Transmitting Tubes

RCA TUBE
HANDBOOK
HB-3

TRANSMITTING TUBE SECTION

This Section contains data on vacuum power tubes, rectifier tubes, magnetrons, and other tube types used in broadcast, television, and communications transmitters, as well as in other types of electronic equipment handling appreciable power.

For further Technical Information, write to Commercial Engineering, Tube Division, Radio Corporation of America, Harrison, N. J.

Typical Operation: Power Output Approx. Watts	RCA Type	Filament or Heater Volts	Cooling	Name	Max. Plate Ratings: Volts	Max. Plate Ratings: Dissipation Watts
Class AB_1 Amplifiers, AF[b] (cont'd)						
80	7842	6.3	C	CT	1000	-
80	7843	26.5	C	CT	1000	-
80	7844	6.3	C	CT	600	-
82[a]	6146	6.3	N	BPT	600	20
82[a]	6146W/ 7212	6.3	N	BPT	600	20
82[a]	6159	26.5	N	BPT	600	20
82[a]	6159W/ 7357	26.5	N	BPT	600	20
82[a]	6883	12.6	N	BPT	600	20
82[a]	7212	6.3	N	BPT	600	20
82[a]	7357	26.5	N	BPT	600	20
82[a]	8032	13.5	N	BPT	600	20
115	845	10	N	T	1250	100
190[a]	7271	13.5	FA	BPT	1100	60
300[a]	828	10	N	BPT	1750	70
345	6155/ 4-125A	5	FA	BPT	3000	125
380[a]	813	10	N	BPT	2250	100
410[a]	7094	6.3	FA	BPT	1500	100
580	7034/ 4X150A	6	FA	BPT	2000	250
580	7035/ 4X150D	26.5	FA	BPT	2000	250
590	7203/ 4CX250B	6	FA	BPT	2000	250
590	7204/ 4CX250F	26.5	FA	BPT	2000	250
635	6156/ 4-250A	5	FA	BPT	4000	250
1600	7650	6.3	FA	CT	3000	600

[d] Quick filament-heating type.

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Typical Operation: Power Output Approx. Watts	RCA Type	Filament or Heater Volts	Cooling	Name	Max. Plate Ratings: Volts	Max. Plate Ratings: Dissipation Watts
Class AB_2 Amplifiers, AF[b]						
36	1619	2.5	N	BPT	400	15
40[a]	6524	6.3	N	TBPT	500	20
40[a]	6850	12.6	N	TBPT	500	20
42[a]	2E24	6.3[d]	N	BPT	400	10
42[a]	2E26	6.3	N	BPT	600	10
42[a]	815	6.3/ 12.6	N	TBPT	400	20
42[a]	6893	12.6	N	BPT	600	10
72	1624	2.5	N	BPT	600	25
80[a]	807	6.3	N	BPT	600	25
80[a]	1625	12.6	N	BPT	600	25
90[a]	6146	6.3	N	BPT	600	20
90[a]	6146W/ 7212	6.3	N	BPT	600	20
90[a]	6159	26.5	N	BPT	600	20
90[a]	6159W/ 7357	26.5	N	BPT	600	20
90[a]	6883	12.6	N	BPT	600	20
90[a]	7212	6.3	N	BPT	600	20
90[a]	7357	26.5	N	BPT	600	20
90[a]	8032	13.5	N	BPT	600	20
140	6816	6.3	FA	CT	1000	115
140	6884	26.5	FA	CT	1000	115
140	7457	6.3	FA	CT	1000	115
140	7842	6.3	C	CT	1000	-
140	7843	26.5	C	CT	1000	-
140	7844	6.3	C	CT	1000	-
550	6155/ 4-125A	5	FA	BPT	3000	125
630	7034/ 4X150A	6	FA	BPT	2000	250

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The *Maximum Ratings* shown are for Continuous Commercial Service, unless otherwise shown.

[a] Intermittent Commercial and Amateur Service ratings are also shown in data.

[b] Typical power output is for two tubes, except for twin-unit types.

[c] Cermolox type is a beam power tube with precision-aligned grids, unitized electrode-and-terminal in coaxial configuration, and ceramic-metal construction.

Cooling	Name
C - Conduction	BPT - Beam Power Tube
	CT - Beam Power Tube—Cermolox Type[c]
FA - Forced-Air	P - Pentode
	PP - Twin Pentode
	T - Triode
N - Natural	TBPT - Twin Beam Power Tube
	TP - Triode Pentode
	TR - Tetrode
L - Liquid (See Data)	TT - Twin Triode
	TTR - Twin Tetrode

Typical Operation Power Output Approx. Watts	RCA Type	Filament or Heater Volts	Cooling	Name	Max. Plate Ratings Volts	Max. Plate Ratings Dissipation Watts
Class A Amplifiers, AF						
-	**6F4**[t]	6.3	N	T	150	2
-	**958A**[t]	1.25	N	T	135	0.6
-	**5718**[t]	6.3	N	T	165	3.3
-	**7060**[t]	12-15	N	TP	300	3
0.135	**955**[t]	6.3	N	T	250	1.6
0.333	**3A5**[t]	1.4/2.8	N	TT	135	0.5
0.6	**5556**	4.5	N	T	350	7.5
1.4	**5618**	3/6	N	P	300	5
2.7	**5686**[t]	6.3	N	BPT	275	8.25
3	**1619**	2.5	N	BPT	400	15

Typical Operation Power Output Approx. Watts	RCA Type	Filament or Heater Volts	Cooling	Name	Max. Plate Ratings Volts	Max. Plate Ratings Dissipation Watts
Class A Amplifiers, AF (cont'd)						
3.8	**801A**	7.5	N	T	600	20
3.9	**2E24**	6.3[d]	N	BPT	300	10
6.5[a]	**802**	6.3	N	P	500	-
30	**845**	10	N	T	1250	100
Class AB_1 Amplifiers, AF[b]						
15[a]	**807**	6.3	N	BPT	400	25[e]
15[a]	**1625**	12.6	N	BPT	400	25[e]
17.5	**1619**	2.5	N	BPT	400	15
20.5[a]	**7551**[t]	12-15	N	BPT	300	10
20.5[a]	**7558**[t]	6.3	N	BPT	300	10
22[a]	**6146**	6.3	N	BPT	400	20[e]
22[a]	**6146W/7212**	6.3	N	BPT	400	20[e]
22[a]	**6159**	26.5	N	BPT	400	20[e]
22[a]	**6159W/7357**	26.5	N	BPT	400	20[e]
22[a]	**6883**	12.6	N	BPT	400	20[e]
22[a]	**7212**	6.3	N	BPT	400	20[e]
22[a]	**7357**	26.5	N	BPT	400	20[e]
22[a]	**8032**	13.5	N	BPT	400	20[e]
26.5[a]	**1614**[t]	6.3	N	BPT	375	21
40[a]	**2E26**	6.3	N	BPT	600	10
40[a]	**6893**	12.6	N	BPT	600	10
44	**829B**	6.3/12.6	N	TBPT	750	30
56[a]	**807**	6.3	N	BPT	600	25
56[a]	**1625**	12.6	N	BPT	600	25
80	**6816**	6.3	FA	CT	1000	115
80	**6884**	26.5	FA	CT	1000	115
80	**7457**	6.3	FA	CT	1000	115

[d] Quick filament-heating type.

[e] Triode connection, grid No. 2 connected to plate.

[t] Data for this type located in *Receiving-Type Industrial Tubes* Section.

Typical Operation Power Output Approx. Watts	RCA Type	Filament or Heater Volts	Cooling	Name	Max. Plate Ratings Volts	Max. Plate Ratings Dissipation Watts
Class AB_2 Amplifiers, AF[b] (cont'd)						
630	**7035/ 4X150D**	26.5	FA	BPT	2000	250
1240	**6156/ 4-250A**	5	FA	BPT	4000	250
Class B Amplifiers, AF[b]						
45	**801A**	7.5	N	T	600	20
105[a]	**809**	6.3	N	T	750	25
175	**830B**	10	N	T	1000	60
235[a]	**811A**	6.3	N	T	1250	45
235[a]	**812A**	6.3	FA	T	1250	45
250[a]	**8005**	10	N	T	1250	75
260	**838**	10	N	T	1250	100
370	**805**	10	N	T	1500	125
590[a]	**810**	10	N	T	2500	125
600[a]	**8000**	10	N	T	2500	125
1640	**5786**	11	FA	T	4000	600
1650[a]	**833A**	10	N	T	3000	300
2400[a]	**833A**	10	FA	T	4000	400
8800	**5762/ 7C24**	12.6	FA	T	6200	3000
8800	**5762A**	12.6	FA	T	6200	4000
10000	**891R**	22	FA	T	10000	3500
10500	**892R**	22	FA	T	12500	4000
15000	**889A**	11	L	T	8500	5000
15000	**889RA**	11	FA	T	8500	5000
22000	**891**	22	L	T	15000	5000
22000	**892**	22	L	T	15000	7500
22500	**207**	22	L	T	15000	7500
46000	**880**	12.6	L	T	10500	15000
50000	**9C25**	6	FA	T	11500	17500

Typical Operation Power Output Approx. Watts	RCA Type	Filament or Heater Volts	Cooling	Name	Max. Plate Ratings Volts	Max. Plate Ratings Dissipation Watts
Class B Amplifiers, AF[b] (cont'd)						
55000	**5771**	7.5	L	T	12500	22500
61000	**9C21**	19.5	L	T	15000	40000
61000	**9C22**	19.5	FA	T	15000	20000
100000	**5671**	11	FA	T	15000	25000
117000	**5770**	11	L	T	15000	50000
Class B Amplifiers, RF Telephony						
2	**5556**	4.5	N	T	350	10
3.5[a]	**802**	6.3	N	P	500	10
7.5	**801A**	7.5	N	T	600	20
10.5[a, f]	**815**	6.3/ 12.6	N	TBPT	400	20
12.5[a]	**807**	6.3	N	BPT	600	25
12.5[a]	**809**	6.3	N	T	750	25
12.5[a]	**1625**	12.6	N	BPT	600	25
16[a]	**804**	7.5	N	P	1250	40
20	**834**	7.5	N	T	1250	50
25[a]	**814**	10	N	BPT	1250	50
26	**830B**	10	N	T	1000	60
36[a]	**828**	10	N	BPT	1250	70
40	**860**	10	N	TR	3000	100
40[a]	**8005**	10	N	T	1250	75
42.5	**838**	10	N	T	1250	100
50[a]	**813**	10	N	BPT	2000	100
53	**803**	10	N	P	2000	125
57.5	**805**	10	N	T	1500	125
58	**6155/ 4-125A**	5	FA	BPT	3000	125
60[a]	**810**	10	N	T	2000	125
65[a]	**8000**	10	N	T	2000	125
126	**6156/ 4-250A**	5	FA	BPT	4000	250

[f] Both sections.

Typical Operation Power Output Approx. Watts	RCA Type	Filament or Heater Volts	Cooling	Name	Max. Plate Ratings Volts	Max. Plate Ratings Dissipation Watts
Class B Amplifiers, RF Telephony (cont'd)						
150[a]	**833A**	10	N	T	3000	300
225[a]	**833A**	10	FA	T	4000	400
400	**827R**	7.5	FA	BPT	3500	800
1800	**892R**	22	FA	T	12500	4000
2000	**889A**	11	L	T	8500	5000
2000	**889RA**	11	FA	T	8500	5000
4000	**207**	22	L	T	15000	10000
4000	**892**	22	L	T	15000	10000
9000	**880**	12.6	L	T	10500	20000
10000	**9C25**	6	FA	T	11500	17500
12000	**5771**	7.5	L	T	12500	22500

Typical Operation Power Output Approx. Watts	Typical Operation Freq. Mc	RCA Type	Filament or Heater Volts	Cooling	Name	Max. Plate Ratings Volts	Max. Plate Ratings Dissipation Watts
Class B Amplifiers, Television Service							
230	900	**6161**	6.3	FA	T	1600	250
250	216	**7034/ 4X150A**	6	FA	BPT	1250	250
250	216	**7035/ 4X150D**	26.5	FA	BPT	1250	250
440	216	**7203/ 4CX250B**	6	FA	BPT	2000	250
440	216	**7204/ 4CX250F**	26.5	FA	BPT	2000	250
1200	900	**6181**	120	FA	BPT	2000	2000

[f] Both sections.
[t] Data for this type located in *Receiving-Type Industrial Tubes* Section.

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Typical Operation Power Output Approx. Watts	Typical Operation Freq. Mc	RCA Type	Filament or Heater Volts	Cooling	Name	Max. Plate Ratings Volts	Max. Plate Ratings Dissipation Watts
Class B Amplifiers, Television Service (cont'd)							
4000	216	**5762/ 7C24**	12.6	FA	T	3700	3000
6350	216	**5762A**	12.6	FA	T	4500	4000
12000	216	**6166**	5	FA	BPT	6000	10000
12000	800	**6448**	1.35	L	BPT	7000	26000
14000	216	**6166A/ 7007**	5	FA	BPT	7500	12000
19000	800	**6806**	1.35	L	BPT	9000	36000
Class C Amplifiers, Plate-Modulated RF Telephony							
-	-	**4037**	6.3	N	T	275	4.25
-	-	**5876**	6.3	N	T	275	4.25
-	-	**5876A**	6.3	N	T	275	4.25
1.7	3000	**7801**	12.6	C	CT	750	-
1.7	3000	**7870**	6.3	C	CT	750	-
3.5[a]	500	**6939**[t]	6.3/ 12.6	N	PP	200	4
4	-	**5556**	4.5	N	T	350	7
5.5[a]	500	**5893**	6	N	T	260	5
6	-	**1613**	6.3	N	P	275	7
6.4[a]	30	**5763**	6	N	BPT	250	8
6.4[a]	30	**6417**	12.6	N	BPT	250	8
6.5[a]	175	**7551**[t]	13.5	N	BPT	250	7
6.5[a]	175	**7558**[t]	6.3	N	BPT	250	7
6.5	175	**7905**[t]	6.3	N	BPT	250	7
6.7[a]	500	**6263**	6	N	T	275	5.5
6.7[a]	500	**6263A**	6	N	T	275	5.5
8[a]	-	**802**	6.3	N	P	400	6.7
9[a,f]	462	**6524**	6.3	N	TBPT	400	13.5
9[a,f]	462	**6580**	12.6	N	TBPT	400	13.5
11	-	**837**	12.6	N	P	400	8

Typical Operation		RCA Type	Fila-ment or Heater Volts	Cool-ing	Name	Max. Plate Ratings	
Power Output Approx. Watts	Freq. Mc					Volts	Dissi-pation Watts
Class C Amplifiers, Plate-Modulated RF Telephony (cont'd)							
11.5[a]	-	**1614**	6.3	N	BPT	325	14[e]
13	-	**1619**	2.5	N	BPT	325	10
13.5[a]	-	**2E24**	6.3[d]	N	BPT	400	6.7
13.5[a]	-	**2E26**	6.3	N	BPT	400	6.7
13.5[a]	-	**6893**	12.6	N	BPT	400	6.7
15	-	**1614**	6.3	N	BPT	325	14
17[a,f]	-	**832A**	6.3/12.6	N	TBPT	600	10
17	400	**7801**	12.6	C	CT	750	-
17	400	**7870**	12.6	C	CT	750	-
18	-	**801A**	7.5	N	T	500	13.5
24	-	**1624**	2.5	N	BPT	500	16.5
28[a]	-	**807**	6.3	N	BPT	475	16.5
28[a]	-	**1625**	12.6	N	BPT	475	16.5
30[a,f]	-	**815**	6.3/12.6	N	TBPT	325	13.5
34[a]	-	**6146**	6.3	N	BPT	480	13.3
34[a]	-	**6146W/7212**	6.3	N	BPT	480	13.3
34[a]	-	**6159**	26.5	N	BPT	480	13.3
34[a]	-	**6159W/7357**	26.5	N	BPT	480	13.3
34[a]	-	**6883**	12.6	N	BPT	480	13.3
34[a]	60	**7212**	6.3	N	BPT	480	13.3
34[a]	60	**7357**	26.5	N	BPT	480	13.3
34[a]	60	**8032**	13.5	N	BPT	480	13.3
38[a]	-	**809**	6.3	N	T	600	17.5
45	400	**6816**	6.3	FA	CT	800	75
45	400	**6884**	26.5	FA	CT	800	75
45	400	**7457**	6.3	FA	CT	800	75
45	400	**7842**	6.3	C	CT	800	-

d Quick filament-heating type.

Typical Operation		RCA Type	Fila-ment or Heater Volts	Cool-ing	Name	Max. Plate Ratings	
Power Output Approx. Watts	Freq. Mc					Volts	Dissi-pation Watts
Class C Amplifiers, Plate-Modulated RF Telephony (cont'd)							
45	400	**7843**	26.5	C	CT	800	-
45	400	**7844**	6.3	C	CT	800	-
50[a]	-	**804**	7.5	N	P	1000	27
50[a,f]	-	**8298**	6.3/12.6	N	TBPT	600	21
50	-	**830B**	10	N	T	800	40
58	-	**834**	7.5	N	T	1000	35
65	1000	**5588**	6.3	FA	T	800	130
70[a,f]	-	**8298**	6.3/12.6	FA	TBPT	600	28
85[a]	-	**812A**	6.3	N	T	1000	30
87[a]	-	**814**	10	N	BPT	1000	34
88[a]	-	**811A**	6.3	N	T	1000	30
90[a]	60	**7271**	13.5	FA	BPT	900	40
100[a]	-	**828**	10	N	BPT	1000	47
100	-	**838**	10	N	T	1000	67
105	-	**860**	10	N	TTR	2000	67
115[a]	-	**8005**	10	N	T	1000	50
120	900	**6161**	6.3	FA	T	1300	167
140	-	**805**	10	N	T	1250	85
155	-	**803**	10	N	P	1600	85
180[a]	60	**7094**	6.3	FA	BPT	1000	67
180[a]	-	**813**	10	FA	BPT	1600	67
230	150	**7034/4X150A**	6	FA	BPT	1600	165
230	150	**7035/4X150D**	26.5	FA	BPT	1600	165
235	175	**7203/4CX250B**	6	FA	BPT	1500	165
235	175	**7204/4CX250F**	26.5	FA	BPT	1500	165

e Triode connection, grid No. 2 connected to plate.
f Both sections.

Typical Operation		RCA Type	Filament or Heater Volts	Cooling	Name	Max. Plate Ratings	
Power Output Approx. Watts	Freq. Mc					Volts	Dissipation Watts
Class C Amplifiers, Plate-Modulated RF Telephony (cont'd)							
250[a]	-	810	10	N	T	1600	85
250[a]	-	8000	10	N	T	1600	85
300	-	6155/ 4-125A	5	FA	BPT	2500	83
510	-	6156/ 4-250A	5	FA	BPT	3200	165
600	400	7650	6.3	FA	CT	2000	400
635	-	833A	10	N	T	2500	200
800	600	7213	5.5	FA	CT	2000	1000
810	-	5786	11	FA	T	2500	400
825	-	827R	7.5	FA	BPT	3000	550
950	400	6181	120	FA	BPT	1600	1300
1000	-	833A	10	FA	T	3000	270
4000	-	889A	11	L	T	6000	3000
4000	-	889RA	11	FA	T	6000	3000
4200	30	5762/ 7C24	12.6	FA	T	5000	2000
4200	30	5762A	12.6	FA	T	5000	2700
4500	900	6448	1.35	L	BPT	4500	16500
5000	-	892R	22	FA	T	10000	2500
5500	60	6166	5	FA	BPT	5000	6600
6000	-	207	22	L	T	10000	6600
6000	-	892	22	L	T	10000	6600
6000	60	6166A/ 7007	5	FA	BPT	5500	8000
10000	400	6806	1.35	L	BPT	5500	17000
18000	-	9C25	6	FA	T	9000	11500
27000	-	880	12.6	L	T	10500	12000
29000	-	5771	7.5	L	T	10000	15000
38000	-	9C21	19.5	L	T	12500	28000
38000	-	9C22	19.5	FA	T	12500	14000
40000	1.6	5671	11	FA	T	12500	17000
45000	-	5770	11	L	T	12500	33000

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Typical Operation		RCA Type	Filament or Heater Volts	Cooling	Name	Max. Plate Ratings	
Power Output Approx. Watts	Freq. Mc					Volts	Dissipation Watts
Class C Amplifiers, Grid-Modulated RF Telephony							
3.8	-	1619	2.5	N	BPT	400	15
4[a]	-	802	6.3	N	P	500	10
5.5	-	837	12.6	N	P	500	12
8	-	1624	2.5	N	BPT	600	25
10.5[a,f]	-	815	6.3/ 12.6	N	TBPT	400	20
21[a]	-	804	7.5	N	P	1250	40
29[a]	-	814	10	N	BPT	1250	50
36[a]	-	828	10	N	BPT	1250	70
50[a]	-	813	10	N	BPT	2000	100
53	-	803	10	N	P	2000	125
65[a]	-	8000	10	N	T	2000	125
400	-	827R	7.5	FA	BPT	3500	800
600	400	7650	6.3	FA	CT	2000	400
Class C Amplifiers, Suppressor-Modulated RF Telephony							
3.5[a]	-	802	6.3	N	P	500	10
5	-	837	12.6	N	P	500	12
21[a]	-	804	7.5	N	P	1250	40
53	-	803	10	N	P	2000	125
Class C Amplifiers, Television Service							
230	900	6161	6.3	FA	T	1600	250
1200	900	6181	120	FA	BPT	2000	2000
4000	216	5762/ 7C24	12.6	FA	T	3700	3000
4000	216	5762A	12.6	FA	T	3700	4000
5300[f]	216	8D21	3.2	L	TTR	6000	6000
12000	216	6166	5	FA	BPT	6000	10000
12000	216	6166A/ 7007	5	FA	BPT	7500	12000

[f] Both sections.

Typical Operation: Power Output Approx. (Watts)	Typical Operation: Freq. (Mc)	RCA Type	Filament or Heater Volts	Cooling	Name	Max. Plate Ratings: Volts	Max. Plate Ratings: Dissipation (Watts)
Class C Amplifiers, RF Telegraphy							
-	1000	**5718**[t]	6.3	N	T	165	3.3
0.475	1700	**5675**	6.3	N	T	300	5
0.5	-	**955**[t]	6.3	N	T	180	-
0.6	-	**958A**[t]	1.25	N	T	135	0.6
1.8	-	**6F4**[t]	6.3	N	T	150	2
2	40	**3A5**[t]	1.4-2.8	N	TT	135	1
2.2	500	**7554**	6.3	N	T	250	2.5
3.2	3000	**7801**	12.6	C	CT	750	-
3.2	3000	**7870**	6.3	C	CT	750	-
3.5	40	**7060**[t]	12-15	N	T-P	300	2.75
4	-	**1626**	12.6	N	T	250	5
4	40	**7054**[t]	13.5	N	P	300	5
4	40	**8077/7054**[t]	13.5	N	P	300	5
5	500	**4037**	6.3	N	T	360	6.25
5	500	**5876**	6.3	N	T	360	6.25
5	500	**5876A**	6.3	N	T	360	6.25
5[a]	500	**6939**[t]	6.3/12.6	N	PP	250	6
5.4[g]	40	**5618**	3/6	N	P	300	5
5.5	1000	**5893**	6	N	T	320	7
6	-	**5556**	4.5	N	T	350	10
6.5	160	**5686**	6.3	N	BPT	275	8.25
7[a]	500	**6263**	6	N	T	330	8
7[a]	500	**6263A**	6	N	T	330	8
7[g]	175	**7905**[t]	6.3[d]	N	BPT	300	10
7.5[a]	500	**6264A**	6	N	T	330	8
8.5[a]	175	**7551**[t]	13.5	N	BPT	300	10
8.5[a]	175	**7558**[t]	6.3	N	BPT	300	10
9	-	**1613**[t]	6.3	N	P	350	10
10.3[a]	30	**5763**	6	N	BPT	300	12
10.3[a]	30	**6417**	12.6	N	BPT	300	12

[d] Quick filament-heating type. [f] Both sections.

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Typical Operation: Power Output Approx. (Watts)	Typical Operation: Freq. (Mc)	RCA Type	Filament or Heater Volts	Cooling	Name	Max. Plate Ratings: Volts	Max. Plate Ratings: Dissipation (Watts)
Class C Amplifiers, RF Telegraphy (cont'd)							
16[a]	-	**802**	6.3	N	P	500	10
17	2500	**6897**	6.3	FA	T	1000	100
19.5	-	**1619**	2.5	N	BPT	400	15
20[a]	125	**2E24**	6.3[d]	N	BPT	500	10
20[a]	125	**2E26**	6.3	N	BPT	500	10
20[a]	125	**6893**	12.6	N	BPT	500	10
21	-	**1614**	6.3	N	BPT	375	21
22	-	**837**	12.6	N	P	500	12
25	-	**801A**	7.5	N	T	600	20
26 (a,f)	-	**832A**	6.3/12.6	N	TBPT	750	15
27	400	**7801**	12.6	C	CT	750	-
27	400	**7870**	6.3	C	CT	750	-
30[g]	175	**4604**	6.3[d]	N	BPT	750	25
35	-	**1624**	2.5	N	BPT	600	25
40[a]	-	**807**	6.3	N	BPT	600	25
40[a]	-	**1625**	12.6	N	BPT	600	25
40	1215	**6816**	6.3	FA	CT	1000	115
40	1215	**6884**	26.5	FA	CT	1000	115
40	1215	**7457**	6.3	FA	CT	1000	115
40	1215	**7842**	6.3	C	CT	1000	-
40	1215	**7843**	26.5	C	CT	1000	-
40	1215	**7844**	6.3	C	CT	1000	-
44 (a,f)	-	**815**	6.3/12.6	N	TBPT	400	20
46 (a,f)	100	**6524**	6.3	N	TBPT	500	20
46 (a,f)	100	**6850**	12.6	N	TBPT	500	20
52[a]	60	**6146**	6.3	N	BPT	600	20
52[a]	60	**6146W/7212**	6.3	N	BPT	600	20

[g] Intermittent Commercial and Amateur Service only.
[t] Data for this type located in *Receiving-Type Industrial Tubes* Section.

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Typical Operation		RCA Type	Filament or Heater Volts	Cooling	Name	Max. Plate Ratings	
Power Output Approx. Watts	Freq. Mc					Volts	Dissipation Watts
Class C Amplifiers, RF Telegraphy (cont'd)							
52[a]	60	6159	26.5	N	BPT	600	20
52[a]	60	6159W/ 7357	26.5	N	BPT	600	20
52[a]	60	6883	12.6	N	BPT	600	20
52[a]	60	7212	6.3	N	BPT	600	20
52[a]	60	7357	26.5	N	BPT	600	20
52[a]	60	8032	13.5	N	BPT	600	20
55[a]	-	809	6.3	N	T	750	25
70[a, f]	-	829B	6.3/ 12.6	N	TBPT	750	30
75	-	834	7.5	N	T	1250	50
80[a]	-	804	7.5	N	P	1250	40
85	470	8072	12-15	C	BPT	2200	-
86[a]	-	826	7.5	FA	T	1000	60
90[a, h]	-	826	7.5	N	T	1000	45
90[a, f]	-	829B	6.3/ 12.6	FA	TBPT	750	40
90	-	830B	10	N	T	1000	60
100	1000	5588	6.3	FA	T	1000	200
130[a]	-	812A	6.3	N	T	1250	45
130[a]	-	814	10	N	BPT	1250	50
130	-	838	10	N	T	1250	100
135[a]	-	811A	6.3	N	T	1250	45
150[a]	-	828	10	N	BPT	1250	70
160[a]	60	7271	13.5	FA	BPT	1100	60
165	-	860	10	N	TTR	3000	100
170[a]	-	8005	10	N	T	1250	75
180	900	6161	6.3	FA	T	1600	250
210	-	803	10	N	P	2000	125
215	-	805	10	N	T	1500	125
235	470	8121	13.5	FA	BPT	2200	150
250-	500	7203/ 4CX250B	6	FA	BPT	2000	250

Typical Operation		RCA Type	Filament or Heater Volts	Cooling	Name	Max. Plate Ratings	
Power Output Approx. Watts	Freq. Mc					Volts	Dissipation Watts
Class C Amplifiers, RF Telegraphy (cont'd)							
250	500	7204/ 4CX250F	26.5	FA	BPT	2000	250
255[a]	60	7094	6.3	FA	BPT	1250	100
275[a]	-	813	10	N	BPT	2000	100
300	470	8122	13.5	FA	BPT	2200	400
325	220	5713	3.3	FA	T	1500	250
370	150	7034/ 4X150A	6	FA	BPT	2000	250
370	150	7035/ 4X150D	26.5	FA	BPT	2000	250
375[a]	-	810	10	N	T	2000	250
375[a]	-	8000	10	N	T	2000	125
375	-	6155/ 4-125A	5	FA	BPT	3000	125
375	1215	7650	6.3	FA	CT	2500	700
600	900	6181	120	FA	BPT	2000	2000
1000[a]	-	833A	10	N	T	3000	300
1000	-	5786	11	FA	T	3000	600
1000	-	6156/ 4-250A	5	FA	BPT	4000	250
1050	-	827R	7.5	FA	BPT	3500	800
1350	600	7213	5.5	FA	CT	2500	1500
1440[a]	-	833A	10	FA	T	4000	400
6500[a,f]	300	8021	3.2	L	TTR	6000	6000
7000	30	5762/ 7C24	12.6	FA	T	6200	3000
7000	30	5762A	12.6	FA	T	6200	4000
9000	216	6166	5	FA	BPT	6900	10000
10000	-	899A	11	L	T	8500	5000
10000	-	899RA	11	FA	T	8500	5000

[f] Both sections.

[h] Intermittent Commercial and Amateur Service.

Typical Operation		RCA Type	Filament or Heater Volts	Cooling	Name	Max. Plate Ratings	
Power Output Approx. Watts	Freq. Mc					Volts	Dissipation Watts
Class C Amplifiers, RF Telegraphy (cont'd)							
10000	-	**891**	22	L	T	12000	6000
10000	-	**891R**	22	FA	T	10000	4000
10000	-	**892R**	22	FA	T	18000	4000
10000	216	**6166A/ 7007**	5	FA	BPT	7500	12000
11000	900	**6448**	1.35	L	BPT	7000	26000
13500	900	**6806**	1.35	L	BPT	9000	35000
14000	-	**892**	22	L	T	15000	10000
15000	-	**207**	22	L	T	15000	10000
32500	-	**9C25**	6	FA	T	11500	17500
40000	25	**880**	12.6	L	T	10500	20000
44000	25	**5771**	7.5	L	T	12500	22500
65000	-	**9C22**	19.5	FA	T	17000	20000
70000	1.6	**5671**	11	FA	T	15000	25000
100000	-	**9C21**	19.5	L	T	17000	40000
114000	-	**5770**	11	L	T	17000	50000
500000	0.425	**6949**	7.3-7.8	L	T	20000	400000
Class C Amplifiers or Oscillators Self-Rectifying							
175[j]	27	**811A**	6.3	N	T	1750	45[k]
200[j]	27	**812A**	6.3	N	T	1750	145
225	-	**813**	10	N	BPT	2800	100
330[j]	50	**8005**	10	N	T	1750	75
650[j]	30	**8000**	10	N	T	2500	125
835[a]	-	**833A**	10	N	T	4250	300
1050	-	**5786**	11	FA	T	4250	600
1150	-	**833A**	10	FA	T	5650	400
3350	-	**5762/ 7C24**	12.6	FA	T	7000	3000
3350	-	**5762A**	12.6	FA	T	7000	4000

j Two tubes.
k Not recommended as oscillator in this class of service.

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Typical Operation		RCA Type	Filament or Heater Volts	Cooling	Name	Max. Plate Ratings	
Power Output Approx. Watts	Freq. Mc					Volts	Dissipation Watts
Class C Amplifiers or Oscillators With Separate Plate Supply							
135	-	**811A**	6.3	N	T	1125	45[k]
135	-	**812A**	6.3	N	T	1125	45[k]
280	-	**813**	6.3	N	BPT	1800	100
330[j]	27	**8005**	10	N	T	1125	75
700[j]	30	**8000**	10	N	T	1800	125
1100[a]	-	**833A**	10	N	T	2700	300
1150	-	**5786**	11	FA	T	2700	600
1460	-	**833A**	10	FA	T	3600	400
5650	-	**5762/ 7C24**	12.6	FA	T	5600	3000
5650	-	**5762A**	12.6	FA	T	5600	4000
Linear RF Amplifiers Single-Sideband Suppressed Carrier— Two-Tone Modulation							
80	30	**8072**	12-15	C	BPT	2200	-
95[a]	60	**7271**	13.5	FA	BPT	1100	60
120	30	**811A**	6.3	N	T	1250	45
170	30	**8121**	13.5	FA	BPT	1100	60
295	30	**7203/ 4CX250B**	6	FA	BPT	2000	250
295	30	**7204/ 4CX250F**	26.5	FA	BPT	2000	250
360	500	**7580**	6	FA	BPT	2000	250
380	30	**8122**	13.5	FA	BPT	2200	400
680	30	**7650**	6.3	FA	BPT	2500	600
600000	10	**6949**	7.3-7.8	L	T	20000	400000

m See data for exact classification in each case.
n Peak value.
p See data for further information on each type.
r In phase operation, unless otherwise specified.
s Quadrature operation.
t Data for this type located in *Receiving-Type Industrial Tubes* Section.

RCA TRANSMITTING TUBE GUIDE

Typical Operation: Power Output Approx. (kw)	Typical Operation: Freq. (Mc)	RCA Type	Filament or Heater Volts	Cooling	Name	Max. Plate Ratings: Volts	Max. Plate Ratings: Dissipation (Watts)
Plate-Pulsed Amplifiers or Oscillators[m]							
1.2	3300	**5893**	6	N	T	1750[n]	6
4.5	1215	**7649**	6.3	FA	CT	3000[n]	115
14	1250	**5946**	6.3	FA	T	7500[n]	250
39	1215	**7651**	6.3	FA	CT	8000[n]	600
65	1215	**7214**	5.5	FA		10000[n]	1500
-	500	**8184**	22-23	FA	CT	25000[n]	10000
2000	425	**6952**	0.95	L	BPT	55000[n]	8000
2000	425	**4605V2**	0.95	L	BPT	55000[n]	8000
Grid-Pulsed Amplifiers or Oscillators[m]							
2.3	1215	**7649**	6.3	FA	CT	2250	115
20	1215	**7214**	5.5	FA	CT	5000	1500
20	1215	**7651**	6.3	FA	CT	5000	600

Power Tubes for Special Applications[p]

Control Amplifier
3C33

CW Oscillator (Klystron)
2K26

Frequency Multipliers

5618	**6161**	**6850**[t]	**7554**[t]
5763	**6264A**	**6939**[t]	**7558**[t]
5876	**6417**	**7054**[t]	**7905**[t]
5876A	**6524**	**7551**[t]	**8077/7054**[t]
5893			

Linear RF Power Amplifier—AM Telephony
7580

Modulator—Rectangular-Wave Modulation
3E29 **6293** **7358**

Pulsed-Oscillators (Magnetrons)
6521 **6865A** **7008** **7111**

Class C Oscillator
6026 **6562/5794A** **7533**

Traveling-Wave Tube
6861

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RCA Type	Filament or Heater Volts	Maximum Plate Ratings[r]: Peak Reverse Volts	Peak Amperes	Average Amperes
Rectifiers				
Half-Wave, Mercury-Vapor Types				
816	2.5	7500	0.5	0.125
866A	2.5	10000	1	0.25
866A	2.5	2500	2	0.5
872A	5	10000	5	1.25
8008	5	10000	5	1.25
575A	5	15000	6	1.5
673	5	15000	6	1.5
6894	5	20000	8.3	1.8
6895	5	20000	8.3	1.8
575A	5	15000[s]	10[s]	2.5[s]
673	5	15000[s]	10[s]	2.5[s]
615/7018	2.5	2000	10	2.5
869B	5	20000	10	2.5
5558	5	5000	15	2.5
6894	5	20000[s]	11.5[s]	2.5[s]
6895	5	20000[s]	11.5[s]	2.5[s]
5561	5	10000	16	4
869B	5	15000[s]	20[s]	5[s]
635/7019	2.5	1000	77	6.4
635L/7020	2.5	1000	77	6.4
5561	5	3000	40	6.4
8578	5	22000	40	10
Full-Wave, Mercury-Vapor Type				
604/7014	2.5	900	10	2.5
Half-Wave, Gas Types				
3B28	2.5	10000	1	0.25
3B25	2.5	4500	2	0.5
3B28	2.5		2	0.5
Half-Wave, Vacuum Types				
5825	1.6	60000	0.04	0.002
2X2A	2.5	12500	0.06	0.0075
8013A	2.5	40000	0.15	0.02
579B	2.5	20000	0.27	0.25
8020	5	40000	0.75	0.1
1616	2.5	6000	0.8	0.13
836	2.5	5000	1	0.25

For footnotes, see reverse side.

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

* FOR DETAILED DATA ON TYPES NOT LISTED IN THESE CHARTS, REFER TO INDIVIDUAL DATA SHEETS IN THE TRANSMITTING TUBE SECTION

These charts are arranged in three parts and contain in the order listed:

1. Data (pages 1 - 7),
2. Terminal Diagrams (pages 7 - 9),
3. Dimensional Outlines — with Maximum Envelope Temperatures (pages 10 - 18).

VACUUM POWER TUBES FOR CW APPLICATIONS (Unless Otherwise Specified[a])

RCA TYPE	DESCRIPTION & COOLING METHOD (C–Conduction, FA–Forced Air, L–Liquid, N–Natural, W–Water)		FILAMENT (F) OR HEATER		CLASS C TELEGRAPHY (CCS) UNLESS OTHERWISE SPECIFIED UNDER MAXIMUM PLATE VOLTS	MAXIMUM RATINGS								TYPICAL OPERATION		
			VOLTS	AMP	FREQ FOR FULL INPUT MC	PLATE VOLTS	GRID-NO.2 VOLTS	Grid-NO.1 VOLTS	PLATE MA	GRID-NO.2 INPUT WATTS	GRID-NO.1 CURRENT IN MA OR INPUT (W) IN WATTS	PLATE DISSIPATION WATTS	AMPLIFICATION OR MU FACTOR	FREQ MC	DRIVER OR DRIVING (T) POWER WATTS	POWER OUTPUT WATTS
2C39A	Triode	FA	6.3	1	2500	1000		-150	125		50	100	100			
2C39WA	Triode	FA	6	1	2500	For data, refer to MIL-E-1/778E (Navy) Specification										
2C40	Lighthouse Triode	N	6.3	0.75	3370	500		-50	25		8	6.5				
2C40A[a]	Lighthouse Triode	N	6.3	0.75	3370	500		-50	25		8	6.5				
2C43	Lighthouse Triode	N	6.3	0.9	1500	500			40			12				

[a] Type 3C33 for Modulators, types 3E29, 3E29A, 4610 for Regulators, type 2C40A for CW and RF-Pulse Applications.

RCA TYPE	DESCRIPTION & COOLING METHOD (C–Conduction, FA–Forced Air, L–Liquid, N–Natural, W–Water)		FILAMENT (F) OR HEATER VOLTS	FILAMENT (F) OR HEATER AMP	CLASS C TELEGRAPHY (CCS) UNLESS OTHERWISE SPECIFIED UNDER MAXIMUM PLATE VOLTS: FREQ FOR FULL INPUT MC	MAXIMUM RATINGS: PLATE VOLTS	GRID-NO.2 VOLTS	GRID-NO.1 VOLTS	PLATE MA	GRID-NO.2 INPUT WATTS	GRID-NO.1 CURRENT IN MA OR INPUT (W) IN WATTS	PLATE DISSIPATION WATTS	AMPLIFICATION OR MU FACTOR	TYPICAL OPERATION: FREQ MC	DRIVER OR DRIVING (T) POWER WATTS	POWER OUTPUT WATTS
2E24	Beam Pwr. Tube[b]	N	6.3F	0.65	125	500	200	-175	75	2.5	3.5	10	7.5	125	0.2T	20
2E26	Beam Pwr. Tube	N	6.3	0.8	125	500	200	-175	75	2.5	3.5	10	6.5	125	0.15T	20
3C33[a]	Twin Triode	N	12.6	1.125		±2000[c]			120			15	11			
3E29[a]		N				5000	850	-225	10[c]	3	1W	15	9			40[c]
3E29A[a]	Twin Beam Power Tube	N	6.3 12.6	2.25 1.125	Max "ON" Time: 12 μsec. Time Interval: 1200 μsec. Peak Plate Volts: 5750 (3E29), 7500 (3E29A)					Typical Operation: Pulse duration: 1.2 μsec.; Duty factor: 0.001						
4-125A/4D21	Beam Pwr. Tube	FA	5F	6.5	120	3000	400	-500	225	20	5W	125				
4-250A/5D22	Beam Pwr. Tube	FA	5F	14.5	75	4000	600	-500	350	35	10W	250				
4E27A/5-125B	Beam Pwr. Tube	N	5F	7.5	75	4000	750	-500	200	20	5W	125				
4X500A	Beam Pwr. Tube	FA	5F	12.2 to 13.7	120	4000	500	-500	350	30	10W	500				
8D21	Twin Tetrode	W	3.2F	125	300	6000	1000	-1000	2000	400	50W	6000	5	300	500T	6500
9C21	Triode	W	19.5F	415	15	17,000		-2000	9000		1500	40,000	40	15	1800T	100,000

[a] Type 3C33 for Modulators, types 3E29, 3E29A, 4610 for Regulators, type 2C40A for CW and RF-Pulse Applications.

[b] Quick-heating type less than 2-second filament heating time.

[c] Peak value.

RCA TYPE	DESCRIPTION & COOLING METHOD (C–Conduction, FA–Forced Air, L–Liquid, N–Natural, W–Water)		FILAMENT (F) OR HEATER		CLASS C TELEGRAPHY (CCS) UNLESS OTHERWISE SPECIFIED UNDER MAXIMUM PLATE VOLTS											
						MAXIMUM RATINGS								TYPICAL OPERATION		
			VOLTS	AMP	FREQ FOR FULL INPUT MC	PLATE VOLTS	GRID-NO.2 VOLTS	GRID-NO.1 VOLTS	PLATE MA	GRID-NO.2 INPUT WATTS	GRID-NO.1 CURRENT IN MA OR INPUT (W) IN WATTS	PLATE DISSIPATION WATTS	AMPLIFICATION OR MU FACTOR	FREQ MC	DRIVER OR DRIVING (T) POWER WATTS	POWER OUTPUT WATTS
9C22	Triode	FA	19.5F	415	5	17,000		-2000	8000		1500	20,000	41	5	1450T	65,000
207	Triode	W	22F	52	1.6	15,000		-3000	2000		200	10,000	20	1.6	235T	15,000
801A	Triode	N	7.5F	1.25	60	600		-200	70		15	20	8	60	4T	25
802	Pentode	N	6.3	0.9	30	500	250	-200	60	6	7.5	10		30	0.25T	16
803	Pentode	N	10	5	20	2000	600	-500	175	30	50	125		20	2T	210
805	Triode	N	10F	3.25	30	1500		-500	210		70	125		30	8.5T	215
807	Beam Pwr. Tube	N	6.3	0.9	60	600	300	-200	100	3.5	5	25	8	60	0.3	40
809	Triode	N	6.3F	2.5	60	750		-200	100		35	25	50	60	2.5T	55
810	Triode	N	10F	4.5	30	2000		-500	250		70	125	36	30	12T	375
813	Beam Pwr. Tube	N	10F	5	30	2000	400	-300	180	22	25	100	8.5	30	1.9T	275
814	Beam Pwr. Tube	N	10F	3.25	30	1250	400	-300	150	10	15	50		30	1.5T	130
815	Twin Beam Power Tube	N	6.3 12.6	1.6 0.8	125	400	225	-175	150	4.5	7	20	6.5	125	0.23T	44
827R	Beam Pwr. Tube	FA	7.5F	25	110	3500	1000	-500	500	150	150	800	16	110	50T	1050
828	Beam Pwr. Tube	N	10F	3.25	30	1250	400	-300	160	16	15	70		30	2.1T	150

RCA TRANSMITTING-TUBE TYPES -Limited Listing

RCA TYPE	DESCRIPTION & COOLING METHOD (C–Conduction, FA–Forced Air, L–Liquid, N–Natural, W–Water)		FILAMENT (F) OR HEATER		CLASS C TELEGRAPHY (CCS) UNLESS OTHERWISE SPECIFIED UNDER MAXIMUM PLATE VOLTS											
						MAXIMUM RATINGS								TYPICAL OPERATION		
			VOLTS	AMP	FREQ FOR FULL INPUT MC	PLATE VOLTS	GRID-NO.2 VOLTS	GRID-NO.1 VOLTS	PLATE MA	GRID-NO.2 INPUT WATTS	GRID-NO.1 CURRENT IN MA OR INPUT (W) IN WATTS	PLATE DISSIPATION WATTS	AMPLIFICATION OR MU FACTOR	FREQ MC	DRIVER OR DRIVING (T) POWER WATTS	POWER OUTPUT WATTS
829B	Twin Beam Power Tube	FA	6.3 / 12.6	2.25 / 1.125	200	750	225	-175	240	7	15	40	9	200	0.4T	90
		N	6.3 / 12.6	2.25 / 1.125		750	225	-175	240	6	15	30	9	200	0.3T	70
830B	Triode	N	10F	2	15	1000		-300	150		30	60	25	15	7T	90
832A	Twin Beam Power Tube	N	6.3 / 12.6	1.6 / 0.8	200	750	250	-175	90	5	6	15	6.5	200	0.19T	26
834	Triode	N	7.5F	3.1	100	1250		-400	100		20	50	10.5	100	4.5T	75
837	Pentode	N	12.6	0.7	20	500	200	-200	80	8	8	12		20	0.4T	22
845	Triode	N	10F	3.25		1250[d]		-400	120			150	5.3			115
860	Tetrode	N	10F	3.25	30	3000	500	-800	150	10	40	100		30	7T	165
880	Triode	W	12.6F	320	1.5	15,000		-1600	4500		1000	20,000	20	1.5	880T	50,000
889A	Triode	W	11F	125	50	8500		-1000	2000		250	5000	21	50	400T	10,000
889RA	Triode	FA	11F	125	40	8500		-1000	2000		250	5000	21	40	400T	10,000
891	Triode	W	22F	60	1.6	12,000		-3000	2000		150	6000	8.5	1.6	375T	10,000
891R	Triode	FA	22F	60	1.6	10,000		-3000	2000		150	4000	8.5	1.6	375T	10,000
892	Triode	W	22F	60	1.6	15,000		-3000	2000		400	10,000	50	1.6	565T	14,000
892R	Triode	FA	22F	60	1.6	12,500		-3000	2000		400	4000	50	1.6	495T	10,000
1613	Pentode	N	6.3	0.7	45	350	275	-100	50	2.5	5	10		45	0.22T	9

[d] Class AB. AF Power Amplifier

RCA TYPE	DESCRIPTION & COOLING METHOD (C–Conduction, FA–Forced Air, L–Liquid, N–Natural, W–Water)		FILAMENT (F) OR HEATER		CLASS C TELEGRAPHY (CCS) UNLESS OTHERWISE SPECIFIED UNDER MAXIMUM PLATE VOLTS											
					MAXIMUM RATINGS									TYPICAL OPERATION		
			VOLTS	AMP	FREQ FOR FULL INPUT MC	PLATE VOLTS	GRID-NO.2 VOLTS	GRID-NO.1 VOLTS	PLATE MA	GRID-NO.2 INPUT WATTS	GRID-NO.1 CURRENT IN MA OR INPUT (W) IN WATTS	PLATE DISSIPATION WATTS	AMPLIFICATION OR MU FACTOR	FREQ MC	DRIVER OR DRIVING (T) POWER WATTS	POWER OUTPUT WATTS
1614	Beam Pwr. Tube	N	6.3	0.9	80	375	300	-125	110	3.5	5	21		80	0.1T	21
1619	Beam Pwr. Tube	N	2.5F	2	45	400	300	-125	75	3.5	5	15		45	0.36T	19.5
1624	Beam Pwr. Tube	N	2.5F	2	60	600	300	-200	90	3.5	5	25		60	0.43T	35
1625	Beam Pwr. Tube	N	12.6	0.45	60	600	300	-200	100	3.5	5	25	8	60	0.3T	40
1626	Triode	N	12.6	0.25	30	250		-150	25		8	5	5	30	0.5T	4
4610[a]	Twin Triode	N	6.3 / 12.6	2.25 / 1.125		3000			100			30				
5556	Triode	N	4.5F	1.1	6	350		-150	40		10	10				
5713	Triode	FA	3.3	11.5	220	1500		-250	300		50	250	25	220	8T	290
5786	Triode	FA	11F	12.5	160	3000		-500	500		150	600	32	160	36T	1000
6146[e]	Beam Pwr. Tube	N	6.3	1.25	60	600	250	-150	140	3	3.5	20	4.5	60	0.2T	52
6146A[e]	Beam Pwr. Tube	N	6.3	1.25	60	600	250	-150	140	3	3.5	25	4.5		0.2T	52
6155	Beam Pwr. Tube	FA	5F	6.5	120	3000	400	-500	225	20	15	125				

[a] Type **3C33** for **Modulators**, types **3E29**, **3E29A**, **4610** for **Regulators**, type **2C40A** for **CW** and **RF-Pulse Applications.**

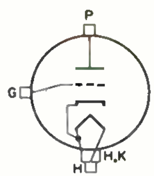
[e] For detailed data on later version of this type refer to 6146B/8298A data sheets, located in the *TRANSMITTING TUBE SECTION*.

RCA TYPE	DESCRIPTION & COOLING METHOD (C-Conduction, FA-Forced Air, L-Liquid, N-Natural, W-Water)		FILAMENT (F) OR HEATER VOLTS	FILAMENT (F) OR HEATER AMP	CLASS C TELEGRAPHY (CCS) UNLESS OTHERWISE SPECIFIED UNDER MAXIMUM PLATE VOLTS: FREQ FOR FULL INPUT MC	MAXIMUM RATINGS: PLATE VOLTS	GRID-NO.2 VOLTS	GRID-NO.1 VOLTS	PLATE MA	GRID-NO.2 INPUT WATTS	GRID-NO.1 CURRENT IN MA OR INPUT (W) IN WATTS	PLATE DISSIPATION WATTS	AMPLIFICATION OR MU FACTOR	TYPICAL OPERATION: FREQ MC	DRIVER OR DRIVING (T) POWER WATTS	POWER OUTPUT WATTS
6156	Beam Pwr. Tube	FA	5F	14.1	75	4000	600	-500	350	35	20	250				
6159	Beam Pwr. Tube	N	26.5	0.3	60	600	250	-150	140	3	3.5	20	4.5	60	0.2T	52
6181	Beam Pwr. Tube	FA	120 Max.	1.6	900	2000	500	-300	1250	40	200	2000	7	900	150	600
6883[f]	Beam Pwr. Tube	N	12.6	0.625	60	600	250	-150	140	3	3.5	20	4.5	60	0.2	52
6893	Beam Pwr. Tube	N	12.6	0.4	125	500	200	-175	75	2.5	3.5	10	6.5	125	0.15	20
6897	Lighthouse Triode	FA	6.3	1.03	2500	1000		-150			50W	100				
7271	Beam Pwr. Tube	FA	13.5	1.25	60	1100	425	-300	340	20	25	60	8	60	4	160
8000	Triode	N	10F	4.5	30	2000		-500	250		40	125	16.5	30	8T	375
8005	Triode	N	10F	3.25	60	1250		-200	200		45	75	20	60	6.5T	170
8032	Beam Pwr. Tube	N	13.5	0.585	60	600	250	-150	140	3	3.5	20	4.5	60	0.2	52
8165/ 4-65A	Beam Pwr. Tube	FA	6	3.2 to 3.8	150	3000	400	-500	150	10	5W	65				
8166/ 4-1000A	Beam Pwr. Tube	FA	7.5F	20 to 22.7	110	6000	1000	-500	700	75	25W	1000				
8168/ 4CX1000A	Beam Pwr. Tube	FA	6.0	8.1to 9.9	110	3000[g]	400		1000	12	0W	1000				

RCA TYPE	DESCRIPTION & COOLING METHOD (C–Conduction, FA–Forced Air, L–Liquid, N–Natural, W–Water)		FILAMENT (F) OR HEATER: VOLTS	FILAMENT (F) OR HEATER: AMP.	CLASS C TELEGRAPHY (CCS) UNLESS OTHERWISE SPECIFIED: FREQ FOR FULL INPUT MC	MAXIMUM RATINGS: PLATE VOLTS	MAXIMUM RATINGS: GRID-NO.2 VOLTS	MAXIMUM RATINGS: GRID-NO.1 VOLTS	MAXIMUM RATINGS: PLATE MA	MAXIMUM RATINGS: GRID-NO.2 INPUT WATTS	MAXIMUM RATINGS: GRID-NO.1 CURRENT IN MA OR INPUT (W) IN WATTS	MAXIMUM RATINGS: PLATE DISSIPATION WATTS	UNDER MAXIMUM PLATE VOLTS: AMPLIFICATION OR MU FACTOR	TYPICAL OPERATION: FREQ MC	TYPICAL OPERATION: DRIVER OR DRIVING (T) POWER WATTS	TYPICAL OPERATION: POWER OUTPUT WATTS
8170/ 4CX5000A	Beam Pwr. Tube	FA	7.5	73 to 78	30	7500	1500		3000	250	75W	5000				
8239/ 3X3000F1	Triode	FA	7.5	49 to 54		6000[d]			2500		50W	3000				
8438/ 4-400A	Beam Pwr. Tube	FA	5	14.5	110	4000	600	-500	350	35	10W	400				

[f] For detailed data on later version of this type refer to 6883B/8032A/8552 and 6146B data sheets, located in the *TRANSMITTING TUBE SECTION*. [g] Linear RF Power Amplifier service, plate current at peak envelope conditions.

