

## Beam Power Tube

FORCED-AIR COOLED AT MAXIMUM RATINGS  
 500 WATTS CW INPUT (ICAS) UP TO 60 Mc  
 335 WATTS CW INPUT (ICAS) UP TO 175 Mc

## GENERAL DATA

## Electrical:

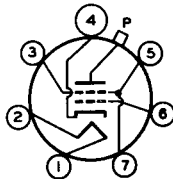
Heater, for Unipotential Cathode:		
Voltage (AC or DC) . . . . .	6.3 ± 10%	volts
Current at 6.3 volts . . . . .	2.85	amp
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 300, grid-No.2 volts = 300, and plate ma = 150. . . . .	7	
Direct Interelectrode Capacitances (Approx.): <sup>a</sup>		
Grid No.1 to plate . . . . .	0.6	μf
Grid No.1 to grid No.2 & internal shield. . . . .	11	μf
Grid No.1 to cathode and heater. . . .	8.5	μf
Grid No.2 & internal shield to plate . . . . .	9.5	μf
Grid No.2 & internal shield to cathode and heater. . . . .	2.0	μf
Plate to cathode and heater. . . . .	0.2	μf

## Mechanical:

Operating Position . . . . .	Any
Maximum Overall Length . . . . .	5"
Seated Length. . . . .	4.44" ± 0.08"
Maximum Diameter . . . . .	2.56"
Weight (Approx.) . . . . .	6 oz
Bulb . . . . .	T20
Socket . . . . .	Johnson Nos.122-247 <sup>b</sup> or 122-248 <sup>b</sup> , or equivalent
Base . . . . .	Jumbo-Button Septar 7-Pin (JEDEC No.E7-46)

## 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

## Thermal:

**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  
 on bulb surface). . . . . 250 max. °C

← Indicates a change.



## AF POWER AMPLIFIER & MODULATOR — Class AB<sub>1</sub><sup>c</sup>

	CCS <sup>d</sup>	ICAS <sup>e</sup>	
<b>Maximum Ratings, Absolute-Maximum Values:</b>			
DC PLATE VOLTAGE. . . . .	1500 max.	2000 max.	volts
DC GRID-NO.2 VOLTAGE. . . . .	400 max.	400 max.	volts
MAX.-SIGNAL DC PLATE CURRENT <sup>f</sup> . . . . .	350 max.	350 max.	ma
MAX.-SIGNAL PLATE INPUT <sup>f</sup> . . . . .	300 max.	400 max.	watts
MAX.-SIGNAL GRID-NO.2 INPUT <sup>f</sup> . . . . .	20 max.	20 max.	watts
PLATE DISSIPATION <sup>f</sup> . . . . .	100 max.	125 max.	watts
<b>PEAK HEATER-CATHODE VOLTAGE:</b>			
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. . . . .	1500	2000	volts
DC Grid-No.2 Voltage <sup>g</sup> . . . . .	400	400	volts
DC Grid-No.1 Voltage <sup>h</sup> . . . . .	-65	-65	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage . . . . .	120	120	volts
Zero-Signal DC Plate Current . . . . .	60	60	ma
Max.-Signal DC Plate Current. . . . .	400	400	ma
Max.-Signal DC Grid-No.2 Current . . . . .	70	70	ma
Effective Load Resistance (Plate to plate). . . . .	8700	12000	ohms
Max.-Signal Driving Power (Approx.) . . . . .	0	0	watts
Max.-Signal Power Output (Approx.) . . . . .	410	560	watts

