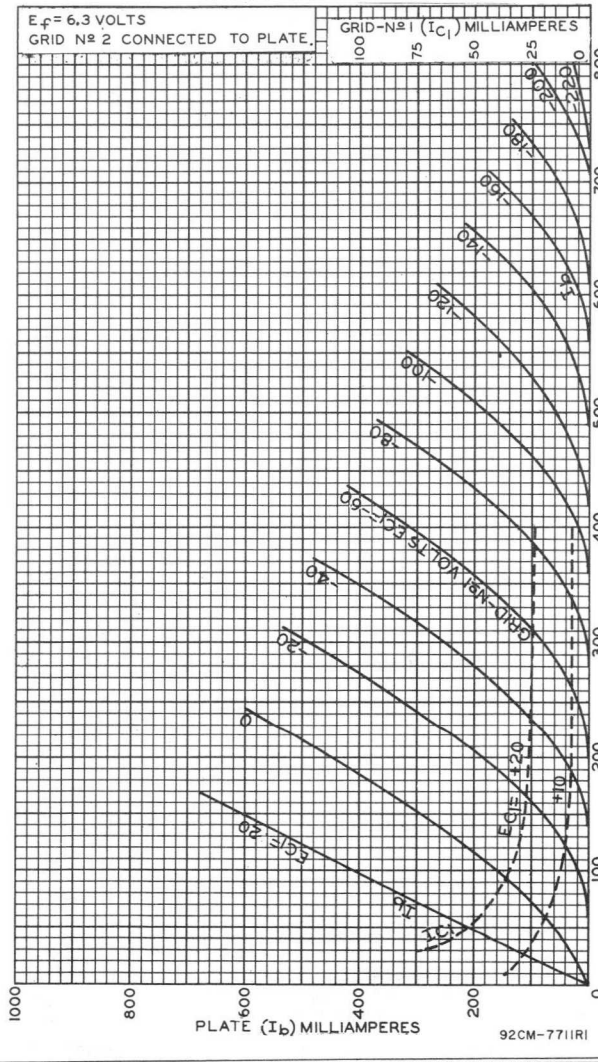


92CS-9618

TYPICAL CHARACTERISTICS
Triode Connection



6155/4-125A
BEAM POWER TUBE

FORCED-AIR COOLED

Useful with full input up to 120 Mc
and with reduced input up to 200 Mc

GENERAL DATA

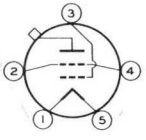
Electrical:

Filament, Thoriated Tungsten:		
Voltage	5.0 ± 5%	ac or dc volts
Current at 5.0 volts	6.5	amp
Mu-Factor, Grid No.2 to Grid No.1, for plate volts = 3000, grid-No.2 volts = 400, and plate ma. = 50	6.2	
Direct Interelectrode Capacitances:		
Grid No.1 to plate	0.07 max.	μμf
Grid No.1 to filament and grid No.2	11	μμf
Plate to filament and grid No.2	3	μμf

Mechanical:

Operating Position	Vertical, base down or up
Maximum Overall Length	5-3/32"
Seated Length	4-3/16" ± 1/4"
Maximum Diameter	2-7/16"
Weight (Approx.)	3 oz
Cap	Skirted Small
Base	Special-Button Giant 5-Pin
Basing Designation for BOTTOM VIEW	5BK

Pin 1 - Filament
Pin 2 - Grid No.2
Pin 3 - Grid No.1
Pin 4 - Grid No.2
Pin 5 - Filament
Cap - Plate



Forced-Air Cooling . . . . . 5 cfm

Under any condition of operation, adequate cooling of the bulb must be provided to limit the seal temperatures to their specified maximum values. At frequencies above 50 Mc, special attention should be given to adequate cooling of the bulb and seals. The use of a heat-radiating plate connector is recommended.

Seal Temperature:		
Plate	220 max.	°C
Grid-No.2, grid-No.1, and filament	180 max.	°C

AF POWER AMPLIFIER & MODULATOR — Class AB_1

Maximum CCS● Ratings, *Absolute Values:*

DC PLATE VOLTAGE	3000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	600 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-500 max.	volts

#, ●: See next page.

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

6155/4-125A

BEAM POWER TUBE

MAX.-SIGNAL DC PLATE CURRENT*			225 max.	ma
MAX.-SIGNAL PLATE INPUT*			350 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT*			20 max.	watts
PLATE DISSIPATION*			125 max.	watts

Typical CCS Operation:

Values are for 2 tubes

DC Plate Voltage	1500	2000	2500	volts
DC Grid-No.2 Voltage⊕	600	600	600	volts
DC Grid-No.1 Voltage★	-94	-95	-97	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage	185	186	190	volts
Zero-Signal DC Plate Current	64	60	60	ma
Max.-Signal DC Plate Current	218	222	216	ma
Zero-Signal DC Grid-No.2 Current	0.3	0.2	0.2	ma
Max.-Signal DC Grid-No.2 Current	27	24	26	ma
Effective Load Resistance (Plate to plate)	12000	17600	25000	ohms
Max.-Signal Driving Power	0	0	0	watts
Max.-Signal Power Output (Approx.)	170	260	345	watts

AF POWER AMPLIFIER & MODULATOR — Class AB_2♦

Maximum CCS● Ratings, *Absolute Values:*

DC PLATE VOLTAGE	3000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	400 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-500 max.	volts
MAX.-SIGNAL DC PLATE CURRENT*	225 max.	ma
MAX.-SIGNAL PLATE INPUT*	500 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT*	20 max.	watts
PLATE DISSIPATION*	125 max.	watts

Typical CCS Operation:

Values are for 2 tubes

DC Plate Voltage	1500	2000	2500	volts
DC Grid-No.2 Voltage⊕	350	350	350	volts
DC Grid-No.1 Voltage**	-48	-50	-51	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage	330	296	240	volts
Zero-Signal DC Plate Current	60	60	60	ma
Max.-Signal DC Plate Current	455	395	302	ma
Zero-Signal DC Grid-No.2 Current	0.5	0.3	0.2	ma
Max.-Signal DC Grid-No.2 Current	84	64	36	ma
Effective Load Resistance (Plate to plate)	7200	12000	20000	ohms
Max.-Signal Driving Power (Approx.)●●	4.8	3.2	1.8	watts
Max.-Signal Power Output (Approx.)	455	550	550	watts

⊕, ●, *, ⊕, ★, ♦, **, ●●: See next page.

6155/4-125A

BEAM POWER TUBE

RF POWER AMPLIFIER — Class B Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum CCS● Ratings, *Absolute Values:*

DC PLATE VOLTAGE	3000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	400 max.	volts
DC PLATE CURRENT	135 max.	ma
PLATE INPUT	200 max.	watts
GRID-No.2 INPUT	14 max.	watts
PLATE DISSIPATION	125 max.	watts

Typical CCS Operation:

DC Plate Voltage	2000	2500	3000	volts
DC Grid-No.2 Voltage	350	350	350	volts
DC Grid-No.1 (Control-Grid) Voltage	-50	-50	-50	volts
Peak RF Grid-No.1 Voltage	65	55	50	volts
DC Plate Current	83	70	60	ma
DC Grid-No.2 Current	1.5	1	1	ma
DC Grid-No.1 Current (Approx.)	1.5	0	0	ma
Driving Power (Approx.)⊕⊕	0.52	0.44	0.45	watt
Power Output (Approx.)	54	55	58	watts

PLATE-MODULATED RF POWER AMPLIFIER — Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum CCS● Ratings, *Absolute Values:*

DC PLATE VOLTAGE	2500 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	400 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-500 max.	volts
DC PLATE CURRENT	200 max.	ma
DC GRID-No.1 CURRENT	15 max.	ma
PLATE INPUT	415 max.	watts
GRID-No.2 INPUT	20 max.	watts
PLATE DISSIPATION	83 max.	watts

Typical CCS Operation:

DC Plate Voltage	2000	2500	volts
DC Grid-No.2 Voltage▲	350	350	volts
DC Grid-No.1 Voltage	-220	-210	volts
Peak AF Grid-No.2 Voltage (100% modulation)	300	300	volts
Peak RF Grid-No.1 Voltage	390	380	volts
DC Plate Current	150	152	ma
DC Grid-No.2 Current	33	30	ma
DC Grid-No.1 Current (Approx.)	5	4.5	ma
Driving Power (Approx.)	2	1.7	watts
Power Output (Approx.)	225	300	watts

⊕, ●, ×, ⊕, ★, ♦, **, ●●, ⊕⊕, ▲: See next page.

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6155/4-125A

BEAM POWER TUBE

RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy♦
and
RF POWER AMPLIFIER — Class C FM Telephony

Maximum CCS● Ratings, *Absolute Values:*

DC PLATE VOLTAGE	3000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	400 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-500 max.	volts
DC PLATE CURRENT	225 max.	ma
DC GRID-No.1 CURRENT	15 max.	ma
PLATE INPUT	625 max.	watts
GRID-No.2 INPUT	20 max.	watts
PLATE DISSIPATION	125 max.	watts

Typical CCS Operation:

DC Plate Voltage	2000	2500	3000	volts
DC Grid-No.2 Voltage	350	350	350	volts
DC Grid-No.1 Voltage	-100	-150	-150	volts
Peak RF Grid-No.1 Voltage	260	330	300	volts
DC Plate Current	200	200	167	ma
DC Grid-No.2 Current	50	40	30	ma
DC Grid-No.1 Current (Approx.)	9	9	6.5	ma
Driving Power (Approx.)	2.4	3	2	watts
Power Output (Approx.)	275	375	375	watts

⊕ Subscript 1 indicates that grid-No.1 current does not flow during any part of the input cycle.

● Continuous Commercial Service

* Averaged over any audio-frequency cycle of sine-wave form.

⊕ Obtained from a fixed supply.

★ Total effective grid-No.1-circuit resistance should not exceed 0.15 megohm.

♦ Subscript 2 indicates that grid-No.1 current flows during some part of input cycle.

** Obtained from fixed supply having dc resistance not exceeding 250 ohms.

●● Driver stage should be capable of supplying the No.1 grids of the class AB_2 stage with the specified driving power at low distortion. The effective resistance per grid-No.1 circuit of the AB_2 stage should be held at a low value.

⊕⊕ At crest of audio-frequency cycle with modulation factor of 1.0.

▲ Obtained preferably from a separate source modulated along with the plate supply, or from the modulated plate supply through a series resistor.

♦ Key-down conditions per tube without amplitude modulation. Amplitude modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

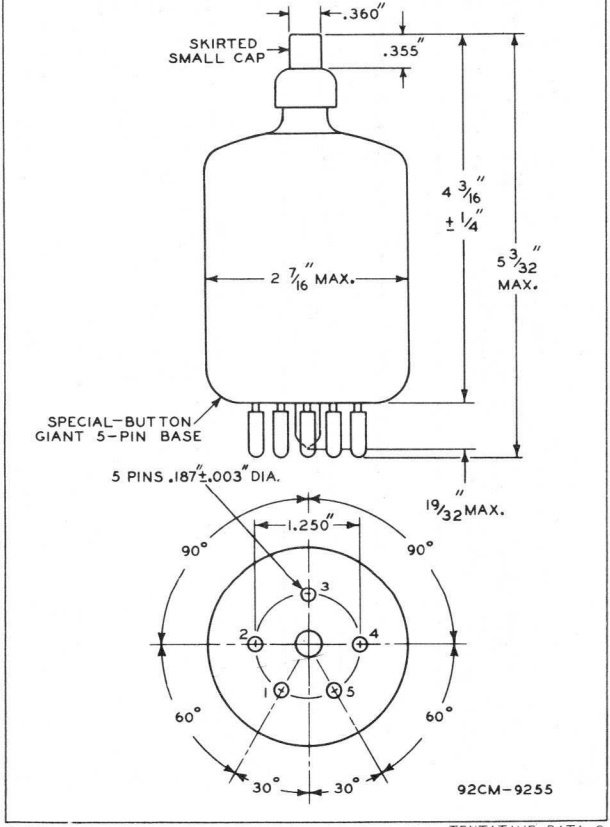
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6155/4-125A

BEAM POWER TUBE

MAXIMUM RATINGS vs OPERATING FREQUENCY

FREQUENCY	120		170		200		Mc
MAX.-PERMISSIBLE PERCENTAGE OF MAX.-RATED PLATE VOLTAGE OR PLATE INPUT:	*Voltage*	*Input*	*Voltage*	*Input*	*Voltage*	*Input*	
Class B telephony	100	100	90	95	70	75	%
Class C telephony	100	100	90	90	67	70	%
Class C telegraphy	100	100	75	90	67	70	%



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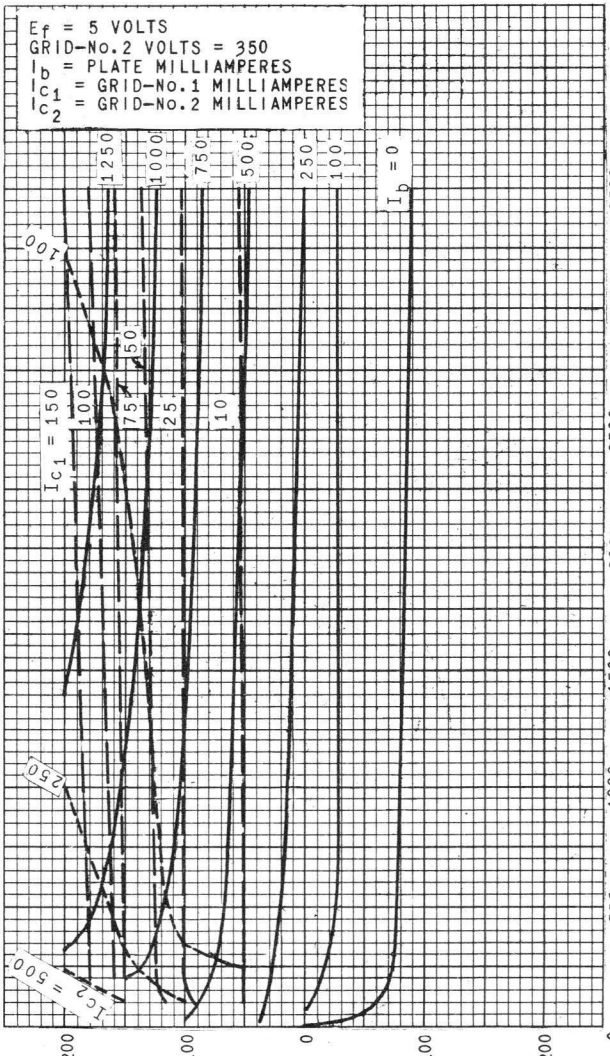
6155/4-125A

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



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

6156/4-250A

BEAM POWER TUBE

FORCED-AIR COOLED

Useful with full input up to 75 Mc
and with reduced input up to 120 Mc

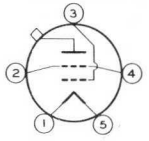
GENERAL DATA

Electrical:

Filament, Thoriated Tungsten:		
Voltage	5.0	ac or dc volts
Current at 5.0 volts	14.1	amp
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 3000, grid-No.2 volts = 500, and plate ma. = 100	5.1	
Direct Interelectrode Capacitances:		
Grid No.1 to plate	0.14 max.	μμf
Grid No.1 to filament and grid No.2	13	μμf
Plate to filament and grid No.2	4.6	μμf

Mechanical:

Operating Position	Vertical, base down or up
Maximum Overall Length	5-29/32"
Seated Length	5" ± 1/4"
Maximum Diameter	3-7/16"
Weight (Approx.)	6 oz
Cap	Small
Base	Special-Button Giant 5-Pin
Basing Designation for BOTTOM VIEW	5BK



Pin 1 - Filament
Pin 2 - Grid No.2
Pin 3 - Grid No.1
Pin 4 - Grid No.2, Internal Shield
Pin 5 - Filament
Cap - Plate

Forced-Air Cooling . . . . . 5 cfm

Under any condition of operation, adequate cooling of the bulb must be provided to limit the seal temperatures to their specified maximum values. At frequencies above 30 Mc, special attention should be given to adequate cooling of the bulb and seals. The use of a heat-radiating plate connector is recommended.

Seal Temperature:		
Plate	220 max.	°C
Grid No.2, grid No.1, and filament	180 max.	°C

AF POWER AMPLIFIER & MODULATOR — Class AB1♦

Maximum CCS● Ratings, *Absolute Values:*

DC PLATE VOLTAGE	4000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	600 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-500 max.	volts

♦,●: See next page.

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

6156/4-250A

BEAM POWER TUBE

MAX.-SIGNAL DC PLATE CURRENT*				350 max.	ma
MAX.-SIGNAL PLATE INPUT*				750 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT*				35 max.	watts
PLATE DISSIPATION*				250 max.	watts

Typical CCS Operation:

Values are for 2 tubes

DC Plate Voltage	1500	2000	2500	3000	volts
DC Grid-No.2 Voltage□	500	500	500	500	volts
DC Grid-No.1 Voltage▲	-85	-88	-91	-94	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage	167	173	178	184	volts
Zero-Signal DC Plate Current	100	100	100	100	ma
Max.-Signal DC Plate Current	300	300	310	310	ma
Effective Load Resistance (Plate to plate)	10000	14500	18000	22000	ohms
Max.-Signal Driving Power	0	0	0	0	watts
Max.-Signal Power Output (Approx.)	265	390	510	635	watts

AF POWER AMPLIFIER & MODULATOR — Class AB_2 ⊕

Maximum CCS● Ratings, *Absolute Values:*

DC PLATE VOLTAGE	4000 max.		volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	600 max.		volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-500 max.		volts
MAX.-SIGNAL DC PLATE CURRENT*	350 max.		ma
MAX.-SIGNAL PLATE INPUT*	1000 max.		watts
MAX.-SIGNAL GRID-No.2 INPUT*	35 max.		watts
PLATE DISSIPATION*	250 max.		watts

Typical CCS Operation:

Values are for 2 tubes

DC Plate Voltage	1500	2000	2500	3000	volts
DC Grid-No.2 Voltage□	300	300	300	300	volts
DC Grid-No.1 Voltage**	-45	-49	-51	-55	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage	323	328	306	280	volts
Zero-Signal DC Plate Current	100	100	100	100	ma
Max.-Signal DC Plate Current	694	694	624	550	ma
Zero-Signal DC Grid-No.2 Current	0	0	0	0	ma
Max.-Signal DC Grid-No.2 Current	116	110	88	69	ma
Effective Load Resistance (Plate to plate)	4550	6600	9200	14000	ohms
Max.-Signal Driving Power (Approx.)○○	8	8	5.8	3.8	watts
Max.-Signal Power Output (Approx.)	660	975	1140	1240	watts

♦,●,*,□,▲,⊕,**,○○: See next page.

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6156/4-250A

BEAM POWER TUBE

RF POWER AMPLIFIER — Class B Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum CCS● Ratings, *Absolute Values:*

DC PLATE VOLTAGE	4000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	600 max.	volts
DC PLATE CURRENT	210 max.	ma
PLATE INPUT	400 max.	watts
GRID-No.2 INPUT	23 max.	watts
PLATE DISSIPATION	250 max.	watts

Typical CCS Operation:

DC Plate Voltage	2500	3500	4000	volts
DC Grid-No.2 Voltage	500	500	500	volts
DC Grid-No.1 (Control-Grid) Voltage	-84	-90	-100	volts
Peak RF Grid-No.1 Voltage	66	61	55.5	volts
DC Plate Current	150	125	94	ma
DC Grid-No.2 Current	0	0	0	ma
DC Grid-No.1 Current (Approx.)	0	0	0	ma
Driving Power (Approx.)★	0.75	0.25	0.06	watt
Power Output (Approx.)	125	125	126	watts

PLATE-MODULATED RF POWER AMPLIFIER — Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum CCS● Ratings, *Absolute Values:*

DC PLATE VOLTAGE	3200 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	600 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-500 max.	volts
DC PLATE CURRENT	275 max.	ma
DC GRID-No.1 CURRENT	20 max.	ma
PLATE INPUT	825 max.	watts
GRID-No.2 INPUT	35 max.	watts
PLATE DISSIPATION	165 max.	watts

Typical CCS Operation:

DC Plate Voltage	2500	3000	volts
DC Grid-No.2 Voltage†	400	400	volts
DC Grid-No.1 Voltage	-200	-310	volts
Peak AF Grid-No.2 Voltage (For 100% modulation)	350	350	volts
Peak RF Grid-No.1 Voltage	326	484	volts
DC Plate Current	200	225	ma
DC Grid-No.2 Current	30	30	ma
DC Grid-No.1 Current (Approx.)	9	9	ma
Driving Power (Approx.)	3	4.4	watts
Power Output (Approx.)	375	510	watts

♦,●,*,□,▲,⊕,**,oo,★,†: See next page.

ELECTRON TUBE DIVISION
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6156/4-250A

BEAM POWER TUBE

RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy♦
and
RF POWER AMPLIFIER — Class C FM Telephony

Maximum CCS● Ratings, *Absolute Values:*

DC PLATE VOLTAGE	4000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	600 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-500 max.	volts
DC PLATE CURRENT	350 max.	ma
DC GRID-No.1 CURRENT	20 max.	ma
PLATE INPUT	1250 max.	watts
GRID-No.2 INPUT	35 max.	watts
PLATE DISSIPATION	250 max.	watts

Typical CCS Operation:

DC Plate Voltage	2500	3000	4000	volts
DC Grid-No.2 Voltage	500	500	500	volts
DC Grid-No.1 Voltage	-150	-180	-225	volts
Peak RF Grid-No.1 Voltage	264	327	374	volts
DC Plate Current	300	345	312	ma
DC Grid-No.2 Current	60	60	45	ma
DC Grid-No.1 Current (Approx.)	9	10	9	ma
Driving Power (Approx.)	2.4	3.3	3.4	watts
Power Output (Approx.)	575	800	1000	watts

♦ Subscript 1 indicates that grid-No.1 current does not flow during any part of the input cycle.

● Continuous Commercial Service.

* Averaged over any audio-frequency cycle of sine-wave form.

□ Obtained from a fixed supply.

▲ Total effective grid-No.1-circuit resistance should not exceed 0.25 megohm.

⊕ Subscript 2 indicates that grid-No.1 current flows during some part of input cycle.

** Obtained from fixed supply having a dc resistance not exceeding 250 ohms.

○○ Driver stage should be capable of supplying the No.1 grids of the class AB_2 stage with the specified driving power at low distortion. The effective resistance per grid-No.1 circuit of the AB_2 stage should be held at a low value.

★ At crest of audio-frequency cycle with modulation factor of 1.0.

† Obtained preferably from a separate source modulated along with the plate supply, or from the modulated plate supply through a series resistor.

♦ Key-down conditions per tube without amplitude modulation. Amplitude modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

6156/4-250A

BEAM POWER TUBE

MAXIMUM RATINGS vs OPERATING FREQUENCY				
FREQUENCY	75	100	120	Mc
MAX.-PERMISSIBLE PERCENTAGE OF MAX.-RATED PLATE VOLTAGE AND PLATE INPUT:				
Class B telephony	100	80	60	%
Class C telephony	100	80	60	%
Class C telegraphy	100	80	60	%

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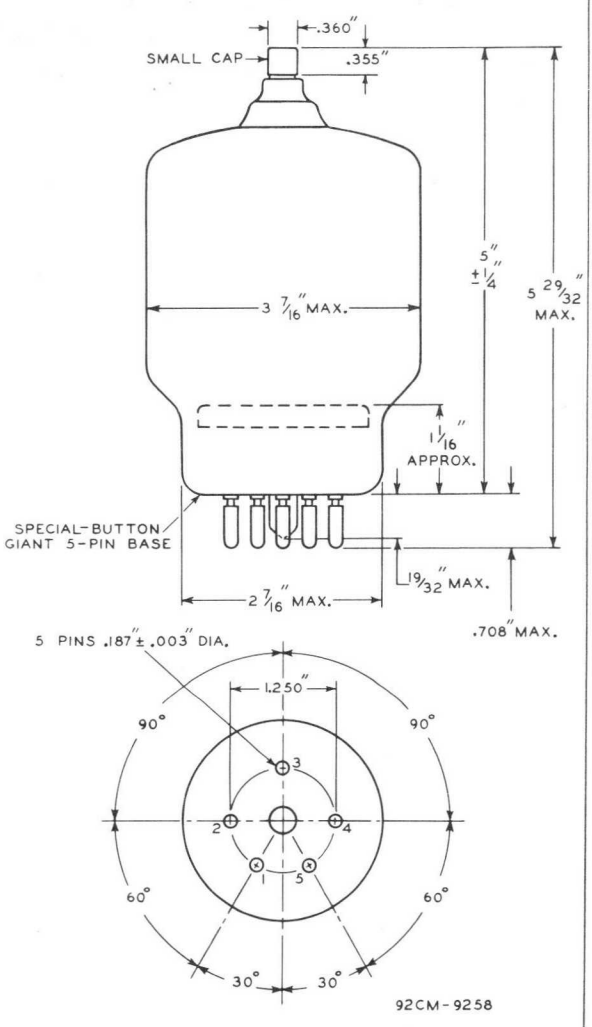
6156/4-250A

BEAM POWER TUBE



ELECTRON TUBE DIVISION
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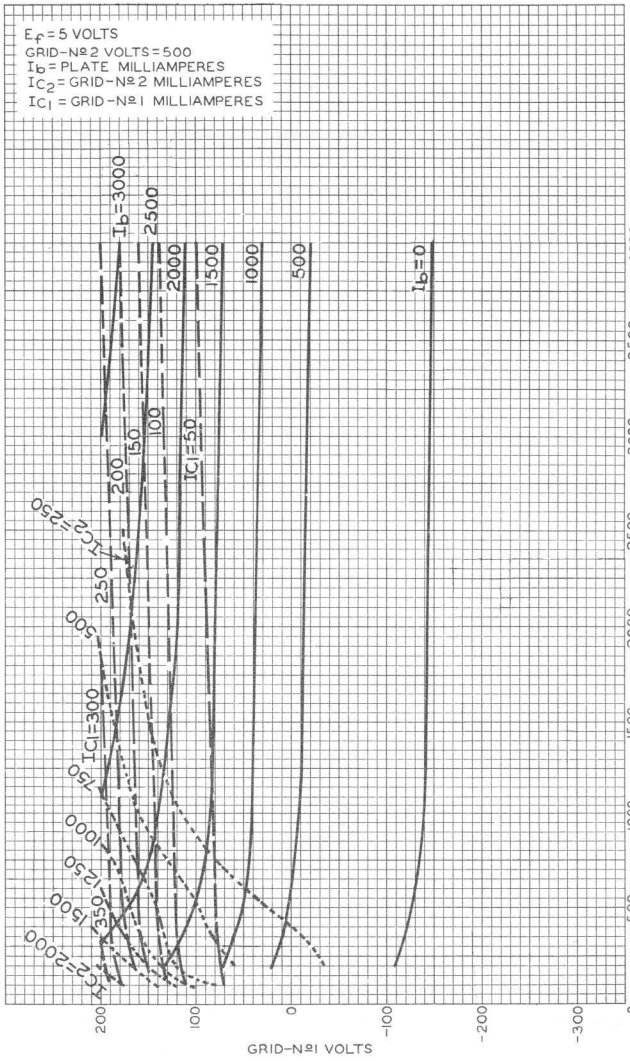
RCA

6156/4-250A

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



Beam Power Tube

HIGH POWER SENSITIVITY

90 WATTS CW INPUT (ICAS) UP TO 60 Mc
60 WATTS CW INPUT (ICAS) AT 175 Mc

The 6159 is the same as the 6146 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	26.5 ± 10%	volts
Current at heater volts = 26.5	0.3	amp

CHARACTERISTICS RANGE VALUES

	Note	*Min.*	*Max.*	
Heater Current	1	0.280	0.320	amp

Note 1: With 26.5 volts ac on heater.

6166

VHF POWER TETRODE

FORCED-AIR COOLED

GENERAL DATA

Electrical:

Filament, Thoriated Tungsten:		
Voltage*	5.0 ± 5%	ac or dc volts
Current at 5 volts	181	amp
Minimum heating time	15	sec
Cold Resistance	0.0038	ohm
Mu Factor, Grid No.2 to Grid No.1 for plate volts = 2000, grid-No.2 volts = 1000, and plate amperes = 2	10	
Direct Interelectrode Capacitances:		
Grid No.1 to plate**	0.6 max.	μμf
Grid No.1 to filament	42	μμf
Plate to filament**	0.08 max.	μμf
Grid No.1 to grid No.2	60	μμf
Grid No.2 to plate	24	μμf

Mechanical:

Operating Position	Vertical, filament end up or down
Maximum Overall Length	11-5/8"
Maximum Diameter	6-13/32"
Weight (Approx.)	15 lbs
Radiator	Integral part of tube

Terminal Connections *(See Dimensional Outline)*:

G_1 – Grid No.1

G_2 – Grid No.2



P – Plate

F – Filament

Air Flow:

Through Radiator--The specified flow of incoming air at a temperature of 45 °C for various plate dissipations, as indicated in the following tabulation, should be delivered by a blower through the radiator before and during the application of any voltages. The air should enter the radiator at its plate-contact-surface end *(See Dimensional Outline)*. Filament power, plate power, and air flow may be removed simultaneously.

Percentage of maximum rated plate dissipation for each class of service	100	80	60	%
Minimum air flow	350	270	200	cfm
Static pressure	3	2.1	1.3	in. of water

* Full rated filament voltage can be applied safely to the cold filament. It is not necessary to provide means for limiting the filament starting current.

**: See next page.

← Indicates a change.

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

6166

VHF POWER TETRODE

To Grid-No.2 Terminal:		
Plate-ring end	§§	
Grid-No.1-terminal end	50 min.	cfm
To Grid-No.1 Terminal and Filament Seals	50 min.	cfm
Incoming-Air Temperature	45 max.	°C
Radiator Temperature (Measured on the core at end away from incoming air)	180 max.	°C
Glass Temperature (At hottest part)	180 max.	°C
Seal Temperature:		
Filament, grid No.1, grid No.2, and plate	180 max.	°C

Fittings:

Filament Connector (2 required)	RCA-216F1
Connector Wrench (2 required)	RCA-212F1

RF POWER AMPLIFIER -- Class B Television Service

Synchronizing-level conditions per tube unless otherwise specified

(Voltages are referred to cathode unless otherwise speicfied)

Maximum CCS● Ratings, *Absolute Values:*

	54 to 216 Mc		
DC PLATE VOLTAGE	6000§	max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	2000	max.	volts
DC PLATE CURRENT	4	max.	amp
PLATE INPUT	22000§	max.	watts
GRID-No.2 INPUT	400	max.	watts
PLATE DISSIPATION	10000	max.	watts
GRID-No.1 (CONTROL-GRID) DISSIPATION	300	max.	watts

Typical Operation in Grid-Drive Circuit:

	Bandwidth▲ of 8.5 Mc	
DC Plate Voltage	5800	volts
DC Grid-No.2 Voltage	1200	volts
DC Grid-No.1 Voltage	-130	volts
Peak RF Grid-No.1 Voltage:		
Synchronizing level	375	volts
Pedestal level	290	volts
DC Plate Current:		
Synchronizing level	3.45	amp
Pedestal level	2.60	amp

** With external flat metal shield 12" square having center hole 4-5/16" diameter. Shield is located in plane of the grid-No.2 terminal, perpendicular to the tube axis, and is connected to grid No.2.

§§ A sufficient quantity of the air flow to the radiator should be directed onto the plate end of the grid-No.2 terminal so that its temperature does not exceed the specified value.

§ For operation on VHF television channels 2 through 6, dc plate voltage may be increased to 6400 volts maximum and plate input may be increased to 24,000 watts maximum provided all other ratings are met.

●,▲: See next page.

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VHF POWER TETRODE

DC Grid-No.2 Current (Pedestal Level).	0.207	amp
DC Grid-No.1 Current (Approx.):		
Synchronizing level.	0.175	amp
Pedestal level	0.085	amp
Driver Power Output (Approx.):♦		
Synchronizing level.	800#	watts
Pedestal level	450	watts
Power Output (Approx.):		
Synchronizing level.	12000	watts
Pedestal level	6800	watts

Typical Operation in Cathode-Drive Circuit:

	Bandwidth▲ of 8.5 Mc	
DC Plate Voltage	5800	volts
DC Grid-No.2 Voltage	800	volts
DC Cathode-to-Grid-No.1 Voltage. . . .	85	volts
Peak RF Cathode-to-Grid-No.1 Voltage:		
Synchronizing level.	330	volts
Pedestal level	260	volts
DC Plate Current:		
Synchronizing level.	3.45	amp
Pedestal level	2.60	amp
DC Grid-No.2 Current (Pedestal Level).	0.152	amp
DC Grid-No.1 Current (Approx.):		
Synchronizing level.	0.202	amp
Pedestal level	0.110	amp
Driver Power Output (Approx.):♣		
Synchronizing level.	1300##	watts
Pedestal level	700	watts
Power Output (Approx.):		
Synchronizing level.	12000	watts
Pedestal level	6800	watts

GRID-MODULATED RF POWER AMPLIFIER -- Class C Television Service

Synchronizing-level conditions per tube unless otherwise specified

Maximum CCS● Ratings, *Absolute Values:*

	54 to 216 Mc	
DC PLATE VOLTAGE	6000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE . .	2000 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE (White Level).	-1000 max.	volts
DC PLATE CURRENT	4 max.	amp
PLATE INPUT.	22000 max.	watts

♣ The driver stage is required to supply tube losses, rf-circuit losses, and rf power added to plate circuit. The driver stage should be designed as indicated under (♦).

This value includes 300 watts of rf-circuit loss at 216 Mc, and 900 watts added to plate circuit.

●,▲,♦,#: See next page. ← Indicates a change.

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VHF POWER TETRODE

GRID-No.2 INPUT	400 max.	watts
PLATE DISSIPATION	10000 max.	watts
GRID-No.1 DISSIPATION	300 max.	watts

Typical Operation in Grid-Drive Circuit:

	Bandwidth▲ of 8.5 Mc	
DC Plate Voltage	5800	volts
DC Grid-No.2 Voltage	1200	volts
DC Grid-No.1 Voltage:		
Synchronizing level	-130	volts
Pedestal level	-195	volts
White level	-350	volts
Peak RF Grid-No.1 Voltage	375	volts
DC Plate Current:		
Synchronizing level	3.45	amp
Pedestal level	2.42	amp
DC Grid-No.2 Current (Pedestal Level)	0.148	amp
→ DC Grid-No.1 Current (Approx.):		
Synchronizing level	0.175	amp
Pedestal level	0.095	amp
Driver Power Output (Approx.):♦		
Synchronizing level	800#	watts
Power Output (Approx.):		
Synchronizing level	12000	watts
Pedestal level	6800	watts

PLATE-MODULATED RF POWER AMPLIFIER -- Class C Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1.0

Maximum CCS● Ratings, *Absolute Values:*†

DC PLATE VOLTAGE	5000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	2000 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-1000 max.	volts
DC PLATE CURRENT	2 max.	amp
DC GRID-No.1 CURRENT	0.6 max.	amp
PLATE INPUT	10000 max.	watts
GRID-No.2 INPUT	270 max.	watts
PLATE DISSIPATION	6600 max.	watts

Typical Operation in Grid-Drive Circuit:

	Up to 30 Mc	
DC Plate Voltage	4700	volts
DC Grid-No.2 Voltage (Modulated 100%)♦	800	volts
DC Grid-No.1 Voltage★	-280	volts
Peak RF Grid-No.1 Voltage	485	volts
DC Plate Current	1.56	amp

▲ Computed between half-power points and based on tube output capacitance only.

This value includes 700 watts of rf-circuit loss at 216 Mc.

●,♦,†,♣,★: See next page. → Indicates a change.

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VHF POWER TETRODE

DC Grid-No.2 Current	0.217	amp
DC Grid-No.1 Current (Approx.)	0.150	amp ←
Driver Power Output (Approx.)	180⊕	watts
Power Output (Approx.)	5500	watts

RF POWER AMPLIFIER & OSCILLATOR -- Class C Telegraphy□
and
RF POWER AMPLIFIER -- Class C FM Telephony

Maximum CCS● Ratings, *Absolute Values:*†

DC PLATE VOLTAGE	6600 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	2000 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-1000 max.	volts
DC PLATE CURRENT	2.75 max.	amp
DC GRID-No.1 CURRENT	0.6 max.	amp
PLATE INPUT	18000 max.	watts
GRID-No.2 INPUT	400 max.	watts
PLATE DISSIPATION	10000 max.	watts

Typical Operation in Grid-Drive Circuit:

		At 216 Mc	
DC Plate Voltage	5800	5800	volts
DC Grid-No.2 Voltage●●	1200	1200	volts
DC Grid-No.1 Voltage▲▲	-130	-175	volts
Peak RF Grid-No.1 Voltage	230	370	volts
DC Plate Current	1.8	2.6	amp
DC Grid-No.2 Current	0.1	0.267	amp
DC Grid-No.1 Current (Approx.)	0.05	0.110	amp ←
Driver Power Output (Approx.)♦	300■	750⊕	watts
Power Output (Approx.)	6000	9000	watts

● Continuous Commercial Service.

♦ The driver stage is required to supply tube losses and rf-circuit losses. The driver stage should be designed to provide an excess of power above the indicated value to take care of variations in line voltage, in components, in initial tube characteristics, and in tube characteristics during life.

† These ratings hold for operation up to 30 Mc; for ratings at higher frequencies, see Maximum Ratings vs Frequency Table.

♦ Obtained preferably from a separate source.

★ Obtained preferably from a combination of 365-ohm grid-No.1 resistor and -170-volt fixed bias.

⊕ This value includes 50 watts of rf-circuit loss at 30 Mc.

□ Key-down conditions per tube without amplitude modulation. Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

●● Obtained preferably from a separate source, or from the plate-supply voltage with a voltage divider, or through a series resistor. A series grid-No.2 resistor should not be used if the 6166 or a preceding stage is keyed. In this case, the regulation of the source should be sufficient to prevent the grid-No.2 voltage from rising above 2000 volts under key-up conditions; and additional fixed grid-No.1 bias must be provided to limit the plate current.

▲▲ Obtained from fixed supply, by grid-No.1 resistor, by cathode resistor, or by combination methods.

■ This value includes 270 watts of rf-circuit loss.

⊕ This value includes 675 watts of rf-circuit loss.

← Indicates a change.

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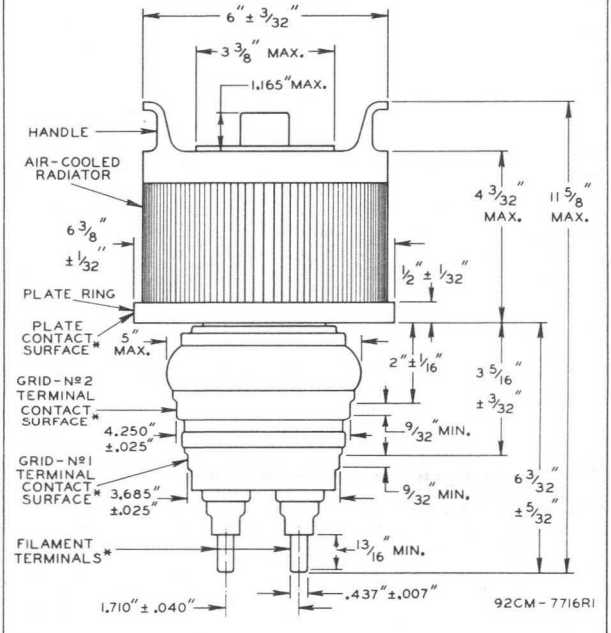
VHF POWER TETRODE

MAXIMUM RATINGS vs OPERATING FREQUENCY

FREQUENCY	30	220	Mc
MAX. PERMISSIBLE PERCENTAGE OF MAX. RATED PLATE VOLTAGE AND PLATE INPUT:			
Class B Television Service	Full Ratings—54 to 216 Mc		
Class C Television Service	Full Ratings—54 to 216 Mc		
Class C Telephony, Plate-Modulated	100	90	%
Class C Telegraphy and FM Telephony	100	90	%



* WITH THE CYLINDRICAL SURFACES OF THE PLATE RING, GRID-No.2 TERMINAL, GRID-No.1 TERMINAL, AND FILAMENT TERMINALS CLEAN, SMOOTH, AND FREE OF BURRS, THE TUBE WILL ENTER A GAUGE AS SHOWN IN SKETCH G_1. PROPER ENTRY OF THE TUBE IN THE GAUGE IS OBTAINED WHEN THE PLATE RING IS ENTIRELY ENGAGED BY HOLE H_1.

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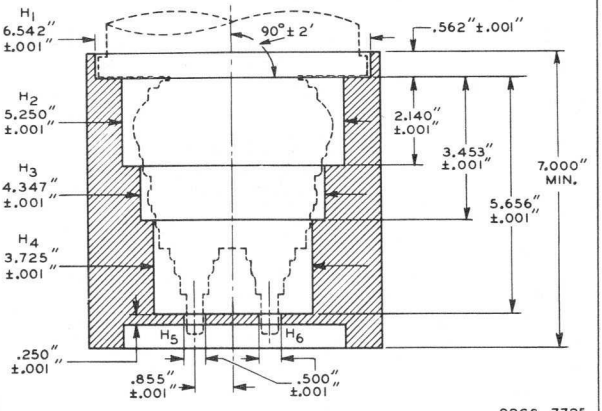
VHF POWER TETRODE

SKETCH G_1



92CS-7725

THE FOUR CYLINDRICAL HOLES H_1, H_2, H_3, AND H_4 HAVE AXES COINCIDENT WITHIN 0.001". THE HOLES H_5 AND H_6 HAVE AXES PARALLEL TO THE AXES OF H_1, H_2, H_3, AND H_4, WITHIN $0^{\circ} \pm 2'$.

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RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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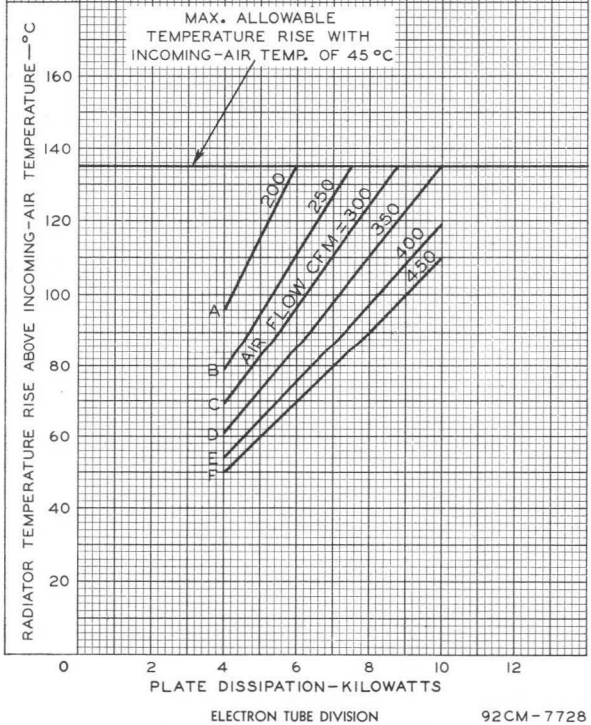
COOLING REQUIREMENTS

E_f = 5.0 VOLTS AC
MAXIMUM RADIATOR TEMPERATURE = 180 °C

CURVE	PRESSURE DROP—INCHES OF WATER
A	1.3
B	1.8
C	2.4
D	3.0
E	3.7
F	4.5

CURVES TAKEN ACCORDING TO NAFM* STANDARDS — BULLETIN Nº 103

*NATIONAL ASSOCIATION OF FAN MFGS., GENERAL MOTORS BLDG., DETROIT, MICH.



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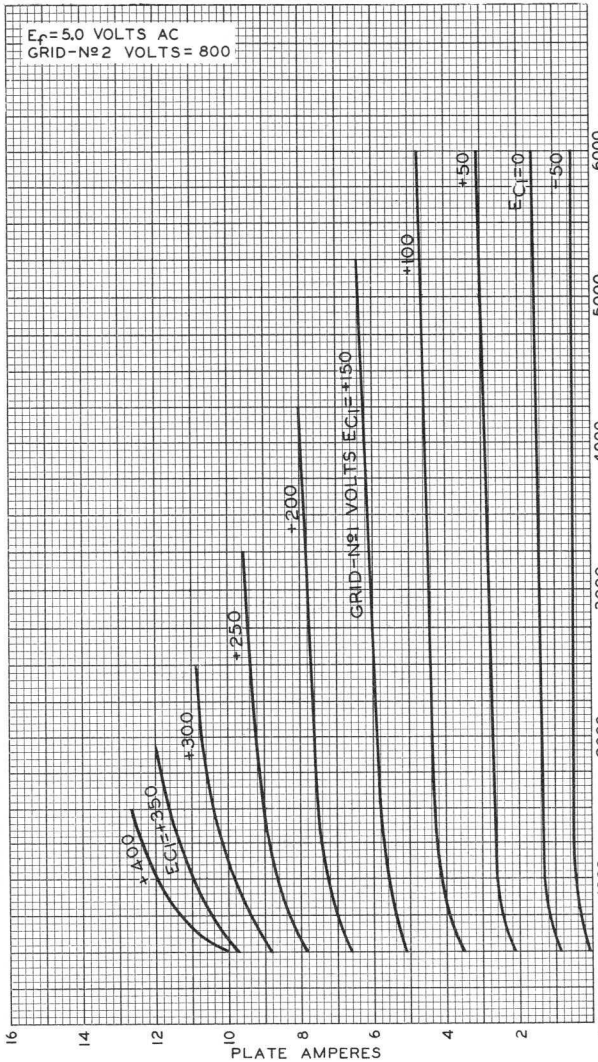
AVERAGE PLATE CHARACTERISTICS



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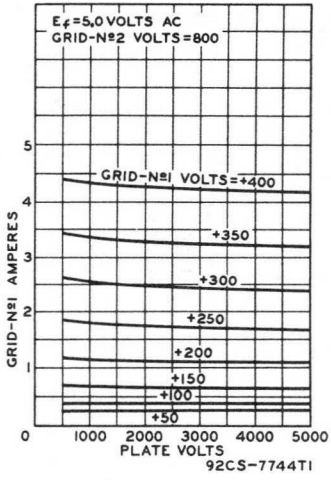
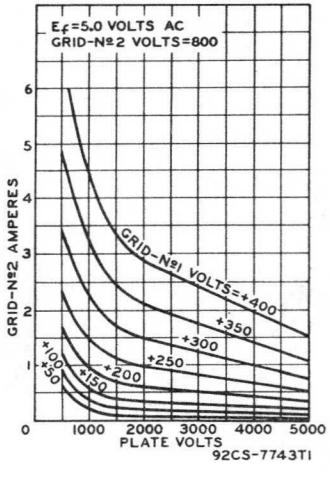
AVERAGE CHARACTERISTICS





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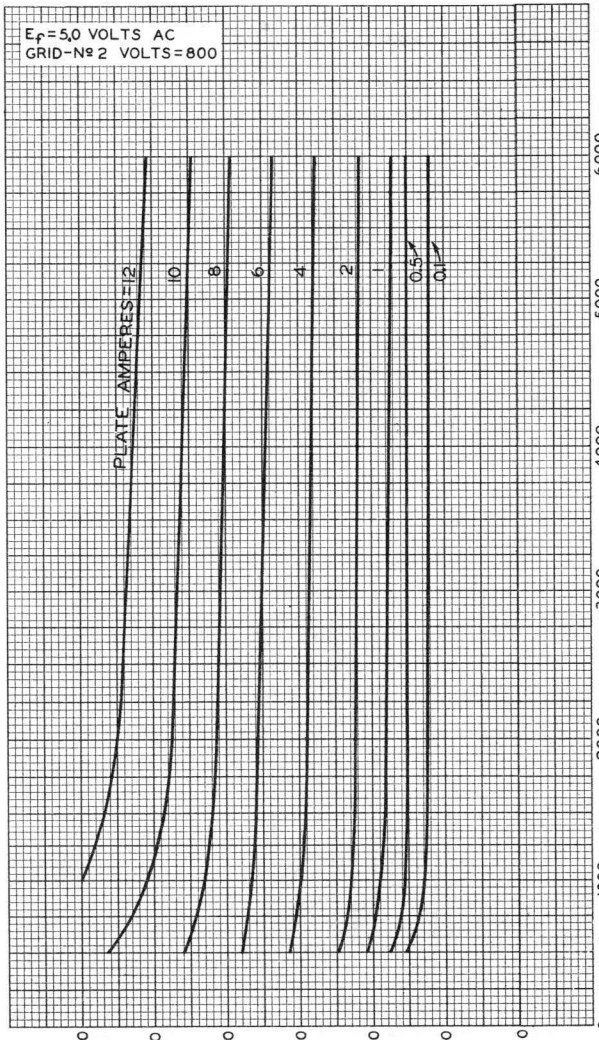
AVERAGE CONSTANT-CURRENT CHARACTERISTICS



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AVERAGE CONSTANT-CURRENT CHARACTERISTICS



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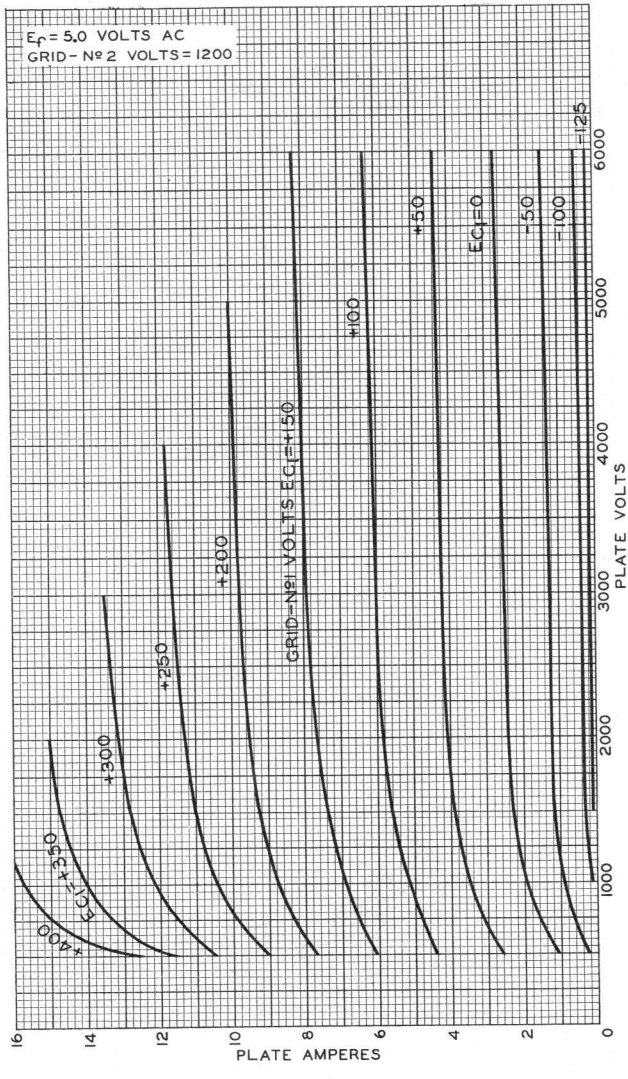
AVERAGE PLATE CHARACTERISTICS



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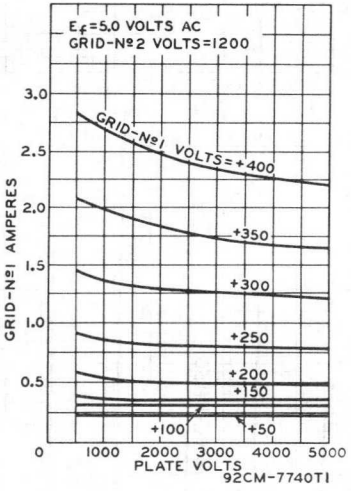
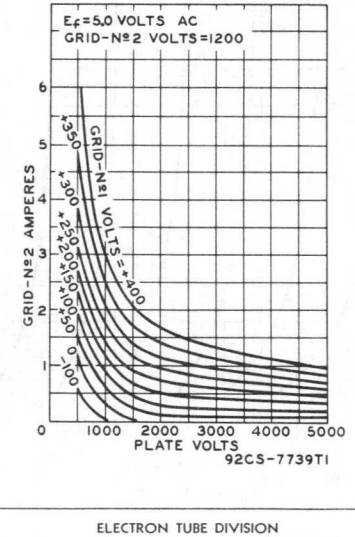
AVERAGE CHARACTERISTICS





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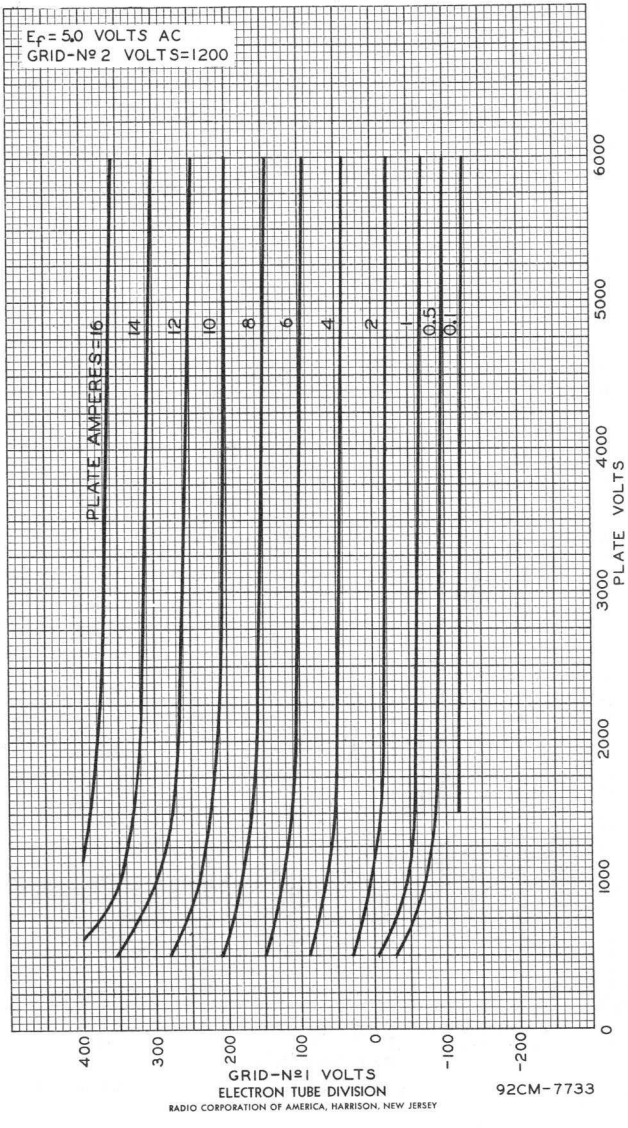
AVERAGE CONSTANT-CURRENT CHARACTERISTICS



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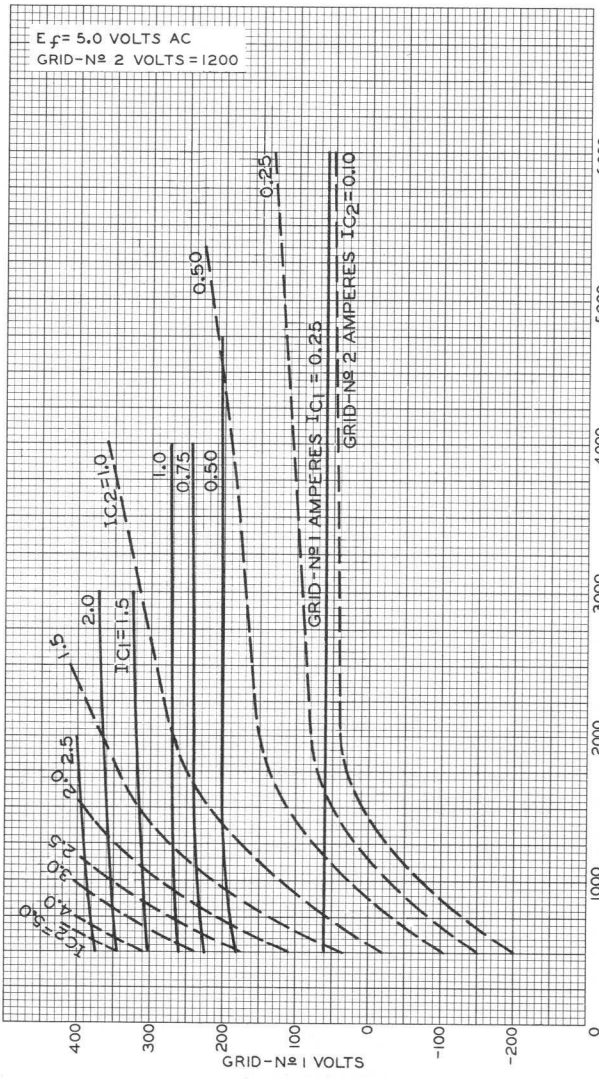
AVERAGE CONSTANT-CURRENT CHARACTERISTICS



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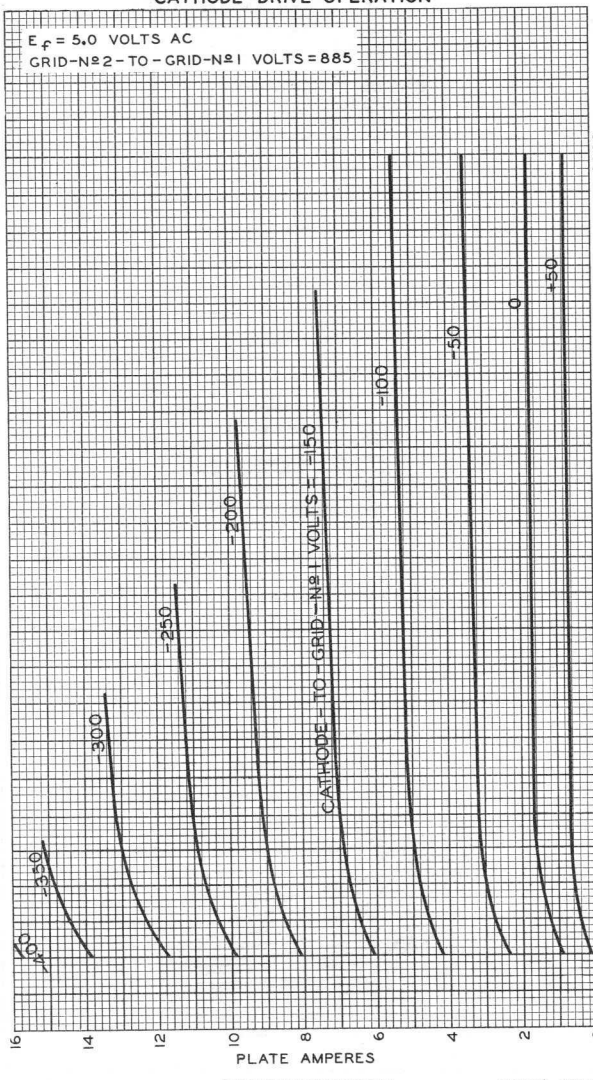
AVERAGE PLATE CHARACTERISTICS

CATHODE-DRIVE OPERATION



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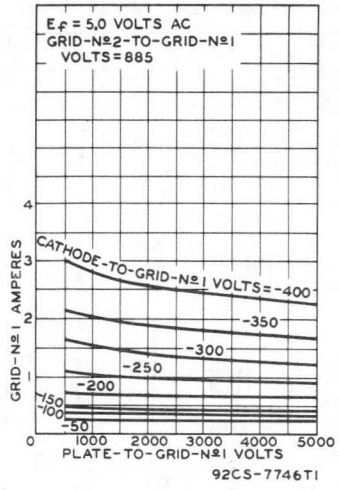
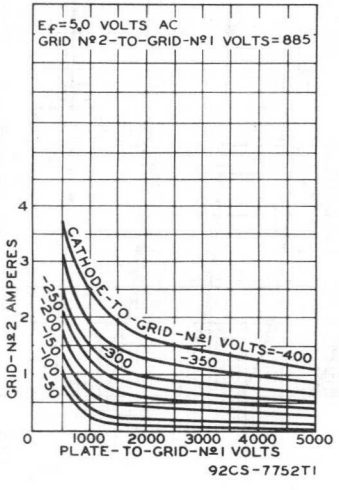
AVERAGE CHARACTERISTICS
CATHODE-DRIVE OPERATION





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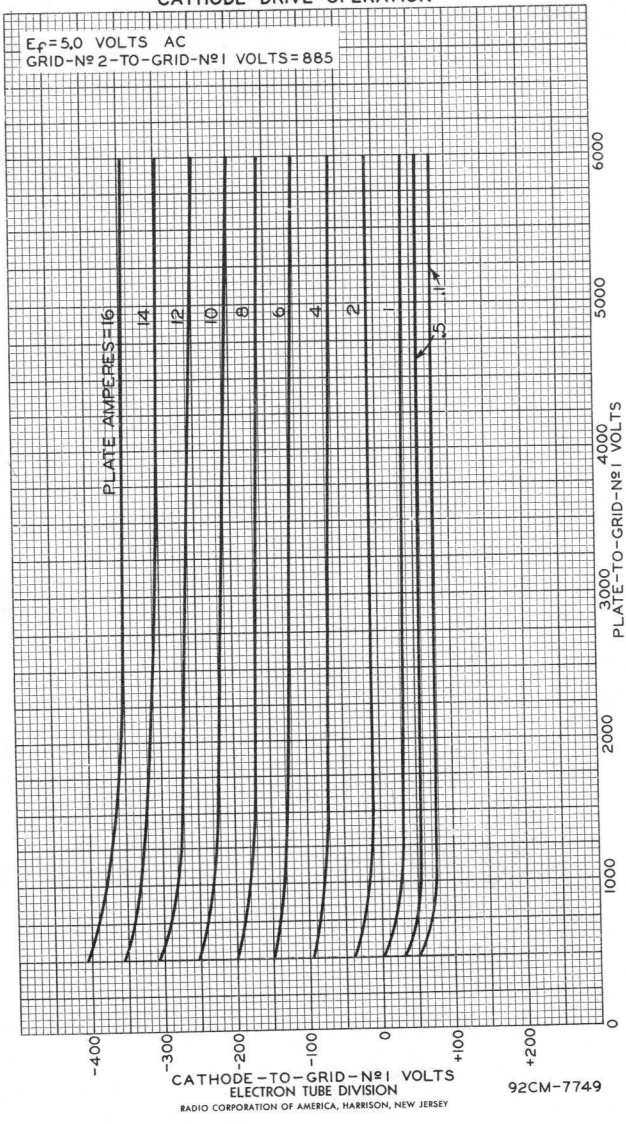
AVERAGE CONSTANT-CURRENT CHARACTERISTICS

CATHODE-DRIVE OPERATION



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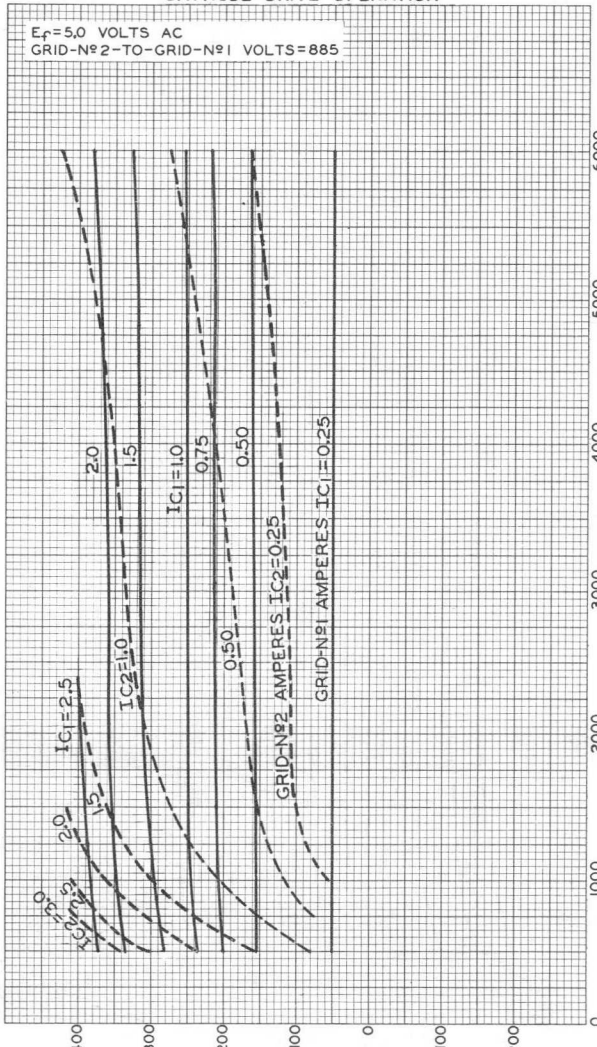
AVERAGE CONSTANT-CURRENT CHARACTERISTICS

CATHODE-DRIVE OPERATION



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BEAM POWER TUBE

FORCED-AIR COOLED

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage*	120 max.	ac or dc volts ←
Current at 120 volts	1.6	amp
Minimum heating time at 117 volts	5	minutes ←
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 1000, grid-No.2 volts = 400, and plate amperes = 1	7	←
Direct Interelectrode Capacitances:		←
Grid No.1 to plate**	0.40 max.	μμf
Grid No.1 to cathode & heater	46	μμf
Plate to cathode & heater**,***	0.10 max.	μμf
Grid No.1 to grid No.2	50	μμf
Grid No.2 to plate	22	μμf
Grid No.2 to cathode & heater***	4.4 max.	μμf

Mechanical:

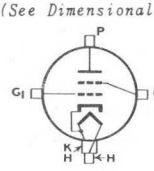
Mounting Position	Vertical, cathode end up or down
Maximum Overall Length	~~7-1/4"~~ ←
Greatest Diameter	5" ± 1/32"
Weight (Approx.)	5 lbs ←
Radiator	Integral part of tube

Terminal Connections *(See Dimensional Outline)*:

G_1 – Grid No.1

G_2 – Grid No.2

H – Heater



K – Cathode

P – Plate

Air Flow:

Through Radiator--The specified flow of incoming air for various plate dissipations, as indicated in the following tabulation, should be delivered by a blower through the radiator in either direction before and during the application of any voltages. In this tabulation, the flow and pressure values are for condition with radiator-temperature rise held constant at 135 °C above incoming-air temperature. Under any condition, the air flow must be ade-

* Because the cathode is subjected to considerable back bombardment as the frequency is increased, with resultant increase in temperature, the heater voltage should be reduced depending on operating conditions and frequency to prevent overheating the cathode and resultant short life.

** With external flat metal shield having a diameter of 8" and center hole approximately 3-7/16" in diameter. Shield is located in plane of the grid-No.2 terminal, perpendicular to the tube axis, and is connected to grid-No.2 terminal.

*** Same as (**) except that center hole has diameter of approximately 3", and shield is connected to grid-No.1 terminal.

← Indicates a change.

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BEAM POWER TUBE

quate to limit the temperature of the radiator to its specified maximum value. Heater power, plate power, and air flow may be removed simultaneously.

Percentage of maximum rated plate dissipation for each class of service	100	75	50	%
Minimum air flow	75	50	30	cfm
Static pressure	0.56	0.25	0.10	in. of water

To Grid-No.2 Terminal--A sufficient quantity of air should be delivered to this terminal so that its temperature does not exceed the specified maximum value.

To Grid-No.1 Terminal, Cathode Terminal, and Heater Pin--An air flow of about 20 cfm from a 1"-diameter nozzle at a distance of 1/2" from the heater pin should be directed onto the cathode terminal and heater pin, and then over the grid-No.1 terminal. The quantity of air should be sufficient so that the temperature of the cathode, heater, and grid-No.1 seals does not exceed the specified maximum value.

Radiator Temperature (Measured on core at end adjacent to plate-terminal flange)	180 max.	°C
Seal and Terminal Temperature: Cathode, heater, grid No.1, grid No.2, and plate	180 max.	°C

RF POWER AMPLIFIER--Class B Television Service

Synchronizing-level conditions per tube unless otherwise specified

Maximum CCS● Ratings, *Absolute Values:*

DC PLATE VOLTAGE	2000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	500 max.	volts
DC PLATE CURRENT	1.75 max.	amp
DC GRID-No.1 (CONTROL-GRID) CURRENT	0.2 max.	amp
PLATE INPUT	3500 max.	watts
GRID-No.2 INPUT	40 max.	watts
PLATE DISSIPATION	2000 max.	watts

Typical Operation in Cathode-Drive Circuit at 900 Mc:

	Bandwidth▲ of 8 Mc	
Air Flow Through Radiator:		
Minimum, with incoming air at 45 °C.	*60*	*cfm*
Static pressure	*0.36*	*in. of water*
DC Plate-to-Grid-No.1 Voltage	1875	volts
DC Grid-No.2-to-Grid-No.1 Voltage	550	volts
DC Cathode-to-Grid-No.1 Voltage	75	volts
Peak RF Cathode-to-Grid-No.1 Voltage:		
Synchronizing level	120	volts
Pedestal level	90	volts

●,▲: See next page.

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BEAM POWER TUBE

DC Plate Current:		
Synchronizing level	1.7	amp
Pedestal level	1.3	amp
DC Grid-No.2 Current (Pedestal Level)	-0.025	amp
DC Grid-No.1 Current (Approx.):		
Synchronizing level	0.075	amp
Pedestal level	0.020	amp
Driver Power Output (Approx.):♣		
Synchronizing level	200	watts
Pedestal level	115	watts
Output-Circuit Efficiency (Approx.)	75	%
Useful Power Output (Approx.):		
Synchronzing level	1200●●	watts
Pedestal level	675●●	watts

BIAS-MODULATED RF POWER AMPLIFIER--Class C Television Service

Synchronizing-level conditions per tube unless otherwise specified

Maximum CCS● Ratings, *Absolute Values:*

DC PLATE VOLTAGE	2000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	500 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE (White Level)	-300 max.	volts
DC PLATE CURRENT	1.75 max.	amp
DC GRID-No.1 CURRENT	0.2 max.	amp
PLATE INPUT	3500 max.	watts
GRID-No.2 INPUT	40 max.	watts
PLATE DISSIPATION	2000 max.	watts

Typical Grid-Bias-Modulated Operation in Cathode-Drive Circuit at 900 Mc:

Bandwidth▲ of 8 Mc

Air Flow Through Radiator:		
Minimum, with incoming air at 45 °C	*60*	*cfm*
Static pressure	*0.36*	*in. of water*
DC Plate-to-Grid-No.1 Voltage	1875	volts
DC Grid-No.2-to-Grid-No.1 Voltage	550	volts
DC Cathode-to-Grid-No.1 Voltage:		
Synchronizing level	75	volts
Pedestal level	105	volts
White level	230	volts
Peak RF Cathode-to-Grid-No.1 Voltage	120	volts
DC Plate Current:		
Synchronizing level	1.7	amp
Pedestal level	1.2	amp
DC Grid-No.2 Current (Pedestal Level)	-0.025	amp
DC Grid-No.1 Current (Approx.):		
Synchronizing level	0.075	amp
Pedestal level	0.020	amp

●,▲,♣,●●: See next page.

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BEAM POWER TUBE

Driver Power Output (Approx.):*		
Synchronizing level	200	watts
Output-Circuit Efficiency (Approx.)	75	%
Useful Power Output (Approx.):		
Synchronizing level	1200●●	watts
Pedestal level	675●●	watts

Typical Cathode-Bias-Modulated Operation in Cathode-Drive Circuit at 900 Mc:

Bandwidth▲ of 8 Mc

Air Flow Through Radiator:		
Minimum, with incoming air at 45 °C.	*60*	*cfm*
Static pressure	*0.36 in. of water*	
DC Plate-to-Grid-No.1 Voltage	1875	volts
DC Grid-No.2-to-Grid-No.1 Voltage	550	volts
DC Cathode-to-Grid-No.1 Voltage:		
Synchronizing level	75	volts
Pedestal level	105	volts
White level	210	volts
Peak RF Cathode-to-Grid No.1 Voltage	120	volts
DC Plate Current:		
Synchronizing level	1.7	amp
Pedestal level	1.2	amp
DC Grid-No.2 Current (Pedestal Level)	-0.025	amp
DC Grid-No.1 Current (Approx.):		
Synchronizing level	0.075	amp
Pedestal level	0.020	amp
Driver Power Output (Approx.):*		
Synchronizing level	200	watts
Output-Circuit Efficiency (Approx.)	75	%
Useful Power Output (Approx.):		
Synchronizing level	1200●●	watts
Pedestal level	675●●	watts

PLATE-MODULATED RF POWER AMPLIFIER--Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum CCS● Ratings, *Absolute Values:*

DC PLATE VOLTAGE	1600 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	400 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-300 max.	volts
DC PLATE CURRENT	1.05 max.	amp
DC GRID-No.1 CURRENT	0.2 max.	amp
PLATE INPUT	1650 max.	watts
GRID-No.2 INPUT	25 max.	watts
PLATE DISSIPATION	1300 max.	watts

▲ Measured between half-power points.

●,*,●●: See next page.

6181

BEAM POWER TUBE

Typical Operation in Cathode-Drive Circuit at 400 Mc:

Air Flow Through Radiator:		
Minimum, with incoming air at 45 °C	*40*	*cfm*
Static pressure	*0.16*	*in. of water*
DC Plate-to-Grid-No.1 Voltage	1775	volts
DC Grid-No.2-to-Grid-No.1 Voltage	550	volts
DC Cathode-to-Grid-No.1 Voltage	175	volts
Peak RF Cathode-to-Grid-No.1 Voltage	210	volts
DC Plate Current	1	amp
DC Grid-No.2 Current	0.065	amp
DC Grid-No.1 Current (Approx.)	0.045	amp
Driver Power Output (Approx.)♣#	250	watts
Output-Circuit Efficiency (Approx.)	90	%
Useful Power Output (Approx.)	950●●	watts

RF POWER AMPLIFIER & OSCILLATOR--Class C Telegraphy□
and
RF POWER AMPLIFIER--Class C FM Telephony

Maximum CCS● Ratings, *Absolute Values:*

DC PLATE VOLTAGE	2000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	500 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-300 max.	volts
DC PLATE CURRENT	1.25 max.	amp
DC GRID-No.1 CURRENT	0.2 max.	amp
PLATE INPUT	2500 max.	watts
GRID-No.2 INPUT	40 max.	watts
PLATE DISSIPATION	2000 max.	watts

Typical Operation in FM Service with Cathode-Drive Circuit at 900 Mc:

Air Flow Through Radiator:		
Minimum, with incoming air at 45 °C	*30*	*cfm*
Static pressure	*0.09*	*in. of water*
DC Plate-to-Grid-No.1 Voltage	1910	volts
DC Grid-No.2-to-Grid-No.1 Voltage†	550	volts
DC Cathode-to-Grid-No.1 Voltage††	110	volts
Peak RF Cathode-to-Grid-No.1 Voltage	120	volts
DC Plate Current	0.9	amp
DC Grid-No.2 Current	0.05	amp
DC Grid-No.1 Current (Approx.)	0.015	amp
Driver Power Output (Approx.)♣	150	watts
Output-Circuit Efficiency (Approx.)	70	%
Useful Power Output (Approx.)	600●●	watts

● Continuous Commercial Service.

♣ The driver stage is required to supply tube losses, rf-circuit losses, and rf power added to the plate input. The driver stage should be designed to provide an excess of power above the indicated value to take care of variations in line voltage, in components, in initial tube characteristics, and in tube characteristics during life.

●●,#,□,†,††: See next page.

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

RCA

6181

BEAM POWER TUBE

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.		
Heater Current	1	1.5	1.7		amp
Direct Interelectrode Capacitances:					
Grid No.1 to plate**	–	–	0.40	✓	μμf
Grid No.1 to cathode & heater	–	42.5	49.5		μμf
Plate to cathode & heater**,***	–	–	0.10	✓	μμf
Grid No.1 to grid No.2	–	47	57		μμf
Grid No.2 to plate	–	20.5	24.5		μμf
Grid No.2 to cathode & heater***	–	–	4.4	✓	μμf
Mu-Factor, Grid No.2 to Grid-No.1	1,2	2.5	11.5		
Grid-No.1 Voltage	1,3	-50	-140		volts
Peak Cathode Current	1,4	12	–		amp

Note 1: With 120 volts ac on heater.

Note 2: With dc plate volts = 1000; dc grid-No.2 volts = 400; and dc grid-No.1 voltage adjusted to produce a dc plate current of 1.0 ampere.

Note 3: With dc plate volts = 1750; dc grid-No.2 volts = 500; and dc grid-No.1 voltage adjusted to produce a dc plate current of 0.1 ampere.

Note 4: Designers should limit the maximum usable cathode current (Plate current plus grid-No.2 current plus grid-No.1 current) to this value under any condition of operation.

** With external flat metal shield having a diameter of 8" and center hole approximately 3-7/16" in diameter. Shield is located in plane of the grid-No.2 terminal, perpendicular to the tube axis, and is connected to grid-No.2 terminal.

*** Same as (**) except that center hole has diameter of approximately 3", and shield is connected to grid-No.1 terminal.

In cathode-drive, plate-modulated, class C rf power amplifier service, the 6181 can be modulated 100% if the rf driver stage is also modulated 100% simultaneously. Care should be taken to insure that the driver-modulation and amplifier-modulation voltages are exactly in phase.

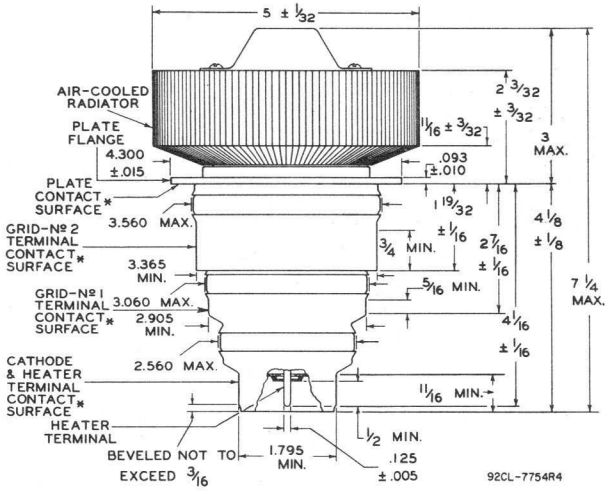
●● This value of useful power is measured at load of output circuit having indicated efficiency.

□ Key-down conditions per tube without amplitude modulation. Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

† Obtained preferably from a separate source, or from the plate-supply voltage with a voltage divider, or through a series resistor. A series grid-No.2 resistor should not be used if the 6181 or a preceding stage is keyed. In this case, the regulation of the source should be sufficient to prevent the grid-No.2 voltage from rising above 500 volts under key-up conditions; and additional fixed grid-No.1 bias must be provided to limit the plate current.

†† Obtained from fixed supply, by grid-No.1 resistor, by cathode resistor, or by combination methods.

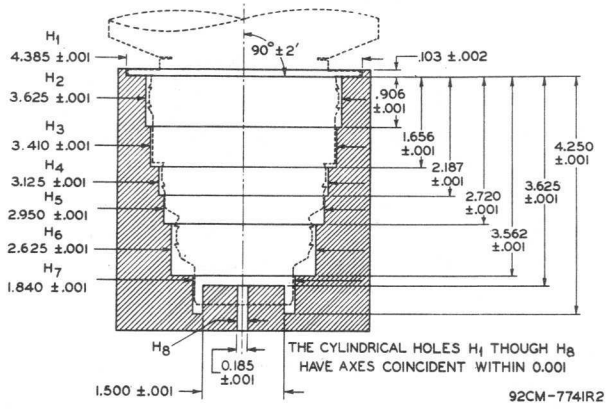
→ Indicates a change.



ALL DIMENSIONS IN INCHES

* WITH THE CYLINDRICAL SURFACES OF THE PLATE FLANGE, GRID-No.2 TERMINAL, GRID-No.1 TERMINAL, CATHODE TERMINAL, AND HEATER-PIN TERMINAL CLEAN, SMOOTH, AND FREE OF BURRS, THE TUBE WILL ENTER A GAUGE AS SHOWN IN SKETCH G_1. PROPER ENTRY OF THE TUBE IN THE GAUGE IS OBTAINED WHEN THE PLATE FLANGE IS SEATED ON THE SHOULDER BETWEEN HOLES H_1 AND H_2. SEATING IS DETERMINED BY FAILURE OF A .010" THICKNESS GAUGE 1/8" WIDE TO ENTER MORE THAN 1/16" BETWEEN SHOULDER SURFACE AND PLATE FLANGE. SLOTS ARE PROVIDED TO PERMIT THIS MEASUREMENT TO BE MADE.

SKETCH G_1

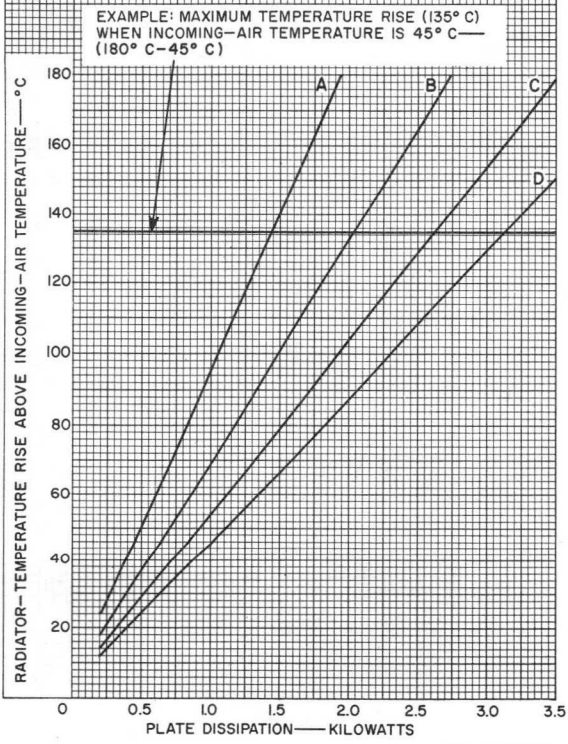


ALL DIMENSIONS IN INCHES

COOLING REQUIREMENTS

E_f=120 VOLTS
MAXIMUM RADIATOR TEMPERATURE=180° C

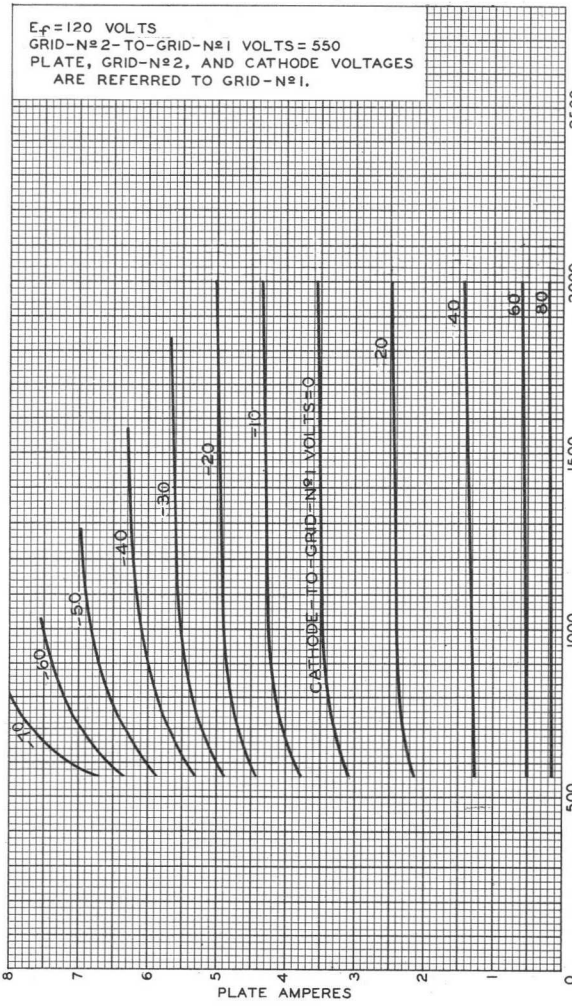
CURVE	AIR FLOW CFM	APPROX. PRESSURE DROP ACROSS RADIATOR INCHES OF WATER
A	50	0.25
B	75	0.56
C	100	1.00
D	125	1.55



92CM-7767R2

6181

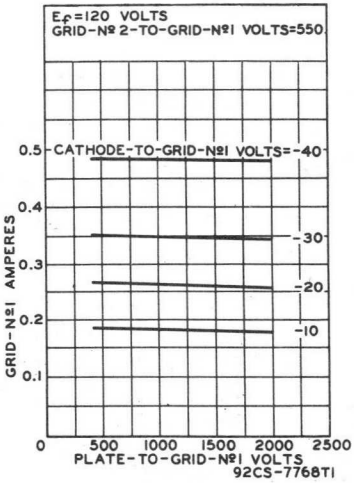
AVERAGE PLATE CHARACTERISTICS
Cathode-Drive Operation

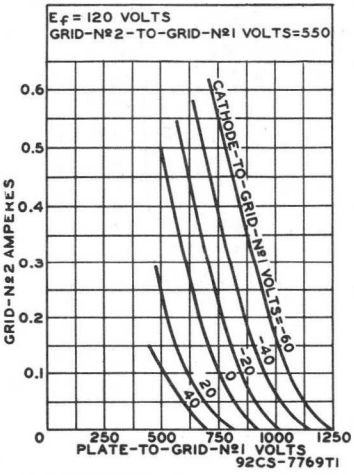


92CM-7766RI

RADIO CORPORATION OF AMERICA
Electron Tube Division Harrison, N. J.

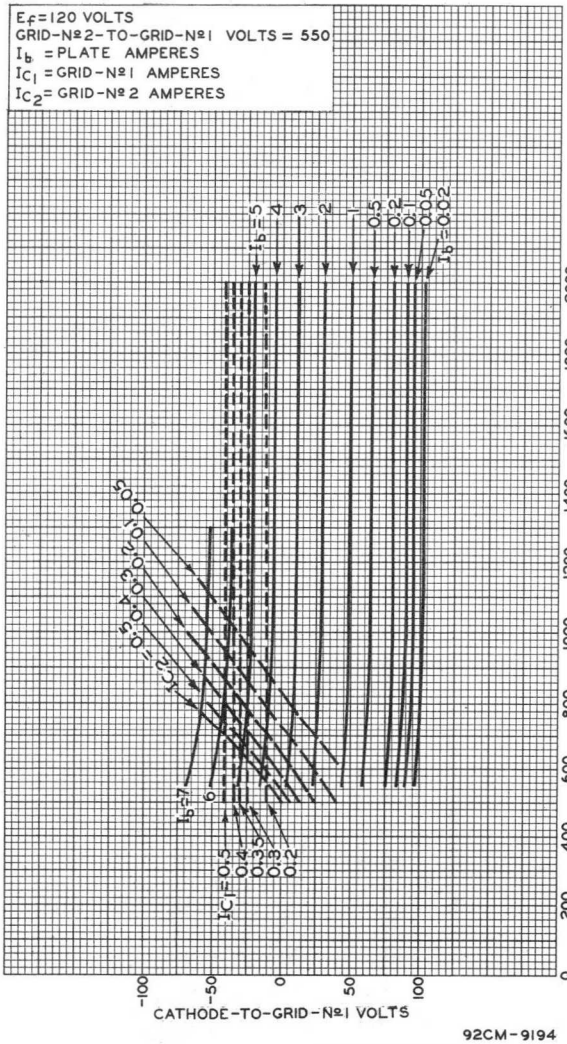
AVERAGE CHARACTERISTICS
Cathode-Drive Operation





6181

AVERAGE CONSTANT-CURRENT CHARACTERISTICS
Cathode-Drive Operation



92CM-9194

RADIO CORPORATION OF AMERICA
Electron Tube Division Harrison, N. J.

6198
VIDICON

600-LINE RESOLUTION

For use in industrial applications

DATA

General:

Heater, for Unipotential Cathode:
- Voltage. . . . . 6.3 ± 10% . . . ac or dc volts
- Current. . . . . 0.6 . . . . . .amp

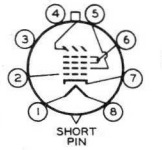
Direct Interelectrode Capacitance:▲
- Target (Signal Electrode) to all other electrodes . . . . . 4.5 μμf

Spectral Response. . . . . *See Curves*

Photoconductive Layer:
- Maximum useful diagonal of rectangular image (4 x 3 aspect ratio) . . . . . 0.62"
- Orientation of quality rectangle—Proper orientation is obtained when the horizontal scan is essentially parallel to the plane passing through the tube axis and short index pin.

Focusing Method. . . . . Magnetic
Deflection Method. . . . . Magnetic
Overall Length . . . . . 6.25" ± 0.25"
Greatest Diameter (Excluding side tip) . . . 1.125" ± 0.010"
Maximum Radius (Including side tip). . . . . 0.805"
Weight (Approx.) . . . . . 2 oz ←
Operating Position . . . .Approx. horizontal, or faceplate up ←
Bulb T8
Base Connector . . . . . Cinch No.54A18088, or equivalent ←
Base . . . . . Small-Button Ditetrar 8-Pin (JETEC No.E8-11)
- Basing Designation for BOTTOM VIEW . . . . . 8HM ←

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Internal Connection— Do Not Use
Pin 4 – Same as Pin 3
Pin 5 – Grid No.2
Pin 6 – Grid No.4, Grid No.3



DIRECTION OF LIGHT: INTO FACE END OF TUBE

Pin 7 – Cathode
Pin 8 – Heater
Flange – Target (Signal Electrode)
Short Index Pin – Same as Pin 3

Maximum Ratings, *Absolute Values:*

TARGET (SIGNAL-ELECTRODE) VOLTAGE.	100 max.	volts ←
GRID-No.4 & GRID-No.3 VOLTAGE.	350 max.	volts
GRID-No.2 VOLTAGE.	350 max.	volts
GRID-No.1 VOLTAGE:		
Negative-bias value.	125 max.	volts
Positive-bias value.	0 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode.	125 max.	volts
Heater positive with respect to cathode.	10 max.	volts

▲ See next page.

← Indicates a change.

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

6198
VIDICON

FACEPLATE:		
Illumination	1000 max.	ft-c
Temperature	60 max.	°C

Typical Operation and Characteristics:

For scanned area of 1/2" x 3/8"

Faceplate Illumination (Highlight)	10 to 20	ft-c
Target (Signal-Electrode) Voltage	10 to 70	volts
Grid-No.4 (Decelerator) & Grid-No.3 (Beam-Focus) Voltage	250●● to 300	volts
Grid-No.2 (Accelerator) Voltage	300	volts
Grid-No.1 Voltage for picture cutoff♦	−45 to −100	volts
Highlight Signal-Output Current#	0.1 to 0.2	μa
Maximum Dark Current	0.02	μa
Uniform 2870° K Tungsten Illumination on Tube Face to Produce Signal-Output Current of 0.1 to 0.2 μa	3 to 10	ft-c
Average "Gamma" of Transfer Characteristic for Signal-Output Current between 0.02 and 0.2 μa	0.65	
Visual Equivalent Signal-to-Noise Ratio (Approx.)*	300:1	
Minimum Peak-to-Peak Blanking Voltage:		
When applied to grid No.1	40	volts
When applied to cathode	10	volts
Field Strength at Center of Focusing Device	40	gauss
Field Strength of Adjustable Alignment Coil	0 to 4	gauss

\# Defined as the component of the target current after the dark-current component has been subtracted.

●● Definition, focus uniformity, and picture quality decrease with decreasing grid-No.3 and grid-No.4 voltage. In general, grid No.3 and grid No.4 should not be operated below 250 volts.

♦ With no blanking voltage on grid No.1.

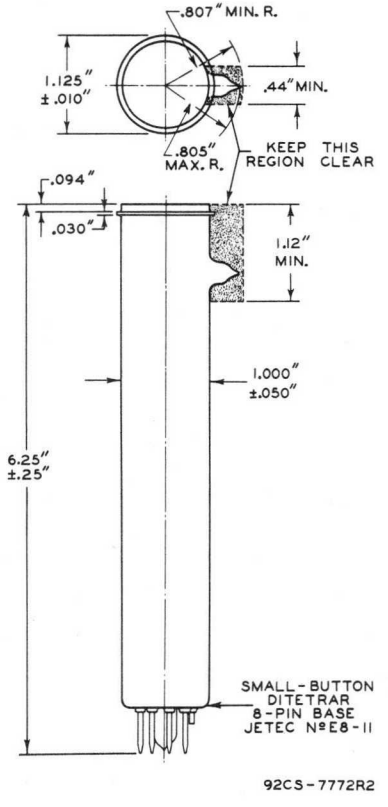
* Measured with a high-gain, low-noise, cascode-input-type amplifier having bandwidth of 5 Mc.

▲ This capacitance, which effectively is the output impedance of the 6198, is increased when the tube is mounted in the deflecting-yoke and focusing-coil assembly. The resistive component of the output impedance is in the order of 100 megohms.

→ Indicates a change.

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

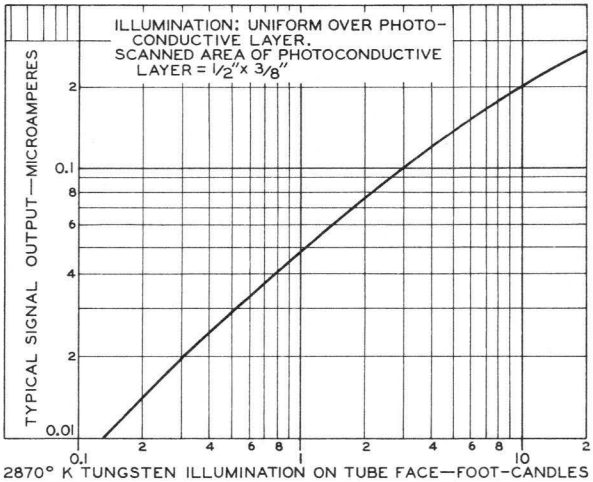
6198
VIDICON



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

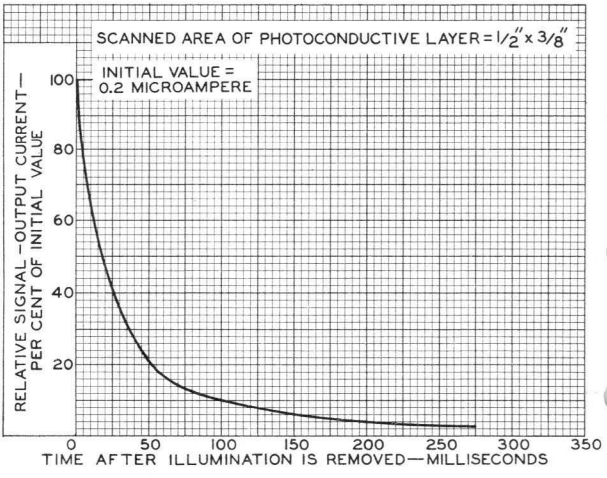
6198

TYPICAL SIGNAL OUTPUT



92CS-7820RI

PERSISTENCE CHARACTERISTIC



RCA

6198

SPECTRAL-SENSITIVITY CHARACTERISTICS

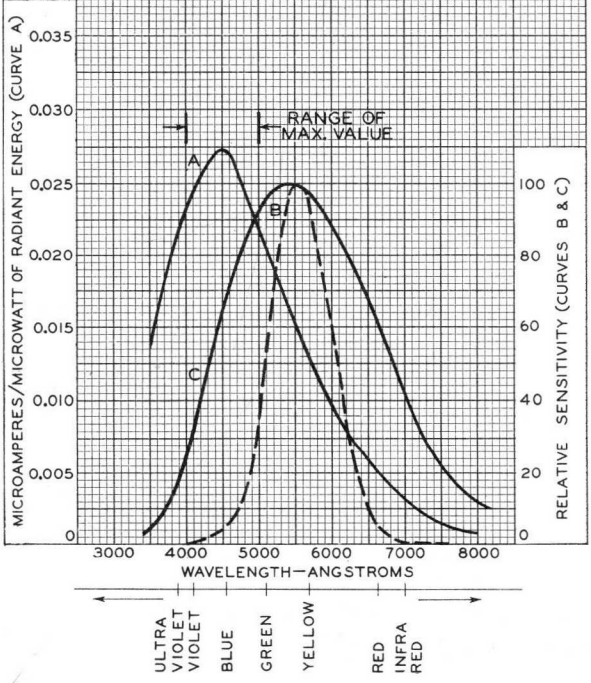
CURVE A: FOR EQUAL VALUES OF SIGNAL-OUTPUT CURRENT AT ALL WAVELENGTHS.

SIGNAL-OUTPUT MICROAMPERES FROM SCANNED AREA OF $\frac{1}{2}$" x $\frac{3}{8}$" = 0.02

DARK CURRENT (MICROAMPERES) = 0.02

CURVE B: SPECTRAL CHARACTERISTIC OF AVERAGE HUMAN EYE.

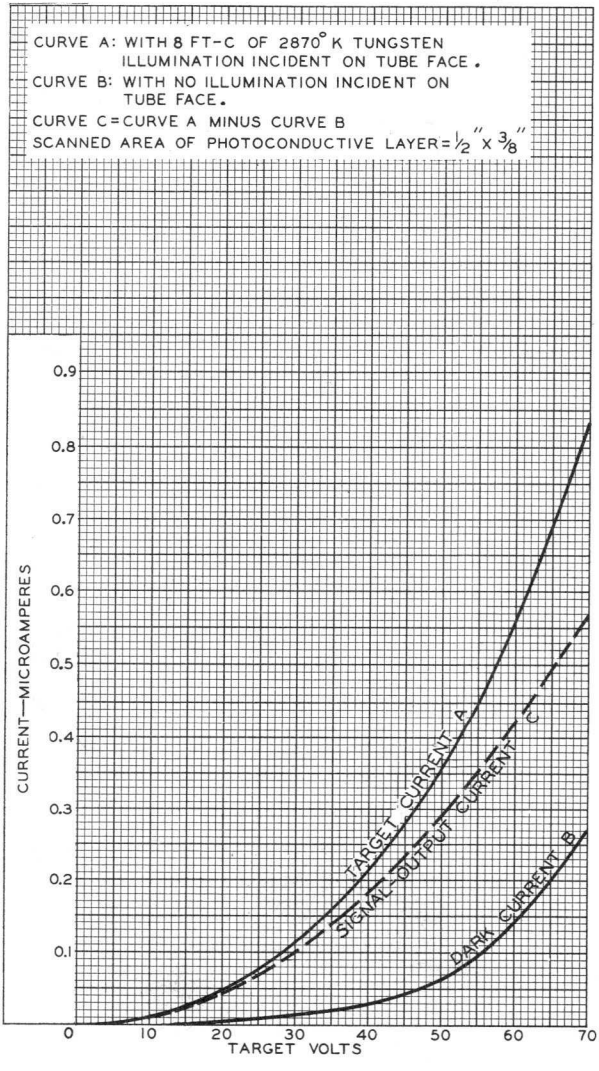
CURVE C: FOR EQUAL VALUES OF SIGNAL-OUTPUT CURRENT WITH RADIANT FLUX FROM TUNGSTEN SOURCE AT 2870° K.



RCA

6198

TYPICAL CHARACTERISTICS



6263

UHF MEDIUM-MU TRIODE

"PENCIL TYPE" WITH EXTERNAL PLATE RADIATOR

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC):		
Under Transmitting Conditions	6.0 ± 10%	volts
Under Standby Conditions	6.3 max.	volts
Current at 6.0 Volts	0.280	amp
Amplification Factor	27	
Transconductance, for dc plate current of 27 milliamperes and dc plate voltage of 200 volts	7000	μmhos

Direct Interelectrode Capacitances:

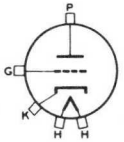
	With External Shield▲	*Without External Shield*	
Grid to Plate	1.5	1.7	μμf
Grid to Cathode	–	2.9	μμf
Plate to Cathode	–	0.08 max.	μμf

Mechanical:

Terminal Connections:

H: Heater

K: Cathode Cylinder (Adjacent to heater lead terminals)



G: Grid Flange (Between glass sections)

P: Plate Cylinder (With integral radiator)

Mounting Position . . . . . Any

Dimensions and Terminal Connections . . . . . See Dimensional Outline

Radiator . . . . . Integral part of tube

Cooling:

In many applications, the 6263 does not require forced-air cooling. The radiator in combination with a connector having adequate heat conduction capability will generally provide adequate cooling under conditions of free circulation of air. The cooling must be sufficient to limit the plate-seal temperature to 175°C. When conditions do not provide adequate circulation of air, provision should be made to direct a blast of cooling air from a small blower through the radiator fins. The quantity of air should be sufficient to limit the plate-seal temperature to 175°C. See curves.

Incoming Air Temperature	40 max.	°C
Plate-Seal Temperature (Measured on Plate Seal).	175 max.	°C
Weight (Approx.).	24 grams (0.85 oz)	
Socket for Heater Leads . .	Cinch No.54A16325, or equivalent	

▲ A flat plate shield 1-1/4" diameter located parallel to the plane of the grid flange and midway between the grid flange and the radiator plate terminal. The shield is tied to the cathode.

6263

6263

UHF MEDIUM-MU TRIODE

RF POWER AMPLIFIER & OSCILLATOR - Class C Telegraphy

*Key-down conditions per tube without amplitude modulation**

	CCS#	ICAS##	
Maximum Ratings, *Absolute Values:*			
*For Pressures down to 46 mm of Hg***			
DC PLATE VOLTAGE	330 max.	400 max.	volts
DC GRID VOLTAGE	-100 max.	-100 max.	volts
DC PLATE CURRENT	40 max.	55 max.	ma
DC GRID CURRENT	25 max.	25 max.	ma
DC CATHODE CURRENT	55 max.	70 max.	ma
PLATE INPUT	13 max.	22 max.	watts
PLATE DISSIPATION	8 max.	13 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	90 max.	90 max.	volts
Heater positive with respect to cathode	90 max.	90 max.	volts
Typical Operation as Oscillator in Cathode-Drive Circuit at 500 Mc:			
DC Plate Voltage	300	350	volts
DC Grid Voltage□	-30	-35	volts
DC Plate Current	35	40	ma
DC Grid Current (Approx.)	11	14	ma
Useful Power Output (Approx.)	5●	7●	watts
Typical Operation as RF Power Amplifier in Cathode-Drive Circuit at 500 Mc:			
DC Plate Voltage	300	350	volts
DC Grid Voltage□	-48	-58	volts
DC Plate Current	35	40	ma
DC Grid Current (Approx.)	13	15	ma
Driver Power Output (Approx.)	2.2	3	watts
Useful Power Output (Approx.)	7●	10●	watts
Maximum Circuit Values (CCS or ICAS Conditions):			
Grid-Circuit Resistance	0.1 max.		megohm

PLATE-MODULATED RF POWER AMPLIFIER - Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

	CCS#	ICAS##	
Maximum Ratings, *Absolute Values:*			
*For Pressures down to 46 mm of Hg***			
DC PLATE VOLTAGE	275 max.	300 max.	volts

* Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

#, ##, **, □, ●: See next page.

6263

UHF MEDIUM-MU TRIODE

DC GRID VOLTAGE	−100 max.	−100 max.	volts
DC PLATE CURRENT	33 max.	46 max.	ma
DC GRID CURRENT	25 max.	25 max.	ma
DC CATHODE CURRENT	50 max.	60 max.	ma
PLATE INPUT	9 max.	15 max.	watts
PLATE DISSIPATION	5.5 max.	9 max.	watts
PEAK HEATER–CATHODE VOLTAGE:			
Heater negative with respect to cathode	90 max.	90 max.	volts
Heater positive with respect to cathode	90 max.	90 max.	volts

Typical Operation in Cathode-Drive Circuit at 500 Mc:

DC Plate Voltage	275	320	volts
DC Grid Voltage□	−42	−52	volts
DC Plate Current	35	35	ma
DC Grid Current (Approx.)	13	12	ma
Driver Power Output (Approx.)	2	2.4	watts
Useful Power Output (Approx.)	6.7●	8●	watts

Maximum Circuit Values (CCS or ICAS Conditions):

Grid-Circuit Resistance	0.1 max.	megohm

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Heater Current	1	0.260	0.300	amp
Grid-to-Plate Capacitance	–	1.45	1.95	μμf
Grid-to-Cathode Capacitance	–	2.45	3.35	μμf
Plate-to-Cathode Capacitance	–	–	0.08	μμf
Plate Current	1,2	18	36	ma
Transconductance	1,2	5600	8400	μmhos
Useful Power Output	3,4	6.5	–	watts

Note 1: With 6.0 volts ac or dc on heater.

Note 2: With dc plate voltage of 200 volts, cathode resistor of 100 ± 1% ohms, and cathode bypass capacitor of 1000 μf.

Note 3: With 5.4 volts ac or dc on heater.

Note 4: With dc plate voltage of 350 volts, grid resistor adjusted to give a dc plate current of 50 milliamperes in a cavity-type oscillator operating at 500 megacycles per second and having an efficiency of about 75 per cent.

** Corresponds to altitude of about 60000 feet.

Continuous Commercial Service.

Intermittent Commercial and Amateur Service.

□ From a grid resistor, or from a suitable combination of grid resistor and fixed supply or grid resistor and cathode resistor.

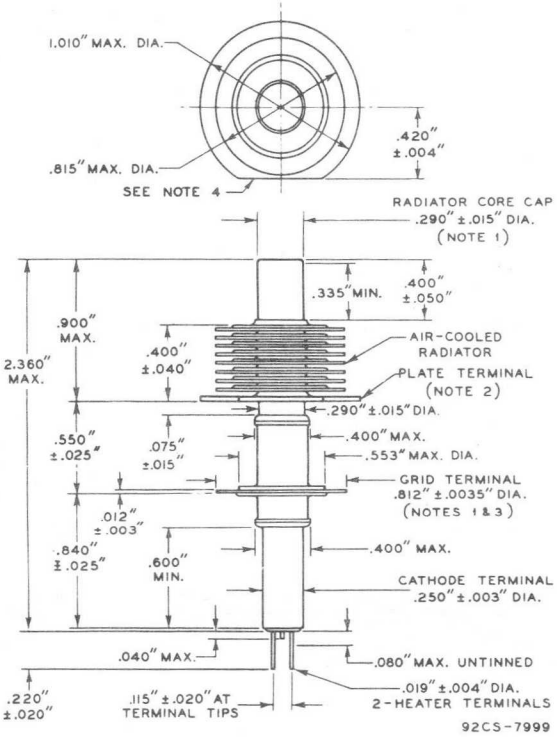
● This value of useful power is measured at load of output circuit having an efficiency of about 75 per cent.

6263

UHF MEDIUM-MU TRIODE

OPERATING FREQUENCY

The 6263 can be operated as an rf power amplifier and oscillator with full ratings at frequencies up to 500 megacycles per second and with reduced ratings at frequencies as high as 1700 megacycles per second.



NOTE 1: MAX. ECCENTRICITY OF ℄ (AXIS) OF RADIATOR-CORE CAP OR GRID-TERMINAL FLANGE WITH RESPECT TO THE ℄ (AXIS) OF THE CATHODE TERMINAL IS 0.015".

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6263

UHF MEDIUM-MU TRIODE

NOTE 2: TILT OF PLATE-TERMINAL FIN OF RADIATOR WITH RESPECT TO ROTATIONAL AXIS OF CATHODE CYLINDER IS DETERMINED BY CHUCKING THE CATHODE TERMINAL, ROTATING THE TUBE, AND GAUGING THE TOTAL TRAVEL DISTANCE OF THE PLATE-TERMINAL FIN PARALLEL TO THE AXIS AT A POINT APPROXIMATELY 0.020" INWARD FROM THE STRAIGHT EDGE OF THE PLATE-TERMINAL FIN FOR ONE COMPLETE ROTATION. THE TOTAL TRAVEL DISTANCE WILL NOT EXCEED 0.035".

NOTE 3: TILT OF GRID-TERMINAL FLANGE WITH RESPECT TO ROTATIONAL AXIS OF CATHODE TERMINAL IS DETERMINED BY CHUCKING THE CATHODE TERMINAL, ROTATING THE TUBE, AND GAUGING THE TOTAL TRAVEL DISTANCE OF THE GRID-TERMINAL FLANGE PARALLEL TO THE AXIS AT A POINT APPROXIMATELY 0.020" INWARD FROM ITS EDGE FOR ONE COMPLETE ROTATION. THE TOTAL TRAVEL DISTANCE WILL NOT EXCEED 0.025".

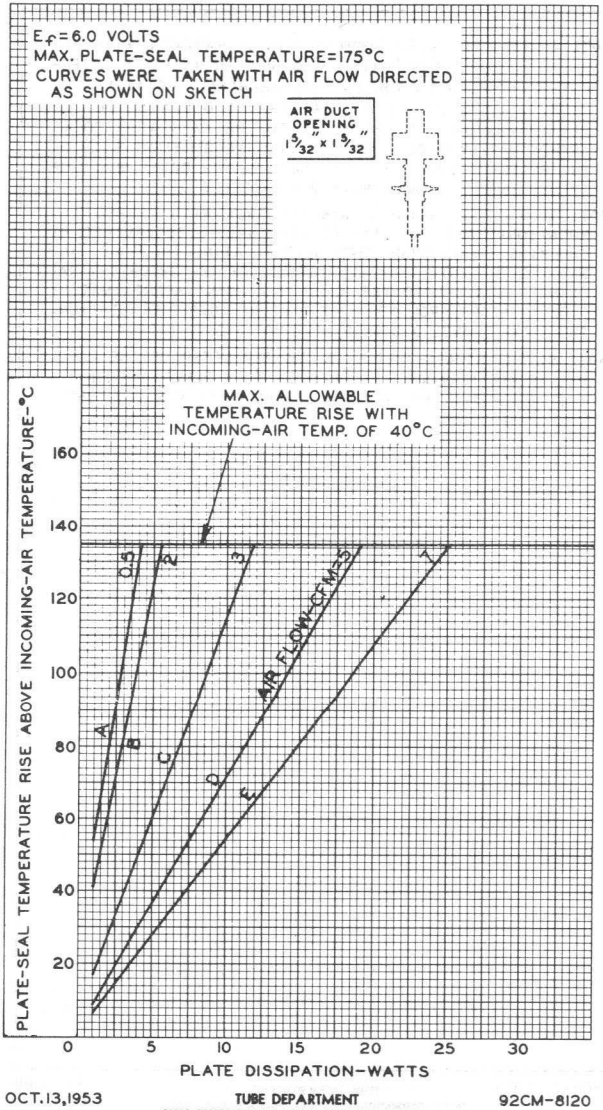
NOTE 4: THE STRAIGHT EDGE ON THE PERIMETER OF THE LARGE FIN (PLATE TERMINAL) IS PARALLEL TO A PLANE THROUGH THE CENTERS OF THE HEATER LEADS AT THEIR SEALS WITHIN 15°.

6263

RCA

6263

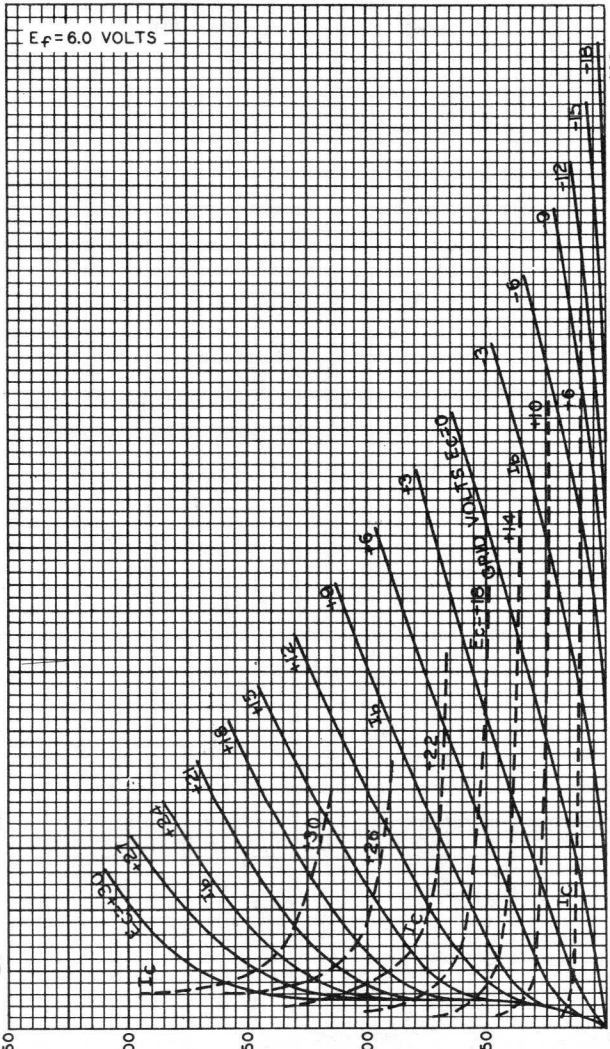
COOLING REQUIREMENTS



RCA

6263

AVERAGE PLATE CHARACTERISTICS



OCT. 7, 1953

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

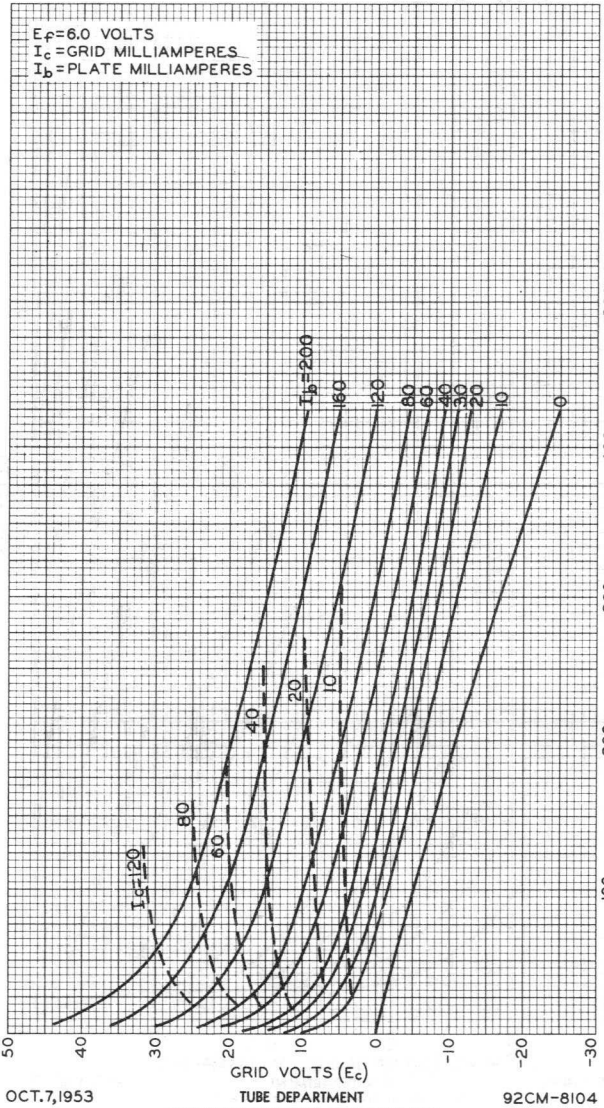
92CM-8103

6263

RCA

6263

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



OCT. 7, 1953

92CM-8104

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6264

UHF MEDIUM-MU TRIODE

"PENCIL TYPE" WITH EXTERNAL PLATE RADIATOR

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC):		
Under Transmitting Conditions	6.0 ± 10%	volts
Under Standby Conditions	6.3 max.	volts
Current at 6.0 volts	0.280	amp
Amplification Factor	40	
Transconductance, for dc plate current of 18.5 milliamperes and dc plate voltage of 200 volts	6800	μmhos

Direct Interelectrode Capacitances:

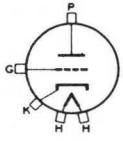
	With External Shield▲	*Without External Shield*	
Grid to Plate	1.5	1.75	μμf
Grid to Cathode	-	2.95	μμf
Plate to Cathode	-	0.07 max.	μμf

Mechanical:

Terminal Connections:

H: Heater

K: Cathode Cylinder (Adjacent to heater-lead terminals)



G: Grid Flange (Between glass sections)

P: Plate Cylinder (With integral radiator)

Mounting Position	Any
Dimensions and Terminal Connections	See Dimensional Outline
Radiator	Integral part of tube

Cooling:

In many applications, the 6264 does not require forced-air cooling. The radiator in combination with a connector having adequate heat conduction capability will generally provide adequate cooling under conditions of free circulation of air. The cooling must be sufficient to limit the plate-seal temperature to 175°C. When conditions do not provide adequate circulation of air, provision should be made to direct a blast of cooling air from a small blower through the radiator fins. The quantity of air should be sufficient to limit the plate-seal temperature to 175°C. See curves.

Incoming Air Temperature	40 max.	°C
Plate-Seal Temperature (Measured on Plate Seal)	175 max.	°C
Weight (Approx.)	24 grams (0.85 oz)	
Socket for Heater Leads . .	Cinch No.54A16325, or equivalent	

▲ A flat plate shield 1-1/4" diameter located parallel to the plane of the grid flange and midway between the grid flange and the radiator plate terminal. The shield is tied to the cathode.

RCA

6264

UHF MEDIUM-MU TRIODE

RF POWER AMPLIFIER AND OSCILLATOR--Class C Telegraphy

*Key-down conditions per tube without amplitude modulation**

	CCS#	ICAS##	
Maximum Ratings, *Absolute Values:*			
*For Pressures Down to 46 mm of Hg***			
DC PLATE VOLTAGE	330 max.	400 max.	volts
DC GRID VOLTAGE	-100 max.	-100 max.	volts
DC PLATE CURRENT	40 max.	50 max.	ma
DC GRID CURRENT	25 max.	25 max.	ma
DC CATHODE CURRENT	55 max.	70 max.	ma
PLATE INPUT	13 max.	22 max.	watts
PLATE DISSIPATION	8 max.	13 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	90 max.	90 max.	volts
Heater positive with respect to cathode	90 max.	90 max.	volts
Typical Operation as Oscillator in Cathode-Drive Circuit at 500 Mc:			
DC Plate Voltage	300	350	volts
DC Grid Voltage†	-25	-30	volts
DC Plate Current	35	35	ma
DC Grid Current (Approx.)	11	13	ma
Useful Power Output (Approx.)	5●	6●	watts
Typical Operation as RF Power Amplifier in Cathode-Drive Circuit at 500 Mc:			
DC Plate Voltage	300	350	volts
DC Grid Voltage†	-42	-45	volts
DC Plate Current	35	40	ma
DC Grid Current (Approx.)	13	15	ma
Driver Power Output (Approx.)	2.4	3	watts
Useful Power Output (Approx.)	7.5●	10●	watts
Maximum Circuit Values (CCS or ICAS Conditions):			
Grid-Circuit Resistance	0.1 max.		megohm

FREQUENCY MULTIPLIER

	CCS#	ICAS##	
Maximum Ratings, *Absolute Values:*			
*For Pressures Down to 46 mm of Hg***			
DC PLATE VOLTAGE	300 max.	350 max.	volts

* Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

#,##,**,†,●: See next page.

6264

UHF MEDIUM-MU TRIODE

DC GRID VOLTAGE	−125 max.	−140 max.	volts
DC PLATE CURRENT	33 max.	45 max.	ma
DC GRID CURRENT	15 max.	15 max.	ma
DC CATHODE CURRENT	45 max.	55 max.	ma
PLATE INPUT	9.9 max.	15.8 max.	watts
PLATE DISSIPATION	6 max.	9.5 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	90 max.	90 max.	volts
Heater positive with respect to cathode	90 max.	90 max.	volts

Typical Operation as Tripler to 510 Mc in Cathode-Drive Circuit:

DC Plate Voltage	300	350	volts
DC Grid Voltage†	−110	−122	volts
DC Plate Current	26	36.5	ma
DC Grid Current (Approx.)	4.1	5.8	ma
Driver Power Output (Approx.)	2.75	4.5	watts
Useful Power Output (Approx.)	2.1●	3.4●	watts

Maximum Circuit Values (CCS or ICAS Conditions):

Grid-Circuit Resistance	0.1 max.	megohm

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Heater Current	1	0.260	0.300	ma
Grid-to-Plate Capacitance	–	1.50	2.0	μμf
Grid-to-Cathode Capacitance	–	2.50	3.40	μμf
Plate-to-Cathode Capacitance	–	–	0.07	μμf
Plate Current	1,2	13	24	ma
Transconductance	1,2	5400	8200	μmhos
Useful Power Output	3,4	6.5	–	watts

Note 1: With 6.0 volts ac or dc on heater.

Note 2: With dc plate voltage of 200 volts, cathode resistor of 100 ± 1% ohms, and cathode bypass capacitor of 1000 μf.

Note 3: With 5.4 volts ac or dc on heater.

Note 4: With plate voltage of 350 volts, grid resistor adjusted to give a dc plate current of 50 milliamperes in a cavity-type oscillator operating at 500 megacycles per second and having an efficiency of about 75 per cent.

* Corresponds to altitude of about 60000 feet.

Continuous Commercial Service.

Intermittent Commercial and Amateur Service.

● This value of useful power is measured at load of output circuit having an efficiency of about 75 per cent.

† From a grid resistor, or from a suitable combination of grid resistor and fixed supply or grid resistor and cathode resistor.

6264

UHF MEDIUM-MU TRIODE

Outline Drawing and
Cooling-Requirement Curves for the 6264
are the same as shown for Type 6263

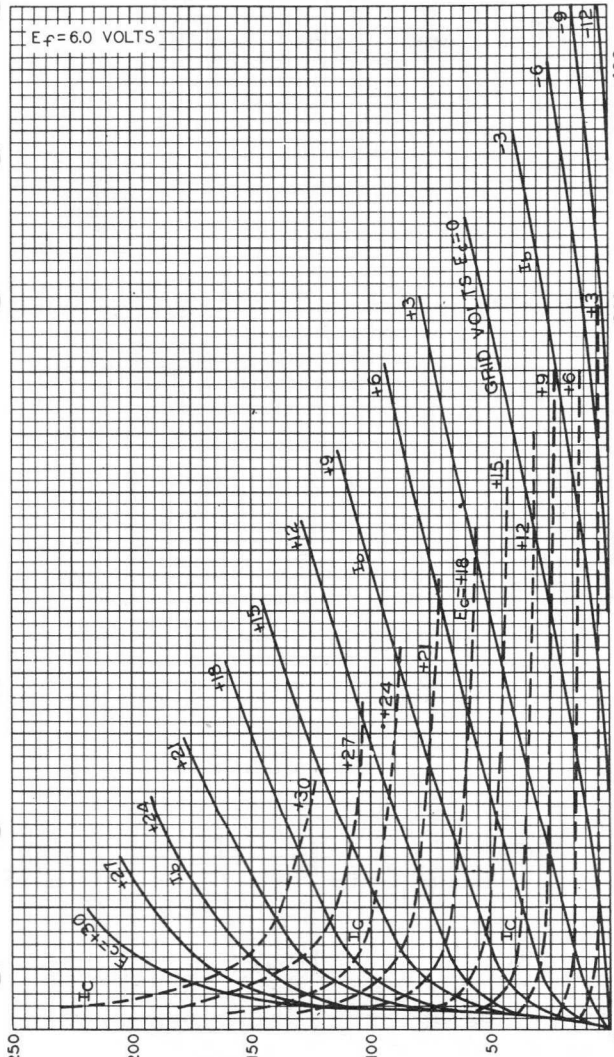
OPERATING FREQUENCY

The 6264 can be operated as a frequency multiplier and as an rf power amplifier and oscillator with full ratings at frequencies up to 500 megacycles per second and with reduced ratings at frequencies as high as 1700 megacycles per second.

RCA

6264

AVERAGE PLATE CHARACTERISTICS



OCT. 8, 1953

TUBE DEPARTMENT

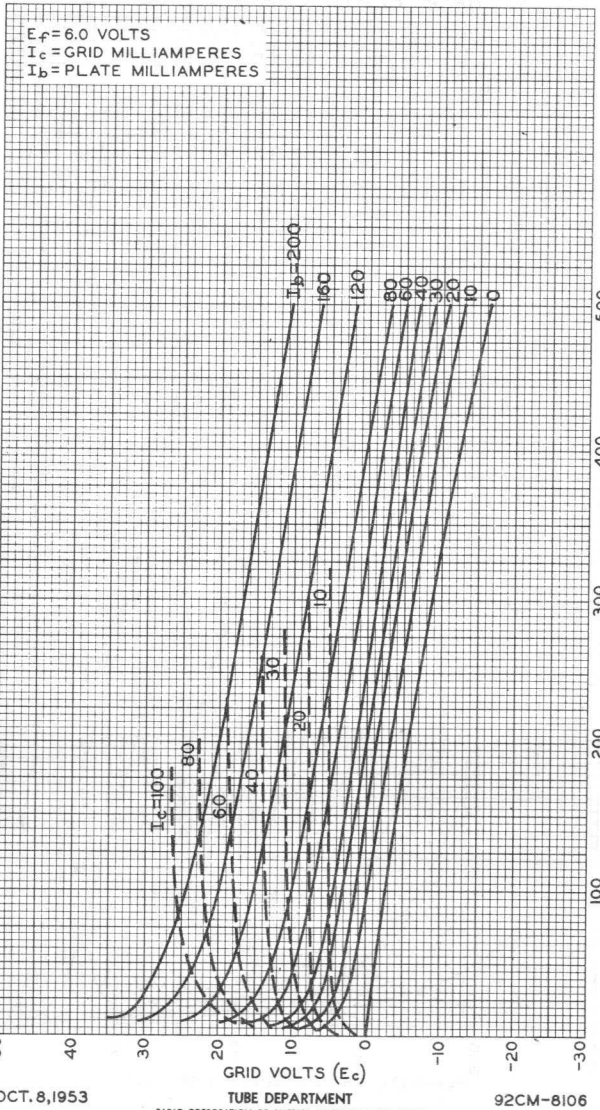
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8105

RCA

6264

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



OCT. 8, 1953

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8106

6326
VIDICON

600-LINE RESOLUTION

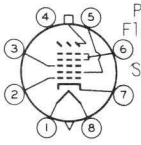
For film pickup
with color or black-and-white TV cameras

DATA

General:

Heater, for Unipotential Cathode:
  Voltage . . . . . 6.3 ± 10% . . . . ac or dc volts
  Current . . . . . 0.6 . . . . . amp
Direct Interelectrode Capacitance:♦
  Target (Signal electrode) to all
  other electrodes. . . . . 4.5 μμf
Spectral Response . . . . . *See curves*
Photoconductive Layer:
  Maximum useful diagonal of rectangular
  image (4 x 3 aspect ratio). . . . . 0.62"
  Orientation of quality rectangle—Proper orientation is obtained when the horizontal scan is essentially parallel to the plane passing through the tube axis and short index pin.
Focusing Method . . . . . Magnetic
Deflection Method . . . . . Magnetic
Overall Length. . . . . 6.25" ± 0.25"
Greatest Diameter (Excluding side tip). . . . 1.125" ± 0.010"
Maximum Radius (Including side tip) . . . . . 0.805"
Weight (Approx.). . . . . 2 oz
Operating Position. . . . Approx. Horizontal, or faceplate up
Bulb. T8
Base Connector. . . . . .Cinch No.54A18088, or equivalent
Base. . . . . .Small-Button Ditetrar 8-Pin (JETEC No.E8-11)
  Basing Designation for BOTTOM VIEW. . . . . 8HL ←

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Grid No.3
Pin 4 – Internal Connection—Do Not Use
Pin 5 – Grid No.2
Pin 6 – Grid No.4, Grid No.5
Pin 7 – Cathode
Pin 8 – Heater
Flange – Target (Signal Electrode)
Short Index Pin – Internal Connection—Do Not Use



DIRECTION OF LIGHT:
INTO FACE END OF TUBE

Maximum Ratings, *Absolute Values:* ←

For scanned area of 1/2" x 3/8"

GRID-No.5 & GRID-No.4 VOLTAGE	350 max.	volts
GRID-No.3 VOLTAGE	350 max.	volts
GRID-No.2 VOLTAGE	350 max.	volts

♦: See next page. ← Indicates a change.

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

6326
VIDICON

GRID-No.1 VOLTAGE:		
Negative bias value.	125 max.	volts
Positive bias value.	0 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode.	125 max.	volts
Heater positive with respect to cathode.	10 max.	volts
DARK CURRENT	0.025 max.	μa
PEAK TARGET (SIGNAL-ELECTRODE) CURRENT . .	0.5 max.	μa
FACEPLATE:		
Illumination	1000 max.	ft-c
Temperature.	60 max.	°C

→ **Typical Operation:**

Grid No.3 connected to grids No.4 and No.5; scanned area of 1/2" x 3/8"; faceplate temperature of 30° to 35° C

Faceplate Illumination:		
Average highlight▲, for pickup from film.	50 to 300	ft-c
Constant highlight, for pickup from live scenes	20	ft-c
Maximum Target (Signal-Electrode) Voltage required to produce dark current of 0.02 μa in any tube**	100	volts
Target (Signal-Electrode) Voltage:†		
For pickup from film	20 to 40	volts
For pickup from live scenes. . . .	40 to 70	volts
Grid-No.5 (Decelerator) and Grids-No.4 & No.3 (Beam-Focus-Electrodes*) Voltage	250⊕ to 300	volts
Grid-No.2 (Accelerator) Voltage. . .	300	volts
Grid-No.1 Voltage for picture cutoff●	-45 to -100	volts
Signal-Output Current:#		
Peak	0.3 to 0.4	μa
Average.	0.1 to 0.2	μa
Dark Current:		
For pickup from film	0.004	μa
For pickup from live scenes. . . .	0.02	μa
Average "Gamma" of Transfer Characteristic for signal-output current between 0.02 μa and 0.2 μa	0.65	
Visual Equivalent Signal-to-Noise Ratio (Approx.)○	300:1	
Minimum Peak-to-Peak Blanking Voltage:		
When applied to grid No.1.	40	volts
When applied to cathode.	10	volts
Field Strength at Center of Focusing Coil (Approx.).	40	gauss
Field Strength of Adjustable Alignment Coil□.	0 to 4	gauss

♦,▲,**,†,*,⊕,●,#,○,□: See next page.

→ Indicates a change.

RCA

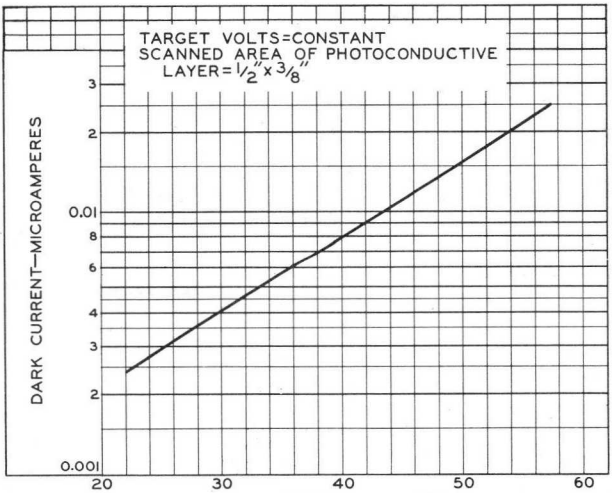
6326

VIDICON

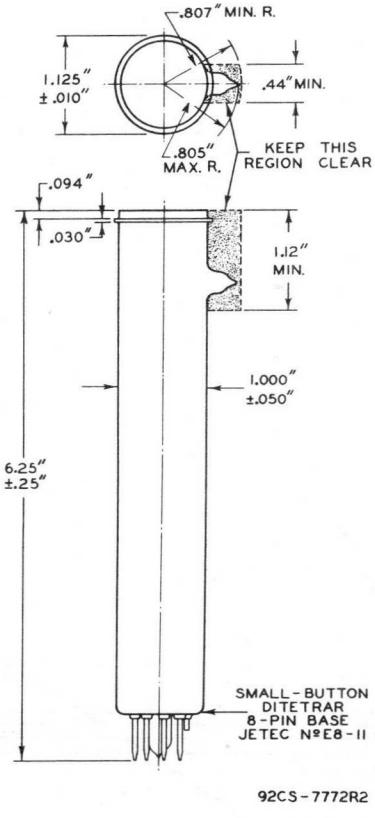
🌡	This capacitance, which effectively is the output impedance of the 6326, is increased when the tube is mounted in the deflecting-yoke and focusing-coil assembly. The resistive component of the output impedance is in the order of 100 megohms.
▲	Averaged over the time of one TV frame.
**	The target (signal-electrode) voltage for each 6326 must be adjusted to that value which gives the desired operating dark current.
†	Indicated range for each type of service serves only to illustrate the operating target- (signal-electrode-) voltage range normally encountered.
*	Beam focus is obtained by combined effect of grids-No.4 & No.3 voltage which should be adjustable over indicated range, and a focusing coil having an average field strength of 40 gausses. If desired, grid No.3 may be operated separately to permit vernier control of focus. Under such conditions, the instantaneous grid-No.3 voltage must always be equal to or greater than the grid-No.4 voltage.
⊕	Definition, focus uniformity, and picture quality decrease with decreasing grids-No.5 & No.4 & No.3 voltage. In general, grids No.5 & No.4 & No.3 should not be operated below 250 volts.
●	With no blanking voltage on grid No.1.
#	Defined as the component of the target (signal-electrode) current after the dark-current component has been subtracted.
○	Measured with high-gain, low-noise, cascode-type amplifier having bandwidth of 5 Mc. Because the noise in such a system is predominately of the high-frequency type, the visual equivalent signal-to-noise ratio is taken as the ratio of highlight video-signal current to rms noise current, multiplied by a factor of 3.
□	The alignment coil should be located on the tube so that its center is at a distance of 3-11/16 inches from the face of the tube, and be positioned so that its axis is coincident with the axis of the tube, the deflecting yoke, and the focusing coil.

DATA 2

TYPICAL CHARACTERISTIC



6326
VIDICON



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

6326

SPECTRAL-SENSITIVITY CHARACTERISTICS

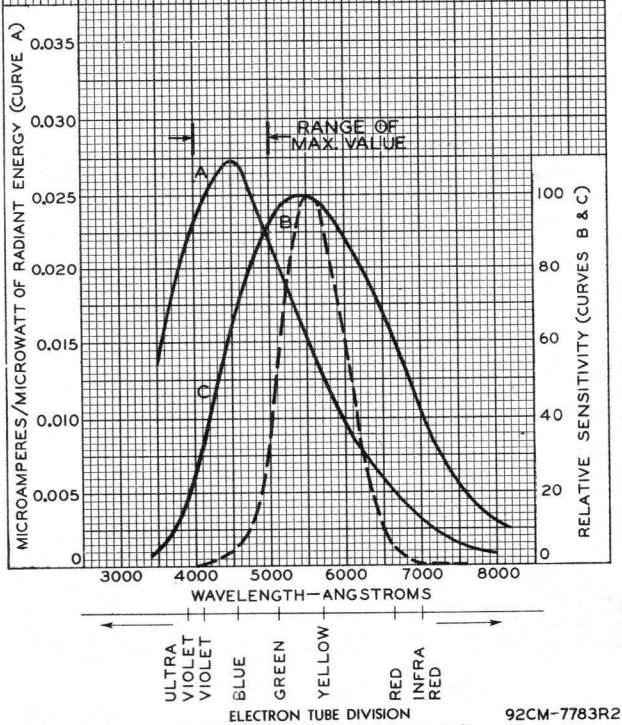
CURVE A: FOR EQUAL VALUES OF SIGNAL—OUTPUT CURRENT AT ALL WAVELENGTHS.