TERMINAL DIAGRAMS



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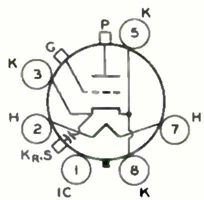

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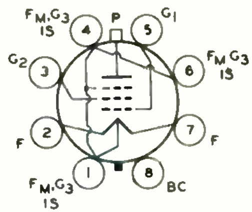

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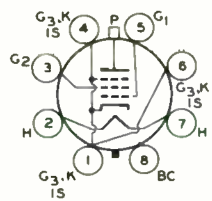

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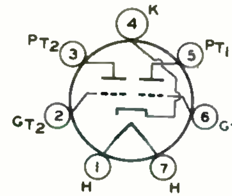

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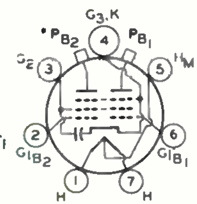

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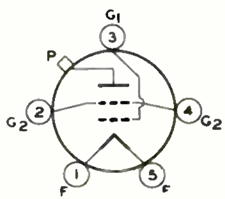

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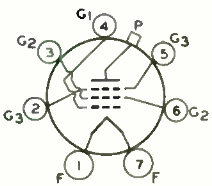

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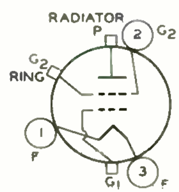

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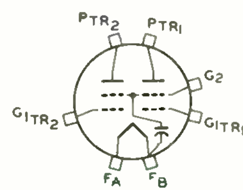

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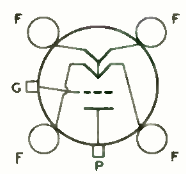

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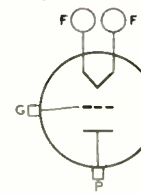

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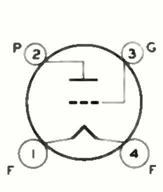

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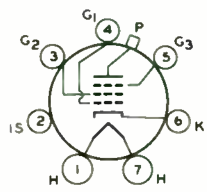

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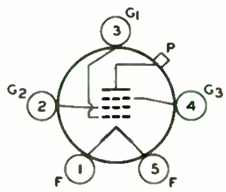

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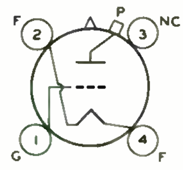

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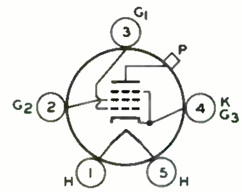

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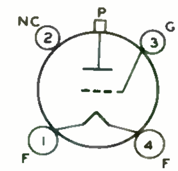

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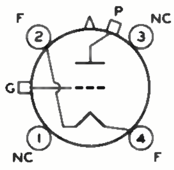

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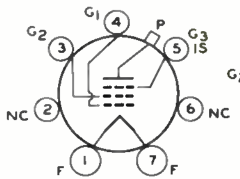

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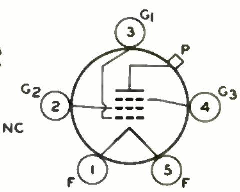

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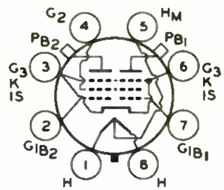

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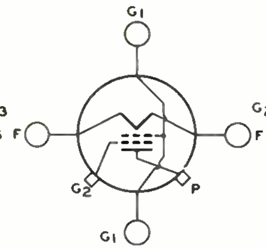

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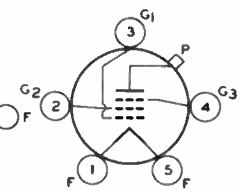

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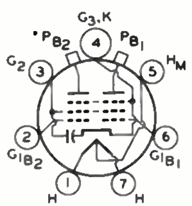

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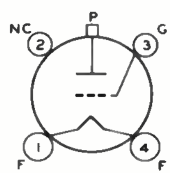

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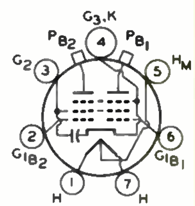

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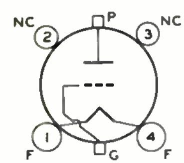

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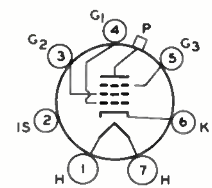

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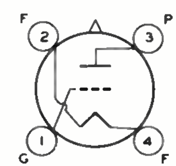

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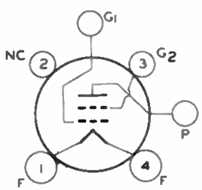

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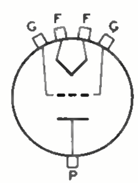

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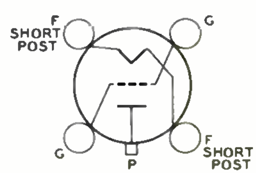

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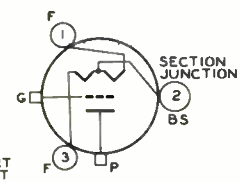

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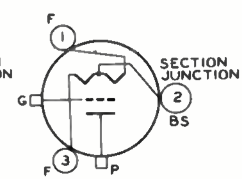

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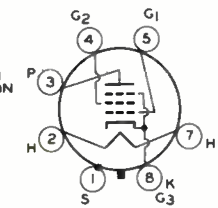

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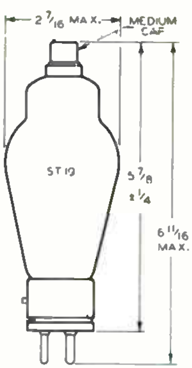

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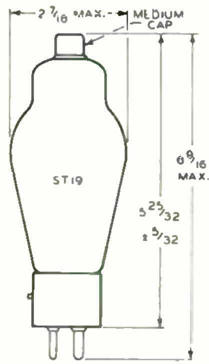

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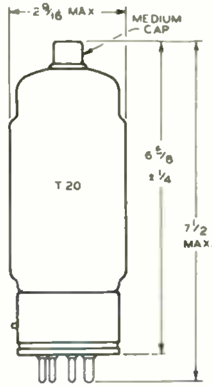

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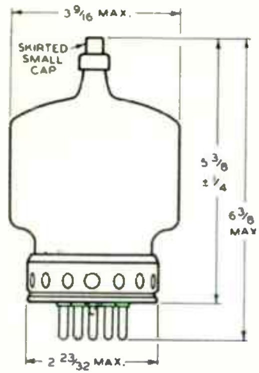

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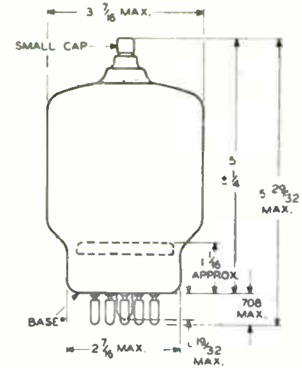

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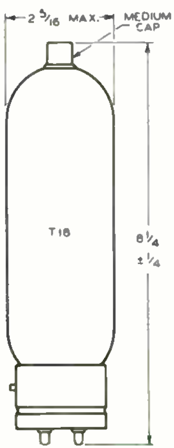

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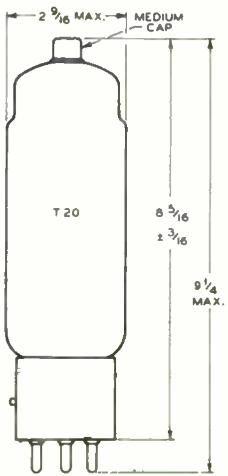

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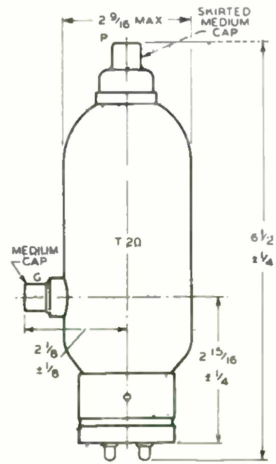

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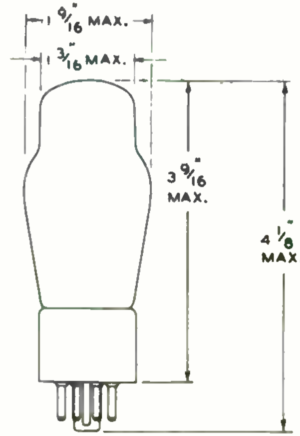

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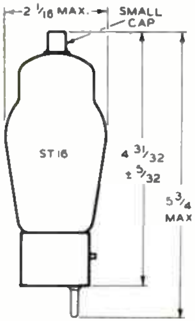

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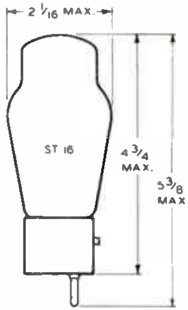

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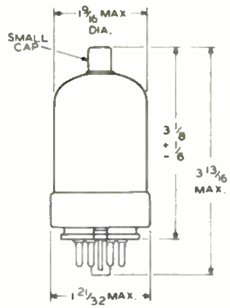

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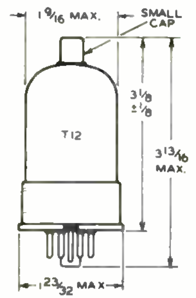

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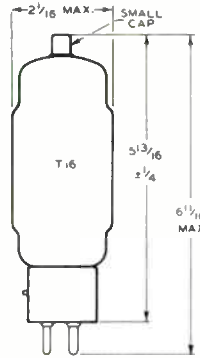

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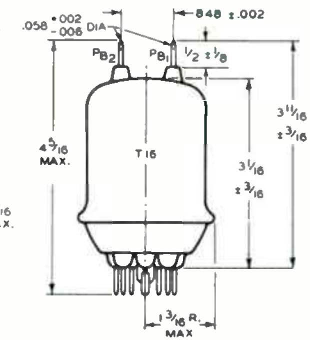

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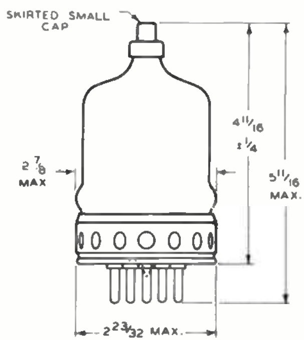

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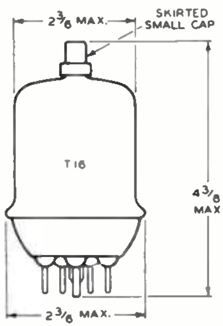

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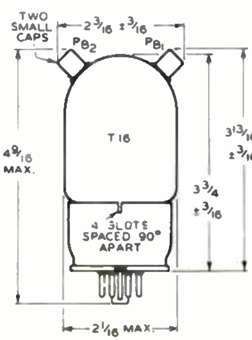

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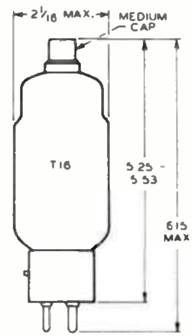

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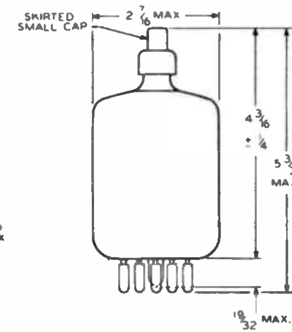

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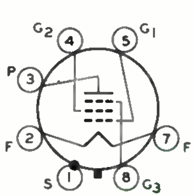
RCA TRANSMITTING-TUBE TYPES -Limited Listing

Terminal Diagrams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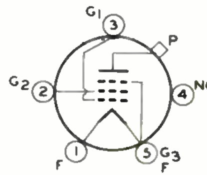
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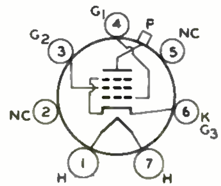
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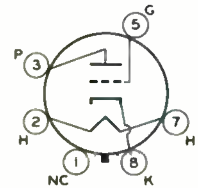
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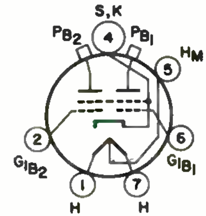
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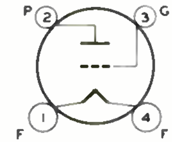
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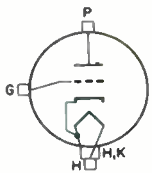
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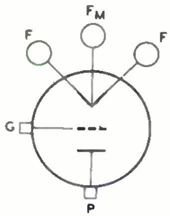
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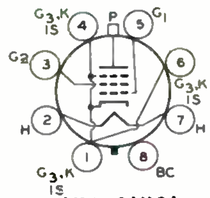
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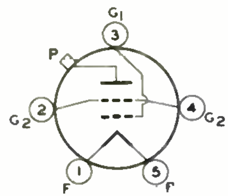
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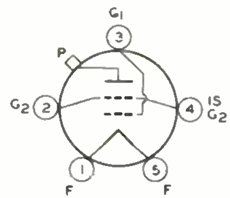
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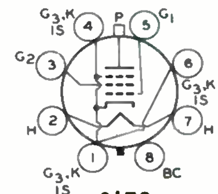
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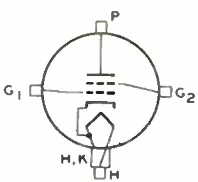
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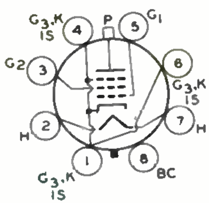
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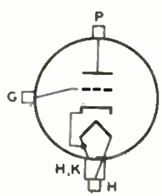
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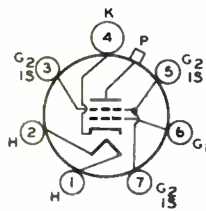
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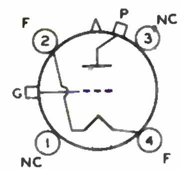
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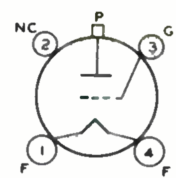
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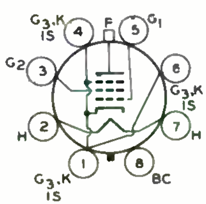
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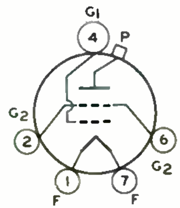
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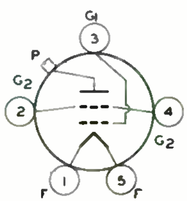
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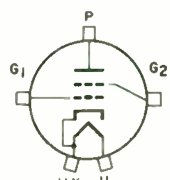
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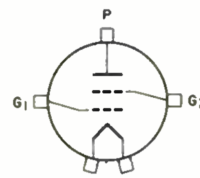
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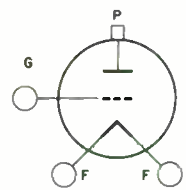
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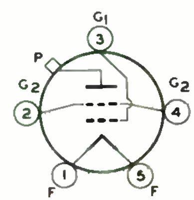
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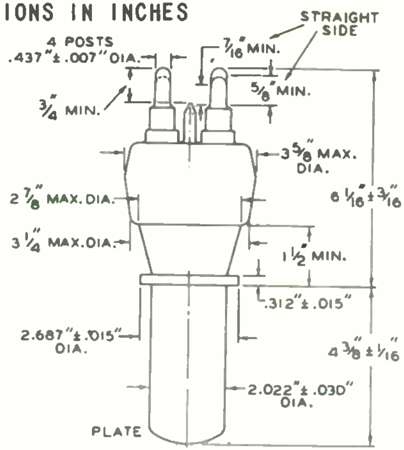
MAXIMUM ENVELOPE TEMPERATURES and KEY TO DIMENSIONAL OUTLINES

Tube Type	Max. Envelope Temperature °C		Key No.	Tube Type	Max. Envelope Temperature °C		Key No.	Tube Type	Max. Envelope Temperature °C		Key No.
	Term. or Rad.	Bulb or Plate Core			Term. or Rad.	Bulb or Plate Core			Term. or Rad.	Bulb or Plate Core	
2C39A	175	175	51	813	-	-	3	4610	-	-	16
2C39WA	200	200	51	814	-	-	24	5556	-	-	43
2C40	175	175	29	815	-	-	19	5713	140	180	53
2C40A	175	175	29	827R	175	150	45	5786	165		
2C43	200	200	30	828	-	-	24		200[b]	180	28
2E24	-	210	33	829B	-	235[c] 265[d]	16	6146	-	220	14
2E26	-	210	33	830B	-	-	15	6146A	-	220	13
3C33	-	250	32	832A	-	200	31	6155	180	220	21
3E29	-	-	16	834	-	-	52	6156	180	220	5
3E29A	-	-	16	837	-	-	11	6159	-	220	14
4-125A/4D21	170	170	17	845	-	-	8	6181	180	-	26
4-250A/5D22	170	170	4	860	-	-	35	6883	-	220	13
4E27A/5-125B	225	225	20	880	150	150	39	6893	-	210	33
4X500A	150	150	50	889A	-	-	22	6897	250	250	49
8D21	150	150	46	889RA	180	150	37	7271	-	250	44
9C21	165	180	40	891	-	150	23	8000	-	-	9
9C22	165	180	34	891R	180	150	36	8005	-	-	1
207	-	Note[a]	38	892	-	150	23	8032	-	220	13
801A	-	-	12	892R	180	150	36	8165/4-65A	200	225	18
802	-	-	11	1613	-	-	42	8166/4-1000A	150	200	41
803	-	-	7	1614	-	-	25	8168/4CX1000A	250	250	48
805	-	-	6	1619	-	-	25	8170/4CX5000A	250	250	27
807	-	-	11	1624	-	-	11	8239/3X3000F1	-	-	47
809	-	-	2	1625	-	-	11	8438/4-400A	200	225	4
810	-	-	9	1626	-	-	10				

[a] Outlet water temperature, 70°C max.
[b] Filament temperature.
[c] Forced-air cooling.
[d] Natural cooling.

DIMENSIONS IN INCHES



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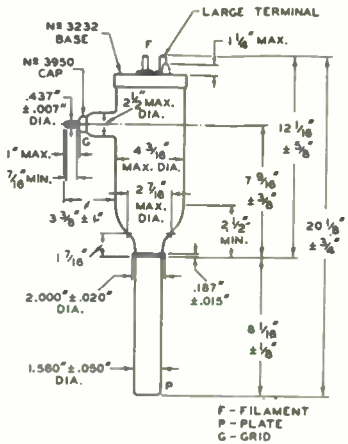

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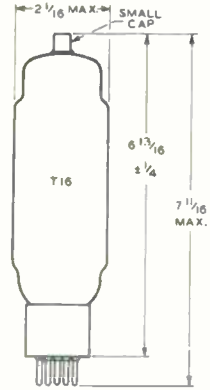

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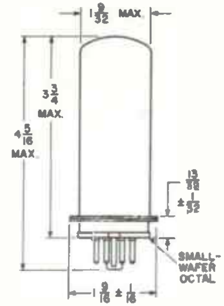

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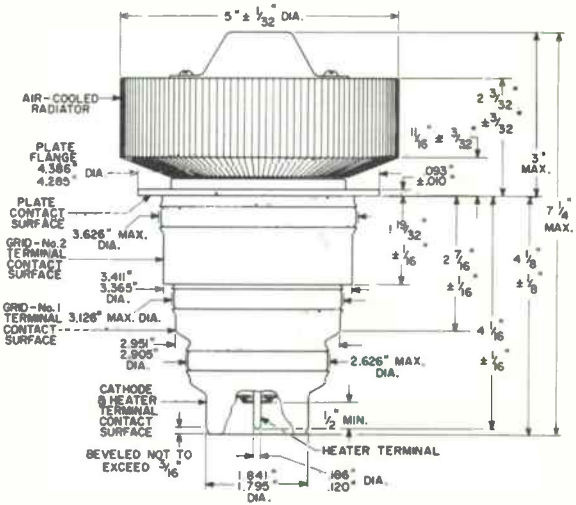

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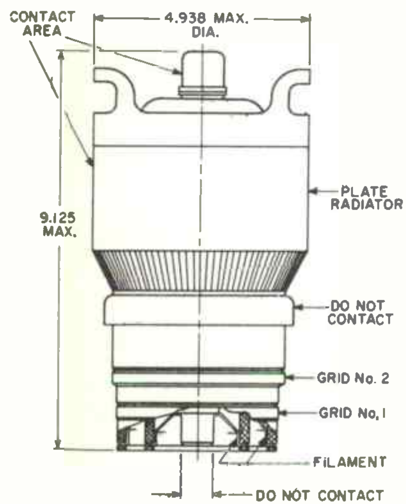

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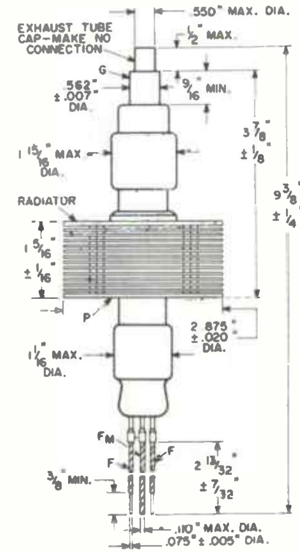

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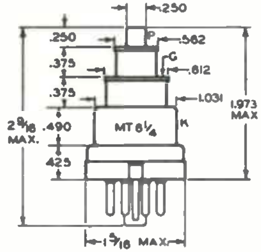
DIMENSIONS IN INCHES



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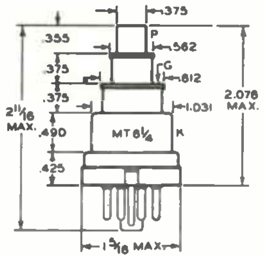

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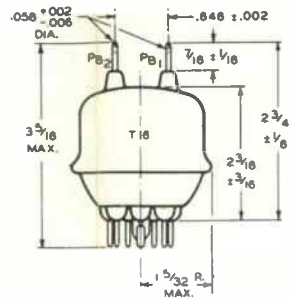

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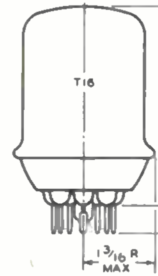

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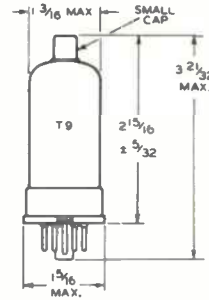

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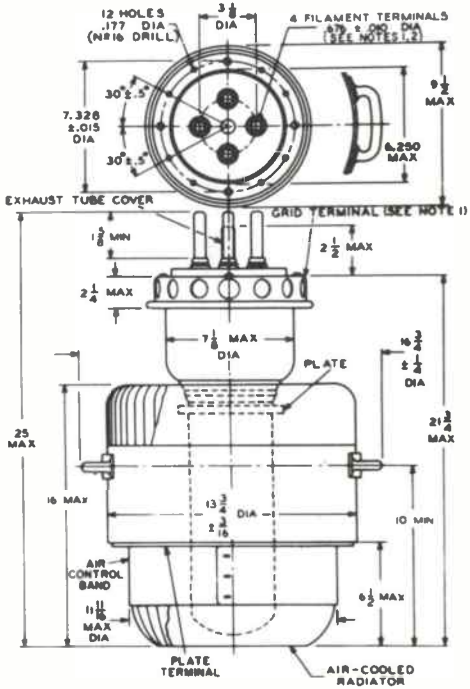

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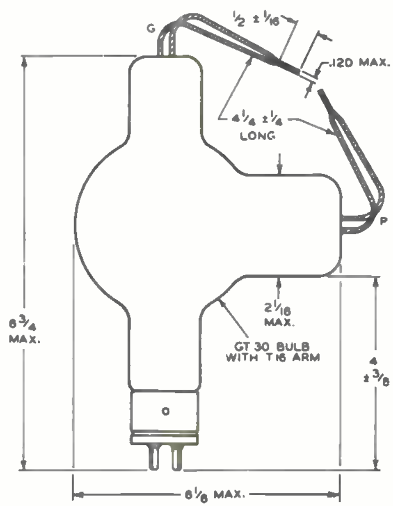

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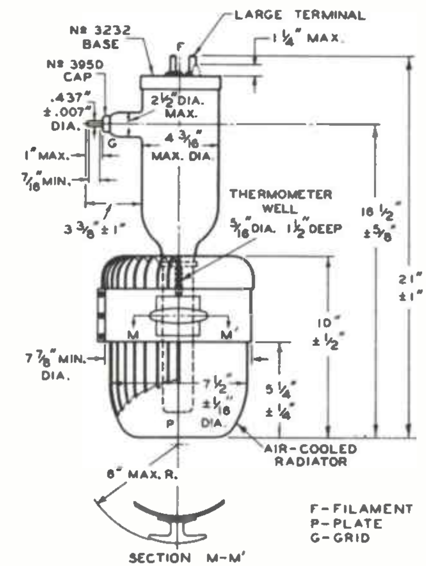

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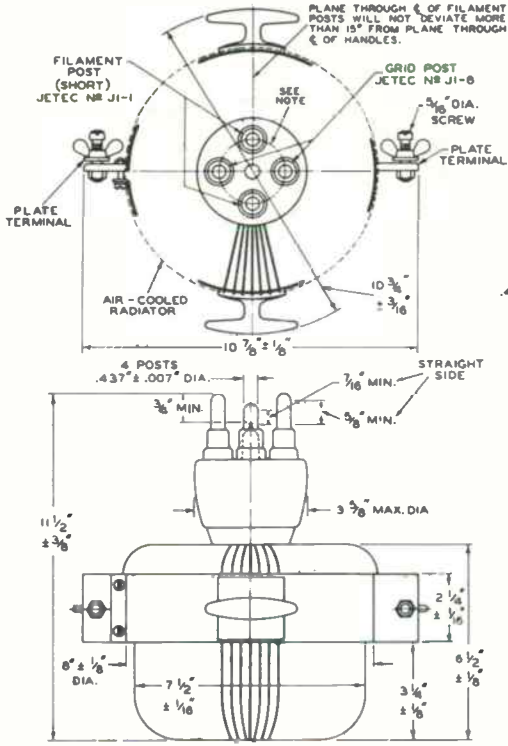

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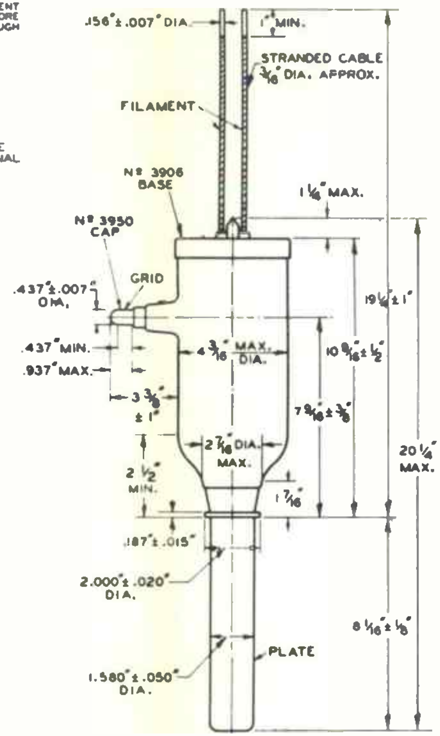

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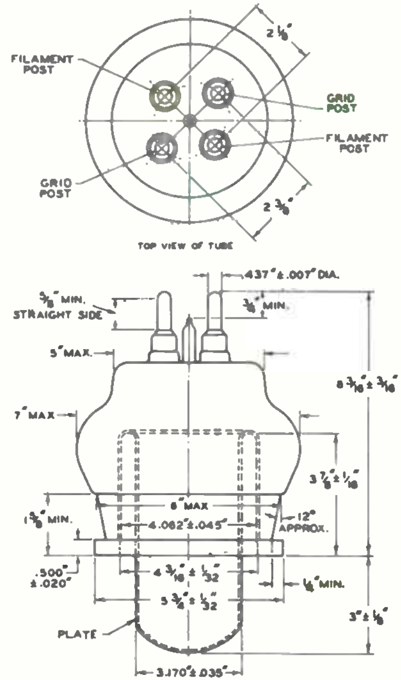

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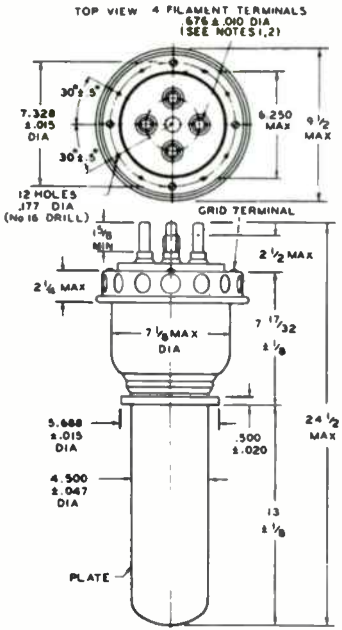

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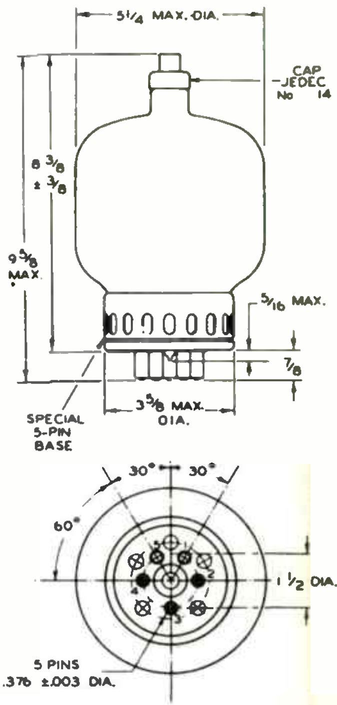

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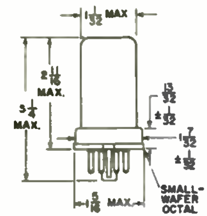

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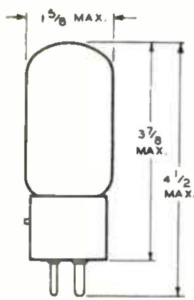

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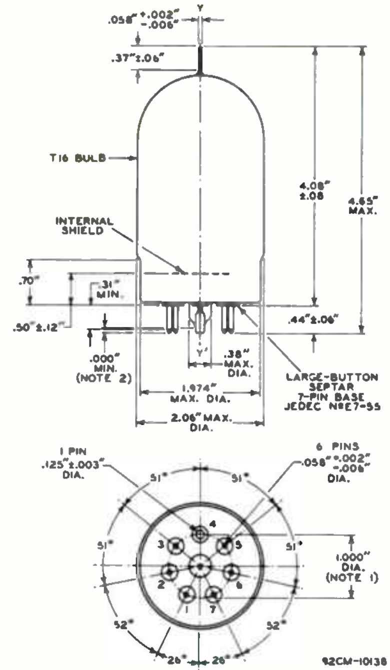

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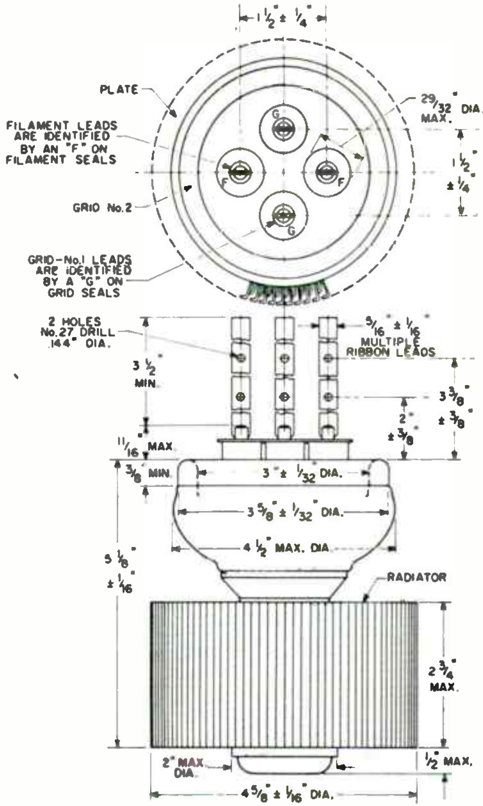

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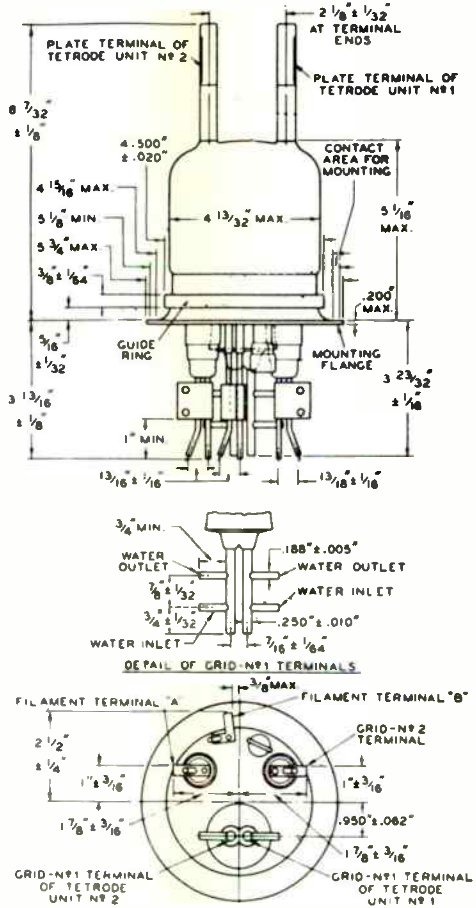

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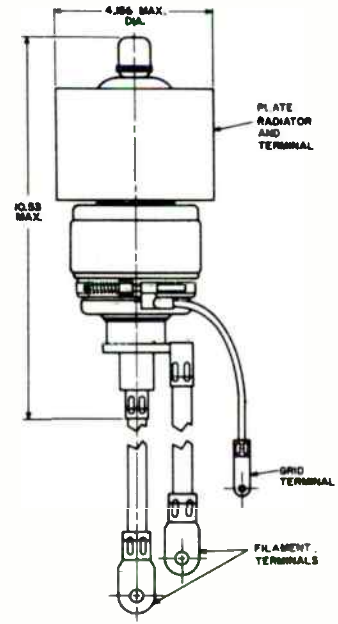

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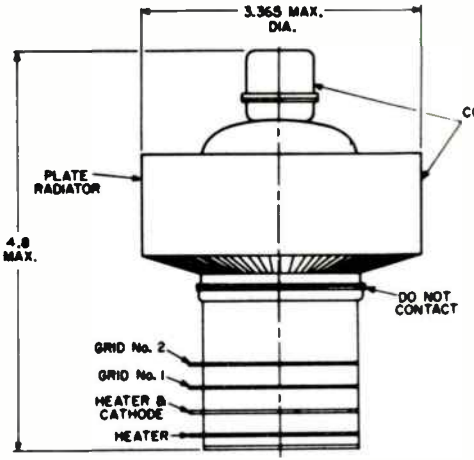

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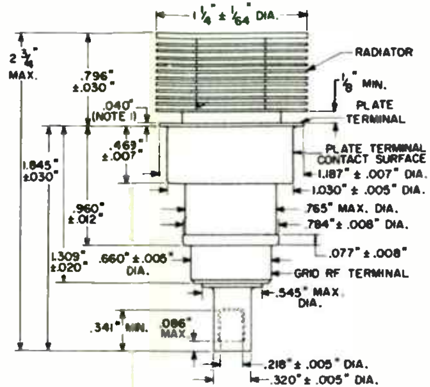

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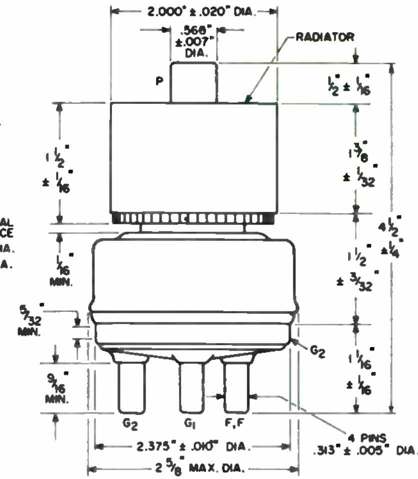

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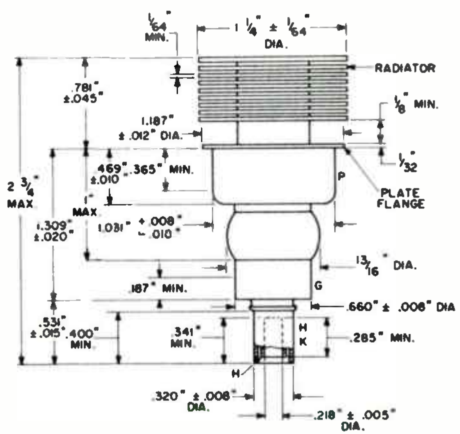

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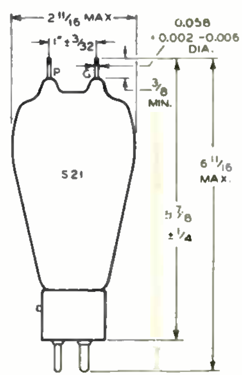

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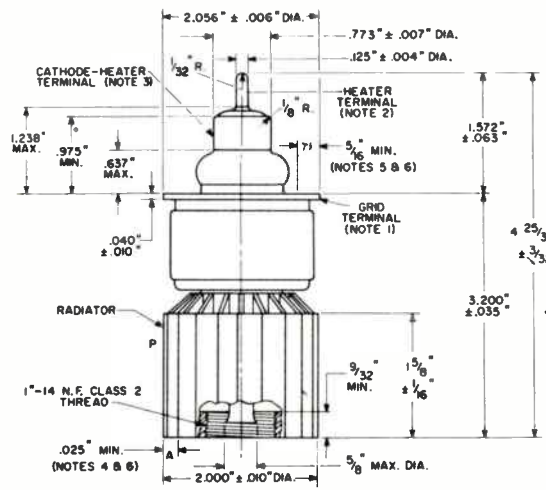

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RCA Transmitting Tube Operating Considerations

The following operating considerations for RCA transmitting tubes are intended for use with the data sheets on individual tube types given in the Handbook. Operating considerations unique to a particular tube type are not included in this presentation but are covered by the Handbook data sheets for the given type.

RATINGS

Refer to the *General Section* of the Handbook for a detailed discussion on Rating Systems and Tube Ratings.

CLEANING

As with other high-voltage equipment, it is essential that external parts of power tubes be kept free from accumulated dirt and moisture to minimize surface leakage and the possibility of arc-over.

Some tube configurations contain re-entrant areas at the edge of the insulator seals. Particular care should be taken to prevent foreign matter from coming in contact with these areas. Unless adequately protected by filtered air, these areas collect dirt rapidly as a result of electrostatic forces and the nature of the air circulation around the tube.

The external parts of the tube should periodically be wiped free of dirt. A recommended procedure for cleaning ceramic-metal tubes is as follows:

1. Remove silicone grease or similar material by use of acetone, or equivalent.

   Caution: Do not allow silicone grease or similar materials to remain on any rf contact surfaces. Severe burning of the contact surfaces of cylindrical-terminal types will occur if the contact fingers do not mate firmly with clean metal contact surfaces.

2. Clean rf contact surfaces with a very fine grade of silicon carbide abrasive pad, or equivalent.

   Caution: Do not permit the cleaning pad to come in contact with the ceramic surfaces. Rub gently to prevent removal of plating.

COOLING CONSIDERATIONS

Tube life can always be extended by maintaining envelope temperatures substantially below the maximum temperature ratings.

The user is cautioned that typical cooling characteristics in the published data are offered only as a guide, and that maximum envelope temperatures in the intended operation are the final rating criteria.

Temperature measurements of the tube envelope must be made to insure operation within maximum ratings. For glass-bulb types, the bulb "hot-spot" must be located with the tube operating in its intended application. A simple technique for locating the "hot-spot" in low-power, receiving-type tubes is to apply a low-temperature-melting paint, such as Tempilaq[a], to the entire bulb surface; the point at which this material first begins to melt is the hottest point on the bulb. For most power tubes, however, this technique is not satisfactory because of radiation effects. Therefore, it is recommended that a thermocouple be moved over the envelope to locate the hottest point on the bulb. (Although the individual thermocouple readings are not precise, the relative readings are sufficient.) Spots of various higher temperature Tempilaq paints may then be applied only to the hottest area; the lowest Tempilaq paint which will not melt must be at or below the maximum temperature rating. See Ref. 1. In general, the hottest point of a ring terminal is at the seal or junction of the terminal and its adjacent glass or ceramic insulator. For some tube types the temperature measurement points are specified on the *Dimensional Outline* in the published data.

All types of heat transfer—radiation, convection, conduction, and combinations thereof—are employed in the various cooling techniques: natural, forced-air, liquid, and conduction cooling.

Natural Cooling—This method is generally used for glass-bulb types having plate dissipation ratings up to about 300 watts.

Temperature should be measured at the hottest point on the bulb using techniques previously discussed.

Adequate free space around the tube is required for all natural cooled types. Avoid reflective heat surfaces such as tube shields. These and other design considerations affecting natural methods of cooling are described in Ref.2.

Forced-Air Cooling—

Glass-Bulb-Types—Forced-air cooling may be applied to glass-bulb types to enhance the convection cooling and reduce bulb temperature. In some glass-bulb types, ratings are given for both natural and forced-air cooling. (The ratings with forced-air cooling reflect the higher permitted value of dissipation.) In general, any natural-cooled type may require some forced-air cooling if operation is near the maximum ratings or if limited space is available around the tube. The final decision can be made only after temperature measurements are made to insure operation below the maximum temperature rating.

Radiator Types—The external plate construction lends itself to compactness, higher frequency operation, increased power capability, and intense-cooling techniques. Because the plate is part of the envelope, transfer of heat by radiation from the plate to the envelope is eliminated. The simplest intense-cooling technique is forced-air. All RCA forced-air-cooled, external-plate types contain integral radiators, which are brazed, pressed, or otherwise secured to the plate to insure intimate thermal contact.

Most of the heat within an electron tube is generated at the plate; additional heat generated from the other electrodes migrates to the plate. Precaution, however, must be taken to insure that none of the other terminals exceed their maximum rated temperature value. It may be necessary to direct some forced air across these terminals.

In general, there are two basic types of radiators: the stacked-disc type of finned radiator for TRANSVERSE FORCED-AIR COOLING, and the radial-fin type of radiator for AXIAL FORCED-AIR COOLING.

Transverse Cooling—Air flow is directed across the radiator from an orifice in a plane normal to the major axis of the tube and at the center of the radiator. More efficient cooling may be accomplished by providing a cowling to direct and confine the air. Pressure drop across the radiator itself is normally insignificant. Typical cooling characteristics for transverse cooling, such as shown in Fig.1, are given in the published data. The following steps illustrate the use of the chart:

1. Estimate probable *Plate Dissipation* from electrical conditions, locate as point "A" on the abscissa axis (80 watts in example), and erect a perpendicular line "ac".
2. Determine temperature rise by subtracting estimated incoming-air temperature (assume 36°C in example) from estimated

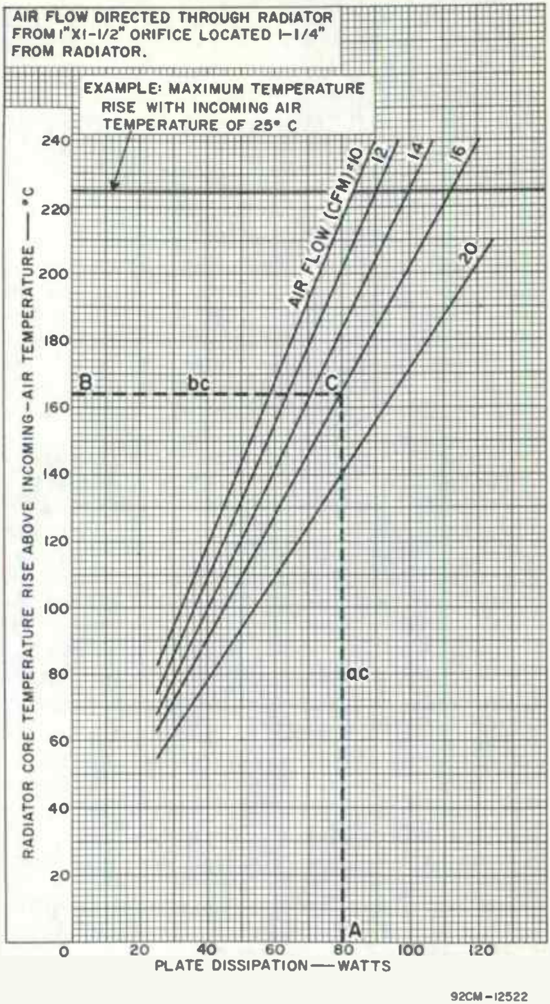

FIG.1 - EXAMPLE OF TYPICAL COOLING CHARACTERISTICS

tube operating temperature (assume 200°C in example), locate the determined value (200°C-36°C = 164°C in example) as point "B" on the ordinate axis, and construct horizontal line "bc".

3. Determine air flow by interpolating the air flow curves at the intersection of lines "ac" and "bc", point "C" (16 cfm in example).

Axial Cooling—Air flow is directed through the radiator by suitable ducts. Air flow may be in either direction unless otherwise specified. Typical cooling characteristics for axial cooling, such as shown in Fig. 2, are given in the published data. The following steps illustrate the use of the chart:

1. Select a tube operating temperature as discussed in this section, locate as point "A" on the abscissa (assume 200°C in example), erect perpendicular line "ab", extend this line until it crosses the estimated plate dissipation curve (240 watts in example) for temperature (solid line), and designate as point "B".
2. Determine air flow by constructing a horizontal line "bc" from point "B" to the ordinate axis and designate point "C" (3.5 cfm in example).
3. Determine the pressure drop across the radiator for the air flow in (2), locate point "D" on line "bc" at the estimated plate dissipation curve (240 watts in example) for pressure drop (dashed line), construct a perpendicular line "de" to the abscissa axis, designate as point "E", and read pressure drop (0.24 inch of water in the example).

See Ref. 3 for detailed information on the blower requirements for forced-air-cooled tubes.

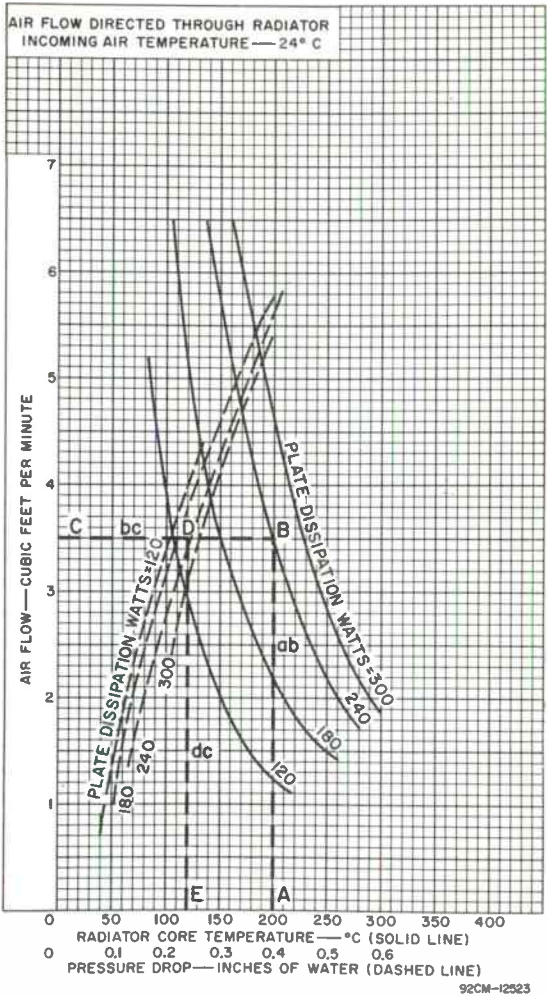

FIG.2 - EXAMPLE OF TYPICAL COOLING CHARACTERISTICS

Liquid Cooling—The liquid-cooling system consists, in general, of a source of cooling liquid, a feed-pipe system which carries the liquid to the water jacket surrounding, and provision for interlocking with the power supplies the liquid flow through the cooling courses. A more sophisticated system would also contain a liquid regeneration loop, flow regulators, and gages. For more detailed information on liquid-cooling systems, see Refs. 4 and 5.

Proper functioning of the coolant system is of the utmost importance. Even a momentary failure of the liquid flow may damage the tube. Without coolant the heat of the filament or heater alone may be sufficient to cause serious harm to some tube types. It is necessary, therefore, to provide a method of preventing tube operation in case the coolant supply should fail. A suitable method is the use of coolant-flow interlocks which open the power supplies when the flow is insufficient or ceases. If there is an interruption of the power supplies, it is then necessary to return the filament or heater voltage to zero and to restart in the normal manner described in the published data. The coolant flow must start before application of any voltage and continue for several seconds after removal of all voltages.

The absolute minimum coolant flow required through the system is given in the published data. Under no circumstances should the temperature of the coolant at any outlet ever exceed the maximum value given in the published data.

When the coolant fluid is water and the tube is used in equipment under conditions such that the ambient temperature is below $0^{\circ}C$, precautions should be taken to prevent the water from freezing in the system.

Use of Water as Coolant—For availability and ease in handling, water is recommended as the coolant wherever possible. It is of utmost importance to maintain a high quality of water in the cooling system. Contamination in the water will hasten scale formation, corrosion, and excessive electrolysis; any one of these conditions can greatly reduce tube life.

Use of Liquids other than Water as Coolant—When ambient temperatures fall below 0°C, it is possible to use coolants such as ethylene-glycol-water solution and FC75b. Neither of these two coolants is as effective a coolant as water, therefore, the plate dissipation and flow data must be modified from that given for water. A more extensive discussion of ethylene-glycol-water solution and FC75 as coolants is given in Ref.4. For information on the use of any coolant for which ratings are not given in the data, contact your RCA field representative or the nearest District Sales Office. A coolant such as oil will require a special plating on the metal of the tube envelope, such as nickel and rhodium to protect the metal surfaces from chemical attack.

Conduction Cooling—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. Primary consideration of the system should be given to the design of a heat-flow path (coupling device) with high thermal conductivity.

Heat Sink—The heat sink should be designed to act as a constant-temperature device to prevent any increase in temperature by dissipating the heat beyond the equipment compartment. Heat sinks can take the form of solids or liquids. In most applications such a heat sink is available in the form of equipment chassis, plate line, or output cavity.

Coupling—There are numerous insulating materials available to serve as the heat-coupling device, such as beryllium oxide (beryllia)[c], high-aluminum oxide (high-alumina), mica, and other insulating bodies. Since the thermal conductivity of these insulators varies considerably, the choice of insulator will depend primarily on the plate dissipation in the given application. For a detailed discussion on conduction cooling, see Ref. 6.

In hf operation the inductive element of the plate circuit is usually a relatively long coil, which does not provide a good thermal path from plate to chassis. Larger shunt capacity can be tolerated, however, and heat can be conducted through a portion of it to the chassis. In uhf operation the permissible shunt capacity of the plate circuit is limited, but the inductive element is short and can usually be made with sufficient cross-sectional area to form an excellent thermal path. In vhf operation a careful compromise of the above is required to obtain adequate rf performance and reasonable cooling.

PRECAUTIONS

The voltages at which power tubes are operated are extremely dangerous. Protection circuits must be provided which will protect operation and maintenance personnel, protect the tube in the event of abnormal circuit operation, and protect the tube circuits in the event of abnormal tube operation. Power tubes require mechanical protective devices such as interlocks, relays, and circuit breakers. Circuit breakers alone may not provide adequate protection in certain high-power-tube circuits when the power-supply filter, modulator, or pulse-forming network stores considerable energy. Additional protection may be provided by the use of high-speed electronic circuits or electronic "crow-bars" to bypass the fault current until mechanical circuit breakers are opened.

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 cannot 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 and discharge high-voltage capacitors when any gate or door on the protective housing is opened, and should prevent the closing of this primary circuit until the door is again locked.

ELECTRICAL CONSIDERATIONS

Cathode—RCA transmitting tubes use a wide variety of cathodes. All utilize thermionic emission and should be operated at a constant temperature.

Refer to the *General Section* of the Handbook for a detailed discussion on TYPES OF CATHODES AND THEIR USE.

Filament or Heater—The rated filament or heater voltage should be applied for the heating time specified in the published data 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 adjusting to the lowest filament or heater supply voltage that will give the desired performance. In general, the filament or heater voltage values given in the published data include the maximum value and the typical value. Exceeding the maximum value will damage or severely shorten the life of the cathode.

The filament or heater voltage should be adjusted to the typical value initially, then reduced to provide satisfactory tube performance; any further reduction will show some degradation.

Good regulation of the filament or heater voltage about the value found above is, in general, economically advantageous from the view-point of tube life. When the rated value is shown with a percentage value in the published data, the percentage value indicates the tolerable momentary fluctuations from the rated value. For longer life, especially at higher operating frequencies, these fluctuations should be reduced by improved power supply regulation.

The cathode may be subjected to back bombardment as the frequency is increased with resultant increase in temperature. In pulse types back bombardment normally need not be considered when the duty factor is small. However, higher duty factors increase the possibility of this effect. In any event, the filament or heater supply voltage should be reduced as described above.

Standby Operation—During standby periods, the tube may be operated at decreased filament or heater voltage to conserve life. It is recommended that the filament or heater voltage be reduced to no less than 80 per cent of normal during standby periods of up to 2 hours. For longer periods, the filament or heater voltage should be turned off.

Filament Overvoltage Pulse Circuits—In certain battery-operated equipment, such as emergency-type, remote-area, or mobile applications, it is of utmost importance to conserve battery power. Quick-heating RCA power tubes provide useful power outputs within about one second from a cold start. This fast "warm-up" feature eliminates the need for standby filament power, resulting in significant conservation of battery power.

In general, "warm-ups" of about one second are adequate in equipment where the microphone switch actuating the transmitter power relay is located in the cradle of the handset, such as a conventional telephone, or similar wall-type installation. However, when the switch is the push-button type located on the handset, faster "warm-ups" are demanded. Extremely fast "warm-ups" of less than 200 milliseconds are possible for such "push-to-talk" microphone switches by the use of a suitably designed filament overvoltage pulse circuit or "hot-shot" circuit.

The diagram shown in Fig.3 depicts the filament-voltage waveform during a transmission using a "hot-shot" circuit. An overvoltage

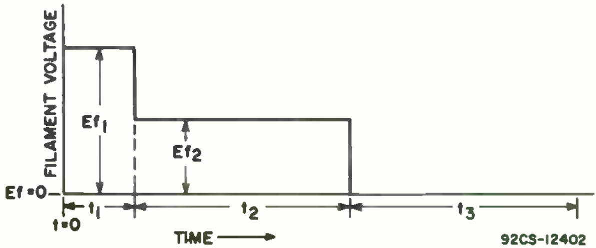

FIG.3 - FILAMENT VOLTAGE WAVE FORM

Ef_1 is applied for time t_1. A transfer switch then reduces the filament voltage to the rated value, Ef_2, for the remainder of transmission time t_2. During standby time t_3, the filament voltage is zero.