## LINEAR RF POWER AMPLIFIER — Class AB<sub>1</sub><sup>c</sup> Single-Sideband Suppressed-Carrier Service

CCS<sup>d</sup> ICAS<sup>e</sup>

### Maximum Ratings, Absolute-Maximum Values:

*Up to 60 Mc*

DC PLATE VOLTAGE. . . . .	1500 max.	2000 max.	volts
DC GRID-NO.2 VOLTAGE. . . . .	400 max.	400 max.	volts
MAX.-SIGNAL DC PLATE CURRENT. . . . .	350 max.	350 max.	ma
MAX.-SIGNAL PLATE INPUT . . . . .	300 max.	400 max.	watts
MAX.-SIGNAL GRID-NO.2 INPUT . . . . .	20 max.	20 max.	watts
PLATE DISSIPATION . . . . .	100 max.	125 max.	watts
<b>PEAK HEATER-CATHODE VOLTAGE:</b>			
Heater negative with respect to cathode. . . . .	135 max.	135 max.	volts
Heater positive with respect to cathode. . . . .	135 max.	135 max.	volts



### Typical Operation for "Single-Tone Modulation":<sup>j</sup>

<i>At 60 Mc</i>			
DC Plate Voltage. . . . .	1500	2000	volts
DC Grid-No.2 Voltage <sup>g</sup> . . . . .	400	400	volts
DC Grid-No.1 Voltage <sup>h</sup> . . . . .	-65	-65	volts
Max.-Signal Peak RF Grid-			
No.1 Voltage. . . . .	60	60	volts
Zero-Signal DC Plate Current . . . . .	30	30	ma
Max.-Signal DC Plate Current . . . . .	200	200	ma
Max.-Signal Grid-No.2			
Current . . . . .	35	35	ma
Effective RF Load Resistance. . . . .	4350	6000	ohms
Max.-Signal Driver Power			
Output (Approx.). . . . .	4	4	watts
Output-Circuit Efficiency			
(Approx.) . . . . .	90	90	%
Max.-Signal Useful Power			
Output (Approx.). . . . .	185 <sup>k</sup>	250 <sup>k</sup>	watts

### LINEAR RF POWER AMPLIFIER — Class B Single-Sideband Suppressed-Carrier Service

*High-Mu Triode Connection<sup>m</sup>*

CCS<sup>d</sup>

ICAS<sup>e</sup>

#### Maximum Ratings, Absolute-Maximum Values:

<i>Up to 60 Mc</i>			
DC PLATE VOLTAGE. . . . .	1500 max.	2000 max.	volts
MAX. SIGNAL DC PLATE CURRENT. . . . .	350 max.	350 max.	ma
MAX.-SIGNAL DC GRID CURRENT			
(Combined Grids No.1 &			
No.2) . . . . .	200 max.	200 max.	ma
MAX.-SIGNAL PLATE INPUT . . . . .	300 max.	450 max.	watts
PLATE DISSIPATION . . . . .	100 max.	125 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"<sup>j</sup>*

DC Plate-to-Grids No.1 &			
No.2 Voltage. . . . .	1350	1750	volts
DC Grids No.1 & No.2			
Voltage . . . . .	0	0	volts
Zero-Signal DC Plate Current. . . . .	30	44	ma
Effective RF Load			
Resistance. . . . .	3800	5100	ohms
Max.-Signal DC Plate Current. . . . .	200	200	ma

← indicates a change.



Max.-Signal DC Grid Current (Combined Grids No.1 & No.2).	140	140	ma
Max.-Signal Peak RF Cathode- to-Grids-No.1 & No.2 Voltage.	50	50	volts
Max.-Signal Driver Power Output (Approx.) <sup>h</sup> .	15	15	watts
Output-Circuit Efficiency (Approx.).	90	90	%
Max.-Signal Useful Power Output (Approx.).	160 <sup>k</sup>	210 <sup>k</sup>	watts

## PLATE-MODULATED RF POWER AMPLIFIER — Class C Telephony

*Carrier conditions per tube for use  
with a maximum modulation factor of 1*  
CCS<sup>d</sup> ICAS<sup>e</sup>

### Maximum Ratings, Absolute-Maximum Values:

For maximum plate voltage and maximum plate  
input above 60 Mc see Rating Chart I