SIGNAL—OUTPUT MICROAMPERES FROM SCANNED AREA OF $\frac{1}{2}$" x $\frac{3}{8}$" = 0.02

DARK CURRENT (MICROAMPERES) = 0.02

CURVE B: SPECTRAL CHARACTERISTIC OF AVERAGE HUMAN EYE.

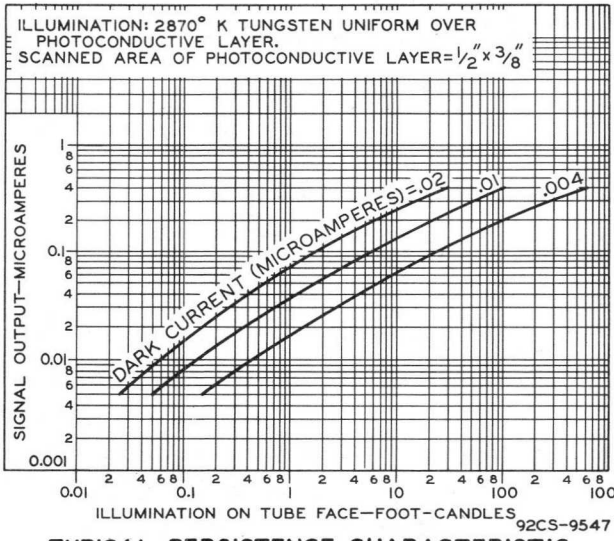
CURVE C: FOR EQUAL VALUES OF SIGNAL-OUTPUT CURRENT WITH RADIANT FLUX FROM TUNGSTEN SOURCE AT 2870° K.



RCA

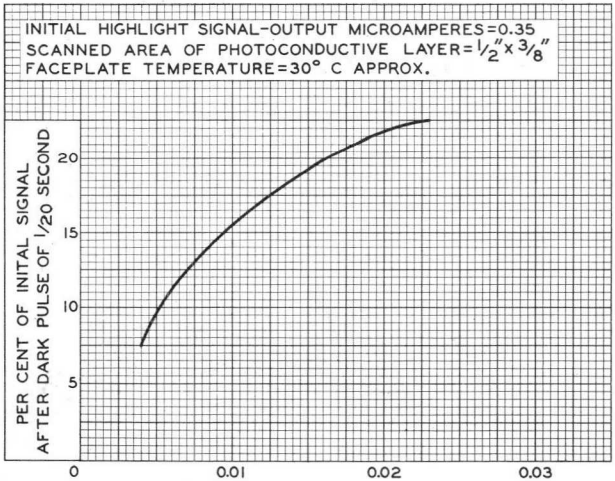
6326

TYPICAL LIGHT-TRANSFER CHARACTERISTICS



92CS-9547

TYPICAL PERSISTENCE CHARACTERISTIC



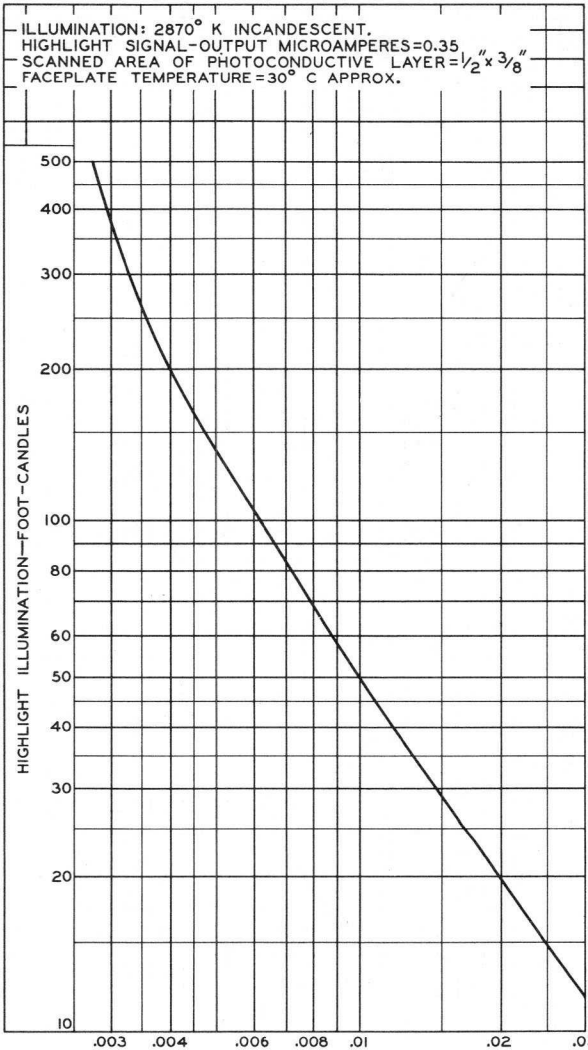
92CS-9550

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

RCA

6326

TYPICAL CHARACTERISTIC



ELECTRON TUBE DIVISION

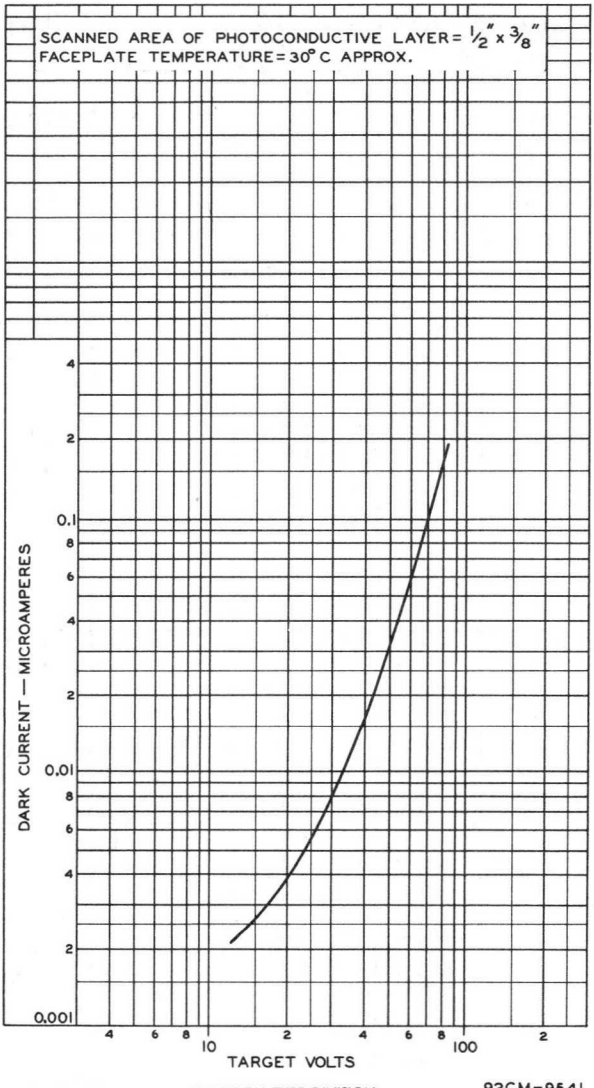
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9545

6326

6326

TYPICAL DARK-CURRENT CHARACTERISTIC



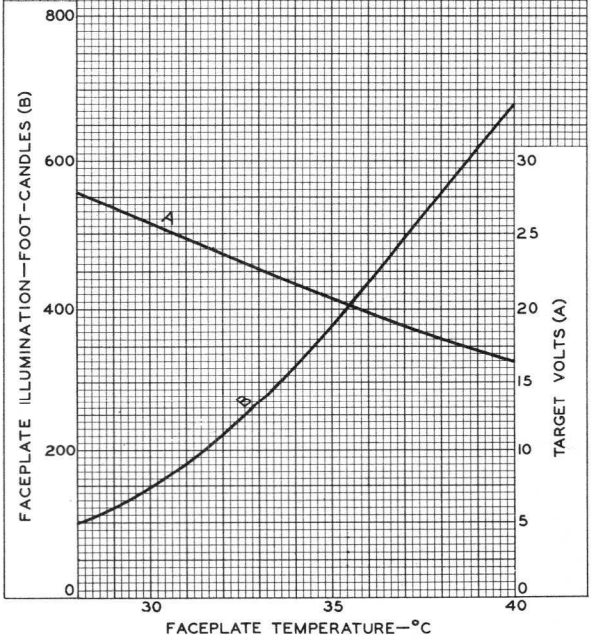
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9541

6326

TYPICAL CHARACTERISTICS

HIGHLIGHT SIGNAL-OUTPUT MICROAMPERES=0.3
DARK CURRENT (MICROAMPERES)=0.004
SCANNED AREA OF PHOTOCONDUCTIVE LAYER=$\frac{1}{2}$" x $\frac{3}{8}$"
CURVE A: TARGET VOLTAGE REQUIRED TO MAINTAIN DARK CURRENT OF 0.004μA.
CURVE B: 2870° K INCANDESCENT ILLUMINATION REQUIRED TO PRODUCE SIGNAL-OUTPUT CURRENT OF 0.3μA.



ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CM-9543

RCA

6372

MULTIPLIER PHOTOTUBE

10-STAGE TYPE WITH
4-1/8" x 3" SEMITRANSPARENT CATHODE AND S-11 RESPONSE

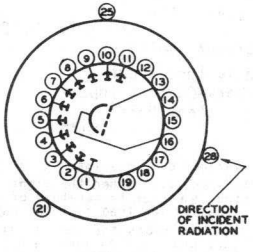
DATA

General:

Spectral Response	S-11	←
Wavelength of Maximum Response	4400 ± 500 angstroms	←
Cathode, Semitransparent:		
Shape	Semicylindrical	
Window:		
Minimum length	4-1/8	in.
Minimum width (Along circumference of bulb)	3	in.
Minimum area	12-3/8	sq. in.
Index of refraction	1.48	
Direct Interelectrode Capacitances (Approx.):		
Anode to dynode No.10	5	μμf
Anode to all other electrodes	6.5	μμf
Maximum Overall Length	7-3/4"	
Maximum Seated Length	7-1/4"	
Length from Base Seat to Center of Useful Cathode Area	3-5/8" ± 1/8"	
Maximum Diameter	2-9/16"	
Mounting Position	Any	
Weight (Approx.)	9 oz	
Bulb	T-20	
Base	Small-Button Twentyninar 22-Pin (JETEC No.E22-16)	

BOTTOM VIEW

Pin 1 – Anode
Pin 2 – Dynode No.10
Pin 3 – Dynode No.9
Pin 4 – Dynode No.8
Pin 5 – Dynode No.7
Pin 6 – Dynode No.6
Pin 7 – Dynode No.5
Pin 8 – Dynode No.4
Pin 9 – Dynode No.3
Pin 10 – Dynode No.2
Pin 11 – Dynode No.1
Pin 12 – Internal Connection-Do Not Use
Pin 13 – Focusing Electrode
Pin 14 – Same as Pin 12
Pin 15 – Same as Pin 12
Pin 16 – Cathode
Pin 17 – Same as Pin 12
Pin 18 – Same as Pin 12
Pin 19 – Same as Pin 12
Pin 21 – Same as Pin 12
Pin 25 – Same as Pin 12
Pin 28 – Same as Pin 12



PINS 1-19: ON 1⅞" DIA. PIN CIRCLE
PINS 21,25,28: ON ⅞" DIA. PIN CIRCLE
PIN CIRCLES ARE CONCENTRIC

← Indicates a change.

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MULTIPLIER PHOTOTUBE

Maximum Ratings, *Absolute Values*:

ANODE-SUPPLY VOLTAGE (DC or Peak AC)	1200 max.	volts
SUPPLY VOLTAGE BETWEEN DYNODE No.10 AND ANODE (DC or Peak AC)	180 max.	volts
DYNODE-No.1 SUPPLY VOLTAGE (DC or Peak AC)	300 max.	volts
FOCUSING-ELECTRODE VOLTAGE (DC or Peak AC)	300 max.	volts
AVERAGE ANODE CURRENT●	0.75 max.	ma
AMBIENT TEMPERATURE	75 max.	°C

Characteristics Range Values for Equipment Design:

Under conditions with supply voltage (E) across a voltage divider providing 1/12 of E between cathode and focusing electrode; 1/12 of E between focusing electrode and dynode No.1; 1/12 of E for each succeeding dynode stage; and 1/12 of E between dynode No.10 and anode

With E=1000 volts (except as noted)

	Min.	*Median*	*Max.*	
Sensitivity:				
→ Radiant, at 4400 angstroms. .	–	16000	–	μamp/μwatt
→ Cathode radiant, at 4400 angstroms	–	0.026	–	μamp/μwatt
Luminous:♦				
At 0 cps.	5	20	–	amp/lumen
At 100 Mc	–	19	–	amp/lumen
Cathode luminous:				
With tungsten light source▲	20	33	–	μamp/lumen
With blue light source† ♦	0.026	–	–	μamp
Current Amplification	–	600000	–	
Equivalent Anode-Dark-Current Input●	–	5×10^{-9}	1×10^{-8}	lumen
Equivalent Noise Input*■	–	1×10^{-10}	–	lumen

● Averaged over any interval of 30 seconds maximum.

♦ For conditions when the light source is a tungsten-filament lamp operated at a color temperature of 2870°K. A light input of 10 microlumens is used. The load resistor has a value of 0.01 megohm.

▲ For conditions the same as shown under (♦) except that the value of light flux is 0.01 lumen and 150 volts are applied between cathode and all other electrodes connected together as anode.

† Under the following conditions: Light incident on the cathode is transmitted through a blue filter (Corning, Glass Code No.5113 polished to 1/2 stock thickness) from a tungsten-filament lamp operated at a color temperature of 2870°K. The value of light flux on the filter is 0.01 lumen. The load resistor has a value of 0.01 megohm, and 150 volts are applied between cathode and all other electrodes connected together as anode.

♦,●,*,■: See next page.

→ Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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MULTIPLIER PHOTOTUBE

♦ For Spectral Characteristic of this source, see sheet SPECTRAL CHARACTERISTIC OF 2870°K LIGHT SOURCE AND SPECTRAL CHARACTERISTIC OF LIGHT FROM 2870°K SOURCE AFTER PASSING THROUGH INDICATED BLUE FILTER at front of this section.

● Measured at a tube temperature of 25°C and with the supply voltage (E) adjusted to give a luminous sensitivity of 20 amperes per lumen. Dark current caused by thermionic emission and ion feedback may be reduced by the use of a refrigerant.

* Under the following conditions: Supply voltage (E) is 1000 volts, 25°C tube temperature, ac-amplifier bandwidth of 1 cycle per second, tungsten light source of 2870°K interrupted at a low audio frequency to produce incident radiation pulses alternating between zero and the value stated. The "on" period of the pulse is equal to the "off" period. The output current is measured through a filter which passes only the fundamental frequency of the pulses.

■ For maximum signal-to-noise ratio, operation with a supply voltage (E) below 1000 volts is recommended.

OPERATING CONSIDERATIONS

The *operating stability* of the 6372 is dependent on the magnitude of the anode current and its duration. When the 6372 is operated at high values of anode current, a drop in sensitivity (sometimes called fatigue) may be expected. The extent of the drop below the tabulated sensitivity values depends on the severity of the operating conditions. After a period of idleness, the 6372 usually recovers a substantial percentage of such loss in sensitivity.

The use of an average anode current well below the maximum rated value of 0.75 milliampere is recommended when stability of operation is important. When maximum stability is required, the anode current should not exceed 100 microamperes.

Electrostatic and/or *magnetic shielding* of the 6372 may be necessary.

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-11 Response
is shown at the front of this Section

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RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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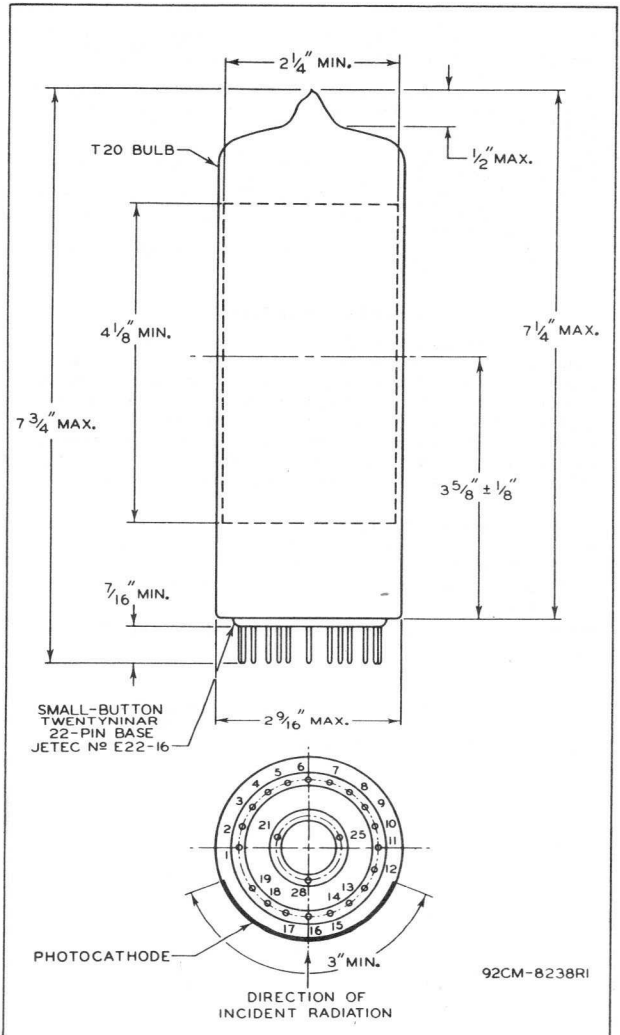
MULTIPLIER PHOTOTUBE



TUBE DIVISION

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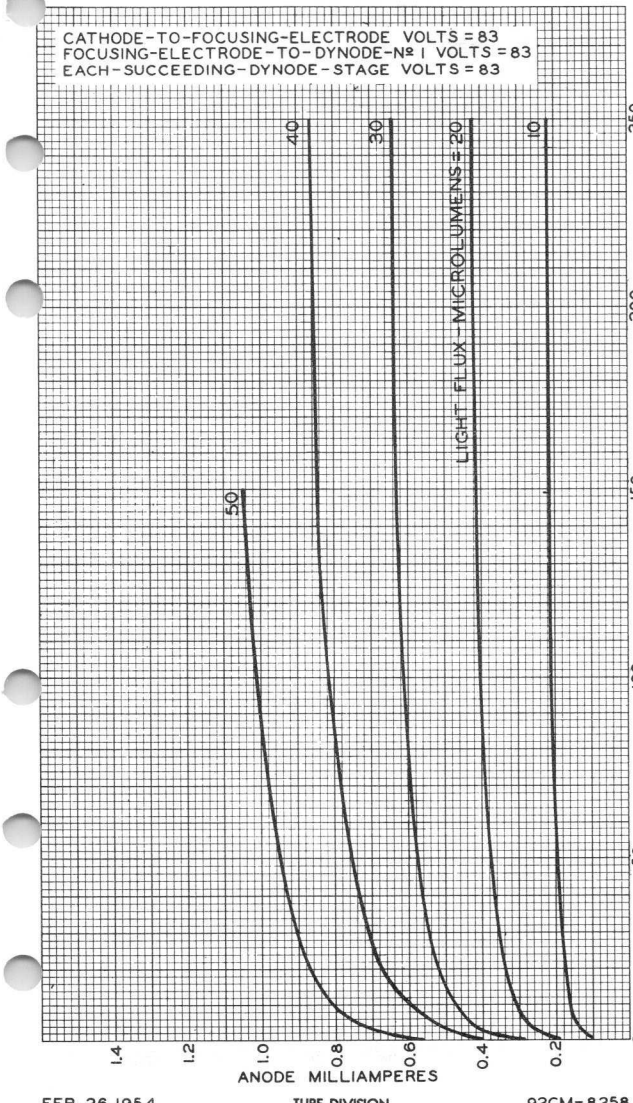
AVERAGE ANODE CHARACTERISTICS



FEB. 26, 1954

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92CM-8258

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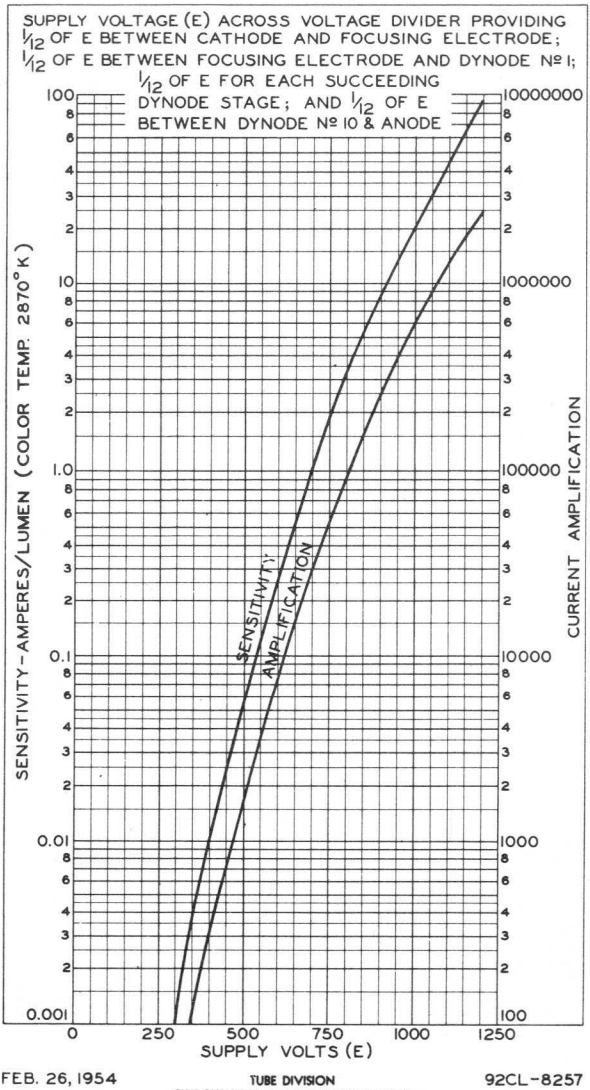
AVERAGE CHARACTERISTICS



FEB. 26, 1954

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CL-8257

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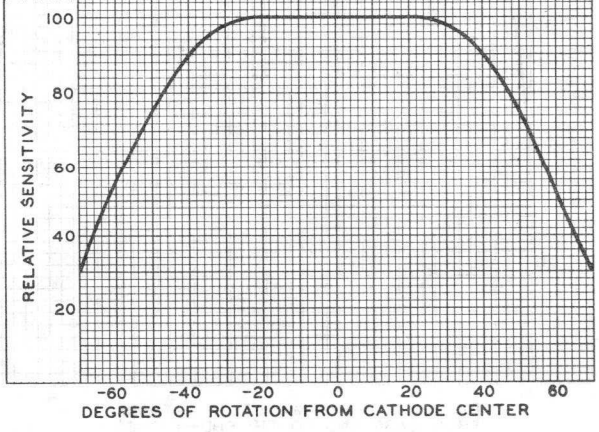
6372

VARIATION IN SENSITIVITY

LIGHT SPOT: ½ INCH DIA. APPROX. POSITIONED MIDWAY ALONG LENGTH OF PHOTOCATHODE

VARIATIONS CAUSED BY INTERCEPTION OF LIGHT BY GRILL HAVE BEEN IGNORED



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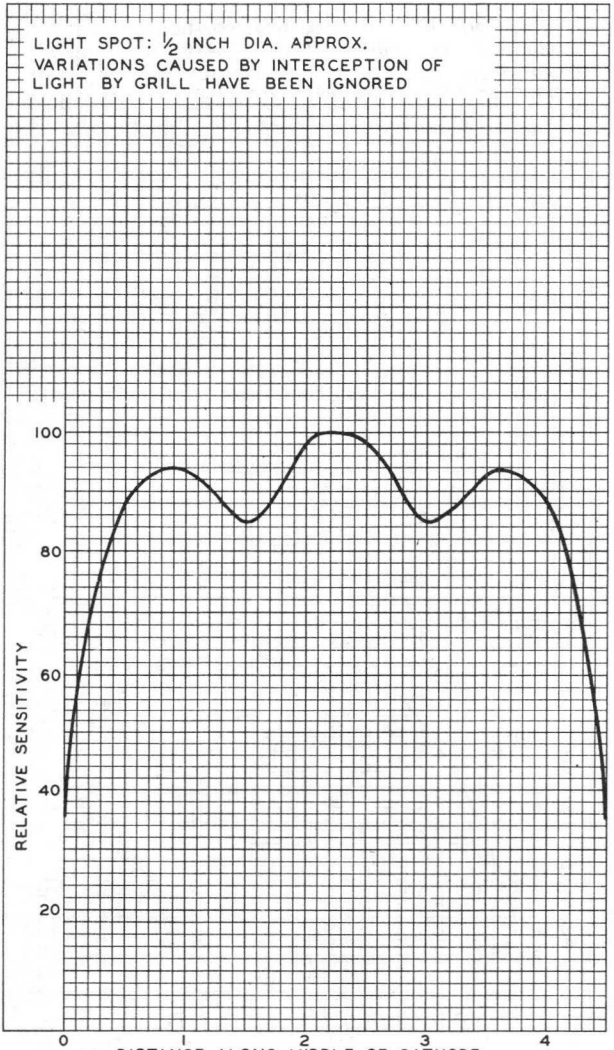
VARIATION IN SENSITIVITY



APRIL 9, 1954 TUBE DIVISION 92CM-8306
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6383

POWER TRIODE

LIQUID AND FORCED-AIR COOLED

Full Input at Frequencies Up to 2000 Mc

GENERAL DATA

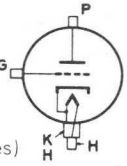
Electrical:

Heater, for Unipotential Cathode:

Voltage*	6.3 av. 6.9 max.	ac or dc volts volts
Current	3.4	amp
Minimum heating time	1	minute
Amplification Factor	27	
Direct Interelectrode Capacitances:		
Grid to plate	6	μμf
Grid to cathode	11	μμf
Plate to cathode⊕	0.22	μμf

Mechanical:

Terminal Connections:



H – Heater Terminals (Center Pin at Cathode End & Cath. Terminal)

K – Cathode Terminal (End Opposite Pipes)

G – Grid Terminal (Between Plate Flange and Cath. Terminal)

P – Plate Terminal (Plate Flange)

Mounting Position	Any
Overall Length	4-3/16" ± 3/32"
Greatest Diameter	1.750" ± 0.010"
Cooling Jacket	Integral part of tube
Mounting	Special

Air Cooling:

Forced-air cooling of the grid terminal, cathode terminal, and glass envelope is required. The air flow must start with the application of any voltages, and be adequate to limit the temperature of the grid terminal, cathode terminal, and glass envelope to their respective maximum values. Heater power, plate power, and air flow may be removed simultaneously.

Liquid Cooling:

Liquid cooling of the plate is required. The liquid flow must start before the application of any voltages. Interlocking of the liquid flow with all power supplies is recommended to prevent tube damage in case of failure of adequate liquid flow. Suitable coolants are: Distilled Water, Butyl Carbitol, Ethylene Glycol, Monsanto OS45 (High Temperature Hydraulic Fluid), and Dow Corning No.200 Fluid.

Liquid-coolant pressure	60 max.	psi
Water flow required:		
With plate dissipation of 300 watts	0.25 min.	gpm
With plate dissipation of 600 watts	0.4 min.	gpm

⊕ With external flat shield 7-1/2" minimum diameter located in plane of the grid terminal and perpendicular to axis of tube. Shield is connected to grid terminal.

*: See next page.

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POWER TRIODE

Water flow obtained:			
With pressure drop of 0.5 psi	0.25	min.	gpm
With pressure drop of 2.0 psi	0.4	min.	gpm
Outlet water temperature	70	max.	°C

For coolants other than water, the flow required, the pressure drop, and the outlet coolant temperature will depend on the characteristics of the coolant.

Plate Temperature (Measured on side of plate flange opposite the pipes and at junction of flange with tube body)	180	max.	°C
Grid-Terminal Temperature	200	max.	°C
Cathode-Terminal Temperature	200	max.	°C
Glass-Envelope Temperature	175	max.	°C
Weight (Approx.)	8		ounces

AF POWER AMPLIFIER & MODULATOR--Class A

Maximum CCS* Ratings, *Absolute Values:*

DC PLATE VOLTAGE	1500	max.	volts
DC GRID VOLTAGE	-300	max.	volts
DC PLATE CURRENT	400	max.	ma
DC GRID CURRENT	75	max.	ma
PLATE INPUT	600	max.	watts
PLATE DISSIPATION	600	max.	watts

Typical Operation (Class A_1):

DC Plate Voltage	1000	1500	volts
DC Grid Voltage	-25	-40	volts
Peak AF Grid Voltage	20	35	volts
DC Plate Current	200	250	ma
Load Resistance	1350	1550	ohms
Power Output♦	20	60	watts

PLATE-MODULATED RF POWER AMP.--Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum CCS* Ratings, *Absolute Values:*

DC PLATE VOLTAGE	1200	max.	volts
DC GRID VOLTAGE	-300	max.	volts
DC PLATE CURRENT	335	max.	ma
DC GRID CURRENT	See Rating Chart		
PLATE INPUT	400	max.	watts
PLATE DISSIPATION	400	max.	watts

♦ Values are based on maximum power output disregarding distortion.

*,•: See next page.

RCA

6383

POWER TRIODE

Typical Operation:

In Cathode-Drive Circuit at	*600 Mc*	*1000 Mc*	
Heater Voltage*.	5.7	4.5	volts
DC Plate-to-Grid Voltage . . .	1340	1315	volts
DC Cathode-to-Grid Voltage . .	140	115	volts
From cathode resistor of▲. .	380	330	ohms
Peak RF Cathode-to-Grid Voltage	200	175	volts
DC Plate Current	335	335	ma
DC Grid Current (Approx.). . .	35	15	ma
Driver Power Output (Approx.)●■	70	76	watts
Output-Circuit Efficiency (Approx.). .	80	60	per cent
Useful Power Output (Approx.).	250○○	190○○	watts

In Cathode-Drive Circuit at	*1100 Mc*	*1500 Mc*	
Heater Voltage*.	4.5	4.5	volts
DC Plate-to-Grid Voltage . . .	1290	1280	volts
DC Cathode-to-Grid Voltage . .	90	80	volts
From cathode resistor of▲. .	260	235	ohms
Peak RF Cathode-to-Grid Voltage	145	130	volts
DC Plate Current	335	335	ma
DC Grid Current (Approx.). . .	12	4	ma
Driver Power Output (Approx.)●■	80	53	watts
Output-Circuit Efficiency (Approx.). .	55	50	per cent
Useful Power Output (Approx.).	160○○	100○○	watts

RF POWER AMPLIFIER & OSC.--Class C Telegraphy□
and
RF POWER AMPLIFIER--Class C FM Telephony

Maximum CCS® Ratings, *Absolute Values:*

DC PLATE VOLTAGE	1500 max.	volts
DC GRID VOLTAGE	-300 max.	volts
DC PLATE CURRENT	400 max.	ma
DC GRID CURRENT	See Rating Chart	
PLATE INPUT	600 max.	watts
PLATE DISSIPATION	600 max.	watts

Typical Operation:

As Amplifier in Cathode-Drive Circuit at	*600 Mc*	*1000 Mc*	
Heater Voltage*.	5.7	4.5	volts
DC Plate-to-Grid Voltage . . .	1640	1615	volts

■ In cathode-drive, plate-modulated class C rf power amplifier service, the 6383 can be modulated 100% if the rf driver stage is also modulated 100% simultaneously. Care should be taken to insure that the driver-modulation and amplifier-modulation voltages are exactly in phase.

□ Key-down conditions per tube without amplitude modulation. Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

*,●,▲,◆,○○: See next page.

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POWER TRIODE

	600 Mc	1000 Mc	
DC Cathode-to-Grid Voltage . .	140	115	volts
From cathode resistor of▲. .	315	275	ohms
Peak RF Cathode-to-Grid Voltage	210	185	volts
DC Plate Current	400	400	ma
DC Grid Current (Approx.). . .	25	20	ma
Driver Power Output (Approx.)●	90	95	watts
Output-Circuit Efficiency (Approx.). .	80	60	per cent
Useful Power Output (Approx.).	380°°	285°°	watts
As Amplifier in Cathode-Drive Circuit at	*1100 Mc*	*1500 Mc*	
Heater Voltage*.	4.5	4.5	volts
DC Plate-to-Grid Voltage . . .	1590	1580	volts
DC Cathode-to-Grid Voltage . .	90	80	volts
From cathode resistor of▲. .	220	200	ohms
Peak RF Cathode-to-Grid Voltage	155	140	volts
DC Plate Current	400	400	ma
DC Grid Current (Approx.). . .	15	5	ma
Driver Power Output (Approx.)●	80	85	watts
Output-Circuit Efficiency (Approx.). .	55	50	per cent
Useful Power Output (Approx.).	240°°	150°°	watts
As Oscillator in Cathode-Drive Circuit at	*600 Mc*	*1000 Mc*	
Heater Voltage*.	5.7	4.5	volts
DC Plate-to-Grid Voltage . . .	1640	1615	volts
DC Cathode-to-Grid Voltage . .	140	115	volts
From cathode resistor of▲. .	315	275	ohms
Peak RF Cathode-to-Grid Voltage	175	140	volts
DC Plate Current	400	400	ma
DC Grid Current (Approx.). . .	45	20	ma
Output-Circuit Efficiency (Approx.). .	80	60	per cent
Useful Power Output (Approx.).	280°°	190°°	watts
As Oscillator in Cathode-Drive Circuit at	*1100 Mc*	*1500 Mc*	
Heater Voltage*.	4.5	4.5	volts
DC Plate-to-Grid Voltage . . .	1590	1580	volts
DC Cathode-to-Grid Voltage . .	90	80	volts
From cathode resistor of▲. .	220	200	ohms
Peak RF Cathode-to-Grid Voltage	120	110	volts
DC Plate Current	400	400	ma
DC Grid Current (Approx.). . .	15	5	ma
Output-Circuit Efficiency (Approx.). .	55	50	per cent
Useful Power Output (Approx.).	150°°	60°°	watts

*, ●, ▲, ◆, °°: See next page.

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POWER TRIODE

FREQUENCY MULTIPLIER--Class C

Maximum CCS* Ratings, *Absolute Values:*

DC PLATE VOLTAGE	1500 max.	volts
DC GRID VOLTAGE	-300 max.	volts
DC PLATE CURRENT	400 max.	ma
DC GRID CURRENT	See Rating Chart	
PLATE INPUT	600 max.	watts
PLATE DISSIPATION	600 max.	watts

Typical Operation in Cathode-Drive Circuit:

	Doubler to 600 Mc	*Doubler to 900 Mc*	
DC Plate-to-Grid Voltage	1760	1675	volts
DC Cathode-to-Grid Voltage	260	175	volts
From cathode resistor of▲	570	415	ohms
Peak RF Cathode-to-Grid Voltage	300	215	volts
DC Plate Current	400	400	ma
DC Grid Current (Approx.)	55	25	ma
Driver Power Output (Approx.)⊕	195	160	watts
Output-Circuit Efficiency (Approx.)	80	60	per cent
Useful Power Output (Approx.)	280°°	225°°	watts

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Heater Current	1	3.05	3.75	amp
Amplification Factor	1,2	20	34	
Grid-Plate Capacitance	-	5.5	6.5	μμf
Grid-Cathode Capacitance	-	9.6	12.4	μμf
Plate-Cathode Capacitance	3	0.12	0.32	μμf
Plate Voltage (1)	1,4	550	810	volts
Plate Voltage (2)	1,5	750	1150	volts
Grid Voltage	1,6	-	-165	volts
Peak Cathode Current	1,7	9	-	amp
Useful Power Output	8,9	140	-	watts

Note 1: With 6.3 volts ac on heater.

Note 2: With dc grid voltage of -15 volts, and dc plate voltage adjusted to give dc plate current of 250 milliamperes.

Note 3: With external shield as described under (⊕).

Note 4: With dc grid voltage of -10 volts, and dc plate voltage adjusted to give dc plate current of 250 milliamperes.

Note 5: With dc grid voltage of -20 volts, and dc plate voltage adjusted to give dc plate current of 250 milliamperes.

Note 6: With dc plate voltage of 1500 volts, and dc grid voltage adjusted to give dc plate current of 1.0 milliampere.

*,●,▲,⊕,°°: See next page.

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POWER TRIODE

Note 7: Designers should limit the maximum useable cathode current (plate current and grid current) to this value under any condition of operation.

Note 8: With 4.5 volts ac on heater.

Note 9: In a self-excited, cathode-drive oscillator circuit and with dc plate-to-grid voltage of 1570 to 1625 volts (in all cases, plate-to-cathode voltage is 1500 volts), dc plate current of 400 ma., dc grid current of -10 to +50 ma., cathode-to-grid voltage of 70 to 125 volts, and frequency of 1100 Mc.

* Operation should always be started with a heater voltage of 6.3 volts. Because the cathode is subjected to considerable back bombardment as the frequency is increased with resultant increase in temperature, the heater voltage should be reduced in accord with the following table to prevent overheating the cathode and resultant short life.

Approx. Frequency Range Mc	*Heater Volts*
up to 550-600	6.3
550 to 750-800	5.7
750 to 975-1025	5.1
975 and above	4.5

● Continuous Commercial Service.

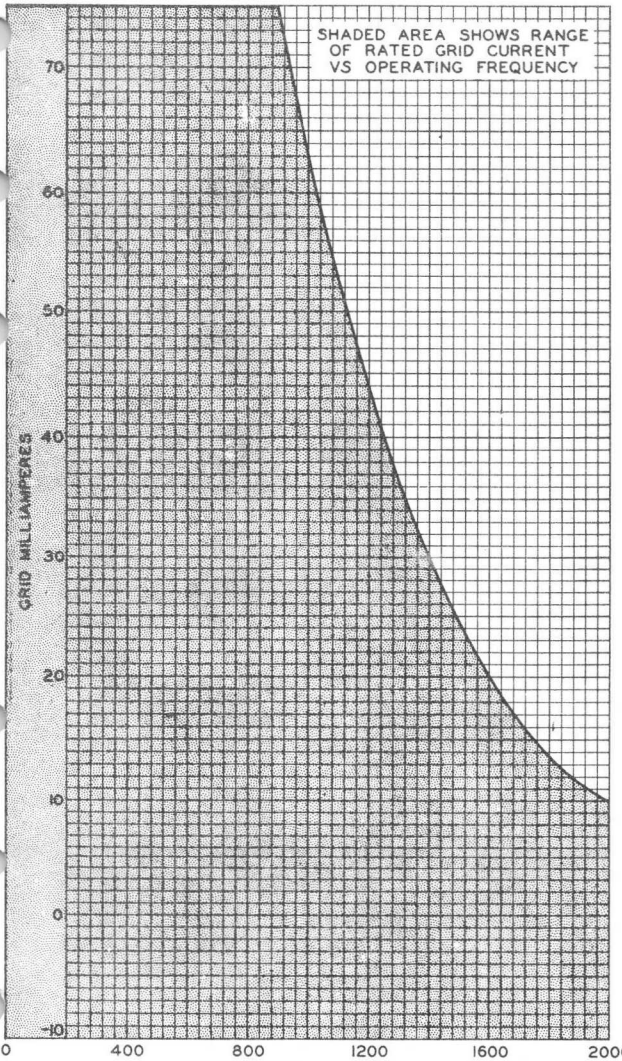
▲ At frequencies below 600 Mc, it is permissible to use a combination of grid and cathode resistors, but the use of a grid resistor alone is not recommended. At frequencies above 600 Mc where the value of grid current may be small, only cathode bias is recommended.

◆ The driver stage is required to supply tube losses, rf circuit losses, and rf power added to plate input. The driver stage should be designed to provide an excess of power above the indicated value to take care of variations in line voltage, in components, in initial tube characteristics, and in tube characteristics during life.

○○ This value of useful power is measured at load of output circuit having indicated efficiency.

6383

RATING CHART



APRIL 20, 1954

TUBE DIVISION
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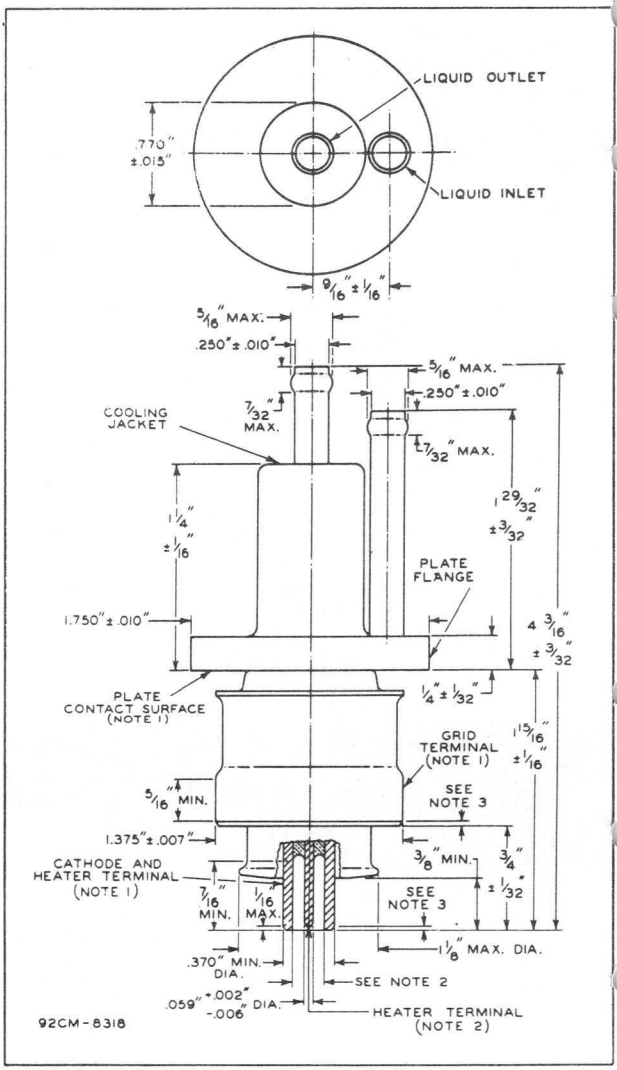
92CM-8321

RCA

6383

POWER TRIODE



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RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6383

POWER TRIODE

NOTE 1: WITH THE CYLINDRICAL SURFACES OF ITS GRID AND CATHODE TERMINALS CLEAN, SMOOTH, AND FREE OF BURRS, THE TUBE WILL ENTER A GAUGE AS SHOWN IN SKETCH G_1. THE FOUR CYLINDRICAL HOLES H_1, H_2, H_3, and H_4 HAVE AXES COINCIDENT WITHIN 0.0005", LENGTHS DETERMINED FROM THE DIMENSIONAL OUTLINE, AND SUCCESSIVELY SMALLER DIAMETERS AS SHOWN IN THE SKETCH.

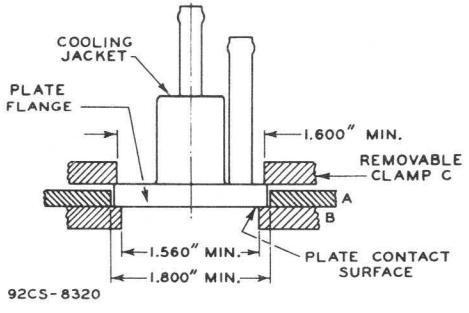
THE PLATE FLANGE WILL BE ENTIRELY ENGAGED BY HOLE H_1, AND CONTACT SURFACE OF THE PLATE FLANGE WILL SEAT ON THE SHOULDER BETWEEN HOLES H_1 AND H_2. THE PLANE SURFACE OF THIS SHOULDER IS $90^0 \pm 2'$ TO THE AXES OF THE HOLES. SEATING IS DETERMINED BY FAILURE OF A 0.005" THICKNESS GAUGE, 1/8" WIDE, TO ENTER MORE THAN 1/16" BETWEEN THIS SHOULDER SURFACE AND THE PLATE CONTACT SURFACE.

WITH THE TUBE PROPERLY SEATED AS DESCRIBED ABOVE, THE GRID TERMINAL WILL BE ENTIRELY ENGAGED BY HOLE H_3, AND THE CATHODE TERMINAL WILL BE ENGAGED BY HOLE H_4 TO A DEPTH OF AT LEAST 1/4".

NOTE 2: CONCENTRICITY OF THE HEATER TERMINAL WITH RESPECT TO THE CATHODE TERMINAL IS DETERMINED BY A GAUGE AS SHOWN IN SKETCH G_2. THE CYLINDRICAL HOLE H_5 AND THE ANNULAR HOLE H_6 HAVE AXES COINCIDENT WITHIN 0.0005". THE CATHODE TERMINAL AND THE HEATER TERMINAL WILL ENTER THIS GAUGE TO A DEPTH OF 3/8".

NOTE 3: MAY BE ROUNDED OR BEVELED NOT TO EXCEED 1/16".

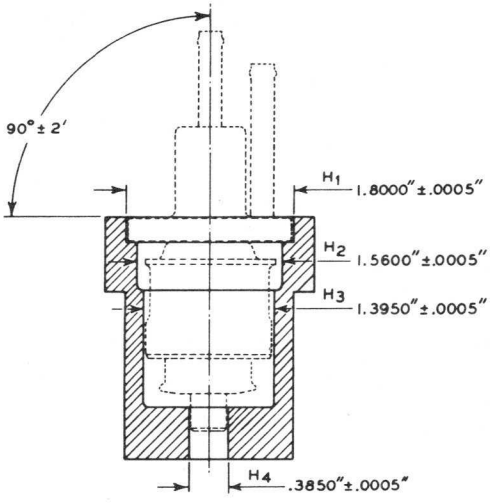
Mounting Arrangement for Use with Coaxial-Line or Cavity Circuits



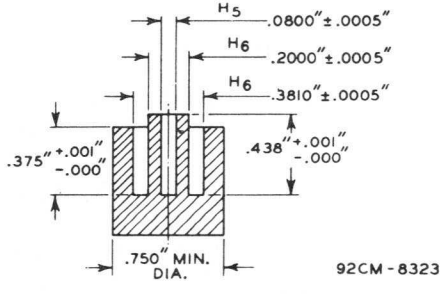
6383

POWER TRIODE

Sketch G_1



Sketch G_2



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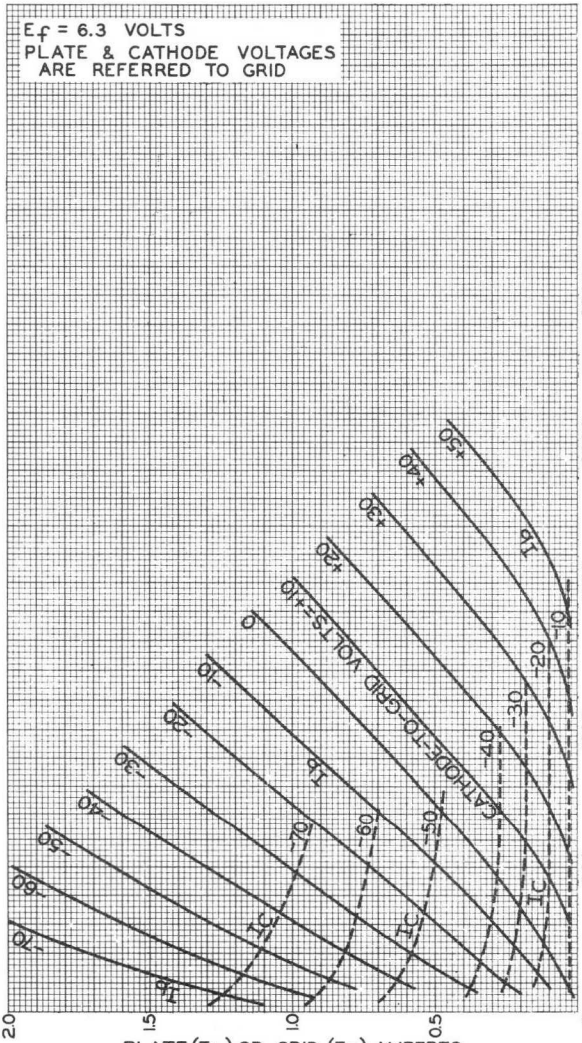
AVERAGE CHARACTERISTICS



APRIL 26, 1954 TUBE DIVISION 92CL-7771RI

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6474/1854

IMAGE ORTHICON

FOR SIMULTANEOUS COLOR PICKUP

MAGNETIC FOCUS MAGNETIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:
- Voltage . . . . . 6.3 ± 10% . . . ac or dc volts
- Current . . . . . 0.6 . . . . . ampere

Direct Interelectrode Capacitance:
- Anode to all other electrodes . . . . . 20 μμf

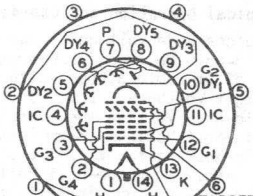
Photocathode, Semitransparent:
- Response . . . See accompanying Spectral Sensitivity curve
- Rectangular image (4 x 3 aspect ratio):
  - Useful size of . . . . . 1.6" max. Diagonal
  - Orientation of . . . Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through center of faceplate and pin No.7 of the shoulder base.

Focusing Method . . . . . Magnetic
Deflection Method . . . . . Magnetic
Overall Length . . . . . 15-3/16" ± 1/4"
Greatest Diameter of Bulb . . . . . 3" ± 1/16"
Minimum Deflecting-Coil Inside Diameter . . . . . 2-3/8"
Deflecting-Coil Length . . . . . 5"
Focusing-Coil Length . . . . . 10"
Alignment-Coil Length . . . . . 15/16"
Photocathode Distance Inside End of Focusing Coil . . . 1/2"
Operating Position: Any except with diheptal base up and tube axis at angle of less than 20° from vertical
Weight (Approx.) . . . . . 1 lb 6 oz
End Base . . . . . Small-Shell Diheptal 14-Pin Base (JETEC No.B14-45)

Pin 1 - Heater
Pin 2 - Grid No.4
Pin 3 - Grid No.3
Pin 4 - Internal Connection—Do Not Use
Pin 5 - Dynode No.2
Pin 6 - Dynode No.4
Pin 7 - Anode
Pin 8 - Dynode No.5
Pin 9 - Dynode No.3
Pin 10 - Dynode No.1, Grid No.2
Pin 11 - Internal Connection—Do Not Use
Pin 12 - Grid No.1
Pin 13 - Cathode
Pin 14 - Heater

BOTTOM VIEW

DIRECTION OF LIGHT: PERPENDICULAR TO LARGE END OF TUBE



WHITE INDEX LINE ON FACE

(Continued on next page)

6474

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IMAGE ORTHICON

Shoulder Base	Keyed Jumbo Annular 7-Pin
Pin 1 - Grid No.6	Pin 5 - Grid No.5
Pin 2 - Photocathode	
Pin 3 - Internal Connection—Do Not Use	Pin 6 - Target
Pin 4 - Internal Connection—Do Not Use	Pin 7 - Internal Connection—Do Not Use

Maximum Ratings, *Absolute Values:*

PHOTOCATHODE:		
Voltage	-550 max.	volts
Illumination	50 max.	ft-c
OPERATING TEMPERATURE:		
Of any part of bulb	50 max.	°C
Of bulb at large end of tube (target section)	35 min.	°C
TEMPERATURE DIFFERENCE:		
Between target section and any part of bulb hotter than target section . .	5 max.	°C
GRID-No.6 VOLTAGE	-550 max.	volts
TARGET VOLTAGE:		
Positive value	10 max.	volts
Negative value	10 max.	volts
GRID-No.5 VOLTAGE	150 max.	volts
GRID-No.4 VOLTAGE	300 max.	volts
GRID-No.3 VOLTAGE	400 max.	volts
GRID-No.2 & DYNODE-No.1 VOLTAGE	350 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value	125 max.	volts
Positive bias value	0 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode .	125 max.	volts
Heater positive with respect to cathode .	10 max.	volts
ANODE-SUPPLY VOLTAGE*	1350 max.	volts
VOLTAGE PER MULTIPLIER STAGE	350 max.	volts

Typical Operation and Characteristics:

Photocathode Voltage (Image Focus) . .	-300 to -500	volts
Grid-No.6 Voltage (Accelerator)— 75% of photocathode voltage	-225 to -375	volts
Target Voltage°	0 to 3	volts
Grid-No.5 Voltage (Decelerator)	0 to 125	volts
Grid-No.4 Voltage (Beam Focus)	160 to 220	volts
Grid-No.3 Voltage#	225 to 330	volts
Grid-No.2 & Dynode-No.1 Voltage	300	volts
Grid-No.1 Voltage for Picture Cutoff ..	-45 to -115	volts

* Ratio of dynode voltages is shown under *Typical Operation.*

° Adjustable from -3 to +5 volts with blanking voltage off.

\# Adjust to give the most uniformly shaded picture near maximum signal.

6474

IMAGE ORTHICON

Dynode–No.2 Voltage	600	volts
Dynode–No.3 Voltage	800	volts
Dynode–No.4 Voltage	1000	volts
Dynode–No.5 Voltage	1200	volts
Anode Voltage	1250	volts
Anode Current (DC)	30	μamp
Signal–Output Current (Peak to peak)	3 to 20	μamp
Target Temperature Range	35 to 45	°C
Ratio of Peak–to–Peak Highlight Video–Signal Current to RMS Noise Current (Approx.)	60	
Minimum Peak–to–Peak Blanking Voltage	5	volts
Field Strength at Center of Focusing Coil▲	75	gausses
Field Strength of Alignment Coil (Approx.)	0 to 3	gausses

▲ Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

OPERATING CONSIDERATIONS

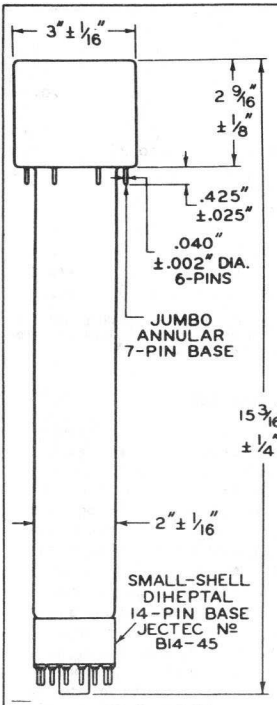
When the equipment design or operating conditions are such that the *maximum temperature rating* or *maximum temperature difference* as given under *Maximum Ratings* will be exceeded, provision should be made to direct a blast of cooling air from the diheptal–base end of the tube along the entire length of the bulb surface, i.e., through the space between the bulb surface and the surrounding deflecting–coil assembly and its extension. Any attempt to effect cooling of the tube by circulating even a large amount of air around the focusing coil will do little good, but a small amount of air directly in contact with the bulb surface will effectively drop the bulb temperature. For this purpose, a small blower is satisfactory, but it should be run at low speed to prevent vibration of the 6474 and the associated amplifier equipment. Unless vibration is prevented, distortion of the picture may occur.

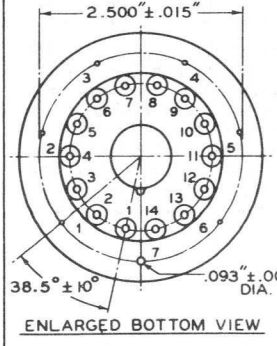
To keep the operating temperature of the large end of the tube from falling below 35°C, some form of controlled heating should be employed. Ordinarily, adequate heat will be supplied by the focusing coil, deflecting coils, and associated amplifier tubes so that the temperature can be controlled by the amount of cooling air directed along the bulb surface. If, in special cases, a target heater is required, it should fit between the focusing coil and the bulb near the shoulder of the tube, and be non–inductively wound.

6474

6474

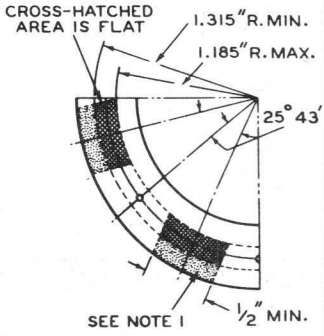
IMAGE ORTHICON





ENLARGED BOTTOM VIEW

DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE



NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.

ANNULAR BASE GAUGE

ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAUGE WITH:

a. SIX HOLES HAVING DIAMETER OF 0.065" ± 0.001" AND ONE HOLE HAVING DIAMETER OF 0.150" ± 0.001". ALL HOLES HAVE DEPTH OF 0.265" ± 0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047". ALL HOLES ARE SPACED AT ANGLES OF 51°26' ± 5' ON CIRCLE DIAMETER OF 2.500" ± 0.015".

b. SIX STOPS HAVING HEIGHT OF 0.187" ± 0.001", CENTERED BETWEEN PIN HOLES, TO BEAR AGAINST FLAT AREAS OF BASE.

c. RIM EXTENDING OUT A MINIMUM OF 1/8" FROM 2-13/16" DIAMETER AND HAVING HEIGHT OF 0.126" ± 0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200" ± 0.001".

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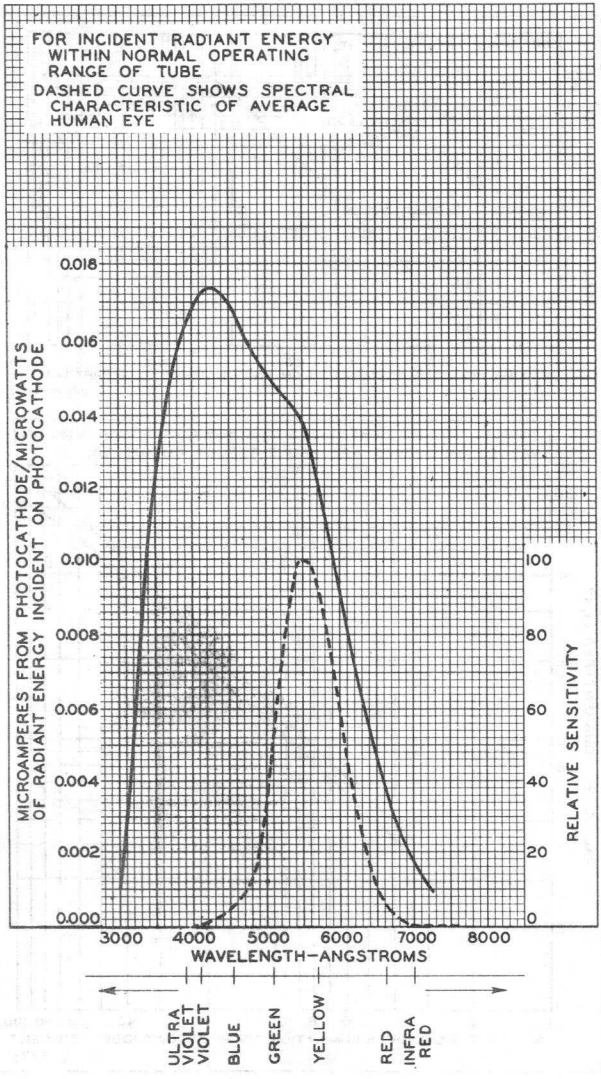
SPECTRAL SENSITIVITY CHARACTERISTIC



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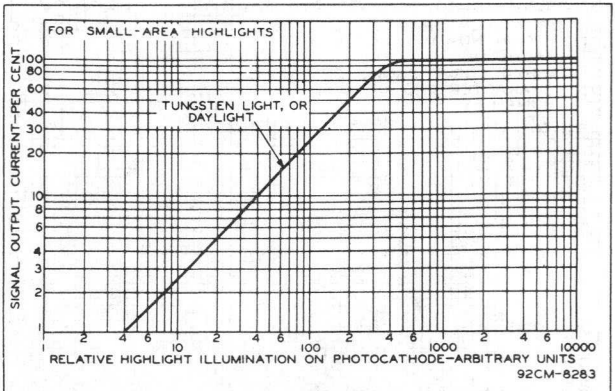
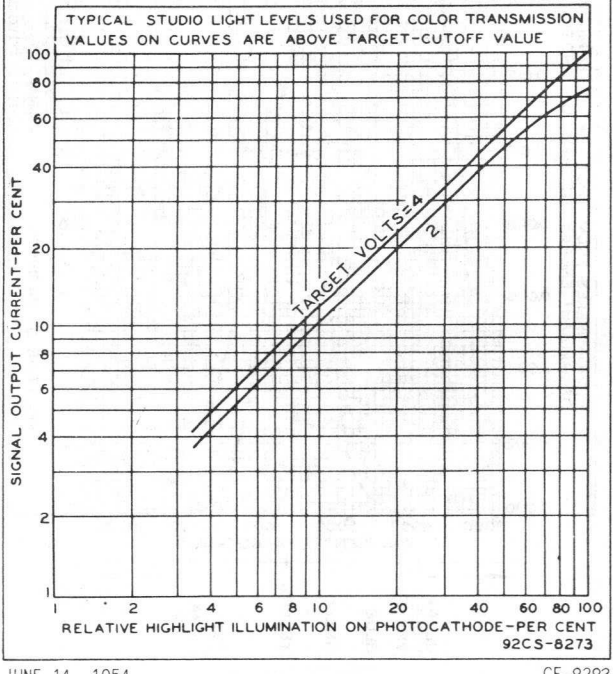
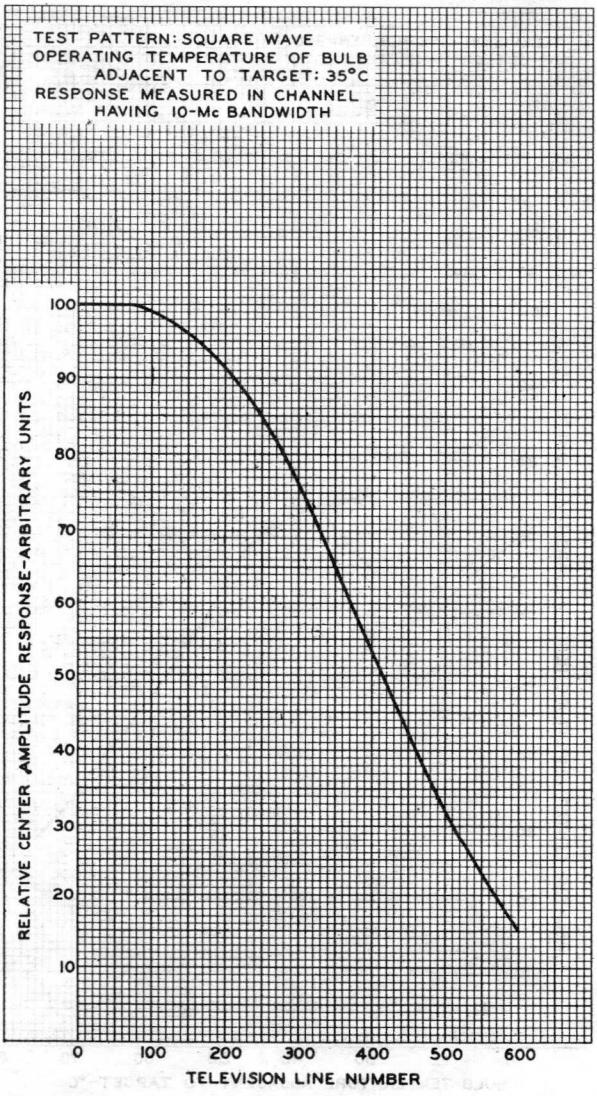
LIGHT TRANSFER CHARACTERISTICS





6474

AMPLITUDE RESPONSE CHARACTERISTIC



MAR. 15, 1954

TUBE DIVISION
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92CM-8271

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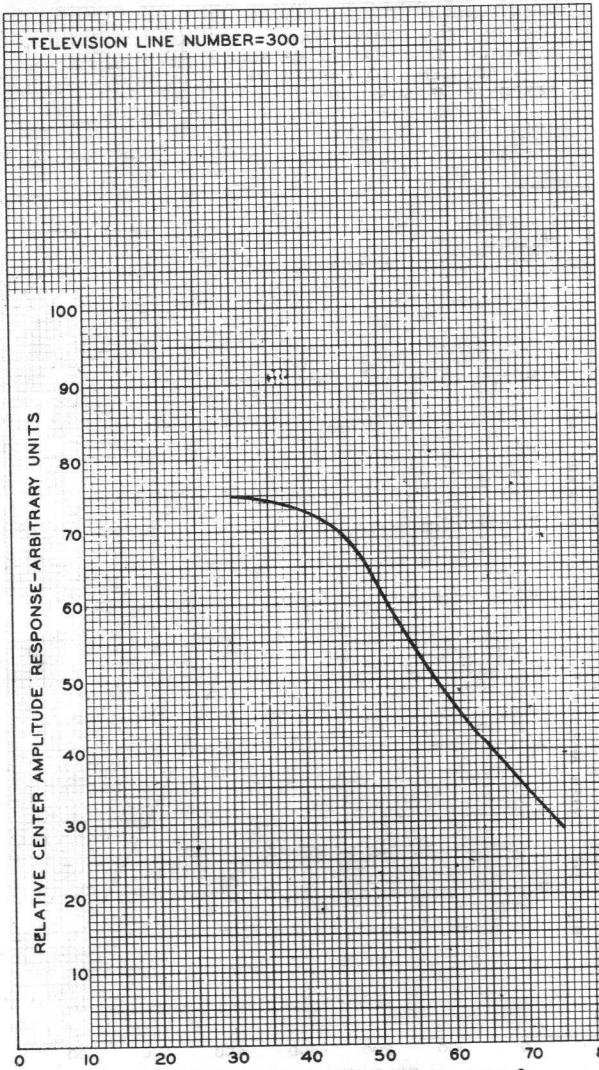
TEMPERATURE EFFECT ON AMPLITUDE RESPONSE



MAR.15,1954

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8272

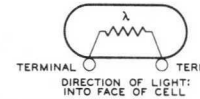
6694-A
PHOTOCONDUCTIVE CELL

CADMIUM-SULFIDE TYPE

DATA

General:

Spectral Response	S-12
Wavelength of Maximum Response	5000 ± 500 angstroms
Sensitive Area:	
Shape	Rectangular
Dimensions (Minimum)	0.020" x 0.018"
Direct Interelectrode Capacitance	0.6 μμf
Maximum Overall Length	0.500"
Maximum Seated Length	0.300"
Width	0.350" ± 0.025"
Depth	0.200" ± 0.020"
Mounting Position	Any
Weight (Approx.)	0.02 oz
Base	Small-Rectangle Linotetrar 2-Pin (JETEC No.E2-33)
Socket	Cinch Part No.46AZ20248, or equivalent



λ indicates that the primary characteristic of the element within the envelope symbol is designed to vary under the influence of light.

Maximum Ratings, *Absolute Values:*

POLARIZING VOLTAGE	150 max.	volts
POWER DISSIPATION	30 max.	mw
AMBIENT-TEMPERATURE RANGE	0 to +70	°C

Characteristics:

Under conditions with polarizing voltage of 90 volts and at ambient temperature of 25°C

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant♦, at 5000 angstroms	–	415	–	μamp/μwatt
Luminous*, at 0 cps	–	1	–	amp/lumen
Luminous intensity▲, at 0 cps	1.9	4	–	μamp/ft-c
Dynamic				*See Curves*
Dark Current	–	–	0.1	μamp
Dark Noise	Essentially lower than that of associated circuit			
Photocurrent:				
Rise				*See Curves*
Decay				*See Curves*

♦ For conditions where the incident power is 0.2 μwatt.

* For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870°K. A light flux of about 100 microlumens is used.

▲: See next page.

TUBE DIVISION
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6694-A
PHOTOCONDUCTIVE CELL

▲ For light conditions the same as shown under (*) except that an incident light intensity of 30 foot-candles is used.

DEFINITIONS

Radiant Sensitivity. The quotient of output current by incident radiant power of a given wavelength, at constant electrode voltages.

Luminous Sensitivity. The quotient of output current by incident luminous flux, at constant electrode voltages.

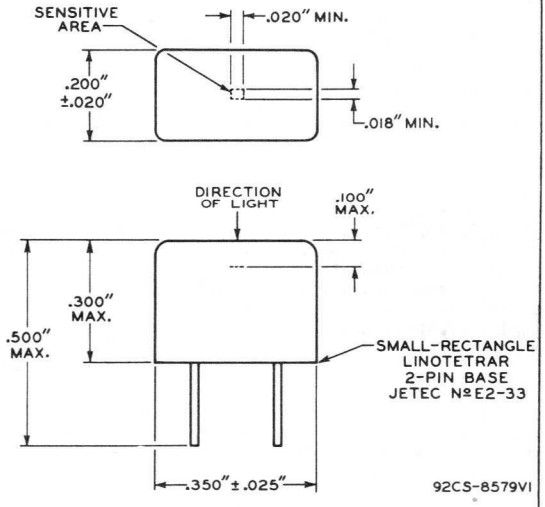
Luminous Intensity Sensitivity. The quotient of output current by the incident luminous intensity, at constant electrode voltages.

Dynamic Sensitivity. The quotient of the modulated component of the electrical output by the modulated component of the incident radiation.

OPERATING CONSIDERATIONS

The *polarizing voltage* for the 6694-A may be applied without regard to polarity. To obtain the full sensitivity of the cell, it is essential that its entire photosensitive area be illuminated. Otherwise, a blocking action produced by the unilluminated area of the cell will occur and cause unsatisfactory operation.

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Photoconductive Cell having S-12 Response
is shown at the front of this Section



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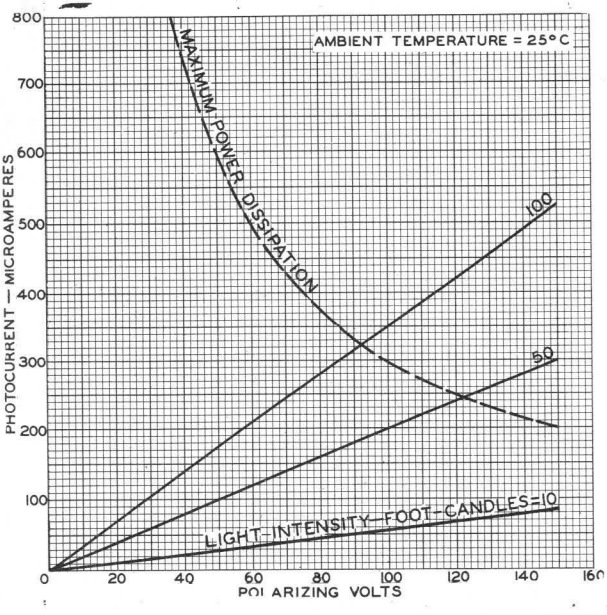
RCA

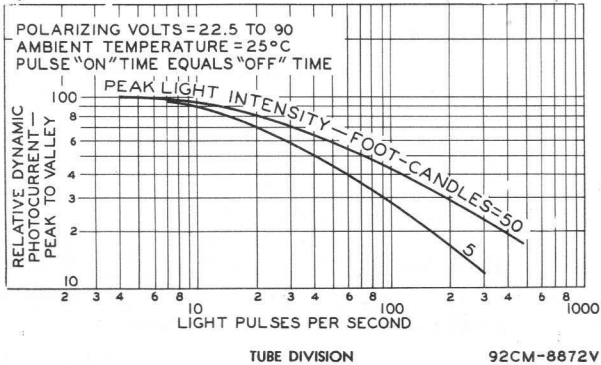
6694-A

AVERAGE CHARACTERISTICS



92CM-8583VI

DYNAMIC SENSITIVITY CHARACTERISTICS



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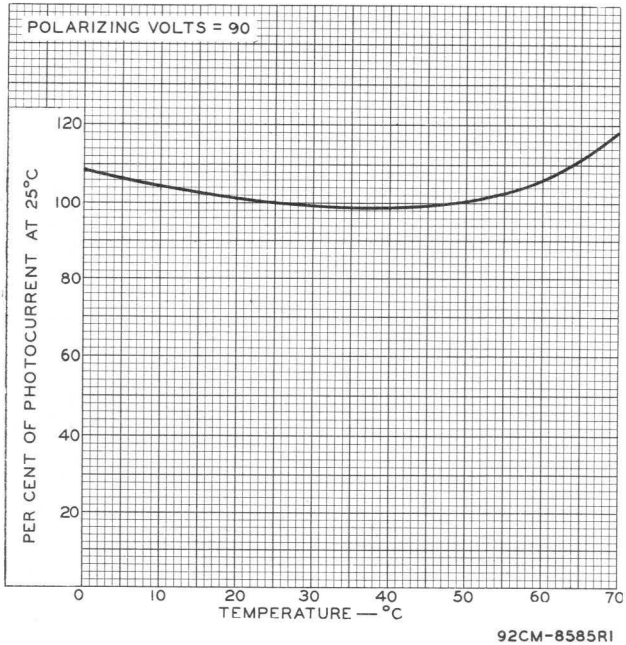
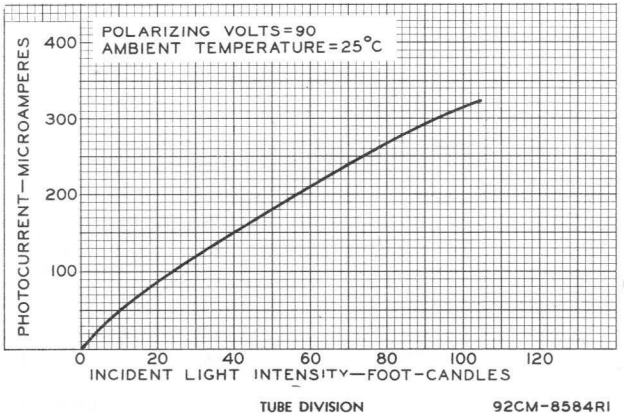
92CM-8872V

6694-A

TYPICAL CHARACTERISTICS



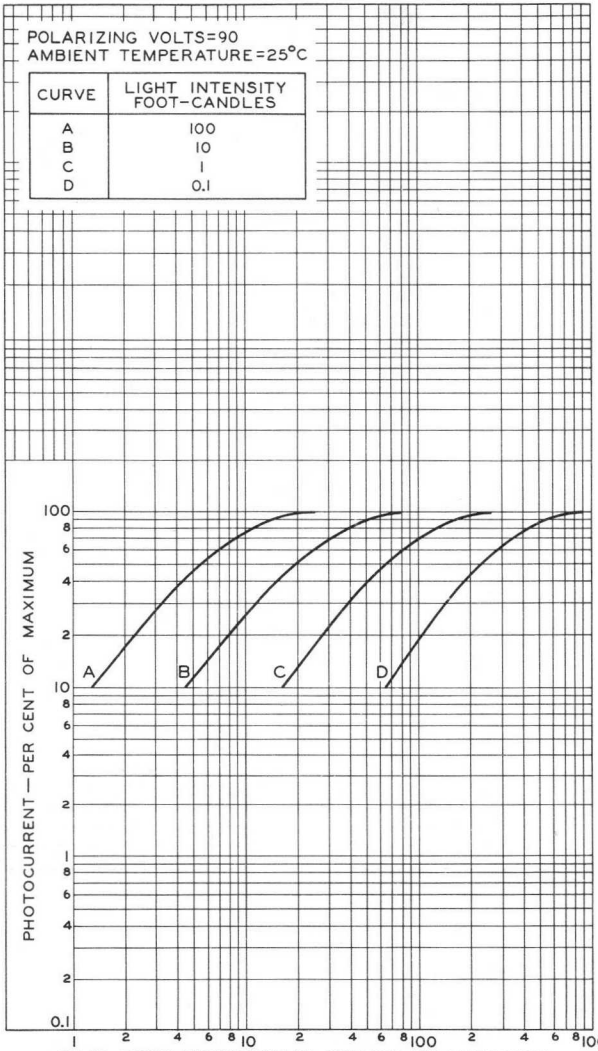
92CM-8585RI



92CM-8584RI

6694-A

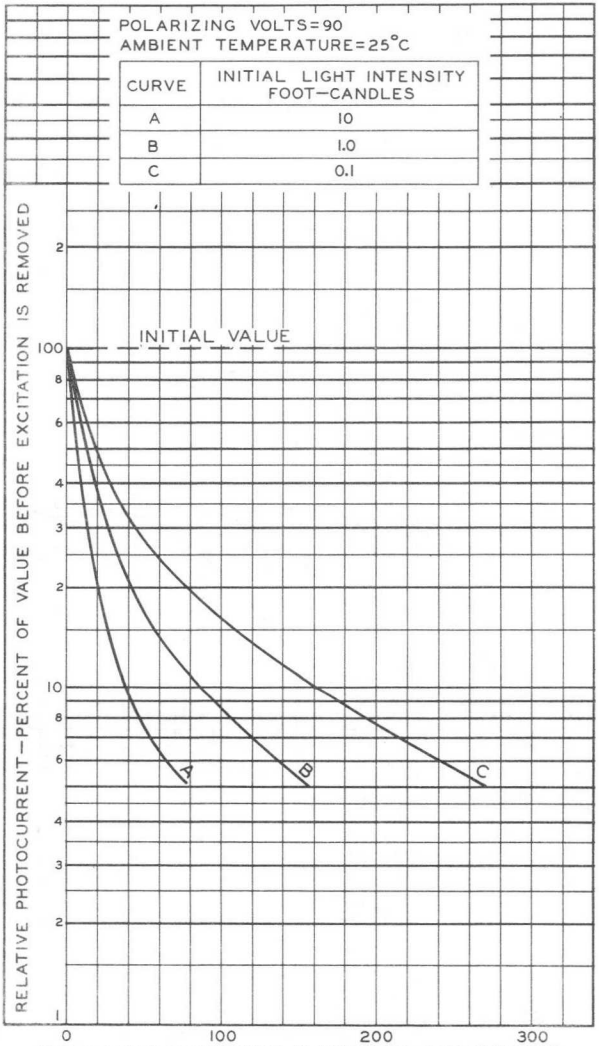
TYPICAL RISE CHARACTERISTICS



6694-A

6694-A

TYPICAL DECAY CHARACTERISTICS



TUBE DIVISION
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92CM-8593RI

6810

MULTIPLIER PHOTOTUBE

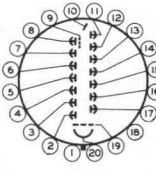
14-STAGE, HEAD-ON TYPE WITH
1-11/16" SEMITRANSPARENT CATHODE AND S-11 RESPONSE
SHORT TIME-RESOLUTION CAPABILITY

DATA

General:

Spectral Response	S-11
Wavelength of Maximum Response	4400 ± 500 angstroms
Cathode, Semitransparent:	
Shape	Circular
Window:	
Area	2.2 sq. in.
Minimum diameter	1-11/16 in.
Index of refraction	1.51
Direct Interelectrode Capacitances (Approx.):	
Anode to dynode No.14	2.4 μμf
Anode to all other electrodes	5.5 μμf
Dynode No.14 to all other electrodes	7.5 μμf
Maximum Overall Length	7-1/2"
Seated Length	6-11/16" ± 3/16"
Maximum Diameter	2-3/8"
Mounting Position	Any
Weight (Approx.)	8 oz
Bulb	T-16
Base	Small-Shell Bidecal 20-Pin (JETEC No.B20-102), Non-hygroscopic
Basing Designation for BOTTOM VIEW	20B

Pin 1 - No Connection
Pin 2 - Dynode No.1
Pin 3 - Dynode No.3
Pin 4 - Dynode No.5
Pin 5 - Dynode No.7
Pin 6 - Dynode No.9
Pin 7 - Dynode No.11
Pin 8 - Dynode No.13
Pin 9 - Grid No.2 (Accelerating Electrode)
Pin 10 - Anode



Pin 11 - Dynode No.14
Pin 12 - Dynode No.12
Pin 13 - Dynode No.10
Pin 14 - Dynode No.8
Pin 15 - Dynode No.6
Pin 16 - Dynode No.4
Pin 17 - Dynode No.2
Pin 18 - No Connection
Pin 19 - Grid No.1 (Focusing Electrode)
Pin 20 - Photocathode

Maximum Ratings, *Absolute Values:*

ANODE-SUPPLY VOLTAGE (DC)	2300 max.	volts
SUPPLY VOLTAGE BETWEEN DYNODE No.14 AND ANODE (DC)	400 max.	volts
SUPPLY VOLTAGE BETWEEN ACCELERATING-ELECTRODE AND DYNODE No.13 (DC)	±500 max.	volts
DYNODE-No.1 SUPPLY VOLTAGE (DC)	400 max.	volts
FOCUSING-ELECTRODE SUPPLY VOLTAGE (DC)	400 max.	volts
AVERAGE ANODE CURRENT•	2 max.	ma
AMBIENT TEMPERATURE	75 max.	°C

• Averaged over any interval of 30 seconds maximum.

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MULTIPLIER PHOTOTUBE

Characteristics Range Values for Equipment Design:

Under conditions with supply voltage (E) across a voltage divider providing electrode voltages shown in Table 1

With E = 2000 volts (except as noted) and Accelerating-Electrode Voltage adjusted to give maximum gain

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4400 angstroms	–	0.6	–	amp/μwatt
Cathode radiant, at 4400 angstroms	–	0.048	–	μamp/μwatt
Luminous:♦				
At 0 cps	120	750	4500	amp/lumen
With dynode No.14 as output electrode†	–	525	–	amp/lumen
Cathode luminous:				
With tungsten light source▲	40	60	–	μamp/lumen
With blue light source⊕◆	0.04	–	–	μamp
Current Amplification	–	12.5×10^6	–	
Equivalent Anode-Dark-Current Input⊕■	–	5×10^{-10}	2×10^{-9}	lumen
Equivalent Noise Input★	–	6×10^{-12}	–	lumen
Dark Current to Any Electrode Except Anode (At 25°C)	–	–	0.75	μamp

With E = 2300 volts (except as noted) and Accelerating-Electrode Voltage adjusted to give maximum gain

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4400 angstroms	–	3.2	–	amp/μwatt
Cathode radiant, at 4400 angstroms	–	0.048	–	μamp/μwatt
Luminous:♦				
At 0 cps	660	4000	28000	amp/lumen
With dynode No.14 as output electrode†	–	2800	–	amp/lumen
Cathode luminous:				
With tungsten light source▲	40	60	–	μamp/lumen
With blue light source⊕◆	0.04	–	–	μamp
Current Amplification	–	66×10^6	–	

♦,†,▲,⊕,◆,⊕,■,★: See next page.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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MULTIPLIER PHOTOTUBE

TABLE I

VOLTAGE TO BE PROVIDED BY DIVIDER

Between	5.4% of Supply Voltage (E) multiplied by
Cathode and Focusing Electrode	1
Focusing Electrode and Dynode No.1	1
Dynode No.1 and Dynode No.2	1
Dynode No.2 and Dynode No.3	1
Dynode No.3 and Dynode No.4	1
Dynode No.4 and Dynode No.5	1
Dynode No.5 and Dynode No.6	1
Dynode No.6 and Dynode No.7	1
Dynode No.7 and Dynode No.8	1
Dynode No.8 and Dynode No.9	1
Dynode No.9 and Dynode No.10	1
Dynode No.10 and Dynode No.11	1
Dynode No.11 and Dynode No.12	1.25
Dynode No.12 and Dynode No.13	1.5
Dynode No.13 and Dynode No.14	1.75
Dynode No.14 and Anode	2
Anode and Cathode	18.5

♦ For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870°K. A light input of 0.1 microlumen is used. The load resistor has a value of 0.01 megohm.

† An output current of opposite polarity to that obtained at the anode may be provided by using dynode No.14 as the output electrode. With this arrangement, the load is connected in the dynode-No.14 circuit and the anode serves only as collector. The value of sensitivity at dynode No.14 is approximately 70% of that when the anode is the output electrode. Specifically, the sensitivity measured at dynode No. 14 is equal to (1-1/g) times the sensitivity measured at the anode, where "g" is the gain of the dynode-No.14 stage.

▲ For conditions the same as shown under (♦) except that the value of light flux is 0.01 lumen and 200 volts are applied between cathode and all other electrodes connected together as anode.

⊕ Under the following conditions: Light incident on the cathode is transmitted through a blue filter (Corning, Glass Code No.5113 polished to 1/2 stock thickness) from a tungsten-filament lamp operated at a color temperature of 2870°K. The value of light flux on the filter is 0.01 lumen. The load resistor has a value of 0.01 megohm, and 200 volts are applied between cathode and all other electrodes connected together as anode.

◆ For spectral characteristic of this source, see sheet SPECTRAL CHARACTERISTIC OF 2870°K LIGHT SOURCE AND SPECTRAL CHARACTERISTIC OF LIGHT FROM 2870°K SOURCE AFTER PASSING THROUGH INDICATED BLUE FILTER at front of this section.

⊕ Measured at a tube temperature of 25°C and with the supply voltage (E) adjusted to give a luminous sensitivity of 2000 amperes per lumen. Dark current caused by thermionic emission and ion feedback may be reduced by the use of a refrigerant.

■ For maximum signal-to-noise ratio, operation with a supply voltage (E) below 2000 volts is recommended.

★ Under the following conditions: Supply voltage (E) is 2000 volts, 25°C tube temperature, external shield potential of -2000 volts, ac-amplifier bandwidth of 1 cycle per second, tungsten light source of 2870°K interrupted at a low audio frequency to produce incident radiation pulses alternating between zero and the value stated. The "on" period of the pulse is equal to the "off" period. The output current is measured through a filter which passes only the fundamental frequency of the pulses.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

6810

MULTIPLIER PHOTOTUBE

OPERATING CONSIDERATIONS

The *operating stability* of the 6810 is dependent on the magnitude of the anode current and its duration. When the 6810 is operated at high values of anode current, a drop in sensitivity (sometimes called fatigue) may be expected. The extent of the drop below the tabulated sensitivity values depends on the severity of the operating conditions. After a period of idleness, the 6810 usually recovers a substantial percentage of such loss in sensitivity.

The use of an average anode current well below the maximum rated value of 2 milliamperes is recommended when stability of operation is important. When maximum stability is required, the anode current should not exceed 250 microamperes.

Electrostatic and/or *magnetic shielding* of the 6810 may be necessary.

The *material* of which the dynodes of the 6810 are made has stable, high-current carrying capabilities and permits the use of a tube manufacturing process which minimizes regenerative effects such as afterpulses. The relative freedom of the 6810 from afterpulses and its small spread in electron transit time make it particularly useful for fast coincidence scintillation counting.

Because the 6810 offers the advantage of small spread in electron transit time, it has a fast pulse rise time. As a result, the 6810 has very short time-resolution capability, i.e., in the order of 1 or 2 millimicroseconds. For an input pulse having a duration of 1 millimicrosecond or less, the time spread of the pulse at the anode is about 9 millimicroseconds measured at 50 per cent of the maximum pulse height, when the supply voltage is 2000 volts and the focusing electrode is connected to dynode No. 1.

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-11 Response
is shown at the front of this Section

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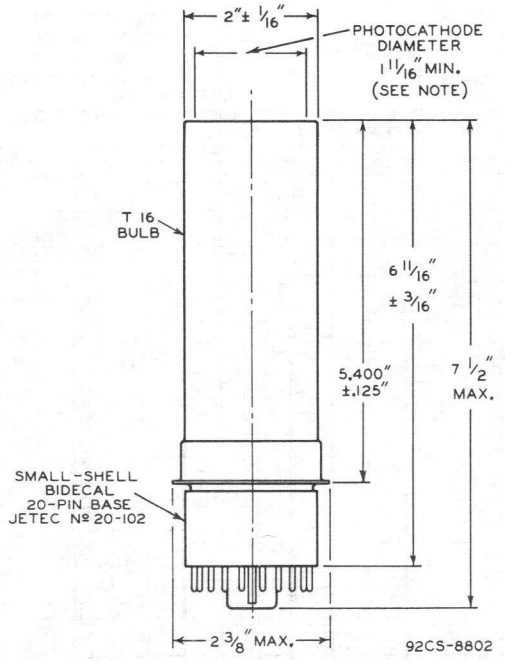
6810

MULTIPLIER PHOTOTUBE



℄ OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF BOTTOM OF THE BASE.

NOTE: WITHIN MINIMUM DIAMETER, DEVIATION FROM FLATNESS WILL NOT EXCEED 0.010" FROM PEAK TO VALLEY.

6810

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6810

AVERAGE ANODE CHARACTERISTICS

CATHODE-TO-GRID-№1 VOLTS = 108

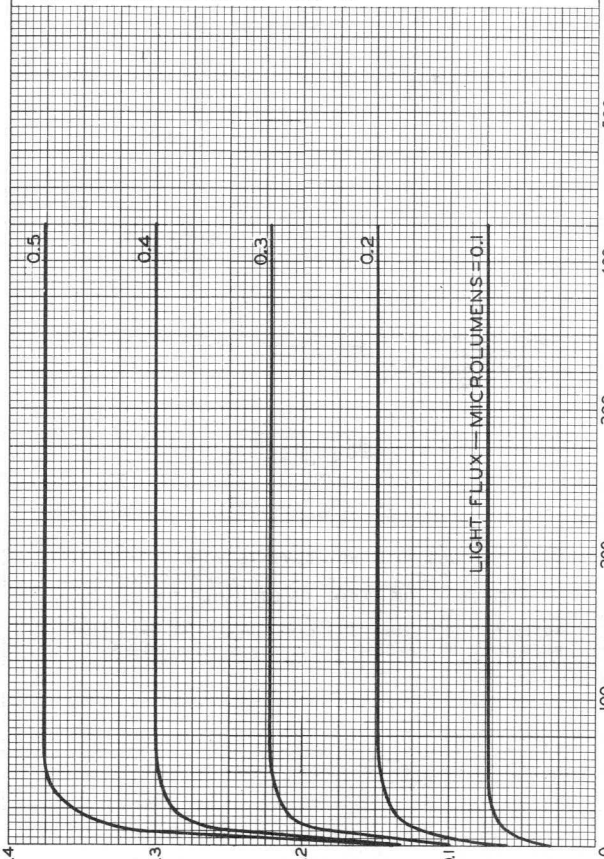
GRID-№1-TO-DYNODE №1 (DY_1) VOLTS = 108

DY_1 - TO - DY_2
DY_2 - TO - DY_3
ETC. TO
DY_{10} - TO - DY_{11}
} VOLTS = 108

DY_{11} - TO - DY_{12} VOLTS = 135
DY_{12} - TO - DY_{13} VOLTS = 160
DY_{13} - TO - DY_{14} VOLTS = 189

GRID-№2 VOLTS ADJUSTED TO GIVE MAX. GAIN

LIGHT SOURCE IS TUNGSTEN FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870°K.



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92CM-8846

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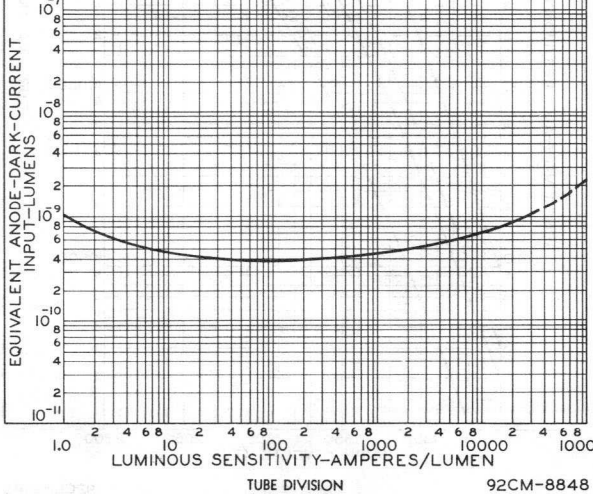
6810

TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC

LUMINOUS SENSITIVITY IS VARIED BY ADJUSTMENT OF THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	5.4% OF E MULTIPLIED BY
CATHODE & GRID №1	1
GRID №1 & DYNODE №1 (DY_1)	1
DY_1 & DY_2	1
DY_2 & DY_3	1
DY_3 & DY_4	1
DY_4 & DY_5	1
DY_5 & DY_6	1
DY_6 & DY_7	1
DY_7 & DY_8	1
DY_8 & DY_9	1
DY_9 & DY_{10}	1
DY_{10} & DY_{11}	1
DY_{11} & DY_{12}	1.25
DY_{12} & DY_{13}	1.50
DY_{13} & DY_{14}	1.75
DY_{14} & ANODE	2.
ANODE & CATHODE	18.5

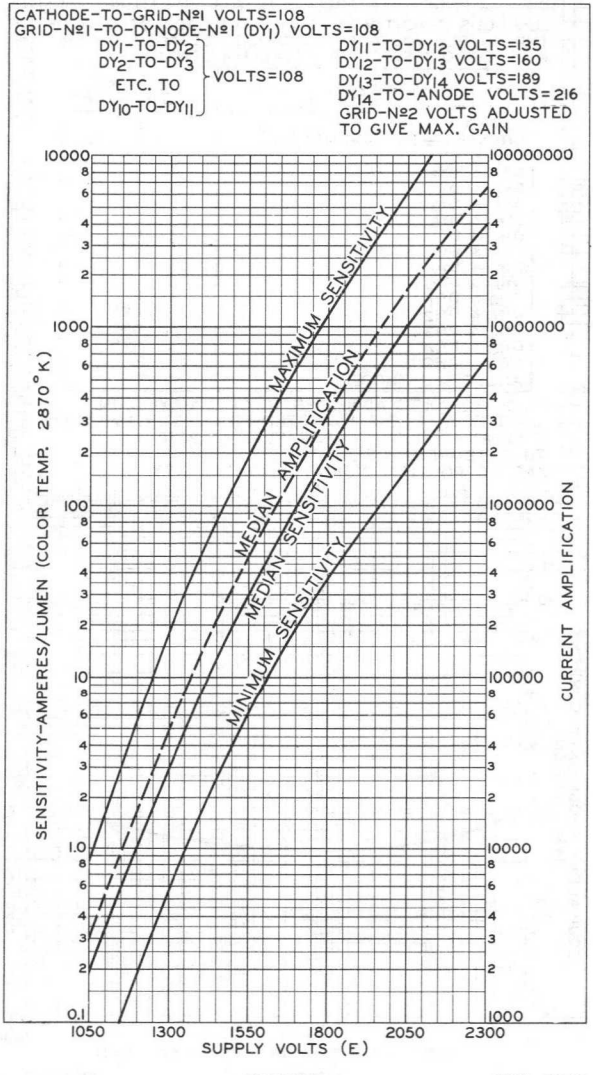
GRID-№2 VOLTS ADJUSTED TO GIVE MAX. GAIN.
LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870°K.
TUBE TEMPERATURE=25°C
DASHED PORTION INDICATES INSTABILITY.



RCA

6810

CHARACTERISTICS



6849

IMAGE ORTHICON

For extremely low-light-level pickup in industrial and scientific-research applications

MAGNETIC FOCUS — MAGNETIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:
- Voltage . . . . . 6.3 ± 10% . . . ac or dc volts
- Current . . . . . 0.6 . . . . . amp

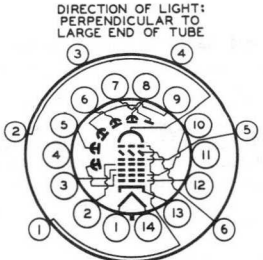
Direct Interelectrode Capacitance (Approx.):
- Anode to all other electrodes . . . . . 12 μμf

Photocathode, Semitransparent:
- Response . . . . . *See accompanying Spectral-Sensitivity-Characteristic curve*
- Rectangular image (4 x 3 aspect ratio):
  - Useful size of . . . . . 1.6" max. diagonal
  - Orientation of . . . . Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through the center of the faceplate and pin 7 of the shoulder base.

Focusing Method . . . . . Magnetic
Deflection Method . . . . . Magnetic
Overall Length . . . . . 15-3/16" ± 1/4"
Greatest Diameter of Bulb . . . . . 3" ± 1/16"
Minimum Deflecting-Coil Inside Diameter . . . . . 2-3/8"
Deflecting-Coil Length . . . . . 5"
Focusing-Coil Length . . . . . 10"
Alignment-Coil Length . . . . . 15/16"
Photocathode Distance Inside End of Focusing Coil . . . . 1/2"
Operating Position: Any except with diheptal base up and tube axis at angle of less than 20° from vertical
Weight (Approx.) . . . . . 1 lb 6 oz
End Base . . . . Small-Shell Diheptal 14-Pin (JETEC No.B14-45)

BOTTOM VIEW

Pin 1 – Heater
Pin 2 – Grid No.4
Pin 3 – Grid No.3
Pin 4 – Internal Connection—Do Not Use
Pin 5 – Dynode No.2
Pin 6 – Dynode No.4
Pin 7 – Anode
Pin 8 – Dynode No.5
Pin 9 – Dynode No.3
Pin 10 – Dynode No.1, Grid No.2
Pin 11 – Internal Connection—Do Not Use
Pin 12 – Grid No.1
Pin 13 – Cathode
Pin 14 – Heater



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6849

IMAGE ORTHICON

Shoulder Base . . . . . Keyed Jumbo Annular 7-Pin

Pin 1 - Grid No.6	Pin 5 - Grid No.5
Pin 2 - Photocathode	
Pin 3 - Internal Connection---Do Not Use	Pin 6 - Target
Pin 4 - Internal Connection---Do Not Use	Pin 7 - Internal Connection---Do Not Use

Maximum Ratings, *Absolute Values:*

PHOTOCATHODE:		
Voltage	-550 max.	volts
Illumination.	50 max.	ft-c
OPERATING TEMPERATURE:		
Of any part of bulb	50 max.	°C
Of bulb at large end of tube (Target section).	35 min.	°C
TEMPERATURE DIFFERENCE:		
Between target section and any part of bulb hotter than target section. . . .	5 max.	°C
GRID-No.6 VOLTAGE	-550 max.	volts
TARGET VOLTAGE:		
Positive value.	10 max.	volts
Negative value.	10 max.	volts
GRID-No.5 VOLTAGE	150 max.	volts
GRID-No.4 VOLTAGE	300 max.	volts
GRID-No.3 VOLTAGE	400 max.	volts
GRID-No.2 & DYNODE-No.1 VOLTAGE	350 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value	125 max.	volts
Positive bias value	0 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode .	125 max.	volts
Heater positive with respect to cathode .	10 max.	volts
ANODE-SUPPLY VOLTAGE*	1350 max.	volts
VOLTAGE PER MULTIPLIER STAGE.	350 max.	volts

Typical Operation and Characteristics:

Photocathode Voltage (Image Focus). . .	-400 to -540	volts
Grid-No.6 Voltage (Accelerator)--- 75% of photocathode voltage	-300 to -405	volts
Target Voltage°	0 to 3	volts
Grid-No.5 Voltage (Decelerator)	0 to 125	volts
Grid-No.4 Voltage (Beam Focus).	130 to 180	volts
Grid-No.3 Voltage#.	225 to 330	volts
Grid-No.2 & Dynode-No.1 Voltage	300	volts
Grid-No.1 Voltage for Picture Cutoff. .	-45 to -115	volts

* Ratio of dynode voltages is shown under *Typical Operation.*

° Adjustable from -3 to +5 volts with blanking voltage off.

\# Adjust to give the most uniformly shaded picture near maximum signal.

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IMAGE ORTHICON

Dynode–No.2 Voltage	600	volts
Dynode–No.3 Voltage	800	volts
Dynode–No.4 Voltage	1000	volts
Dynode–No.5 Voltage	1200	volts
Anode Voltage	1250	volts
Anode Current (DC)	3	μa
Signal–Output Current (Peak to peak)	0.01 to 5	μa
Target–Temperature Range	35 to 45	°C
Minimum Peak–to–Peak Blanking Voltage▲	5	volts
Field Strength at Center of Focusing Coil▲	75	gausses
Field Strength of Alignment Coil (Approx.)	0 to 3	gausses

▲ Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

OPERATING CONSIDERATIONS

When the equipment design or operating conditions are such that the *maximum temperature rating* or *maximum temperature difference* as given under *Maximum Ratings* will be exceeded, provision should be made to direct a blast of cooling air from the diheptal-base end of the tube along the entire length of the bulb surface, i.e., through the space between the bulb surface and the surrounding deflecting-coil assembly and its extension. Any attempt to effect cooling of the tube by circulating even a large amount of air around the focusing coil will do little good, but a small amount of air directly in contact with the bulb surface will effectively drop the bulb temperature. For this purpose, a small blower is satisfactory, but it should be run at low speed to prevent vibration of the 6849 and the associated amplifier equipment. Unless vibration is prevented, distortion of the picture may occur.

To keep the operating temperature of the large end of the tube from falling below 35 °C, some form of controlled heating should be employed. Ordinarily, adequate heat will be supplied by the focusing coil, deflecting coils, and associated amplifier tubes so that the temperature can be controlled by the amount of cooling air directed along the bulb surface. If, in special cases, a target heater is required, it should fit between the focusing coil and the bulb near the shoulder of the tube, and be non-inductively wound.

Resolution in excess of 450 lines at the center of the picture can be produced by the 6849 under the higher light-level conditions. With decreasing illumination levels, the resolution decreases. To utilize such resolution capability in the horizontal direction with the standard scanning rate of 525 lines, it is necessary to use a video amplifier having a bandwidth of at least 6 megacycles. The maximum resolution obtainable is limited by the mesh-screen portion of the target.

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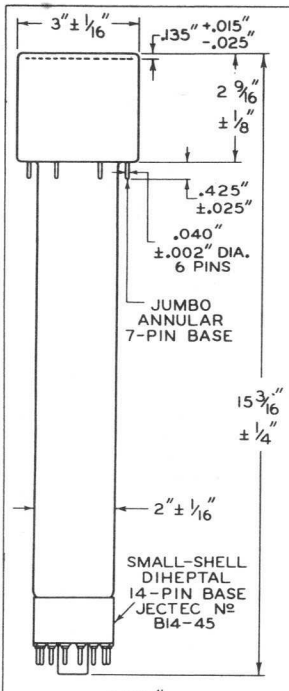
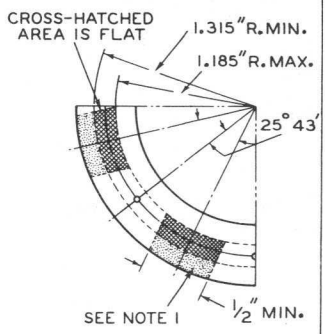
RCA

6849

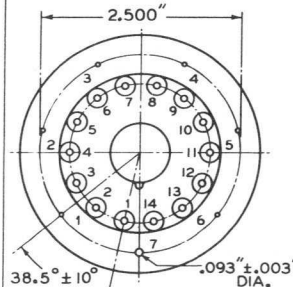
IMAGE ORTHICON



DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE



NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.



ENLARGED BOTTOM VIEW

ANNULAR-BASE GAUGE

ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAUGE WITH:

a. SIX HOLES HAVING DIAMETER OF 0.065" ± 0.001" AND ONE HOLE HAVING DIAMETER OF 0.150" ± 0.001". ALL HOLES HAVE DEPTH OF 0.265"±0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047". ALL HOLES ARE SPACED AT ANGLES OF 51°26' ± 5' ON CIRCLE DIAMETER OF 2.500" ± 0.001".

b. SIX STOPS HAVING HEIGHT OF 0.187" ± 0.001", CENTERED BETWEEN PIN HOLES, TO BEAR AGAINST FLAT AREAS OF BASE.

c. RIM EXTENDING OUT A MINIMUM OF 1/8" FROM 2-13/16" DIAMETER AND HAVING HEIGHT OF 0.126" ± 0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200" ± 0.001".

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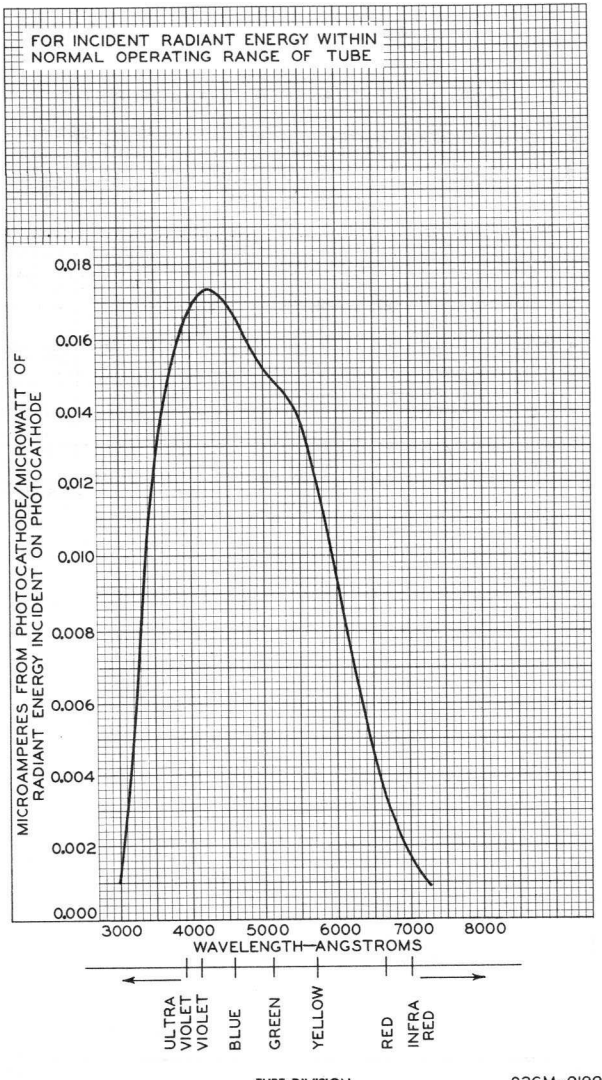
SPECTRAL-SENSITIVITY CHARACTERISTIC



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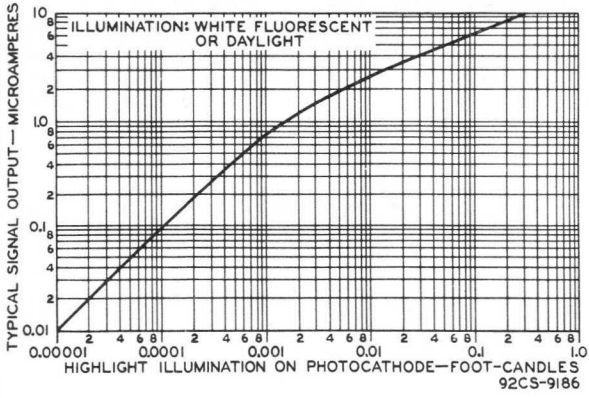
6849

IMAGE ORTHICON

BASIC LIGHT-TRANSFER CHARACTERISTIC



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6865-A
MAGNETRON

TUNABLE TYPE

FORCED-AIR COOLED INTEGRAL MAGNET

For use as a pulsed oscillator at frequencies between 8750 and 9600 Mc

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage	13.75 ± 10%	ac or dc volts
Current at 13.75 volts	3.15	amp
Starting current	The maximum instantaneous starting current must never exceed 12 amperes, even momentarily	
Minimum Cathode Heating Time	2.5	minutes
Frequency	8750 to 9600	Mc
Maximum Frequency Pulling at VSWR of 1.5	13	Mc

Mechanical:

Operating Position . . . . . Any

Dimensions . . . . . *See Dimensional Outline*

Air Flow:

To Fins--An air stream should be directed along the cooling fins toward the body of the tube. Adequate flow should be provided so that the temperature of the anode block does not exceed 150° C.

To Heater-Cathode Terminal--Adequate flow should be provided to maintain the temperature of the heater-cathode terminal below 165° C.

Waveguide Output Flange . . . . . Mates with Modified JAN UG-52A/U Flange

Tuner . . . . . Calibrated, equipped with lock

Weight (Approx.) . . . . . 11-1/2 lbs

PULSED-OSCILLATOR SERVICE

Maximum and Minimum Ratings, *Absolute Values:*

For duty cycle up to 0.001 maximum

PEAK ANODE VOLTAGE	23 max.	kv
PEAK ANODE CURRENT	27.5 max.	amp
PEAK POWER INPUT●	630 max.	kw
AVERAGE POWER INPUT	0.63 max.	kw
PULSE DURATION	2.5 max.	μsec
RATE OF RISE OF VOLTAGE PULSE	180 max.	kv/μsec
	70 min.	kv/μsec
ANODE-BLOCK TEMPERATURE	150 max.	°C
HEATER-CATHODE-TERMINAL TEMPERATURE	165 max.	°C
LOAD-VOLTAGE STANDING-WAVE RATIO	1.5 max.	

●: See next page.

RCA

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MAGNETRON

Typical Operation▲ with Load-Voltage Standing-Wave Ratio Equal to or Less than 1.05, Except as Noted:

With duty cycle of 0.001

Heater Voltage	*See Operating Considerations*		
Peak Anode Voltage	22	22	kv
Peak Anode Current	27.5	27.5	amp
Pulse-Repetition Rate	400	2000	cps
Pulse Duration	2.5	0.5	μsec
RF Bandwidth with worst phasing of 1.5 VSWR	0.8	4	Mc
Side Lobes with worst phasing of 1.5 VSWR	8	10	db
Pulling Figure at VSWR of 1.5	10	10	Mc
Pushing Figure	0.2	0.2	Mc/amp
Thermal Factor for any 30° range of anode-block temperature between −55° and 150° C	0.2	0.2	Mc/°C
Peak Power Output	220	220	kw

● For atmospheric pressure greater than 600 millimeters of mercury in the vicinity of the heater-cathode stem. Operation at pressures lower than 600 millimeters of mercury may result in arc-over across the stem with consequent damage to the tube. The waveguide must always be pressurized to a minimum of 15 psi absolute to prevent arcing, especially when there is a mismatched load. Arcing in the waveguide due to lack of pressure can damage the tube.

▲ It is essential that the input circuit be designed so that if arcing occurs the energy per pulse delivered to the tube cannot greatly exceed the normal energy per pulse. To satisfy this requirement, it is recommended that pulsers of the discharging-network type be used.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Heater Current	1	2.9	3.5	amp
Peak Anode Voltage	2	20	23	kv
Peak Power Output	3	190	–	kw
Pulses Missing from Total	4,5	–	0.25	%

Note 1: With 13.75 volts ac or dc on heater.

Note 2: With peak anode current of 27.5 amperes. For heater voltage, *see Operating Considerations.*

Note 3: With peak anode current of 27.5 amperes corresponding to a peak anode voltage in the order of 22 kv, anode-block temperature of 115° C approx., pulse duration of 2.5 microseconds, and maximum load-voltage standing-wave ratio equal to or less than 1.05. For heater voltage, *see Operating Considerations.*

Note 4: Pulses are considered to be missing if the energy level at the operating frequency is less than 70 per cent of the normal value.

Note 5: With peak anode current of 27.5 amperes corresponding to a peak anode voltage in the order of 22 kv, anode-block temperature of 115° C approx., pulse duration of 1 microsecond, load-voltage standing-wave ratio of 1.5, and load-voltage standing-wave ratio phase adjusted to produce maximum instability. For heater voltage, *see Operating Considerations.*

6865-A

MAGNETRON

DEFINITIONS

Smooth Peak Value. The maximum value of a smooth curve drawn through the average of the fluctuation over the top of a voltage or current pulse.

Pulse Width. The time interval between the two points of the current pulse at which the current is 50 per cent of the smooth peak value.

Rate of Rise of Voltage Pulse. The steepest slope of the voltage-pulse leading edge above 50 per cent of the smooth peak value. Measurement of the rate of rise of voltage should be made using a capacitance divider with an input capacitance not exceeding 6 $\mu\mu f$. An oscilloscope of sufficient bandpass, such as the Tektronix 517 or equivalent, should be used.

OPERATING CONSIDERATIONS

Mounting of the 6865-A should be accomplished by means of the mounting flange which may be positioned to operate the tube in any orientation. The flange is made so as to permit use of the 6865-A in applications requiring a pressure seal. Care should be taken by the equipment designer to insure that the tube is mounted on a surface having adequate flatness so as to avoid possible distortion of the mounting flange when it is bolted to the mounting surface.

Fastening the JAN RG-51/U waveguide to the waveguide output flange of the tube is accomplished in the following manner. A JAN UG-52A/U choke flange or equivalent should be modified by drilling out the screw threads from the four mounting holes in the choke flange using a No. 15 drill. This operation will permit four size 8-32 bolts inserted through the flange mounting holes to engage the threaded waveguide output flange of the tube. It is recommended that the choke flange be sufficiently tight to avoid arcing and other contact effects. Before the choke flange is fastened to the waveguide output flange of the tube, the user should make certain that the waveguide window is entirely free of dust to prevent possible arcing with consequent damage to the tube.

Cooling of the anode block is accomplished by directing a separate stream of clean air through each set of cooling fins toward the anode block, from two 3/4"-diameter ducts placed 1/2" to 3/4" from the fins. Adequate flow should be provided to maintain the temperature of the anode block below 150° C under any condition of operation. Failure to provide adequate cooling will impair tube life. Cooling of the heater-cathode terminal may be required under some conditions to maintain the temperature of this terminal below 165° C.

The heater terminal and the *heater-cathode terminal require the use of a connector with flexible leads* such as the Ucinite* No. 115364 with built-in capacitor, or equivalent. Unless flexible leads are used, the heater and heater-cathode seals may be damaged.

A *heater starter* should be used to raise the voltage gradually and to limit the instantaneous starting current

* Manufactured by Ucinite Division of United-Carr Fastener Corporation, Newtonville 60, Massachusetts.

6865-A
MAGNETRON

through the heater when the circuit is first closed. The starter may be either a system of time-delay relays cutting resistance out of the circuit, a high-reactance heater transformer, or a simple rheostat. Regardless of the method of control, it is important that the maximum instantaneous starting current never exceed, even momentarily, a value of 12 amperes. Exceeding this value may damage the heater.

After the heater voltage is raised to its rated value of 13.75 volts, allow the cathode to warm up for at least 2-1/2 minutes to make sure that the cathode reaches operating temperature. When the cathode has reached full operating temperature, high-voltage pulses, negative with respect to anode (ground), can be applied to the heater-cathode terminal. As soon as the 6865-A begins to oscillate, the heater voltage (E_f) should be reduced in accordance with the following formulas, depending on the average power input (P_i) to the tube:

$$P_i \text{ up to } 450 \text{ watts: } E_f = 13.75\left(1 - \frac{P_i}{450}\right) \text{ volts}$$

$$P_i \text{ greater than } 450 \text{ watts: } E_f = 0 \text{ volts}$$

When the 6865-A is oscillating, the cathode is subjected to considerable electron bombardment which raises the temperature of the cathode. The magnitude of such heating is a function of the total dissipation and must be compensated by reduction of heater voltage in order to prevent overheating of the cathode. Failure to start the tube at rated heater voltage and to reduce the heater voltage as soon as oscillation starts may adversely affect tube life.

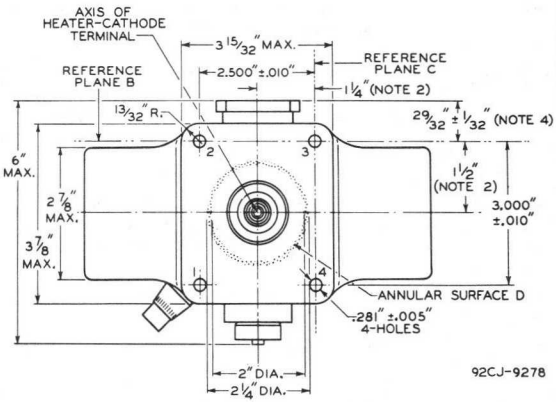
The heater should be protected against input-pulse power by placing a suitable capacitor in shunt with the heater leads as near the heater-cathode stem as possible in order to limit high transient voltages from developing across the heater. This capacitor may be incorporated in the design of the connector for the heater terminal and heater-cathode terminal.

Tuning is accomplished by turning the tuning knob until the setting of the micrometer-type indicator is reached which corresponds to the desired frequency, as determined from the calibration chart prepared for and affixed to each tube. Then lock the tuning knob by tightening the locking nut. For precise tuning adjustment, the final indicator setting should be approached using the same direction of rotation of the tuning knob. There is little frequency drift after changing tuner setting.

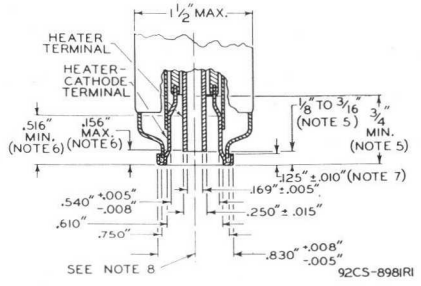
Our engineers are ready to assist you in circuit applications of the RCA-6865-A. For further information, write to Commercial Engineering, RCA, Harrison, New Jersey, giving complete details as to the proposed service.

6865-A
MAGNETRON

BOTTOM VIEW



DETAIL A



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

6865-A
MAGNETRON

REFERENCE PLANE A IS DEFINED AS THE PLANE THROUGH THAT PORTION OF THE MOUNTING FLANGE DESIGNATED AS ANNULAR SURFACE D.

REFERENCE PLANE B IS DEFINED AS THE PLANE WHICH IS PERPENDICULAR TO PLANE A AND PASSES THROUGH THE EXACT CENTERS OF MOUNTING-FLANGE HOLES No.2 & No.3.

REFERENCE PLANE C IS DEFINED AS THE PLANE WHICH IS PERPENDICULAR TO PLANE A & PLANE B AND PASSES THROUGH THE EXACT CENTER OF MOUNTING-FLANGE HOLES No.3 & No.4.

NOTE 1: SURFACE E OF THE WAVEGUIDE OUTPUT FLANGE, AND THE ENTIRE MOUNTING FLANGE ARE MADE SO THAT THEY MAY BE USED TO PROVIDE A HERMETIC SEAL.

NOTE 2: THE AXIS OF THE HEATER-CATHODE TERMINAL WILL BE WITHIN THE CONFINES OF A CYLINDER WHOSE RADIUS IS 3/64" AND WHOSE AXIS IS PERPENDICULAR TO REFERENCE PLANE A AT THE SPECIFIED LOCATION.

NOTE 3: ALL POINTS ON MOUNTING FLANGE WILL LIE WITHIN 0.015" ABOVE OR BELOW REFERENCE PLANE A.

NOTE 4: THE LIMITS INCLUDE ANGULAR AS WELL AS LATERAL DEVIATIONS.

NOTE 5: THESE DIMENSIONS DEFINE EXTREMITIES OF THE 0.169" INTERNAL DIAMETER OF THE CYLINDRICAL HEATER TERMINAL.

NOTE 6: THESE DIMENSIONS DEFINE EXTREMITIES OF THE 0.540" INTERNAL DIAMETER OF THE CYLINDRICAL HEATER-CATHODE TERMINAL.

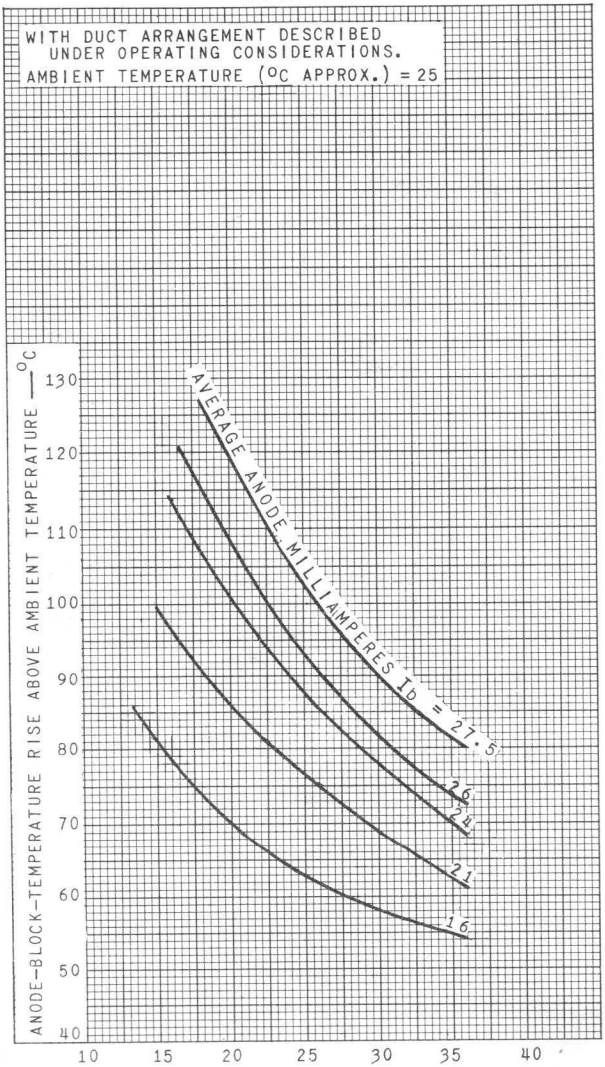
NOTE 7: NO PART OF THE CONNECTOR DEVICE FOR THE HEATER AND HEATER-CATHODE TERMINALS SHOULD BEAR AGAINST THE UNDERSIDE OF THIS LIP.

NOTE 8: THE HEATER TERMINAL AND THE HEATER-CATHODE TERMINAL ARE CONCENTRIC WITHIN 0.010".

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

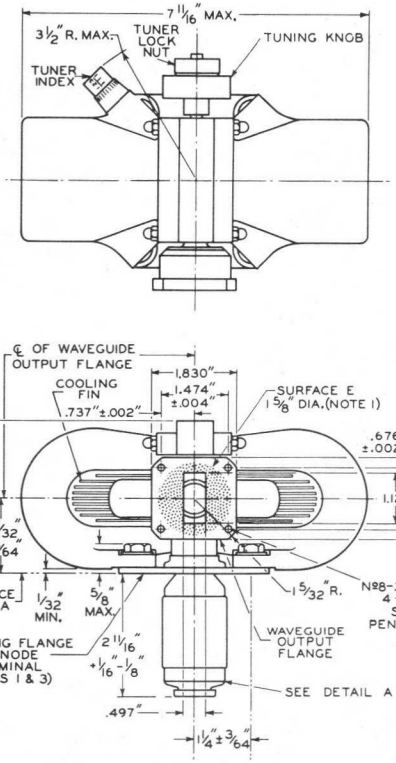
6865-A

TYPICAL COOLING REQUIREMENTS



ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CS-9284R1

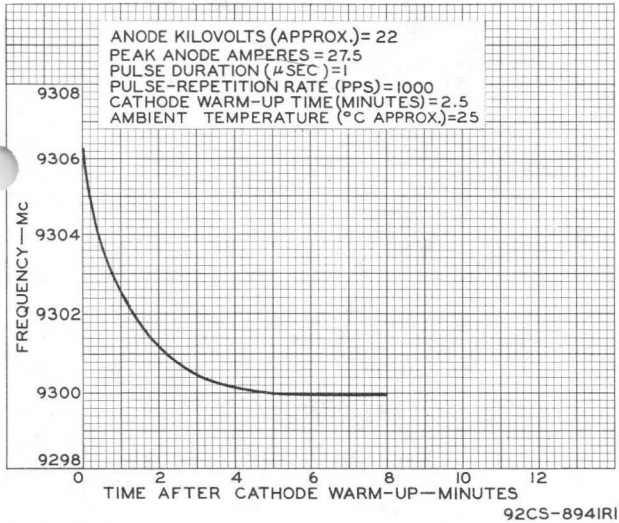
6865-A
MAGNETRON



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

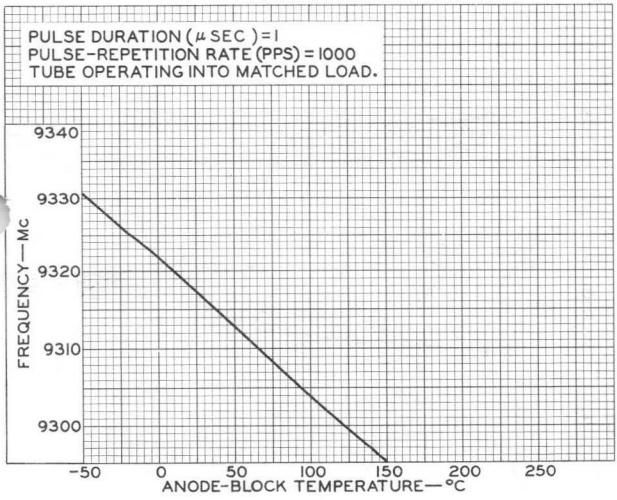
6865-A

TYPICAL STABILIZATION CHARACTERISTIC



92CS-8941RI

TYPICAL THERMAL-FACTOR CHARACTERISTIC

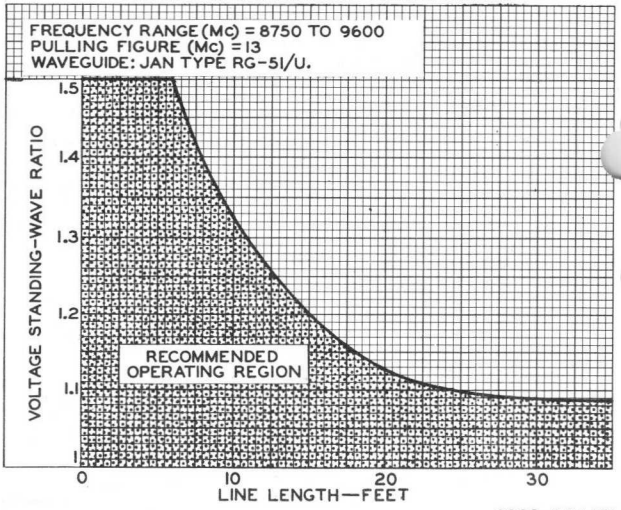


ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CS-9285RI

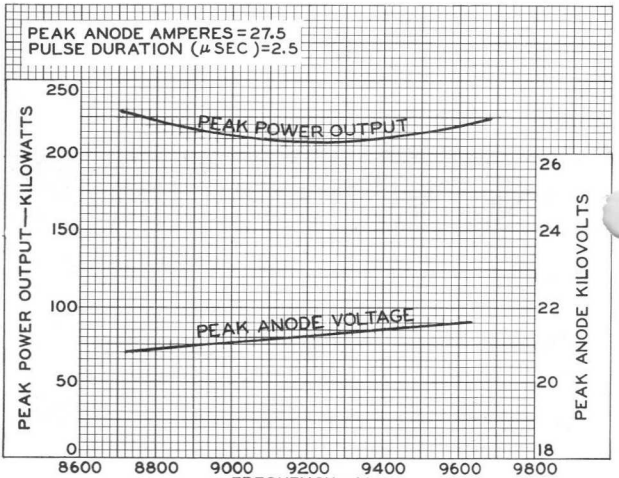
6865-A

EFFECT OF LENGTH OF TRANSMISSION LINE BETWEEN OUTPUT FLANGE AND LOAD ON ALLOWABLE VOLTAGE STANDING-WAVE RATIO



92CS-8944RI

TYPICAL PERFORMANCE CURVES

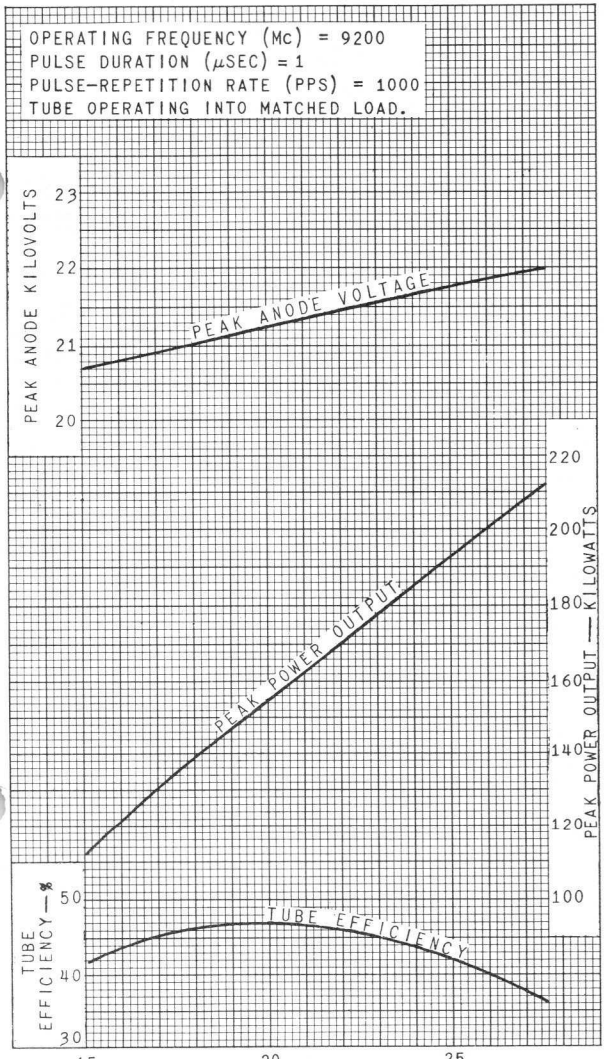


ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CS-9286RI

6865-A

TYPICAL PERFORMANCE CURVES

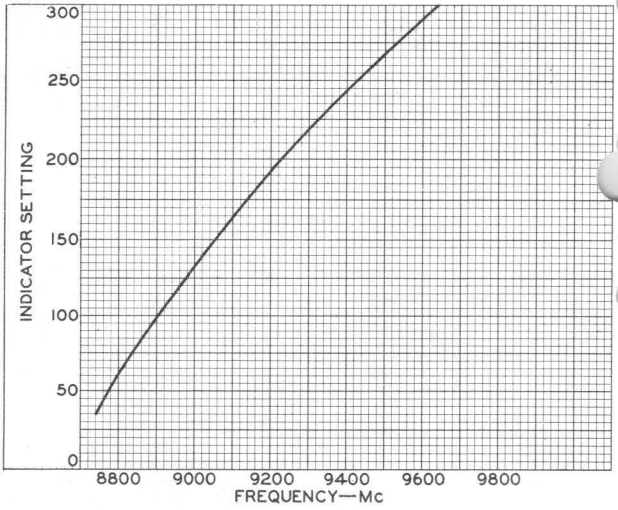


ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CS-8945R1

6865-A

REPRESENTATIVE TUNING CHARACTERISTIC



92CS-8943

Beam Power Tube

HIGH POWER SENSITIVITY

90 WATTS CW INPUT (ICAS) UP TO 60 Mc
60 WATTS CW INPUT (ICAS) AT 175 Mc

The 6883 is the same as the 6146 except for the following items:

Electrical:

Heater, for Unipotential Cathode:
Voltage (AC or DC). . . . . 12.6 ± 10% volts
Current at heater volts = 12.6. . . . 0.625 amp

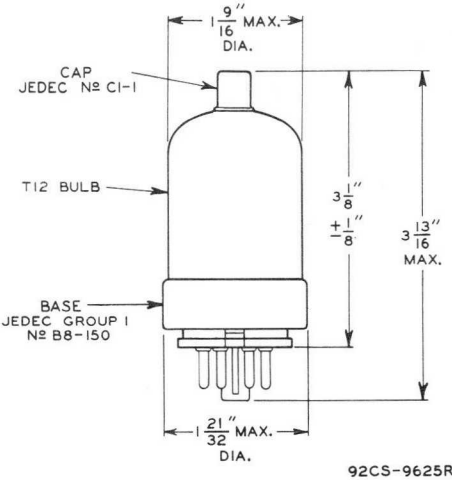
Mechanical:

Maximum Diameter. . . . . 1-21/32"
Base. . . . . Small-Wafer Octal 8-Pin with Sleeve (JEDEC No.B8-150)

CHARACTERISTICS RANGE VALUES

	Note	Min.	Max.	
Heater Current.	1	0.588	0.663	amp

Note 1: With 12.6 volts ac on heater.



← Indicates a change.

Beam Power Tube

Useful with Full Input up to 125 Mc
and with Reduced Input up to 175 Mc

The 6893 is the same as the 2E26 except for the following items: ←

Heater, for Unipotential Cathode:

Voltage (AC or DC)	12.6 ± 10%	volts
Current at heater volts = 12.6	0.4	amp

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Heater Current	1	0.37	0.43	amp
Useful Power Output	4	18	–	watts

Note 1: With 12.6 volts ac on heater.

Note 4: In a single-tube self-excited oscillator circuit, and with heater volts = 12.6 ac, dc plate volts = 500, dc grid-No.2 volts = 200, grid-No.1 resistor (megohms) = 0.015 ± 10%, dc plate ma. = 60 maximum, dc grid-No.1 ma. = 1.8 to 2.2, and frequency (Mc) = 15.

← Indicates a change.

Half-Wave Mercury-Vapor Rectifier

GENERAL DATA

Electrical:

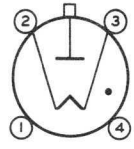
Filament, Coated:
- Voltage (AC) . . . . . 5.0 ± 5% volts
- Current at filament volts = 5.0 . . . . . 10 amp
- Minimum heating time at rated voltage . . . 30 sec

Peak Tube Voltage Drop. . . .See *Characteristics Range Values*

Mechanical:

Operating Position. . . . . Vertical, base down
Maximum Overall Length. . . . . 10-13/32"
Seated Length . . . . . 9-7/32" ± 7/16"
Maximum Diameter. . . . . 2-5/8"
Weight (Approx.). . . . . 9 oz
Bulb. T20
Cap . . . . . .Medium (JEDEC No.C1-5) ←
Cap Connector . . . . . .Millen No.36011, or equivalent
Socket. . . . . Johnson No.123-206, or equivalent
Base. . . . . Large-Shell Super-Jumbo 4-Pin with Bayonet (JEDEC No.A4-88), or Large-Metal-Shell Super-Jumbo 4-Pin with Bayonet (JEDEC No.A4-18)
Basing Designation for BOTTOM VIEW. 2P

Pin 1 – No Internal Connection
Pin 2 – Filament, Cathode Shield



Pin 3 – Filament
Pin 4 – No Internal Connection
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 range 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[a]. . . . . 13 °C
- Full load[b]. . . . . 18.5 °C

← Indicates a change.

HALF-WAVE RECTIFIER — In Phase Operation[c]

Maximum Ratings, *Absolute-Maximum Values:*

For supply frequency of 60 cps

	Operating Condensed-Mercury-Temperature Range			
	20 to 60 °C	20 to 55 °C	20 to 50 °C	
PEAK INVERSE ANODE VOLTAGE. .	10000 max.	15000 max.	20000 max.	volts
ANODE CURRENT:				
Peak	8.3 max.	8.3 max.	8.3 max.	amp
Average[d]	1.8 max.	1.8 max.	1.8 max.	amp
Fault, for duration of 0.1 second max.	100 max.	100 max.	100 max.	amp

HALF-WAVE RECTIFIER — Quadrature Operation[e]

Maximum Ratings, *Absolute-Maximum Values:*

For supply frequency of 60 cps

	Operating Condensed-Mercury-Temperature Range			
	20 to 60 °C	20 to 55 °C	20 to 50 °C	
PEAK INVERSE ANODE VOLTAGE. .	10000 max.	15000 max.	20000 max.	volts
ANODE CURRENT:				
Peak	11.5 max.	11.5 max.	11.5 max.	amp
Average[d]	2.5 max.	2.5 max.	2.5 max.	amp
Fault, for duration of 0.1 second max.	100 max.	100 max.	100 max.	amp

[a] With 4.75 volts rms on filament, and no heat-conserving enclosure.

[b] With 5.25 volts rms on filament, quadrature operation, average anode amperes = 2.5, and no heat-conserving enclosure.

[c] Filament voltage in phase with anode voltage.

[d] Averaged over any period of 20 seconds maximum.

[e] Filament voltage out of phase (60° to 120°) with anode voltage.

CHARACTERISTICS RANGE VALUES[f] FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Filament Current.	1	9	11	amp
Critical Anode Voltage.	2	10	100	volts
Peak Tube Voltage Drop.	3	–	25	volts

Note 1: With 5 volts rms on filament.

