6146

VHF BEAM POWER AMPLIFIER

GENERAL DATA

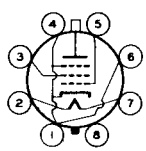
Electrical:

Heater, for Unipotential Cathode:		
Voltage	6.3 ± 10%	ac or dc volts
Current	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	0.22 max.	μμf
Input	13.5	μμf
Output	8.5	μμf

Mechanical:

Mounting Position	Any
Overall Length	3-11/16" ± 1/8"
Seated Length	3-1/8" ± 1/8"
Maximum Diameter	1-23/32"
Bulb	T-12
Cap	Small (JETEC No.C1-1)
Base	Large-Wafer Octal 8-Pin Micanol with Sleeve No.R-6876 (JETEC No.B8-86)

BOTTOM VIEW



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) . . . . . 220 max. °C

AF POWER AMPLIFIER & MODULATOR--Class AB1†

Triode Connection--Grid No.2 Connected to Plate

	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

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

†, •, ••, **: See next page.

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VHF BEAM POWER AMPLIFIER

	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:

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.	110	80	80	ma
Max.-Signal DC Plate Current.	144	136	136	ma
Effective Load Resistance (Plate to plate)	5000	8000	8000	ohms
Max.-Signal Driving Power (Approx.).	0	0	0	watts
Total Harmonic Distortion. .	5	4.6	4.6	%
Max.-Signal Power Output (Approx.)	8	19	19	watts

Maximum Circuit Values (CCS or ICAS Conditions):

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.	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

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

○ 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.

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RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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VHF BEAM POWER AMPLIFIER

	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 CCS Operation:

Values are for 2 tubes

DC Plate Voltage	400	500	600	volts
DC Grid-No.2 Voltage▲	190	180	190	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	86	70	60	ma
Max.-Signal DC Plate Current	228	220	200	ma
Zero-Signal DC Grid-No.2 Current	2	1.4	1	ma
Max.-Signal DC Grid-No.2 Current	30	19.5	30.5	ma
Effective Load Resistance (Plate to plate)	4000	5000	7500	ohms
Max.-Signal Driving Power (Approx.)	0	0	0	watts
Total Harmonic Distortion	8	8	8	%
Max.-Signal Power Output (Approx.)	55	70	82	watts

Typical ICAS Operation:

Values are for 2 tubes

DC Plate Voltage	600	750	volts
DC Grid-No.2 Voltage▲	200	200	volts
DC Grid-No.1 (Control-Grid) Voltage:			
From fixed-bias source	-50	-50	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage	100	100	volts
Zero-Signal DC Plate Current	52	57	ma
Max.-Signal DC Plate Current	239	227	ma
Zero-Signal DC Grid-No.2 Current	1.2	1	ma
Max.-Signal DC Grid-No.2 Current	25.2	27.5	ma
Effective Load Resistance (Plate to plate)	5500	8000	ohms
Max.-Signal Driving Power (Approx.)	0	0	watts
Total Harmonic Distortion	7.5	5.7	%
Max.-Signal Power Output (Approx.)	94	120	watts

Maximum Circuit Values (CCS or ICAS Conditions):

Grid-No.1-Circuit Resistance:○○		
With fixed bias	0.1 max.	megohm
With cathode bias	Not recommended	

•, ••, ••, ○○, ▲: See next page.

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VHF BEAM POWER AMPLIFIER

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	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

Typical CCS 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	-40	-40	-45	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage	86	87	99	volts
Zero-Signal DC Plate Current	63	64	31	ma
Max.-Signal DC Plate Current	232	242	207	ma
Zero-Signal DC Grid-No.2 Current	1.5	1.2	0.7	ma
Max.-Signal DC Grid-No.2 Current	28	26	31	ma
Max.-Signal DC Grid-No.1 Current	0.3	0.3	0.5	ma
Effective Load Resistance (Plate to plate)	4000	5000	7500	ohms
Max.-Signal Driving Power (Approx.)◆	0.01	0.01	0.02	watt
Total Harmonic Distortion	9.7	9.7	9.7	%
Max.-Signal Power Output (Approx.)	60	81	90	watts

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

∞ 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 the specified value of 0.1 megohm. 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 the specified value of 0.5 megohm.