DC PLATE VOLTAGE . . . . .	1000 max.	1200 max.	volts
DC GRID-NO.2 VOLTAGE . . . . .	400 max.	400 max.	volts
DC GRID-NO.1 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. . . . .	250 max.	335 max.	watts
GRID-NO.2 INPUT. . . . .	13.5 max.	13.5 max.	watts
PLATE DISSIPATION. . . . .	67 max.	83 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	1200	volts
DC Grid-No.2 Voltage <sup>p</sup> . . . . .	400	400	volts
DC Grid-No.1 Voltage <sup>q</sup> . . . . .	-130	-130	volts
Peak RF Grid-No.1 Voltage. . . . .	145	150	volts
DC Plate Current . . . . .	250	275	ma
DC Grid-No.2 Current . . . . .	20	20	ma
DC Grid-No.1 Current (Approx.)	5	5	ma
Driver Power Output (Approx.) <sup>n,r</sup> . . . . .	5	5	watts
Output-Circuit Efficiency (Approx.). . . . .	90	90	%
Useful Power Output (Approx.).	165 <sup>k</sup>	240 <sup>k</sup>	watts

*At 175 Mc*

DC Plate Voltage . . . . .	700	820	volts
DC Grid-No.2 Voltage <sup>p</sup> . . . . .	400	400	volts
DC Grid-No.1 Voltage <sup>q</sup> . . . . .	-130	-130	volts
DC Plate Current . . . . .	250	275	ma
DC Grid-No.2 Current . . . . .	8	8	ma



DC Grid-No.1 Current (Approx.).	6	6	ma
Driver Power Output (Approx.) <sup>n, r</sup> . . . . .	8	8	watts
Output-Circuit Efficiency (Approx.). . . . .	85	85	%
Useful Power Output (Approx.).	105 <sup>k</sup>	135 <sup>k</sup>	watts

**Maximum Circuit Values:**

Grid-No.1-Circuit Resistance <sup>s</sup> .	30000 max.	30000 max.	ohms
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**RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy<sup>t</sup>**  
and

**RF POWER AMPLIFIER — Class C FM Telephony**

CCS<sup>d</sup>ICAS<sup>e</sup>**Maximum Ratings, Absolute-Maximum Values:**

For maximum plate voltage and maximum plate  
input above 60 Mc, see Rating Chart II

DC PLATE VOLTAGE . . . . .	1250 max.	1500 max.	volts
DC GRID-No.2 VOLTAGE . . . . .	400 max.	400 max.	volts
DC GRID-No.1 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. . . . .	375 max.	500 max.	watts
GRID-No.2 INPUT. . . . .	20 max.	20 max.	watts
PLATE DISSIPATION. . . . .	100 max.	125 max.	watts
<b>PEAK HEATER-CATHODE VOLTAGE:</b>			
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

	CCS <sup>d</sup>		ICAS <sup>e</sup>	
DC Plate Voltage . . . . .	1000	1250	1500	volts
DC Grid-No.2 Voltage <sup>y</sup> . . . . .	400	400	400	volts
DC Grid-No.1 Voltage <sup>v</sup> . . . . .	-100	-100	-100	volts
Peak RF Grid-No.1 Voltage. . . . .	125	120	125	volts
DC Plate Current . . . . .	330	300	330	ma
DC Grid-No.2 Current . . . . .	20	18	20	ma
DC Grid-No.1 Current (Approx.). . . . .	5	5	5	ma
Driver Power Output (Approx.) <sup>n, r</sup> . . . . .	4	4	4	watts
Output-Circuit Efficiency (Approx.). . . . .	90	90	90	%
Useful Power Output (Approx.). . . . .	215 <sup>k</sup>	255 <sup>k</sup>	340 <sup>k</sup>	watts

At 175 Mc

DC Plate Voltage . . . . .	665	875	1000	volts
DC Grid-No.2 Voltage <sup>y</sup> . . . . .	400	400	400	volts