The block diagram shown in Fig.4 depicts the basic requirements of a "hot-shot" circuit in conjunction with the communication equipment. The auxiliary circuit must provide a low-impedance filament overvoltage source, a rated filament voltage source, an accurately timed means of switching these sources, and a protective circuit to prevent possible damage to the tube filament from repeated applications of overvoltage with insufficient time for the filament to cool between transmissions. Both filament voltages are obtained from the transmitter power supply. Power is supplied simultaneously to the transmitter and timer

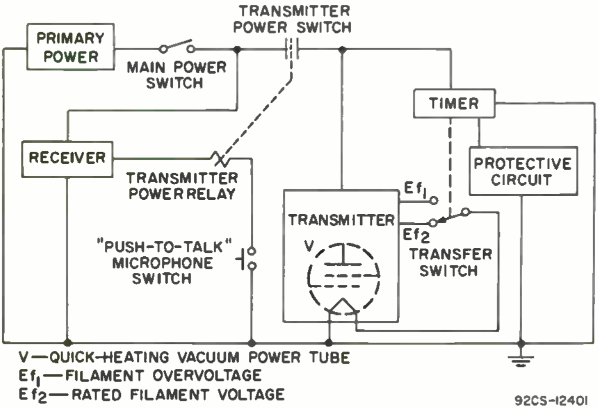

FIG.4 - BASIC RECEIVER-TRANSMITTER WITH AUXILIARY "HOT-SHOT" CIRCUIT

by the "push-to-talk" microphone switch. The transfer switch, which is initially connected to the filament overvoltage source, is switched by the timer to the rated filament voltage source in the required time (pulse duration) after application of power to the transmitter.

Before a "hot-shot" circuit can be designed for a quick-heating tube, it is necessary to establish maximum ratings for the peak voltage (on the order of 2 to 3 times the rated filament voltage) and duration of the filament overvoltage pulse for the desired heating time. Filament overvoltage pulse ratings are given in the published data on quick-heating tube types.

Any "hot-shot" circuit design must provide protection against the application of the filament overvoltage pulse to a hot filament.

It is recommended that a dummy filament, simulating the resistance of the specific tube type, be used in the initial testing or checking of a "hot-shot" circuit design. Otherwise, any fault—especially an excessive pulse duration can cause catastrophic failure of the tube.

Plate Voltage Supply—Power-amplifier tubes usually obtain plate voltage from rectifiers provided with suitable filter circuits, although batteries or local dc generators are sometimes used, especially in portable and mobile equipment.

A time-delay relay should be provided in the plate-supply circuit to delay application of plate voltage until the filament or heater has reached normal operating temperature.

An interlocking relay system should be provided to prevent application of plate voltage prior to the application of sufficient bias voltage and/or rf drive to grid No. 1; otherwise, with insufficient bias, the resultant high plate current may cause excessive plate dissipation with consequent damage to the tube. RF-load shorts or other causes of high output VSWR may also cause high dissipations, excessive voltage gradients, or insulator flash-overs. The VSWR should be monitored and the detected signal used to actuate the interlock system to remove the plate voltage in less than 10 milliseconds after the fault occurs.

In beam power tubes with closely spaced electrodes, extremely high-voltage gradients occur even with moderate tube operating voltages. Consequently, momentary fault currents may cause catastrophic failure unless protection is provided. A series impedance in the plate lead is recommended. A resultant plate impedance, which will provide a plate-voltage-supply regulation of no better than 10 per cent, is usually sufficient.

Grid-No.2 Voltage Supply—The grid No.2 must be protected by a time-delay and interlocking relay similar to the plate-voltage-supply protection described for Plate Voltage Supply. The plate voltage should be applied simultaneously with or before the grid-No.2 voltage; otherwise, with voltage on grid No.2 only, grid-No.2 current may be large enough to cause excessive grid-No.2 dissipation. If the grid-No.2 voltage is obtained from the plate voltage supply, these precautions will have been accomplished.

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 the net result of these component currents is read on a meter in the grid-No.2 circuit, grid-No.2 dissipation can not be accurately determined. Operation similar to conditions given under *Typical Operation* in the published data will minimize the possibility of exceeding maximum dissipation.

In tubes with precision-aligned grids, such as Cermolox tubes, the grid-No.2 circuit must be capable of maintaining the proper grid-No.2 voltage in the presence of moderate negative dc current as well as normal values of 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 currents on the order of one-tenth the required plate current.

RCA Transmitting Tube Operating Considerations

Grid-No.1 Voltage Supply—The grid-No.1 bias circuit should preferably be adjustable to permit small variations of grid-No.1 voltage. This bias adjustment will permit setting the desired plate current, and it will minimize variations in tube performance. Sufficient fixed bias or cathode resistor bias should be provided to protect the tube in the event that the drive signal is lost.

The design of the bias-voltage supply should include an instantaneous over-current relay. The action of the over-current relay and the inherent regulation of the supply should be such that no damage to the tube or supply will result from an accidental short at the tube connection or from an internal tube fault.

The rf-power-input transmission line should be provided with VSWR protection to remove drive power as well as plate (and grid No.2) voltage within 10 milliseconds in the event of abnormal changes in input VSWR during operation.

CLASSES OF SERVICE

AF Power Amplifiers—The current and power values in the Maximum Ratings are averaged over any audio-frequency cycle of sine-wave form. The driver stage should be capable of supplying at low distortion the No.1 grid(s) with the value of peak af voltage given in the *Typical Operation* of the published data. In no case should the Grid-No.1-Circuit Resistance exceed the value specified under *Maximum Circuit Values*. Transformer or impedance coupling devices are recommended.

Individual bias adjustment for each tube (unit) should be used to balance the loading and minimize distortion. In push-pull operation the bias of each tube (unit) should be adjusted to divide the value of zero-signal plate current in the published data equally between the two tubes (units).

RCA Transmitting Tube Operating Considerations

Except for class A amplifiers, the average plate and grid No.2 currents vary with the amplitude of the driving signal. Hence, serious distortion and inadequate power output will result with large input signals unless the plate and grid-No.2 power supplies are well regulated.

Class A—This class normally does not draw grid-No.1 current or requires tube driving power and can employ simple cathode bias. Where class A_2 (indicating grid-No.1 current flows during part of the cycle) is specified, the grid-No.1 circuit precautions discussed under class AB_2 operation will apply.

Class AB_1—The subscript 1 in class AB_1 indicates that grid-No.1 current does not flow during any part of the cycle.

Class B and Class AB_2—These classes normally draw grid-No.1 current (indicated by the subscript 2 in AB_2) with large signals and, therefore, require tube driving power. To minimize distortion, the grid-No.1 bias supply preferably should be regulated or held to a low value of effective resistance. Transformer coupling should be used.

RF Power Amplifiers or Oscillators—On modern ceramic-metal envelope types, the frequency selected is usually the maximum value at which reasonable gain and efficiency are obtained. In glass-envelope types, the maximum frequency is selected as the frequency above which excessive rf envelope losses require voltage deratings and reduced efficiency requires input deratings.

Driving power values given in the published data include only the power that must be delivered to the tube and bias supply. The term, "driving power", is normally used only at low frequencies where circuit losses are small.

Where *Driver-Power Output* is shown in the published data, the rf losses associated with a typical input circuit are also included.

In cathode-drive circuits, a portion of the driver-power output and the developed rf power output act in series to supply the load circuit. If the driving power is increased, the output will always increase. In a grid-drive circuit, a saturation effect takes place; i.e., above a certain value of driving voltage and current, the output increases very slowly and may even decrease. It is important to recognize this difference and not try to saturate a cathode-drive stage; otherwise, the maximum grid-No.1 and grid-No.2 input may easily be exceeded.

Parasitic oscillations may be experienced under certain operating conditions. Such oscillations result in erratic performance and may cause damage to the tube and/or associated circuitry. Operating conditions and external circuits should be adjusted for operation without oscillations. References 10 and 11 are suggested for further information on the detection and suppression of parasitic oscillations.

Class C Plate-Modulated-Power Amplifiers— In plate-modulated class C amplifier service, the tube can be modulated 100 per cent. The grid-No.2 voltage must be modulated simultaneously with the plate voltage so that the ratio of grid-No.2 voltage to plate voltage remains constant.

Grid-No.2 voltage should be obtained preferably from a separate source modulated from a separate winding on the modulation transformer.

Bias voltage may be obtained from a grid-No.1 resistor, but preferably is obtained from a combination of grid-No.1 resistor with either fixed supply or cathode resistor to protect the tube in the event the drive signal is lost.

In cathode-drive, plate-modulated, class C rf power amplifier service, the tube can be modulated 100 per cent if the rf driver stage is simultaneously modulated 100 per cent. Care should be taken to insure that the driver-modulation and amplifier-modulation voltages are exactly in phase.

Class C CW Power Amplifiers—In class C rf telegraphy service, the tube may generally be supplied with bias by any convenient method: from fixed supply, by grid-No.1 resistor, by cathode resistor, or by combination methods. However, when the tube is used in the final amplifier or a preceding stage of a transmitter designed for break-in operation and oscillator keying, an amount of fixed bias must be used to limit the plate current and, therefore, the plate dissipation to a safe value. Some fixed bias is preferred in any event to protect the tube in case the drive signal is lost.

Grid-No.2 voltage should be obtained preferably from a separate source. It can also be obtained 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 tube is used in a circuit which is not keyed.

Linear RF Power Amplifiers—The classes of operation suitable for linear rf power amplifiers include: class A, class AB_1, class AB_2, class B with bias, and class B with zero bias. Class A operation is the more nearly linear, but it is also the least efficient. Application is generally limited to low-power-level amplification. Class AB_1 produces the best compromise for linearity, efficiency, and gain. Class AB_2 or class B operation provides higher output for applications where sufficient driving power is available to permit some "swamping", and where linearity requirements are less stringent. Class B zero-bias operation with suitable high mu triodes may be used when adequate driving power is available.

In general, grid-No.2 voltage should be obtained from a separate, well-regulated source. In circuits where the grid-No.1 current is drawn, a separate, well-regulated source is also required.

(1) - **Single-Sideband, Suppressed Carrier Service**—Single sideband suppressed carrier operation is a form of linear amplifier service in which only one sideband is transmitted, and the carrier is suppressed.

The values of *Distortion Products Level* given under *Typical Operation* in the published data are referenced to either of the two tones for "two-tone" modulation and are without the use of feedback to enhance linearity.

(2) - **Class B and Class C Television Service**—Television is a form of linear amplifier service in which the rf carrier is modulated by a video signal. Typical operation is given at conditions of a specified bandwidth measured between the half-power points.

The values for the pertinent parameters given under *Typical Operation* in the published data are given at the synchronizing (sync) level and pedestal level (black level or blanking level).

(3) - **Class B Telephony Service**—Class B telephony service is a form of linear amplifier service in which the grid is excited with an rf carrier that is modulated at audio frequencies in one of the preceding stages. Under these conditions, plate dissipation is greatest when the carrier is unmodulated. Grid bias should be obtained from a dc voltage source of good regulation.

Pulsed RF Amplifiers and Oscillators—This service consists of the generation and amplification of an rf signal, the envelope of which is a waveform limited to intermittent pulses of defined shape, duration, and repetition frequency. Pulse duration and duty factor are sometimes limited directly by the maximum ratings. More frequently, the maximum ratings define a relationship between these factors as a maximum "ON" time in a given time interval in order to cover pulse-train inputs. Typical operation, in general, is given for conditions with a rectangular waveshape pulse of a given duration and duty factor. For operation at pulse durations or duty factors other than those given in the published data, see Ref.12.

In the amplifier service, the power supply pulses should preferably start shortly after and end shortly before the rf drive pulse to reduce the possibility of parasitic oscillations. If the rf drive pulses are "gated" within the power-supply pulses (the rf drive pulse starts shortly after and ends shortly before the power-supply pulses), the desired "gate" conditions should be observed carefully when no rf drive pulse is present to be assured that no oscillations are present.

The peak input energy required during the pulse is normally obtained from capacitor banks that must store many times this peak value to prevent excessive voltage droop. Consequently, it is particularly important to observe all the precautions for limiting tube input during faults which are described under Grid-No.2 Voltage Supply.

Pulse-Modulated RF Amplifiers—This service consists of the simultaneous amplification and pulse modulation of a cw rf signal. If differs from the other more conventional modulated rf amplifier services in that the modulating waveform is limited to intermittent pulses of defined shape, duration, and repetition frequency. This type of amplification/modulation is normally done at low power levels; hence, few power tubes are rated specifically for this service.

Pulse Modulator Service—The tube supplies a modulation signal consisting of intermittent pulses of defined shape, duration, and repetition frequency. Ratings, waveforms, and precautions are similar to those given for pulsed rf amplifier service (except there is no rf drive signal).

Observation of the exact waveforms must be made with an oscilloscope. In this manner, transient voltage or current spikes caused by unavoidable circuit reactances may be observed. Transient values must be held within the maximum ratings given in the published data.

High-power pulse modulators, when used to "clip" or "flat-top" the output waveform by the overdriving technique, must provide grid-No.1 and grid-No.2 input protection.

Plate current flow during the "OFF" time will contribute to plate dissipation; the bias voltage should be sufficient to hold the plate current below the required levels for any tube. The control limits, such as found in the Characteristics Range Values will provide information in determining the required bias. Current flow during the rise time and the fall time of a "rectangular" pulse can contribute significantly to plate dissipation; this current flow should be considered if the theoretical plate dissipation is close to the rated value.

Voltage Regulator Service—The tube acts as a "pass tube" having a controllable voltage drop in a series-regulated voltage-supply circuit. The plate voltage rating can be interpreted as applying to the actual plate-to-cathode voltage of the tube rather than the supply voltage. In this case, adequate protective devices must be used to protect the tube in the event of a shorted load. Special precaution should be made to observe the maximum circuit values for grid-No.1 and grid-No.2 impedance. For information on voltage regulator circuits, see Refs. 13, 14, and 15.

It is recommended that only tube types rated for this service be used since the use of a high power vacuum tube in a high-voltage, low-current application will frequently result in the selection of a tube inadequately controlled in the low-current region.

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[a] Made by the Tempil Corp., 132 W. 22nd Street, New York 1, New York.

[b] Manufactured by the Fluorchemical Division, Minnesota Mining and Manufacturing Co., 900 Bush Avenue, St.Paul 6, Minnesota.

[c] Warning: Beryllia dust and fumes are highly toxic to mucous membranes and may cause serious ulcers when imbedded under the skin. See References 7, 8, and 9.

REFERENCES

Copies for references 1, 3, 4, and 6 may be obtained by writing to Commercial Engineering, Radio Corporation of America, Harrison, New Jersey.

1. *Techniques for Measuring Electron-Tube Bulb Temperatures, RCA Application Note, AN-200.*

2. *Design Manual of Natural Methods of Cooling Electronic Equipment,* Department of the Navy, Bureau of Ships, Navships 900, 192.

3. *Blower Requirements for RCA Forced-Air-Cooled Tubes,* RCA Application Note, AN-161.

4. *Application Guide for RCA Super-Power Tubes,* 1CE-279A.

5. *Design Manual of Methods of Liquid Cooling Electronic Equipment,* Department of the Navy, Bureau of Ships, Navships 900, 195.

6. J. W. Gaylord, *"The Conduction Cooling of Power Tubes in Vehicular Communication Equipment,"* IEEE Transactions on Vehicular Communications, September, 1963.

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7. D. W. White, Jr. and J. E. Burke, *"The Metal Beryllium"* (book), published by the American Society for Metals, Cleveland, Ohio.

8. Donald P. O'Neil, *"Toxic Materials Machined Safely,"* American Machinist, June 4. 1955.

9. Sidney Laskin, Robert A. N. Turner, and Herbert E. Stokinger, *"Analysis of Dust and Fume Hazards in a Beryllium Plant,"* U.S. Atomic Energy Commission, MDDC-1355.

10. F. E. Terman, *"Radio Engineers' Handbook,"* pages 498 to 503 of 1943 edition. Published by McGraw-Hill Pub. Co., Inc.

11. EE Staff of MIT, *"Applied Electronics,"* page 619.

12. *Predicted Cathode Capability,* RCA Power Tube Engineering Note, IEN-1.

13. F. V. Hunt, & R. W. Hickman, Review of Scientific Instruments, *"On Electronic Voltage Stabilizers,"* January, 1939.

14. F. E. Terman, *"Radio Engineers' Handbook,"* pages 614 and 615 of 1943 edition. Published by McGraw-Hill Pub. Co., Inc.

15. Cruft Electronics Staff, *"Electronic Circuits and Tubes,"* page 575. Published by McGraw-Hill Pub. Co., Inc.

Transmitting Tube Ratings vs Operating Frequency

The MAXIMUM RATINGS given for each type on its data pages apply only when the type is operated at frequencies lower than some specified value which depends on the design of the type. As the frequency is raised above the specified value, the radio-frequency currents, dielectric losses, and heating effects increase rapidly. Most types can be operated above their specified maximum frequency provided the plate voltage and plate input are reduced in accordance with the information given in the following tabulation.

TUBE TYPE	OPERATING FREQUENCY Mc	MAXIMUM PERMISSIBLE PERCENTAGE OF MAXIMUM RATED PLATE VOLTAGE & PLATE INPUT		
		TELEPHONY		TELEGRAPHY
		Class B, Class C Grid or Suppressor Modulated	Class C Plate-Modulated	Class C Unmodulated
8021	300	100	–	100
207	Same as for Type 892			
211	15 30 80	100 88 70	100 80 50	100 80 50
801-A	60 75 120	100 93 78	100 80 50	100 80 50
803	20 40 60	100 86 80	100 77 60	100 77 60
805	30 45 80	100 90 77	100 82 55	100 82 55
807	60 80 125	100 90 75	100 80 55	100 80 55
809	60 70 120	100 93 75	100 88 50	100 88 50
810	30 60 100	100 88 80	100 70 50	100 70 50
813[a]	30 60 120	100 88 76	100 75 50	100 75 50

[a] In Self-Rectifying Oscillator or Amplifier Service, and in Amplifier or Oscillator Service with Separate, Rectified, Unfiltered, Single-Phase, Full-Wave Plate Supply, the 813 has the same maximum permissible percentages as those shown for Class C Telegraphy.

Transmitting Tube Ratings vs Operating Frequency

TUBE TYPE	OPERATING FREQUENCY Mc	MAXIMUM PERMISSIBLE PERCENTAGE OF MAXIMUM RATED PLATE VOLTAGE & PLATE INPUT		
		TELEPHONY		TELEGRAPHY
		Class B, Class C Grid or Suppressor Modulated	Class C Plate-Modulated	Class C Unmodulated
814	30 50 75	100 90 85	100 80 64	100 80 64
815	125 175 200	100 85 75	100 80 70	100 80 70
828	30 50 75	100 90 80	100 80 65	100 80 65
830-B	15 30 60	100 87 74	100 77 54	100 77 54
832-A	200 250	– –	100 89	100 89
834	100 170 350	100 89 73	100 80 53	100 80 53
835	20 40 100	100 85 70	100 80 50	100 80 50
837	20 40 60	– – –	100 76 62	100 76 62
838	30 60 120	100 85 70	100 75 50	100 75 50
860	Same as for Type 838			
880	25 50 75 100	*Voltage* *Input* 100 100 80 94 68 85 60 75	100 72 56 45	100 75 62 50
889-A	50 100 150	100 85 72	100 75 50	100 75 50
889R-A	40 65 100	100 85 72	100 78 60	*Volt.* *Input* 100 100 87 73 65 50

Transmitting Tube Ratings vs Operating Frequency

TUBE TYPE	OPERATING FREQUENCY Mc	MAXIMUM PERMISSIBLE PERCENTAGE OF MAXIMUM RATED PLATE VOLTAGE & PLATE INPUT — TELEPHONY: Class B, Class C Grid or Suppressor Modulated	TELEPHONY: Class C Plate-Modulated	TELEGRAPHY: Class C Unmodulated
891	1.6	–	–	100
	7.5	–	–	75
	20	–	–	50
891-R	1.6	–	–	100
	7.5	–	–	75
	20	–	–	50
892	1.6	100	100	100
	7.5	85	85	75
	20	76	75	50
892-R	1.6	100	100	100
	7.5	85	75	75
	20	76	50	50
1613	45	–	100	100
	60	–	90	90
	90	–	85	85
1614	80	–	100	100
	120	–	75	75
1619	45	100	100	100
	60	93	90	90
	90	85	77	77
1624	60	100	100	100
	80	90	80	80
	125	75	55	55
1625	Same as for Type 807			
1626	30	–	–	100
	60	–	–	96
	90	–	–	93
5713	220	–	–	100
5763			*Volt.* *Input*	*Volt.* *Input*
	50	–	100 100	100 100
	175	–	100 80	100 80
5771				*Volt.* *Input*
	1.6	100	100	120 112.5
	25	100	100	100
	50	75	75	75
5786	160	–	100	100
6417	Same as for Type 5763			
8005	60	100	100	100
	80	90	75	75
	100	83	60	60

CIRCUITS FOR HOT-CATHODE MERCURY-VAPOR & GAS RECTIFIER TUBES

Numerical Relationships Among Electrical Quantities

E = Trans. Sec. Voltage (RMS)
E_{av} = Average DC Output 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_p = Anode Current (RMS)
I_{pm} = Peak Anode Current
P_{al} = Line Volt-Amperes
P_{ap} = Trans. Pri. Volt-Amperes
P_{as} = Trans. Sec. Volt-Amperes
P_{dc} = DC Power ($E_{av} \times I_{av}$)

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*	Fig. 6	Fig. 7	Fig. 8
Voltage Ratios								
E/E_{av}	2.22	1.11	1.11	0.854	0.854	0.427	0.785	0.74
E_{bmi}/E	1.41	2.83	1.41	2.45	2.45	2.45	2.83	2.83
E_{bmi}/E_{av}	3.14	3.14	1.57	2.09	2.09	1.05	2.22	2.09
E_m/E_{av}	3.14	1.57	1.57	1.21	1.05	1.05	1.11	1.05
E_r/E_{av}	1.11	0.472	0.472	0.177	0.04	0.04	0.106	0.04
Frequency Ratio								
f_r/f	1	2	2	3	6	6	4	6
Current Ratios								
I_p/I_{av}	1.57	0.785	0.785	0.578	0.289	0.578	0.5	0.408
I_b/I_{av}	1	0.5	0.5	0.33	0.167	0.33	0.25	0.167
Resistive Load								
I_{pm}/I_{av}	3.14	1.57	1.57	1.21	0.52	1.05	1.11	1.05
I_{pm}/I_b	3.14	3.14	3.14	3.63	3.14	3.14	4.5	6.3
Inductive Load□								
I_{pm}/I_{av}	—	1	1	1	0.5	1	1	1
Power Ratios								
Resistive Load								
P_{as}/P_{dc}	3.49	1.74	1.24	—	—	—	—	—
P_{ap}/P_{dc}	2.69	1.23	1.24	—	—	—	—	—
P_{al}/P_{dc}	2.69	1.23	1.24	—	—	—	—	—
Inductive Load□								
P_{as}/P_{dc}	—	1.57	1.11	1.71	1.48	1.05	1.57	1.81
P_{ap}/P_{dc}	—	1.11	1.11	1.21	1.05	1.05	1.11	1.29
P_{al}/P_{dc}	—	1.11	1.11	1.21	1.05	1.05	1.11	1.05

* Bleeder current of 2% full-load current will provide exciting current for balance coil and thus avoid poor regulation at light loading.

□ The use of a large filter-input choke is assumed.

CIRCUITS FOR HOT-CATHODE MERCURY-VAPOR & GAS RECTIFIER TUBES

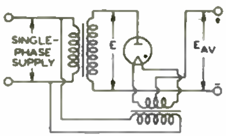


FIG. 1 HALF-WAVE SINGLE-PHASE

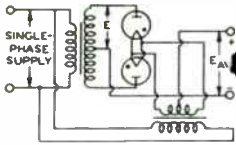


FIG. 2 FULL-WAVE SINGLE-PHASE

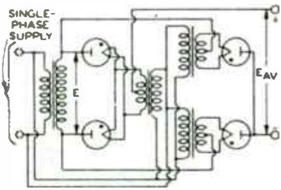


FIG. 3 SERIES SINGLE-PHASE

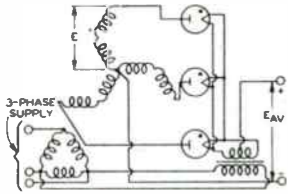


FIG. 4 HALF-WAVE THREE-PHASE

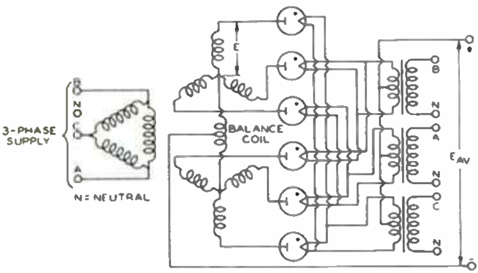


FIG 5 PARALLEL THREE-PHASE (QUADRATURE OPERATION)

92CL-7673A

RCA

CIRCUITS FOR HOT-CATHODE MERCURY-VAPOR & GAS RECTIFIER TUBES

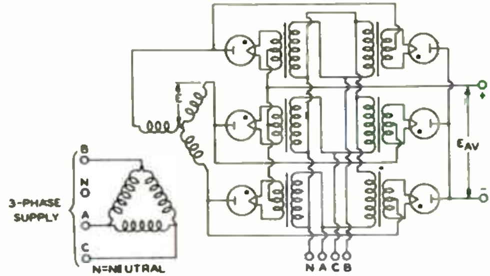


FIG. 6 SERIES THREE-PHASE (QUADRATURE OPERATION)

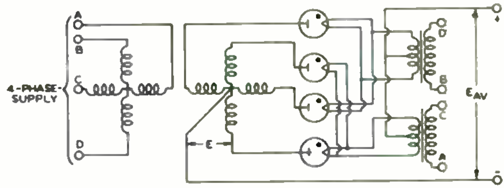


FIG. 7 HALF-WAVE FOUR-PHASE (QUADRATURE OPERATION)

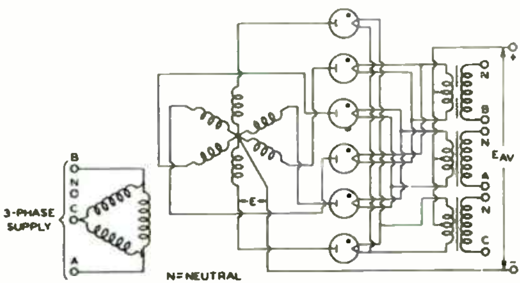


FIG. 8 HALF-WAVE SIX-PHASE (QUADRATURE OPERATION)

92CL-7673B

2K26

2K26
KLYSTRON

SINGLE-RESONATOR, REFLEX TYPE

Frequency: 6250 to 7060 Mc.

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage	6.3 ± 0.5	ac or dc volts
Current	0.44	amp
Frequency Range	6250 to 7060	Mc

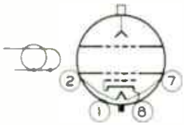
Mechanical:

Mounting Position	Any
Dimensions, Terminal Connections, and Mechanical Tuning Mechanism	See Outline Drawing
Resonant Cavity	Integral Part of Tube
Envelope	Metal
Cap	Miniature with Wafer
Base	Small-Wafer Octal 4-Pin with Pin No.4 replaced by Coaxial Output Line

BOTTOM VIEW

Pin 1 - Shell, Resonator

Pin 2 - Heater



Pin 7 - Heater

Pin 8 - Cathode

Cap - Reflector Terminal

NOTE: COAXIAL OUTPUT LINE PASSES THROUGH VACANT PIN POSITION NO.4

CW OSCILLATOR - Class C

Maximum Ratings, *Absolute Values*:

DC RESONATOR VOLTAGE	330 max.	volts
DC REFLECTOR VOLTAGE:		
Positive Value	0 max.	volts
Negative Value	350 max.	volts
DC RESONATOR CURRENT	35 max.	ma
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	50 max.	volts
Heater positive with respect to cathode	50 max.	volts
AMBIENT TEMPERATURE OF SHELL	110 max.	°C
TEMPERATURE OF COAXIAL OUTPUT LINE	90 max.	°C

Typical Operation ▫ at 6660 Mc in Mode "A" with 3/4" x 1-1/2" Wave Guide

DC Resonator Voltage	300	volts
DC Reflector Voltage Range▲	-65 to -120	volts
DC Resonator Current	25	ma
DC Reflector Current	less than 7	µa

(continued on next page)

▫,▲: See next page.

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

2K26

2K26
KLYSTRON

Half-Power Electronic-Tuning
Frequency Change■ . . . . 55 Mc
Power Output . . . . 120 mw

▲ Adjusted for maximum power output at the given operating frequency.

■ Change in frequency between the two half-power points when the reflector voltage is varied above and below the point of maximum power output corresponding to the given frequency.

□ The coaxial output line is coupled to the specified wave guide through the wide-band coaxial coupling unit shown on following pages.

INSTALLATION NOTES

A socket for the 2K26 may be obtained by removing the clip from the No.4 pin position of an octal socket and drilling the No.4 opening large enough to admit the co-axial line and the surrounding coupling unit. To guard against excessive strain on the coaxial output line, the tube must be securely fastened by a clamp on the base of the socket mounting. Bumping or continued pressure on the output line will seriously damage the tube. The proper area for clamping on the shoulder of the header skirt is shown on the Outline Drawing.

2K26
KLYSTRON

OPERATING NOTES

All tabulated data and curve information shown for the 2K26 were taken with the specified coupling unit and wave guide. It is important that this coupling unit or its electrical equivalent be used to insure tube interchangeability and satisfactory tuning characteristics. In addition, the standing-wave ratio of the coupler should not exceed 0.8 db. (1.1 voltage-standing-wave ratio).

In most applications the cathode of the 2K26 is operated at a negative potential with respect to ground so that the tube shell, which is integral with the resonator, is at ground potential. In those applications which do not operate with the shell at ground potential, it is essential that the 2K26 be surrounded by a grounded shield and tuned with an insulated tool, in order to protect the user from contact with high voltage. The shield design should permit adequate ventilation to assure that ambient temperature, as measured with a thermometer inserted between the metal tube shell and the shield, will be less than the maximum rated value. Ambient temperature changes will cause the resonator to expand or contract, producing a change in frequency. For best frequency stability, the 2K26 should be operated at nearly constant ambient temperature and with a well-regulated power supply.

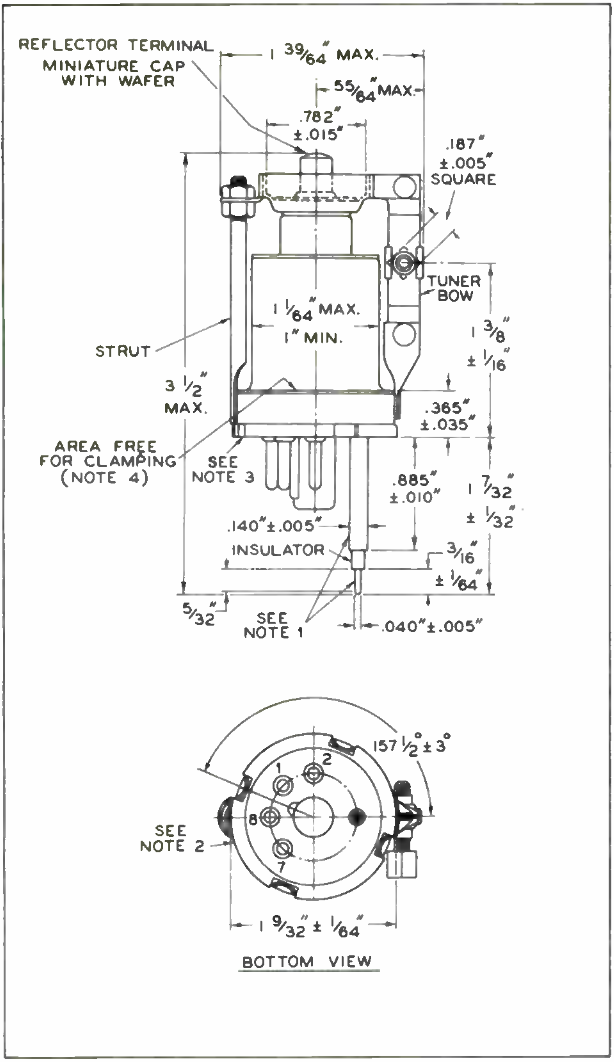
Shielding of the reflector and resonator voltage leads as close to the tube as possible is essential to avoid modulation of the tube output by any external voltages. In addition, the connection to the reflector terminal must be insulated to withstand the total acceleration and reflector voltage. To avoid damage to the tube, the reflector potential must never become positive with respect to the cathode.

Tuning of the 2K26 is accomplished by mechanical and electronic means. The mechanical tuning system is designed to permit approximate adjustment of frequency, but is not recommended for use where continual or frequent adjustment of frequency is required. Approximately five full turns of the frequency-adjustment screw are sufficient to tune the tube over its rated frequency range. The electronic tuning range is dependent upon reflector voltage, the type of load and the kind of coupling to the load.

Voltage modes are regions within the total range of reflector voltage in which oscillations will occur. The typical operating conditions and curves shown for type 2K26 apply to mode "A", the only mode recommended for this tube.

2K26

2K26
KLYSTRON

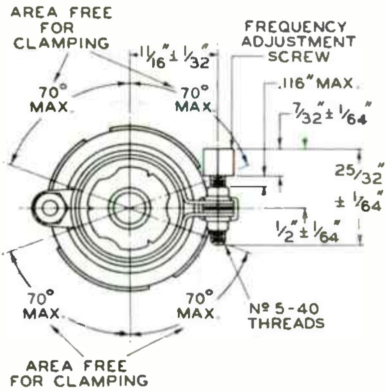


NOV. 15, 1948 CE-6986VA

RCA

2K26

KLYSTRON



TOP VIEW

NOTE 1: THE INNER AND OUTER CONDUCTORS OF THE COAXIAL OUTPUT LINE ARE CONCENTRIC WITHIN 0.010".

NOTE 2: BASE-PIN AND COAXIAL-OUTPUT-LINE POSITIONS ARE HELD TO TOLERANCES SUCH THAT PINS AND OUTPUT LINE WILL FIT FLAT-PLATE GAUGE HAVING (a) THICKNESS OF 1-7/32", (b) 4 HOLES WITH DIAMETER OF 0.1030" ± 0.0005" FROM TOP SURFACE OF GAUGE TO A DEPTH OF 0.25" AND THEN WITH DIAMETER INCREASED BY APPROXIMATELY 1/64" FOR REMAINING DEPTH OF HOLE, SO LOCATED ON A 0.6870" ± 0.0005" DIAMETER CIRCLE THAT THE DISTANCE ALONG THE CHORD BETWEEN ANY TWO ADJACENT HOLE CENTERS IS 0.2630" ± 0.0005", (c) ONE HOLE WITH DIAMETER OF 0.1600" ± 0.0005" TO DEPTH OF 1-7/32" WHOSE CENTER IS LOCATED ON THE SPECIFIED PIN CIRCLE A DISTANCE DETERMINED BY LAYING OFF ON THE TOP SURFACE OF THE GAUGE COUNTERCLOCKWISE FROM THE LAST OF THE FOUR HOLES TWO CONSECUTIVE CHORDS EACH 0.2630" ± 0.0005", AND (d) A CENTER HOLE WITH A MINIMUM DIAMETER OF 0.400" TO CLEAR THE BASE PLUG AND KEY. PIN AND OUTPUT-LINE FIT IN GAUGE SHALL BE SUCH THAT GAUGE TOGETHER WITH SUPPLEMENTARY WEIGHT TOTALING 2 LBS. WILL NOT BE LIFTED WHEN PINS AND COAXIAL OUTPUT LINE ARE WITHDRAWN.

NOTE 3: SMALL-WAFER OCTAL 4-PIN BASE WITH PIN No.4 REPLACED BY COAXIAL OUTPUT LINE.

NOTE 4: MINIMUM WIDTH OF SHOULDER IS 0.045".

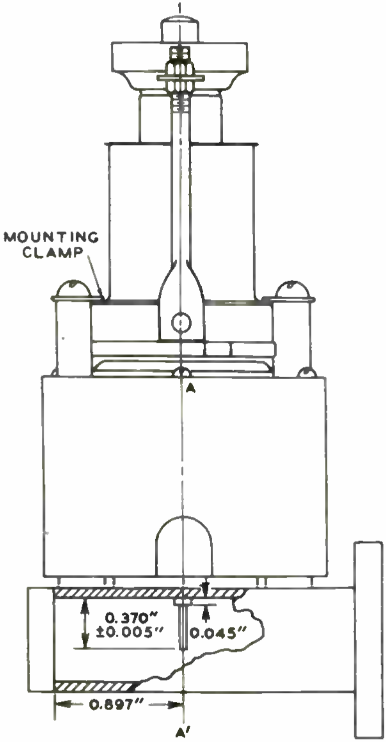
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

2K26
KLYSTRON

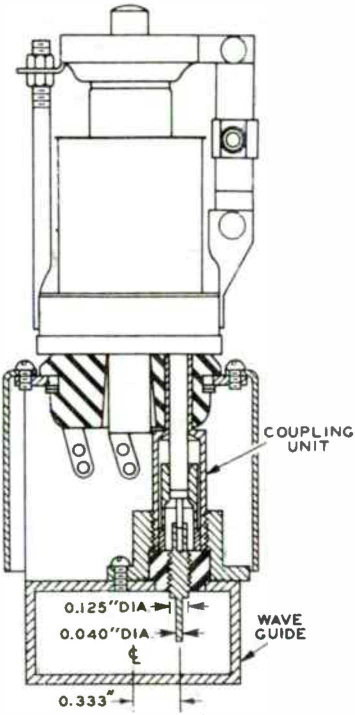
COUPLING ARRANGEMENT

RCA-2K26 Coupled to a 3/4" x 1-1/2" Wave Guide Through a Coaxial Transducer Coupling Circuit



KLYSTRON

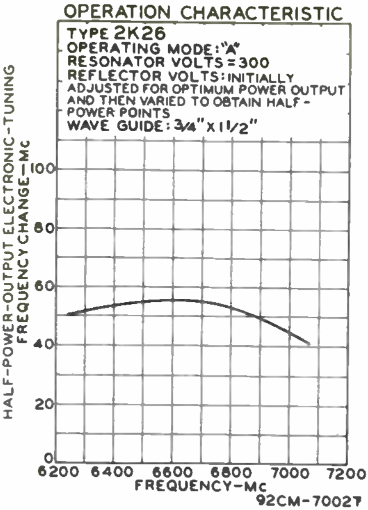
COUPLING ARRANGEMENT (Cont'd)

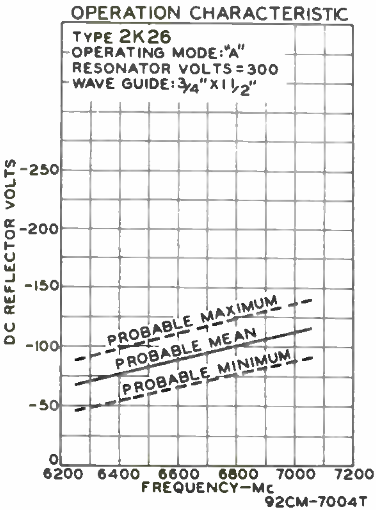


2K26

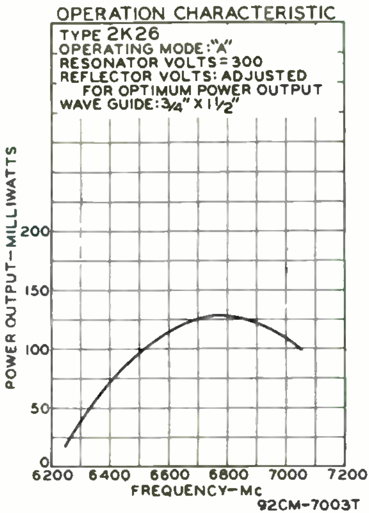
RCA

2K26
KLYSTRON





2K26
KLYSTRON



RCA

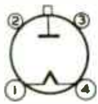
3B25

HALF-WAVE GAS RECTIFIER

HOT-CATHODE TYPE

Filament*	Coated	
Voltage	2.5	a-c volts
Current	5.0	amp.
Tube Voltage Drop (Approx.)	10	volts
Overall Length		5-7/8" ± 7/16"
Seated Height		5-1/4" ± 7/16"
Maximum Diameter		2-1/16"
Bulb		T-16
Cap		Medium
Base		Medium 4-Pin, Bayonet

Pin 1 - Filament
Pin 2 - No Connection
Pin 3 - No Connection



Pin 4 - Filament, Cathode Shield
Cap - Anode

RCA Socket — Stock No. 9919
Mounting Position — Any

BOTTOM VIEW (4P)

Maximum Ratings Are Absolute Values

MAXIMUM RATINGS

Peak Inverse Anode Voltage●	4500 max.	volts ←
Peak Anode Current	2 max.	amp.
Average Anode Current**	0.5 max.	amp.
Surge Anode Current for max. of 0.1 sec.	20 max.	amp.
Ambient Temperature Range	-75 to +90	°C

* Filament voltage must be applied at least 30 seconds before application of anode voltage.

● These ratings apply to the 3B25 when it is operated from a power supply having a frequency up to 500 cycles per second. If a contemplated application involves high supply frequencies, please write, stating the proposed operating frequency, to the attention of the Commerical Engineering Department, Harrison, N.J., as to the required reduction in ratings.

** For an averaging period of 30 seconds.

If the plate 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.

For *rectifier circuits*, refer to Type 872-A/872.

The table below classifies suitable rectifier circuits for the 3B25 and shows their safe maximum input and maximum output operating conditions for a peak inverse voltage of 4000 volts. The values are based on a sine-wave input and the use of a suitable choke preceding any condenser in the filter circuit.

CIRCUIT	MAXIMUM A-C INPUT VOLTS□ (RMS)	APPROX. D-C OUTPUT VOLTS TO FILTER	MAX. D-C OUTPUT CURRENT amperes
SINGLE-PHASE FULL-WAVE (2 tubes) Fig. 1	1400 per tube	1270	1.0
SINGLE-PHASE FULL-WAVE (4 tubes) Fig. 2	2800 total	2540	1.0
THREE-PHASE HALF-WAVE Fig. 3	1630 per leg	1910	1.5
THREE-PHASE DOUBLE-Y PARALLEL Fig. 4	1630 per leg	1910	3.0
THREE-PHASE FULL-WAVE Fig. 5	1630 per leg	3820	1.5

□ For maximum peak inverse voltage of 4000 volts. ← Indicates a change.

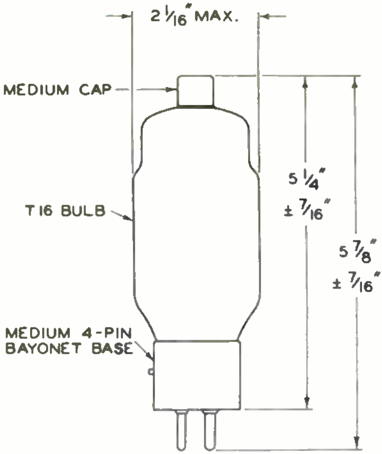
JULY 1, 1945 — TENTATIVE DATA

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

RCA

3B25

HALF-WAVE GAS RECTIFIER



92CM-6555R1

3B28

3B28

HALF-WAVE GAS RECTIFIER

HOT-CATHODE TYPE

GENERAL DATA

Electrical:

Filament, Coated:

Voltage	2.5 ± 5%	ac volts
Current at 2.5 volts. .	5	amp
Minimum Heating Time Befor Anode Voltage is Applied	10	seconds
Peak Anode Voltage Drop (Approx.)	10	volts

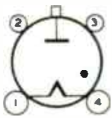
Mechanical:

Mounting Position	Any
Overall Length.	5.87" to 6.15"
Seated Length	5.25" to 5.53"
Maximum Diameter.	2-1/16"
Bulb.	T-16
Cap	Medium (JETEC No.C1-5)
Base. . . Medium-Shell Small 4-Pin, Bayonet	(JETEC No.A4-10)
Basing Designation for BOTTOM VIEW.	$4P_1$

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*:

	Rating I	*Rating II*	
PEAK INVERSE ANODE VOLTAGE. .	5000 max.	10000 max.	volts
ANODE CURRENT:			
Peak.	2 max.	1 max.	amp
Average*.	0.5 max.	0.25 max.	amp
Fault, for duration of 0.1 second max.. . .	20 max.	20 max.	amp
FREQUENCY OF POWER SUPPLY . .	500 max.	150 max.	cps
AMBIENT TEMPERATURE	-75 to +90	-75 to +90	°C

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Filament Current.	1	-	5.40	amp
Critical Anode Voltage.	2	-	50	volts
Peak Anode Voltage Drop	3	-	14	volts

Note 1: with 2.5 volts rms on filament.

Note 2: with 2.38 volts rms on filament.

* Averaged over any period of 30 seconds maximum.

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RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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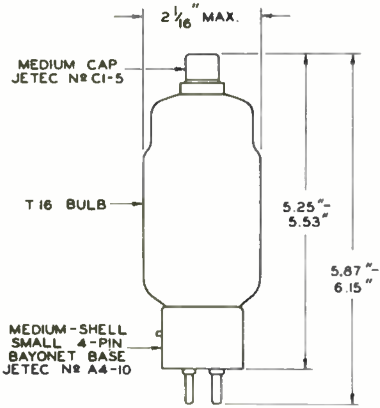
3B28

HALF-WAVE GAS RECTIFIER

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.

OPERATING NOTES

The filament-supply voltage for the 3B28 may be either in phase or out of phase with the anode voltage. With out-of phase excitation (quadrature operation), improved utilization of the cathode is possible. Although the 3B28 carries no higher anode-current rating for quadrature operation than for in-phase operation, quadrature operation is conducive to appreciably longer tube life. For optimum results, the filament and anode voltages should be 90° out of phase. In practical applications however, nearly, full realization of the advantages of this type of excitation is possible even when the phase difference between the filament and anode supply voltages ranges from the optimum value by as much as ± 30°. In polyphase operation where the anode voltage shifts 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.



92CM-7642

RCA

3B28

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 P_{dc}	
Fig. 1 **Half-Wave** **Single-Phase** In-Phase Operation	7000▲ 3500●	3200 1600	0.25 0.5		0.8 0.8	
Fig. 2 **Full-Wave** **Single-Phase** In-Phase Operation	3500▲ 1700●	3200 1600	0.5 1.0		1.6 1.6	
Fig. 3 **Series** **Single-Phase** In-Phase Operation	7000▲ 3500●	6400 3200	0.5 1.0		3.2 3.2	
Fig. 4 **Half-Wave** **Three-Phase** In-Phase Operation	4000▲ 2000●	4800 2400	0.75 1.5		3.6 3.6	
Fig. 5 **Parallel** **Three-Phase** Quadrature Operation	4000▲ 2000●	4800 2400	1.5 3.0		7.2 7.2	
Fig. 6 **Series** **Three-Phase** Quadrature Operation	4000▲ 2000●	9600 4800	0.75 1.5		7.2 7.2	
			Resistive Load	*Inductive Load*	*Resistive Load*	*Inductive Load*
Fig. 7 **Half-Wave** **Four-Phase** Quadrature Operation	3500▲ 1700●	4500 2250	0.9 1.8	1.0 2.0	4.0 4.0	4.5 4.5
			Resistive Load	*Inductive Load*	*Resistive Load*	*Inductive Load*
Fig. 8 **Half-Wave** **Six-Phase** Quadrature Operation	3500▲ 1700●	4800 2400	0.95 1.9	1.0 2.0	4.5 4.5	4.8 4.8

▲ For maximum peak inverse anode voltage of 10000 volts.
● For maximum peak inverse anode voltage of 5000 volts.

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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4-65A
BEAM POWER TUBE

Useful at maximum ratings with natural cooling at frequencies up to 50 Mc; at maximum ratings with forced-air cooling from 50 to 150 Mc; and with reduced ratings at higher frequencies

GENERAL DATA

Electrical:

Filament, Thoriated Tungsten:		
Voltage	6 ± 5%	ac or dc volts ←
Current	3.5	amp
Transconductance, for plate volts = 500, grid-No.2 volts = 250, and plate ma. = 125	4000	μmhos ←
Mu-Factor, Grid No.2 to Grid No.1	5	
Direct Interelectrode Capacitances:°		
Grid No.1 to plate	0.12 max.	μμf
Grid No.1 to filament and grid No.2	8	μμf
Plate to filament and grid No.2	2.1	μμf

Mechanical:

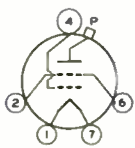
Operating Position	Vertical, base down or up
Maximum Overall Length	4-3/8"
Seated Length	3-11/16" ± 3/16"
Maximum Diameter	2-3/8"
Weight (Approx.)	3 oz ←
Cap	Skirted Small (JETEC No.C1-22) ←
Heat-Radiating Plate Connector	Eimac HR-6, or equivalent
Socket	Johnson No.122-101, or equivalent
Base	Special-Button 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

Bulb and Seal Temperatures:

Continuous Service . . . . 225 max. °C ←

Adequate ventilation around the tube must be provided to prevent the temperature of the bulb and seals from exceeding the specified maximum value.

°: See next page. ← Indicates a change.

RCA

4-65A

BEAM POWER TUBE

Intermittent Service ("On" period does not exceed 5 minutes and is followed by "off" period of the same or greater duration)	250 max.	°C

When ambient temperature does not exceed 30° C and the operating frequency is below 50 Mc, it will not usually be necessary to provided forced-air cooling of the bulb and seals to prevent exceeding the specified maximum temperature value provided a heat-radiating plate connector is used and adequate ventilation is provided.

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
MAX.-SIGNAL DC PLATE CURRENT**	150 max.	ma
MAX.-SIGNAL GRID-No.2 INPUT**.	10 max.	watts
PLATE DISSIPATION**.	65 max.	watts

Typical Operation:

Values are for 2 tubes

DC Plate Voltage	1000	1500	1750	volts
DC Grid-No.2 Voltage■.	500	500	500	volts
DC Grid-No.1 (Control-Grid) Voltage▲	-85	-90	-90	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage.	170	180	180	volts
Zero-Signal DC Plate Current .	60	60	60	ma
Max.-Signal DC Plate Current .	170	180	170	ma
Zero-Signal DC Grid-No.2 Current.	0	0	0	ma
Max.-Signal DC Grid-No.2 Current.	30	20	23	ma
Effective Load Resistance (Plate to plate)	9000	15000	20000	ohms
Max.-Signal Driving Power (Approx.).	0	0	0	watts
Max.-Signal Power Output (Approx.).	80	145	175	watts

Maximum Circuit Values:

Effective Grid-No.1-Circuit Resistance . .	0.25 max.	megohm

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 . . .	600 max.	volts

○, *, ●, **, ■, ▲, †: see next page.

→ Indicates a change.

4-65A

BEAM POWER TUBE

MAX.-SIGNAL DC PLATE CURRENT**	150 max.	ma
MAX.-SIGNAL DC GRID-No.2 INPUT**	10 max.	watts
PLATE DISSIPATION**	65 max.	watts

Typical Operation:

Values are for 2 tubes

DC Plate Voltage	600	1000	1500	1800	volts
DC Grid-No.2 Voltage	250	250	250	250	volts
DC Grid-No.1 (Control-Grid) Voltage:▲▲ From fixed supply of	-40	-40	-45	-50	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage	240	210	200	180	volts
Zero-Signal DC Plate Current	60	60	60	50	ma
Max.-Signal DC Plate Current	300	300	250	220	ma
Zero-Signal DC Grid-No.2 Current	0	0	0	0	ma
Max.-Signal DC Grid-No.2 Current	80	60	40	30	ma
Effective Load Resistance (Plate to plate)	3600	6800	14000	20000	ohms
Max.-Signal Average Driving Power (Approx.)	3.7	3	1.9	1.3	watts
Max.-Signal Peak Driving Power (Approx.)§	7.4	6	3.8	2.6	watts
Max.-Signal Power Output (Approx.)	90	170	250	270	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	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	120 max.	ma
GRID-No.1 INPUT	5 max.	watts
GRID-No.2 INPUT	10 max.	watts
PLATE DISSIPATION	45 max.	watts

Typical Operation:

DC Plate Voltage	600	1000	1500	2000	2500	volts
DC Grid-No.2 Voltage°°	250	250	250	250	250	volts
DC Grid-No.1 Voltage⊕	-120	-125	-125	-130	-135	volts
Peak AF Grid-No.2 Voltage (For 100% modulation)	250	250	250	250	250	volts
Peak RF Grid-No.1 Voltage	215	220	220	225	215	volts
DC Plate Current	120	120	120	120	110	ma
DC Grid-No.2 Current	40	40	40	40	25	ma

°, *, ●, **, ■, ▲, †, ▲▲, §, °°, ⊕: See next page.

← Indicates a change.

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4-65A

BEAM POWER TUBE

DC Grid-No.1 Current (Approx.)	15	16	16	16	12	ma
Driving Power (Approx.) .	3.2	3.5	3.5	3.6	2.6	watts
Power Output (Approx.). .	45	90	140	195	230	watts

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.	150 max.	ma
GRID-No.1 INPUT	5 max.	watts
GRID-No.2 INPUT	10 max.	watts
PLATE DISSIPATION	65 max.	watts

Typical Operation:

DC Plate Voltage.	600	1000	1500	2000	3000	volts
DC Grid-No.2 Voltage. . .	250	250	250	250	250	volts
DC Grid-No.1 Voltage. . .	-75	-80	-85	-90	-100	volts
Peak RF Grid-No.1 Voltage.	170	175	180	190	170	volts
DC Plate Current.	150	150	150	140	115	ma
DC Grid-No.2 Current. . .	40	40	40	40	22	ma
DC Grid-No.1 Current (Approx.)	18	17	18	11	10	ma
Driving Power (Approx.) .	3.1	3	3.2	2.1	1.7	watts
Power Output (Approx.). .	45	95	165	215	280	watts

LINEAR RF POWER AMPLIFIER — Class AB1
Single-Sideband Suppressed-Carrier Service

Maximum CCS• Ratings, ***Absolute Values:***

	Up to 50 Mc	
DC PLATE VOLTAGE.	3000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE. . .	600 max.	volts
MAX.-SIGNAL DC PLATE CURRENT.	150 max.	ma
GRID-No.2 INPUT	10 max.	watts
PLATE DISSIPATION	65 max.	watts

Typical Operation for "Single-Tone Modulation" and/or "Two-Tone Modulation":

DC Plate Voltage. . .	1000	1500	2000	2500	3000	volts
DC Grid-No.2 Voltage.	510	480	450	405	360	volts
DC Grid-No.1 (Control-Grid) Voltage▲. . .	-110	-105	-100	-90	-85	volts
Zero-Signal DC Plate Current	45	30	22	17	15	ma

○,*,●,**,■,▲,†,▲▲,§,∞,●,#: see next page. →Indicates a change.

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

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4-65A

BEAM POWER TUBE

Effective RF Load Resistance.	3240	7500	12600	19000	24900	ohms
"Single-Tone Modulation":♣						
Max.-Signal Peak RF Grid-No.1 Voltage	110	105	100	90	85	volts
Max.-Signal DC Plate Current	100	90	80	70	65	ma
Max.-Signal DC Grid-No.2 Current. . .	17	13	11	8.5	6.5	ma
Max.-Signal DC Grid-No.1 Current. . .	0	0	0	0	0	ma
Max.-Signal Power Output.	40	75	100	115	130	watts
"Two-Tone Modulation":♣♣						
Average DC Plate Current	80	70	60	50	45	ma
Average DC Grid-No.2 Current. . .	6	4	3	2.5	1.5	ma

○ Without external shield.

