

Beam Power Tube

HIGH POWER SENSITIVITY
90 WATTS CW INPUT (ICAS)
UP TO 60 Mc

RCA "DARK HEATER"
60 WATTS CW INPUT (ICAS)
AT 175 Mc

CONTROLLED ZERO-BIAS
PLATE CURRENT

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
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Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 200, grid-No.2 volts = 200, and plate ma. = 100.	4.5	
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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
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Plate to cathode & grid No.3 & internal shield, grid No.2, base sleeve, and heater	8.5	pf
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Mechanical:

Operating Position.	Any
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Maximum Overall Length.	3-13/16"
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Seated Length	3-1/8" ± 1/8"
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Maximum Diameter.	1-23/32"
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Weight (Approx.).	2.3 oz
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Bulb.	T12
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Cap	Small (JEDEC No.C1-1)
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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

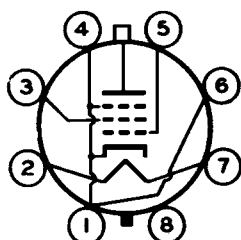
Basing Designation for BOTTOM VIEW. 7CK

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 AB₁^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

Typic^{a1} 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 AB₂^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 AB₁ 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
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RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy^v 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

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



CCS ICAS

Typical Operation:

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
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^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 AB₁ 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 AB₂ stage.

ⁿ To minimize distortion, the effective resistance per grid-No.1 circuit of the AB₂ 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 and 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 $\pm$ 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	
	<i>Voltage</i>	<i>Input</i>	<i>Voltage</i>	<i>Input</i>
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.

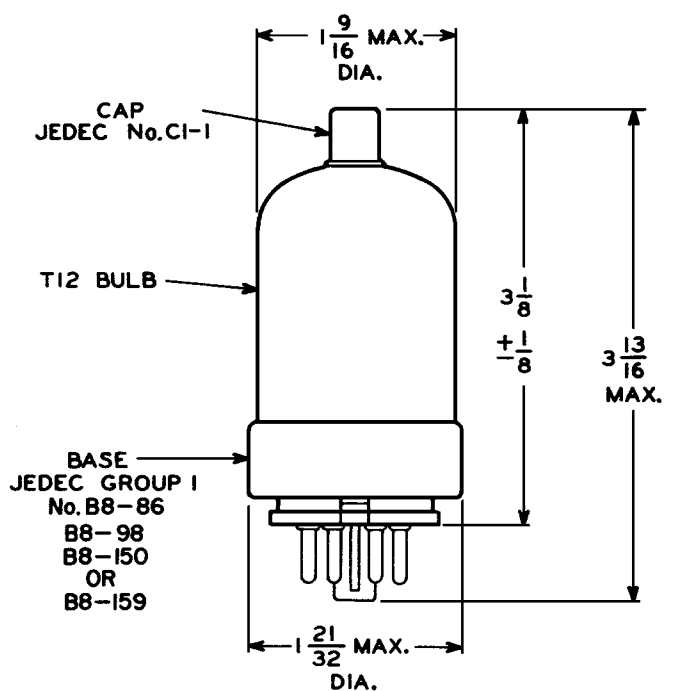
Connections to the plate should be made with a flexible lead to prevent any strain on the seal at the cap.

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.