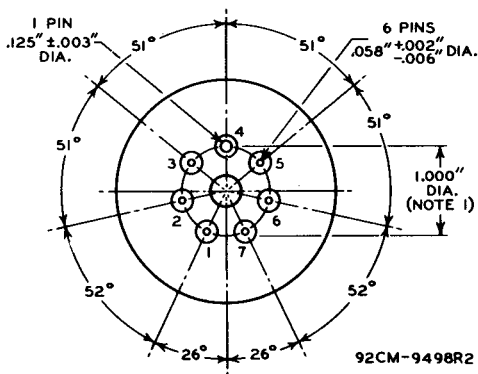
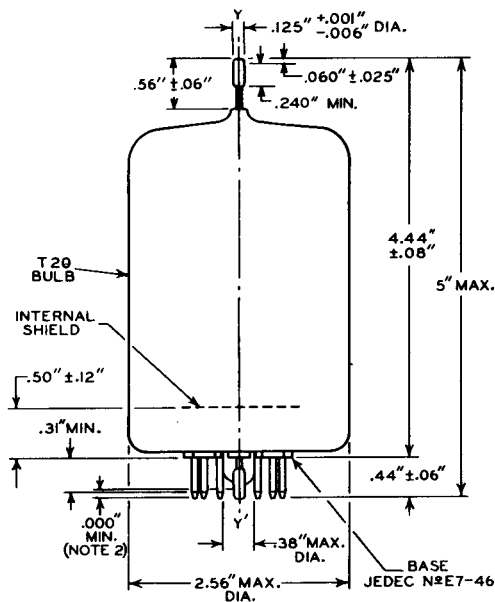
DC Grid-No.1 Voltage <sup>v</sup> . . . . .	-100	-100	-100	volts
DC Plate Current . . . . .	335	300	335	ma
DC Grid-No.2 Current . . . . .	8	7	8	ma
DC Grid-No.1 Current (Approx.) . . . . .	5	5	5	ma
Driver Power Output (Approx.) <sup>n</sup> . . . . .	8	7	8	watts
Output-Circuit Efficiency (Approx.) . . . . .	85	85	85	%
Useful Power Output (Approx.) . . . . .	130 <sup>k</sup>	170 <sup>k</sup>	215 <sup>k</sup>	watts

### Maximum Circuit Values:

Grid-No.1-Circuit Resistance <sup>a</sup> . . . . .	30000 max.	ohms
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- <sup>a</sup> without external shield.
- <sup>b</sup> E.F. Johnson Company, Waseca, Minnesota. The separate shield rings furnished with these sockets should be discarded since these rings do not accommodate the 7094.
- <sup>c</sup> Subscript 1 indicates that grid-No.1 current does not flow during any part of the input cycle.
- <sup>d</sup> Continuous Commercial Service.
- <sup>e</sup> Intermittent Commercial and Amateur Service.
- <sup>f</sup> Averaged over any audio-frequency cycle of sine-wave form.
- <sup>g</sup> Obtained preferably from a fixed supply.
- <sup>h</sup> Obtained from a fixed supply.
- <sup>j</sup> "Single-Tone Modulation" 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-side-band suppressed-carrier system when a single audio frequency of constant amplitude is applied to the input of the system.
- <sup>k</sup> This value of useful power is measured at load of output circuit having indicated efficiency.
- <sup>m</sup> Grids No.1 and No.2 connected together.
- <sup>n</sup> 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.
- <sup>p</sup> 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.
- <sup>q</sup> 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.
- <sup>r</sup> Indicated values are for operation at 60 Mc. Less driver power output is required at frequencies below 60 Mc.
- <sup>s</sup> When grid No.1 is driven positive the total dc grid-No.1-circuit resistance should not exceed the specified maximum 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.
- <sup>t</sup> 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.
- <sup>u</sup> 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.
- <sup>v</sup> Obtained from a grid-No.1 resistor, or from a combination of grid-No.1 resistor with either fixed supply or cathode resistor.