* 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 source having good regulation.

▲ Adjusted to give indicated value of zero-signal plate current.

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

▲▲ Adjusted to give indicated value of zero-signal plate current. The dc resistance of the bias source should not exceed 250 ohms.

§ The 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 class AB_2 stage should be held at a low value.

○○ Modulation voltage for grid No.2 is obtained by supplying the dc grid-No.2 voltage from the modulated plate supply through a series dropping resistor or an af reactor, or from a separate winding on the modulation transformer.

● The use of bias obtained partially from a grid resistor is recommended.

\# 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. When the 4-65A is used in the final amplifier or a preceeding stage of a transmitter designed for break-in operation or oscillator keying, a small amount of fixed bias must be used to maintain the plate dissipation within the rated value. With 2000 volts on the plate, and 250 volts on grid No.2, a fixed bias of at least -40 volts should be used.

♣ "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.

♣♣ "Two-Tone" operation refers to the simultaneous amplification of the two equal-amplitude, radio-frequency signals resulting from modulation of a single-sideband, suppressed-carrier transmitter by two audio-frequency signals of equal amplitude. The data shown for "Two-Tone" modulation refer to the case in which the peak amplitude of the resultant rf grid signal is equal to "(Max.-Signal) Peak RF Grid-No.1 Voltage" as specified under "Single-Tone" modulation.

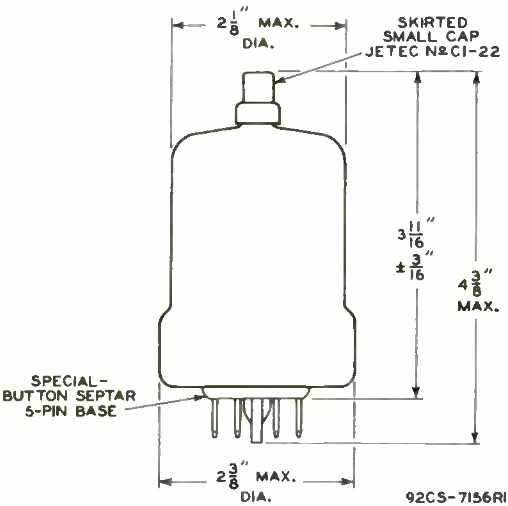
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

4-65A

BEAM POWER TUBE

MAXIMUM RATINGS vs OPERATING FREQUENCY		
FREQUENCY	50	Mc
MAXIMUM-PERMISSIBLE PERCENTAGE OF MAXIMUM-RATED PLATE VOLTAGE OR PLATE INPUT:		
Class C plate-modulated telephony	100	%
Class C telegraphy	100	%



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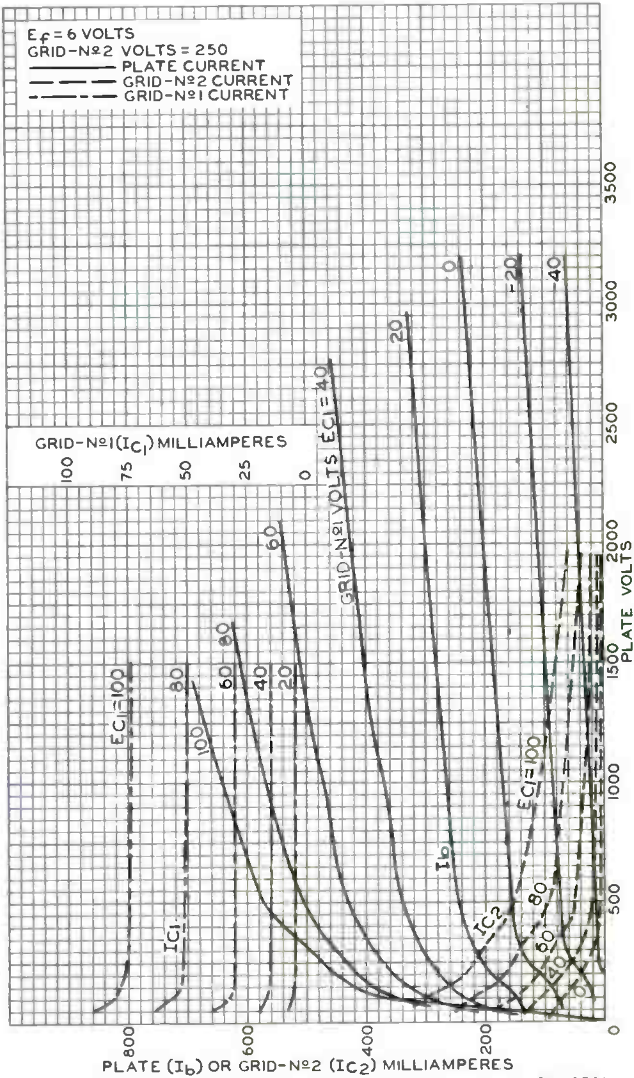
4-65A

TYPICAL CHARACTERISTICS



ELECTRON TUBE DIVISION

92CM-9591

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

4-65A

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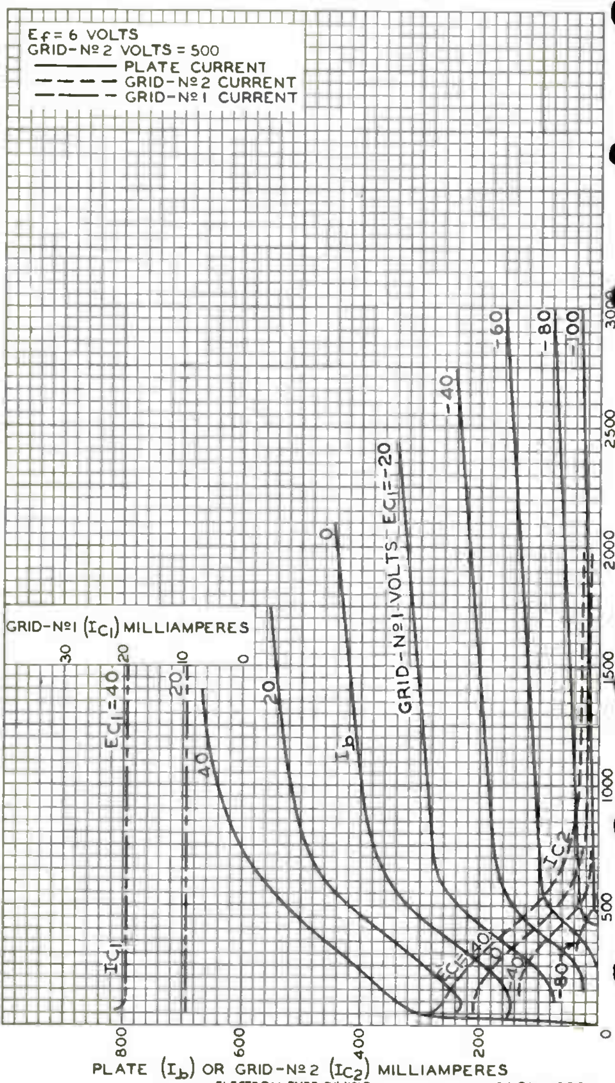
4-65A

TYPICAL CHARACTERISTICS



ELECTRON TUBE DIVISION

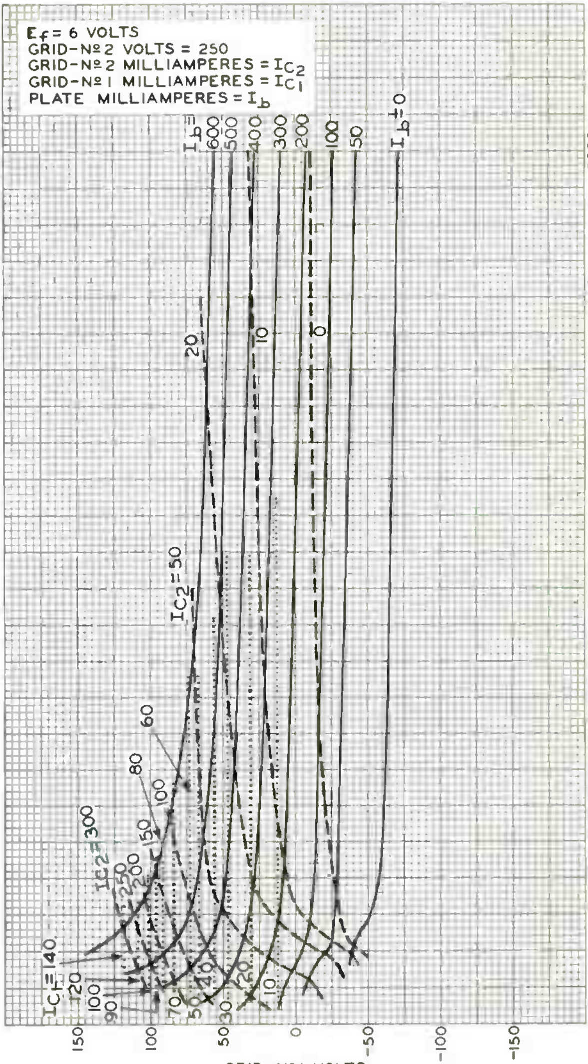
92CM-9590

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

4-65A

4-65A

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



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

92CM-7155R1

4-400A

Beam Power Tube

FORCED-AIR COOLED

GENERAL DATA

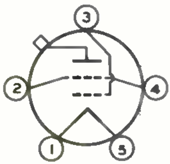
Electrical:

Filament, Thoriated Tungsten:		
Voltage (AC or DC)	5 ± 5%	volts
Current at 5 volts	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 (Approx.):		
Grid No.1 to plate	0.12	μμf
Grid No.1 to filament, grid No.2, and base shell	13	μμf
Plate to filament, grid No.2, and base shell	4.6	μμf

Mechanical:

Operating Position	Vertical, base down ←
Maximum Overall Length	6-3/8"
Seated Length	5-3/8" ± 1/4"
Maximum Diameter	3-9/16"
Weight (Approx.)	9 oz
Cap	Skirted Small (JEDEC No.C1-22)
Base[a]	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 15 cfm at a static pressure of 0.4 inch of water are required through the base when the recommended socket and chimney are used.

Base-Seal Temperature	200 max.	°C
Plate-Seal Temperature	225 max.	°C

← indicates a change.

→ **Components:**

Socket. . . . Johnson 122-275, National HX-100, or equivalent
Chimney . . . . Penta Labs PL-C1, or equivalent
Heat-Radiating Plate Connector. . . Eimac HR-6, or equivalent

AF POWER AMPLIFIER & MODULATOR — Class AB

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

DC PLATE VOLTAGE	4000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	800 max.	volts
MAX.-SIGNAL DC PLATE CURRENT[c]	350 max.	ma
GRID-No.2 INPUT[c]	35 max.	watts
GRID-No.1 (CONTROL-GRID) INPUT[c]	10 max.	watts
PLATE DISSIPATION[c]	400 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[b] Ratings, *Absolute-Maximum Values:*

→ *At frequencies up to 110 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	270 max.	watts

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

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

At frequencies up to 110 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	400 max.	watts

[a] Metal base shell should be grounded by means of suitable spring fingers.
[b] Continuous Commercial Service.
[c] Averaged over any audio-frequency cycle of sine-wave form.
[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.

→ indicates a change.

4-1000A
BEAM POWER AMPLIFIER
FORCED-AIR COOLED

GENERAL DATA

Electrical:

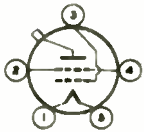
Filament, Thoriated Tungsten:		
Voltage	7.5 ± 5%	ac or dc volts
Current	21	amp
Mu-Factor, Grid No.2 to Grid No.1	7	
Transconductance for plate volts = 2500, grid-No.2 volts = 500, and plate ma. = 300	10000	μmhos
Direct Interelectrode Capacitances:		
Grid No.1 to Plate*	0.24	μμf
Input	27.2	μμf
Output	7.6	μμf

Mechanical:

Mounting Position	Vertical, base up or down
Overall Length	9-1/4" ± 3/8"
Seated Length	8-3/8" ± 3/8"
Maximum Diameter	5-1/4"
Cap	Skirted Medium
Base	Special Ventilated Metal-Shell 5-Pin
Socket	Eimac 4-1000A Air-System Socket, or equivalent

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

Air Flow:

Through Base—A sufficient air flow 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
Plate Heat-Dissipating Connector	Eimac HR-8, or equivalent	

AF POWER AMPLIFIER & MODULATOR--Class AB_1 †

Maximum CCS● Ratings, ***Absolute Values:***

DC PLATE VOLTAGE	6000 max.	volts

* Without external shielding and with base sleeve grounded.

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

●: See next page.

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

4-1000A

POWER TETRODE

DC GRID-No.2 (SCREEN) VOLTAGE	1000 max.	volts
MAX.-SIGNAL DC PLATE CURRENT**	700 max.	ma
PLATE DISSIPATION**	1000 max.	watts
GRID-No.2 DISSIPATION**	75 max.	watts

Typical Operation:

Values are for 2 tubes

DC Plate Voltage	4000	5000	6000	volts
DC Grid-No.2 Voltage	1000	1000	1000	volts
DC Grid-No.1 (Control-Grid) Voltage . . .	-115	-125	-135	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage . . .	230	250	270	volts
Zero-Sig. DC Plate Current . .	300	240	200	ma
Max.-Sig. DC Plate Current . .	1050	1000	950	ma
Zero-Sig. DC Grid-No.2 Cur. . .	0	0	0	ma
Max.-Sig. DC Grid-No.2 Cur. . .	60	60	64	ma
Effective Load Resistance (Plate to plate) . . .	7000	10000	14000	ohms
Max.-Signal Driving Power (Approx.) . . .	0	0	0	watts
Max.-Signal Power Output (Approx.) . . .	2340	3100	3840	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	6000 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	1000 max.	volts
MAX.-SIGNAL DC PLATE CURRENT**	700 max.	ma
PLATE DISSIPATION**	1000 max.	watts
GRID-No.2 DISSIPATION**	75 max.	watts

Typical Operation:

Values are for 2 tubes

DC Plate Voltage	4000	5000	6000	volts
DC Grid-No.2 Voltage	500	500	500	volts
DC Grid-No.1 (Control-Grid) Voltage . . .	-60	-70	-75	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage . . .	280	290	260	volts
Zero-Sig. DC Plate Current . .	300	200	150	ma
Max.-Sig. DC Plate Current . .	1200	1100	950	ma

** 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.

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

4-1000A

POWER TETRODE

Zero-Sig. DC Grid-No.2 Cur. . .	0	0	0	ma
Max.-Sig. DC Grid-No.2 Cur. . .	95	90	65	ma
Effective Load Resistance (Plate to plate)	7000	11000	15000	ohms
Max.-Signal Driving Power (Approx.)	11	11	9.4	watts
Max.-Signal Power Output (Approx.)	3000	3800	3900	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:*

	Up to 30 Mc	*From 30 to 110 Mc*	
DC PLATE VOLTAGE	5500 max.	5000 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE . . .	1000 max.	1000 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE . . .	-500 max.	-500 max.	volts
DC PLATE CURRENT	600 max.	600 max.	ma
PLATE DISSIPATION	670 max.	670 max.	watts
GRID-No.2 DISSIPATION	75 max.	75 max.	watts
GRID-No.1 DISSIPATION	25 max.	25 max.	watts

Typical Operation up to 30 Mc:

DC Plate Voltage	5500	volts
DC Grid-No.2 Voltage (Modulated 100%) . . .	500	volts
DC Grid-No.1 Voltage	-200	volts
Peak AF Grid-No.2 Voltage (For 100% modulation)	250	volts
Peak RF Grid-No.1 Voltage	325	volts
DC Plate Current	600	ma
DC Grid-No.2 Current	105	ma
DC Grid-No.1 Current (Approx.)	28	ma
Driving Power (Approx.)	9	watts
Power Output (Approx.)	2630	watts

Typical Operation from 30 to 110 Mc:

DC Plate Voltage	3000	4000	5000	volts
DC Grid-No.2 Voltage (Modulated 100%)	500	500	500	volts
DC Grid-No.1 Voltage	-200	-200	-200	volts
Peak AF Grid-No.2 Voltage (For 100% modulation)	250	250	250	volts
Peak RF Grid-No.1 Voltage	340	335	335	volts
DC Plate Current	600	600	600	ma
DC Grid-No.2 Current	145	132	130	ma
DC Grid-No.1 Current (Approx.).	36	33	33	ma

●: See next page.

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

4-1000A

POWER TETRODE

Driving Power (Approx.)●	12	11	11	watts
Power Output (Approx.)	1390	1910	2440	watts

RF POWER AMPLIFIER & OSC.--Class C Telegraphy□ and RF POWER AMPLIFIER--Class C FM Telephony

Maximum CCS● Ratings, *Absolute Values:*

	Up to 110 Mc	
DC PLATE VOLTAGE	6000 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	1000 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-500 max.	volts
DC PLATE CURRENT	700 max.	ma
DC PLATE DISSIPATION	1000 max.	watts
DC GRID-No.2 DISSIPATION	75 max.	watts
DC GRID-No.1 DISSIPATION	25 max.	watts

Typical Operation up to 110 Mc--Single Tube:

DC Plate Voltage	3000	4000	5000	6000	volts
DC Grid-No.2 Voltage	500	500	500	500	volts
DC Grid-No.1 Voltage	-150	-150	-200	-200	volts
Peak RF Grid-No.1 Voltage	290	290	355	350	volts
DC Plate Current	700	700	700	700	ma
DC Grid-No.2 Current	146	137	147	140	ma
DC Grid-No.1 Current (Approx.)	38	39	45	42	ma
Driving Power (Approx.)●	11	12	16	15	watts
Power Output (Approx.)	1430	2100	2810	3400	watts

Typical Operation at 110 Mc--Two Tubes in Push-Pull Circuit:

DC Plate Voltage	4000	5000	6000	volts
DC Grid-No.2 Voltage	450	500	500	volts
DC Grid-No.1 Voltage	-150	-160	-180	volts
DC Plate Current	1150	1250	1250	ma
DC Grid-No.2 Current	280	240	250	ma
DC Grid-No.1 Current	80	80	100	ma
Driver Power Output (Approx.)♣	350	400	400	watts
Useful Power Output (Approx.)♣♣	3000	4200	5200	watts

● Continuous Commercial Service.

● The values of required driving power increase above 30 Mc. At 110 Mc. the driver should be capable of providing 200 watts per tube to supply feed-through power, circuit losses and radiation losses.

□ 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.

♣ Indicated values include power required by a practical resonant circuit and by the tube.

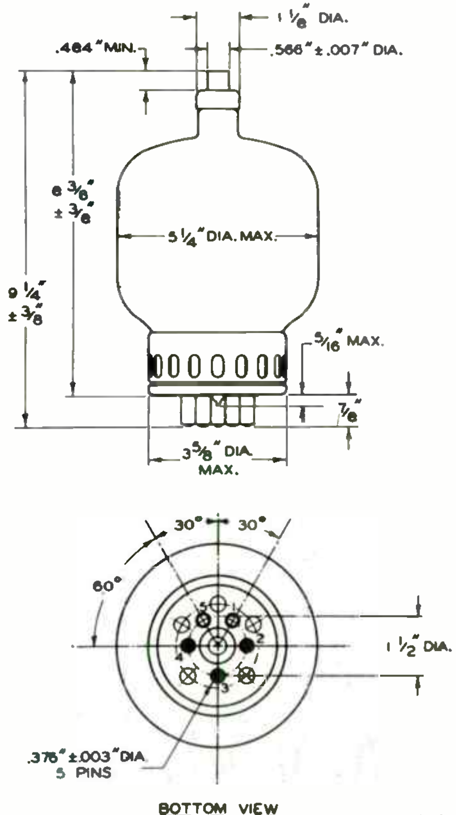
♣♣ Indicated values of useful power are measured in load circuit.

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

4-1000A

4-1000A

POWER TETRODE



OCT. 1, 1953

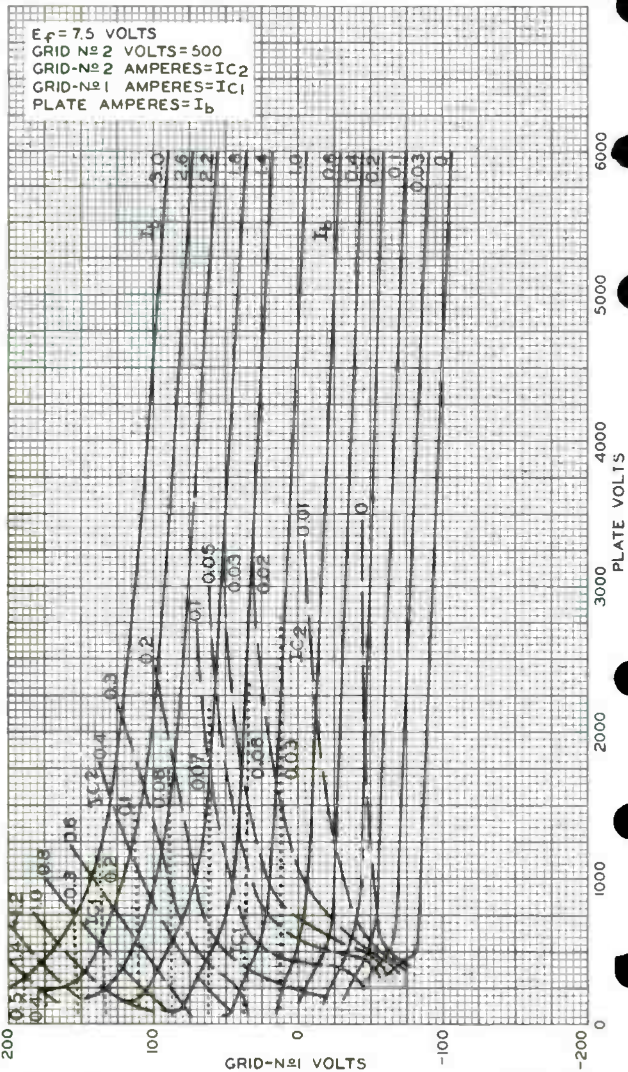
CE-7930

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

4-1000A

4-1000A

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



FEB. 10, 1953

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7921

Beam Power Tube

FORCED-AIR COOLED — GROUNDED-GRID TYPE

GENERAL DATA

Electrical:

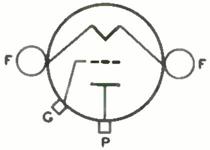
Filament, Multistrand Thoriated Tungsten:		
Excitation	DC or Single Phase AC	
Voltage (AC or DC)	6.0	volts
Current	285	amp
Cold Resistance	0.0025	ohms
Amplification Factor	32	
Direct Interelectrode Capacitances (Approx.):		
Grid to plate	34.0	pf
Grid to filament	60.0	pf
Plate to filament	1.0	pf

Mechanical:

Operating Position	Vertical, filament end up
Maximum Overall Length	17-3/8"
Maximum Diameter	14-1/4"
Weight (Approx.)	85 lbs
Radiator	Integral part of tube
Mounting	Special

Terminal Diagram (See *Dimensional Outline*):

F - Filament
G - Grid



P - Plate

Thermal:

Air Flow:

Upward through radiator	1000 min.	cfm

The specified air flow at a pressure of 2.1 inches of water should be delivered by a blower vertically upward through the radiator before and during the application of any voltages.

To filament seals	10	cfm

The specified air flow must 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 seals to the maximum value.

Incoming Air Temperature	45 max.	°C
Radiator Temperature	210 max.	°C
Bulb Temperature	180 max.	°C
Seal Temperature (Filament, grid, and plate)	165 max.	°C

← Indicates a change.

AF POWER AMPLIFIER and MODULATOR — Class B

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

DC PLATE VOLTAGE	11500 max.	volts
MAX.-SIGNAL DC PLATE CURRENT[b]	4 max.	amp
MAX.-SIGNAL PLATE INPUT[b]	40 max.	kw
PLATE DISSIPATION[b]	17.5 max.	kw

Typical Operation:

Values are for 2 tubes

DC Plate Voltage	10500	volts
DC Grid Voltage	-250	volts
Peak AF Grid-to-Grid Voltage	1310	volts
Zero-Signal DC Plate Current	1.7	amp
Max.-Signal DC Plate Current	7	amp
Effective Load Resistance (plate to plate)	3300	ohms
Max.-Signal Driving Power (Approx.)	1500	watts
Max.-Signal Power Output (Approx.)	50	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	9000 max.	volts
DC GRID VOLTAGE	-2000 max.	volts
DC PLATE CURRENT	3.2 max.	amp
DC GRID CURRENT	0.65 max.	amp
PLATE INPUT	26 max.	kw
PLATE DISSIPATION	11.5 max.	kw

Typical Operation in Grounded-Filament Circuit:

DC Plate Voltage	8000	volts
DC Grid Voltage:[c]		
From a grid resistor of:		
1280 ohms	-650	volts
Peak RF Grid Voltage	1100	volts
DC Plate Current	2.5	amp
DC Grid Current (Approx.)[d]	0.51	amp
Driving Power (Approx.)[d]	510	watts
Power Output (Approx.)	15.8	kw

Typical Operation in Grounded-Grid Circuit:

Same values as for Grounded-Filament Circuit with the following exceptions:

Driving Power (Approx.)[e]	3000	watts
Power Output (Approx.)	18	kw

RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy[f]

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

DC PLATE VOLTAGE	11500 max.	volts
DC GRID VOLTAGE	−2000 max.	volts
DC PLATE CURRENT	4 max.	amp
DC GRID CURRENT	0.65 max.	amp
PLATE INPUT	40 max.	kw
PLATE DISSIPATION	17.5 max.	kw

Typical Operation in Grounded-Filament Circuit:

DC Plate Voltage	10000	11000	volts
DC Grid Voltage:[g]			
From a grid resistor of:			
860 ohms	−500	–	volts
900 ohms	–	−540	volts
From a cathode resistor of:			
125 ohms	−500	–	volts
130 ohms	–	−540	volts
Peak RF Grid Voltage	1000	1050	volts
DC Plate Current	3.5	3.6	amp
DC Grid Current (Approx.)[d]	0.58	0.61	amp
Driving Power (Approx.)[d]	515	575	watts
Power Output (Approx.)	25	29.5	kw

Typical Operation in Grounded-Grid Circuit:

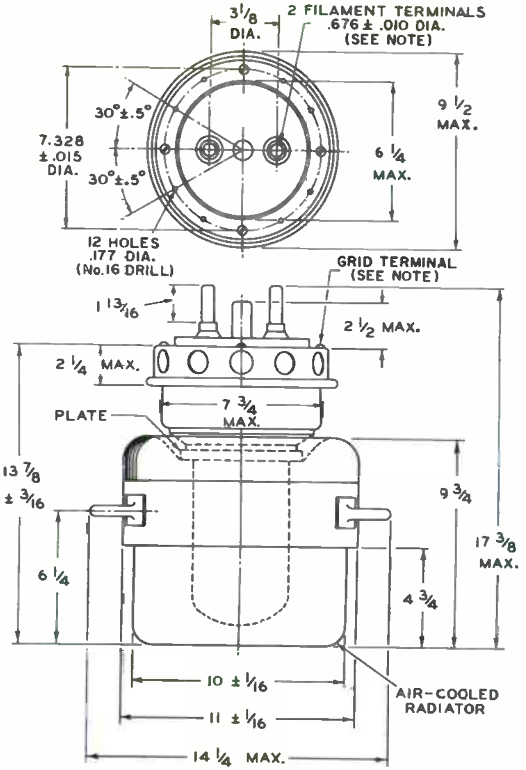
Same values as for Grounded-Grid Circuit with the following exceptions:

Driving Power (Approx.)	3400	3750	watts
Power Output (Approx.)	28	32.5	kw

[a] Continuous Commercial Service.
[b] Averaged over any audio-frequency cycle of sine-wave form.
[c] Obtained from a fixed supply, grid resistor, or a combination of both.
[d] For effect of load resistance on grid current and driving power, refer to TUBE RATINGS — *Grid Current and Driving Power* in the General Section.
[e] Carrier power of driver modulated 100 per cent.
[f] 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.
[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

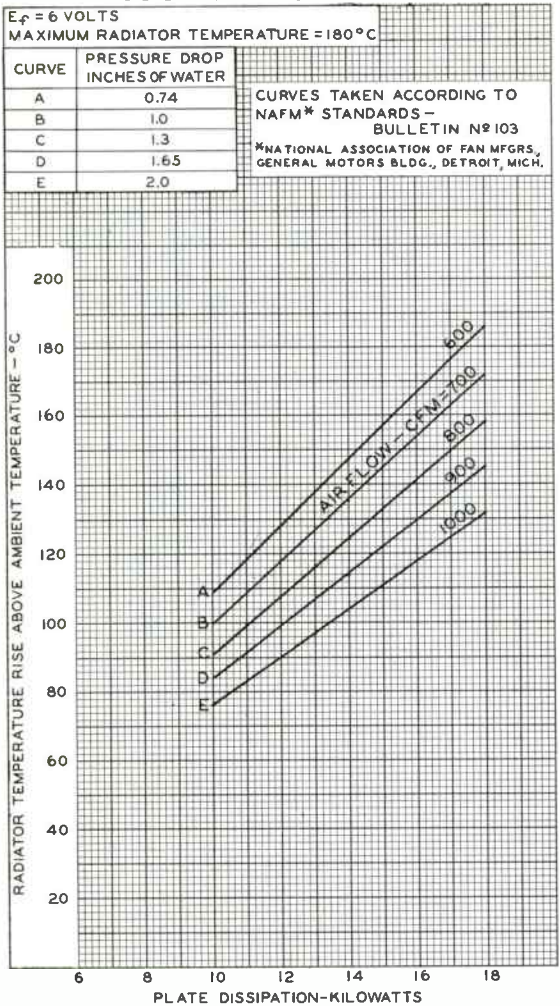
OPERATING FREQUENCY Mc	MAXIMUM PERMISSIBLE PERCENTAGE OF MAXIMUM-RATED PLATE VOLTAGE & PLATE INPUT		
	TELEPHONY		TELEGRAPHY
	Class B, Class C Grid or Suppressor Modulated	Class C Plate-Modulated	Class C Unmodulated
30	100	100	100
50	93	87	87
75	87	74	74
100	80	61	61



ALL DIMENSIONS IN INCHES

NOTE: FLEXIBLE CONNECTIONS ARE REQUIRED.

COOLING REQUIREMENTS



CURVE	PRESSURE DROP INCHES OF WATER
A	0.74
B	1.0
C	1.3
D	1.65
E	2.0

92CM-6761

575-A

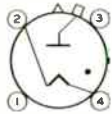
HALF-WAVE MERCURY-VAPOR RECTIFIER

The 575-A is the same as the 673 except for the following items:

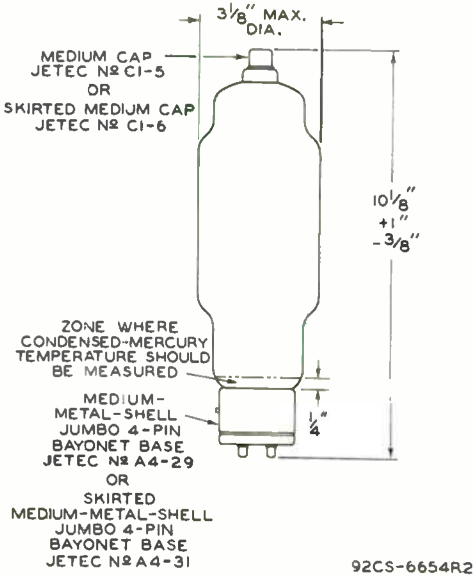
Mechanical:

Overall Length	10-1/8" + 1" - 3/8"
Maximum Diameter	3-1/8"
Weight (Approx.)	10.8 oz
Cap	Medium (JETEC No.C1-5), or Skirted Medium (JETEC No.C1-6)
Base	Medium-Metal-Shell Jumbo 4-Pin with Bayonet (JETEC No.A4-29), or Skirted Medium-Metal-Shell Jumbo 4-Pin with Bayonet (JETEC No.A4-31)
Basing Designation for BOTTOM VIEW	4AT

Pin 1 - No Connection
Pin 2 - Filament, Cathode Shield



Pin 3 - No Connection
Pin 4 - Filament
Cap - Anode



← Indicates a change.

Full-Wave Gas and Mercury-Vapor Rectifier

GENERAL DATA

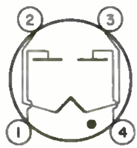
Electrical:[a]

Filament, Coated:		
Voltage (AC)	2.5	volts
Current at 2.5 volts	11.5 ± 1.0	amp
Minimum heating time prior to tube conduction	15	sec
Typical Anode Starting Voltage	10	volts
Peak Tube Voltage Drop at anode amperes = 5	10	volts

Mechanical:

Operating Position	Vertical, base down
Maximum Overall Length	7-1/2"
Maximum Diameter	2-1/16"
Weight (Approx.)	5 oz
Bulb	T16
Socket	Super-Jumbo 4-Contact
Base	Medium-Metal-Shell Super-Jumbo 4-Pin (JEDEC No.A4-81)
Basing Designation for BOTTOM VIEW	4BS

Pin 1 - Anode No.2
Pin 2 - Filament



Pin 3 - Filament
Pin 4 - Anode No.1

Thermal:

Type of Cooling	Convection	
Temperature Rise of Condensed Mercury to Equilibrium Above Ambient Temperature (Approx.):		
No load	18	°C
Full load	28	°C

FULL-WAVE RECTIFIER[a]

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

For power-supply frequency of 60 cps

PEAK INVERSE ANODE VOLTAGE	900 max.	volts
ANODE CURRENT (Each Anode):		
Peak	10 max.	amp
Average[b]	2.5 max.	amp
Fault	150 max.	amp
CONDENSED-MERCURY TEMPERATURE RANGE (Operating)[c]	0 to +90	°C

[a] With circuit returns to filament-transformer center-tap.

[b] Averaged over any interval of 5 seconds maximum.

[c] For longest life, the operating condensed-mercury temperature range after warm-up should be kept between +40° and +90° C which corresponds approximately to +15° to +65° C ambient.

Half-Wave Mercury-Vapor Rectifier

GENERAL DATA

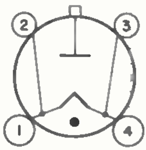
Electrical:[a]

Filament, Coated:		
Voltage (AC)	2.5	volts
Current at 2.5 volts	7 ± 1	amp
Minimum heating time prior to tube conduction	20	sec
Typical Anode Starting Voltage	13	volts
Peak Tube Voltage Drop at anode amperes = 8	12	volts

Mechanical:

Operating Position	Vertical, base down
Maximum Overall Length	6-3/8"
Maximum Diameter	2-1/16"
Weight (Approx.)	4 oz
Bulb	ST16
Cap	Medium (JEDEC No.C1-5)
Socket	Small 4-Contact
Base	Medium-Shell Small 4-Pin with Bayonet (JEDEC No.A4-10)
Basing Designation for BOTTOM VIEW	4AU

Pin 1 – Filament
Pin 2 – Filament
Pin 3 – Filament



Pin 4 – Filament
Cap – Anode

Thermal:

Type of Cooling	Convection	
Temperature Rise of Condensed Mercury to Equilibrium Above Ambient Temperature (Approx.)	30	°C

HALF-WAVE RECTIFIER[a]

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

For power-supply frequency of 60 cps

PEAK INVERSE ANODE VOLTAGE	2000 max.	volts
ANODE CURRENT:		
Peak	10 max.	amp
Average[b]	2.5 max.	amp
Fault	250 max.	amp
CONDENSED-MERCURY TEMPERATURE RANGE (Operating)	+35 to +80	°C

[a] With circuit returns to filament-transformer center-tap.
[b] Averaged over any interval of 5 seconds maximum.

Half-Wave Gas and Mercury-Vapor Rectifier

GENERAL DATA

Electrical:[a]

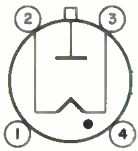
Filament, Coated:		
Voltage (AC)	2.5	volts
Current at 2.5 volts	18 ± 2	amp
Minimum heating time prior to tube conduction	60	sec
Typical Anode Starting Voltage	20	volts
Peak Tube Voltage Drop at anode amperes = 20	9	volts

Mechanical:

Operating Position	Vertical, base down
Maximum Overall Length	9-1/2"
Maximum Diameter	2-1/16"
Weight (Approx.)	6 oz
Bulb	T16
Cap	Medium (JEDEC No.C1-5)
Socket	Super-Jumbo 4-Contact
Base	Medium-Metal-Shell Super-Jumbo 4-Pin

Terminal Diagram: BOTTOM VIEW

Pin 1 - No Internal Connection
Pin 2 - Filament
Pin 3 - Filament



Pin 4 - No Internal Connection
Cap - Anode

Thermal:

Type of Cooling		Convection
Temperature Rise of Condensed Mercury to Equilibrium Above Ambient Temperature (Approx.)	30	°C

HALF-WAVE RECTIFIER[a]

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

For power-supply frequency of 60 cps

PEAK INVERSE ANODE VOLTAGE	1000 max.	volts
ANODE CURRENT:		
Peak	77 max.	amp
Average[b]	6.4 max.	amp
Fault	770 max.	amp
CONDENSED-MERCURY TEMPERATURE RANGE (Operating)[c]	-40 to +100	°C

[a] With circuit returns to filament-transformer center-tap.

[b] Averaged over any interval of 20 seconds maximum.

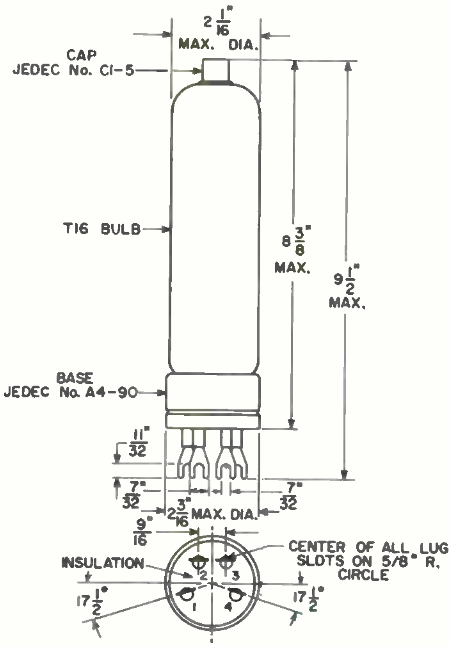
[c] For longest life, the operating condensed-mercury temperature range after warm-up should be kept between +40° and +100° C which corresponds approximately to +10° to +70° C ambient.

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)



673

HALF-WAVE MERCURY-VAPOR RECTIFIER

GENERAL DATA

Electrical:

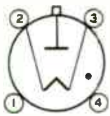
Filament, Coated:

Voltage	5 ± 5%	ac volts
Current at 5 volts	10	amp
Minimum heating time at rated voltage	30	sec
Peak Tube Voltage Drop (Approx.)	10	volts

Mechanical:

Operating Position	Vertical, base down
Maximum Overall Length	11-7/16"
Seated Length	9-9/16" + 1-1/16" – 1/4"
Maximum Diameter	3-1/8"
Weight (Approx.)	10.8 oz
Cap	Medium (JETEC No.C1-5)
Base	Large-Metal-Shell Super-Jumbo 4-Pin with Bayonet (JETEC No.A4-18)
Basing Designation for BOTTOM VIEW	2P

Pin 1 – No Connection
Pin 2 – Filament, Cathode Shield



Pin 3 – Filament
Pin 4 – No 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*	12	°C
Full load▲	17.5	°C

* With 4.75 volts rms on filament, and no heat-conserving enclosure.

▲ With 5.25 volts rms on filament, quadrature operation, average anode current = 2.5 amperes, and no heat-conserving enclosure.

← indicates a change.

RCA

673

HALF-WAVE MERCURY-VAPOR RECTIFIER

HALF-WAVE RECTIFIER — In-Phase Operation●

Maximum Ratings, *Absolute Values: For supply frequency of 60 cps*

	Operating Condensed-Mercury-Temperature Range		
	20° to 60° C	20° to 50° C	
PEAK INVERSE ANODE VOLTAGE	10000 max.	15000 max.	volts
ANODE CURRENT:			
Peak	7 max.	6 max.	amp
Average**	1.75 max.	1.5 max.	amp
Fault, for duration of 0.1 second maximum	100 max.	100 max.	amp

HALF-WAVE RECTIFIER — Quadrature Operation●●

Maximum Ratings, *Absolute Values: For supply frequency of 60 cps*

	Operating Condensed-Mercury-Temperature Range		
	20° to 60° C	20° to 50° C	
PEAK INVERSE ANODE VOLTAGE	10000 max.	15000 max.	volts
ANODE CURRENT:			
Peak	10 max.	10 max.	amp
Average**	2.5 max.	2.5 max.	amp
Fault, for duration of 0.1 second maximum	100 max.	100 max.	amp

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Filament Current	1	-	11.5	amp
Critical Anode Voltage	2	-	100	volts
Peak Tube Voltage Drop	3	-	16	volts

Note 1: With 5 volts rms on filament.

Note 2: With 4.75 volts rms on filament, and condensed-mercury temperature at 20° C.

Note 3: With 5 volts rms on filament, condensed-mercury temperature of 35° ± 5° C, peak anode current of 20 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.

● Filament voltage in phase with anode voltage.

** Averaged over any interval of 20 seconds maximum.

●● Filament voltage out of phase (60° to 120°) with anode voltage.

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HALF-WAVE MERCURY-VAPOR RECTIFIER

For Circuit Figures, see Front of this Section

<table>
<tr><th>CIRCUIT</th><th>MAX. TRANS. SEC. VOLTS (RMS)
E</th><th>APPROX. DC OUTPUT VOLTS TO FILTER
Eav</th><th colspan="2">MAX. DC OUTPUT AMPERES
Iav</th><th colspan="2">MAX. DC OUTPUT KW TO FILTER
Pdc</th></tr>
<tr><td>Fig. 1
Half-Wave
Single-Phase
In-Phase Operation</td><td>10600□
7000▲</td><td>4800
3200</td><td colspan="2">1.50
1.75</td><td colspan="2">7.1
5.5</td></tr>
<tr><td>Fig. 2
Full-Wave
Single-Phase
In-Phase Operation</td><td>5300□
3500▲</td><td>4800
3200</td><td colspan="2">3.00
3.50</td><td colspan="2">14.2
11.0</td></tr>
<tr><td>Fig. 3
Series
Single-Phase
In-Phase Operation</td><td>10600□
7000▲</td><td>9600
6400</td><td colspan="2">3.00
3.50</td><td colspan="2">28.4
22.0</td></tr>
<tr><td>Fig. 4
Half-Wave
Three-Phase
In-Phase Operation</td><td>6100□
4000▲</td><td>7200
4800</td><td colspan="2">4.50
5.25</td><td colspan="2">32.2
25.0</td></tr>
<tr><td>Fig. 5
Parallel
Three-Phase
Quadrature Operation</td><td>6100□
4000▲</td><td>7200
4800</td><td colspan="2">15.0
15.0</td><td colspan="2">108
72</td></tr>
<tr><td>Fig. 6
Series
Three-Phase
Quadrature Operation</td><td>6100□
4000▲</td><td>4300
9600</td><td colspan="2">7.5
7.5</td><td colspan="2">108
72</td></tr>
<tr><td>Fig. 7
Half-Wave
Four-Phase
Quadrature Operation</td><td>5300□
3500▲</td><td>6750
4500</td><td>Resistive Load
9.0
9.0</td><td>Inductive Load
10.0
10.0</td><td>Resistive Load
60.8
40.5</td><td>Inductive Load
67.5
45.0</td></tr>
<tr><td>Fig. 8
Half-Wave
Six-Phase
Quadrature Operation</td><td>5300□
3500▲</td><td>7200
4800</td><td>Resistive Load
9.5
9.5</td><td>Inductive Load
10.0
10.0</td><td>Resistive Load
68.4
45.6</td><td>Inductive Load
72.0
48.0</td></tr>
</table>

□ For maximum peak inverse anode voltage of 15,000 volts, and condensed-mercury-temperature range of 20° to 50° C.

▲ For maximum peak inverse anode voltage of 10,000 volts, and condensed-mercury-temperature range of 20° to 60° C.

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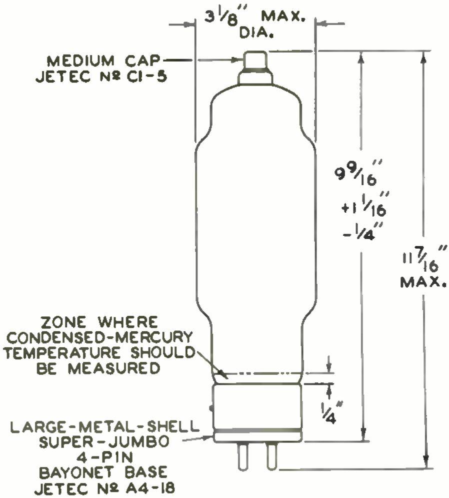
HALF-WAVE MERCURY-VAPOR RECTIFIER

OPERATING CONSIDERATIONS

Shields and rf filter circuits should be provided for the 673 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. Rf filters are employed to prevent damage caused by rf currents which might otherwise be fed back into the rectifier tubes.



92CS-6655R3

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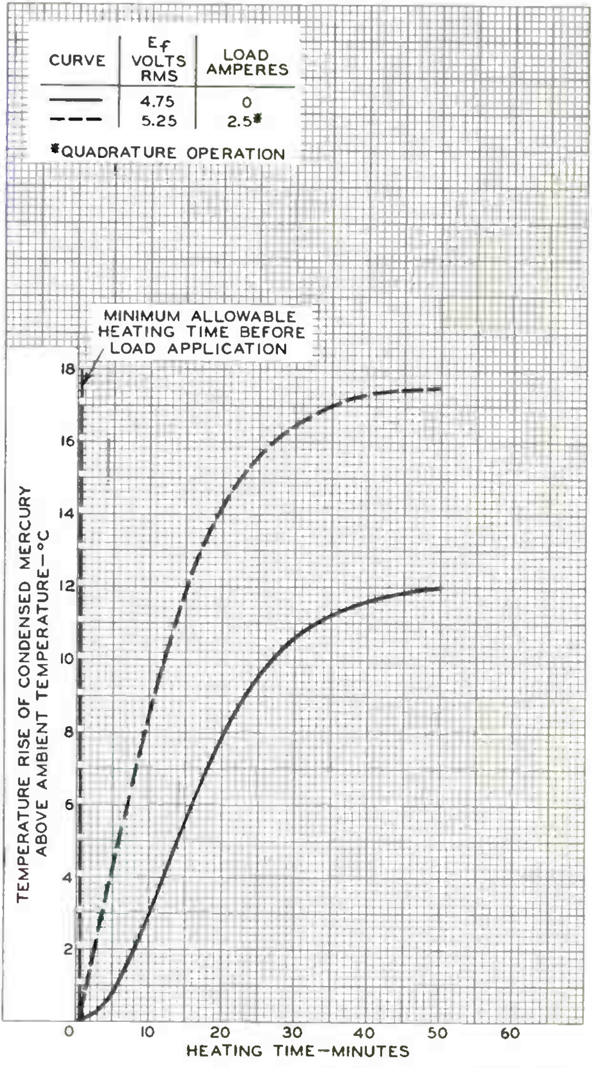
RATE OF RISE OF COND-MERCURY TEMPERATURE



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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.)°	0.35	0.3	0.25	0.5	watt
Power Output (Approx.)	11	12	16	28	watts

° 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	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 °°	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

°° 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:

	CCS	CCS	CCS	ICAS	
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.

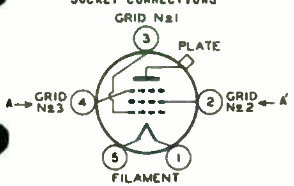
For the 804 as a crystal-controlled oscillator, typical operating conditions are: d-c plate volts, 1250; d-c suppressor volts, 0; d-c screen volts, 300; grid resistor, 30000 ohms; d-c plate ma., 42; and d-c screen ma., 24.

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

TOP VIEW OF SOCKET CONNECTIONS



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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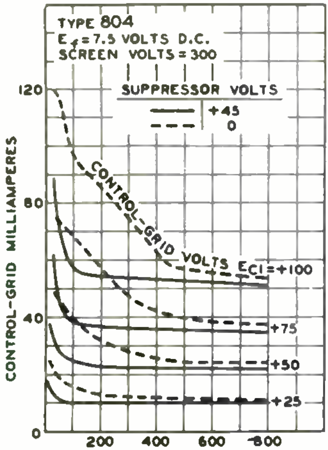
R-F POWER AMPLIFIER PENTODE

AVERAGE CHARACTERISTICS



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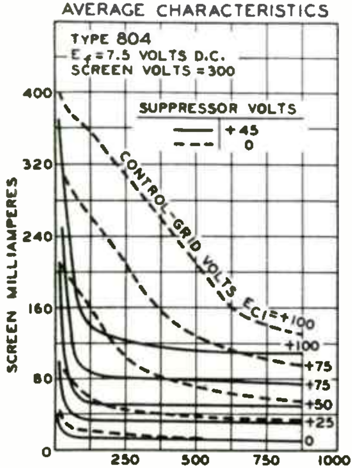
AVERAGE CHARACTERISTICS



92C-4565R1

FEB. 2, 1940

92C-4564R1,
4565R1

811A

Power Triode

GENERAL DATA

Electrical:

Filament, Thoriated Tungsten:

Voltage (AC or DC)	6.3	volts
Current	4	amp
Amplification Factor	160	

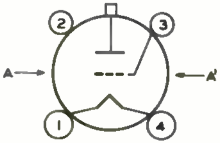
Direct Interelectrode Capacitances (Approx.):

Grid to plate	5.5	pf
Grid to filament	5.9	pf
Plate to filament	0.7	pf

Mechanical:

Operating Position	Vertical, base down; or Horizontal, pins 1 & 4 in vertical plane
Maximum Overall Length	6-15/32"
Seated Length	5-11/16" ± 5/32"
Maximum Diameter	2-7/16"
Weight	2.7 oz
Bulb	ST19
Cap	Medium (JEDEC No.C1-5)
Base	Medium-Shell Small 4-Pin Micanol with Bayonet (JEDEC No.A4-10)
Basing Designation for BOTTOM VIEW	3G

Pin 1 – Filament
Pin 2 – Do Not Use



Pin 3 – Grid
Pin 4 – Filament
Cap – Plate

AA'=PLANE OF ELECTRODES

AF POWER AMPLIFIER & MODULATOR — Class B

Maximum Ratings, *Absolute-Maximum Values:*

	CCS[a]	ICAS[b]	
DC PLATE VOLTAGE	1250 max.	1500 max.	volts
MAX.-SIGNAL DC PLATE CURRENT	175 max.	175 max.	ma
MAX.-SIGNAL PLATE INPUT	165 max.	235 max.	watts
PLATE DISSIPATION[c]	45 max.	65 max.	watts

Typical Operation:

Values are for two tubes[d]

DC Plate Voltage	750	1250	1000	1250	1500	volts
DC Grid Voltage[e]	0	0	0	0	-4.5	volts
Peak AF Grid-to-Grid Voltage	197	145	185	175	170	volts
Zero-Signal DC Plate Current	32	50	44	54	32	ma

← Indicates a change.

	CCS		ICAS			
Max.-Signal DC Plate Current	350	260	350	350	313	ma
Effective Load Resistance (Plate to plate).	5100	12400	7400	9200	12400	ohms
Max.-Signal Driving Power (Approx.) . .	9.7	3.8	7.5	6.0	4.4	watts
Max.-Signal Power Output (Approx.). .	178	235	248	310	340	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	ICAS	
DC PLATE VOLTAGE.	1000 max.	1250 max.	volts
DC GRID VOLTAGE	-200 max.	-200 max.	volts
DC PLATE CURRENT.	125 max.	150 max.	ma
DC GRID CURRENT	50 max.	50 max.	ma
PLATE INPUT	115 max.	175 max.	watts
PLATE DISSIPATION	30 max.	45 max.	watts

Typical Operation:

DC Plate Voltage.	1000	1250	volts
DC Grid Voltage:[f]			
From a grid resistor of:			
1200 ohms	-55	-	volts
2700 ohms	-	-120	volts
Peak RF Grid Voltage.	150	250	volts
DC Plate Current.	115	140	ma
DC Grid Current (Approx.)[g]. . .	45	45	ma
Driving Power (Approx.)[g]. . . .	6.1	10	watts
Power Output (Approx.).	88	135	watts

RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy[h]

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

	CCS	ICAS	
DC PLATE VOLTAGE.	1250 max.	1500 max.	volts
DC GRID VOLTAGE	-200 max.	-200 max.	volts
DC PLATE CURRENT.	175 max.	175 max.	ma
DC GRID CURRENT	50 max.	50 max.	ma
PLATE INPUT	175 max.	260 max.	watts
PLATE DISSIPATION	45 max.	65 max.	watts

Typical Operation:

DC Plate Voltage.	1250	1500	volts
DC Grid Voltage:[j]			
From a grid resistor of:			
1100 ohms	-50	-	volts
1750 ohms	-	-70	volts

From a cathode resistor of:			
270 ohms	−50	–	volts
330 ohms	–	−70	volts
Peak RF Grid Voltage	140	175	volts
DC Plate Current	140	173	ma
DC Grid Current (Approx.)[g]	45	40	ma
Driving Power (Approx.)[g]	5.7	7.1	watts
Power Output (Approx.)	135	200	watts

SELF-RECTIFYING AMPLIFIER[k] — Class C

Maximum CCS Ratings, ***Absolute-Maximum Values:***

AC PLATE VOLTAGE (RMS)	1750 max.	volts
DC GRID VOLTAGE	−125 max.	volts
DC PLATE CURRENT	65 max.	ma
DC GRID CURRENT	25 max.	ma
PLATE INPUT	125 max.	watts
PLATE DISSIPATION	45 max.	watts

Typical Operation in Push-Pull Circuit at 27 Mc:

Values are for 2 tubes

AC Plate Voltage (RMS)	1750	volts
DC Grid Voltage:[f,m]		
From a grid resistor of:		
1500 ohms	−70	volts
DC Plate Current	130	ma
DC Grid Current (Approx.)	46	ma
Driving Power (Approx.)[n]	12	watts
Power Output (Approx.)	175	watts
Useful Power Output (Approx.)—75% circuit efficiency	130	watts

AMPLIFIER[k] — Class C

With Separate, Rectified, Unfiltered, Single-Phase, Full-Wave Plate Supply

Maximum CCS Ratings, ***Absolute-Maximum Values:***

DC PLATE VOLTAGE	1125 max.	volts
DC GRID VOLTAGE	−125 max.	volts
DC PLATE CURRENT	160 max.	ma
DC GRID CURRENT	45 max.	ma
PLATE INPUT	175 max.	watts
PLATE DISSIPATION	45 max.	watts

Typical Operation:

DC Plate Voltage	1125	volts
DC Grid Voltage:[f,m]		
From a grid resistor of:		
1400 ohms	−35	volts
DC Plate Current	125	ma
DC Grid Current (Approx.)	25	ma
Driving Power (Approx.)[k]	3	watts
Power Output (Approx.)	135	watts

LINEAR RF POWER AMPLIFIER — Class AB_2

Single-Sideband Suppressed-Carrier Service

Maximum Ratings, *Absolute-Maximum Values up to 30 Mc:*

	CCS	ICAS	
DC PLATE VOLTAGE	1250 max.	1500 max.	volts
DC PLATE CURRENT:			
Max.-Signal (Single-Tone) or Peak-Envelope (Two-Tone)	175 max.	175 max.	ma
DC GRID CURRENT	50 max.	50 max.	ma
DC PLATE INPUT:			
Max.-Signal (Single-Tone) or Peak-Envelope (Two-Tone)	165 max.	235 max.	watts
PLATE DISSIPATION	45 max.	65 max.	watts

Typical Operation with "Single-Tone" Modulation:[q]

DC Plate Voltage	1250	1500	volts
DC Grid Voltage[r]	0	-4.5	volts
Zero-Signal DC Plate Current	25	16	ma
Effective RF Load Resistance	5700	6000	ohms
DC Plate Current	130	157	ma
DC Grid Current	30	30	ma
Peak RF Grid Voltage	78	88	volts
Driver Power Output, (Approx.)[s]	7	8	watts
Output-Circuit Efficiency (Approx.)	90	90	%
Useful Max.-Signal Power Output (Approx.)	120[t]	160[t]	watts

Typical Operation with "Two-Tone" Modulation at 30 Mc:[u]

DC Plate Voltage	1250	1500	volts
DC Grid Voltage[r]	0	-4.5	volts
Zero-Signal DC Plate Current	25	16	ma
Effective RF Load Resistance	5700	6000	ohms
DC Plate Current:			
Peak-Envelope	130	157	ma
Average	91	110	ma
Average DC Grid Current	20	20	ma
Peak-Envelope Driver Power Output (Approx.)[s]	7	8	watts
Output-Circuit Efficiency (Approx.)	90	90	%
Distortion Products Level:[v]			
Third order	-26	-25	db
Fifth order	-32	-30	db
Useful Power Output (Approx.):			
Peak-Envelope	120[t]	160[t]	watts
Average	60[t]	80[t]	watts

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Filament Current	1	3.75	4.25	amp
Amplification Factor	1,2	144	176	
Grid-Plate Capacitance	-	4.9	6.3	pf
Grid-Filament Capacitance	-	4.9	6.9	pf

→ Indicates a change.