Note 2: With 5 volts rms on filament, and condensed-mercury temperature of 20° C.

Note 3: With 5 volts rms on filament, condensed-mercury temperature of 35 ± 5° C, peak anode current of 11.5 amperes provided by half-cycle pulse from a 60-cps sine wave and recurring approximately once per second. Tube drop is measured by an oscilloscope connected between anode and center-tap of filament transformer.

[f] Throughout tube life.

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[g]	6300	1.8	11.5
	10600[h]	4700	1.8	8.5
	7000[j]	3200	1.8	5.5
Fig. 2 **Full-Wave** **Single-Phase** In-Phase Operation	7000[g]	6300	3.6	23
	5300[h]	4700	3.6	17
	3500[j]	3200	3.6	11
Fig. 3 **Series** **Single-Phase** In-Phase Operation	14000[g]	12700	3.6	46
	10600[h]	9500	3.6	34
	7000[j]	6300	3.6	22
Fig. 4 **Half-Wave** **Three-Phase** In-Phase Operation	8100[g]	9500	5.4	51
	6100[h]	7100	5.4	38
	4000[j]	4700	5.4	25
Fig. 5 **Parallel** **Three-Phase** Quadrature Operation	8100[g]	9500	15.0	143
	6100[h]	7100	15.0	106
	4000[j]	4700	15.0	71
Fig. 6 **Series** **Three-Phase** Quadrature Operation	8100[g]	19000	7.5	143
	6100[h]	14200	7.5	106
	4000[j]	9500	7.5	71
Fig. 7 **Half-Wave** **Four-Phase** Quadrature Operation			*Resistive Load* / *Inductive Load*	*Resistive Load* / *Inductive Load*
	7000[g]	9000	10 / 10	90 / 90
	5300[h]	6700	10 / 10	67 / 67
	3500[j]	4500	10 / 10	45 / 45
Fig. 8 **Half-Wave** **Six-Phase** Quadrature Operation			*Resistive Load* / *Inductive Load*	*Resistive Load* / *Inductive Load*
	7000[g]	9500	11 / 11.5	105 / 110
	5300[h]	7100	11 / 11.5	78 / 81
	3500[j]	4700	11 / 11.5	52 / 55

[g] For maximum peak inverse anode voltage of 20000 volts, and condensed-mercury-temperature range of 20 to 50° C.

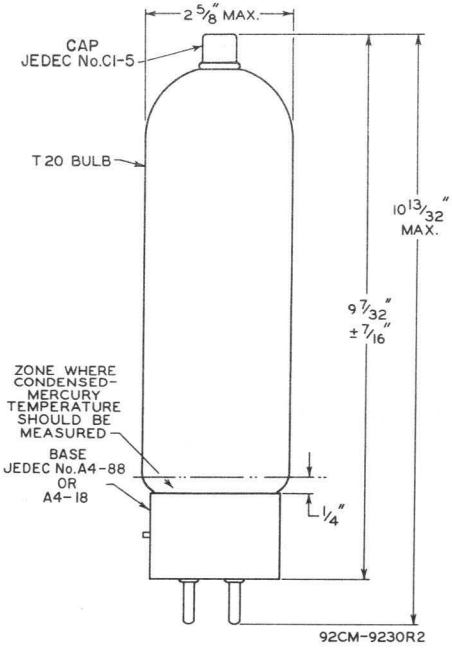
[h] For maximum peak inverse anode voltage of 15000 volts, and condensed-mercury-temperature range of 20 to 55° C.

[j] For maximum peak inverse anode voltage of 10000 volts, and condensed-mercury-temperature range of 20 to 60° C.

OPERATING CONSIDERATIONS

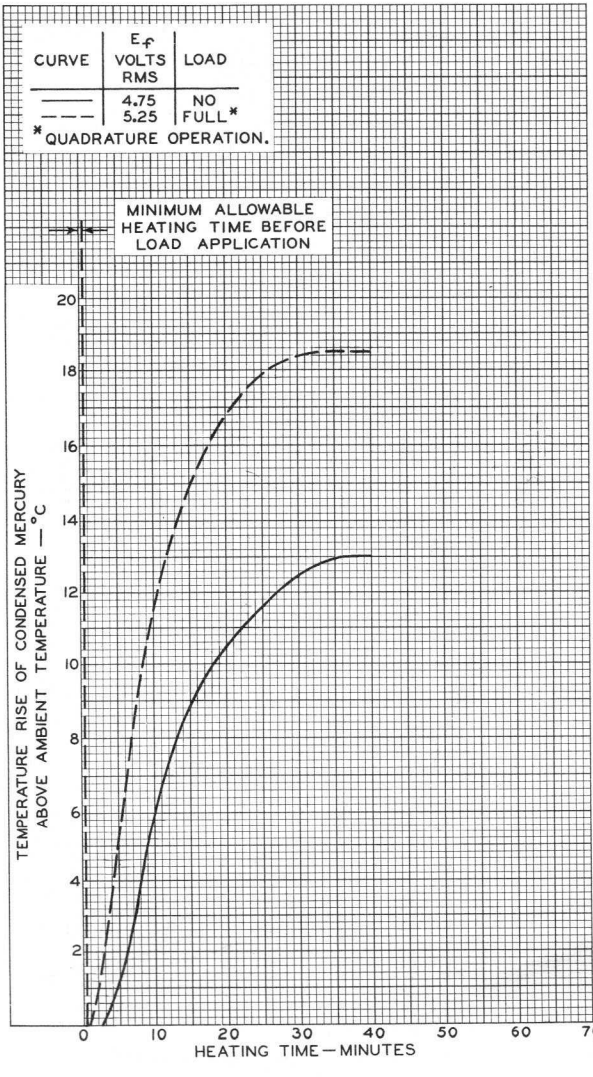
X rays are produced when the 6895 is operated with a peak inverse anode voltage above 16,000 volts (absolute value). These rays can constitute a health hazard unless the tube is adequately shielded for X-ray radiation. Although relatively simple shielding should prove adequate, make sure that it provides the required protection to the operator.

Shields and rf filter circuits should be provided for the 6895 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 rectifier tubes.



6895

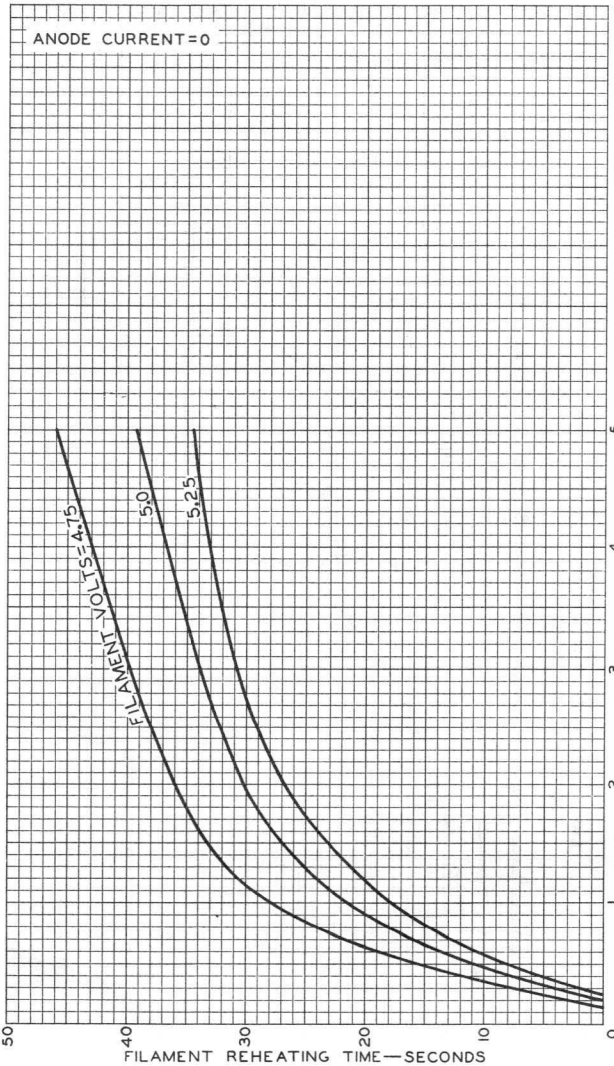
RATE OF RISE OF COND.-MERCURY TEMPERATURE



RCA

6895

FILAMENT REHEATING TIME REQUIRED
AFTER POWER-SUPPLY INTERRUPTION



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8300

6896/1855

GRAPHECHON

Signal-Converter Storage Tube

TWO COAXIAL ELECTRON GUNS

ELECTROSTATIC FOCUS — MAGNETIC DEFLECTION

INDUCED-CONDUCTIVITY WRITING — CAPACITANCE-CHARGE READING

For use in data-processing applications where signal information must be transformed continuously from one time base to another

DATA

General:

	Writing Gun	Reading Gun	
Heater, for Unipotential Cathode:			
Voltage (AC or DC)	6.3 ± 10%	6.3 ± 10%	volts
Current	0.6	0.6	amp
Direct Interelectrode Capacitances:			
Grid No.1 to all other electrodes	9	10.5	μμf
Cathode to all other electrodes	5.5	6.5	μμf
Backing-electrode to shading-electrode	40 min.		μμf
Backing-electrode and shading-electrode to all other electrodes (Effective output capacitance)	7		μμf
Focusing Method	Electrostatic	Electrostatic	
Deflection Method	Magnetic	Magnetic	
Deflection Angle (Approx.)	40°	40°	

Overall Length . . . . . 18-3/4" ± 3/8"

Greatest Diameter . . . . . 2.320" ± 0.010"

Minimum Useful Target Diameter . . . . . 1.3"

Operating Position . . . Any except those positions where the Diheptal base is up and the tube axis is at an angle of less than 60° from the vertical.

Weight (Approx.) . . . . . 1 lb

Bases:

Writing section . . . . . Long Medium-Shell Octal 8-Pin (JETEC No. B8-65)

Reading section . . . . . Small-Shell Diheptal 14-Pin (JETEC No. B14-45)

Socket Connections:

WRITING SECTION — Octal Base

Pin 1 - Heater	Pin 6 - Grid No.2
Pin 2 - Grid No.1	Pin 7 - Cathode
Pin 3 - No Connection	Pin 8 - Heater
Pin 4 - Grid No.3	G_{4_W}, C - Grid No.4, External Conductive Coating
Pin 5 - No Connection	

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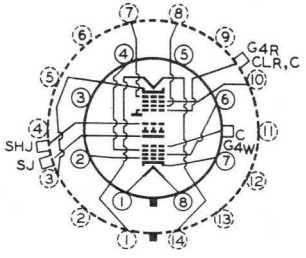
GRAPHECHON
Signal-Converter Storage Tube

READING SECTION — Diheptal Base

Pin 1 – Heater
Pin 2 – No Connection
Pin 3 – Cathode
Pin 4 – Internal Connection—Do Not Use
Pin 5 – No Connection
Pin 6 – No Connection
Pin 7 – Grid No.1
Pin 8 – Grid No.3
Pin 9 – No Connection
Pin 10 – Internal Connection—Do Not Use
Pin 11 – Grid No.2
Pin 12 – No Connection
Pin 13 – No Connection
Pin 14 – Heater
G_{4R}, CL_R, C – Grid No.4, Collector, External Conductive Coating
SJ – Backing-Electrode (Center flange)
SHJ – Shading-Electrode (Conductive L-shaped strip adjacent to center flange)

Basing Diagram:
With each base viewed from its respective end of tube:



SOLID-LINE CIRCLES DEPICT OCTAL BASE
BROKEN-LINE CIRCLES DEPICT DIHEPTAL BASE

Maximum Ratings, *Absolute Values:*

BACKING-ELECTRODE-TO-SHADING-ELECTRODE VOLTAGE:

Backing-electrode positive with respect to shading-electrode.	0 max.	volts
Backing-electrode negative with respect to shading-electrode.	37.5 max.	volts

BACKING-ELECTRODE-TO-GRID-No.4 (Either gun) VOLTAGE:

Backing-electrode positive with respect to grid No.4.	0 max.	volts
Backing-electrode negative with respect to grid No.4.	12.5 max.	volts

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GRAPHECHON

Signal-Converter Storage Tube

SHADING-ELECTRODE-TO-GRID-No.4 (Either gun) VOLTAGE:			
Shading-electrode positive with respect to grid No.4.	25 max.		volts
Shading-electrode negative with respect to grid No.4.	0 max.		volts
	Writing Gun	**Reading Gun**	
Voltages are referred to cathode of respective gun unless otherwise indicated			
GRID-No.4 VOLTAGE	13000 max.	1500 max.	volts
GRID-No.4-TO-GRID-No.2 VOLTAGE.	10000 max.	–	volts
GRID-No.3 VOLTAGE	3000 max.	400 max.	volts
GRID-No.2 VOLTAGE	450 max.	1500 max.	volts
GRID-No.1 VOLTAGE:			
Negative bias value	180 max.	125 max.	volts
	70 min.	0 min.	volts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode.	100 max.	100 max.	volts
Heater positive with respect to cathode.	10 max.	10 max.	volts

Typical Operation and Characteristics:

With grid No.4 of Writing Gun and grid No.4 of Reading Gun grounded			
Backing-Electrode-to-Grid-No.4 (Either gun) Voltage.	−10		volts
Shading-Electrode-to-Grid-No.4 (Either gun) Voltage.	+20		volts
	Writing Gun	**Reading Gun**	
Voltages are referred to ground unless otherwise indicated			
Grid-No.4 Voltage*.	0	0	volts
Grid-No.3 Voltage for focus.	−7800 to −7000	−800 to −700	volts
Grid-No.2 Voltage	−8750	0	volts
Grid-No.1-to-Cathode Voltage for beam-current cutoff.	−70 to −120	−25 to −65	volts
Cathode Voltage	−9000	−1000	volts
Grid-No.1 Drive above Cutoff:			
For target current** of 5 μa#:			
Average value	38	–	volts
Maximum value	56	–	volts
For target current of 1 μa##:			
Average value	–	5	volts
Maximum value	–	12.5	volts

*, **, #, ##: See next page.

6896/1855

GRAPHECHON

Signal-Converter Storage Tube

	Writing Gun	Reading Gun	
Max. Grid-No.3 Current:			
For target current of 5 μa.	230	–	μa
For target current of 1 μa.	–	15	μa
Max. Cathode Current:			
For target current of 5 μa.	235	–	μa
For target current of 1 μa.	–	16	μa
Beam-Landing Position . . .	🌡	🌡🌡	
Storage Factor for essentially saturated writing●.	2.5	–	μa-sec
Storage-Factor Variation:			
Circular⌖	25	–	%
Radial□	25	–	%

Maximum Circuit Values:

	Writing Gun	Reading Gun	
Grid-No.1-Circuit Resistance.	1.5 max.	1.5 max.	megohms

* Grid No.4 of Writing Gun and grid No.4 of Reading Gun are normally operated at zero (ground) potential.

** Measured with backing-electrode voltage and shading-electrode voltage of 75 volts with respect to grid No.4 of either gun. With either the writing beam or the reading beam turned on, the total current flowing in the paralleled backing-electrode circuit and shading-electrode circuit is approximately equal to the beam current and is called the "target current". This current is not signal current.

\# This value represents peak writing-beam current necessary to write to saturation a range calibration ring at approximately 20% maximum range in a particular PPI radar application as follows:

Maximum range.	80,000 yards
Pulse-repetition frequency	60 cps
Antenna-rotation rate.	15 rpm
Pulse width.	10 μsec

In general, the value of peak writing-beam current necessary for saturated writing increases with increasing antenna-rotation rate and decreases with increasing pulse-repetition frequency, maximum range, and pulse width.

\#\# This value represents the average reading-beam current for reading durations in the order of 2.5 seconds.

🌡 with the tube shielded from all extraneous fields and all metal parts of the tube demagnetized, the undeflected focused beam will fall within a circle having a diameter equal to 3% of the minimum useful target diameter and having its center coincident with the center of the target.

🌡🌡 with the tube shielded from all extraneous fields and all metal parts of the tube demagnetized, the undeflected focused beam will fall within a circle having a diameter equal to 4% of the minimum useful target diameter and having its center coincident with the center of the target.

● Storage factor is defined as the product of the initial value of the peak amplitude of the signal output current (above background or equilibrium level) and the time required for the peak amplitude of the signal output current to drop to 50% of its initial value.

⌖, □: See next page.

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GRAPHECHON
Signal-Converter Storage Tube

⌖ On a circle having its center coincident with the center of the target and a radius which is 75% of the target radius, under conditions of saturated writing for any given set of reading conditions.

□ From the center of the target to a circle having its center coincident with the center of the target and a radius which is 75% of the target radius, under conditions of saturated writing for any given set of reading conditions.

OPERATING CONSIDERATIONS

Shielding. Magnetic shielding of the entire tube must be provided to prevent the influence of external magnetic fields on its performance. Use of a properly annealed high-permeability material for shielding is recommended. It is also recommended that the base end of the reading gun be electrostatically shielded to reduce interference with the sensitive reading beam.

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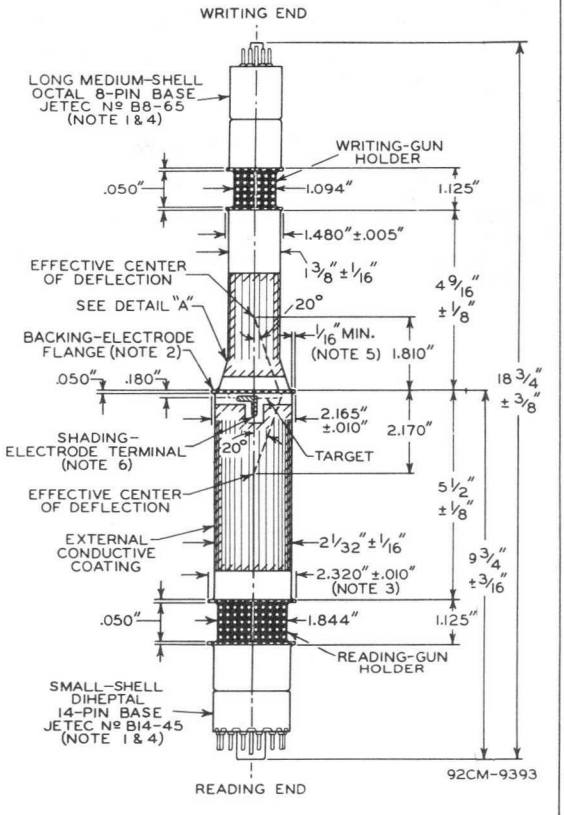
GRAPHECHON
Signal-Converter Storage Tube



NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND THE KEY OF THE DIHEPTAL BASE MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND THE KEY OF THE OCTAL BASE BY AN ANGULAR TOLERANCE OF 10° MEASURED ABOUT THE TUBE AXIS. BOTH KEYS ARE ON THE SAME SIDE OF THE TUBE.

NOTE 2: THE CIRCUMFERENCE OF THE BACKING-ELECTRODE FLANGE WILL FALL WITHIN A 2.165" ± 0.010" DIAMETER CIRCLE CONCENTRIC WITH THE AXIS OF THE WRITING-GUN HOLDER.

Notes 3 to 6: See next page.

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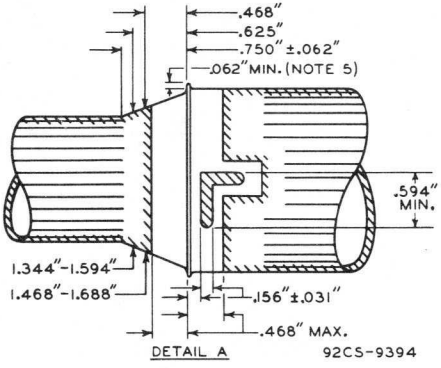
NOTE 3: THE CIRCUMFERENCE OF EITHER RIM OF THE READING-GUN HOLDER WILL FALL WITHIN A 2.320" ± 0.010" DIAMETER CIRCLE CONCENTRIC WITH THE AXIS OF THE WRITING-GUN HOLDER.

NOTE 4: THE AXIS OF EITHER THE OCTAL OR DIHEPTAL BASE WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE AXIS OF THE TUBE ENVELOPE.

NOTE 5: WITHIN THIS DIMENSION, THERE WILL BE NO GLASS AT ANY POINT ON THE WRITING-GUN SIDE OF FLANGE.

NOTE 6: THE PLANE THROUGH THE TUBE AXIS AND THE KEY OF THE DIHEPTAL BASE MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND THE SHADING-ELECTRODE TERMINAL (PORTION EXTENDING PARALLEL WITH TUBE AXIS) BY AN ANGULAR TOLERANCE OF 5° MEASURED ABOUT THE TUBE AXIS.



DETAIL A 92CS-9394

ELECTRON TUBE DIVISION
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6896

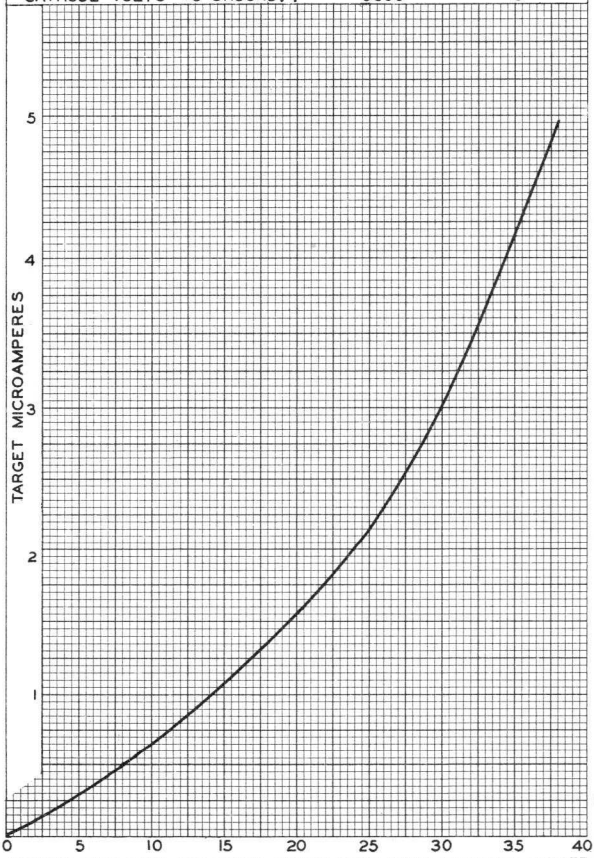
6896/1855

AVERAGE GRID-Nº1-DRIVE CHARACTERISTIC

WRITING GUN

E_f = 6.3 VOLTS—WRITING GUN
BACKING-ELECTRODE-TO-GRID-Nº4 VOLTS = -10
SHADING-ELECTRODE-TO-GRID-Nº4 VOLTS = +20

	Writing Gun	*Reading Gun*
GRID-Nº 4 VOLTS TO GROUND . .	0	0
GRID-Nº 3 VOLTS	ADJUSTED FOR FOCUS	0
GRID-Nº2 VOLTS TO GROUND . .	-8750	0
GRID-Nº1 VOLTS	ADJUSTED TO CUTOFF	0
CATHODE VOLTS TO GROUND, ,	-9000	0



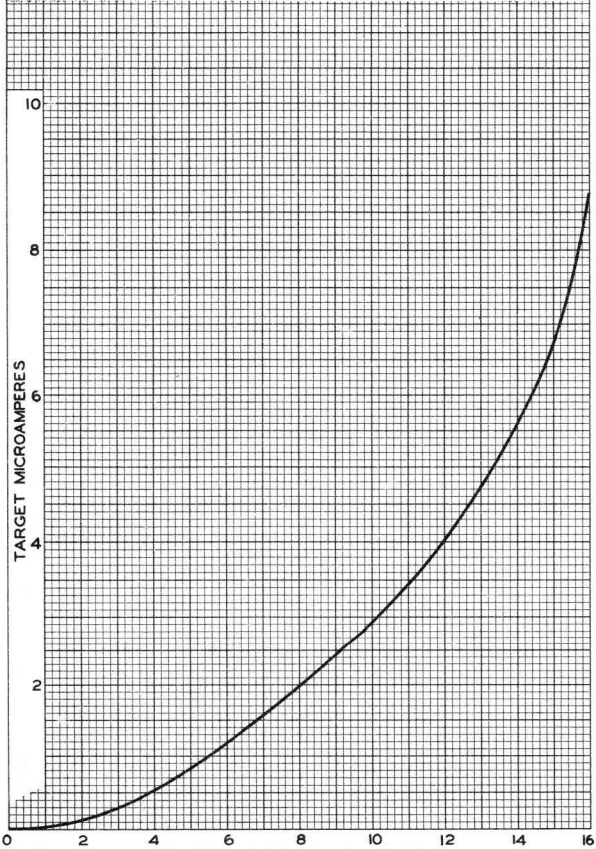
6896/1855

AVERAGE GRID-Nº1-DRIVE CHARACTERISTIC

READING GUN

E_f = 6.3 VOLTS—READING GUN
BACKING-ELECTRODE-TO-GRID-Nº4 VOLTS = -10
SHADING-ELECTRODE-TO-GRID-Nº4 VOLTS = +20

	Writing Gun	*Reading Gun*
GRID-Nº4 VOLTS TO GROUND	0	0
GRID-Nº3 VOLTS	0	ADJUSTED FOR FOCUS
GRID-Nº2 VOLTS TO GROUND	0	0
GRID-Nº1 VOLTS	0	ADJUSTED TO CUTOFF
CATHODE VOLTS TO GROUND	0	-1000



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

92CM-9404

6896

RCA

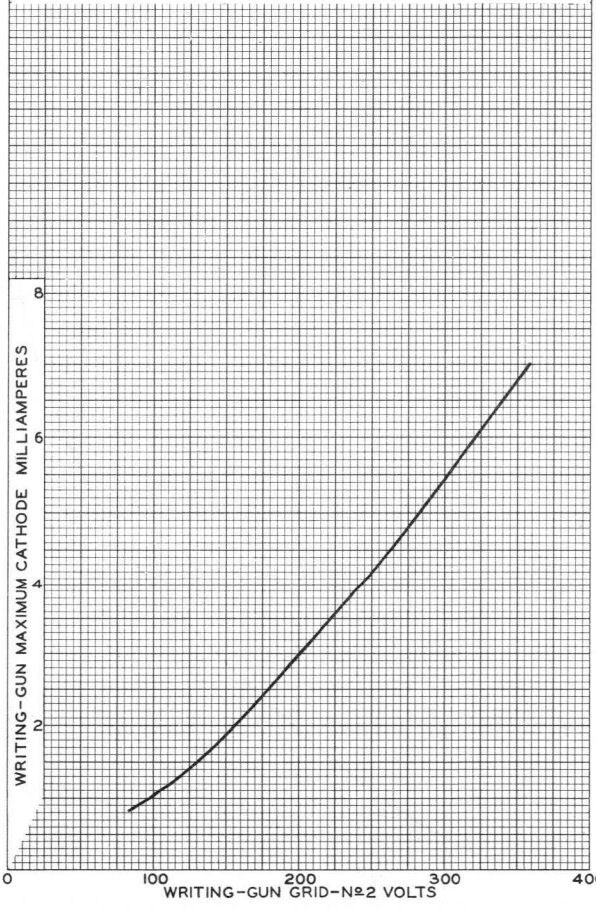
6896/1855

MAXIMUM CATHODE CURRENT

WRITING GUN

E_f = 6.3 VOLTS—WRITING GUN
BACKING-ELECTRODE-TO-GRID-№4 VOLTS = -10
SHADING-ELECTRODE-TO-GRID-№4 VOLTS = +20

	Writing Gun	*Reading Gun*
GRID-№4 VOLTS TO CATHODE	10000	0
GRID-№3 VOLTS TO CATHODE	1700	0
GRID-№2 VOLTS TO CATHODE	VARIED AS SHOWN	0
GRID-№1 VOLTS TO CATHODE	0	0



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

92CM-9405

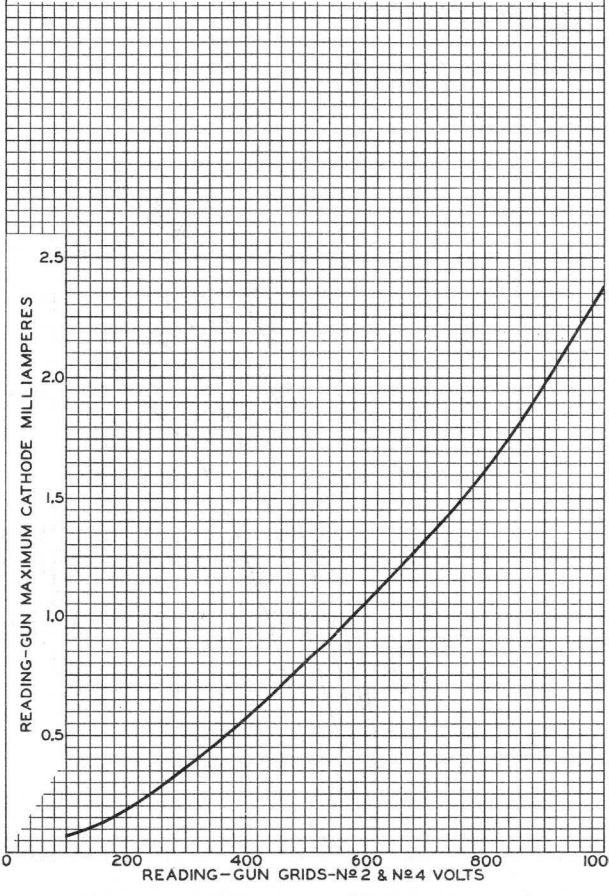
6896/1855

MAXIMUM CATHODE CURRENT

READING GUN

E_f = 6.3 VOLTS—READING GUN
BACKING-ELECTRODE-TO-GRID-№4 VOLTS = -10
SHADING-ELECTRODE-TO-GRID-№4 VOLTS = +20

	Writing Gun	*Reading Gun*
GRID-№4 VOLTS TO CATHODE	0	VARIED AS SHOWN
GRID-№3 VOLTS TO CATHODE	0	300
GRID-№2 VOLTS TO CATHODE	0	VARIED AS SHOWN
GRID-№1 VOLTS TO CATHODE	0	0



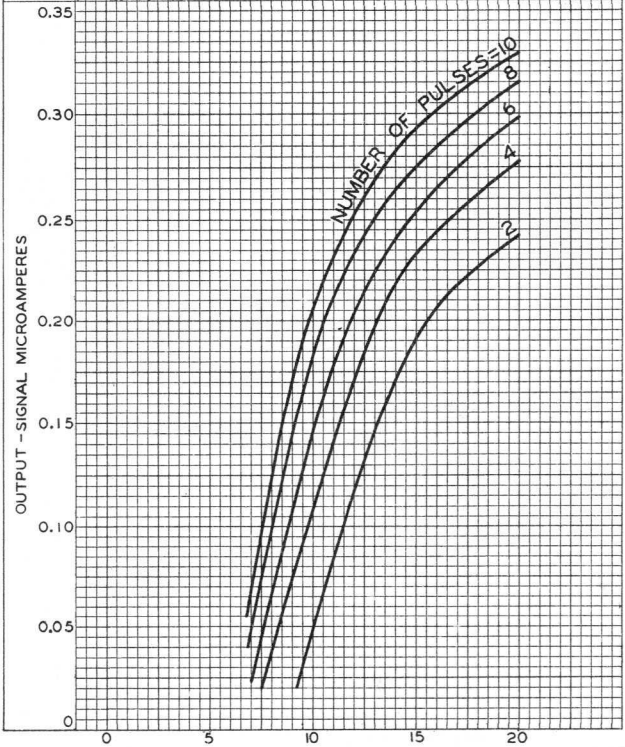
6896

6896/1855

OPERATION CHARACTERISTICS

E_f = 6.3 VOLTS – EACH GUN
BACKING-ELECTRODE-TO-GRID-№4 VOLTS = -10
SHADING-ELECTRODE-TO-GRID-№4 VOLTS = +20

	Writing Gun	*Reading Gun*
GRID-№4 VOLTS TO GROUND	0	0
GRID-№3 VOLTS	ADJUSTED FOR FOCUS	ADJUSTED FOR FOCUS
GRID-№2 VOLTS TO GROUND	-8750	0
GRID-№1 VOLTS	ADJUSTED TO CUTOFF	ADJUSTED TO GIVE TARGET μA = 0.5
CATHODE VOLTS TO GROUND	-9000	-1000
TARGET MICROAMPERES	—	0.5
SCANNING:	PPI	TV
RATE (REV/SEC)	0	—
SWEEP PRF (PPS)	1000	—
SWEEP TIME (μSEC/RADIUS)	100	—
INPUT SIGNAL, RECTANGULAR PULSE:		
DURATION (μSEC)	1	—
REPETITION RATE (PPS)	1000	—
NUMBER OF PULSES	AS SHOWN	—



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

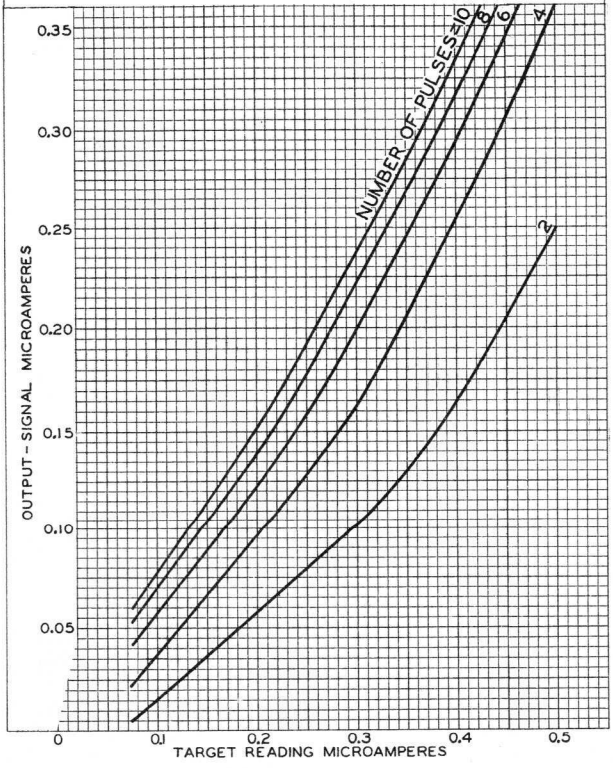
92CL-9406

6896/1855

OPERATION CHARACTERISTICS

E_f = 6.3 VOLTS—EACH GUN
BACKING-ELECTRODE-TO-GRID-№4 VOLTS = -10
SHADING-ELECTRODE-TO-GRID-№4 VOLTS = +20

	Writing Gun	*Reading Gun*
GRID-№4 VOLTS TO GROUND	0	0
GRID-№3 VOLTS	ADJUSTED FOR FOCUS	ADJUSTED FOR FOCUS
GRID-№2 VOLTS TO GROUND	-8750	0
GRID-№1 VOLTS	ADJUSTED TO CUTOFF	VARIED TO GIVE TARGET μA AS SHOWN
CATHODE VOLTS TO GROUND	-9000	-1000
GRID-№1 PEAK PULSE VOLTS FROM BEAM-CURRENT CUTOFF	12.5	—
SCANNING:	PPI	TV
RATE (REV/SEC)	0	—
SWEEP PRF (PPS)	1000	—
SWEEP TIME (μSEC/RADIUS)	100	—
INPUT SIGNAL, RECTANGULAR PULSE:		
DURATION (μSEC)	1	—
REPETITION RATE (PPS)	1000	—
NUMBER OF PULSES	AS SHOWN	—



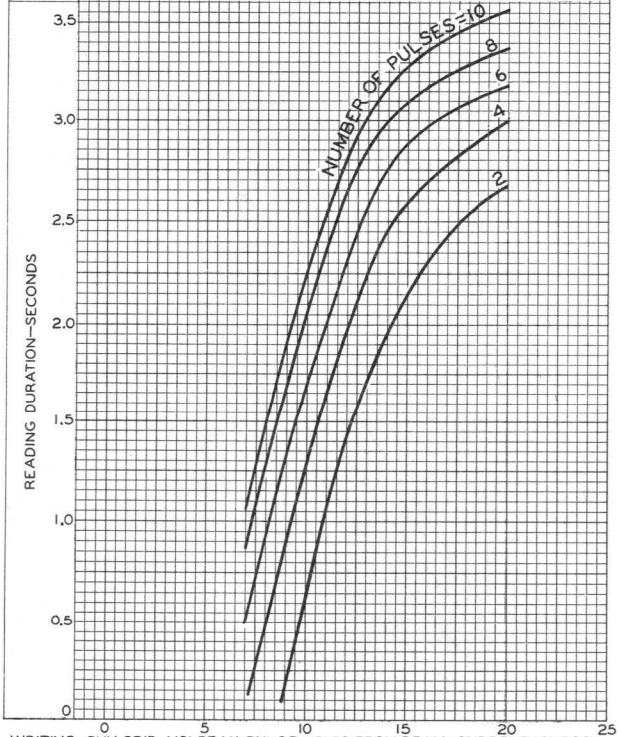
RCA

6896/1855

OPERATION CHARACTERISTICS

E_f = 6.3 VOLTS—EACH GUN
BACKING-ELECTRODE-TO-GRID-№4 VOLTS = -10
SHADING-ELECTRODE-TO-GRID-№4 VOLTS = +20

	Writing Gun	*Reading Gun*
GRID-№4 VOLTS TO GROUND	0	0
GRID-№3 VOLTS	ADJUSTED FOR FOCUS	ADJUSTED FOR FOCUS
GRID-№2 VOLTS TO GROUND	-8750	0
GRID-№1 VOLTS	ADJUSTED TO CUTOFF	ADJUSTED TO GIVE TARGET μA=0.5
CATHODE VOLTS TO GROUND	-9000	-1000
TARGET MICROAMPERES	—	0.5
SCANNING:	PPI	TV
RATE (REV/SEC)	0	—
SWEEP PRF (PPS)	1000	—
SWEEP TIME (μSEC/RADIUS)	100	—
INPUT SIGNAL, RECTANGULAR PULSE:		
DURATION (μSEC)	1	—
REPETITION RATE (PPS)	1000	—
NUMBER OF PULSES	AS SHOWN	—

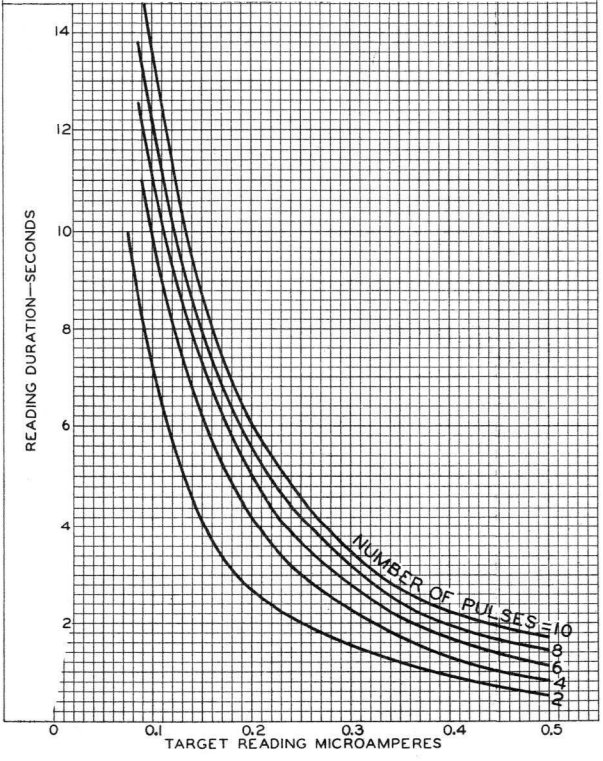


6896/1855

OPERATION CHARACTERISTICS

E_f = 6.3 VOLTS—EACH GUN
BACKING-ELECTRODE-TO-GRID-№4 VOLTS = -10
SHADING-ELECTRODE-TO-GRID-№4 VOLTS = +20

	Writing Gun	*Reading Gun*
GRID-№4 VOLTS TO GROUND	0	0
GRID-№3 VOLTS	ADJUSTED FOR FOCUS	ADJUSTED FOR FOCUS
GRID-№2 VOLTS TO GROUND	-8750	0
GRID-№1 VOLTS	ADJUSTED TO CUTOFF	VARIED TO GIVE TARGET μA AS SHOWN
CATHODE VOLTS TO GROUND	-9000	-1000
GRID-№1 PEAK PULSE VOLTS FROM BEAM-CURRENT CUTOFF	12.5	—
SCANNING:	PPI	TV
RATE (REV/SEC)	0	—
SWEEP PRF (PPS)	1000	—
SWEEP TIME(μSEC/RADIUS)	100	—
INPUT SIGNAL,RECTANGULAR PULSE:		
DURATION (μSEC)	1	—
REPETITION RATE (PPS)	1000	—
NUMBER OF PULSES	AS SHOWN	—



6897

Power Triode

FORCED-AIR COOLED

For Cathode-Drive Applications at Frequencies up to 2500 Mc

GENERAL DATA

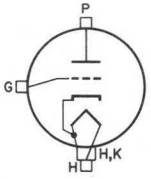
Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)[a]	6.3 ± 5%	volts
Current at heater volts = 6.3	1.03	amp
Amplification Factor	95	
Transconductance, for dc plate volts = 600 and dc plate ma. = 75	24800	μmhos
Direct Interelectrode Capacitances (Approx.):[b]		
Grid to plate	2	μμf
Grid to cathode	6.5	μμf
Plate to cathode	0.024	μμf

Mechanical:

Operating Position	Any
Maximum Overall Length	2-3/4"
Diameter	1-1/4" ± 1/64"
Mounting	Only plate flange to be used as socket stop and clamping surface
Weight (Approx.)	2 oz
Radiator	Integral part of tube

Terminal Diagram (See *Dimensional Outline*):



P – Plate

G – Grid

K – Cathode

H – Heater

Thermal:

Air Flow:

Through radiator—Adequate air flow should be delivered by a blower during the application of any voltages.

To plate, grid, cathode, and heater seals—A sufficient quantity of air should be delivered to these seals to prevent their temperature from exceeding the specified maximum value.

Seal Temperature (Plate, grid, cathode, and heater)	250 max.	°C
Recommended Air-Flow Cowling	157-JAN	
Recommended Air Flow on Plate Radiator at sea level with incoming-air temperature (°C) = 25, plate dissipation (watts) = 100	12.5	cfm

← Indicates a change.

PLATE-MODULATED RF POWER AMPLIFIER — Class C Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1

Maximum CCS[c] Ratings, *Absolute-Maximum Values:*

For frequencies up to 2500 Mc

DC PLATE VOLTAGE	600[d]	max.	volts
GRID VOLTAGE:			
Negative-bias value	150	max.	volts
Peak-negative-rf value	400	max.	volts
Peak-positive-rf value	30	max.	volts
DC GRID CURRENT	50	max.	ma
DC CATHODE CURRENT	100	max.	ma
GRID INPUT	2	max.	watts
PLATE DISSIPATION	70	max.	watts

RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy[e]

Maximum CCS[c] Ratings, *Absolute-Maximum Values:*

For frequencies up to 2500 Mc

DC PLATE VOLTAGE	1000	max.	volts
GRID VOLTAGE:			
Negative-bias value	150	max.	volts
Peak-negative-rf value	400	max.	volts
Peak-positive-rf value	30	max.	volts
DC GRID CURRENT	50	max.	ma
DC CATHODE CURRENT	125	max.	ma
GRID INPUT	2	max.	watts
PLATE DISSIPATION	100	max.	watts

[a] Because the cathode is subjected to considerable back bombardment as the frequency is increased with resultant increase in temperature, the heater voltage should be reduced depending on operating conditions and frequency to prevent overheating the cathode and resultant short life.

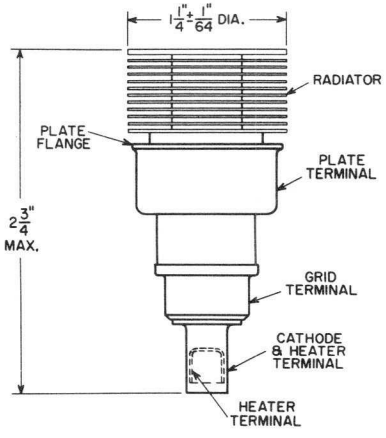
→ [b] With special shielded socket.

[c] Continuous Commercial Service.

[d] For modulation factors less than 1, a higher dc plate voltage may be used provided the sum of the peak-positive audio voltage and the dc plate voltage does not exceed 1200 volts.

[e] Key-down conditions per tube without amplitude modulation. Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

→ Indicates a change.


1 1/4 ± 1/64" DIA.
RADIATOR
PLATE FLANGE
PLATE TERMINAL
2 3/4" MAX.
GRID TERMINAL
CATHODE & HEATER TERMINAL
HEATER TERMINAL
92CS-11372

6957

PHOTOCONDUCTIVE CELL

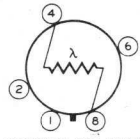
CADMIUM-SULFIDE, HEAD-ON TYPE

DATA

General:

Spectral Response	S-15
Wavelength of Maximum Response	5800 ± 500 angstroms
Sensitive Surface, Including Metallic Strips:	
Shape	Rectangular
Length (Minimum)	0.650"
Width (Minimum)	0.540"
Area (Minimum)	0.35 sq. in.
Maximum Overall Length	2-7/32"
Maximum Seated Length	1-11/16"
Seated Length to Plane of Sensitive Surface	1" ± 3/32"
Maximum Diameter	1-9/32"
Operating Position	Any
Weight (Approx.)	0.9 oz
Bulb	T9
Base	Intermediate-Shell Octal 5-Pin (JETEC No.B5-10)
Basing Designation for BOTTOM VIEW	8HV

Pin 1 – No Connection
Pin 2 – No Connection



DIRECTION OF LIGHT: INTO END OF BULB

Pin 4 – Terminal
Pin 6 – No Connection
Pin 8 – Terminal

Maximum Ratings, *Absolute Values:*

POLARIZING VOLTAGE	250 max.	volts
POWER DISSIPATION:		
Sensitive surface fully illuminated	0.5 max.	watt
Sensitive surface partially illuminated	1.4 max.	watts/sq. in.
PHOTOCURRENT	50 max.	ma
AMBIENT-TEMPERATURE RANGE	-75 to +60	°C

Characteristics:

Under conditions with polarizing voltage of 50 volts dc and at ambient temperature of 25° C

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant#, at 5800 angstroms	–	300	–	μa/μw
Luminous*, at 0 cps	–	0.85	–	amp/lumen
Illumination♦, at 0 cps	2000	4000	8000	μa/ft-c
Photocurrent▲	–	–	20	μa
Rise				*See Curves*
Decay				*See Curves*

For conditions where the incident power is 6.65 microwatts.

*,♦,▲: See next page.

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

TENTATIVE DATA

6957

PHOTOCONDUCTIVE CELL

* For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K. A light flux of about 2.5 millilumens is used.

• For conditions the same as shown under (*) except that an incident illumination of 1.0 foot-candle is used.

▲ Measured approximately 10 seconds after removal of incident illumination of 1.0 foot-candle.

DEFINITIONS

Illumination Sensitivity. The quotient of the output current by the incident illumination, at constant electrode voltages.

OPERATING CONSIDERATIONS

The *polarizing voltage* for the 6957 may be applied without regard to polarity.

Exposure of the 6957 to radiation so intense as to cause excessive heating of the cell may permanently damage it.

The *angle of view* of the 6957 may be narrowed by the use of a hood of the desired length placed around the bulb end of the cell.

In some applications where the light source is several feet from the cell, a simple lens arrangement in which a suitable lens at the light source is used to collimate the light beam and another lens is used in front of the cell to converge the beam onto the sensitive area, will serve to utilize the available amount of light most effectively.

For a given illumination, the output current will have its highest value when the incident illumination is normal (angle of incidence is 90°) to the face of the cell. For smaller angles of incidence, the output current decreases. The decrease depends upon several factors including the angle of incidence of the illumination, the amount of illumination, and the area of sensitive surface illuminated.

SPECTRAL-SENSITIVITY CHARACTERISTIC of Photoconductive Cell having S-15 Response is shown at the front of this Section

ELECTRON TUBE DIVISION
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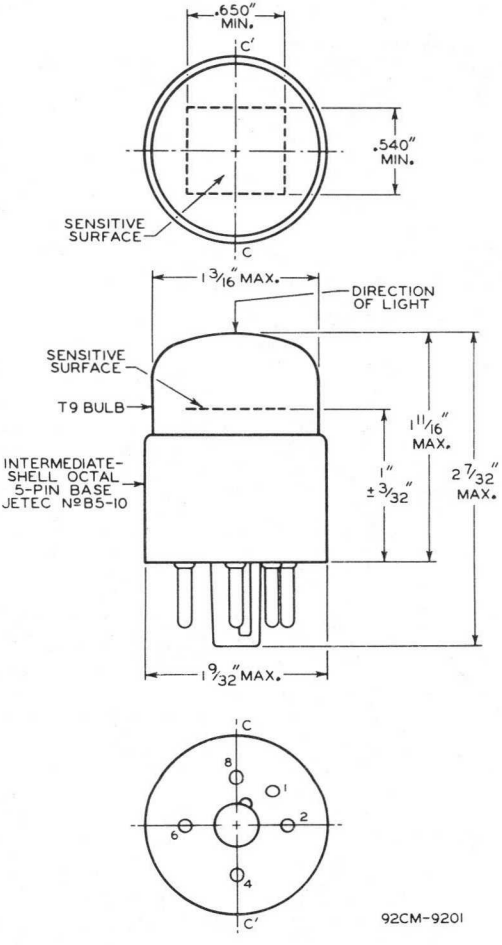
TENTATIVE DATA

6957

PHOTOCONDUCTIVE CELL



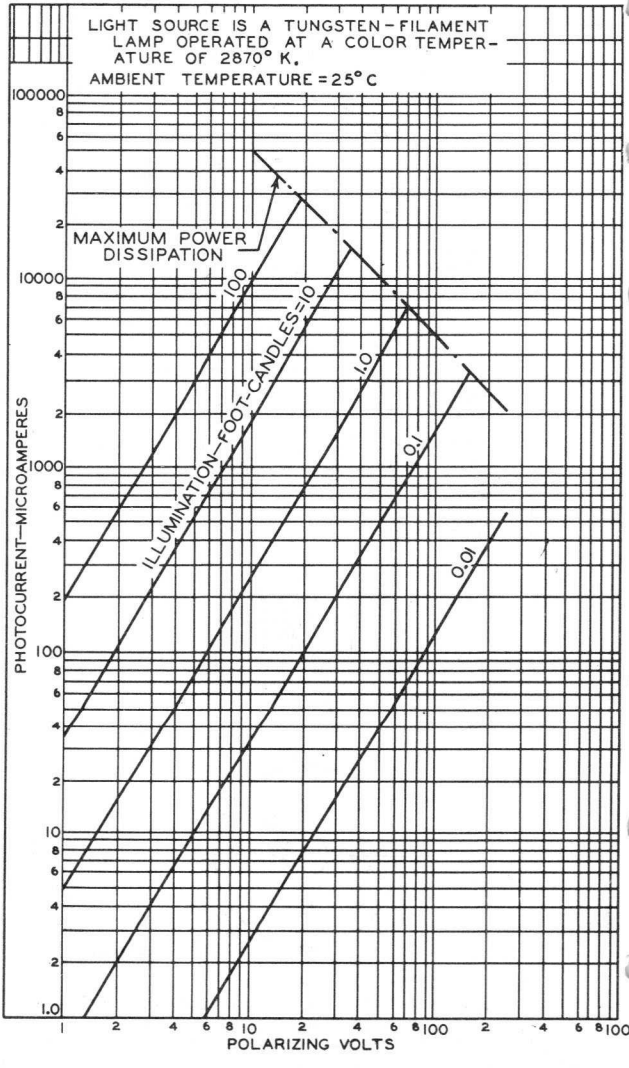
PLANE THROUGH MINOR AXIS (CC') OF SENSITIVE SURFACE AND CELL AXIS MAY VARY FROM PLANE THROUGH THE CELL AXIS AND PINS 4 AND 8 BY ANGULAR TOLERANCE (MEASURED ABOUT THE CELL AXIS) OF ± 10°.

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

RCA

6957

AVERAGE CHARACTERISTICS



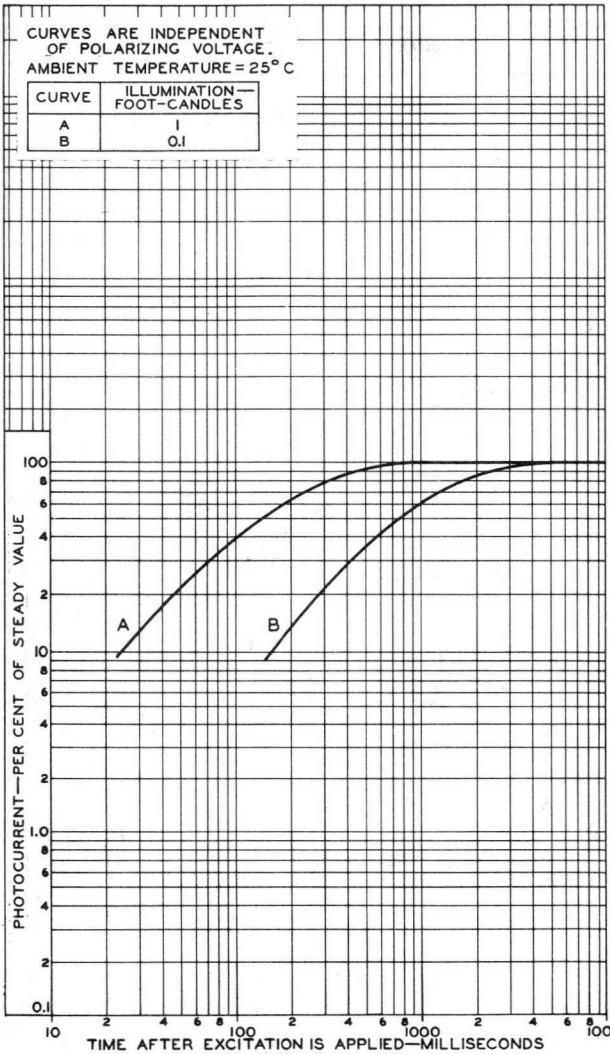
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9209

RCA

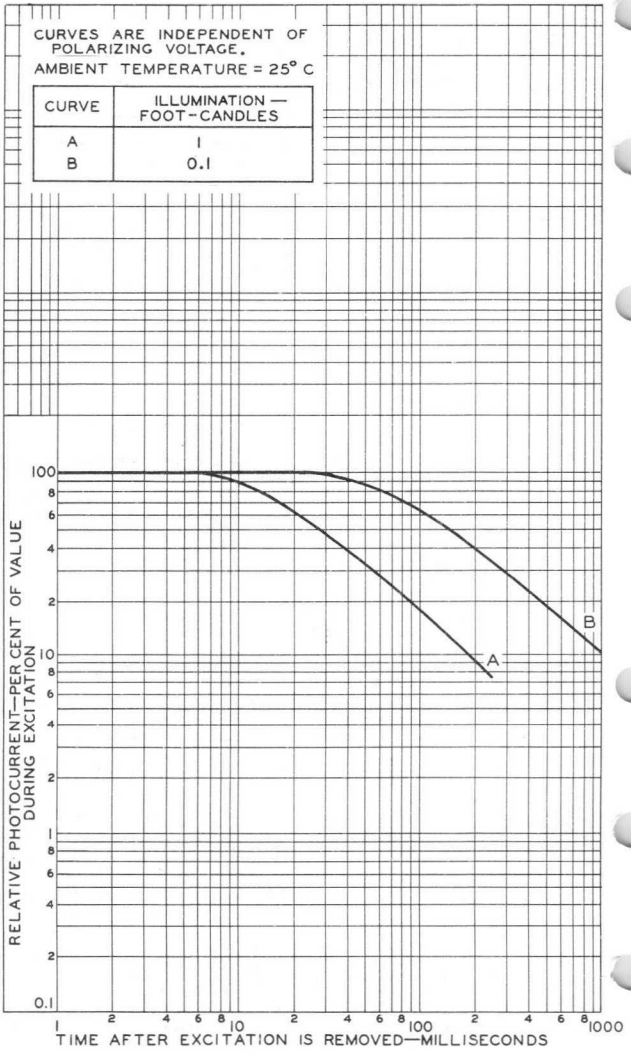
6957

TYPICAL RISE CHARACTERISTICS



6957

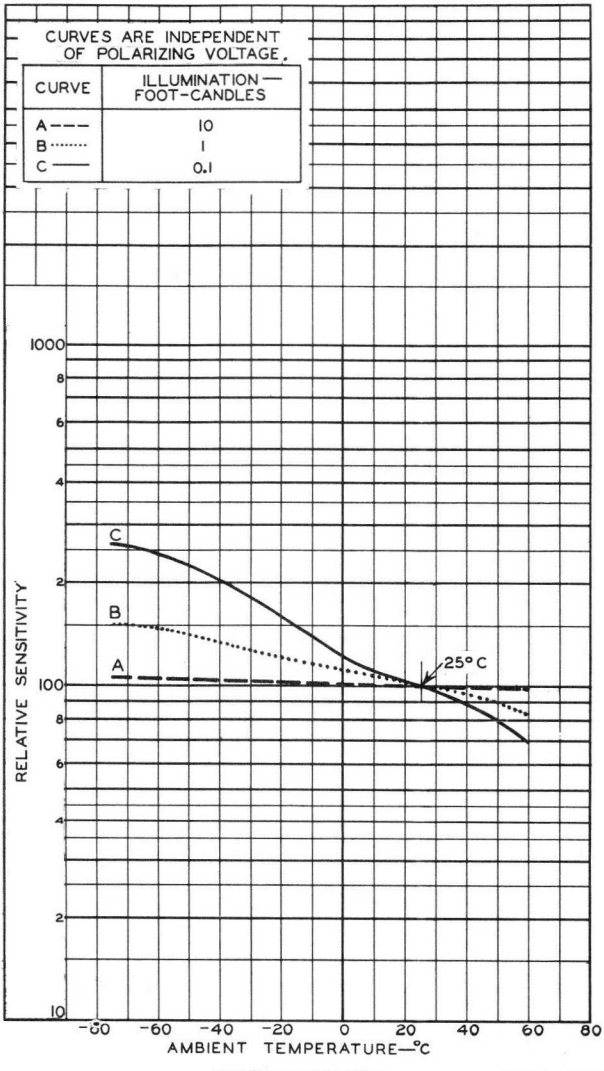
TYPICAL DECAY CHARACTERISTICS



RCA

6957

TYPICAL CHARACTERISTICS



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

92CM-9208

7029

MULTIPLIER PHOTOTUBE

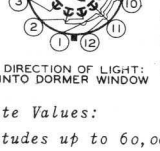
10-STAGE, DORMER-WINDOW TYPE WITH SEMITRANS-PARENT CATHODE ON REFLECTIVE SUBSTRATE AND S-17 RESPONSE

DATA

General:

Spectral Response		S-17
Wavelength of Maximum Response	4900 ± 500	angstroms
Cathode, Semitransparent on Reflective Substrate:		
Shape	Rectangular on concave spherical surface	
Minumum projected length on plane of window	0.65	in.
Minimum projected width on plane of window	0.5	in.
Direct Interelectrode Capacitances (Approx.):		
Anode to dynode No.10	4	μμf
Anode to all other electrodes	7	μμf
Maximum Overall Length		3.75"
Maximum Seated Length		3.25"
Length from Base Seat to Center of Window Area	2.69" ± 0.19"	
Diameter	1.50" ± 0.06"	
Operating Position		Any
Weight (Approx.)		3 oz
Bulb		T12 with Special End Contour
Socket		Eby No.9058, or equivalent
Base		Ultrashort Small-Shell Duodecal 12-Pin (JETEC No.B12-186), Non-hygroscopic
Basing Designation for BOTTOM VIEW		12AH

Pin 1 – Dynode No.1
Pin 2 – Dynode No.3
Pin 3 – Dynode No.5
Pin 4 – Dynode No.7
Pin 5 – Dynode No.9
Pin 6 – Anode



DIRECTION OF LIGHT: INTO DORMER WINDOW

Pin 7 – Dynode No.10
Pin 8 – Dynode No.8
Pin 9 – Dynode No.6
Pin 10 – Dynode No.4
Pin 11 – Dynode No.2
Pin 12 – Cathode

Maximum Ratings, *Absolute Values:*

For altitudes up to 60,000 feet

ANODE-SUPPLY VOLTAGE (DC or Peak AC)	1250 max.	volts
SUPPLY VOLTAGE BETWEEN DYNODE No.10 AND ANODE (DC or Peak AC)	250 max.	volts
DYNODE-No.1 SUPPLY VOLTAGE (DC or Peak AC)	300 max.	volts
AVERAGE ANODE CURRENT•	20 max.	μa
AMBIENT-TEMPERATURE RANGE	-50 to +75	°C

•: See next page.

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MULTIPLIER PHOTOTUBE

Characteristics Range Values for Equipment Design:

Under conditions with supply voltage (E) across voltage divider providing 1/11 of E per stage

With E = 1000 volts (except as noted)

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4900 angstroms.	–	27200	–	μa/μw
Cathode radiant, at 4900 angstroms	–	0.085	–	μa/μw
Luminous●	10	40	300	amp/lumen
Cathode luminous:				
With tungsten light source▲	100	125	–	μa/lumen
With blue light source⊕◆ .	0.006	–	–	μa
Current Amplification	–	320000	–	
Equivalent Anode-Dark-Current Input⊕■	–	4×10^{-10}	–	lumen
Equivalent Noise Input★ . . .	–	1.1×10^{-11}	–	lumen

● Averaged over any interval of 30 seconds maximum.

◆ For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K. A light input of 1 microlumen is used. The load resistor has a value of 0.01 megohm.

▲ For conditions the same as shown under (◆) except that the value of light flux is 0.001 lumen and 100 volts are applied between cathode and all other electrodes connected together as anode.

⊕ Under the following conditions: Light incident on the cathode is transmitted through a blue filter (Corning Glass Code No.5113 polished to 1/2 stock thickness) from a tungsten-filament lamp operated at a color temperature of 2870° K. The value of light flux on the filter is 0.001 lumen. The load resistor has a value of 0.01 megohm, and 100 volts are applied between cathode and all other electrodes connected together as anode.

◆ For spectral characteristic of this source, see sheet SPECTRAL CHARACTERISTIC OF 2870° K LIGHT SOURCE AND SPECTRAL CHARACTERISTIC OF LIGHT FROM 2870° K SOURCE AFTER PASSING THROUGH INDICATED BLUE FILTER at front of this Section.

⊕ Measured at a tube temperature of 25° C and with the supply voltage (E) adjusted to give a luminous sensitivity of 20 amperes per lumen. Dark current caused by thermionic emission and ion feedback may be reduced by the use of a refrigerant.

■ For maximum signal-to-noise ratio, operation with a supply voltage (E) below 1000 volts is recommended.

★ Under the following conditions: Supply voltage (E) is 1000 volts, 25° C tube temperature, ac-amplifier bandwidth of 1 cycle per second, tungsten light source at color temperature of 2870° K interrupted at a low audio frequency to produce incident radiation pulses alternating between zero and the value stated. The "on" period of the pulse is equal to the "off" period. The output current is measured through a filter which passes only the fundamental frequency of the pulses.

SPECIAL PERFORMANCE DATA

4-Hour Stability Life Performance:

This test is performed on each 7029. Before this test is made, the tube is kept in total darkness for 24 hours. Under conditions with supply volts E = 1000, tube temperature of 25° C, and light flux adjusted to give an

anode current = 10 microamperes within 1 minute after turning on light source, the tube is operated for 4 hours. At the end of this period the anode current will not increase by more than 1 microampere nor decrease by more than 1.5 microamperes.

OPERATING CONSIDERATIONS

The *operating stability* of the 7029 is dependent on the magnitude of the anode current and its duration. When the 7029 is operated at high values of anode current, a drop in sensitivity (sometimes called fatigue) may be expected. The extent of the drop below the tabulated sensitivity values depends on the severity of the operating conditions. After a period of idleness, the 7029 usually recovers a substantial percentage of such loss in sensitivity.

The use of an average anode current well below the maximum rated value of 20 microamperes is recommended when stability of operation is important. When greater stability is required, the anode current should not exceed 10 microamperes.

Electrostatic and/or magnetic shielding of the 7029 may be necessary. It is to be noted that the use of an external magnetic and/or electrostatic shield at high negative potential presents a safety hazard unless the shield is connected through a high impedance in the order of 10 megohms to the potential. If the shield is not so connected, *extreme care should be observed in providing adequate safeguards to prevent personnel from coming in contact with the high potential of the shield.*

SPECTRAL-SENSITIVITY CHARACTERISTIC of Phototube having S-17 Response is shown at the front of this Section

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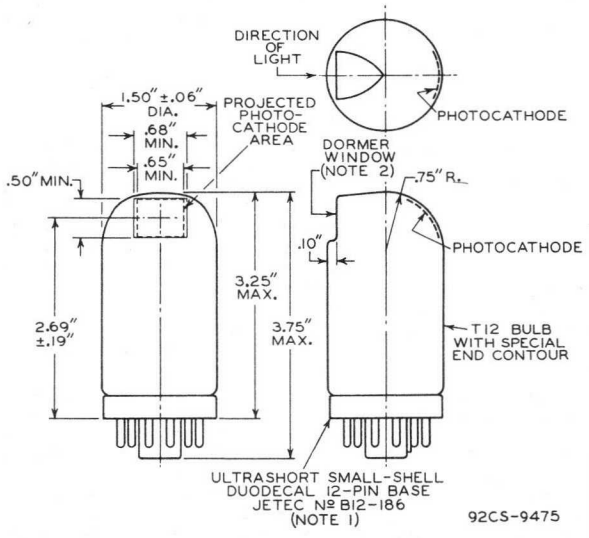
MULTIPLIER PHOTOTUBE



NOTE 1: ℄ OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF BOTTOM OF THE BASE.

NOTE 2: DORMER WINDOW IS ON OPPOSITE SIDE OF TUBE FROM BASE KEY.

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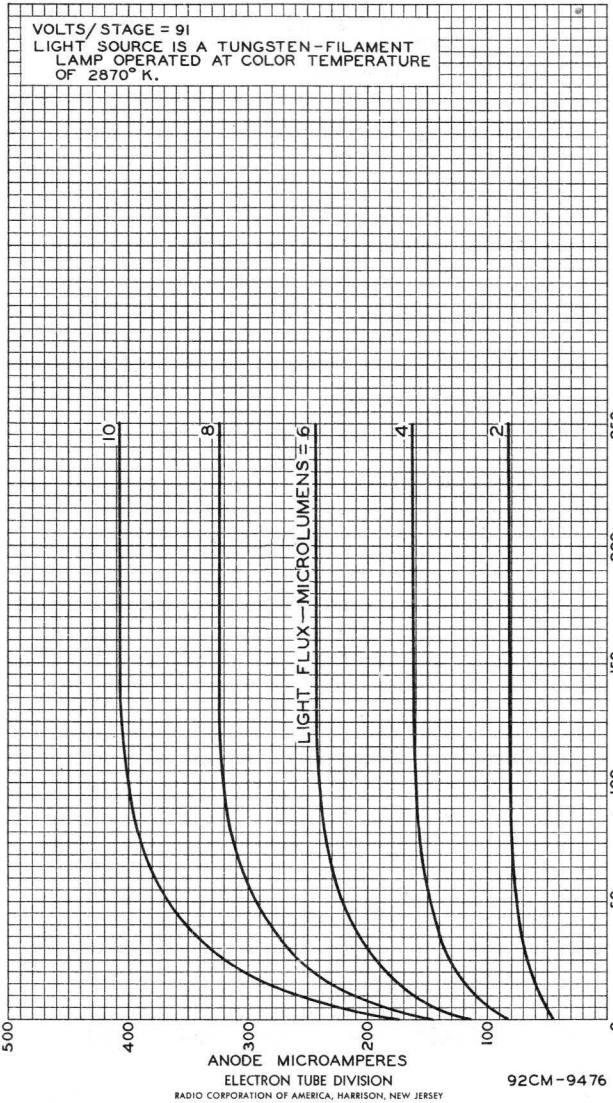
AVERAGE ANODE CHARACTERISTICS



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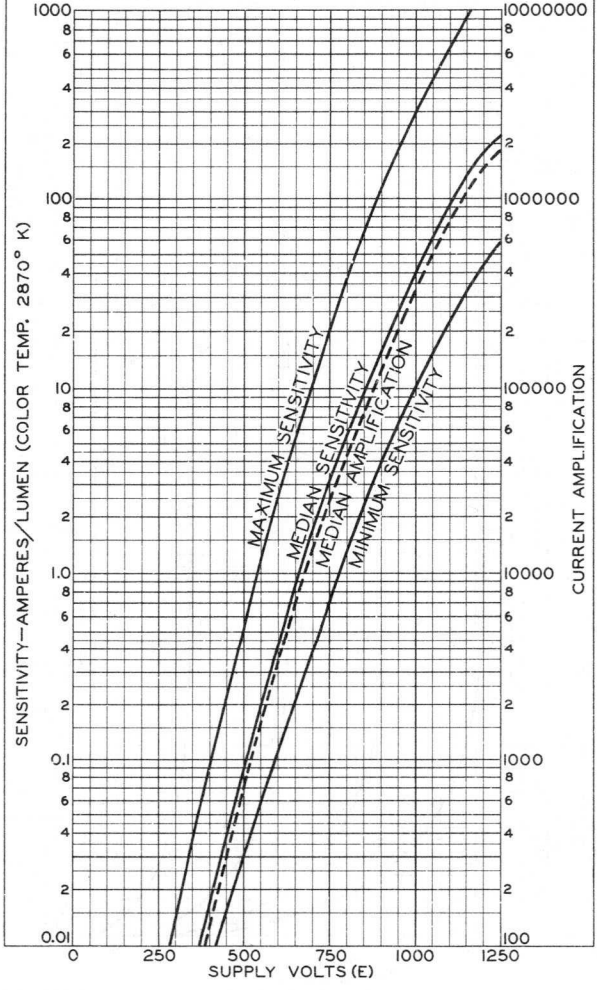
CHARACTERISTICS

SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER PROVIDING 1/11 OF E BETWEEN CATHODE AND DYNODE Nº 1; 1/11 OF E FOR EACH SUCCEEDING DYNODE STAGE; AND 1/11 OF E BETWEEN DYNODE Nº 9 AND ANODE.



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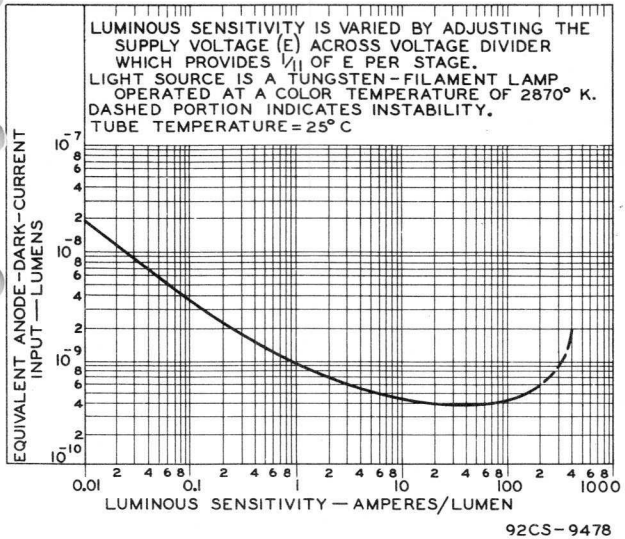
TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC



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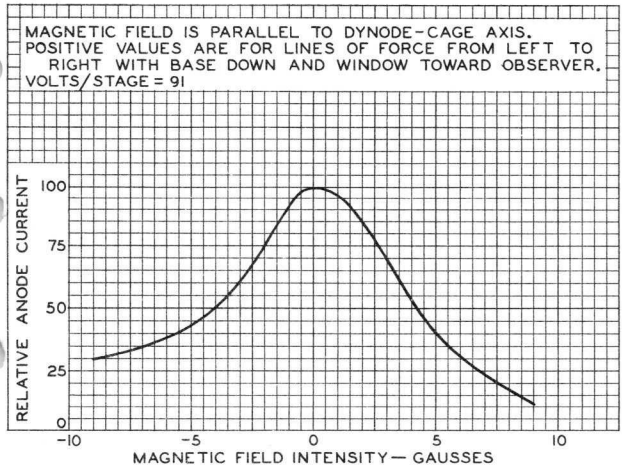
EFFECT OF MAGNETIC FIELD ON ANODE CURRENT



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7037

IMAGE ORTHICON

For simultaneous color pickup

MAGNETIC FOCUS MAGNETIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:
- Voltage . . . . . 6.3 ± 10% . . . ac or dc volts
- Current . . . . . 0.6 . . . . . amp

Direct Interelectrode Capacitance:
- Anode to all other electrodes . . . . . 12 μμf

Photocathode, Semitransparent:
- Response. . . . . *See accompanying Spectral-Sensitivity Characteristics curve*
- Rectangular image (4 x 3 aspect ratio):
  - Useful size of. . . . . 1.8" max. Diagonal
    - Note: The size of the optical image focused on the photocathode should be adjusted so that its maximum diagonal does not exceed the specified value. The corresponding electron image on the target should have a size such that the corners of the rectangle just touch the target ring.
  - Orientation of. . . . Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through center of faceplate and pin 7 of the shoulder base.

Focusing Method . . . . . Magnetic
Deflection Method . . . . . Magnetic
Overall Length. . . . . 15.20" ± 0.25"
Greatest Diameter of Bulb . . . . . 3.00" ± 0.06"
Minimum Deflecting-Coil Inside Diameter . . . . . 2-3/8"
Deflecting-Coil Length. . . . . 5"
Focusing-Coil Length. . . . . 10"
Alignment-Coil Length . . . . . 15/16"
Photocathode Distance Inside End of Focusing Coil . . . 1/2"
Operating Position. . . . . *See Operating Considerations*
Weight (Approx.). . . . . 1 lb 6 oz
End Base. . . . Small-Shell Diheptal 14-Pin (JETEC No.B14-45)

BOTTOM VIEW■

Pin 1 – Heater
Pin 2 – Grid No.4
Pin 3 – Grid No.3
Pin 4 – Internal Connection—Do Not Use
Pin 5 – Dynode No.2
Pin 6 – Dynode No.4
Pin 7 – Anode
Pin 8 – Dynode No.5
Pin 9 – Dynode No.3
Pin 10 – Dynode No.1, Grid No.2
Pin 11 – Internal Connection—Do Not Use
Pin 12 – Grid No.1
Pin 13 – Cathode
Pin 14 – Heater

■ See basing diagram on next page.

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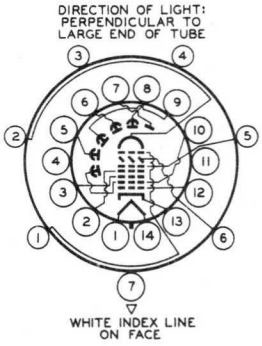
IMAGE ORTHICON

Shoulder Base . . . . . Keyed Jumbo Annular 7-Pin

BOTTOM VIEW



Pin 1 – Grid No.6

Pin 2 – Photocathode

Pin 3 – Internal Connection—Do Not Use

Pin 4 – Internal Connection—Do Not Use

Pin 5 – Grid No.5

Pin 6 – Target

Pin 7 – Internal Connection—Do Not Use

Maximum and Minimum Ratings, *Absolute Values:*

PHOTOCATHODE:		
Voltage	-550 max.	volts
Illumination.	50 max.	ft-c
OPERATING TEMPERATURE:		
Of any part of bulb	50 max.	°C
Of bulb at large end of tube (Target section).	40 min.	°C
TEMPERATURE DIFFERENCE:		
Between target section and any part of bulb hotter than target section. . .	5 max.	°C
GRID-No.6 VOLTAGE	-550 max.	volts
TARGET VOLTAGE:		
Positive value.	10 max.	volts
Negative value.	10 max.	volts
GRID-No.5 VOLTAGE	150 max.	volts
GRID-No.4 VOLTAGE	300 max.	volts
GRID-No.3 VOLTAGE	400 max.	volts
GRID-No.2 & DYNODE-No.1 VOLTAGE	350 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value	125 max.	volts
Positive bias value	0 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode.	125 max.	volts
Heater positive with respect to cathode.	10 max.	volts
ANODE-SUPPLY VOLTAGE*	1350 max.	volts
VOLTAGE PER MULTIPLIER STAGE.	350 max.	volts

*: See next page.

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IMAGE ORTHICON

Typical Operation and Characteristics	Range Values:	
Photocathode Voltage (Image Focus)	−400 to −540	volts
Grid-No.6 Voltage (Accelerator)— Approx. 75% of photocathode voltage	−300 to −405	volts
Target-Cutoff Voltage[o]	−3 to +1	volts
Grid-No.5 Voltage (Decelerator)	0 to 125	volts
Grid-No.4 Voltage (Beam Focus)	140 to 180	volts
Grid-No.3 Voltage[#]	225 to 330	volts
Grid-No.2 & Dynode-No.1 Voltage	300	volts
Grid-No.1 Voltage for picture cutoff	−45 to −115	volts
Dynode-No.2 Voltage	600	volts
Dynode-No.3 Voltage	800	
Dynode-No.4 Voltage	1000	volts
Dynode-No.5 Voltage	1200	volts
Anode Voltage	1250	volts
Anode Current (DC)	30	μa
Signal-Output Current (Peak to peak)	3 to 24	μa
Target-Temperature Range	40 to 45	°C
Ratio of Peak-to-Peak Highlight Video-Signal Current to RMS Noise Current (Approx.)	60	
Minimum Peak-to-Peak Blanking Voltage	5	volts
Field Strength at Center of Focusing Coil[▲]	75	gausses
Field Strength of Alignment Coil (Approx.)	0 to 3	gausses

* Ratio of dynode voltages is shown under *Typical Operation*.

[o] Normal setting of target voltage is +2 volts from target cutoff. The target-supply voltage should be adjustable from −3 to +5 volts.

[#] Adjust to give the most uniformly shaded picture near maximum signal.

[▲] Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

OPERATING CONSIDERATIONS

The *operating position* of the 7037 should preferably be such that any loose particles in the neck of the tube will not fall down and strike or become lodged on the target. Therefore, it is recommended that the tube never be operated in a vertical position with the Diheptal-base end up nor in any other position where the axis of the tube with base up makes an angle of less than 20° with the vertical.

When the equipment design or operating conditions are such that the maximum temperature rating or maximum temperature difference as given under ***Maximum Ratings*** will be exceeded, provision should be made to direct a blast of cooling air

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IMAGE ORTHICON

from the Diheptal-base end of the tube along the entire length of the bulb surface, i.e., through the space between the bulb surface and the surrounding deflecting-coil assembly and its extension. Any attempt to effect cooling of the tube by circulating even a large amount of air around the focusing coil will do little good, but a small amount of air directly in contact with the bulb surface will effectively drop the bulb temperature. For this purpose, a small blower is satisfactory, but it should be run at low speed to prevent vibration of the 7037 and the associated amplifier equipment. Unless vibration is prevented, distortion of the picture may occur.

Ordinarily, the temperature in a camera equipped with a blower will not exceed 45° C, except in very hot weather or unless the target heater is left on accidentally for a long period.

To keep the operating temperature of the large end of the tube from falling below 45° C, some form of controlled heating should be employed. Ordinarily, adequate heat will be supplied by the focusing coil, deflecting coils, and associated amplifier tubes so that the temperature can be controlled by the amount of cooling air directed along the bulb surface. If, in special cases, a target heater is required, it should fit between the focusing coil and the bulb near the shoulder of the tube, and be non-inductively wound.

Resolution in excess of 500 lines at the center of the picture can be produced by the 7037 when operated for color reproduction.

To utilize the resolution capability of the 7037 in the horizontal direction with the standard scanning rate of 525 lines, it is necessary to use a video amplifier having a bandwidth of at least 6 megacycles.

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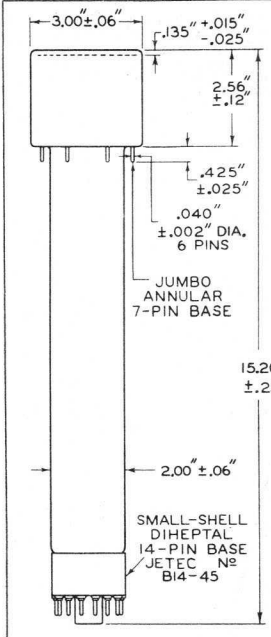
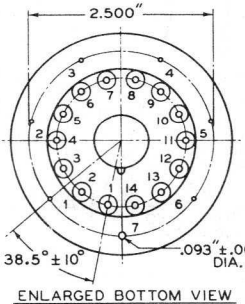
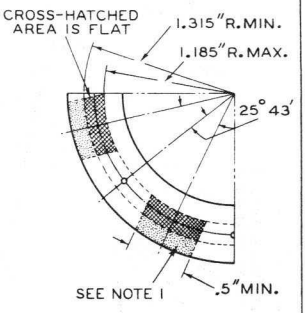
IMAGE ORTHICON





ENLARGED BOTTOM VIEW

DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE



NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.

ANNULAR-BASE GAUGE

ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAUGE WITH:

a. SIX HOLES HAVING DIAMETER OF 0.065" ± 0.001" AND ONE HOLE HAVING DIAMETER OF 0.150" ± 0.001". ALL HOLES HAVE DEPTH OF 0.265" ± 0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047". ALL HOLES ARE SPACED AT ANGLES OF 51°26' ± 5' ON CIRCLE DIAMETER OF 2.500" ± 0.001".

b. SEVEN STOPS HAVING HEIGHT OF 0.187" ± 0.001", CENTERED BETWEEN PIN HOLES, TO BEAR AGAINST FLAT AREAS OF BASE.

c. RIM EXTENDING OUT A MINIMUM OF 0.125" FROM 2.812" DIAMETER AND HAVING HEIGHT OF 0.126" ± 0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200" ± 0.001".

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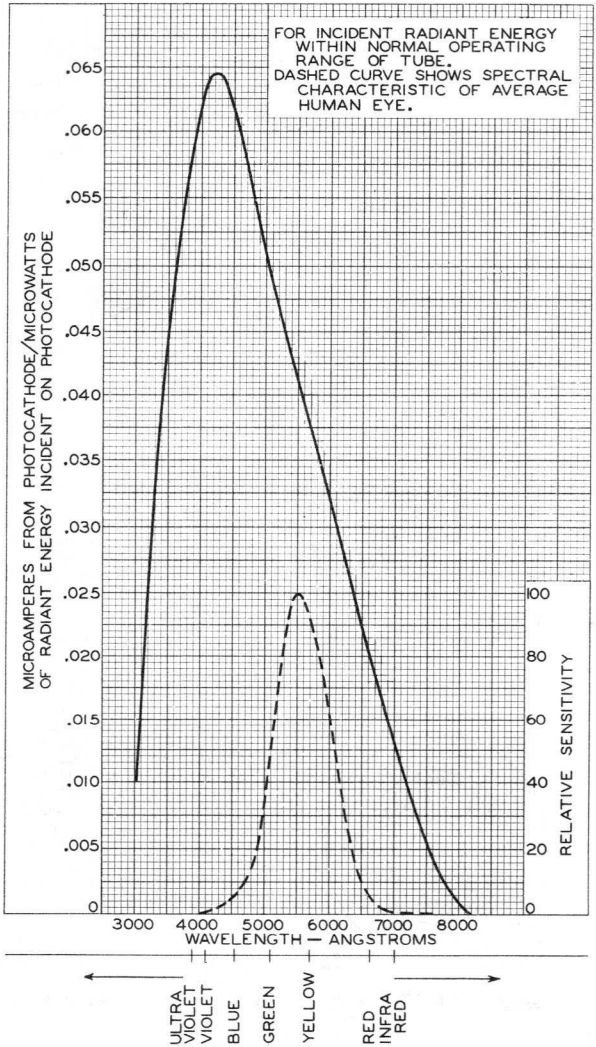
SPECTRAL-SENSITIVITY CHARACTERISTICS



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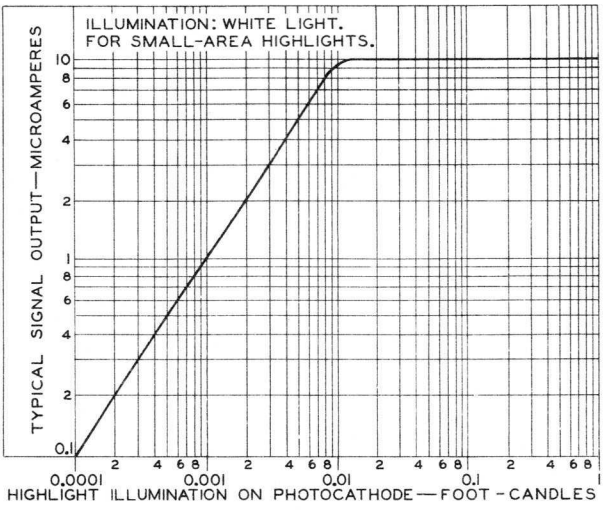
BASIC LIGHT-TRANSFER CHARACTERISTIC



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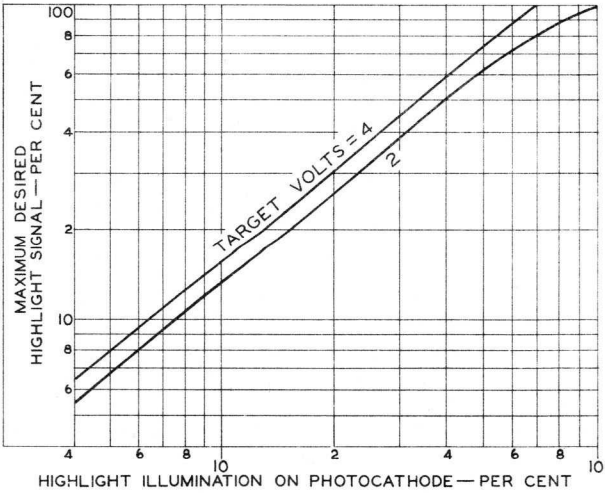
LIGHT-TRANSFER CHARACTERISTICS



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92CS-9441

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Vidicon

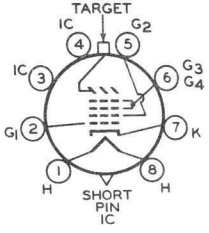
MAGNETIC FOCUS — 1" Diameter — MAGNETIC DEFLECTION

For Live and Film Pickup With Color or Black-and-White TV Cameras

General:

Heater, for Unipotential Cathode:	
Voltage (AC or DC)	6.3 ± 10% volts
Current at heater volts = 6.3	0.6 amp
Direct Interelectrode Capacitance:[a]	
Target to all other electrodes	4.6 pf
Spectral Response	See Accompanying *Curves*
Photoconductive Layer:	
Maximum useful diagonal of rectangular image (4 x 3 aspect ratio)[b]	0.62"
Focusing Method	Magnetic
Deflection Method	Magnetic
Overall Length	6.25" ± 0.25"
Greatest Diameter	1.125" ± 0.010"
Operating Position	Any
Weight (Approx.)	2 oz
Bulb	T8
Focusing Coil	Cleveland Electronics[c,d] No.VF-115-5, or equivalent
Deflecting Yoke	Cleveland Electronics[c,d] No.VY-111-3, or equivalent
Alignment Coil	Cleveland Electronics[c,d] No.VA-118, or equivalent
Socket	Cinch[e] No.54A18088, or equivalent
Base	Small-Button Ditetrar 8-Pin (JEDEC No.E8-11)
Basing Designation for BOTTOM VIEW	8HM

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Do Not Use
Pin 4 – Do Not Use
Pin 5 – Grid No.2
Pin 6 – Grid No.3 & No.4
Pin 7 – Cathode
Pin 8 – Heater
Flange – Target
Short Pin – Do Not Use



DIRECTION OF LIGHT: INTO FACE END OF TUBE

Maximum Ratings, *Absolute-Maximum Values:*

For scanned area of 1/2" x 3/8"

Grid-No.3 & Grid-No.4 Voltage	750 max. volts ←
Grid-No.2 Voltage	750 max. volts ←
Grid-No.1 Voltage:	
Negative-bias value	125 max. volts
Positive-bias value	0 max. volts

← Indicates a change.

Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode.	125 max.	volts
Heater positive with respect to cathode.	10 max.	volts
Dark Current.	0.25 max.	μa
Peak Target Current	0.55 max.	μa
Faceplate:		
Illumination	1000 max.	fc
Temperature.	60 max.	°C

Typical Operation:

For scanned area of 1/2" x 3/8" and faceplate temperature of 30° to 35° C

Grid-No.4 (Decelerator) & Grid-No.3 (Beam-Focus Electrode[f]) Voltage	250[g] to 300	volts
Grid-No.2 (Accelerator) Voltage	300	volts
Grid-No.1 Voltage for picture cutoff[h]	-45 to -100	volts
Average "Gamma" of Transfer Characteristic for signal-output current between 0.02 μa and 0.2 μa.	0.65	
Visual Equivalent Signal-to-Noise Ratio (Approx.)[j]	300:1	
Minimum Peak-to-Peak Blanking Voltage:		
When applied to grid No.1	75	volts
When applied to cathode	20	volts
Field Strength at Center of Focusing Coil (Approx.).	40	gauss
Field Strength of Adjustable Alignment Coil[k]	0 to 4	gauss

Maximum-Sensitivity Operation for Live-Scene Pickup

Faceplate Illumination (Highlight).	2	fc
Maximum Target Voltage required to produce dark current of 0.2 μa in any tube[m].	110	volts
Target Voltage[n]	60 to 100	volts
Dark Current[p]	0.2	μa
Target Current (Highlight)[q]	0.4 to 0.5	μa
Signal-Putput Current:[r]		
Peak.	0.2 to 0.3	μa
Average	0.08 to 0.1	μa

Average-Sensitivity Operation for Live-Scene Pickup

Faceplate Illumination (Highlight).	15	fc
Maximum Target Voltage required to produce dark current of 0.02 μa in any tube[m].	60	volts
Target Voltage[n]	30 to 50	volts
Dark Current.	0.02	μa
Target Current (Highlight)[q]	0.3 to 0.4	μa
Signal-Output Current:[r]		
Peak.	0.3 to 0.4	μa
Average	0.1 to 0.2	μa

Minimum-Lag Operation for Film Pickup

Faceplate Illumination (Highlight)	100	fc
Maximum Target Voltage required to produce dark current of 0.004 μa in any tube[m]	30	volts
Target Voltage[n]	15 to 25	volts
Dark Current	0.004	μa
Target Current (Highlight)[q]	0.3 to 0.4	μa
Signal-Output Current:[r]		
Peak	0.3 to 0.4	μa
Average	0.1 to 0.2	μa

[a] This capacitance, which effectively is the output impedance of the 7038, is increased when the tube is mounted in the deflecting-yoke and focusing-coil assembly. The resistive component of the output impedance is in the order of 100 megohms.

[b] Proper orientation of quality rectangle is obtained when the horizontal scan is essentially parallel to the straight sides of the masked portions of the faceplate. The straight sides are parallel to the plane passing through the tube axis and short pin. The masking is for orientation only and does not define the proper scanned area of photoconductive layer.

[c] Cleveland Electronics Inc., 1974 East 61st St., Cleveland, Ohio.

[d] These components are chosen to provide tube operation with minimum beam-landing error.

[e] Cinch Manufacturing Corp., 1026 South Homan Avenue, Chicago 24, Ill.

[f] Beam focus is obtained by combined effect of grid-No.3 voltage which should be adjustable over indicated range, and a focusing coil having an average field strength of 40 gauss.

[g] Definition, focus uniformity, and picture quality decrease with decreasing grid-No.4 and grid-No.3 voltage. In general, grid No.4 and grid No.3 should be operated above 250 volts.

[h] With no blanking voltage on grid No.1.

[j] Measured with high-gain, low-noise, cascode-input-type amplifier having bandwidth of 5 Mc. Because the noise in such a system is predominately of the high-frequency type, the visual equivalent signal-to-noise ratio is taken as the ratio of highlight video-signal current to rms noise current, multiplied by a factor of 3.

[k] The alignment coil should be located on the tube so that its center is at a distance of 3-11/16 inches from the face of the tube, and be positioned so that its axis is coincident with the axis of the tube, the deflecting yoke, and the focusing coil.

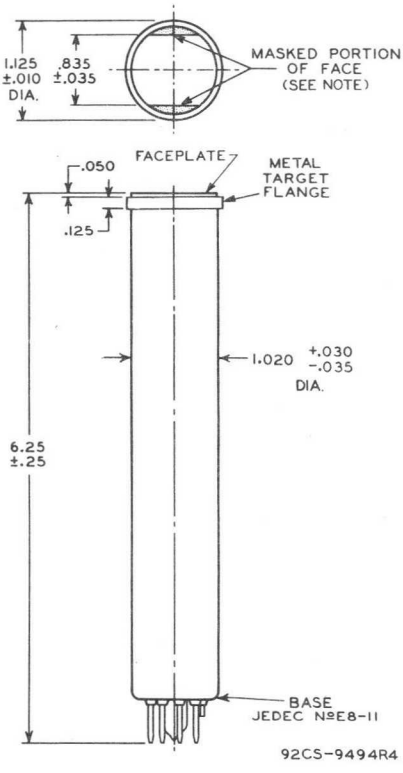
[m] The target voltage for each 7038 must be adjusted to that value which gives the desired operating dark current.

[n] Indicated range for each type of service serves only to illustrate the operating target-voltage range normally encountered.

[p] The deflecting circuits must provide extremely linear scanning for good black-level reproduction. Dark-current signal is proportional to the scanning velocity. Any change in scanning velocity produces a black-level error in direct proportion to the change in scanning velocity.

[q] Video amplifiers must be designed properly to handle target currents of this magnitude to avoid amplifier overload or picture distortion.

[r] Defined as the component of the target current after the dark-current component has been substracted.



DIMENSIONS IN INCHES

Note: Straight sides of masked portions are parallel to the plate passing through tube axis and short pin.

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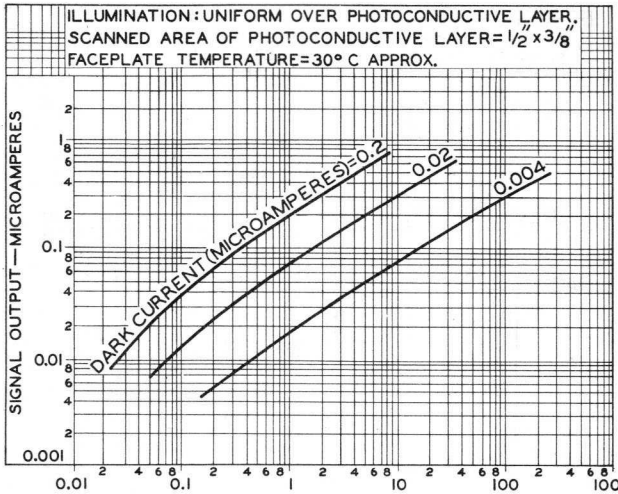
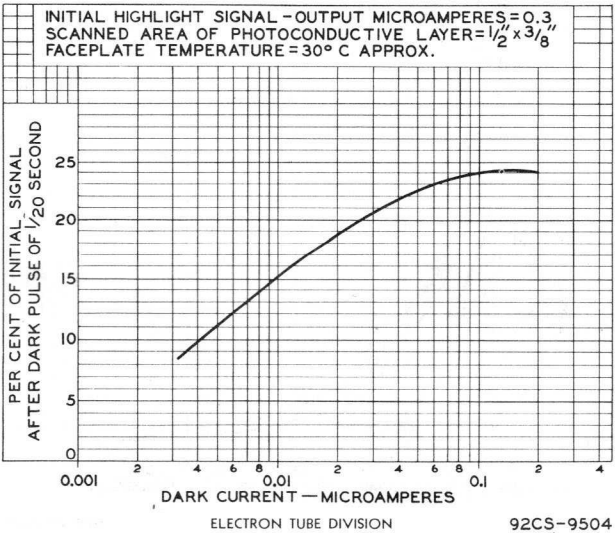
TYPICAL LIGHT-TRANSFER CHARACTERISTICS



92CS-9495

TYPICAL PERSISTENCE CHARACTERISTIC



92CS-9504

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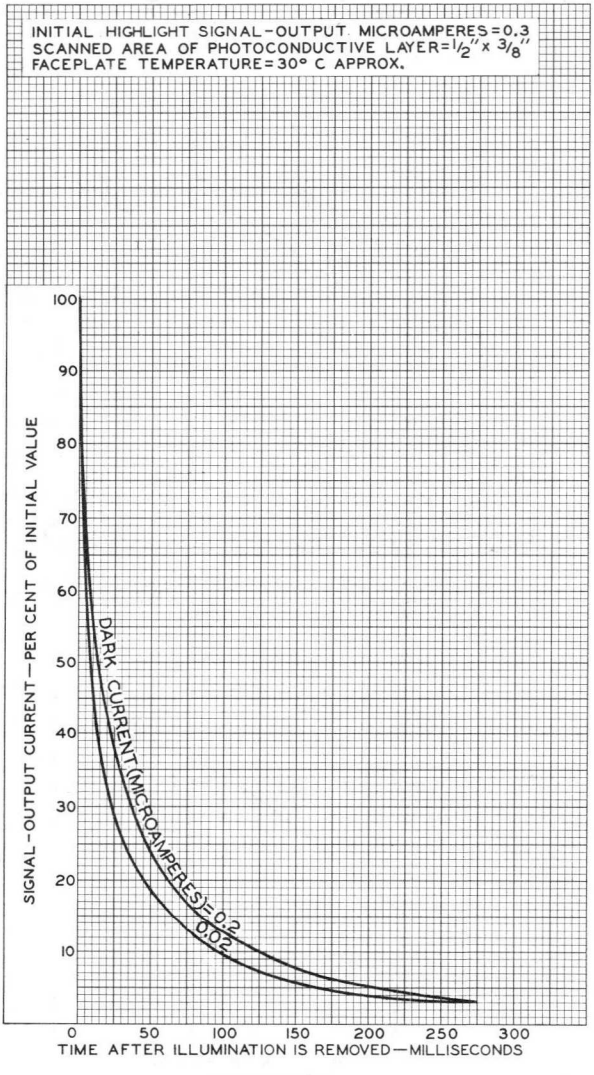
TYPICAL PERSISTENCE CHARACTERISTICS



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MULTIPLIER PHOTOTUBE

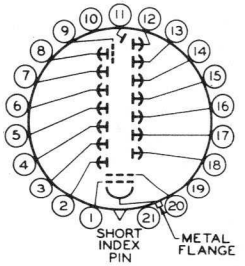
14-STAGE, HEAD-ON, FLAT-FACEPLATE TYPE WITH 4-7/16" CURVED, SEMITRANSPARENT CATHODE AND EXTENDED S-11 RESPONSE VERY-SHORT TIME-RESOLUTION CAPABILITY

DATA

General:

Spectral Response	Extended S-11 *(See Curve)*	
Wavelength of Maximum Response	4200 ± 500	angstroms
Faceplate, with flat external surface	Ultraviolet-Transmitting Glass	
Cathode, Semitransparent:		
Shape	Curved Circular	
Window:		
Area	15.5	sq. in.
Minimum diameter	4-7/16	in.
Index of refraction	1.468	
Direct Interelectrode Capacitances (Approx.):		
Anode to dynode No.14	2.4	μμf
Anode to all other electrodes	5	μμf
Dynode No.14 to all other electrodes	7	μμf
Maximum Overall Length	11-1/8"	
Seated Length	9-3/4" ± 1/4"	
Envelope	*See Dimensional Outline*	
Cathode Terminal	Metal Flange	
Operating Position	Any	
Weight (Approx.)	1 lb 14 oz	
Socket	Alden Part No.435SBA, or equivalent	
Base	Small-Button Thirtyfivar 21-Pin (JETEC No.E21-40)	
Basing Designation for BOTTOM VIEW	21A	

Pin 1 – Grid No.1
Pin 2 – Dynode No.1
Pin 3 – Dynode No.3
Pin 4 – Dynode No.5
Pin 5 – Dynode No.7
Pin 6 – Dynode No.9
Pin 7 – Dynode No.11
Pin 8 – Dynode No.13
Pin 9 – Grid No.3 (Accelerating Electrode)
Pin 10 – No Connection
Pin 11 – Anode
Pin 12 – Dynode No.14
Pin 13 – Dynode No.12
Pin 14 – Dynode No.10
Pin 15 – Dynode No.8
Pin 16 – Dynode No.6
Pin 17 – Dynode No.4
Pin 18 – Dynode No.2
Pin 19 – No Connection



Pin 20 – Grid No.2
Pin 21 – No Connection
Metal Flange – Cathode

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MULTIPLIER PHOTOTUBE

Maximum Ratings, *Absolute Values:*

DC ANODE-SUPPLY VOLTAGE	3400 max.	volts
DC SUPPLY VOLTAGE BETWEEN DYNODE No.14 AND ANODE	400 max.	volts
DC SUPPLY VOLTAGE BETWEEN CONSECUTIVE DYNODES	400 max.	volts
DC SUPPLY VOLTAGE BETWEEN GRID No.3 AND DYNODE No.13	500 max.	volts
DC GRID-No.2 SUPPLY VOLTAGE	1500 max.	volts
DC SUPPLY VOLTAGE BETWEEN GRID-No.2 AND ANODE	2300 max.	volts
DC GRID-No.1 SUPPLY VOLTAGE	1200 max.	volts
DC SUPPLY VOLTAGE BETWEEN DYNODE No.1 AND GRID No.2	400 max.	volts
AVERAGE ANODE CURRENT●	2 max.	ma
AMBIENT-TEMPERATURE RANGE	-125 to +75	°C

Characteristics Range Values for Equipment Design:

Under conditions with supply voltage (E) across a voltage divider providing electrode voltages shown in Table I

With E = 2800 volts (except as noted), and with grid-No.3, grid-No.1, and dynode-No.1 voltages adjusted to give maximum gain

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at 4200 angstroms	–	0.140	–	amp/μw
Cathode radiant, at 4200 angstroms	–	0.046	–	μa/μw
Luminous:#				
At 0 cps	40	180	1500	amp/lumen
With dynode No.14 as output electrode†	–	108	–	amp/lumen
Cathode luminous:				
With tungsten light source▲	40	60	–	μa/lumen
With blue light source**◆	4	–	–	μa
Current Amplification	–	3×10^6	–	
Equivalent Anode-Dark-Current Input■	–	2×10^{-9}	1.2×10^{-8}	lumen
	–	26×10^{-5}◆	156×10^{-5}◆	watt
Equivalent Noise Input★	–	1×10^{-11}	–	lumen
	–	13×10^{-7}◆	–	watt

●,#,†,▲,**,◆,■,★: See next page.

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MULTIPLIER PHOTOTUBE

	Min.	Median	Max.	
Greatest Transit-Time Spread: Within a circle centered on tube face and having a diameter of—				
3 inches.	–	0.5	–	milliμsec
4 inches.	–	4	–	milliμsec

With E = 3400 volts (except as noted), and with grid-No.3, grid-No.1, and dynode-No.1 voltages adjusted to give maximum gain

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4200 angstroms	–	0.91	–	amp/μW
Cathode radiant, at 4200 angstroms. . .	–	0.046	–	μa/μW
Luminous:#				
At 0 cps.	–	1200	–	amp/lumen
With dynode No.14 as output electrode†.	–	800	–	amp/lumen
Cathode luminous:				
With tungsten light source▲	40	60	–	μa/lumen
With blue light source**♦	4	–	–	μa
Current Amplification .	–	20×10^6	–	

● Averaged over any interval of 30 seconds maximum.

Under the following conditions: The light source is a tungsten-filament lamp operated at a color temperature of 2870° K. A light input of 0.1 microlumen is used. The load resistor has a value of 0.01 megohm.

† An output current of opposite polarity to that obtained at the anode may be provided by using dynode No.14 as the output electrode. With this arrangement, the load is connected in the dynode-No.14 circuit and the anode serves only as collector. This type of operation is suitable only for small output signals or for applications where linearity is not required.

▲ Under the following conditions: The light source is a tungsten-filament lamp operated at a color temperature of 2870° K. The value of light flux is 0.01 lumen and 200 volts are applied between cathode and all other electrodes connected together as anode. The load resistor has a value of 0.01 megohm.

** Under the following conditions: Light incident on the cathode is transmitted through a blue filter (Corning, Glass Code No.5113 polished to 1/2 stock thickness) from a tungsten-filament lamp operated at a color temperature of 2870° K. The value of light flux on the filter is 0.01 lumen. The load resistor has a value of 0.01 megohm, and 200 volts are applied between cathode and all other electrodes connected together as anode.

♦ For spectral characteristic of this source, see sheet SPECTRAL CHARACTERISTIC OF 2870° K LIGHT SOURCE AND SPECTRAL CHARACTERISTIC OF LIGHT FROM 2870° K SOURCE AFTER PASSING THROUGH INDICATED BLUE FILTER at front of this section.

●,#,♦,*: See next page.

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MULTIPLIER PHOTOTUBE

⊕ Measured at a tube temperature of 25° C and with the supply voltage (E) adjusted to give a luminous sensitivity of 500 amperes per lumen. Dark current caused by thermionic emission and ion feedback may be reduced by the use of a refrigerant.

■ For maximum signal-to-noise ratio, operation with a supply voltage (E) below 2000 volts is recommended.

● Measured at 4200 angstroms.

★ Under the following conditions: Supply voltage (E) is 2800 volts, 25° C tube temperature, tungsten light source of 2870° K interrupted at a low audio frequency to produce incident radiation pulses alternating between zero and the value stated. The "on" period of the pulse is equal to the "off" period. The output current is measured through a filter which passes only the fundamental frequency of the pulses.

TABLE I

VOLTAGE TO BE PROVIDED BY DIVIDER

Between	3.8% of Supply Voltage (E) Multiplied By
Cathode and Grid No.1	2 approx.*
Cathode and Grid No.2	11.5
Grid No.2 and Dynode No.1	1 approx.*
Grid No.2 and Dynode No.2	2
Dynode No.2 and Dynode No.3	1
Dynode No.3 and Dynode No.4	1
Dynode No.4 and Dynode No.5	1
Dynode No.5 and Dynode No.6	1
Dynode No.6 and Dynode No.7	1
Dynode No.7 and Dynode No.8	1
Dynode No.8 and Dynode No.9	1
Dynode No.9 and Dynode No.10	1
Dynode No.10 and Dynode No.11	1
Dynode No.11 and Dynode No.12	1
Dynode No.12 and Dynode No.13	1
Dynode No.13 and Dynode No.14	1
Dynode No.14 and Anode	1
Anode and Cathode	26.5

* Adjusted to give maximum gain.

OPERATING CONSIDERATIONS

Connection to the *metal flange* is made by a spring-finger ring bearing against the edge of the flange.

The *operating stability* of the 7046 is dependent on the magnitude of the anode current and its duration. When the 7046 is operated at high average values of anode current, a drop in sensitivity (sometimes called fatigue) may be expected. The extent of the drop below the tabulated sensitivity values depends on the severity of the operating conditions. After a period of idleness, the

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MULTIPLIER PHOTOTUBE

7046 usually recovers a substantial percentage of such loss in sensitivity.

The use of an average anode current well below the maximum-rated value of 2 milliamperes is recommended when stability of operation is important. When maximum stability is required, the anode current should not exceed 100 microamperes.

With certain orientations of the 7046, it will be observed that the earth's magnetic field is sufficient to cause a noticeable decrease in the response of the tube. To prevent such decrease in response of the tube, magnetic shielding must be provided. A suitable shield may be obtained from James Millen Mfg. Co., Malden, Mass. by ordering Part No.80805P. In general, it is recommended that the shield be connected to cathode potential.

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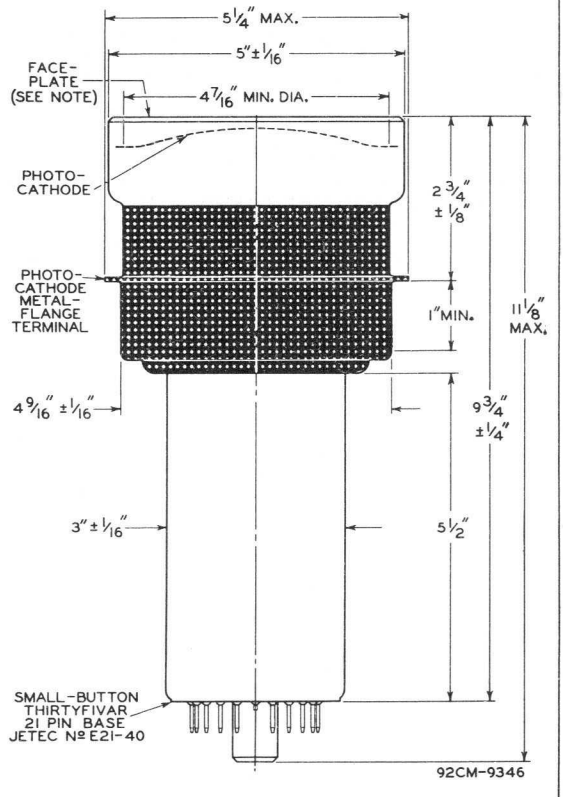
MULTIPLIER PHOTOTUBE



℄ OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF BOTTOM OF THE BASE.

NOTE: WITHIN 4-7/16" DIAMETER, DEVIATION FROM FLATNESS OF EXTERNAL SURFACE OF FACEPLATE WILL NOT EXCEED 0.015" FROM PEAK TO VALLEY.

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

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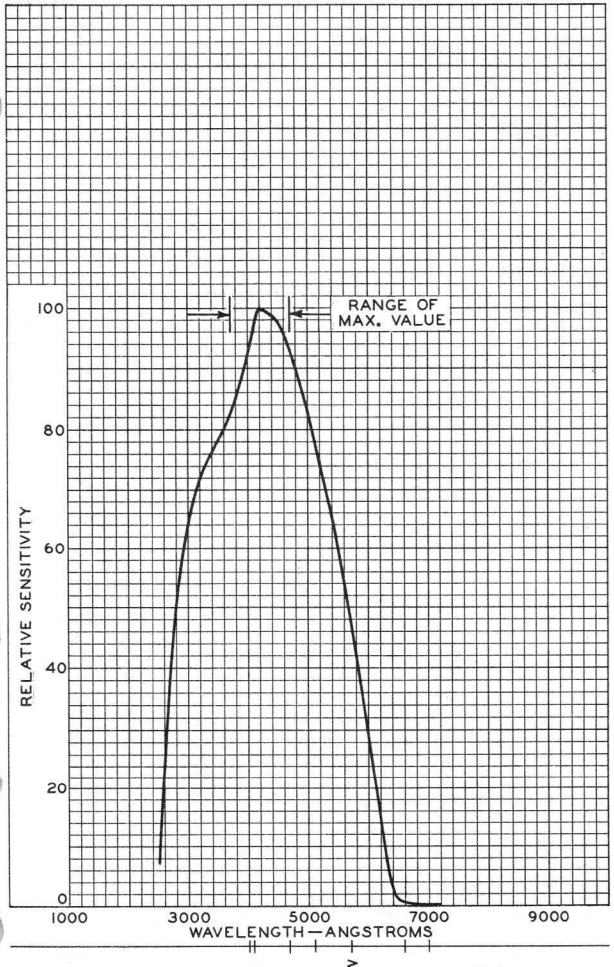
TENTATIVE
SPECTRAL SENSITIVITY CHARACTERISTIC
FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS



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92CM-9372

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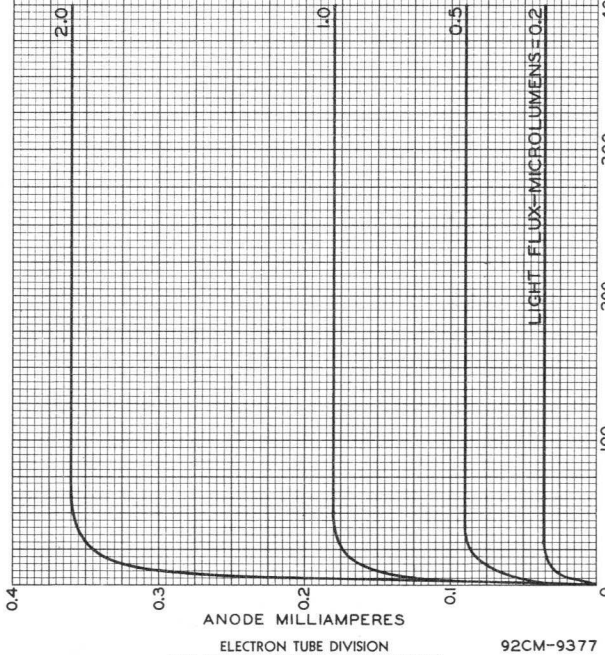
AVERAGE ANODE CHARACTERISTICS

CATHODE-TO-GRID-№2 VOLTS=1215
GRID-№2-TO-DYNODE-№2 (DY_2) VOLTS=212
DY_1-TO-DY_2
DY_2-TO-DY_3
ETC. THRU
DY_{13}-TO-DY_{14}
} VOLTS=106
GRID-№1 VOLTAGE, GRID-№3 VOLTAGE, AND DY_1 VOLTAGE ADJUSTED FOR MAXIMUM ANODE CURRENT.
LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870° K.



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RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9377

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TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC

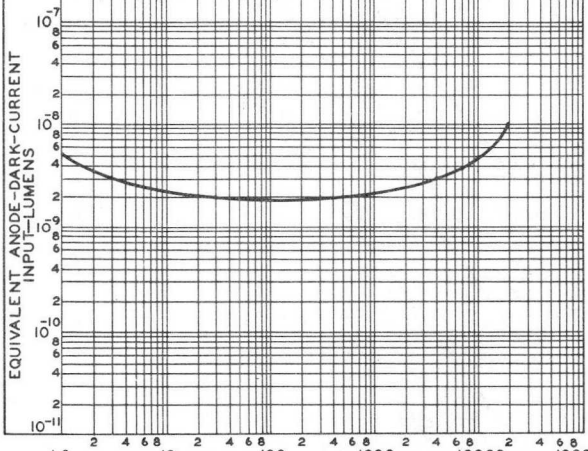
LUMINOUS SENSITIVITY IS VARIED BY ADJUSTMENT OF THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	3.8 % OF E MULTIPLIED BY
CATHODE & GRID Nº1	2 APPROX.*
CATHODE & GRID Nº2	11.5
GRID Nº2 & DYNODE Nº1 (DY_1)	1 APPROX.*
GRID Nº2 & DY_2	2
DY_2 & DY_3	1
DY_3 & DY_4	1
DY_4 & DY_5	1
DY_5 & DY_6	1
DY_6 & DY_7	1
DY_7 & DY_8	1
DY_8 & DY_9	1
DY_9 & DY_{10}	1
DY_{10} & DY_{11}	1
DY_{11} & DY_{12}	1
DY_{12} & DY_{13}	1
DY_{13} & DY_{14}	1
DY_{14} & ANODE	1
ANODE & CATHODE	26.5

* ADJUSTED TO GIVE MAXIMUM GAIN.

LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870° K.

TUBE TEMPERATURE = 25° C



ELECTRON TUBE DIVISION 92CM-9374

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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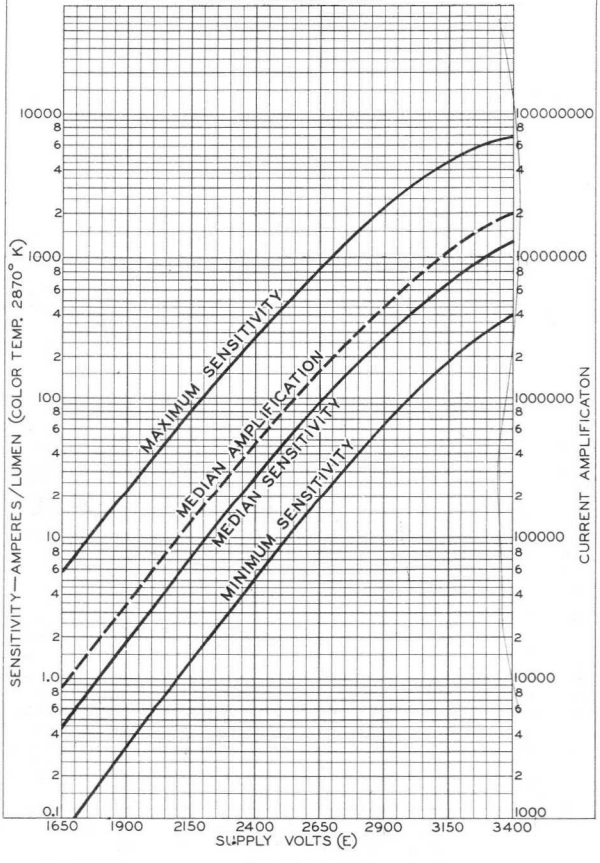
CHARACTERISTICS

THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	3.8 % OF E MULT. BY
CATHODE & GRID Nº 1	2 APPROX.*
CATHODE & GRID Nº 2	11.5
GRID Nº 2 & DYNODE Nº 1 (DY_1)	1 APPROX.*
GRID Nº 2 & DYNODE Nº 2	2
DY_2 & DY_3 ETC. THRU DY_{14} & ANODE	1

*ADJUSTED TO GIVE MAXIMUM GAIN.



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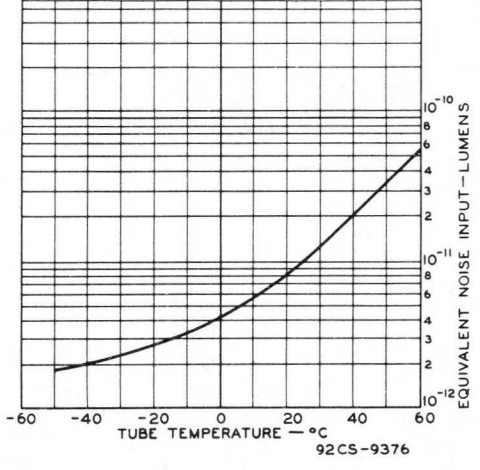
EQUIVALENT-NOISE-INPUT CHARACTERISTIC

CATHODE-TO-GRID-№2 VOLTS=1215
GRID-№2-TO-DYNODE-№2 (DY_2) VOLTS=212
DY_1-TO-DY_2
DY_2-TO-DY_3
ETC. THRU
DY_{14}-TO-ANODE
} VOLTS=106
GRID-№1 VOLTAGE, GRID-№3 VOLTAGE, AND DY_1 VOLTAGE ADJUSTED FOR MAXIMUM ANODE CURRENT.
BANDWIDTH (CPS) = 1
LIGHT SOURCE: TUNGSTEN AT 2870° K INTERRUPTED AT 90 CPS TO PRODUCE PULSES ALTERNATING BETWEEN ZERO AND FLUX VALUE SHOWN FOR ANY GIVEN TUBE TEMPERATURE; "ON" PERIOD OF PULSE EQUAL TO "OFF" PERIOD; RMS SIGNAL CURRENT = RMS NOISE CURRENT.



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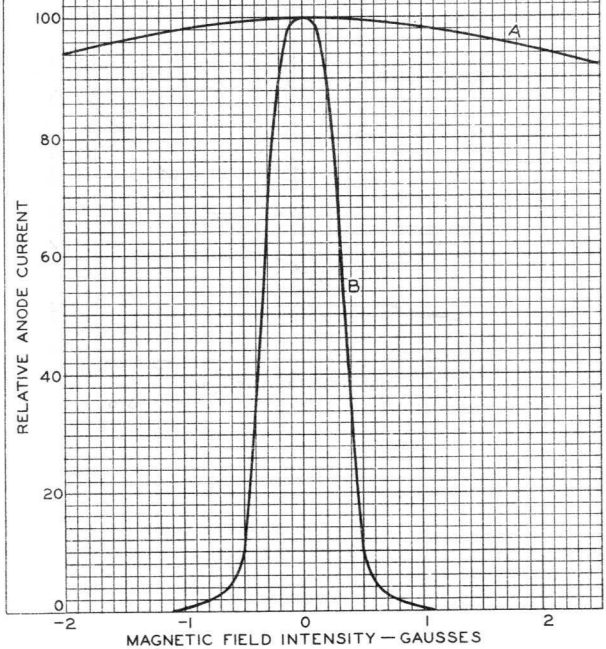
EFFECT OF MAGNETIC FIELD ON ANODE CURRENT

CATHODE-TO-GRID-Nº2 VOLTS=1215
GRID-Nº2-TO-DYNODE-Nº2 (DY_2) VOLTS=212
DY_1-TO-DY_2
DY_2-TO-DY_3
ETC. THRU
DY_{14}-TO-ANODE
} VOLTS=106

GRID-Nº1 VOLTAGE, GRID-Nº3 VOLTAGE, AND DY_1 VOLTAGE ADJUSTED FOR MAXIMUM ANODE CURRENT.
MAGNETIC FIELD IS PERPENDICULAR TO DYNODE SPACERS AND IS CENTERED BETWEEN CATHODE & DYNODE Nº1.
POSITIVE VALUES ARE FOR LINES OF FORCE FROM RIGHT TO LEFT WITH INDEX PIN OF BASE TOWARD RIGHT OF OBSERVER.

CURVE	CONDITION
A	WITH EXTERNAL SHIELD MILLEN Nº80805P, OR EQUIVALENT.
B	WITHOUT EXTERNAL SHIELD.



ELECTRON TUBE DIVISION
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92CM-9379RI

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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:

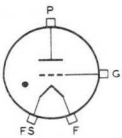
Operating Position	Any
Maximum Overall Length	11.8"
Maximum Radius (Including grid terminal)	2.88"
Maximum Diameter (Excluding grid terminal)	4.62"
Weight (Approx.)	3 lbs
Bulb	T36

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.

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

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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_l = 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_l/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_bE_{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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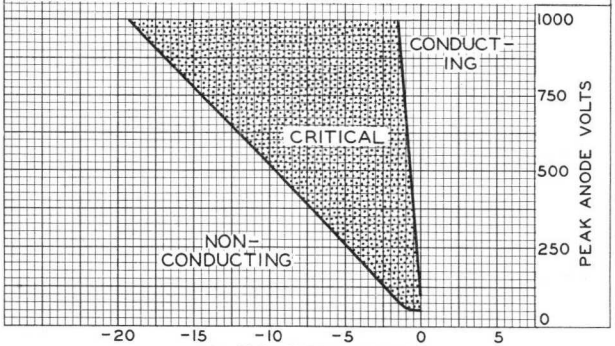
7086

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

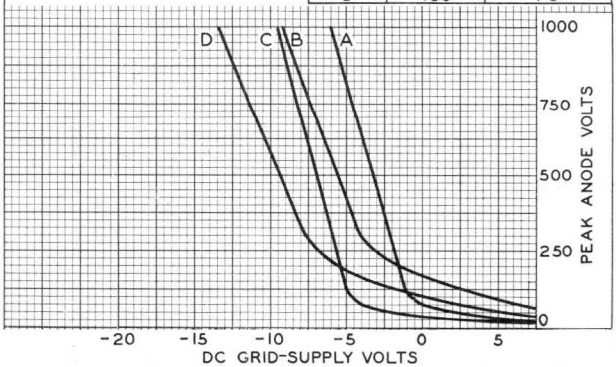


92CS-9436

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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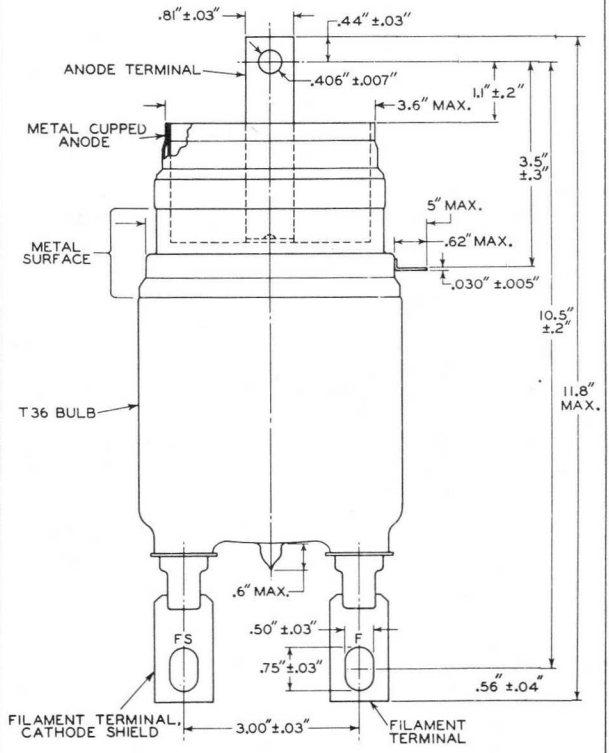
7086

XENON THYRATRON



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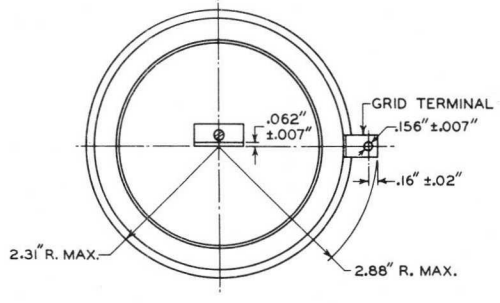
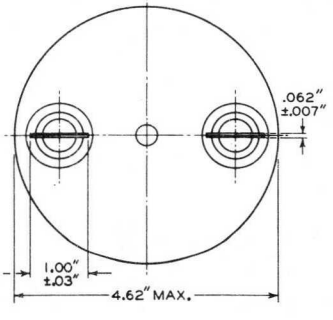
7086

XENON THYRATRON



TOP VIEW



BOTTOM VIEW

92CJ-9424

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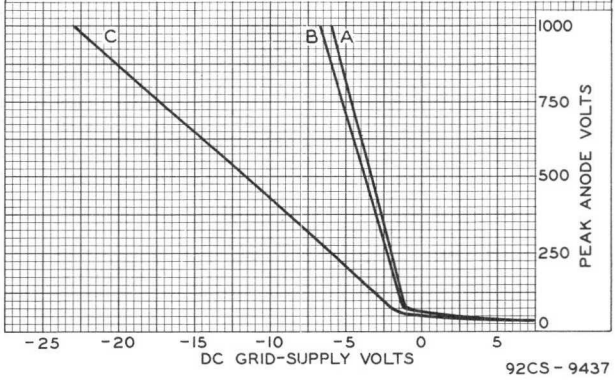
7086

SHIFT OF CONTROL CHARACTERISTICS
WITH CHANGE IN GRID-RESISTOR VALUE

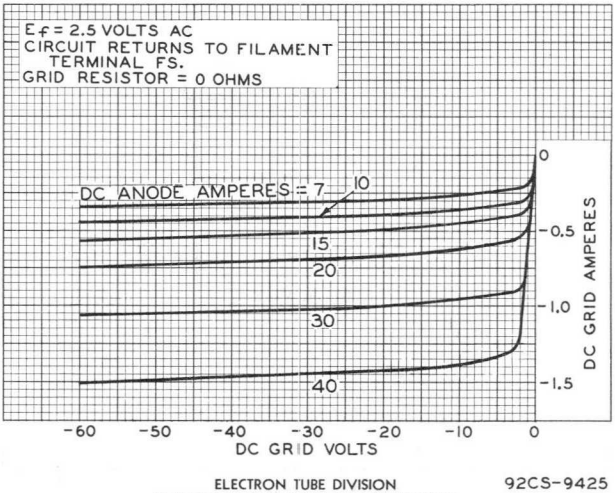
E_f = 2.5 VOLTS AC
*BETWEEN FILAMENT VOLTAGE AT TERMINAL F AND ANODE VOLTAGE (WITH RESPECT TO VOLTAGE AT FS).

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



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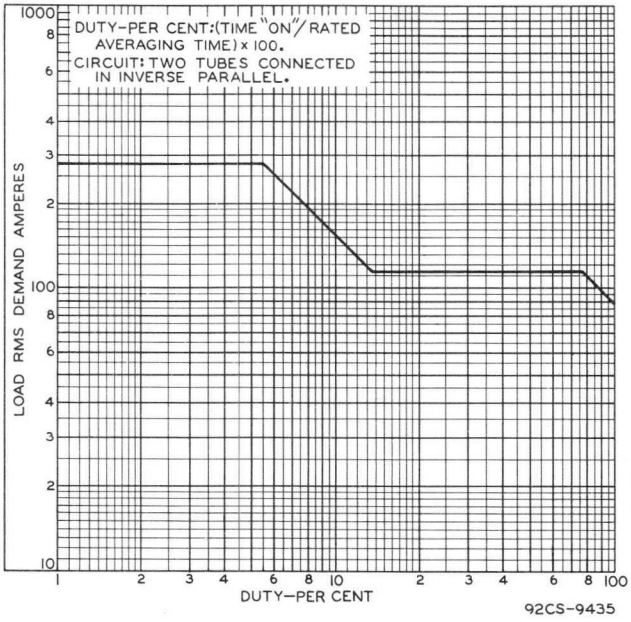
92CS-9425

7086

CURRENT DEMAND CHARACTERISTIC
AC VOLTAGE CONTROL SERVICE



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XENON THYRATRON

AC Voltage Control

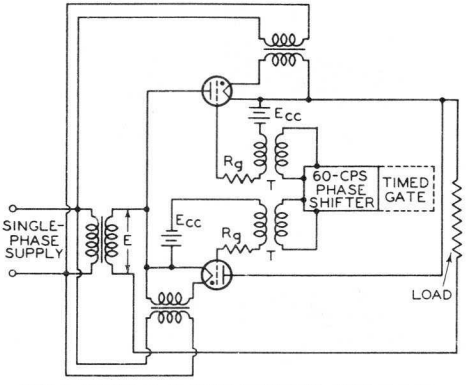

FIG. 1 SINGLE-PHASE INVERSE-PARALLEL

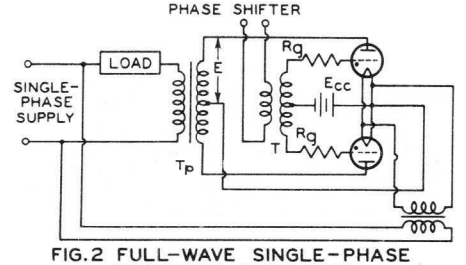

FIG. 2 FULL-WAVE SINGLE-PHASE REFLECTED IMPEDANCE

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

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7086
XENON THYRATRON

DC Voltage Control

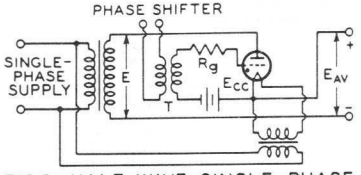

FIG.3 HALF-WAVE SINGLE-PHASE

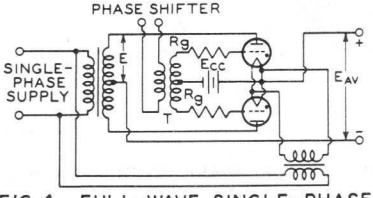

FIG.4 FULL-WAVE SINGLE-PHASE

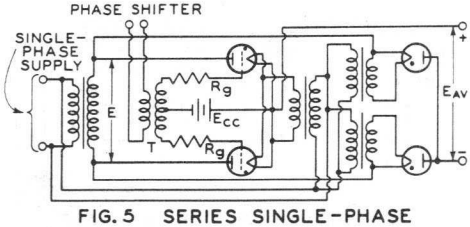

FIG. 5 SERIES SINGLE-PHASE

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

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

7112
MAGNETRON

TUNABLE TYPE

FORCED-AIR COOLED INTEGRAL MAGNET

For use as a pulsed oscillator at frequencies between 8500 and 9600 Mc

The 7112 differs from the 7110 and the 7111 only mechanically in the location of the tuning control and the micrometer-type indicator provided to facilitate frequency calibration of each tube. The 7112 features a tuning shaft which permits the use of a remote control for adjustment. The 7112 is the same as the 7110 except for the following items:

Mechanical:

Tuning Shaft with Associated Calibrated Indicator:
Revolutions (Approx.) to cover full range of 8500 to 9600 Mc 25

OPERATING CONSIDERATIONS

The 7112 can be tuned in the same manner as the 7110 except that a screw-driver slot is provided in the tuning shaft. If desired, a flexible coupling may be attached to this shaft and the tube tuned remotely. The design of the 7112 provides an essentially constant operating frequency without requiring a positive mechanical lock even though the tube is subjected to vibration.

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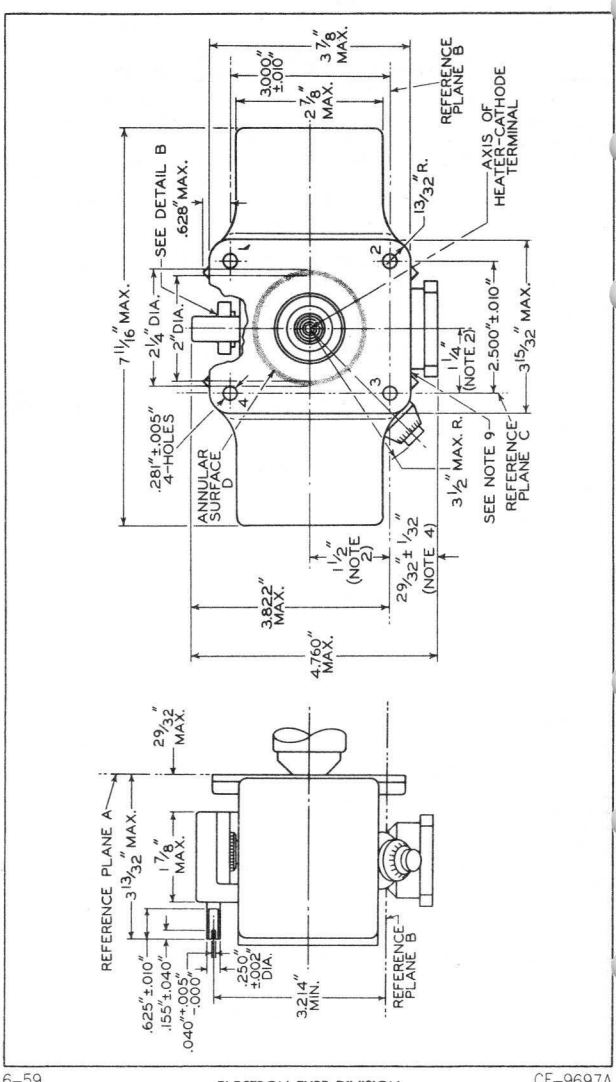
RCA

7112

MAGNETRON



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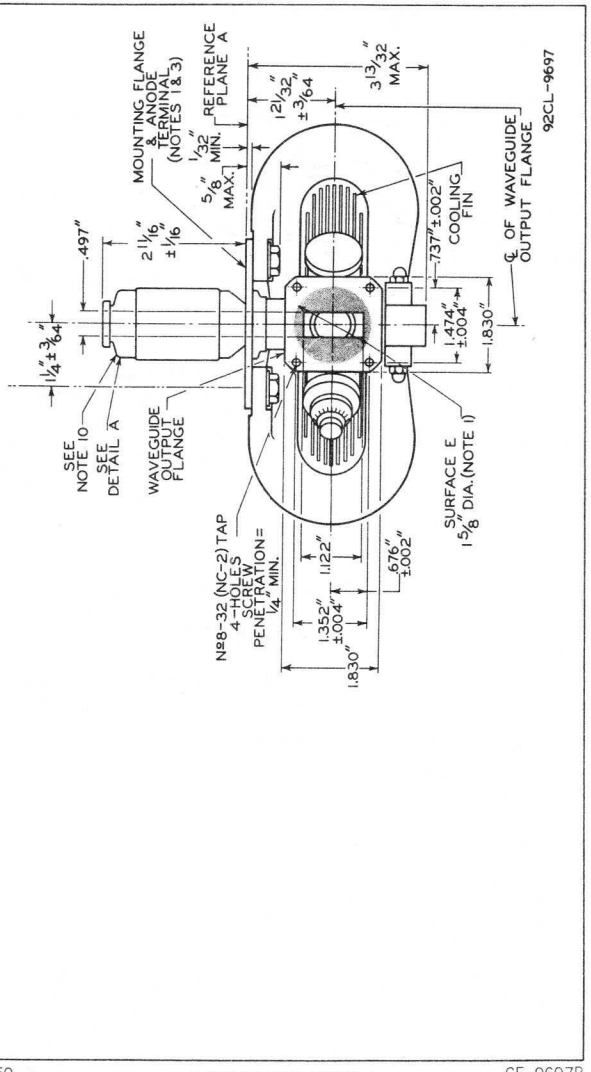
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

7112

MAGNETRON



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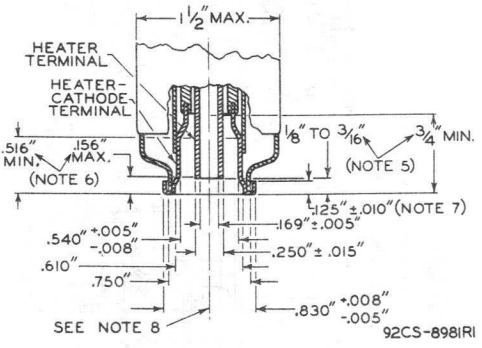
7112

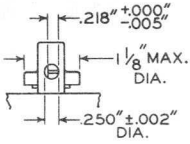
MAGNETRON

DETAIL A



DETAIL B

Bottom View



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CE-8981R1
-9697C

MAGNETRON

REFERENCE PLANE A IS DEFINED AS THE PLANE THROUGH THAT PORTION OF THE MOUNTING FLANGE DESIGNATED AS ANNULAR SURFACE D.