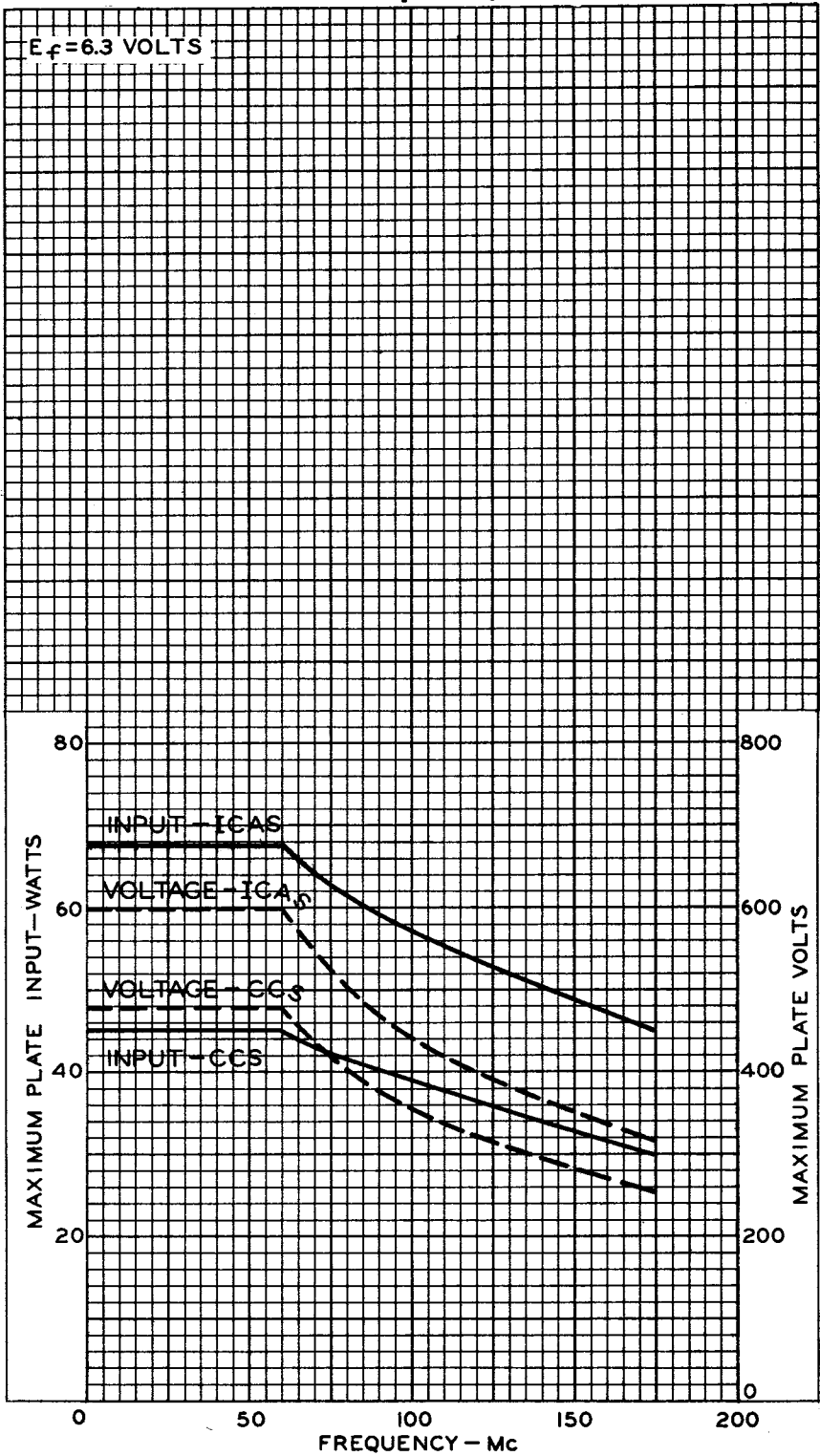
6146A



92CS-1204IR1

DIMENSIONS IN INCHES