Plate-Filament Capacitance.	-	0.52	0.88	pf
Plate Current	1,3	16	36	ma
Grid Current.	1,4	25	85	ma
Useful Power Output	1,5	160	-	watts ←

Note 1: With dc filament voltage of 6.3 volts.
Note 2: With dc plate current of 20 ma. and dc grid voltage of -1 volt.
Note 3: With dc plate voltage of 2000 volts and dc grid voltage of -2 volts.
Note 4: With dc plate voltage of 200 volts and dc grid voltage of +50 volts.
Note 5: With dc plate voltage of 1500 volts. dc plate current of 175 ma; dc grid current of 34 to 50 ma; grid resistor of 3500 ± 10% ohms; and frequency of 15 Mc.

a Continuous Commercial Service.

b Intermittent Commercial and Amateur Service.

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

d When two or more tubes are used precautions should be taken to balance the plate currents.

e For ac filament supply.

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

g For effect of load resistance on grid current and driving power, refer to TUBE RATINGS — *Grid Current and Driving Power* in the General Section.

h 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.

j Obtained from fixed supply, by grid resistor, by cathode resistor, or by combination methods.

k The 811A is not recommended for oscillator service in applications involving wide variations in load. For such applications, the 812A with its low amplification factor is preferred because of its ability to oscillate over a wide range of load variation.

m The 811A can be biased by any convenient method. However, the use of a grid resistor is preferred because the bias is automatically adjusted as the load on the circuit varies. In those applications, such as are encountered in therapeutic equipment, 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.

n From a self-rectifying driver.

p From a driver with a rectified, unfiltered, single-phase, full-wave plate supply.

q "Single-Tone" 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.

r Obtained preferably from a separate, well-regulated supply.

s Driver power output represents circuit losses and is the actual power measured at input to the grid circuit. The actual power required depends on the operating frequency and the circuit used.

t This value of useful power is measured at load of output circuit having indicated efficiency.

u "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.

v Referenced to either of the two tones and without the use of feedback to enhance linearity.

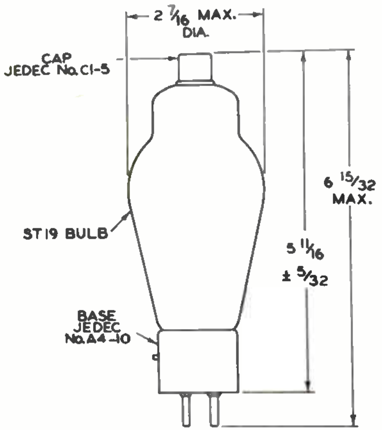
OPERATING CONSIDERATIONS

Plate shows no color when tube is operated at maximum CCS ratings, and shows a barely perceptible red color at maximum ICAS ratings.

← Indicates a change.

MAXIMUM RATINGS vs OPERATING FREQUENCY

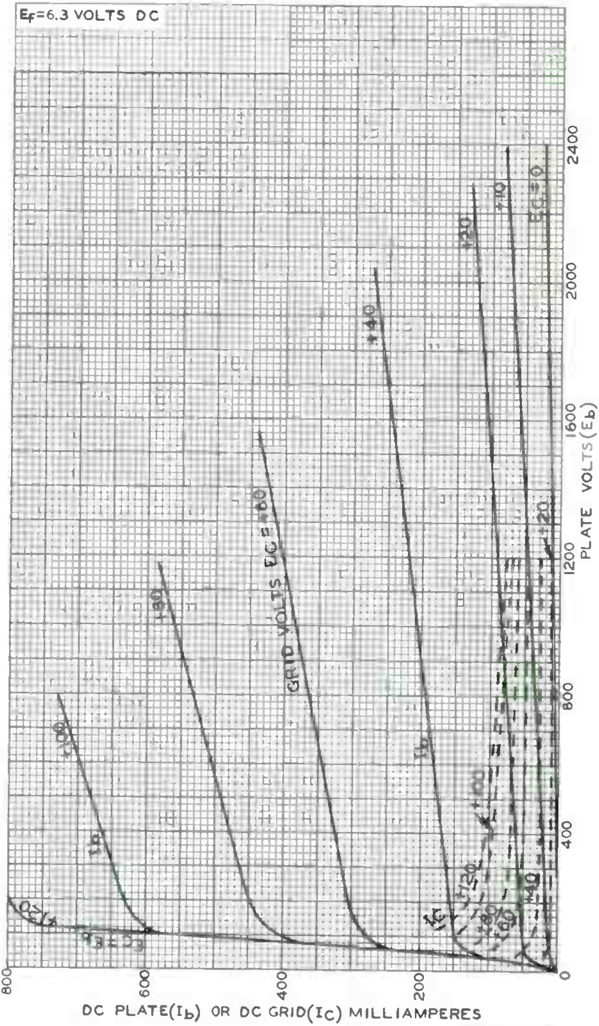
OPERATING FREQUENCY Mc	MAXIMUM PERMISSIBLE PERCENTAGE OF MAXIMUM PLATE VOLTAGE & PLATE INPUT	
	TELEPHONY	TELEGRAPHY
	Class C Plate-Modulated	Class C
30	100	100
60	89	89
80	70	70
100	55	55



92CS-6905R2

ALL DIMENSIONS IN INCHES

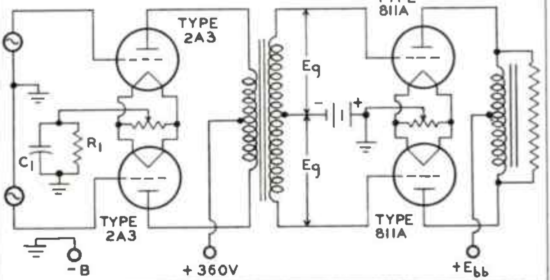
AVERAGE PLATE CHARACTERISTICS

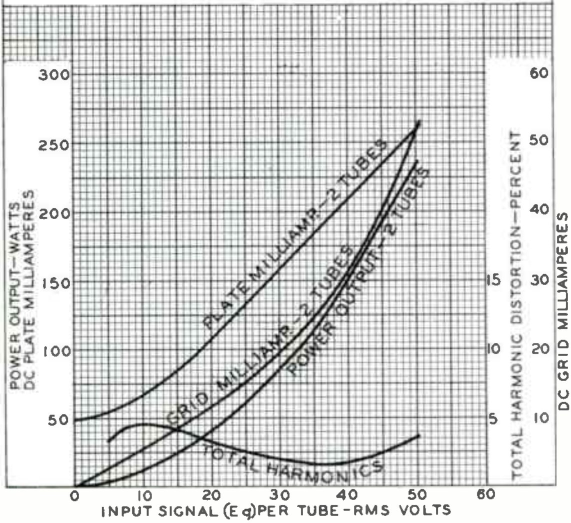


92CM-6075

OPERATION CHARACTERISTICS

E_f = 6.3 VOLTS AC FOR 811A's & 2.5 VOLTS AC FOR 2A3's
INPUT: CLASS AB_1-TWO TYPE 2A3's; PLATE-SUPPLY VOLTS = 360; CATHODE-BIAS RESISTOR(R_1) = 780 OHMS; BYPASS CAPACITOR(C_1)=80 µf
INTERSTAGE TRANSFORMER (T):
VOLTAGE RATIO $\frac{\text{PRIMARY}}{\text{1/2 SEC.}} = 6$
OUTPUT: CLASS B-TWO TYPE 811A's; PLATE-SUPPLY VOLTS (E_{bb})=1250; DC GRID VOLTS=0; PLATE-TO-PLATE LOAD=12 400 OHMS

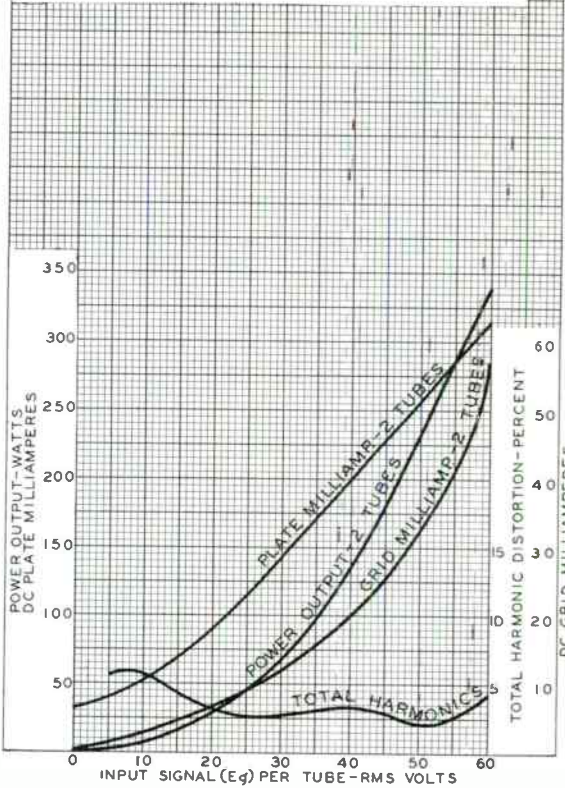




92CM-7138

OPERATION CHARACTERISTICS

E_f = 6.3 VOLTS AC FOR 811A'S & 2.5 VOLTS AC FOR 2A3'S
CIRCUIT ARRANGEMENT: SAME AS ON DWG. 92CM-7138 UNDER TYPE 811A
INPUT: CLASS AB1-TWO TYPE 2A3'S; PLATE-SUPPLY VOLTS = 360; CATHODE-BIAS RESISTOR (R_1) = 780 OHMS; BYPASS CAPACITOR (C_1) = 80 µf
INTERSTAGE TRANSFORMER (T):
VOLTAGE RATIO $\frac{\text{PRIMARY}}{\frac{1}{2}\text{ SEC.}} = 6$
OUTPUT: CLASS B-TWO TYPE 811A'S; PLATE-SUPPLY VOLTS (E_{bb}) = 1500; DC GRID VOLTS = −4.5; PLATE-TO-PLATE LOAD = 12400 OHMS



92CM-7139

Power Triode

GENERAL DATA

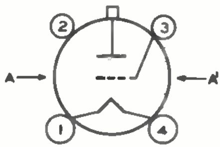
Electrical:

Filament, Thoriated Tungsten:		
Voltage (AC or DC)	6.3 ± 0.3	volts
Current at filament volts = 6.3	4	
Amplification Factor	29	
Direct Interelectrode Capacitances:		
Grid to plate	5.5	pf
Grid to filament	5.4	pf
Plate to filament	0.77	pf

Mechanical:

Operating Position	Vertical, base down; or Horizontal, pins 1 and 4 in vertical plane
Maximum Overall Length	6-15/32"
Seated Length	5-11/16" ± 5/32"
Maximum Diameter	2-7/16"
Weight	2.7 oz
Bulb	ST19
Cap	Medium (JEDEC No.C1-5)
Base	Medium-Shell Small 4-Pin Micanol with Bayonet (JEDEC No.A4-10)
Basing Designation for BOTTOM VIEW	3G

Pin 1 – Filament
Pin 2 – Do Not Use



Pin 3 – Grid
Pin 4 – Filament
Cap – Plate

AA'=PLANE OF ELECTODES

AF POWER AMPLIFIER & MODULATOR — Class B

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

	CCS●	*ICAS*●●	
DC PLATE VOLTAGE	1250 max.	1500 max.	volts
MAX.-SIGNAL DC PLATE CURRENT*	175 max.	175 max.	ma
MAX.-SIGNAL PLATE INPUT*	165 max.	235 max.	watts
PLATE DISSIPATION*	45 max.	65 max.	watts

Typical Operation:

Values are for 2 tubes

DC Plate Voltage	1250	1500	volts
DC Grid Voltage#	-40	-48	volts
Peak AF Grid-to-Grid Voltage	225	270	volts
Zero-Signal DC Plate Current	22	28	ma

* Averaged over any audio-frequency cycle of sine-wave form.
●, ●●, #: See next page. ← Indicates a change.

	CCS●	ICAS●●	
Max.-Signal DC Plate Current. .	260	310	ma
Effective Load Resistance (plate-to-plate).	12200	13200	ohms
Max.-Signal Driving Power (Approx.)	3.5	5	watts
Max.-Signal Power Output (Approx.)	235	340	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●	ICAS●●	
DC PLATE VOLTAGE.	1000 max.	1250 max.	volts
DC GRID VOLTAGE	-200 max.	-200 max.	volts
DC PLATE CURRENT.	125 max.	150 max.	ma
DC GRID CURRENT	35 max.	35 max.	ma
PLATE INPUT	115 max.	175 max.	watts
PLATE DISSIPATION	30 max.	45 max.	watts

Typical Operation:

	CCS●	ICAS●●	
DC Plate Voltage.	1000	1250	volts
DC Grid Voltage●.	-110	-115	volts
	3400	3300	ohms
Peak RF Grid Voltage.	220	240	volts
DC Plate Current.	115	140	ma
DC Grid Current (Approx.) . . .	33	35	ma
Driving Power (Approx.)	6.6	7.6	watts
Power Output (Approx.).	85	130	watts

RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy

Key-down conditions per tube without modulation⌧⌧

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

	CCS●	ICAS●●	
DC PLATE VOLTAGE.	1250 max.	1500 max.	volts
DC GRID VOLTAGE	-200 max.	-200 max.	volts
DC PLATE CURRENT.	175 max.	175 max.	ma
DC GRID CURRENT	35 max.	35 max.	ma
PLATE INPUT	175 max.	260 max.	watts
PLATE DISSIPATION	45 max.	65 max.	watts

Typical Operation:

	CCS●	ICAS●●	
DC Plate Voltage.	1250	1500	volts
DC Grid Voltage▲▲	-90	-120	volts
	3000	4000	ohms
	530	590	ohms
Peak RF Grid Voltage.	200	240	volts
DC Plate Current.	140	173	ma
DC Grid Current (Approx.) . . .	30	30	ma
Driving Power (Approx.)	5.4	6.5	watts
Power Output (Approx.).	130	190	watts

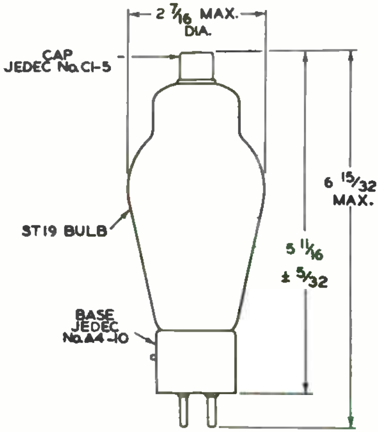
●, ●●, #, ●, ▲▲, ⌧⌧: See next page.

OPERATING CONSIDERATIONS

Plate shows no color when tube is operated at maximum CCS ratings, and shows a barely perceptible red color at maximum ICAS ratings.

MAXIMUM RATINGS vs OPERATING FREQUENCY

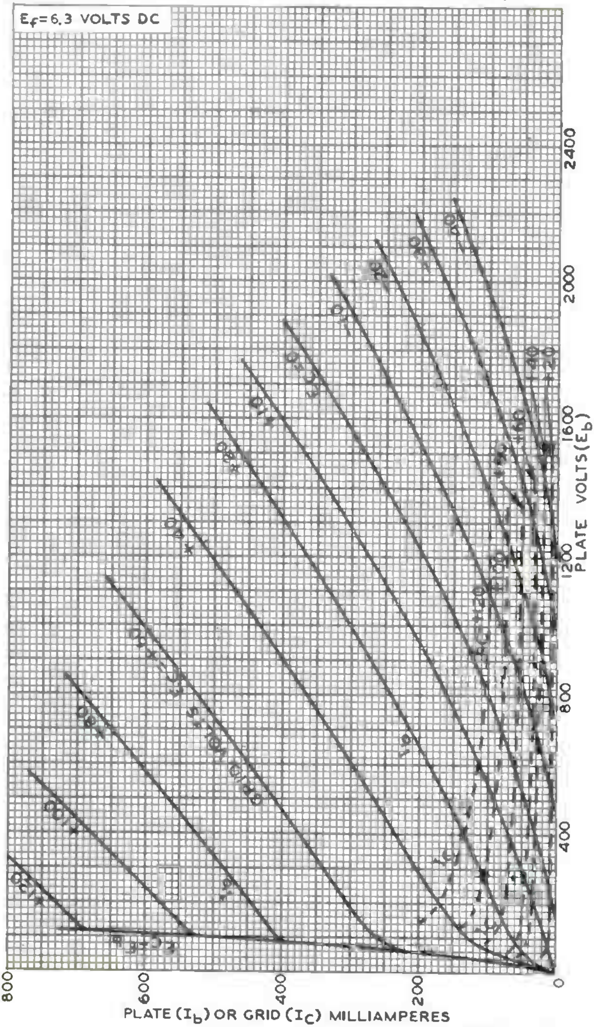
OPERATING FREQUENCY Mc	MAXIMUM PERMISSIBLE PERCENTAGE OF MAXIMUM PLATE VOLTAGE & PLATE INPUT	
	TELEPHONY	TELEGRAPHY
	Class C Plate-Modulated	Class C
30	100	100
60	89	89
80	70	70
100	55	55



92CS-6905R2

ALL DIMENSIONS IN INCHES

AVERAGE PLATE CHARACTERISTICS

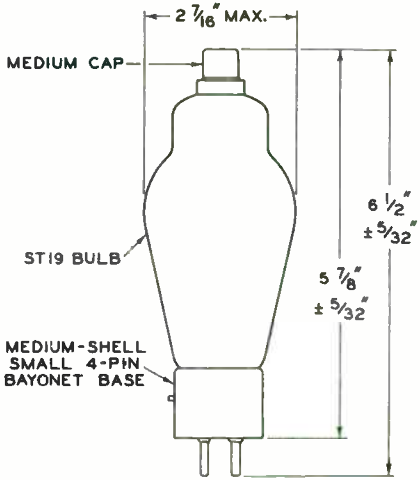


92CM-6074R1

RCA

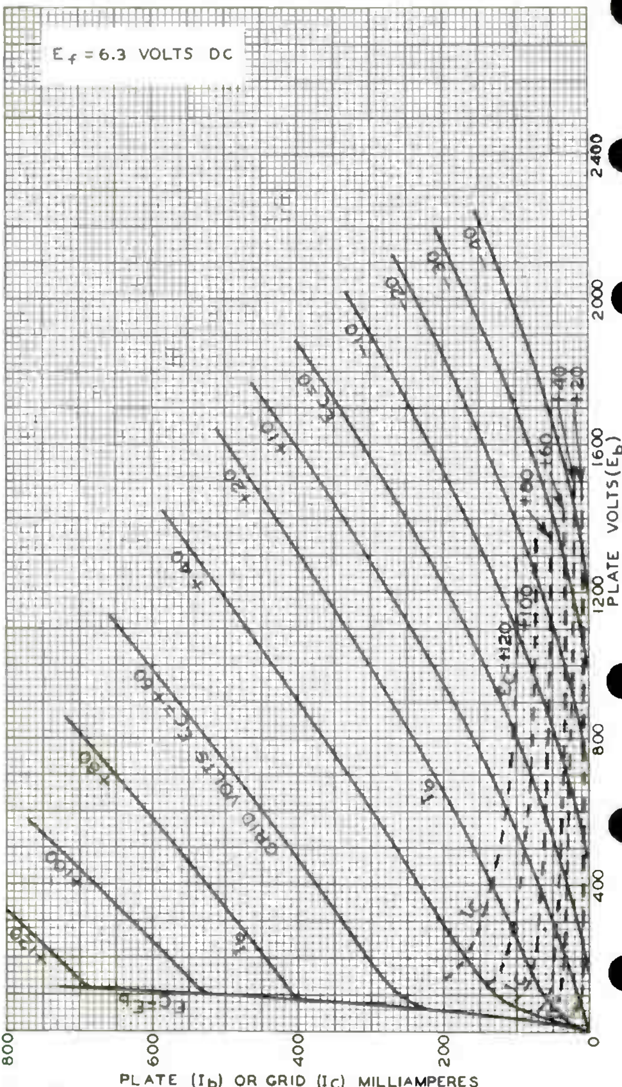
812-A

POWER TRIODE



RCA

812-A
AVERAGE PLATE CHARACTERISTICS



MAY 13, 1948 — TUBE DEPARTMENT — 92CM-6074R1

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

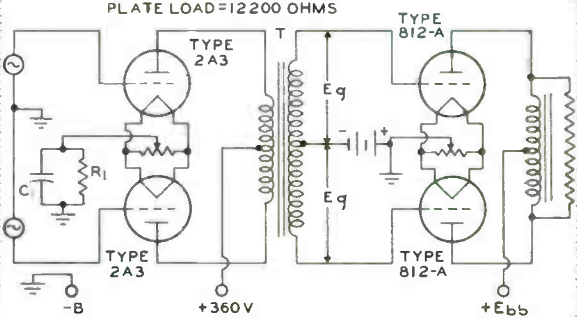
812-A

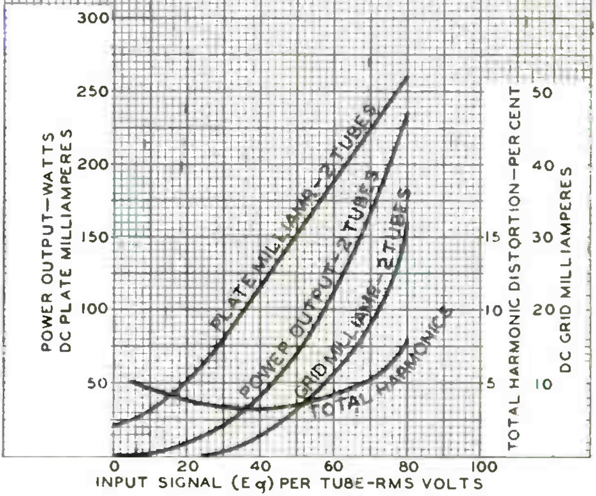
OPERATION CHARACTERISTICS

E_f = 6.3 VOLTS AC FOR 812-A's & 2.5 VOLTS AC FOR 2A3's
INPUT: CLASS AB_1 – TWO TYPE 2A3's; PLATE-SUPPLY VOLTS = 360; CATHODE-BIAS RESISTOR (R_1) = 780 OHMS; BYPASS CAPACITOR (C_1) = 80 µf
INTERSTAGE TRANSFORMER (T):

VOLTAGE RATIO $\frac{\text{PRIMARY}}{\text{1/2 SEC.}}$ = 1.4

OUTPUT: CLASS B – TWO TYPE 812-A's; PLATE VOLTS (E_{bb}) = 1250; DC GRID VOLTS = –40; PLATE-TO-PLATE LOAD = 12200 OHMS



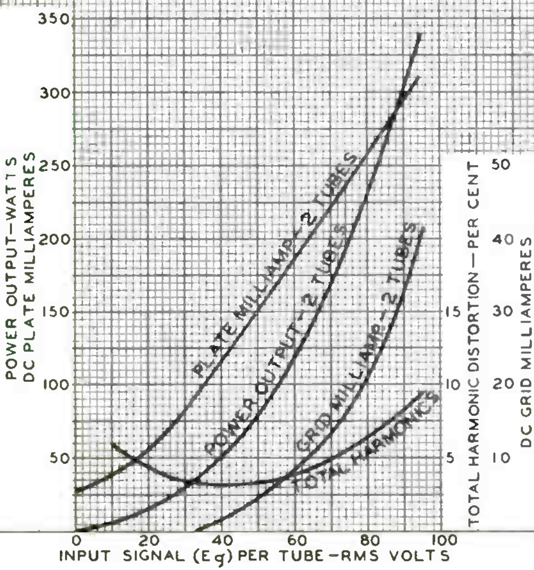


RCA

812-A

OPERATION CHARACTERISTICS

E_f = 6.3 VOLTS AC FOR 812-A's & 2.5 VOLTS AC FOR 2A3's
CIRCUIT ARRANGEMENT: SAME AS ON DWG. 92CM-6938 UNDER TYPE 812-A
INPUT: CLASS AB_1 — TWO TYPE 2A3's; PLATE-SUPPLY VOLTS = 360; CATHODE-BIAS RESISTOR (R_1) = 780 OHMS; BYPASS CAPACITOR (C_1) = 80 μf
INTERSTAGE TRANSFORMER (T):
VOLTAGE RATIO $\frac{\text{PRIMARY}}{\text{1/2 SEC.}}$ = 1.4
OUTPUT: CLASS B — TWO TYPE 812-A's; PLATE VOLTS (E_{bb}) = 1500; DC GRID VOLTS = -48; PLATE-TO-PLATE LOAD = 13200 OHMS



RCA

816

HALF-WAVE MERCURY-VAPOR RECTIFIER

GENERAL DATA

Electrical:

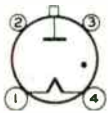
Filament, Coated:

Voltage	2.5	ac volts
Current	2.0	amp
Heating Time	10	sec.
Tube Voltage Drop (Approx.)	15	volts

Mechanical:

Mounting Position	Vertical, Base Down
Overall Length	4-9/16" ± 1/8"
Seated Length	3-15/16" ± 1/8"
Maximum Diameter	1-9/16"
Bulb	ST-12
Cap	Small
Base	Small-Shell Small 4-Pin
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:* •

COND.-MERCURY TEMP. RANGE	20 – 60	°C
PEAK INVERSE ANODE VOLTAGE	7500 max.	volts
PEAK ANODE CURRENT	500 max.	ma
AVERAGE ANODE CURRENT	125 max.	ma

• For supply frequency up to 150 cycles per second.

The table on the following page classifies suitable rectifier circuits for the 816 and shows their safe maximum input and maximum output operating conditions for a peak inverse voltage of 7500 volts. These values are based on a sine-wave input and the use of a suitable choke preceding any capacitor in the filter circuit.

816

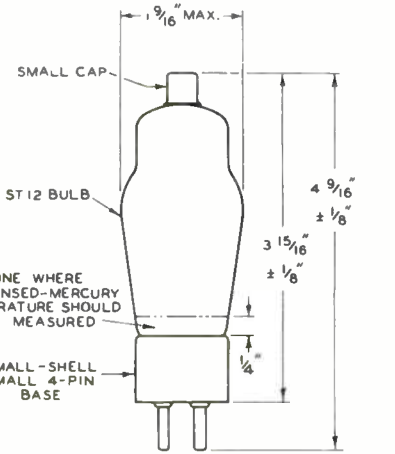
HALF-WAVE MERCURY-VAPOR RECTIFIER

CIRCUIT□	MAXIMUM AC INPUT VOLTS (RMS)*	APPROX. DC OUTPUT VOLTS TO FILTER*	MAXIMUM DC LOAD CURRENT amperes
SINGLE-PHASE FULL-WAVE (2 tubes) FIG. 1	5300 total	2390	0.25
SINGLE-PHASE FULL-WAVE (4 tubes) FIG. 2	5300 total	4780	0.25
THREE-PHASE HALF-WAVE FIG. 3	3050 per leg	3570	0.375
THREE-PHASE DOUBLE-Y PARALLEL FIG. 4	3050 per leg	3570	0.75
THREE-PHASE FULL-WAVE FIG. 5	3050 per leg	7140	0.375

□ For RECTIFIER CIRCUITS and RF FILTER CONSIDERATIONS refer to Type 872-A

* For maximum peak inverse voltage of 7500 volts.

NOTE: 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-6277R2

826
TRANSMITTING TRIODE

GENERAL DATA

Electrical:

Filament, Thoriated Tungsten:†

Voltage	7.5	ac or dc volts
Current	4	amp
Amplification Factor	31	

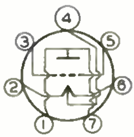
Direct Interelectrode Capacitances:

Grid to Plate	3	μμf ←
Grid to Filament	3	μμf ←
Plate to Filament	1.1	μμf ←

Mechanical:

Mounting Position	Vertical Only, Base up or down
Overall Length	3-1/2" ± 3/16"
Seated Length	3-1/16" ± 3/16"
Maximum Diameter	See Outline Drawing
Bulb	T-16
Base	Medium Molded-Flare Septar 7-Pin
Basing Designation for BOTTOM VIEW	7BO

Pin 1 – Plate
Pin 2 – Filament
Pin 3 – Grid
Pin 4 – Filament Center-Tap



Pin 5 – Grid
Pin 6 – Filament
Pin 7 – Plate

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*: ←

	NATURAL COOLING CCS•	NATURAL COOLING ICAS••	
DC PLATE VOLTAGE	800 max.	1000 max.	volts
DC GRID VOLTAGE	-600 max.	-600 max.	volts
DC PLATE CURRENT	95 max.	125 max.	ma
DC GRID CURRENT	40 max.	40 max.	ma
PLATE INPUT	60 max.	95 max.	watts
PLATE DISSIPATION	30 max.	45 max.	watts

Typical Operation with Natural Cooling: ←

DC Plate Voltage	–	1000	volts
DC Grid Voltage•#	–	-160	volts
	–	4000	ohms
Peak RF Grid Voltage	–	320	volts
DC Plate Current	–	95	ma
DC Grid Current (Approx.)□	–	40	ma
Driving Power (Approx.)□	–	11.5	watts
Power Output (Approx.)	–	70	watts

†, •, ••, •, #, □: See next page.

← indicates a change.

826

826

TRANSMITTING TRIODE

Maximum Ratings, *Absolute Values:* FORCED-AIR COOLING

	CCS●	ICAS●●	
DC PLATE VOLTAGE	800 max.	1000 max.	volts
DC GRID VOLTAGE	-600 max.	-600 max.	volts
DC PLATE CURRENT	95 max.	125 max.	ma
DC GRID CURRENT	40 max.	40 max.	ma
PLATE INPUT	75 max.	125 max.	watts
PLATE DISSIPATION	40 max.	60 max.	watts

Typical Operation with Forced-Air Cooling:

DC Plate Voltage	800	1000	volts
DC Grid Voltage◉#	-100	-100	volts
	2800	2800	ohms
Peak RF Grid Voltage	198	210	volts
DC Plate Current	94	125	ma
DC Grid Current (Approx.)□	35	35	ma
Driving Power (Approx.)□	6.3	6.6	watts
Power Output (Approx.)	53	90	watts

RF POWER AMPLIFIER & OSCILLATOR – Class C Telegraphy

Key-down conditions per tube without modulation□□

Maximum Ratings, *Absolute Values:* NATURAL COOLING

	CCS●	ICAS●●	
DC PLATE VOLTAGE	1000 max.	1000 max.	volts
DC GRID VOLTAGE	-600 max.	-600 max.	volts
DC PLATE CURRENT	125 max.	140 max.	ma
DC GRID CURRENT	40 max.	40 max.	ma
PLATE INPUT	95 max.	130 max.	watts
PLATE DISSIPATION	45 max.	55 max.	watts

Typical Operation with Natural Cooling:

DC Plate Voltage	–	1000	volts
DC Grid Voltage#▲	–	-70	volts
	–	2000	ohms
	–	425	ohms
Peak RF Grid Voltage	–	183	volts
DC Plate Current	–	130	ma
DC Grid Current (Approx.)	–	35	ma
Driving Power (Approx.)	–	5.8	watts
Power Output (Approx.)	–	90	watts

Maximum Ratings, *Absolute Values:* FORCED-AIR COOLING

	CCS●	ICAS●●	
DC PLATE VOLTAGE	1000 max.	1250 max.	volts
DC GRID VOLTAGE	-600 max.	-600 max.	volts
DC PLATE CURRENT	125 max.	140 max.	ma
DC GRID CURRENT	40 max.	40 max.	ma
PLATE INPUT	125 max.	175 max.	watts
PLATE DISSIPATION	60 max.	75 max.	watts

†,●,●●,◉,#,□,□□,▲: See next page.

→ Indicates a change.

826

826

TRANSMITTING TRIODE

Typical Operation with Forced-Air Cooling:

DC Plate Voltage	1000	1250	volts
DC Grid Voltage#▲	-70	-125	volts
	2000	3600	ohms
	440	780	ohms
Peak RF Grid Voltage	183	245	volts
DC Plate Current	125	125	ma
DC Grid Current (Approx.)	35	35	ma
Driving Power (Approx.)	5.8	7.7	watts
Power Output (Approx.)	86	120	watts

† 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 rf 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. RF by-passing of the grid- and plate-return circuits should be made to the center lead of the filament.

● Continuous Commercial Service.

●● Intermittent Commercial and Amateur Service.

● Obtained by grid resistor of value shown. Fixed supply not recommended for linear modulation.

\# Grid voltages are given with respect to the mid-point of filament operated on ac. If dc is used, each stated value of grid voltage should be decreased by one-half the filament voltage and the circuit returns made to the negative end of the filament.

□ 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.

▲ Obtained from fixed supply, by grid resistor (2000, 2000, 3600) or by cathode resistor (425, 440, 780).

NOTE: When the 826 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 1250 volts, a fixed bias of at least -22.5 volts should be used.

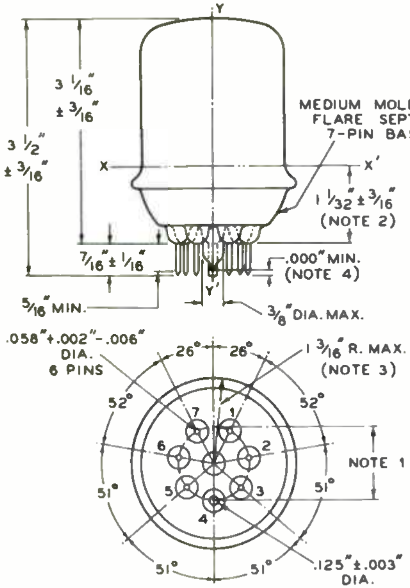
Data on operating frequencies for the 826 are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY. Adequate shielding must be provided at the higher frequencies. At the very-high frequencies, push-pull operation is recommended and it is desirable to use each tube with its two grid terminals connected together as well as its two plate terminals connected together, in order to reduce the respective lead inductances.

← Indicates a change.

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

826
TRANSMITTING TRIODE



92CM-6131R2

BOTTOM VIEW

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" ± 0.0005" 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: 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

(continued on next page)

826

TRANSMITTING TRIODE

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.

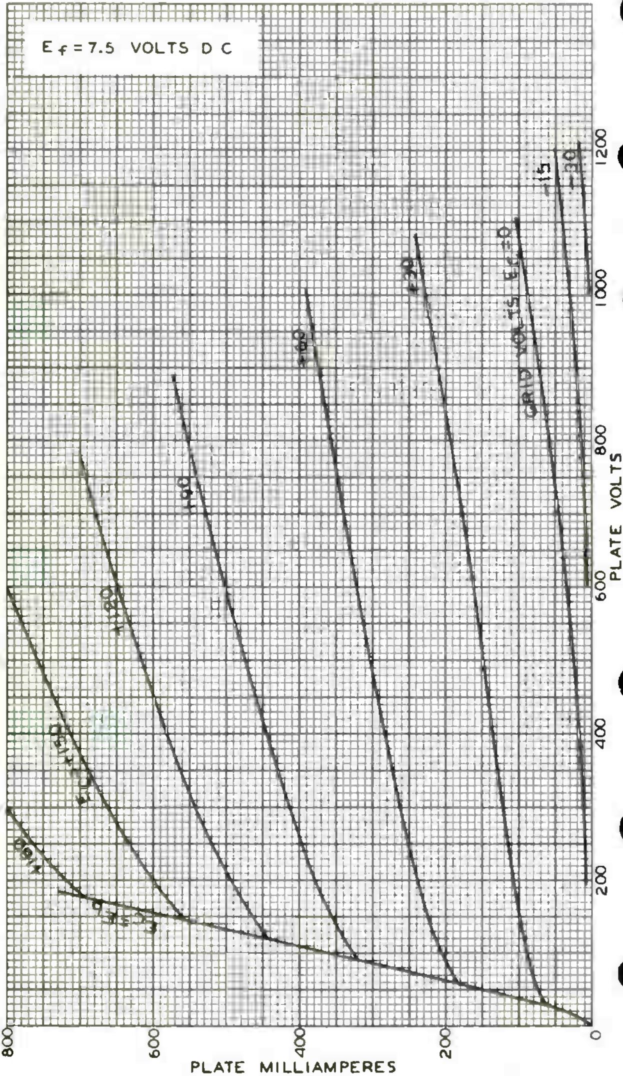
NOTE 3: MINIMUM DIAMETER OF TUBE-SEAL FLANGE WILL BE SUCH THAT A RING GAUGE HAVING I.D. OF 2.125" - 0.000" + 0.003" AND THICKNESS OF 0.125" ± 0.010" WILL NOT PASS THE FLANGE WHEN TRIED AT ANY ANGLE.

NOTE 4: EXHAUST TIP WILL NOT EXTEND BEYOND THE PLANE WHICH PASSES THROUGH THE ENDS OF THE THREE LONGEST PINS.

RCA

826

AVERAGE PLATE CHARACTERISTICS



SEPT. 9, 1940

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6210

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)

MAR. 20, 1936 — TENTATIVE DATA

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.

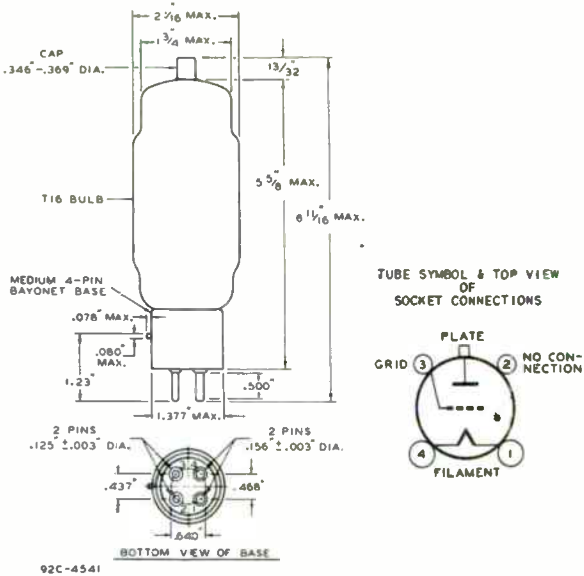
For operation of the 830-B at the higher frequencies, refer to sheet TRANS. TUBE RATINGS vs FREQUENCY.

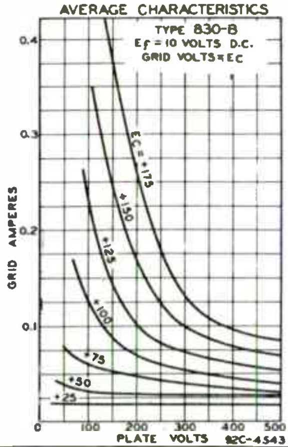
(continued on next page)

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC

830-B
R-F POWER AMPLIFIER, OSCILLATOR, CLASS B MODULATOR

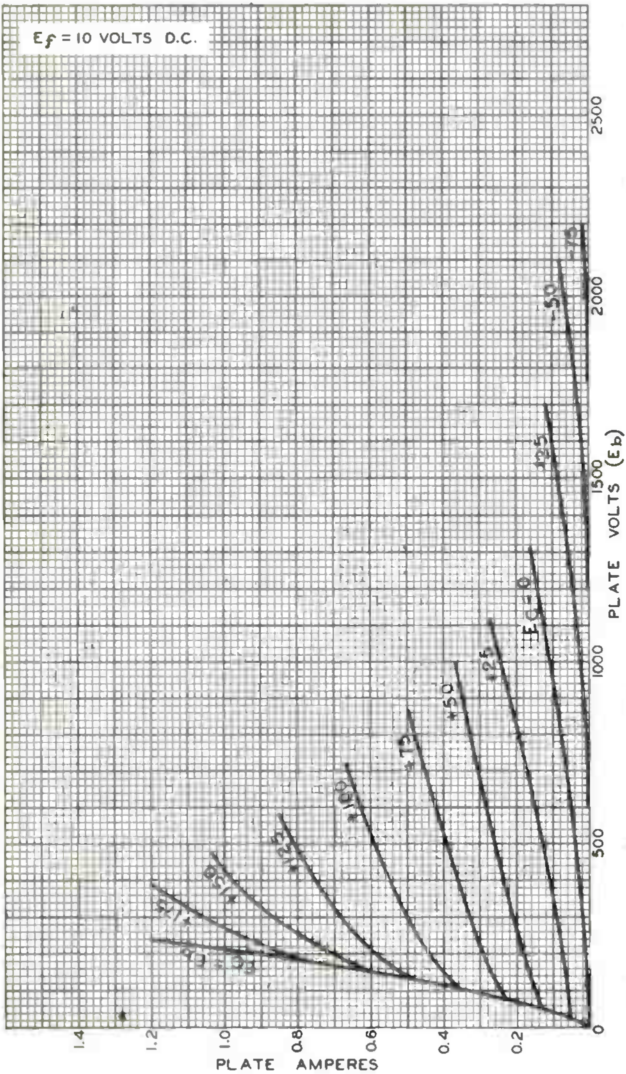
(continued from preceding page)





830-B

AVERAGE PLATE CHARACTERISTICS



JAN. 17, 1936

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY INC

92C-4542

Power Triode

THORIATED-TUNGSTEN FILAMENT — RUGGED STRUCTURE
ZIRCONIUM-COATED ANODE — POST TERMINALS
1250 WATTS CW INPUT (CCS) TO 30 Mc WITH NATURAL COOLING
1800 WATTS CW INPUT (CCS) TO 20 Mc WITH FORCED-AIR COOLING

GENERAL DATA

Electrical:

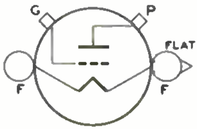
Filament, Thoriated Tungsten:		
Voltage (AC or DC)	10 ± 5%	volts
Current at heater volts = 10	10	amp
Amplification Factor, for grid volts = -10 and plate ma. = 200	35	
Direct Interelectrode Capacitances:		
Grid to plate	6.3	μμf
Grid to filament	12.3	μμf
Plate to filament	8.5	μμf

Mechanical:

Operating Position	Vertical, with filament posts up or down; Horizontal, with plane of electrodes vertical (on edge)
Overall Length	8-5/8" ± 3/16"
Maximum Diameter	4-19/32"
Bulb	T36
Weight (Approx.)	1 lb

Terminal Connections (See *Dimensional Outline*):

F - Filament
G - Grid



P - Plate

Thermal:

Cooling:

Natural or *forced air*—depending on the operating conditions. *Natural Cooling* means that adequate free circulation of air around the tube is necessary. *Forced-Air Cooling* means that an air flow of 40 cfm from a 2"-diameter nozzle directed vertically on bulb between grid and plate seals is required to limit temperature between these seals to 145° C.

Fittings:

Johnson (E.F. Johnson Company, Waseca, Minn.) Assembly Cat. No.124-212 consisting of ceramic mounting for filament end and two heat-radiating connectors for grid and plate terminals.

●,●●,*: See next page. — ← indicates a change.

AF POWER AMPLIFIER & MODULATOR — Class B

NATURAL COOLING

Maximum Ratings, *Absolute-Maximum Values:*

	CCS●	ICAS●●	
DC PLATE VOLTAGE	3000 max.	3300 max.	volts
MAX.-SIGNAL DC PLATE CURRENT*	500 max.	500 max.	ma
MAX.-SIGNAL PLATE INPUT*	1125 max.	1300 max.	watts
PLATE DISSIPATION*	300 max.	350 max.	watts

Typical Operation with Natural Cooling:

Values are for 2 tubes

	CCS●	ICAS●●	
DC Plate Voltage	3000	3300	volts
DC Grid Voltage#	-70	-80	volts
Peak AF Grid-to-Grid Voltage	400	440	volts
Zero-Signal DC Plate Current	100	100	ma
Max.-Signal DC Plate Current	750	780	ma
Effective Load Resistance (Plate to plate)	9500	10500	ohms
Max.-Signal Driving Power (Approx.)	20	30	watts
Max.-Signal Power Output (Approx.)	1650	1900	watts

FORCED-AIR COOLING

Maximum Ratings, *Absolute-Maximum Values:*

	CCS●	ICAS●●	
DC PLATE VOLTAGE	4000 max.	4000 max.	volts
MAX.-SIGNAL DC PLATE CURRENT*	500 max.	500 max.	ma
MAX.-SIGNAL PLATE INPUT*	1600 max.	1800 max.	watts
PLATE DISSIPATION*	400 max.	450 max.	watts

Typical Operation with Forced-Air Cooling:

Values are for 2 tubes

	CCS●	ICAS●●	
DC Plate Voltage	4000	4000	volts
DC Grid Voltage#	-100	-100	volts
Peak AF Grid-to-Grid Voltage	480	510	volts
Zero-Signal DC Plate Current	100	100	ma
Max.-Signal DC Plate Current	800	900	ma
Effective Load Resistance (Plate to plate)	12000	11000	ohms
Max.-Signal Driving Power (Approx.)	29	38	watts
Max.-Signal Power Output (Approx.)	2400	2700	watts

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

●,●●,#: See next page.

833-A

833-A

POWER TRIODE

RF POWER AMPLIFIER - Class B Telephony

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

NATURAL COOLING

	CCS•	ICAS••	
Maximum Ratings, ***Absolute Values:***			
DC PLATE VOLTAGE.	3000 max.	3300 max.	volts
DC PLATE CURRENT.	300 max.	300 max.	ma
PLATE INPUT	450 max.	525 max.	watts
PLATE DISSIPATION	300 max.	350 max.	watts
Typical Operation with Natural Cooling:			
DC Plate Voltage.	3000	3300	volts
DC Grid Voltage#.	-70	-100	volts
Peak RF Grid Voltage. . . .	90	110	volts
DC Plate Current.	150	150	ma
DC Grid Current (Approx.) .	2	2	ma
Driving Power (Approx.)▲. .	10	11	watts
Power Output (Approx.). . .	150	200	watts

FORCED-AIR COOLING

	CCS•	ICAS••	
Maximum Ratings, ***Absolute Values:***			
DC PLATE VOLTAGE.	4000 max.	4000 max.	volts
DC PLATE CURRENT.	300 max.	300 max.	ma
PLATE INPUT	600 max.	675 max.	watts
PLATE DISSIPATION	400 max.	450 max.	watts
Typical Operation with Forced-Air Cooling:			
DC Plate Voltage.	4000	4000	volts
DC Grid Voltage#.	-120	-120	volts
Peak RF Grid Voltage. . . .	120	130	volts
DC Plate Current.	150	150	ma
DC Grid Current (Approx.) .	2	3	ma
Driving Power (Approx.)▲. .	14	21	watts
Power Output (Approx.). . .	225	250	watts

PLATE-MODULATED RF POWER AMPLIFIER - Class C Telephony

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

NATURAL COOLING

	CCS•	ICAS••	
Maximum Ratings, ***Absolute Values:***			
DC PLATE VOLTAGE.	2500 max.	3000 max.	volts
DC GRID VOLTAGE	-500 max.	-500 max.	volts
DC PLATE CURRENT.	400 max.	400 max.	ma

For ac filament supply.

▲ At crest of audio-frequency cycle with modulation factor of 1.0.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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POWER TRIODE

	CCS●	ICAS●●	
DC GRID CURRENT	100 max.	100 max.	ma
PLATE INPUT	835 max.	1000 max.	watts
PLATE DISSIPATION	200 max.	250 max.	watts

Typical Operation with Natural Cooling:

DC Plate Voltage.	2500	3000	volts
DC Grid Voltage◆.	-300	-240	volts
From a grid resistor of .	4000	3400	ohms
Peak RF Grid Voltage. . . .	460	410	volts
DC Plate Current.	335	335	ma
DC Grid Current (Approx.)⊛.	75	70	ma
Driving Power (Approx.)⊛. .	30	26	watts
Power Output (Approx.). . .	635	800	watts

FORCED-AIR COOLING

Maximum Ratings, *Absolute Values:*

	CCS●	ICAS●●	
DC PLATE VOLTAGE.	3000 max.	4000 max.	volts
DC GRID VOLTAGE	-500 max.	-500 max.	volts
DC PLATE CURRENT.	450 max.	450 max.	ma
DC GRID CURRENT	100 max.	100 max.	ma
PLATE INPUT	1250 max.	1800 max.	watts
PLATE DISSIPATION	270 max.	350 max.	watts

Typical Operation with Forced-Air Cooling:

DC Plate Voltage.	3000	4000	volts
DC Grid Voltage◆.	-300	-325	volts
From a grid resistor of .	3600	3600	ohms
Peak RF Grid Voltage. . . .	490	520	volts
DC Plate Current.	415	450	ma
DC Grid Current (Approx.)⊛.	85	90	ma
Driving Power (Approx.)⊛. .	37	42	watts
Power Output (Approx.). . .	1000	1500	watts

RF POWER AMPLIFIER & OSCILLATOR--Class C Telegraphy◻◻ and RF POWER AMPLIFIER--Class C FM Telephony

NATURAL COOLING

Maximum Ratings, *Absolute Values:*

	CCS●	ICAS●●	
DC PLATE VOLTAGE.	3000 max.	3300 max.	volts
DC GRID VOLTAGE	-500 max.	-500 max.	volts
DC PLATE CURRENT.	500 max.	500 max.	ma

◆ Obtained by grid resistor, or from a combination of grid 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.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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833-A

POWER TRIODE

	CCS●		ICAS●●		
DC GRID CURRENT	100 max.		100 max.		ma
PLATE INPUT	1250 max.		1500 max.		watts
PLATE DISSIPATION	300 max.		350 max.		watts

Typical Operation with Natural Cooling:

	CCS		ICAS		
DC Plate Voltage	2250	3000	3000	3000	volts
DC Grid Voltage	-125	-200	-160	-155	volts
From a grid resistor of	1500	3600	2300	2150	ohms
From a cathode resistor of	235	425	400	270	ohms
Peak RF Grid Voltage	300	360	310	350	volts
DC Plate Current	445	415	335	500	ma
DC Grid Current (Approx.)⊕	85	55	70	70	ma
Driving Power (Approx.)⊕	23	20	20	25	watts
Power Output (Approx.)	780	1000	800	1150	watts

FORCED-AIR COOLING

Maximum Ratings, *Absolute Values:*

	CCS●	ICAS●●	
DC PLATE VOLTAGE	4000 max.	4000 max.	volts
DC GRID VOLTAGE	-500 max.	-500 max.	volts
DC PLATE CURRENT	500 max.	500 max.	ma
DC GRID CURRENT	100 max.	100 max.	ma
PLATE INPUT	1800 max.	2000 max.	watts
PLATE DISSIPATION	400 max.	450 max.	watts

Typical Operation with Forced-Air Cooling:

	CCS	ICAS	
DC Plate Voltage	4000	4000	volts
DC Grid Voltage▲▲	-200	-225	volts
From a grid resistor of	2650	2400	ohms
From a cathode resistor of	380	380	ohms
Peak RF Grid Voltage	375	415	volts
DC Plate Current	450	500	ma
DC Grid Current⊕	75	95	ma
Driving Power (Approx.)⊕	26	35	watts
Power Output (Approx.)	1440	1600	watts

⊕ Subject to wide variation depending on the impedance of the load circuit. High-impedance load circuits require more grid current and driving power to obtain the desired output. Low-impedance load circuits need less grid current and driving power, but plate-circuit efficiency is sacrificed. The driver stage should have good regulation and should be capable of delivering considerably more than the required driving power.

▲▲ Obtained from fixed supply, by grid resistor, by cathode resistor, or by combination methods.

●, ●●: See next page.

← Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA HARRISON, NEW JERSEY

RCA

833-A

POWER TRIODE

NOTE: When the 833-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 a plate voltage of 4000 volts, a fixed bias of at least -90 volts should be used.