REFERENCE PLANE B IS DEFINED AS THE PLANE WHICH IS PERPENDICULAR TO PLANE A AND PASSES THROUGH THE EXACT CENTERS OF MOUNTING-FLANGE HOLES 2 AND 3.

REFERENCE PLANE C IS DEFINED AS THE PLANE WHICH IS PERPENDICULAR TO PLANE A AND PLANE B AND PASSES THROUGH THE EXACT CENTERS OF MOUNTING-FLANGE HOLES 3 AND 4.

NOTE 1: SURFACE E OF THE WAVEGUIDE OUTPUT FLANGE AND THE ENTIRE SURFACE OF THE MOUNTING FLANGE ARE MADE SO THAT THEY MAY BE USED TO PROVIDE A HERMETIC SEAL.

NOTE 2: THE AXIS OF THE HEATER-CATHODE TERMINAL WILL BE WITHIN THE CONFINES OF A CYLINDER WHOSE RADIUS IS 3/64" AND WHOSE AXIS IS PERPENDICULAR TO REFERENCE PLANE A AT THE SPECIFIED LOCATION.

NOTE 3: ALL POINTS ON THE MOUNTING FLANGE WILL LIE WITHIN 0.015" ABOVE OR BELOW REFERENCE PLANE A.

NOTE 4: THE LIMITS INCLUDE ANGULAR AS WELL AS LATERAL DEVIATIONS.

NOTE 5: THESE DIMENSIONS DEFINE EXTREMITIES OF THE 0.169" INTERNAL DIAMETER OF THE CYLINDRICAL HEATER TERMINAL.

NOTE 6: THESE DIMENSIONS DEFINE EXTREMITIES OF THE 0.540" INTERNAL DIAMETER OF THE CYLINDRICAL HEATER-CATHODE TERMINAL.

NOTE 7: NO PART OF THE CONNECTOR DEVICE FOR THE HEATER AND HEATER-CATHODE TERMINALS SHOULD BEAR AGAINST THE UNDERSIDE OF THIS LIP.

NOTE 8: THE HEATER TERMINAL AND THE HEATER-CATHODE TERMINAL ARE CONCENTRIC WITHIN 0.010".

NOTE 9: ANODE TEMPERATURE MEASURED AT JUNCTION OF WAVEGUIDE AND ANODE BLOCK.

NOTE 10: CATHODE TEMPERATURE MEASURED HERE.

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

7183
DISPLAY STORAGE TUBE

DIRECT-VIEW TYPE
4"-DIAMETER DISPLAY

WRITING GUN:
MAGNETIC DEFLECTION
ELECTROSTATIC FOCUS

VIEWING GUN:
NO DEFLECTION
NO FOCUS

DATA

General:

	Writing Section	Viewing Section	
Heater, for Unipotential Cathode:			
Voltage (AC or DC) . .	6.3 ± 10%	6.3 ± 10%	volts
Current.	0.6	0.6	amp
Minimum Cathode Heating Time before other electrode voltages are applied.	–	30	sec
Direct Interelectrode Capacitances (Approx.):[o]			
Grid No.1 to all other tube electrodes. . .	7	7.5	μμf
Cathode to all other tube electrodes. . .	5	5	μμf
Backplate to all other tube electrodes. . .	–	300	μμf
Focusing Method.	Electrostatic	None	
Deflection Method. . . .	Magnetic	None	
Deflection Angle	♦	–	
Phosphor	–	P20, Aluminized	
Fluorescence	–	Yellow-Green	
Phosphorescence. . . .	–	Yellow-Green	

Minimum Useful Screen Diameter . . . . . 4"
Maximum Overall Length . . . . . 11.62"
Seated Length. . . . . 11.16" ± 0.10"
Maximum Tube Radius. . . . . 3.00"
Maximum Tube Diameter. . . . . 5.19"
Greatest Bulb Diameter . . . . . 5.00" ± 0.06"
Ambient-Temperature Range. . . . . -65° to $+100^{o}$ C
Operating Position . . . . . Any
Weight (Approx.) . . . . . 1-3/4 lbs
Terminal Connectors. . . . . *See Operating Considerations*
Bulb Terminals:
  Caps (Three) . . . . . .Recessed Small Cavity (JETEC No.J1-21)
  Flexible leads (Two) . . . . . *See Dimensional Outline*
Base:
  Writing gun. . . . . Small-Button Neoditetrar 8-Pin (JETEC No.E8-49)
  Viewing gun. . . . . .Small-Button Miniature 7-Pin (JETEC No.E7-1)

o, ♦: See next page.

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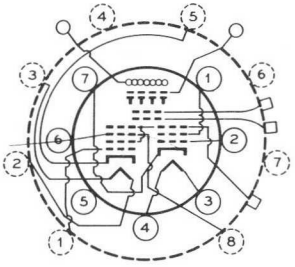
7183

DISPLAY STORAGE TUBE

BOTTOM VIEW



SOLID-LINE CIRCLES DEPICT
MINIATURE 7-PIN BASE
BROKEN-LINE CIRCLES DEPICT
NEODITETRAR 8-PIN BASE

WRITING SECTION▲
Small-Button Neoditetrar 8-Pin Base

Pin 1 - Grid No.1
Pin 2 - Heater
Pin 3 - Heater
Pin 4 - Internal Connection — Do Not Use
Pin 5 - Cathode
Pin 6 - Internal Connection — Do Not Use
Pin 7 - No Connection
Pin 8 - Grid No.3

VIEWING SECTION
Small-Button Miniature 7-Pin Base

Pin 1 - Grid No.2
Pin 2 - Grid No.1
Pin 3 - Heater
Pin 4 - Heater
Pin 5 - Internal Connection — Do Not Use
Pin 6 - No Connection
Pin 7 - Cathode

Flexible Lead (Large) - Screen
Flexible Lead (Small) - Backplate
Recessed Cavity Cap:
Located 1-1/4" from Tube Face - Grid No.5
Located 3" from Tube Face - Grid No.4
Located Near Viewing Gun - Grid No.3, Grids No.4 & No.2 of Writing Gun

Maximum Ratings, *Absolute Values:*

	Writing Section	Viewing Section	
SCREEN VOLTAGE .	-	10000 max.**	volts
PEAK BACKPLATE VOLTAGE. . . .	-	30 max.**	volts

o, ♦, ▲, **: See next page.

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DISPLAY STORAGE TUBE

	Writing Section		Viewing Section		
	Equivalent Values		*Equivalent Values*		
GRID-No.5 VOLTAGE. . . .	–	–	–	300 max.**	volts
GRID-No.4 VOLTAGE. . . .	2900 max.*▲	150 max.**	–	150 max.**	volts
GRID-No.3 VOLTAGE. . . .	1200 max.*	–	2900 max.*▲	150 max.**	volts
GRID-No.2 VOLTAGE. . . .	2900 max.*▲	150 max.**	–	150 max.**	volts
CATHODE VOLTAGE.	–	-2750 max.**	–	–	volts
GRID-No.1 VOLTAGE:					
Negative-bias value. . . .	200 max.*		100 max.**		volts
Positive-bias value. . . .	0 max.*		0 max.**		volts
Positive-peak value. . . .	2 max.*		0 max.**		volts
PEAK HEATER-CATHODE VOLTAGE:					
Heater negative with respect to cathode. . .	125 max.*		125 max.**		volts
Heater positive with respect to cathode. . .	125 max.*		125 max.**		volts

VIEWING SECTION**

Operating Values and Typical Performance Characteristics:

To prevent possible damage to the tube, allow the viewing-gun beam current to reach normal operating value before turning on the writing-gun beam current, and keep the viewing beam on till the writing beam is turned off

Screen Voltage	8500	volts
DC Backplate Voltage	0	volts
Grid-No.5 Voltage#	220 to 250	volts
Grid-No.4 Voltage#	40 to 100	volts
Grid-No.3 Voltage#▲	10 to 40**	volts
	2510 to 2540*	volts
Grid-No.2 Voltage#	100	volts
Grid-No.1 Voltage#	0 to -75	volts
Maximum Screen Current	0.6	ma
Maximum Peak Backplate Current	2	ma
Maximum Grid-No.5 Current◆	2.4	ma

o, ◆, ▲, **, *, #, ●: See next page.

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DISPLAY STORAGE TUBE

Maximum Grid-No.4 Current♦	0.3	ma
Maximum Grid-No.3 Current♦	0.5	ma
Maximum Grid-No.2 Current♦	0.08	ma
Maximum Cathode Current♦	4	ma
Number of Half-Tone Steps□	5	
Viewing Duration▲▲	20	sec
Maximum Erasing-Uniformity Factor:□□		
For 4"-diameter area (A_4)	0.65	
For the 3.5"-diameter portion ($A_{3.5}$) centered on A_4	0.50	
Resolution#	50	lines/in.
Brightness♦♦	1500	fl

WRITING SECTION●

Operating Values:

	Equivalent Values		
Grid-No.4 Voltage#▲	2510 to 2540*	10 to 40**	volts
Grid-No.3 Voltage for focus	425 to 925*	–	volts
Grid-No.2 Voltage#▲	2510 to 2540*	10 to 40**	volts
Maximum Grid-No.1 Voltage for cutoff of undeflected focused spot	−130*	−2630**	volts
Cathode Voltage	–	−2500**	volts
Maximum Grid-No.3 Current	−15 to +10		μa
Maximum Peak Cathode Current	4.5		ma

VIEWING SECTION AND WRITING SECTION

Maximum and Minimum Circuit Values:

Grid-No.1-Circuit Resistance (Either gun)	1 max.	megohm
Series Current-Limiting Resistor (Unbypassed) in Grid-No.5 (Viewing-Section) Circuit	0.005 min.	megohm
Backplate-Circuit Resistance	0.005 max.	megohm
Series Current-Limiting Resistance in Screen Circuit	1 min.	megohm

o Without external shield.

♦ *See accompanying drawing CE-9578 showing angles of deflection.*

▲ Grids No.4 & No.2 of Writing Gun are connected together and to grid No.3 of Viewing Gun within the tube.

** Voltages are shown with respect to cathode of Viewing Gun.

* Voltages are shown with respect to cathode of Writing Gun.

Adjusted for brightest, most uniform pattern.

♦♦ For conditions with combined adjustment of grid-No.1 voltage, grid-No.2 voltage, grid-No.3 voltage, and grid-No.4 voltage to give brightest, most uniform pattern. After final adjustment, the grid-No.1 voltage should not be more positive than −20 volts to maintain electrode current within the maximum value indicated.

□ Observed with an RCA-2F21 Monoscope display.

▲▲ Expressed in terms of the time required for the brightness of the unwritten background to rise from just zero brightness (viewing-beam cutoff) to 10% of saturated brightness.

□□, #, ♦♦, ●: See next page.

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DISPLAY STORAGE TUBE

□□ Determined as follows: With no erasing pulse, overscan the storage surface with writing beam to obtain maximum pattern brightness. Then cut off writing beam and adjust erasing pulse to obtain complete erasure in approximately 10 seconds. Measure time (t_1) from start of erasing to the instant at which any area within the 4" diameter (or the 3.5"-diameter portion) is reduced to background-brightness level, and time (t_2) from start of erasing to the instant at which the entire area within the 4" diameter area (or the 3.5"-diameter portion) is reduced to background-brightness level. The erasing-uniformity factor is defined as $(t_2-t_1)/t_2$.

⊕ Measured by shrinking-raster method at a display brightness of 50 per cent of saturated brightness and with grids No.2 & No.4 of Writing Gun at about +2500 volts with respect to cathode of Writing Gun.

◆◆ Measured with entire storage grid written to produce saturated brightness and with screen at indicated voltage.

● The cathode of the Writing Gun is operated at about −2500 volts with respect to the cathode of the Viewing Gun which is usually operated at ground potential.

OPERATING CONSIDERATIONS

Support and shielding for the 7183 may be provided by a shield made of properly annealed high-permeability material. The screen lead and the backplate lead should be placed outside the shield.

Terminal Connectors. The *base pins* of the Neoditetrar 8-pin base on the Writing-Gun neck fit the Ditetrar 8-contact connector, such as Cinch No.54A18088, or equivalent. The *base pins* of the Small-Button Miniature 7-pin base on the Viewing-Gun neck fit the Miniature 7-contact socket. The *recessed cavity caps* require standard flexible-lead connectors as used for television picture tubes.

To prevent possible damage to the tube, allow the viewing-gun beam current to reach normal operating value before turning on the writing-gun beam current, and keep the viewing beam on till the writing beam is turned off.

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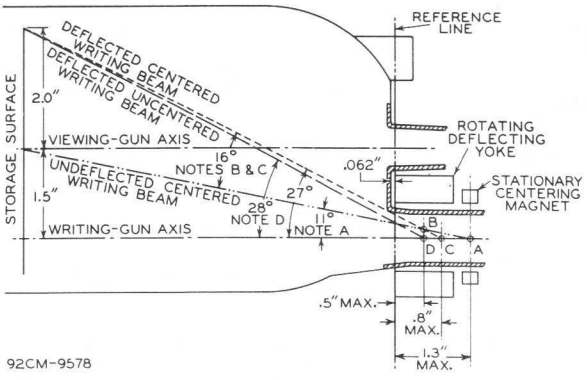
DISPLAY STORAGE TUBE

ANGLES OF DEFLECTION AND CENTERS OF DEFLECTION FOR WRITING GUN WHEN USED WITH ROTATING 2-COIL YOKE AND STATIONARY 4-COIL YOKE



92CM-9578

NOTE A: CENTERING OF THE WRITING BEAM ON THE STORAGE SURFACE IS NECESSARY FOR A CENTERED PPI DISPLAY. THE BEAM IS CENTERED BY SHIFTING IT FROM THE WRITING-GUN AXIS THROUGH AN ANGLE OF 11° WITH A CENTERING MAGNET WHOSE EFFECTIVE CENTER (A) IS LOCATED 1.3" FROM REFERENCE LINE.

NOTE B: WITH ROTATING YOKE WHOSE EFFECTIVE CENTER OF DEFLECTION (B) IS LOCATED 0.5" FROM REFERENCE LINE, THE CENTERED WRITING BEAM (NOTE A) MUST BE DEFLECTED THROUGH AN ANGLE OF 32° TO SWEEP FULLY THE STORAGE SURFACE.

NOTE C: WITH STATIONARY TV-TYPE YOKE WHOSE EFFECTIVE CENTER OF DEFLECTION (C) IS LOCATED 0.8" FROM REFERENCE LINE, THE CENTERED WRITING BEAM MUST BE DEFLECTED THROUGH AN ANGLE OF 32° TO SWEEP FULLY THE STORAGE SURFACE.

NOTE D: WHEN ROTATING YOKE IS USED WITH UNCENTERED DISPLAY, i.e., THE WRITING BEAM IS NOT CENTERED (NOTE A) BUT STRIKES THE STORAGE SURFACE ON THE WRITING-GUN AXIS, AND WITH THE EFFECTIVE CENTER OF DEFLECTION OF THE ROTATING YOKE LOCATED 0.5" FROM THE REFERENCE LINE, THE UNCENTERED WRITING BEAM MUST BE DEFLECTED THROUGH AN ANGLE OF 56° TO SWEEP FULLY THE STORAGE SURFACE.

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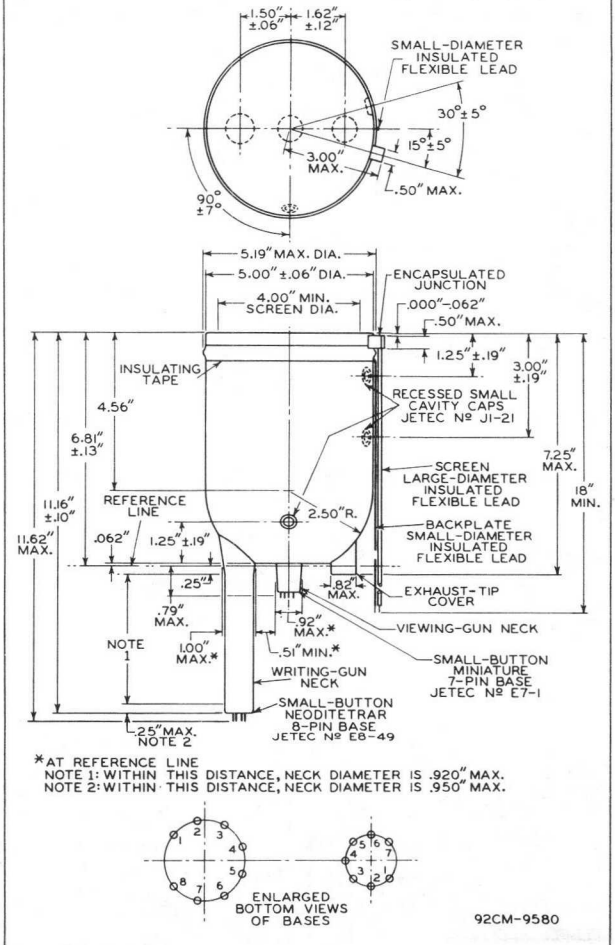
DISPLAY STORAGE TUBE



*AT REFERENCE LINE
NOTE 1: WITHIN THIS DISTANCE, NECK DIAMETER IS .920" MAX.
NOTE 2: WITHIN THIS DISTANCE, NECK DIAMETER IS .950" MAX.

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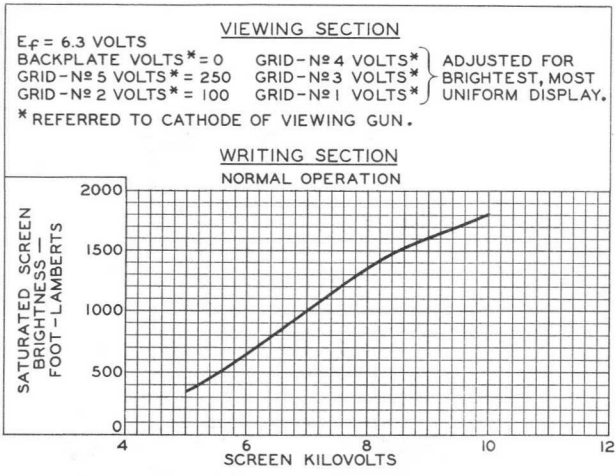
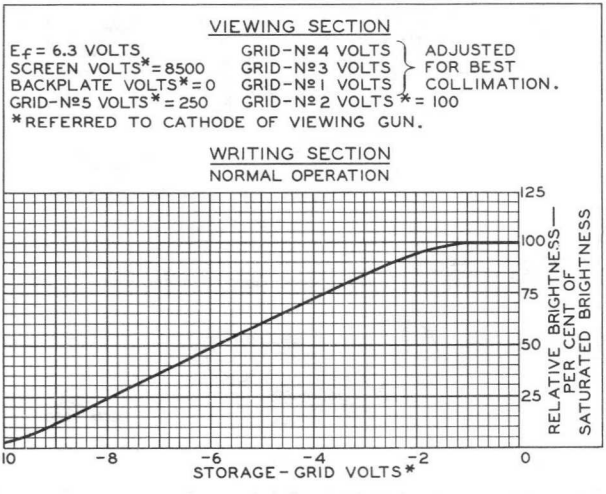
TYPICAL CHARACTERISTIC



92CS-9553

TYPICAL STORAGE-GRID CHARACTERISTIC



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

92CS-9554

RCA

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TYPICAL ERASURE CHARACTERISTICS

VIEWING SECTION

E_f = 6.3 VOLTS
SCREEN VOLTS* = 8500
BACKPLATE VOLTS* = 0
GRID-№5 VOLTS* = 250

GRID-№4 VOLTS } ADJUSTED
GRID-№3 VOLTS } FOR BEST
GRID-№1 VOLTS } COLLIMATION.
GRID-№2 VOLTS* = 100

* REFERRED TO CATHODE OF VIEWING GUN.

ERASING CONDITIONS

PULSE SHAPE: RECTANGULAR
PULSE DURATION: 10 μSEC. APPROX.
PULSE REPETITION FREQUENCY:
——— CURVES: 2000 PPS
- - - - CURVE : 500 PPS

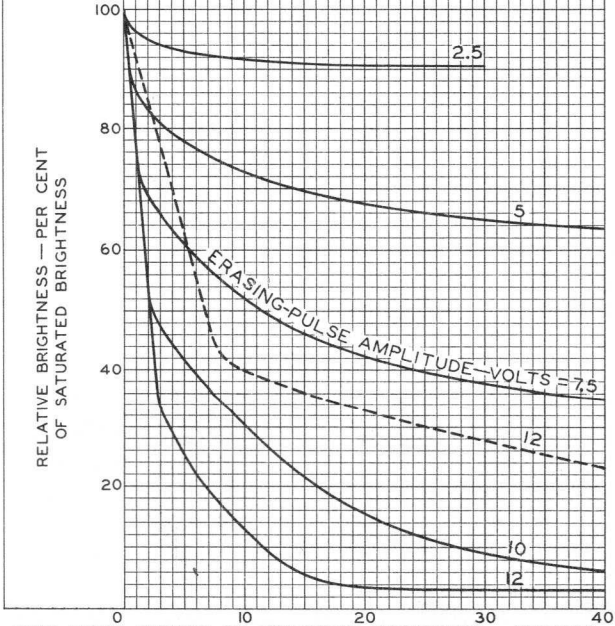

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IMAGE ORTHICON

MAGNETIC FOCUS — MAGNETIC DEFLECTION

Shock and vibration resistant
For use under adverse environmental conditions

DATA

General:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.6	amp
Direct Interelectrode Capacitance:		
Anode to all other electrodes	12	μμf
Wavelength of Maximum Response	4500 ± 300	angstroms
Photocathode, Semitransparent:		
Response		S-10
Rectangular image (4 x 3 or 3 x 4 aspect ratio):		
Useful size of	1.8" max.	diagonal

Note: The size of the optical image focused on the photocathode should be adjusted so that its maximum diagonal does not exceed the specified value. The corresponding electron image on the target should have a size such that the corners of the rectangle just touch the target ring.

Orientation of . Proper orientation is obtained when the vertical or horizontal scan is essentially parallel to the plane passing through center of faceplate and pin 7 of the shoulder base.

Focusing Method	Magnetic
Deflection Method	Magnetic
Overall Length	15.20" ± 0.25"
Greatest Diameter of Bulb	3.00" ± 0.06"
Minimum Deflecting-Coil Inside Diameter	2.38"
Deflecting-Coil Length	5"
Focusing-Coil Length	10"
Alignment-Coil Length	0.94"
Photocathode Distance Inside End of Focusing Coil	0.50"
Operating Position	*See Operating Considerations*
Weight (Approx.)	1 lb 6 oz
Shoulder Base	Keyed Jumbo Annular 7-Pin

BOTTOM VIEW■

Pin 1 – Grid No.6
Pin 2 – Photocathode
Pin 3 – Internal Connection—Do Not Use
Pin 4 – Internal Connection—Do Not Use
Pin 5 – Grid No.5
Pin 6 – Target
Pin 7 – Internal Connection—Do Not Use

■ See basing diagram on next page.

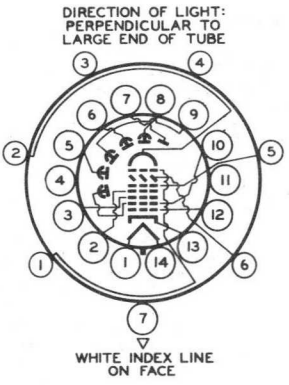
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

7198

IMAGE ORTHICON

End Base. . . . . Small-Shell Diheptal 14-Pin
(JEDEC Group 5, No.B14-45)
BOTTOM VIEW

Pin 1 – Heater
Pin 2 – Grid No.4
Pin 3 – Grid No.3
Pin 4 – Internal Connection—Do Not Use
Pin 5 – Dynode No.2
Pin 6 – Dynode No.4
Pin 7 – Anode
Pin 8 – Dynode No.5
Pin 9 – Dynode No.3
Pin 10 – Dynode No.1, Grid No.2
Pin 11 – Internal Connection—Do Not Use
Pin 12 – Grid No.1
Pin 13 – Cathode
Pin 14 – Heater



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

PHOTOCATHODE:		
Voltage	−650 max.	volts
Illumination.	50 max.	fc
OPERATING TEMPERATURE:		
Of any part of bulb	71 max.	°C
Of bulb at large end of tube (Image section)	20 min.	°C
TEMPERATURE DIFFERENCE:		
Between image section and any part of bulb hotter than image section . .	7.5 max.	°C
STORAGE-TEMPERATURE RANGE	−65 to +71	°C
GRID-No.6 VOLTAGE	−650 max.	volts
TARGET VOLTAGE:		
Positive value.	10 max.	volts
Negative value.	10 max.	volts
GRID-No.5 VOLTAGE	150 max.	volts
GRID-No.4 VOLTAGE	300 max.	volts
GRID-No.3 VOLTAGE	400 max.	volts
GRID-No.2 & DYNODE-No.1 VOLTAGE	400 max.	volts
GRID-No.1 VOLTAGE:		
Negative-bias value	125 max.	volts
Positive-bias value	0 max.	volts
DYNODE-No.2-TO-DYNODE-No.1 VOLTAGE. . . .	350 max.	volts
DYNODE-No.3-TO-DYNODE-No.2 VOLTAGE. . . .	350 max.	volts
DYNODE-No.4-TO-DYNODE-No.3 VOLTAGE. . . .	680 max.	volts
DYNODE-No.5-TO-DYNODE-No.4 VOLTAGE. . . .	350 max.	volts
ANODE-TO-DYNODE-No.5 VOLTAGE.	100 max.	volts
ANODE SUPPLY VOLTAGE*	1850 max.	volts

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IMAGE ORTHICON

PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode. .	125 max.	volts
Heater positive with respect to cathode. .	10 max.	volts

Typical Operating Values:

Photocathode Voltage (Image focus) . .	-400 to -600	volts
Grid-No.6 Voltage (Accelerator)— Approx. 75% of photocathode voltage .	-300 to -450	volts
Target-Cutoff Voltage●	-3 to +1	volts
Grid-No.5 Voltage (Decelerator). . . .	0 to 125	volts
Grid-No.4 Voltage (Beam focus)	130 to 180	volts
Grid-No.3 Voltage▲	225 to 330	volts
Grid-No.2 & Dynode-No.1 Voltage. . . .	300	volts
Grid-No.1 Voltage for picture cutoff .	-45 to -115	volts
Dynode-No.2 Voltage.	600	volts
Dynode-No.3 Voltage.	800	volts
Dynode-No.4 Voltage.	1000	volts
Dynode-No.5 Voltage.	1200	volts
Anode Voltage.	1250	volts
Target-Temperature Range	35 to 45	°C
Minimum Peak-to-Peak Blanking Voltage.	5	volts
Field Strength at Center of Focusing Coil♦.	75	gausses
Field Strength of Alignment Coil (Approx.)	0 to 3	gausses

Performance Data:

With conditions shown under Typical Operating Values and altitude up to 60,000 feet (unless otherwise noted)

Cathode Radiant Sensitivity at 4500 angstroms.	0.028 μa/μw
Anode Current (DC)—For Highlight Illumination on Photocathode at 0.01 footcandle.	30 μa
Signal-Output Current (Peak to peak)	*See Curve*
Ratio of Peak-to-Peak Video-Signal Current to RMS Noise Current for Bandwidth of 9 Mc.	*See Curve*
Center Square-Wave Amplitude Response**.	*See Curves*

Vibration Tests. These tests are performed on a sample lot of tubes from each production run with highlight illumination on photocathode of 0.003 footcandle. Tubes and their associated components# are vibrated on apparatus providing dynamic conditions similar to those described in MIL-E-5272A□, paragraph 4.7.1.

Resonance. Tubes and associated components# are vibrated (per the method of MIL-E-5272A□, paragraph 4.7.1.1) at 25° C and at vibration accelerations not exceeding 10 g in each of three mutually perpendicular axes for 3 hours or one million cycles, whichever is less. After vibration,

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IMAGE ORTHICON

the center resolution of the tubes will be at least 525 lines as determined with an RETMA Resolution Chart, or equivalent, with not more than 0.003-footcandle highlight illumination on the photocathode.

Cycling. Tubes and associated components# are vibrated (per the method of MIL-E-5272A□, paragraph 4.7.1.2 pertaining to specimen without vibration isolators) in each of three mutually perpendicular axes at 25° C and at vibration accelerations not exceeding 5 g. One survey cycle is made for each axis. The cycle has a duration of one hour during which time the frequency is varied from 5 to 500 and back to 5 cycles per second. During this test, the tubes will maintain center resolution of at least 350 lines as determined with an RETMA Resolution Chart, or equivalent, with not more than 0.003-footcandle highlight illumination on the photocathode. After vibration the center resolution, determined under the same conditions as above, will be at least 525 lines.

Shock Tests. These tests are performed on a sample lot of tubes from each production run with no voltages applied to the tubes. Tubes alone are subjected in these tests (per the method of MIL-E-5272A□, paragraph 4.15.2.1) to 12 impact shocks of 30 g, each shock impulse having a time duration of 11 ± 1 milliseconds. The intensity is within ± 10 per cent as measured with a filter having a bandwidth of 0.2 to 250 cycles per second. The maximum g is reached in approximately 5-1/2 milliseconds. The shock is applied in the following directions: a) vertically, perpendicular to longitudinal axis, 3 shocks in each direction; b) horizontally, perpendicular to longitudinal axis, 3 shocks in each direction. After shock tests, the tubes are operable and will have resolution of at least 525 lines as determined with an RETMA Resolution Chart, or equivalent, with not more than 0.003-footcandle highlight illumination on the photocathode.

Temperature-Humidity Tests. These tests are performed on a sample lot of tubes from each production run and with no voltages applied to the tubes. The tubes are subjected (per MIL-E-005272B(USAF)⊕, paragraph 4.4.1, Procedure I) to relative humidities up to and including 95 per cent at temperatures up to and including +71° C. Following this test the tubes are operative, and there will be no picture streaking or other evidence of arcing when operated under the following conditions: grid-No.1 voltage adjusted for cutoff; photocathode voltage = -650 volts; grid-No.6 voltage = -650 volts; dynode-No.2 voltage = 700 volts; dynode-No.3 voltage varied from 780 to 1050 volts; dynode-No.4 voltage = 1400 volts; dynode-No.5 voltage = 1750 volts; and anode voltage = 1850 volts. In addition, the leakage resistance

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IMAGE ORTHICON

determined separately between each of six specific Diheptal-base pins (pins 5,6,7,8,9, and 10) and the 13 other Diheptal-base pins tied together and grounded will be greater than 500 megohms when a voltage of 350 volts is applied between that specific pin and the others.

* Ratio of dynode voltages is shown under *Typical Operating Values*.

● Normal setting of target voltage is +2 volts from target cutoff. The target supply voltage should be adjustable from −3 to +5 volts.

▲ Adjust to produce maximum signal.

♦ Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

** Measured with amplifier having flat frequency response.

Tube sockets and components assembly which consists of the deflecting coils, focusing coil, and alignment coil.

□ 1 January 1956.

⊕ 5 June 1957.

OPERATING CONSIDERATIONS

The *operating position* of the 7198 should preferably be such that any loose particles in the neck of the tube will not fall down and strike or become lodged on the target. Therefore, it is recommended that the tube never be operated in a vertical position with the Diheptal-base end up nor in any other position where the axis of the tube with base up makes an angle of less than 20° with the vertical.

Resolution capability of 7198 is in excess of 600 TV lines.

SPECTRAL-SENSITIVITY CHARACTERISTIC of Photosensitive Device having S-10 Response is shown at the front of this Section

RCA

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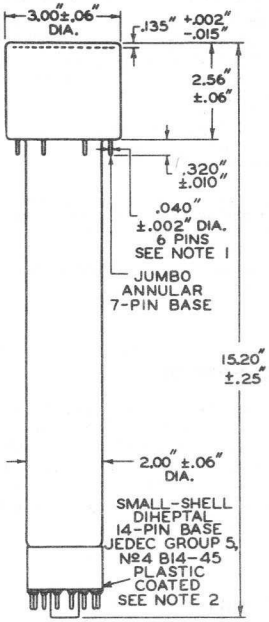
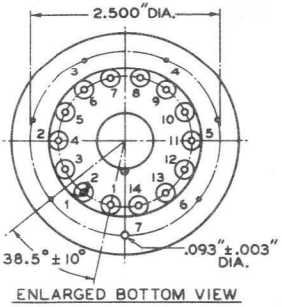
IMAGE ORTHICON



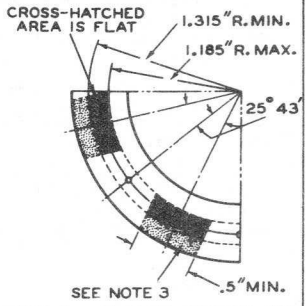


ENLARGED BOTTOM VIEW

92CM-10289

NOTE 1: ENDS OF PINS CHAMFERED 45°; FLAT ENDS 0.020" ± 0.010".

DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE



NOTE 2: PLASTIC COATING MAY INCREASE DIAMETER OF BASE SHELL TO 2.08" MAX. AND MAY INCREASE HEIGHT OF BASE SHELL BY 0.03" MAX.

NOTE 3: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.

ANNULAR-BASE GAUGE

ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAUGE WITH:

a. SIX HOLES HAVING DIAMETER OF 0.065" ± 0.001" AND ONE HOLE HAVING DIAMETER OF 0.150" ± 0.001". ALL HOLES HAVE DEPTH OF 0.265" ± 0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047". ALL HOLES ARE SPACED AT ANGLES OF 51°26' ± 5' ON CIRCLE DIAMETER OF 2.500" ± 0.001".

b. SEVEN STOPS HAVING HEIGHT OF 0.187" ± 0.001", CENTERED BETWEEN PIN HOLES, TO BEAR AGAINST FLAT AREAS OF BASE.

c. RIM EXTENDING OUT A MINIMUM OF 0.125" FROM 2.812" DIAMETER AND HAVING HEIGHT OF 0.126" ± 0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200" ± 0.001".

RCA

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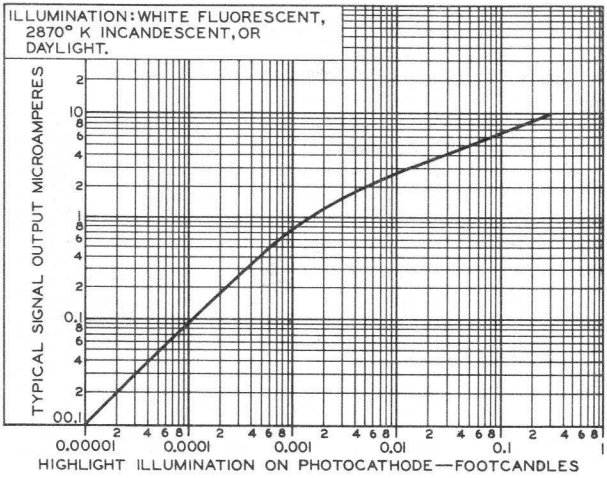
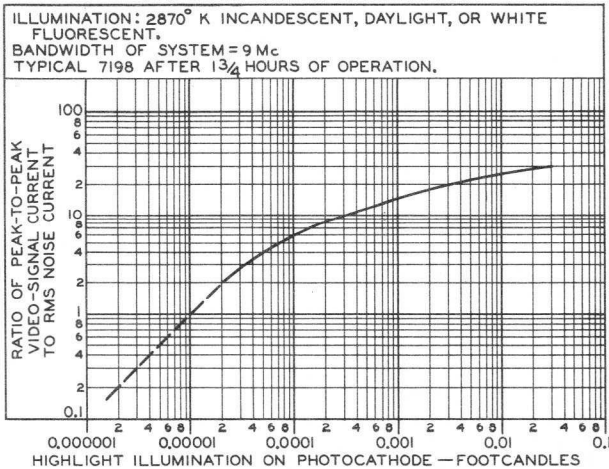
BASIC LIGHT-TRANSFER CHARACTERISTIC



92CS-10288

TYPICAL CHARACTERISTIC

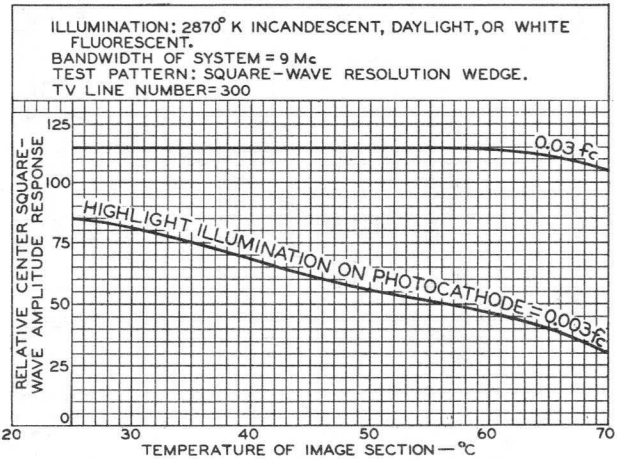


92CS-10279

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

7198

TYPICAL CHARACTERISTICS



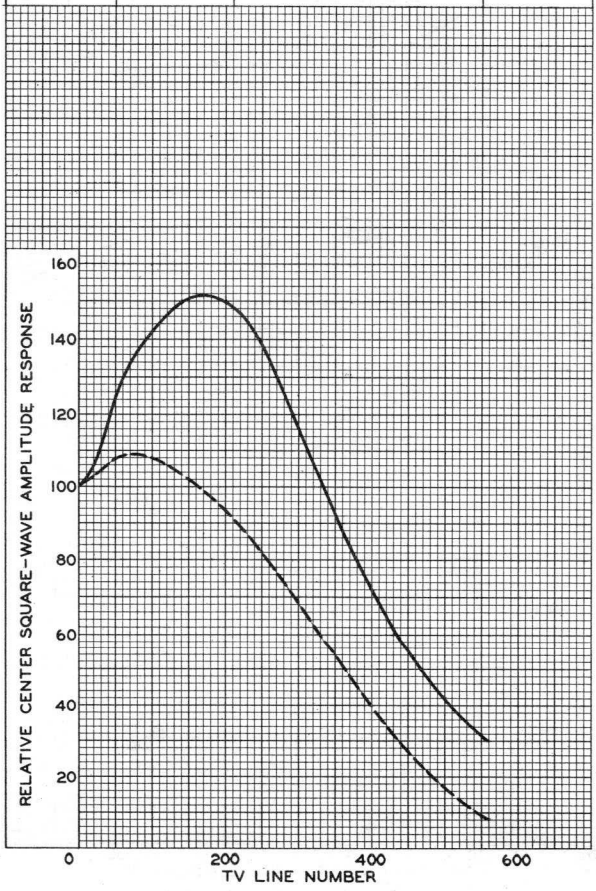
92CS-10280

7198

TYPICAL CHARACTERISTICS

ILLUMINATION: 2870° K INCANDESCENT, DAYLIGHT, OR WHITE FLUORESCENT.
BANDWIDTH OF SYSTEM = 9Mc
TEMPERATURE OF IMAGE SECTION = 40° C
TYPICAL 7198 AFTER $1\frac{3}{4}$ HOURS OF OPERATION.

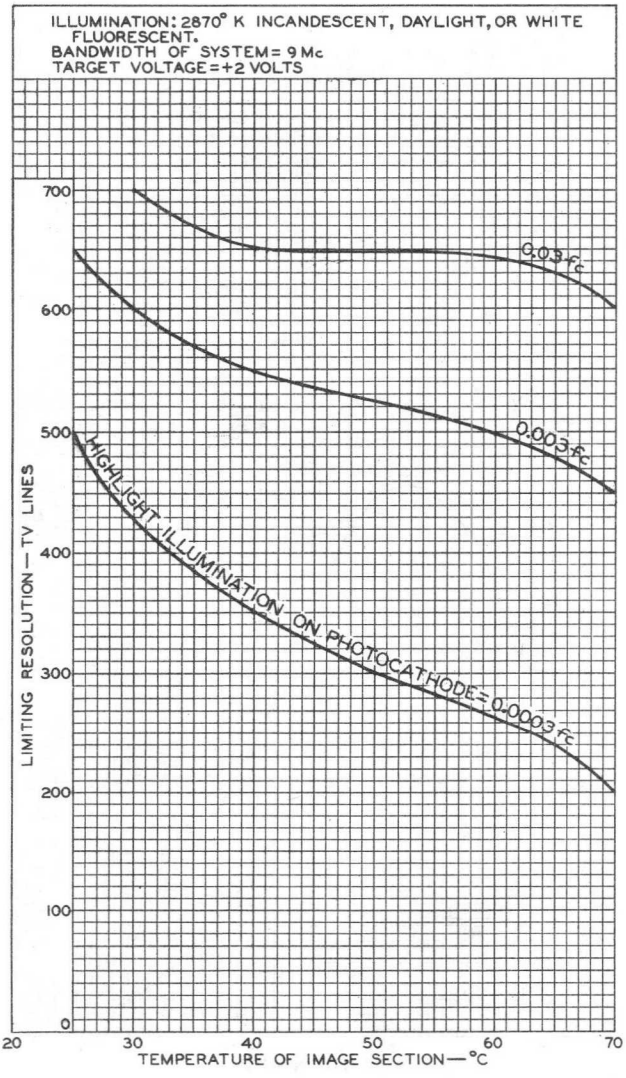
CURVE	HIGHLIGHT ILLUMINATION ON PHOTOCATHODE
———	0.03 FOOTCANDLE
— — —	0.003 FOOTCANDLE



RCA

7198

TYPICAL CHARACTERISTICS

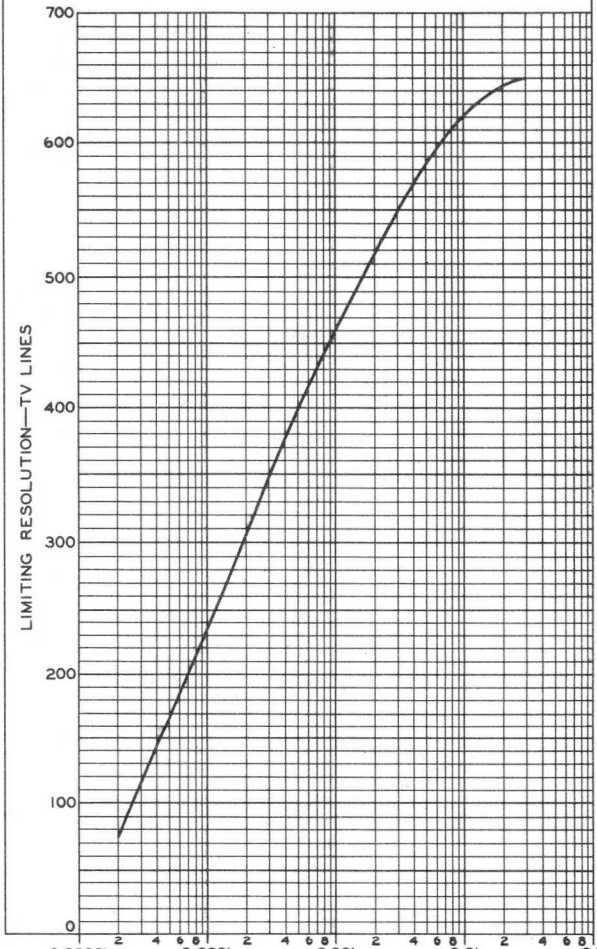


RCA

7198

TYPICAL CHARACTERISTIC

ILLUMINATION: 2870° K INCANDESCENT, DAYLIGHT, OR WHITE FLUORESCENT.
BANDWIDTH OF SYSTEM = 9 Mc
TEMPERATURE OF IMAGE SECTION = 40° C
TYPICAL 7198 AFTER 1¾ HOURS OF OPERATION.



ELECTRON TUBE DIVISION 92CM-10286

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

Beam Power Tube

90 Watts CW Input (ICAS) up to 60 Mc
60 Watts CW Input (ICAS) up to 175 Mc
For Use under Severe Shock and Vibration

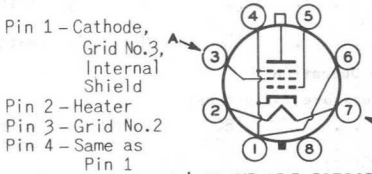
GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ±10%	volts
Current at heater volts = 6.3	1.25	amp
Transconductance, for plate volts = 200, grid-No.2 volts = 200, and plate ma. = 100	7000	μmhos
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 200, grid-No.2 volts = 200, and plate ma. = 100	4.5	
Direct Interelectrode Capacitances:*		
Grid No.1 to plate	0.24 max.	μμf
Grid No.1 to cathode & grid No.3 & internal shield, grid No.2, base sleeve, and heater	13.0	μμf ←
Plate to cathode & grid No.3 & internal shield, grid No.2, base sleeve, and heater	8.5	μμf

Mechanical:

Operating Position	Any
Maximum Overall Length	3-13/16"
Seated Length	3-1/8" ± 1/8"
Maximum Diameter	1-21/32"
Weight (Approx.)	2 oz
Bulb	T12
Cap	Small (JEDEC No.C1-1)
Socket	Standard Octal 8-Contact
Base	Small Micanol-Wafer Octal 8-Pin with "770" Sleeve (JEDEC Group 1, No.B8-150)
Basing Designation for BOTTOM VIEW	7CK ←



AA' = PLANE OF ELECTRODES

* See next page.

← Indicates a change.

AF POWER AMPLIFIER & MODULATOR — Class AB_1†

Maximum Ratings, *Absolute-Maximum Values:*

	CCS●	*ICAS*●●	
DC PLATE VOLTAGE	600 max.	750 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	250 max.	250 max.	volts
MAX.-SIGNAL DC PLATE CURRENT**	125 max.	135 max.	ma
MAX.-SIGNAL PLATE INPUT**	60 max.	85 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT**	3 max.	3 max.	watts
PLATE DISSIPATION**	20 max.	25 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	135 max.	135 max.	volts
Heater positive with respect to cathode	135 max.	135 max.	volts
BULB TEMPERATURE (At hottest point on bulb surface)	220 max.	220 max.	°C

Typical CCS Push-Pull Operation:

Values are for 2 tubes

DC Plate Voltage	400	500	600	volts
DC Grid-No.2 Voltage▲	190	185	180	volts
DC Grid-No.1 (Control-Grid) Voltage:				
With fixed-bias source	-40	-40	-45	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage	80	80	90	volts
Zero-Signal DC Plate Current	63	57	26	ma
Max.-Signal DC Plate Current	228	215	200	ma
Zero-Signal DC Grid-No.2 Current	2.5	2	1	ma
Max.-Signal DC Grid-No.2 Current	25	25	23	ma
Effective Load Resistance (Plate to plate)	4000	5500	7000	ohms
Max.-Signal Driving Power (Approx.)	0	0	0	watts
Max.-Signal Power Output (Approx.)	55	70	82	watts

Typical ICAS Push-Pull Operation:

Values are for 2 tubes

DC Plate Voltage	600	750	volts
DC Grid-No.2 Voltage▲	200	195	volts
DC Grid-No.1 (Control-Grid) Voltage:			
From fixed-bias source	-50	-50	volts

*,†,●,●●,**,▲: See next page.

7212

BEAM POWER TUBE

Peak AF Grid-No.1-to-Grid-No.1 Voltage.	100	100	volts
Zero-Signal DC Plate Current . . .	28	23	ma
Max.-Signal DC Plate Current . . .	229	220	ma
Zero-Signal DC Grid-No.2 Current .	1	1	ma
Max.-Signal DC Grid-No.2 Current .	27	26	ma
Effective Load Resistance (Plate to plate)	6000	8000	ohms
Max.-Signal Driving Power (Approx.).	0	0	watts
Max.-Signal Power Output (Approx.).	95	120	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance under any condition:$^{oo\clubsuit}$

For fixed-bias operation	0.1 max.	megohm
For cathode-bias operation	Not recommended	

AF POWER AMPLIFIER & MODULATOR — Class AB_1†

Triode Connection§

	CCS•	*ICAS*••	
Maximum Ratings, *Absolute Values:*			
DC PLATE VOLTAGE	400 max.	400 max.	volts
MAX.-SIGNAL DC PLATE CURRENT**.	90 max.	90 max.	ma
MAX.-SIGNAL PLATE INPUT**.	35 max.	35 max.	watts
PLATE DISSIPATION**. . . .	20 max.	25 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode . .	135 max.	135 max.	volts
Heater positive with respect to cathode . .	135 max.	135 max.	volts
BULB TEMPERATURE (At hottest point on bulb surface).	220 max.	220 max.	°C

Typical Push-Pull Operation:

Values are for 2 tubes

DC Plate Voltage	250	400	400	volts
DC Grid-No.1 Voltage . . .	-50	-100	-100	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage◇ . . .	100	200	200	volts
Zero-Signal DC Plate Current.	120	40	40	ma
Max.-Signal DC Plate Current.	125	100	100	ma
Effective Load Resistance (Plate to plate)	5000	8000	8000	ohms

*, †, •, ••, **, ▲, oo, ♣, §, ◇: See next page.

7212

BEAM POWER TUBE

	CCS●		ICAS●●	
Max.-Signal Driving Power (Approx.)	0	0	0	watts
Max.-Signal Power Output (Approx.)	10	22	22	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance under any condition:⁰⁰⊕		
For fixed-bias operation	0.1 max.	megohm
For cathode-bias operation	0.5 max.	megohm

AF POWER AMPLIFIER & MODULATOR — Class AB_2#

Maximum Ratings, *Absolute Values:*

	CCS●	ICAS●●	
DC PLATE VOLTAGE	600 max.	750 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	250 max.	250 max.	volts
MAX.-SIGNAL DC PLATE CURRENT**	125 max.	135 max.	ma
MAX.-SIGNAL PLATE INPUT**	62.5 max.	90 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT**	3 max.	3 max.	watts
PLATE DISSIPATION**	20 max.	25 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	135 max.	135 max.	volts
Heater positive with respect to cathode	135 max.	135 max.	volts
BULB TEMPERATURE (At hottest point on bulb surface)	220 max.	220 max.	°C

Typical CCS Push-Pull Operation:

Values are for 2 tubes

DC Plate Voltage	400	500	600	volts
DC Grid-No.2 Voltage▲	175	175	165	volts
DC Grid-No.1 (Control-Grid) Voltage:				
From fixed-bias source	-41	-44	-44	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage	95	102	97	volts
Zero-Signal DC Plate Current	33	27	22	ma
Max.-Signal DC Plate Current	232	242	207	ma
Zero-Signal DC Grid-No.2 Current	1.1	0.7	0.6	ma

*, †, ●, ●●, **, ▲, ⁰⁰, ♣, §, ○, ⊕, #: See next page.

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BEAM POWER TUBE

Max.-Signal DC Grid-No.2 Current.	18	18	17	ma
Max.-Signal DC Grid-No.1 Current.	1.6	1.9	1.1	ma
Effective Load Resistance (Plate to plate)	3700	4600	6800	ohms
Max.-Signal Driving Power (Approx.)♦	0.2	0.3	0.2	watt
Max.-Signal Power Output (Approx.).	62	83	90	watts

Typical ICAS Push-Pull Operation:

Values are for 2 tubes

DC Plate Voltage	600	750	volts
DC Grid-No.2 Voltage▲.	190	165	volts
DC Grid-No.1 (Control-Grid) Voltage: From fixed-bias source . . .	-48	-46	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage.	109	108	volts
Zero-Signal DC Plate Current .	28	22	ma
Max.-Signal DC Plate Current .	270	240	ma
Zero-Signal DC Grid-No.2 Current.	1.2	0.3	ma
Max.-Signal DC Grid-No.2 Current.	20	20	ma
Max.-Signal DC Grid-No.1 Current.	2	2.6	.ma
Effective Load Resistance (Plate to plate)	5000	7400	ohms
Max.-Signal Driving Power (Approx.)♦	0.3	0.4	watt
Max.-Signal Power Output (Approx.).	113	131	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance:♦

For fixed-bias operation	30000 max. ohms
For cathode-bias operation	Not recommended

PLATE-MODULATED RF POWER AMPLIFIER — Class C Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1

	CCS●	*ICAS*●●	
Maximum Ratings, *Absolute Values:*			
DC PLATE VOLTAGE	480 max.	600 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE.	250 max.	250 max.	volts

*, †, ●, ●●, **, ▲, ○○, ♣, §, ○, ⊕, #, ♦: See next page.

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BEAM POWER TUBE

	CCS●		ICAS●●	
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	−150 max.		−150 max.	volts
DC PLATE CURRENT	117 max.		125 max.	ma
DC GRID-No.1 CURRENT	3.5 max.		4 max.	ma
PLATE INPUT	45 max.		67.5 max.	watts
GRID-No.2 INPUT	2 max.		2 max.	watts
PLATE DISSIPATION	13.3 max.		16.7 max.	watts
PEAK HEATER-CATHODE VOLTAGE:				
Heater negative with respect to cathode	135 max.		135 max.	volts
Heater positive with respect to cathode	135 max.		135 max.	volts
BULB TEMPERATURE (At hottest point on bulb surface)	220 max.		220 max.	°C
Typical Operation:				
	At frequencies up to 60 Mc			
DC Plate Voltage	400	475	600	volts
DC Grid-No.2 Voltage♦	150	135	150	volts
From a series resistor of	33000	51000	56000	ohms
DC Grid-No.1 Voltage★	−87	−77	−87	volts
From a grid-No.1 resistor of	27000	27000	27000	ohms
Peak RF Grid-No.1 Voltage	107	95	107	volts
DC Plate Current	112	94	112	ma
DC Grid-No.2 Current	7.8	6.4	7.8	ma
DC Grid-No.1 Current (Approx.)	3.4	2.8	3.4	ma
Driving Power (Approx.)	0.4	0.3	0.4	watt
Power Output (Approx.)	32	34	52	watts
Maximum Circuit Values (CCS or ICAS):				
Grid-No.1-Circuit Resistance‡			30000 max.	ohms

RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy■
and
RF POWER AMPLIFIER — Class C FM Telephony

	CCS●	ICAS●●	
Maximum Ratings, *Absolute Values;*			
DC PLATE VOLTAGE	600 max.	750 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	250 max.	250 max.	volts

*, †, ●, ●●, **, ▲, ○○, ♣, §, ○, ⊕, #, ♦, ♦, ★, ‡, ■: See next page.

7212

BEAM POWER TUBE

	CCS●		ICAS●●		
DC GRID-No.1 (CONTROL-GRID) VOLTAGE.	−150 max.		−150 max.		volts
DC PLATE CURRENT	140 max.		150 max.		ma
DC GRID-No.1 CURRENT . .	3.5 max.		4 max.		ma
PLATE INPUT.	67.5 max.		90 max.		watts
GRID-No.2 INPUT.	3 max.		3 max.		watts
PLATE DISSIPATION. . . .	20 max.		25 max.		watts
PEAK HEATER-CATHODE VOLTAGE:					
Heater negative with respect to cathode .	135 max.		135 max.		volts
Heater positive with respect to cathode .	135 max.		135 max.		volts
BULB TEMPERATURE (At hottest point on bulb surface).	220 max.		220 max.		°C
Typical Operation:					
As amplifier at frequencies up to 60 Mc					
DC Plate Voltage	500	600	600	750	volts
DC Grid-No.2 Voltage⊕⊕ .	170	150	180	160	volts
From a series resistor of.	36000	51000	43000	56000	ohms
DC Grid-No.1 Voltage■. .	−66	−58	−71	−62	volts
From a grid-No.1 resistor of.	27000	20000	24000	20000	ohms
From a cathode resistor of.	470	470	430	470	ohms
Peak RF Grid-No.1 Voltage.	84	73	91	79	volts
DC Plate Current	135	112	150	120	ma
DC Grid-No.2 Current . .	9	9	10	11	ma
DC Grid-No.1 Current (Approx.).	2.5	2.8	2.8	3.1	ma
Driving Power (Approx.).	0.2	0.2	0.3	0.2	watt
Power Output (Approx.) .	48	52	66	70	watts

Typical Operation:			
As amplifier at frequency of 175 Mc			
DC Plate Voltage	320	400	volts
DC Grid-No.2 Voltage⊕⊕ .	180	190	volts
For a series resistor of.	13000	20000	ohms
DC Grid-No.1 Voltage■. .	−51	−54	volts
From a grid-No.1 resistor of.	27000	24000	ohms
From a cathode resistor of.	330	330	ohms

*, †, ●, ●●, **, ▲, ○○, ♣, §, ○, ⊕, #, ◆, ♦, ★, ‡, ■, ⊕⊕, ■: See next page.

7212

BEAM POWER TUBE

	CCS●	*ICAS*●●	
Peak RF Grid-No.1 Voltage.	64	68	volts
DC Plate Current	140	150	ma
DC Grid-No.2 Current . . .	10	10.4	ma
DC Grid-No.1 Current (Approx.).	2	2.2	ma
Driving Power (Approx.). .	3	3	watts
Power Output (Approx.) . .	25	35	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance‡. . . . . 30000 max. ohms

* Without external shield.

† Subscript 1 indicates that grid-No.1 current does not flow during any part of the input cycle.

● Continuous Commercial Service.

●● Intermittent Commercial and Amateur Service.

** Averaged over any audio-frequency cycle of sine-wave form.

▲ Preferably obtained from a separate source or from the plate-voltage supply with a voltage divider.

oo The type of input coupling network used should not introduce too much resistance in the grid-No.1 circuit. Transformer- or impedance-coupling devices are recommended.

♣ When the 7212 is operated as a beam power tube in class AB_1 service, only fixed bias should be used, and the dc grid-No.1-circuit resistance should never exceed the specified value of 0.1 megohm.

§ With grid No.2 connected to plate.

o The driver stage should be capable of supplying the No.1 grids of the class AB_1 stage with the specified driving voltage at low distortion.

⊕ When the 7212 is connected as a triode and its grid No.1 is operated with fixed bias, the dc grid-No.1-circuit resistance should never exceed the specified value of 0.1 megohm. If higher values of grid-No.1-circuit resistance are desired, cathode bias must be employed. Under no circumstances should the dc grid-No.1-circuit resistance exceed the specified value of 0.5 megohm.

Subscript 2 indicates that grid-No.1 current flows during some part of the input cycle.

♦ Driver stage should be capable of supplying the specified driving power at low distortion to the No.1 grids of the AB_2 stage. To minimize distortion, the effective resistance per grid-No.1 circuit of the AB_2 stage should be held at a low value. For this purpose, the use of transformer coupling is recommended. In no case, however, should the total dc grid-No.1-circuit resistance exceed 30,000 ohms when the 7212 is operated at maximum ratings. For operation at less than maximum ratings, the dc grid-No.1-circuit resistance may be as high as 100,000 ohms.

♦ Obtained preferably from a separate source modulated along with the plate supply or from the modulated plate supply through a series resistor.

★ Obtained from grid-No.1 resistor or from a combination of grid-No.1 resistor with either fixed supply or cathode resistor.

‡ When grid No.1 is driven positive and the 7212 is operated at maximum ratings, the total dc grid-No.1-circuit resistance should not exceed the specified value of 30,000 ohms. If this value is insufficient to provide adequate bias, the additional required bias must be supplied by a cathode resistor or fixed supply. For operation at less than maximum ratings, the dc grid-No.1-circuit resistance may be as high as 100,000 ohms.

■ ⊕⊕ ✖ , , : See next page.

■ Key-down conditions per tube without amplitude modulation. Amplitude modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

⊕⊕ Obtained preferably from a seperate source, or from the plate supply voltage with a voltage divider, or through a series resistor. A series grid-No.2 resistor should be used only when the 7212 is used in a circuit which is not keyed. Grid-No.2 voltage must not exceed 400 volts under key-up conditions.

◪ Obtained from fixed supply, by grid-No.1 resistor, by cathode resistor, or by combination methods.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Heater Current	1	1.175	1.325	amp
Direct Interelectrode Capacitances:				
Grid No.1 to plate	2	–	0.24	μμf
Grid No.1 to cathode & grid No.3 & internal shield, grid No.2, base sleeve, and heater	2	12.0	15.0	μμf
Plate to cathode & grid No.3 & internal shield, grid No.2, base sleeve, and heater	2	7.3	9.5	μμf
Plate Current	3	46	94	ma
Grid-No.2 Current	3	–	5.5	ma
Heater-Cathode Leakage Current:				
Heater 100 volts negative with respect to cathode	1	–	100	μa
Heater 100 volts positive with respect to cathode	1	–	100	μa
Useful Power Output	4	47	–	watts
Mu-Factor, Grid No.1 to Grid No.2	5	3.6	5.4	

Note 1: With 6.3 volts ac on heater.

Note 2: Without external shield.

Note 3: With 6.3 volts ac on heater, dc plate volts = 300, dc grid-No.2 volts = 200, and dc grid-No.1 volts = -33.

Note 4: In a single-tube, self-excited oscillator circuit, and with 6.3 volts ac on heater, dc plate volts = 600, dc grid-No.2 volts = 180, grid-No.1 resistor (ohms) = 30,000 ± 10%, dc plate ma. = 100 to 112, dc grid-No.2 ma. = 23 maximum, dc grid-No.1 ma. = 2 to 2.5 and frequency (Mc) = 15.

Note 5: With 6.3 volts ac on heater, dc plate volts = 200, plate ma. = 100, and grid-No.2 volts = 200.

SPECIAL RATINGS & PERFORMANCE DATA

500-g Shock Rating:

This test is performed on a sample lot of tubes from each production run. Tubes are held rigid and are subjected in four different positions to an impact acceleration of 500 g. At the end of this test, tubes are required to meet the following limits:

← Indicates a change.

Useful RF Power Output. . . . . 42 min. watts
For conditions shown under *Characteristics Range Values, Note 4.*
Heater-Cathode
Leakage Current . . . . See *Characteristics Range Values*
The tubes must also meet the established limit for low-frequency vibration (See below).

Fatigue Rating:

This test is performed on a sample lot of tubes from each production run. Tubes are rigidly mounted and subjected to 2.5-g vibrational acceleration at 25 cycles per second for 32 hours in each of three positions. At the end of this test, tubes are required to meet the following limits:
Useful RF Power Output. . . . . 42 min. watts
For conditions shown under *Characteristics Range Values, Note 4.*
Heater-Cathode
Leakage Current . . . . See *Characteristics Range Values*
The tubes must also meet the established limit for low-frequency vibration (See below).

Low-Frequency Vibration Performance:

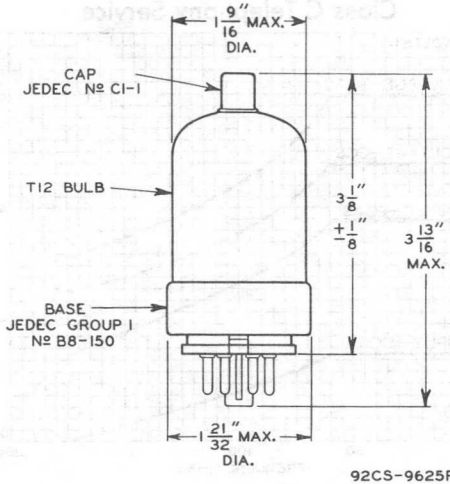
This test is performed on a sample lot of tubes from each production run under the following conditions: Heater volts = 6.3, plate-supply volts = 250, grid-No.2 volts = 200, grid-No.1 voltage varied to give a plate current of 10 milliamperes, plate load resistor (ohms) = 2000, and vibrating frequency of 25 cycles per second with a fixed amplitude of 0.040 inch (total excursion 0.080 inch). The rms output voltage across the plate load resistor as a result of vibration of the tube must not exceed 500 millivolts.

Variable-Frequency Vibration Performance (1):

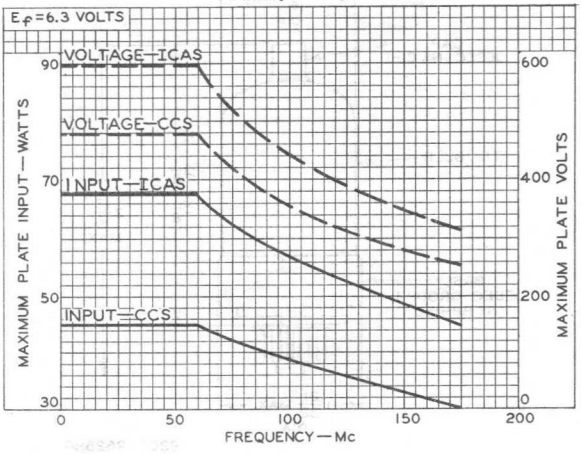
This test is performed on a sample lot of tubes from each production run. Tubes are vibrated in each of 3 positions through frequency range of from 10 to 50 cycles per second and back to 10 cycles per second. The tubes are vibrated under the same conditions as specified for *Low-Frequency Vibration Performance.* During the test, the tubes will not show an rms output voltage across the plate load resistor in excess of 500 millivolts. At the end of this test, the tubes will not show tap or permanent interelectrode shorts or defects that cause the tubes to be inoperable.

Variable-Frequency Vibration Performance (2):

This test is performed on a sample lot of tubes from each production run. Tubes are vibrated in each of 3 positions, perpendicular and parallel to major axis of the tube, and parallel to longitudinal axis of the tube, through the frequency range from 50 to 120 cycles per second at a fixed acceleration of 10 g under the same voltage, current and load conditions as specified for *Low-Frequency Vibration Performance.* During this test, the tubes will not show an rms output voltage across the plate load resistor in excess of 500 millivolts.

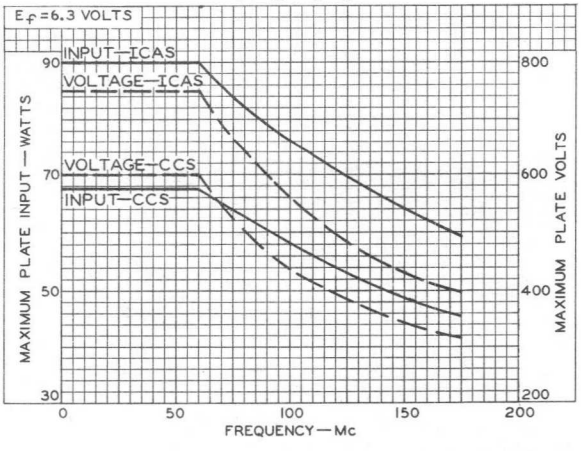

1 9/16" MAX. DIA.
CAP
JEDEC Nº C1-1
T12 BULB
3 1/8" +1/-1/8"
3 13/16" MAX.
BASE
JEDEC GROUP 1
Nº B8-150
1 21/32" MAX. DIA.
92CS-9625R4

RATING CHART I
Class C Telephony Service



92CS-9614

RATING CHART II
Class C Telegraphy Service



92CS-9615

7212

AVERAGE PLATE CHARACTERISTICS

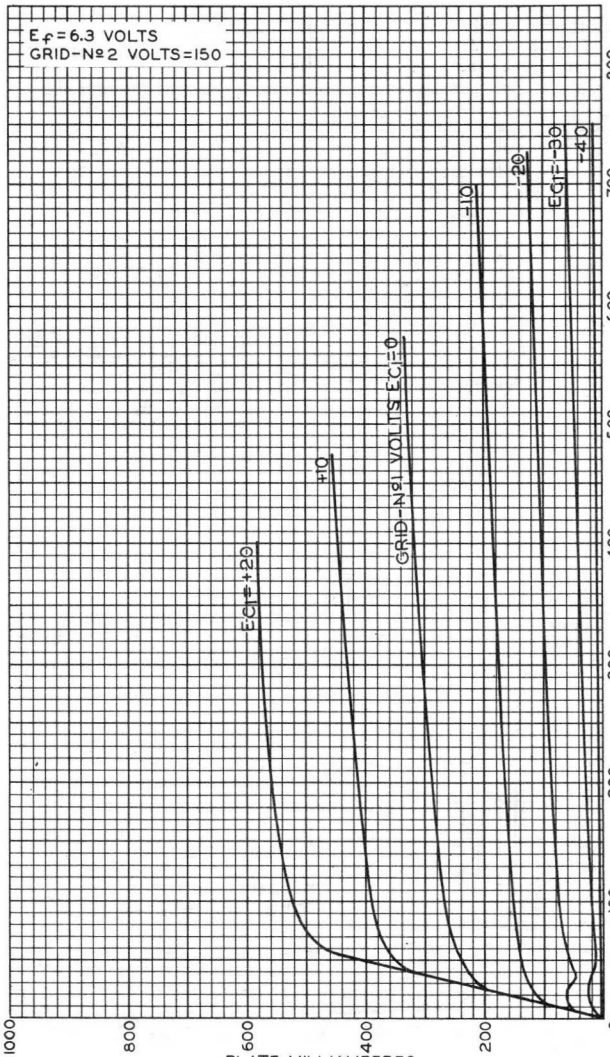


PLATE MILLIAMPERES

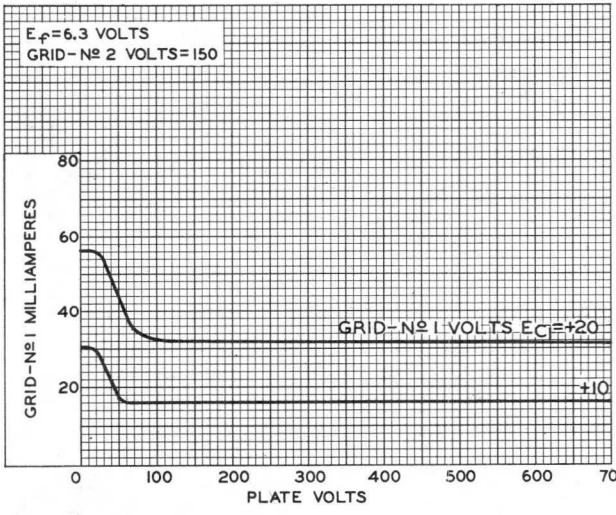
ELECTRON TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

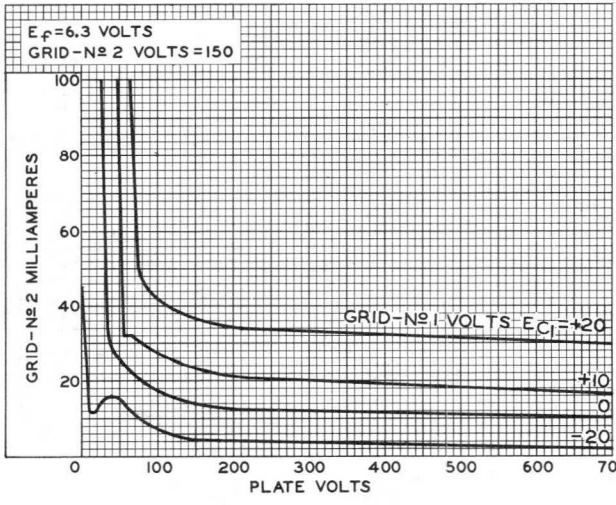
92CM-8145

7212

AVERAGE CHARACTERISTICS



92CS-9619



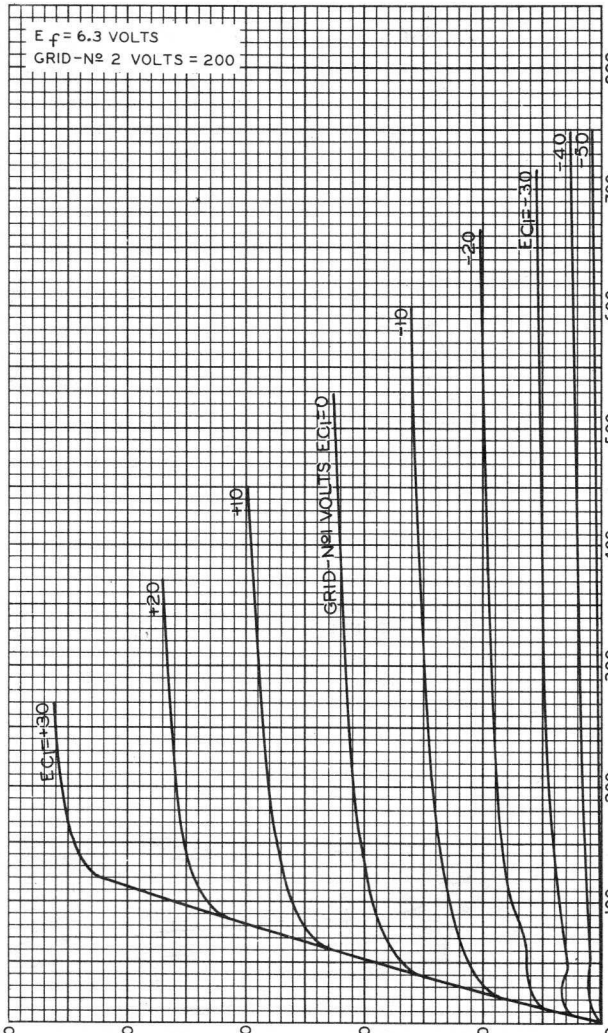
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CS-9620

RCA

7212

AVERAGE PLATE CHARACTERISTICS



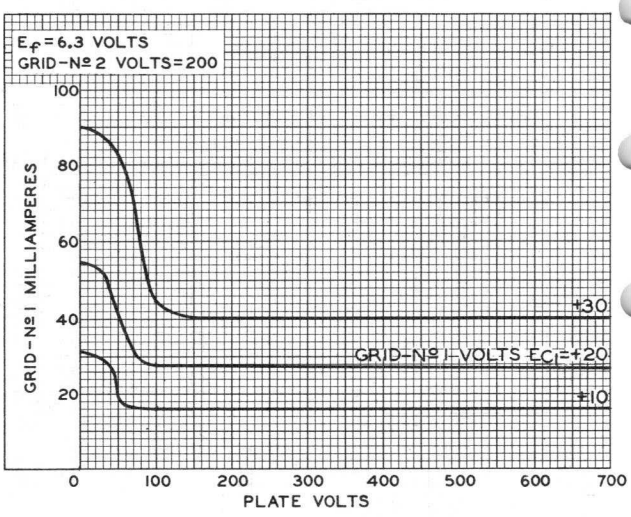
ELECTRON TUBE DIVISION

92CM-7707RI

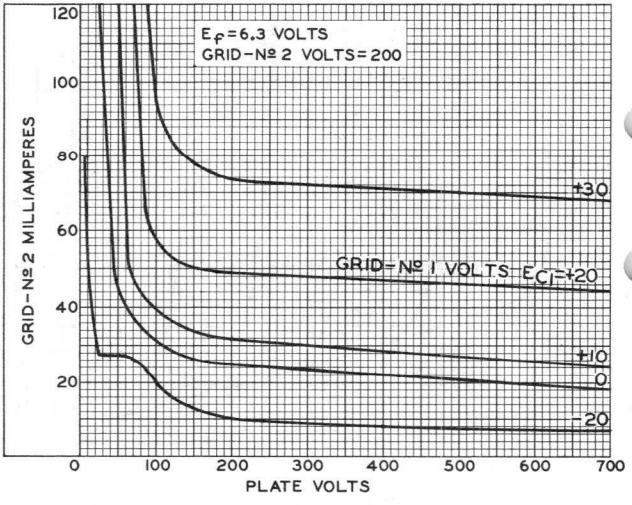
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

7212

AVERAGE CHARACTERISTICS



92CS-9617



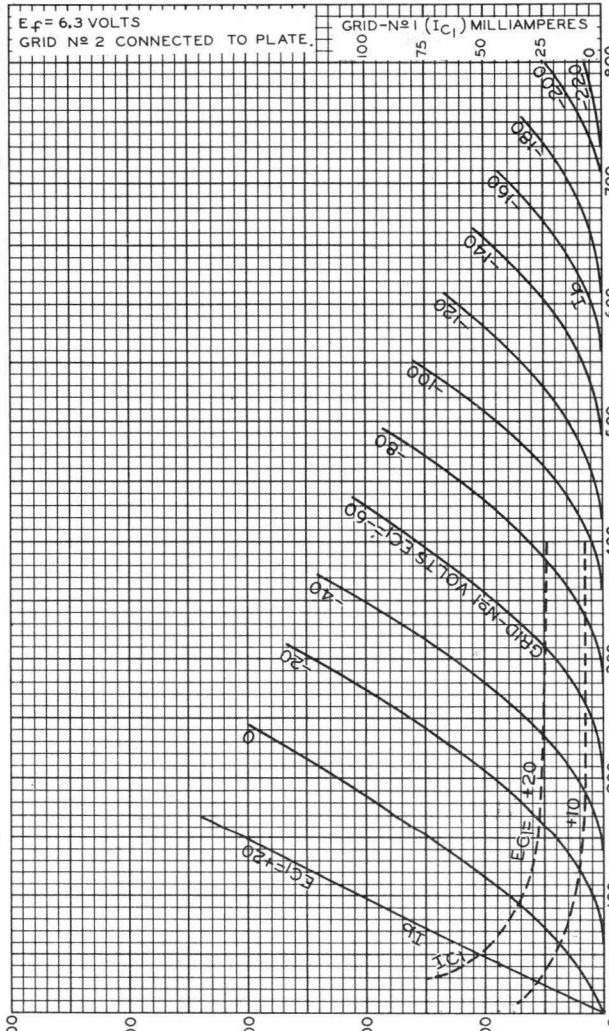
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CS-9618

RCA

7212

AVERAGE CHARACTERISTICS
TRIODE CONNECTION



ELECTRON TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7711RI

7223

PHOTOJUNCTION CELL

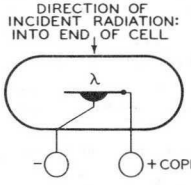
GERMANIUM P–N ALLOY JUNCTION, HEAD-ON TYPE
HAVING S-14 RESPONSE

For computer, punched-tape, punched-card, and sound pickup-from-film applications

DATA

General:

Spectral Response	S-14
Wavelength of Maximum Response	15000 angstroms
Window	Glass
Minimum diameter	0.060"
Length (Excluding flexible leads)	0.520" + 0.060" – 0.100"
Diameter	0.080" ± 0.003"
Envelope Seals	Hermetic
Operating Position	Any
Weight (Approx., avoirdupois)	3 grains
Leads, Flexible	2
Minimum length	1"
Diameter and polarity	*See Dimensional Outline*



λ indicates that the primary characteristic of the element within the envelope symbol is designed to vary under the influence of light.

Maximum Ratings, *Absolute Values:*

POLARIZING VOLTAGE	50 max.	volts
POWER DISSIPATION	0.025 max.	watt
AMBIENT TEMPERATURE	50 max.	°C

Characteristics:

Under conditions with polarizing voltage of 2.5 volts and ambient temperature of 25° C, unless otherwise noted

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant intensity, at 15000 angstroms	–	0.68	–	μa/watt/meter²
Illumination†▲	0.1	0.2	0.5	μa/ft-c
Dark Current:				
At polarizing voltage of 2.5 volts	–	–	14	μa
At polarizing voltage of 50 volts	–	–	35	μa

†,▲: See next page.

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

TENTATIVE DATA

7223

PHOTOJUNCTION CELL

Photocurrent:
Rise . . . . . *See Curve*
Decay . . . . . *See Curve*

† For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K.

▲ The value of illumination incident on the window is 73 foot-candles.

OPERATING CONSIDERATIONS

The *flexible leads* of the 7223 are usually soldered to the circuit elements. Soldering of the leads may be made close to the seals provided care is taken to conduct excessive heat away from the seals. Otherwise, the heat of soldering will open the seals and damage the cell.

A *clamp* around the metal shell of the cell may be used to hold the cell in position. However, care must be taken in clamping to avoid crushing or otherwise damaging the metal shell, the glass window, or the lead seals. *Do not solder or braze directly to the metal shell* of the cell.

The cell must be *polarized* by connecting the positive voltage to the copper-plated lead.

The use of an optical system to *focus the incident radiation* onto the window is suggested, especially when the level of incident radiation is low.

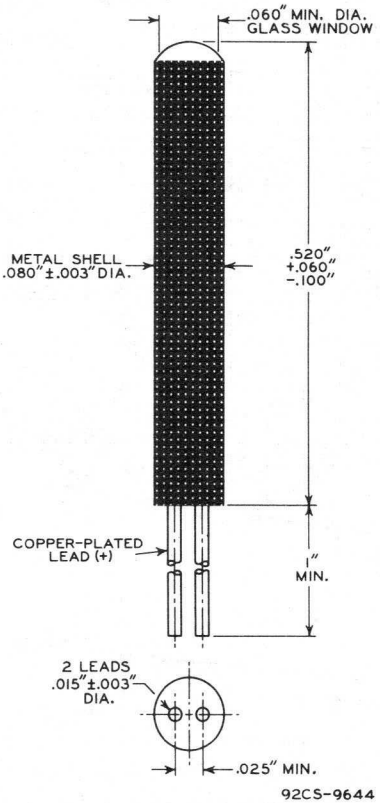
Exposure of the 7223 to intense radiation, such as focused sunlight, should be avoided under all conditions including the condition when no voltage is applied to the cell. Permanent damage to the cell may result if it is exposed to radiant energy so intense as to cause excessive heating of the cell.

With no radiation on the window of the cell, some *dark current* will flow across the junction. This current can be reduced, as shown in the accompanying curve, by operation of the cell at reduced ambient temperature.

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Photojunction Cell having S-14 Response
is shown at the front of this Section

7223

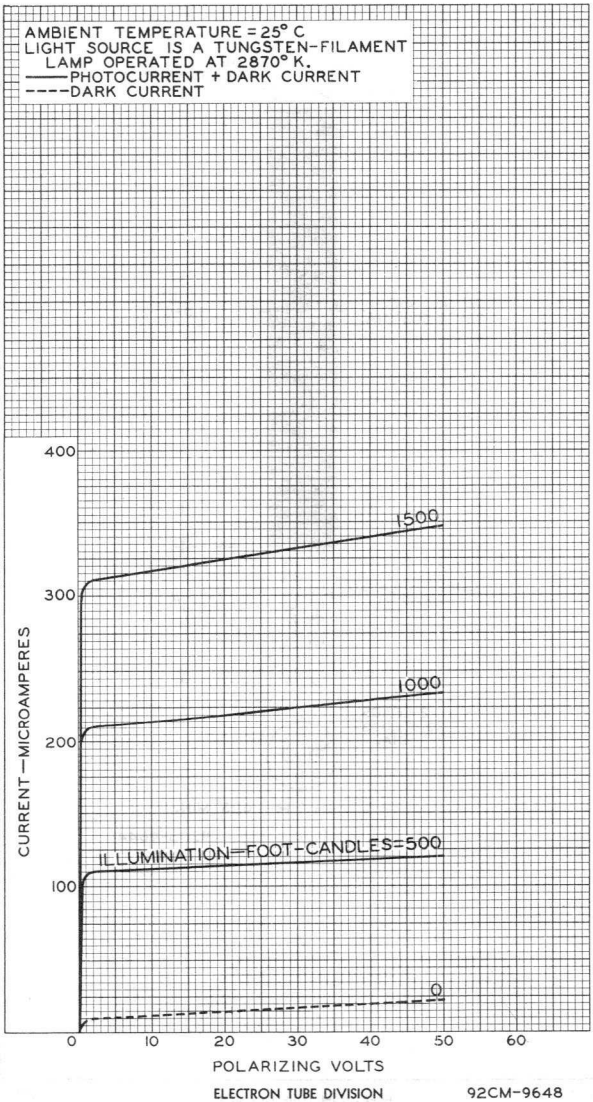
PHOTOJUNCTION CELL



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

7223

AVERAGE CHARACTERISTICS

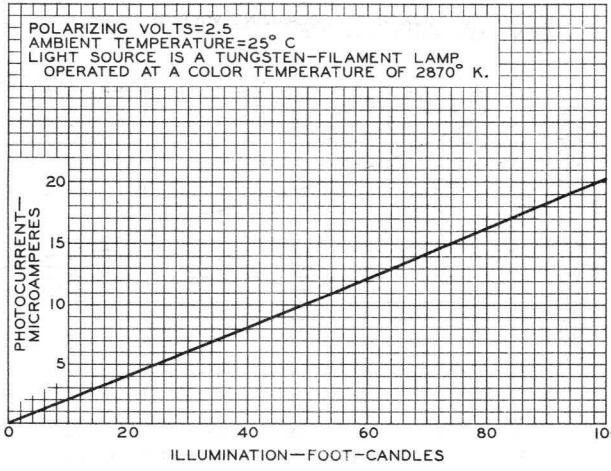


ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9648

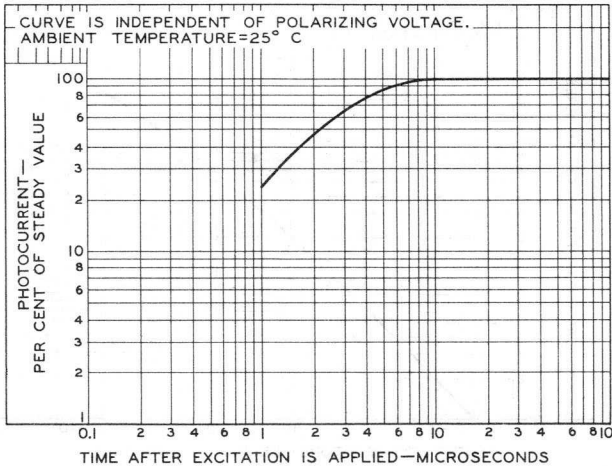
7223

TYPICAL CHARACTERISTIC



92CS-9650

TYPICAL RISE CHARACTERISTIC



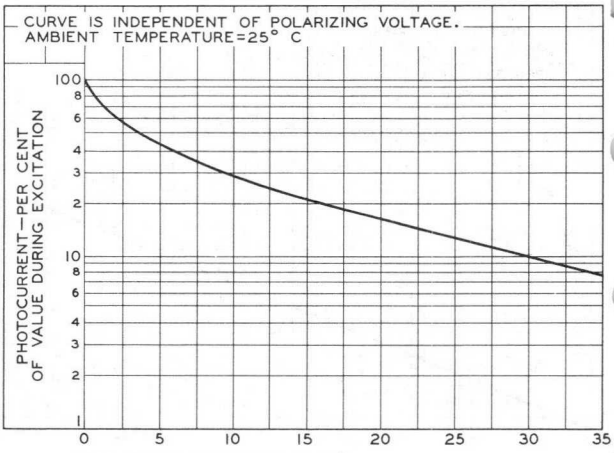
ELECTRON TUBE DIVISION 92CS-9654

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

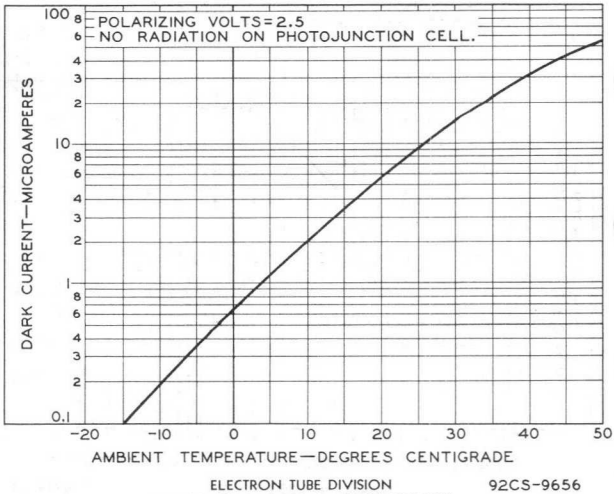
7223

TYPICAL DECAY CHARACTERISTIC



92CS-9655

TYPICAL CHARACTERISTIC



92CS-9656

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

7224

PHOTOJUNCTION CELL

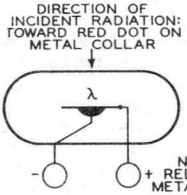
GERMANIUM P-N ALLOY JUNCTION, SIDE-ON TYPE
HAVING S-14 RESPONSE

For sound pickup-from-film, computer, punched-tape, and punched-card applications

DATA

General:

Spectral Response	S-14
Wavelength of Maximum Response	15000 angstroms
Sensitive Area:	
Shape	Circular
Diameter (Minimum)	0.045"
Length (Excluding flexible leads)	0.46" ± 0.04"
Seated Length to Center of Sensitive Area	0.330" ± 0.050"
Maximum Diameter	0.300"
Envelope	Glass with Metal Collar
Envelope Seals	Hermetic
Operating Position	Any
Weight (Approx.)	1 gram
Leads, Flexible	2
Minimum length	1.25"
Diameter and polarity	*See Dimensional Outline*



λ *indicates that the primary characteristic of the element within the envelope symbol is designed to vary under the influence of light.*

Maximum Ratings, *Absolute Values:*

POLARIZING VOLTAGE	50 max.	volts
POWER DISSIPATION	0.03 max.	watt
AMBIENT-TEMPERATURE RANGE (During operation)	-40 to +50	°C
STORAGE-TEMPERATURE RANGE	-65 to +75	°C

Characteristics:

Under conditions with polarizing voltage of 45 volts and ambient temperature of 25° C

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at 15000 angstroms	-	0.52	-	μa/μw

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

TENTATIVE DATA

7224

PHOTOJUNCTION CELL

	Min.	Median	Max.	
Luminous*.	–	14	–	ma/lumen
Illumination*†	0.5	0.7	–	μa/ft-c
Dark Current	–	–	35	μa
Photocurrent:				
Rise				*See Curve*
Decay.				*See Curve*

* For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K.

† The value of illumination incident on the sensitive area is 73 footcandles.

OPERATING CONSIDERATIONS

The *flexible leads* of the 7224 are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seals. Otherwise, the heat of the soldering operation will crack the glass seals of the leads and damage the cell.

A *clamp* around the glass envelope may be used to hold the cell in position. However, care must be taken in clamping to avoid cracking the metal-collar-to-envelope seal. *Do not solder or braze directly to the metal collar of the cell.*

The cell must be *polarized* by connecting the positive voltage to the lead indexed by the red dot on the metal collar.

The use of an optical system to *focus the incident radiation* onto the sensitive area of the cell is suggested, especially when the incident-radiation level is low. For high values of incident radiation, the entire side of the cell may be irradiated, but only that radiation intercepted by the sensitive area is effective in producing photocurrent.

Exposure of the 7224 to intense radiation, such as focused sunlight, should be avoided under all conditions including the condition when no voltage is applied to the cell. Permanent damage to the cell may result if it is exposed to radiant energy so intense as to cause excessive heating of the cell.

With no radiation on the sensitive area of the cell, some *dark current* will flow across the junction. This current can be reduced, as shown in the accompanying curve, by operation of the cell at reduced ambient temperature.

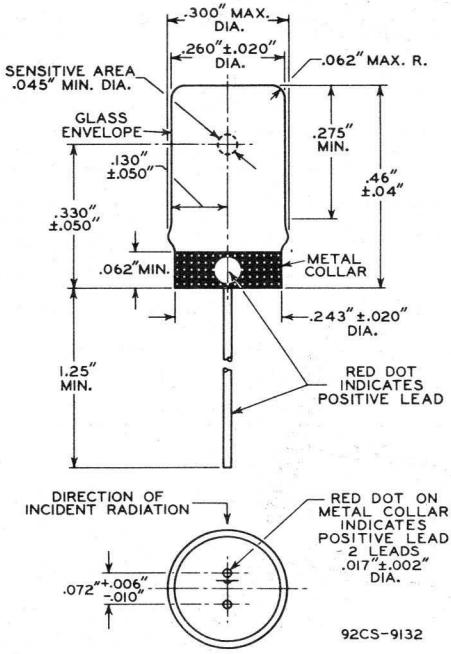
SPECTRAL-SENSITIVITY CHARACTERISTIC of Photojunction Cell having S-14 Response is shown at the front of this Section

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

TENTATIVE DATA

7224

PHOTOJUNCTION CELL



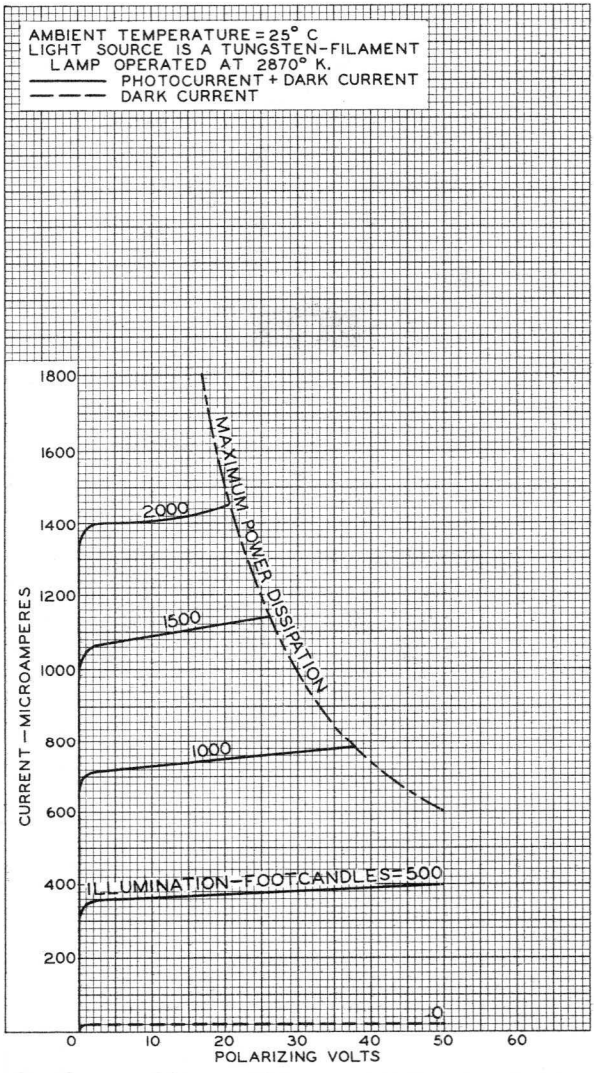
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

7224

RCA

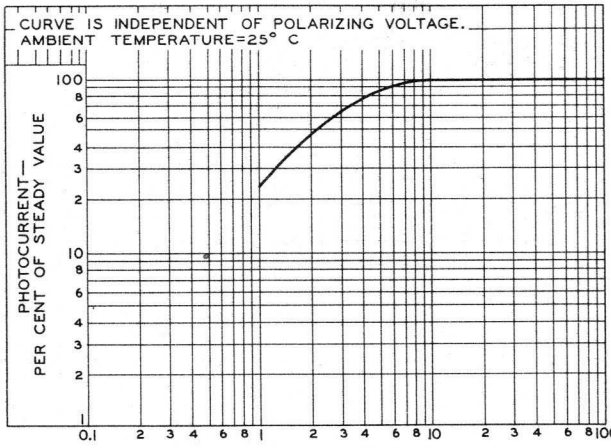
7224

AVERAGE CHARACTERISTICS



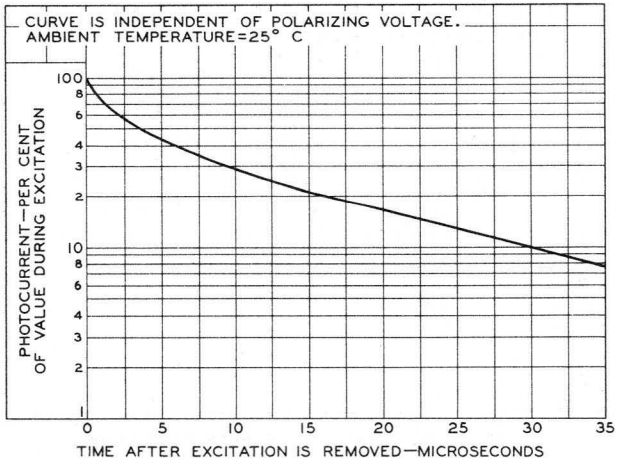
7224

TYPICAL RISE CHARACTERISTIC



92CS-9654

TYPICAL DECAY CHARACTERISTIC

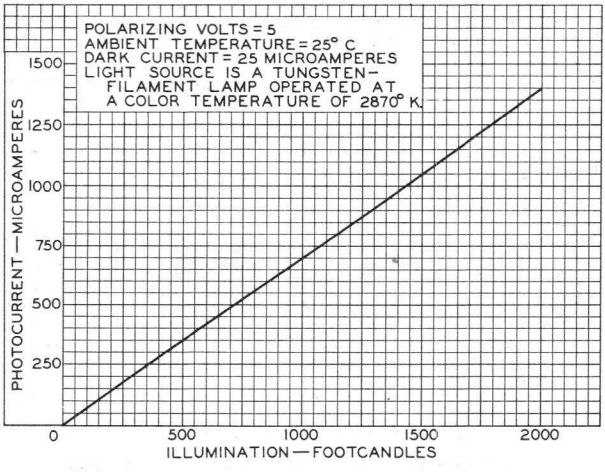


ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CS-9655

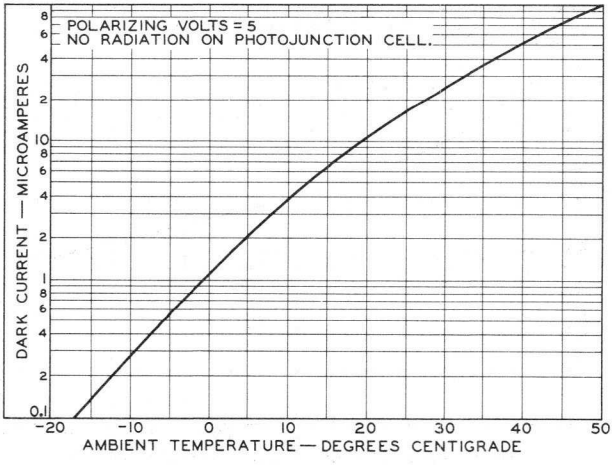
7224

TYPICAL CHARACTERISTIC



92CS-9675

TYPICAL DARK-CURRENT CHARACTERISTIC

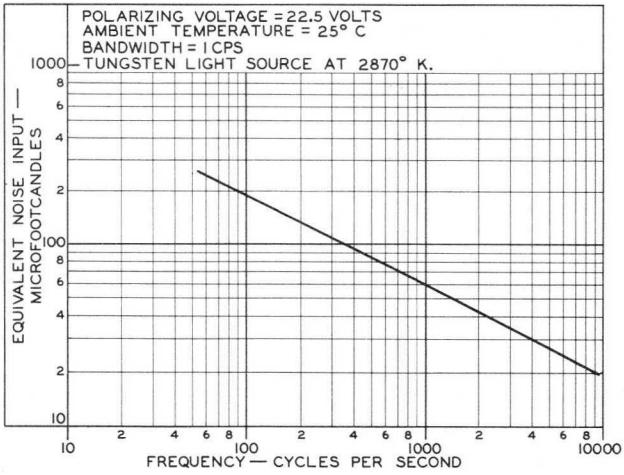


92CS-9676

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

7224

EQUIVALENT-NOISE-INPUT CHARACTERISTIC



92CS-9678

7262
VIDICON

LOW-POWER (0.6-WATT) HEATER — 600-LINE RESOLUTION

For use in small, compact, transistorized TV cameras

DATA

General:

Heater, for Unipotential Cathode:
- Voltage . . . . . 6.3 ± 10% . . . . ac or dc volts
- Current . . . . . 0.095 . . . . . amp

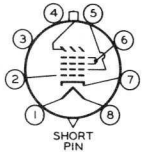
Direct Interelectrode Capacitance:♦
- Target to all other electrodes . . . . . 4.6 μμf

Spectral Response . . . . . *See Curves*

Photoconductive Layer:
- Maximum useful diagonal of rectangular image (4 x 3 aspect ratio) . . . . . 0.62"
- Orientation of quality rectangle—Proper orientation is obtained when the horizontal scan is essentially parallel to the straight sides of the masked portions of the faceplate. The straight sides are parallel to the plane passing through the tube axis and short index pin. The masking is for orientation only and does not define the proper scanned area of the photoconductive layer.

Focusing Method . . . . . Magnetic
Deflection Method . . . . . Magnetic
Overall Length . . . . . 5.12" ± 0.06"
Greatest Diameter . . . . . 1.125" ± 0.010"
Weight (Approx.) . . . . . 2 oz
Operating Position . . . . . Any
Bulb T8
Base Connector . . . . . Cinch No.54A18088, or equivalent
Base . . . . . Small-Button Ditetrar 8-Pin (JEDEC No.E8-11)
Basing Designation for BOTTOM VIEW 8HM

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Internal Connection—Do Not Use
Pin 4 - Same as Pin 3
Pin 5 - Grid No.2
Pin 6 - Grid No.4, Grid No.3
Pin 7 - Cathode
Pin 8 - Heater
Flange - Target
Short Index Pin - Same as Pin 3



DIRECTION OF LIGHT: INTO FACE END OF TUBE

Maximum Ratings, *Absolute Values:*
For scanned area of 1/2" x 3/8"

GRID-No.3 & GRID-No.4 VOLTAGE	350 max.	volts
GRID-No.2 VOLTAGE	350 max.	volts
GRID-No.1 VOLTAGE:		
Negative-bias value	125 max.	volts
Positive-bias value	0 max.	volts

♦: See next page.

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

RCA

7262

VIDICON

PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode.	125 max.	volts
Heater positive with respect to cathode.	10 max.	volts
DARK CURRENT	0.25 max.	μa
PEAK TARGET CURRENT.	0.55 max.	μa
FACEPLATE:		
Illumination	1000 max.	ft-c
Temperature.	60 max.	°C

Typical Operation:

For scanned area of 1/2" x 3/8" and faceplate temperature of 30° to 35° C

Grid-No.4 (Decelerator) & Grid-No.3 (Beam-focus electrode*) Voltage.	250□ to 300	volts
Grid-No.2 (Accelerator) Voltage.	300	volts
Grid-No.1 Voltage for picture cutoff●.	-45 to -100	volts
Average "Gamma" of Transfer Characteristic for signal-output current between 0.02 μa and 0.2 μa	0.65	
Visual Equivalent Signal-to-Noise Ratio (Approx.)★	300:1	
Minimum Peak-to-Peak Blanking Voltage:		
When applied to grid No.1.	75	volts
When applied to cathode.	20	volts
Field Strength at Center of Focusing Coil (Approx.).	40	gausses
Field Strength of Adjustable Alignment Coil⊕.	0 to 4	gausses

Maximum-Sensitivity Operation for Live-Scene Pickup

Faceplate Illumination (Highlight)	2	ft-c
Maximum Target Voltage required to produce dark current of 0.2 μa in any tube**.	110	volts
Target Voltage†.	60 to 100	volts
Dark Current▲.	0.2	μa
Target Current (Highlight)■.	0.4 to0.5	μa
Signal-Output Current:✱		
Peak	0.2 to0.3	μa
Average.	0.08 to 0.1	μa

Average-Sensitivity Operation for Live-Scene Pickup

Faceplate Illumination (Highlight)	15	ft-c
Maximum Target Voltage required to produce dark current of 0.02 μa in any tube**.	60	volts
Target Voltage†.	30 to 50	volts

♦,*,□,●,★,⊕,**,†,▲,■,✱: See next page.

7262

VIDICON

Dark Current	0.02	μa
Target Current (Highlight)■	0.3 to 0.4	μa
Signal-Output Current:#		
Peak	0.3 to 0.4	μa
Average	0.1 to 0.2	μa

Minimum-Lag Operation for Film Pickup

Faceplate Illumination (Highlight)	100	ft-c
Maximum Target Voltage required to produce dark current of 0.004 μa in any tube**■	30	volts
Target Voltage†	15 to 25	volts
Dark Current	0.004	μa
Target Current (Highlight)■	0.3 to 0.4	μa
Signal-Output Current:#		
Peak	0.3 to 0.4	μa
Average	0.1 to 0.2	μa

🌡 This capacitance, which effectively is the output impedance of the 7262, is increased when the tube is mounted in the deflecting-yoke and focusing-coil assembly. The resistive component of the output impedance is in the order of 100 megohms.

● Beam focus is obtained by combined effect of grid-No.3 voltage which should be adjustable over indicated range, and a focusing coil having an average field strength of 40 gausses.

□ Definition, focus uniformity, and picture quality decrease with decreasing grid-No.4 and grid-No.3 voltage. In general, grid No.4 and grid No.3 should be operated above 250 volts.

● With no blanking voltage on grid No.1.

★ Measured with high-gain, low-noise, cascode-input-type amplifier having bandwidth of 5 Mc. Because the noise in such a system is predominately of the high-frequency type, the visual equivalent signal-to-noise ratio is taken as the ratio of the highlight video-signal current to rms noise current, multiplied by a factor of 3.

⊕ The alignment coil should be located on the tube so that its center is at a distance of 3-11/16 inches from the face of the tube, and be positioned so that its axis is coincident with the axis of the tube, the deflecting yoke, and the focusing coil.

** The target voltage for each 7262 must be adjusted to that value which gives the desired operating dark current.

† Indicated range for each type of service serves only to illustrate the operating target-voltage range normally encountered.

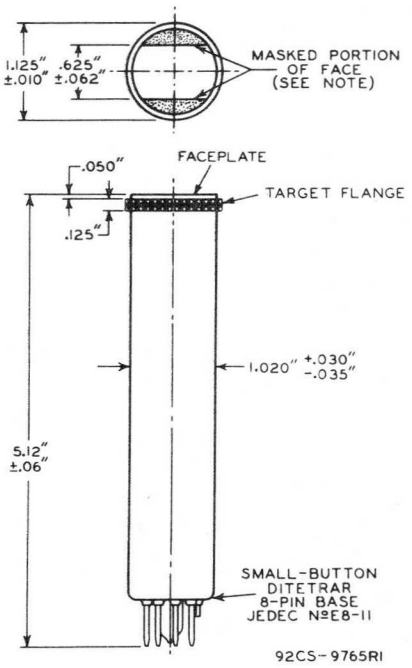
▲ The deflecting circuits must provide extremely linear scanning for good black-level reproduction. Dark-current signal is proportional to the scanning velocity. Any change in scanning velocity produces a black-level error in direct proportion to the change in scanning velocity.

■ Video amplifiers must be designed properly to handle target currents of this magnitude to avoid amplifier overload or picture distortion.

Defined as the component of the target current after the dark-current component has been substracted.

7262

VIDICON



NOTE: STRAIGHT SIDES OF MASKED PORTIONS ARE PARALLEL TO THE PLANE PASSING THROUGH TUBE AXIS AND SHORT INDEX PIN.

RCA

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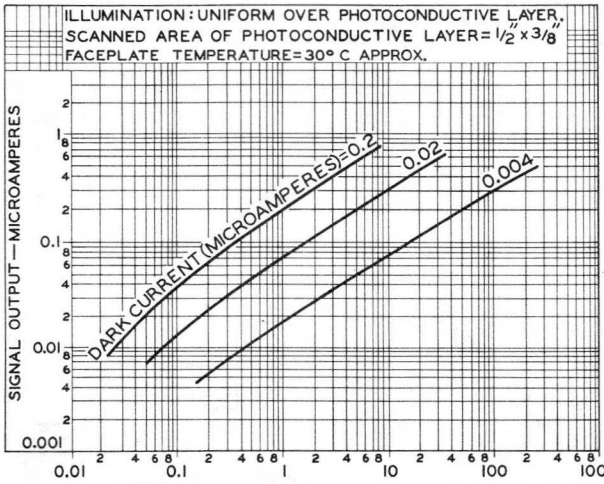
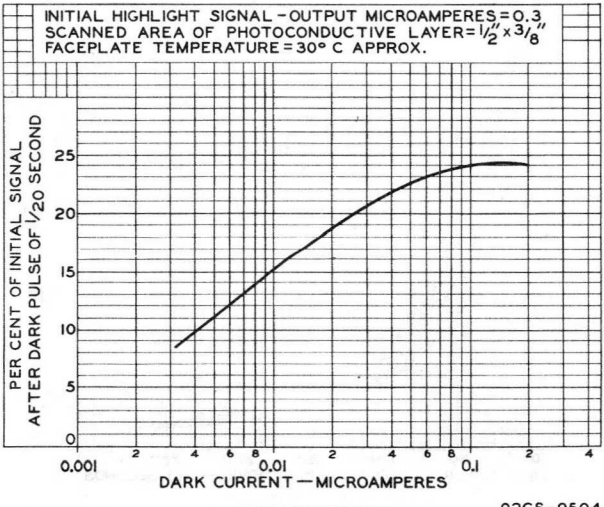
TYPICAL LIGHT-TRANSFER CHARACTERISTICS



92CS-9495

TYPICAL PERSISTENCE CHARACTERISTIC



92CS-9504

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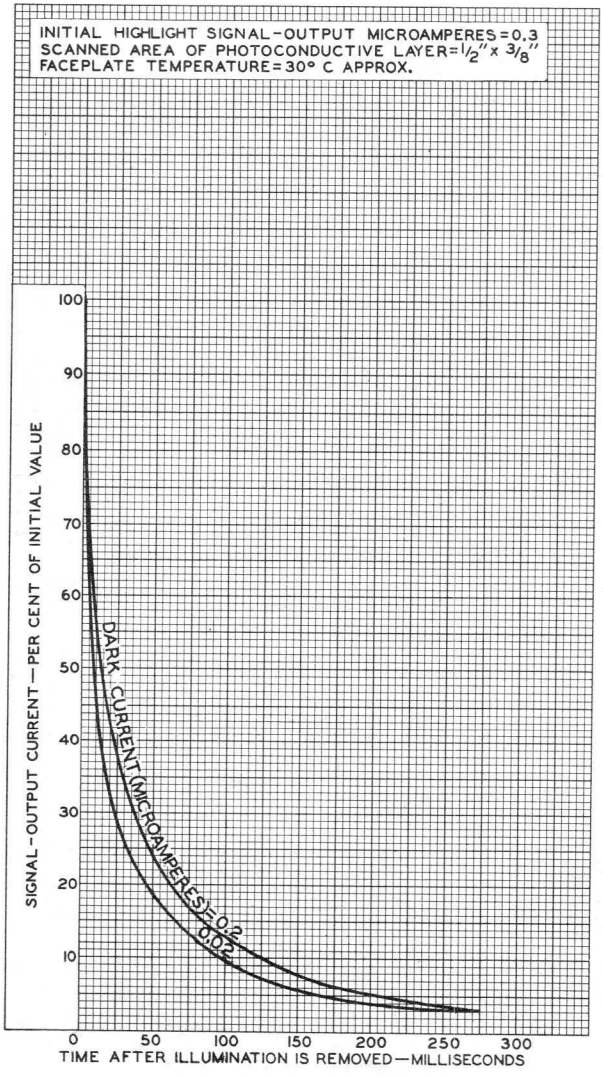
7262

TYPICAL PERSISTENCE CHARACTERISTICS



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RCA

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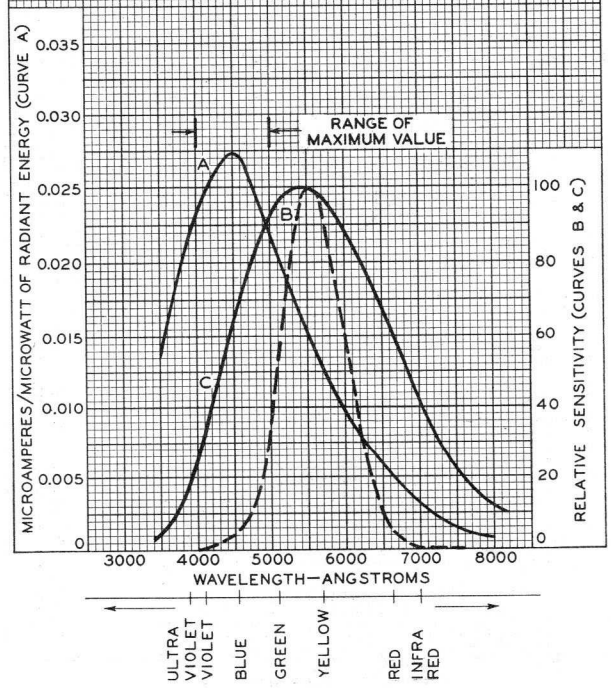
SPECTRAL-SENSITIVITY CHARACTERISTICS

CURVE A: FOR EQUAL VALUES OF SIGNAL-OUTPUT CURRENT AT ALL WAVELENGTHS.

SIGNAL-OUTPUT MICROAMPERES FROM SCANNED AREA OF $\frac{1}{2}'' \times \frac{3}{8}'' = 0.02$
DARK CURRENT (MICROAMPERES) = 0.02

CURVE B: SPECTRAL CHARACTERISTIC OF AVERAGE HUMAN EYE.

CURVE C: FOR EQUAL VALUES OF SIGNAL-OUTPUT CURRENT WITH RADIANT FLUX FROM TUNGSTEN SOURCE AT 2870° K.



RCA

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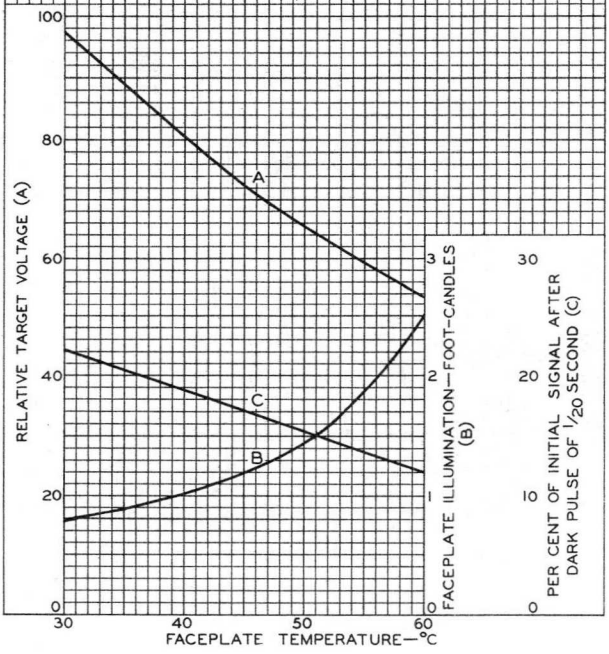
TYPICAL CHARACTERISTICS

HIGHLIGHT SIGNAL - OUTPUT MICROAMPERES = 0.2
DARK CURRENT (MICROAMPERES) = 0.2
SCANNED AREA OF PHOTOCONDUCTIVE LAYER = $\frac{1}{2}$" x $\frac{3}{8}$"
CURVE A: RELATIVE TARGET VOLTAGE REQUIRED TO MAINTAIN DARK CURRENT OF 0.2 μA.
CURVE B: 2870° K INCANDESCENT ILLUMINATION REQUIRED TO PRODUCE SIGNAL - OUTPUT CURRENT OF 0.2 μA.
CURVE C: PERSISTENCE (LAG) CHARACTERISTIC FOR AN INITIAL SIGNAL-OUTPUT CURRENT OF 0.2 μA.



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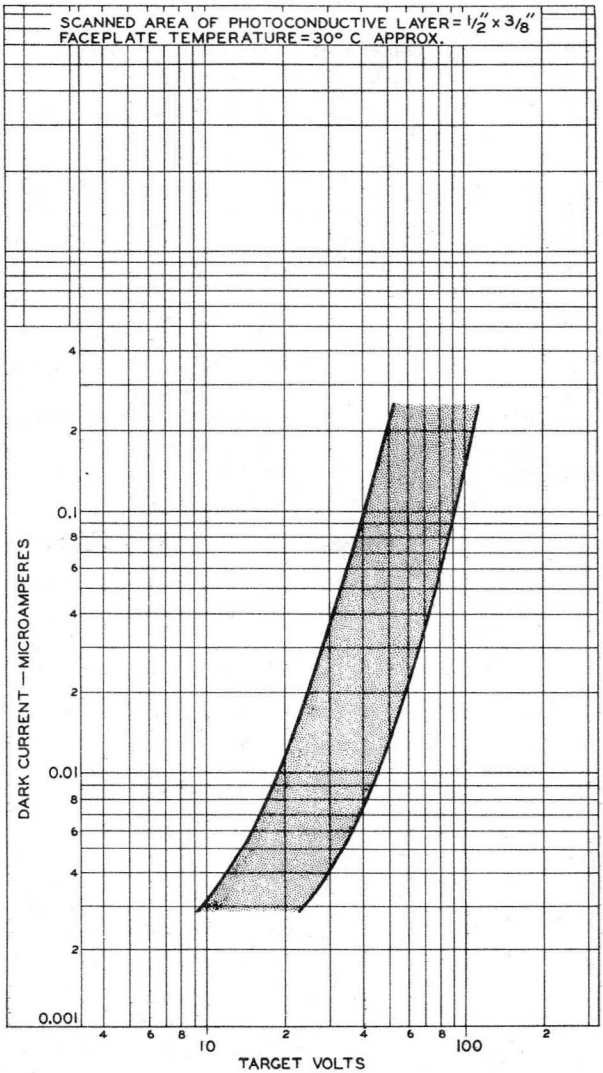
DARK-CURRENT RANGE



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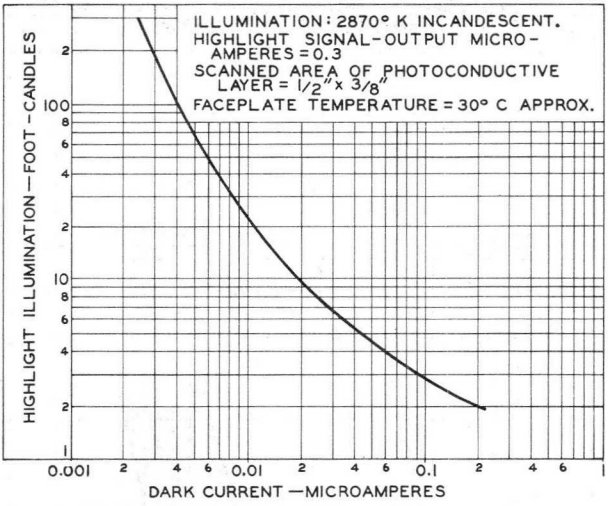
TYPICAL CHARACTERISTIC



92CS-9493

7263
VIDICON

LOW-POWER (0.6-WATT) HEATER 600-LINE RESOLUTION

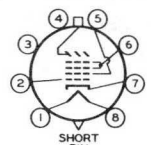
For use under severe shock and vibration, high humidity, and altitudes up to 50,000 feet in small, compact, transistorized TV cameras

DATA

General:

Heater, for Unipotential Cathode:		
Voltage	6.3 ± 10%	ac or dc volts
Current	0.095	amp
Direct Interelectrode Capacitance:♦		
Target to all other electrodes	4.6	μμf
Spectral Response		*See Curves*
Photoconductive Layer:		
Maximum useful diagonal of rectangular image (4 x 3 aspect ratio)		0.62"
Orientation of quality rectangle—Proper orientation is obtained when the horizontal scan is essentially parallel to the plane passing through the tube axis and short index pin.		
Focusing Method		Magnetic
Deflection Method		Magnetic
Overall Length		5.12" ± 0.06"
Greatest Diameter		1.125" ± 0.010"
Weight (Approx.)		2 oz
Operating Position		Any
Bulb		T8
Base Connector		Cinch No.54A18088, or equivalent
Base		Small-Button Ditetrar 8-Pin (JEDEC No.E8-11)
Basing Designation for BOTTOM VIEW		8HM

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Internal Connection—Do Not Use
Pin 4 - Same as Pin 3
Pin 5 - Grid No.2
Pin 6 - Grid No.4, Grid No.3



DIRECTION OF LIGHT: INTO FACE END OF TUBE

Pin 7 - Cathode
Pin 8 - Heater
Flange - Target
Short Index Pin - Same as Pin 3

Maximum Ratings, *Absolute-Maximum Values:*

For altitudes up to 50,000 feet and scanned area of 1/2" x 3/8"

GRID-No.3 & GRID-No.4 VOLTAGE	350 max.	volts
GRID-No.2 VOLTAGE	350 max.	volts
GRID-No.1 VOLTAGE:		
Negative-bias value	125 max.	volts
Positive-bias value	0 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	10 max.	volts

♦: See next page.

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DARK CURRENT	0.25 max.	μa
PEAK TARGET CURRENT	0.55 max.	μa
FACEPLATE:		
Illumination	1000 max.	ft-c
Temperature (Operating or storage)	60 max.	°C

Typical Operation:

For scanned area of 1/2" x 3/8" and faceplate temperature of 30° to 35° C

Grid-No.4 (Decelerator) & Grid-No.3 (Beam-Focus-Electrode*) Voltage	250□ to 300	volts
Grid-No.2 (Accelerator) Voltage	300	volts
Grid-No.1 Voltage for picture cutoff●	-45 to -100	volts
Average "Gamma" of Transfer Characteristic for signal-output current between 0.02 μa and 0.2 μa	0.65	
Visual Equivalent Signal-to-Noise Ratio (Approx.)○	300:1	
Minimum Peak-to-Peak Blanking Voltage:		
When applied to grid No.1	75	volts
When applied to cathode	20	volts
Field Strength at Center of Focusing Coil (Approx.)	40	gausses
Field Strength of Adjustable Alignment Coil⊕	0 to 4	gausses

Maximum-Sensitivity Operation for Live-Scene Pickup

Faceplate Illumination (Highlight)	2	ft-c
Maximum Target Voltage required to produce dark current of 0.2 μa in any tube**	110	volts
Target Voltage†	60 to 100	volts
Dark Current▲	0.2	μa
Target Current (Highlight)■	0.4 to 0.5	μa
Signal-Output Current:#		
Peak	0.2 to 0.3	μa
Average	0.08 to 0.1	μa

Average-Sensitivity Operation for Live-Scene Pickup

Faceplate Illuminiation (Highlight)	15	ft-c
Maximum Target Voltage required to produce dark current of 0.02 μa in any tube**	60	volts
Target Voltage†	30 to 50	volts
Dark Current	0.02	μa
Target Current (Highlight)■	0.3 to 0.4	μa

●, *, □, ●, ○, ⊕, **, †, ▲, ■, #: See next page.

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VIDICON

Signal-Output Current:#		
Peak	0.3 to 0.4	μa
Average	0.1 to 0.2	μa
Minimum-Lag Operation for Film Pickup		
Faceplate Illumination (Highlight)	100	ft-c
Maximum Target Voltage required to produce dark current of 0.004 μa in any tube**	30	volts
Target Voltage†	15 to 25	volts
Dark Current	0.004	μa
Target Current (Highlight)■	0.3 to 0.4	μa
Signal-Output Current:#		
Peak	0.3 to 0.4	μa
Average	0.1 to 0.2	μa

🌡 This capacitance, which effectively is the output impedance of the 7263, is increased when the tube is mounted in the deflecting-yoke and focusing-coil assembly. The resistive component of the output impedance is in the order of 100 megohms.

* Beam focus is obtained by combined effect of grid-No.3 voltage which should be adjustable over indicated range, and a focusing coil having an average field strength of 40 gausses.

□ Definition, focus uniformity, and picture quality decrease with decreasing grid-No.4 and grid-No.3 voltage. In general, grid No.4 and grid No.3 should be operated above 250 volts.

● With no blanking voltage on grid No.1.

○ Measured with high-gain, low-noise, cascode-input-type amplifier having bandwidth of 5 Mc. Because the noise in such a system is predominately of the high-frequency type, the visual equivalent signal-to-noise ratio is taken as the ratio of highlight video-signal current to rms noise current, multiplied by a factor of 3.

⊕ The alignment coil should be located on the tube so that its center is at a distance of 3-11/16 inches from the face of the tube, and be positioned so that its axis is coincident with the axis of the tube, the deflecting yoke, and the focusing coil.

** The target voltage for each 7263 must be adjusted to that value which gives the desired operating dark current.

† Indicated range for each type of service serves only to illustrate the operating target-voltage range normally encountered.

▲ The deflecting circuits must provide extremely linear scanning for good black-level reproduction. Dark-current signal is proportional to the scanning velocity. Any change in scanning velocity produces a black-level error in direct proportion to the change in scanning velocity.

■ Video amplifiers must be designed properly to handle target currents of this magnitude to avoid amplifier overload or picture distortion.

\# Defined as the component of the target current after the dark-current component has been subtracted.

SPECIAL PERFORMANCE DATA

In connection with the following tests, sample 7263's will maintain resolution as determined with a RETMA Resolution Chart, or equivalent, and will faithfully reproduce all resolution wedges and grey scales of the chart.

Vibration Tests:

These tests are performed under conditions for *Average-Sensitivity Operation for Live-Scene Pickup* on a sample lot

of tubes from each production run. Tubes and their associated components§ are vibrated on apparatus providing dynamic conditions similar to those described in MIL-E-5272B♦, paragraph 4.7.1.

Resonance. Tubes and associated components§ are vibrated (per the method of MIL-E-5272B♦, paragraph 4.7.1.1) for 1 hour at +25° C, for 15 minutes at 0° C, and for 15 minutes at +55° C.

Cycling. Tubes and associated components§ are vibrated (per the method of MIL-E-5272B♦, paragraph 4.7.1.2 pertaining to specimen without vibration isolators) for 1 hour at +25° C, for 15 minutes at 0° C, and for 15 minutes at +55° C.

Temperature-Pressure (Altitude) Tests:

Tubes and associated components§ are subjected (per the method of MIL-E-5400# paragraph 3.2.20, 3.2.20.1, and 3.2.20.1.1) to the separate and combined effects of varying temperature 0° to +55° C and varying barometric pressure 30 to 3.4 inches of mercury. The pressures correspond to sea level and to an altitude of 50,000 feet, respectively.

Shock Tests:

These tests are performed with no voltages applied and on a sample lot of tubes from each production run. Tubes and their associated components§ are subjected in these tests (per MIL-E-5400#, paragraph 3.2.21.2.1) to 18 impact shocks of 15 g consisting of 3 shocks in opposite directions along each of three mutually perpendicular axes of the tube. Each shock impulse has a duration of 11 ± 1 milliseconds with a maximum impact acceleration occurring at approximately 5.5 milliseconds.

Temperature-Humidity Tests:

These tests are performed with no voltages applied to the 7263. The 7263 and associated components§ are subjected (per the method of MIL-E-5400#, paragraph 3.2.20.2B) to relative humidities up to and including 100 per cent at temperatures up to and including +50° C.

§ Tube socket such as Cinch No. 54A18088 and RCA Assembly No. 200SDU501, or equivalent, which consists of the deflecting coils, focusing coil, alignment coil, shield, and target connector.

♦ 5 June 1957, Procedure I of Military Specification.

1 January 1956.

OPERATING CONSIDERATIONS

The *target connection* is made by a suitable spring contact bearing against the edge of the target flange. This spring contact may conveniently be provided as part of the focusing-coil design.

Support for the 7263 should be provided such that, under vibration and shock, the tube will not be displaced with respect

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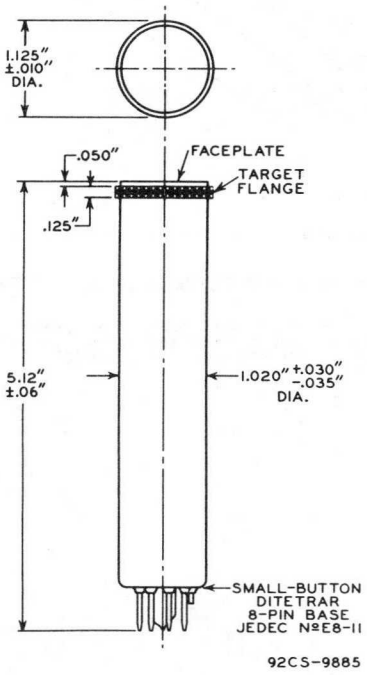
VIDICON

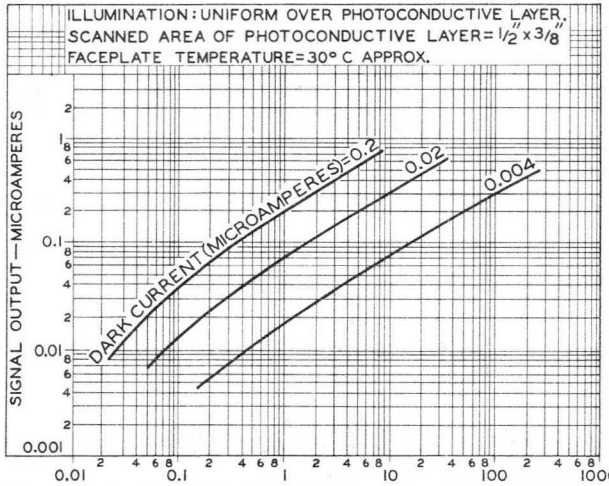
to the focusing, deflecting, and alignment fields. Suitable support is provided for the tube and its socket in the RCA Deflection Assembly 200SDU501, or equivalent. Orientation of the 7263 in its support should be such that the horizontal scan is essentially parallel to the plane passing through the tube axis and short index pin.



RCA

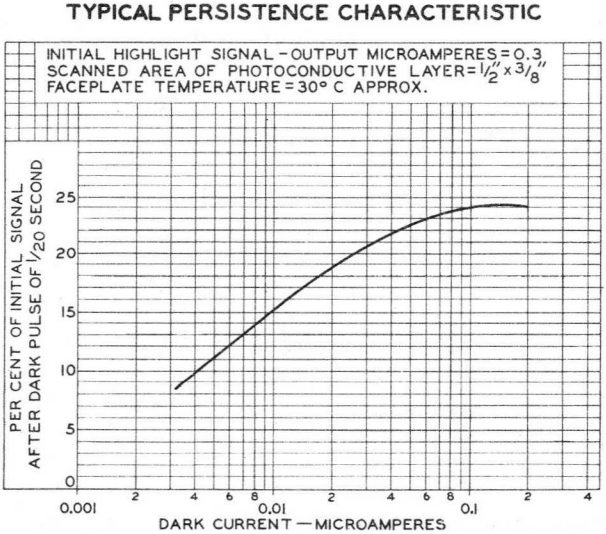
7263

TYPICAL LIGHT-TRANSFER CHARACTERISTICS



92CS-9495

TYPICAL PERSISTENCE CHARACTERISTIC



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92CS-9504

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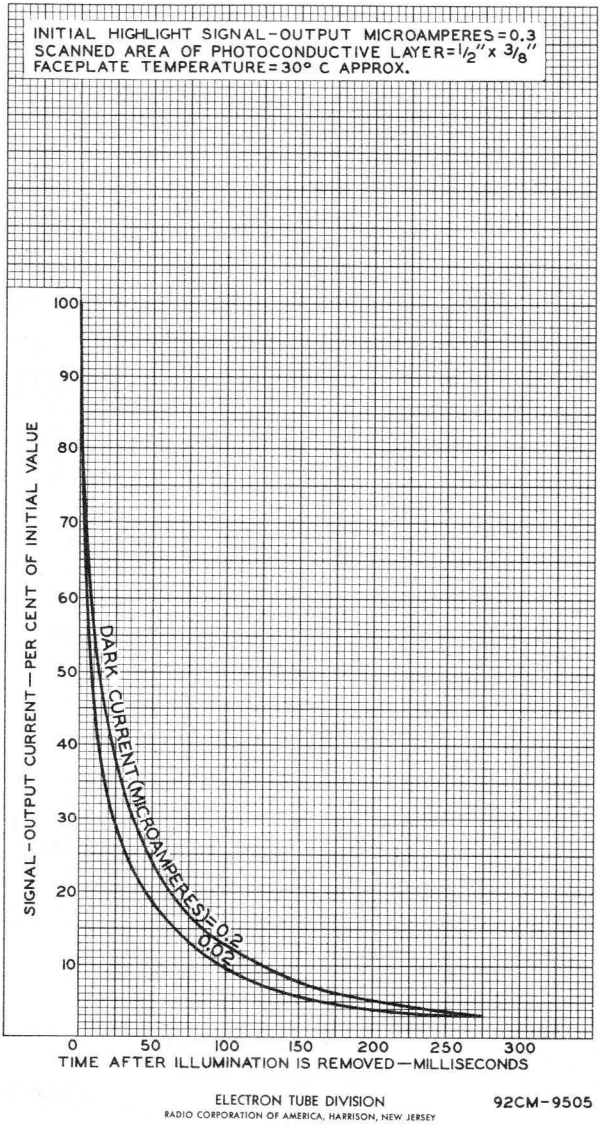
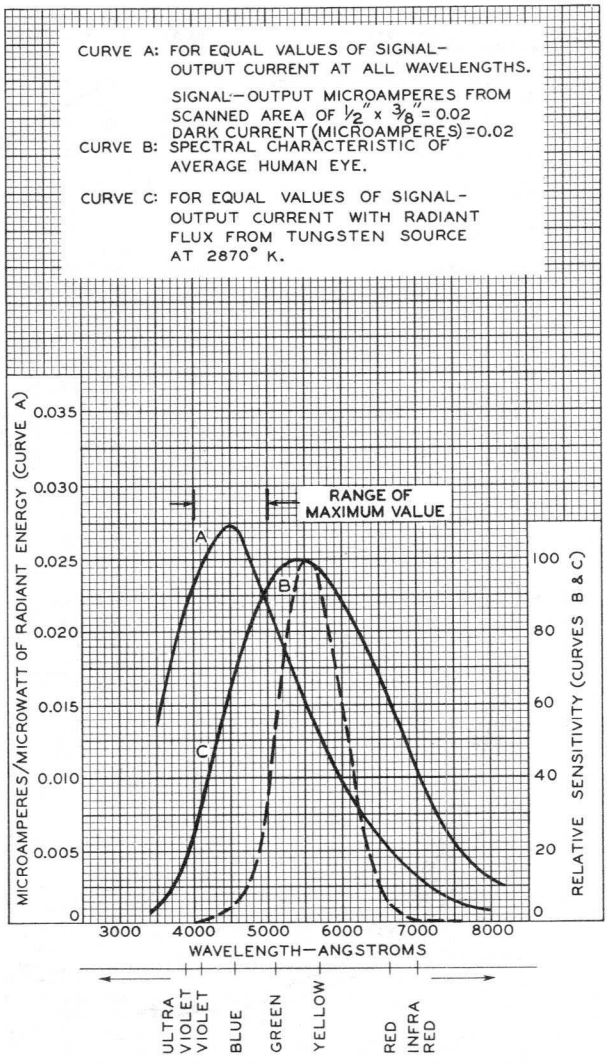
TYPICAL PERSISTENCE CHARACTERISTICS



RCA

7263

SPECTRAL—SENSITIVITY CHARACTERISTICS

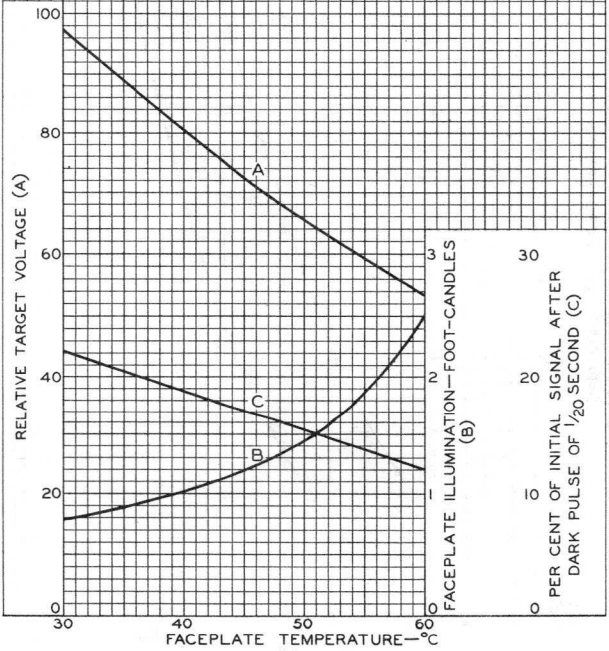


RCA

7263

TYPICAL CHARACTERISTICS

HIGHLIGHT SIGNAL - OUTPUT MICROAMPERES = 0.2
DARK CURRENT (MICROAMPERES) = 0.2
SCANNED AREA OF PHOTOCONDUCTIVE LAYER = $\frac{1}{2}'' \times \frac{3}{8}''$
CURVE A: RELATIVE TARGET VOLTAGE REQUIRED TO MAINTAIN DARK CURRENT OF 0.2 μA.
CURVE B: 2870° K INCANDESCENT ILLUMINATION REQUIRED TO PRODUCE SIGNAL - OUTPUT CURRENT OF 0.2 μA.
CURVE C: PERSISTENCE (LAG) CHARACTERISTIC FOR AN INITIAL SIGNAL-OUTPUT CURRENT OF 0.2 μA.