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

●, ●●, ▲, ◆: See next page.

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VHF BEAM POWER AMPLIFIER

Typical ICAS Operation:

	Values are for 2 tubes		
DC Plate Voltage	600	750	volts
DC Grid-No.2 Voltage▲	185	165	volts
DC Grid-No.1 (Control-Grid) Voltage:			
From fixed-bias source	-50	-45	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage	113	101	volts
Zero-Signal DC Plate Current	41	35	ma
Max.-Signal DC Plate Current	270	240	ma
Zero-Signal DC Grid-No.2 Current	0.9	0.6	ma
Max.-Signal DC Grid-No.2 Current	29	21	ma
Max.-Signal DC Grid-No.1 Current	0.8	0.7	ma
Effective Load Resistance (Plate to plate)	5500	8000	ohms
Max.-Signal Driving Power (Approx.)♦	0.04	0.03	watt
Total Harmonic Distortion	11	10	%
Max.-Signal Power Output (Approx.)	115	130	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 max. modulation factor of 1.0

	CCS●	*ICAS*●●	
Maximum Ratings, *Absolute Values*:			
DC PLATE VOLTAGE	480 max.	600 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	250 max.	250 max.	volts
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.	4.0 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

▲ 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 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 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.

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VHF BEAM POWER AMPLIFIER

	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:				
DC Plate Voltage	400	475	600	volts
DC Grid-No.2 Voltage♦	150	135	150	volts
From a series resistor of	21500	26500	37500	ohms
DC Grid-No.1 Voltage★	-85	-85	-85	volts
From a grid resistor of	28300	28300	28300	ohms
Peak RF Grid-No.1 Voltage	100	99	100	volts
DC Plate Current	112	94	113	ma
DC Grid-No.2 Current	11.6	12.8	12	ma
DC Grid-No.1 Current (Approx.)	3	3	3	ma
Driving Power (Approx.)	0.3	0.3	0.3	watt
Power Output (Approx.)	34	33	52	watts
Maximum Circuit Values (CCS or ICAS Conditions):				
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) VOLTAGE	250 max.	250 max.	volts
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.	4.0 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

♦ Obtained preferably from a separate source modulated 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.

□ 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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VHF BEAM POWER AMPLIFIER

	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 as Amplifier 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	29200	40200	28000	40100	ohms
DC Grid-No.1 Voltage■	-85	-85	-85	-85	volts
From a grid-No.1 resistor of	28300	28300	28300	28300	ohms
From a cathode resistor of	570	670	510	620	ohms
Peak RF Grid-No.1 Voltage	99	100	102	100	volts
DC Plate Current	135	113	150	120	ma
DC Grid-No.2 Current	11.3	11.2	15	14.7	ma
DC Grid-No.1 Current (Approx.)	3	3	3	3	ma
Driving Power (Approx.)	0.3	0.3	0.3	0.3	watt
Power Output (Approx.)	50	52	69	69	watts

Typical Operation as Amplifier at 175 Mc:			
DC Plate Voltage	320	400	volts
DC Grid-No.2 Voltage●●	180	200	volts
From a series resistor of	15500	22200	ohms
DC Grid-No.1 Voltage■	-54	-54	volts
From a grid resistor of	30000	30000	ohms
From a cathode resistor of	360	335	ohms
Peak RF Grid-No.1 Voltage	70	70	volts
DC Plate Current	140	150	ma
DC Grid-No.2 Current	9	9	ma
DC Grid-No.1 Current (Approx.)	1.8	1.8	ma
Driving Power (Approx.)	2	3	watts
Power Output (Approx.)	25	35	watts

● Continuous Commercial Service.

●● Intermittent Commercial and Amateur 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 6146 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.

‡: See next page.