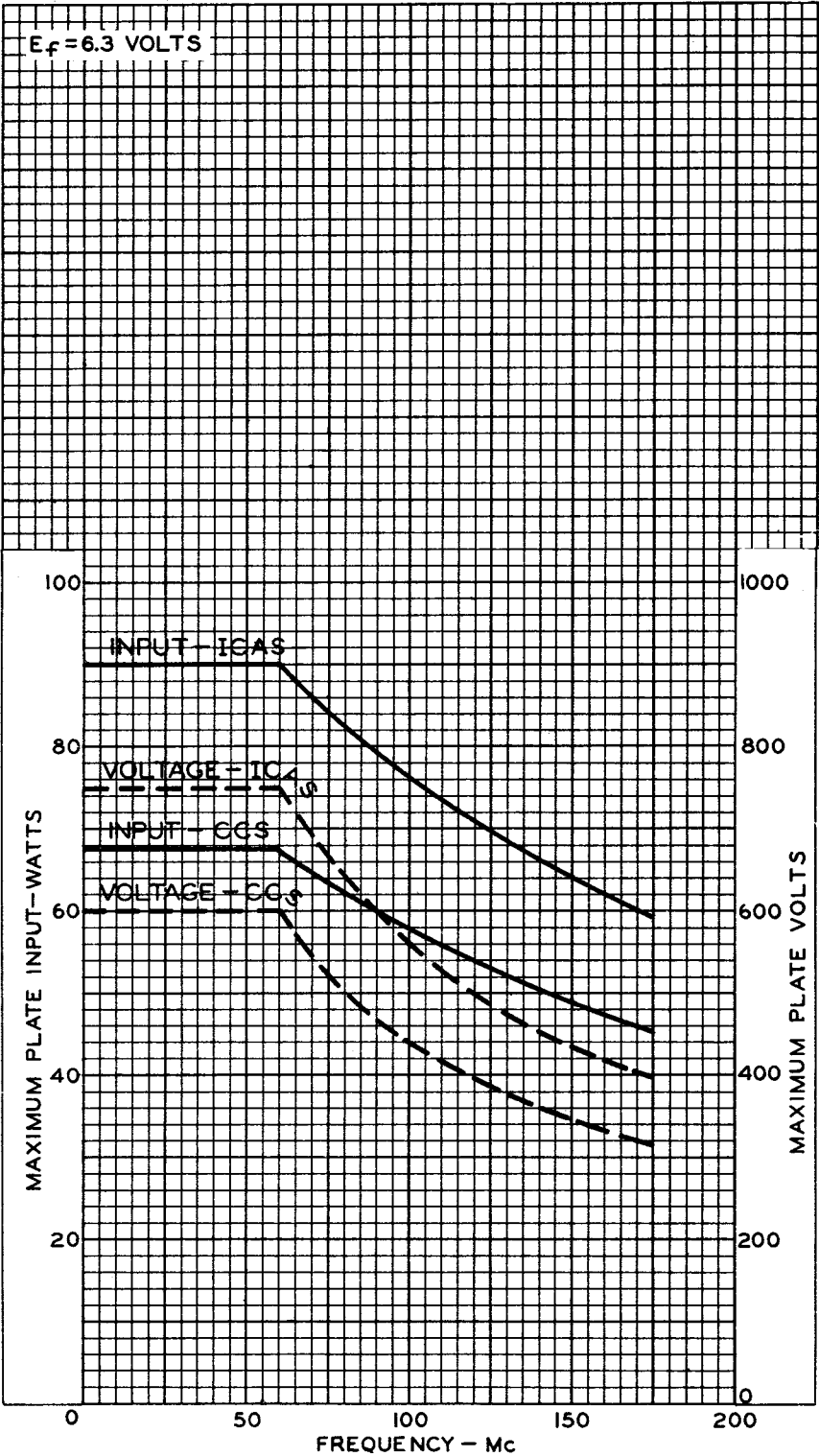
RATING CHART I Class C Telephony Service