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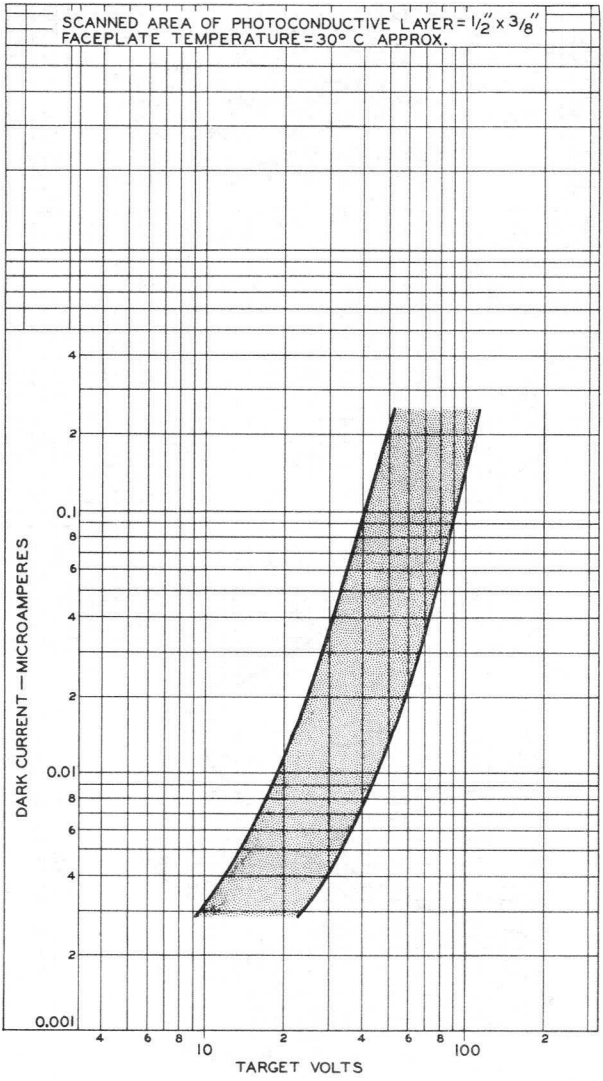
92CM-9499

RCA

7263

DARK-CURRENT RANGE



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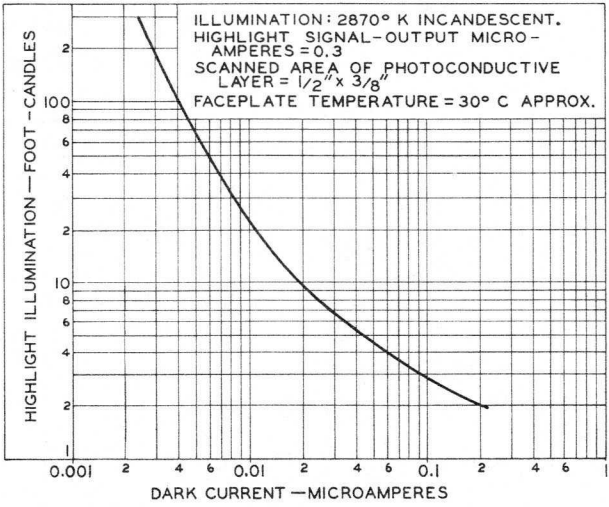
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9497

7263

TYPICAL CHARACTERISTIC



92CS-9493

7268A

Display-Storage Tube

"RUGGEDIZED" TYPE
TWO WRITING GUNS
ONE VIEWING GUN

5-INCH DIAMETER
4-INCH-DIAMETER DISPLAY
INTEGRAL MAGNETIC SHIELD

For Use in Military and Commercial Information-Handling Displays Where Rough Tube Usage May be Encountered. The 7268A is Unilaterally Interchangeable with Type 7268.

ELECTRICAL

Heater, for Unipotential Cathode		
All guns		
Voltage (AC or DC)	6.3 ± 10%	V
Current at 6.3 V	0.6	A
Cathode Heating Time	30	s
Minimum, before other electrode voltages are applied		

Writing Section - Each Gun

Focusing Method	Electrostatic	
Deflection Method	Electrostatic	
Deflecting-Electrode Arrangement	See *Dimensional Outline*	
Direct Interelectrode Capacitances		
Grid No.1 to all other electrodes	15 max	pF
Cathode to all other electrodes	8 max	pF
Deflecting electrode DJ1 to deflecting electrode DJ2	3 max	pF
Deflecting electrode DJ3 to deflecting electrode DJ4	2 max	pF
DJ1 to all other electrodes	10 max	pF
DJ2 to all other electrodes	10 max	pF
DJ3 to all other electrodes	10 max	pF
DJ4 to all other electrodes	10 max	pF

Viewing Section

Direct Interelectrode Capacitances		
Grid No.1 to all other electrodes	18 max	pF
Cathode to all other electrodes	10 max	pF
Backplate to all other electrodes	110 max	pF

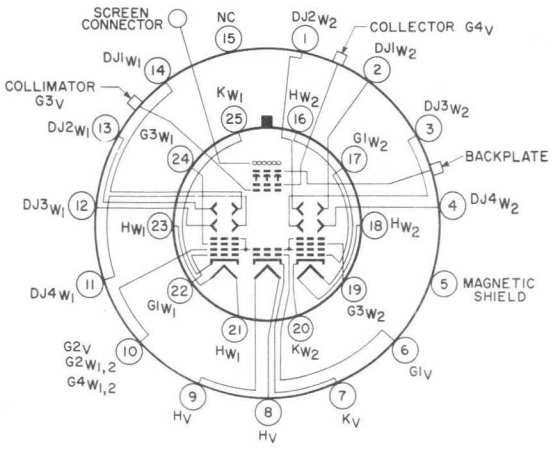
OPTICAL

Phosphor . . . . . P20, Aluminized

MECHANICAL

Operating Position	Any
Minimum Useful Viewing Diameter	4 in
Maximum Overall Length	16 in
Maximum Diameter	5.28 in
Excluding screen lead	
Screen-Connector Assembly	See *Dimensional Outline*
Weight	5-1/4 lb
Bulb Terminals	Recessed Small-Ball (JEDEC No.J1-22)
Caps (Three)	
Base	JEDEC No.B25-216

TERMINAL DIAGRAM (Bottom View)



Pin 1 – Deflecting Electrode DJ2 of Writing Gun No.2
Pin 2 – Deflecting Electrode DJ1 of Writing Gun No.2
Pin 3 – Deflecting Electrode DJ3 of Writing Gun No.2
Pin 4 – Deflecting Electrode DJ4 of Writing Gun No.2
Pin 5 – Integral Magnetic Shield
Pin 6 – Grid No.1 of Viewing Gun
Pin 7 – Cathode of Viewing Gun
Pin 8 – Heater of Viewing Gun
Pin 9 – Heater of Viewing Gun
Pin 10 – Grid No.2 of Viewing Gun, Grid No.2 and Grid No.4 of Writing Guns No.1 and No.2
Pin 11 – Deflecting Electrode DJ4 of Writing Gun No.1
Pin 12 – Deflecting Electrode DJ3 of Writing Gun No.1
Pin 13 – Deflecting Electrode DJ2 of Writing Gun No.1
Pin 14 – Deflecting Electrode DJ1 of Writing Gun No.1
Pin 15 – NC — No Internal Connection
Pin 16 – Heater of Writing Gun No.2
Pin 17 – Grid No.1 of Writing Gun No.2
Pin 18 – Heater of Writing Gun No.2
Pin 19 – Grid No.3 of Writing Gun No.2
Pin 20 – Cathode of Writing Gun No.2
Pin 21 – Heater of Writing Gun No.1
Pin 22 – Grid No.1 of Writing Gun No.1
Pin 23 – Heater of Writing Gun No.1
Pin 24 – Grid No.3 of Writing Gun No.1
Pin 25 – Cathode of Writing Gun No.1
Flexible Lead–Screen (Encapsulated)
Recessed Small Ball Caps—
Over Pin No.3 Collimator (Viewing Grid No.3)
Over Pin No.13 Collector (Viewing Grid No.4)
Over Pin No.14 Backplate

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Electronic Components and Devices Harrison, N. J.

MAXIMUM AND MINIMUM RATINGS, ABSOLUTE-MAXIMUM VALUES

All voltages are shown with respect to the cathode of the viewing gun unless otherwise specified.

	Min	Max	
Screen Voltage			
Peak	-	11500	V
DC	0	11000	V
DC Backplate Voltage	0	35	V
Collector Voltage[a]	0	300	V
Viewing-grid-No.4			
Collimator Voltage[b]	0	300	V
Viewing-grid-No.3			
Viewing-Grid-No.2, Writing-Grid-No.4, and Writing-Grid-No.2 voltage[c,d]	0	200	V
Viewing-Grid-No.1 Voltage[a]	-150	0	V
Viewing-Gun Heater-to-Cathode Voltage	-125	125	V
Magnetic Shield Voltage	-200	200	V
Writing-Grid-No.4, Writing-Grid-No.2 To Any Deflecting Electrode Voltage	-500	500	V
Each gun[b]			
Writing-Grid-No.3 Voltage	0	2000	V
Each gun[c]			
Writing-Grid-No.1 Voltage	-200	(d)	V
Each gun[c]			
Writing-Gun Cathode Voltage	-2800	0	V
Each gun			
Writing-Gun Heater-To-Cathode Voltage	-125	125	V
Each gun			
Series Current-Limiting Resistor			
Unbypassed, in screen circuit	1	-	MΩ
Unbypassed, in viewing-grid-No.4 circuit	0.005	-	MΩ

RECOMMENDED OPERATING VALUES

All voltages are shown with respect to the cathode of the viewing gun unless otherwise specified.

Screen Voltage	10000	V
Backplate Voltage[e]	2	V
Collector Voltage	265	V
Viewing-grid No.4		
Collimator Voltage[f]	50 to 125	V
Viewing-grid No.3		
Viewing-Grid-No.2 Voltage[a]	100	V
Viewing-Grid-No.1 Voltage[f]	-50 to 0	V
Writing-Grid-No.3 Voltage	-2325 to -1975	V
Each gun[g]		
Writing-Grid-No.1 Voltage		
Each gun	(d,h)	V
Writing-Gun Cathode Voltage	-2400	V
Magnetic Shield Voltage	0	V
Average Deflecting Plate Voltage[j]	100	V
Circuit Values		
Grid-No.1 circuit resistance, either gun	1 max	MΩ

Circuit Values (cont'd)

Impedance in any deflecting electrode circuit[k]	0.01	max	MΩ
Backplate-circuit resistance	0.005	max	MΩ
Series current-limiting resistor:			
Unbypassed, in screen circuit	1		MΩ
Unbypassed, in collector viewing-grid-No.4 circuit	0.01		MΩ

CHARACTERISTICS

	Min	*Typ*	*Max*	
Useful Viewing Diameter	4	-	-	in
Brightness (Luminance)[m]	-	2500	-	fL
Viewing Duration[n]	15	-	-	s
Erase Time[k]	-	28	-	ms
Resolution[q]	70	-	-	lines/in
Undeflected Spot Position	-	-	(r)	mm
Deflection Factors				
DJ1 & DJ2	82	-	100	V/in
DJ3 & DJ4	82	-	100	V/in

[a] These voltages should never be adjusted to values which will permit the display of a sharply-defined circular area of brightness having a diameter of less than 3.5 inches. See *Operating Procedure* for the proper set-up to follow.

[b] Grids No.4 and No.2 of writing gun and the grid No.2 of viewing gun are connected within the tube.

[c] Voltages are shown with respect to cathode of writing gun.

[d] The writing-gun grid No.1 should never be more positive than necessary to write the display to saturated brightness for a given scanning and drive condition. In no case should the writing-gun grid-No.1 voltage have a value greater than zero with respect to the writing-gun cathode.

[e] The backplate should be maintained at 2 volts between erasing pulses when dynamic erasure is employed.

[f] Adjusted for brightest, most uniform, full-size pattern.

[g] Adjusted for the smallest, most circular spot.

[h] The bias-voltage value for writing-beam cutoff is between -60 and -100 volts with respect to writing-gun cathode.

[j] With respect to the viewing-gun cathode for each pair of deflecting electrodes.

[k] Recommended value for minimum distortion because of viewing beam collection by the deflecting plates. Where strict display accuracy and display uniformity are not required, the impedance value for any deflecting-electrode circuit may be as high as 0.1 megohm maximum. For optimum performance, it is recommended that the deflecting-electrode-circuit impedances be approximately equal.

[m] Brightness (Luminance) is measured after the entire display is written to saturated brightness, the writing gun has been turned off, and with no erasing pulse applied.

[n] The time required for any 0.5-inch diameter area of the 4-inch-diameter viewing area to rise spontaneously (with no writing or erasing) from zero brightness (viewing-beam visual cutoff) to 10% of saturated brightness.

[p] With the display at saturated brightness, a series of rectangular pulses 5 milliseconds in width and at a repetition frequency of 2 p/s is applied to the backplate. The number of pulses required to just erase completely the center of the display is noted. This number is multiplied by 5 milliseconds to obtain the erase time. The amplitude of the erase pulses is adjusted to obtain the minimum erase time.

[q] Measured by the "shrinking" raster method under conditions of continuous writing and erasing with erase pulses of 60 μsec width and a repetition frequency of 300 p/s. The amplitude of the erase pulses is adjusted to provide 3.5-second erasure and grid No.1 is adjusted to provide 1000 foot-lamberts brightness of the just "shrunken" raster.

[r] The undeflected spot position must fall within a square having a 15 millimeter side (maximum) centered on the tube face and parallel to a trace produced by one set of deflecting plates.

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Performance Data:

Writing Ability and *Writing Uniformity* characteristics are measured singly for both guns. A 3.5 x 3.5 inch raster is centered on the tube face. Vertical scanning is accomplished by an interrupted linear sawtooth waveform having a scan time of 625 microseconds and a prf of 500 p/s. Horizontal scanning is provided by a triangular waveform having a scan rate of 3.5 inches per second.

Writing Ability. The writing-gun grid No. 1 of the gun under test is driven above cutoff during the vertical scan time by white noise, of approximately 5 megacycles bandwidth, having a zero-to-peak amplitude of approximately 35 volts. The display brightness under these conditions shall be at least 20% of saturated brightness.

Writing Uniformity. This characteristic is determined under the same conditions as specified above except that the rms amplitude of the white noise is adjusted to produce brightness of 40% of saturated brightness of the dimmest area in the display. The measured brightness at the brightest area of the display shall be not more than 80% of saturated brightness.

Environmental Tests:

The 7268A is designed to withstand the following operational and non-operational environmental tests.

Operational Tests:

Sinusoidal Vibration. This test consists of tube vibration in each of three orthogonal axes. One of these axes is in the plane passing through the major axis of the tube and the center of the tube-base key. The tube is mounted so that its major axis is parallel to the plane of the earth. A total of 6 cycles of swept sinusoidal vibration, from 10 to 500 and back to 10 cycles per second, is performed. The duration of a sweep cycle is 15 minutes. The frequencies of any resonant points are noted. The sinusoidal vibration schedule is shown below.

Double Amplitude inches	Peak Acceleration g's	Sweep Frequency c/s	Sweep Cycle Duration minutes
0.27	-	10 to 20	15
-	4	20 to 46	
-	2	46 to 500	
-	2	500 to 46	
-	4	46 to 20	
0.27	-	20 to 10	

Vibration of Resonance. This test consists of tube vibration at the resonant point or points determined in *Sinusoidal Vibration* for a period of 30 minutes. If more than one

resonant point is noted for a given axis, the tube is vibrated for a total of 30 minutes at that resonant point in each axis most likely to produce tube failure. If no resonant points are determined in *Sinusoidal Vibration*, the tube is vibrated for 60 minutes at a frequency of 55 cycles per second.

Low Pressure - High Temperature. This test consists of tube storage for a period of not less than one hour at a temperature of +100 °C. At the termination of this storage period, the tube is operated with the values shown under *Recommended Operating Values* applied and at a pressure equivalent to an altitude of 32,000 feet. The temperature is then reduced to +53 °C. The tube is stored at this temperature for 1 hour and then is operated with normal voltages applied at a pressure equivalent to an altitude of 60,000 feet.

Low Temperature. This test consists of the tube being maintained at a temperature of -65 °C for 48 hours. At the end of this period and while the tube is still at -65 °C, the tube is operated with recommended voltages applied for 15 minutes.

Non-Operational Tests:

Temperature Cycling. This test consists of tube storage for a period of not less than 2 hours at a temperature of -65 °C followed within 5 minutes by storage for a period of 2 hours at a temperature of +100 °C. A minimum of five consecutive cycles are performed.

High Pressure. This test consists of tube exposure to an absolute pressure of 45 pounds per square inch for a period of at least 60 seconds. This pressure shall be attained within 60 seconds.

Torque. This test consists of the application of a torque of 40 inch-pounds between the integral magnetic shield and the tube base.

Salt Spray. This test consists of tube exposure to a fine spray from a salt solution for a period of 48 hours. The ambient temperature is maintained at approximately 35 °C.

OPERATING PROCEDURE

The following steps should be followed when the 7268A is first placed in operation. Refer to the precautions shown under *Operating Considerations* in the publication ICE-277 "RCA Display-Storage Tubes". *Note that all electrode voltages are referred to the cathode of the viewing gun unless otherwise specified.*

1. *Viewing Gun*-Apply power to the heater of the viewing gun and allow 60 seconds for the cathode to reach normal operating temperature. Next apply the following voltages to the viewing-gun electrodes: zero volts to the viewing-gun cathode, zero volts to the viewing-gun grid No. 1, +100 volts to the viewing-gun grid No. 2, +125 volts to the collimator, +265 volts to the collector, +2 volts to the backplate, and +10,000 volts to the screen. Except for the application of screen voltage, which may be increased, at the user's option,

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from 0 volts to 10,000 volts slowly, all of the above voltage values should be applied to the tube simultaneously and without first passing through intermediate voltage values. Next apply dynamic erasing pulses to the backplate. Adjust the viewing-gun grid-No. 1 voltage to a value midway between zero volts and that voltage at which the viewing diameter begins to decrease. Reduce the collimator voltage until the viewing diameter starts to decrease, and then increase the collimator voltage by 10 volts. The storage property of the tube can be observed by setting the amplitude of the dynamic erasing pulses at +12 volts for several seconds and by then reducing it to zero volts. As the erasing pulse amplitude is reduced the screen should go dark. The 7268A is now storing an overall "black picture" and stays in this condition until the screen begins to brighten as a result of the storage grid being gradually discharged by positive ions landing on it.

2. *Writing Gun*—Apply power to the heater of the writing gun and allow 60 seconds for the cathode to reach normal operating temperature. Then, with reference to the typical operating values shown in the tabulated data under *Recommended Operating Values,* set the grid-No. 1 voltage to cutoff, and apply dc voltages to the electrodes of the writing gun. With the screen made dark by the charging method described under (1), the grid-No. 1 bias is reduced until the writing beam is seen as a spot on the screen. If the beam is caused to move, either by centering adjustment or by application of deflection voltage, it should leave a bright trace. After an area has been written to full brightness, the writing-beam spot may be seen as a slightly brighter spot on the bright background. Writing-beam focus can then be optimized by adjusting the grid-No. 3 voltage.

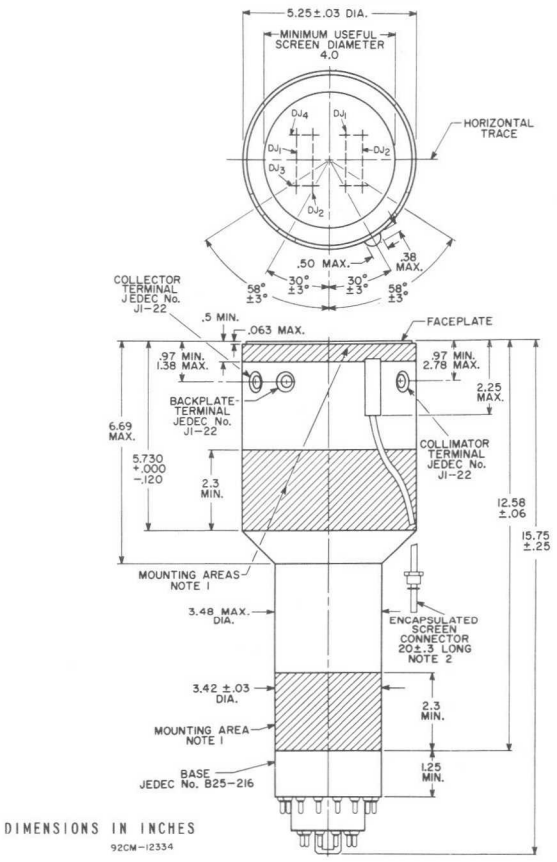
3. *Final Display Adjustments*—The dc bias and the video-signal amplitude applied to grid No. 1 or cathode of the writing gun should be adjusted to set the black level and the highlight level in the display. These adjustments depend on the scanning rate used. Resolution decreases with increasing writing-gun beam current. Excessive writing-gun beam current will produce screen saturation and any further beam-current increase will not produce additional highlight brightness and may also decrease half-tone rendition. It is recommended that the writing-beam current always be adjusted to a minimum value to produce the best display without saturation of highlight brightness. The dynamic erasing-pulse amplitude and duty cycle should be adjusted in accordance with the information contained in ICE-277. The collimator voltage should be adjusted for optimum display uniformity. If the collimator voltage is too high, the center area of the display will tend to erase slowly. If the collimator voltage is too low, the edges of the display will tend to erase slowly.

The following operating precautions must be followed to protect the 7268A from inadvertent damage—

1. Do not exceed maximum ratings.
2. Be sure to include the screen resistor.
3. Be sure to include the collector resistor.

4. Do not apply excessive writing-beam current density.
5. Protect against scanning failure.
6. Protect against loss of bias.
7. Apply voltages to tube in correct order.
8. Never write unless viewing beam is on.
9. Stay within recommended viewing-grid voltage ranges.

DIMENSIONAL OUTLINE



Note 1: The indicated areas are recommended for mounting purposes.

Note 2: Amp Part No. Amp 832 692-0; manufactured by Aircraft Marine Products, Inc., Harrisburg, Pa., or equivalent.

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BEAM POWER TUBE

FORCED-AIR COOLED AT MAXIMUM RATINGS

315 Watts CW Input (ICAS) up to 60 Mc
235 Watts CW Input (ICAS) at 175 Mc

GENERAL DATA

Electrical:

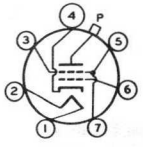
Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	3.1	amp
Mu-Factor, grid No.2 to grid No.1 for plate volts = 250, grid-No.2 volts = 250, and plate ma. = 100	8	
Direct Interelectrode Capacitances (Approx):		
Grid No.1 to plate	0.4	μμf
Grid No.1 to grid No.2 & internal shield	10	μμf
Grid No.1 to cathode and heater	8	μμf
Grid No.2 & internal shield to plate	10	μμf
Grid No.2 & internal shield to cathode and heater	2.2	μμf
Plate to cathode and heater	0.14	μμf
Heater to cathode	17	μμf

Mechanical:

Operating Position	Any
Maximum Overall Length	4.65"
Seated Length	4.08" ± 0.08"
Maximum Diameter	2.06"
Weight (Approx.)	3.5 oz
Bulb	T16
Socket	Johnson No.122-105*, or equivalent
Base	Large-Button Septar 7-Pin (JEDEC No.E7-55)

BOTTOM VIEW

Pin 1 - Heater
Pin 2 - Heater
Pin 3 - Grid No.2, Internal Shield
Pin 4 - Cathode



Pin 5 - Grid No.2, Internal Shield
Pin 6 - Grid No.1
Pin 7 - Grid No.2, Internal Shield
P - Plate

Cooling—Free circulation of air around the tube is required. Under operating conditions at maximum ratings, some forced-air cooling will be required from a small fan to prevent exceeding the specified maximum bulb temperature.

Bulb Temperature (At hottest point)	250 max.	°C

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BEAM POWER TUBE

AF POWER AMPLIFIER & MODULATOR — Class AB_1♦

	CCS●	ICAS●●	
Maximum Ratings, *Absolute-Maximum Values:*			
DC PLATE VOLTAGE	1100 max.	1350 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	425 max.	425 max.	volts
MAX.-SIGNAL DC PLATE CURRENT■	340 max.	340 max.	ma
MAX.-SIGNAL PLATE INPUT■	180 max.	250 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT■	20 max.	20 max.	watts
PLATE DISSIPATION■	60 max.	80 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	135 max.	135 max.	volts
Heater positive with respect to cathode	135 max.	135 max.	volts
Typical Operation:			
Values are for 2 tubes			
DC Plate Voltage	1000	1250	volts
DC Grid-No.2 Voltage§	400	400	volts
DC Grid-No.1 (Control-Grid) Voltage**	-50	-50	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage	88	92	volts
Zero-Signal DC Plate Current	78	88	ma
Max.-Signal DC Plate Current	330	370	ma
Max.-Signal DC Grid-No.2 Current	90	90	ma
Effective Load Resistance (Plate to plate)	6800	7880	ohms
Max.-Signal Driving Power (Approx.)	0	0	watts
Max.-Signal Power Output (Approx.)	190	270	watts
Maximum Circuit Values:			
Grid-No.1-Circuit Resistance	30000 max.	30000 max.	ohms

LINEAR RF POWER AMPLIFIER — Class AB_1
Single-Sideband Suppressed-Carrier Service

	CCS●	ICAS●●	
Maximum Ratings, *Absolute-Maximum Values:*			
	Up to 60 Mc		
DC PLATE VOLTAGE	1100 max.	1350 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	425 max.	425 max.	volts
MAX.-SIGNAL DC PLATE CURRENT	340 max.	340 max.	ma

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BEAM POWER TUBE

	CCS●		ICAS●●		
MAX.-SIGNAL PLATE INPUT. . . .	180	max.	250	max.	watts
MAX.-SIGNAL GRID-No.2 INPUT. .	20	max.	20	max.	watts
PLATE DISSIPATION.	60	max.	80	max.	watts
PEAK HEATER-CATHODE VOLTAGE:					
Heater negative with respect to cathode	135	max.	135	max.	volts
Heater positive with respect to cathode	135	max.	135	max.	volts
Typical Operation:					
	At 60 Mc				
DC Plate Voltage	1000		1250		volts
DC Grid-No.2 Voltage§.	400		400		volts
DC Grid-No.1 (Control-Grid) Voltage**.	−50		−50		volts
Zero-Signal DC Plate Current .	39		44		ma
Effective RF Load Resistance	3400		3940		ohms
With "Single-Tone Modulation":♦♦					
Max.-signal dc plate current.	165		185		ma
Max.-signal dc grid-No.2 current.	45		45		ma
Max.-signal peak rf grid-No.1 voltage	44		46		volts
Max.-signal driver power output (Approx.)	4.5		4.5		watts
Output-circuit efficiency (Approx.).	90		90		%
Max.-signal useful power output (Approx).	95✱		135✱		watts
With "Two-Tone Modulation":♦					
Average dc plate current . .	122		137		ma
Average dc grid-No.2 current.	26		26		ma
Max.-resultant-signal peak rf grid-No.1 voltage . . .	44		46		volts
Output-circuit efficiency (Approx.).	90		90		%
Distortion-products level:♠					
3rd order.	−26Φ		−26Φ		db
5th order.	−33Φ		−33Φ		db
Useful power output (Approx.):					
Average.	47.5✱		67.5✱		watts
Peak envelope.	95✱		135✱		watts
Maximum Circuit Values:					
Grid-No.1-Circuit Resistance.	30000	max.	30000	max.	ohms

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BEAM POWER TUBE

LINEAR RF POWER AMPLIFIER — Class B
Single-Sideband Suppressed-Carrier Service

High-Mu Triode Connection▲

	CCS●		ICAS●●		
Maximum Ratings, *Absolute-Maximum Values:*					
	Up to 60 Mc				
DC PLATE VOLTAGE.	1100	max.	1350	max.	volts
MAX.-SIGNAL DC PLATE CURRENT.	340	max.	340	max.	ma
MAX.-SIGNAL DC COMBINED GRIDS No.1 & No.2 CURRENT .	170	max.	170	max.	ma
MAX.-SIGNAL PLATE INPUT . . .	180	max.	250	max.	watts
PLATE DISSIPATION	60	max.	80	max.	watts
PEAK HEATER-CATHODE VOLTAGE:					
Heater negative with respect to cathode. . . .	135	max.	135	max.	volts
Heater positive with respect to cathode. . . .	135	max.	135	max.	volts
Typical Operation:					
In cathode-drive circuit at 60 Mc with "Single-Tone Modulation"●●					
DC Plate-to-Grids No.1 & No.2 Voltage.	1000		1250		volts
DC Grids No.1 & No.2 Voltage	0		0		volts
Zero-Signal DC Plate Current.	20		25		ma
Effective RF Load Resistance.	3400		3680		ohms
Max.-Signal DC Plate Current.	170		180		ma
Max.-Signal DC Combined Grids No.1 & No.2 Current .	108		94		ma
Max.-Signal Peak RF Cathode-to-Grids No.1 & No.2 Voltage.	40		40		volts
Max.-Signal Driver Power Output (Approx.)▲▲	13		15		watts
Output-Circuit Efficiency (Approx.)	90		90		%
Max.-Signal Useful Power Output (Approx.).	100✚		140✚		watts

PLATE-MODULATED RF POWER AMPLIFIER — Class C Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1

	CCS●		ICAS●●		
Maximum Ratings, *Absolute-Maximum Values:*					
For maximum plate voltage and maximum plate input above 60 Mc, see Rating Chart I					
DC PLATE VOLTAGE.	900	max.	1100	max.	volts

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BEAM POWER TUBE

	CCS●		ICAS●●		
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	425	max.	425	max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-300	max.	-300	max.	volts
DC PLATE CURRENT	280	max.	280	max.	ma
DC GRID-No.1 CURRENT	25	max.	30	max.	ma
PLATE INPUT	160	max.	210	max.	watts
GRID-No.2 INPUT	13.5	max.	13.5	max.	watts
PLATE DISSIPATION	40	max.	50	max.	watts
PEAK HEATER-CATHODE VOLTAGE:					
Heater negative with respect to cathode	135	max.	135	max.	volts
Heater positive with respect to cathode	135	max.	135	max.	volts
Typical Operation:					
At 60 Mc					
DC Plate Voltage	800		1000		volts
DC Grid-No.2 Voltage▲	400		400		volts
DC Grid-No.1 Voltage★	-105		-107		volts
Peak RF Grid-No.1 Voltage	110		114		volts
DC Plate Current	175		190		ma
DC Grid-No.2 Current	30		30		ma
DC Grid-No.1 Current (Approx.)	4		4		ma
Driver Power Output (Approx.)♣,▲▲	4		4		watts
Output-Circuit Efficiency (Approx.)	90		90		%
Useful Power Output (Approx.)	90♣		130♣		watts
At 175 Mc					
DC Plate Voltage	535		665		volts
DC Grid-No.2 Voltage▲	400		400		volts
DC Grid-No.1 Voltage★	-115		-119		volts
DC Plate Current	200		220		ma
DC Grid-No.2 Current	15		15		ma
DC Grid-No.1 Current (Approx.)	6		6		ma
Driver Power Output (Approx.)▲▲	10		10		watts
Output-Circuit Efficiency (Approx.)	85		85		%
Useful Power Output (Approx.)	60♣		85♣		watts
Maximum Circuit Values:					
Grid-No.1-Circuit Resistance‡	30000	max.	30000	max.	ohms

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BEAM POWER TUBE

RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy†
and
RF POWER AMPLIFIER — Class C FM Telephony

	CCS●		ICAS●●		
Maximum Ratings, *Absolute-Maximum Values:*					
For maximum plate voltage and maximum plate input above 60 Mc, see Rating Chart II					
DC PLATE VOLTAGE	1100	max.	1350	max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	425	max.	425	max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-300	max.	-300	max.	volts
DC PLATE CURRENT	340	max.	340	max.	ma
DC GRID-No.1 CURRENT	25	max.	30	max.	ma
PLATE INPUT	235	max.	315	max.	watts
GRID-No.2 INPUT	20	max.	20	max.	watts
PLATE DISSIPATION	60	max.	80	max.	watts
PEAK HEATER-CATHODE VOLTAGE:					
Heater negative with respect to cathode	135	max.	135	max.	volts
Heater positive with respect to cathode	135	max.	135	max.	volts
Typical Operation:					
At 60 Mc					
DC Plate Voltage	1000		1250		volts
DC Grid-No.2 Voltage■■	300		300		volts
DC Grid-No.1 Voltage●●	-79		-80		volts
Peak RF Grid-No.1 Voltage	98		111		volts
DC Plate Current	225		250		ma
DC Grid-No.2 Current	25		30		ma
DC Grid-No.1 Current (Approx.)	5		5		ma
Driver Power Output (Approx.)♣,▲▲	4		4		watts
Output-Circuit Efficiency (Approx.)	90		90		%
Useful Power Output (Approx.)	160♣		225♣		watts
Typical Operation:					
At 175 Mc					
DC Plate Voltage	650		850		volts
DC Grid-No.2 Voltage■■	400		400		volts
DC Grid-No.1 Voltage●●	-99		-100		volts
DC Plate Current	265		275		ma
DC Grid-No.2 Current	15		15		ma
DC Grid-No.1 Current (Approx.)	7.5		8		ma
Driver Power Output (Approx.)▲▲	10		10		watts

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RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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BEAM POWER TUBE

	CCS●	*ICAS*●●	
Output-Circuit Efficiency (Approx.)	85	85	%
Useful Power Output (Approx.)	95✤	135✤	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance‡	30000 max.	30000 max.	ohms

○ Without external shield.

* E.F. Johnson Company, Waseca, Minnesota.

♦ Subscript 1 indicates that grid-No.1 current does not flow during any part of the input cycle.

● Continuous Commercial Service.

●● Intermittent Commercial and Amateur Service.

■ Averaged over any audio-frequency cycle of sine-wave form.

§ Obtained preferably from a fixed supply.

** Obtained from a fixed supply.

♦♦ "Single-Tone Modulation" operation refers to that class of amplifier service in which the input consists of a monofrequency rf signal having constant amplitude. This signal is produced in a single-sideband suppressed-carrier system when a single audio frequency of constant amplitude is applied to the input of the system.

♦ "Two-Tone Modulation" operation refers to that class of amplifier service in which the input consists of two equal monofrequency rf signals having constant amplitude. These signals are produced in a single-sideband suppressed-carrier system when two equal-and-constant-amplitude audio frequencies are applied to the input of the system.

✤ This value of useful power is measured at load of output circuit having indicated efficiency.

♠ Referenced with respect to the peak envelope power output obtained at maximum drive.

ф Maximum encountered at any driving level up to 100%.

⧗ Grids No.1 and No.2 connected together.

▲▲ Driver stage is required to supply tube losses and rf-circuit losses. The driver stage should be designed to provide an excess of power above the indicated values to take care of variations in line voltage, in components, in initial tube characteristics, and in tube characteristics during life.

▲ Obtained preferably from a separate source modulated along with the plate supply, or from the modulated plate supply through a series resistor. It is recommended that this resistor be adjustable to permit obtaining the desired operating plate current after initial tuning adjustments are made.

★ Obtained from a grid-No.1 resistor or from a combination of grid-No.1 resistor with either fixed supply or cathode resistor. The combination of grid resistor and fixed supply has the advantage of not only protecting the tube from damage through loss of excitation but also of minimizing distortion by bias-supply compensation.

♣ Indicated values are for operation at 60 Mc. Less driver power output is required at frequencies below 60 Mc.

‡ If this value is insufficient to provide adequate bias, the additional required bias must be supplied by a cathode resistor or fixed supply.

† Key-down conditions per tube without amplitude modulation. Amplitude modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

■■ Obtained preferably from a separate source or from the plate-voltage supply with a voltage divider. If a series resistor is used, it should be adjustable to permit obtaining the desired operating plate current after initial tuning adjustments are completed. Grid-No.2 voltage must not exceed 500 volts under key-up conditions.

⊕⊕ Obtained from a grid-No.1 resistor, or from a combination of grid-No.1 resistor with either fixed supply or cathode resistor.

RCA

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BEAM POWER TUBE

OPERATING CONSIDERATIONS

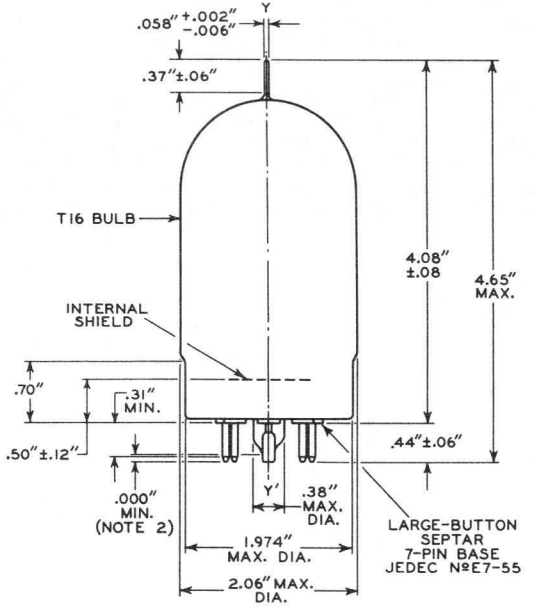
Shielding of the 7270 in rf service is required for stable operation. A convenient method of shielding is to mount the socket approximately 5/8" beneath a hole in the chassis plate so that when the 7270 is inserted in the socket, the internal shield (*See Dimensional Outline*) of the tube will be close to the edge of the hole and in the same plane as the chassis plate. This arrangement provides an effective shield to isolate the grid-No.1 circuit from the plate circuit.

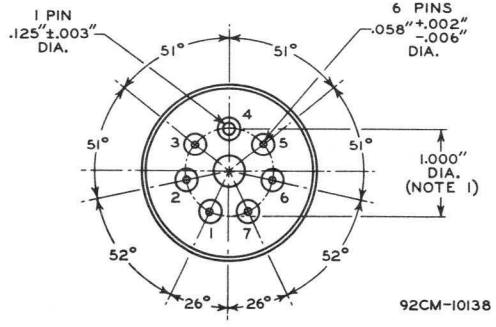
The *connection to the plate terminal* should be flexible in order to prevent subjecting the plate-terminal seal to any strain. The connection should never be soldered to the plate terminal. A plate connector of the heat-radiating type is recommended.

The *plate* shows no color when the 7270 is operated at maximum rated plate dissipation under CCS conditions. At maximum rated plate dissipation under ICAS conditions, the plate may show a barely discernible color in a dark room.

7270

BEAM POWER TUBE





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

7270

BEAM POWER TUBE

THE REFERENCE AXIS Y–Y' IS DEFINED AS THE AXIS OF THE BASE–PIN GAUGE DESCRIBED IN NOTE 1:

NOTE 1: ANGULAR VARIATIONS BETWEEN PINS AND VARIATION IN PIN–CIRCLE DIAMETER ARE HELD TO TOLERANCES SUCH THAT PINS WILL ENTER TO A DISTANCE OF 0.375" A FLAT–PLATE BASE–PIN GAUGE HAVING SIX HOLES 0.0800" ± 0.0005" AND ONE HOLE 0.1450" ± 0.0005" ARRANGED ON A 1.0000" ± 0.0005" CIRCLE AT SPECIFIED ANGLES WITH TOLERANCE OF ± 5' FOR EACH ANGLE. GAUGE IS ALSO PROVIDED WITH A HOLE 0.500" ± 0.010" CONCENTRIC WITH PIN CIRCLE WHOSE CENTER IS ON THE AXIS Y–Y'.

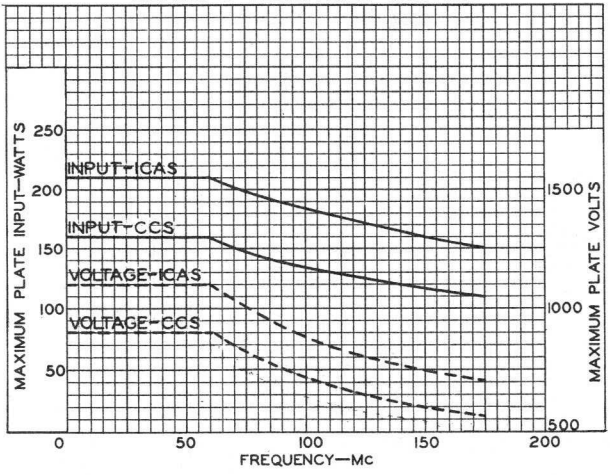
NOTE 2: EXHAUST TIP WILL NOT EXTEND BEYOND THE PLANE WHICH PASSES THROUGH THE ENDS OF THE THREE LONGEST PINS.

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

RCA

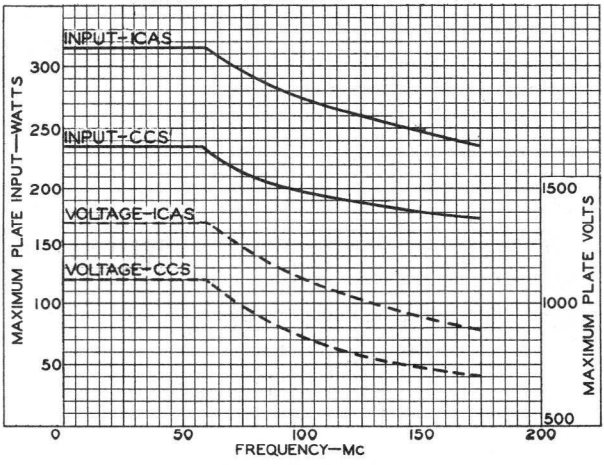
7270

RATING CHART I
CLASS C TELEPHONY SERVICE



92CS-10155

RATING CHART II
CLASS C TELEGRAPHY SERVICE



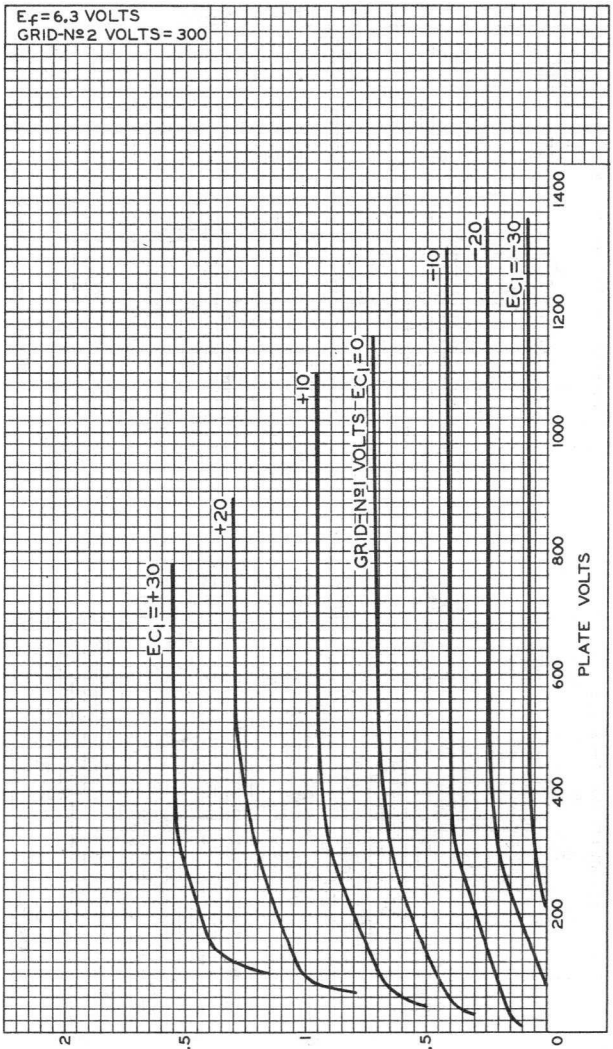
92CS-10156

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

RCA

7270

TYPICAL PLATE CHARACTERISTICS



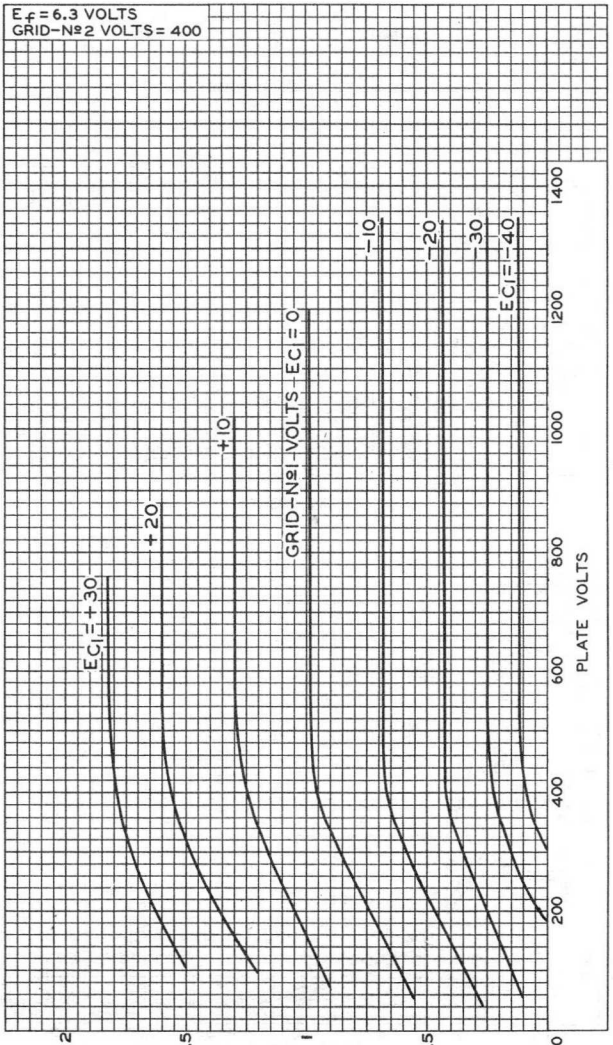
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-10157

RCA

7270

TYPICAL PLATE CHARACTERISTICS

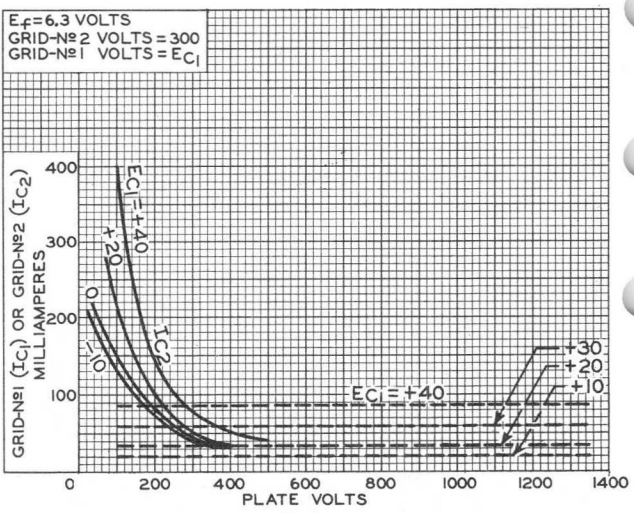


ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

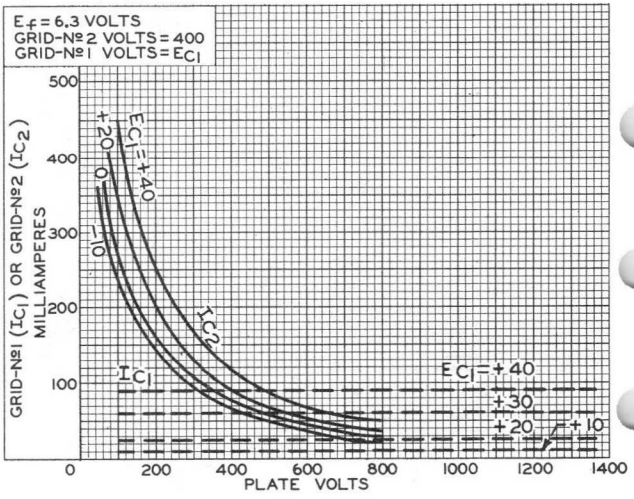
92CM-10175

7270

TYPICAL CHARACTERISTICS

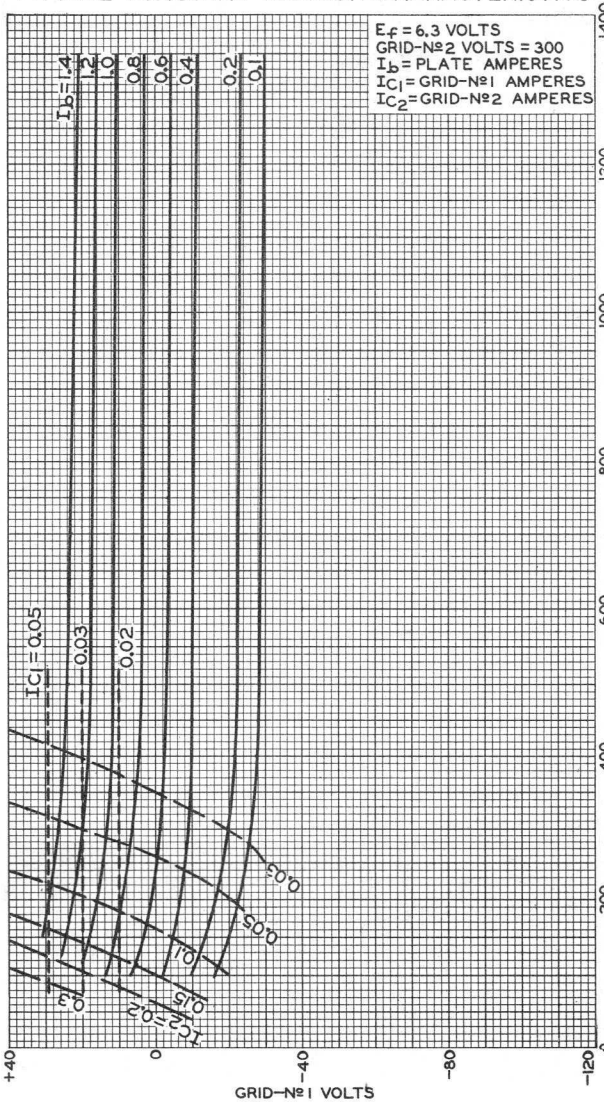


92CS-10158



92CS-10171

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



ELECTRON TUBE DIVISION

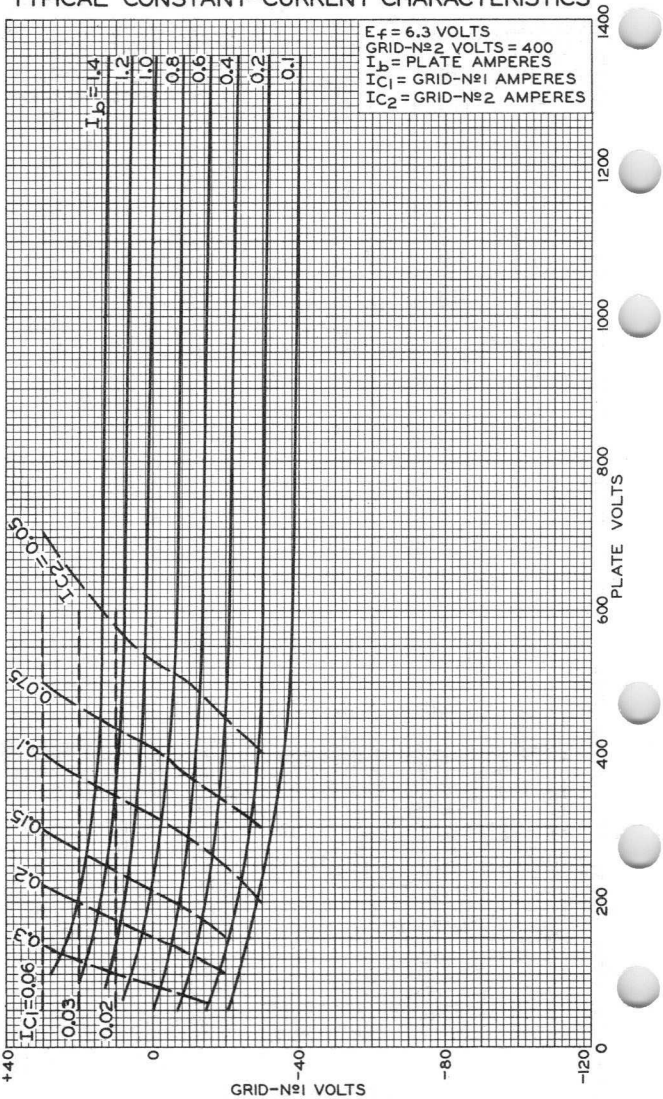
92CM-10169

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

7270

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



ELECTRON TUBE DIVISION

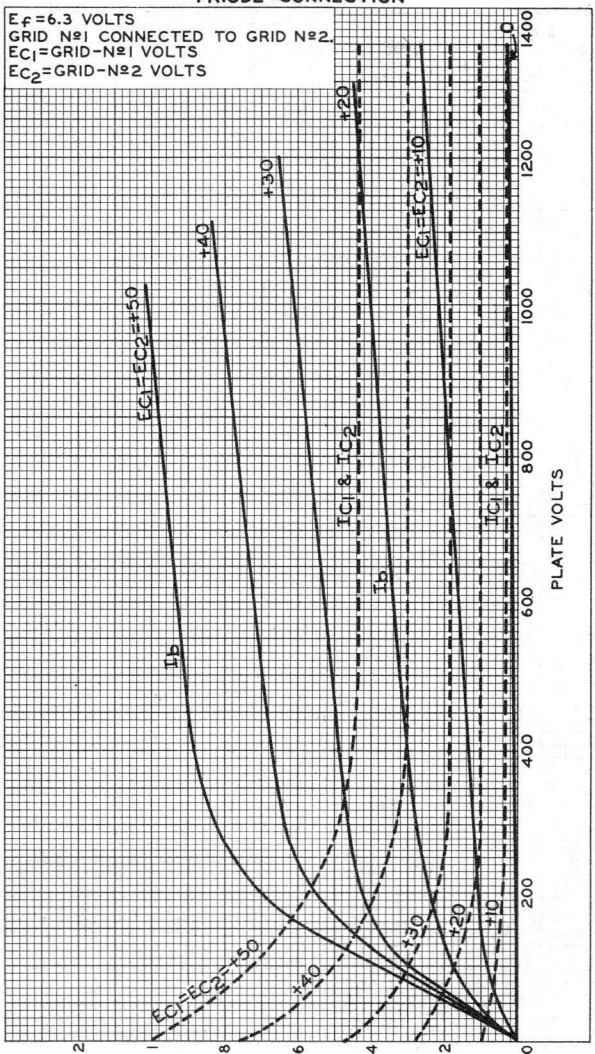
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-10176

RCA

7270

TYPICAL CHARACTERISTICS
TRIODE CONNECTION



ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CM-10173RI

7270

RCA

7270

TYPICAL CONSTANT-CURRENT CHARACTERISTICS

TRIODE CONNECTION



ELECTRON TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-10178R1

7271

BEAM POWER TUBE

FORCED-AIR COOLED AT MAXIMUM RATINGS
315 WATTS CW INPUT (ICAS) UP TO 60 Mc
235 WATTS CW INPUT (ICAS) AT 175 Mc

For use in mobile equipment operating directly from 6-cell storage-battery systems

The 7271 is the same as the 7270 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (DC)	13.5 $^{+10\%}_{-20\%}$	volts
Current at 13.5 volts.	1.25	amp

SPECIAL PERFORMANCE DATA

The 7271 is intended primarily for operation in mobile equipment having a nominal 12-volt power-supply system. In properly designed equipment, a 10% reduction in electrode voltages caused by a 10% reduction in the voltage of a 13.5-volt power supply will result in less than 3 db decrease in useful power output from any individual 7271. Similarly, a 20% reduction will result in a decrease in useful power output not exceeding 8 db.

Image Orthicon

MAGNETIC FOCUS MAGNETIC DEFLECTION

ANTI-GHOST IMAGE SECTION

For Outdoor and Studio Pickup with Black-and-White TV Cameras

DATA

General:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.6	amp
Direct Interelectrode Capacitance (Approx.):		
Anode to all other electrodes	12	μμf
Spectral Response		S-10
Wavelength of Maximum Response	4500 ± 300	angstroms
Photocathode, Semitransparent:		
Rectangular image (4 x 3 aspect ratio):		
Useful size of	1.8" max.	diagonal

Note: The size of the optical image focused on the photocathode should be adjusted so that its maximum diagonal does not exceed the specified value. The corresponding electron image on the target should have a size such that the corners of the rectangle just touch the target ring; a condition that may be achieved in some camera designs with a 1.6" diagonal image on the photocathode.

Orientation of. .Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through center of faceplate and pin 7 of the shoulder base. The horizontal and vertical scan should preferably start at the corner of the raster nearest pin 6 of the shoulder base.

Focusing Method	.Magnetic
Deflection Method	.Magnetic
Overall Length	15.20" ± 0.25"
Greatest Diameter of Bulb	3.00" ± 0.06"
Minimum Deflection-Coil Inside Diameter	2-3/8"
Deflecting-Coil Length	5"
Focusing-Coil Length	10"
Alignment-Coil:	
Length	15/16"
Position on neck	.Centerline of coil located 8.5" from flat area of the jumbo annular base.
Photocathode Distance Inside End of Focusing Coil	1/2"

Operating Position. . . The tube should never be operated in a vertical position with the Diheptal-base end up nor in any other position where the axis of the tube with the base up makes an angle of less than 20° with the vertical.

Weight (Approx.) . . . . . 1 lb 2 oz

7293A

Shoulder Base. . . . . .Keyed Jumbo Annular 7-Pin

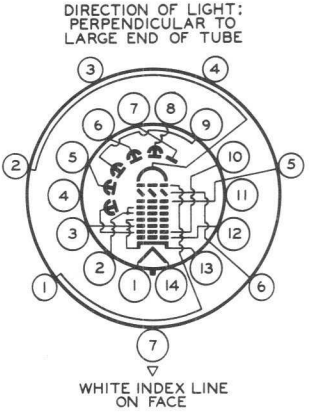
BOTTOM VIEW

Pin 1 - Grid No.6
Pin 2 - Photocathode
Pin 3 - Internal Connection—Do Not Use
Pin 4 - Internal Connection—Do Not Use
Pin 5 - Grid No.5
Pin 6 - Target
Pin 7 - Internal Connection—Do Not Use

End Base . . . . . .Small-Shell Diheptal 14-Pin (JEDEC Group 5, No.B14-45)

BOTTOM VIEW

Pin 1 - Heater
Pin 2 - Grid No.4, Field Mesh
Pin 3 - Grid No.3
Pin 4 - Internal Connection—Do Not Use
Pin 5 - Dynode No.2
Pin 6 - Dynode No.4
Pin 7 - Anode
Pin 8 - Dynode No.5
Pin 9 - Dynode No.3
Pin 10 - Dynode No.1, Grid No.2
Pin 11 - Internal Connection—Do Not Use
Pin 12 - Grid No.1
Pin 13 - Cathode, Suppressor Grid
Pin 14 - Heater



NOTE: In the tube symbol, the suppressor grid connected to the cathode, and the field-mesh grid connected to grid No.4, are intentionally without numbers to avoid upsetting industry practice of associating functional camera control knobs with specified grid numbers. For example, beam-focus control is generally associated with knob identified as G_4 (grid No.4).

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

PHOTOCATHODE:		
Voltage.	-700 max.	volts
Illumination	50 max.	fc
OPERATING TEMPERATURE:		
Any part of bulb	65 max.	°C
Of bulb at large end of tube (Target section)	35 min.	°C
TEMPERATURE DIFFERENCE:		
Between target section and any part of bulb hotter than target section	5 max.	°C
GRID-No.6 VOLTAGE.	-700 max.	volts
TARGET VOLTAGE:		
Positive value	10 max.	volts
Negative value	10 max.	volts
GRID-No.5 VOLTAGE.	150 max.	volts

GRID-No.4 VOLTAGE	350 max.	volts
GRID-No.3 VOLTAGE	400 max.	volts
GRID-No.2 & DYNODE-No.1 VOLTAGE	350 max.	volts
GRID-No.1 VOLTAGE:		
Negative-bias value	125 max.	volts
Positive-bias value	0 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	10 max.	volts
ANODE SUPPLY VOLTAGE[a]	1350 max.	volts
VOLTAGE PER MULTIPLIER STAGE	350 max.	volts

Typical Operating Values:[b]

Photocathode Voltage (Image Focus)[c]	-400 to -540	volts
Grid-No.6 Voltage (Accelerator)—		
Approx. 75% of photocathode voltage[d]	-300 to -405	volts
Target-Cutoff Voltage[e]	-3 to +1	volts
Grid-No.5 Voltage (Decelerator)	0 to 40	volts
Grid-No.4 Voltage (Beam Focus)[c]	140 to 180	volts
Grid-No.3 Voltage[f]	260 to 300	volts
Grid-No.2 & Dynode-No.1 Voltage	300	volts
Grid-No.1 Voltage for Picture Cutoff	-45 to -115	volts
Dynode-No.2 Voltage	600	volts
Dynode-No.3 Voltage	800	volts
Dynode-No.4 Voltage	1000	volts
Dynode-No.5 Voltage	1200	volts
Anode Voltage	1250	volts
Target-Temperature Range	35 to 45	°C
Minimum Peak-to-Peak Blanking Voltage	5	volts
Field Strength at Center of Focusing Coil[g]	75	gausses
Field Strength of Alignment Coil	0 to 3	gausses

Performance Data:

With conditions shown under Typical Operating Values and with camera lens set to bring the picture highlights one stop above the "knee" of the light-transfer characteristic

	Min.	*Average*	*Max.*	
Cathode Radiant Sensitivity at 4500 angstroms	-	0.028	-	μa/μw
Luminous Sensitivity (2870° K)	30	60	-	μa/lm
Anode Current (DC)	-	30	50	μa
Signal-Output Current (Peak to peak)	5	-	30	μa
Ratio of Peak-to-Peak Highlight Video-Signal Current to RMS Noise Current for bandwidth of 4.5 Mc.	35:1	45:1	-	←
Photocathode Illumination at 2870° K required to reach "knee" of light-transfer characteristic	-	0.01	0.028	fc

← Indicates a change.

Amplitude Response at 400 TV lines per picture height (Per cent of large-area black to large-area white)[h]	30	40	–	%
Limiting Horizontal Resolution	500	–	–	TV lines

[a] Dynode-voltage values are shown under *Typical Operating Values*.

[b] With 7293A operated in RCA-TK-11 or -TK-31 camera. Other cameras may require slightly different voltage ranges.

[c] Adjust for best focus.

[d] For minimum highlight flare or "ghost" the grid-No.6 voltage should be 73 per cent of the photocathode voltage.

[e] Normal setting of target voltage is +2 volts from target cutoff. The target supply voltage should be adjustable from -3 to +5 volts.

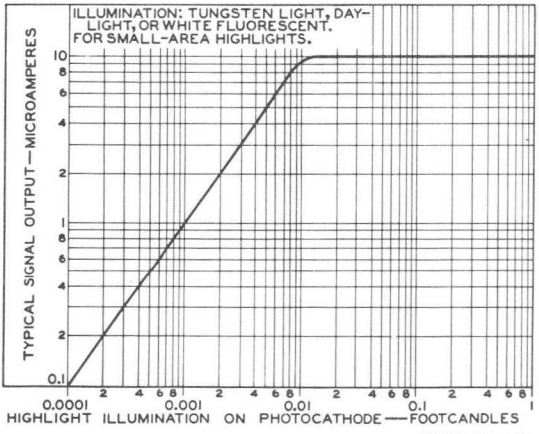
[f] Adjust to give the most uniformly shaded picture near maximum signal.

[g] Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

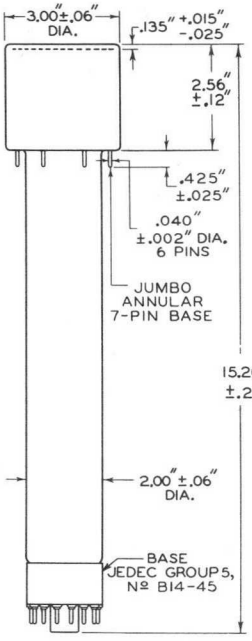
[h] Measured with amplifier having flat frequency response.

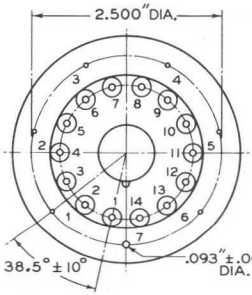
SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-10 RESPONSE is shown at front of this Section

BASIC LIGHT-TRANSFER CHARACTERISTIC



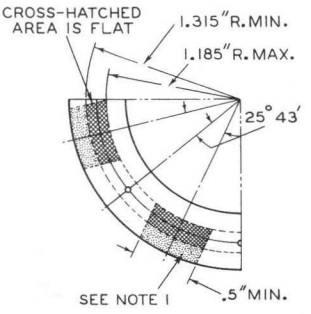
92CS-7296R2





ENLARGED BOTTOM VIEW

DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE



NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.

ANNULAR-BASE GAUGE

ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAUGE WITH:

a. SIX HOLES HAVING DIAMETER OF 0.065" ± 0.001" AND ONE HOLE HAVING DIAMETER OF 0.150" ± 0.001". ALL HOLES HAVE DEPTH OF 0.265" ± 0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047". ALL HOLES ARE SPACED AT ANGLES OF 51°26' ± 5' ON CIRCLE DIAMETER OF 2.500" ± 0.001".

b. SEVEN STOPS HAVING HEIGHT OF 0.187" ± 0.001", CENTERED BETWEEN PIN HOLES TO BEAR AGAINST FLAT AREAS OF BASE.

c. RIM EXTENDING OUT A MINIMUM OF 0.125" FROM 2.812" DIAMETER AND HAVING HEIGHT OF 0.126" ± 0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200" ± 0.001".

92CM-8293R3

7293A/L

Image Orthicon

LONG-LIFE TARGET
MAGNETIC FOCUS

MAGNETIC DEFLECTION
ANTI-GHOST IMAGE SECTION

For Outdoor and Studio Pickup with Black-and-White TV Cameras. The 7293A/L is Directly Interchangeable with the 7293A in All Cameras.

The 7293A/L is the same as the 7293A except utilizes a longer-life non-deteriorating glass target.

The sturdy, long-life, non-deteriorating, glass target of type 7293A/L is characterized by high gain, resistance to "burn-in", and the absence of any granular structure. Because charge transportation through this target material is electronic rather than ionic as in ordinary glass targets, the electrical characteristics of the target, such as secondary emission and resistivity, are essentially constant and sensitivity of the 7293A/L is stable throughout life.

Other important advantages of this target are that the undesirable characteristics of scene retention or "sticking-picture" and raster "burn-in" due to underscanning are significantly reduced. The resistance of the 7293A/L to image "burn-in" provides a highly desirable operational feature because it is not necessary to use an orbiter or continually move the camera when focused on a stationary scene.

OPERATING CONSIDERATIONS

Dos and Don'ts on Use of RCA-7293A/L

Dos

1. Allow 7293A/L to warm up prior to operation.
2. Hold temperature of the 7293A/L within operating range.
3. Make sure alignment coil is properly adjusted.
4. Adjust beam-focus control for best usable resolution.
5. Condition spare 7293A/L's by operating several hours once each month.
6. Determine proper operating point with target voltage adjusted to exactly 2 volts above target cutoff.
7. Uncap lens before voltages are applied to the 7293A/L.

Don'ts

1. Don't force the 7293A/L into its shoulder socket.
2. Don't operate the 7293A/L without scanning.
3. Don't operate a 7293A/L having an ion spot.
4. Don't use more beam current than necessary to discharge the highlights of the scene.
5. Don't turn off beam while voltages are applied to photocathode, grid No.6, target, dynodes, and anode during warm-up or standby operation.

7295-A

Image Orthicon

MAGNETIC FOCUS **MAGNETIC DEFLECTION**

EXCELLENT RESOLUTION CAPABILITY

For Outdoor and Studio Pickup with High-Quality Black-and-White TV Cameras. The 7295-A is Unilaterally Interchangeable with Type 7295.

DATA

General:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.6	amp
Direct Interelectrode Capacitance:		
Anode to all other electrodes	12	μμf
Spectral Response		S-10
Wavelength of Maximum Response	4500 ± 300	angstroms
Photocathode, Semitransparent:		
Rectangular image (4 x 3 aspect ratio):		
Useful size of	1.6" max.	diagonal

Note: The size of the optical image focused on the photocathode should be adjusted so that its maximum diagonal does not exceed the specified value. The corresponding electron image on the target should have a size such that the corners of the rectangle just touch the target ring.

Orientation of. . . Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through center of the faceplate and the grid-No.6 envelope terminal. The horizontal and vertical scan should start at the corner of the picture between the grid-No.6 and the photocathode envelope terminals.

Target-to-Mesh Spacing	0.002	in.
Focusing Method		Magnetic
Deflection Method		Magnetic
Overall Length	19.375" ± 0.310"	
Greatest Diameter of Bulb	4.500" ± 0.094"	
Minimum Deflecting-Coil Inside Diameter	3.2"	
Deflecting-Coil Length	7"	
Focusing-Coil Length	15"	
Alignment-Coil:		
Position on neck. . .	Centerline of magnetic field should be located 9.25" from the flat area of the shoulder.	
Operating Position	See *Operating Considerations*	
Weight (Approx.)	2.3 lbs	
Envelope Terminals	5	

BOTTOM VIEW▲

Terminal Over Pin 2 – Field Mesh
Terminal Over Pin 4 – Photocathode (PC)
Terminal On Side of Envelope
Opposite Base Key – Grid No.6 (G_6)

▲ See basing diagram on next page.

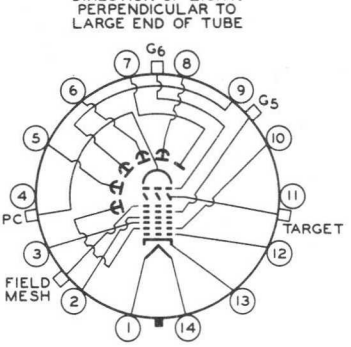
7295-A

Terminal Over Pin 9 – Grid No.5 (G_5)
Terminal Over Pin 11 – Target

End Base. . . . . Small-Shell Diheptal 14-Pin
(JEDEC Group 5, No.B14-45)

BOTTOM VIEW

Pin 1 – Heater
Pin 2 – Grid No.4
Pin 3 – Grid No.3
Pin 4 – Internal Connection—Do Not Use
Pin 5 – Dynode No.2
Pin 6 – Dynode No.4
Pin 7 – Anode
Pin 8 – Dynode No.5
Pin 9 – Dynode No.3
Pin 10 – Dynode No.1, Grid No.2
Pin 11 – Internal Connection—Do Not Use
Pin 12 – Grid No.1
Pin 13 – Cathode
Pin 14 – Heater



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

PHOTOCATHODE:		
Voltage.	−700 max.	volts
Illumination	50 max.	fc
OPERATING TEMPERATURE:		
Any part of bulb	65 max.	°C
Of bulb at large end of tube (Image section).	35 min.	°C
TEMPERATURE DIFFERENCE:		
Between image section and any part of bulb hotter than image section. . .	5 max.	°C
GRID-No.6 VOLTAGE.	−700 max.	volts
TARGET VOLTAGE:		
Positive value	10 max.	volts
Negative value	10 max.	volts
FIELD-MESH VOLTAGE●.	30 max.	volts
GRID-No.5 VOLTAGE.	300 max.	volts
GRID-No.4 VOLTAGE.	350 max.	volts
GRID-No.3 VOLTAGE.	400 max.	volts
GRID-No.2 & DYNODE-No.1 VOLTAGE.	350 max.	volts
GRID-No.1 VOLTAGE:		
Negative-bias value.	125 max.	volts
Positive-bias value.	0 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode. .	125 max.	volts
Heater positive with respect to cathode. .	10 max.	volts
ANODE SUPPLY VOLTAGE★.	1650 max.	volts
VOLTAGE PER MULTIPLIER STAGE	350 max.	volts

Typical Operating Values:♦

Photocathode Voltage	−600	volts
Grid-No.6 Voltage (Image Focus) Approx. 50% of photocathode voltage♦	−250 to −350	volts
Target Voltage Above Cutoff♠	2 to 3	volts
Field-Mesh Voltage●	15 to 25	volts
Grid-No.5 Voltage (Decelerator)	40	volts
Grid-No.4 Voltage (Beam Focus)	70 to 90	volts
Grid-No.3 Voltage♣	250 to 275	volts
Grid-No.2 & Dynode-No.1 Voltage	280	volts
Grid-No.1 Voltage for picture cutoff	−45 to −115	volts
Dynode-No.2 Voltage	600	volts
Dynode-No.3 Voltage	800	volts
Dynode-No.4 Voltage	1000	volts
Dynode-No.5 Voltage	1200	volts
Anode Voltage	1250	volts
Target-Temperature Range	35 to 45	°C
Minimum Peak-to-Peak Blanking Voltage	5	volts
Field Strength of Focusing Coil (Approx.):⊕		
At center of scanning section	60	gausses
In plane of photocathode	120	gausses
Field Strength of Alignment Coil	0 to 3	gausses

Performance Data:

With conditions shown under Typical Operating Values, target voltage adjusted to 3 volts above cutoff, and with the camera lens adjusted so that the picture highlights are twice those required to reach the "knee" of the accompanying Basic Light-Transfer-Characteristic Curve except as otherwise specified

	Min.	*Average*	*Max.*	
Cathode Radiant Sensitivity at 4500 angstroms	−	0.028	−	μa/μw
Anode Current (DC)	−	30	−	μa
Signal-Output Current (Peak to Peak)	5	−	30	μa
Ratio of Peak-to-Peak Highlight Video Signal Current to RMS Noise Current for Bandwidth of 4.5 Mc	−	65:1	−	
Photocathode Illumination at 2870° K Required to Reach "Knee" of Light Transfer Characteristic	−	0.04	0.075	fc
Amplitude Response at 400 TV Lines per Picture Height (Per cent of large-area black to large-area white)*	40	56	−	%

● With respect to grid No.4.

★ Dynode-voltage values are shown under Typical Operating Values.

♦ With 7295-A operated in RCA TK-12 camera at fixed photocathode voltage.

♦ Adjust for optimum focus.

♠ The target supply voltage should be adjustable from -5 to 5 volts.

♣ Adjust to give the most uniformly shaded picture near maximum signal.

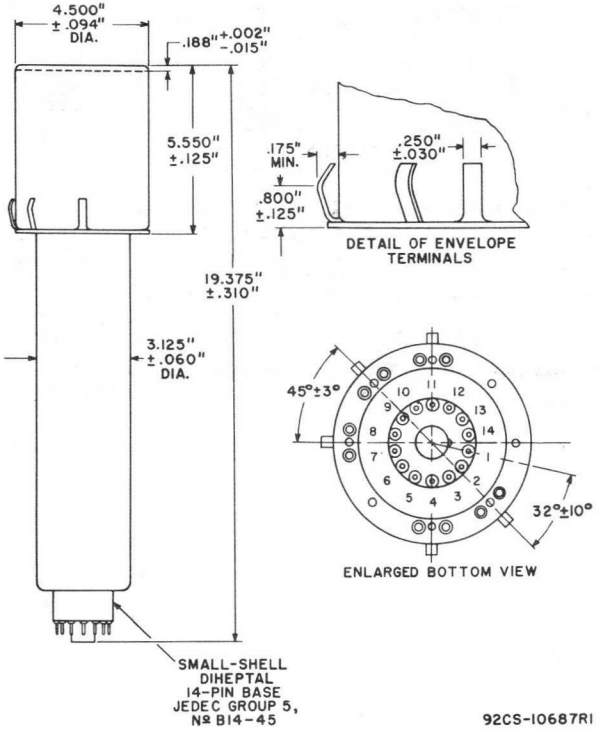
⊕ Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

Measured with amplifier having flat frequency response.

OPERATING CONSIDERATIONS

The *operating position* of the 7295-A should preferably be such that any loose particles in the neck of the tube will not fall down and strike or become lodged on the target. Therefore, it is recommended that the tube never be operated in a vertical position with the Diheptal-base end up nor in any other position where the axis of the tube with base up makes an angle of less than 20° with the vertical.

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Photosensitive Device having S-10 Response
is shown at the front of this Section


4.500"
± .094"
DIA.
.188" +.002"
-.015"
5.550"
±.125"
19.375"
±.310"
3.125"
± .060"
DIA.
SMALL-SHELL
DIHEPTAL
14-PIN BASE
JEDEC GROUP 5,
Nº B14-45
.175"
MIN.
.800"
±.125"
.250"
±.030"
DETAIL OF ENVELOPE
TERMINALS
45°±3°
32°±10°
1
2
3
4
5
6
7
8
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10
11
12
13
14
ENLARGED BOTTOM VIEW
92CS-10687RI

BASIC LIGHT-TRANSFER CHARACTERISTIC

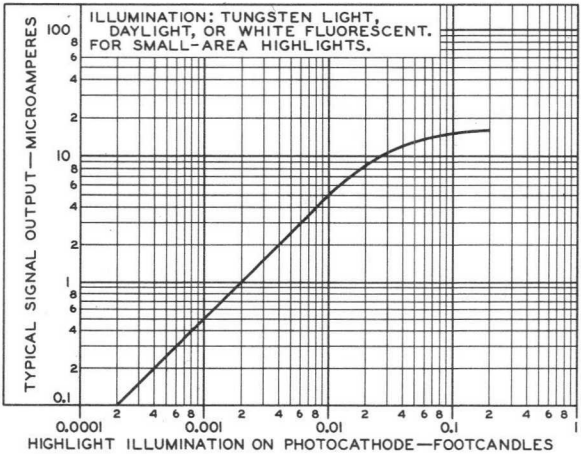


Image Orthicon

LONG-LIFE TARGET
MAGNETIC FOCUS

FIELD-MESH TYPE
MAGNETIC DEFLECTION

For High-Quality Black-and-White TV Pickup in Studio or Outdoor Service. The 7295B/L is Directly Interchangeable with the 7295, 7295A, and 7295B in all Cameras.

The 7295B/L is the same as the 7295B except utilizes a stable, long-life glass target.

The stable, long-life, glass target of type 7295B/L is characterized by high gain, resistance to "burn-in", and the absence of any granular structure. Because charge transportation through this target material is electronic rather than ionic as in ordinary glass targets, the electrical characteristics of the target, such as secondary emission and resistivity, are essentially constant and sensitivity of the 7295B/L is stable throughout life.

Other important advantages of this target are that the undesirable characteristics of scene retention or "sticking picture" and raster "burn-in" due to underscanning are significantly reduced. The resistance of the 7295B/L to image "burn-in" provides a highly desirable operational feature because it is not necessary to use an orbiter or continually move the camera when focused on a stationary scene.

OPERATING CONSIDERATIONS

Dos and Don'ts on Use of RCA-7295B/L

Dos

1. Allow the 7295B/L to warm up prior to operation.
2. Hold temperature of the 7295B/L within operating range.
3. Make sure alignment coil is properly adjusted.
4. Adjust beam-focus control for best usable resolution.
5. Condition spare 7295B/L's by operating several hours once each month.
6. Determine proper operating point with target voltage adjusted to the desired voltage above target cutoff.
7. Uncap lens before voltages are applied to the 7295B/L.

Don'ts

1. Don't force the 7295B/L into its shoulder socket.
2. Don't operate the 7295B/L without scanning.
3. Don't operate a 7295B/L having an ion spot.
4. Don't use more beam current than necessary to discharge the highlights of the scene.
5. Don't turn off beam while voltages are applied to photocathode, grid No. 6, target, dynodes, and anode during warm-up or standby operation.

7357

BEAM POWER TUBE

90 Watts CW Input (ICAS) up to 60 Mc
60 Watts CW Input (ICAS) at 175 Mc
For use under severe shock and vibration

The 7357 is the same as the 7212 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	26.5 ± 10%	volts
Current at 26.5 volts	0.3	amp

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Heater Current	1	0.28	0.32	amp

Note 1: With 26.5 volts ac on heater.

Beam Power Tube

For Pulse-Modulator Service under Severe Shock and Vibration

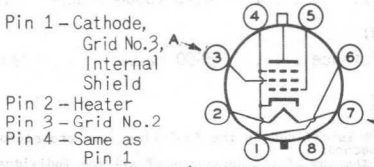
GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at heater volts = 6.3	1.25	amp
Transconductance, for plate volts = 200, grid-No.2 volts = 200, and plate ma. = 100	7000	μmhos
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 200, grid-No.2 volts = 200, and plate ma. = 100	4.5	
Direct Interelectrode Capacitances:[a]		
Grid No.1 to plate	0.24 max.	μμf
Grid No.1 to cathode & grid No.3 & internal shield, grid No.2, base sleeve, and heater	13.0	μμf
Plate to cathode & grid No.3 & internal shield, grid No.2, base sleeve, and heater	8.5	μμf

Mechanical:

Operating Position	Any
Maximum Overall Length	3-13/16"
Seated Length	3-1/8" ± 1/8"
Maximum Diameter	1-21/32"
Weight (Approx.)	2 oz
Bulb	T12
Cap	Small (JEDEC No.C1-1)
Socket	Standard Octal 8-Contact
Base	Small-Micanol-Wafer Octal 8-Pin with "770" Sleeve (JEDEC Group 1, No.B8-150)
Basing Designation for BOTTOM VIEW	7CK ←



AA'=PLANE OF ELECTRODES

MODULATOR — Rectangular-Wave Modulation

Maximum and Minimum CCS[b] Ratings, *Absolute-Maximum Values:*

For duty factor[c] between 0.001 and 1 and maximum averaging time of 10,000 μsec in any interval

DC PLATE SUPPLY VOLTAGE (E_{bb})[d]	See *Rating Chart I*
INSTANTANEOUS PLATE VOLTAGE	115% of E_{bb}

← Indicates a change.

DC GRID-No.2 SUPPLY VOLTAGE[d]	500 max.	volts
DC GRID-No.1 SUPPLY VOLTAGE[d]	300 max. Minimum—See *Rating Chart I*	volts
GRID-No.1 VOLTAGE:		
Instantaneous-negative value	400 max.	volts
Peak-positive value	100 max.	volts
PEAK PLATE CURRENT	See *Rating Chart II*	
PEAK GRID-No.2 CURRENT	0.75 max.	amp
PEAK GRID-No.1 CURRENT	0.5 max.	amp
PLATE INPUT	80 max.	watts
GRID-No.2 INPUT	1.75 max.	watts
GRID-No.1 INPUT	0.5 max.	watt
PLATE DISSIPATION[e]	See *Rating Chart I*	
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	135 max.	volts
Heater positive with respect to cathode	135 max.	volts
BULB TEMPERATURE (At hottest point on bulb surface)	220 max.	°C

Typical Operation:

With rectangular-wave shapes in accompanying test circuit and with duty factor[c] of 0.01

DC Plate Supply Voltage	3000	volts
DC Grid-No.2 Supply Voltage	300	volts
DC Grid-No.1 Supply Voltage	−175	volts
Peak-Positive Grid-No.1 Voltage	65	volts
Plate Current:		
Peak	1.5	amp
Average	0.015	amp
DC Grid-No.2 Current	0.004	amp
DC Grid-No.1 Current	0.0025	amp
Load Resistance (R_L), 100 watts, non-inductive	1500 ± 5%	ohms
Coupling Capacitor (C_3)	0.25 (5000 v dc)	μf

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	3000 max.	ohms

[a] Without external shield.

[b] Continuous Commercial Service.

[c] *Duty Factor* for the 7358 is defined as the "on" time in microseconds divided by 10,000 microseconds.
"On" Time is defined as the sum of the durations of all the individual pulses which occur during any 10,000-microsecond interval.
"Pulse Duration" is defined as the time interval between the two points on the pulse at which the instantaneous value is 70 per cent of the peak value. The peak value is defined as the maximum value of a smooth curve through the average of the fluctuations over the top portion of the pulse.

[d] For tube protection, it is essential that sufficient resistance be used in the plate supply circuit, the grid-No.2 supply circuit, and the grid-No.1 supply circuit so that the short-circuit current is limited to 0.5 ampere in each circuit.

[e] Averaged over any interval not exceeding 10,000 microseconds. Care should be used in determining the plate dissipation. A calculated value based on rectangular pulses can be considerably in error when

the actual pulses have a finite rise and fall time. Plate dissipation should preferably be determined by measuring the bulb temperature under actual operating conditions; then, with the tube in the same socket and under the same ambient-temperature conditions, apply to the tube sufficient dc input to obtain the same bulb temperature. This value of dc input is a measure of the plate dissipation.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Heater Current	1	1.175	1.325	amp
Direct Interelectrode Capacitances:				
Grid No.1 to plate	2	–	0.24	μμf
Grid No.1 to cathode & grid No.3 & internal shield, grid No.2, base sleeve, and heater	2	12.0	15.0	μμf
Plate to cathode & grid No.3 & internal shield, grid No.2, base sleeve, and heater	2	7.3	9.5	μμf
Mu-Factor, Grid No.2 to Grid No.1	1,3	3.6	5.4	
Plate Current	1,4	46	94	ma
Grid-No.2 Current	1,4	0	5.5	ma
Peak Plate Current	1,5	2.4	–	amp
Heater-Cathode Leakage Current:				
Heater 100 volts negative with respect to cathode	1	–	100	μa
Heater 100 volts positive with respect to cathode	1	–	100	μa

Note 1: With 6.3 volts ac on heater.

Note 2: Without external shield.

Note 3: With dc plate volts = 200, dc grid-No.2 volts = 200, and dc grid-No.1 voltage adjusted to give dc plate current of 100 ma.

Note 4: With dc plate volts = 300, dc grid-No.2 volts = 200, and dc grid-No.1 volts = -33.

Note 5: With the tube in the accompanying test circuit under the following conditions: rectangular-wave modulation (e_{g1}) applied to grid No.1; pulse duration of 1 microsecond approx.; pulse-repetition rate (approx. 3000 pps) adjusted to give dc plate current of 9 ma. minimum; dc plate supply volts = 3500; dc grid-No.2 supply volts = 500 applied simultaneously with the plate voltage; dc grid-No.1 supply volts = -300; peak-positive grid-No.1 swing of 100 volts; coupling capacitor (C_3) having value of 0.1 μf, 5000 volts dc; and load resistance (R_L) of 1000 ± 5% ohms, 50 watts, non-inductive.

SPECIAL TESTS & PERFORMANCE DATA

500-g Shock Test:

This test is performed on a sample lot of tubes from each production run. Tubes are held rigid and are subjected in four different positions to an impact acceleration of 500 g. At the end of this test, tubes are required to meet the following limits:

Peak Plate Current . . . . . 2.4 min. amp

For conditions shown under *Characteristics Range Values.*

← Indicates a change.

Heater–Cathode

Leakage Current. . . . . See *Characteristics Range Values*

The tubes must also meet the established limit for low-frequency vibration (See below).

Fatigue Test:

This test is performed on a sample lot of tubes from each production run. Tubes are rigidly mounted and subjected to 2.5 g vibrational acceleration at 25 cycles per second for 32 hours in each of three positions. At the end of this test, tubes are required to meet the following limits:

Peak Plate Current . . . . . 2.2 min. amp

For conditions shown under *Characteristics Range Values.*

Heater–Cathode

Leakage Current. . . . See *Characteristics Range Values*

The tubes must also meet the established limit for low-frequency vibration (See below).

Low-Frequency Vibration Performance:

This test is performed on a sample lot of tubes from each production run under the following conditions: Heater volts = 6.3, plate supply volts = 250, grid-No.2 volts = 200, grid-No.1 voltage varied to give a plate current of 10 millamperes, plate load resistor (ohms) = 2000 and vibrating frequency of 25 cycles per second with a fixed amplitude of 0.040 inch (total excursion 0.080 inch). The rms output voltage across the plate load resistor as a result of vibration of the tube must not exceed 500 millivolts.

Variable-Frequency Vibration Performance (1):

This test is performed on a sample lot of tubes from each production run. Tubes are vibrated in each of 3 positions through frequency range of from 10 to 50 cycles per second and back to 10 cycles per second. The tubes are vibrated under the same conditions as specified for *Low Frequency Vibration Performance.* During the test, the tubes will not show an rms output voltage across the plate load resistor in excess of 500 millivolts. At the end of this test, the tubes will not show defects that cause the tubes to be inoperable.

Variable-Frequency Vibration Performance (2):

This test is performed on a sample lot of tubes from each production run. Tubes are vibrated in each of 3 positions, perpendicular and parallel to major axis of the tube, and parallel to longitudinal axis of the tube, through the frequency range from 50 to 120 cycles per second at a fixed acceleration of 10 g under the same voltage, current and load conditions as specified for *Low Frequency Vibration Performance.* During this test, the tubes will not show an rms output voltage across the plate load resistor in excess of 500 millivolts.

OPERATING CONSIDERATIONS

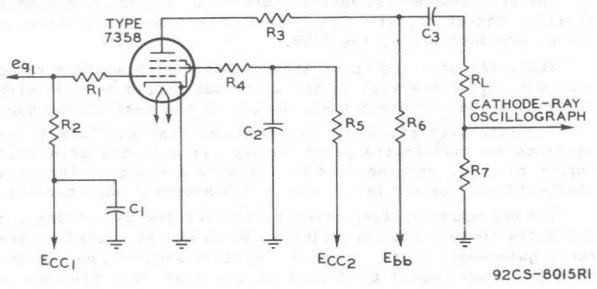
The *bulb* becomes hot during operation. To insure adequate cooling, therefore, it is essential that free circulation of air be provided around the 7358.

The *plate* shows no color when operated with maximum rated dissipation. Connection to the plate cap should be made with a flexible lead to prevent any strain on the seal of the cap.

For *tube protection*, it is essential that sufficient resistance be used in the plate supply circuit, the grid-No.2 supply circuit, and the grid-No.1 supply circuit so that the short-circuit current is limited to 0.5 ampere in each circuit.

The *accompanying test circuit* requires the use of damping resistors to suppress oscillations which may be caused by the rectangular-wave signal. These resistors should be non-inductive and they should be placed as close as possible to the socket terminals.

TEST CIRCUIT FOR TYPE 7358



C_1: 0.1 μf, 600 v dc.
C_2: 2 μf, 600 v dc.
C_3: For values, See *Typical Operation* and *Characteristics Range Values (Note 5)*.
R_1: 20 ohms, 1 watt, non-inductive.
R_2: 30,000 ohms, 1 watt.
R_3: 10 ohms, 5 watts, non-inductive.
R_4: 25 ohms, 1 watt, non-inductive.

E_{cc_1}: Grid-No.1 Supply Voltage.
E_{cc_2}: Grid No.2 Supply Voltage.
E_{bb}: Plate Supply Voltage.
e_{g_1}: Rectangular-Wave Signal Voltage.
R_5: 1000 ohms, 1 watt.
R_6: 10,000 ohms, 50 watts.
R_7: 30 ± 1% ohms, 5 watts, non-inductive.
R_L: For values, See *Typical Operation* and *Characteristics Range Values (Note 5)*.

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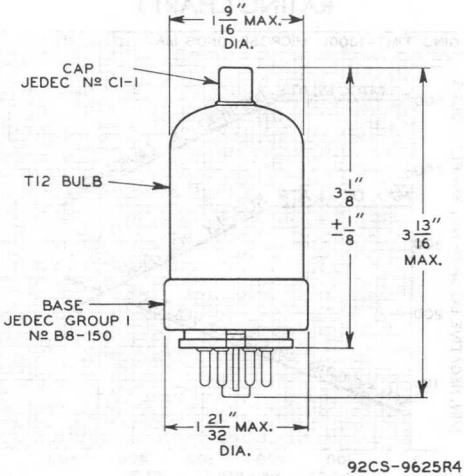
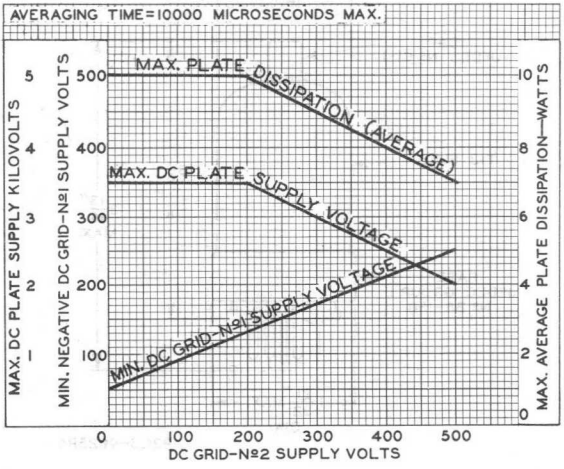
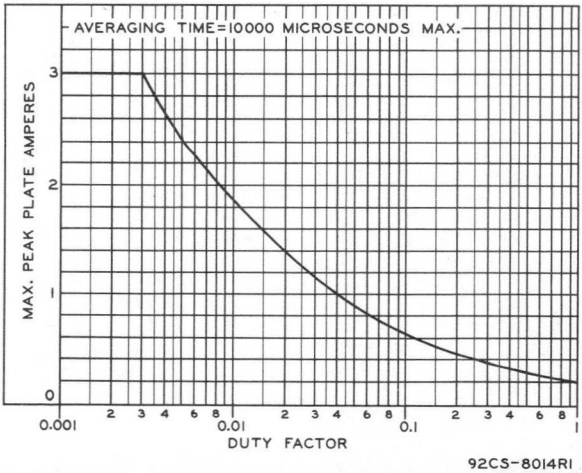

1 9/16" MAX. DIA.
CAP
JEDEC Nº C1-1
T12 BULB
3 1/8" +1/8"
3 13/16" MAX.
BASE
JEDEC GROUP 1
Nº B8-150
1 21/32" MAX. DIA.
92CS-9625R4

RATING CHART I



92CS-8012RI

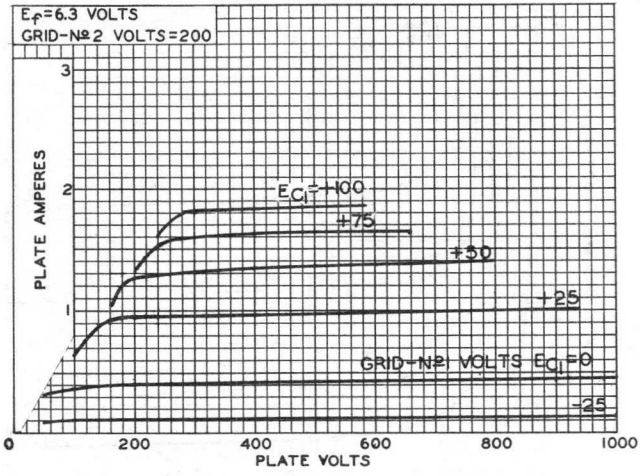
RATING CHART II



92CS-8014RI

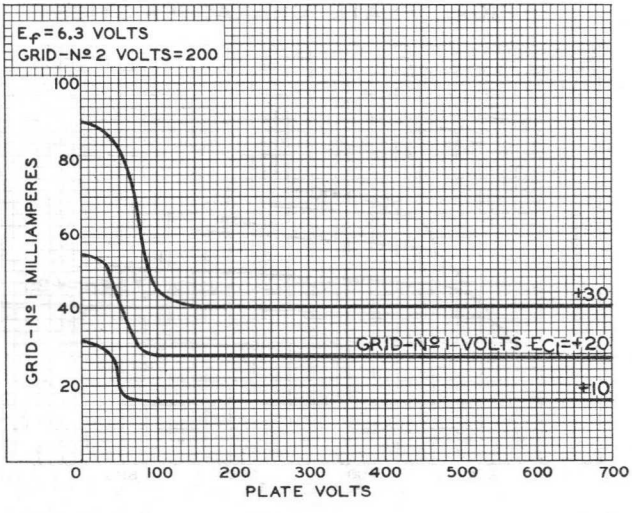
7358

TYPICAL PLATE CHARACTERISTICS



92CS-10124

TYPICAL CHARACTERISTICS

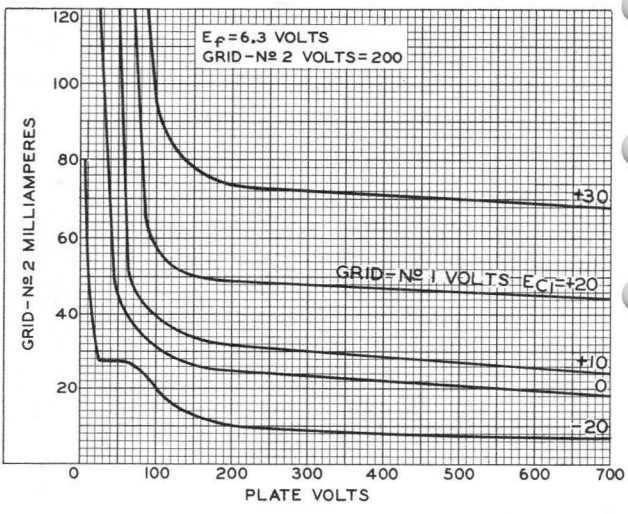


92CS-9617

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

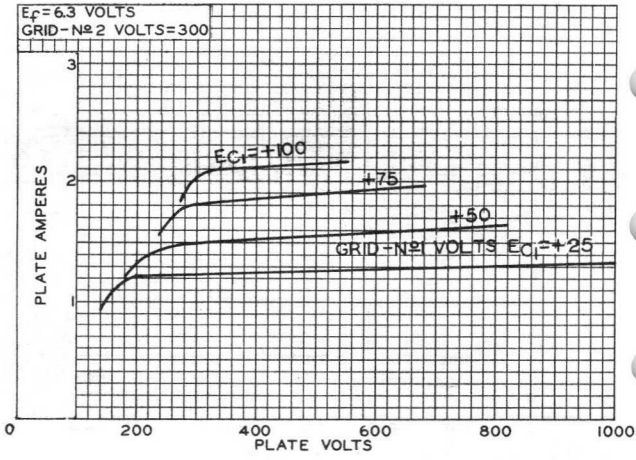
7358

TYPICAL CHARACTERISTICS



92CS-9618

TYPICAL PLATE CHARACTERISTICS

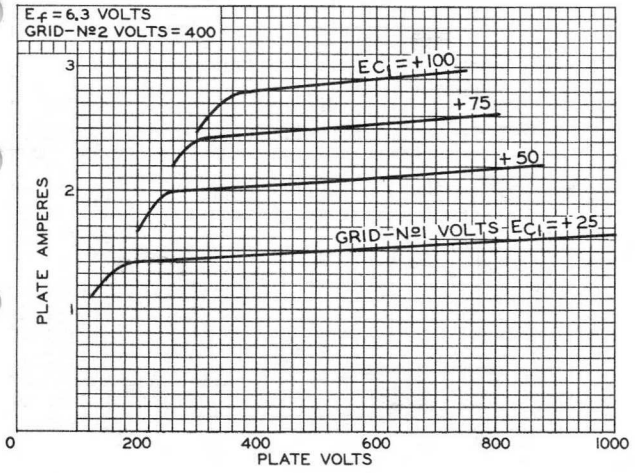


ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CS-10125

7358

TYPICAL PLATE CHARACTERISTICS



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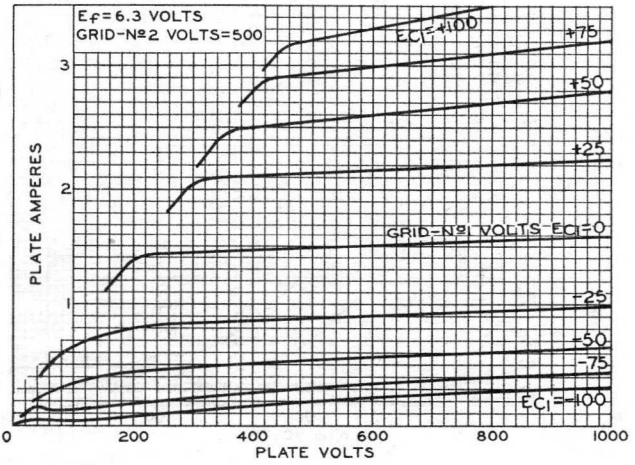
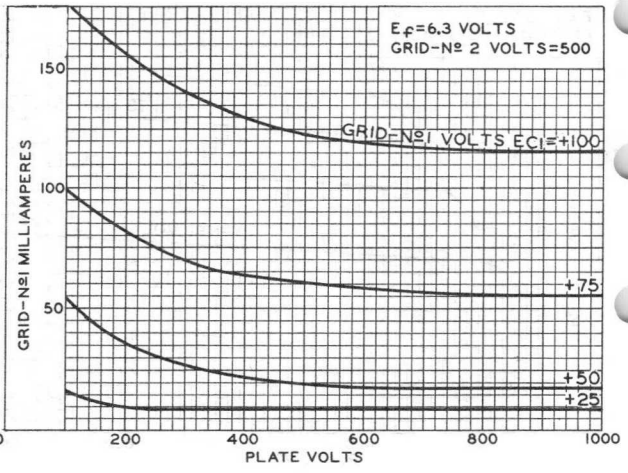


92CS-10127

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

7358

TYPICAL CHARACTERISTICS



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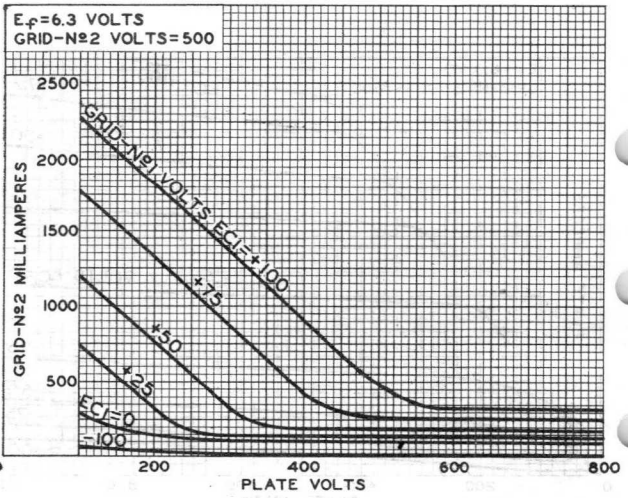


92CS-10130

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

7389-A

Image Orthicon

MAGNETIC FOCUS **MAGNETIC DEFLECTION**

VERY HIGH SIGNAL-TO-NOISE RATIO

For High-Quality Black-and-White Studio TV Cameras. The 7389-A is Unilaterally Interchangeable with Type 7389.

DATA

General:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.6	amp
Direct Interelectrode Capacitance:		
Anode to all other electrodes	12	μμf
Spectral Response		S-10
Wavelength of Maximum Response	4500 ± 300	angstroms
Photocathode, Semitransparent:		
Rectangular image (4 x 3 aspect ratio):		
Useful size of	1.6" max.	diagonal

Note: The size of the optical image focused on the photocathode should be adjusted so that its maximum diagonal does not exceed the specified value. The corresponding electron image on the target should have a size such that the corners of the rectangle just touch the target ring.

Orientation of. . Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through center of faceplate and the grid-No.6 envelope terminal. The horizontal and vertical scan should start at the corner of the picture between the grid-No.6 and the photocathode envelope terminals.

Target-to-Mesh Spacing	0.001	in.
Focusing Method		Magnetic
Deflection Method		Magnetic
Overall Length	19.375" ± 0.310"	
Greatest Diameter of Bulb	4.500" ± 0.094"	
Minimum Deflecting-Coil Inside Diameter	3.2"	
Deflecting-Coil Length	7"	
Focusing-Coil Length	15"	
Alignment-Coil:		
Position on neck	Centerline of magnetic field should be located 9.25" from the flat area of the shoulder.	
Operating Position	See *Operating Considerations*	
Weight (Approx.)	2.3 lbs	
Envelope Terminals	5	

BOTTOM VIEW▲

Terminal Over Pin 2 - Field Mesh
Terminal Over Pin 4 - Photocathode (PC)
Terminal On Side Of Envelope Opposite Base Key - Grid No.6 (G_6)

▲ See basing diagram on next page.

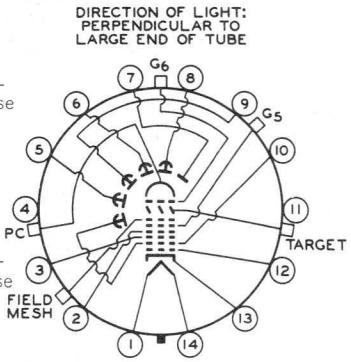
7389-A

Terminal Over Pin 9 – Grid No.5 (G_5)
Terminal Over Pin 11 – Target

End Base. . . . . Small-Shell Diheptal 14-Pin
(JEDEC Group 5, No.B14-45)

BOTTOM VIEW

Pin 1 – Heater
Pin 2 – Grid No.4
Pin 3 – Grid No.3
Pin 4 – Internal Connection—Do Not Use
Pin 5 – Dynode No.2
Pin 6 – Dynode No.4
Pin 7 – Anode
Pin 8 – Dynode No.5
Pin 9 – Dynode No.3
Pin 10 – Dynode No.1, Grid No.2
Pin 11 – Internal Connection—Do Not Use
Pin 12 – Grid No.1
Pin 13 – Cathode
Pin 14 – Heater



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

PHOTOCATHODE:		
Voltage.	-700 max.	volts
Illumination	50 max.	fc
OPERATING TEMPERATURE:		
Any part of bulb	65 max.	°C
Of bulb at large end of tube (Image section).	35 min.	°C
TEMPERATURE DIFFERENCE:		
Between image section and any part of bulb hotter than image section.	5 max.	°C
GRID-No.6 VOLTAGE.	-700 max.	volts
TARGET VOLTAGE:		
Positive value	10 max.	volts
Negative value	10 max.	volts
FIELD-MESH VOLTAGE●.	30 max.	volts
GRID-No.5 VOLTAGE.	300 max.	volts
GRID-No.4 VOLTAGE.	350 max.	volts
GRID-No.3 VOLTAGE.	400 max.	volts
GRID-No.2 & DYNODE-No.1 VOLTAGE.	350 max.	volts
GRID-No.1 VOLTAGE:		
Negative-bias value.	125 max.	volts
Positive-bias value.	0 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode. .	125 max.	volts
Heater positive with respect to cathode. .	10 max.	volts
ANODE-SUPPLY VOLTAGE★.	1650 max.	volts
VOLTAGE PER MULTIPLIER STAGE	350 max.	volts

Typical Operating Values:♦

Photocathode Voltage	−600	volts
Grid-No.6 Voltage (Image focus) Approx. 50% of photocathode voltage♦	−250 to −350	volts
Target Voltage Above Cutoff♠	2 to 3	volts
Field Mesh Voltage●	15 to 25	volts
Grid-No.5 Voltage (Decelerator)	40	volts
Grid-No.4 Voltage (Beam Focus)	70 to 90	volts
Grid-No.3 Voltage♣	250 to 275	volts
Grid-No.2 & Dynode-No.1 Voltage	280	volts
Grid-No.1 Voltage for Picture Cutoff	−45 to −115	volts
Dynode-No.2 Voltage	600	volts
Dynode-No.3 Voltage	800	volts
Dynode-No.4 Voltage	1000	volts
Dynode-No.5 Voltage	1200	volts
Anode Voltage	1250	volts
Target Temperature Range	35 to 45	°C
Minimum Peak-to-Peak Blanking Voltage	5	volts
Field Strength of Focusing Coil:⊕		
At center of scanning section (Approx.)	60	gausses
In plane of photocathode (Approx.)	120	gausses
Field Strength of Alignment Coil	0 to 3	gausses

Performance Data:

With conditions shown under Typical Operating Values, target voltage adjusted to 3 volts above cutoff, and with the camera lens set to bring the picture highlights 1/2 stop above the "knee" of the Basic Light-Transfer-Characteristic Curve except as otherwise specified

	Min.	*Average*	*Max.*	
Cathode Radiant Sensitivity at 4500 angstroms	−	0.028	−	μa/μw
Anode Current (DC)	−	30	−	μa
Signal-Output Current (Peak to Peak)	5	−	40	μa
Ratio of Peak-to-Peak High-light Video-Signal Current to RMS Noise Current for Bandwidth of 4.5 Mc	−	95:1	−	
Photocathode Illumination at 2870° K Required to Reach "Knee" of Light Transfer Characteristic	−	0.075	0.15	fc
Amplitude Response at 400 TV Lines per Picture Height (Per cent of large-area black to large-area white)	40	56	−	%

● With respect to grid No.4.

★ Dynode-voltage values are shown under *Typical Operating Values*.

♦ With 7389-A operated in RCA TK-12 camera at fixed photocathode voltage.

♣ Adjust for optimum focus.

♠ The target supply voltage should be adjustable from −5 to 5 volts.

♣ Adjust to give the most uniformly shaded picture near maximum signal.

⊕ Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

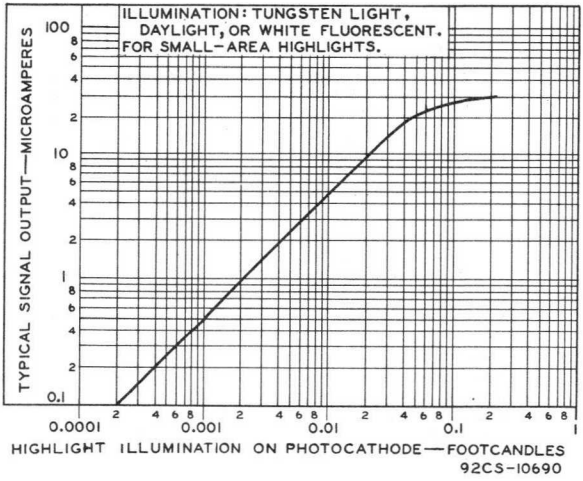
Measured with amplifier having flat frequency response.

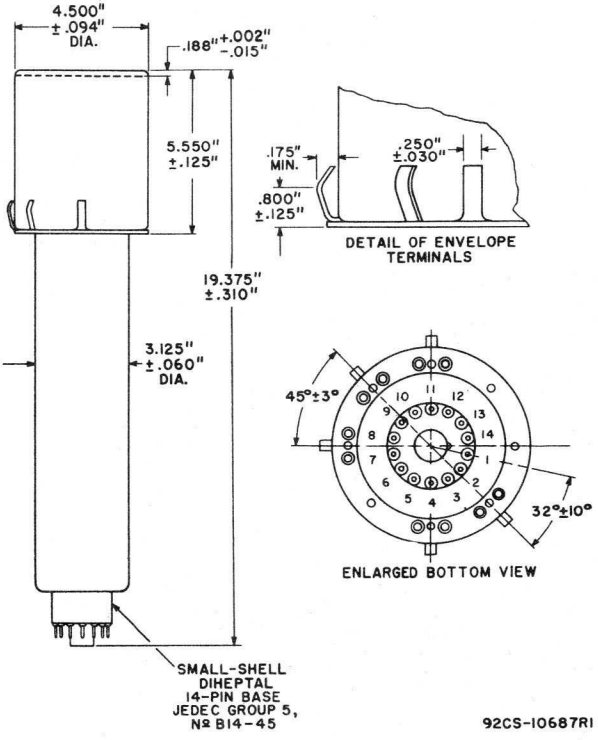
OPERATING CONSIDERATIONS

The *operating position* of the 7389-A should preferably be such that any loose particles in the neck of the tube will not fall down and strike or become lodged on the target. Therefore, it is recommended that the tube never be operated in a vertical position with the Diheptal-base end up nor in any other position where the axis of the tube with base up makes an angle of less than 20° with the vertical.

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Photosensitive Device having S-10 Response
is shown at the front of this Section

BASIC LIGHT-TRANSFER CHARACTERISTIC




4.500"
±.094"
DIA.
.188"+.002"
-.015"
5.550"
±.125"
19.375"
±.310"
3.125"
±.060"
DIA.
SMALL-SHELL
DIHEPTAL
14-PIN BASE
JEDEC GROUP 5,
Nº B14-45
.175"
MIN.
.800"
±.125"
.250"
±.030"
DETAIL OF ENVELOPE
TERMINALS
45°±3°
32°±10°
ENLARGED BOTTOM VIEW
92CS-10687R1

7389B/L

Image Orthicon

"MICRODAMP" CONSTRUCTION FOR REDUCED MICROPHONICS
FIELD MESH FOR REDUCED "WHITE EDGE" EFFECTS

LONG-LIFE TARGET
MAGNETIC FOCUS

FIELD-MESH TYPE
MAGNETIC DEFLECTION

For Extremely High-Quality Performance in Black-and-White Studio TV Cameras and Television Tape-Recording Operations. The 7389B/L is Directly Interchangeable with the 7389, 7389A, and 7389B in all Cameras.

The **7389B/L** *is the same as the* **7389B** *except utilizes a stable, long-life glass target.*

The stable, long-life, glass target of type 7389B/L is characterized by high gain, resistance to "burn-in", and the absence of any granular structure. Because charge transportation through this target material is electronic rather than ionic as in ordinary glass targets, the electrical characteristics of the target, such as secondary emission and resistivity, are essentially constant and sensitivity of the 7389B/L is stable throughout life.

Other important advantages of this target are that the undesirable characteristics of scene retention or "sticking picture" and raster "burn-in" due to underscanning are significantly reduced. The resistance of the 7389B/L to image "burn-in" provides a highly desirable operational feature because it is not necessary to use an orbiter or continually move the camera when focused on a stationary scene.

OPERATING CONSIDERATIONS

Dos and Don'ts on Use of RCA 7389B/L

Dos

1. Allow the 7389B/L to warm up prior to operation.
2. Hold temperature of the 7389B/L within operating range.
3. Make sure alignment coil is properly adjusted.
4. Adjust beam-focus control to best usable resolution.
5. Condition spare 7389B/L's by operating several hours once each month.
6. Determine proper operation point with target voltage adjusted to the desired voltage above target cutoff.
7. Uncap lens before voltage are applied to the 7389B/L.

Don'ts

1. Don't force the 7389B/L into its shoulder socket.
2. Don't operate the 7389B/L without scanning.
3. Don't operate a 7389B/L having an ion spot.
4. Don't use more beam current than necessary to discharge the highlights of the scene.
5. Don't turn off beam while voltages are applied to photocathode, grid No. 6, target, dynodes, and anode during warm-up or standby operation.

7404

IMAGE-CONVERTER TUBE

MONOVOLTAGE TYPE HAVING S-21 RESPONSE

For use, in combination with suitable optical systems, in viewing an object or specimen irradiated with near-ultraviolet radiation

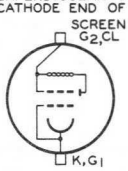
DATA

General:

Spectral Response	S-21
Wavelength of Maximum Response	4400 ± 500 angstroms
Photocathode, Semitransparent:	
Shape	Circular
Minimum useful diameter	0.75"
Fluorescent Screen:	
Shape	Circular
Minimum useful diameter	0.57"
Phosphor	P20■, Aluminized
Fluorescence	Yellow-Green
Phosphorescence	Yellow-Green
Persistence	Medium-Short
Focusing Method (Self-focusing)	Electrostatic
Overall Length	2.28" ± 0.05"
Greatest Diameter (Excluding side tip)	1.35" ± 0.03"
Maximum Radius (Including side tip)	0.75"
Weight (Approx.)	1.5 oz
Operating Position	Any

Terminal Connections *(See Dimensional Outline)*:

DIRECTION OF INCIDENT RADIATION: PERPENDICULAR TO PHOTOCATHODE END OF TUBE



CL – Collector

G_1 – Grid No.1 (Focusing Electrode)

G_2 – Grid No.2 (Focusing & Accelerating Electrode)

K – Photocathode

Maximum Ratings, *Absolute-Maximum Values:*

FLUORESCENT-SCREEN VOLTAGE:□		
Peak instantaneous	13000 max.	volts
Average (DC)	12500 max.	volts
AVERAGE PHOTOCATHODE CURRENT (Continuous operation)*	0.35 max.	μa
AMBIENT TEMPERATURE	75 max.	°C

Characteristics:

At Ambient Temperature of 25° C

Fluorescent-Screen Voltage (DC)□	12000	volts
Median Paraxial Magnification Factor♦	0.75	
Median Conversion Efficiency†	6000	lumens/watt
Minimum Resolution▲	25	line pairs per mm

7404

IMAGE-CONVERTER TUBE

Median Equivalent Screen-Background Input at 2537 angstroms§. . . . . 1×10^{-10} watt/cm^2

■ For Curves, *see front of Cathode-Ray Tube, Storage Tube, & Monoscope Section. See also Operating Considerations.*

□ Referred to photocathode.

* Averaged over any interval of 10 seconds maximum.

● Defined as the ratio of the linear size of the image on the fluorescent screen to the linear size of the image on the photocathode. The image on the photocathode consists of two parallel lines 0.08" long, each located 0.08" from the tube axis. Size of the image on the fluorescent screen is determined by measuring the spacing between the two parallel lines.

† Defined as the quotient of luminous flux output to incident radiant flux at 2537 angstroms.

▲ The resolution, both horizontally and vertically in a 0.15-inch-diameter circle centered on the photocathode, is determined with a pattern consisting of alternate black and white lines of equal width. Any two adjacent lines are designated as a "line-pair".

§ Defined as that value of incident radiation required to cause an increase in screen brightness equal to the screen-background brightness.

OPERATING CONSIDERATIONS

The curves giving the *spectral-energy emission characteristic* and the *persistence characteristics* of phosphor P20 are located in the front of the Cathode-Ray Tube, Storage Tube, & Monoscope Section. Only persistence-characteristic curve A applies to the 7404.

Subjecting the 7404 to intense incident-radiation levels may temporarily decrease the tube's sensitivity even though there is no voltage applied. The magnitude and duration of this decrease depend on the length of exposure. Permanent damage to the tube may result if it is exposed to radiant energy so great as to cause excessive heating of the photocathode.

Support for the 7404 may be provided at the photocathode end by a cushioned arrangement and at the screen end by a suitable fixture which will exert adequate but not excessive pressure to hold the tube firmly against the cushion.

Connections to the two terminals of the tube, indicated on the *Dimensional Outline*, should not be soldered to the terminals. They may be made by spring fingers engaging the rim or the straight side of each terminal.

Magnetic shielding of the 7404 is required to minimize the effects of extraneous fields on tube performance. It is to be noted that ac magnetic fields are particularly objectionable in that they seriously impair tube resolution. If an iron or steel case is used, care should be taken in its construction to insure that the case is completely demagnetized.

The *high voltage at which the 7404 is operated may be very dangerous.* Great care should be taken in the design of apparatus to prevent the user from coming in contact with the high voltage. Precautions must include safeguards which eliminate all hazards to operating personnel. In the use of high-voltage tubes, such as the 7404, it should always be

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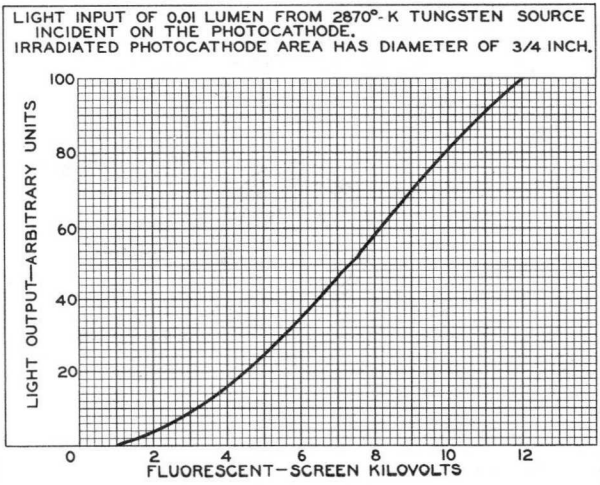
7404

IMAGE-CONVERTER TUBE

remembered that high voltage may appear at normally low-potential points in the circuit because of capacitor breakdown or incorrect circuit connections. Before any part of the circuit is touched, the voltage-supply switch should be turned off and both terminals of any capacitors connected to ground.

The curve showing the Tentative Spectral-Sensitivity Characteristic of Photosensitive Device having S-21 Response located at the front of this Section applies to the 7404

AVERAGE CHARACTERISTIC



92CS-10030

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7404

IMAGE-CONVERTER TUBE

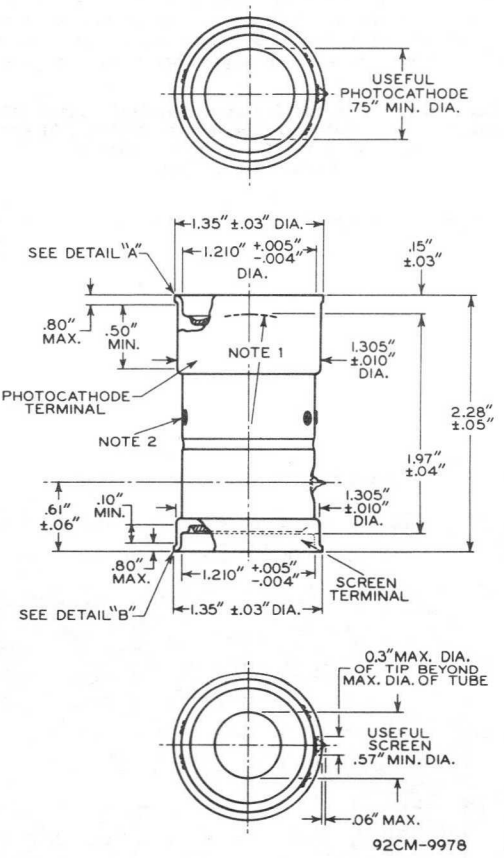

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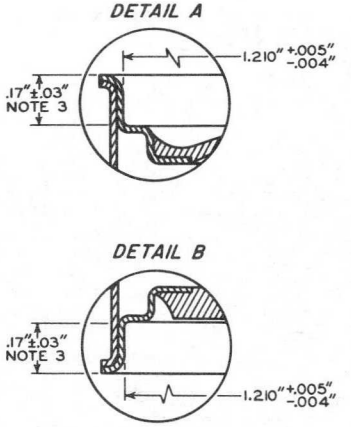
IMAGE-CONVERTER TUBE



NOTE 1: RADIUS OF CURVATURE OF FACEPLATE IS 1.230" ± 0.005"; FACEPLATE THICKNESS AT CENTER IS 0.030" ± 0.005".

NOTE 2: FIVE INSULATED LEAD TIPS WILL NOT EXTEND BEYOND MAXIMUM OUTSIDE DIAMETER OF TUBE. LEADS ARE USED ONLY DURING TUBE MANUFACTURE.

NOTE 3: DEPTH IS MEASURED TO TANGENT OF THE TWO RADII.

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7404

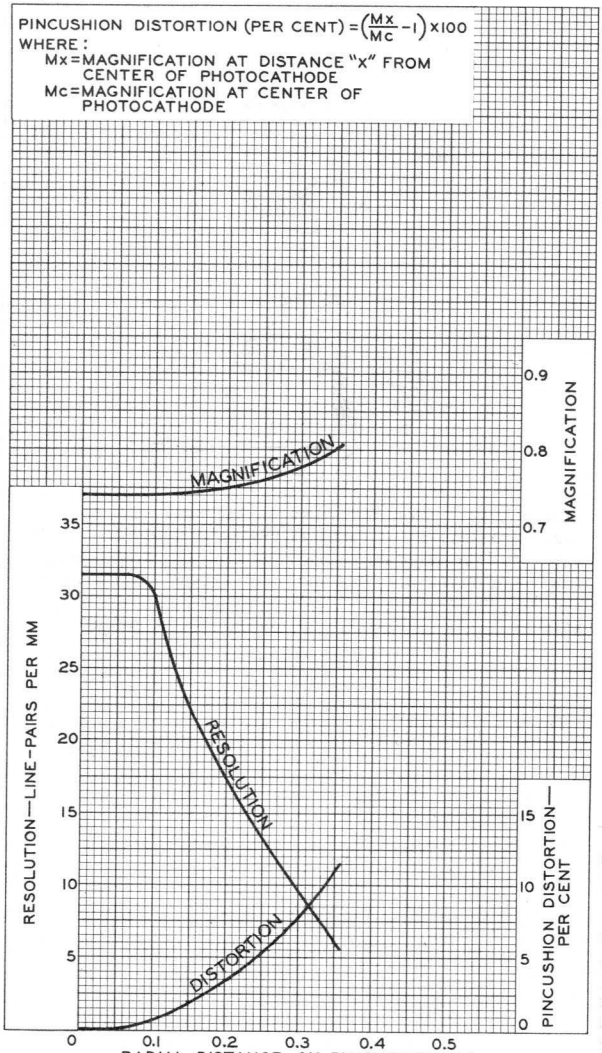
AVERAGE CHARACTERISTICS

PINCUSHION DISTORTION (PER CENT) $= \left(\frac{Mx}{Mc} - 1\right) \times 100$

WHERE:

Mx = MAGNIFICATION AT DISTANCE "x" FROM CENTER OF PHOTOCATHODE

Mc = MAGNIFICATION AT CENTER OF PHOTOCATHODE



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7448

DISPLAY STORAGE TUBE

DIRECT-VIEW TYPE
3.8"-DIAMETER DISPLAY

WRITING GUN:
ELECTROSTATIC DEFLECTION
ELECTROSTATIC FOCUS

VIEWING GUN:
NO DEFLECTION
NO FOCUS

DATA

General:

	Writing Section	Viewing Section	
Heater, for Unipotential Cathode:			
Voltage (AC or DC)	6.3	6.3	volts
Current	0.6	0.6	amp
Minimum Cathode Heating Time before other electrode voltages are applied	–	30	sec
Direct Interelectrode Capacitances (Approx.):[o]			
Grid No.1 to all other tube electrodes	6.5	11	μμf
Cathode to all other tube electrodes	5.5	8	μμf
Backplate to all other tube electrodes	–	116	μμf
Deflecting electrode DJ_1 to deflecting electrode DJ_2	1.9	–	μμf
Deflecting electrode DJ_3 to deflecting electrode DJ_4	2	–	μμf
DJ_1 to all other tube electrodes	6	–	μμf
DJ_2 to all other tube electrodes	7	–	μμf
DJ_3 to all other tube electrodes	5.5	–	μμf
DJ_4 to all other tube electrodes	4.8	–	μμf
Focusing Method	Electrostatic	None	
Deflection Method	Electrostatic	None	
Deflecting-Electrode Arrangement	*See Dimensional Outline*	–	
Phosphor (For Curves, see front of this Section)	–	P20, Aluminized	
Fluorescence	–	Yellow-Green	
Phosphorescence	–	Yellow-Green	

Minimum Useful Viewing Diameter♥	3.8"
Maximum Overall Length	13.64"
Seated Length	12.50" ± 0.39"
Greatest Bulb Diameter	5.25" ± 0.06"
Maximum Tube Radius	2.69"
Bulb Terminals:	
Caps (Three)	Recessed Small Ball (JEDEC No.J1-22)
Cap	Recessed Small Cavity (JEDEC No.J1-21)
Temperature Range:	
Operating	-55° to +85° C
Storage	-65° to +100° C
Operating Position	Any
Weight (Approx.)	2-3/4 lbs
Base	Medium-Shell Diheptal 14-Pin (JEDEC Group 5, No.B14-38)

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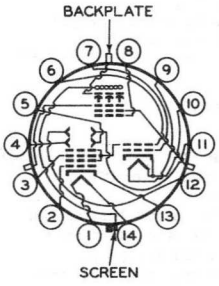
DISPLAY STORAGE TUBE

BOTTOM VIEW

Pin 1 – Heater of Writing Gun
Pin 2 – Grid No.1 of Writing Gun
Pin 3 – Grid No.3 of Writing Gun
Pin 4 – Deflecting Electrode DJ_3 of Writing Gun
Pin 5 – Deflecting Electrode DJ_4 of Writing Gun
Pin 6 – Grid No.2 of Viewing Gun, Grid No.2 and Grid No.4 of Writing Gun
Pin 7 – Grid No.1 of Viewing Gun
Pin 8 – Grid No.3 of Viewing Gun
Pin 9 – Heater of Viewing Gun
Pin 10 – Heater and Cathode of Viewing Gun
Pin 11 – Deflecting Electrode DJ_1 of Writing Gun
Pin 12 – Deflecting Electrode DJ_2 of Writing Gun



Pin 13 – Cathode of Writing Gun
Pin 14 – Heater of Writing Gun
Recessed Ball Cap:
Over Pin 3—Grid No.5 of Viewing Gun
Over Pin 12—Grid No.4 of Viewing Gun
On Side of Tube Opposite Base Key—Backplate
Recessed Cavity Cap:
Over Base Key—Screen

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

For altitudes up to 10,000 feet

	Writing Section		Viewing Section		
SCREEN VOLTAGE.	–		11000 max.**		volts
BACKPLATE VOLTAGE (Peak). .	–		20 max.**		volts
	Equivalent Values		*Equivalent Values*		
GRID-No.5 VOLTAGE	–	–	–	300 max.**	volts
GRID-No.4 VOLTAGE	2950 max.*▲	200 max.**	–	300 max.**	volts
GRID-No.3 VOLTAGE	1200 max.*	-1550 max.**	–	{200 max.** / 10 min.**}	volts
PEAK VOLTAGE BETWEEN GRID No.3 AND GRIDS No.2 & No.4.	–	2950 max.	–	–	volts

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DISPLAY STORAGE TUBE

	Writing Section		Viewing Section		
GRID-No.2 VOLTAGE	2950 max.*▲	200 max.**	2950 max.*▲	200 max.**	volts
CATHODE VOLTAGE	–	-2750 max.**	–	–	volts
GRID-No.1 VOLTAGE:					
Negative-bias value . . .	200 max.*		200 max.**		volts
Positive-bias value . . .	0 max.*		0 max.**		volts
Positive-peak value . . .	2 max.*		0 max.**		volts
PEAK VOLTAGE BETWEEN GRIDS No.2 & No.4 AND ANY DEFLECTING ELECTRODE . .	500 max.		–		volts
PEAK HEATER-CATHODE VOLTAGE:					
Heater negative with respect to cathode . .	125 max.*		–		volts
Heater positive with respect to cathode . .	125 max.*		–		volts

VIEWING SECTION**

Operating Values and Typical Performance Characteristics:

To prevent possible damage to the tube, allow the viewing-gun beam current to reach normal operating value before turning on the writing-gun beam current, and keep the viewing-gun beam on till the writing beam is turned off

Screen Voltage.	10000	10000	volts
Backplate Voltage (DC).	2	2	volts
Grid-No.5 Voltage	210	150	volts
Grid-No.4 Voltage#.	50 to 150	30 to 90	volts
Grid-No.3 Voltage#.	10 to 50	10 to 40	volts
Grid-No.2 Voltage▲.	150	125	volts
Grid-No.1 Voltage#.	0 to -80	0 to -60	volts
Maximum Screen Current.	0.75	0.5	ma
Maximum Backplate Current (Peak). . . .	2	1.5	ma
Maximum Grid-No.5 Current	3	2.5	ma
Maximum Grid-No.4 Current	3	2.5	ma
Maximum Grid-No.3 Current	5	4	ma

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DISPLAY STORAGE TUBE

Maximum Grid-No.2 Current■	3	2.5	ma
Maximum Cathode Current	8	6.5	ma
Number of Half-Tone Steps□	5	5	
Viewing Duration▲▲	20	40	sec
Maximum Erasing-Uniformity Factor□□	0.45	0.4	
Resolution##	50	50	lines/in.
Brightness◆◆	2750	1500	fl

WRITING SECTION●

Range Values for Equipment Design:*

For any grids-No.2 & No.4 voltage ($E_{c_{2+4}}$) between 1500 and 2750 volts▲

Grid-No.3 Voltage for focus	17.5% to 37.5% of $E_{c_{2+4}}$	volts
Maximum Grid-No.1 Voltage for cutoff of undeflected focused spot	−4.6% of $E_{c_{2+4}}$	volts
Maximum Grid-No.3 Current	−15 to +10	μa
Maximum Cathode Current	*See Curve*	
Deflection Factors:		
DJ_1 & DJ_2	36 to 48	v dc/in./kv of $E_{c_{2+4}}$
DJ_3 & DJ_4	35 to 47	v dc/in./kv of $E_{c_{2+4}}$
Focused Beam Position	##	
Writing Speed††	300000	in./sec

Examples of Use of Design Ranges:*

For grids-No.2 & No.4 voltage ($E_{c_{2+4}}$)▲	*2000*	*volts*
Grid-No.3 Voltage for focus	350 to 750	volts
Maximum Grid-No.1 Voltage for cutoff of undeflected focused spot	−92	volts
Deflection Factors:		
DJ_1 & DJ_2	72 to 96	volts
DJ_3 & DJ_4	70 to 94	volts

Equivalent Values of Writing-Gun Voltages Referred to Cathode of Viewing Gun:

Cathode Voltage	−1850	−1875	volts
Grid-No.3 Voltage for focus	−1100 to −1500	−1125 to −1525	volts
Grids-No.2 & No 4 Voltage▲	+150	+125	volts

VIEWING SECTION and WRITING SECTION

Circuit Values:

Grid-No.1-Circuit Resistance (Either gun)	1 max.	megohm
Resistance in Any Deflecting-Electrode Circuit■	0.1 max.	megohm
Series Current-Limiting Resistor (Unbypassed) in Grid-No.5 (Viewing-Section) Circuit	0.01 min.	megohm

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DISPLAY STORAGE TUBE

Backplate-Circuit Resistance.	0.005 max. megohm
Series Current-Limiting Resistance in Screen Circuit.	1 min. megohm

○ Without external shield.