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Maximum Circuit Values (CCS or ICAS Conditions):

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

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

(Preliminary)

	Note	Min.	Max.	
Heater Current	1	1.175	1.325	amp
Grid-No.1-to-Plate Capacitance.	2	–	0.22	μμf
Input Capacitance.	2	11.1	15.9	μμf
Output Capacitance	2	6.4	10.6	μμf
Plate Current.	3	45	83	ma
Grid-No.2 Current.	3	–	5	ma
Useful Power Output.	4	47.5	–	watts

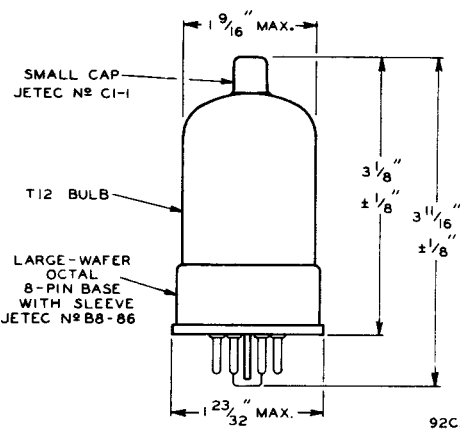
Note 1: With 6.3 volts ac on heater.

Note 2: With no external shield. Base sleeve (pin No.8) is grounded.

Note 3: With 5.5 volts ac on heater, 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 5.5 volts ac on heater, dc plate voltage of 600 volts, dc grid-No.2 voltage of 180 volts, grid-No.1 resistor of 0.030 ± 10% megohm, max. dc plate current of 100 ma. to 112 ma., dc grid-No.1 current of 2 to 2.5 ma., and frequency of 15 Mc.

‡ 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.



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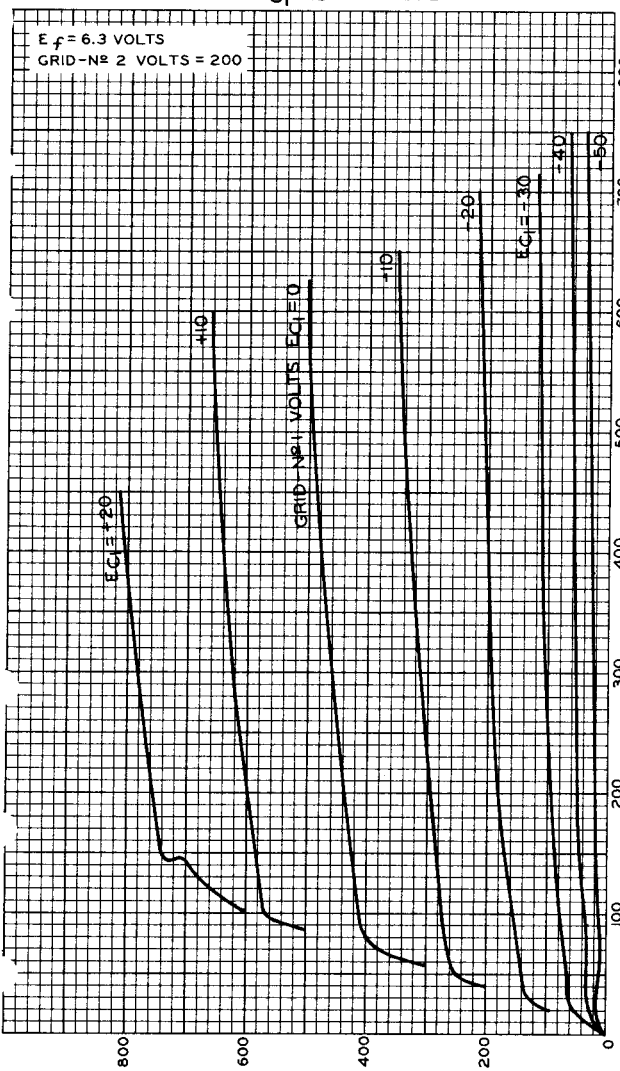
AVERAGE PLATE CHARACTERISTICS
WITH E_{C1} AS VARIABLE