→ **SELF-RECTIFYING OSCILLATOR OR AMPLIFIER - Class C**

NATURAL COOLING

	CCS•	*ICAS*••	
Maximum Ratings, ***Absolute Values:***			
AC PLATE VOLTAGE (RMS) . . .	4250 max.	4650 max.	volts
DC GRID VOLTAGE	-315 max.	-315 max.	volts
DC PLATE CURRENT.	250 max.	250 max.	ma
DC GRID CURRENT	50 max.	50 max.	ma
PLATE INPUT**	1180 max.	1290 max.	watts
PLATE DISSIPATION	300 max.	350 max.	watts
Typical Operation with Natural Cooling:			
AC Plate Voltage (RMS). . .	4000	4400	volts
DC Grid Voltage♦.	-80	-85	volts
From a grid resistor of	2200	2400	ohms
DC Plate Current.	240	240	ma
DC Grid Current (Approx.) .	37	36	ma
Driving Power (Approx.)## .	13	13.5	watts
Output-Circuit Efficiency (Approx.). . . .	85	85	%
Useful Power Output (Approx.)	710□	800□	watts

FORCED-AIR COOLING

	CCS•	
Maximum Ratings, ***Absolute Values:***		
AC PLATE VOLTAGE (RMS).	5650 max.	volts
DC GRID VOLTAGE	-315 max.	volts
DC PLATE CURRENT.	250 max.	ma
DC GRID CURRENT	50 max.	ma
PLATE INPUT	1570 max.	watts
PLATE DISSIPATION	400 max.	watts
Typical Operation with Forced-Air Cooling:		
AC Plate Voltage (RMS).	5300	volts
DC Grid Voltage♦.	-97	volts
From a grid resistor of	2700	ohms
DC Plate Current.	240	ma
DC Grid Current (Approx.)	35	ma
Driving Power (Approx.)##	14	watts
Output-Circuit Efficiency (Approx.) . . .	85	%
Useful Power Output (Approx.)	975□	watts

** Power input to plate is 1.11 times the product of ac plate voltage (rms) and the dc plate current.

From a self-rectified driver.

•, ••, ♦, □: See next page. → Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

833-A

POWER TRIODE

AMPLIFIER or OSCILLATOR — Class C

With Separate, Rectified, Unfiltered, Single-Phase, Full-Wave Plate Supply

NATURAL COOLING

Maximum Ratings, *Absolute Values:*

	CCS•	ICAS••	
DC PLATE VOLTAGE	2700 max.	3000 max.	volts
DC GRID VOLTAGE	-450 max.	-450 max.	volts
DC PLATE CURRENT	500 max.	500 max.	ma
DC GRID CURRENT	100 max.	100 max.	ma
PLATE INPUT†	1250 max.	1500 max.	watts
PLATE DISSIPATION	300 max.	350 max.	watts

Typical Operation with Natural Cooling:

	CCS•	ICAS••	
DC Plate Voltage	2500	2750	volts
DC Grid Voltage♦	-130	-135	volts
From a grid resistor of	1560	1770	ohms
DC Plate Current	450	450	ma
DC Grid Current (Approx.)	83	76	ma
Driving Power (Approx.)††	27	25	watts
Output-Circuit Efficiency (Approx.)	85	85	%
Useful Power Output (Approx.)	935□	1020□	watts ←

FORCED-AIR COOLING

Maximum Ratings, *Absolute Values:*

	CCS•	
DC PLATE VOLTAGE	3600 max.	volts
DC GRID VOLTAGE	-450 max.	volts
DC PLATE CURRENT	500 max.	ma
DC GRID CURRENT	100 max.	ma
PLATE INPUT†	1800 max.	watts
PLATE DISSIPATION	400 max.	watts

Typical Operation with Forced-Air Cooling:

	CCS•	
DC Plate Voltage	3300	volts
DC Grid Voltage♦	-155	volts
From a grid resistor of	2100	ohms
DC Plate Current	450	ma
DC Grid Current (Approx.)	73	ma
Driving Power (Approx.)††	26	watts
Output-Circuit Efficiency (Approx.)	85	%
Useful Power Output (Approx.)	1240□	watts ←

• Continuous Commercial Service.

•• Intermittent Commercial and Amateur Service.

† Power input to plate is 1.23 times the product of dc plate voltage times dc plate current.

□ This value of useful power is measured at load of output circuit having the indicated efficiency.

♦, ††: See next page.

← Indicates a change.

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

833-A

833-A

POWER TRIODE

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Filament Current.	1	9.4	10.6	amp
Direct Interelectrode Capacitances:				
Grid to plate	-	5.5	7.1	μμf
Grid to filament. . . .	-	10.1	14.5	μμf
Plate to filament . . .	-	6.4	10.6	μμf
Amplification Factor. . .	2	31.5	38.5	
Grid Current.	3	160	380	ma
Plate Current (1)	3	490	810	ma
Plate Current (2)	4	60	140	ma
Power Output.	5	1150	-	watts

Note 1: With 10 volts dc on filament.

Note 2: With 10 volts ac on filament, dc grid voltage of -10 volts, and dc plate voltage adjusted to give dc plate current of 200 ma.

Note 3: With 10 volts ac on filament, dc plate voltage of 100 volts, and dc grid voltage of +100 volts.

Note 4: With 10 volts ac on filament, dc plate voltage of 2500 volts, and dc grid voltage of -50 volts.

Note 5: In self-excited oscillator circuit, and with 10 volts ac on filament, dc plate voltage of 4000 volts, dc plate current of 450 ma., dc grid current of 80 to 120 ma., grid resistor of 5000 ohms, and frequency of 30 Mc.

♣ Obtained from a grid resistor of the value shown or from a combination of grid resistor and cathode resistor. Fixed bias operation is not recommended. The bias resistor should not be bypassed for the plate and grid voltage supply frequency.

†† From a driver with a rectified, unfiltered, single-phase, full wave plate supply.

RATINGS vs FREQUENCY WITH NATURAL COOLING

FREQUENCY	30	50	75	Mc
MAXIMUM PERMISSIBLE PERCENTAGE of MAXIMUM RATED PLATE VOLTAGE and PLATE INPUT:				
Class B telephony	100	98	94	%
Class C telephony	100	90	72	%
Class C telegraphy	100	90	72	%

RATINGS vs FREQUENCY WITH FORCED-AIR COOLING

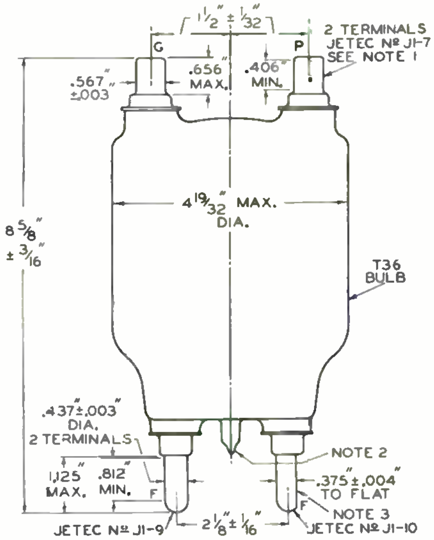
FREQUENCY	20	50	75	Mc
MAXIMUM PERMISSIBLE PERCENTAGE of MAXIMUM RATED PLATE VOLTAGE and PLATE INPUT:				
Class B telephony	100	97	93	%
Class C telephony	100	83	65	%
Class C telegraphy	100	83	65	%

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

RCA

833-A

POWER TRIODE



92CM-4786R5

NOTE 1: THE ANGLE FORMED ON A PLANE NORMAL TO THE TUBE AXIS BY THE INTERSECTION OF THE PLANE DETERMINED BY THE AXIS OF THE FILAMENT TERMINALS WITH THE PLANE DETERMINED BY THE AXIS OF THE GRID AND PLATE TERMINALS IS NOT MORE THAN 5°.

NOTE 2: THE MOUNTING SHOULD PROVIDE LIBERAL CLEARANCE FOR THIS TIP.

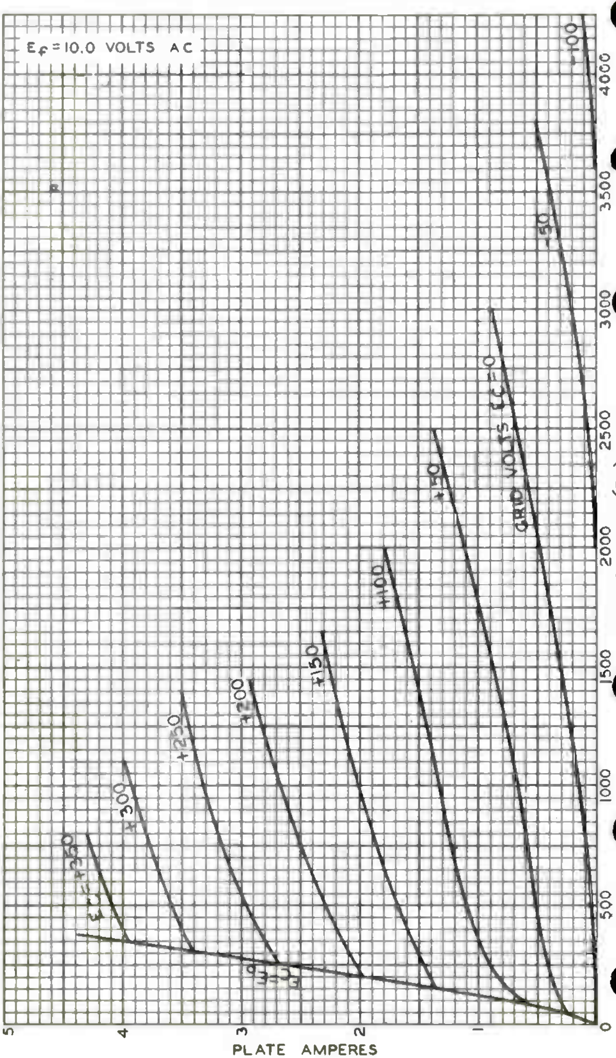
NOTE 3: THE PLANE THROUGH THE FLAT SIDE OF THE FILAMENT TERMINAL IS 90° ±7° WITH RESPECT TO THE PLANE THROUGH THE AXES OF THE FILAMENT TERMINALS.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

833-A

AVERAGE PLATE CHARACTERISTICS



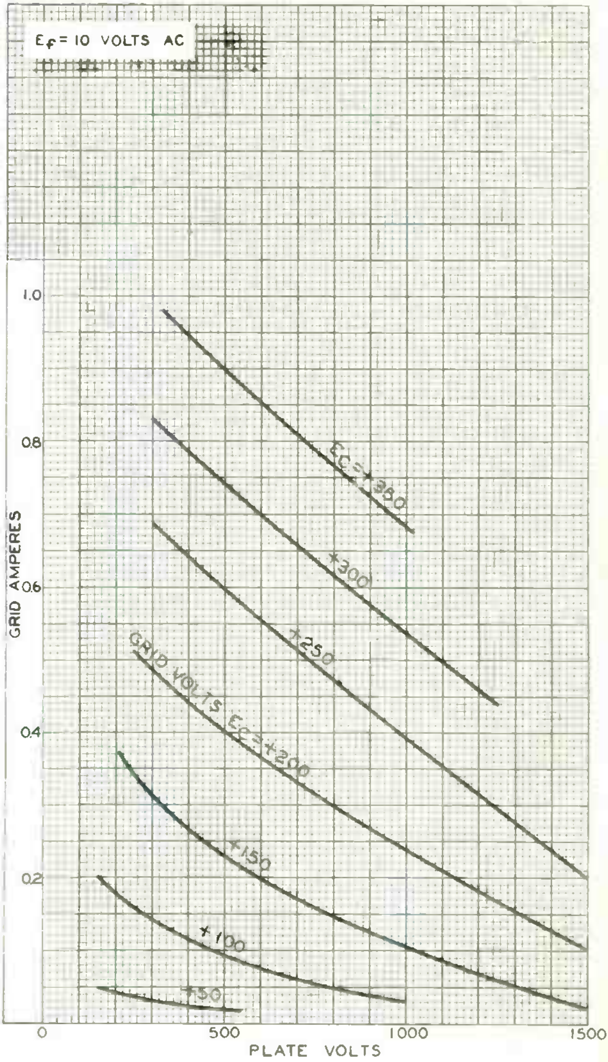
TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6196

833-A

TYPICAL CHARACTERISTICS



TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6197

RCA

835
R-F POWER AMPLIFIER, A-F POWER AMPLIFIER, MODULATOR

Filament	Thoriated Tungsten	
Voltage	10	a-c or d-c volts
Current	3.25	amp.
Amplification Factor	12	
Direct Interelectrode Capacitances:		
Grid to Plate	9.25	µµf
Grid to Filament	6	µµf
Plate to Filament	5	µµf
Maximum Overall Length		7-7/8"
Maximum Diameter		2-5/16"
Bulb		T-18
Base		Jumbo 4-Pin
RCA Socket (Type UT-541-A)		Stock No.9936 ←

For additional data, see Type 211. The 211 and the 835 are identical except for interelectrode capacitances.

Data on operating frequencies for the 835 are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY.

FILE RENEWAL NOTICE

836
HALF-WAVE HIGH-VACUUM RECTIFIER

Heater	Coated Unipotential Cathodes*	←
Voltage	2.5	a-c volts
Current	5.0	amp.
Maximum Overall Length		6-9/16"
Maximum Diameter		2-7/16"
Bulb		ST-19
Cap		Medium
Base		Medium 4-Pin, Bayonet
RCA Socket (Type UR-542-A)		Stock No.9937

Maximum Ratings Are Absolute Values

MAXIMUM RATINGS

Peak Inverse Plate Voltage	5000 max. volts
Peak Plate Current	1.0 max. amp.
Average Plate Current	0.25 max. amp.

* The cathodes should be allowed to come up to operating temperature before plate current is drawn from the tube. For average conditions the delay is approximately 40 seconds.

The 836 has two separate cathodes each of which is connected to its respective heater. Plate circuit return should be made to the center-tap of the heater transformer. ←

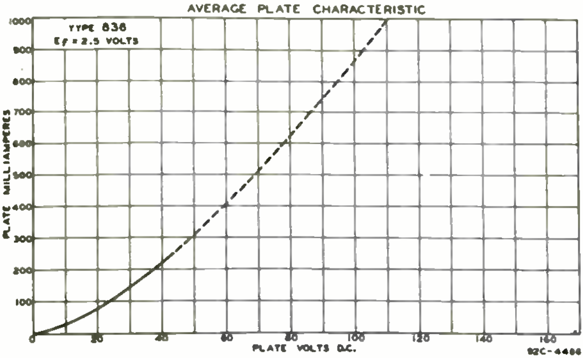
← Indicates a change.

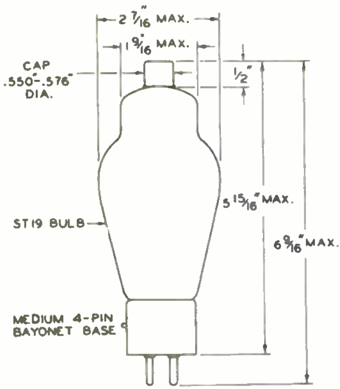
RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC

RCA

836

HALF-WAVE HIGH VACUUM RECTIFIER

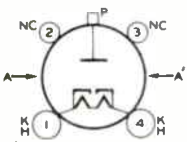




TUBE MOUNTING POSITION

Any

BOTTOM VIEW OF
SOCKET CONNECTIONS



AA'=PLANE OF ELECTRODES

Pin 1 - Heater & Cathode
Pin 2 - No Connection
Pin 3 - No Connection
Pin 4 - Heater & Cathode
Cap - Plate

← Indicates a change.

Dec. 1, 1942 DATA

851

MODULATOR, A-F POWER AMPLIFIER, R-F POWER AMPLIFIER, OSCILLATOR

Filament	Thoriated Tungsten	
Voltage	11	a-c or d-c volts
Current	15.5	amp.
Amplification Factor	20.5	
Direct Interelectrode Capacitances (approx.):		
Grid to Plate	47	μμf
Grid to Filament	25.5	μμf
Plate to Filament	4.5	μμf
Overall Length		17-1/2" ± 1/8"
Maximum Diameter		6-1/8"
Bulb		T-48
Cap		No.1902
Base		No.3117

MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS

A-F POWER AMPLIFIER & MODULATOR - Class A

D-C Plate Voltage			2500 max.	volts
Plate Dissipation			600 max.	watts
Typical Operation:				
Filament Voltage	11	11	11	a-c volts
D-C Plate Voltage	1500	2000	2500	volts
D-C Grid Voltage	-49	-65	-92	volts
Peak A-F Grid Voltage	44	60	87	volts
D-C Plate Current	175	270	240	ma.
Plate Resistance	1800	1500	1600	ohms
Load Resistance	3700	3100	5000	ohms
Power Output	46	100	160	watts

A-F POWER AMPLIFIER & MODULATOR - Class B

D-C Plate Voltage			3000 max.	volts
Max-Signal D-C Plate Current*			1 max.	amp.
Max-Signal Plate Input*			2250 max.	watts
Plate Dissipation*			750 max.	watts
Typical Operation - 2 tubes:				
Unless otherwise specified, values are for 2 tubes.				
Filament Voltage	11	11	11	a-c volts
D-C Plate Voltage	2000	2500	3000	volts
D-C Grid Voltage	-85	-111	-135	volts
Peak A-F Grid-to-Grid Volt.	500	490	490	volts
Zero-Signal D-C Plate Cur.	0.12	0.12	0.11	amp.
Max-Signal D-C Plate Cur.	1.7	1.4	1.2	amp.
Load Resistance (per tube)	650	1000	1400	ohms
Effective Load Resistance (plate to plate)	2600	4000	5600	ohms
Max-Signal Driving Power	20	12	6	approx. watts
Max-Signal Power Output	2.2	2.3	2.4	approx. kw

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

← Indicates a change

851

851

MODULATOR, A-F POWER AMPLIFIER, R-F POWER AMPLIFIER, OSCILLATOR

(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			2500	max.	volts
D-C Plate Current			0.75	max.	amp.
R-F Grid Current			8	max.	amp.
Plate Input			1100	max.	watts
Plate Dissipation			750	max.	watts
Typical Operation:					
Filament Voltage	11	11	11	a-c	volts
D-C Plate Voltage	1500	2000	2500		volts
D-C Grid Voltage	-60	-85	-110		volts
→ Peak R-F Grid Voltage	150	140	135		volts
D-C Plate Current	0.62	0.475	0.39		amp.
Driving Power ** °	40	25	20	approx.	watts
Power Output	275	300	325	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		2000	max.	volts
D-C Grid Voltage		-500	max.	volts
D-C Plate Current		1	max.	amp.
D-C Grid Current		0.2	max.	amp.
R-F Grid Current		8	max.	amp.
Plate Input		1800	max.	watts
Plate Dissipation		500	max.	watts
Typical Operation:				
Filament Voltage	11	11	a-c	volts
D-C Plate Voltage	1500	2000		volts
D-C Grid Voltage	-250	-300		volts
Peak R-F Grid Voltage	475	525		volts
D-C Plate Current	0.9	0.85		amp.
D-C Grid Current **	0.15	0.125	approx.	amp.
Driving Power **	75	65	approx.	watts
Power Output	900	1250	approx.	watts

R-F POWER AMPLIFIER & OSCILLATOR - Class C Telegraphy

Key-down conditions per tube without modulation#

D-C Plate Voltage			2500	max.	volts
→ D-C Grid Voltage			-500	max.	volts
D-C Plate Current			1	max.	amp.
D-C Grid Current			0.2	max.	amp.
R-F Grid Current			10	max.	amp.
Plate Input			2500	max.	watts
Plate Dissipation			750	max.	watts
Typical Operation:					
Filament Voltage	11	11	11	a-c	volts
D-C Plate Voltage	1500	2000	2500		volts

** See next page.

← Indicates a change

851

MODULATOR, A-F POWER AMPLIFIER, R-F POWER AMPLIFIER, OSCILLATOR

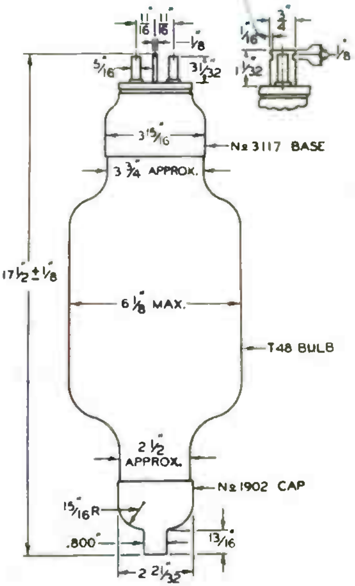
(continued from preceding page)

D-C Grid Voltage	-150	-200	-250	approx. volts
Peak R-F Grid Voltage	375	425	450	approx. volts
D-C Plate Current	0.9	0.9	0.9	amp.
D-C Grid Current **	0.15	0.12	0.1	approx. amp.
Driving Power **	55	50	45	approx. watts
Power Output	900	1250	1700	approx. watts

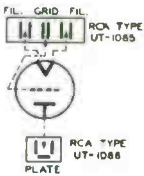
** Subject to wide variations as explained on sheet TRANS. TUBE RATINGS.

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

For use of the 851 at the higher frequencies, refer to sheet TRANS. TUBE RATINGS vs FREQUENCY.



TUBE SYMBOL & CONNECTIONS TO END-MOUNTINGS.



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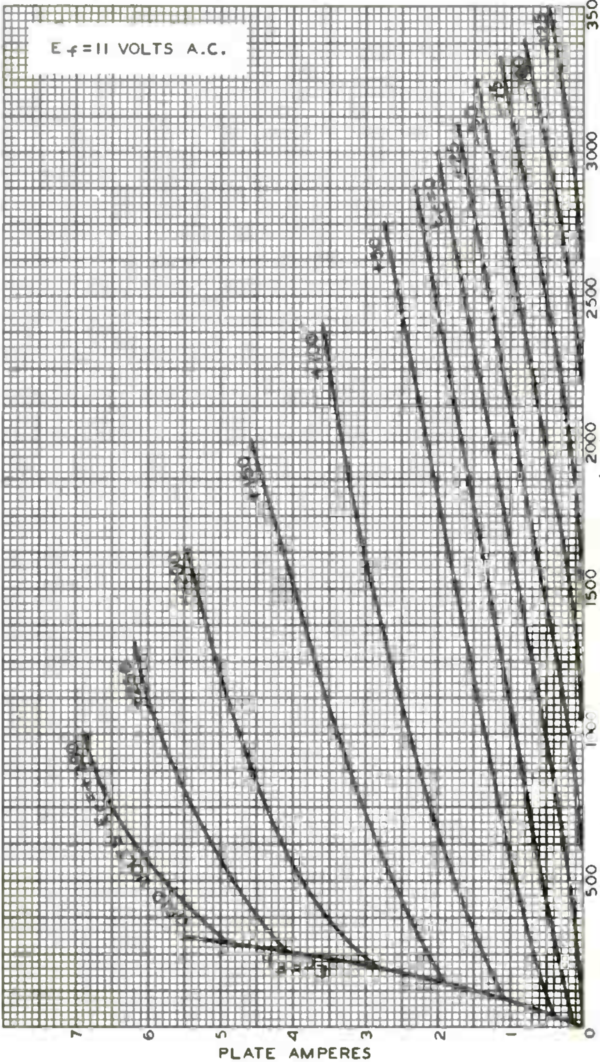
AVERAGE PLATE CHARACTERISTICS



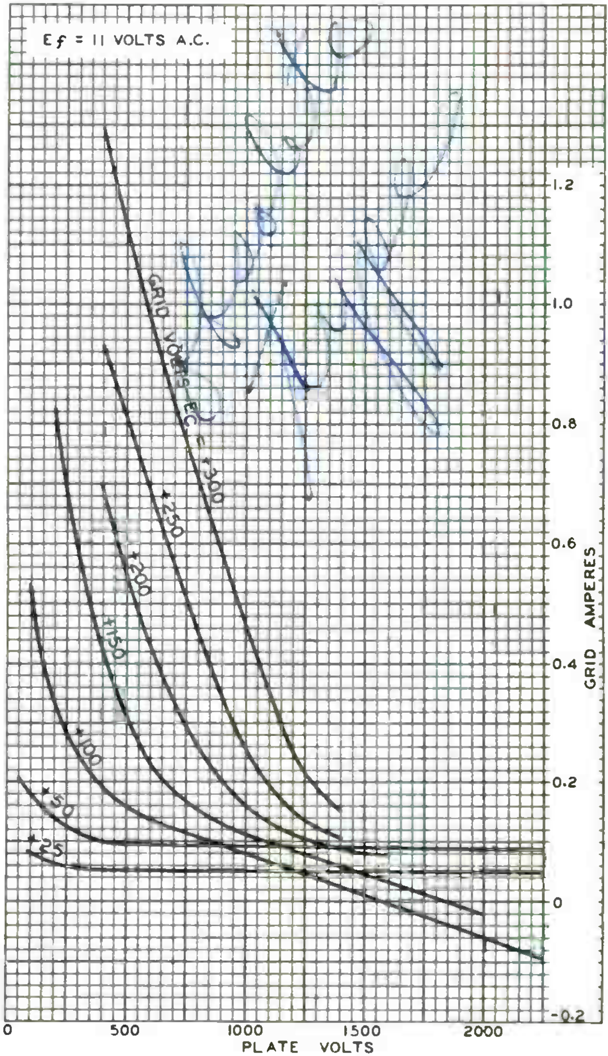
JUNE 3, 1935

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC.

92C-4454

851

TYPICAL CHARACTERISTICS



JUNE 3, 1935

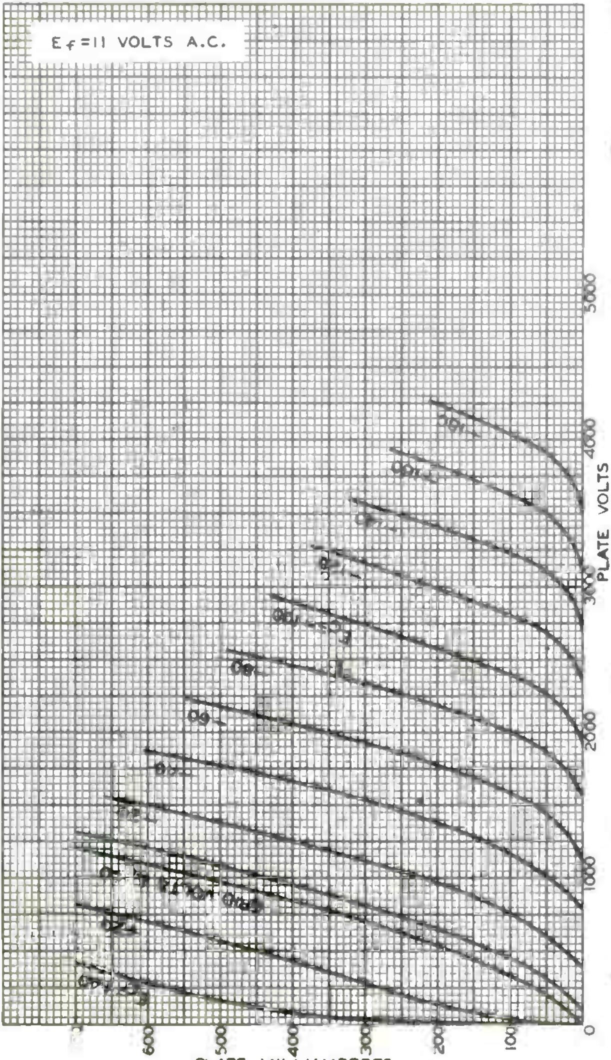
RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC.

92C-4455

851

851

AVERAGE PLATE CHARACTERISTICS



AUG. 29, 1928

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC.

92S-5497

RCA

857-B

HALF-WAVE MERCURY-VAPOR RECTIFIER

GENERAL DATA

Electrical:

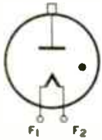
Filamentary Cathode, Coated:

Voltage	5 ± 5%	ac volts
Current	30	amp
Minimum heating time at rated voltage	60	sec
Peak Tube Voltage Drop (Approx.)	15	volts

Mechanical:

Terminal Connections:

F_1 – Filament (Insulated)



F_2 – Filament, Cathode Shield, Shell (Anode Return)

Cap – Anode

Mounting Position	Vertical with filament end down
Maximum Overall Length (Including flexible leads)	29-7/8"
Seated Length	19-1/2" ± 3/8"
Maximum Diameter	7-1/8"
Weight (Approx.)	4 lbs
Bulb	GT-56
Cap	Skirted Large (JETEC No.C1-10)
Base	Terminal-Support Shell (JETEC No.FO-2)

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	11.5	°C
Full load	15	°C

* With filament volts = 4.75 and no heat-conserving enclosure.

← Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

857-B

HALF-WAVE MERCURY-VAPOR RECTIFIER

HALF-WAVE RECTIFIER

Maximum Ratings, *Absolute Values: For supply frequency of 60 cps*

	Operating Condensed-Mercury Temperature Range 25° to 60°C	30° to 40°C	
PEAK INVERSE ANODE VOLTAGE	10000 max.	22000 max.	volts
ANODE CURRENT:			
Peak	40 max.	40 max.	amp
Average**	10 max.	10 max.	amp
Fault, for duration of 0.2 second max.	400 max.	400 max.	amp

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Filament Current	1	–	33	amp
Critical Anode Voltage	2	–	100	volts
Peak Tube Voltage Drop	3	–	25	volts

Note 1: With 5 volts rms on filament.

Note 2: With 4.75 volts rms on filament, and condensed-mercury temperature at 25°C, or above.

Note 3: With 5 volts rms on filament, condensed-mercury temperature of 35° ± 5°C, peak anode current of 100 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.

OPERATING CONSIDERATIONS

X-Ray Warning. X-rays are produced when the 857-B is operated with a peak inverse voltage above 16000 volts (absolute value). These rays can constitute a health hazard unless the tube is adequately shielded for X-ray radiation. Although relatively simple shielding should prove adequate, make sure that it provides the required protection to the operator.

Shields and rf filter circuits should be provided for the 857-B 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. Rf filters are employed to prevent damage caused by rf currents which might otherwise be fed back into the rectifier tubes.

** Averaged over any period of 30 seconds maximum.

→ Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

857-B

HALF-WAVE MERCURY-VAPOR RECTIFIER

For Circuit Figures, see Front of this Section

<table>
<tr><th rowspan="2">CIRCUIT</th><th rowspan="2">MAX. TRANS. SEC. VOLTS (RMS) E</th><th rowspan="2">APPROX. DC OUTPUT VOLTS TO FILTER Eav</th><th colspan="2">MAX. DC OUTPUT AMPERES Iav</th><th colspan="2">MAX. DC OUTPUT KW TO FILTER Pdc</th></tr>
<tr><th>Resistive Load</th><th>Inductive Load</th><th>Resistive Load</th><th>Inductive Load</th></tr>
<tr><td>Fig. 1
Half-Wave
Single-Phase
In-Phase Operation</td><td>15400□
7000▲</td><td>7000
3200</td><td colspan="2">10
10</td><td colspan="2">70
32</td></tr>
<tr><td>Fig. 2
Full-Wave
Single-Phase
In-Phase Operation</td><td>7700□
3500▲</td><td>7000
3200</td><td colspan="2">20
20</td><td colspan="2">140
64</td></tr>
<tr><td>Fig. 3
Series
Single-Phase
In-Phase Operation</td><td>15400□
7000▲</td><td>14000
6400</td><td colspan="2">20
20</td><td colspan="2">280
128</td></tr>
<tr><td>Fig. 4
Half-Wave
Three-Phase
In-Phase Operation</td><td>8900□
4000▲</td><td>10500
4800</td><td colspan="2">30
30</td><td colspan="2">315
44</td></tr>
<tr><td>Fig. 5
Parallel
Three-Phase
Quadrature Operation</td><td>8900□
4000▲</td><td>10500
4800</td><td colspan="2">60
60</td><td colspan="2">630
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<tr><td>Fig. 6
Series
Three-Phase
Quadrature Operation</td><td>8900□
4000▲</td><td>21000
9600</td><td colspan="2">30
30</td><td colspan="2">630
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<tr><td>Fig. 7
Half-Wave
Four-Phase
Quadrature Operation</td><td>7700□
3500▲</td><td>10100
4600</td><td>36
36</td><td>40
40</td><td>364
166</td><td>404
184</td></tr>
<tr><td>Fig. 8
Half-Wave
Six-Phase
Quadrature Operation</td><td>7700□
3500▲</td><td>10500
4800</td><td>38
38</td><td>40
40</td><td>399
182</td><td>420
192</td></tr>
</table>

□ For maximum peak inverse anode voltage of 22000 volts and maximum average current of 10 amperes.

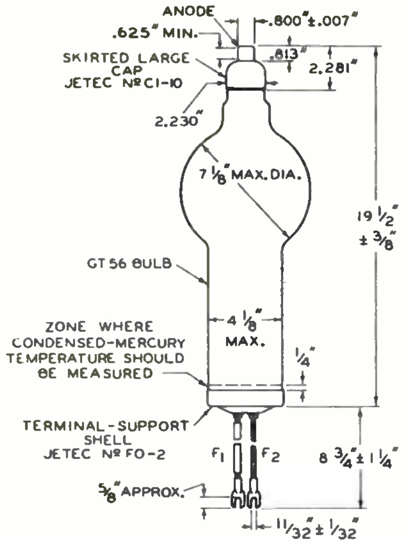
▲ For maximum peak inverse anode voltage of 10000 volts and maximum average current of 10 amperes.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

857-B

HALF-WAVE MERCURY-VAPOR RECTIFIER



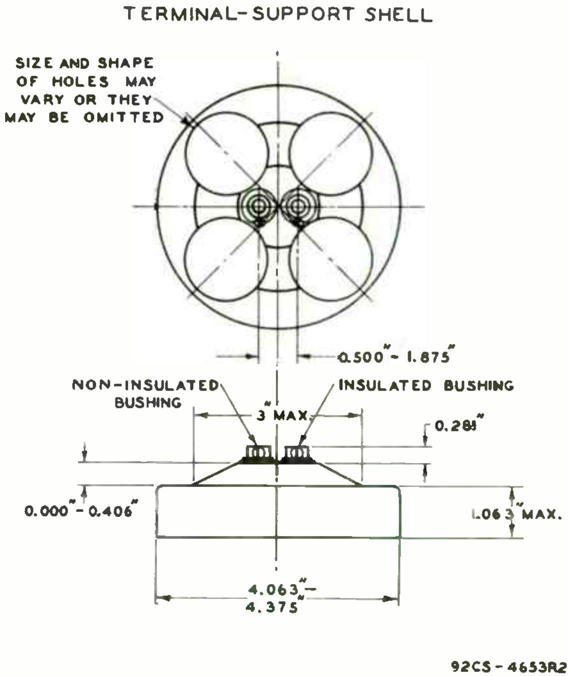
F_1 = FILAMENT (INSULATED)
F_2 = FILAMENT, CATHODE SHIELD, AND SHELL (ANODE RETURN)

92CM-4649R3

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

857-B

HALF-WAVE MERCURY-VAPOR RECTIFIER

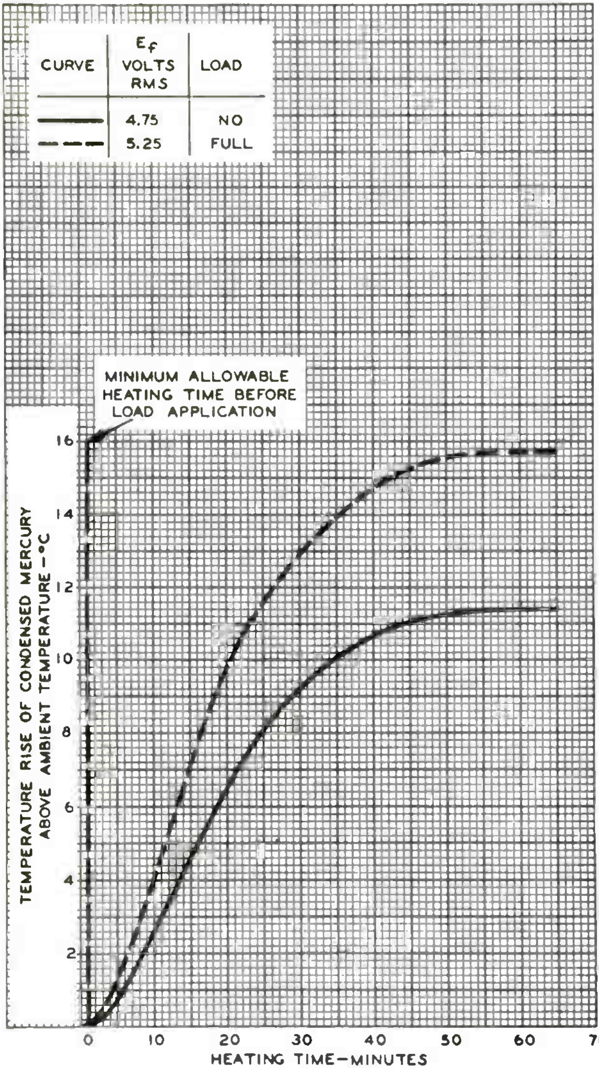


JETEC No. FO-2
RCA No. 3911

RCA

857-B

RATE OF RISE OF COND.-MERCURY TEMPERATURE



APRIL 16, 1951

TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7639

861

SCREEN GRID R-F POWER AMPLIFIER

Filament	Thoriated Tungsten	
Voltage	11	a-c or d-c volts
Current	10	amp.
Amplification Factor	300 approx.	
Transconductance for plate current of 130 ma.	2100	μmhos
Direct Interelectrode Capacitances (approx.):		
Grid to Plate	0.10* maximum	μμf
Input	14.5	μμf
Output	10.5	μμf
Overall Length		17-3/32" ± 1/8"
Maximum Radius		6-5/8"
Bulb		GT-56 with arm
Cap (opposite filament base)		No.3909
Cap (on side of bulb)		No.3910
Base		No.3503
RCA End-Mountings		Types UT-1085, UT-1086 ←

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			3500 max.	volts
D-C Screen Voltage			750 max.	volts ←
D-C Plate Current			250 max.	ma.
Plate Input			600 max.	watts
Screen Input			35 max.	watts
Plate Dissipation			400 max.	watts
Typical Operation:				
D-C Plate Voltage	2500	3000	3500	volts
D-C Screen Voltage □	500	500	500	volts
D-C Grid Voltage	-60	-60	-60	volts
Peak R-F Grid Voltage	250	245	215	volts
D-C Plate Current	190	175	150	ma.
D-C Grid Current **	4	4	4	approx. ma.
Driving Power ○ **	20	15	15	approx. watts
Power Output	140	160	175	approx. watts

□ Use of a series resistor is not recommended.
○ 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

D-C Plate Voltage	3000 max.	volts
D-C Screen Voltage	750 max.	volts ←
D-C Grid Voltage	-1000 max.	volts
D-C Plate Current	300 max.	ma.
D-C Grid Current	75 max.	ma.
Plate Input	650 max.	watts
Screen Input	30 max.	watts
Plate Dissipation	270 max.	watts

* With external shielding.
** See next page.

<- Indicates a change.

JULY 1, 1938 DATA

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC.

861
SCREEN GRID R-F POWER AMPLIFIER

(continued from preceding page)

Typical Operation:

D-C Plate Voltage	2000	2500	3000	volts
D-C Screen Voltage△	30000	50000	70000	ohms
	425	400	375	volts
→ D-C Grid Voltage ¶	3900	3800	3600	ohms
	-250	-225	-200	volts
Peak R-F Grid Voltage	675	625	575	volts
D-C Plate Current	250	220	200	ma.
D-C Grid Current **	65	60	55	approx.ma.
Driving Power **	45	40	35	approx.watts
Power Output	285	340	400	approx.watts

△ Obtained from modulated fixed supply or modulated plate-voltage supply through resistor.
¶ Obtained by grid-leak resistor or partial self-bias methods.

R-F POWER AMPLIFIER & OSCILLATOR - Class C Telegraphy

Key-down conditions per tube without modulation #

D-C Plate Voltage	3500 max.	volts
→ D-C Screen Voltage	750 max.	volts
D-C Grid Voltage	-1000 max.	volts
D-C Plate Current	350 max.	ma.
D-C Grid Current	75 max.	ma.
Plate Input	1200 max.	watts
Screen Input	35 max.	watts
Plate Dissipation	400 max.	watts

Typical Operation:

D-C Plate Voltage	2000	3000	3500	volts
D-C Screen Voltage □	500	500	500	volts
→ D-C Grid Voltage ●	6300	6300	6300	ohms
	-250	-250	-250	volts
Peak R-F Grid Voltage	725	725	725	volts
D-C Plate Current	300	300	300	ma.
D-C Screen Current	60	50	40	ma.
D-C Grid Current **	40	40	40	approx.ma.
Driving Power **	30	30	30	approx.watts
Power Output	400	600	700	approx.watts

● Obtained by grid-leak resistor or other fixed- or self-bias method.
□ Use of series resistor is not recommended.
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.

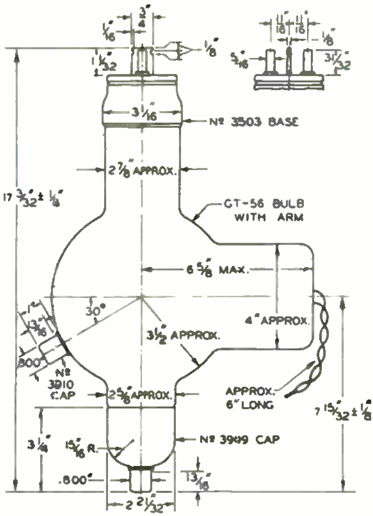
For use of the 861 at the higher frequencies, refer to sheet TRANS. TUBE RATINGS vs FREQUENCY.

← Indicates a change.

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC.

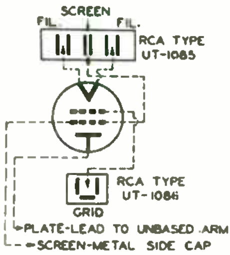
RCA

861
SCREEN GRID R-F POWER AMPLIFIER



92S-4324

TUBE SYMBOL & CONNECTIONS TO END-MOUNTINGS



NOTE:- SCREEN CONNECTION TO BOTH BLADE AND METAL SIDE CAP

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC

RCA

861

AVERAGE PLATE CHARACTERISTICS

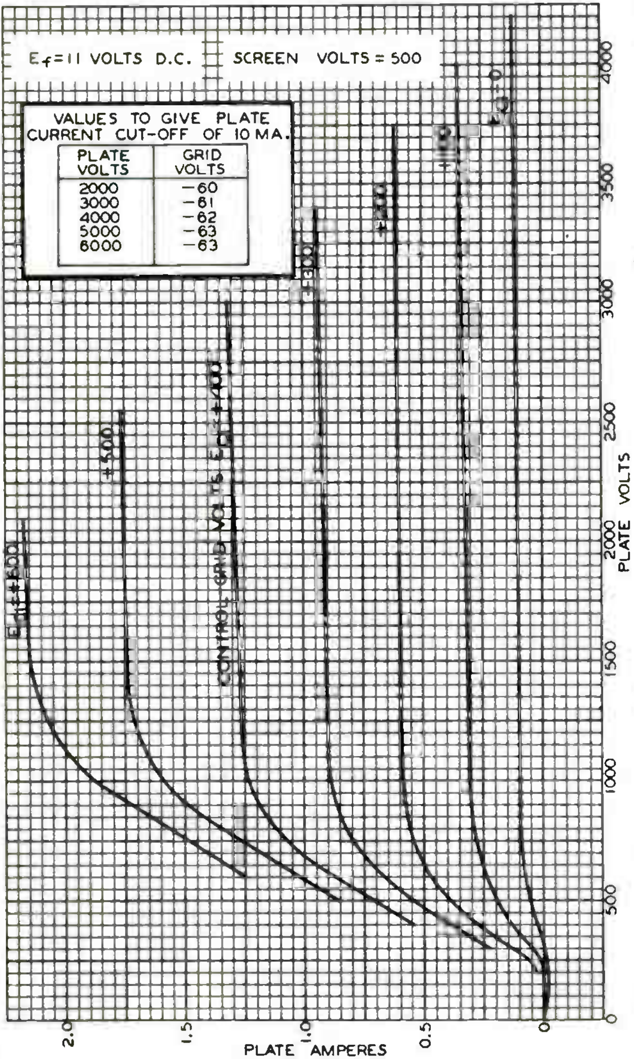


PLATE VOLTS	GRID VOLTS
2000	−60
3000	−61
4000	−62
5000	−63
6000	−63

JUNE 22, 1934

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC.

92S—5548

865

SCREEN GRID R-F POWER AMPLIFIER

Filament	Thoriated Tungsten	
Voltage	7.5	a-c or d-c volts
Current	2.0	amp.
Amplification Factor	150 approx.	
Mutual Conductance for plate current of 18 ma.	750	μmhos
Direct Interelectrode Capacitances:		
Grid to Plate	0.10* maximum	μμf
Input	8.5	μμf
Output	8.0	μμf
Maximum Overall Length		5-3/4"
Maximum Diameter		2-1/16"
Bulb		ST-16
Cap		Small Metal
Base		Medium 4-Pin Bayonet

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		750 max.	volts
D-C Screen Voltage		175 max.	volts
D-C Plate Current		30 max.	ma.
R-F Grid Current		4 max.	amp.
Plate Input		22.5 max.	watts
Screen Input		3 max.	watts
Plate Dissipation		15 max.	watts
Typical Operation:			
Filament Voltage	7.5	7.5	a-c volts
D-C Plate Voltage	500	750	volts
D-C Screen Voltage	125	125	volts
D-C Grid Voltage	-30	-30	volts
D-C Plate Current	30	22	ma.
D-C Grid Current	5	3	approx. ma.
Driving Power ° **	2	1.5	approx. watts
Power Output	3	4.5	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 Screen Voltage	175 max.	volts
D-C Grid Voltage	-200 max.	volts
D-C Plate Current	60 max.	ma.
D-C Grid Current	15 max.	ma.
R-F Grid Current	4 max.	amp.

* with external shielding.

** See next page.

(continued on next page)

865

SCREEN GRID R-F POWER AMPLIFIER

(continued from preceding page)

Plate Input		30 max.		watts
Screen Input		2 max.		watts
Plate Dissipation		10 max.		watts
Typical Operation:				
Filament Voltage	7.5	7.5	a-c	volts
D-C Plate Voltage	375	500		volts
D-C Screen Voltage	125	125		volts
D-C Grid Voltage	-120	-120		volts
D-C Plate Current	50	40		ma.
D-C Grid Current **	11	9	approx.	ma.
Driving Power **	3	2.5	approx.	watts
Power Output	8.5	10	approx.	watts

R-F POWER AMPLIFIER & OSCILLATOR – Class C Telegraphy

Key-down conditions per tube without modulation #

D-C Plate Voltage				750 max.		volts
D-C Screen Voltage				175 max.		volts
D-C Grid Voltage				-200 max.		volts
D-C Plate Current				60 max.		ma.
D-C Grid Current				15 max.		ma.
R-F Grid Current				5 max.		amp.
Plate Input				45 max.		watts
Screen Input				3 max.		watts
Plate Dissipation				15 max.		watts
Typical Operation:						
Filament Voltage	7.5	7.5	7.5	7.5	a-c	volts
D-C Plate Voltage	375	500	625	750		volts
D-C Screen Voltage	125	125	125	125		volts
D-C Grid Voltage	-80	-80	-80	-80		volts
D-C Plate Current	55	50	45	40		ma.
D-C Grid Current **	11	9	6	5.5	approx.	ma.
Driving Power **	2.5	2.0	1.2	1.0	approx.	watts
Power Output	8.5	10	14	16	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.

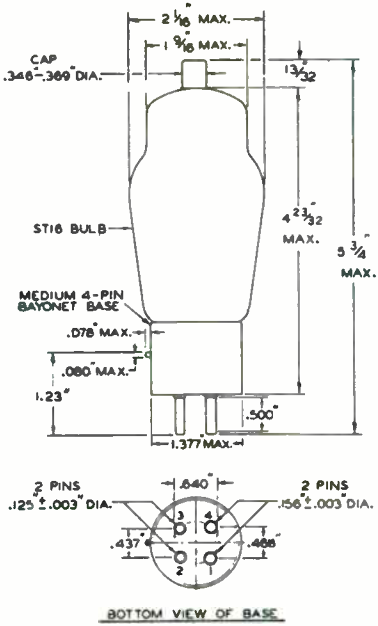
For use of the 865 at the higher frequencies, refer to sheet TRANS. TUBE RATINGS vs. FREQUENCY.

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC.

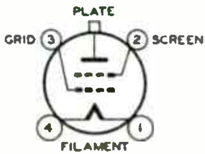
RCA

865

SCREEN GRID R-F POWER AMPLIFIER



TUBE SYMBOL & TOP VIEW OF SOCKET CONNECTIONS



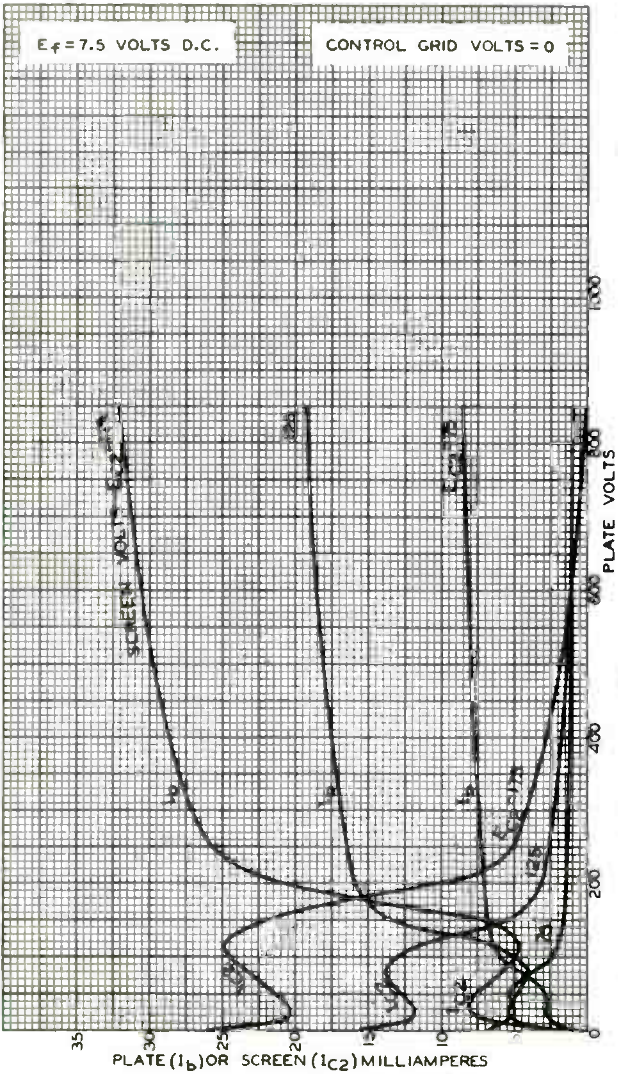
JUNE 15, 1936

DATA 2

865

865

AVERAGE PLATE CHARACTERISTICS



MAY 10, 1935

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY INC

925—5498R1

866-A/866

HALF-WAVE MERCURY-VAPOR RECTIFIER

This type supersedes RCA Types 866 and 866-A

Filament *	Coated	
Voltage	2.5	a-c volts
Current	5.0	amp.
Overall Length		5-3/8" ± 3/16"
Seated Height		5-3/4" ± 3/16"
Maximum Diameter		2-7/16"
Bulb		ST-19
Cap		Medium, with Insulating Collar
Base		Medium 4-Pin, Bayonet
RCA Socket		Stock No.9937

Maximum Ratings Are Absolute Values

MAXIMUM RATINGS

	Rating 1	Rating 2	Rating 3		
Supply Frequency	150	150	1000	max.	~
Condensed-Mercury Temperature Range#	25 - 60	25 - 70	25 - 70		°C
Peak Inverse Plate Voltage	10000	2000	5000	max.	volts
Peak Plate Current	1.0	2.0	1.0	max.	amp.
Average Plate Current	0.25	0.5	0.25	max.	amp.
Tube Voltage Drop	15	15	15	approx.	volts

* The filament of the 866-A/866 is partially shielded from the plate to permit operation from a power supply having a frequency up to 1000 cycles per second. The filament should be allowed to come up to operating temperature before plate voltage is applied. For average conditions, the delay is approximately 30 seconds.

Operation at 40° ± 5°C is recommended.

For *shielding* and *r-f filter circuits*, refer to Type 872-A/872.

NOTES ON RATINGS 1 and 3

The table on the next page gives empirical values of choke inductance (L) and the condenser capacitance (C) for choke-input-to-filter circuits which will keep the peak plate current below the recommended maximum, provided the average d-c load current does not exceed the maximum load-current values shown. Values of (L) and (C) are based on a 60-cycle a-c voltage supply.

The capacitance (C) is small enough to prevent excessive surges when power is first applied to the circuit, and yet large enough to give adequate filtering. If the inductance (L) is increased, it is permissible to increase the capacitance in the same proportion. In a two-section filter with two inductances of unequal value, the larger inductance should be placed next to the rectifier tubes. With such an arrangement, the maximum value of each capacitance should be determined on the basis of the value of the inductance preceding it.

The circuits (see Type 872-A/872) of Figs. 1, 2, and 3 will give a ripple voltage less than 5% when used with a two-section filter having the minimum of inductance and the corresponding maximum of capacitance. The circuits of Figs. 4 and 5 will give a ripple voltage of less than 1%. For any of these circuits, better filtering may be obtained with the inductances larger than the minimum given in the table. For these larger inductances, the corresponding capacitances may be increased by the same percentage as the inductances to give still better results.

← Indicates a change.

JUNE 30, 1944 DATA

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

866-A/866

866-A/866

HALF-WAVE MERCURY-VAPOR RECTIFIER

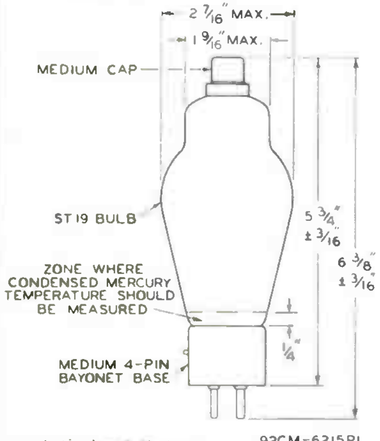
For Circuits, refer to Type 872-A/872.