♥ Minimum useful viewing area may be eccentric with respect to the tube face.

** Voltages are shown with respect to cathode of Viewing Gun.

* Voltages are shown with respect to cathode of Writing Gun.

▲ Grids No.2 and No.4 of Writing Gun are connected together and to grid No.2 of Viewing Gun within the tube.

Adjusted for brightest, most uniform pattern.

◪ With writing beam cut off, Since grid No.2 of the Viewing Gun and grids No.2 and No.4 of the Writing Gun are connected together within the tube, the maximum total current collected by these electrodes is essentially equal to the sum of the maximum grid-No.2 current of the Viewing Gun and the maximum cathode current of the Writing Gun *(See Writing-Gun-Current-Characteristic Curve).*

□ Observed with an RCA-2F21 Monoscope display.

▲▲ Expressed in terms of the time required for the brightness of the unwritten background to rise from just zero brightness (viewing-beam cutoff) to 10 per cent of saturated brightness.

□□ Determined as follows: With no erasing pulse, overscan the storage surface with writing beam to obtain maximum pattern brightness. Then cut off writing beam. Apply rectangular erasing pulses having an amplitude of between 8 to 10 volts and adjust duty cycle to obtain complete erasure in approximately 10 seconds. Measure time (t_1) from start of erasing to the instant at which any area within the minimum useful viewing diameter is reduced to background-brightness level, and time (t_2) from start of erasing to the instant at which the entire area within the minimum useful viewing-diameter area is reduced to background-brightness level. The erasing-uniformity factor is defined as $(t_2 - t_1)/t_2$.

⊕ Measured by shrinking-raster method at a display brightness of 50 per cent of saturated brightness and with grids No.2 & No 4 of Writing Gun at about +2000 volts with respect to cathode of Writing Gun.

⊕⊕ Measured with entire storage grid written to produce saturated brightness and with screen at indicated voltage.

● The cathode of the Writing Gun is operated at about −2000 volts with respect to the cathode of the Viewing Gun which is usually operated at ground potential.

The center of the undeflected focused beam will fall within a circle having a 10-mm radius and having its center on the Writing-Gun axis *(See Dimensional Outline)* under the following conditions: grids No.2 & No.4 of Writing Gun at +2000 volts with respect to cathode of Writing Gun, grid No.3 of Writing Gun at voltage to give focus, grid No.1 of Writing Gun at voltage which will permit storage of a charge just sufficient to give a barely perceptible spot on screen, Viewing Section operating under normal conditions, and tube shielded against extraneous fields.

†† Measured under conditions of writing from just zero brightness (viewing-beam cutoff) to maximum brightness with grid No.1 of Writing Gun at −10 volts with respect to cathode of Writing Gun, and grids No.2 & No.4 of Writing Gun at +2000 volts with respect to cathode of Writing Gun.

■ It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

OPERATING CONSIDERATIONS

Shielding. Magnetic shielding must be provided to prevent external fields from interfering with the required accurate control of the low-velocity viewing beam. A cylindrical shield of properly annealed high-permeability material about 1/16-inch thick is usually satisfactory.

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

7448

DISPLAY STORAGE TUBE

Terminal Connections. The *base pins* of the 7448 fit the Diheptal 14-contact socket. The *Recessed Small Ball caps* and the *Recessed Small Cavity cap* require standard flexible-lead connectors.

The high voltages at which the 7448 is operated may be very dangerous. Great care should be taken in the design of apparatus to prevent the operator from coming in contact with the high voltages. Safety precautions include the enclosing of high-potential terminals and the use of interlocking switches to break the primary circuit of the power supply when access to the equipment is desired.

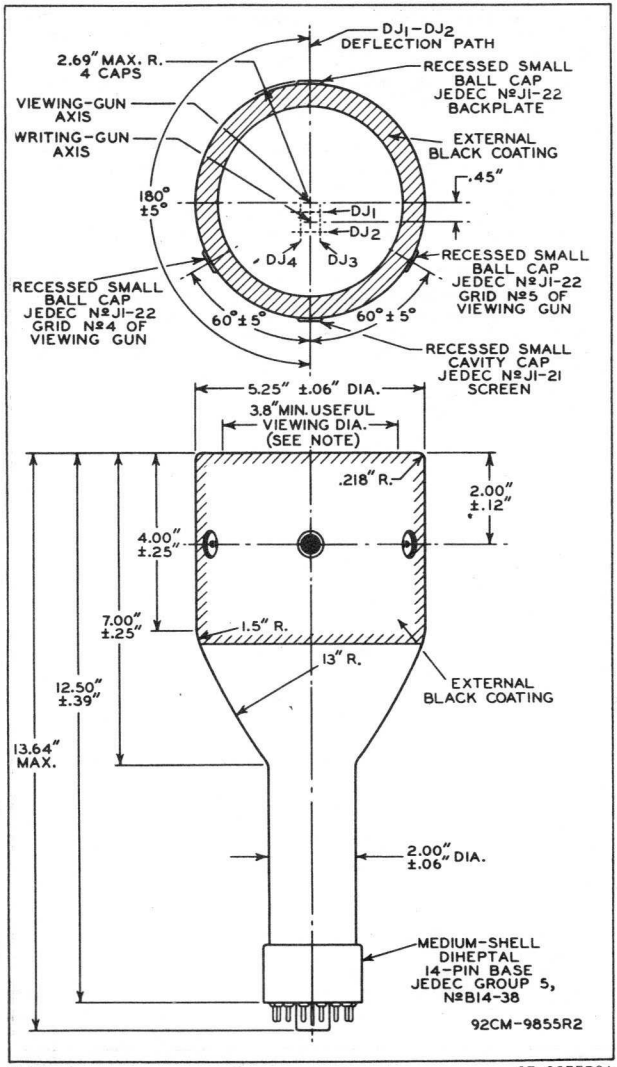
In the use of high-voltage tubes, it should always be remembered that high voltages may appear at normally low-potential points in the circuit as a result of capacitor breakdown or incorrect circuit connections. Therefore, before any part of the circuit is touched, the power-supply switch should be turned off, and both terminals of any capacitors grounded.

To prevent possible damage to the tube, allow the Viewing-Gun beam current to reach normal operating value before turning on the Writing-Gun beam current, and keep the viewing beam on till the writing beam is turned off.

Failure of scanning while the writing beam is turned on may permanently damage the storage grid. Therefore, provision should be made to cut off automatically the writing-beam current in case of a scanning failure. The writing-beam current can be cut off by an electronic switch which applies -200 volts bias to grid No.1 of the Writing Gun. This switch should be actuated by a portion of the scanning voltages applied to both sets of deflecting electrodes.

7448

DISPLAY STORAGE TUBE



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

7448

DISPLAY STORAGE TUBE

NOTE: MINIMUM USEFUL VIEWING AREA MAY BE ECCENTRIC WITH RESPECT TO THE TUBE FACE. THE MINIMUM USEFUL VIEWING AREA WILL HAVE DIAMETER OF 3.8".

CENTER LINE OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM PERPENDICULAR ERECTED AT CENTER OF BOTTOM OF BASE.

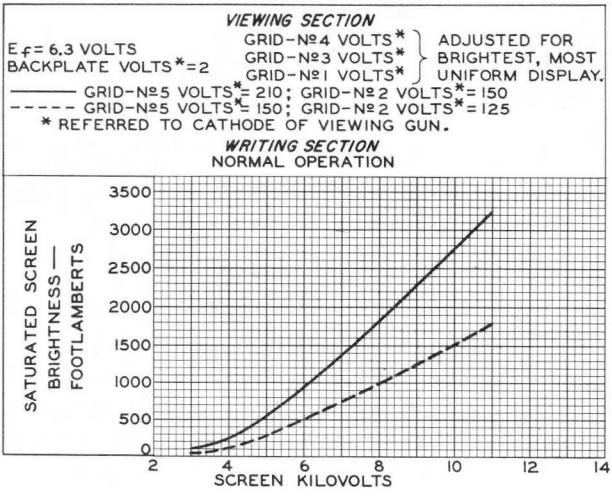
DEFLECTING ELECTRODES DJ_1 AND DJ_2 ARE NEARER THE SCREEN: DEFLECTING ELECTRODES DJ_3 AND DJ_4 ARE NEARER THE BASE. WITH DJ_1 POSITIVE WITH RESPECT TO DJ_2, THE SPOT WILL BE DEFLECTED TOWARD PIN 8; LIKEWISE, WITH DJ_3 POSITIVE WITH RESPECT TO DJ_4, THE SPOT WILL BE DEFLECTED TOWARD PIN 4.

THE ANGLE BETWEEN THE DEFLECTION PATH PRODUCED BY DJ_1 AND DJ_2 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND THE BASE KEY BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF $\pm$ 10°. THE ANGLE BETWEEN THE DEFLECTION PATH PRODUCED BY DJ_1 AND DJ_2 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND THE SCREEN CAP BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF $\pm$ 10°. ANGLE BETWEEN $DJ_1 - DJ_2$ DEFLECTION PATH AND $DJ_3 - DJ_4$ DEFLECTION PATH IS $90^{o} \pm 3^{o}$.

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

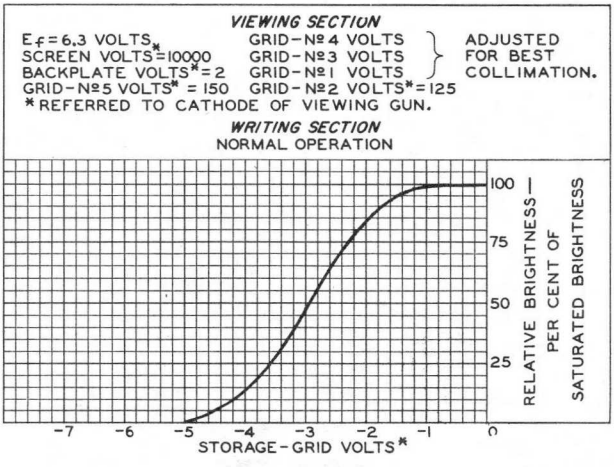
7448

TYPICAL CHARACTERISTICS



92CS-9858

TYPICAL STORAGE-GRID CHARACTERISTIC



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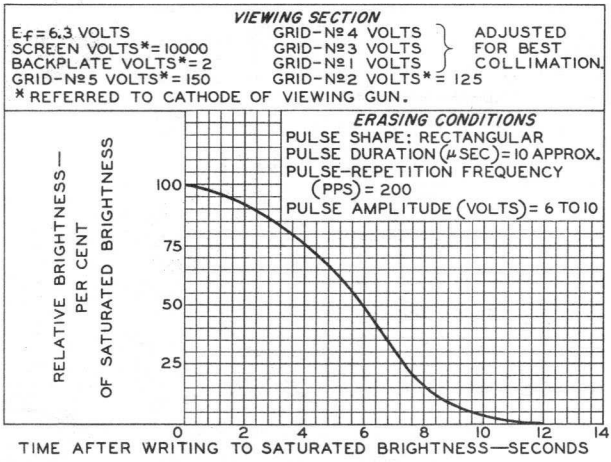
92CS-9861

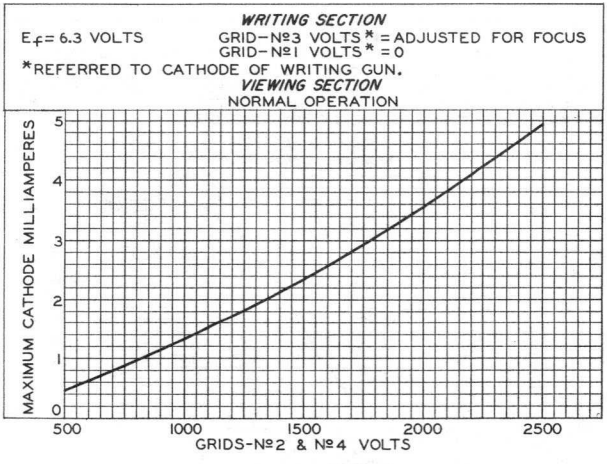
7448

TYPICAL ERASURE CHARACTERISTIC



92CS-9860

WRITING-GUN-CURRENT CHARACTERISTIC



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

92CS-9859RI

Image Orthicon

MAGNETIC FOCUS S-10 RESPONSE MAGNETIC DEFLECTION

For Color and High-Quality Black-and-White TV Cameras

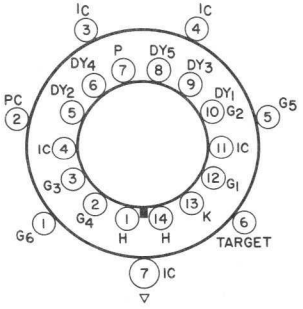
GENERAL

Heater, for Unipotential Cathode		
Voltage (AC or DC)	6.3 ± 10%	V
Current at 6.3 V	0.600	A
Direct Interelectrode Capacitance		
Anode to all other electrodes	12	pF
Maximum Target-to-Mesh Spacing	0.0008	in
Photocathode, Semitransparent		
Response	S-10	
Wavelength of maximum response	4500 ± 300	angstroms
Retangular image (4 x 3 aspect ratio):[a]		
Useful size[b]	1.8-inch max	diagonal
Focusing Method	Magnetic	
Deflection Method	Magnetic	
Overall Length	15.2 ± 0.25	in
Greatest Diameter of Bulb	3.00 ± 0.06	in
Minimum Deflecting-Coil Inside Diameter	2-3/8	in
Deflecting-Coil Length	5	in
Focusing-Coil Length	10	in
Alignment Coil		
Length	15/16	in
Position on neck	Centerline of coil located 8.5 inches from the flat area of the jumbo annular base	
Photocathode Distance Inside End of Focusing Coil	1/2	in
Operating Position	See *Operating Considerations*	
Weight (Approx.)	1 lb 6 oz	

TERMINAL DIAGRAM (Bottom View)

Shoulder Base: Keyed Jumbo Annular 7-Pin

Pin 1 – Grid No.6
Pin 2 – Photocathode
Pin 3 – Do Not Use
Pin 4 – Do Not Use
Pin 5 – Grid No.5
Pin 6 – Target
Pin 7 – Do Not Use



Direction of Light: Perpendicular to large End of Tube

End Base: Small-Shell Diheptal 14-Pin (JEDEC No. B14-45)

Pin 1 – Heater	Pin 8 – Dynode No. 5
Pin 2 – Grid No. 4	Pin 9 – Dynode No. 3
Pin 3 – Grid No. 3	Pin 10 – Dynode No. 1, Grid No. 2
Pin 4 – Do Not Use	Pin 11 – Do Not Use
Pin 5 – Dynode No. 2	Pin 12 – Grid No. 1
Pin 6 – Dynode No. 4	Pin 13 – Cathode
Pin 7 – Anode	Pin 14 – Heater

ABSOLUTE-MAXIMUM RATINGS

Photocathode		
Voltage	-550	V
Illumination	50	fc
Operating Temperature		
Of any part of bulb	50	°C
Of bulb at large end of tube (Image section)	35 min	°C
Temperature Difference	5	°C
Between image section and any part of bulb hotter than image section		
Grid-No. 6 Voltage	-550	V
Target Voltage		
Positive value	10	V
Negative value	10	V
Grid-No. 5 Voltage	150	V
Grid-No. 4 Voltage	300	V
Grid-No. 3 Voltage	400	V
Grid-No. 2 & Dynode-No. 1 Voltage	350	V
Grid-No. 1 Voltage		
Negative-bias value	125	V
Positive-bias value	0	V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode	125	V
Heater positive with respect to cathode	10	V
Anode-Supply Voltage[c]	1350	V
Voltage Per Multiplier Stage	350	V

TYPICAL OPERATING VALUES

Photocathode Voltage (Image focus)[d]	-400 to -540	V
Grid-No. 6 Voltage (Accelerator)— Approx. 65% of photocathode voltage	-260 to -350	V
Target-Cutoff Voltage[e]	-3 to 1	V
Grid-No. 5 Voltage (Decelerator)	0 to 125	V
Grid-No. 4 Voltage (Beam focus)[d]	140 to 180	V
Grid-No. 3 Voltage[f]	225 to 330	V
Grid-No. 2 & Dynode-No. 1 Voltage	300	V
Grid-No. 1 Voltage for Picture Cutoff	-45 to -115	V
Dynode-No. 2 Voltage	600	V
Dynode-No. 3 Voltage	800	V
Dynode-No. 4 Voltage	1000	V
Dynode-No. 5 Voltage	1200	V
Anode Voltage	1250	V
Target-Temperature Range	35 to 45	°C

Minimum Peak-to-Peak Blanking Voltage	5	V
Field Strength at Center of Focusing Coil[g]. . .	75	G
Field Strength of Alignment Coil (Approx.). . .	0 to 3	G

PERFORMANCE DATA

With conditions shown under Typical Operating Values and with picture highlights at the "knee" of the light-transfer characteristic

	Min	Typ	Max	
Cathode Radiant Sensitivity at 4500 angstroms.	-	0.028	-	μA/μW
Anode Current (DC).	-	30	-	μA
Signal-Output Current (Peak to Peak)	5	-	38	μA
Ratio of Peak-to-Peak Highlight Video-Signal Current to RMS Noise Current for Bandwidth of 4.5 Mc/s.	40:1	55:1	-	
Photocathode Illumination at 2870°K Required to Reach "Knee" of Light-Transfer Characteristic.	-	0.028	0.04	fc
Amplitude Response at 400 TV Lines per Picture Height (Per cent of large-area black to large-area white)[h].	38	55	-	% ←

[a] Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through center of faceplate and pin 7 of the shoulder base, The horizontal and vertical scan should start at the corner of the raster nearest pin 6 of the shoulder base.

[b] The size of the optical image focused on the photocathode should be adjusted so that its maximum diagonal does not exceed the specified value. The corresponding electron image on the target should have a size such that the corners of the rectangle just touch the target ring.

[c] Ratio of dynode voltages is shown under *Typical Operating Values*.

[d] Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

[e] Normal setting of target voltage is +2 volts from target cutoff. The target supply voltage should be adjustable from -3 volts to +5 volts.

[f] Adjust to give the most uniformly shaded picture near maximum signal.

[g] Within this range, the actual focusing-voltage value will not differ by more than 2% from that for any other tube when all other operating conditions are held constant, i.e., when different tubes are operated in the same camera with the same deflecting yoke, withfixed focusing-field current, with grid-No.6 voltage at a fixed percentage of the photocathode voltage, and with all other voltages held constant.

[h] Measured with amplifier having flat frequency responses.

OPERATING CONSIDERATIONS

The *operating position* of the 7513 should preferably be such that any loose particles in the neck of the tube will not fall down and strike or become lodged on the target. Therefore, it is recommended that the tube never be operated in a vertical position with the Diheptal-base end up nor in any other position where the axis of the tube with base up makes an angle of less than 20° with the vertical.

Resolution in excess of 500 lines at the center of the picture can be produced by the 7513.

← Indicates a change.

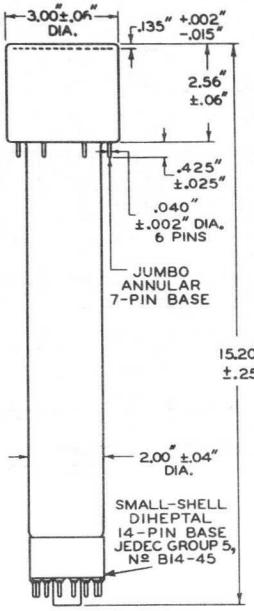
To utilize the resolution capability of the 7513 in the horizontal direction with the standard scanning rate of 525 lines, it is necessary to use a video amplifier having a bandwidth of at least 6 megacycles.

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Photosensitive Device having S-10 Response
is shown at the front of this Section

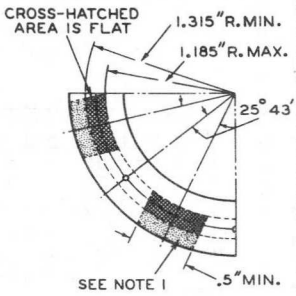
RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

7513

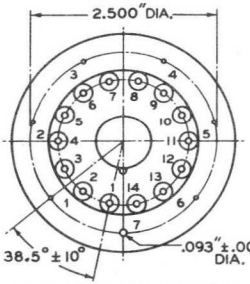
IMAGE ORTHICON



DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE



NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.



ENLARGED BOTTOM VIEW

ANNULAR-BASE GAUGE

ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAUGE WITH:

a. SIX HOLES HAVING DIAMETER OF 0.065" ± 0.001" AND ONE HOLE HAVING DIAMETER OF 0.150" ± 0.001". ALL HOLES HAVE DEPTH OF 0.265"±0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047". ALL HOLES ARE SPACED AT ANGLES OF 51°26' ± 5' ON CIRCLE DIAMETER OF 2.500" ± 0.001".

b. SEVEN STOPS HAVING HEIGHT OF 0.187" ± 0.001", CENTERED BETWEEN PIN HOLES, TO BEAR AGAINST FLAT AREAS OF BASE.

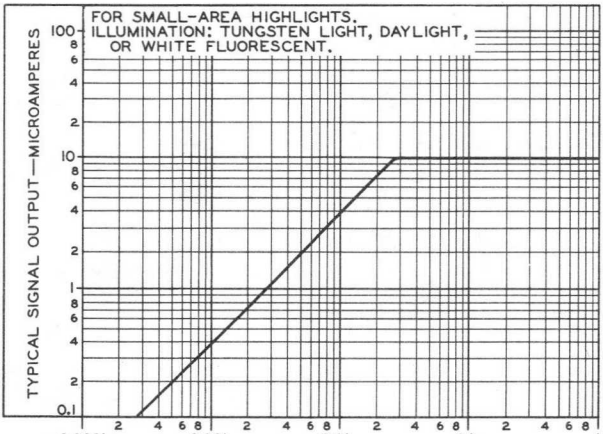
c. RIM EXTENDING OUT A MINIMUM OF 0.125" FROM 2.812" DIAMETER AND HAVING HEIGHT OF 0.126" ± 0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200" ± 0.001".

92CM-10154RI

7513

BASIC LIGHT-TRANSFER CHARACTERISTIC



7513/L

Image Orthicon

LONG-LIFE TARGET
MAGNETIC FOCUS

MAGNETIC DEFLECTION
PRECISION CONSTRUCTION TYPE

For Studio Pickup with Color and High-Quality Black-and-White TV Cameras. The 7513/L is Directly Interchangeable with the 7513 in All Cameras.

The 7513/L is the same as the 7513 except utilizes a longer life non-deteriorating glass target.

The sturdy, long-life, non-deteriorating, glass target of type 7513/L is characterized by high gain, resistance to "burn-in", and the absence of any granular structure. Because charge transportation through this target material is electronic rather than ionic as in ordinary glass targets, the electrical characteristics of the target, such as secondary emission and resistivity, are essentially constant and sensitivity of the 7513/L is stable throughout life.

Other important advantages of this target are that the undesirable characteristics of scene retention or "sticking picture" and raster "burn-in" due to underscanning are significantly reduced. The resistance of the 7513/L to image "burn-in" provides a highly desirable operational feature because it is not necessary to use an orbiter or continually move the camera when focused on a stationary scene.

OPERATING CONSIDERATIONS

Dos and Don'ts on Use of RCA-7513/L

Dos

1. Allow the 7513/L to warm up prior to operation.
2. Hold temperature of the 7513/L within operating range.
3. Make sure alignment coil is properly adjusted.
4. Adjust beam-focus control for best usable resolution.
5. Condition spare 7513/L's by operating several hours once each month.
6. Determine proper operating point with target voltage adjusted to exactly 2 volts above target cutoff.
7. Uncap lens before voltages are applied to the 7513/L.

Don'ts

1. Don't force the 7513/L into its shoulder socket.
2. Don't operate the 7513/L without scanning.
3. Don't operate a 7513/L having an ion spot.
4. Don't use more beam current than necessary to discharge the highlights of the scene.
5. Don't turn off beam while voltages are applied to photocathode, grid No.6, target, dynodes, and anode during warm-up or standby operation.

7536

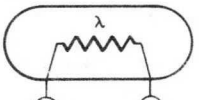
PHOTOCONDUCTIVE CELL

CADMIUM-SULFIDE, SIDE-ON TYPE
HAVING S-15 RESPONSE

DATA

General:

Spectral Response	S-15
Wavelength of Maximum Response	5800 ± 500 angstroms
Sensitive Surface:	
Shape	Rectangular
Length (Minimum)	0.20 in.
Width (Minimum)	0.02 in.
Area (Minimum)	0.004 sq. in.
Maximum Length (Excluding flexible leads)	1.35"
Diameter	0.29" ± 0.01"
Leads, Flexible	2
Minimum length	3.0"
Diameter	0.016" ± 0.005"
Operating Position	Any
Weight (Approx.)	0.06 oz



TERMINAL TERMINAL

DIRECTION OF LIGHT:
INTO SIDE OF BULB

λ indicates that the primary characteristic of the element within the envelope symbol is designed to vary under the influence of light.

Maximum Ratings, *Absolute-Maximum Values:*

VOLTAGE BETWEEN TERMINALS (DC or Peak AC)	200 max.	volts
PHOTOCURRENT	1000 max.	μa
POWER DISSIPATION	50 max.	mw
AMBIENT TEMPERATURE	60 max.	°C

Characteristics:

With dc voltage of 12 volts between terminals and an ambient temperature of 25° C

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant♦, at 5800 angstroms	–	1580	–	μa/μw
Luminous*#	–	4.5	–	amp/lumen
Illumination*#	100	300	800	μa/fc
Photocurrent▲	–	–	0.1	μa
Rise				*See Curves*
Decay				*See Curves*

7536
PHOTOCONDUCTIVE CELL

♦ For conditions where the incident power is 2×10^{-9} watt.

* For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K.

\# Incident illumination on the sensitive surface is 0.01 footcandle.

▲ Measured approximately 20 seconds after removal of incident-illumination level of 0.01 footcandle.

OPERATING CONSIDERATIONS

The *flexible leads* of the 7536 are usually soldered to the circuit elements. Soldering of the leads may be made close to the seals provided care is taken to conduct excessive heat away from the seals. Otherwise, the heat of soldering will break the seals and damage the cell.

A *clamp* around the glass envelope may be used to hold the cell in position. However, care must be taken in clamping to avoid cracking the glass envelope or introducing strains in the envelope which could lead to eventual breakage.

The *voltage between terminals* of the 7536 may be applied without regard to polarity.

The *angle of view* of the 7536 may be narrowed by the use of a hood of the desired length placed in front of the sensitive surface.

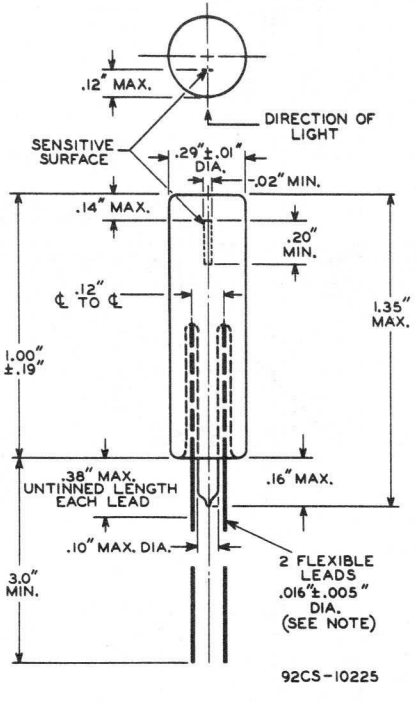
If the source of radiation is some distance from the cell, the use of a lens system may be desirable to utilize more effectively the available radiation. *However, the radiation should not be focused onto such a small area that localized overheating of the sensitive surface may result with consequent adverse affects on its characteristics.* Exposure of the 7536 to radiation (even without voltage applied) so intense as to cause excessive heating of the cell may permanently damage it.

For a given illumination, the output current will have its highest value when the incident illumination is normal (angle of incidence is 90°) to the face of the cell. For smaller angles of incidence, the output current decreases. The decrease depends upon several factors including the angle of incidence of the illumination, the amount of illumination, and the area of sensitive surface illuminated.

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Photoconductive Cell having S-15 Response
is shown at the front of this Section

7536

PHOTOCONDUCTIVE CELL

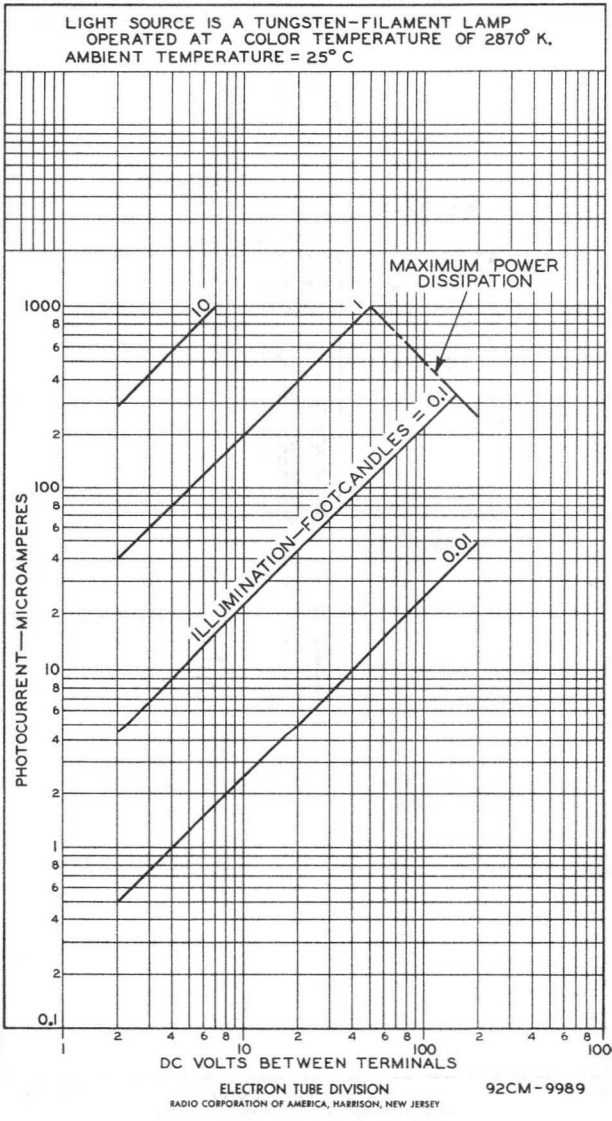


NOTE: THE SPECIFIED LEAD DIAMETER IS MAINTAINED ONLY WITHIN THE UNTINNED LENGTH.

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

7536

AVERAGE CHARACTERISTICS



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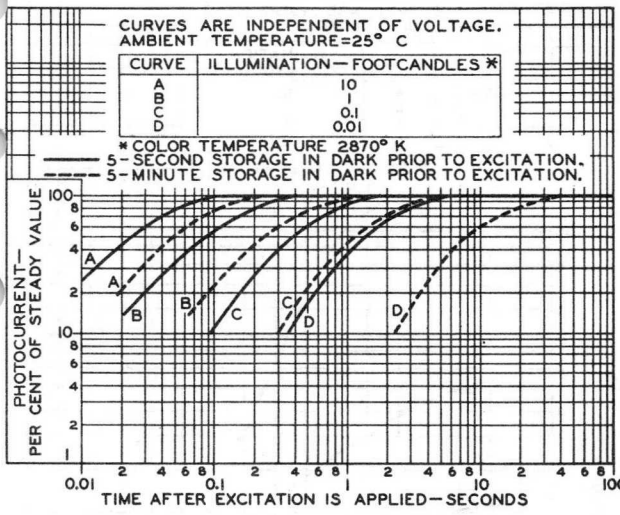
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9989

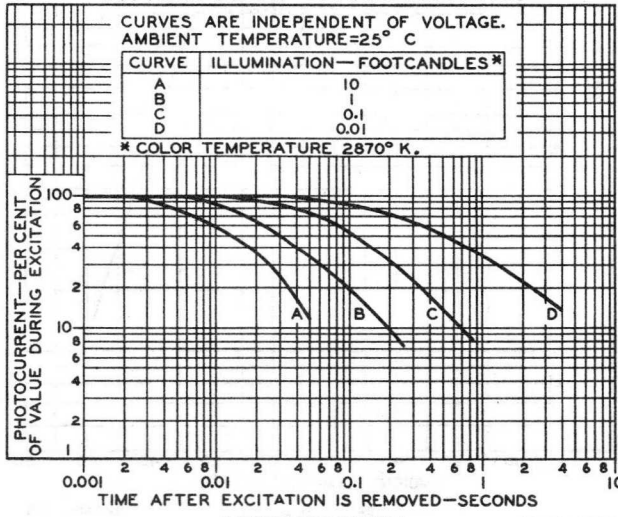
7536

TYPICAL RISE CHARACTERISTICS



92CS-9532

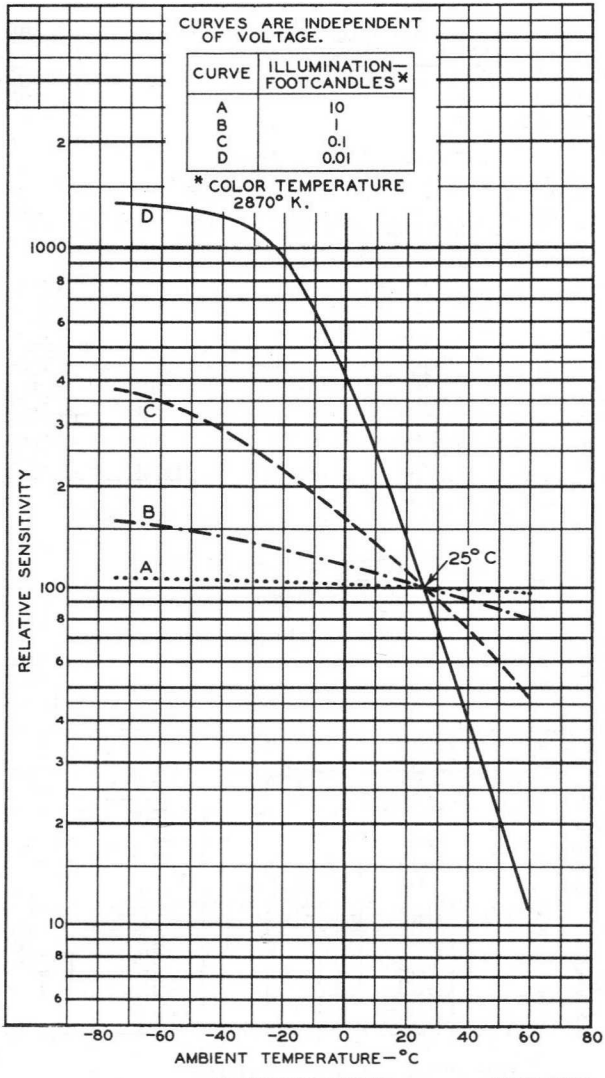
TYPICAL DECAY CHARACTERISTICS



RCA

7536

TYPICAL CHARACTERISTICS

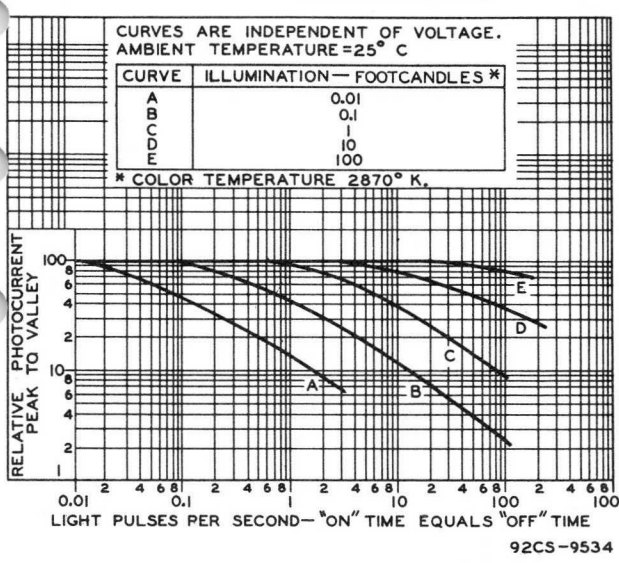


ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9538

7536

RESPONSE CHARACTERISTICS



92CS-9534

7580

BEAM POWER TUBE

FORCED-AIR COOLED
CERAMIC-METAL SEALS — 400 WATTS PEP* OUTPUT AT 30 Mc
COAXIAL-ELECTRODE STRUCTURE — 360 WATTS PEP OUTPUT AT 500 Mc
COMPACT DESIGN — INTEGRAL RADIATOR

Useful at frequencies up to 500 Mc

GENERAL DATA

Electrical:

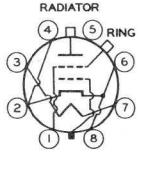
Heater, for Unipotential Cathode:		
Voltage (AC or DC)§	6 ± 10%	volts
Current at 6 volts	2.6	amp
Minimum heating time	30	sec
Mu-Factor, Grid No.2 to Grid No.1, for grid-No.2 volts = 300 and grid-No.2 ma. = 50	4	
Direct Interelectrode Capacitances (Approx.):○		
Grid No.1 to plate	0.03	μμf
Grid No.1 to cathode, grid No.2, and heater	17	μμf
Plate to cathode, grid No.2, and heater	4.5	μμf

Mechanical:

Operating Position	Any
Maximum Overall Length	2.464"
Maximum Seated Length	1.910"
Maximum Diameter	1.640"
Weight (Approx.)	4 oz
Radiator	Integral part of tube
Socket	Air-System Socket, such as Johnson No.124-110-1●● (Supplied with Air Chimney)
Base	Special 8-Pin

BOTTOM VIEW

Pin 1 - Grid No.2★
Pin 2 - Cathode
Pin 3 - Heater
Pin 4 - Cathode
Pin 5 - Internal Connection—Do Not Use
Pin 6 - Cathode
Pin 7 - Heater
Pin 8 - Cathode
Base Index Plug-Grid No.1
Radiator-Plate Ring Terminal■-Grid No.2



Air Flow:

Through indicated air-system socket—This fitting directs the air over the base seals; past the grid-No.2 seal, envelope, and plate seal; and through the radiator to provide effective cooling with minimum air flow. When the tube is operated at maximum plate dissipation for each class of service, a minimum air flow of 3.8 cfm through the system is required. The corresponding pressure drop is approximately 0.3 inch of water. These requirements are for operation at sea level and at an

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BEAM POWER TUBE

ambient temperature of 20° C. At higher altitudes and ambient temperatures, the air flow must be increased to maintain the respective seal temperatures and the plate temperature within maximum ratings.

Without air-system socket—if an air-system socket is not used, it is essential that adequate cooling air be directed over the base seals, past the envelope, and through the radiator. Under these conditions and with the tube operating at maximum plate dissipation for each class of service, a minimum air flow of 3.6 cfm must pass through the radiator. The corresponding pressure drop is approximately 0.1 inch of water. These requirements are for operation at sea level and at an ambient temperature of 20° C. At higher altitudes and ambient temperatures, the air flow must be increased to maintain the respective seal temperatures and the plate temperature within maximum ratings.

Plate Temperature (Measured on base end of plate surface at junction with fins).	250 max.	°C
Temperature of Plate Seal, Grid-No.2 Seal, and Base Seals.	250 max.	°C

LINEAR RF POWER AMPLIFIER
Single-Sideband Suppressed-Carrier Service

Peak envelope conditions for a signal having a minimum peak-to-average power ratio of 2

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

For altitudes up to 20,000 feet and frequencies up to 500 Mc

DC PLATE VOLTAGE.	2000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE. . . .	500 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE . . .	-250 max.	volts
DC PLATE CURRENT AT PEAK OF ENVELOPE. . .	350 max.†	ma
PLATE DISSIPATION	250 max.	watts
GRID-No.2 DISSIPATION	12 max.	watts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode.	150 max.	volts
Heater positive with respect to cathode.	150 max.	volts

Typical CCS Operation with "Two-Tone Modulation":▲

	At 30 Mc	*At 500 Mc*	
DC Plate Voltage.	2000	2000	volts
DC Grid-No.2 Voltage‡	400	400	volts
DC Grid-No.1 Voltage:			
With fixed-bias source. . . .	-77	-77	volts
Zero-Signal DC Plate Current. .	70	70	ma
Effective RF Load Resistance. .	3050	3050	ohms

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	At 30 Mc	*At 500 Mc*	
DC Plate Current:			
Peak envelope	350	350	ma
Average	225	225	ma
DC Grid-No.2 Current:			
Peak envelope	35	25	ma
Average	16	10	ma
Average DC Grid-No.1 Current.	0.05⊕	0.05⊕	ma
Peak-Envelope Driver Power Output (Approx.)○○	1	12	watts
Output-Circuit Efficiency (Approx.)	95	85	%
Distortion Products Level:●			
Third order	21	-	db
Fifth order	29	-	db
Useful Power Output (Approx.):			
Peak envelope	400✱	360✱	watts
Average	200✱	180✱	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under any condition:		
With fixed bias	25000 max.	ohms
With cathode bias	Not recommended	

LINEAR RF POWER AMPLIFIER — AM Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1

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

For altitudes up to 20,000 feet and frequencies up to 500 Mc

DC PLATE VOLTAGE	2000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	500 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-250 max.	volts
DC PLATE CURRENT	180 max.	ma
PLATE DISSIPATION	250 max.	watts
GRID-No.2 DISSIPATION	12 max.	watts
GRID-No.1 DISSIPATION	2 max.	watts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode.	150 max.	volts
Heater positive with respect to cathode.	150 max.	volts

Typical CCS Operation:

	At 30 Mc	*At 500 Mc*	
DC Plate Voltage	2000	2000	volts
DC Grid-No.2 Voltage‡	400	400	volts
DC Grid-No.1 Voltage:			
With fixed-bias source.	-77	-77	volts
DC Plate Current.	175	175	ma
DC Grid-No.2 Current.	6	4	ma

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	At 30 Mc	*At 500 Mc*	
Effective RF Load Resistance. .	3050	3050	ohms
Driver Power Output (Approx.)oo	0.25	3	watts
Output-Circuit Efficiency (Approx.)	95	85	%
Useful Power Output (Approx.) .	100✤	90✤	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under any condition:		
With fixed bias	25000 max.	ohms
With cathode bias	Not recommended	

** Peak-envelope power.

* Because the cathode is subjected to considerable back bombardment as the frequency is increased with resultant increase in temperature, the heater voltage should be reduced depending on operating conditions and frequency to prevent overheating the cathode and resultant short life.

o With cylindrical shield JEDEC No.320 surrounding radiator, and with a cylindrical shield JEDEC No.321 surrounding the grid-No.2 ring terminal. Both shields are connected to ground.

●● Available from E.F. Johnson Co., Waseca, Minnesota.

★ For use at lower frequencies.

■ For use at higher frequencies.

● Continuous Commercial Service.

† The maximum rating for a signal having a minimum peak-to-average power ratio less than 2, such as is obtained in "Single-Tone" operation, is 250 ma. During short periods of circuit adjustment under "Single-Tone" conditions, the average plate current may be as high as 350 ma.

▲ *Two-Tone Modulation* operation refers to that class of amplifier service in which the input consists of two equal monofrequency rf signals having constant amplitude. These signals are produced in a single-sideband suppressed-carrier system when two equal-and-constant amplitude audio frequencies are applied to the input of the system.

‡ Obtained preferably from a fixed supply.

⊕ This value represents the approximate grid-No.1 current obtained due to initial electron velocities and contact-potential effects when grid No.1 is driven to zero volts at maximum signal.

oo Driver power output represents circuit losses and is the actual power measured at input to grid-No.1 circuit of the 7580. The actual power required depends on the operating frequency and the circuit used. The tube driving power is approximately zero watts.

♦ Without the use of feedback to enhance linearity.

✤ This value of useful power is measured at load of output circuit having indicated efficiency.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Heater Current.	1	2.3	2.9	amp
Direct Interelectrode Capacitances:o				
Grid No.1 to plate. . . .	-	-	0.06	μμf
Grid No.1 to cathode, grid No.2, and heater .	-	16	18.5	μμf
Plate to cathode, grid No.2, and heater. . . .	-	4.	5	μμf

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	Note	Min.	Max.	
Grid-No.1 Voltage:				
Negative.	1,2,5,6	55	100	volts
Positive.	1,5,6,7	3	12	volts
Grid-No.2 Current (1) . . .	1,3,5,6	-7	+3	ma
Grid-No.2 Current (2) . . .	1,5,6,7	-	260	ma
Grid-No.1 Current	1,5,6,7	-	150	ma
Useful Power Output	4,5,6	225	-	watts

Note 1: With 6 volts on heater.

Note 2: With dc plate voltage of 2000 volts, dc grid-No.2 voltage of 400 volts, and grid-No.1 voltage adjusted to give plate current of 67 ma.

Note 3: With dc plate voltage of 1000 volts, dc grid-No.2 voltage of 300 volts, and grid-No.1 voltage adjusted to give plate current of 150 ma.

Note 4: With heater voltage of 5.5 volts, dc plate voltage of 2000 volts, dc grid-No.2 voltage of 300 volts, dc grid-No.1 bias of -90 volts, dc grid-No.1 current of 25 ma. maximum, grid-No.1 signal voltage adjusted to produce dc plate current of 250 ma., and coaxial-cavity amplifier circuit operating at a frequency of 475 Mc.

Note 5: With Forced-Air Cooling as specified under GENERAL DATA—*Air System Socket.*

Note 6: Heater voltage must be applied for at least 30 seconds before application of other voltages.

Note 7: With dc plate voltage of 250 volts, dc grid-No.2 voltage of 250 volts, and grid-No.1 voltage adjusted to give peak plate current of 1 ampere. This test is performed using pulse technique to prevent tube damage. Square pulses of 4500 μs duration at a repetition rate of 11 ± 1 pps are used.

SPECIAL PERFORMANCE DATA

Interelectrode Leakage:

This test is destructive and is performed on a sample lot of tubes from each production run under the following conditions: ac heater volts = 6.6, no voltage on other elements, and specified forced-air cooling for *Air System Socket.* At the end of 500 hours, with tube at 25° C, and with no voltage applied to heater, the minimum resistance between indicated electrodes as measured with a 500-volt Megger-type ohmmeter having an internal impedance of 2.5 megohms, will be:

Grid No.1 and grid No.2	10 min.	megohms
Grid No.1 and cathode	10 min.	megohms
Grid No.2 and cathode	10 min.	megohms

OPERATING CONSIDERATIONS

The *socket* for the 7580 should be of a type (such as that indicated in the tabulated data) which permits adequate air-cooling of the tube. Although the base will fit a conventional lock-in socket, the latter does not permit adequate cooling and its use is therefore not recommended.

The *plate connection* is made by a metal band or spring contacts to the cylindrical surface of the radiator. It is essential that the contact areas be kept clean to minimize rf losses especially at the higher frequencies.

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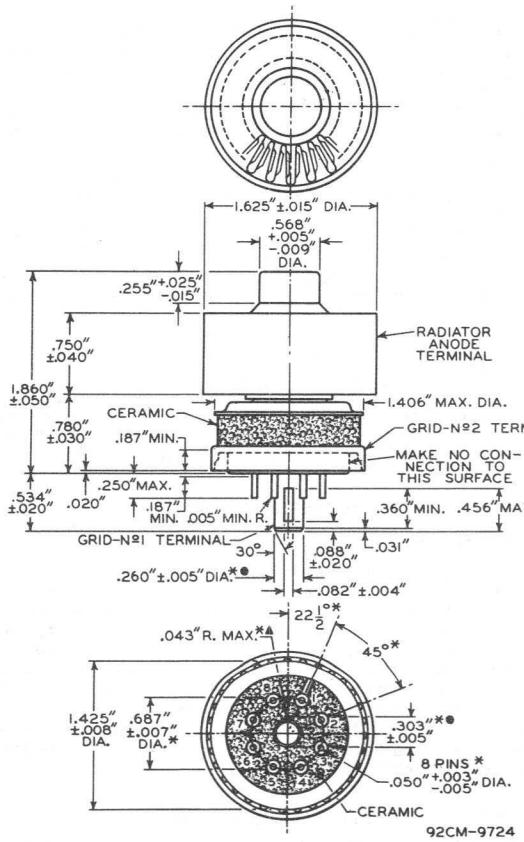
BEAM POWER TUBE



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BEAM POWER TUBE

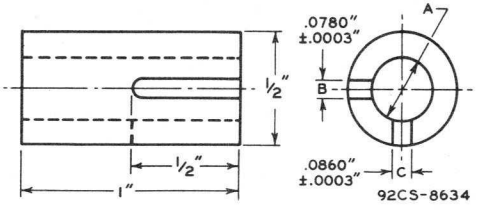
GRID-No.1-PLUG DIMENSIONS ARE MEASURED BY GAUGES G_1 AND G_2. IN THE FOLLOWING INSTRUCTIONS FOR THE USE OF THESE GAUGES, "GO" INDICATES THAT THE ENTIRE GRID-No.1-PLUG KEY WILL ENTER THE GAUGE; AND "NO-GO" INDICATES THAT THE GRID-No.1-PLUG KEY WILL NOT ENTER THE GAUGE MORE THAN 1/16". INSTRUCTIONS FOR THE USE OF THE GAUGES FOLLOW:

▲ GAUGES G_1-1, G_1-2, G_1-3, AND G_1-4:
USING ONLY SLOT C, TRY THESE GAUGES IN NUMERICAL ORDER UNTIL ONE IS FOUND THAT WILL ACCEPT THE ENTIRE GRID-No.1 PLUG. USING THE FIRST GAUGE THUS FOUND, IT WILL NOT BE POSSIBLE TO INSERT THE GRID-No.1 PLUG IN SLOT B.

● GAUGES G_2-1, G_2-2, AND G_2-3:
THE GRID-No.1 PLUG WILL BE REJECTED BY GAUGES G_2-1 AND G_2-2, BUT WILL BE ACCEPTED BY GAUGE G_2-3.

* BASE-PIN POSITIONS ARE HELD TO TOLERANCES SUCH THAT THE ENTIRE LENGTH OF THE PINS WILL, WITHOUT UNDUE FORCE, PASS INTO AND DISENGAGE FROM THE FLAT-PLATE GAUGE G_3.

GAUGE G_1



Gauge	Dimension A
G_1 - 1	.2575" + .0000" − .0005"
G_1 - 2	.2600" + .0000" − .0005"
G_1 - 3	.2625" + .0000" − .0005"
G_1 - 4	.2650" + .0000" − .0005"

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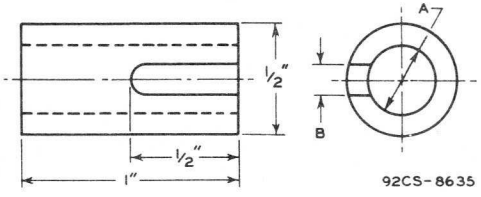
GAUGE G_2



Gauge	Dimension	
	A	B
G_2-1	.2550" + .0000" − .0005"	.125"
G_2-2	.2980" + .0000" − .0005"	none
G_2-3	.3080" + .0000" − .0005"	none

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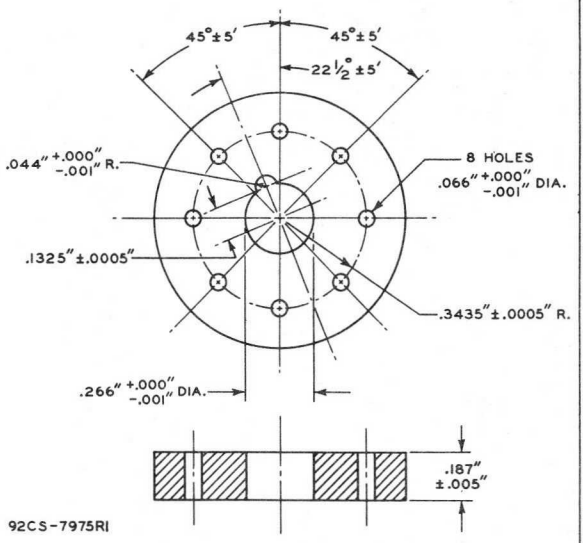
GAUGE G_3



TOLERANCES ARE NOT CUMULATIVE

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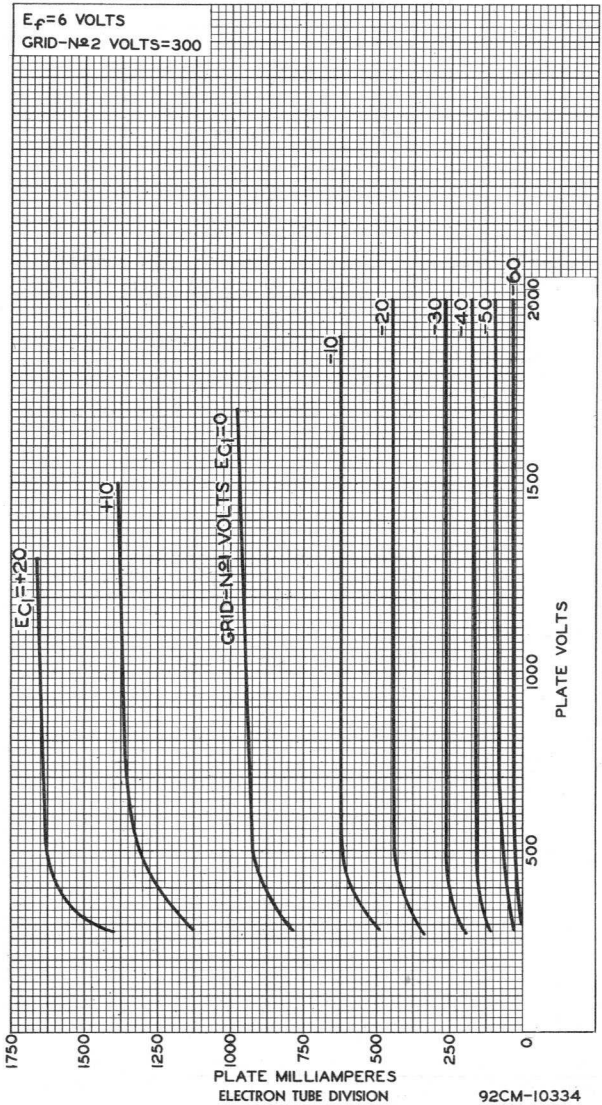
TYPICAL PLATE CHARACTERISTICS



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92CM-10334

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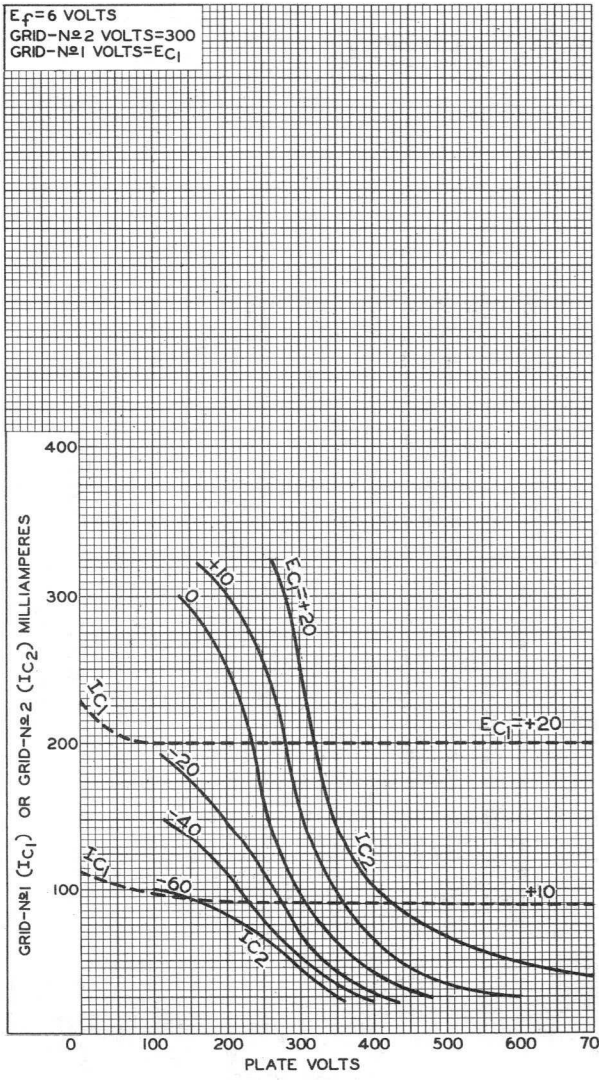
TYPICAL CHARACTERISTICS



RCA

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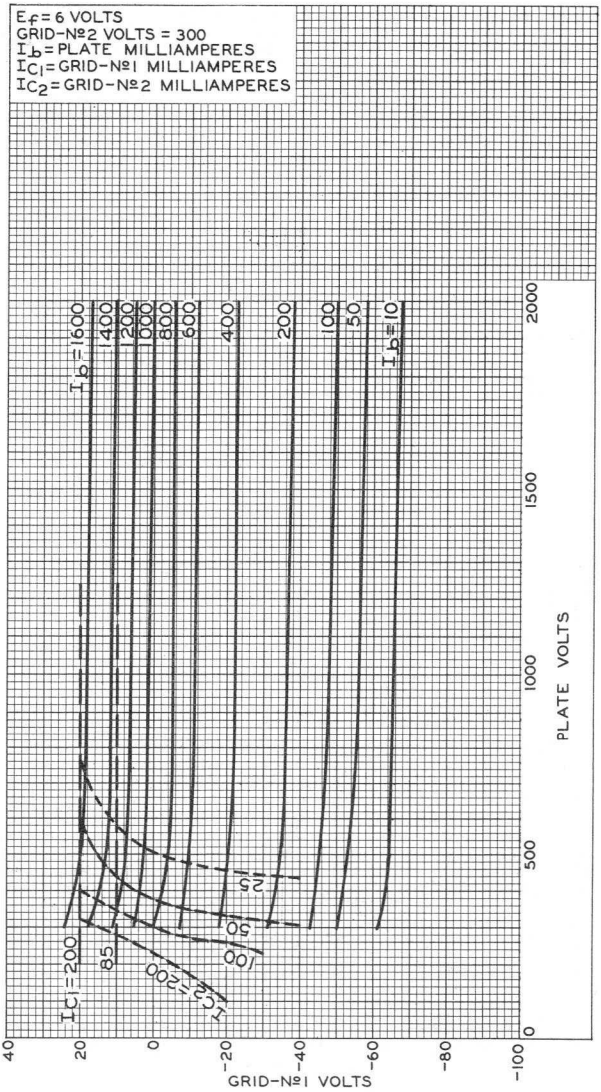
TYPICAL CONSTANT-CURRENT CHARACTERISTICS



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92CM-10332

RCA

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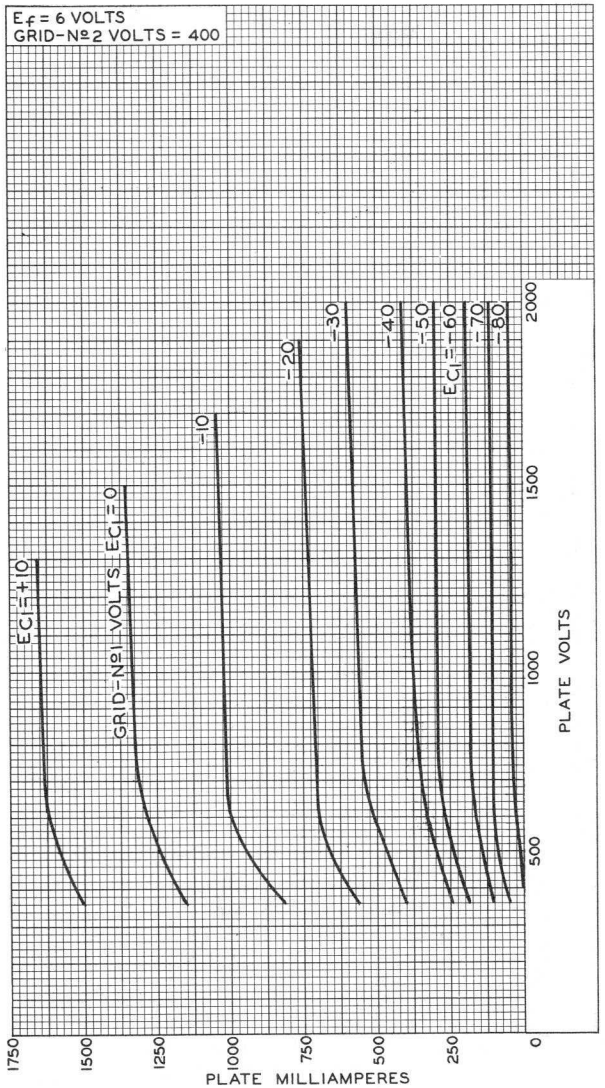
TYPICAL PLATE CHARACTERISTICS



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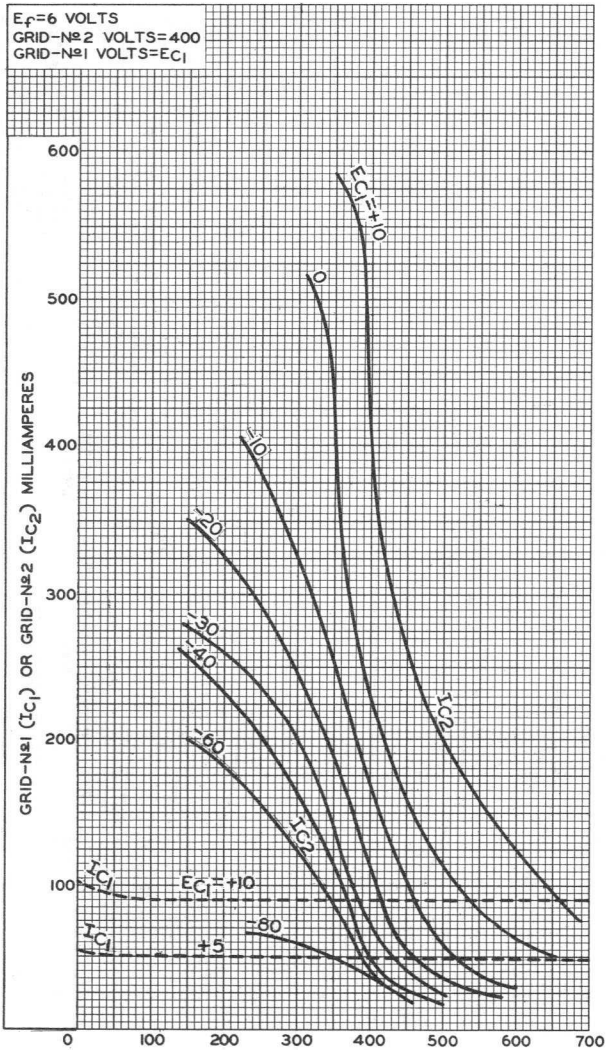
TYPICAL CHARACTERISTICS



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92CM-10335

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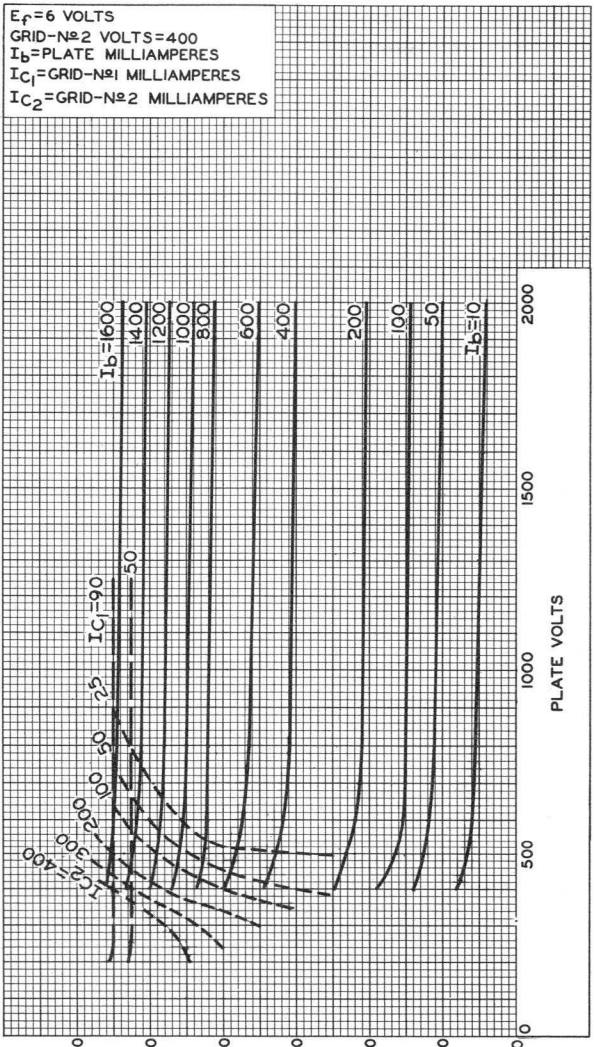
TYPICAL CONSTANT-CURRENT CHARACTERISTICS



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92CM-10336

Medium-Mu Triode

NUVISTOR TYPE
For Industrial Applications

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.14	amp
Direct Interelectrode Capacitances (Approx.):		
Grid to plate	2.2	μμf
Grid to cathode, shell, and heater	4	μμf
Plate to cathode, shell, and heater	1.4	μμf
Plate to cathode	0.2	μμf
Heater to cathode	1.3	μμf

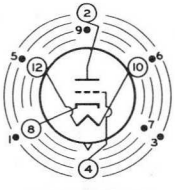
Characteristics, Class A_1 Amplifier:

Plate Supply Voltage	–	–	75	volts
Plate Voltage	26.5	40	–	volts
Grid Supply Voltage	0	0	0	volts
Cathode Resistor	–	–	130	ohms
Amplification Factor	31	35	33	
Grid-Circuit Resistance	0.5	0.5	–	megohm
Plate Resistance (Approx.)	4400	3200	2900	ohms
Transconductance	7000	11000	11500	μmhos
Plate Current	2.8	6.8	10.5	ma
Grid Voltage (Approx.) for plate μa = 10	–	–	-6.5	volts

Mechanical:

Operating Position . . . . . Any
Maximum Overall Length . . . . . 0.8"
Maximum Seated Length . . . . . 0.625"
Maximum Diameter . . . . . 0.440"
Envelope . . . . . Metal Shell
Socket . . . Cinch Mfg. Corp. No.133 65 10 001, or equivalent
Base . . . . . Medium Ceramic-Wafer Twelvar 5-Pin (JEDEC No.E5-65)
Basing Designation for BOTTOM VIEW 12AQ

Pin 1▲ - Internal Connection—Do Not Use
Pin 2 - Plate
Pin 3 - Same as Pin 1
Pin 4 - Grid
Pin 5 - Same as Pin 1
Pin 6 - Same as Pin 1
Pin 7 - Same as Pin 1
Pin 8 - Cathode
Pin 9 - Same as Pin 1
Pin 10 - Heater
Pin 12 - Heater



INDEX=LARGE LUG
●= PIN CUT OFF

INDUSTRIAL SERVICE

Maximum Ratings, *Absolute-Maximum Values:*

For operation at any altitude

PLATE SUPPLY VOLTAGE	330 max.	volts
PLATE VOLTAGE	110 max.	volts
GRID VOLTAGE:		
Negative-bias value	55 max.	volts
Peak-positive value	4 max.	volts
GRID CURRENT	2 max.	ma
PLATE CURRENT	20 max.	ma
PLATE DISSIPATION	1 max.	watt
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	100 max.	volts
Heater positive with respect to cathode	100 max.	volts

Maximum Circuit Values:

Grid-Circuit Resistance:●		
For fixed-bias operation	0.5 max.	megohm
For cathode-bias operation	1 max.	megohm

▲ Pin is cut off close to ceramic wafer.

● For operation at metal-shell temperatures up to 100° C.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Heater Current	1	0.132	0.148	amp
Direct Interelectrode Capacitances:				
Grid to plate	2	1.9	2.5	μμf
Grid to cathode, shell, and heater	2	3.5	4.5	μμf
Plate to cathode, shell, and heater	2	1.1	1.6	μμf
Heater to cathode	2	1	1.6	μμf
Plate to cathode	2	0.14	0.26	μμf
Plate Current (1)	1,3	9	12	ma
Plate Current (2)	1,4	–	50	μa
Transconductance (1)	1,3	10000	13000	μmhos
Transconductance (2)	3,5	9000	–	μmhos
Transconductance Change: Difference between Transconductance (1) and Transconductance (2), expressed in per cent of Transconductance (1)	–	–	15	%
Reverse Grid Current	1,6	–	0.3	μa
Amplification Factor	1,3	26	38	
Heater-Cathode Leakage Current:				
Heater negative with respect to cathode	1,7	–	10	μa
Heater positive with respect to cathode	1,7	–	10	μa

Leakage Resistance:				
Between grid and all other electrodes tied together. .	1,8	500	–	megohms
Between plate and all other electrodes tied together. .	1,9	500	–	megohms

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

Note 2: Measured in accordance with EIA Standard RS-191-A.

Note 3: With dc plate supply volts = 75, cathode resistor = 130 ohms, and cathode-bypass capacitor = 1000 μf.

Note 4: With dc plate volts = 75, dc grid volts = -7, and metal shell connected to ground.

Note 5: With 5.7 volts ac or dc on heater.

Note 6: With dc plate volts = 100, grid supply volts = -2.25, grid resistor = 0.5 megohm, and metal shell connected to ground.

Note 7: With 100 volts dc applied between heater and cathode.

Note 8: With grid 100 volts negative with respect to all other electrodes tied together.

Note 9: With plate 300 volts negative with respect to all other electrodes tied together.

SPECIAL RATINGS & PERFORMANCE DATA

Shock Rating:

Impact Acceleration . . . . . 1000 max. g

This test is performed on a sample lot of tubes from each production run to determine ability of tube to withstand the specified impact acceleration. Tubes are held rigid in four different positions in a Navy Type, High-impact (flyweight) Shock Machine and are subjected to 20 blows at a hammer angle of 60° (equivalent to the specified maximum impact acceleration). At the end of this test, tubes are criticized for change in transconductance, reverse grid current, and heater-cathode leakage current, and are then subjected to the Variable-Frequency Vibration Test described below.

Fatigue Rating:

Vibrational Acceleration. . . . . 2.5 max. g

This test is performed on a sample lot of tubes to determine ability of tube to withstand the specified vibrational acceleration. Tubes are rigidly mounted, supplied with nominal heater voltage only, and subjected for 48 hours to 2.5-g vibrational acceleration at 60 cycles per second in the X_1 position. At the end of this test, tubes are criticized for the same characteristics and end-point values as in the Shock Rating Test described above.

Variable-Frequency Vibration Performance:

This test is performed on a sample lot of tubes from each production run. The tube is operated under the conditions specified in CHARACTERISTICS RANGE VALUES for Transconductance (1) with the addition of a plate-load resistor of 2000 ohms. During operation, tube is vibrated in the X_1 position through the frequency range from 50 to 10,000 cycles per second with a constant vibrational acceleration of 1 g. During the test, tube will not show an rms output voltage across the plate-

load resistor in excess of: (1) 50 millivolts from 50 to 5000 cps, (2) 250 millivolts from 5000 to 7000 cps, and (3) 500 millivolts from 7000 to 10,000 cps.

Low-Pressure Voltage-Breakdown Test:

This test is performed on a sample lot of tubes from each production run. In this test, tubes are operated with 240 rms volts applied between plate and all other electrodes and will not break down or show evidence of corona when subjected to air pressures equivalent to altitudes of up to 100,000 feet.

Heater Cycling:

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

This test is performed on a sample lot of tubes from each production run under the following conditions: heater volts = 7.5 cycled one minute on and two minutes off; heater 100 volts negative with respect to cathode; grid, plate, and metal shell connected to ground. At the end of this test, tubes are tested for open heaters, heater-cathode shorts, and heater-cathode leakage current.

Shorts, Continuity, and Reverse Grid Current:

This test is performed on a sample lot of tubes from each production run. Tubes are subjected to the Thyratron-Type Shorts Test described in MIL-E-1D, Amendment 2, Paragraph 4.7.7, except that tapping is done by hand with a soft rubber tapper★. See accompanying Shorts-Test Acceptance-Limits curve. Tubes are criticized for permanent or temporary shorts and open circuits, and also test is made for reverse grid current in excess of one microampere under the conditions specified in CHARACTERISTICS RANGE VALUES for reverse grid current.

Interelectrode Leakage:

Leakage Resistance. . . . . 500 min. megohms

These tests are performed on a sample lot of tubes from each production run under the following conditions: heater volts = 6.3, (1) plate = 300 volts negative with respect to all other electrodes tied together, and (2) grid = 100 volts negative with respect to all other electrodes tied together. Tubes are rejected if the leakage resistance between plate and all other electrodes under condition (1), or between grid and all other electrodes under condition (2), is less than 500 megohms.

Early-Hour Stability Life Performance:

This test is performed on a sample lot of tubes from each production run to insure that tubes are properly stabilized. In this test, tubes are operated for 20 hours at maximum-rated plate dissipation. After two hours of operation and again after 20 hours of operation, tubes are checked for transconductance under the conditions specified in CHARACTERISTICS RANGE VALUES for Transconductance (1). A tube is rejected if its transconductance after two or 20 hours of operation has changed more than 10 per cent from the 0-hour value.

100-Hour Life Performance:

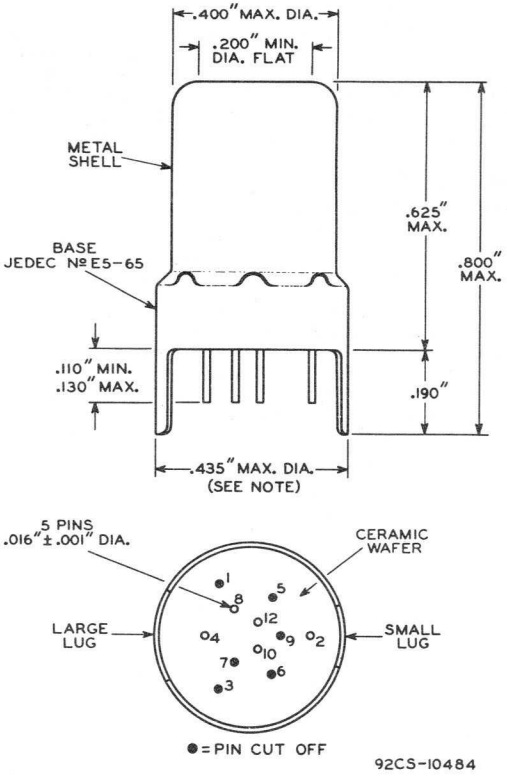
This test is performed on a sample lot of tubes from each production run to insure a low percentage of early-hour inoperatives. Tubes are operated for 100 hours at maximum-rated plate dissipation, and then subjected to the Intermittent Shorts Test previously described. Tubes must then show a transconductance of not less than 7500 micromhos under the conditions specified in CHARACTERISTICS RANGE VALUES for Transconductance (1).

1000-Hour 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 guard against epidemic failures due to excessive changes in any of the characteristics indicated below. In this test, tubes are operated for 1000 hours at maximum-rated plate dissipation, and then criticized for inoperatives, reverse grid current, heater-cathode leakage current, and leakage resistance. In addition, the average change in transconductance of the lot from the 0-hour value for Transconductance (1) specified in CHARACTERISTICS RANGE VALUES, must not exceed 15 per cent at 500 hours, and 20 per cent at 1000 hours.

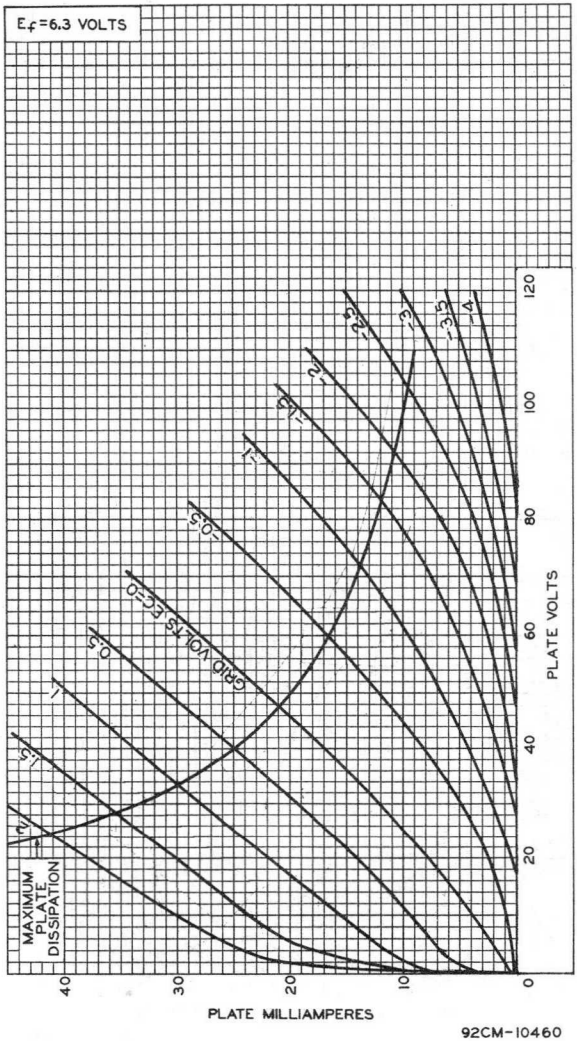
★ Specifications for tapper supplied on request.

7586



NOTE: MAXIMUM OUTSIDE DIAMETER OF 0.440" IS PERMITTED ALONG 0.190" LUG LENGTH.

AVERAGE PLATE CHARACTERISTICS



92CM-10460

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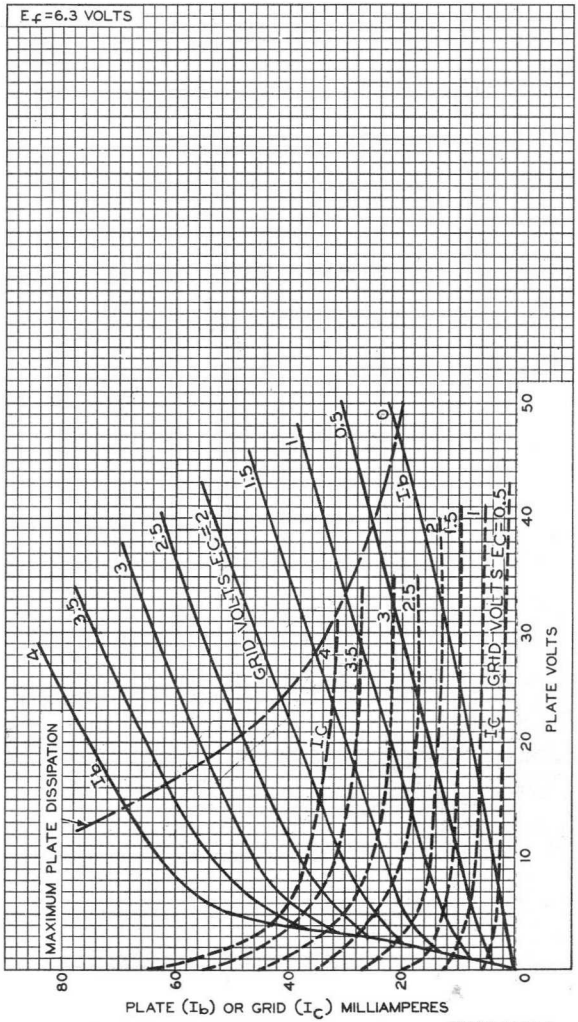
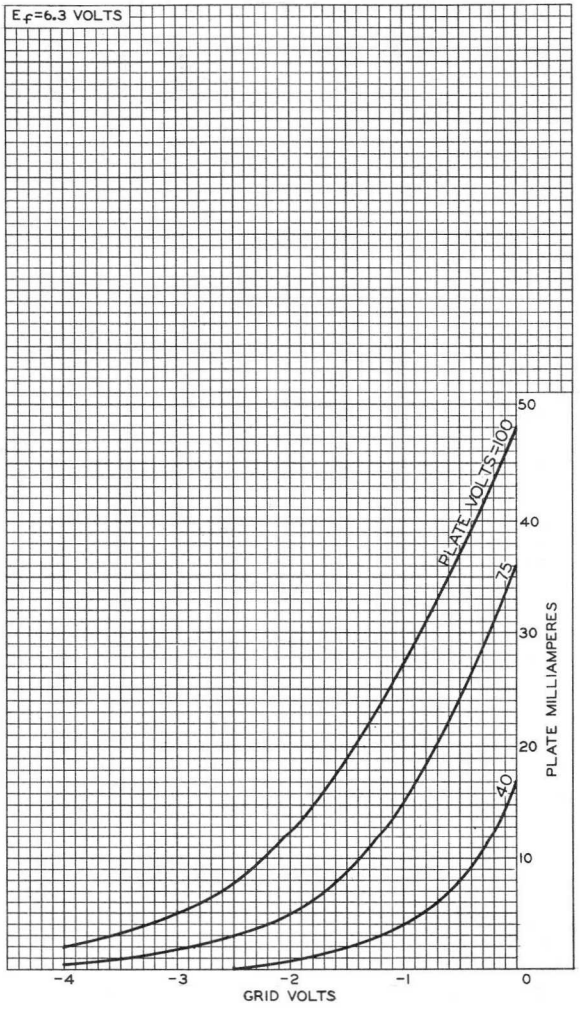
AVERAGE CHARACTERISTICS



92CM-10464

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.

AVERAGE CHARACTERISTICS



92CM-10461

SHORTS-TEST ACCEPTANCE LIMITS

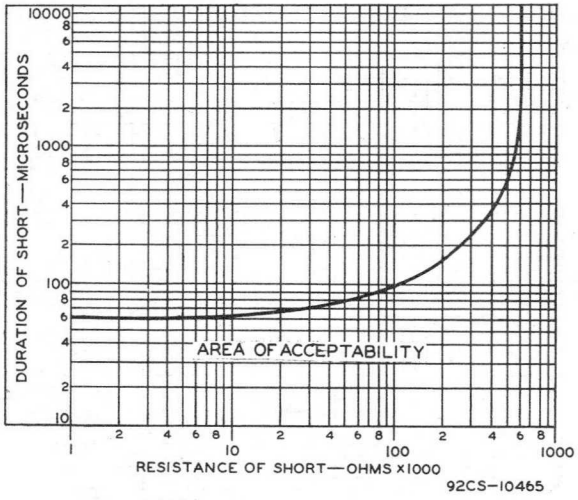


Image Orthicon

SEMICONDUCTIVE TARGET, S-10 RESPONSE
VERY HIGH SENSITIVITY — MAGNETIC FOCUS
HIGH RESOLUTION — MAGNETIC DEFLECTION

For Studio and Remote Low-Light Level Color and Black-and-White TV Pickup. Sensitivity Equivalent to Film having ASA Exposure Index of 20,000.

DATA

General:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.6	amp
Direct Interelectrode Capacitance:		
Anode to all other electrodes	12	pf
Spectral Response		S-10
Wavelength of Maximum Response	4500 ± 300	angstroms
Photocathode, Semitransparent:		
Rectangular image (4 x 3 aspect ratio):		
Useful size of	1.8" max.	diagonal

Note: The size of the optical image focused on the photocathode should be adjusted so that its maximum diagonal does not exceed the specified value. The corresponding electron image on the target should have a size such that the corners of the rectangle just touch the target ring.

Orientation of . . Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through center of faceplate and pin 7 of the shoulder base.

Focusing Method	Magnetic
Deflection Method	Magnetic
Overall Length	15.20" ± 0.25"
Greatest Diameter of Bulb	3.00" ± 0.06"
Minimum Deflecting-Coil Inside Diameter	2-3/8"
Deflecting Coil	Cleveland Electronics, Part No.OY-1[a], or equivalent
Deflecting-Coil Length	5"
Focusing Coil	Cleveland Electronics, Part No.OF-2[a], or equivalent
Focusing-Coil Length	10"
Alignment Coil	Cleveland Electronics, Part No.OA-3[a], or equivalent
Alignment-Coil Length	15/16"
Photocathode Distance Inside End of Focusing Coil	1/2"
Socket	Cinch Part No.3M14[b], or equivalent

Operating Position . . The tube should never be operated in a vertical position with the diheptal-base end up nor in any other position where the axis of the tube with the base up makes an angle of less than 20° with the vertical.

Weight (Approx.) . . . . . 1 lb 6 oz

7629A

Shoulder Base. . . . . Keyed Jumbo Annular 7-Pin

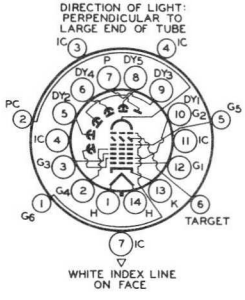
BOTTOM VIEW

Pin 1 – Grid No.6
Pin 2 – Photocathode
Pin 3 – Do Not Use
Pin 4 – Do Not Use
Pin 5 – Grid No.5
Pin 6 – Target
Pin 7 – Do Not Use

End Base . . . Small-Shell Diheptal 14-Pin (JEDEC No.B14-45)

BOTTOM VIEW

Pin 1 – Heater
Pin 2 – Grid No.4
Pin 3 – Grid No.3
Pin 4 – Do Not Use
Pin 5 – Dynode No.2
Pin 6 – Dynode No.4
Pin 7 – Anode
Pin 8 – Dynode No.5
Pin 9 – Dynode No.3
Pin 10 – Dynode No.1, Grid No.2
Pin 11 – Do Not Use
Pin 12 – Grid No.1
Pin 13 – Cathode
Pin 14 – Heater



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

PHOTOCATHODE:		
Voltage.	−550 max.	volts
Illumination	50 max.	fc
OPERATING TEMPERATURE:		
Of any part of bulb.	55 max.	°C
Of bulb at large end of tube (Target section)	0 min.	°C
TEMPERATURE DIFFERENCE:		
Between target section and any part of bulb hotter than target section	5 max.	°C
GRID-No.6 VOLTAGE.	−550 max.	volts
TARGET VOLTAGE:		
Positive value	10 max.	volts
Negative value	10 max.	volts
GRID-No.5 VOLTAGE.	150 max.	volts
GRID-No.4 VOLTAGE.	300 max.	volts
GRID-No.3 VOLTAGE.	400 max.	volts
GRID-No.2 & DYNODE-No.1 VOLTAGE.	350 max.	volts
GRID-No.1 VOLTAGE:		
Negative-bias value.	125 max.	volts
Positive-bias value.	0 max.	volts
VOLTAGE PER MULTIPLIER STAGE	350 max.	volts
ANODE-SUPPLY VOLTAGE[C].	1350 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	10 max.	volts

Typical Operating Values:[d]

Photocathode Voltage (Image Focus)[e]	-400 to -540	volts
Grid-No.6 Voltage (Accelerator)— (Approx. 75% of photocathode voltage)	-300 to -405	volts
Target-Cutoff Voltage[f]	-3 to 1	volts
Grid-No.5 Voltage (Decelerator)	0 to 125	volts
Grid-No.4 Voltage (Beam Focus)[e]	140 to 180	volts
Grid-No.3 Voltage[g]	225 to 330	volts
Grid-No.2 & Dynode-No.1 Voltage	300	volts
Grid-No.1 Voltage for Picture Cutoff	-45 to -115	volts
Dynode-No.2 Voltage	600	volts
Dynode-No.3 Voltage	800	volts
Dynode-No.4 Voltage	1000	volts
Dynode-No.5 Voltage	1200	volts
Anode Voltage	1250	volts
Minimum Peak-to-Peak Blanking Voltage	5	volts
Field Strength at Center of Focusing Coil[h]	75	gausses
Field Strength of Alignment Coil	0 to 3	gausses

Performance Data:

With conditions shown under Typical Operating Values and with camera lens set to bring the picture highlights one stop above the "knee" of the accompanying Basic Light-Transfer-Characteristic Curve

	Min.	Typ.	Max.	
Cathode Radiant Sensitivity at 4500 angstroms	-	0.033	-	a/w
Luminous Sensitivity	40	65	-	μa/lm
Anode Current (DC)	-	30	-	μa
Signal-Output Current (Peak to Peak)	4	6	10	μa
Ratio of Peak-to-Peak Highlight Video-Signal Current to RMS Noise Current for Bandwidth of 4.5 Mc	-	32:1	-	
Photocathode Illumination at 2870° K Required to bring Picture Highlights One Stop above "Knee" of Light Transfer Characteristic	-	0.007	-	fc
Peak-to-Peak Response to Square-Wave Test Pattern of 400 TV Lines Per Picture Height (Per cent of large-area black to large-area white)[j]	-	65	-	%

a Made by Cleveland Electronics Inc., 1974 East 61st Street, Cleveland, Ohio.

b Made by Cinch Manufacturing Company, 1026 South Homan Avenue, Chicago 24, Illinois.

c Dynode voltage values are shown under *Typical Operating Values*.

d With 7629A operated in properly adjusted RCA TK-31 camera.

e Adjust for best focus.

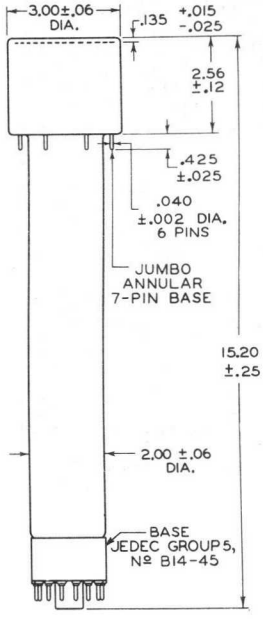
f Normal setting of target voltage is +2 volts from target cutoff. The target supply voltage should be adjustable from -3 to 5 volts.

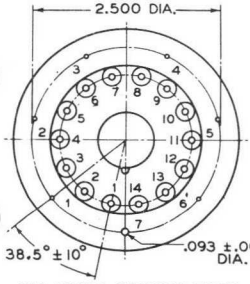
g Adjust to give the most uniformly shaded picture near maximum signal.

h Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with indicator located outside of and at the image end of the focusing coil.

j Measured with amplifier having flat frequency response.

SPECTRAL-SENSITIVITY CHARACTERISTIC
OF PHOTOSENSITIVE DEVICE HAVING S-10 RESPONSE
is shown at front of this Section



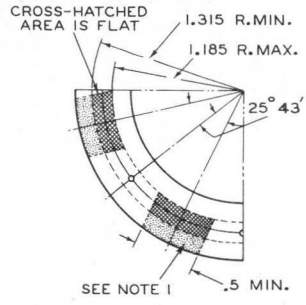


ENLARGED BOTTOM VIEW

92CM-8293R3

DIMENSIONS IN INCHES

DETAIL OF BOTTOM VIEW
OF JUMBO ANNULAR BASE



NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.

ANNULAR BASE GAUGE

Angular variations between pins as well as eccentricity of neck cylinder with respect to photocathode cylinder are held to tolerances such that pins and neck cylinder will fit flat-plate gauge with:

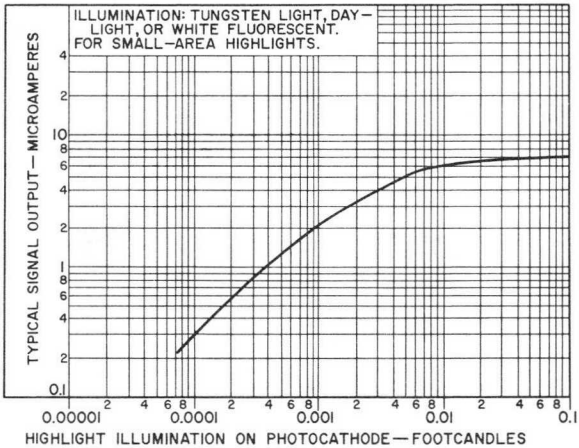
a. Six holes having diameter of 0.065" ± 0.001" and one hole having diameter of 0.150" ± 0.001". All holes have depth of 0.265" ± 0.001". The six 0.065" holes are enlarged by 45° taper to depth of 0.047". All holes are spaced at angles of 51°26′ ± 5′ on circle diameter of 2.500" ± 0.001".

b. Seven stops having height of 0.187" ± 0.001", centered between pin holes, to bear against flat areas of base.

c. Rim extending out a minimum of 0.125" from 2.812" diameter and having height of 0.126" ± 0.001".

d. Neck-cylinder clearance hole having diameter of 2.200" ± 0.001".

BASIC LIGHT-TRANSFER CHARACTERISTIC



7649

Beam Power Tube

CERAMIC-METAL SEALS — COAXIAL-ELECTRODE STRUCTURE
"ONE-PIECE" ELECTRODE DESIGN — INTEGRAL RADIATOR
FORCED-AIR COOLED — 9000-WATTS PEAK-PULSE INPUT UP TO 1215 Mc
MATRIX-TYPE, OXIDE-COATED, UNIPOTENTIAL CATHODE

For Use at Frequencies up to 2000 Mc under Severe Shock and Vibration

GENERAL DATA

Electrical:

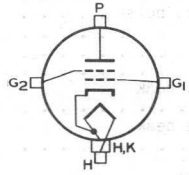
Heater, for Matrix-Type, Oxide-Coated, Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at heater volts = 6.3	3.2	amp
Minimum heating time	60	sec
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 1000, grid-No.2 volts = 500, and plate ma. = 115.	18	
Direct Interelectrode Capacitances:[a]		
Grid No.1 to plate	0.13 max.	μμf
Grid No.1 to cathode & heater	14	μμf
Plate to cathode & heater	0.019 max.	μμf
Grid No.1 to grid No.2	20	μμf
Grid No.2 to plate	6.5	μμf ←
Grid No.2 to cathode & heater	1.3 max.	μμf

Mechanical:

Operating Position	Any
Overall Length	1.885" + 0.070" - 0.080"
Greatest Diameter (See *Dimensional Outline*)	1.250" ± 0.015"
Weight (Approx.)	2 oz
Radiator	Integral part of tube
Socket:	
For frequencies up to about 400 Mc	[b]
For use at higher frequencies . . . See *Mounting Arrangement*	

Terminal Connections (See *Dimensional Outline*):

G_1 – Grid-No.1–Terminal Contact Surface
G_2 – Grid-No.2–Terminal Contact Surface
H – Heater–Terminal Contact Surface



H,K – Heater- & Cathode–Terminal Contact Surface
P – Plate–Terminal Contact Surface

Air Flow:

Through radiator—Adequate air flow to limit the plate terminal temperature to 250° C should be delivered by a blower

← Indicates a change.

through the radiator before and during the application of plate, grid-No.2, and grid-No.1 voltages. Typical values of air flow directed through the radiator without cowling and with cowling versus plate dissipation are shown in accompanying *Typical-Cooling-Requirements* curves. Plate power, grid-No.2 power, and air flow may be removed simultaneously.

To Grid-No.2, Grid-No.1, Cathode, and Heater Terminals—A sufficient quantity of air should be delivered to these seals to prevent their temperature from exceeding the specified maximum value of 250° C.

During Standby Operation—Cooling air is not normally required when only heater voltage is applied to the tube.

Terminal Temperature (Plate, grid No.2, grid No.1, cathode, and heater)	250 max.	°C

GRID-AND-SCREEN-PULSED RF AMPLIFIER

Maximum CCS[c] Ratings, *Absolute-Maximum Values:*

For maximum "on" time[d] of 10 microseconds

	Up to 1215 Mc	
→DC PLATE VOLTAGE	2250 max.	volts
PEAK POSITIVE PULSE-GRID-No.2 VOLTAGE	750 max.	volts
DC GRID-No.1 VOLTAGE	-200 max.	volts
DC PLATE CURRENT DURING PULSE	3000 max.	ma
DC PLATE CURRENT	80 max.	ma
GRID-No.2 INPUT (Average)	4.5 max.	watts
GRID-No.1 INPUT (Average)	2 max.	watts
PLATE DISSIPATION (Average)	115 max.	watts

Typical Operation:

In class-AB_2 cathode-drive[e] circuit with rectangular-wave pulses at 1215 Mc and with duty factor[f] of 0.01

DC Plate Voltage	1350	1500	volts
Peak Positive-Pulse Grid-No.2 Voltage	700	700	volts
DC Grid-No.1 Voltage	0	0	volts
DC Plate Current during pulse	2700	3000	ma
DC Plate Current	47	53	ma
DC Grid-No.2 Current	1.6	2	ma
DC Grid-No.1 Current	5	5	ma
Driver Power Output at peak of pulse (Approx.)[g]	390	460	watts
Useful Power Output at peak of pulse (Approx.)	1600[h]	2300[h]	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under any condition	30000 max.	ohms

→Indicates a change.

PLATE-AND-SCREEN-PULSED RF AMPLIFIER

Maximum CCS[c] Ratings, *Absolute-Maximum Values:*

For maximum "on" time[d] of 10 microseconds

	Up to 1215 Mc	
PEAK POSITIVE-PULSE PLATE VOLTAGE	3000 max.	volts
PEAK POSITIVE-PULSE GRID-No.2 VOLTAGE	750 max.	volts
DC GRID-No.1 VOLTAGE	-200 max.	volts
DC PLATE CURRENT DURING PULSE	3000 max.	ma
DC PLATE CURRENT	50 max.	ma
GRID-No.2 INPUT (Average)	4.5 max.	watts
GRID-No.1 INPUT (Average)	2 max.	watts
PLATE DISSIPATION (Average)	115 max.	watts

Typical Operation:

In class AB_2 cathode-drive[e] circuit with rectangular-wave pulses at 1215 Mc and with duty factor[f] of 0.01

Peak Positive-Pulse Plate Voltage	2700	3000	volts
Peak Positive-Pulse Grid-No.2 Voltage	700	700	volts
DC Grid-No.1 Voltage	0	0	volts
DC Plate Current during pulse	2700	3000	ma
DC Plate Current	32	35	ma
DC Grid-No.2 Current	1	2	ma
DC Grid-No.1 Current	9	8	ma
Driver Power Output at peak of pulse (Approx.)[g]	350	450	watts
Useful Power Output at peak of pulse (Approx.)	3700[h]	4500[h]	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under any condition	30000 max.	ohms

[a] Measured with special shield adapter.

[b] For socket to be used with the 7649 consult manufacturers such as J-V-M Microwave Company, 4631 Lawndale Avenue, Lyons, Illinois; E. F. Johnson, Waseca, Minnesota; and Collins Radio Company, 855 35th Street North, Cedar Rapids, Iowa.

[c] Continous Commercial Service.

[d] *"On" time* is defined as the sum of the durations of all the individual pulses which occur during any 1000-microsecond interval. An increase in dc plate current during the pulse may be permissible at shorter "on" times, and a decrease is usually required at longer "on" times. *Pulse duration* is defined as the time interval between the two points on the pulse at which the instantaneous value is 70 per cent of the peak value. The peak value is defined as the maximum value of a smooth curve through the average of the fluctuations over the top portion of the pulse.

[e] Cathode is at dc ground potential.

[f] *Duty factor* is defined as the ratio of "on" time to total elapsed time in any 1000-microsecond interval.

[g] Driver power output includes circuit losses and feed-through power. It is actual power measured at input to the tube drive circuit. It will vary with frequency of operation and driver circuitry.

[h] This value of useful power is measured in load of output circuit.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

		Note	Min.	Max.	
1.	Heater Current	1	2.90	4.00	amp
2.	Direct Interelectrode Capacitances:				
	Grid No.1 to plate	2	–	0.13	μμf
	Grid No.1 to cathode & heater	2	11.8	15.2	μμf
	Plate to cathode & heater	2	–	0.019	μμf
	Grid No.1 to grid No.2	2	17.3	21.9	μμf
	Grid No.2 to plate	2	5.8	6.8	μμf
	Grid No.2 to cathode & heater	2	–	1.3	μμf
3.	Grid-No.1 Voltage	1,3	-20	-50	volts
4.	Grid-No.1 Voltage	1,7	-6	-18	volts
5.	Reverse Grid-No.1 Current	1,7	–	-20	μa
6.	Grid-No.2 Current	1,3	-5	11	ma
7.	Peak Emission Voltage	1,4	–	250	volts
8.	Interelectrode Leakage Resistance	5	1	–	megohm
9.	Power Output	1,6	4500	–	watts
10.	Grid-No.1 Cutoff Voltage	1,8	–	-104	volts

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

Note 2: Measured with special shield adapter.

Note 3: With dc plate voltage of 1000 volts, dc grid-No.2 voltage of 700 volts, and dc grid-No.1 voltage adjusted to give a dc plate current of 115 ma.

Note 4: For conditions with 6.3 volts on heater; grid No.1, grid No.2, and plate tied together; and pulse-voltage source connected between plate and cathode. Pulse duration is 2 microseconds, pulse-repetition frequency is 60 pps, and duty factor is 0.00012. The voltage-pulse amplitude is adjusted until a peak cathode current of 13 amperes is obtained. After 1 minute at this value, the voltage-pulse amplitude will not exceed 200 volts (peak).

Note 5: Under conditions with tube at 20° to 30° C for at least 30 minutes without any voltages applied to the tube. The minimum resistance between any two electrodes as measured with a 200-volt Megger-type ohmmeter having an internal impedance of 1 megohm, will be 1 megohm.

Note 6: In a plate-and-screen-pulsed cathode-drive cavity at 1215 Mc and for conditions with 6.3 volts ac or dc on heater, peak plate voltage of 3000 volts, peak grid-No.2 voltage of 700 volts, driver power of 560 peak watts, and grid-No.1 voltage varied for peak plate current of 3 amperes. Pulse duration is 10 microseconds and duty factor is 0.01.

Note 7: With dc plate voltage of 1000 volts, dc grid-No.2 voltage of 300 volts, and dc grid-No.1 voltage adjusted to give a dc plate current of 115 ma.

Note 8: With dc plate voltage of 2250 volts, dc grid-No.2 voltage of 700 volts, and dc grid-No.1 voltage adjusted to give a dc plate current of 5 ma.

SPECIAL TESTS & PERFORMANCE DATA

Resonances in the tube mountings used in the following tests can cause the specified environmental conditions to produce greatly amplified effects. Extreme care must, therefore, be used in the design of the mountings to minimize resonance. Design details of mountings used by the RCA Electron Tube Division to perform these tests may be obtained from RCA Commercial Engineering, Harrison, New Jersey, on request.

→Indicates a change.

50-g, 11-Millisecond Shock Test:

This test is performed on sample lots of tubes to determine the ability of the tube to withstand the specified long-duration impact acceleration. Tubes are held rigid in six different positions in a Medium-impact Shock Machine and are subjected to three blows in each position. At the end of this test, tubes are required to meet the limits for items 1, 3, 5, 8, 9, and 10 under *Characteristics Range Values for Equipment Design.*

500-g, Nominal 3/4-Millisecond Shock Test:

This test is performed on sample lots of tubes to determine the ability of the tube to withstand the specified impact acceleration. Tubes are held rigid in four different positions in a High-impact Shock Machine and are subjected to five blows in each position. At the end of this test, tubes are required to meet the limits for items 1, 3, 5, 8, 9, and 10 under *Characteristics Range Values for Equipment Design.*

5-to-2000 cps Vibration Test:

This test is performed on sample lots of tubes to determine the ability of the tube to withstand variable-frequency vibration. With heater voltage of 6.3 volts ac or dc, dc plate supply voltage of 300 volts, dc grid-No.2 voltage of 250 volts, grid-No.1 voltage adjusted to give dc plate current of 10 ma., and plate load resistor of 2000 ohms. The tube is vibrated along each of three mutually perpendicular axes over an 8-minute sweep consisting of:

a. 5-to-10 cps with fixed double amplitude of 0.08 inch ± 10%.

b. 10-to-15 cps at fixed acceleration of 0.41 g ± 10%.

c. 15-to-75 cps with fixed double amplitude of 0.036 inch ± 10%.

d. 75-to-2000 cps at fixed acceleration of 10 g ± 10%.

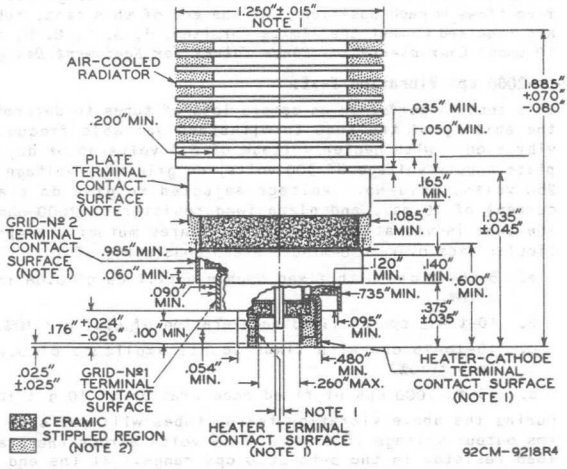
During the above vibration tests, tubes will not show an rms output voltage in excess of 15 volts across the plate load resistor in the 5-to-2000 cps range. At the end of this test, tubes are required to meet the limits for items 1, 3, 5, 8, 9, and 10 under *Characteristics Range Values for Equipment Design.*

OPERATING CONSIDERATIONS

A suggested *mounting arrangement* for the 7649 is shown in the accompanying drawing along with a layout of the associated contacts. Flexible connectors are required for the plate, grid-No.2, grid-No.1, cathode, and heater contact surfaces.

During standby periods in intermittent operation, it is recommended that the heater voltage be maintained at normal operating value when the period is less than 15 minutes, and that it be reduced to 80 per cent of normal when the period is between 15 minutes and 2 hours. For longer periods, the heater voltage should be turned off.

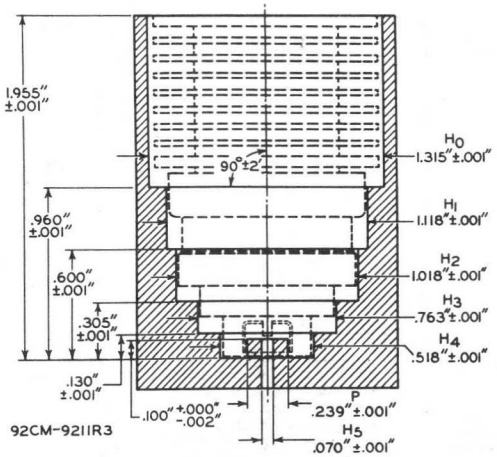
The maximum-rated plate and grid-No.2 voltages of this tube are extremely dangerous. Great care should be taken during the adjustment of circuits. The tube and its associated apparatus, especially all parts which may be at high potential above ground, should be housed in a protective enclosure. The protective housing should be designed with interlocks so that personnel can not possibly come in contact with any high-potential point in the electrical system. The interlock devices should function to break the primary circuit of the high-voltage supplies when any gate or door on the protective housing is opened, and should prevent the closing of the primary circuit until the door is again locked.



NOTE 1: WITH THE CYLINDRICAL SURFACES OF THE PLATE TERMINAL, GRID-No.2 TERMINAL, GRID-No.1 TERMINAL, HEATER-CATHODE TERMINAL, AND HEATER TERMINAL CLEAN, SMOOTH, AND FREE OF BURRS, THE TUBE WILL ENTER A GAUGE AS SHOWN IN SKETCH G_1. THE TUBE IS PROPERLY SEATED IN THE GAUGE WHEN A 0.010"-THICKNESS GAUGE 1/8" WIDE WILL NOT ENTER BETWEEN THE HEATER-CATHODE TERMINAL AND THE BOTTOM SURFACE OF H_4. THE GAUGE IS PROVIDED WITH A SLOT TO PERMIT MAKING MEASUREMENT OF SEATING OF HEATER-CATHODE TERMINAL ON BOTTOM OF HOLE H_4.

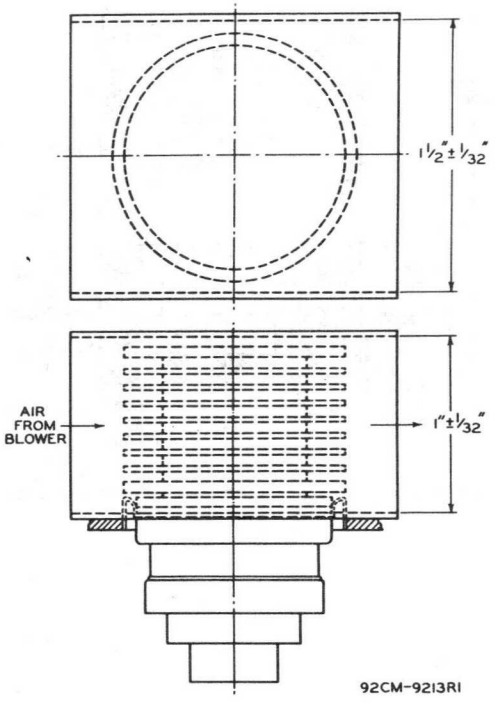
NOTE 2: KEEP ALL STIPPLED REGIONS CLEAR. DO NOT ALLOW CONTACTS OR CIRCUIT COMPONENTS TO PROTRUDE INTO THESE ANNULAR VOLUMES.

SKETCH G_1

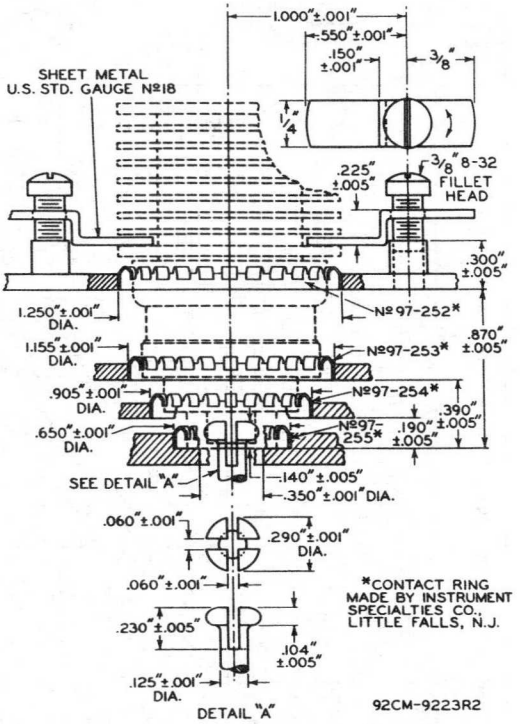


THE AXES OF THE CYLINDRICAL HOLES H_0 THROUGH H_5 AND THE AXES OF POST P ARE COINCIDENT WITHIN 0.001".

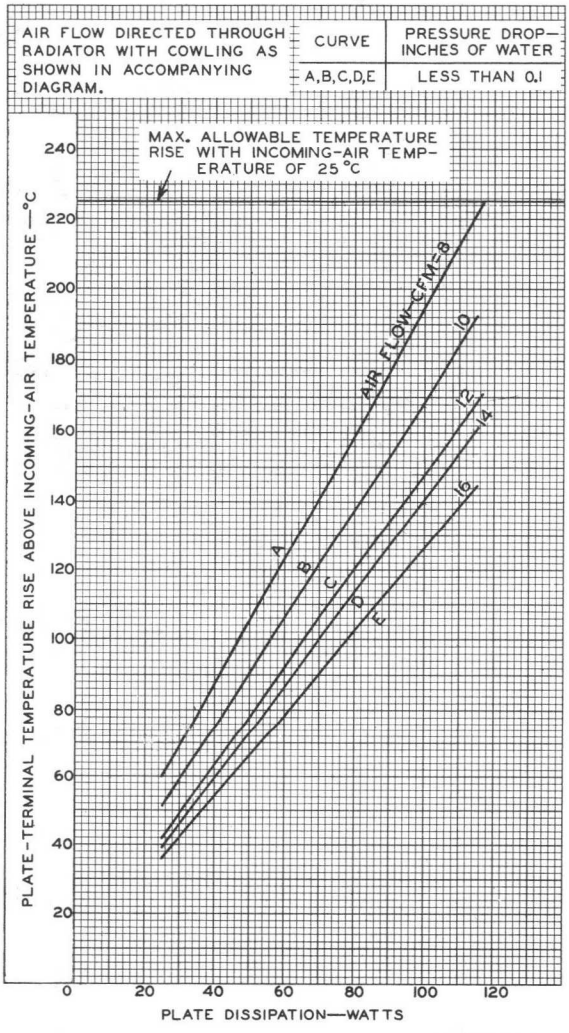
RECOMMENDED COWLING FOR DIRECTING AIR FLOW THROUGH RADIATOR



SUGGESTED MOUNTING ARRANGEMENT & LAYOUT OF ASSOCIATED CONTACTS

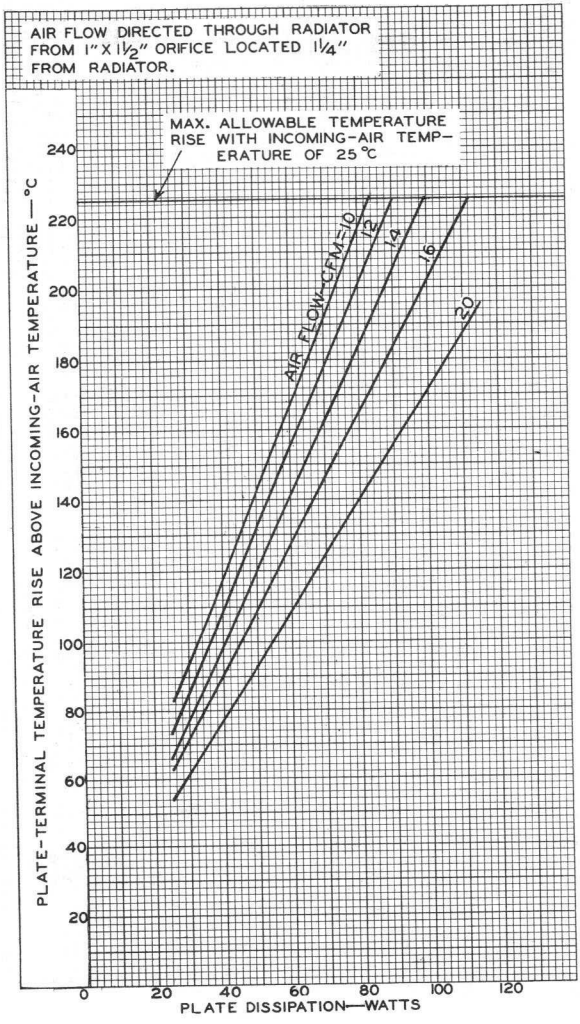


TYPICAL COOLING REQUIREMENTS
With Cowling



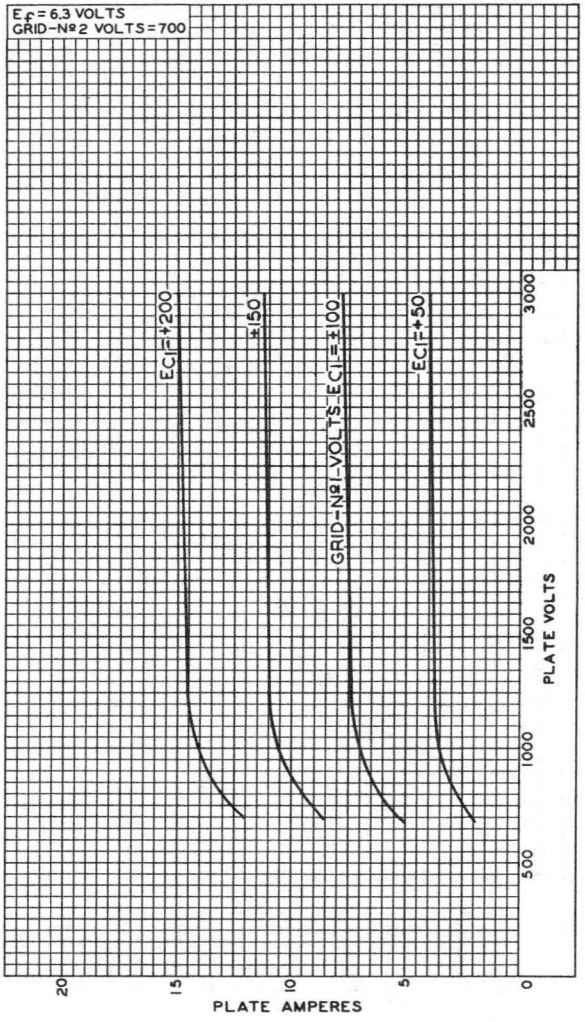
92CM-9219RI

TYPICAL COOLING REQUIREMENTS
Without Cowling



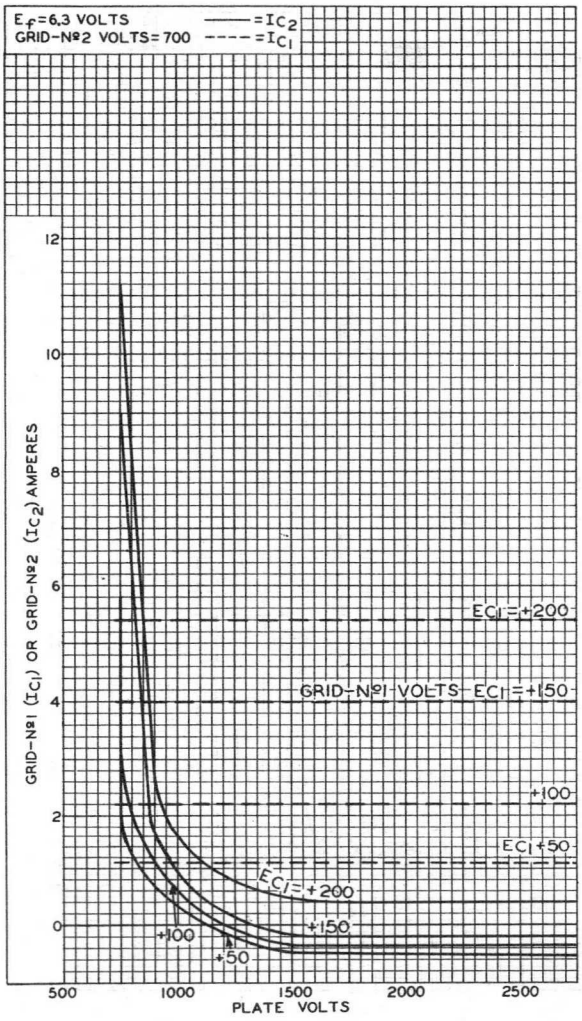
92CM-9220R1

TYPICAL PLATE CHARACTERISTICS



92CM-10649RI

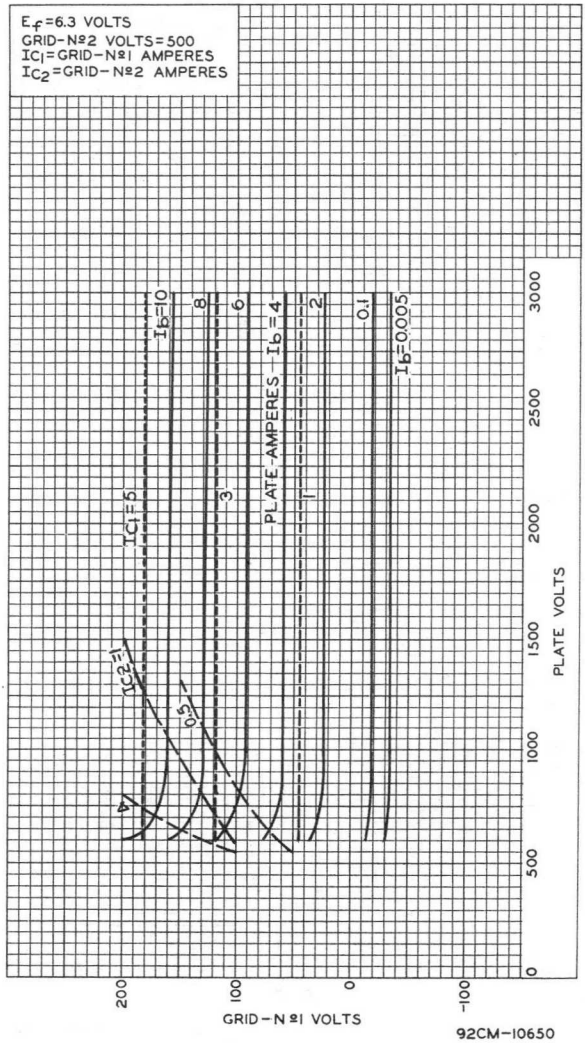
TYPICAL CHARACTERISTICS



92CM-10653

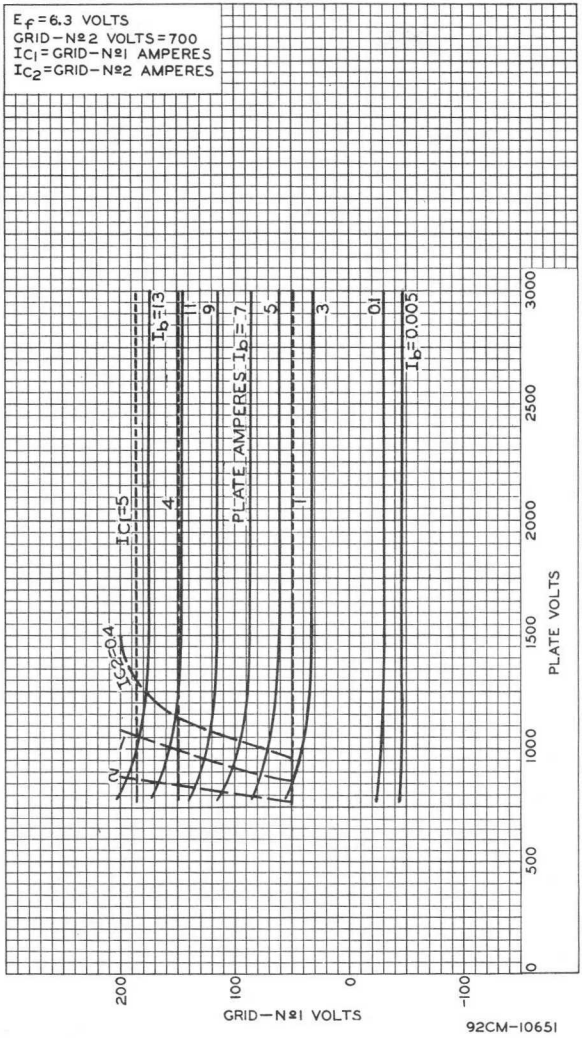
7649

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM-10650

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



7697

Vidicon

For Industrial TV Applications with Black-and-White TV Cameras

DATA

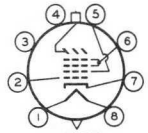
General:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.6	amp
Direct Interelectrode Capacitance:		
Target to all other electrodes	3.1	μμf
Spectral Response		S-18
Wavelength of Maximum Response	4500 + 500 − 300	angstroms
Radiant Sensitivity at 4500 angstroms	0.08	μa/μwatt
Photoconductive Layer:		
Maximum useful diagonal of rectangular image (4 x 3 aspect ratio)	0.625"	

Orientation of quality rectangle—Proper orientation is obtained when the horizontal scan is essentially parallel to the plane passing through the tube axis and short index pin.

Focusing Method	Magnetic
Deflection Method	Magnetic
Overall Length	6.250" ± 0.063"
Greatest Diameter	1.125" ± 0.010"
Weight (Approx.)	2 oz
Operating Position	Any
Bulb	T8
Socket	Cinch No.54A18088, or equivalent
Base	Small-Button Ditetrar 8-Pin (JEDEC No.E8-11)
Basing Designation for BOTTOM VIEW	8HM

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Internal Connection—Do Not Use
Pin 4 – Same as Pin 3
Pin 5 – Grid No.2
Pin 6 – Grid No.4, Grid No.3



DIRECTION OF LIGHT: INTO FACE END OF TUBE

Pin 7 – Cathode
Pin 8 – Heater
Flange – Target
Short Index Pin – Same as Pin 3

Maximum Ratings, *Absolute-Maximum Values:*

For scanned area of 1/2" x 3/8"

GRID-No.3 & GRID-No.4 VOLTAGE	750 max.	volts
GRID-No.2 VOLTAGE	750 max.	volts
GRID-No.1 VOLTAGE:		
Negative-bias value	300 max.	volts
Positive-bias value	0 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	10 max.	volts

PEAK TARGET CURRENT[a]	0.6 max.	μa
FACEPLATE:		
Illumination	500 max.	fc
Temperature	71 max.	°C

Typical Operation:

For scanned area of 1/2" x 3/8" and faceplate temperature of 30° to 35° C

Grid-No.4 (Decelerator) & Grid-No.3 (Beam-Focus-Electrode[b]) Voltage	200[c] to 300	volts
Grid-No.2 (Accelerator) Voltage	300	volts
Grid-No.1 Voltage for picture cutoff[d]	-45 to -100	volts
Average "Gamma" of Transfer Characteristic for signal-output current between 0.05 μa and 0.2 μa	0.55	
Target Voltage to produce 0.02 μa dark current:		
Maximum	30	volts
Typical	25	volts
Minimum Peak-to-Peak Blanking Voltage:		
When applied to grid No.1	30	volts
When applied to cathode	10	volts
Field Strength at center of focusing coil (Approx.)	40	gausses
Field Strength of Adjustable Alignment Coil[e]	0 to 4	gausses

Maximum-sensitivity operation

Faceplate Illumination (Highlight)	0.5	fc
Target Voltage[f]	35 to 70	volts
Dark Current[g]	0.2	μa
Signal-Output Current:[h]		
Typical	0.2	μa

[a] Video amplifiers must be designed properly to handle target currents of this magnitude to avoid amplifier overload or picture distortion.

[b] Beam focus is obtained by combined effect of grid-No.3 voltage which should be adjustable over indicated range, and a focusing coil having an average field strength of 40 gausses.

[c] Definition, focus uniformity, and picture quality decrease with decreasing grid-No.4 and grid-No.3 voltage. In general, grid No.4 and grid No.3 should be operated above 250 volts.

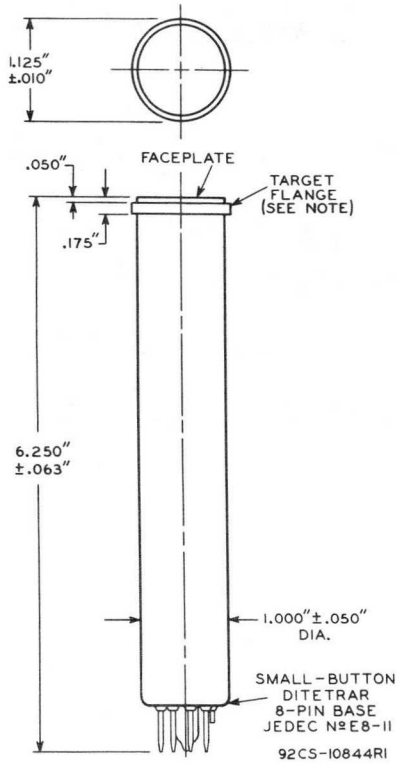
[d] With no blanking voltage on grid No.1.

[e] The alignment coil should be located on the tube so that its center is at a distance of 3-11/16 inches from the face of the tube, and be positioned so that its axis is coincident with the axis of the tube, the deflecting yoke, and the focusing coil.

[f] The target voltage for each 7697 must be adjusted to that value which gives the desired operating dark current.

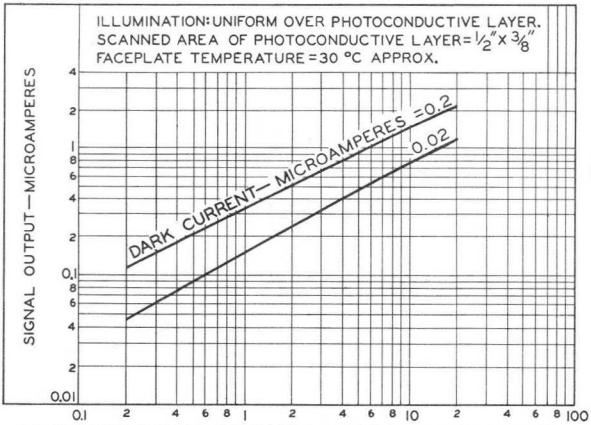
[g] The deflecting circuits must provide extremely linear scanning for good black-level reproduction. Dark-current signal is proportional to the scanning velocity. Any change in scanning velocity produces a black-level error in direct proportion to the change in scanning velocity.

[h] Defined as the component of the highlight target current after the dark-current component has been subtracted.



NOTE: THE TARGET CONNECTOR MUST BE CAPABLE OF MAKING CONTACT AT ANY POINT ON TARGET FLANGE.

TYPICAL LIGHT-TRANSFER CHARACTERISTICS



92CS-10847

7844

Beam Power Tube

CERAMIC-METAL SEALS
UNIPOTENTIAL CATHODE
CONDUCTION COOLED

COAXIAL-ELECTRODE STRUCTURE
INTEGRAL CONDUCTION CYLINDER
180 WATTS CW INPUT UP TO 1215 Mc

For Use at Frequencies up to 2000 Mc

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)▲	6.3 ± 10%	volts
Current at heater volts = 6.3	2.1	amp
Minimum heating time	60	sec
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 250, grid-No.2 volts = 250, and plate ma. = 100.	18	
Direct Interelectrode Capacitances:●		
Grid No.1 to plate	0.065 max.	μμf
Grid No.1 to cathode & heater	14	μμf
Plate to cathode & heater	0.015 max.	μμf
Grid No.1 to grid No.2	17	μμf ←
Grid No.2 to plate	4.4	μμf
Grid No.2 to cathode & heater	0.4 max.	μμf

Mechanical:

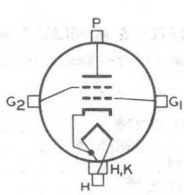
Operating Position	Any
Overall Length	1.885" +0.070" -0.080"
Greatest Diameter (See *Dimensional Outline*)	1.119"
Weight (Approx.)	2 oz
Socket:	
For frequencies up to about 400 Mc	★
For use at higher frequencies . . .See *Mounting Arrangement*	

Terminal Connections (See *Dimensional Outline*):

G_1 – Grid-No.1– Terminal Contact Surface

G_2 – Grid-No.2– Terminal Contact Surface

H – Heater– Terminal Contact Surface



H,K – Heater– & Cathode– Terminal Contact Surface

P – Plate– Terminal Contact Surface

Thermal:

Conduction-Cylinder Temperature	250 max.	°C
Seal Temperature (Plate, Grid No.2, Grid No.1, Cathode, and Heater)	250 max.	°C

Cooling, Conduction:

The conduction cylinder must be thermally coupled to a constant-temperature device (heat sink—solid or liquid) to limit the conduction cylinder to the specified maximum

← Indicates a change.

value of 250° C. The plate, grid-No.2, grid-No.1, cathode, and heater terminals may also require coupling to the heat sink to limit their respective seal temperature to the specified maximum value of 250° C.

AF POWER AMPLIFIER & MODULATOR — Class AB_1♦

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

DC PLATE VOLTAGE	1000 max.	volts
DC GRID-No.2 VOLTAGE	300 max.	volts
MAX.-SIGNAL DC PLATE CURRENT♠	180 max.	ma
MAX.-SIGNAL PLATE INPUT♠	180 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT♠	7 max.	watts
PLATE DISSIPATION♠	♣	

Typical CCS Push-Pull Operation:

Values are for 2 tubes

DC Plate Voltage	650	850	volts
DC Grid-No.2 Voltage⊕	300	300	volts
DC Grid-No.1 Voltage from fixed-bias source	−15	−15	volts
Peak Grid-No.1-to-Grid-No.1 Voltage#	30	30	volts
Zero-Signal DC Plate Current	80	80	ma
Max.-Signal DC Plate Current	200	200	ma
Zero-Signal DC Grid-No.2 Current	0	0	ma
Max.-Signal DC Grid-No.2 Current	20	20	ma
Effective Load Resistance (Plate to plate)	4330	7000	ohms
Max.-Signal Driving Power (Approx.)	0	0	watts
Max.-Signal Power Output (Approx.)	50	80	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under any condition:*

For fixed-bias operation	30000 max.	ohms
For cathode-bias operation	Not recommended	

AF POWER AMPLIFIER & MODULATOR — Class AB_2*

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

DC PLATE VOLTAGE	1000 max.	volts
DC GRID-No.2 VOLTAGE	300 max.	volts
MAX.-SIGNAL DC PLATE CURRENT♠	180 max.	ma
MAX.-SIGNAL DC GRID-No.1 CURRENT♠	30 max.	ma
MAX.-SIGNAL PLATE INPUT♠	180 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT♠	7 max.	watts
PLATE DISSIPATION♠	♣	

Typical CCS Push-Pull Operation:

Values are for 2 tubes

DC Plate Voltage	650	850	volts
DC Grid-No.2 Voltage⊕	300	300	volts
DC Grid-No.1 Voltage from fixed-bias source	−15	−15	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage	46	46	volts
Zero-Signal DC Plate Current	80	80	ma
Max.-Signal DC Plate Current	355	355	ma
Zero-Signal DC Grid-No.2 Current	0	0	ma

Max.-Signal DC Grid-No.2 Current	25	25	ma
Max.-Signal DC Grid-No.1 Current	15	15	ma
Effective Load Resistance (Plate to plate)	2450	3960	ohms
Max.-Signal Driving Power (Approx.)†	0.3	0.3	watt
Max.-Signal Power Output (Approx.)	85	140	watts

LINEAR RF POWER AMPLIFIER

Single-Sideband Suppressed-Carrier Service

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

	Up to 1215 Mc	
DC PLATE VOLTAGE	1000 max.	volts
DC GRID-No.2 VOLTAGE	300 max.	volts
MAX.-SIGNAL DC PLATE CURRENT	180 max.	ma
MAX.-SIGNAL DC GRID-No.1 CURRENT	30 max.	ma
MAX.-SIGNAL PLATE INPUT	180 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT	7 max.	watts
PLATE DISSIPATION	♣	

Typical CCS Class AB_1 "Single-Tone" Operation:

	Up to 60 Mc		
DC Plate Voltage	650	850	volts
DC Grid-No.2 Voltage®	300	300	volts
DC Grid-No.1 Voltage	-15	-15	volts
Zero-Signal DC Plate Current	40	40	ma
Zero-Signal DC Grid-No.2 Current	0	0	ma
Effective RF Load Resistance	2165	3500	ohms
Max.-Signal DC Plate Current	100	100	ma
Max.-Signal DC Grid-No.2 Current	10	10	ma
Max.-Signal DC Grid-No.1 Current	0	0	ma
Max.-Signal Peak RF Grid-No.1 Voltage	15	15	volts
Max.-Signal Driving Power (Approx.)	0	0	watts
Max.-Signal Power Output (Approx.)	25	40	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under any condition:

For fixed-bias operation	30000 max.	ohms
For cathode-bias operation	Not recommended	

PLATE-MODULATED RF POWER AMPLIFIER — Class C Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1

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

	Up to 1215 Mc	
DC PLATE VOLTAGE	800 max.	volts
DC GRID-No.2 VOLTAGE	300 max.	volts
DC GRID-No.1 VOLTAGE	-100 max.	volts
DC PLATE CURRENT	150 max.	ma
DC GRID-No.1 CURRENT	30 max.	ma
PLATE INPUT	120 max.	watts
GRID-No.2 INPUT	4.6 max.	watts
PLATE DISSIPATION	♣	

Typical CCS Operation:

	At 400 Mc		
DC Plate Voltage	400	700	volts
DC Grid-No.2 Voltage§	200	250	volts
DC Grid-No.1 Voltage□	-20	-50	volts
DC Plate Current	100	130	ma
DC Grid-No.2 Current	5	10	ma
DC Grid-No.1 Current	5	10	ma
Driver Power Output (Approx.)◇	2	3	watts
Useful Power Output (Approx.)	16	45	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under any condition	30000▽ max.	ohms

RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy▲▲
and
RF POWER AMPLIFIER — Class C FM Telephony

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

	Up to 1215 Mc	
DC PLATE VOLTAGE	1000 max.	volts
DC GRID-No.2 VOLTAGE	300 max.	volts
DC GRID-No.1 VOLTAGE	-100 max.	volts
DC PLATE CURRENT	180 max.	ma
DC GRID-No.1 CURRENT	30 max.	ma
PLATE INPUT	180 max.	watts
GRID-No.2 INPUT	7 max.	watts
PLATE DISSIPATION	♣	

Typical CCS Operation:

	At 400 Mc		*At 1215 Mc*	
DC Plate Voltage	400	900	900	volts
DC Grid-No.2 Voltage●●	200	300	300	volts
DC Grid-No.1 Voltage★★	-35	-30	-22	volts
DC Plate Current	150	170	170	ma
DC Grid-No.2 Current	5	1	1	ma
DC Grid-No.1 Current	3	10	4	ma
Driver Power Output (Approx.)◇	3	3	5	watts
Useful Power Output (Approx.)	23	80	40	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under any condition	30000▽ max.	ohms

▲ Because the cathode is subjected to considerable back bombardment as the frequency is increased with resultant increase in temperature, the heater voltage should be reduced depending on operating conditions and frequency to prevent overheating the cathode and resultant short life.