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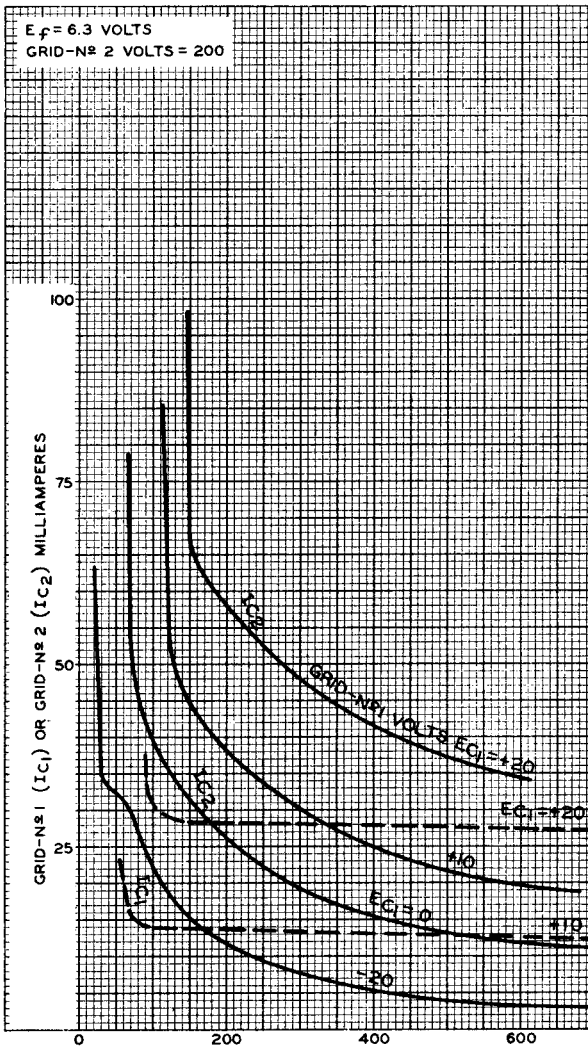
AVERAGE CHARACTERISTICS



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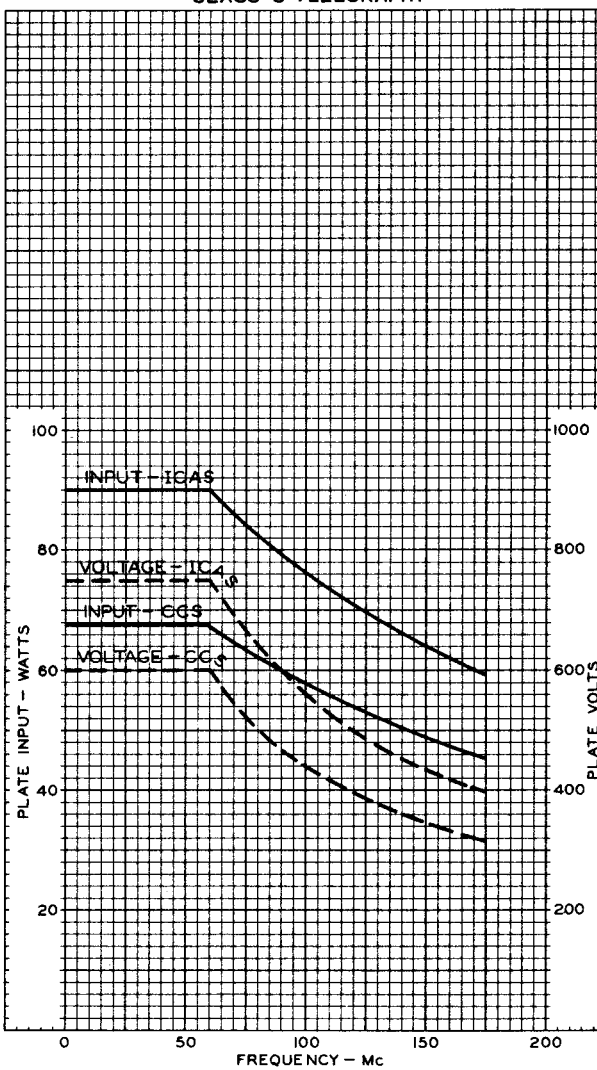
MAXIMUM RATINGS vs OPERATING FREQUENCY