(continued from preceding page)

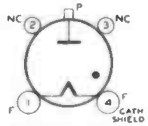
CIRCUIT	A-C INPUT VOLTS** (RMS)	MAX. D-C OUTPUT VOLTS TO FILTER	CHOKE INPUT ONE-SECTION FILTER: MIN. CHOKE (L) henrys	MAX. CONDENSER (C) µf	MAX. D-C LOAD CURRENT amperes
SINGLE-PHASE FULL-WAVE (2 tubes) FIG.1	3535 per tube	3180	8.0	1.25	0.5
	3000 " "	2700	6.8	1.5	0.5
	2000 " "	1800	4.5	2.1	0.5
	1500 " "	1350	3.4	2.8	0.5
SINGLE-PHASE FULL-WAVE (4 tubes) FIG.2	7070 total	6360	16.0	0.6	0.5
	6000 "	5400	13.5	0.7	0.5
	5000 "	4500	11.0	0.9	0.5
	4000 "	3600	8.9	1.1	0.5
THREE-PHASE HALF-WAVE FIG.3	4080 per leg	4780	3.2	1.4	0.75
	3000 " "	3510	2.2	2.0	0.75
	2000 " "	2340	1.4	3.0	0.75
	1500 " "	1750	1.1	4.0	0.75
THREE-PHASE DOUBLE-Y PARALLEL FIG.4	4080 per leg	4780	2.0	0.5	1.5
	3000 " "	3510	1.5	0.7	1.5
	2000 " "	2340	1.0	1.1	1.5
	1500 " "	1750	0.7	1.5	1.5
THREE-PHASE FULL-WAVE FIG.5	4080 per leg	9570	1.8	0.5	0.75
	3000 " "	7020	1.4	0.7	0.75
	2000 " "	4680	0.9	1.2	0.75
	1500 " "	3510	0.7	1.5	0.75
SINGLE-PHASE FULL-WAVE (2 tubes) FIG.1 *	3535 per tube	3950	-	-	0.25
	3000 " "	3390	-	-	0.25
	2000 " "	2260	-	-	0.25
	1500 " "	1700	-	-	0.25

* with condenser input to filter.

** For use under the conditions of the 10000-volt peak inverse rating. If the 866-A/866 is to be used under frequency and/or temperature conditions such that the peak inverse voltage is limited to 5000 volts, the a-c input voltage and d-c output voltage values in the table should be multiplied by a factor of 0.5 to give new values for the 5000-volt conditions.



BOTTOM VIEW OF SOCKET CONNECTIONS



● = GAS TUBE TYPE

Pin 1 - Filament
Pin 2 - No Connection
Pin 3 - No Connection
Pin 4 - Filament
Cap - Plate

TUBE MOUNTING POSITION

VERTICAL: Base down.
HORIZONTAL: No.

← Indicates a change.

92CM-6215R1

869-B

HALF-WAVE MERCURY-VAPOR RECTIFIER

GENERAL DATA

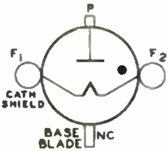
Electrical:

Filamentary Cathode, Coated:

Voltage	5 ± 5%	ac volts
Current	19	amperes
Minimum Heating Time at Rated Voltage . .	60	seconds
Peak Tube Voltage Drop (Approx.) . . .	15	volts

Mechanical:

Terminal Connections:



F_1 – Filament, Cathode Shield (Anode Return)

F_2 – Filament

Cap – Anode

F_1 IS ON LEFT SIDE OF TUBE TYPE MARKING ON BASE

Mounting Position	Vertical with filament end down
Overall Length	14-1/4" ± 3/16"
Maximum Diameter	5-1/8"
Bulb	GT-40
Cap . . . . Skirted Large	JETEC No.C1-9; RCA No.3905
Base	JETEC No.A3-20; RCA No.3502

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	15	°C
Full Load	20	°C

HALF-WAVE RECTIFIER—In-Phase Operation●

Maximum Ratings, *Absolute Values: For supply frequency of 60 cps*

	Operating Condensed-Mercury Temperature Range			
	30° to 60°C	30° to 50°C	30° to 40°C	
PEAK INVERSE ANODE VOLTAGE	10000 max.	15000 max.	20000 max.	volts

•,●: See next page.

869-B

HALF-WAVE MERCURY-VAPOR RECTIFIER

	Operating Condensed-Mercury Temperature Range			
	30° to 60°C	30° to 50°C	30° to 40°C	
ANODE CURRENT:				
Peak	10 max.	10 max.	10 max.	amp
Average** . .	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

HALF-WAVE RECTIFIER—Quadrature Operation••

Maximum Ratings, *Absolute Values: For supply frequency of 60 cps*

	Operating Condensed-Mercury Temperature Range			
	30° to 60°C	30° to 50°C	30° to 40°C	
PEAK INVERSE ANODE VOLTAGE	10000 max.	15000 max.	20000 max.	volts
ANODE CURRENT:				
Peak	20 max.	20 max.	10 max.	amp
Average** . .	5 max.	5 max.	2.5 max.	amp
Fault, for duration of 0.1 second max.	100 max.	100 max.	100 max.	amp

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Filament Current	1	–	21	amp
Critical Anode Voltage . .	2	–	100	volts
Peak Tube Voltage Drop . .	3	–	17	volts

Note 1: With 5 volts rms on filament.

Note 2: With 4.75 volts rms on filament, and condensed-mercury temperature at 30°C.

Note 3: With 5 volts rms on filament, condensed-mercury temperature of 35° ± 5°C, peak anode current of 50 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.

* With filament volts = 4.75 and no heat-conserving enclosure.

• Filament voltage in phase with anode voltage.

•• Filament voltage out of phase (60° to 120°) with anode voltage.

** Averaged over any period of 30 seconds maximum.

OPERATING NOTES

X-Ray Warning. X-rays are produced when the B69-B is operated with a peak inverse anode voltage above 16000 volts (absolute value). These rays can constitute a health hazard unless the tube is adequately shielded for x-ray radiation.

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

869-B

HALF-WAVE MERCURY-VAPOR 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 P_{dc}
Fig. 1 **Half-Wave** **Single-Phase** In-Phase Operation	14000□ 10600▲ 7000*	6300 4700 3100	2.5 2.5 2.5	16 12 8
Fig. 2 **Full-Wave** **Single-Phase** In-Phase Operation	7000□ 5300▲ 3500*	6300 4700 3100	5.0 5.0 5.0	32 24 16
Fig. 3 **Series** **Single-Phase** In-Phase Operation	14000□ 10600▲ 7000*	12700 9500 6300	5.0 5.0 5.0	64 48 32
Fig. 4 **Half-Wave** **Three-Phase** In-Phase Operation	8100□ 6100▲ 4000*	9500 7100 4700	7.5 7.5 7.5	72 54 36
Fig. 5 **Parallel** **Three-Phase** Quadrature Operation	8100□ 6100▲ 4000*	9500 7100 4700	15.0 30.0 30.0	143 215 143
Fig. 6 **Series** **Three-Phase** Quadrature Operation	8100□ 6100▲ 4000*	19000 14200 9500	7.5 15.0 15.0	143 215 143
Fig. 7 **Half-Wave** **Four-Phase** Quadrature Operation	7000□ 5300▲ 3500*	9000 6700 4500	*Resistive Load*: 9.0, 18.0, 18.0 *Inductive Load*: 10.0, 20.0, 20.0	*Resistive Load*: 81, 121, 81 *Inductive Load*: 90, 135, 90
Fig. 8 **Half-Wave** **Six-Phase** Quadrature Operation	7000□ 5300▲ 3500*	9500 7100 4700	*Resistive Load*: 9.5, 19.0, 19.0 *Inductive Load*: 10.0, 20.0, 20.0	*Resistive Load*: 91, 136, 91 *Inductive Load*: 96, 143, 96

□ For maximum peak inverse anode voltage of 20000 volts, and condensed-mercury-temperature range of 30° to 40°C.

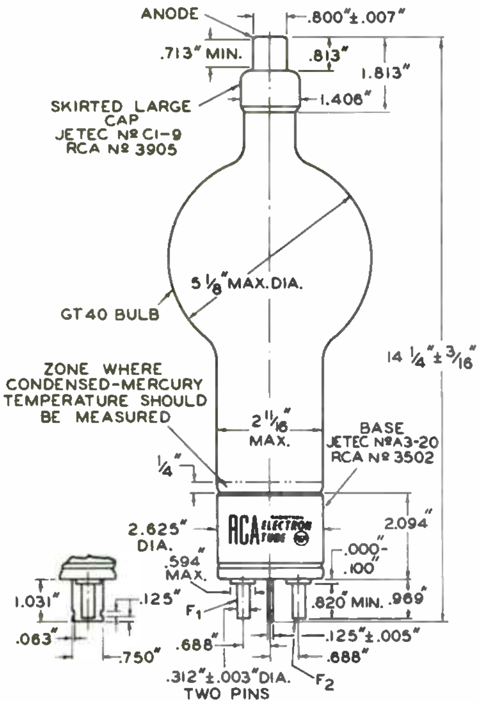
▲ For maximum peak inverse anode voltage of 15000 volts, and condensed-mercury-temperature range of 30° to 50°C.

* For maximum peak inverse anode voltage of 10000 volts, and condensed-mercury-temperature range of 30° to 60°C.

RCA

869-B

HALF-WAVE MERCURY-VAPOR RECTIFIER



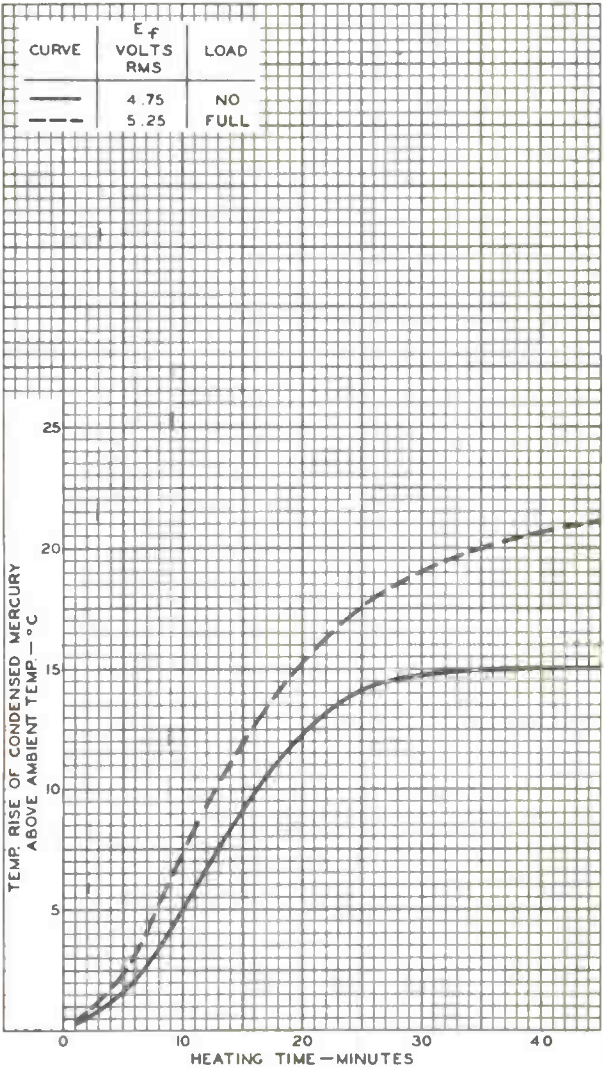
F_1 = FILAMENT AND CATHODE SHIELD (ANODE RETURN)

F_2 = FILAMENT

92CM-4330R4

869-B

RATE OF RISE OF COND.-MERCURY TEMPERATURE



APRIL 12, 1951

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7634

RCA

872-A/872

HALF-WAVE MERCURY-VAPOR RECTIFIER

This Type Supersedes RCA Types 872 and 872-A

Filament*	Coated	
Voltage	5.0	a-c volts
Current	7.5	amp.
Maximum Overall Length		8-1/2"
Maximum Diameter		2-5/16"
Bulb		T-18
Cap	Medium Metal, with Insulating Collar	
Base°		Jumbo 4-Large Pin
RCA Socket (Type UT-541-A)		Stock No.9936

Maximum Ratings Are Absolute Values

MAXIMUM RATINGS

Peak Inverse Voltage		
For Supply Frequency up to 150 ~		
Cond.-Mercury Temp. 20° to 60°C #	10000 max.	volts
Cond.-Mercury Temp. 20° to 70°C #	5000 max.	volts
Peak Plate Current	5 max.	amp.
Average Plate Current	1.25 max.	amp.
Tube Voltage Drop (Approx.)	10	volts

° Base shell is not connected within the base to either filament lead.
Operation at 40° ± 5°C is recommended.
* The filament of the 872-A/872 should be allowed to come up to operating temperature before plate voltage is applied. For average conditions the delay is approximately 30 seconds.

If the plate 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.

Shielding and *r-f filter circuits* should be isolated from the transmitter as much as possible in order to avoid the detrimental effects of magnetic and electrostatic fields. These fields tend to produce breakdown in the mercury vapor, are detrimental to tube life and make filtering difficult. External shielding should be used when the tubes are in proximity to these external fields. R-f filtering should be used when the tubes are affected by r-f voltages. When shields are used, special attention must be given to adequate ventilation and to the maintenance of normal condensed-mercury temperature.

The table below classifies suitable rectifier circuits for the 872-A/872 and shows their safe maximum input and maximum output operating conditions for a peak inverse voltage of 10000 volts. The values are based on sine-wave input and the use of a suitable choke preceding any condenser in the filter circuit. If the 872-A/872 is to be used under temperature conditions such that the peak inverse voltage is limited to 5000 volts, the a-c input voltage and d-c output voltage values in the table should be multiplied by a factor of 0.5 to give the maximum values for the 5000-volt conditions.

CIRCUIT	MAXIMUM A-C INPUT VOLTS° (RMS)	APPROX. D-C OUTPUT VOLTS TO FILTER	MAX. D-C OUTPUT CURRENT amperes
SINGLE-PHASE FULL-WAVE (2 tubes) Fig. 1	3535 per tube	3180	2.5
SINGLE-PHASE FULL-WAVE (4 tubes) Fig. 2	7070 total	6360	2.5
THREE-PHASE HALF-WAVE Fig. 3	4080 per leg	4780	3.75
THREE-PHASE DOUBLE-Y PARALLEL Fig. 5	4080 per leg	4780	7.5
THREE-PHASE FULL-WAVE Fig. 5	4080 per leg	9570	3.75

° For maximum peak inverse voltage of 10000 volts.

AUG. 1, 1942

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TENTATIVE DATA

CIRCUITS FOR HOT-CATHODE MERCURY-VAPOR RECTIFIER TUBES

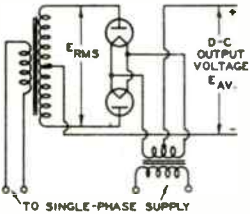


FIG. 1

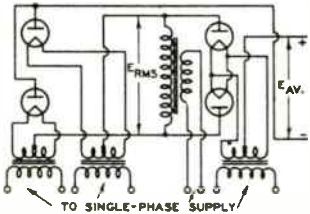


FIG. 2

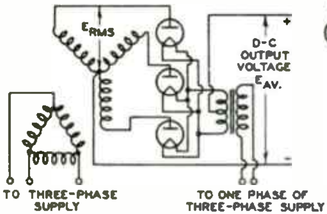


FIG. 3

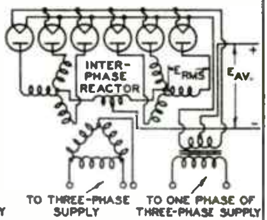


FIG. 4

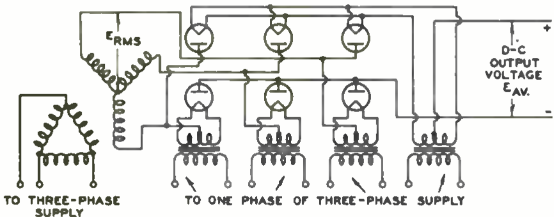


FIG. 5

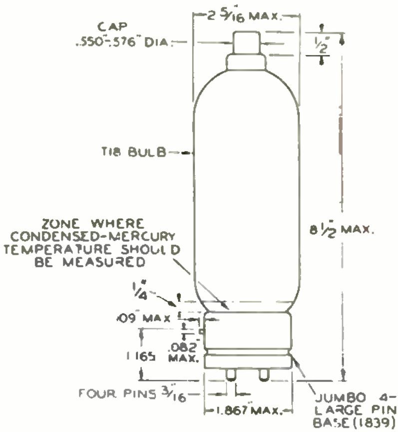
FIGURE	CIRCUIT	$E_{AVERAGE}$	$E_{INVERSE}$	$I_{AVERAGE}$
1	SINGLE-PHASE FULL-WAVE (2 TUBES)	0.318 $E_{MAXIMUM}$ 0.450 E_{RMS}	3.14 $E_{AVERAGE}$	0.636 $I_{MAXIMUM}$
2	SINGLE-PHASE FULL-WAVE (4 TUBES)	0.636 $E_{MAXIMUM}$ 0.900 E_{RMS}	1.57 $E_{AVERAGE}$	0.636 $I_{MAXIMUM}$
3	THREE-PHASE HALF-WAVE	0.827 $E_{MAXIMUM}$ 1.170 E_{RMS}	2.09 $E_{AVERAGE}$	0.827 $I_{MAXIMUM}$
4	THREE-PHASE DOUBLE-Y PARALLEL	0.827 $E_{MAXIMUM}$ 1.170 E_{RMS}	2.09 $E_{AVERAGE}$	1.91 $I_{MAXIMUM}$
5	THREE-PHASE FULL-WAVE	1.65 $E_{MAXIMUM}$ 2.34 E_{RMS}	1.045 $E_{AVERAGE}$	0.955 $I_{MAXIMUM}$

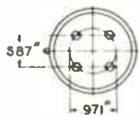
CONDITIONS ASSUMED :-
(1) SINE-WAVE SUPPLY (2) BALANCED PHASE VOLTAGES (3) ZERO TUBE DROP
(4) PURE RESISTANCE LOAD (5) NO FILTER USED

RCA

872-A/872

HALF-WAVE MERCURY-VAPOR RECTIFIER





BOTTOM VIEW OF BASE

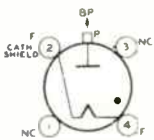
92C-6396

TUBE MOUNTING POSITION

VERTICAL: Base down.
HORIZONTAL: No.

BOTTOM VIEW OF
SOCKET CONNECTIONS

Pin 1 - No Connection
Pin 2 - Filament, Cathode Shield
Pin 3 - No Connection
Pin 4 - Filament
Cap - Plate
● - Gas Type Tube



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1616

HALF-WAVE HIGH-VACUUM RECTIFIER

Filament	Coated	
Voltage †	2.5	a-c volts
Current	5.0	amp.
Maximum Overall Length		6-13/16" ←
Maximum Diameter		2-1/16"
Bulb		T-16
Cap		Medium Metal
Base		Medium 4-Pin, Bayonet
RCA Socket (UT-542-A)		Stock No. 9937 ←

Maximum Ratings Are Absolute Values

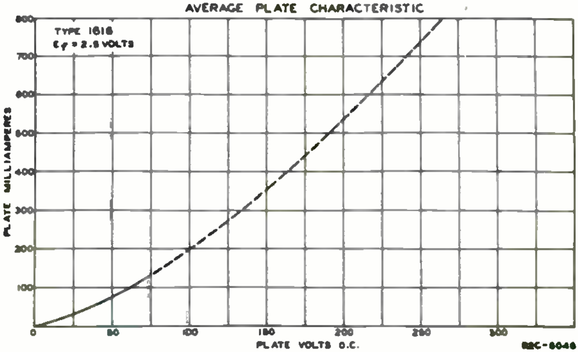
MAXIMUM RATINGS

Peak Inverse Voltage	5500 max.	volts
Peak Plate Current	0.8 max.	amp.
Surge Current	2.5 max.*	amp.
Average Plate Current	0.13 max.	amp.

* Equipment should be designed so that this value is not exceeded during switching operations.

† Should not deviate more than ±5% from the rated value.

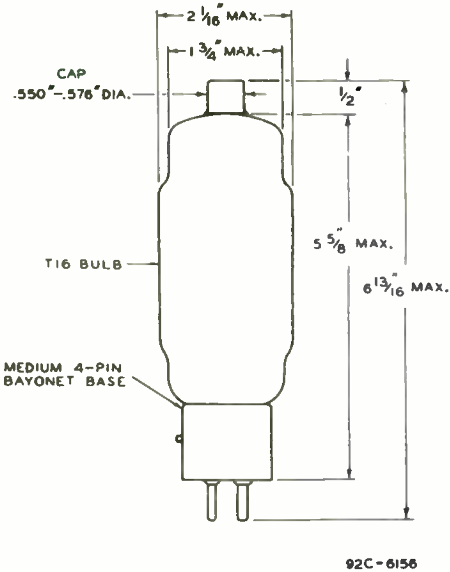
AVERAGE PLATE CHARACTERISTIC



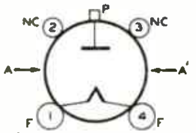
← Indicates a change.

1616

HALF-WAVE HIGH-VACUUM RECTIFIER



BOTTOM VIEW OF SOCKET CONNECTIONS



AA'=PLANE OF ELECTRODES

F - Filament
NC - No Connection
P - Plate

TUBE MOUNTING POSITION

VERTICAL: Base down
HORIZONTAL: Plate in vertical plane (on edge)

May 1, 1942

DATA

Super-Power Triode

5 MW PEAK POWER OUTPUT IN LONG-PULSE SERVICE AT 440 MHz

CERAMIC-METAL SEALS	INTEGRAL WATER DUCTS
DOUBLE-ENDED CONSTRUCTION	17.00 INCH MAX. LENGTH
COAXIAL-ELECTRODE STRUCTURE	14.125 INCH MAX. DIAMETER

WATER COOLED

For Use as a Plate-Pulsed Amplifier at Frequencies up to 605 MHz, for Long Range Search Radar, Pulsed Transmission in Communications Service, and Particle Accelerator Service.

ELECTRICAL

Filamentary Cathode, Multistrand Thoriated Tungsten[n]—

Current (DC):		
Typical operating range value	6800 to 7200[a]	A
Maximum range value	7000 to 7400[a]	A
Maximum value for starting, even momentarily	2000	A
Minimum time to reach operating current	30	s
Minimum time at normal operating current before plate voltage is applied	60	s
Voltage (DC):[b]		
Typical range value for prescribed operating current	3.6 to 4.5	V
Maximum value under any condition	4.65	V

Direct Interelectrode Capacitances

Grid to plate	150	pF
Grid to cathode	1600	pF
Plate to cathode	less than 1.0	pF

MECHANICAL

Operating Position	Tube axis vertical, either end up	
Overall Length	17.00 max	in
Maximum Diameter	14.125 max	in
Terminal Connections	See *Dimensional Outline*	
Weight		
Uncrated	175	lb
Crated	340	lb

THERMAL[p, q]

Ceramic-Bushing Temperature	150 max	°C
Metal-Surface Temperature	150 max	°C
Minimum Storage Temperature	-65 min	°C

Water Flow

	Typ. Flow g/m	*Absolute Min. Flow g/m*	*Pressure Differential Flow Typ. Flow[c] psi*
To plate, total flow for two parallel input and output coolant courses	160	150	45 max
To upper grid coolant course	3	2	25 max
To lower coolant course	3	2	25 max

Water Flow (cont'd)

	Typ. Flow g/m	*Absolute Min. Flow g/m*	*Pressure Differential for Typ. Flow*[c] *psi*	
To grid cathode coolant course	35	30	30	max

Resistivity of water at 25°C:		
Plate and grid water.	1 min	MΩ-cm
Grid-cathode water.	5 min	MΩ-cm
Water temperature from any outlet	70 max	°C
External gas pressure[d].	65 max	psig
Gauge pressure at any inlet[d].	90 max	psig

TERMINAL DIAGRAM (Bottom View)

FI – Filament Terminal (Inner)
FO – Filament Terminal (Outer)
KURF – Upper RF Cathode Terminal
KLRF – Lower RF Cathode Terminal
GUIRF – Upper RF Grid Input Terminal
GUORF – Upper RF Grid Output Terminal
GLIRF – Lower RF Grid Input Terminal
GLORF – Lower RF Grid Output Terminal
PLRF – Lower RF Plate Terminal
PURF – Upper RF Plate Terminal

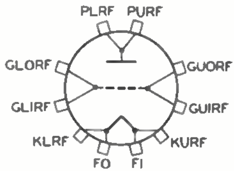


PLATE-PULSED AMPLIFIER—Class B[r]

For a maximum "ON" time[e] of 2200 microseconds in any 34000-microsecond interval

Absolute-Maximum Ratings

	Up to 450 MHz	*Up to 605 MHz*	
Peak Positive-Pulse Plate Voltage[f,g]. . . .	34	25	kV
Peak Negative Grid Voltage.	150	150	V
Peak Plate Current.	300	300	A
Peak Cathode Current[h]	600	600	A
DC Plate Current.	19.5	19.5	A
DC Cathode Current.	39	39	A
Plate Input (Average)	664	487	kW
Plate Dissipation (Average)	300	300	kW

Typical Operation

With rectangular wave shape in cathode-drive circuit with duty factor[j] of 0.06 and pulse duration of 2000 microseconds

	At 440 MHz		*At 550 MHz*	
Peak Positive Pulse Plate-to-Grid Voltage[f,g]	30	33	20	kV
Peak Cathode-to-Grid Voltage[k] .	80	60	100	V
Peak Plate Current.	285	295	250	A

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Electronic Components and Devices Harrison, N. J.

		At 440 MHz	At 550 MHz	
Peak Cathode Current[h]	570	590	500	A
DC Plate Current	17.1	17.7	15	A
DC Cathode Current	34.2	35.4	30	A
Peak Driving Power Output. .	170	200	225	kW
Useful Power Output at Peak of Pulse (Approx.).	4	5	2.5	MW

Absolute-Maximum Ratings

For a maximum "ON" time of 10000 microseconds in any 155000-microsecond interval

	Up to 450 MHz	
Peak Positive-Pulse Plate Voltage[f,g].	28	kV
Peak Negative Grid Voltage	150	V
Peak Plate Current	250	A
Peak Cathode Current[h].	500	A
DC Plate Current	16.25	A
DC Cathode Current	32.5	A
Plate Input (Average).	45.5	kW
Plate Dissipation (Average).	200	kW

Typical Operation

With rectangular wave shape in cathode-drive circuit at 440 MHz with duty factor[j] of 0.06 and pulse duration of 1000 microseconds

Peak Positive-Pulse Plate-to-Grid Voltage[f,g]	25	kV
Peak Cathode-to-Grid Voltage[k].	50	V
Peak Plate Current	220	A
Peak Cathode Current[h].	440	A
DC Plate Current	13.2	A
DC Cathode Current	27.4	A
Peak Driver Power Output[m].	140	kW
Useful Power Output at Peak of Pulse (Approx.) . .	2.5	MW

CHARACTERISTICS RANGE VALUES

	Note	Min	Max	
Input Strap-Resonant Frequency	-	90	140	MHz
Output Strap-Resonant Frequency. . . .	-	300	340	MHz
Useful Power Output.	1	4	-	MW

Note 1: For conditions with filament current at prescribed typical operating value supplied with the tube, see footnote (a), peak positive-pulse plate-to-grid voltage = 32000 max. volts, peak current = 18 max. amperes, frequency = 400 to 450 MHz, pulse duration = 2000 microseconds, duty factor = 0.06, and peak pulse driving power = 220000 max. watts.

a The typical and maximum operating filament currents recommended for each tube are specified on a label attached to the outside diameter of the plate terminal of each tube. The specified maximum filament current for each tube is a maximum rating which should not be exceeded, even momentarily, during operation of the tube. The life of the tube can be conserved by operating the filament at the lowest current which will enable the tube to provide the desired power output. Because the filament when operated near the maximum value usually provides emission in excess of any requirements within the tube ratings, the filament current should be reduced to a value that will give adequate but not excessive emission for any particular application. Good regulation of the filament current is, in general, economically advantageous from the viewpoint of tube life.

b Measured between KLRF and KURF (See *Terminal Diagram*).

c Measured directly across cooled element for the indicated typical flow.

d With the gauge located in an area where the maximum pressure external to the gauge is one atmosphere absolute.

e "*ON*" time is defined as the sum of the duration of all individual pulses which occur during the indicated interval. *Pulse duration* is defined as the time interval between the two points on the pulse at which the instantaneous value is 50% of the peak power 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.

f The magnitude of any spike on the plate voltage pulse should not exceed its peak value by more than 10%, and the duration of any spike when measured at the peak-value level should not exceed 100 microseconds. 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.

g Under most conditions pressurized cavities will be required for operation at the indicated typical voltages to prevent flash-over at the tube seals.

h Peak cathode current is the total of the peak plate current and the peak rectified grid current. (Pulses are not coincident, hence they cannot be added arithmetically).

j Duty factor is the product of the pulse duration and repetition rate.

k Preferably obtained from a cathode bias resistor.

m The driver stage is required to supply tube losses, rf circuit losses, and rf power added to the plate circuit. 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, and in initial tube characteristics during life.

The following footnotes apply to the *RCA Transmitting Tube Operating Considerations* given at the front of this section.

n See *Electrical Considerations* - Filament or Heater.

p See *Cooling Considerations* - Forced-Air Cooling.

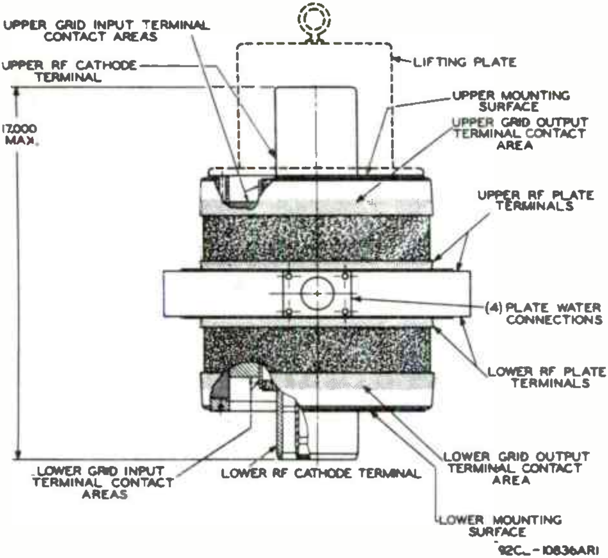
q See *Cooling Considerations* - Liquid Cooling.

r See *Classes of Service*.

FOR ADDITIONAL INFORMATION ON THIS TYPE, WRITE FOR TECHNICAL BULLETIN AND APPLICATION GUIDE FOR RCA SUPER POWER TUBES, ICE-279A AVAILABLE FROM:

Commercial Engineering
Electronic Components and Devices
Radio Corporation of America
Harrison, New Jersey

SIMPLIFIED DIMENSIONAL OUTLINE[s]



DIMENSIONS IN INCHES

[s] A detailed Dimensional Outline and associated Gauge Drawings are given in the Technical Bulletin available upon request.

High-Mu Triode

CERAMIC-METAL PENCIL TYPE

FAST WARM-UP TIME — FAST HEAT DISSIPATION

For use in plate-pulsed operation as a power amplifier, oscillator, and frequency multiplier in compact mobile and aircraft equipment at frequencies up to 4 Gc/s and above and at altitudes up to 25,000 feet without pressurization.

ELECTRICAL

Heater, for Unipotential Cathode		
Voltage (AC or DC)	6.3 ± 10%	V
Current at 6.3 V	0.300	A
Cathode Warmup Time (Average) to reach 80% of operating plate current	10	s
DC plate supply volts = 80, grid volts = 0, cathode resistor = 0 Ω, load resistor = 10 Ω, heater volts = 6.3		
Amplification Factor	70	
Transconductance	22500	μmhos
DC plate mA = 14, dc plate volts = 125, cathode resistor = 50 Ω		
Direct Interelectrode Capacitances		
Grid to plate	2.0	pF
Grid to cathode and heater	5.8	pF
Plate to cathode and heater	0.08 max	pF

MECHANICAL

Operating Position . . . . . Any

Dimensions and Terminal Connections . . . . . See accompanying *Dimensional Outline*

Weight (Approx.) . . . . . 0.3 oz

Sockets

Heater-Terminals Connector . . . . . Grayhill[a] No. 22-5, or equivalent

Socket for operation up to about 550 Mc/s (Including heater-terminals connector) . . . . . Jettron[b] No. CD7010, or equivalent

Cavities (Including heater-terminals connector) . . . . . J-V-M[c] No. D-7980 Series, Resdel[d] No. 10 Series, AML, Inc,[e] MCL, Inc,[f] or equivalent

Terminal Connections (see *Dimensional Outline*):

H – Heater Pin
K – Cathode Cylinder (Adjacent to Heater Pins)
G – Grid Flange
P – Plate Cylinder (Adjacent to pinch-off)

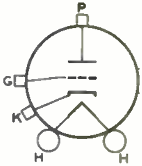


PLATE PULSED SERVICE—CLASS C

Absolute Maximum Ratings (Up to 4 Gc/s)

For a maximum "ON" time[g] of 5 microseconds in any 5000-microsecond interval.

Peak Positive-Pulse Plate-Supply Voltage	2000	V
Peak Plate Current from Pulse Supply	3.0	A
DC Plate Current	3.0	mA
DC Grid Current	1.5	mA
Pulse Duration	1.5	μs
Duty Factor	0.001	
Plate-Seal Temperature[h]	225	°C

Typical Operation as Oscillator with Rectangular Wave Shape in Cathode-Drive Circuit at 3.3 Gc/s

With duty factor[j] of 0.001 and pulse duration of 1 microsecond

Peak Positive-Pulse Plate-Supply Voltage	1750	V
DC Plate Current	2.5	mA
DC Grid Current	1.0	mA
Grid Resistor	50	Ω
Useful Power Output at Peak of Pulse (Approx.)	1000	W

Typical Operation as Frequency Doubler to 1 Gc/s with Rectangular Wave Shape in Cathode-Drive Circuit

Peak Positive-Pulse Plate-Supply Voltage	1200	V
DC Plate Current	0.4	mA
DC Grid Current	0.2	mA
Grid Resistor	2000	Ω
Driver Power Output (Approx.)	50	W
Useful Power Output (Approx.)	100	W

RF POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY[k]

RF POWER AMPLIFIER—CLASS C FM TELEPHONY

Absolute Maximum Ratings (Up to 4 Gc/s)

DC Plate Voltage	300	V
DC Grid Voltage	-50	V
DC Plate Current	35	mA
DC Cathode Current	45	mA
DC Grid Current	15	mA
Plate-Seal Temperature[h]	225	°C
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode	50	V
Heater positive with respect to cathode	50	V

Typical Operation as RF Power Amplifier in Cathode-Drive Circuit at 550 Mc/s

DC Plate Voltage	250	300	V
DC Grid Voltage	-6.5	-9	V
Grid Resistor	500	700	Ω
DC Plate Current	31	35	mA
DC Grid Current	13	13	mA
Driver Power Output (Approx.)	0.2	0.2	W
Useful Power Output (Approx.)	4.8	6	W

Maximum Circuit Value

Grid-Circuit Resistance	0.25	MΩ

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CHARACTERISTICS RANGE VALUES

	Note	Min	Max	
Heater Current	1	0.270	0.330	A
Direct Interelectrode Capacitances				
Grid to plate	-	1.7	2.4	pF
Grid to cathode	-	5.0	6.5	pF
Plate to cathode	-	-	0.08	pF
Heater-Cathode Leakage Current				
Heater negative with respect to cathode	1,2	-	30	μA
Heater positive with respect to cathode	1,3	-	30	μA
Reverse Grid Current	1,4	-	0.3	μA
Transconductance	1,5	18000	27000	μmhos
Plate Current (1)	1,5	13	25	mA

Note 1: With 6.3 volts ac or dc on heater.

Note 2: With 60 volts dc between heater and cathode, heater negative with respect to cathode.

Note 3: With 60 volts dc between heater and cathode, heater positive with respect to cathode.

Note 4: With dc plate voltage of 200 volts, dc grid voltage of -2 volts, grid resistor of 0.5 megohm.

Note 5: With dc plate-supply voltage of 125 volts, cathode resistor of 50 ohms, and cathode bypass capacitor of 1000 μf.

[a] Grayhill, Inc., 561 Hillgrove Ave., LaGrange, Ill.

[b] Jettron Products, Inc., 56 Route 10, Hanover, N.J.

[c] Fidelitone Microwave, Inc., JVM Division, 6415 N. Ravenswood Ave., Chicago, Ill. Indicated No. applies to a series of cavities covering the range from 220 to 3500 Mc/s.

[d] Resdel Engineering Corp., 330 South Fair Oaks Ave., Pasadena, Calif. This series of cavities covers the range from 215 to 2325 Mc/s.

[e] Applied Microwave Laboratory, Inc., 106 Albion St., Wakefield, Mass.

[f] Microwave Cavity Laboratory, Inc., 10 Beach Ave., LaGrange, Ill.

[g] *"ON"* time is defined as the sum of the duration of all individual pulses which occur during the indicated 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 power 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.

[h] In applications where the plate dissipation exceeds 2.5 watts, it is important that a large area of contact be provided between the plate cylinder and the terminal to provide adequate heat conduction.

[j] Duty factor is the product of pulse duration and repetition rate. For variable pulse durations and pulse repetition rates, the duty factor is defined as the ratio of time "ON" to total elapsed time in any 5000-microsecond interval.

[k] 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.

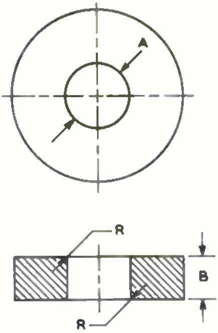
OPERATING CONSIDERATIONS

Connections to the cathode cylinder, grid flange, and plate cylinder should be made by flexible spring contacts. The connectors should make firm, large-surface contact, yet must be sufficiently flexible to insure that no part of the tube is subjected to excessive strain.

The *cathode* should preferably be connected to one side of the heater. When, in some circuit designs, the heater is not connected directly to the cathode, precautions must be taken to hold the peak heater-cathode voltage to the maximum rated values shown in the tabulated data.

GAUGES

Gauge	Type	Dimension		
		Diameter A	Thickness B	Radius R
G_1-1	Go	0.25200" +0.00000" -0.00007"	0.320" +0.001" -0.000"	0.003" Max
G_1-2	No-Go	0.24500" +0.00007" -0.00000"	-	-
G_3-1	Go	0.55700" +0.00000" -0.00007"	-	-
G_3-2	No-Go	0.54700" +0.00007" -0.00000"	-	-



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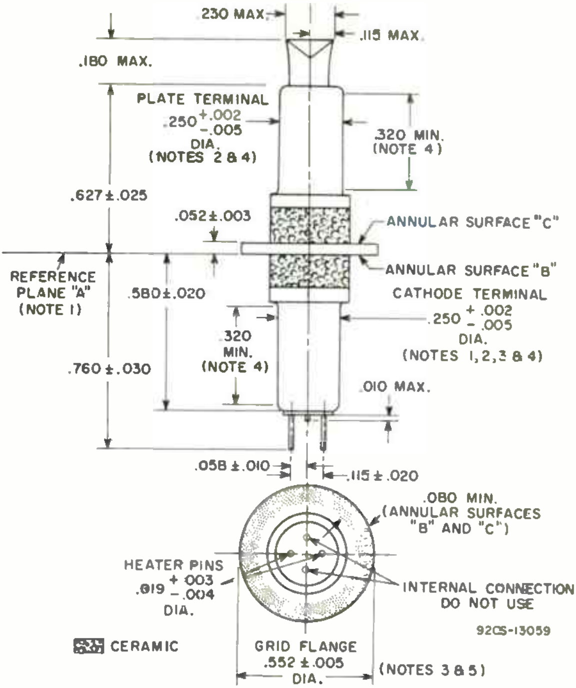
DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

Reference Plane "A" is defined as that plane against which annular surface "B" of the grid flange abuts.

Annular Surface "B" is on the side of the grid flange toward the cathode cylinder.

Annular Surface "C" is on the side of the grid flange toward the plate cylinder.

Note 1: With annular surface "B" resting on reference plane "A". The axis of the cathode cylinder will be within 2° of a line perpendicular to reference plane "A".

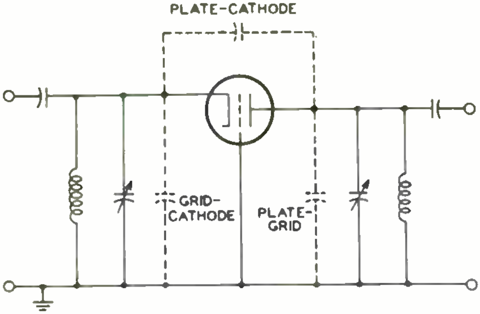
Note 2: The axes of the plate cylinder and cathode cylinder will coincide within 0.010 inch.

Note 3: The axes of the cathode cylinder and grid flange will coincide within 0.005 inch.

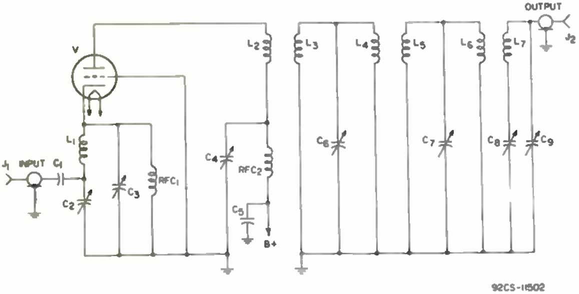
Note 4: The diameter along the 0.320 inch minimum length is measured with "GO" and "NO-GO" ring gauges G1-1 and G1-2, respectively.

Note 5: This diameter is measured with "GO" and "NO-GO" gauges G3-1 and G3-2, respectively.

TYPICAL CATHODE-DRIVE POWER AMPLIFIER CIRCUIT



TYPICAL BROADBAND AMPLIFIER CIRCUIT



C_1: 100 to 500 pF.
C_2, C_3, C_4, C_6, C_7, C_8, C_9: 0.8-8.5 pF
Glass Dielectric Trimmers—JFD VC 20G or equivalent.
C_5: 300 pF.
J_1, J_2: BNC Connectors.
L_1, L_2, L_3, L_4, L_5, L_6, L_7:
For Frequency Range of:
200-500 Mc/s—Two Turns, 1/2 inch Dia., Spaced 3/8 inch, Silver-Plated #14 Wire.
500-1000 Mc/s—One Turn, 1/2 inch Dia., Silver-Plated #14 Wire.
RFC_1, RFC_2: Ohmite Z-450 RF Chokes, or equivalent.
V: RCA-4028A

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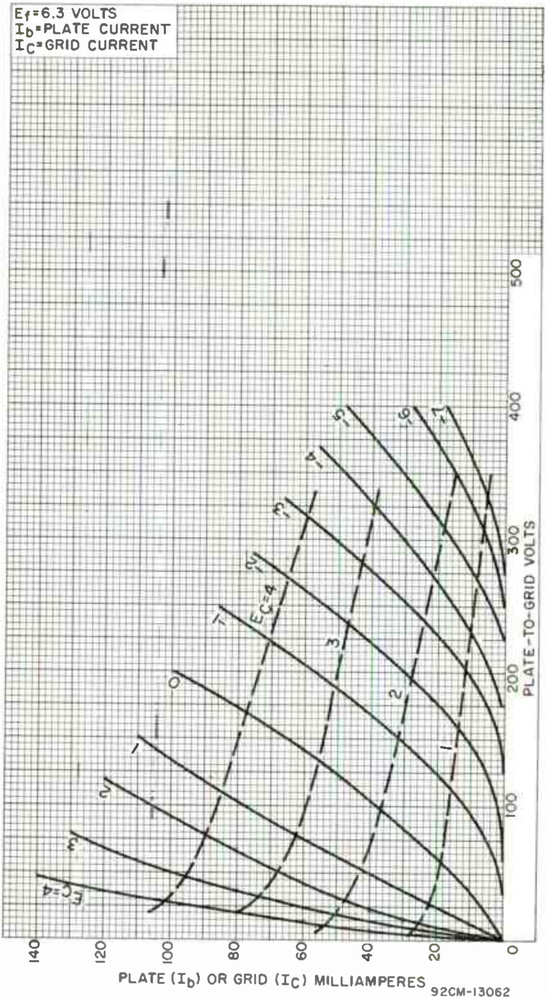
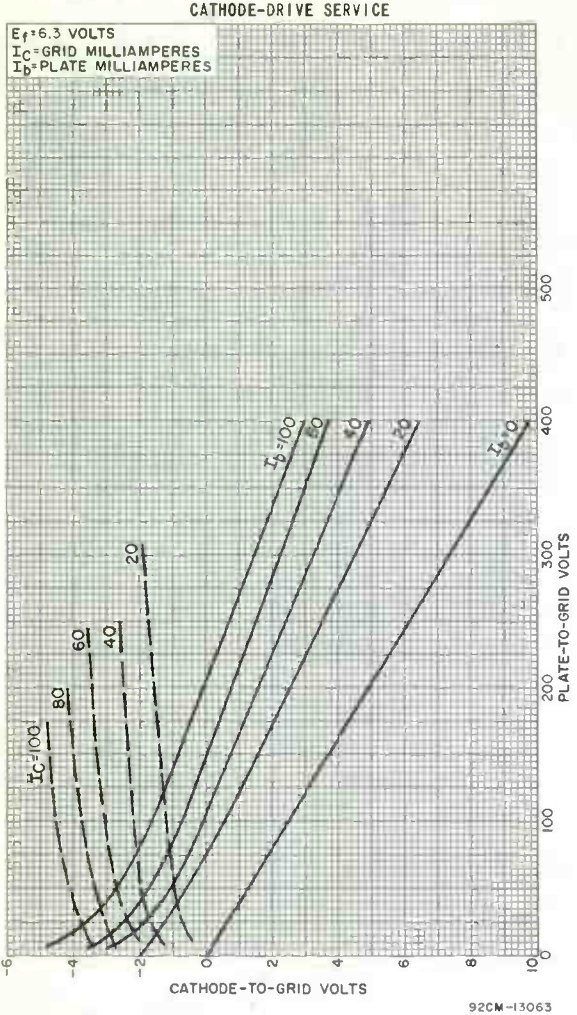
Average Characteristics

CATHODE-DRIVE SERVICE



Average Constant-Current Characteristics



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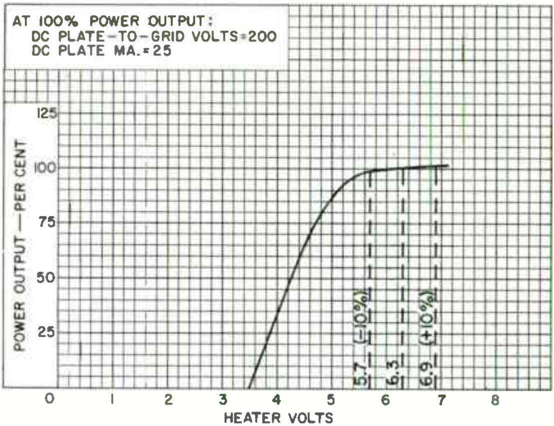
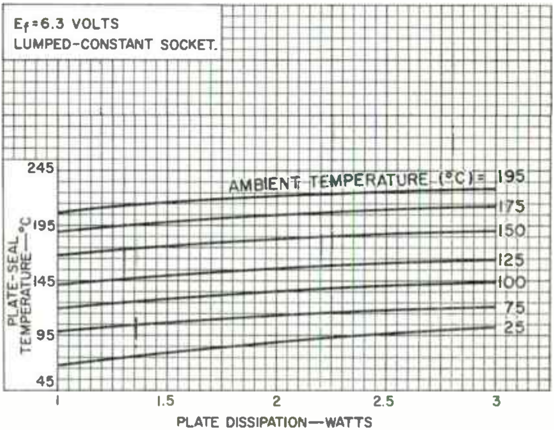
Typical Oscillator Power Output as a Function of Variations in Heater Voltage



92CS-11624R1

Plate-Seal Temperature as a Function of Ambient Temperature With Lumped-Constant Circuit



92CS-11488

High-Mu Triode

OCTAL-BASED PENCIL TUBE

For RF-Power-Amplifier, Oscillator, and Frequency-Multiplier Applications at Altitudes up to 100,000 Feet Without Pressurization

Replaces Type 2C40A in Most Applications

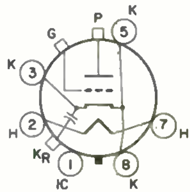
ELECTRICAL

Heater, for Unipotential Cathode		
Voltage (AC or DC)	6.3 ± 10%	V
Current at 6.3 volts	0.145	A
Cathode Warmup Time to reach 90 percent of		
Typical oscillator power output	10 max	s
Operating dc plate current	15 max	s
Amplification Factor	30	
Transconductance for dc plate mA = 18 and dc plate volts = 250	5500	μmhos
Direct Interelectrode Capacitances (Approx.)		
Grid to plate	1.1	pF
Grid to cathode	1.8	pF
Plate to cathode	0.05 max	pF
Cathode to rf cathode terminal	100	pF

MECHANICAL

Operating Position . . . . Any
Maximum Overall Length . . . . 3.125 in
Maximum Diameter . . . . 1.312 in
Base. . .Small H-Wafer Octal 6-Pin (JEDEC Group 1, No.B6-108)
Terminal Connections BOTTOM VIEW

Pin 1 – Do Not Use
Pin 2 – Heater
Pin 3 – Cathode
Pin 5 – Cathode
Pin 7 – Heater
Pin 8 – Cathode
K_R – Cathode rf terminal (Cylinder adjacent to base)
G – Grid (Flange between insulator sections)
P – Plate (Cylinder adjacent to upper insulator section)



THERMAL

Plate Seal Temperature . . . . 175 max °C

CLASS A1 RF AMPLIFIER

Maximum CCS Ratings, Absolute-Maximum Values up to 2000 Mc/s

For Altitudes up to 25000 ft

DC Plate Voltage	300	V
DC Grid Voltage	-100	V
DC Plate Current	25	mA

Plate Dissipation[a]	6.25	W
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode	90	V
Heater positive with respect to cathode	90	V

Maximum Circuit Value

Grid-Circuit Resistance	0.5	MΩ

RF POWER AMPLIFIER AND OSCILLATOR — CLASS C TELEGRAPHY

Key-down conditions per tube without amplitude modulation[b]

Maximum CCS Ratings, Absolute-Maximum Values up to 2000 Mc/s

For Altitudes up to 25000 ft

DC Plate Voltage	360	V
DC Grid Voltage	-100	V
DC Plate Current	25	mA
DC Grid Current	8	mA
Plate Input	9	W
Plate Dissipation[a]	6.25	W
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode	90	V
Heater positive with respect to cathode	90	V

Typical CCS Operation

As oscillator in cathode-drive circuit

	At 500	*2000*	*3000*	*Mc/s*
DC Plate-to-Grid Voltage	262	252	252	V
DC Cathode-to-Grid Voltage[c]	12	2	2	V
DC Plate Current	23	23	25	mA
DC Grid Current (Approx.)	6	3	4	mA
Useful Power Output (Approx.)	3	0.45	0.1	W

As rf power amplifier in cathode-drive circuit at 500 Mc/s

DC Plate-to-Grid Voltage	326	V
DC Cathode-to-Grid Voltage[c]	51	V
DC Plate Current	23	mA
DC Grid Current (Approx.)	7	mA
Driver Power Output (Approx.)	2	W
Useful Power Output (Approx.)	5	W

Maximum Circuit Value

Grid-Circuit Resistance	0.1	MΩ

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 2000 Mc/s

For Altitudes up to 25000 ft

DC Plate Voltage	275	V
DC Grid Voltage	-100	V
DC Plate Current	22	mA
DC Grid Current	8	mA

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Plate Input	6	W
Plate Dissipation[a]	4.25	W
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode	90	V
Heater positive with respect to cathode	90	V

Maximum Circuit Value

Grid-Circuit Resistance	0.1	MΩ

CHARACTERISTICS RANGE VALUES

	Note	Min	Max	
Heater Current	1	0.130	0.160	A
Direct Interelectrode Capacitances				
Grid to plate	-	0.8	1.3	µF
Grid to cathode	-	1.5	2.1	µF
Plate to cathode	-	-	0.05	µF
Heater-Cathode Leakage Current				
Heater negative with respect to cathode	1,2	-	50	µA
Heater positive with respect to cathode	1,3	-	50	µA
Reverse Grid Current	1,4	-	1	µA
Amplification Factor	1,5	22	38	
Transconductance	1,5	4000	7000	µmhos
Plate Current (1)	1,5	13.5	24.5	mA
Plate Current (2)	1,6	-	55	µA
Power Output	1,7	0.15		W

Note 1: With 6.3 volts ac or dc on heater.

Note 2: With 100 volts dc between heater and cathode, heater negative with respect to cathode.

Note 3: With 100 volts dc between heater and cathode, heater positive with respect to cathode.

Note 4: With dc plate voltage of 250 volts, dc grid voltage of -2.5 volts, grid resistor of 0.5 megohm.

Note 5: With dc plate-supply voltage of 250 volts, cathode resistor of 200 ohms, and cathode bypass capacitor of 1000 microfarads.

Note 6: With dc plate voltage of 250 volts and dc grid voltage of -25 volts.

Note 7: With dc plate voltage of 250 volts, grid resistor adjusted to give a dc plate current of 25 milliamperes in a cavity-type oscillator operating at 1800 ± 25 megacycles per second.

[a] In applications where the plate dissipation exceeds 2.5 watts, it is important that a large area of contact be provided between the plate cylinder and the terminal to provide adequate heat conduction.

[b] Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115 percent of the carrier conditions.

[c] Obtained from grid resistor.

SPECIAL TESTS AND PERFORMANCE DATA

Low-Pressure Voltage Breakdown Test

This test (similar to MIL-E-1D, par. 4.9.12.1) is periodically performed on a sample lot of tubes. Tubes are tested in a chamber at an air pressure equivalent to an altitude of 25,000 feet. Breakdown should not occur when a 60-cycle rms voltage of 500 volts is applied between the plate cylinder and grid flange.

Low-Frequency Vibration Performance

This test (similar to MIL-E-1D, par. 4.9.19.1) is performed on a sample lot of tubes from each production run under the following conditions:

Heater voltage of 6.3 volts, dc plate-supply voltage of 250 volts, grid voltage of -2.5 volts, and plate load resistor of 10,000 ohms. The tubes are vibrated in a plane perpendicular to the tube axis at 25 cycles per second at an acceleration of 2.5 g. The rms output voltage across the plate load resistor as a result of vibration of the tube should not exceed 100 millivolts.

High-Frequency Vibration Performance

This test (similar to MIL-E-1D, par. 4.9.19.2) is performed on a sample lot of tubes from each production run. The tube is vibrated perpendicular to its axis, with no voltages applied to the tube. Vibration frequency is 40-60 c/s and acceleration is 10 g. At the end of this test, tubes should not show temporary or permanent shorts or open circuits and should meet the following limits:

Heater-Cathode Leakage Current . . . . 50 max µA

For conditions shown under *Characteristics Range Values Notes 1,2 and 1,3.*

Low-Frequency Vibration (rms) . . . . 100 max mV

For conditions shown above under *Low-Frequency Vibration Performance.*

Transconductance. . . . . 3900 min µmhos

For conditions shown under *Characteristics Range Values Notes 1,5.*

Shorts and Continuity Test

This test (similar to MIL-E-1D, par. 4.7.3) is performed on all tubes from each production run. Voltage applied between adjacent elements of the tube under test should be between 20 and 70 volts dc or peak ac. Plate and cathode terminals are tied together and connected to the grid terminal through the shorts test equipment. Tubes are tapped with a rubber tapper three times in each of three mutually perpendicular directions. If a short indication is obtained, the tapping cycle is repeated two times for verification. Acceptance criteria is based on the "Resistance vs. Time Duration" curve shown in par. 4.7.7 of MIL-1-D, Amendment 5.