● Measured with special shield adapter.

★ For socket to be used with the 7844, consult manufacturers such as J-V-M Microwave Company, 9300 West 47th Street, Brookfield, Illinois; E.F. Johnson Company, Waseca, Minnesota; and Collins Radio Company, 855 35th Street North, Cedar Rapids, Iowa; and Jettron Products, Route 10, Hanover, New Jersey.

♦ Subscript 1 indicates that grid-No.1 current does not flow during any part of the input cycle.

Continuous Commercial Service.

Averaged over any audio-frequency cycle of sine-wave form.

Maximum plate dissipation is a function of the maximum plate input, efficiency of the class of service, and the effectiveness of the cooling system. See *Cooling, Conduction* under *General Data*, and also *Cooling Considerations*.

Preferably obtained from a fixed supply.

The driver stage should be capable of supplying the No.1 grids of the Class AB_1 stage with the specified driving voltage at low distortion.

The resistance introduced into the grid-No.1 circuit by the input coupling should be held to a low value. In no case should it exceed the specified maximum value. Transformer- or impedance-coupling devices are recommended.

Subscript 2 indicates that grid-No.1 current flows during some part of the input cycle.

Driver stage should be capable of supplying the specified driving power at low distortion to the No.1 grids of the AB_2 stage. To minimize distortion, the effective resistance per grid-No.1 circuit of the AB_2 stage should be held at a low value. For this purpose, the use of transformer coupling is recommended.

"Single-Tone" operation refers to that class of amplifier service in which the grid-No.1 input consists of a monofrequency rf signal having constant amplitude. This signal is produced in a single-sideband suppressed-carrier system when a single audio frequency of constant amplitude is applied to the input of the system.

Obtained preferably from a separate source modulated along with the plate supply.

Obtained from grid-No.1 resistor or from a combination of grid-No.1 resistor with either fixed supply or cathode resistor.

The driver stage is required to supply tube losses and rf-circuit losses. It should be designed to provide an excess of power above the indicated values to take care of variations in line voltage, components, initial tube characteristics, and tube characteristics during life.

If this value is insufficient to provide adequate bias, the additional required bias must be supplied by a cathode resistor or fixed supply.

Key-down conditions per tube without amplitude modulation. Amplitude modulation essentially negative may be used if the positive peak of the audio frequency envelope does not exceed 115 per cent of the carrier conditions.

Obtained preferably from a fixed supply, or from the plate supply voltage with a voltage divider.

Obtained from fixed supply, by grid-No.1 resistor, by cathode resistor, or by combination methods.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Heater Current	1	1.84	2.26	amp
Direct Interelectrode Capacitances:				
Grid No.1 to plate	2	–	0.065	μμf
Grid No.1 to cathode & heater	2	11.8	15.2	μμf
Plate to cathode & heater	2	–	0.015	μμf
Grid No.1 to grid No.2	2	15.9	18.9	μμf ←
Grid No.2 to plate	2	4	5	μμf
Grid No.2 to cathode & heater	2	–	0.4	μμf
Grid-No.1 Voltage	1,3	-6	-15	volts ←
Grid-No.1 Cutoff Voltage	1,4	–	-30	volts
Grid-No.1 Current	1,5	10	–	ma
Reverse Grid-No.1 Current	1,3	–	-20	μa
Grid-No.2 Current	1,3	-8	+2	ma
Peak Emission Voltage	1,6	–	400	volts
Interelectrode Leakage Resistance	7	1	–	megohm
Useful Power Output	8	80	–	watts

← Indicates a change.

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

Note 2: Measured with special shield adapter.

Note 3: With dc plate voltage of 1000 volts, dc grid-No.2 voltage of 300 volts, and dc grid-No.1 voltage adjusted to give a dc plate current of 115 ma.

Note 4: With dc plate voltage of 1000 volts, dc grid-No.2 voltage of 250 volts, and dc grid-No.1 voltage adjusted to give a dc plate current of 1 ma.

Note 5: With plate and grid-No.2 floating and dc grid-No.1 voltage of +2 volts.

Note 6: For conditions with: grid No.1, grid No.2, and plate tied together; and pulse-voltage source connected between plate and cathode. Pulse duration is 2 microseconds, pulse-repetition frequency is 60 pps, and duty factor is 0.00012. The voltage-pulse amplitude is adjusted until a peak cathode current of 10 amperes is obtained. After 1 minute at this value, the voltage-pulse amplitude will not exceed 400 volts (peak).

Note 7: Under conditions with tube at 20° to 30° C for at least 30 minutes without any voltages applied to the tube. The minimum resistance between any two adjacent electrodes as measured with a 200-volt Megger-type ohmmeter having an internal impedance of 1 megohm, will be 1 megohm.

Note 8: In a single-tube, grid-driven, coaxial-cavity class-C-amplifier circuit at 400 Mc and for conditions with 5.7 volts ac or dc on heater, dc plate voltage of 100 volts, dc grid-No.2 voltage of 300 volts, grid-No.1 resistor adjustable between 1000 and 10,000 ohms, dc plate current of 180 ma. maximum, dc grid-No.1 current of 20 ma. maximum, and driver power output of 3 watts.

COOLING CONSIDERATIONS

The conduction-cooling system consists, in general, of a constant-temperature device (heat sink) and suitable heat-flow path (coupling) between the heat sink and tube. Careful consideration should be given to the design of a heat-flow path through a coupling device having low electrical conductivity and high thermal conductivity.

The maximum plate dissipation may be calculated from the equation:

$$W = KA \frac{(T_2 - T_1)}{L}$$

where:

W = maximum plate dissipation in watts

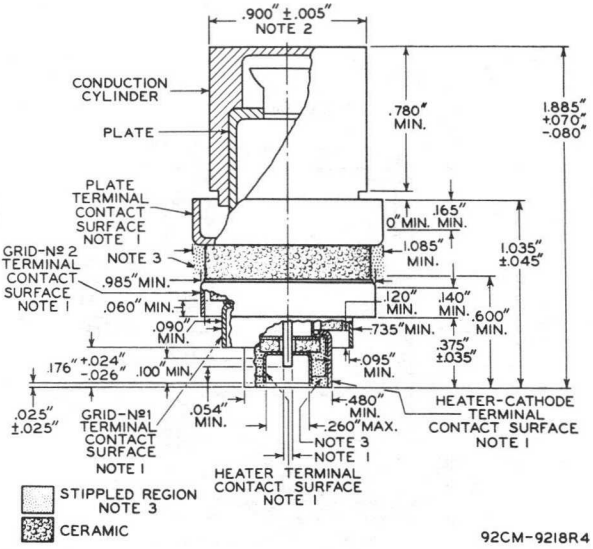
K = thermal conductivity[♦♦] of the coupling material

A = area measured at right angles to the direction of the flow of heat in square inches

T_2, T_1 = temperature in degrees Centigrade of planes or surfaces under consideration

L = length of heat path in inches through coupling material to produce temperature gradient

♦♦ Thermal conductivity is defined as the time rate of transfer of heat by conduction, through unit thickness, across unit area for unit difference of temperature. It is measured in watts per square inch for a thickness of one inch and a difference of temperature of 1° C.

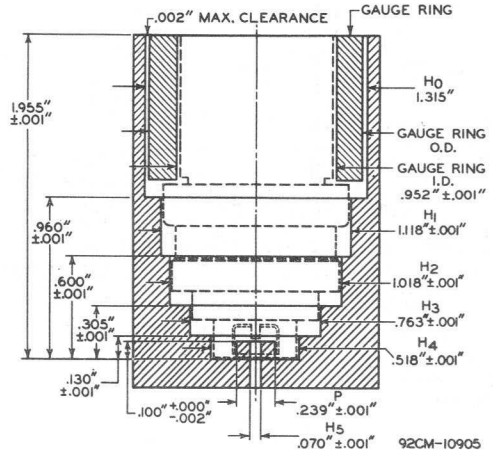


NOTE 1: WITH THE CYLINDRICAL SURFACES OF THE PLATE TERMINAL, GRID-No.2 TERMINAL, GRID-No.1 TERMINAL, HEATER-CATHODE TERMINAL, AND HEATER TERMINAL CLEAN, SMOOTH, AND FREE OF BURRS, THE TUBE WILL ENTER A GAUGE AS SHOWN IN SKETCH G_1. THE TUBE IS PROPERLY SEATED IN THE GAUGE WHEN A 0.010"-THICKNESS GAUGE 1/8" WIDE WILL NOT ENTER BETWEEN THE HEATER-CATHODE TERMINAL AND THE BOTTOM SURFACE OF H_4. THE GAUGE IS PROVIDED WITH A SLOT TO PERMIT MAKING MEASUREMENT OF SEATING OF HEATER-CATHODE TERMINAL ON BOTTOM OF HOLE H_4.

NOTE 2: WITH THE TUBE SEATED IN GAUGE AND WITH THE CONDUCTION CYLINDER CLEAN, SMOOTH, AND FREE OF BURRS, THE GAUGE RING WILL SLIP OVER CONDUCTION CYLINDER AS SHOWN IN SKETCH G_1.

NOTE 3: KEEP ALL STIPPLED REGIONS CLEAR. DO NOT ALLOW CONTACTS OR CIRCUIT COMPONENTS TO PROTRUDE INTO THESE ANNULAR VOLUMES.

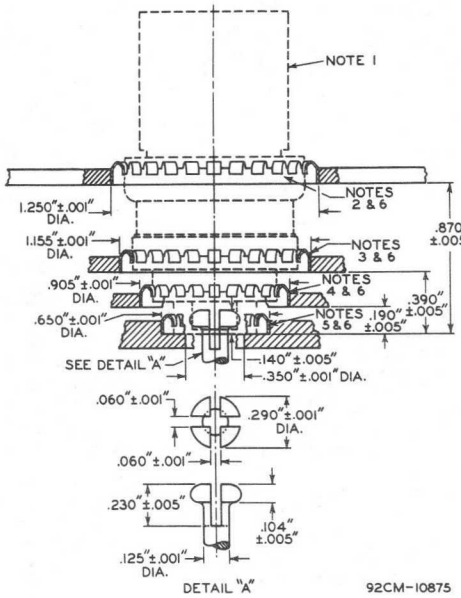
SKETCH G1



THE AXES OF THE CYLINDRICAL HOLES H_1 THROUGH H_5 AND THE AXIS OF POST P ARE COINCIDENT WITHIN 0.001".

THE AXES OF THE GAUGE-RING INSIDE DIAMETER AND GAUGE-RING OUTSIDE DIAMETER ARE COINCIDENT WITHIN 0.001".

SUGGESTED MOUNTING ARRANGEMENT & LAYOUT OF ASSOCIATED CONTACTS



NOTE 1: IF A CLAMP IS USED, IT MUST BE ADJUSTABLE IN A PLANE NORMAL TO THE MAJOR TUBE AXIS TO COMPENSATE FOR VARIATIONS IN CONCENTRICITY BETWEEN THE CONDUCTION CYLINDER AND THE CONTACT TERMINALS.

NOTE 2: CONTACT RING No. 97-252 OR FINGER STOCK No. 97-380.

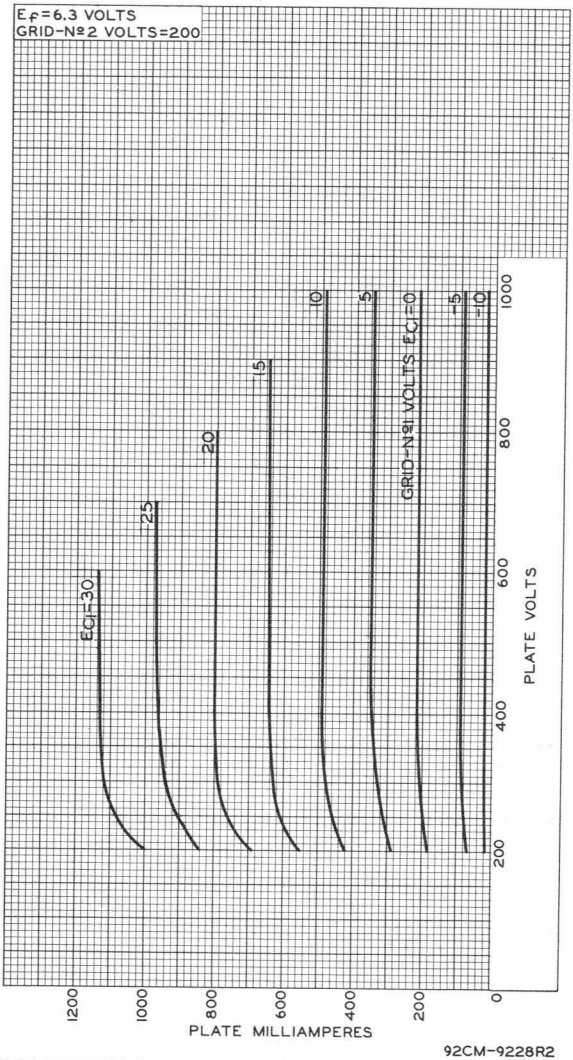
NOTE 3: CONTACT RING No. 97-253 OR FINGER STOCK No. 97-380.

NOTE 4: CONTACT RING No. 97-254 OR FINGER STOCK No. 97-380.

NOTE 5: CONTACT RING No. 97-255 OR FINGER STOCK No. 97-380.

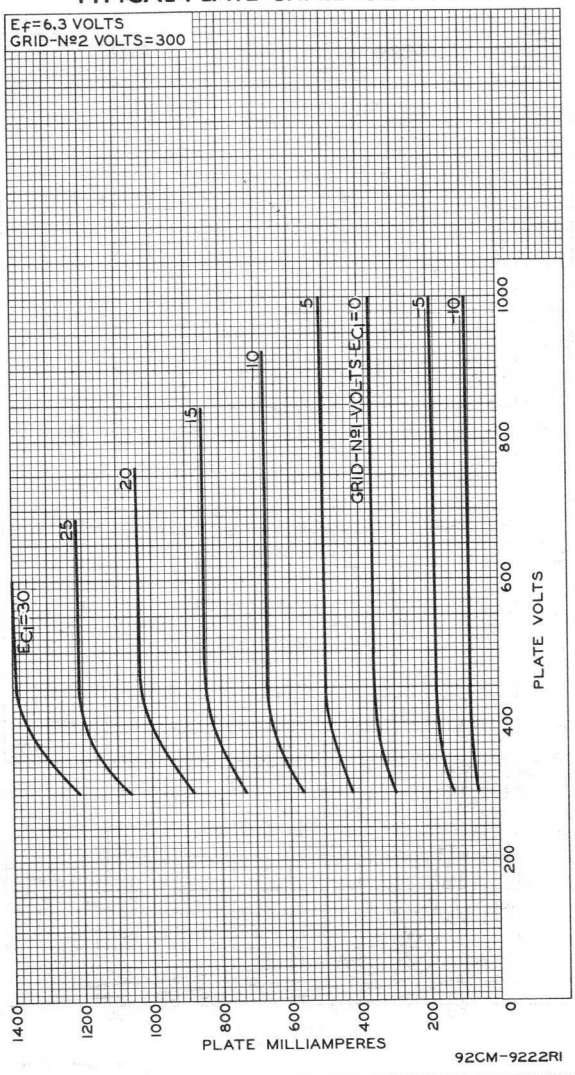
NOTE 6: THE SPECIFIED CONTACT RING OF PREFORMED FINGER STOCK AND FINGER STOCK No. 97-380 PROVIDE ADEQUATE ELECTRICAL CONTACT, BUT THE FINGER STOCK No. 97-380 IS LESS SUSCEPTIBLE TO BREAKAGE THAN THE SPECIFIED CONTACT RING. BOTH TYPES ARE MADE BY INSTRUMENTS SPECIALTIES COMPANY, LITTLE FALLS, NEW JERSEY.

TYPICAL PLATE CHARACTERISTICS

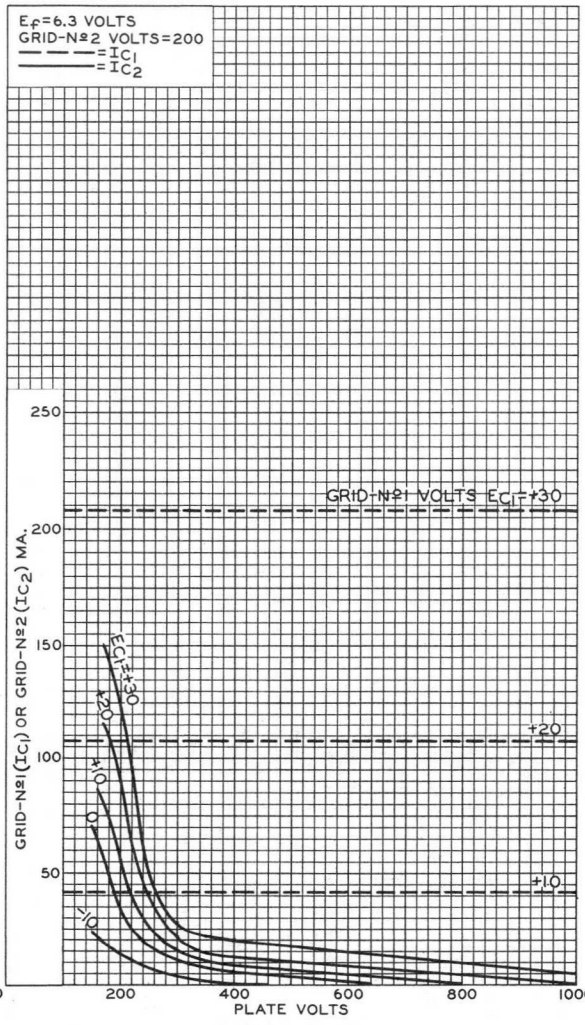


92CM-9228R2

TYPICAL PLATE CHARACTERISTICS

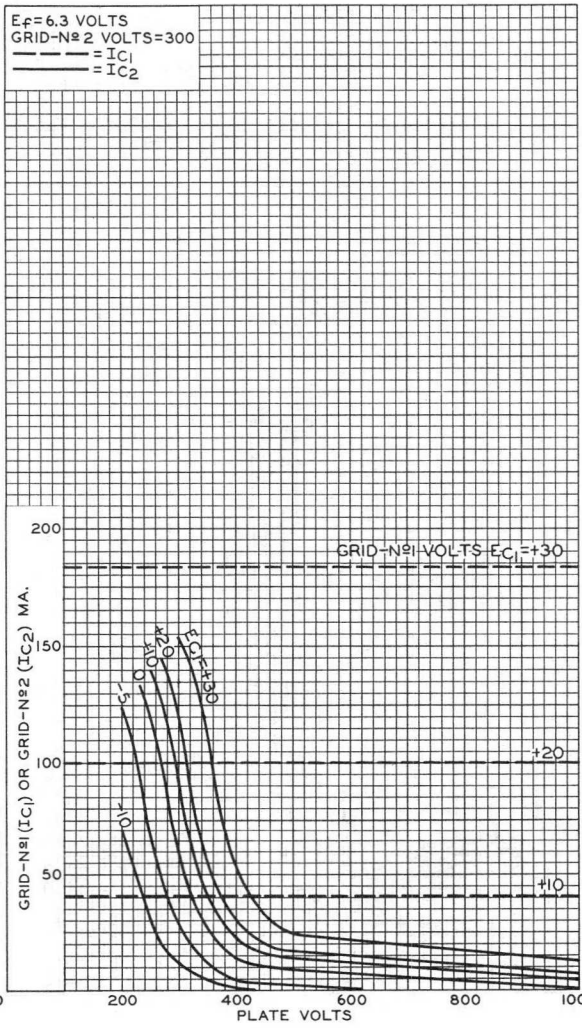


TYPICAL CHARACTERISTICS



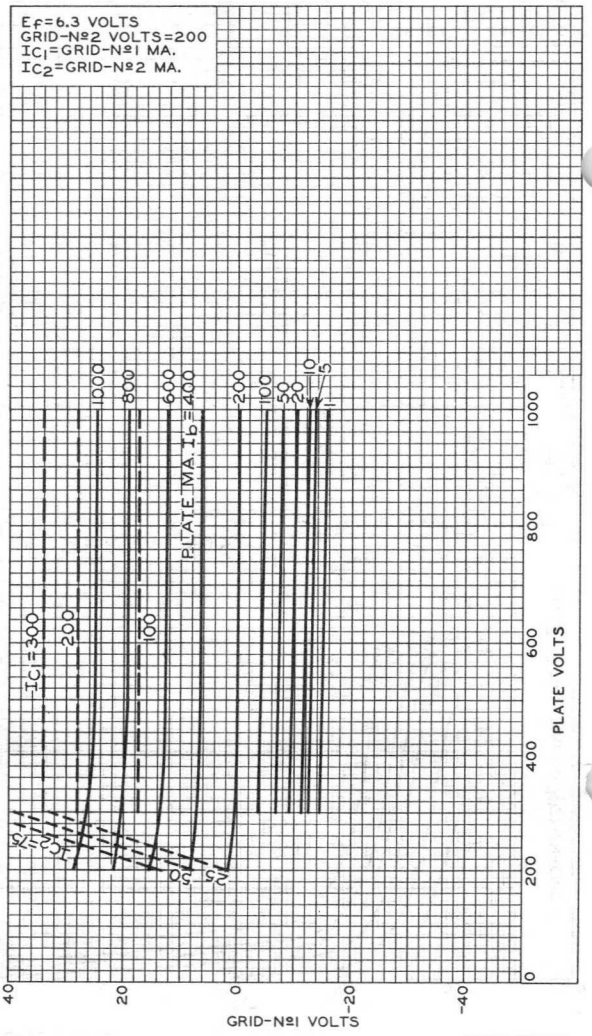
92CM-9224RI

TYPICAL CHARACTERISTICS



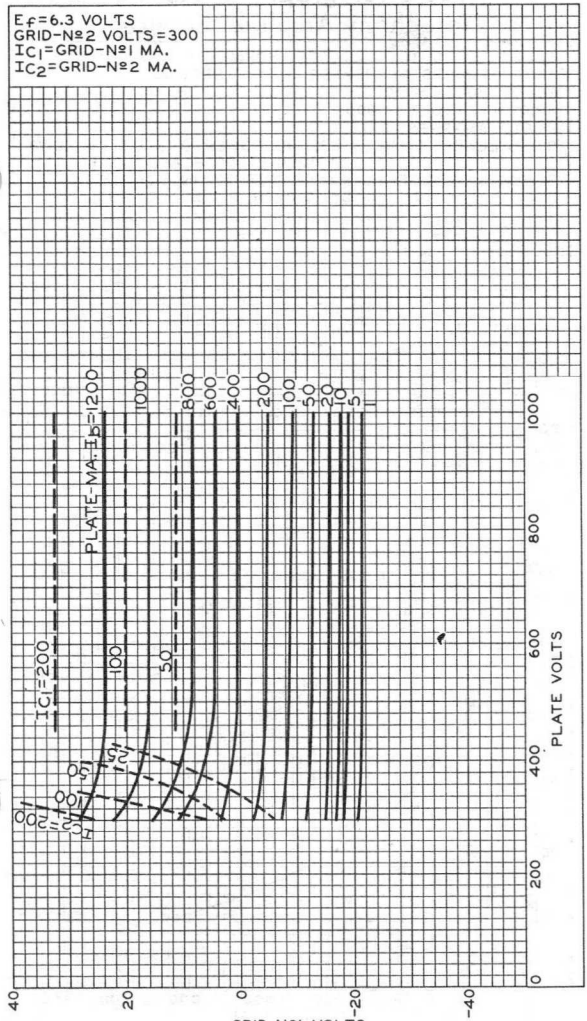
92CM-9225R2

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM-9233RI

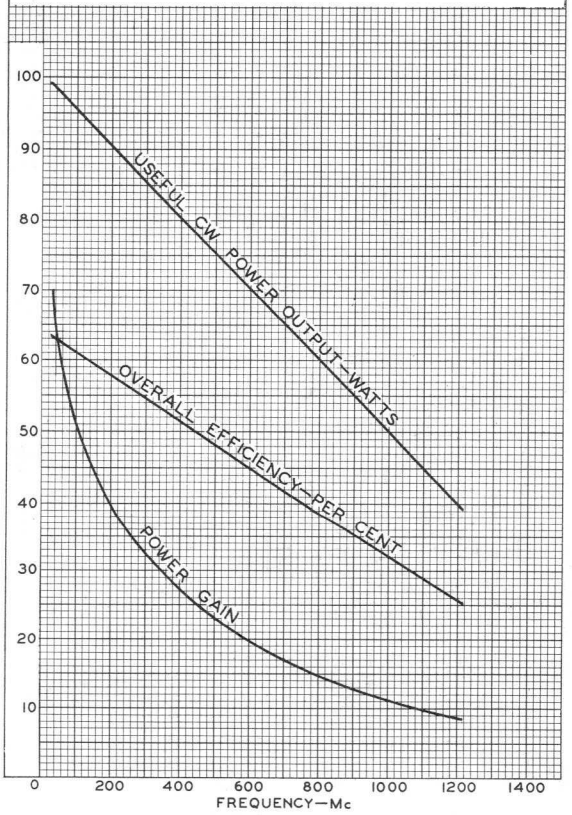
TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM-9232RI

TYPICAL PERFORMANCE CHARACTERISTICS
In Class C Telegraphy or Class C FM Telephony Amplifier Service

E_f = ADJUSTED TO SIMULATE NORMAL OPERATING CONDITIONS OF HEATER IN UHF SERVICE
PLATE VOLTS = 900
GRID-Nº2 VOLTS = 300
PLATE AMPERES = 0.170
OVERALL EFFICIENCY = USEFUL POWER OUTPUT IN LOAD DIVIDED BY DC PLATE INPUT
POWER GAIN = USEFUL POWER OUTPUT IN LOAD DIVIDED BY DRIVER POWER OUTPUT



92CM-9221

7846

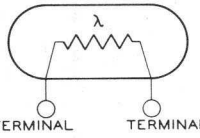
Photoconductive Cell

CADMIUM-SELENIDE, HEAD-ON TYPE

DATA

General:

Spectral Response	See *Accompanying Curve*
Wavelength of Maximum Response	7300 ± 500 angstroms
Sensitive Surface:	
Shape	Rectangular
Length	0.220" ± 0.015"
Width	0.008" ± 0.003"
Area (Average)	0.00176 sq. in.
Maximum Length (Excluding flexible leads)	0.500"
Diameter	0.29" ± 0.01"
Envelope	Glass
Seals	Hermetic
Leads, Flexible	2
Minimum length	1.5"
Diameter	0.016" ± 0.003"
Operating Position	Any
Weight (Approx.)	0.04 oz



λ *indicates that the primary characteristic of the element within the envelope symbol is designed to vary under the influence of light.*

Maximum Ratings, *Absolute-Maximum Values:*

VOLTAGE BETWEEN TERMINALS (DC or Peak AC)	100 max.	volts
PHOTOCURRENT	1000 max.	μa
POWER DISSIPATION	30 max.	mw
AMBIENT TEMPERATURE	50 max.	°C

Characteristics:

With dc voltage of 22.5 volts between terminals and an ambient temperature of 25° C

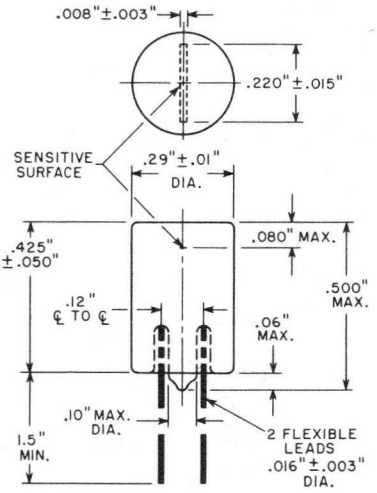
	Min	Median	Max.	
Sensitivity:				
Radiant▲ at 7300 angstroms	–	6550	–	a/w
Luminous●,★	–	41	–	a/lm
Illumination●,★	–	500	–	μa/fc
Photocurrent♦	–	–	0.05	μa

▲ For conditions where the incident power is 7.65×10^{-10} watts.

● For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870° K.

★ Incident illumination on the sensitive surface is 0.01 footcandle.

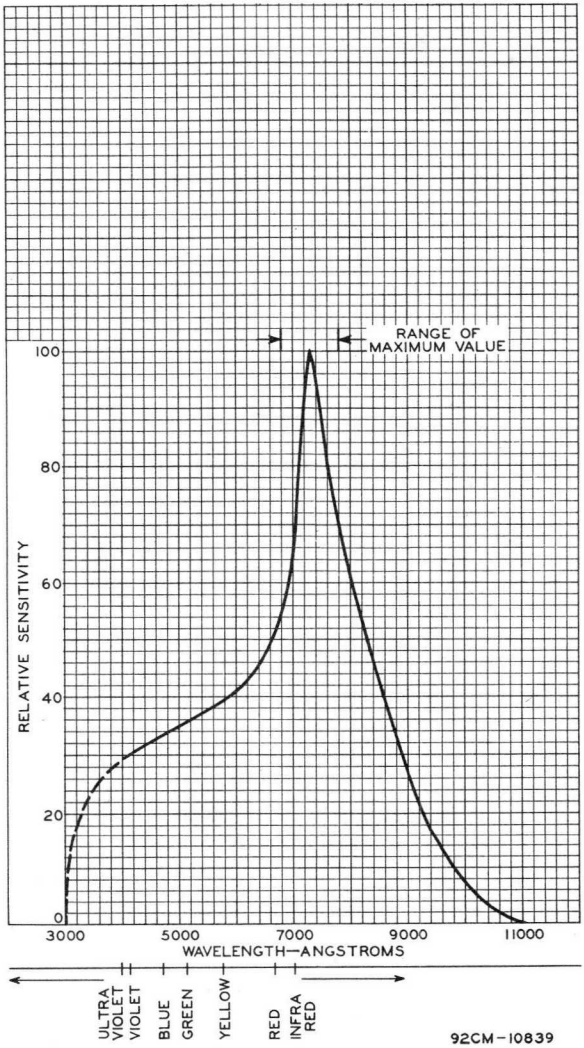
◆ Measured 20 seconds after removal of incident-illumination level of 0.01 footcandle.



92CS-10865

SPECTRAL-SENSITIVITY CHARACTERISTIC

For Equal Values of Radiant Flux at All Wavelengths



92CM-10839

Image Orthicon

SEMICONDUCTIVE TARGET, S-20 RESPONSE
VERY HIGH SENSITIVITY — MAGNETIC FOCUS
VERY HIGH RESOLUTION — MAGNETIC DEFLECTION

For Extremely Low-Light-Level Black-and-White TV Pickup High-Resolution Pictures at 10^{-5} Footcandle, and Useful Pictures at 10^{-6} Footcandle

DATA

General:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.6	amp
Direct Interelectrode Capacitance:		
Anode to all other electrodes	12	pf
Spectral Response		S-20
Wavelength of Maximum Response	4200 ± 500	angstroms
Photocathode, Semitransparent:		
Rectangular image (4 x 3 aspect ratio):		
Useful size of	1.8" max.	diagonal

Note: The size of the optical image focused on the photocathode should be adjusted so that its maximum diagonal does not exceed the specified value. The corresponding electron image on the target should have a size such that the corners of the rectangle just touch the target ring.

Orientation of . . Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through center of faceplate and pin 7 of the shoulder base.

Focusing Method	Magnetic
Deflection Method	Magnetic
Overall Length	15.20" ± 0.25"
Greatest Diameter of Bulb	3.00" ± 0.06"
Minimum Deflecting-Coil Inside Diameter	2-3/8"
Deflecting Coil	Cleveland Electronics, Part No.0Y-1[a], or equivalent
Deflecting-Coil Length	5"
Focusing Coil	Cleveland Electronics, Part No.0F-2[a], or equivalent
Focusing Coil Length	10"
Alignment Coil	Cleveland Electronics, Part No.0A-3[a], or equivalent
Alignment-Coil Length	15/16"
Photocathode Distance Inside End of Focusing Coil	1/2"
Socket	Cinch Part No.3M14[b], or equivalent

Operating Position. . The tube should never be operated in a vertical position with the diheptal-base end up nor in any other position where the axis of the tube with the base up makes an angle of less than 20° with the vertical.

Weight (Approx.) . . . . . 1 lb 6 oz

7967

Shoulder Base. . . . . .Keyed Jumbo Annular 7-Pin

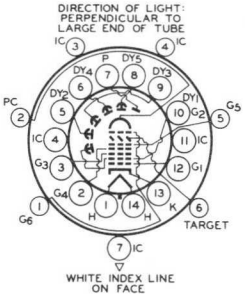
BOTTOM VIEW

Pin 1 - Grid No.6
Pin 2 - Photocathode
Pin 3 - Do Not Use
Pin 4 - Do Not Use
Pin 5 - Grid No.5
Pin 6 - Target
Pin 7 - Do Not Use

End Base . . . .Small-Shell Diheptal 14-Pin (JEDEC No.B14-45)

BOTTOM VIEW

Pin 1 - Heater
Pin 2 - Grid No.4
Pin 3 - Grid No.3
Pin 4 - Do Not Use
Pin 5 - Dynode No.2
Pin 6 - Dynode No.4
Pin 7 - Anode
Pin 8 - Dynode No.5
Pin 9 - Dynode No.3
Pin 10 - Dynode No.1, Grid No.2
Pin 11 - Do Not Use
Pin 12 - Grid No.1
Pin 13 - Cathode
Pin 14 - Heater



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

PHOTOCATHODE:		
Voltage.	-550 max.	volts
Illumination	50 max.	fc
MAXIMUM OPERATING PHOTOCATHODE ILLUMINATION	0.001 max.	fc
OPERATING TEMPERATURE:		
Any part of bulb	55 max.	°C
Of bulb at large end of tube (Target section)	0 min.	°C
TEMPERATURE DIFFERENCE:		
Between target section and any part of bulb hotter than target section	5 max.	°C
GRID-No.6 VOLTAGE	-550 max.	volts
TARGET VOLTAGE:		
Positive value	4 max.	volts
Negative value	10 max.	volts
GRID-No.5 VOLTAGE.	150 max.	volts
GRID-No.4 VOLTAGE.	300 max.	volts
GRID-No.3 VOLTAGE.	400 max.	volts
GRID-No.2 & DYNODE-NO.1 VOLTAGE.	350 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value.	125 max.	volts
Positive bias value.	0 max.	volts
VOLTAGE PER MULTIPLIER STAGE	350 max.	volts
ANODE-SUPPLY VOLTAGE[c].	1350 max.	volts

PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode. .	125 max.	volts
Heater positive with respect to cathode. .	10 max.	volts

Typical Operating Values:[d]

Photocathode Voltage (Image Focus).	−400 to −540	volts
Grid-No.6 Voltage (Accelerator)-(Approx. 75% photocathode voltage)	−300 to −405	volts
Target-Cutoff Voltage[e]	−3 to 1	volts
Grid-No.5 Voltage (Decelerator).	0 to 125	volts
Grid-No.4 Voltage (Beam Focus)	140 to 180	volts
Grid-No.3 Voltage[f]	225 to 330	volts
Grid-No.2 & Dynode-No.1 Voltage.	300	volts
Grid-No.1 Voltage for Picture Cutoff	−45 to −115	volts
Dynode-No.2 Voltage.	600	volts
Dynode-No.3 Voltage.	800	volts
Dynode-No.4 Voltage.	1000	volts
Dynode-No.5 Voltage.	1200	volts
Anode Voltage.	1250	volts
Minimum Peak-to-Peak Blanking Voltage	5	volts
Field Strength at Center of Focusing Coil[g]	75	gausses
Field Strength of Alignment Coil	0 to 3	gausses

Performance Data:[h]

With conditions shown under Typical Operating Values and with an illumination level on the photocathode of 0.00001 footcandle

	Min.	*Typ.*	*Max.*	
Cathode Radiant Sensitivity at 4200 angstroms.	–	0.073	–	a/w
Luminous Sensitivity.	120	170	–	μa/lm
Anode Current (DC).	–	0.3	–	μa
Signal-Output Current (Peak to Peak).	–	0.1	–	μa
Ratio of Peak-to-Peak Highlight Video-Signal Current to RMS Noise Current for Bandwidth of 4.5 Mc	–	3:1	–	
Limiting Horizontal Resolution	–	650	–	TV Lines

[a] Made by Cleveland Electronics Inc., 1974 East 61st Street, Cleveland, Ohio.

[b] Made by Cinch Manufacturing Company, 1026 South Homan Avenue, Chicago 24, Illinois.

[c] Dynode voltage values are shown under *Typical Operating Values*.

[d] With 7967 operated in properly adjusted RCA TK-31 camera.

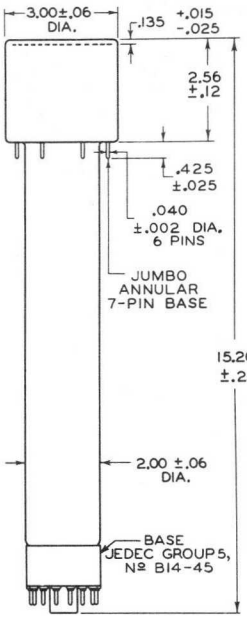
[e] Normal setting of target voltage is +2 volts from target cutoff. The target supply voltage should be adjustable from −3 to 5 volts.

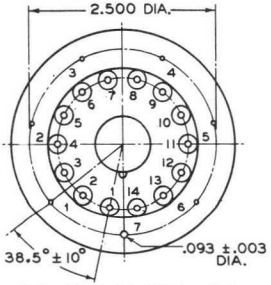
[f] Adjust to give the most uniformly shaded picture near maximum signal.

[g] Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with indicator located outside of and at the image end of the focusing coil.

[h] With output from the 7967 coupled into a low-noise video amplifier.

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-20 Response is shown at front of this Section



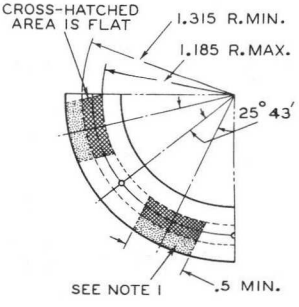


ENLARGED BOTTOM VIEW

92CM-8293R3

DIMENSIONS IN INCHES

DETAIL OF BOTTOM VIEW
OF JUMBO ANNULAR BASE



NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.

ANNULAR BASE GAUGE

Angular variations between pins as well as eccentricity of neck cylinder with respect to photocathode cylinder are held to tolerances such that pins and neck cylinder will fit flat-plate gauge with:

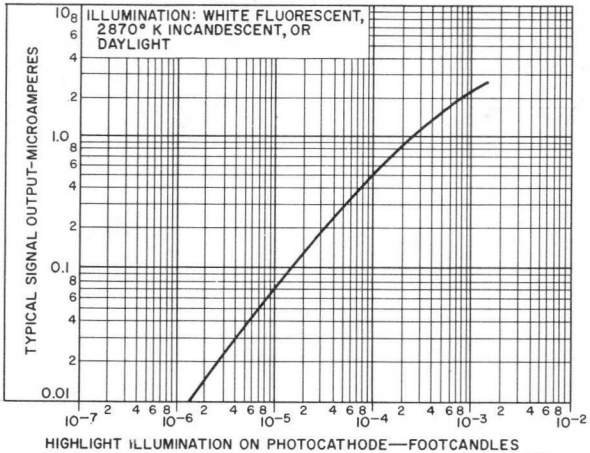
a. Six holes having diameter of 0.065" ± 0.001" and one hole having diameter of 0.150" ± 0.001". All holes have depth of 0.265" ± 0.001". The six 0.065" holes are enlarged by 45° taper to depth of 0.047". All holes are spaced at angles of 51°26′ ± 5′ on circle diameter of 2.500" ± 0.001".

b. Seven stops having height of 0.187" ± 0.001", centered between pin holes, to bear against flat areas of base.

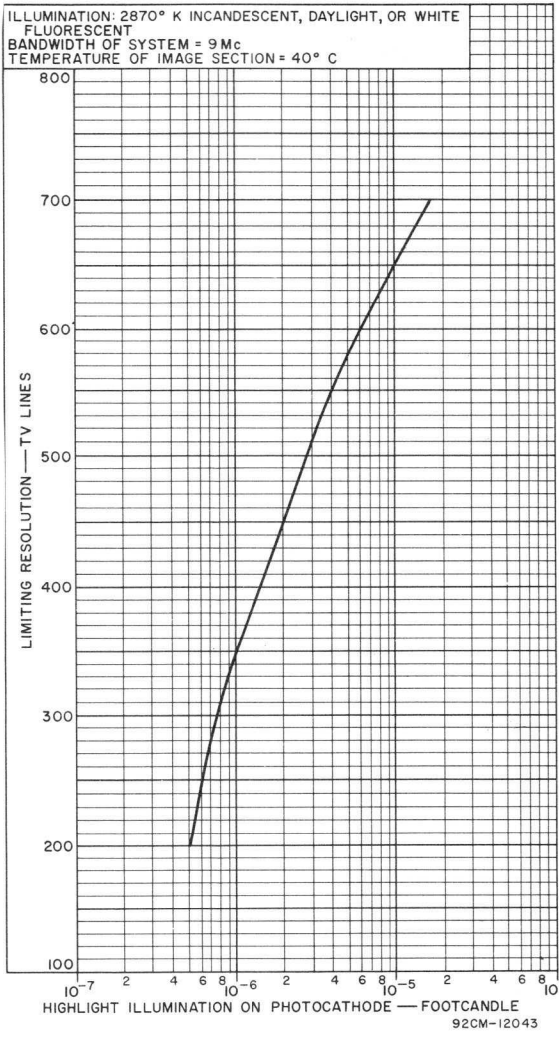
c. Rim extending out a minimum of 0.125" from 2.812" diameter and having height of 0.126" ± 0.001".

d. Neck-cylinder clearance hole having diameter of 2.200" ± 0.001".

BASIC LIGHT-TRANSFER CHARACTERISTIC



EFFECT OF PHOTOCATHODE ILLUMINATION ON LIMITING RESOLUTION OF TYPICAL 7967



8000

POWER TRIODE

Useful with full input up to 30 Mc and with reduced input up to 100 Mc

GENERAL DATA

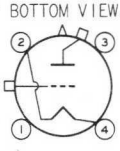
Electrical:

Filament, Thoriated Tungsten:		
Voltage	10 ± 5%	ac or dc volts
Current at 10 volts	4.5	amp
Amplification Factor, for grid volts = -95 and plate ma.= 54	16.5	
Direct Interelectrode Capacitances:		
Grid to plate	6.4	μμf
Grid to filament	5	μμf
Plate to filament	3.3	μμf

Mechanical:

Mounting Position	Vertical, base down, or Horizontal with pins 1 & 2 in vertical plane
Overall Length	8-1/2" ± 1/4"
Maximum Radius (Including side cap)	2-1/8" ± 1/8"
Weight (Approx.)	8 oz
Bulb	T-20
Top Cap	Skirted Medium (JETEC No.C1-14)
Side Cap	Medium (JETEC No.C1-5)
Base	Medium-Metal-Shell Jumbo 4-Pin with Bayonet (JETEC No.A4-29)
Basing Designation for BOTTOM VIEW	2N

Pin 1 - No Connection
Pin 2 - Filament
Pin 3 - Same as Pin 1



Pin 4 - Filament
Top Cap - Plate
Side Cap - Grid

AF POWER AMPLIFIER & MODULATOR - Class B

	CCS●	ICAS●●	
Maximum Ratings, *Absolute Values:*			
DC PLATE VOLTAGE	2500 max.	2750 max.	volts
MAX.-SIGNAL DC PLATE CURRENT*	250 max.	250 max.	ma
MAX.-SIGNAL PLATE INPUT*	425 max.	510 max.	watts
PLATE DISSIPATION*	125 max.	175 max.	watts
Typical Operation:			
Values are for 2 tubes			
DC Plate Voltage	2000	2250	volts
DC Grid Voltage	-120	-130	volts
Peak AF Grid-to-Grid Voltage	520	560	volts
Zero-Signal DC Plate Current	60	65	ma

* Averaged over any audio-frequency cycle of sine-wave form.

●, ●●: See next page.

← Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

8000

POWER TRIODE

	CCS●	ICAS●●	
Max.-Signal DC Plate Current .	425	450	ma
Effective Load Resistance (Plate to plate).	10800	12000	ohms
Max.-Signal Driving Power (Approx.)	6.5	7.9	watts
Max.-Signal Power Output (Approx.)	600	725	watts

RF POWER AMPLIFIER - Class B Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

	CCS●	ICAS●●	
Maximum Ratings, *Absolute Values:*			
DC PLATE VOLTAGE.	2000 max.	2500 max.	volts
DC PLATE CURRENT.	185 max.	185 max.	ma
PLATE INPUT	190 max.	225 max.	watts
PLATE DISSIPATION	125 max.	175 max.	watts
Typical Operation:			
→ DC Plate Voltage.	2000	2250	volts
DC Grid Voltage	−130	−145	volts
Peak RF Grid Voltage.	140	150	volts
DC Plate Current.	95	100	ma
DC Grid Current (Approx.) . .	0.5	0	ma
Driving Power (Approx.) . . .	4.8	5.4	watts
Power Output (Approx.). . . .	65	75	watts

GRID-MODULATED RF POWER AMPLIFIER -- Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

	CCS●	ICAS●●	
Maximum Ratings, *Absolute Values:*			
DC PLATE VOLTAGE.	2000 max.	2500 max.	volts
DC GRID VOLTAGE	−500 max.	−500 max.	volts
DC PLATE CURRENT.	185 max.	185 max.	ma
PLATE INPUT	190 max.	225 max.	watts
PLATE DISSIPATION	125 max.	175 max.	watts
Typical Operation:			
DC Plate Voltage.	2000	2250	volts
DC Grid Voltage	−250	−265	volts
Peak RF Grid Voltage.	265	270	volts
Peak AF Grid Voltage.	120	115	volts
DC Plate Current.	95	100	ma
DC Grid Current (Approx.) . .	0	0	ma
Driving Power (Approx.)▲. . .	4.3	2.5	watts
Power Output (Approx.). . . .	65	75	watts

▲ At crest of audio-frequency cycle with modulation factor of 1.0.

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

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

8000

POWER TRIODE

PLATE-MODULATED RF POWER AMPLIFIER -- Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

	CCS●	*ICAS*●●	
Maximum Ratings, *Absolute Values:*			
DC PLATE VOLTAGE	1600 max.	2000 max.	volts
DC GRID VOLTAGE	-500 max.	-500 max.	volts
DC PLATE CURRENT	210 max.	250 max.	ma
DC GRID CURRENT	40 max.	45 max.	ma
PLATE INPUT	335 max.	500 max.	watts
PLATE DISSIPATION	85 max.	125 max.	watts
Typical Operation:			
DC Plate Voltage	1600	2000	volts
DC Grid Voltage⊕	-300	-370	volts
From grid resistor of	15000	10000	ohms
Peak RF Grid Voltage	470	630	volts
DC Plate Current	210	250	ma
DC Grid Current (Approx.)	20	37	ma
Driving Power (Approx.)	8.5	20	watts
Power Output (Approx.)	250	380	watts

RF POWER AMPLIFIER & OSCILLATOR - Class C Telegraphy□ and RF POWER AMPLIFIER - Class C FM Telephony

	CCS●	*ICAS*●●	
Maximum Ratings, *Absolute Values:*			
DC PLATE VOLTAGE	2000 max.	2500 max.	volts
DC GRID VOLTAGE	-500 max.	-500 max.	volts
DC PLATE CURRENT	250 max.	300 max.	ma
DC GRID CURRENT	40 max.	45 max.	ma
PLATE INPUT	500 max.	750 max.	watts
PLATE DISSIPATION	125 max.	175 max.	watts
Typical Operation:			
DC Plate Voltage	2000	2500	volts
DC Grid Voltage:			
From fixed supply of	-195	-240	volts
From grid resistor of	8200	6200	ohms ←
From cathode resistor of	680	680	ohms ←
Peak RF Grid Voltage	370	480	volts
DC Plate Current	250	300	ma
DC Grid Current (Approx.)	24	40	ma
Driving Power (Approx.)	8	18	watts
Power Output (Approx.)	375	575	watts

●● Intermittent Commercial and Amateur Service.

⊕ Obtained from fixed supply, by grid resistor, by cathode resistor, or by combination methods.

●,□: See next page.

← Indicates a change.

8000

POWER TRIODE

NOTE: When the 8000 is used in the final amplifier or a preceding stage of a transmitter designed for break-in operation and oscillator keying, a small amount of fixed-bias must be used to maintain the plate current at a safe value. With a plate voltage of 2500 volts a fixed bias of at least −140 volts should be used.

OSCILLATOR - Class C

Operation with Unfiltered Plate Supply

	Supply 1■	*Supply 2*♦	
Maximum CCS● Ratings, *Absolute Values:*			
RMS PLATE VOLTAGE	2500 max.	–	volts
DC PLATE VOLTAGE	–	1800 max.	volts
DC GRID VOLTAGE	−200 max.	−300 max.	volts
DC PLATE CURRENT	160 max.	225 max.	ma
DC GRID CURRENT	25 max.	35 max.	ma
PLATE INPUT	450 max.	500 max.	watts
PLATE DISSIPATION	125 max.	125 max.	watts
Typical Push-Pull Operation at 30 Mc:			
Values are for 2 tubes			
RMS Plate Voltage	2500	–	volts
DC Plate Voltage	–	1800	volts
→ Grid Resistor§	3300	4700	ohms
DC Plate Current	320	450	ma
DC Grid Current	30	35	ma
Power Output (Approx.)	650	700	watts
Output-Circuit Efficiency (Approx.)	85	85	%
Useful Power Output (Approx.)	550♦	600♦	watts

● Continuous Commercial Service.

□ Key-down conditions per tube without amplitude modulation. Amplitude modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

■ Self-rectified ac supply.

♦ Separate rectified (no filter), single-phase, full-wave plate supply.

§ The 8000 can be biased by any convenient method, but the use of a grid resistor is preferred because the bias is automatically varied as the load on the circuit varies. In those applications where grid current and grid voltage may vary widely because of fluctuating loads, it is important to design equipment so that the maximum grid-current and grid-voltage ratings are never exceeded for any load. An approximate rule is to adjust the grid-current and grid-voltage values at full load to one-half of the corresponding maximum values. This operating condition permits grid-voltage values to rise from zero load to twice their full-load values, and usually provides adequate leeway.

♦ This value of useful power is measured at load of output circuit having the indicated efficiency.

→ Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

8000

POWER TRIODE

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Filament Current	1	4.2	4.8	amp
Direct Interelectrode Capacitances:				
Grid to plate	2	5.6	7.2	μμf
Grid to filament	2	4.1	5.9	μμf
Plate to filament	2	2.4	4.2	μμf
Amplication Factor	1,3	14.8	18.2	
Grid Current	1,4	55	95	ma
Plate Current (1)	1,4	300	500	ma
Plate Current (2)	1,5	33	75	ma
Power Output	1,6	425	-	watts

Note 1: With 10 volts ac on filament.

Note 2: Without external shield.

Note 3: With grid volts = -95, and dc plate voltage adjusted to give dc plate current of 54 ma.

Note 4: With dc plate volts = 100, and dc grid volts = +100.

Note 5: With dc plate volts = 2000, and dc grid volts = -95.

Note 6: In self-excited oscillator circuit, and with dc plate volts = 2250, dc plate ma. = 275, dc grid ma. = 35 to 45, grid resistor (ohms) = 8200, and frequency (Mc) = 15.

MAXIMUM RATINGS vs OPERATING FREQUENCY

FREQUENCY	30	60	100	Mc
MAXIMUM PERMISSIBLE PERCENTAGE OF MAXIMUM RATED PLATE VOLTAGE AND PLATE INPUT:				
Class B Telephony	100	88	80	%
Class C Plate-Modulated Telephony	100	70	50	%
Class C Telegraphy	100	70	50	%

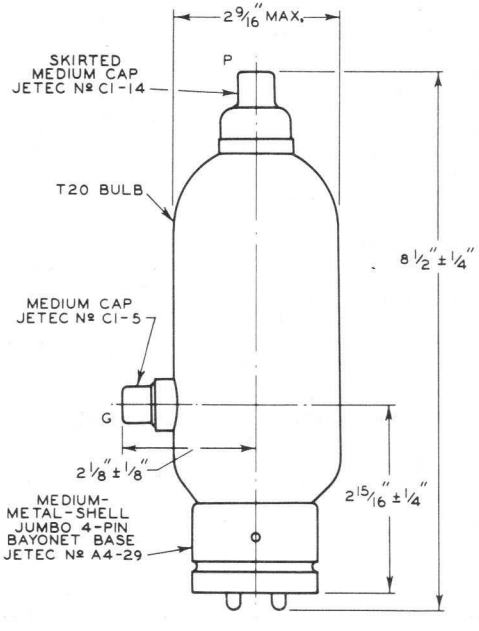
OPERATING CONSIDERATIONS

The *plate* of the 8000 shows a barely perceptible red color when the tube is operated at maximum CCS ratings and a cherry-red color at maximum ICAS ratings.

← Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

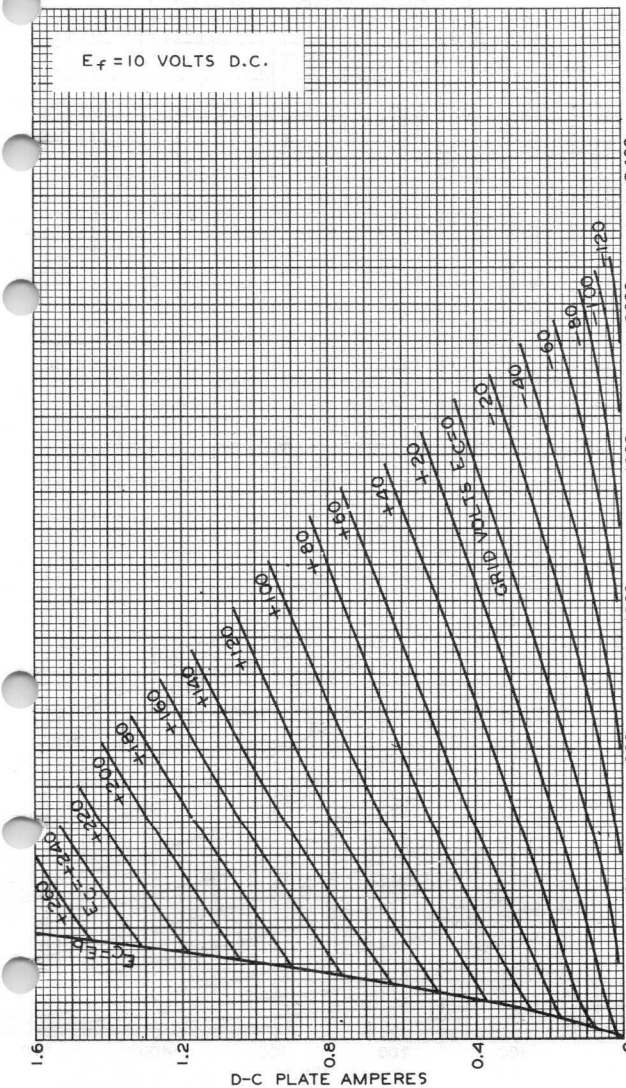
8000
POWER TRIODE



RCA

8000

AVERAGE PLATE CHARACTERISTICS



SEPT. 20, 1940

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

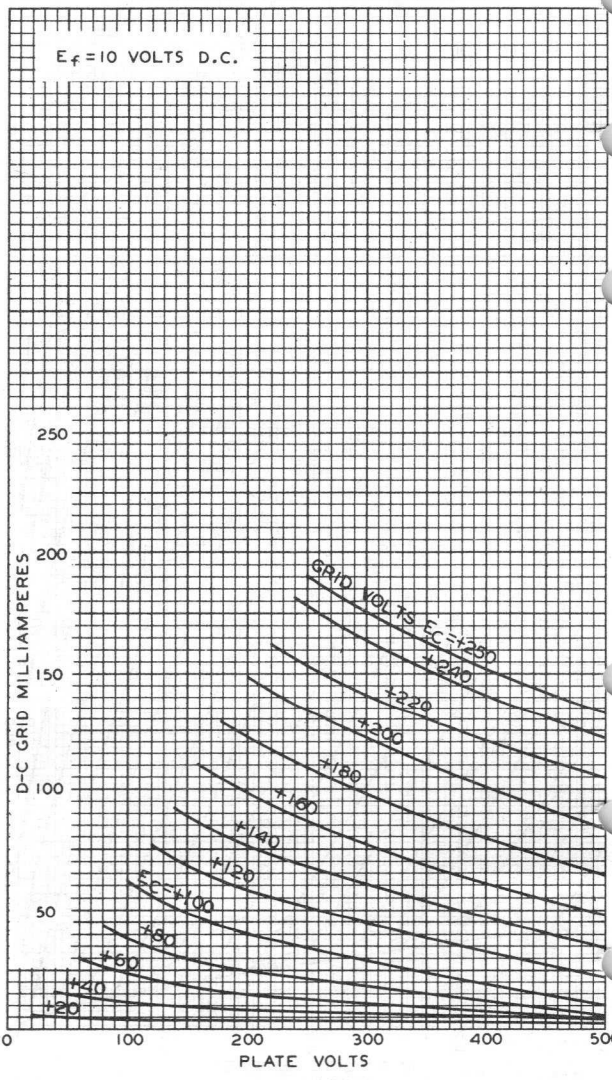
92CM-6212

8000

RCA

8000

TYPICAL CHARACTERISTICS



FEB. 12, 1941

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6213

8003

OSCILLATOR, POWER AMPLIFIER, MODULATOR

Filament	Thoriated Tungsten	
Voltage	10	a-c or d-c volts
Current	3.25	amp.
Amplification Factor	12	
Direct Interelectrode Capacitances (Approx.):		
Grid to Plate	11.7	μμf
Grid to Filament	5.8	μμf
Plate to Filament	3.4	μμf
Maximum Overall Length		8-1/2"
Maximum Diameter		2-9/16"
Bulb		T-20
Cap		Medium Metal
Base		Jumbo 4-Large Pin

MAXIMUM CCS RATINGS with TYPICAL OPERATING CONDITIONS

CCS = Continuous Commercial Service

A-F POWER AMPLIFIER & MODULATOR - Class B

	CCS	
D-C Plate Voltage	1350 max.	volts
Max.-Signal D-C Plate Current*	250 max.	ma.
Max.-Signal Plate Input*	330 max.	watts
Plate Dissipation*	100 max.	watts
Typical Operation:		
Unless otherwise specified, values are for 2 tubes		
D-C Plate Voltage	1350	volts
D-C Grid Voltage#	-100	volts
Peak A-F Grid-to-Grid Voltage	480	volts
Zero-Sig. D-C Plate Current	40	ma.
Max.-Sig. D-C Plate Current	490	ma.
Load Resistance (per tube)	1500	ohms
Effective Load Resistance (plate to plate)	6000	ohms
Max.-Sig. Driving Power	10.5 approx.	watts
Max.-Sig. Power Output	460 approx.	watts

* Averaged over any audio-frequency cycle of sine-wave form.

R-F POWER AMPLIFIER - Class B Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

	CCS	
D-C Plate Voltage	1350 max.	volts
D-C Plate Current	150 max.	ma.
Plate Input	150 max.	watts
Plate Dissipation	100 max.	watts
Typical Operation:		
D-C Plate Voltage	1350	volts
D-C Grid Voltage#	-110	volts
Peak R-F Grid Voltage	135	volts
D-C Plate Current	110	ma.
D-C Grid Current**	1.5 approx.	ma.
Driving Power** °	8 approx.	watts
Power Output	50 approx.	watts

° At crest of audio-frequency cycle with modulation factor of 1.0.
With a-c filament supply.
**: See end of tabulation.

8003

OSCILLATOR, POWER AMPLIFIER, MODULATOR

(continued from preceding page)

PLATE-MODULATED R-F POWER AMPLIFIER - Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

	CCS	
D-C Plate Voltage	1100 max.	volts
D-C Grid Voltage	-400 max.	volts
D-C Plate Current	200 max.	ma.
D-C Grid Current	50 max.	ma.
Plate Input	220 max.	watts
Plate Dissipation	67 max.	watts
Typical Operation:		
D-C Plate Voltage	1100	volts
D-C Grid Voltage △	-260	volts
	6500	ohms
Peak R-F Grid Voltage	430	volts
D-C Plate Current	200	ma.
D-C Grid Current**	40 approx.	ma.
Driving Power**	15 approx.	watts
Power Output	167 approx.	watts

△ Obtained from grid resistor of value shown or by combination methods.

R-F POWER AMPLIFIER & OSCILLATOR - Class C Telegraphy

Key-down conditions per tube without modulation ##

	CCS	
D-C Plate Voltage	1350 max.	volts
D-C Grid Voltage	-400 max.	volts
D-C Plate Current	250 max.	ma.
D-C Grid Current	50 max.	ma.
Plate Input	330 max.	watts
Plate Dissipation	100 max.	watts
Typical Operation:		
D-C Plate Voltage	1350	volts
D-C Grid Voltage ◊	-175	volts
	5000	ohms
	625	ohms ←
Peak R-F Grid Voltage	350	volts
D-C Plate Current	245	ma.
D-C Grid Current**	35 approx.	ma.
Driving Power**	11 approx.	watts
Power Output	250 approx.	watts

◊ Obtained from fixed supply, by grid resistor (5000) or by cathode resistor (630).

NOTE: When the 8003 is used in the final amplifier or a preceding stage of a transmitter designed for break-in operation and oscillator keying, a small amount of fixed bias must be used to maintain the plate current at a safe value. With plate voltage of 1350 volts, a fixed bias at least -85 volts should be used.

**, ##: See end of tabulation.

← Indicates a change.

8003

OSCILLATOR, POWER AMPLIFIER, MODULATOR

(continued from preceding page)

OSCILLATOR – OPERATION WITH UNFILTERED PLATE SUPPLY

	Supply 1	*Supply 2*	
Plate Voltage	1500 max.	1200 max.	volts
D-C Grid Voltage	-200 max.	-250 max.	volts
D-C Plate Current	200 max.	225 max.	ma.
D-C Grid Current	30 max.	45 max.	ma.
Plate Input	330 max.	330 max.	watts
Plate Dissipation	100 max.	100 max.	watts
Typical Operation in push-pull circuit at 25 Mc:			
Unless otherwise specified, values are for 2 tubes			
Plate Voltage	1500 (RMS)	1200	volts
Grid Resistor	2000	3000	ohms
D-C Plate Current	400	450	ma.
D-C Grid Current	35	45	ma.
Power Output	500	450	approx. watts
Circuit Power Output (85% circuit efficiency)	425	380	approx. watts

1 Self-rectified a-c supply. (Plate voltages are RMS values.)

2 Separate rectified (no filter) single-phase, full-wave plate supply.

For applications where grid current and grid voltage may vary widely because of fluctuating loads. It is important to design equipment so that the maximum grid-current and grid-voltage ratings are never exceeded for any load. An approximate rule is to adjust the grid-current and grid-voltage values at full-load to one-half of the corresponding maximum values. This operating condition permits grid-current and grid voltage values to rise for zero-load to twice their full-load values, and usually provides adequate leeway.

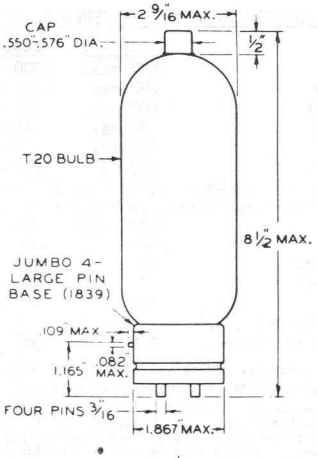
Data on operating frequencies for the 8003 are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY.

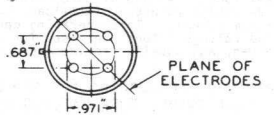
CURVES for the 8003 are the same as those for Type 211.

←Indicates a change.

8003

OSCILLATOR, POWER AMPLIFIER, MODULATOR

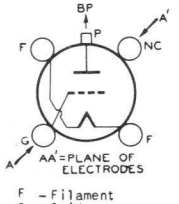




BOTTOM VIEW OF BASE

92C-6203

BOTTOM VIEW OF
SOCKET CONNECTIONS



F - Filament
G - Grid
P - Plate
NC - No Connection
BP - Bayonet Pin

TUBE MOUNTING POSITION

VERTICAL: Base down.
HORIZONTAL: With plane of electrodes vertical (on edge).

8005
POWER TRIODE

GENERAL DATA

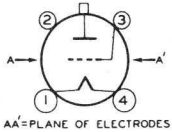
Electrical:

Filament, Thoriated Tungsten:		
Voltage (AC or DC)	10 ± 0.5	volts
Current, with 10 volts on filament	3.25	amp
Amplification Factor	20	
Direct Interelectrode Capacitances:		
Grid to Plate	5	μμf
Grid to Filament	6.4	μμf
Plate to Filament	1	μμf

Mechanical:

Mounting Position	Vertical, Base down; or Horizontal, with pins 2 and 3 in vertical plane
Overall Length	6-7/16" ± 1/4"
Seated Length	5-7/8" ± 1/4"
Diameter	2-7/16"
Bulb	ST-19
Cap	Medium, with Insulating Collar
Base	Medium-Metal-Shell Small 4-Pin, Bayonet
Basing Designation for BOTTOM VIEW	3G

Pin 1 - Filament
Pin 2 - No Connection



AA'=PLANE OF ELECTRODES

Pin 3 - Grid
Pin 4 - Filament
Cap - Plate

AF POWER AMPLIFIER & MODULATOR - Class B

Maximum Ratings, *Absolute Values*:

	CCS●	ICAS●●	
DC PLATE VOLTAGE	1250 max.	1500 max.	volts
MAX.-SIGNAL DC PLATE CURRENT*	200 max.	200 max.	ma
MAX.-SIGNAL PLATE INPUT*	225 max.	250 max.	watts
PLATE DISSIPATION*	75 max.	85 max.	watts

Typical Operation:

Values are for 2 tubes

DC Plate Voltage	1250	1500	volts
DC Grid Voltage#	-55	-67.5	volts ←
Peak AF Grid-to-Grid Voltage	290	330	volts ←
Zero-Signal DC Plate Current	40	40	ma
Max.-Signal DC Plate Current	320	330	ma ←
Effective Load Resistance (plate-to-plate)	8000	9800	ohms
Max.-Signal Driving Power (Approx.)	4	5.5	watts ←
Max.-Signal Power Output (Approx.)	250	330	watts ←

* Averaged over any audio-frequency cycle of sine-wave form.
●, ●●, #: See next page. ← Indicates a change.

8005
POWER TRIODE

RF POWER AMPLIFIER – Class B Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values*:

	CCS●	*ICAS*●●	
DC PLATE VOLTAGE	1250 max.	1500 max.	volts
DC PLATE CURRENT	100 max.	100 max.	ma
PLATE INPUT	110 max.	125 max.	watts
PLATE DISSIPATION	75 max.	85 max.	watts

Typical Operation:

DC Plate Voltage	1250	1500	volts
DC Grid Voltage#	-65	-80	volts
Peak RF Grid Voltage	85	90	volts
DC Plate Current	85	83	ma
DC Grid Current (Approx.)	2	1	ma
Driving Power (Approx.)▲	5.5	5	watts
Power Output (Approx.)	40	45	watts

▲ At crest of audio-frequency cycle with modulation factor of 1.0.

PLATE-MODULATED RF POWER AMPLIFIER – Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values*:

	CCS●	*ICAS*●●	
DC PLATE VOLTAGE	1000 max.	1250 max.	volts
DC GRID VOLTAGE	-200 max.	-200 max.	volts
DC PLATE CURRENT	160 max.	200 max.	ma
DC GRID CURRENT	45 max.	45 max.	ma
PLATE INPUT	160 max.	240 max.	watts
PLATE DISSIPATION	50 max.	75 max.	watts

Typical Operation:

DC Plate Voltage	1000	1250	volts
DC Grid Voltage⊕	-195	-195	volts
	7000	7000	ohms
Peak RF Grid Voltage	350	350	volts
DC Plate Current	160	190	ma
DC Grid Current (Approx.)	28	28	ma
Driving Power (Approx.)	9	9	watts
Power Output (Approx.)	115	170	watts

●, ●●, #, ⊕: See next page.

8005
POWER TRIODE

RF POWER AMPLIFIER & OSCILLATOR – Class C Telegraphy

Key-down conditions per tube without modulation[□□]

Maximum Ratings, *Absolute Values:*

	CCS[●]	*ICAS*[●●]	
DC PLATE VOLTAGE	1250 max.	1500 max.	volts
DC GRID VOLTAGE	−200 max.	−200 max.	volts
DC PLATE CURRENT	200 max.	200 max.	ma
DC GRID CURRENT	45 max.	45 max.	ma
PLATE INPUT	240 max.	300 max.	watts
PLATE DISSIPATION	75 max.	85 max.	watts

Typical Operation:

DC Plate Voltage	1250	1500	volts
DC Grid Voltage[▲▲]	−115	−130	volts
	3800	4000	ohms
	520	560	ohms
Peak RF Grid Voltage	240	255	volts
DC Plate Current	190	200	ma
DC Grid Current (Approx.)	30	32	ma
Driving Power (Approx.)	6.5	7.5	watts
Power Output (Approx.)	170	220	watts

SELF-RECTIFYING OSCILLATOR or AMPLIFIER – Class C

Maximum Ratings, *Absolute Values:*

	CCS[●]	
AC PLATE VOLTAGE (RMS)	1750 max.	volts
DC GRID VOLTAGE	−125 max.	volts
DC PLATE CURRENT	125 max.	ma
DC GRID CURRENT	25 max.	ma
PLATE INPUT	240 max.	watts
PLATE DISSIPATION	75 max.	watts

Typical Operation in Push-Pull Circuit at 50 Mc:

Values are for 2 tubes

AC Plate Voltage (RMS)	1750	volts
Grid Resistor[●]	2000	ohms
DC Plate Current	250	ma
DC Grid Current (at full load)	35	ma
Power Output (Approx.)	330	watts
Useful Power Output (Approx.)– 75% circuit efficiency	250	watts

●, ●●, ▲▲, □□, ◆: See next page.

8005
POWER TRIODE

AMPLIFIER or OSCILLATOR – Class C

With Separate, Rectified, Unfiltered, Single-Phase, Full-Wave Plate Supply

Maximum Ratings, *Absolute Values*:

	CCS●	
DC PLATE VOLTAGE	1125 max.	volts
DC GRID VOLTAGE	-125 max.	volts
DC PLATE CURRENT	180 max.	ma
DC GRID CURRENT	40 max.	ma
PLATE INPUT	240 max.	watts
PLATE DISSIPATION	75 max.	watts

Typical Operation in Push-Pull Circuit at 27 Mc:

Values are for 2 tubes

DC Plate Voltage	1100	volts
Grid Resistor#	2000	ohms
DC Plate Current	360	ma
DC Grid Current	40	ma
Power Output (Approx.)	330	watts
Circuit Power Output (Approx.)– 85% circuit efficiency	280	watts

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Filament Current	1	3.1	3.4	amp
Amplification Factor	1,2	18	22	
Grid-Plate Capacitance	–	4.3	5.7	μμf
Grid-Filament Capacitance	–	5.3	7.5	μμf
Plate-Filament Capacitance	–	0.75	1.25	μμf
Grid Current	1,3	–	98	ma
Plate Current	1,4	30	70	ma
→ Useful Power Output	1,5	195	–	watts

Note 1: DC filament voltage = 10 volts.

Note 2: With dc grid voltage of -50 volts and plate voltage adjusted to give plate current of 50 ma.

Note 3: With dc plate voltage of 200 volts and dc grid voltage of +100 volts.

Note 4: With dc plate voltage of 1500 volts and dc grid voltage of -55 volts.

Note 5: With dc plate voltage of 1500 volts, plate current of 200 ma., grid current of 32 to 48 ma., grid resistor of 5000 ohms and frequency of 15 Mc.

● Continuous Commercial Service. → Indicates a change.

●● Intermittent Commercial and Amateur Service.

For ac filament supply.

⊕ Obtained by grid resistor of value shown or by partial self-bias methods.

□□ Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

▲▲ Obtained from fixed supply, by grid resistor (3800,4000) or by cathode resistor (520,560).

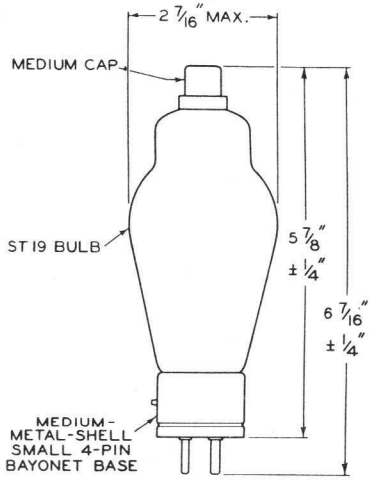
* See next page.

8005
POWER TRIODE

The 8005 can be biased by any convenient method, but the use of a grid resistor is preferred because the bias is automatically varied as the load on the circuit varies. In those applications where grid current and grid voltage may vary widely because of fluctuating loads, it is important to design equipment so that the maximum grid-current and grid-voltage ratings are never exceeded for any load. An approximate rule is to adjust the grid-current and grid-voltage values at full-load to one-half of the corresponding maximum values. This operating condition permits grid-current and grid-voltage values to rise from zero load to twice their full-load values, and usually provides adequate leeway.

NOTE: When the 8005 is used in the final amplifier or a preceding stage of a transmitter designed for break-in operation and oscillator keying, a small amount of fixed-bias must be used to maintain the plate current at a safe value. With a plate voltage of 1500 volts, a fixed bias of at least -50 volts should be used.

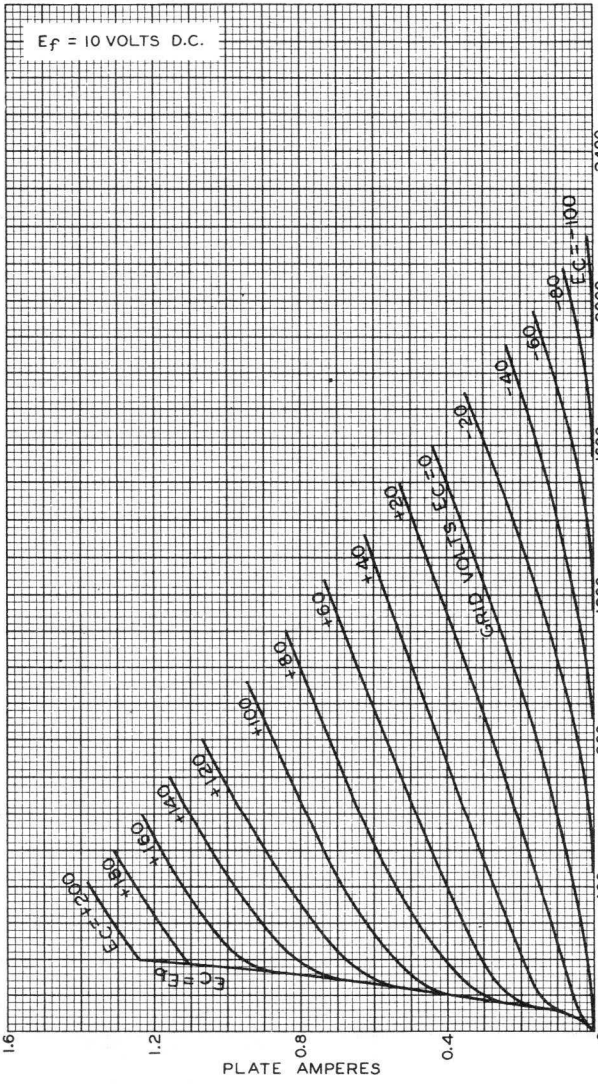
Data on operating frequencies for the 8005 are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY.



92CM-6283R2

8005

AVERAGE PLATE CHARACTERISTICS



APRIL 30, 1941

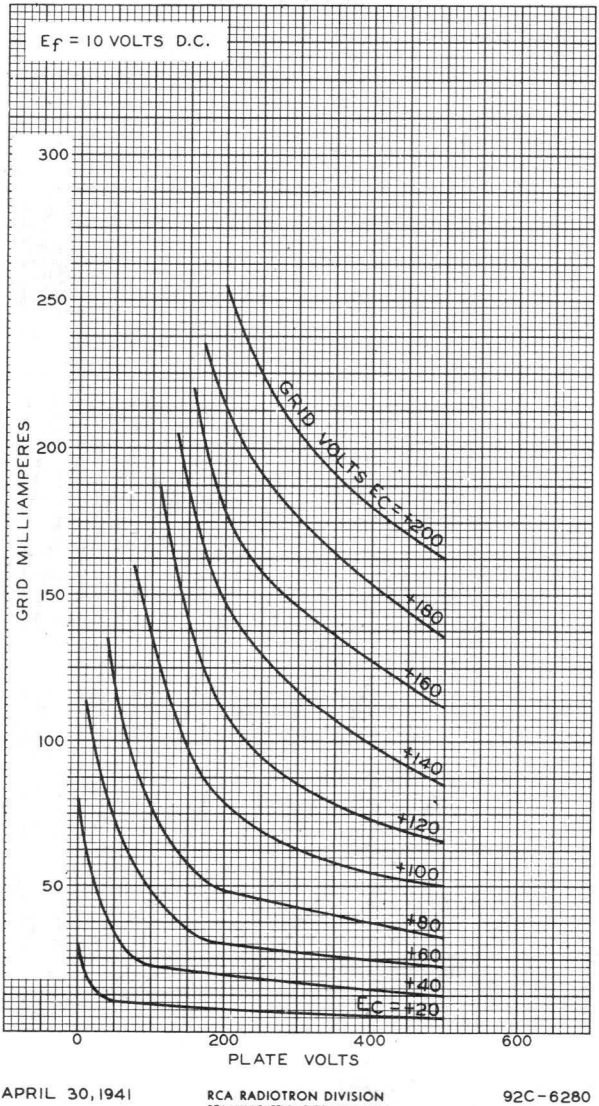
RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC.

92C-6279

8005

8005

TYPICAL CHARACTERISTICS



8012-A

U-H-F TRANSMITTING TRIODE

The 8012-A supersedes the Type 8012.

GENERAL DATA

Electrical:

Filament, Thoriated Tungsten:**		
Voltage	6.3	ac or dc volts
Current	1.92	amp.
Amplification Factor	18	
Direct Interelectrode Capacitances:		
Grid to Plate	2.5	μμf
Grid to Filament	2.7	μμf
Plate to Filament	0.4	μμf

Mechanical:

Mounting Position. . . . . Vertical Only

Cooling – *Forced-Air Cooling* is required when plate dissipation exceeds 75% of the rated value.

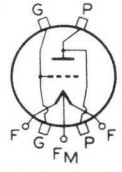
Maximum Overall Length (Excluding Flexible Leads). . 3-15/16"

Greatest Radius. . . . . 1-1/8" ± 1/16"

Bulb T-8

Terminal Connections . . *See Outline Drawing*

F – Filament
F_M – Filament Mid-Tap
G – Grid
P – Plate



G TERMINALS NEARER FILAMENT LEADS
P TERMINALS NEARER BULB TIP

GRID-MODULATED R-F POWER AMPLIFIER – Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values:*	CCS*	
D-C PLATE VOLTAGE	1000 max.	volts
D-C GRID VOLTAGE	-200 max.	volts
D-C PLATE CURRENT	65 max.	ma.
PLATE INPUT	50 max.	watts
PLATE DISSIPATION	40 max.	watts

Typical Operation:		
D-C Plate Voltage	1000	volts
D-C Grid Voltage □	-135	volts
	2500	ohms
Peak R-F Grid Voltage	155	volts
Peak A-F Grid Voltage	65	volts
D-C Plate Current	50	ma.
D-C Grid Current *	4 approx.	ma.
Driving Power *▲	3.5 approx.	watts
Power Output	20 approx.	watts

□, ▲. See next page. *, *, **: See end of tabulation.

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

8012-A

U-H-F TRANSMITTING TRIODE

(continued from preceding page)

□ Obtained from fixed supply or by cathode resistor of value shown.
▲ At crest of audio-frequency cycle with modulation factor of 1.0.

PLATE-MODULATED R-F POWER AMPLIFIER - Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum Ratings, *Absolute Values:*	CCS ■		
D-C PLATE VOLTAGE	800	max.	volts
D-C GRID VOLTAGE	-200	max.	volts
D-C PLATE CURRENT	65	max.	ma.
D-C GRID CURRENT	20	max.	ma.
PLATE INPUT	33	max.	watts
PLATE DISSIPATION	27	max.	watts

Typical Operation:			
D-C Plate Voltage	800		volts
D-C Grid Voltage ‡	-105		volts
	10000		ohms
Peak R-F Grid Voltage	145		volts
D-C Plate Current	40		ma.
D-C Grid Current*	10.5	approx.	ma.
Driving Power*	1.4	approx.	watts
Power Output	22	approx.	watts

‡ Obtained preferably from grid resistor of value shown, or combination of grid resistor with either fixed supply or suitably by-passed cathode resistor.

R-F POWER AMPLIFIER & OSCILLATOR - Class C Telegraphy

Key-down conditions per tube without modulation #

Maximum Ratings, *Absolute Values:*	CCS ■		
D-C PLATE VOLTAGE	1000	max.	volts
D-C GRID VOLTAGE	-200	max.	volts
D-C PLATE CURRENT	80	max.	ma.
D-C GRID CURRENT	20	max.	ma.
PLATE INPUT	50	max.	watts
PLATE DISSIPATION	40	max.	watts

Typical Operation:			
D-C Plate Voltage	1000		volts
D-C Grid Voltage °	-90		volts
	6400		ohms
	1400		ohms
Peak R-F Grid Voltage	130		volts
D-C Plate Current	50		ma.
D-C Grid Current *	14	approx.	ma.
Driving Power *	1.6	approx.	watts
Power Output	35	approx.	watts

#, °, *: See next page.
■ CCS = Continuous Commercial Service.

8012-A

U-H-F TRANSMITTING TRIODE

(continued from preceding page)

○ Obtained from fixed supply, or grid resistor (6400), or by cathode resistor (1400). When the 8012-A is used in the final amplifier or a preceding stage of a transmitter designed for break-in operation and oscillator keying, a small amount of fixed bias must be used to maintain the plate current at a safe value. With plate voltage of 1000 volts a fixed bias of at least -40 volts should be used.

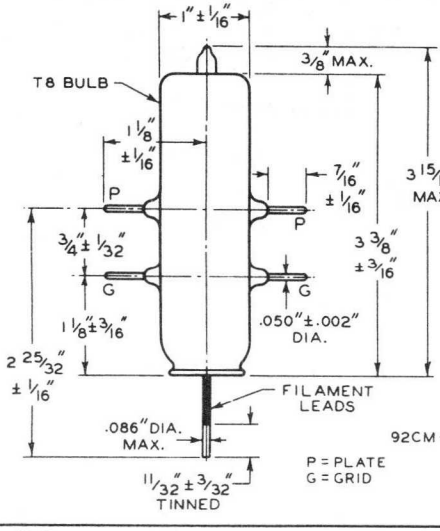
** The filament is center-tapped and the center lead is brought out of the tube. With this design, it is possible to minimize the effect of filament lead inductance by connecting all three filament leads in parallel through r-f by-pass capacitors. The center-lead of this parallel connection should not be returned directly to the center-tap of the filament-transformer winding or to ground, although it may be by-passed to either of these points if desired.

* Subject to wide variations as explained on sheet TUBE RATINGS in General Section.

Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

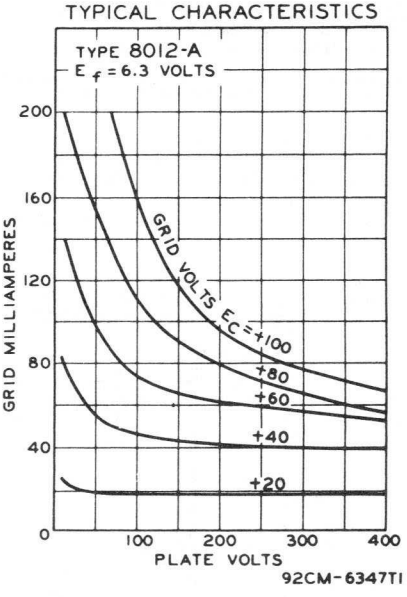
The 8012-A may be operated with maximum ratings at frequencies up to 500 megacycles but as the frequency is raised, the efficiency and power output fall off. At 600 megacycles an efficiency of about 35% can be expected. Since the efficiency at 600 megacycles is relatively low, the plate of the 8012-A has been designed to have an unusually high dissipation rating.

Data on operating frequencies for the 8012-A are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY.



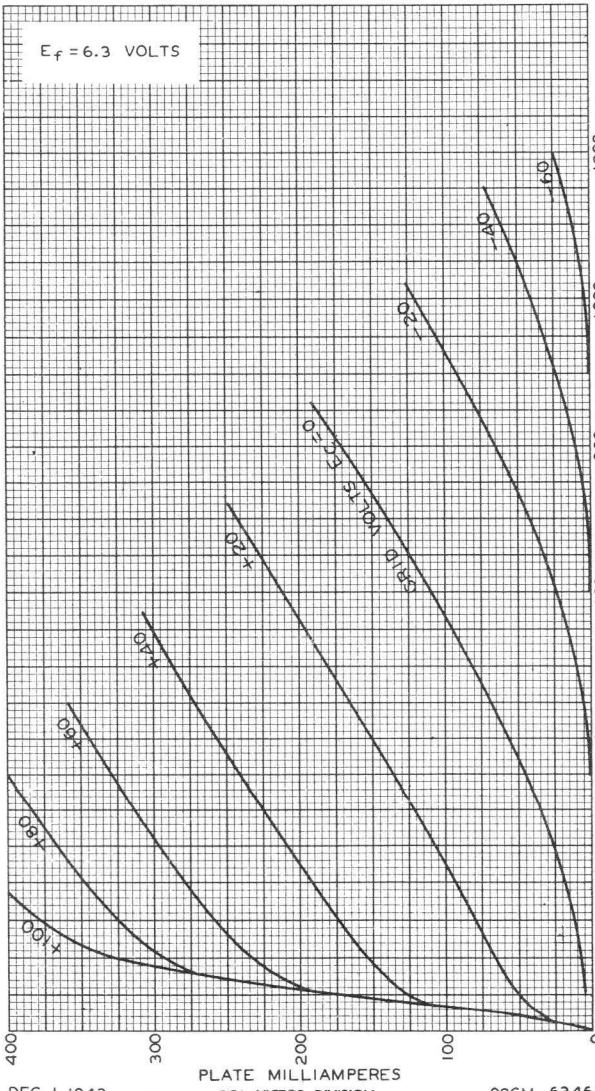
8012-A

U-H-F TRANSMITTING TRIODE



8012-A

AVERAGE PLATE CHARACTERISTICS



DEC. 1, 1943

92CM-6346

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

Beam Power Tube

90 WATTS CW INPUT (ICAS) UP TO 60 Mc
60 WATTS CW INPUT (ICAS) UP TO 175 Mc

GENERAL DATA

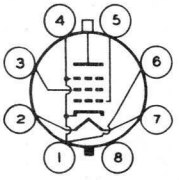
Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)[a]	13.5	volts
Current at heater volts = 13.5	0.585	amp
Minimum heating time	60	sec
Transconductance, for plate volts = 200, grid-No.2 volts = 200, and plate ma. = 100	7000	μmhos
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 200, grid-No.2 volts = 200 and plate ma. = 100	4.5	
Direct Interelectrode Capacitances:[b]		
Grid No.1 to plate	0.24 max.	pf
Grid No.1 to cathode & grid No.3 & internal shield, grid No.2, base sleeve, and heater	13.0	pf
Plate to cathode & grid No.3 & internal shield, grid No.2, base sleeve, and heater	8.5	pf

Mechanical:

Operating Position	Any
Maximum Overall Length	3-13/16"
Seated Length	3-1/8" ± 1/8"
Maximum Diameter	1-21/32"
Weight (Approx.)	2.3 oz
Bulb	T12
Cap	Small (JEDEC No.C1-1)
Base	Small-Wafer Octal 8-Pin with "770" Sleeve (JEDEC Group 1, No.B8-150)
Basing Designation for BOTTOM VIEW	7CK

Pin 1 - Cathode, Grid No.3, Internal Shield
Pin 2 - Heater
Pin 3 - Grid No.2
Pin 4 - Same as Pin 1



Pin 5 - Grid No.1
Pin 6 - Same as Pin 1
Pin 7 - Heater
Pin 8 - Base Sleeve
P Cap - Plate

8032

AF POWER AMPLIFIER & MODULATOR — Class AB_1[c]

Maximum Ratings, *Absolute-Maximum Values:*

	CCS[d]	ICAS[e]	
DC PLATE VOLTAGE	600 max.	750 max.	volts
DC GRID-No.2 VOLTAGE	250 max.	250 max.	volts
MAX.-SIGNAL DC PLATE CURRENT[f]	125 max.	135 max.	ma
MAX.-SIGNAL PLATE INPUT[f]	60 max.	85 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT[f]	3 max.	3 max.	watts
PLATE DISSIPATION[f]	20 max.	25 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	135 max.	135 max.	volts
Heater positive with respect to cathode	135 max.	135 max.	volts
BULB TEMPERATURE (At hottest point on bulb surface)	220 max.	220 max.	°C

Typical CCS Push-Pull Operation:

Values are for 2 tubes

DC Plate Voltage	400	500	600	volts
DC Grid-No.2 Voltage[g]	190	185	180	volts
DC Grid-No.1 Voltage:				
With fixed-bias source	-40	-40	-45	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage[h]	80	80	90	volts
Zero-Signal DC Plate Current	63	57	26	ma
Max.-Signal DC Plate Current	228	215	200	ma
Zero-Signal DC Grid-No.2 Current	2.5	2	1	ma
Max.-Signal DC Grid-No.2 Current	25	25	23	ma
Effective Load Resistance (Plate to plate)	4000	5500	7000	ohms
Max.-Signal Driving Power (Approx.)	0	0	0	watts
Max.-Signal Power Output (Approx.)	55	70	82	watts

Typical ICAS Push-Pull Operation:

Values are for 2 tubes

DC Plate Voltage	600	750	volts
DC Grid-No.2 Voltage[g]	200	195	volts
DC Grid-No.1 Voltage:			
From fixed-bias source	-50	-50	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage[h]	100	100	volts
Zero-Signal DC Plate Current	28	23	ma
Max.-Signal DC Plate Current	229	220	ma
Zero-Signal DC Grid-No.2 Current	1	1	ma
Max.-Signal DC Grid-No.2 Current	27	26	ma
Effective Load Resistance (Plate to plate)	6000	8000	ohms
Max.-Signal Driving Power (Approx.)	0	0	watts
Max.-Signal Power Output (Approx.)	95	120	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance under any condition:[j]
- With fixed bias . . . . . 0.1 max. megohm
- With cathode bias . . . . . Not recommended

AF POWER AMPLIFIER & MODULATOR — Class AB_1

Triode Connection—Grid No.2 Connected to Plate

	CCS	ICAS	
Maximum Ratings, *Absolute-Maximum Values:*			
DC PLATE VOLTAGE	400 max.	400 max.	volts
MAX.-SIGNAL DC PLATE CURRENT[f]	90 max.	90 max.	ma
MAX.-SIGNAL PLATE INPUT[f]	35 max.	35 max.	watts
PLATE DISSIPATION[f]	20 max.	25 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	135 max.	135 max.	volts
Heater positive with respect to cathode	135 max.	135 max.	volts
BULB TEMPERATURE (At hottest point on bulb surface)	220 max.	220 max.	°C

Typical Push-Pull Operation:

	Values are for 2 tubes			
DC Plate Voltage	250	400	400	volts
DC Grid-No.1 Voltage	-50	-100	-100	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage[h]	100	200	200	volts
Zero-Signal DC Plate Current	120	40	40	ma
Max.-Signal DC Plate Current	125	100	100	ma
Effective Load Resistance (Plate-to-plate)	5000	8000	8000	ohms
Max.-Signal Driving Power (Approx.)	0	0	0	watts
Max.-Signal Power Output (Approx.)	10	22	22	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance under any condition:[j]
- With fixed bias . . . . . 0.1 max. megohm
- With cathode bias . . . . . 0.5 max. megohm

AF POWER AMPLIFIER & MODULATOR — Class AB_2[k]

Maximum Ratings, *Absolute-Maximum Values:*

	CCS	ICAS	
DC PLATE VOLTAGE	600 max.	750 max.	volts
DC GRID-No.2 VOLTAGE	250 max.	250 max.	volts

8032

	CCS	ICAS	
MAX.-SIGNAL DC PLATE CURRENT[f]	125 max.	135 max.	ma
MAX.-SIGNAL PLATE INPUT[f]	62.5 max.	90 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT[f]	3 max.	3 max.	watts
PLATE DISSIPATION[f]	20 max.	25 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	135 max.	135 max.	volts
Heater positive with respect to cathode	135 max.	135 max.	volts
BULB TEMPERATURE (At hottest point on bulb surface)	220 max.	220 max.	°C

Typical CCS Push-Pull Operation:

Values are for 2 tubes

DC Plate Voltage	400	500	600	volts
DC Grid-No.2 Voltage[g]	175	175	165	volts
DC Grid-No.1 Voltage:				
From fixed-bias source	-41	-44	-44	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage	95	102	97	volts
Zero-Signal DC Plate Current	33	27	22	ma
Max.-Signal DC Plate Current	232	242	207	ma
Zero-Signal DC Grid-No.2 Current	1.1	0.7	0.6	ma
Max.-Signal DC Grid-No.2 Current	18	18	17	ma
Max.-Signal DC Grid-No.1 Current	1.6	1.9	1.1	ma
Effective Load Resistance (Plate to plate)	3700	4600	6800	ohms
Max.-Signal Driving Power (Approx.)[■]	0.2	0.3	0.2	watt
Max.-Signal Power Output (Approx.)	62	83	90	watts

Typical ICAS Push-Pull Operation:

Values are for 2 tubes

DC Plate Voltage	600	750	volts
DC Grid-No.2 Voltage[g]	190	165	volts
DC Grid-No.1 Voltage:			
From fixed-bias source	-48	-46	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage	109	108	volts
Zero-Signal DC Plate Current	28	22	ma
Max.-Signal DC Plate Current	270	240	ma
Zero-Signal DC Grid-No.2 Current	1.2	0.3	ma
Max.-Signal DC Grid-No.2 Current	20	20	ma
Max.-Signal DC Grid-No.1 Current	2	2.6	ma
Effective Load Resistance (Plate to plate)	5000	7400	ohms
Max.-Signal Driving Power (Approx.)[■]	0.3	0.4	watt
Max.-Signal Power Output (Approx.)	113	131	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance:[n]	
With fixed bias	30000 max. volts
With cathode bias	Not recommended

PLATE-MODULATED RF POWER AMPLIFIER — Class C Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1 and at frequencies up to 60 Mc

	CCS	ICAS	
Maximum Ratings, *Absolute-Maximum Values:*			
For maximum plate voltage and maximum plate input above 60 Mc, see Rating Chart I			
DC PLATE VOLTAGE	480 max.	600 max.	volts
DC GRID-No.2 VOLTAGE	250 max.	250 max.	volts
DC GRID-No.1 VOLTAGE	−150 max.	−150 max.	volts
DC PLATE CURRENT	117 max.	125 max.	ma
DC GRID-No.1 CURRENT	3.5 max.	4 max.	ma
PLATE INPUT	45 max.	67.5 max.	watts
GRID-No.2 INPUT	2 max.	2 max.	watts
PLATE DISSIPATION	13.3 max.	16.7 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	135 max.	135 max.	volts
Heater positive with respect to cathode	135 max.	135 max.	volts
BULB TEMPERATURE (At hottest point on bulb surface)	220 max.	220 max.	°C

Typical Operation:				
DC Plate Voltage	400	475	600	volts
DC Grid-No.2 Voltage[P]	150	135	150	volts
From a series resistor of	33000	51000	56000	ohms
DC Grid-No.1 Voltage[F]	−87	−77	−87	volts
From a grid resistor of	27000	27000	27000	ohms
Peak RF Grid-No.1 Voltage	107	95	107	volts
DC Plate Current	112	94	112	ma
DC Grid-No.2 Current	7.8	6.4	7.8	ma
DC Grid-No.1 Current (Approx.)	3.4	2.8	3.4	ma
Driving Power (Approx.)	0.4	0.3	0.4	watt
Power Output (Approx.)	32	34	52	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance[S] . . . . . 30000 max. ohms

RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy
and
RF POWER AMPLIFIER — Class C FM Telephony

	CCS	ICAS	
Maximum Ratings, *Absolute-Maximum Values:*			
At frequencies up to 60 Mc. For maximum plate voltage and maximum plate input above 60 Mc, see Rating Chart II.			
DC PLATE VOLTAGE	600 max.	750 max.	volts
DC GRID-No.2 VOLTAGE	250 max.	250 max.	volts
DC GRID-No.1 VOLTAGE	−150 max.	−150 max.	volts
DC PLATE CURRENT	140 max.	150 max.	ma

8032

	CCS	ICAS	
DC GRID-No.1 CURRENT.	3.5 max.	4 max.	ma
PLATE INPUT	67.5 max.	90 max.	watts
GRID-No.2 INPUT	3 max.	3 max.	watts
PLATE DISSIPATION	20 max.	25 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode.	135 max.	135 max.	volts
Heater positive with respect to cathode.	135 max.	135 max.	volts
BULB TEMPERATURE (At hottest point on bulb surface). . . .	220 max.	220 max.	°C

Typical Operation:

As amplifier up to 60 Mc

DC Plate Voltage.	500	600	600	750	volts
DC Grid-No.2 Voltage[t] . . .	170	150	180	160	volts
From a series resistor of .	36000	51000	43000	56000	ohms
DC Grid-No.1 Voltage[u] . . .	-66	-58	-71	-62	volts
From a grid-No.1 resistor of	27000	20000	24000	20000	ohms
From a cathode resistor of	470	470	430	470	ohms
Peak RF Grid-No.1 Voltage .	84	73	91	79	volts
DC Plate Current.	135	112	150	120	ma
DC Grid-No.2 Current. . . .	9	9	10	11	ma
DC Grid-No.1 Current (Approx.)	2.5	2.8	2.8	3.1	ma
Driving Power (Approx.) . .	0.2	0.2	0.3	0.2	watt
Power Output (Approx.). . .	48	52	66	70	watts

As amplifier at 175 Mc

DC Plate Voltage.	320	400	volts
DC Grid-No.2 Voltage[t]	180	190	volts
From a series resistor of . .	13000	20000	ohms
DC Grid-No.1 Voltage[u]	-51	-54	volts
From a grid resistor of . . .	27000	24000	ohms
From a cathode resistor of . .	330	330	ohms
Peak RF Grid-No.1 Voltage . . .	64	68	volts
DC Plate Current.	140	150	ma
DC Grid-No.2 Current.	10	10.4	ma
DC Grid-No.1 Current (Approx.).	2	2.2	ma
Driving Power (Approx.)	3	3	watts
Power Output (Approx.).	25	35	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance[s]	30000 max.	ohms

[a] Heater voltage fluctuations will cause variations in power output. The 8032 is designed to meet the EIA Standard RS152A.

[b] With no external shield.

[c] Subscript 1 indicates that grid-No.1 current does not flow during any part of the input cycle.

[d] Continuous Commercial Service.

[e] Intermittent Commercial and Amateur Service.

f Averaged over any audio-frequency cycle or sine-wave form.

g Obtained preferably from a separate source or from the plate voltage supply with a voltage divider.

h The driver stage should be capable of supplying the No.1 grids of the class AB_1 stage with the specified driving voltage at low distortion.

j The type of input coupling network used should not introduce too much resistance in the grid-No.1 circuit. Transformer or impedance coupling devices are recommended.

k Subscript 2 indicates that grid-No.1 current flows during some part of the input cycle.

m Driver stage should be capable of supplying the specified driving power at low distortion to the No.1 grids of the AB_2 stage.

n To minimize distortion, the effective resistance per grid-No.1 circuit of the AB_2 stage should be held at a low value. For this purpose the use of transformer coupling is recommended. In no case, however, should the total dc grid-No.1-circuit resistance exceed 30,000 ohms when the 8032 is operated at maximum ratings. For operation at less than maximum ratings, the dc grid-No.1-circuit resistance may be as high as 100,000 ohms.

p Obtained preferably from a separate source modulated with the plate supply, or from the modulated plate supply through a series resistor.

r Obtained from grid-No.1 resistor or from a combination of grid-No.1 resistor with either fixed supply or cathode resistor.

s When grid No.1 is driven positive and the 8032 is operated at maximum ratings, the total dc grid-No.1-circuit resistance should not exceed the specified value of 30,000 ohms. If this value is insufficient to provide adequate bias, the additional required bias must be supplied by a cathode resistor or fixed supply. For operation at less than maximum ratings, the dc grid-No.1-circuit resistance may be as high as 100,000 ohms.

t Obtained preferably from separate source, or from the plate-supply voltage with a voltage divider, or through a series resistor. A series grid-No.2 resistor should be used only when the 8032 is used in a circuit which is not keyed. Grid-No.2 voltage must not exceed 400 volts under key-up conditions.

u Obtained from fixed supply, by grid-No.1 resistor, by cathode resistor, or by combination methods.

CHARACTERISTICS RANGE VALUES

	Note	*Min.*	*Max.*	
Heater Current	1	0.550	0.620	amp
Direct Interelectrode Capacitances:				
Grid No.1 to plate	2	–	0.24	pf
Grid No.1 to cathode & grid No.3 & internal shield, grid No.2, base sleeve, and heater	2	12.0	15.0	pf
Plate to cathode & grid No.3 & internal shield, grid No.2, base sleeve, and heater	2	7.3	9.5	pf
Plate Current	3	46	94	ma
Grid-No.2 Current	3	–	5.5	ma
Dynamic Grid-No.2 Current	4	3	21	ma
Useful Power Output	4	47	–	watts

Note 1: With 13.5 volts ac on heater.

Note 2: With no external shield.

Note 3: With rated ac heater voltage, dc plate voltage of 300 volts, dc grid-No.2 voltage of 200 volts, and dc grid-No.1 voltage of -33 volts.

Note 4: In a single-tube, self-excited oscillator circuit, and with rated ac heater voltage, dc plate voltage of 600 volts, dc grid-No.2 voltage of 180 volts, grid-No.1 resistor of 30,000 ± 10 per cent ohms, dc plate current of 100 to 112 ma., dc grid-No.1 current of 2 to 2.5 ma., and frequency of 15 Mc.

MAXIMUM RATINGS vs OPERATING FREQUENCY

OPERATING FREQUENCY Mc	MAXIMUM PERMISSIBLE PERCENTAGE OF MAXIMUM RATED PLATE VOLTAGE & PLATE INPUT			
	TELEPHONY		TELEGRAPHY	
	Class C Plate-Modulated		Class C Unmodulated	
	Voltage	*Input*	*Voltage*	*Input*
60	100	100	100	100
80	84	92	84	92
125	65	78	65	78
150	58	72	58	72
160	56	70	56	70
175	53	67	53	67

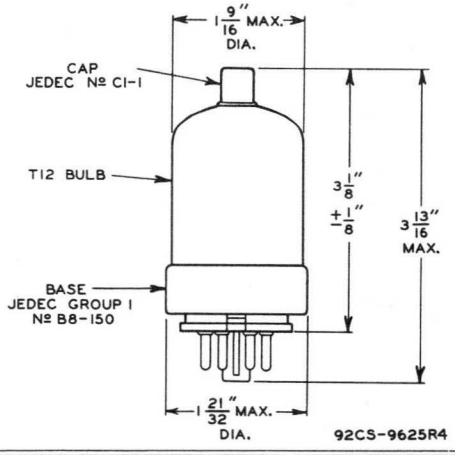
OPERATING CONSIDERATIONS

The maximum bulb temperature is a tube rating and is to be observed in the same manner as other ratings. The temperature may be measured with temperature-sensitive paint, such as Tempilaq. The latter is made by the Tempil Corporation, 132 West 22nd Street, New York 11, New York.

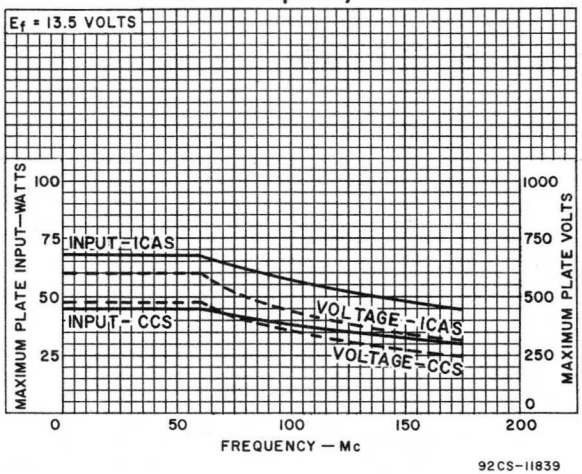
To insure adequate cooling, it is essential that free circulation of air be provided around the tube. In most cases, no additional air is required.

The plate shows no color when the 8032 is operated at full ratings under either CCS or ICAS conditions.

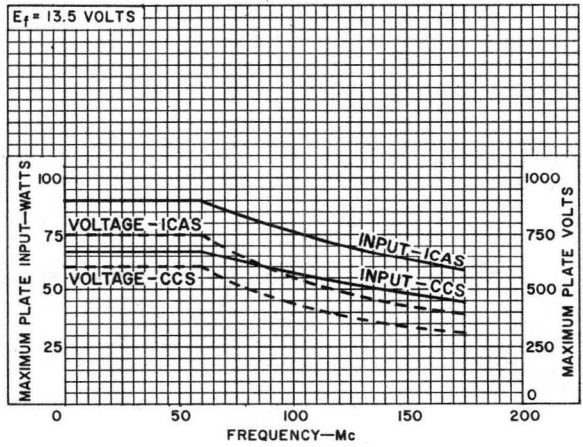
Connections to the plate should be made with a flexible lead to prevent any strain on the seal at the cap.



RATING CHART I
Class C Telephony Service

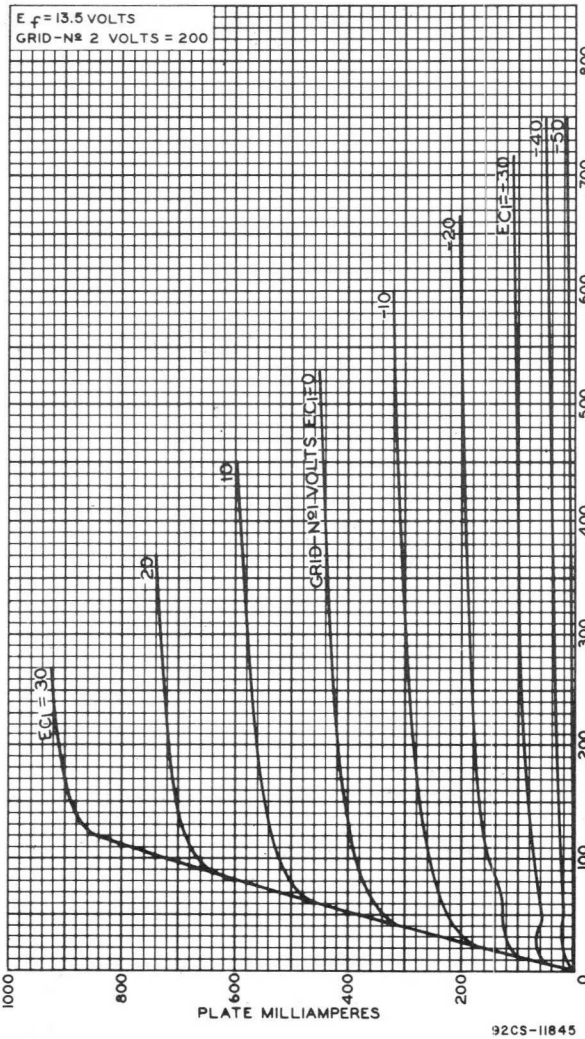


RATING CHART II
Class C Telegraphy Service



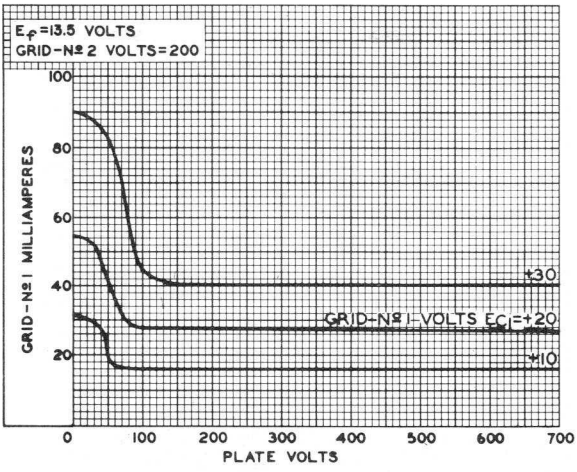
8032

TYPICAL PLATE CHARACTERISTICS

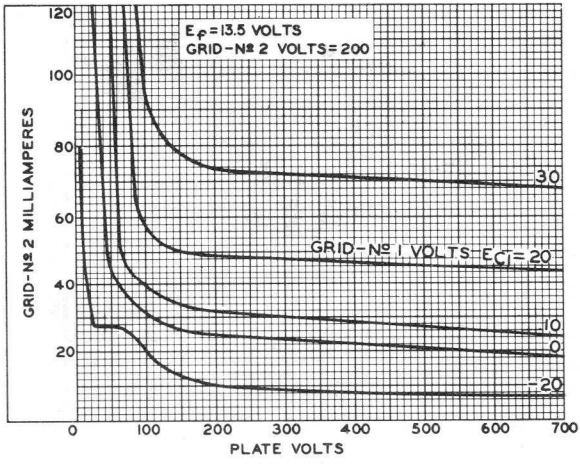


RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.

TYPICAL CHARACTERISTICS

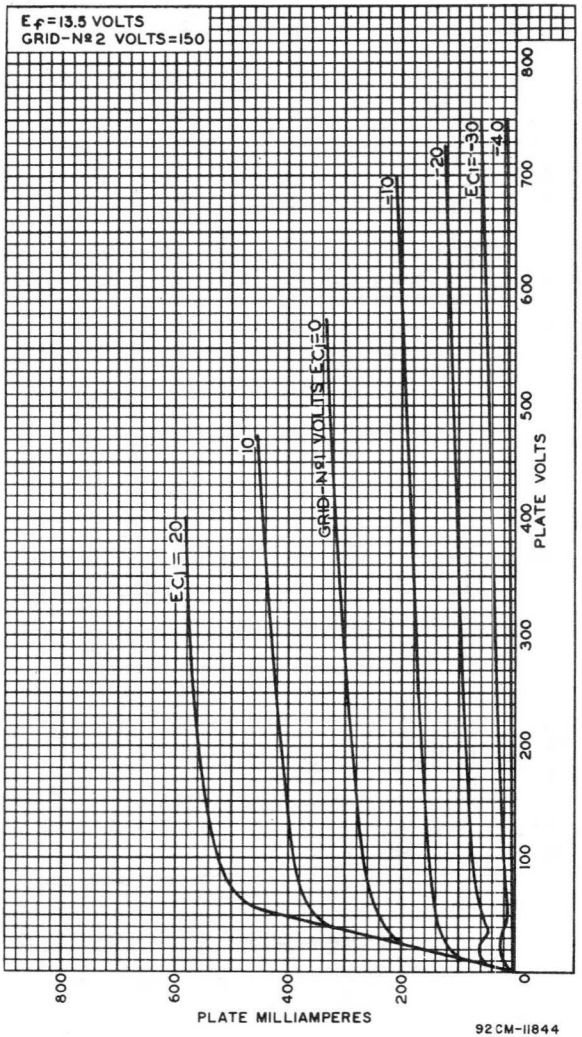


92CS-11847



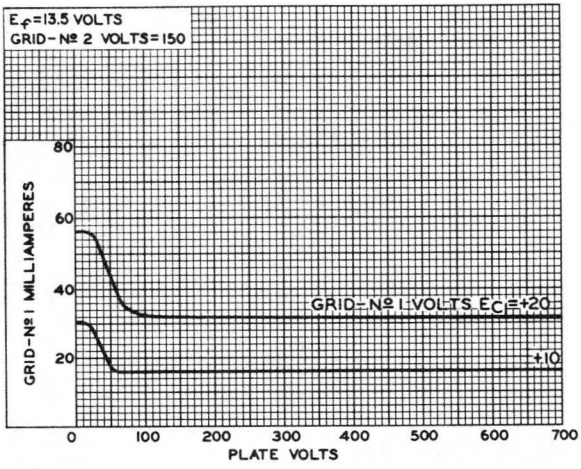
92CS-11848

TYPICAL PLATE CHARACTERISTICS

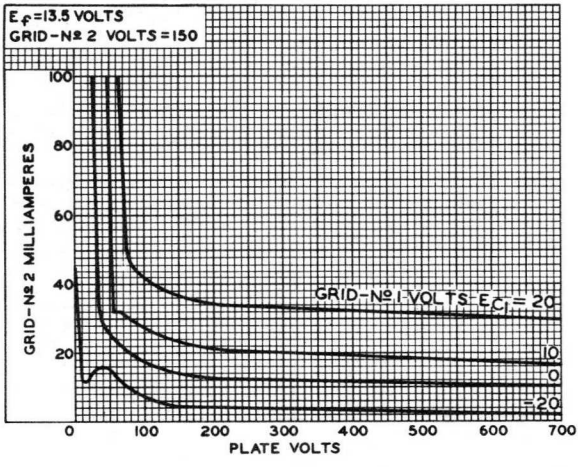


92CM-11844

TYPICAL CHARACTERISTICS



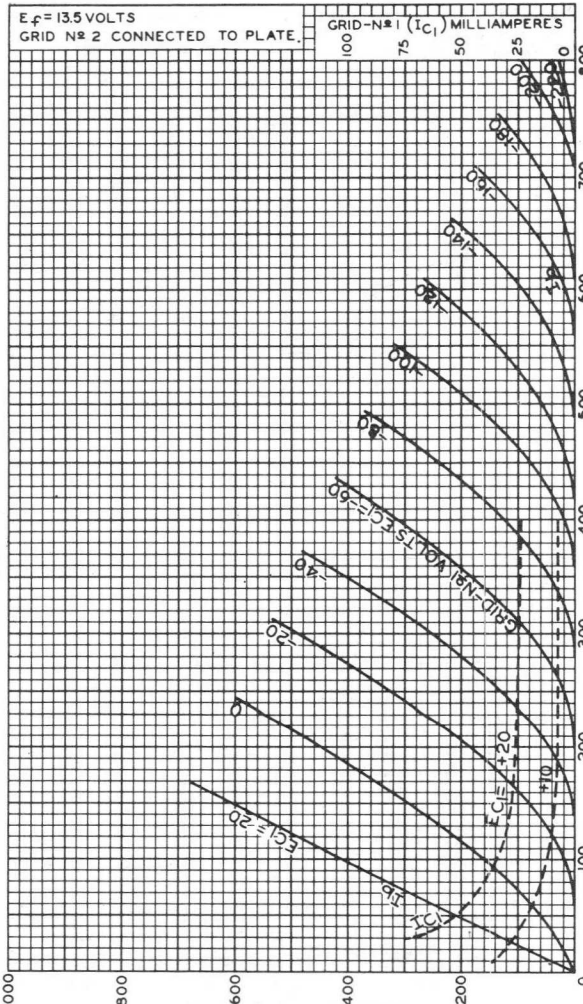
92CS-11849



92CS-11850

8032

TYPICAL CHARACTERISTICS
Triode Connection



92CM-11846

8093A

Image Orthicon

MAGNETIC FOCUS **MAGNETIC DEFLECTION**

ANTI-GHOST IMAGE SECTION

For Studio Black-and-White TV Cameras. The 8093A is Unilaterally Interchangeable with the 8093.

DATA

General:

Heater, for Unipotential Cathode:
- Voltage (AC or DC). . . . . 6.3 ± 10% volts
- Current at heater volts = 6.3 . . . 0.600 amp

Direct Interelectrode Capacitance (Approx.):
- Anode to all other electrodes . . . 12 μμf

Target-to-Mesh Spacing (Average). . . . . 0.001"

Spectral Response S-10

Wavelength of Maximum Response. . . . 4500 ± 300 angstroms

Photocathode, Semitransparent:

Rectangular image (4 x 3 aspect ratio):

Useful size of. . . . . 1.8" max. diagonal

Note: The size of the optical image focused on the photocathode should be adjusted so that its maximum diagonal does not exceed the specified value. The corresponding electron image on the target should have a size such that the corners of the rectangle just touch the target ring; a condition that may be achieved in some camera designs with a 1.6" diagonal image on the photocathode.

Orientation of. . Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through center of faceplate and pin 7 of the shoulder base. The horizontal and vertical scan should preferably start at the corner of the raster nearest pin 6 of the shoulder base.

Focusing Method . . . . . .Magnetic

Deflection Method . . . . . .Magnetic

Overall Length. . . . . 15.20" ± 0.25"

Greatest Diameter of Bulb . . . . . 3.00" ± 0.06"

Minimum Deflection-Coil Inside Diameter . . . . . 2-3/8"

Deflecting-Coil Length. . . . . 5"

Focusing-Coil Length. . . . . 10"

Alignment-Coil:
- Length. . . . . 15/16"
- Position on neck. . . . . Centerline of coil located 8.5" from flat area of the jumbo annular base.

Photocathode Distance Inside End of Focusing Coil . . . 1/2"

Operating Position. . .The tube should never be operated in a vertical position with the Diheptal-base end up nor in any other position where the axis of the tube with the base up makes an angle of less than 20° with the vertical.

Weight (Approx.). . . . . 1 lb 2 oz

8093A

Shoulder Base . . . . . Keyed Jumbo Annular 7-Pin

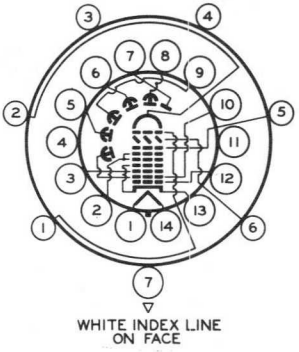
BOTTOM VIEW

Pin 1 – Grid No.6
Pin 2 – Photocathode
Pin 3 – Do Not Use
Pin 4 – Do Not Use
Pin 5 – Grid No.5
Pin 6 – Target
Pin 7 – Do Not Use

End Base. . . . . Small-Shell Diheptal 14-Pin
(JEDEC Group 5, No.B14-45)

BOTTOM VIEW

DIRECTION OF LIGHT:
PERPENDICULAR TO
LARGE END OF TUBE



WHITE INDEX LINE
ON FACE

Pin 1 – Heater
Pin 2 – Grid No.4, Field Mesh
Pin 3 – Grid No.3
Pin 4 – Do Not Use
Pin 5 – Dynode No.2
Pin 6 – Dynode No.4
Pin 7 – Anode
Pin 8 – Dynode No.5
Pin 9 – Dynode No.3
Pin 10 – Dynode No.1, Grid No.2
Pin 11 – Do Not Use
Pin 12 – Grid No.1
Pin 13 – Cathode, Suppressor Grid
Pin 14 – Heater

NOTE: In the tube symbol, the suppressor grid connected to the cathode, and the field-mesh grid connected to grid No.4, are intentionally without numbers to avoid upsetting industry practice of associating functional camera control knobs with specified grid numbers. For example, beam-focus control is generally associated with knob identified as G_4 (Grid No.4).

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

PHOTOCATHODE:		
Voltage	-550 max.	volts
Illumination.	50 max.	fc
OPERATING TEMPERATURE:		
Any part of bulb.	50 max.	°C
Of bulb at large end of tube (Target section).	35 min.	°C
TEMPERATURE DIFFERENCE:		
Between target section and any part of bulb hotter than target section. . .	5 max.	°C
GRID-No.6 VOLTAGE . . :	-550 max.	volts
TARGET VOLTAGE:		
Positive value.	10 max.	volts
Negative value.	10 max.	volts
GRID-No.5 VOLTAGE	150 max.	volts
GRID-No.4 VOLTAGE	300 max.	volts
GRID-No.3 VOLTAGE	400 max.	volts
GRID-No.2 & DYNODE-No.1 VOLTAGE	350 max.	volts

GRID-No.1 VOLTAGE:		
Negative-bias value	125 max.	volts
Positive-bias value	0 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	10 max.	volts
ANODE SUPPLY VOLTAGE[a]	1350 max.	volts
VOLTAGE PER MULTIPLIER STAGE	350 max.	volts

Typical Operating Values:[b]

Photocathode Voltage (Image Focus)[c]	-325 to -475	volts
Grid-No.6 Voltage (Accelerator)— Approx. 75% of photocathode voltage[d]	-210 to -360	volts
Target-Cutoff Voltage[e]	-3 to +1	volts
Grid-No.5 Voltage (Decelerator)	0 to 40	volts
Grid-No.4 Voltage (Beam Focus)[c]	140 to 180	volts
Grid-No.3 Voltage[f]	260 to 300	volts
Grid-No.2 & Dynode-No.1 Voltage	300	volts
Grid-No.1 Voltage for Picture Cutoff	-45 to -115	volts
Dynode-No.2 Voltage	600	volts
Dynode-No.3 Voltage	800	volts
Dynode-No.4 Voltage	1000	volts
Dynode-No.5 Voltage	1200	volts
Anode Voltage	1250	volts
Target-Temperature Range	35 to 45	°C
Minimum Peak-to-Peak Blanking Voltage	5	volts
Field Strength at Center of Focusing Coil[g]	75	gausses
Field Strength of Alignment Coil	0 to 3	gausses

Performance Data:

With conditions shown under Typical Operating Values and with camera lens set to bring the picture highlights one stop above the "knee" of the light-transfer characteristic

	Min.	Average	Max.	
Cathode Radiant Sensitivity at 4500 angstroms	–	0.028	–	μa/μw
Luminous Sensitivity (2870° K)	30	60	–	μa/lm
Anode Current (DC)	–	30	50	μa
Signal-Output Current (Peak to peak)	5	–	30	μa
Ratio of Peak-to-Peak Highlight Video-Signal Current to RMS Noise Current for bandwidth of 4.5 Mc	40	50	–	←
Photocathode Illumination at 2870° K required to bring picture highlights one stop above the "knee" of light-transfer characteristic	–	0.040	0.060	fc

← Indicates a change.

Amplitude Response at 400 TV lines per picture height (Per cent of large-area black to large-area white)[h].	40	60	–	%
Limiting Horizontal Resolution.	500	675	–	TV lines
Uniformity:				
Ratio of shading (Background) signal to highlight signal.	–	0.12	0.15	
Variation of highlight signal (Per cent of maximum highlight signal)[j].	–	20	25	%

[a] Dynode-voltage values are shown under *Typical Operating Values.*

[b] With 8093A operated in RCA-TK-11 or -TK-31 camera. Other cameras may require slightly different voltage ranges.

[c] Adjust for best focus.

[d] For minimum highlight flare or "ghost" the grid-No.6 voltage should be 73 per cent of the photocathode voltage.

[e] Normal setting of target voltage is +2 volts from target cutoff. The target supply voltage should be adjustable from -3 to +5 volts.

[f] Adjust to give the most uniformly shaded picture near maximum signal.

[g] Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

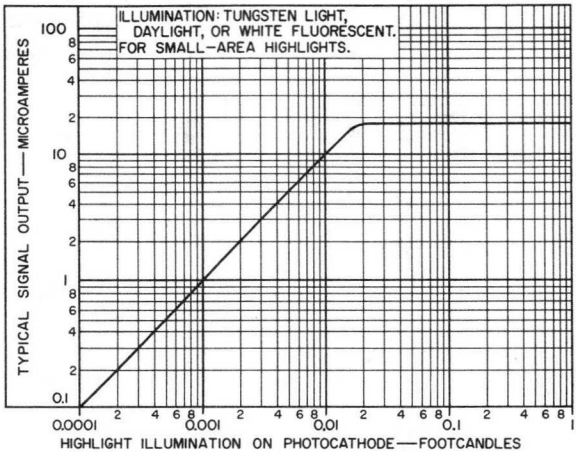
[h] Measured with amplifier having flat frequency response.

[j] Variation of response over scanned area.

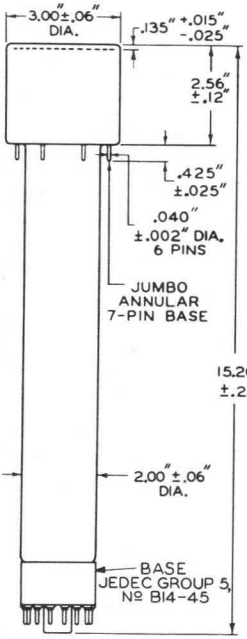
SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-10 RESPONSE
is shown at front of this section

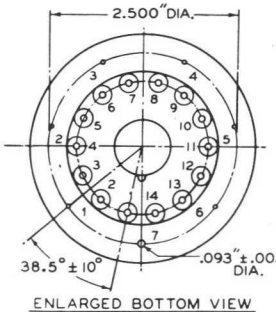
→ Indicates a change.

BASIC LIGHT-TRANSFER CHARACTERISTIC



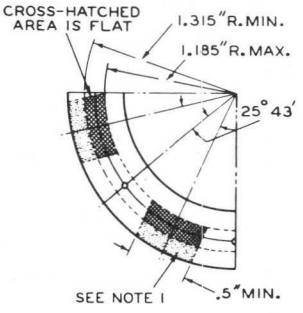
8093A





ENLARGED BOTTOM VIEW

DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE



NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.

ANNULAR-BASE GAUGE

ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAUGE WITH:

a. SIX HOLES HAVING DIAMETER OF 0.065" ± 0.001" AND ONE HOLE HAVING DIAMETER OF 0.150" ± 0.001". ALL HOLES HAVE DEPTH OF 0.265" ± 0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047". ALL HOLES ARE SPACED AT ANGLES OF 51°26' ±5' ON CIRCLE DIAMETER OF 2.500" ± 0.001".

b. SEVEN STOPS HAVING HEIGHT OF 0.187" ± 0.001", CENTERED BETWEEN PIN HOLES TO BEAR AGAINST FLAT AREAS OF BASE.

c. RIM EXTENDING OUT A MINIMUM OF 0.125" FROM 2.812" DIAMETER AND HAVING HEIGHT OF 0.126" ± 0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200" ± 0.001".

92CM-8293R3

Image Orthicon

LONG-LIFE TARGET, FIELD-MESH, ANTIGHOST IMAGE SECTION

MAGNETIC FOCUS **MAGNETIC DEFLECTION**

For High-Quality Pictures in Black-and-White TV Service Using Conventional Lighting Facilities and Ordinary Operating Techniques. The 8093A/L is Directly Interchangeable with the 8093 and 8093A in All Cameras.

The 8093A/L is the same as the 8093A except utilizes a longer life non-deteriorating glass target.

The sturdy, long-life, non-deteriorating, glass target of type 8093A/L is characterized by high gain, resistance to "burn-in", and the absence of any granular structure. Because charge transportation through this target material is electronic rather than ionic as in ordinary glass targets, the electrical characteristics of the target, such as secondary emission and resistivity, are essentially constant and sensitivity of the 8093A/L is stable throughout life.

Other important advantages of this target are that the undesirable characteristics of scene retention or "sticking picture" and raster "burn-in" due to underscanning are significantly reduced. The resistance of the 8093A/L to image "burn-in" provides a highly desirable operational feature because it is not necessary to use an orbiter or continually move the camera when focused on a stationary scene.

OPERATING CONSIDERATIONS

Dos and Don'ts on Use of RCA-8093A/L

Dos

1. Allow the 8093A/L to warm up prior to operation.
2. Hold temperature of the 8093A/L within operating range.
3. Make sure alignment coil is properly adjusted.
4. Adjust beam-focus control for best usable resolution.
5. Condition spare 8093A/L's by operating several hours once each month.
6. Determine proper operating point with target voltage adjusted to exactly 2 volts above target cutoff.
7. Uncap lens before voltages are applied to the 8093A/L.

Don'ts

1. Don't force the 8093A/L into its shoulder socket.
2. Don't operate the 8093A/L without scanning.
3. Don't operate a 8093A/L having an ion spot.
4. Don't use more beam current than necessary to discharge the highlights of the scene.
5. Don't turn off beam while voltages are applied to photocathode, grid No.6, target, dynodes, and anode during warm-up or standby operation.

8134/V1

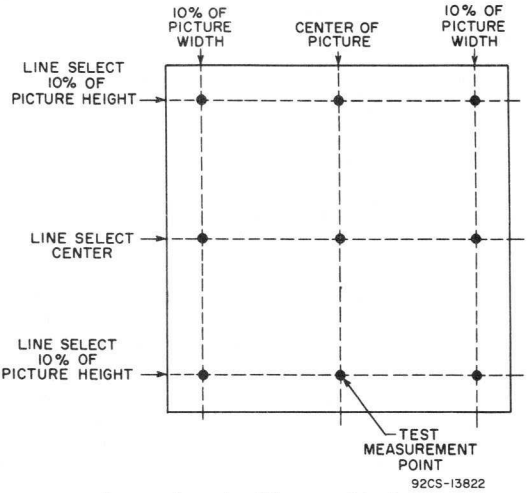
Vidicon

SEPARATE GRID-No.5 CONNECTION — LOW-POWER (0.6-WATT) DARK HEATER
ELECTROSTATIC FOCUS — MAGNETIC DEFLECTION

For Compact, Lightweight, Transistorized TV Cameras in Industrial and Other Closed-Circuit TV Systems. Designed to Provide High-Quality Service in Color TV Cameras.

The 8134/V1 is electrically and mechanically identical with the 8134 except for the primary difference that it is tested to meet extremely stringent criteria or signal uniformity or shading, and associated characteristics such as beam astigmatism and beat pattern.

SIGNAL UNIFORMITY TEST POINTS



5 cm x 5 cm Oscilloscope Display

SIGNAL-UNIFORMITY TEST

The 8134/V1 is tested for *Signal Uniformity* in an RCA Monochrome TK-27 Simulator as follows:

Heater Voltage	6.0	V
Grid-No.6 & Grid-No.3 Voltage	850	V
Grid-No.5 Voltage	365	V
Grid-No.2 Voltage	100 to 300	V
Grid-No.1 Voltage	-20	V

Beam current is adjusted to just discharge the target by varying the grid-No.2 voltage within the specified range. The camera is interconnected with appropriate camera controls, picture monitor, and oscilloscope. An opaque mask, having an 0.44 x 0.33-inch rectangular opening, is centered on the face of the 8134/V1. The tube face is illuminated with uniform light from a collimated point source.

After target voltage is adjusted to 10 volts (dc), the brightness of the light source is varied to obtain a peak signal current of 0.4 microampere. To assure full target signal is being discharged, the beam control is adjusted until peak signal amplitude is obtained on the display of the oscilloscope. The illumination is then reduced to obtain a peak signal current of 0.3 microampere without further adjustment of beam current. The signal amplitude is set to 100 per cent at the exact center of picture — 5 cm on the oscilloscope — with the blanking level equal to zero.

With horizontal and vertical scanning centered, the scan amplitudes are adjusted to just match the optical window provided by the 0.44 x 0.33-inch mask. The beam of the 8134/V1 is aligned for the most symmetrical and uniform signal with the horizontal line selector passing through the center of the picture. The line selector is then repositioned at a point 10 per cent down from the top of the picture and then 10 per cent up from the bottom of the picture. If required, additional adjustments in alignment are made to obtain minimum total deviation over the entire picture area from the 100 per cent signal amplitude.

Best possible electrical focus is maintained throughout these adjustments consistent with achieving the absolute minimum deviation in signal uniformity. Immediately prior to final measurement, the beam astigmatism of the 8134/V1 is such that at least 300 TV lines vertical resolution is visible at the center of the picture when the horizontal resolution is adjusted for 400 TV lines, or more. Under these conditions, no beat patterns shall be discernible in the picture.

The difference in signal between the 100 per-cent signal area and the other eight points shown under *Signal Uniformity Test Points* is noted. The permissible signal spread between the highest and lowest points does not exceed 15 per cent.

RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

8165/4-65A

Beam Power Tube

Operates at Maximum Ratings up to 150 Mc, and with Reduced Ratings at Higher Frequencies. Forced-Air Cooling may be Required Above 50 Mc.

GENERAL DATA

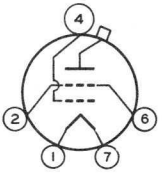
Electrical:

	Min.	*Av.*	*Max.*	
Filament, Thoriated Tungsten:				
Voltage (AC or DC)	-	6[a]	-	volts
Current at filament volts = 6 . .	3.2		3.8	amp
Mu-Factor, Grid No.2 to Grid No.1 .	5	-	7	
Direct Interelectrode Capacitances (Approx.):				
Grid No.1 to plate	-	-	0.12	pf
Grid No.1 to filament and grid No.2.	6	-	8.5	pf
Plate to filament and grid No.2.	1.9	-	2.6	pf

Mechanical:

Operating Position . . . . . .Vertical, base up or down
Maximum Overall Length . . . . . 4-3/16"
Maximum Diameter . . . . . 2-3/8"
Weight (Approx.) . . . . . 3 oz
Cap. . . . . Skirted Small (JEDEC No.C1-22)
Base . . . . . .Special-Button Septar 5-Pin

BOTTOM VIEW



Pin 1 - Filament
Pin 2 - Grid No.2
Pin 4 - Grid No.1
Pin 6 - Grid No.2
Pin 7 - Filament
Cap - Plate

Thermal:

Seal Temperatures. . . . . 200 max. °C
Bulb Temperature . . . . . 225 max. °C

Adequate ventilation around the tube must be provided to prevent the temperatures of the bulb and seals from exceeding the specified maximum values.