CLASS C TELEGRAPHY



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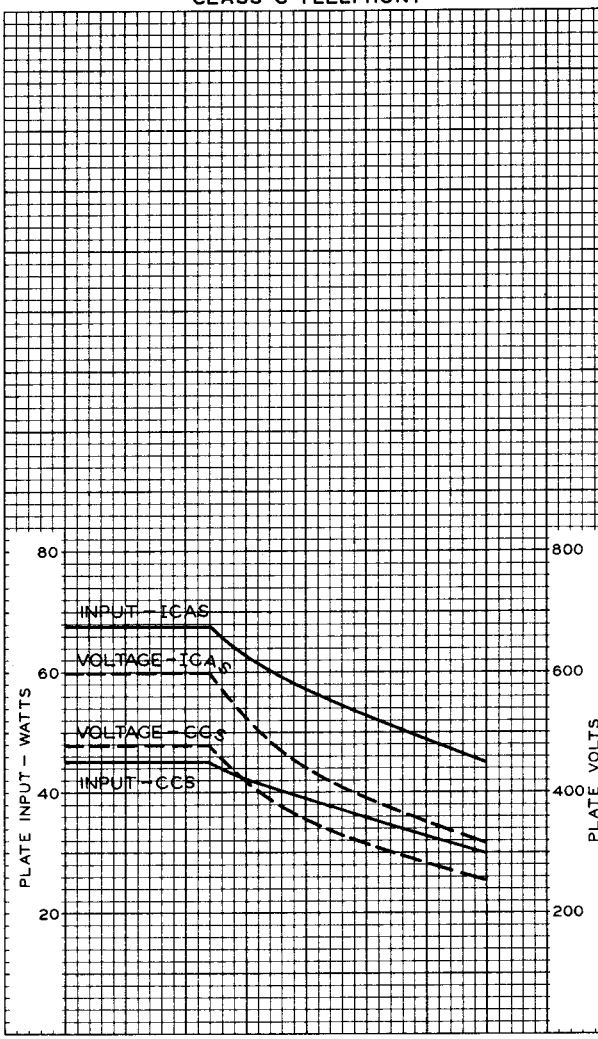
MAXIMUM RATINGS vs OPERATING FREQUENCY

CLASS C TELEPHONY



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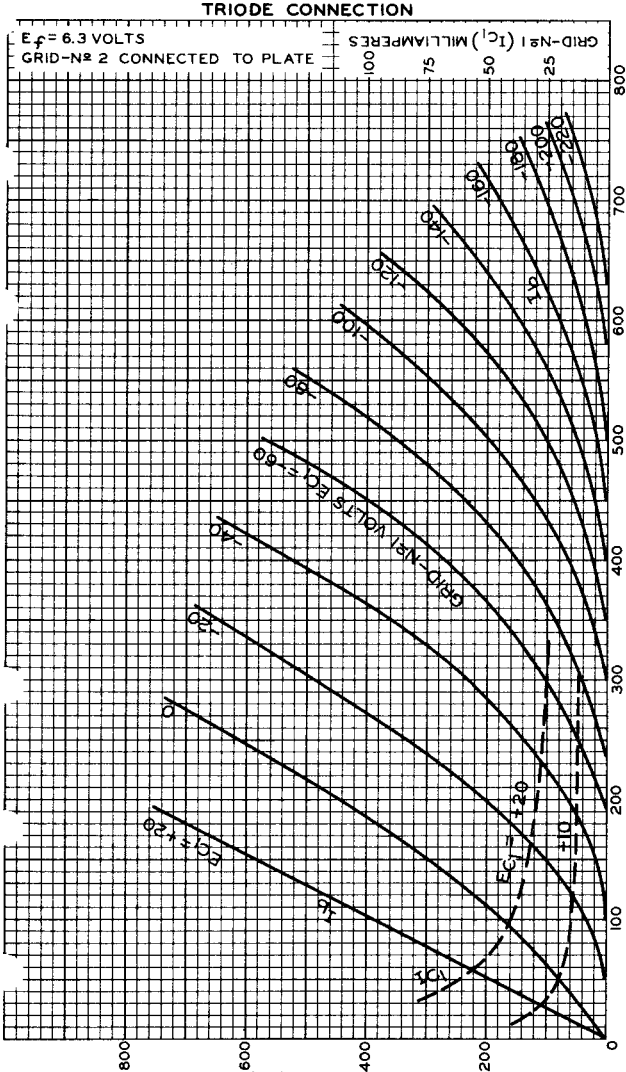
AVERAGE CHARACTERISTICS

TRIODE CONNECTION



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