92CM-7712RI



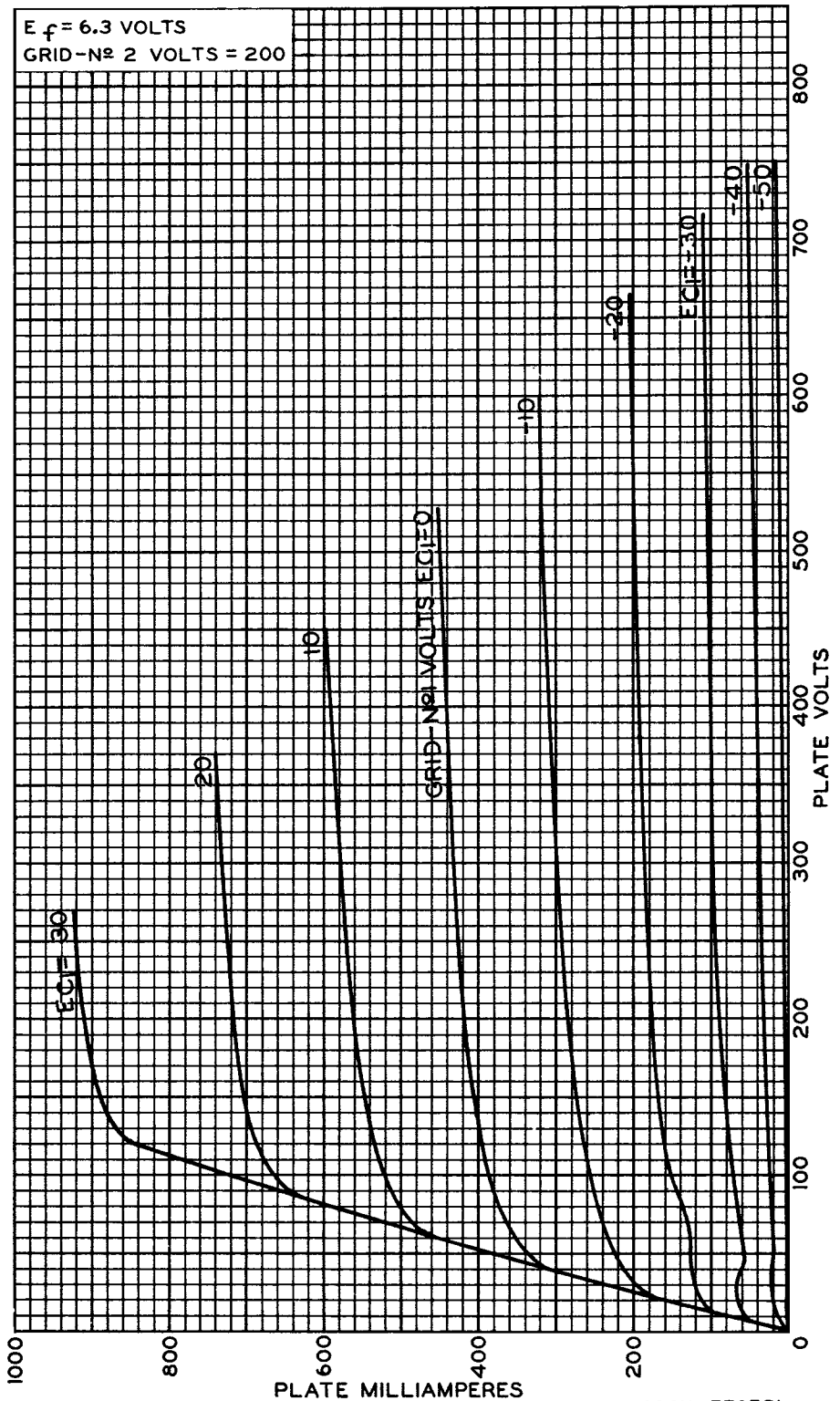
RATING CHART II
Class C Telegraphy Service