THE REFERENCE AXIS Y-Y' IS DEFINED AS THE AXIS OF THE BASE PIN GAUGE DESCRIBED IN NOTE 1:

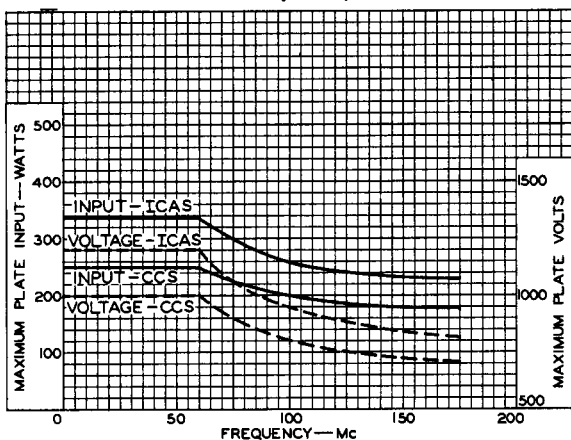
**NOTE 1:** ANGULAR VARIATIONS BETWEEN PINS AND VARIATION IN PIN-CIRCLE DIAMETER ARE HELD TO TOLERANCES SUCH THAT PINS WILL ENTER TO A DISTANCE OF 0.375" A FLAT-PLATE BASE-PIN GAUGE HAVING SIX HOLES 0.0800"  $\pm$  0.0005" AND ONE HOLE 0.1450"  $\pm$  0.0005" ARRANGED ON A 1.0000"  $\pm$  0.0005" DIAMETER CIRCLE AT SPECIFIED ANGLES WITH TOLERANCE OF  $\pm$  5' FOR EACH ANGLE. GAUGE IS ALSO PROVIDED WITH A HOLE 0.500"  $\pm$  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.



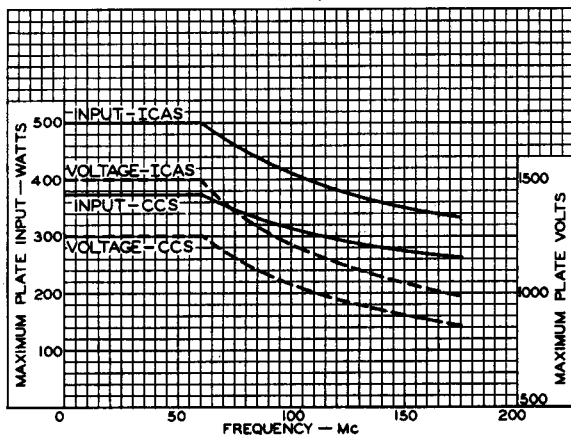


## RATING CHART I Class C Telephony Service



92CS-9492

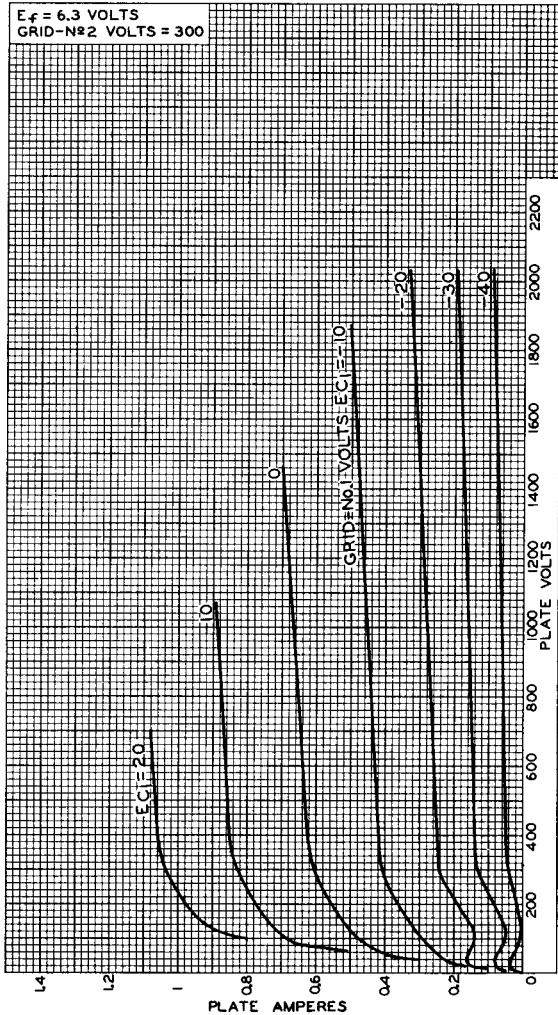
## RATING CHART II Class C Telephony Service