Components:

Socket . . . . Johnson 122-101, National HX-29, or equivalent
Heat-Radiating Plate Connector . . .Eimac HR-6, or equivalent

AF POWER AMPLIFIER & MODULATOR — Class AB$_1$[b]

Maximum CCS[c] Ratings, *Absolute-Maximum Values:*

DC PLATE VOLTAGE	3000 max.	volts
DC GRID-No.2 VOLTAGE	600 max.	volts
DC PLATE CURRENT	150 max.	ma
GRID-No.2 INPUT	10 max.	watts
PLATE DISSIPATION	65 max.	watts

PF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy[d] and RF POWER AMPLIFIER - Class C FM Telephony

Maximum CCS Ratings, *Absolute-Maximum Values:*

At frequencies up to 150 Mc

DC PLATE VOLTAGE	3000 max.	volts
DC GRID-No.2 VOLTAGE	400 max.	volts
DC GRID-No.1 VOLTAGE	−500 max.	volts
DC PLATE CURRENT	150 max.	ma
GRID-No.2 INPUT	10 max.	watts
GRID-No.1 INPUT	5 max.	watts
PLATE DISSIPATION	65 max.	watts

PLATE-MODULATED RF POWER AMPLIFIER — Class C Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1

Maximum CCS Ratings, *Absolute-Maximum Values:*

At frequencies up to 150 Mc

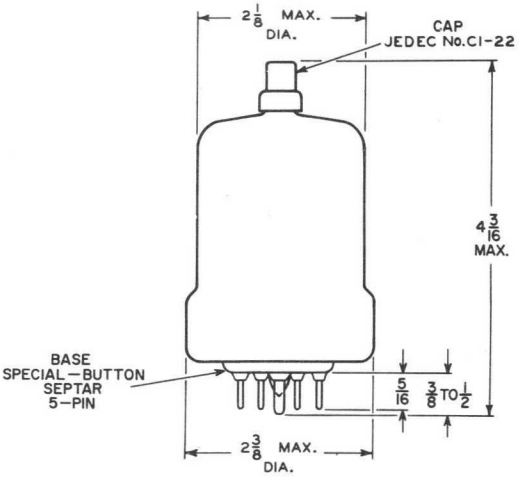
DC PLATE VOLTAGE	2500 max.	volts
DC GRID-No.2 VOLTAGE	400 max.	volts
DC GRID-No.1 VOLTAGE	−500 max.	volts
DC PLATE CURRENT	120 max.	ma
GRID-No.2 INPUT	10 max.	watts
GRID-No.1 INPUT	5 max.	watts
PLATE DISSIPATION	45 max.	watts

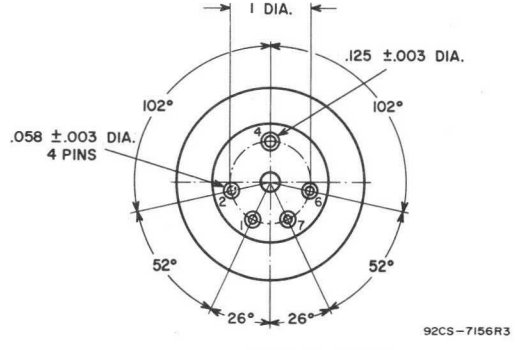
[a] The filament voltage, as measured at the filament pins, should be 6.0 volts. For long life, excursions from this value should not exceed ± 5 per cent.

[b] Subscript 1 indicates that grid-No.1 current does not flow during any part of the input cycle.

[c] Continuous Commercial Service.

[d] Key-down conditions per tube without amplitude modulation. Amplitude modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.





ALL DIMENSIONS IN INCHES

Beam Power Tube

FORCED-AIR COOLED

GENERAL DATA

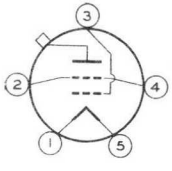
Electrical:

	Min.	Av.	Max.	
Filament, Thoriated Tungsten:				
Voltage (AC or DC).	–	7.5[a]	–	volts
Current at filament volts = 7.5	20	–	22.7	amp
Transconductance.	–	10000	–	μmhos
Mu-Factor, Grid No.2 to Grid No.1.	6.1	–	7.7	
Direct Interelectrode Capacitances (Approx.):[b]				
Grid No.1 to plate.	–	–	0.36	pf
Grid No.1 to filament and grid No.2	24	–	32	pf
Plate to filament and grid No.2.	7	–	9.5	pf

Mechanical:

Operating Position. . . . . Vertical, base up or down
Maximum Overall Length. . . . . 9-5/8"
Seated Length . . . . . 8-3/8" ± 3/8"
Maximum Diameter. . . . . 5-1/4"
Weight (Approx.). . . . . 1.5 lbs
Cap . . . . . Skirted Medium (JEDEC No.C1-14)
Base. . . . . .Special Ventilated Metal-Shell 5-Pin

BOTTOM VIEW



Pin 1 – Filament
Pin 2 – Grid No.2
Pin 3 – Grid No.1
Pin 4 – Grid No.2
Pin 5 – Filament
Cap – Plate

Thermal:

Forced-Air Cooling:

Through Base—A sufficient airflow should be provided to keep the base-seal temperature below its specified maximum value. The air should enter through the socket, cool the base pins, flow through the base, and then be directed along the bulb envelope.

To Plate Seal—Adequate air should be circulated around the envelope and plate seal to keep the temperature of the latter below its specified maximum value.

Base-Seal Temperature	150 max.	°C
Plate-Seal Temperature	200 max.	°C

Components:

Socket . . . . .Eimac SK-500 Air-System Socket, or equivalent
Heat-Radiating Plate Connector . . .Eimac HR-8, or equivalent

AF POWER AMPLIFIER & MODULATOR—Class AB

Maximum CCS[c] Ratings, *Absolute-Maximum Values:*

DC PLATE VOLTAGE	6000 max.	volts
DC GRID-No.2 VOLTAGE	1000 max.	volts
MAX.-SIGNAL DC PLATE CURRENT	700 max.	ma
GRID-No.2 INPUT	75 max.	watts
PLATE DISSIPATION	1000 max.	watts

RF POWER AMPLIFIER & OSCILLATOR—Class C Telegraphy[d] and RF POWER AMPLIFIER—Class C FM Telephony

Maximum CCS Ratings, *Absolute-Maximum Values:*

At frequencies up to 110 Mc

DC PLATE VOLTAGE	6000 max.	volts
DC GRID-No.2 VOLTAGE	1000 max.	volts
DC GRID-No.1 VOLTAGE	-500 max.	volts
DC PLATE CURRENT	700 max.	ma
GRID-No.2 INPUT	75 max.	watts
GRID-No.1 INPUT	25 max.	watts
PLATE DISSIPATION	1000 max.	watts

PLATE-MODULATED RF POWER AMPLIFIER—Class C Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1

Maximum CCS Ratings, *Absolute-Maximum Values:*

At frequencies up to 110 Mc

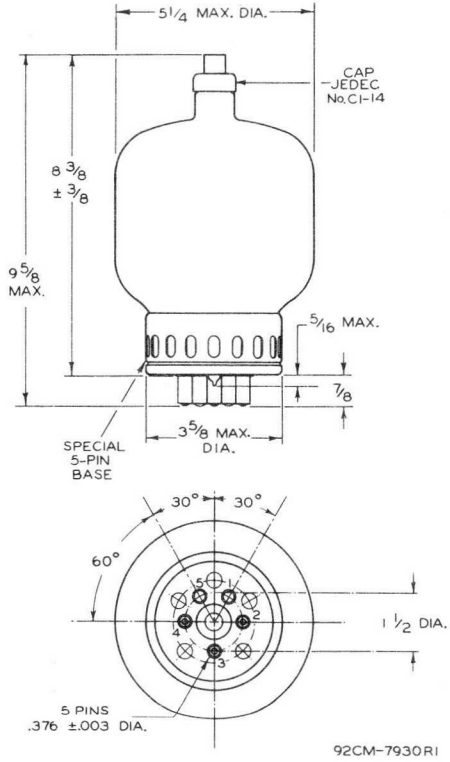
DC PLATE VOLTAGE	5000 max.	volts
DC GRID-No.2 VOLTAGE	1000 max.	volts
DC GRID-No.1 VOLTAGE	-500 max.	volts
DC PLATE CURRENT	600 max.	ma
GRID-No.2 INPUT	75 max.	watts
GRID-No.1 INPUT	25 max.	watts
PLATE DISSIPATION	670 max.	watts

[a] The filament voltage as measured at the filament pins, should be 7.5 volts. For long life, excursions from this value should not exceed ±5 per cent.

[b] With external shield.

[c] Continuous Commercial Service.

[d] Key-down conditions per tube without amplitude modulation. Amplitude modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.



DIMENSIONS IN INCHES

8168/4CX1000A

Beam Power Tube

FORCED-AIR COOLED

GENERAL DATA

Electrical:

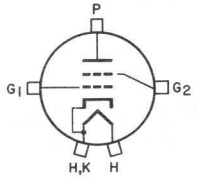
	Min.	Av.	Max.	
Heater, for Unipotential Cathode:				
Voltage (AC or DC)	–	6 ± 5%	–	volts
Current at 6 volts	9.5		11.5	amp
Heating Time	3	–	–	minutes
Transconductance	–	37000	–	μmhos
Direct Interelectrode Capacitances (Approx.)[a]:				
Grid No.1 to plate	–	–	0.02	pf
Grid No.1 to grid No.2, cathode, and heater	77	–	90	pf
Plate to grid No.2, cathode, and heater	11	–	13	pf

Mechanical:

Operating Position	Any
Maximum Overall Length	4.8"
Maximum Diameter	3.365"
Weight (Approx.)	27 oz

Terminal Diagram (See *Dimensional Outline*):

P – Plate
G_1 – Grid No.1
G_2 – Grid No.2



K – Cathode
H – Heater

Thermal:

Seal Temperatures	200 max.	°C
Plate Core Temperature	250 max.	°C
Incoming Air Temperature	40 max.	°C
Air Flow	28 min.	cfm
Static Pressure	0.25 in. of water	

Components:

Socket . . . . . Eimac SK-800 Series, or equivalent

8168/4CX1000A

AF POWER AMPLIFIER & MODULATOR — Class AB_1 [b]
and
LINEAR RF POWER AMPLIFIER
Single-Sideband Suppressed-Carrier Service

For frequencies up to 30 Mc

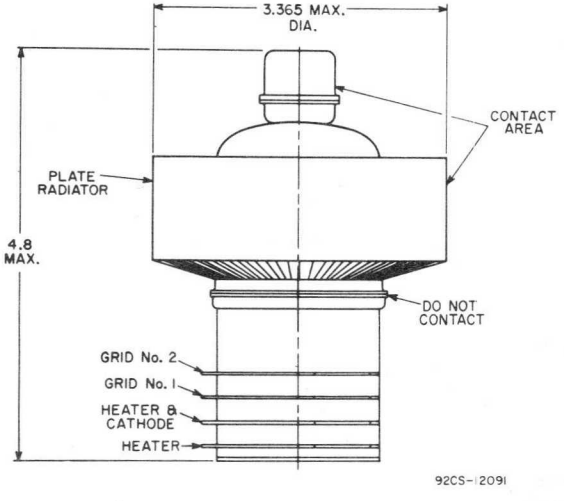
Maximum CCS[c] Ratings, *Absolute-Maximum Values:*

DC Plate Voltage	3000 max.	volts
DC Grid-No.2 Voltage	400 max.	volts
DC Plate Current	1 max.	amp
Grid-No.2 Input	12 max.	watts
Grid-No.1 Input	0 max.	watts
Plate Dissipation	1000 max.	watts

[a] With external shield.

[b] Subscript 1 indicates that grid-No.1 current does not flow during any part of the input cycle.

[c] Continuous Commercial Service.



DIMENSIONS IN INCHES

8170/4CX5000A

Beam Power Tube

FORCED-AIR COOLED

GENERAL DATA

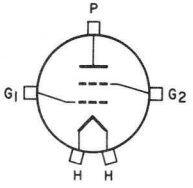
Electrical:

	Min.	Av.	Max.	
Filament, Thoriated Tungsten:				
Voltage (AC or DC)	–	7.5 ± 5%	–	volts
Current at 7.5 volts	73	–	78	amp
Mu-Factor, Grid No.2 to Grid No.1	–	4.5	–	
Direct Interelectrode Capacitances (Approx.):				
Grid No.1 to plate	–	–	1	pf
Grid No.1 to filament and grid No.2	108	–	122	pf
Plate to filament and grid No.2	18	–	23	pf

Mechanical:

Operating position	Vertical, base up or down
Maximum Overall Length	9.125"
Maximum Diameter	4.938"
Weight (Approx.)	9.5 lbs

Terminal Diagram (See *Dimensional Outline*):



P – Plate
G_1 – Grid No.1
G_2 – Grid No.2
H – Heater

Thermal:

Seal Temperatures			250 max.	°C
Plate Core Temperature			250 max.	°C
Incoming Air Temperature			50 max.	°C
Air Flow, with Eimac Air-System Socket SK-300A and Air Chimney SK-306:				
	For frequencies up to 30 Mc			
Plate dissipation	3000	5000	6000	watts
Minimum air flow	105	190	230	cfm
Static pressure	0.7	1.5	2.0	in. of water

Components:

Socket . . . . . Eimac SK-300A Air-System Socket, or equivalent

Chimney . . . . . Eimac SK-306, or equivalent

8170/4CX5000A

AF POWER AMPLIFIER & MODULATOR — Class AB_1[a]
and
LINEAR RF POWER AMPLIFIER
Single-Sideband Suppressed-Carrier Service

For frequencies up to 30 Mc

Maximum CCS[b] Ratings, *Absolute-Maximum Values:*

DC Plate Voltage	7500 max.	volts
DC Grid-No.2 Voltage	1500 max.	volts
DC Plate Current	4 max.	amp
Grid-No.2 Input	250 max.	watts
Grid-No.1 Input	75 max.	watts
Plate Dissipation	6000 max.	watts

RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy[c]
and
RF POWER AMPLIFIER — Class C Telephony

Maximum CCS Ratings, *Absolute-Maximum Values:*

	Up to 30 Mc	*Up to 110 Mc*	
DC Plate Voltage	7500 max.	6500 max.	volts
DC Grid-No.2 Voltage	1500 max.	1500 max.	volts
DC Plate Current	3 max.	2.6 max.	amp
DC Grid-No.2 Input	250 max.	250 max.	watts
DC Grid-No.1 Input	75 max.	75 max.	watts
Plate Dissipation	5000 max.	5000 max.	watts

PLATE-MODULATED RF POWER AMPLIFIER — Class C Telephony

Carrier Conditions per tube for use with a maximum modulation factor of 1

Maximum CCS Ratings, *Absolute-Maximum Values:*

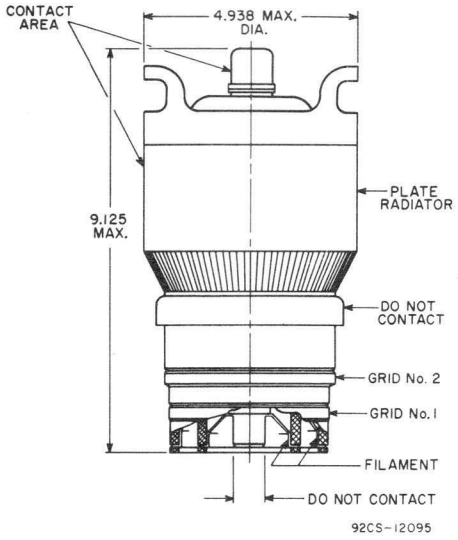
At frequencies up to 30 Mc

DC Plate Voltage	5000 max.	volts
DC Grid-No.2 Voltage	1000 max.	volts
DC Plate Current	2.5 max.	amp
Grid-No.2 Input	250 max.	watts
Grid-No.1 Input	75 max.	watts
Plate Dissipation	3500 max.	watts

[a] Subscript 1 indicates that grid-No.1 current does not flow during any part of the input cycle.

[b] Continuous Commercial Service.

[c] Key-down conditions per tube without amplitude modulation. Amplitude modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.



DIMENSIONS IN INCHES

8227

Beam Power Tube

CERMOLOX®
17 KILOWATTS PEAK POWER OUTPUT AT 1215 Mc
FORCED-AIR COOLED — HIGH GAIN-BANDWIDTH PRODUCTS
INTEGRAL RADIATOR — MATRIX-TYPE CATHODE

For Pulsed RF Amplifier Service in Compact Aircraft, Mobile, and Stationary Equipment in the UHF Frequency Range

GENERAL DATA

Electrical:

Heater, for Matrix-Type, Oxide-Coated, Unipotential Cathode:		
Voltage (AC or DC)[a]	6.3	volts
Current at heater volts = 6.3	3.2	volts
Minimum heating time	60	sec
Direct Interelectrode Capacitances:[b]		
Grid No.1 to plate	0.13 max.	pf
Grid No.1 to cathode & heater	15	pf
Plate to cathode & heater	0.019 max.	pf
Grid No.1 to grid No.2	20	pf
Grid No.2 to plate	4.6	pf
Grid No.2 to cathode & heater	1.30 max.	pf

Mechanical:

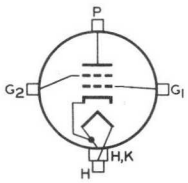
Operating Position	Any
Overall Length	2.445" ± 0.075"
Greatest Diameter (See *Dimensional Outline*)	1.250" ± 0.015"
Weight (Approx.)	2 oz
Radiator	Integral part of tube

Terminal Connections (See *Dimensional Outline*):

G_1 – Grid-No.1-Terminal Contact Surface

G_2 – Grid-No.2-Terminal Contact Surface

H – Heater-Terminal Contact Surface



H,K – Heater- & Cathode-Terminal Contact Surface

P – Plate-Terminal Contact Surface

Thermal:

Plate, Grid No.2, Grid No.1, Cathode, and Heater Temperature[c]	250 max.	°C
Radiator Core Temperature[c]	250 max.	°C

Air Flow:

Through radiator — Adequate air flow to limit the radiator core temperature to 250° C should be delivered by a blower across the radiator before and during the application of plate, grid-No.2, and grid-No.1 voltages. Typical values of air flow directed across the radiator versus plate dissipation are shown in accompanying *Typical-Cooling-Requirements (With and without cowling)* curves.

To Plate, Grid-No.2, Grid-No.1, Cathode, and Heater Terminals — A sufficient quantity of air should flow across each of these terminals so that their temperature does not exceed the specified maximum value of 250° C.

During Standby Operation — Cooling air is not usually required when only heater voltage is applied to the tube.

Plate Power, Grid-No.2 Power, Heater Power, and Air Flow — These may be removed simultaneously.

At Sea Level — Cooling requirements, with air flow directed through the radiator as shown in accompanying *Typical-Cooling-Requirements* curve, may be met by use of the following blowers and associated motors manufactured by Rotron Manufacturing Company Incorporated, Woodstock, New York, or equivalent:

For 100% Plate Dissipation:				
Blower Model No.	KS-2505	AS-2505	AXIMAX I	AXIMAX I
Motor Model No.	165AS	323JS	464YS	499JS
Phase (ϕ)	1	3	1	3
Frequency (cps)	60	60	400	400
Voltage (v)	115	220	115	200
For 80% Plate Dissipation:				
Blower Model No.	KS-202	AS-202	AXIXAX I	AXIMAX I
Motor Model No.	92AS	323JS	464YS	499JS
Phase (ϕ)	1	3	1	3
Frequency (cps)	60	60	400	400
Voltage (v)	115	220	115	200
For 60% Plate Dissipation:				
Blower Model No.	KS-1504	AS-1504	AXIMAX I	AXIMAX I
Motor Model No.	92AS	323JS	464YS	499JS
Phase (ϕ)	1	3	1	3
Frequency (cps)	60	60	400	400
Voltage (v)	115	220	115	200

PULSED RF AMPLIFIER

Maximum Ratings, *Absolute-Maximum Values:*

For frequencies up to 1215 Mc and for a maximum "on" time[d] as specified in any 1000-microsecond interval.

PEAK POSITIVE-PULSE PLATE VOLTAGE . . .	7000 max.	volts
DC PLATE VOLTAGE.	4000 max.	volts
DC OR PEAK POSITIVE-PULSE GRID-No.2 VOLTAGE	1000 max.	volts
DC OR PEAK POSITIVE-PULSE GRID-No.2 TO GRID-No.1 VOLTAGE.	1000 max.	volts
DC NEGATIVE OR PEAK NEGATIVE-PULSE GRID-No.1 VOLTAGE	200 max.	volts

DC PLATE CURRENT DURING PULSE:		
With 10-microsecond "ON" time	4.5 max.	amp
With 5-microsecond "ON" time	6 max.	amp
DC PLATE CURRENT:		
With 10-microsecond "ON" time	0.070 max.	amp
With 5-microsecond "ON" time	0.050 max.	amp
GRID-No.2 INPUT[e] (Average)	10 max.	watts
GRID-No.1 INPUT (Average)	5 max.	watts
PLATE DISSIPATION (Average)	125 max.	watts

Typical Operation:

In a cathode-drive circuit, with rectangular waveshape pulses of 5-microsecond duration and duty factor of 0.005, at 1215 Mc.

With pulsed rf drive and pulsed grid-No.2 supply voltage

DC Plate Voltage	4000	volts
Peak Positive-Pulse Grid-No.2 Voltage	1000	volts
DC Grid-No.2 Voltage	-90	volts
DC Grid-No.1 Voltage	0	volts
Peak Plate Current	6	amp
DC Plate Current	0.030	amp
DC Grid-No.2 Current	0.003	amp
DC Grid-No.1 Current	0.010	amp
Peak Driver Power Output (Approx.)[f]	1250	watts
Output-Circuit Efficiency (Approx.)	93	%
Useful Peak Pulse Power Output (Approx.)[g]	10000	watts

Maximum Circuit Values:

Grid-No.1 Circuit Resistance	30000 max.	ohms
Grid-No.2 Circuit Impedance	10000 max.	ohms
Plate Circuit Impedance	[h]	

With pulsed rf drive, pulsed grid-No.2 supply voltage, and pulsed plate supply voltage

Peak Positive-Pulse Plate Voltage	7000	volts
Peak Positive-Pulse Grid-No.2 Voltage	1000	volts
DC Grid-No.1 Voltage	0	volts
Peak Plate Current	6	amp
DC Plate Current	0.030	amp
DC Grid-No.2 Current	0.003	amp
DC Grid-No.1 Current	0.010	amp
Peak Driver Power Output (Approx.)[f]	1250	watts
Output-Circuit Efficiency (Approx.)	87	%
Useful Peak Pulse Power Output (Approx.)[g,j]	17000	watts ←

Maximum Circuit Values:

Grid-No.1 Circuit Resistance	30000 max.	ohms
Grid-No.2 Circuit Impedance	10000 max.	ohms
Plate Circuit Impedance	[h]	

← Indicates a change.

[a] See *Operating Considerations* under *Heater*.

[b] Measured with special shield adapter.

[c] See *Operating Considerations* under *Temperature* and also *Dimensional Outline* for temperature measurement points.

[d] *"On" time* is defined as the sum of the duration of all the individual pulses which occur during an indicated interval. *Pulse duration* is defined as the time interval between the two points on the pulse at which the instantaneous value is 70 per cent of the peak power value. *Peak value* is defined as the maximum value of a smooth curve through the average of the fluctuations over the top portions of the pulse.

Duty factor is defined as the ratio of "on" time to indicated interval.

[e] See *Operating Considerations* under *Grid No.2*.

[f] Driver power output includes circuit losses and feed-through power. It is the actual power measured at input to the tube drive circuit. It will vary with frequency of operation and driver circuitry.

[g] Measured in the load of a coaxial-cavity circuit having the output circuit efficiency specified.

[h] See *Operating Considerations* under *Precautions*.

[j] For Minimum Useful Power Output value, see *Characteristics Range Values, Test No.9*.

CHARACTERISTICS RANGE VALUES

Test No.	*Note*	*Min.*	*Max.*	
1. Heater Current	1	2.90	3.55	amp
2. Direct Interelectrode Capacitances:				
Grid No.1 to plate	2	–	0.13	pf
Grid No.1 to cathode & heater	2	13.5	16.5	pf
Plate to cathode & heater	2	–	0.019	pf
Grid No.1 to grid No.2	2	16.8	22.2	pf
Grid No.2 to plate	2	3.6	5.6	pf
Grid No.2 to cathode & heater	2	–	1.30	pf
3. Grid-No.1 Voltage (1)	1,3	-11.5	-24.5	volts
4. Grid-No.1 Voltage (2)	4	-30	-62	volts
5. Grid-No.1 Cutoff Voltage	1,5	–	-95	volts
6. Reverse Grid-No.1 Current	1,3	–	-20	μa
7. Grid-No.2 Current	1,4	-5	+11	ma
8. Interelectrode Leakage Resistance:				
Between plate and all other electrodes	6	10	–	megohms
Between any two electrodes except plate	6	1	–	megohm
9. Useful Peak Pulse Power Output	7	15000	–	watts

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

Note 2: Measured with special shield adapter.

Note 3: With dc plate voltage of 2500 volts, dc grid-No.2 voltage of 300 volts, and dc grid-No.1 voltage adjusted to give a dc plate current of 50 ma.

Note 4: With dc plate voltage of 2500 volts, dc grid-No.2 voltage of 700 volts, and dc grid-No.1 voltage adjusted to give a dc plate current of 50 ma.

Note 5: With dc plate voltage of 4000 volts, dc grid-No.2 voltage of 700 volts, and dc grid-No.1 voltage adjusted to give a dc plate current of 5 ma.

Note 6: Under conditions with tube at 20° to 30° C without any voltages applied to the tube, the resistance between the two electrodes is measured with a 200-volt Megger-type ohmmeter having an internal impedance of 1.0 megohm.

Note 7: In a plate-and-screen-pulsed cathode-drive cavity at 1215 Mc and for conditions with 6.3 volts ac or dc on heater, peak positive-pulse plate voltage of 7000 volts and a maximum driver power output of 1500 peak watts, peak positive-pulse grid-No.2 voltage of 1000 volts, grid-No.1 voltage of 0 volts, and tuning circuit and drive are adjusted for maximum power output with peak plate current not to exceed 6 amperes. Pulse duration is 5 microseconds and duty factor is 0.005.

OPERATING CONSIDERATIONS

Heater

The heater of the 8227 should be operated at constant voltage rather than constant current. The rated heater voltage of 6.3 volts should be applied for 60 seconds to allow the cathode to reach normal operating temperature before voltages are applied to other electrodes.

The life of the cathode can be conserved by operating at the lowest heater voltage which will give adequate but not excessive emission to enable the 8227 to give the desired power output. Good regulation of the heater voltage is in general economically advantageous from the viewpoint of tube life; in no case should the voltage fluctuations be more than 5%.

The cathode may be subjected to back bombardment as the frequency is increased with resultant increase in temperature. When the duty factor is small, back bombardment normally need not be considered. When high duty factors are encountered, the necessary heater voltage should be determined as follows: with all other voltages constant, the minimum heater-supply voltage conditions at this reduced value shall provide satisfactory tube performance; any further reduction will show some degradation.

Temperature

The maximum radiator core or electrode temperature of 250° C is a tube rating and is to be observed in the same manner as other ratings. The temperature may be measured with temperature-sensitive paint, such as Tempilaq. This paint is manufactured in the form of liquid or stick by the Tempil Corporation, 132 West 22nd Street, New York 11, N. Y.

Grid No.2

Grid-No.2 current is composed of a positive-current component resulting from cathode emission to grid No.2 and a negative-current component resulting from secondary emission phenomena. Because it is the net result of these component currents which is read on a meter in the grid-No.2 circuit, grid-No.2 dissipation cannot be accurately determined. Operation similar to conditions given under *Typical Operation* in the tabulated data section will minimize the possibility of exceeding maximum grid-No.2 input rating.

The grid-No.2 circuit must be capable of maintaining the proper grid-No.2 voltage in the presence of moderate average negative dc current as well as normal values of average positive current. Complete protection can be achieved by the use of a well-regulated power supply, a grid-No.2-to-ground impedance that is low enough to prevent gradual build-up of grid-No.2 voltage and/or catastrophic build-up (runaway) under negative current conditions and a current overload relay to protect the grid-No.2 against positive or negative current of the order of 10 ma.

Standby Operation

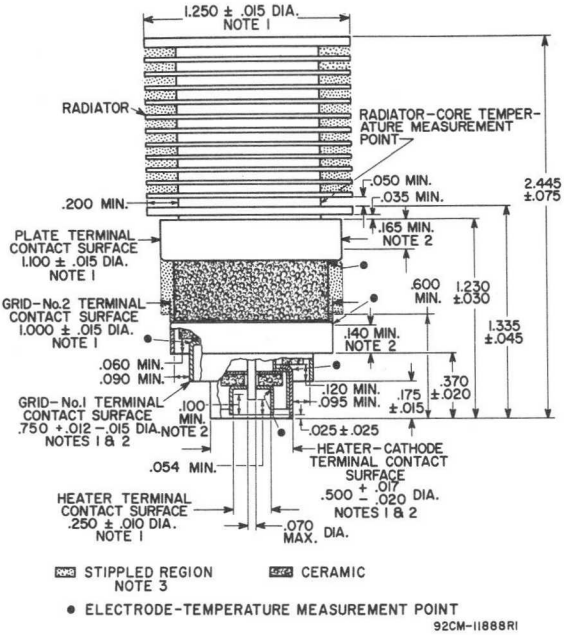
During long or frequent standby periods, the 8227 may be operated at decreased heater voltage to conserve life. It is recommended that the heater voltage be reduced to 80% of normal during standby periods up to 2 hours. For longer periods, the heater voltage should be turned off.

Precautions

In beam power tubes with closely spaced electrodes, such as the 8227, extremely high voltage gradients occur even with moderate tube operating voltages. Any arcover between electrodes may be destructive. A series impedance in the plate lead is recommended. The resultant plate impedance giving a plate-voltage-supply regulation of no better than 10% is usually sufficient.

Protective devices should be used to protect not only the plate but also grid No.2 against overload. In order to prevent excessive plate current flow and resultant overheating of the tube, the common ground lead of the plate circuit should be connected in series with the coil of an instantaneous overload relay. This relay should be adjusted to remove the dc plate voltage and dc grid-No.2 voltage when the average value of plate current reaches a value slightly higher than normal plate current. A protective device in the grid-No.2 supply should remove the grid-No.2 voltage when the dc grid-No.2 current reaches a value slightly higher than normal.

The rated plate and grid-No.2 voltages of this tube are extremely dangerous. Great care should be taken during the adjustment of circuits. The tube and its associated apparatus, especially all parts which may be at high potential above ground, should be housed in a protective enclosure. The protective housing should be designed with interlocks so that personnel can not possibly come in contact with any high-potential point in the electrical system. The interlock device should function to break the primary circuit of the high-voltage supplies when any gate or door of the protective housing is opened, and should prevent the closing of the primary circuit until the door is again locked.



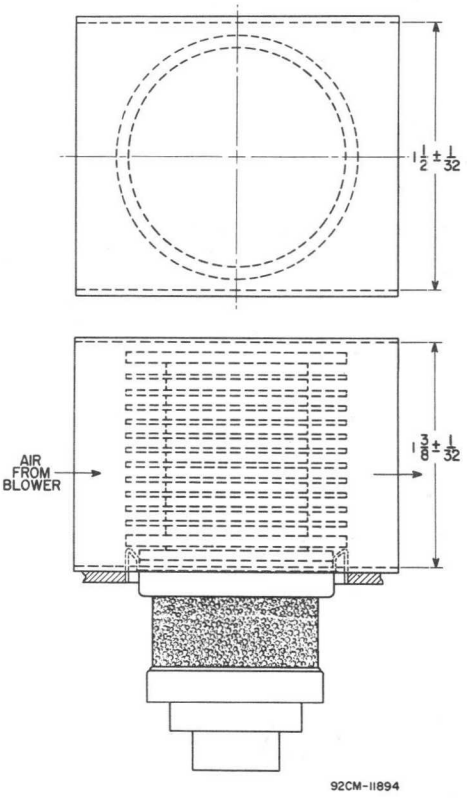
ALL DIMENSIONS IN INCHES

NOTE 1: SEE *SKETCH G1* FOR THE MAXIMUM DIAMETRICAL SPACE REQUIRED BY THE 8227 BASED UPON THE DIAMETER AND ECCENTRICITY OF RADIATOR BAND AND OF EACH RING TERMINAL.

NOTE 2: THE DIAMETER OF THE TERMINAL IS HELD TO THE INDICATED VALUE ONLY OVER THE CONTACT SURFACE LENGTH. THE CONTACT SURFACE LENGTH OF THE HEATER-CATHODE AND GRID-No.1 TERMINALS EXTENDS FROM THE EDGE OF ITS TERMINAL TO THE PLANE COINCIDENT WITH THE EDGE OF THE ADJACENT LARGER TERMINAL.

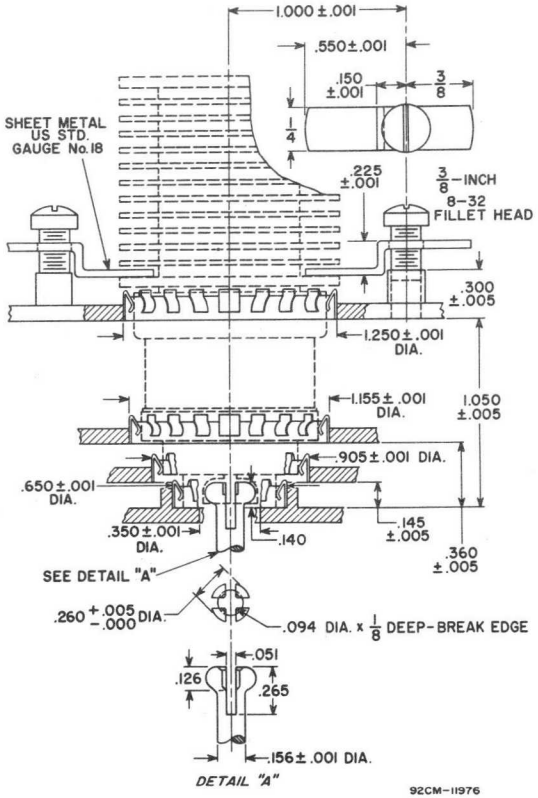
NOTE 3: KEEP ALL STIPPLED REGIONS CLEAR. DO NOT ALLOW CONTACTS OR CIRCUIT COMPONENTS TO PROTRUDE INTO THESE ANNULAR REGIONS.

RECOMMENDED COWLING
FOR DIRECTING AIR FLOW ACROSS RADIATOR



ALL DIMENSIONS IN INCHES

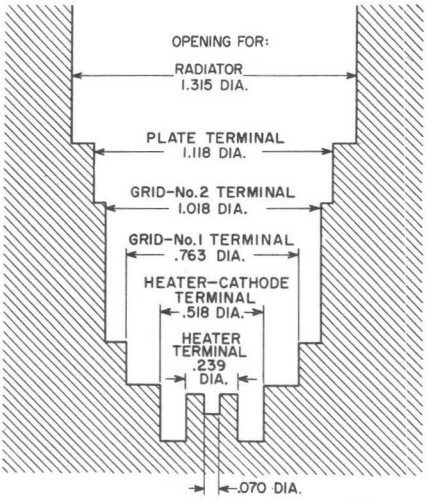
PREFERRED MOUNTING ARRANGEMENT
& LAYOUT OF ASSOCIATED CONTACTS



ALL DIMENSIONS IN INCHES

NOTE: ALL FINGER STOCK (No. 97-380) MADE BY INSTRUMENT SPECIALTIES COMPANY, LITTLE FALLS, NEW JERSEY.

SKETCH G1

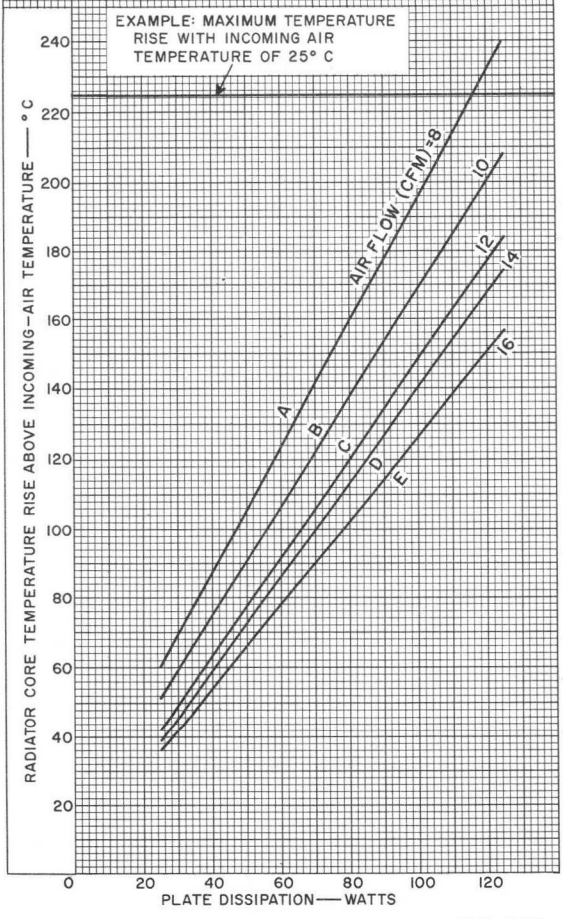


ALL DIMENSIONS IN INCHES

TYPICAL COOLING REQUIREMENTS
With Cowling

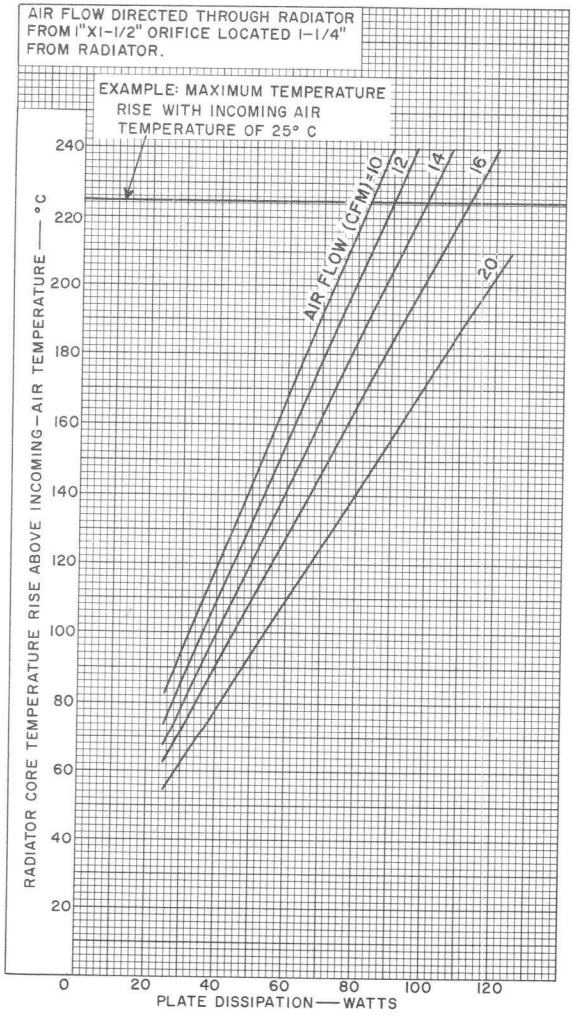
AIR FLOW DIRECTED THROUGH RADIATOR WITH COWLING AS SHOWN IN ACCOMPANYING DIAGRAM.

CURVE	PRESSURE DROP—INCHES OF WATER
A,B,C,D,E	LESS THAN 0.1



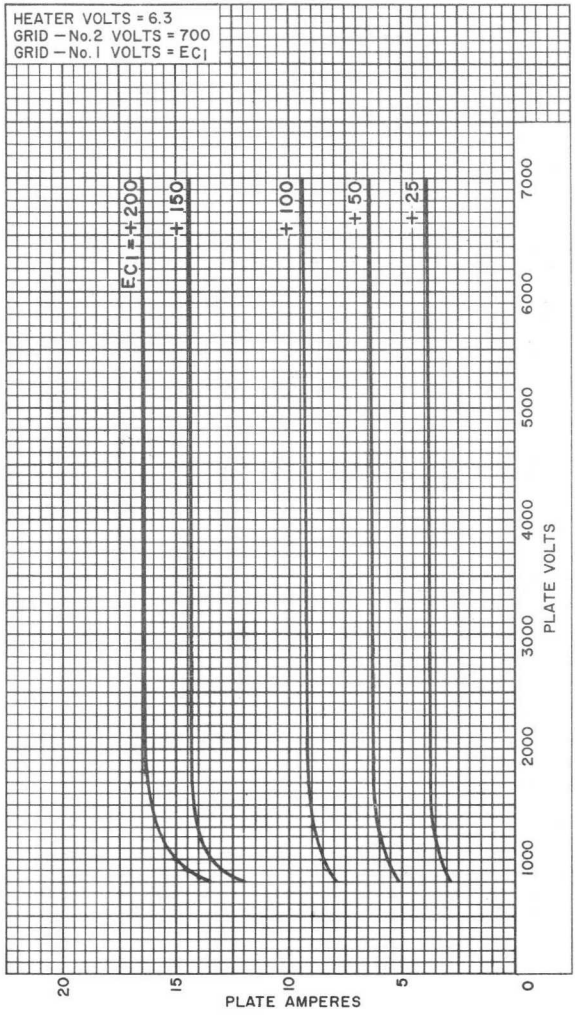
92CM—11999

TYPICAL COOLING REQUIREMENTS
Without Cowling



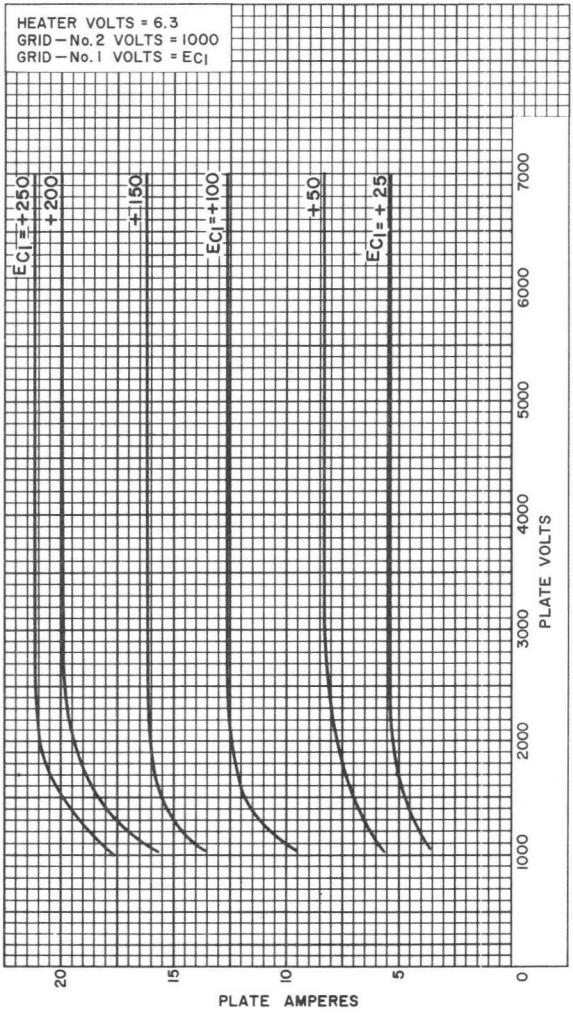
92CM-12000

TYPICAL PLATE CHARACTERISTICS



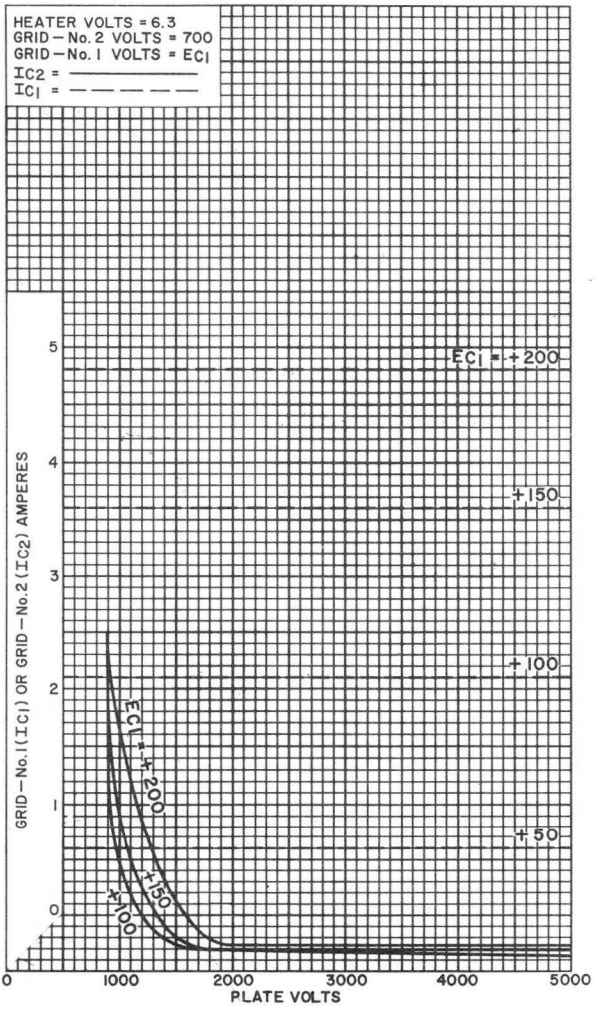
92CM — 11883

TYPICAL PLATE CHARACTERISTICS



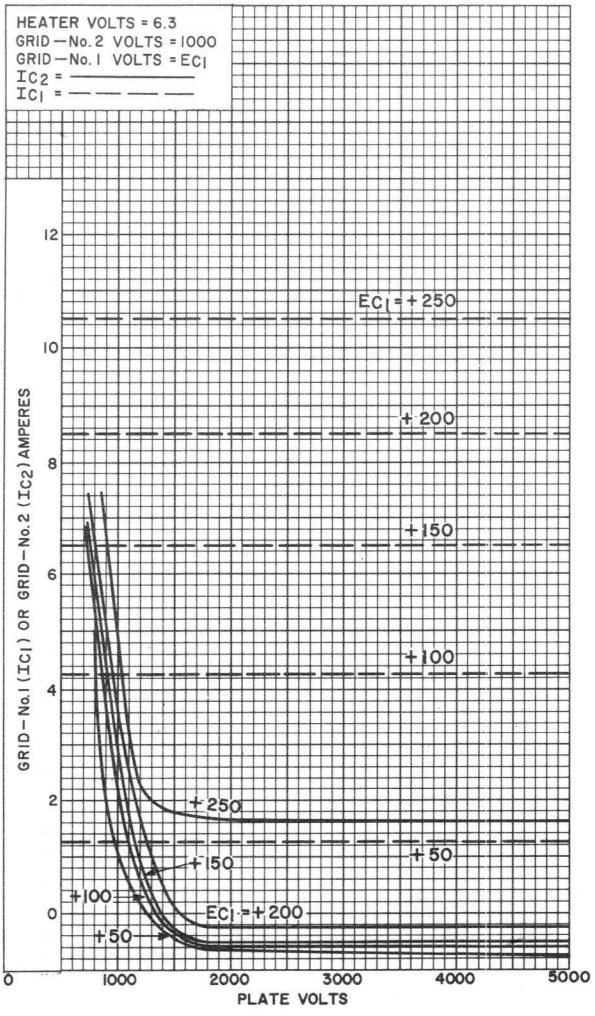
92CM—11889

TYPICAL CHARACTERISTICS



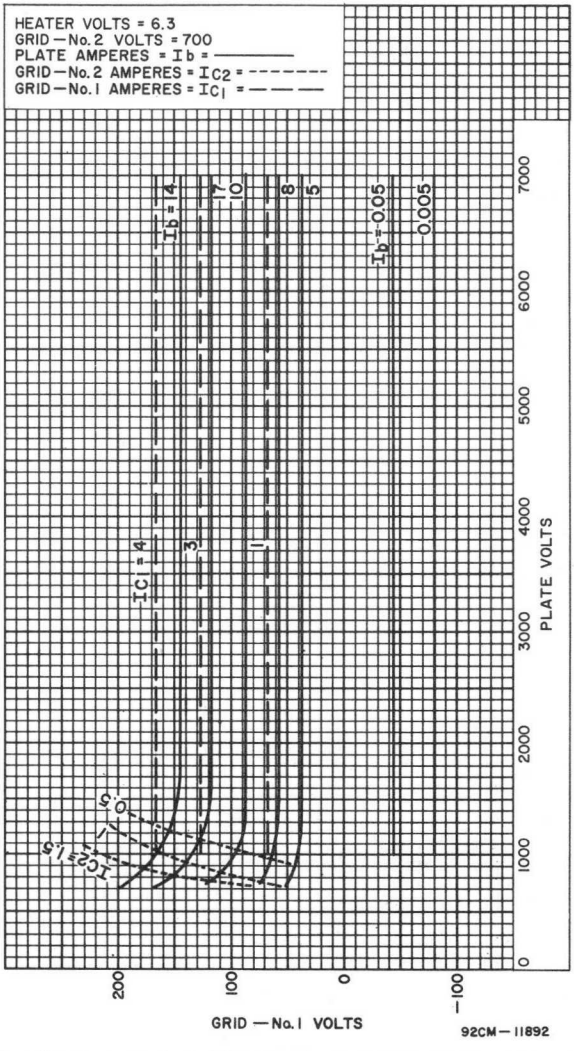
92CM — 11884

TYPICAL CHARACTERISTICS

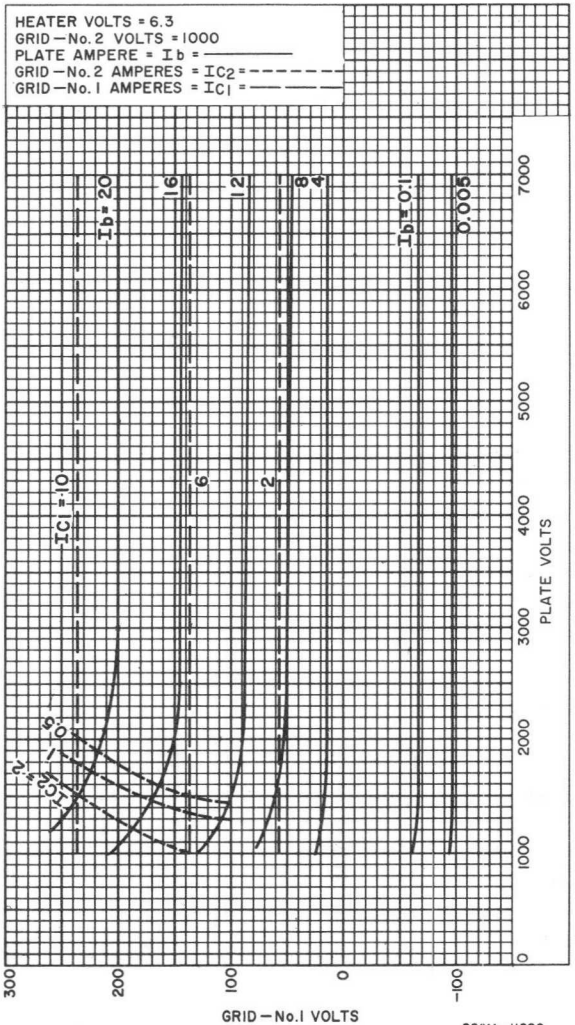


92CM—11891

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM—11890

8239/3X3000F1

Low-Mu Triode

FORCED-AIR COOLED

GENERAL DATA

Electrical:

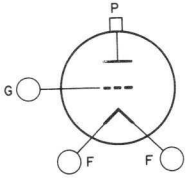
	Min.	Av.	Max.	
Filament, Thoriated Tungsten:				
Voltage (AC or DC)	–	7.5 ± 5%	–	volts
Current at 7.5 volts	49	–	54	amp
Amplification Factor	4.4	–	5.6	
Transconductance, for plate volts = 3000, and plate amp = 1	–	11000	–	μmhos
Direct Interelectrode Capacitances (Approx.):				
Grid to plate	–	17	–	pf
Grid to filament	–	30	–	pf
Plate to filament	–	2.6	–	pf

Mechanical:

Operating Position	Vertical, base up or down
Maximum Rigid Length	10.53"
Maximum Diameter	4.156"
Weight (Approx.)	7.5 lbs

Terminal Connections (See Outline):

G – Grid
F – Filament



P – Plate

Thermal:

Seal Temperatures	150 max.	°C
Plate Core Temperature	150 max.	°C
Air Flow	160 min.	cfm
Static Pressure	3.6 in. of water	

AF POWER AMPLIFIER & MODULATOR — Class AB_1 [a]

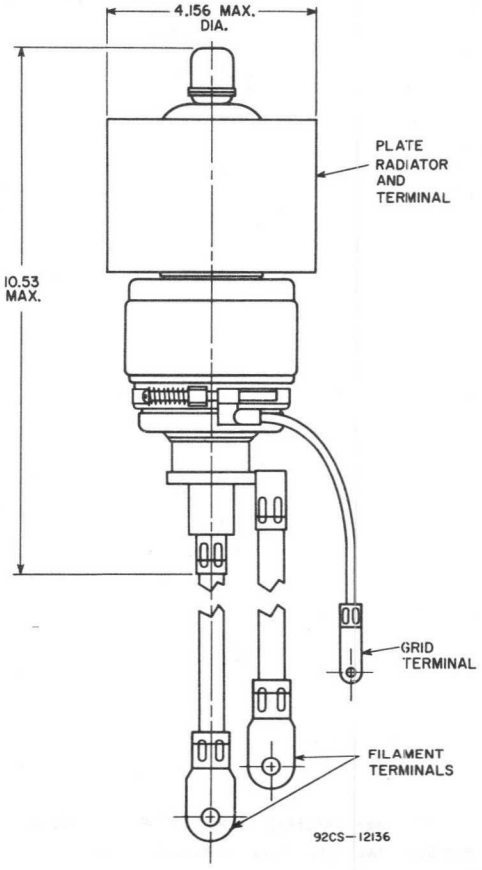
Maximum CCS[b] Ratings, *Absolute-Maximum Values:*

DC Plate Voltage	6000 max.	volts
DC Plate Current	2.5 max.	amp
Grid Input	50 max.	watts
Plate Dissipation	3000 max.	watts

[a] Subscript 1 indicates that grid current does not flow during any part of the input cycle.

[b] Continuous Commercial Service.

8239/3X3000F1



DIMENSIONS IN INCHES

BR1162 — TYT-6000A Mullard
BR1160 Philips AC170

Vidicon

1" - DIAMETER

MAGNETIC FOCUS **MAGNETIC DEFLECTION**

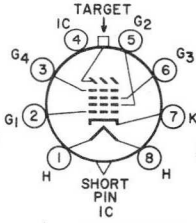
For Live-Scene, or Film Pickup with Black-and White or Color Cameras. Features High Resolution with High Sensitivity and Low Lag. Grid No.3 and Grid No.4 Have Separate Base Terminals.

General:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.6	amp
Direct Interelectrode Capacitance:[a]		
Target to all other electrodes	4.6	pf
Spectral Response	See *Curve*	
Photoconductive Layer:		
Maximum useful diagonal of rectangular image (4 x 3 aspect ratio)	0.62"	

Orientation of quality rectangle—Proper orientation is obtained when the horizontal scan is essentially parallel to the straight sides of the masked portions of the faceplate. The straight sides are parallel to the plane passing through the tube axis and short pin. The masking is for orientation only and does not define the proper scanned area of the photoconductive layer.

Focusing Method	Magnetic
Deflection Method	Magnetic
Overall Length	6.250" ± 0.125"
Greatest Diameter	1.125" ± 0.010"
Operating Position	Any
Weight (Approx.)	2 oz
Bulb	T8
Focusing Coil	Cleveland Electronics[b,c] No.VF-115-12, or equivalent
Deflecting Yoke	Cleveland Electronics[b,c] No.VY-111-3, or equivalent
Alignment Coil	Cleveland Electronics[b,c] No.VA-118, or equivalent
Base	Small-Button Ditetrar 8-Pin, (JEDEC No.E8-11)
Socket	Cinch[d] No.54A18088, or equivalent
Basing Designation for BOTTOM VIEW	8ME



Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Grid No.4
Pin 4 - Do Not Use
Pin 5 - Grid No.2
Pin 6 - Grid No.3
Pin 7 - Cathode
Pin 8 - Heater
Flange - Target
Short Pin - Do Not Use

DIRECTION OF LIGHT:
INTO FACE END OF TUBE

Maximum Ratings, *Absolute-Maximum Values:*

For scanned area of 1/2" x 3/8"

Grid-No.4 Voltage	1000 max.	volts
Grid-No.3 Voltage	1000 max.	volts
Grid-No.2 Voltage	750 max.	volts
Grid-No.1 Voltage:		
Negative bias value	300 max.	volts
Positive bias value	0 max.	volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	10 max.	volts
Target Voltage	100 max.	volts
Dark Current	0.25 max.	μa
Peak Target Current[e]	0.55 max.	μa
Faceplate:		
Illumination	1000 max.	fc
Temperature	71 max.	°C

Typical Operation and Performance Data:

For scanned area of 1/2" x 3/8" and faceplate temperature of 30° to 35° C

	Low-Voltage Operation	*High-Voltage Operation*	
Grid-No.4 (Decelerator) Voltage	500	750	volts
Grid-No.3 (Beam-Focus Electrode) Voltage[f]	300[g]	450[g]	volts
Grid-No.2 (Accelerator) Voltage	300	300	volts
Grid-No.1 Voltage for Picture Cutoff[h]	-45 to -100	-45 to -100	volts
Lag[j], Typical	20	20	%
Average "Gamma" of Transfer Characteristic for signal-output current between 0.02 μa and 0.2 μa	0.65	0.65	
Visual Equivalent Signal-to-Noise Ratio (Approx.)[k]	300:1	300:1	
Minimum Peak-to-Peak Blanking Voltage:			
When applied to grid No.1	75	75	volts
When applied to cathode	20	20	volts
Limiting Resolution:			
At center of picture	900	1000	TV lines
At corner of picture	600	700	TV lines

	Low-Voltage Operation	*High-Voltage Operation*	
Amplitude Response to a 400 TV Line Square-Wave Test Pattern at Center of Picture	35	45	%
Field Strength at Center of Focusing Coil[f]	41 ± 4	52 ± 4	gauss
Peak Deflecting-Coil Current:			
Horizontal	180	220	ma
Vertical	33	40	ma
Field Strength of Adjustable Alignment Coil[m]	0 to 4	0 to 4	gauss

Maximum-Sensitivity Operation - 0.1 Footcandle on Faceplate

Faceplate Illumination (Highlight)	0.1	fc
Target Voltage[n,p]	35 to 70	volts
Dark Current[q]	0.2	μa
Signal-Output Current:[r]		
Typical	0.14	μa

Intermediate-Sensitivity Operation - 0.5 Footcandle on Faceplate

Faceplate Illumination (Highlight)	0.5	fc
Target Voltage[n,p]	30 to 60	volts
Dark Current[q]	0.10	μa
Signal-Output Current:[r]		
Typical	0.27	μa

Average-Sensitivity Operation - 1.0 Footcandle on Faceplate

Faceplate Illumination (Highlight)	1.0	fc
Target Voltage[n,p]	20 to 40	volts
Dark Current[q]	0.02	μa
Signal-Output Current:[r]		
Typical	0.20	μa
Minimum	0.15	μa

High-Light Level Operation - 10 Footcandles on Faceplate

Faceplate Illumination (Highlight)	10	fc
Target Voltage[n,p]	10 to 22	volts
Dark Current[q]	0.005	μa
Signal-Output Current:[r]		
Typical	0.3	μa

[a] This capacitance, which effectively is the output impedance of the 8507, is increased when the tube is mounted in the deflecting-yoke and focusing-coil assembly. The resistive component of the output impedance is in the order of 100 megohms.

[b] Cleveland Electronics Inc., 1974 East 61st Street, Cleveland, Ohio.

[c] These components are chosen to provide tube operation with minimum beam-landing error when mounted in the recommended position along the tube axis.

[d] Cinch Manufacturing Corporation, 1026 S. Homan Avenue, Chicago 24, Illinois.

[e] Video amplifiers must be designed to handle target currents of this magnitude to avoid amplifier overload or picture distortion.

[f] Beam focus is usually attained by varying the focus-coil current to obtain a field-strength value within the range shown under *Typical Operation and Performance Data.* If the field-strength of the focus coil is fixed, beam focus is obtained within a ± 10 per cent range of the grid-No.4 and grid No.3 voltages. However, the recommended ratio of 0.6 between grid No.3 and grid No.4 must be maintained as these voltages are varied.

[g] In general, grid No.3 should be operated above 250 volts and be 0.6 of grid-No.4 voltage.

[h] With no blanking voltage on grid No.1.

[j] Defined as the per cent of initial value of signal-output current 1/20 second after illumination is removed. Values shown are for initial signal-output current of 0.2 microampere and a dark current of 0.02 microampere.

[k] Measured with high-gain, low-noise, cascode-input-type amplifier having bandwidth of 5 Mc and a peak signal-output current of 0.35 microampere. Because the noise in such a system is predominately of the high-frequency type, the visual equivalent signal-to-noise ratio is taken as the ratio of the highlight video-signal current to rms noise current, multiplied by a factor of 3.

[m] The alignment coil should be located on the tube so that its center is at a distance of 3-11/16 inches from the face of the tube, and be positioned so that its axis is coincident with the axis of the tube, the deflecting yoke, and the focusing coil.

[n] The target voltage for each 8507 must be adjusted to that value which gives the desired operating dark current.

[p] Indicated range for each type of service serves only to illustrate the operating target-voltage range normally encountered.

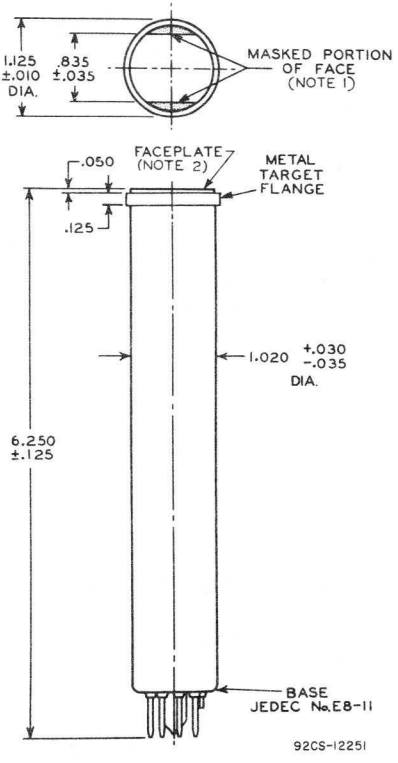
[q] The deflecting circuits must provide extremely linear scanning for good black-level reproduction. Dark-current signal is proportional to the scanning velocity. Any change in scanning velocity produces a black-level error in direct proportion to the change in scanning velocity.

[r] Defined as the component of the highlight target current after the dark-current component has been subtracted.

OPERATING CONSIDERATIONS

The *resolution capability* of the 8507 at the center of the picture is about 1000 TV lines and about 700 TV lines at the corner. This high resolution is obtained when the 8507 is operated with a grid-No.4 voltage of 750 volts and a grid-No.3 voltage of 450 volts. When the 8507 is operated at a grid-No.4 voltage of 500 volts and a grid-No.3 voltage of 300 volts, its resolution is about 900 TV lines at the center and 600 TV lines at the corner of the picture.

The *target connection* is made by a suitable spring contact bearing against the edge of the metal ring at the face end of the tube. This spring contact may conveniently be provided as part of the focusing-coil design.

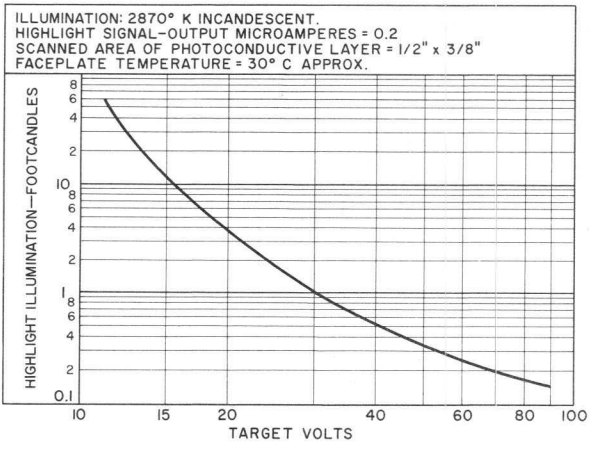


DIMENSIONS IN INCHES

Note 1: Straight sides of masked portions are parallel to the plane passing through tube axis and short index pin.

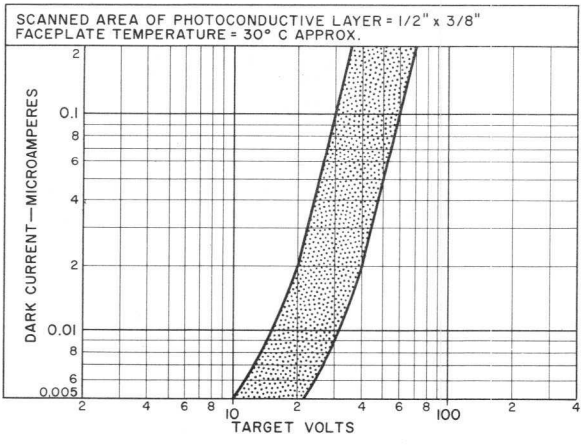
Note 2: Faceplate thickness is 0.094" ± 0.012".

TYPICAL CHARACTERISTIC



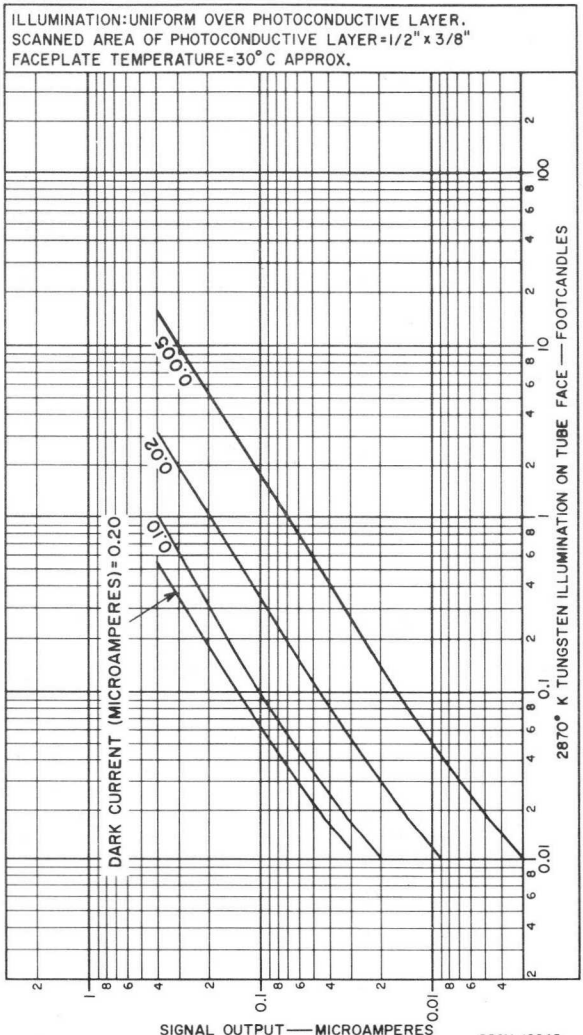
92CS-12236

DARK-CURRENT RANGE

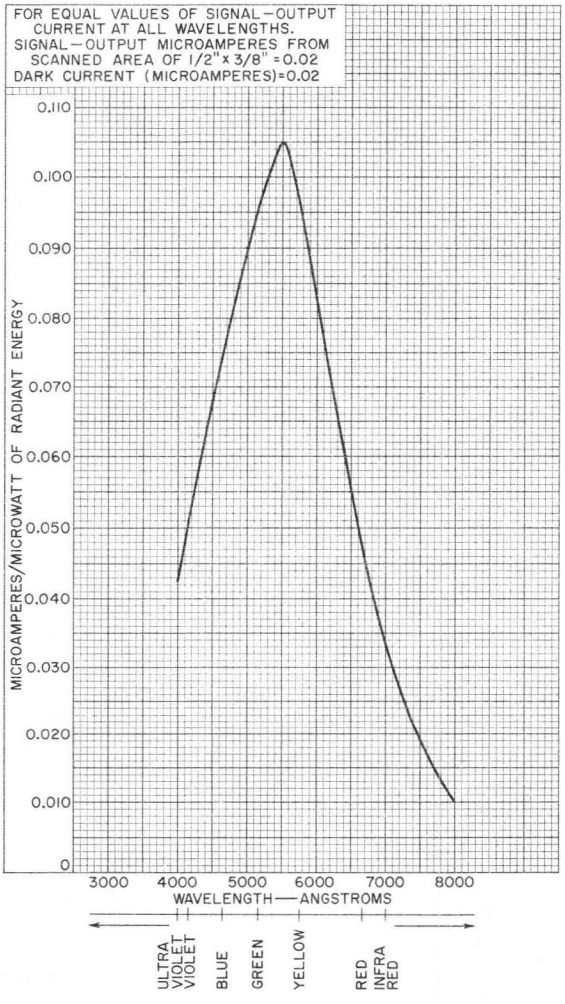


92CS-12235

TYPICAL LIGHT TRANSFER CHARACTERISTICS

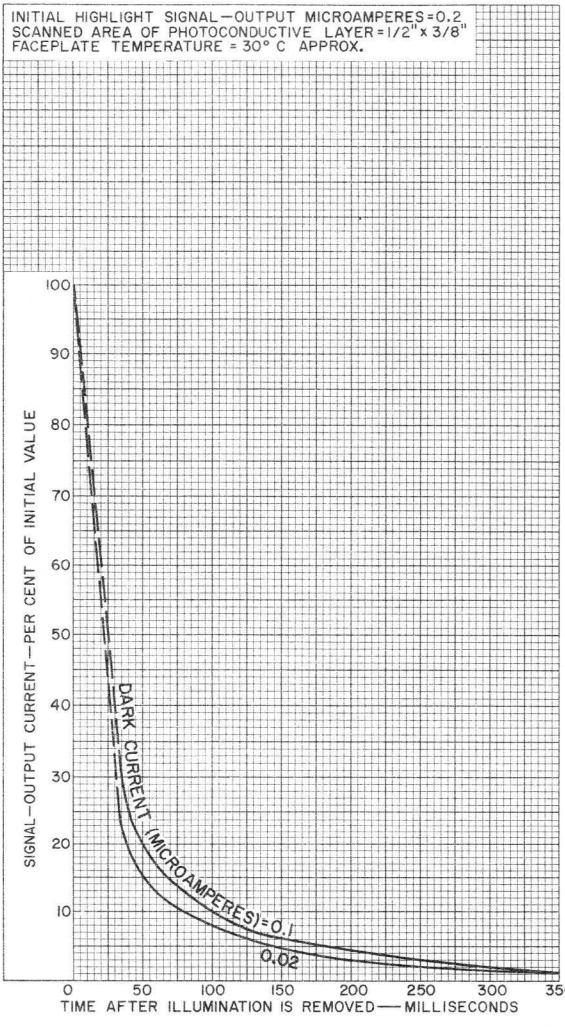


TYPICAL SPECTRAL-SENSITIVITY CHARACTERISTIC



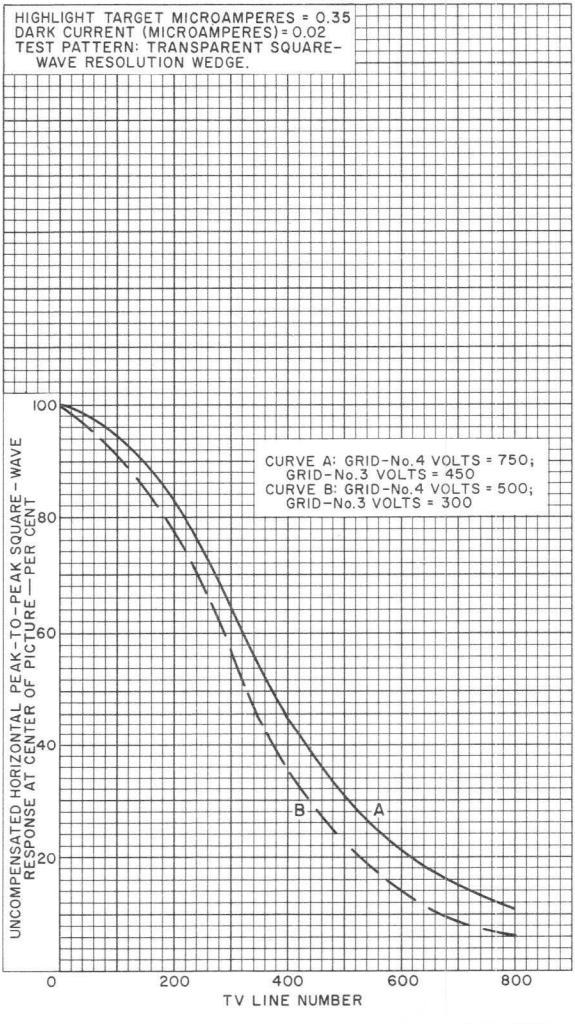
92CM-11619

TYPICAL PERSISTENCE CHARACTERISTICS



92CM-11615

TYPICAL HORIZONTAL SQUARE-WAVE RESPONSE CHARACTERISTICS



92CM-12232

8572

Vidicon

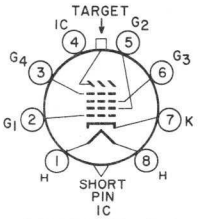
MAGNETIC FOCUS 1" - DIAMETER MAGNETIC DEFLECTION

For High-Resolution Film Pickup with Black-and-White or Color Cameras. Grid No.3 and Grid No.4 Have Separate Base Terminals.

General:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.6	amp
Direct Interelectrode Capacitance:[a]		
Target to all other electrodes	4.6	pf
Spectral Response	See accompanying *Typical Spectral Sensitivity Characteristic Curves*	
Photoconductive Layer:		
Maximum useful diagonal of rectangular image (4 x 3 aspect ratio)[b]	0.62"	
Focusing Method	Magnetic	
Deflection Method	Magnetic	
Overall Length	6.250" ± 0.125"	
Greatest Diameter	1.125" ± 0.010"	
Operating Position	Any	
Weight (Approx.)	2 oz	
Bulb	T8	
Focusing Coil	Cleveland Electronics[c,d] No.VF-115-12, or equivalent	
Deflecting Yoke	Cleveland Electronics[c,d] No.VY-111-3, or equivalent	
Alignment Coil	Cleveland Electronics[c,d] No.VA-118, or equivalent	
Socket	Cinch[e] No.54A18088, or equivalent	
Base	Small-Button Ditetrar 8-Pin, (JEDEC No.E8-11)	
Basing Designation for BOTTOM VIEW	8ME	

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Grid No.4
Pin 4 – Do Not Use
Pin 5 – Grid No.2
Pin 6 – Grid No.3
Pin 7 – Cathode
Pin 8 – Heater
Flange – Target
Short Pin – Do Not Use



DIRECTION OF LIGHT:
INTO FACE END OF TUBE

Maximum Ratings, *Absolute-Maximum Values:*

For scanned area of 1/2" x 3/8"

Grid-No.4 Voltage	1000	volts
Grid-No.3 Voltage	1000	volts
Grid-No.2 Voltage	750	volts

Grid-No.1 Voltage:		
Negative bias value	300	volts
Positive bias value	0	volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode	125	volts
Heater positive with respect to cathode	10	volts
Target Voltage	125	volts
Dark Current	0.25	μa
Peak Target Current[f]	0.55	μa
Faceplate:		
Illumination	1000	fc
Temperature	71	°C

Typical Operation and Performance Data:

For scanned area of 1/2" x 3/8" and faceplate temperature of 30° to 35° C

	Low-Voltage	High-Voltage	
Grid-No.4 (Decelerator) Voltage	500	750	volts
Grid-No.3 (Beam-Focus Electrode) Voltage[g]	300[h]	450[h]	volts
Grid-No.2 (Accelerator) Voltage	300	300	volts
Grid-No.1 Voltage for Picture Cutoff[j]	-45 to -100	-45 to -100	volts
Average "Gamma" of Transfer Characteristic for signal-output current between 0.02 μa and 0.2 μa	0.65	0.65	
Visual Equivalent Signal-to-Noise Ratio (Approx.)[k]	300:1	300:1	
Lag[m]-Typical Value for minimum lag operation	7.5	7.5	%
Minimum Peak-to-Peak Blanking Voltage:			
When applied to grid No.1	75	75	volts
When applied to cathode	20	20	volts
Limiting Resolution:			
At center of picture	900	1000	TV lines
At corner of picture	600	700	TV lines
Field Strength at Center of Focusing Coil[g]	41 ± 4	52 ± 4	gauss
Amplitude Response to a 400 TV Line Square-Wave Test Pattern at Center of Picture	35	45	%
Peak Deflecting-Coil Current:			
Horizontal	180	220	ma
Vertical	33	40	ma
Field Strength of Adjustable Alignment Coil[n]	0 to 4	0 to 4	gauss

Average-Sensitivity Operation for Live-Scene Pickup
10 Footcandles on Faceplate

Faceplate Illumination (Highlight)	10	fc
Target Voltage[p,q]	25 to 60	volts
Dark Current[r]	0.02	μa
Signal-Output Current[s] (Typical)	0.3	μa

Minumum-Lag Operation for Film Pickup
100 Footcandles on Faceplate

Faceplate Illumination (Highlight)	100	fc
Target Voltage[p,q]	12 to 30	volts
Dark Current[r]	0.004	μa
Signal-Output Current[s] (Typical)	0.3	μa

[a] This capacitance, which effectively is the output impedance of the 8572 is increased when the tube is mounted in the deflecting-yoke and focusing-alignment assembly. The resistive component of the output impedance is in the order of 100 megohms.

[b] Proper orientation of quality rectangle is obtained when the horizontal scan is essentially parallel to the plane passing through the axis and short pin. The masking is for orientation only and does not define the proper scanned area of photoconductive layer. Final orientation should be such that the image also fits inside of any internal mask of the mesh assembly.

[c] Cleveland Electronics Inc., 1974 East 61st St., Cleveland, Ohio.

[d] These components are chosen to provide tube operation with minimum beam-landing error when mounted in the recommended position along the tube axis.

[e] Cinch Manufacturing Corporation, 1026 S. Homan Avenue, Chicago 24, Illinois.

[f] Video amplifiers must be designed to handle target currents of this magnitude to avoid amplifier overload or picture distortion.

[g] Beam focus is usually attained by varying the focus-coil current to obtain a field-strength value within the range shown under *Typical Operation and Performance Data*. If the field-strength of the focus coil is fixed, beam focus is obtained within a ± 10 per cent range of the grid-No.4 and grid-No.3 voltages. However, the recommended ratio of 0.6 between grid No.3 and grid No.4 must be maintained as these voltages are varied.

[h] In general, grid No.3 should be operated above 250 volts and be 0.6 of grid-No.4 voltage.

[j] With no blanking voltage on grid No.1.

[k] Measured with high-gain, low-noise, cascode-input-type amplifier having bandwidth of 5 Mc and a peak signal-output current of 0.35 microampere. Because the noise in such a system is predominately of the high-frequency type, the visual equivalent signal-to-noise ratio is taken as the ratio of the highlight video-signal current to rms noise current, multiplied by a factor of 3.

[m] Defined as the per cent of initial value of signal-output current 1/20 second after illumination is removed. Values shown are for initial signal-output current of 0.3 microampere and a dark current of 0.004 microampere.

[n] The alignment coil should be located on the tube so that its center is at a distance of 3-11/16 inches from the face of the tube, and be positioned so that its axis is coincident with the axis of the tube, the deflecting yoke, and the focusing coil.

[p] The target voltage for each 8572 must be adjusted to that value which gives the desired operating dark current.

[q] Indicated range for each type of service serves only to illustrate the operating target-voltage range normally encountered.

[r] The deflecting circuits must provide extremely linear scanning for good black-level reproduction. Dark current signal is proportional to the scanning velocity. Any change in scanning velocity produces a black-level error in direct proportion to the change in scanning velocity.

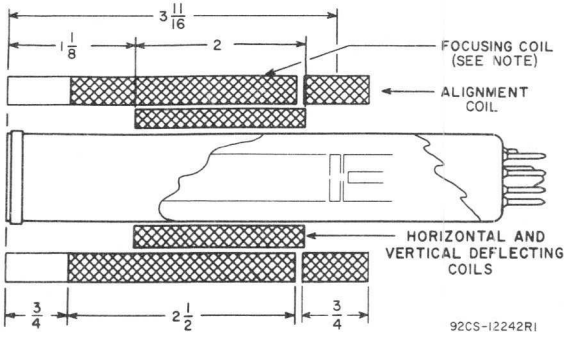
[s] Defined as the component of the highlight target current after the dark-current component has been subtracted.

OPERATING CONSIDERATIONS

The *target connection* is made by a suitable spring contact bearing against the edge of the metal ring at the face end of the tube. This spring contact may conveniently be provided as part of the focusing-coil design.

COMPONENT LOCATIONS

Recommended Location and Length of Deflecting, Focusing, and Alignment Components to obtain Minimum Beam-Landing Error



DIMENSIONS IN INCHES

Note: Cross-hatching indicates wound portion of focusing coil.

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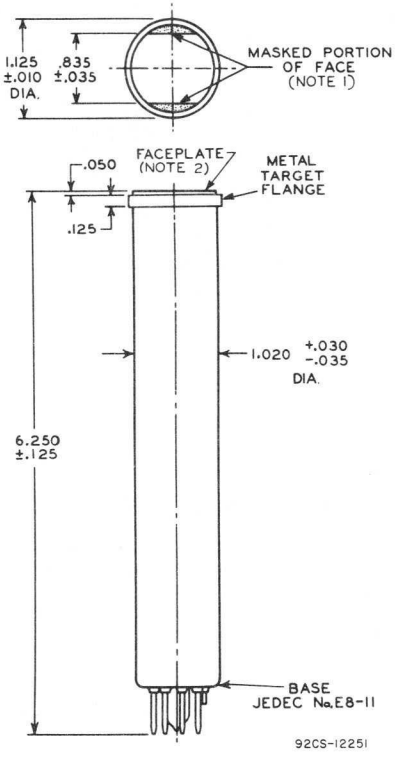
DIMENSIONAL OUTLINE

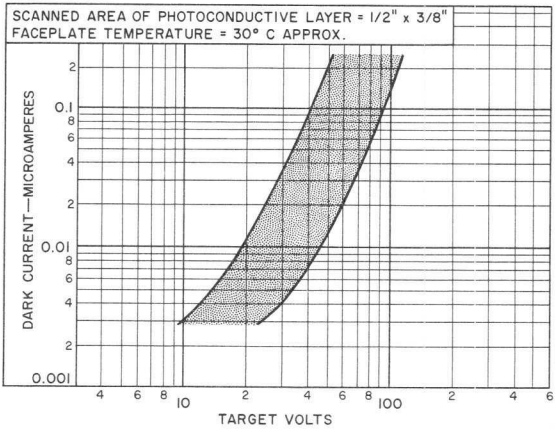


DIMENSIONS IN INCHES

Note 1: Straight sides of masked portions are parallel to the plane passing through tube axis and short index pin.

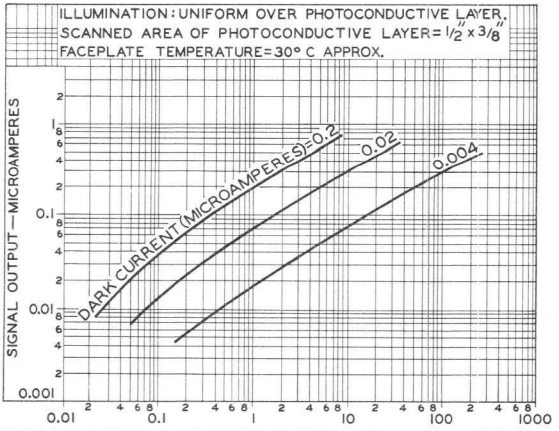
Note 2: Faceplate thickness is 0.094" ± 0.012".

RANGE OF DARK CURRENT



92CS-12575

LIGHT TRANSFER CHARACTERISTICS



92CS-9495

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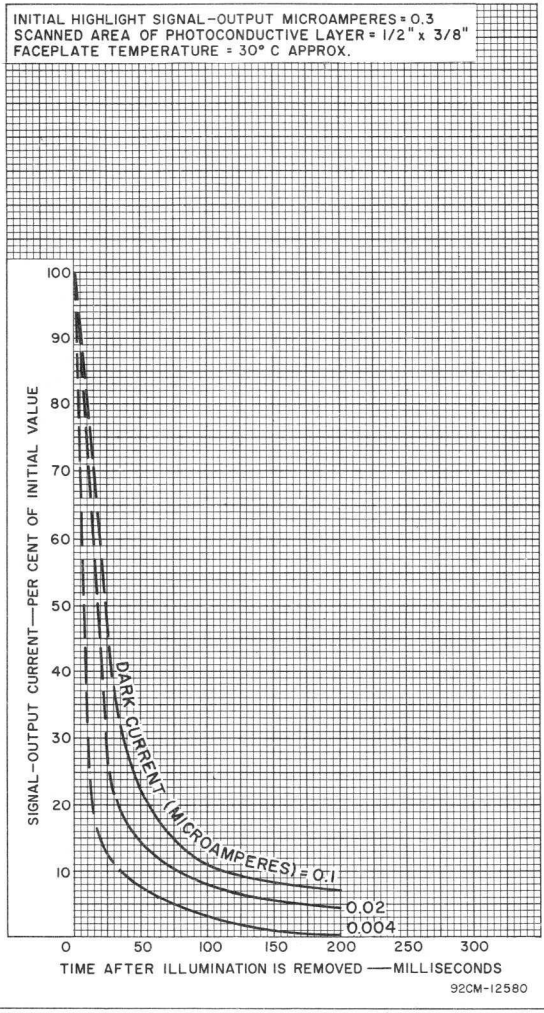
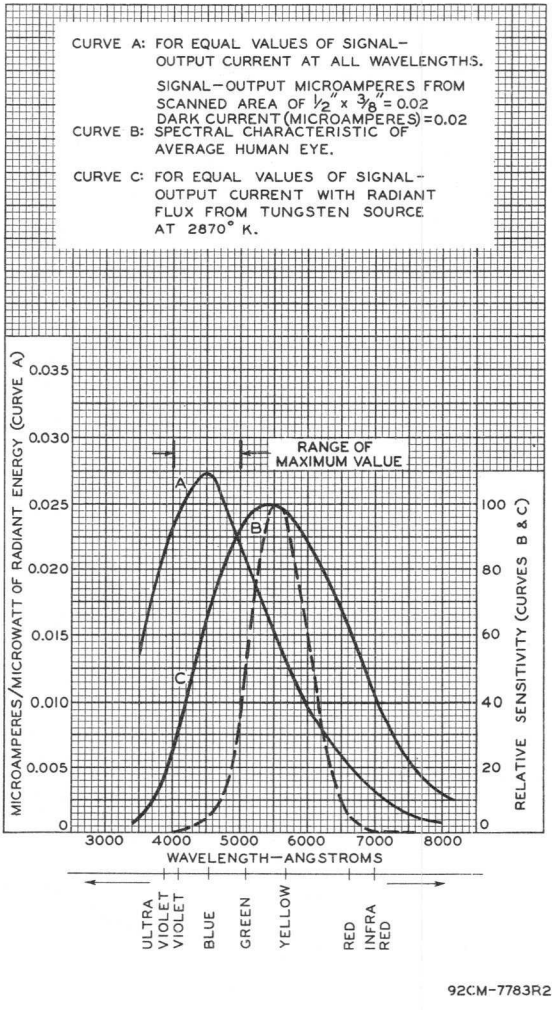
TYPICAL PERSISTENCE CHARACTERISTICS



TYPICAL SPECTRAL SENSITIVITY CHARACTERISTIC



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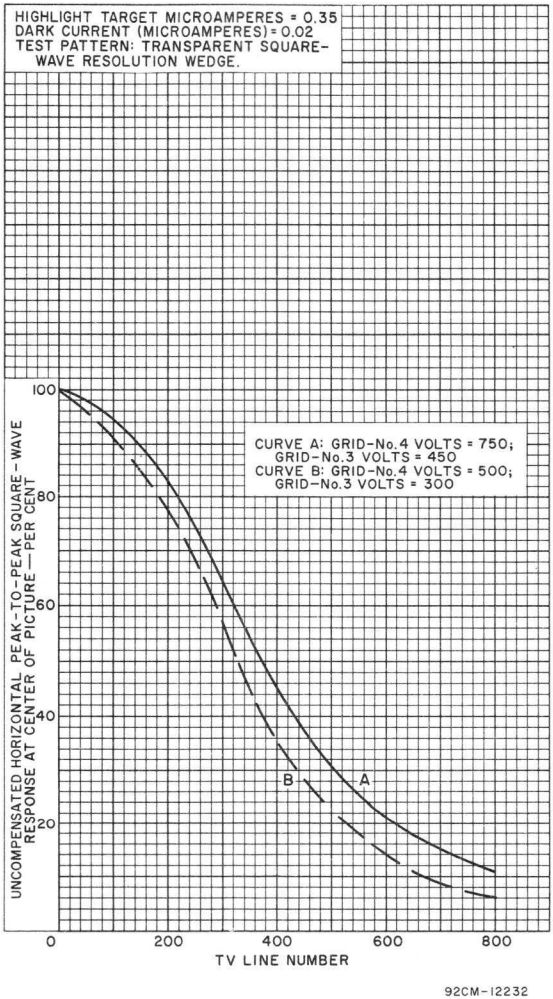
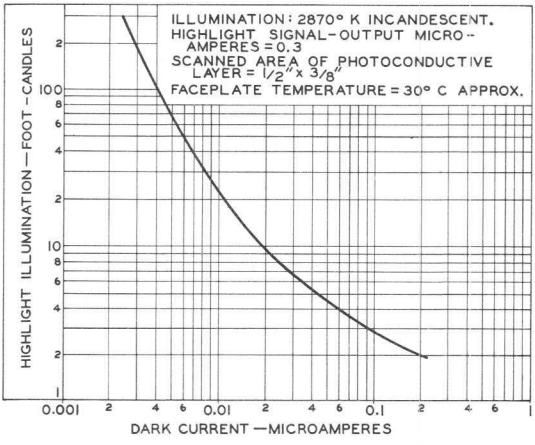
UNCOMPENSATED HORIZONTAL SQUARE-WAVE RESPONSE



92CM-12232

TYPICAL CHARACTERISTIC



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Vidicon

LOW-POWER (0.6-WATT) "DARK HEATER" MAGNETIC FOCUS — 1" - DIAMETER MAGNETIC DEFLECTION

For Live-Scene Pickup in Industrial Closed-Circuit TV in Compact Transistorized Black-and-White or Color Cameras. Features High Resolution with High Sensitivity and Low Lag. Grid No.3 and Grid No.4 Have Separate Base Terminals.

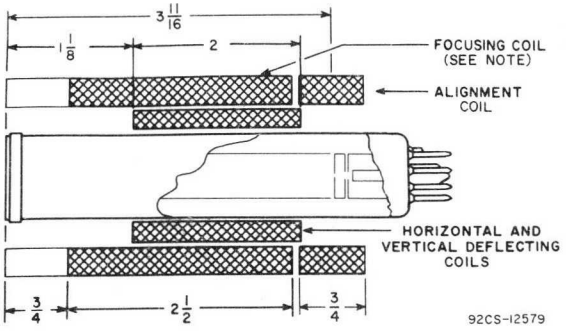
The 8573 is the same as the 8507 except for the following:

General:

Heater, for Unipotential Cathode:		
Current at 6.3 volts	0.095	amp
Overall Length	5.12" ± 0.06"	

RECOMMENDED LOCATION AND LENGTH OF DEFLECTING, FOCUSING, AND ALIGNMENT COMPONENTS

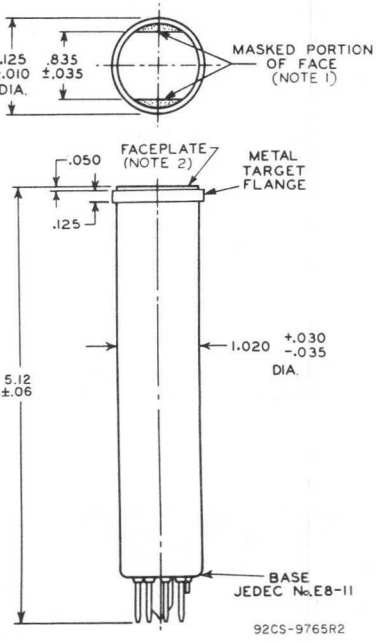
For Minimum Beam-Landing Error



DIMENSIONS IN INCHES

Note: Cross-hatching indicates wound portion of focusing coil.

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

Note 1: Straight sides of masked portions are parallel to the plane passing through tube axis and short index pin.

Note 2: Faceplate thickness is 0.094" ± 0.012".

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8646

Beam Power Tube

COAXIAL-ELECTRODE STRUCTURE
CERAMIC-METAL CONSTRUCTION

UNIPOTENTIAL CATHODE
FORCED-AIR COOLED

For Use as an RF Power Amplifier, Oscillator, Regulator, Distributed Amplifier, or Linear RF Power Amplifier in Mobile or Stationary Equipment

ELECTRICAL

Heater, for Unipotential Cathode[f]		
Voltage (AC or DC)[a]	26.5 ± 10%	V
Current at 26.5 V	0.64	A
Minimum heating time	60	s
Mu-Factor, Grid No.2 to Grid No.1	12	
Direct Interelectrode Capacitances[b]		
Grid No.1 to plate	0.13 max	pF
Grid No.1 to cathode	16	pF
Plate to cathode	0.011	pF
Grid No.1 to grid No.2	22	pF
Grid No.2 to plate	6.5	pF
Grid No.2 to cathode	3.2	pF
Cathode to heater	5.2	pF

MECHANICAL

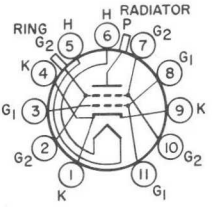
Operating Position	Any
Maximum Overall Length	2.196 in
Seated Length	1.850 ± 0.065 in
Diameter	1.460 ± 0.015 in
Weight (Approx.)	3 oz
Socket	Johnson[c] No.124-311-100, Mycalex[d] No.CP464-2, or equivalent
Grid-No.2 Bypass Capacitor	Johnson[c] No.124-121, or equivalent
Base	Large Wafer Elevenar 11-Pin with Ring (JEDEC No.E11-81)

THERMAL

Terminal Temperature (All Terminals)	250 max	°C
Radiator Core Temperature See *Dimensional Outline*	250 max	°C
Air Flow[g] See *Typical Cooling Characteristics*		

TERMINAL DIAGRAM (Bottom View)

Pin 1 – Cathode
Pin 2 – Grid No.2
Pin 3 – Grid No.1
Pin 4 – Cathode
Pin 5 – Heater
Pin 6 – Heater
Pin 7 – Grid No.2
Pin 8 – Grid No.1
Pin 9 – Cathode
Pin 10 – Grid No.2



Pin 11 – Grid No.1
Radiator – Plate Terminal
Ring – Grid-No.2 Terminal
Contact Surface (For use at higher frequencies)

LINEAR RF POWER AMPLIFIER[h]

Single-Sideband Suppressed-Carrier Service

Peak envelope conditions for a signal having a minimum peak-to-average power ratio of 2

Maximum CCS Ratings, Absolute-Maximum Values

	Up to 500 Mc/s	
DC Plate Voltage	2200	V
DC Grid-No.2 Voltage	400	V
DC Grid-No.1 Voltage	-100	V
DC Plate Current at Peak of Envelope	450[e]	mA
DC Grid-No.1 Current	100	mA
Plate Dissipation	150	W
Grid-No.2 Dissipation	8	W
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode	150	V
Heater positive with respect to cathode	150	V

Maximum Circuit Values

Grid-No.1-Circuit Resistance Under Any Condition		
With fixed bias	25,000	Ω
With fixed bias (In Class AB_1 operation)	100,000	Ω
With cathode bias	Not recommended	
Grid-No.2 Circuit Impedance	*See Note*[j]	
Plate Circuit Impedance	*See Note*[k]	

Typical CCS Operation with "Two-Tone Modulation"

	At 30 Mc/s		
DC Plate Voltage	1000	1500	V
DC Grid-No.2 Voltage	250	250	V
DC Grid-No.1 Voltage	-20	-20	V
Zero-Signal DC Plate Current	100	100	mA
Effective RF Load Resistance	2270	3800	Ω
DC Plate Current at Peak of Envelope	210	210	mA
Average DC Plate Current	160	160	mA
DC Grid-No.2 Current at Peak of Envelope	10	10	mA
Average DC Grid-No.2 Current	7	7	mA
Average DC Grid-No.1 Current	0.05	0.05	mA
Peak-Envelope Driver Power Output (Approx.)	0.3	0.3	W
Output-Circuit Efficiency (Approx.)	90	85	%
Distortion Products Level			
Third Order	35	35	dB
Fifth Order	40	40	dB
Useful Power Output (Approx.)			
Average	55	85	W
Peak envelope	110	170	W

PLATE-MODULATED RF POWER AMPLIFIER — Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1

Maximum CCS Ratings, Absolute-Maximum Values

	Up to 500 Mc/s	
DC Plate Voltage	1800	V
DC Grid-No.2 Voltage	400	V

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	Up to 500 Mc/s	
DC Grid-No.1 Voltage	-100	V
DC Plate Current	250	mA
DC Grid-No.1 Current	100	mA
Grid-No.2 Input	5	W
Plate Dissipation	105	W

RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy[h] and RF POWER AMPLIFIER — Class C FM Telephony[h]

Maximum CCS Ratings, Absolute-Maximum Values

	Up to 500 Mc/s	
DC Plate Voltage	2200	V
DC Grid-No.2 Voltage	400	V
DC Grid-No.1 Voltage	-100	V
DC Plate Current	300	mA
DC Grid-No.1 Current	100	mA
Grid-No.2 Dissipation	8	W
Plate Dissipation	150	W
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode	150	V
Heater positive with respect to cathode	150	V

Maximum Circuit Values

Grid-No.1-Circuit Resistance Under Any Condition		
With fixed bias	25,000	Ω
Grid-No.2 Circuit Impedance	*See Note*[j]	
Plate Circuit Impedance	*See Note*[k]	

Typical CCS Operation

In Grid-Drive Circuit at 50 Mc/s

DC Plate Voltage	700	1000	1500	V
DC Grid-No.2 Voltage	175	200	200	V
DC Grid-No.1 Voltage	-10	-30	-30	V
DC Plate Current	300	300	300	mA
DC Grid-No.2 Current	25	20	20	mA
DC Grid-No.1 Current	50	40	40	mA
Driver Power Output (Approx.)	1.2	2.0	2.0	W
Useful Power Output	120	175	275	W

In Grid-Drive Circuits at 470 Mc/s

DC Plate Voltage	700	1000	1500	V
DC Grid-No.2 Voltage	200	200	200	V
DC Grid-No.1 Voltage	-30	-30	-30	V
DC Plate Current	300	300	300	mA
DC Grid-No.2 Current	10	10	5	mA
DC Grid-No.1 Current	30	30	30	mA
Driver Power Output (Approx.)	8	8	8	W
Useful Power Output	100	165	235	W

[a] Because the cathode is subjected to back bombardment as the frequency is increased with resultant increase in temperature, the heater voltage should, for optimum life, be reduced to a value such that at the heater voltage obtained at minimum supply voltage conditions (all other voltages constant) the tube performance just starts to show some degradation; e.g., at 470 Mc/s, heater volts = 24.5 (Approx.).

b Measured with special shield adapter.

c E. F. Johnson Co., 299 10th Ave. S. W., Waseca, Minn.

d Mycalex Corp. of America, 125 Clifton Blvd., Clifton, N.J.

e The maximum rating for a signal having a minimum peak-to-average power ratio less than 2, such as is obtained in "Single-Tone" operation, is 300 mA. During short periods of circuit adjustment under "Single-Tone" conditions, the average plate current may be as high as 450 mA.

The following footnotes apply to the *RCA Transmitting Tube Operating Considerations* given at front of this section.

f See *Electrical Considerations* — Filament or Heater.

g See *Cooling Considerations* — Forced-Air Cooling.

h See *Classes of Service*

j See *Electrical Considerations* — Grid-No.2 Voltage Supply

k See *Electrical Considerations* — Plate Voltage Supply

CHARACTERISTICS RANGE VALUES

	Note	*Min*	*Max*	
1. Heater Current	1	0.60	0.68	A
2. Direct Interelectrode Capacitances				
Grid No.1 to plate	2	-	0.13	pF
Grid No.1 to cathode	2	14.3	17.7	pF
Plate to cathode	2	0.0065	0.0155	pF
Grid No.1 to grid-No.2	2	19.8	24.2	pF
Grid No.2 to plate	2	5.7	7.1	pF
Grid No.2 to cathode	2	2.6	3.6	pF
Cathode to heater	2	4.9	5.5	pF
3. Grid-No.1 Voltage	1,3	-8	-19	V
4. Reverse Grid-No.1 Current	1,3	-	-25	μA
5. Grid-No.2 Current	1,3	-7	+6	mA
6. Peak Emission	1,4	13	-	peak A
7. Interelectrode Leakage Resistance	5	1.0	-	MΩ
8. Cutoff Grid-No.1 Voltage	1,6	-	-44	V

Note 1: With 26.5 volts ac or dc on heater.

Note 2: Measured with special shield adapter.

Note 3: With dc plate voltage at 700 volts, dc grid-No.2 voltage of 250 volts, and dc grid-No.1 voltage adjusted to give a dc plate current of 185 mA.

Note 4: For conditions with grid No.1, grid No.2, and plate tied together; and pulse voltage source connected between plate and cathode. Pulse duration is 2.5 microseconds and pulse repetition frequency is 60 pps. The voltage-pulse amplitude is 200 volts peak. After 1 minute at this value, the current-pulse amplitude will not be less than the value specified.

Note 5: Under conditions with tube at 20° to 30°C for at least 30 minutes without any voltages applied to the tube. The resistance between any two electrodes as measured with a 200-volt Megger-type ohmmeter having an internal impedance of 1.0 megohm, will be less than the value specified.

Note 6: With dc plate voltage of 2000 volts, dc grid-No.2 voltage of 250 volts, and dc grid-No.1 voltage varied to obtain a plate current of 5 mA.

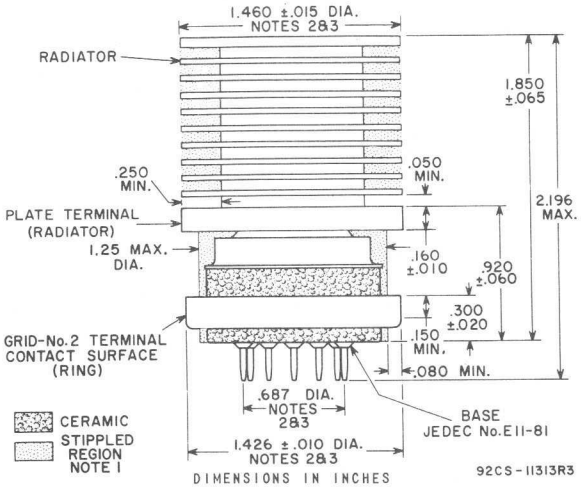
OPERATING CONSIDERATIONS

For considerations common to all RCA Power tubes, See *RCA Transmitting Tube Operating Considerations* given at front of this section. Additional considerations specifically for the 8646 are given below.

Mounting. The plate connection to the 8646 may be made by a metal band or spring contacts to the larger fin of the radiator which is located at the base end.

If rigid connections are made to more than one plane (base, flange, and radiator), adjustment must be made in a plane normal to the major tube axis to compensate for variations in concentricity for the associated parts of the tube. See *Dimensional Outline*.

DIMENSIONAL OUTLINE



Note 1: Keep all stippled regions clear. Do not allow contacts or circuit components to protrude into these annular volumes.

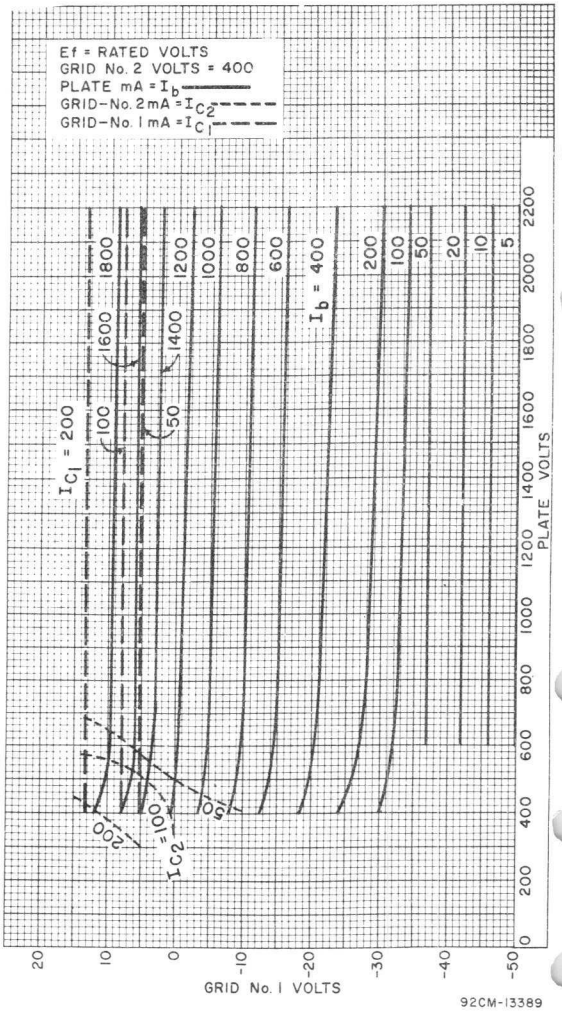
Note 2: The diameters of the radiator, grid-No. 2 terminal contact surface, and pin circle to be concentric within the following values of maximum full indicator reading:

Radiator to Grid-No. 2 Terminal Contact Surface. .	0.030 in max
Radiator to Pin Circle.	0.040 in max
Grid-No. 2 Terminal Contact Surface to Pin Circle . .	0.030 in max

Note 3: The full indicator reading is the maximum deviation in radial position of a surface when the tube is completely rotated about the center of the reference surface. It is a measure of the total effect of runout and ellipticity.

Typical Constant-Current Characteristics

For Grid-No. 2 Voltage = 400 Volts



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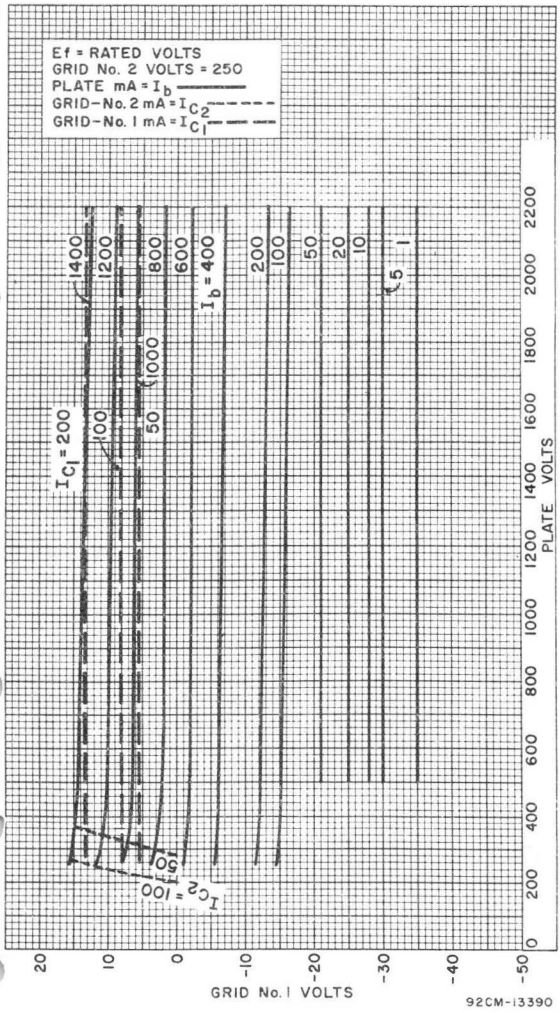
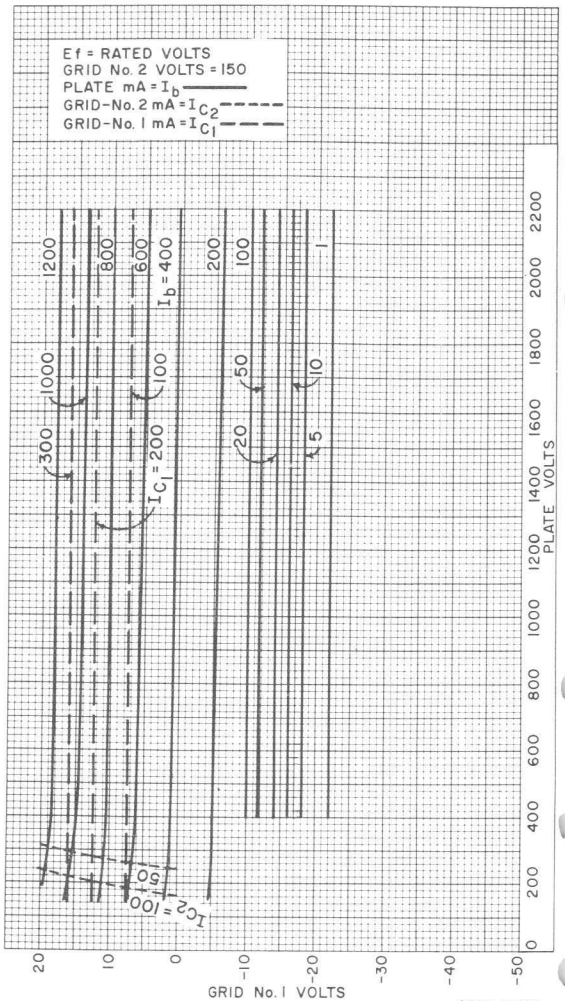
Typical Constant-Current Characteristics

For Grid-No. 2 Voltage = 250 Volts



Typical Constant-Current Characteristics

For Grid-No. 2 Voltage = 150 Volts



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Typical Cooling Characteristics

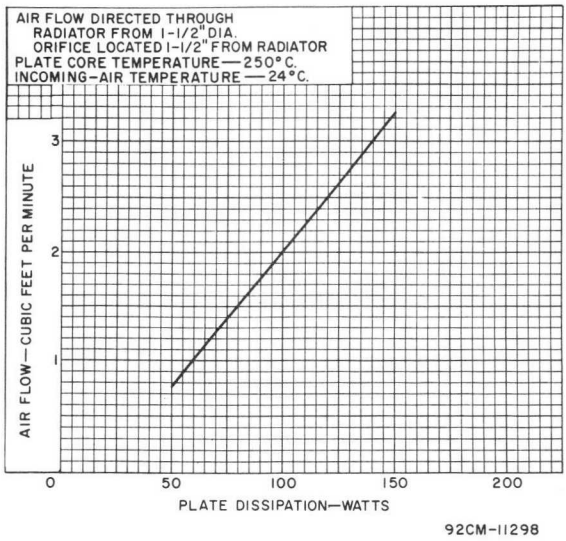

Image Orthicon

MAGNETIC FOCUS 2-INCH DIAMETER MAGNETIC DEFLECTION

For Portable, Broadcast, Scientific, or Industrial TV Pickup Service

GENERAL

Heater, for Unipotential Cathode
Voltage (AC or DC) . . . . . 6.3 ± 10% V
Current at 6.3 volts . . . . . 0.095 A
Direct Interelectrode Capacitance
Anode to all other electrodes. . . . . 8 pF
Target-to-Mesh
Spacing. . . . . 0.001 in (0.0254 mm)
Capacitance. . . . . 75 pF
Spectral Response. . . . . . See *Typical Spectral Sensitivity Characteristic*
Window Material. . . . . .Corning[a] No.7056, or equivalent
Photocathode Material. . . . . Bialkali (Cs-K-Sb)
Photocathode, Semitransparent
Rectangular image (4 x 3 aspect ratio)[b]
Useful size of[c]. . . . . 0.6 in (15.2 mm) max. diagonal
Focusing Method. . . . . . Magnetic
Deflection Method. . . . . . Magnetic
Maximum Overall Length . . . . . 10.25 in (260.4 mm)
Maximum Diameter of Bulb . . . . . 2.10 in (53.4 mm)
Shoulder Base. . . . . . Special Annular 11-Pin (JEDEC No.E11-96)
End Base . . . . . Special 15-Pin (JEDEC No.E15-95)
Socket . . . . . Alden[d] Part No.216SBA, or equivalent
Storage and Operating Position . . . . .The tube should never be placed in a vertical position with the base end up nor in any other position where the axis of the tube with the base up makes an angle of less than 20° with the vertical.
Weight (Approx.) . . . . . 8 oz (227g)
Minimum Deflecting-Coil Inside Diameter. . 1.55 in (39.4 mm)
Deflection, Focus, and Alignment Coil Assemblies[e]
For transistor-drive amplifier circuits—
Celco[f], Part No.C2060-2, or equivalent:
Horizontal—250 μH; Vertical—30 mH
Cleveland[g], Part No.2DA-1063, or equivalent:
Horizontal—800 μH; Vertical—40 mH
For tube-drive amplifier circuits—
Celco[f], Part No.C2060-1, or equivalent:
Horizontal—4 mH; Vertical—30 mH
Cleveland[g], Part No.2DA-1059, or equivalent:
Horizontal—6 mH; Vertical—125 mH

ABSOLUTE-MAXIMUM VALUES

Voltages are with respect to thermionic cathode unless otherwise specified

Photocathode
Voltage. . . . . -1150 V

Photocathode (cont'd)		
Illumination (See *Caution*) . .	.50 lm/ft^2 (footcandles) - 538 lux	
Operating Temperature[h]		
Any part of bulb	50	°C
Of bulb at large end of tube (Image section) . .	35 min	°C
Temperature Difference		
Between image section and any part of bulb hotter than image section.	5	°C
Grid-No.6 Voltage.	-625	V
Target Voltage		
Positive value	10	V
Negative value	10	V
Field-Mesh Voltage[j].	25	V
Grid-No.5 Voltage.	325	V
Grid-No.4 Voltage.	325	V
Grid-No.3 Voltage.	325	V
Grid-No.2 & Dynode-No.1 Voltage.	350	V
Grid-No.1 Voltage		
Negative bias value.	125	V
Positive bias value.	0	V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode.	125	V
Heater positive with respect to cathode.	10	V
Anode-Supply Voltage[k].	1700	V
Voltage Between Consecutive Dynodes.	625	V
Voltage Between Anode and Dynode No.5.	300	V

TYPICAL OPERATING VALUES

Heater Voltage	6.3	V
Photocathode Voltage (Image Focus)[m]. . . .	-750 to -1050	V
Grid-No.6 Voltage (Accelerator) - Approx. 55% of Photocathode Voltage . . .	-410 to -580	V
Target Voltage Above Cutoff[n]	3	V
Field-Mesh Voltage[j].	15	V
Grid-No.5 Voltage (Decelerator).	100 to 200	V
Grid-No.4 Voltage (Beam Focus)	100 to 200	V
Grid-No.3 Voltage[p]	240 to 280	V
Grid-No.2 & Dynode-No.1 Voltage.	280	V
Grid-No.1 Voltage for Picture Cutoff . . .	-30 to -90	V
Dynode-No.2 Voltage.	575	V
Dynode-No.3 Voltage.	600 to 850	V
Dynode-No.4 Voltage.	1125	V
Dynode-No.5 Voltage.	1400	V
Anode Voltage.	1500	V
Recommended Target Temperature Range[h]. . .	35 to 45	°C
Peak-to-Peak Blanking Voltage.	5	V
Field Strength of Focusing Coil:[q]		
At center of scanning section.	68	G
In plane of photocathode	180	G
In region of grid No.3 (7.38 inches behind faceplate)	10	G
Field Strength of Alignment Coil	0 to 4	G

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PERFORMANCE CHARACTERISTICS RANGE VALUES

With conditions shown under Typical Operating Values, camera lens set to bring picture highlights to the "knee" of the light transfer characteristic, 525 line scanning, interlaced 2:1, frame time of 1/30 second, and 0.6 inch diagonal with 4 x 3 aspect ratio.

	Min	Typ	Max	
Cathode Radiant Sensitivity at 4000 angstroms	-	0.06	-	A/W
Cathode Luminous Sensitivity (2870° K)[r]	40	75	-	μA/lm
Anode Current (DC)	-	15	-	μA
Signal-Output Current (Peak to Peak)[s]	1.5	4	-	μA
Signal-to-Noise Ratio[t]	-	30:1 (29.5 dB)	-	
Photocathode Illumination at 2870° K Required to Bring Highlights to the "knee" of Light Transfer Characteristic	-	0.075		0.1 lm/ft² (fc)
Amplitude Response at 400 TV Lines per Picture Height (per cent of large-area black to large-area white)[u]	20	25	-	%
Limiting Center Resolution	-	600	-	TV lines/ picture height

[a] Made by Corning Glass Works, Corning, N.Y.

[b] Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through the guide pin of the shoulder base and the major tube axis. The horizontal and vertical scan should preferably start at the corner of the raster nearest pin 4 of the shoulder base.

[c] The size of the optical image focused on the photocathode should be adjusted so that its maximum diagonal does not exceed the specified value. The corresponding electron image on the target should have a size such that the corners of the rectangle just touch the target ring.

[d] Made by Alden Products Co., 9140 N. Main St., Brockton 64, Mass.

[e] The yoke must be shielded with a cylindrical high-permeability material enclosing the alignment-coil portion of the assembly to reduce the magnetic field intensity in the region of grid No.3 to approximately 10 gauss.

[f] Made by Constantine Engineering Laboratories Co., 70 Constantine Drive, Mahwah, N.J.

[g] Made by Cleveland Electronics, Inc., 2000 Highland Road, Twinsburg, Ohio 44087.

[h] Operation outside of the *Recommended Target Temperature Range* shown under *Typical Operating Values* will not damage the 8685 provided the *Maximum Temperature Ratings* of the tube are not exceeded. Optimum performance, however, is only obtained when the tube is operated within the *Recommended Target Temperature Range*.

[j] With respect to grid No.4.

[k] Dynode-voltage values are shown under *Typical Operating Values*.

[m] Adjust for best focus.

[n] Normal setting of target voltage is 3 volts from target cutoff. The target supply voltage should be adjustable from -3 to +5 volts.

[p] Adjust to give the most uniformly shaded picture near maximum signal.

[q] Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with indicator located outside of and at the image end of the focusing coil. The faceplate of the tube must be in mechanical contact with the faceplate coil.

[r] Under the following conditions: The light source is a tungsten-filament lamp having a lime-glass envelope. It is operated at a color temperature of 2870° K. The value of light flux is 1×10^{-4} lumen and -90 to -175 volts is applied between photocathode and grounded grid No.6 and target assembly. Voltage is not applied to the other tube electrodes.

[s] With a dynode-No.3 voltage of 725 volts.

[t] With a noise equivalent bandwidth of 4.5 MHz. Peak signal output is measured with respect to "capped" black. Signal-to-noise ratio is dependent upon tube operating conditions and on the method of measurement. Significant factors affecting this ratio include target voltage, bandwidth, system line number and frame time, amount of beam current employed, and the choice of reference signal black level.

[u] Measured with amplifier having flat frequency response.

Dos and Don'ts on Use of RCA-8685

Dos

1. Allow the 8685 to warm up prior to operation.
2. Hold temperature of the 8685 within operating range.
3. Make sure alignment coil is properly adjusted.
4. Adjust beam-focus control for best usable resolution.
5. Condition spare 8685's by operating several hours once each month.
6. Determine proper operating point with target voltage adjusted to exactly 3 volts above target cutoff.
7. Uncap lens before voltages are applied to the 8685.
8. Turn off the camera or the image-section high voltage supply if the lens turret or the yoke and 8685 must be "swung out" to clean the lens of the tube faceplate.

Don'ts

1. Don't force the 8685 into its shoulder socket.
2. Don't operate the 8685 without scanning.
3. Don't operate an 8685 having an ion spot.
4. Don't use more beam current than necessary to discharge the highlights of the scene.
5. Don't turn off beam while voltages are applied to photocathode, grid No.6, target, dynodes, and anode during warmup or standby operation.
6. Don't remove the lens turret or lens when the camera is turned on, or when voltages are applied to the image section of the 8685, unless the light level incident on the tube can be reduced below 50 footcandles.

CAUTION

Care should be taken to avoid operating the camera with the lens turret removed, or swinging the tube and focusing coil away from the optical system of the camera, when voltages are applied to the tube. Excessive illumination for short periods of time under these conditions may damage the photocathode of the 8685.

OPERATING TECHNIQUES

With lens uncapped and the lens iris opened, proper voltages should be applied to the 8685 and the grid-No.1 voltage should immediately be adjusted to produce a small amount of beam current. This prevents the mesh from being electrostatically pulled into contact with the glass disc. Adjust the deflection

circuits so that the beam "overscans" the target, i.e., so that the area of the target scanned is greater than its sensitive area. Note that overscanning the target results in a smaller-than-normal picture on the monitor. The lens should be capped and the tube should be allowed to warm up for 10 minutes before use or before adjustments are made.

Next, uncap the lens and partially open the lens iris. Increase the target voltage until information appears on the monitor. Then adjust beam focus, image focus, and optical focus until detail can be discerned in the picture. Adjust alignment-coil-current controls until picture response is maximum. If picture appears in negative contrast, increase the beam current. Further adjust the alignment-coil current so that the center of the picture does not move when the beam-focus control (grid No.4) is varied, but simply goes in and out of focus. During alignment of the beam, and also during operation of the tube, always keep the beam current as low as possible to give the best picture quality and also to prevent excessive noise.

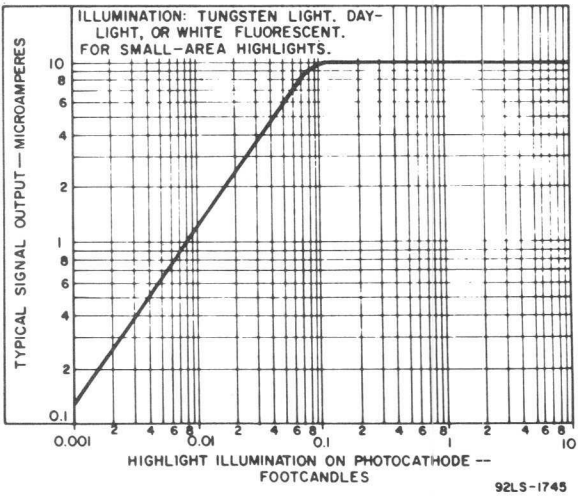
Next, focus the camera on a test pattern. The camera-to-test pattern distance should be set so that the corners of the test-pattern image just touch the inside of the target ring. The deflection circuits are next adjusted so that the entire test pattern just fills the TV raster. The target voltage is then advanced or reduced to the point where a reproduction of the test pattern is just discernible on the monitor. This value of target voltage is known as the "target-cutoff voltage". The target voltage should then be raised exactly two volts above the cutoff-voltage value, and the beam-current control adjusted to give just sufficient beam current to discharge the highlights.

Then adjust the lens to produce best optical focus, and the voltage on the photocathode as well as the voltage on grid No.4 to produce the sharpest picture. Grid No.4 should be adjustable within the range of 100 to 200 volts. There are several voltage values outside of this range which will provide beam focus. However, such focus modes are not recommended.

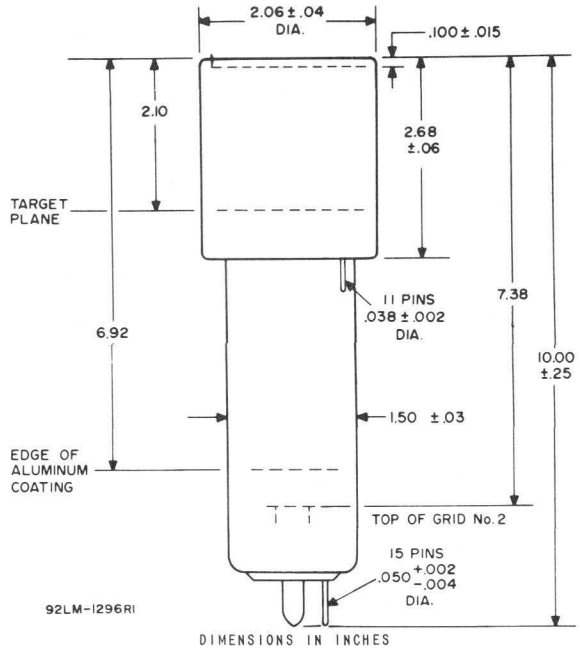
At this point, attention should be given to the grid-No.5, grid-No.3, and the grid-No.6 controls. Grid-No.5 and grid-No.6 controls should be adjusted to produce the best center-to-edge focus and the best picture geometry. Both the grid-No.6 and grid-No.5 controls produce a rotation of the edges of the picture, and influence the uniformity of focus from center to the edges of the picture. It is necessary to adjust these two controls successively to arrive at the best combination of focus and picture geometry. While changing grid-No.6 and grid-No.5 voltages, it will also be necessary to refocus the image section by adjusting the photocathode-voltage control. After the above mentioned controls are properly adjusted, the grid-No.3 control should be adjusted for maximum signal output. The deflecting yoke and the 8685 should be rotated, if necessary, so that the horizontal scanning of the camera is parallel to the horizontal plane of the scene.

Finally, readjust the target voltage so that it is accurately set to 3 volts above target cutoff. The lens opening should be set to meet the requirements of the particular operating mode. This setting typically places scene highlights at the knee or one stop over the knee of the light transfer characteristic.

Basic Light Transfer Characteristic

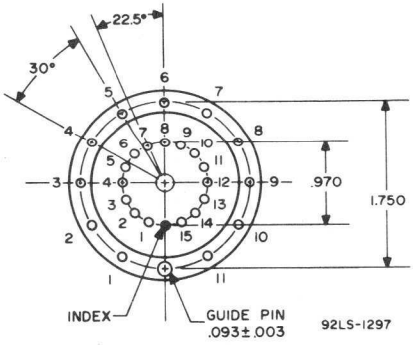


DIMENSIONAL OUTLINE



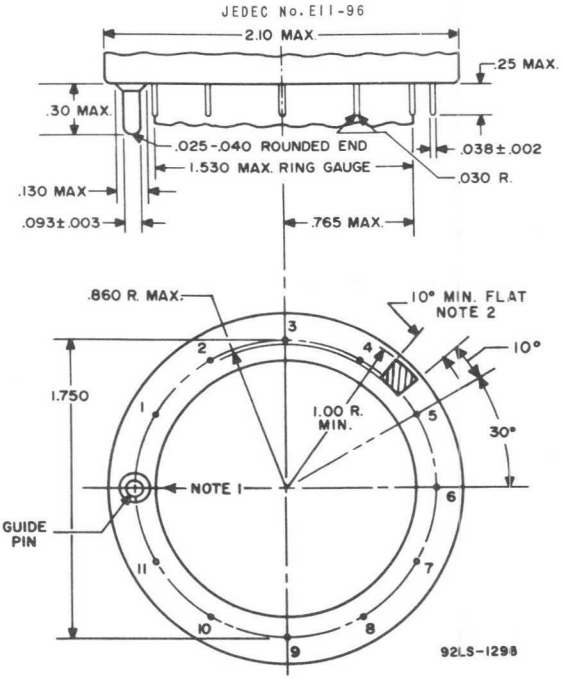
DIMENSIONS IN INCHES

BOTTOM VIEW



DETAIL OF SPECIAL SHOULDER BASE

JEDEC No. E11-96



DIMENSIONS IN INCHES

Note 1: White guide line on faceplate is on this radius.

Note 2: 12 flat areas between each pair of pins.

Pin 1 – Field Mesh
Pin 2 – Internal Connection—Do Not Use
Pin 3 – Photocathode
Pin 4 – Internal Connection—Do Not Use
Pin 5 – Grid No.5
Pin 6 – Internal Connection—Do Not Use
Pin 7 – Grid No.6
Pin 8 – Internal Connection—Do Not Use
Pin 9 – No Connection
Pin 10 – Internal Connection—Do Not Use
Pin 11 – Target
Guide Pin – No Internal Connection

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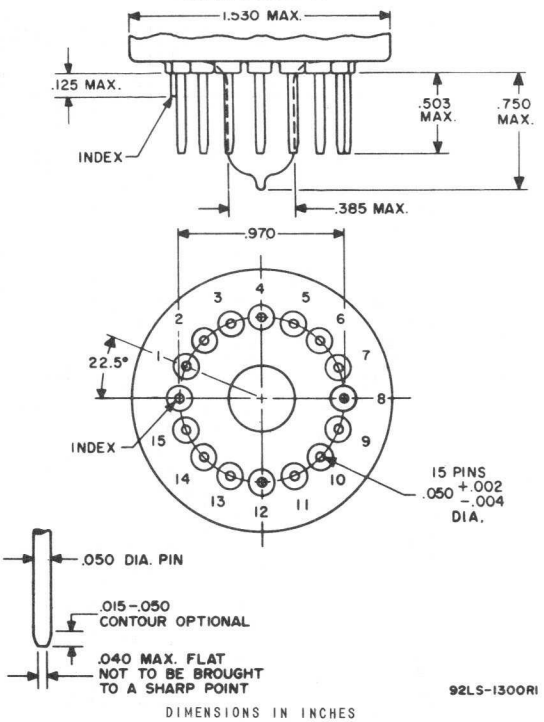
DETAIL OF SPECIAL END BASE

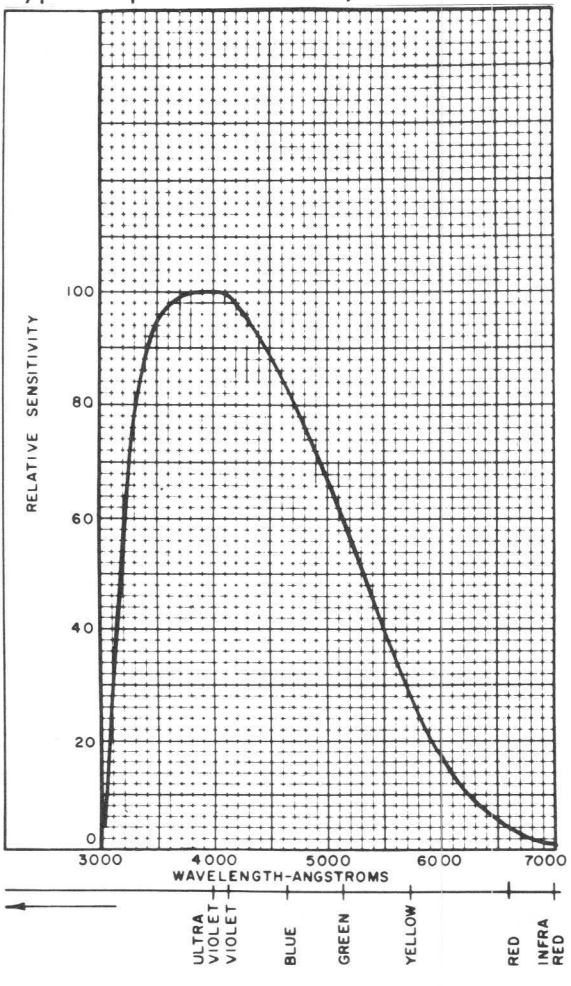
JEDEC No. E15-95



DIMENSIONS IN INCHES

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Grid No.3
Pin 4 – Grid No.4
Pin 5 – Internal Connection—Do Not Use
Pin 6 – Dynode No.1, Grid No.2
Pin 7 – Dynode No.2
Pin 8 – Dynode No.4
Pin 9 – Anode
Pin 10 – Dynode No.5
Pin 11 – Dynode No.3
Pin 12 – Internal Connection—Do Not Use
Pin 13 – Internal Connection—Do Not Use
Pin 14 – Cathode
Pin 15 – Heater

Typical Spectral Sensitivity Characteristic



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9004

U-H-F DIODE

ACORN TYPE

Heater	Coated Unipotential Cathode	
Voltage	6.3	a-c or d-c volts
Current	0.15	amp.
Direct Interelectrode Capacitances:°		
Plate to Cathode	1.3	μμf
Plate to Heater	0.3 approx.	μμf
Heater to Cathode	2.2 approx.	μμf
Overall Length		1-7/32" ± 5/32"
Overall Diameter		1-3/32" ± 1/16"
Bulb		T-4½
RCA Socket		Stock No.9925
Mounting Position		Any

Maximum Ratings Are Design-Center Values

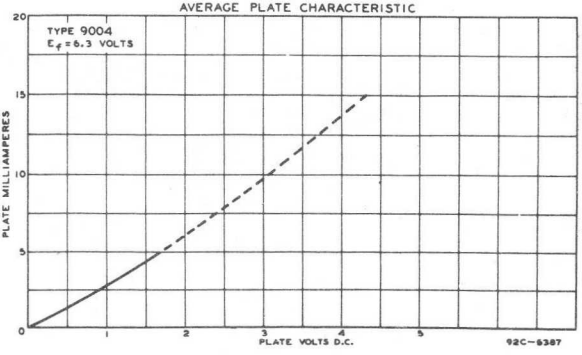
RECTIFIER

A-C Plate Voltage (RMS)	117 max. volts
D-C Output Current	5 max. ma.

The resonant frequency of the 9004 is approximately 850 Mc.

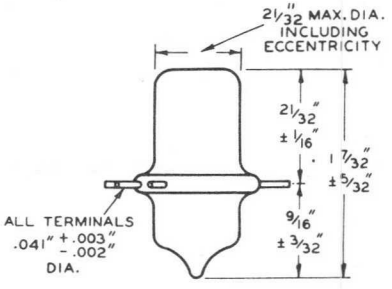
°With no external shield.

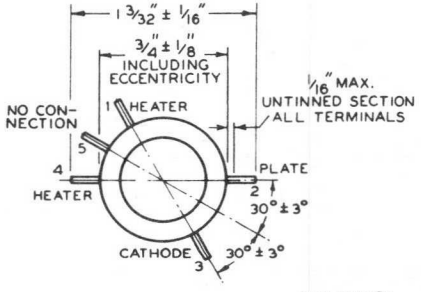
AVERAGE PLATE CHARACTERISTIC



9004

U-H-F DIODE





BOTTOM VIEW

92C-6353R1

→ Indicates a change.

9004

AVERAGE CHARACTERISTICS