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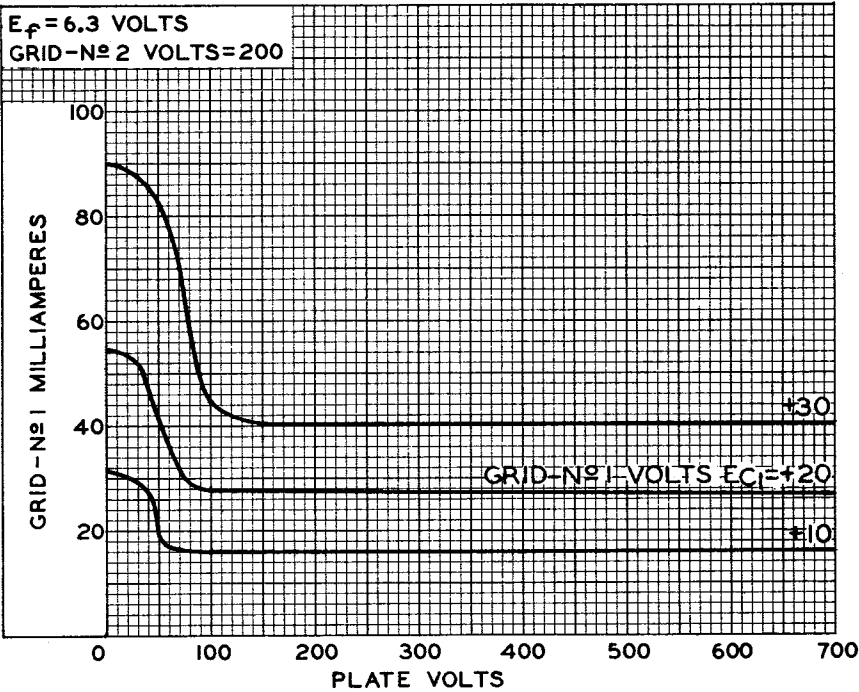
TYPICAL PLATE CHARACTERISTICS



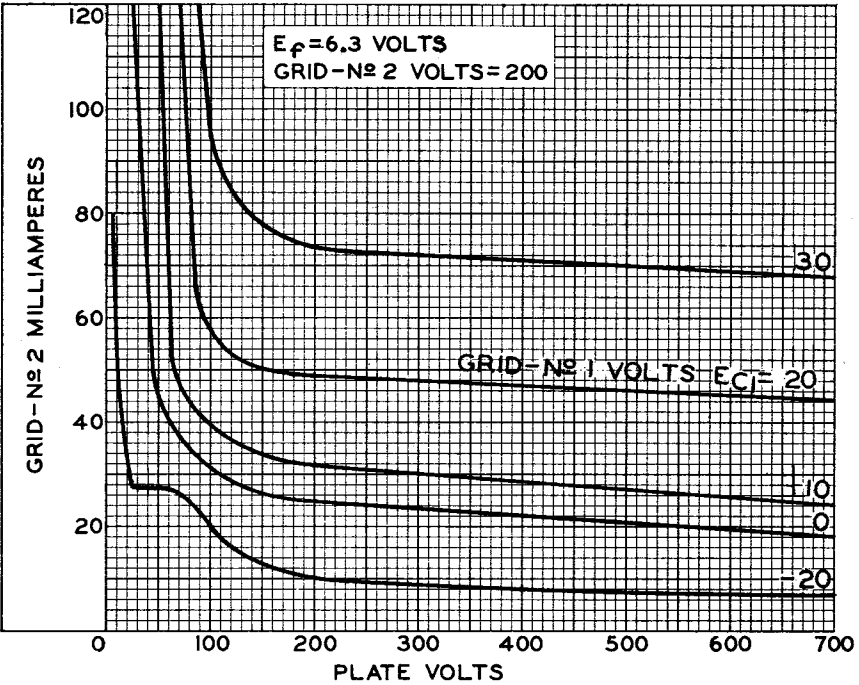
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TYPICAL CHARACTERISTICS