92CS-9491



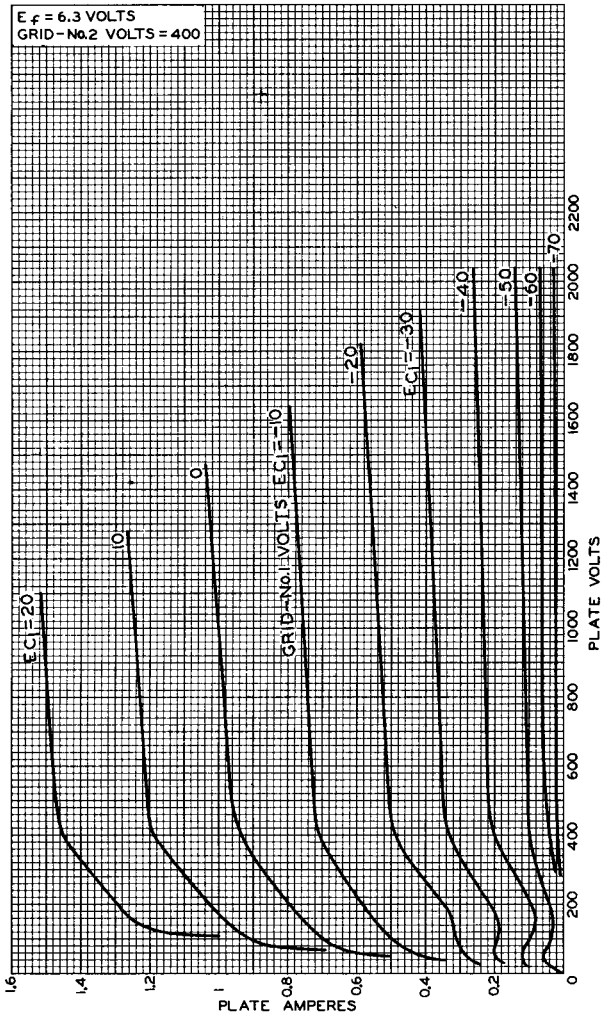
## TYPICAL PLATE CHARACTERISTICS



92CM-9511



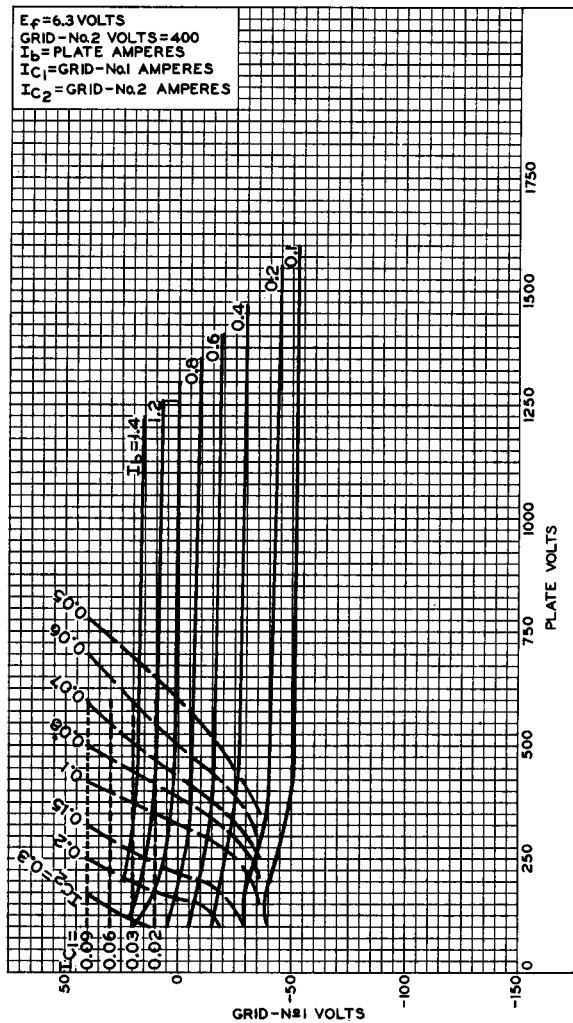
## TYPICAL PLATE CHARACTERISTICS



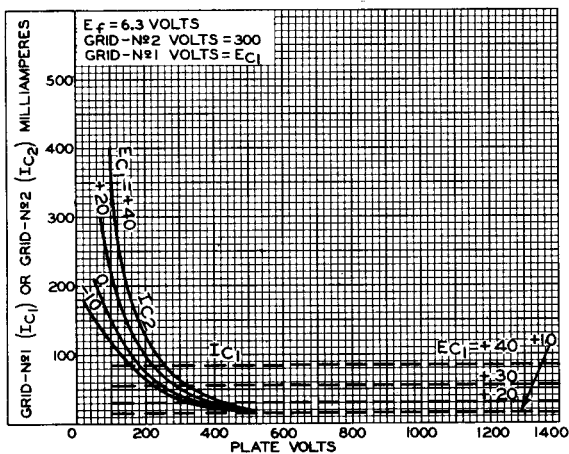
92CM-9502RI



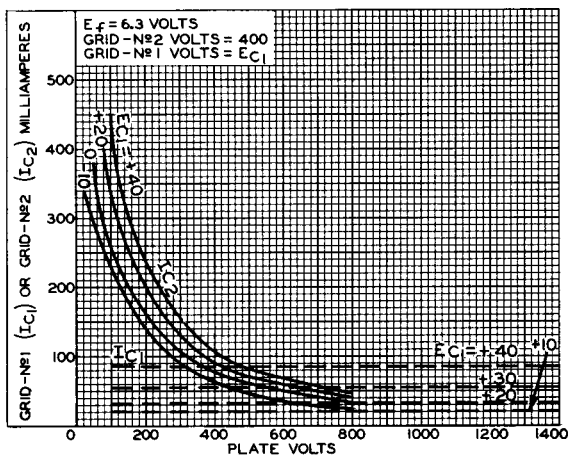
## AVERAGE CONSTANT-CURRENT CHARACTERISTICS