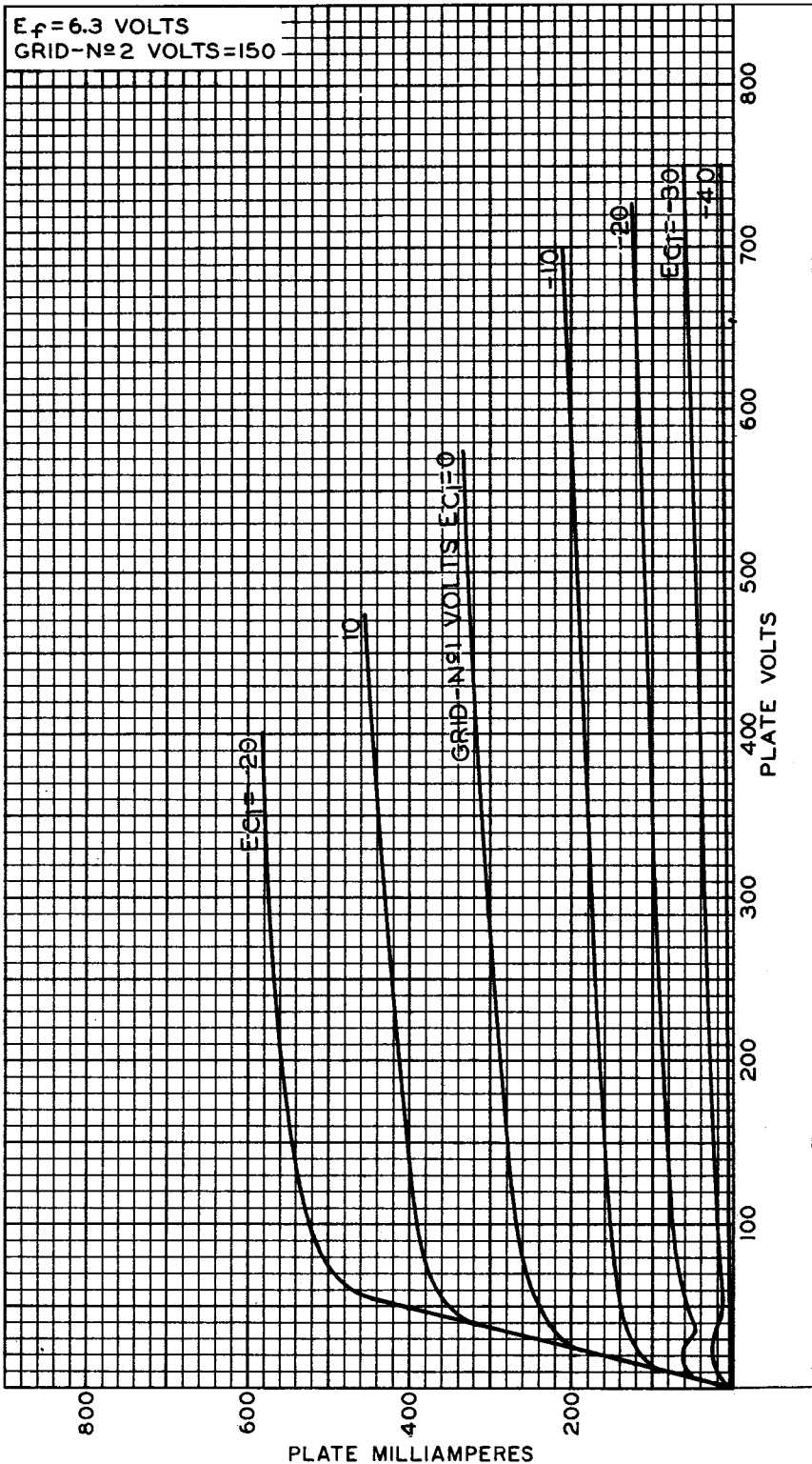
92CS-9617



92CS-9618



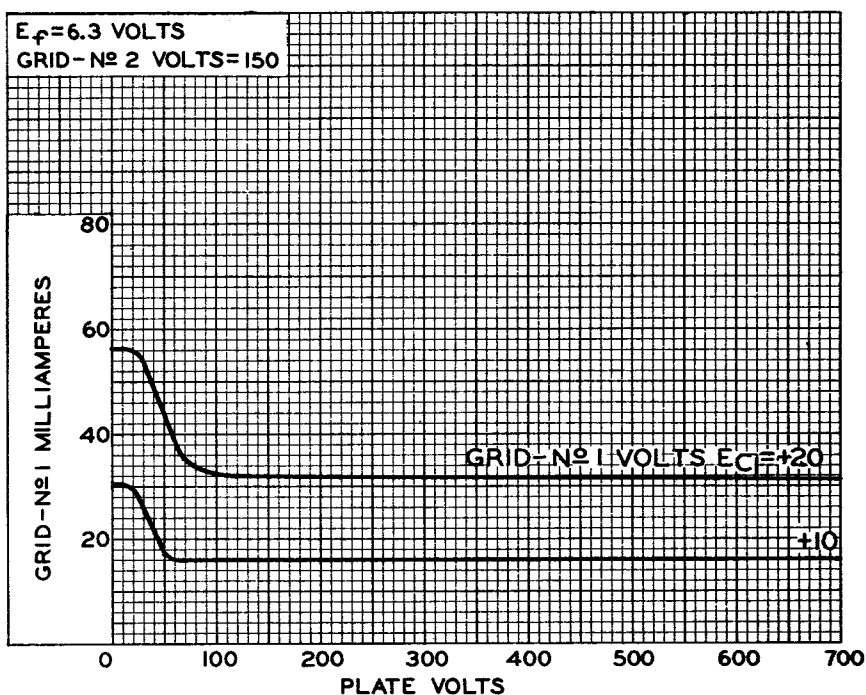
TYPICAL PLATE CHARACTERISTICS