## TYPICAL CHARACTERISTICS



92CS-9501R1

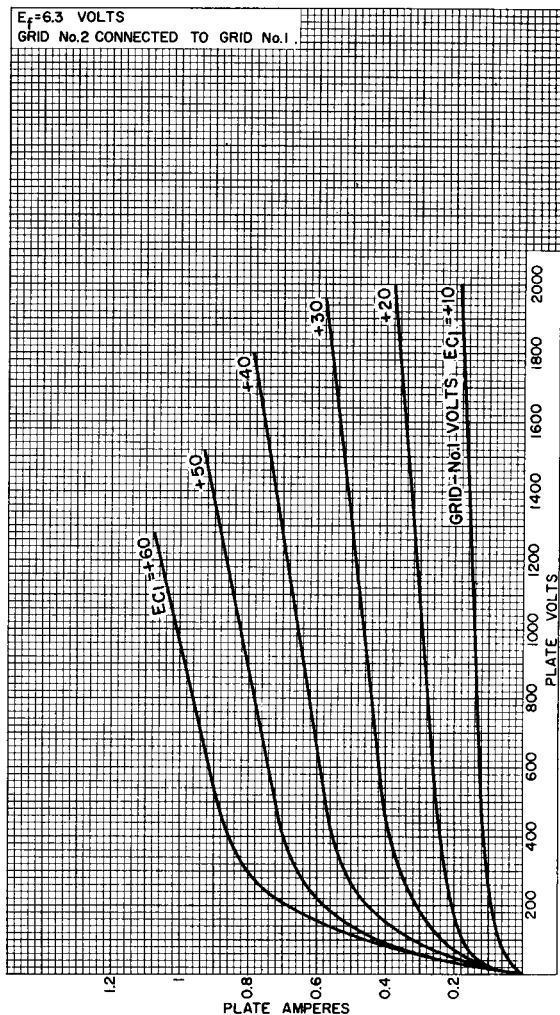


92CS-9500R1



# TYPICAL PLATE CHARACTERISTICS

## Triode Connection

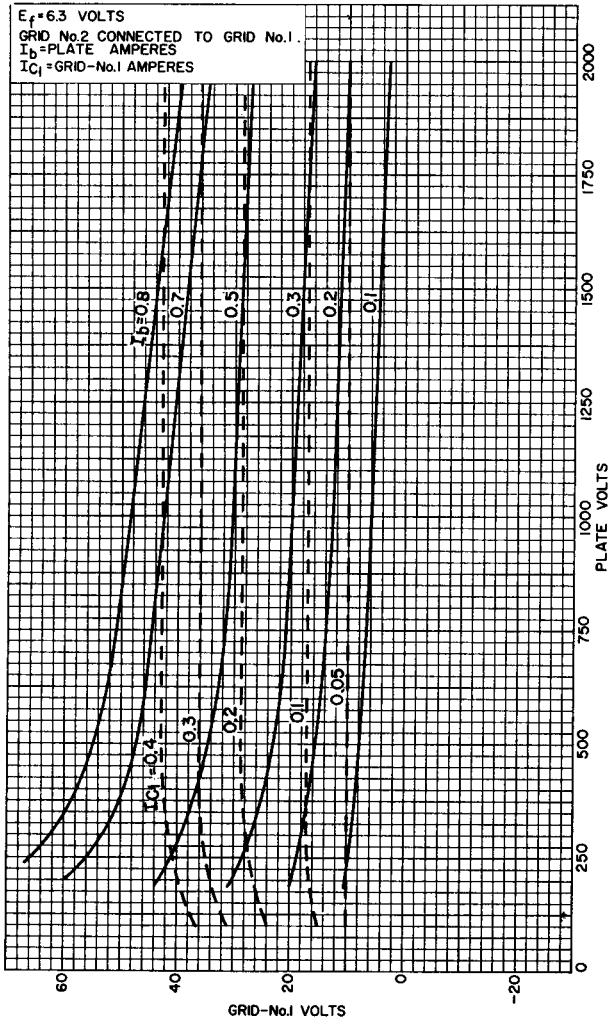


92CM-11045RI



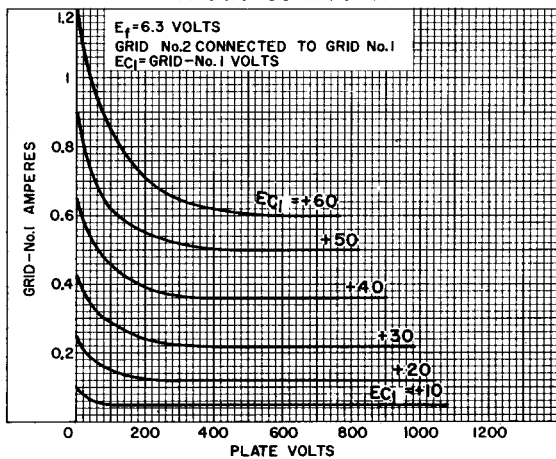
# TYPICAL CONSTANT-CURRENT CHARACTERISTICS

## Triode Connection



92CM-11047RI



TYPICAL CHARACTERISTICS  
Triode Connection

92CS-11046RI