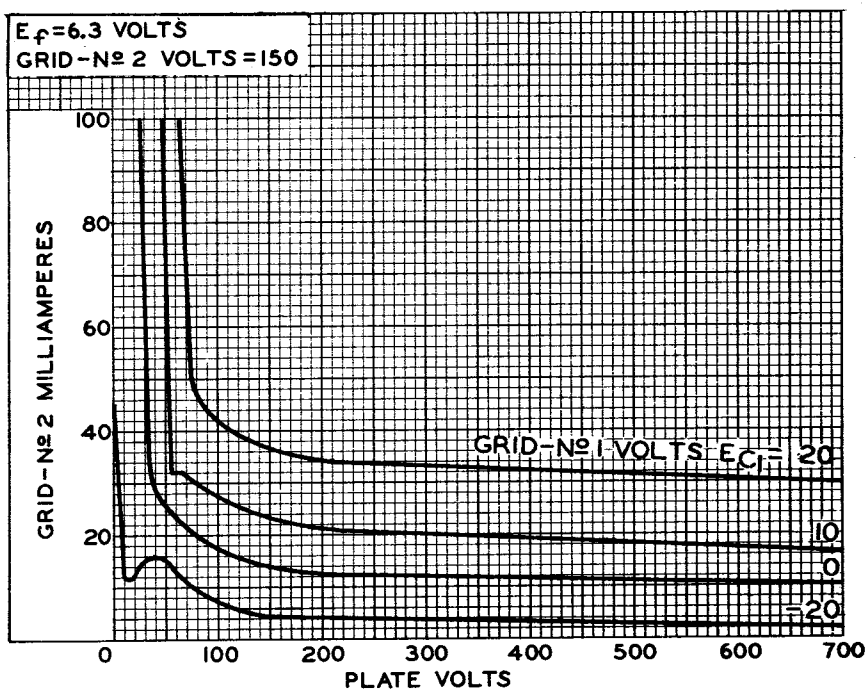
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TYPICAL CHARACTERISTICS



92CS-9619



92CS-9620