Glass Seal Fracture Tests

Fracture tests are performed on sample lots of subassemblies during manufacture.

1. Tubes (prior to final assembly) are placed on supports spaced 15/16 ± 1/64 inch apart with the grid flange centered

between these supports. Tubes should withstand gradual application, perpendicular to the tube axis, of a force of 30 pounds upon the grid flange without causing fracture of the glass insulation.

2. Tubes (prior to final assembly) are held by clamping to the cathode cylinder. Tubes should withstand gradual application of a torque of 12.5 inch-pounds upon the plate terminal without causing fracture of the glass insulation.

Dynamic Life Performance

This test (similar to MIL-E-1D, par. 4.11.3.2) is performed on a sample lot of tubes from each production run to insure high quality of rf performance. Each tube is life-tested in a cavity-type oscillator at 500 ± 15 Mc/s under the following conditions:

Heater voltage of 6.3 volts, plate-supply voltage of 300 volts, cathode resistor adjusted to give a dc plate current of 25 mA and value recorded, heater positive with respect to cathode by 100 volts, and plate-seal temperature of 175° C min.

At the end of 500 hours, the tube should not show permanent shorts or open circuits and will be criticized for the total number of defects in the sample lot and for the number of tubes failing to meet the following limit.

Power Output.	0.2 min	W

For conditions shown under *Characteristics Range Values Notes 1, 7.*

OPERATING CONSIDERATIONS

Mechanical

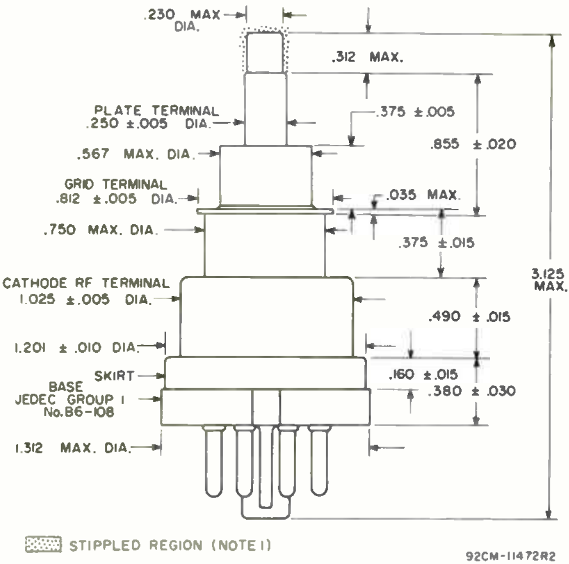
The *maximum plate-seal temperature* of 175° C is a tube rating and is to be observed in the same manner as other ratings. The temperature of the plate seal should be measured on the plate seal. The temperature may be measured with temperature-sensitive paint, such as *Tempilaq*. The latter is made by the Tempil Corporation, 132 W. 22nd Street, New York 11, N. Y., in the form of a liquid or stick.

The *mounting* for the 4037A in cavity-type circuits should support the tube by the cathode cylinder which should make firm contact to the cavity surface. Connections to the grid flange and plate cylinder must be made by contacts with flexible leads to allow for variations in tube dimensions and eccentricities of the tube structure. In addition the plate connector should make firm, large-surface contact and be capable of conducting heat so that the plate-seal temperature will not exceed 175° C under any operating conditions. Contact should not be made to the 0.230-inch cap at the plate-terminal end of the tube as indicated on the *Dimensional Outline*.

Electrical

The *cathode* should preferably be connected to one side of the heater. When, in some circuit designs, the heater is not connected directly to the cathode, precautions must be taken to hold the peak heater-cathode voltage to the maximum values shown in the tabulated data.

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

Note 1: Keep all stippled regions clear. Do not allow contacts or circuit components to protrude into these areas.

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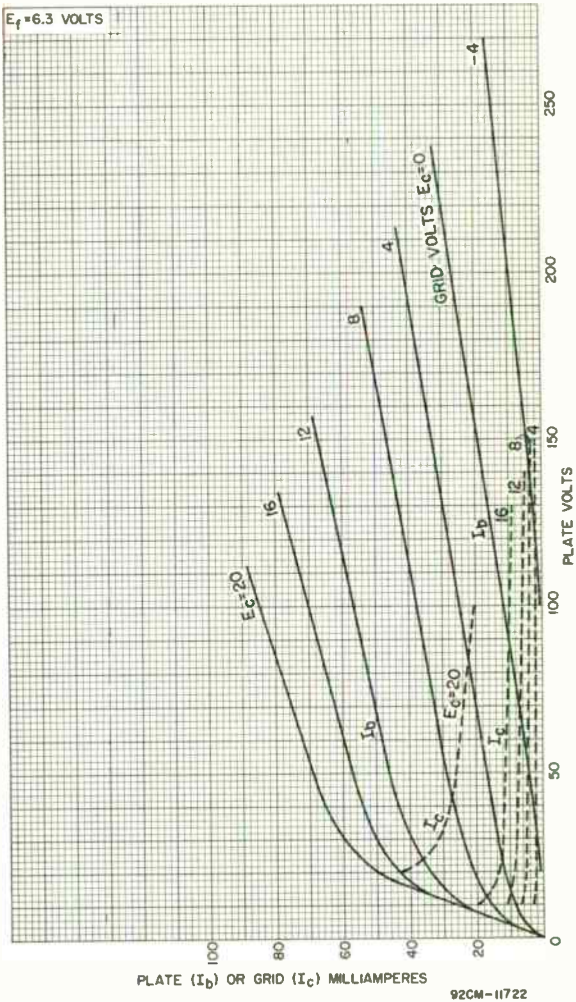
Average Characteristics



92CM-11722

Traveling-Wave Tube

HELIX-TRANSMISSION-LINE TYPE

FREQUENCY RANGE
1—2 Gc (L-Band)

INTEGRAL PERIODIC-PERMANENT-MAGNET TYPE

Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 5%	volts
Current at heater volts = 6.3	1.75	amp
Starting Current	Must never exceed 4 amperes, even momentarily	
Minimum Cathode Heating Time	3	minutes
Frequency Range	1 to 2	Gc
Cold Insertion Loss	60	db
Thermostatic Switch:		
Current rating:		
At 125 volts ac		6 amp
At 240 volts ac		3 amp
Input VSWR	1.8:1 max.	
Output VSWR	1.8:1 max.	

Mechanical:

Operating Position	Any
Maximum Overall Length	20.50"
Maximum Height	3.875"
Maximum Width	3.125"
Maximum Shell Diameter	1.625"
Weight (Approx.)	6.5 pounds
Connectors:	
RF Input	Type N Plug (UG-18 8/U)
RF Output	Type N Plug (UG-18 8/U)
Terminal Leads	See accompanying *Dimensional Outline*

Thermal:

Collector Temperature[a]	225 max.	°C
Air Flow into Radiator	25 min.	cfm

RF POWER AMPLIFIER

Maximum Ratings, *Absolute-Maximum Values:*

DC Collector Voltage	3000	volts
DC Helix Voltage	2500	volts
DC Grid-No.2 Voltage	1700	volts
DC Collector Current	80	ma
DC Helix Current	3	ma
DC Grid-No.2 Current	1	ma
RF Power Input	5	watts

[a] The thermostatic switch will open when collector temperature exceeds 225°C.

Typical Operation at 1.4Gc:

DC Collector Voltage	2200	volts
DC Helix Voltage	2200	volts
DC Grid-No.2 Voltage	1500	volts
DC Collector Current	70	ma
DC Helix Current	0.25	ma
DC Grid-No.2 Current	0.25	ma
Gain at 10 Watts	28	db
Saturated Power Output	13	watts

CHARACTERISTICS RANGE VALUES

	Note	*Min.*	*Max.*	
Heater Current	1	-	2	amp
DC Collector Voltage	2,3	1800	2500	volts
DC Helix Voltage	2,3	1800	2500	volts
DC Grid-No.2 Voltage	3	1150	1600	volts
DC Collector Current	3	60	75	ma
DC Helix Current	3	-	1.1	ma
DC Grid-No.2 Current	-	-	1	ma

Note 1: With heater volts = 6.3.

Note 2: Normally the tube is operated with the helix voltage equal to the collector voltage.

Note 3: Specific operating value is supplied with each tube.

OPERATING CONSIDERATIONS

The *magnetic field* required to focus the electron beam in the 4053 is supplied by integral periodic permanent magnets. Although the periodic-magnet structure is difficult to demagnetize and has little stray field, care should be taken to prevent the presence of any appreciable external transverse magnetic field which might cause defocusing of the electron beam within the tube. Magnetic material should be kept at least eight inches away from the tube.

Impedance match between the 4053 rf power output and the load should have a voltage standing wave ratio (VSWR) no greater than 2:1. With VSWR's in excess of this value, oscillations may occur causing permanent damage to the tube. Tubes should not be operated without a termination.

Forced-air cooling of the collector is necessary whenever collector current is flowing. Failure to observe this precaution may result in permanent damage to the tube. It is recommended that the forced-air cooling be applied when the heater power is applied.

A thermostatic switch is mounted on the collector of the 4053 which opens when the collector temperature exceeds a safe limit. It is recommended that the thermostatic switch be used in an interlock circuit in the power supply for the collector, helix, and grid-No.2 voltages. The thermostatic switch will carry 6 amperes at 125 volts ac or 3 amperes at 240 volts ac.

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The power supply should incorporate a helix-current overload protective device to prevent damage to the tube in the event of loss of collector voltage. Such a condition would cause the entire electron beam current to flow to the helix and thereby overheat that electrode. If it is desired to remove all voltages by a single control, the time-constant values of the power supply should be chosen so that the helix voltage decays faster than the collector voltage.

As the grid-No.2 voltage increases from zero to the operating value, the helix current may reach as high as 10 ma in the vicinity of 200 to 600 volts on grid No.2, then will fall below 2 ma at the proper operating grid-No.2 voltage. The helix supply should have adequate regulation to handle this transient during the turn on procedure. In order to protect the tube, the helix supply should also have an interlock to open the circuit if the helix current exceeds 3 ma longer than a few milliseconds.

Mounting. The 4053 may be mounted in any position by means of bolts through either set of holes in the two mounting blocks.

Electrical connections are made to the 4053 by means of the seven leads. These color-coded, flexible, insulated leads are identified on the *Dimensional Outline*. RF input and output connections are made to type N plugs (UG-18 E/U) on the tube (see *Dimensional Outline*). The collector is connected to the capsule and is normally grounded.

The rated values for collector voltage, helix voltage, and grid-No.2 voltage are high enough to be dangerous to the user. Care should be taken during adjustment of circuits, especially when exposed circuit parts are at a high dc potential.

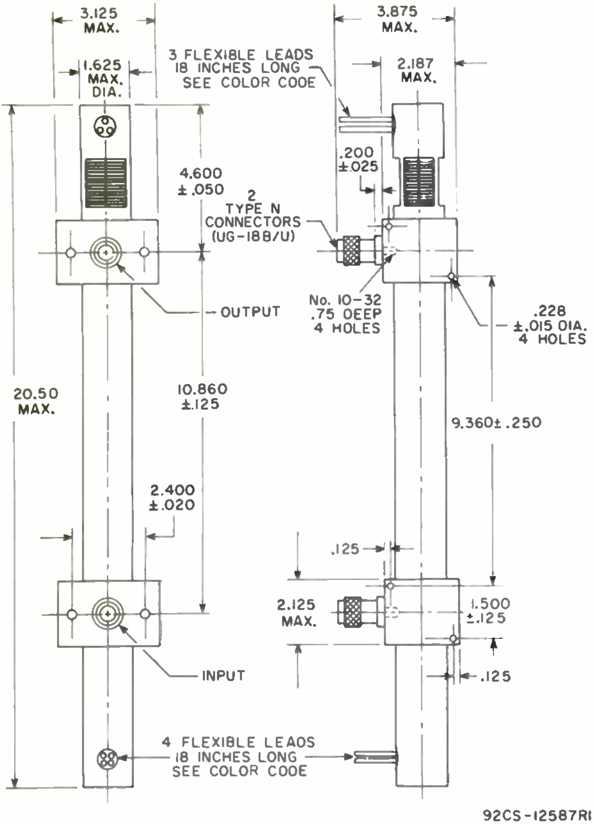
STARTING PROCEDURE

Voltages should be applied to the 4053 in the following sequence: Apply the rated heater voltage and allow tube to warm-up for 3 minutes minimum. Then apply the collector voltage as specified on the tube label. Next, apply the helix voltage as specified on the tube label. Finally, increase the grid-No.2 voltage in a few milliseconds to obtain the collector current specified on the tube label. The three power supplies can be controlled by one switch provided there is a sufficient delay in application of the grid-No.2 voltage to allow the collector and helix voltages to stabilize first.

TURN-OFF PROCEDURE

To turn off the tube, remove the electrode voltages in the following sequence. First reduce the grid-No.2 voltage, then remove the helix voltage, collector voltage, and heater voltage in that order. The three power supplies can be controlled by one switch provided the grid-No.2 voltage decays faster than the collector and helix voltages.

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

COLOR CODE OF LEADS

HEATER	Brown
HEATER, CATHODE, GRID No.1 . . .	Yellow
HELIX.	Orange
GRID No.2.	Blue
COLLECTOR, SHELL	Black
THERMOSTATIC SWITCH (2).	White

High-Mu Triode

CERAMIC-METAL PENCIL TUBE
FAST WARM-UP TIME WITH EXCELLENT THERMAL STABILITY

For Plate- or Grid-Pulsed Oscillator and Grid- or Cathode-Pulsed Amplifier Applications to 4000 Mc/s and for Frequency Multiplier Service to over 1000 Mc/s

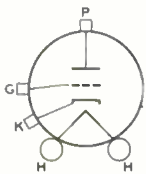
ELECTRICAL

Heater, for Unipotential Cathode		
Voltage (AC or DC)	6.3 ± 10%	V
Current at heater volts = 6.3	0.295	A
Amplification Factor	70	
Transconductance, for dc plate mA = 40, dc plate volts = 150	35000	µmhos
Direct Interelectrode Capacitances[a]		
Grid to plate	1.9	pF
Grid to cathode	5.5	pF
Plate to cathode	0.07 max	pF

MECHANICAL

Operating Position . . . . Any
Weight . . . . 0.4 oz
Altitude (without pressurization, 3500 V dc applied between plate cylinder and grid flange) . . . . 25000 ft
Dimensions and Terminal Connections . . . . . See Accompanying *Dimensional Outline*
Socket for Heater Pins . . Grayhill No.22-3[b], Cinch 54A16325[c], or equivalent
Terminal Connections (See *Dimensional Outline*)

H – Heater
K – Cathode



G – Grid
P – Plate

THERMAL

Plate-Seal Temperature . . . . 225 max °C

PLATE-PULSED SERVICE - Class C

Maximum Ratings, Absolute-Maximum Values

For a maximum "ON" time[d] of 50 microseconds in any 5000-microsecond interval

Peak Positive-Pulse Plate-Supply Voltage	3500	V
Peak Plate Current (from pulse supply)	3	A
DC Plate Current	40	mA
DC Grid Current	15	mA
Plate Dissipation	10	W
Pulse Duration	5	µs
Duty Factor	0.01	

Typical Operation

As Plate-Pulsed Oscillator with Rectangular Shape at 3300 Mc/s

With duty factor[f] of 0.001 and pulse duration[e] of 1 microsecond at a pulse repetition rate of 1000 pps

Peak Positive-Pulse Plate-Supply Voltage	1750	V
DC Plate Current	3	mA
DC Grid Current	1.4	mA
Grid Resistor	2000	Ω
Useful Power Output at Peak of Pulse	1300	W

GRID-PULSED OR CATHODE-PULSED SERVICE - Class C

Maximum Ratings, Absolute-Maximum Values

With duty factor of 0.01 and pulse width of 5 microseconds

Plate Supply Voltage	2000	V
Peak Plate Current	3	A
DC Grid Bias Voltage	-100 min	V
Peak Grid Current	1.5	A
Plate Dissipation	10	W

Typical Operation

As Grid-Pulsed Amplifier with Rectangular Shape at 1090 Mc/s

With pulse duration of 0.5 microsecond at a pulse repetition rate of 2000 pps

Plate Supply Voltage	1000	V
Peak Plate Current	1.5	A
DC Grid Bias Voltage	-30	V
Peak Driver Power	50	W
Peak Power Output	600	W

[a] With external shield.

[b] Grayhill, Inc., 561 Hillgrove Ave., LeGrange, Ill.

[c] Cinch Mfg. Co., 1026 South Homan Ave., Chicago, Ill.

[d] "ON" time is defined as the sum of the duration of all individual pulses occurring during the indicated interval.

[e] Pulse Duration is defined as the time interval between the 2 points on the pulse at which the instantaneous value is 70% of the peak power value.

[f] Duty Factor is the product of pulse duration and repetition rate. For variable pulse durations and pulse repetition rates (pps), the duty factor is defined as the ratio of time "ON" to total elapsed time in any 5000-microsecond interval.

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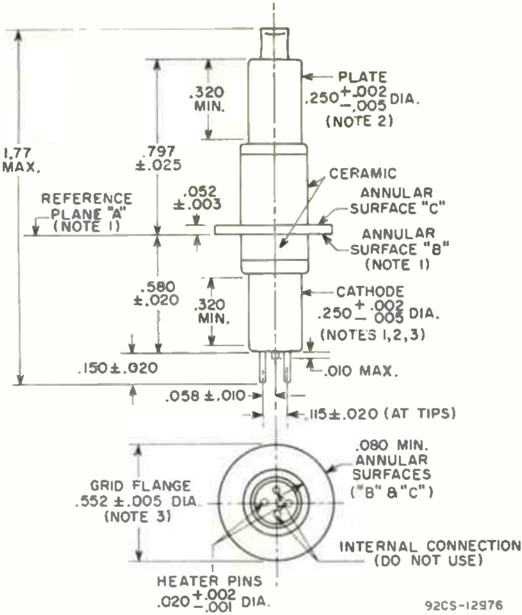
DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

Reference Plane "A" is defined as that plane against which annular surface "B" of the grid flange abuts.

Annular Surface "B" is on the side of the grid flange toward the cathode cylinder.

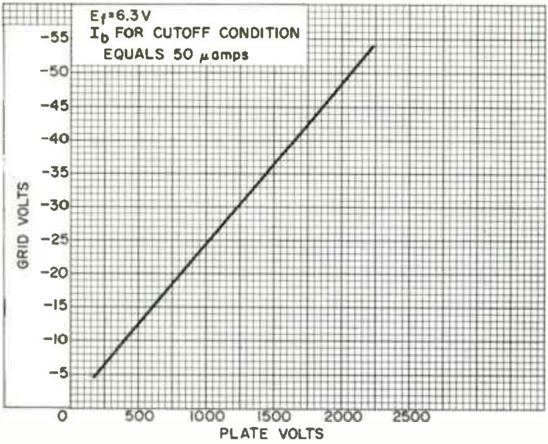
Annular Surface "C" is on the side of the grid flange toward the plate cylinder.

Note 1: With annular surface "B" resting on reference plane "A", the axis of the cathode cylinder will be within 2° of a line perpendicular to reference plane "A".

Note 2: The axes of the plate cylinder and cathode cylinder will coincide within 0.010 inch.

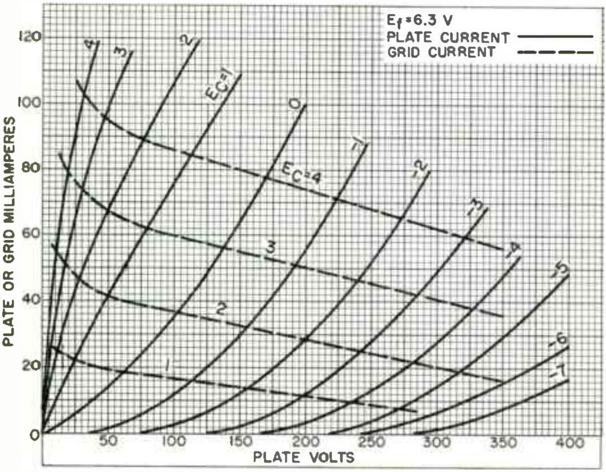
Note 3: The axes of the cathode cylinder and grid flange will coincide within 0.010 inch.

Plate-Current Cutoff Characteristic



92CS-13207

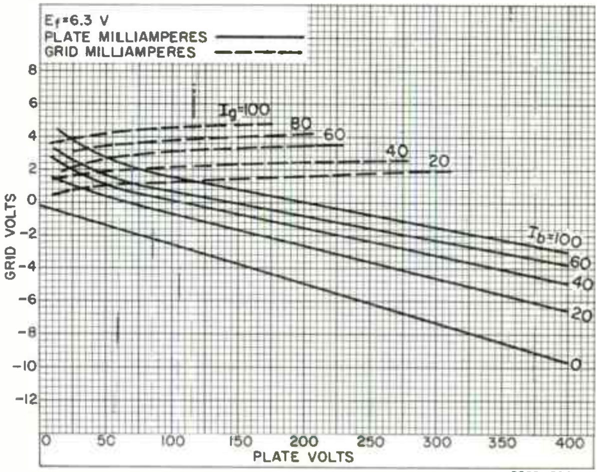
Average Characteristics in Cathode-Drive Service



92CS-13208

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

Average Constant-Current Characteristics in Cathode-Drive Service



92CS-13209

Medium-Mu Triode

GLASS-METAL PENCIL TYPE

For Use at Frequencies Up to 4000 Mc/s in Pulse Service and 2000 Mc/s in CW Service

ELECTRICAL

Heater, for Unipotential Cathode		
Voltage (AC or DC):		
Under transmitting conditions.	6.0 ± 10%	V
Under standby conditions	6.3 max	V
Current at 6.0 V	0.300	A
Amplification Factor	40	
Transconductance	7300	μmhos
For dc plate current of 22 mA and dc plate voltage of 200 V		
Direct Interelectrode Capacitances (Approx.)		
Grid to plate.	1.8	pF
Grid to cathode.	3.2	pF
Plate to cathode.	0.07 max	pF

MECHANICAL

Operating Position	Any	
Dimensions and Terminal Connections . . .	See *Dimensional Outline*	
Plate Seal Temperature	175 max	°C
Weight (Approx.)	0.4	oz
Sockets		
Heater terminals connector.	Grayhill No. 22-3[a]	

TERMINAL CONNECTIONS (See *Dimensional Outline*)

H - Heater
K - Cathode (Cylinder adjacent to heater pins)
G - Grid (Flange between glass sections)
P - Plate (Cylinder adjacent to pinch-off)

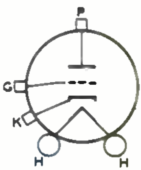


PLATE-PULSED OSCILLATOR[b]—CLASS C

Maximum CCS[c] Ratings, Absolute-Maximum Values

For a maximum "ON" time[d] of 5 microseconds in any 500-microsecond interval.

For altitudes up to 30,000 feet

	Up to 4000 Mc/s	
Peak Positive-Pulse Plate-Supply Voltage[e] . . .	2000	V
Peak Grid-Bias Voltage		
Negative pulse	150	V
Positive pulse	25	V
Peak Plate Current	3	A
From pulse supply		
Peak Rectified Grid Current.	1.5	A
DC Plate Current	0.03	A

	Up to 4000 Mc/s	
DC Grid Current	0.013	A
Plate Dissipation[f]	7	W
Pulse Duration	5	μs

Typical Operation with Rectangular Wave Shape in Cathode-Drive Circuit at 3300 Mc/s

With duty factor[g] of 0.01 and pulse duration of 1 microsecond

Peak Positive-Pulse Plate-Supply Voltage[e]	1750	V
Peak Negative-Pulse		
Grid-bias voltage	110	V
From grid resistor of	100	Ω
Peak Plate Current	3	A
From pulse supply		
Peak Rectified Grid Current	1.1	A
DC Plate Current	0.03	A
DC Grid Current	0.011	A
Useful Power Output	800	W
At peak of pulse[h] (approx.)		

RF POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

Key-down conditions per tube without amplitude modulation[j]

Absolute-Maximum Ratings

For altitudes up to 60,000 feet

	CCS	ICAS[k]	
DC Plate Voltage	330	400	V
DC Grid Voltage	-100	-100	V
DC Plate Current	40	55	mA
DC Grid Current	25	25	mA
DC Cathode Current	55	70	mA
Plate Input	13.2	22	W
Plate Dissipation	8	13	W
Peak Heater-Cathode Voltage:			
Heater negative with respect to cathode	50	50	W
Heater positive with respect to cathode	50	50	W

Typical Operation as Oscillator in Cathode-Drive Circuit at 500 Mc/s

	CCS	ICAS	
DC Plate-to-Grid Voltage	325	380	V
DC Cathode-to-Grid Voltage[m]	25	30	V
DC Plate Current	35	35	mA
DC Grid Current (Approx.)	11	13	mA
Useful Power Output (Approx.)	5[n]	6[n]	W

Typical Operation as Oscillator in Cathode-Drive Circuit at 1700 Mc/s

	CCS	
DC Plate-to-Grid Voltage[m]	263	V
DC Cathode-to-Grid Voltage	13	V
DC Plate Current	40	mA
DC Grid Current (Approx.)	13	mA
Useful Power Output (Approx.)	1[n]	W

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Typical Operation as RF Power Amplifier in Cathode-Drive Circuit at 500 Mc/s

	CCS	*ICAS*	
DC Plate-to-Grid Voltage	342	395	V
DC Cathode-to-Grid Voltage[m]	42	45	V
DC Plate Current	35	40	mA
DC Grid Current (Approx.)	13	15	mA
Driver Power Output (Approx.)	2.4	3	W
Useful Power Output (Approx.)	7.5[n]	10[n]	W
Maximum Circuit Values			
Grid-Circuit Resistance	0.1	0.1	MΩ

FREQUENCY MULTIPLIER

Absolute-Maximum Ratings

For altitudes up to 60,000 feet

	CCS	*ICAS*[k]	
DC Plate Voltage	300	350	V
DC Grid Voltage	-125	-140	V
DC Plate Current	33	45	mA
DC Grid Current	25	25	mA
DC Cathode Current	45	55	mA
Plate Input	9.9	15.9	W
Plate Dissipation	6	9.5	W
Peak Heater-Cathode Voltage:			
Heater negative with respect to cathode	50	50	V
Heater positive with respect to cathode	50	50	V

Typical Operation as Tripler to 510 Mc/s in Cathode-Drive Circuit

	CCS	*ICAS*	
DC Plate-to-Grid Voltage	410	472	V
DC Cathode-to-Grid Voltage[m]	110	122	V
DC Plate Current	26	36.5	mA
DC Grid Current (Approx.)	4.1	5.8	mA
Driver Power Output (Approx.)	2.75	4.5	W
Useful Power Output (Approx.)	2.1[n]	3.4[n]	W
Maximum Circuit Values			
Grid-Circuit Resistance	0.1	0.1	MΩ

[a] Grayhill Inc., 561 Hillgrove Ave., LaGrange, Ill.

[b] In this class of service, the heater should be allowed to warm up for a minimum of 60 seconds before plate voltage is applied.

[c] Continuous Commercial Service.

[d] "ON" time is defined as the sum of the duration of all individual pulses which occur during the indicated 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 power 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] The magnitude of any spike on the plate voltage pulse should not exceed a value of 2000 volts with respect to cathode and its duration should not exceed 0.01 microsecond measured at the peak-pulse-value level.

[f] In applications where the plate dissipation exceeds 3 watts, it is important that a large area of contact be provided between the plate cylinder and the connector in order to provide adequate heat conduction.

[g] Duty factor is the product of pulse duration and repetition rate. For variable pulse durations and pulse repetition rates, the duty factor is defined as the ratio of time "ON" to total elapsed time in any 500-microsecond interval.

[h] The power output at peak of pulse is obtained from the average power output using the duty factor of the peak pulse. This procedure is necessary since the power output pulse duty factor may be less than the applied voltage pulse duty factor because of a delay in the start of rf power output.

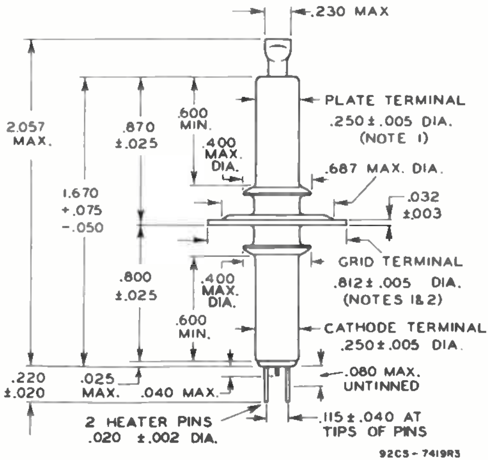
[j] Modulation, essentially negative, may be used if the positive peak of the audio-frequency envelope does not exceed 115 percent of the carrier conditions.

[k] Intermittent Commercial and Amateur Service.

[m] From a grid resistor, or from a suitable combination of grid resistor and fixed supply or grid resistor and cathode resistor.

[n] This value of useful power is measured at load of output circuit having an efficiency of about 75 percent.

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

Note 1: Max. eccentricity of center line (Axis) of plate terminal or grid-terminal flange with respect to the center line (Axis) of the cathode terminal is 0.010 inch.

Note 2: 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 of a point approximately 0.020 inch inward from its edge for one complete rotation. The total travel distance will not exceed 0.020 inch.

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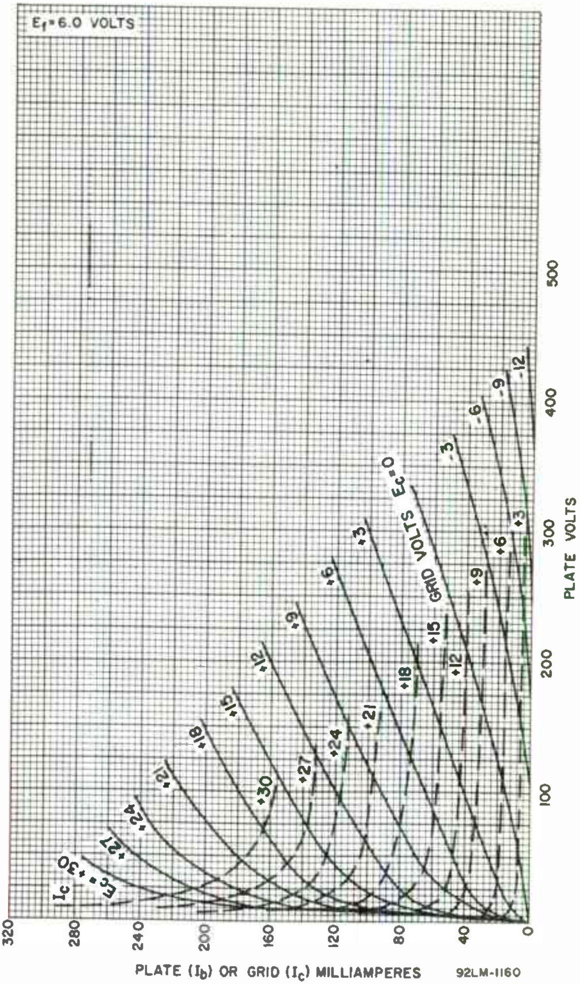
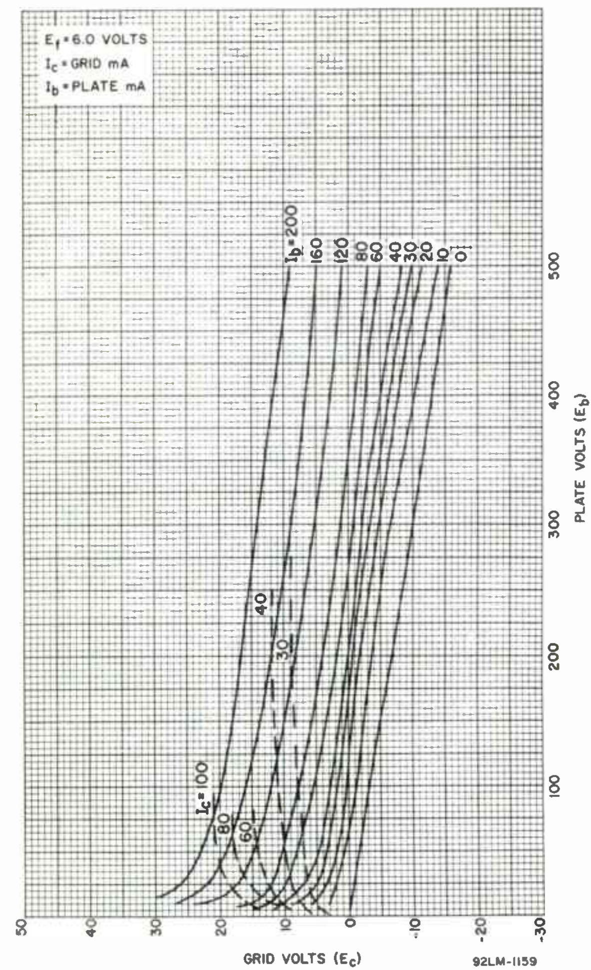
Electronic Components and Devices Harrison, N. J.

Average Plate Characteristics



Average Constant-Current Characteristics



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

L-Band Pencil-Tube Oscillator-Amplifier

1090 Mc/s — 500 W PEAK

These Units[d] are Designed to Implement New Airborne Transponder Systems

ELECTRICAL

Heater, for Unipotential Cathode		
Voltage (AC or DC)	6.3 ± 10%	V
Current at 6.3 V (Total)	0.66 max	A
Frequency	1090	Mc/s
RF Coaxial Output		
Terminal	Sealectro No. 50-047-0129	
Characteristic impedance (approx.)	50	Ω
Output VSWR All phase angles	1.5:1	

MECHANICAL

Operating Position	Any
Dimensions and Terminal Connections	See *Dimensional Outlines*
Weight (Approx.)	7 oz

ENVIRONMENTAL

The units will remain stable within ± 2.5 Mc/s in frequency and ± 3 dB in peak power output (from nominal conditions) under any combination of the following conditions:

Vibration	Curve IV of MIL-E-5400 and Curve IV MIL-T-5422E	
Shock	15	g
Ambient Temperature	-54 to 95	°C
Altitude	30000	ft
Output VSWR All phase angles	1.5:1	
Plate and Heater Voltage Variation	±10	%
Duty Factor	0.01	

GRID-PULSED OSCILLATOR—CLASS C

Absolute-Maximum Ratings

For a maximum "ON" time[a] of 12.5[b] microseconds in any 2500-microsecond interval

DC Plate Voltage Each unit	1100	V
Peak Oscillator Grid Current	0.5	A
Peak Amplifier Cathode Current	2	A
Peak Plate Current		
Oscillator	0.7	A
Amplifier	1.5	A
Plate Dissipation Total	18	W
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode	60	V
Heater positive with respect to cathode	60	V

TYPICAL OPERATION

With Rectangular Wave Shape in Grid-Drive Circuit at 1090 Mc/s

With duty factor[c] of 0.01 and pulse duration of 0.45 microsecond

DC Plate Voltage.	1000	V
Each unit		
Oscillator Grid Bias.	-80	V
Amplifier Cathode Bias.	25	V
DC Plate Current.	20	mA
Total		
Useful Power Output	500	W
At peak of pulse		

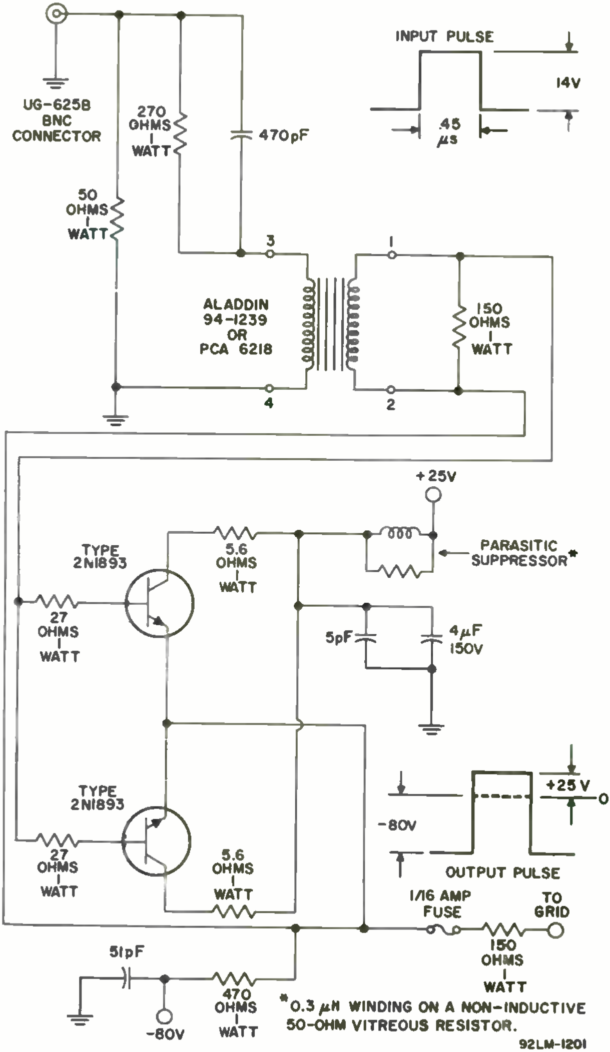
[a] *"ON"* time is defined as the sum of the duration of all individual pulses which occur during the indicated interval. *Pulse duration* is defined as the time interval between the two points on the pulse at which the instantaneous value is 70% of the peak power value. The *peak value* is defined as the maximum value of a smooth curve through the average of the fluctuations over the top portion of the pulse.

[b] This value is for continuous pulsing. The *"ON"* time can be 25 microseconds when the units are operated 10 minutes per hour.

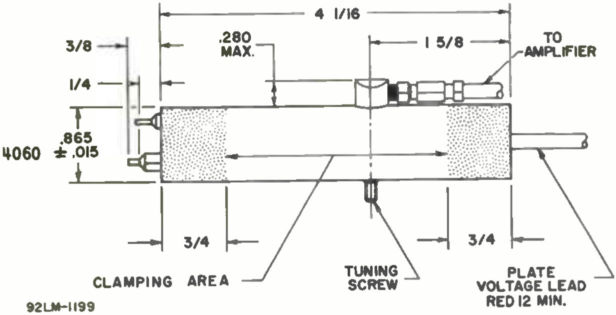
[c] Duty factor is the product of pulse duration and repetition rate. For variable pulse durations and pulse repetition rates, the duty factor is defined as the ratio of the time *"ON"* to total elapsed time in any 2500-microsecond interval.

[d] The ruggedized oscillator-amplifier combination is built to satisfy all AIMS/FAA (Army Integrated Meteorological Systems) requirements.

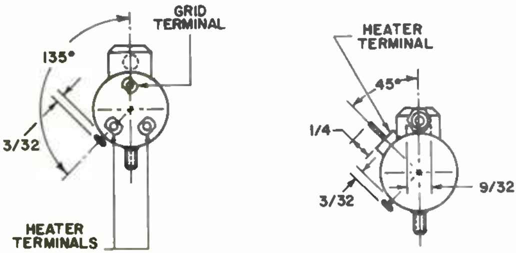
RECOMMENDED GRID-PULSE AMPLIFIER (MODULATOR)



DIMENSIONAL OUTLINES

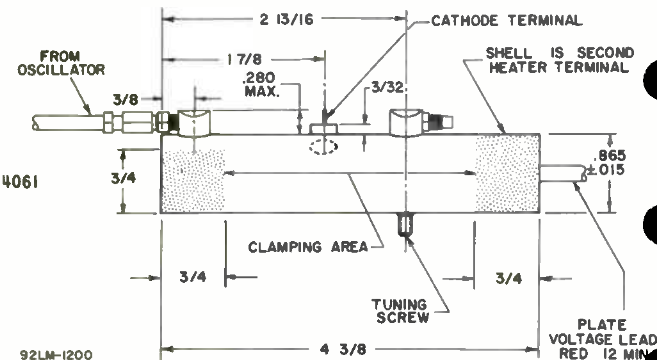


92LM-1199



4060 LEFT SIDE VIEW

4061 LEFT SIDE VIEW



92LM-1200

DIMENSIONS IN INCHES

These units are supplied without the mounting brackets; they are also available with brackets upon request.

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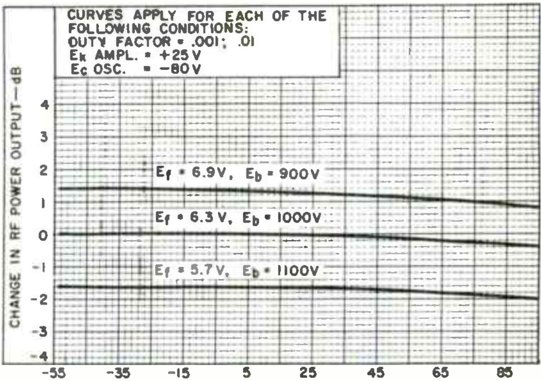
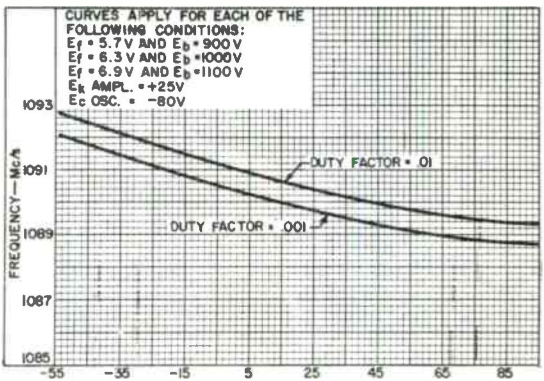
Typical Change in Power Output vs. Temperature



92LS-1204

Typical Output Frequency vs. Temperature



92LS-1203

Beam Power Tube

FORCED-AIR COOLED
CERAMIC-METAL CONSTRUCTION "ONE-PIECE" ELECTRODE DESIGN
COAXIAL-ELECTRODE STRUCTURE INTEGRAL RADIATOR
MATRIX-TYPE, OXIDE-COATED, UNIPOTENTIAL CATHODE

For Voltage-Regulator Applications

GENERAL DATA

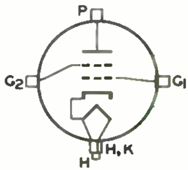
Electrical:

Heater, for Matrix-Type Oxide-Coated Unipotential Cathode:		
Voltage (AC or DC)	5.5 typical 6.0 max.	volts volts
Current at heater volts = 5.5 . . .	17.3	amp
Minimum heating time at heater volts = 5.5.	5	minutes
Mu-Factor, Grid No.2 to Grid No.1, for plate volts = 2500, grid No.2 volts = 600, and plate ma. = 600. .	17	

Mechanical:

Operating Position. . . . . Any
Overall Length. . . . . 3.25"
Diameter. 3.725" ± 0.035"
Radiator. . . . . Integral part of tube
Weight (Approx.). . . . . 2 lbs
Terminal Connections (See *Dimensional Outline*):

G1 - Grid No.1
G2 - Grid No.2
H - Heater



K - Cathode
P - Plate

Thermal:

Terminal Temperature (Plate, grid No.2, grid No.1, cathode, and heater).	250 max.	°C

Air Flow:

Through radiator—Adequate air flow to limit the plate-terminal temperature to 250° C should be delivered by a blower through the radiator before and during the application of heater, plate, grid No.2, and grid No.1 voltages. Typical values of air flow directed through the radiator versus plate dissipation are shown in accompanying *Typical-Cooling-Requirements* curve. Plate power, grid-No.2 power, heater 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 directed at the heater terminal and allowed to flow past each of these terminals so that its temperature does not exceed the specified maximum value of 250° C. An air flow of 10 cfm is usually adequate.

VOLTAGE REGULATOR

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

DC PLATE VOLTAGE.	3500 max.	volts
DC GRID-No.2 VOLTAGE.	1000 max.	volts
DC PLATE CURRENT.	1 max.	amp
GRID-No.2 INPUT	50 max.	watts
PLATE DISSIPATION	1750 max.	watts

CHARACTERISTICS RANGE VALUES

	Min.	*Max.*	
1. Heater Current	16.3	18.2	amp
2. Direct Interelectrode Capacitances:			
Grid No.1 to cathode	37	46	μμf
Grid No.1 to grid No.2	46	62	μμf
Grid No.1 to plate[b].	-	0.17	μμf
Grid No.2 to cathode[c].	-	1.40	μμf
Grid No.2 to plate	14.6	17.8	μμf
Plate to cathode[b,c].	-	0.017	μμf
3. Grid-No.1 Voltage[d] (1)	5	30	volts
4. Grid-No.1 Voltage[e] (2)	5	30	volts
5. Grid-No.2 Current[d] (1)	-15	0	ma
6. Grid-No.2 Current[e] (2)	-30	0	ma
7. Pulse Emission Voltage[f].	-	650	volts

[a] Continuous Commercial Service.

[b] With external, flat, metal shield having diameter of 8", and center hole approximately 3" in diameter provided with spring fingers that connect the shield to grid-No.2 terminal. Shield is located in plane of grid-No.2 terminal perpendicular to the tube axis.

[c] With external, flat, metal shield having diameter of 8", and center hole approximately 2-3/8" in diameter provided with spring fingers that connect the shield to grid-No.1 terminal. Shield is located in plane of grid-No.1 terminal perpendicular to the tube axis.

[d] With dc plate voltage 3500 volts, dc grid-No.2 voltage of 400 volts, grid-No.1-circuit resistance of 30,000 ohms, and dc grid-No.1 voltage adjusted to give a dc plate current of 0.25 ampere.

[e] With dc plate voltage of 600 volts, dc grid-No.2 voltage of 400 volts, grid-No.1-circuit resistance of 30,000 ohms, and dc grid-No.1 voltage adjusted to give a dc plate current of 0.5 ampere.

[f] With grid No.1, grid No.2, and plate tied together; and a pulse-voltage source connected between plate and cathode. The half-sinusoid (Approx.) pulse is 2 microseconds between the two points on the pulse at which the instantaneous value is 50% of the peak value, pulse-repetition frequency is 60 cps, and duty factor is 0.00012. The voltage-pulse amplitude is adjusted until a peak cathode current of 90 amperes is obtained. After 2 minutes at this value, the voltage-pulse amplitude will not exceed 650 volts peak.

SPECIAL TEST

5-to-400 cps Vibration Test:

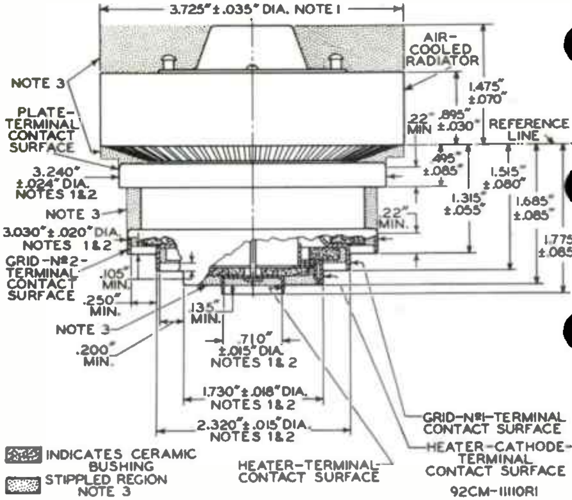
This test is performed on sample lots of tubes to determine the ability of the tube to withstand variable-frequency vibration. With heater voltage of 5.5 volts ac, dc plate supply voltage of 450 volts, dc grid-No.2 supply voltage of 300 volts, and grid-No.1 supply voltage adjusted to give dc plate current of 10 ma. Plate load resistor = 2000 ohms, grid-No.2 resistor = 1000 ohms, and grid-No.1 resistor = 30 ohms. The tube is vibrated along each of three mutually perpendicular axes over a 6-minute sweep consisting of:

(a) 5 to 22 cps with a fixed double amplitude of 0.240 inch ±10%.
(b) 22 to 200 cps at a fixed acceleration of 10 g ± 10%.
(c) 200 to 400 cps at a fixed acceleration of 3 g ± 10%.

At the end of this test, the tubes are required to meet the limits of items 1,3,4,5,6, and 7 under *Characteristics Range Values.*

OPERATING CONSIDERATIONS

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 cannot 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.

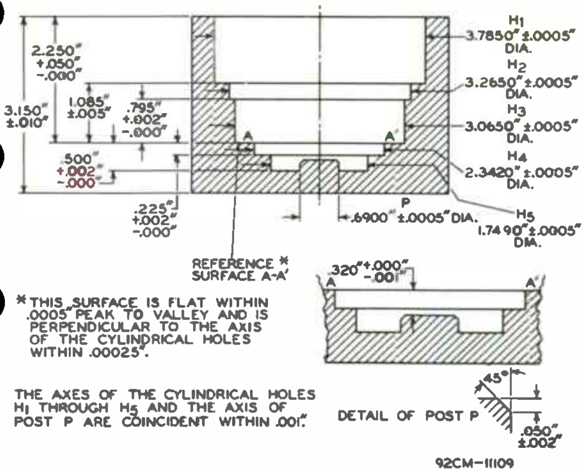


NOTE 1: WITH THE CYLINDRICAL SURFACES OF THE RADIATOR BAND, PLATE TERMINAL, GRID-No.2 TERMINAL, GRID-No.1 TERMINAL, HEATER-CATHODE TERMINAL, AND HEATER TERMINAL CLEAN, SMOOTH, AND FREE OF BURRS, THE TUBE WILL ENTER A GAUGE AS SHOWN IN SKETCH G_1. PROPER ENTRY OF THE TUBE IS OBTAINED WHEN THE GRID-No.2 TERMINAL IS SEATED ON THE SHOULDER A-A'. THE TUBE IS PROPERLY SEATED ON THE SHOULDER WHEN A 0.010"-THICKNESS GAUGE 1/8" WIDE WILL NOT ENTER MORE THAN 1/16" BETWEEN THE SHOULDER SURFACE AND THE GRID-No.2 TERMINAL. THE GAUGE IS PROVIDED WITH SLOTS TO PERMIT MAKING MEASUREMENT OF SEATING OF GRID-No.2 TERMINAL ON SHOULDER A-A'.

NOTE 2: THE DIAMETER OF EACH TERMINAL IS HELD TO INDICATED VALUES ONLY OVER THE INDICATED MINIMUM LENGTH OF ITS CONTACT SURFACE.

NOTE 3: KEEP ALL STIPPLED REGIONS CLEAR. DO NOT ALLOW CONTACTS OR CIRCUIT COMPONENTS TO PROTRUDE INTO THESE ANNULAR VOLUMES.

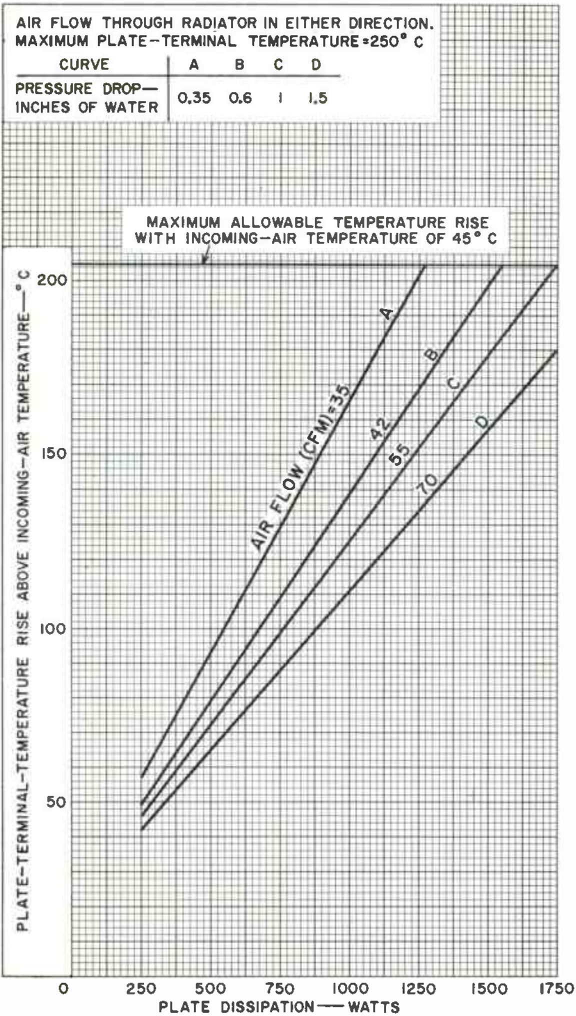
SKETCH G_1



* THIS SURFACE IS FLAT WITHIN .0005" PEAK TO VALLEY AND IS PERPENDICULAR TO THE AXIS OF THE CYLINDRICAL HOLES WITHIN .00025".

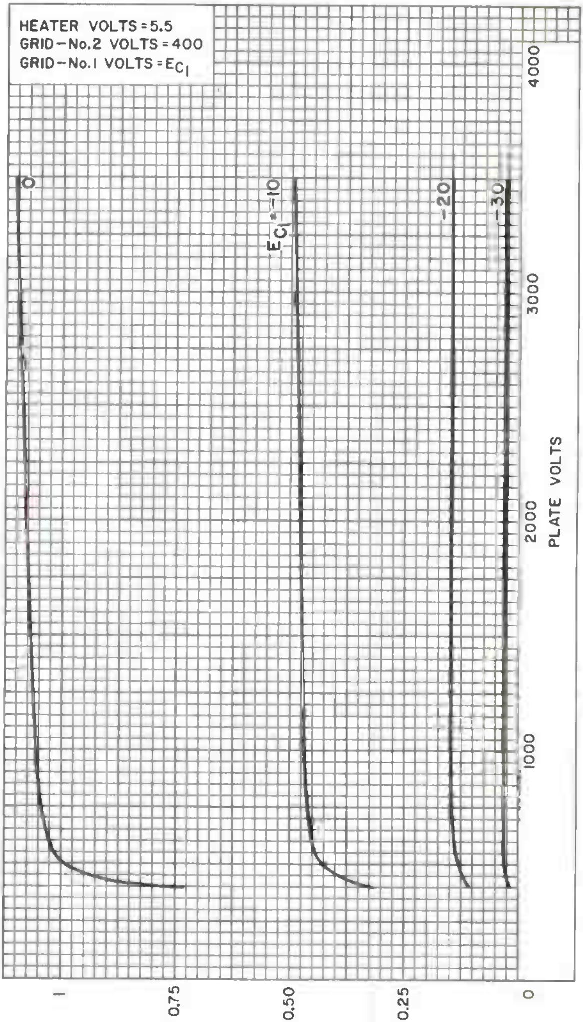
THE AXES OF THE CYLINDRICAL HOLES H_1 THROUGH H_5 AND THE AXIS OF POST P ARE COINCIDENT WITHIN .001".

TYPICAL COOLING REQUIREMENTS

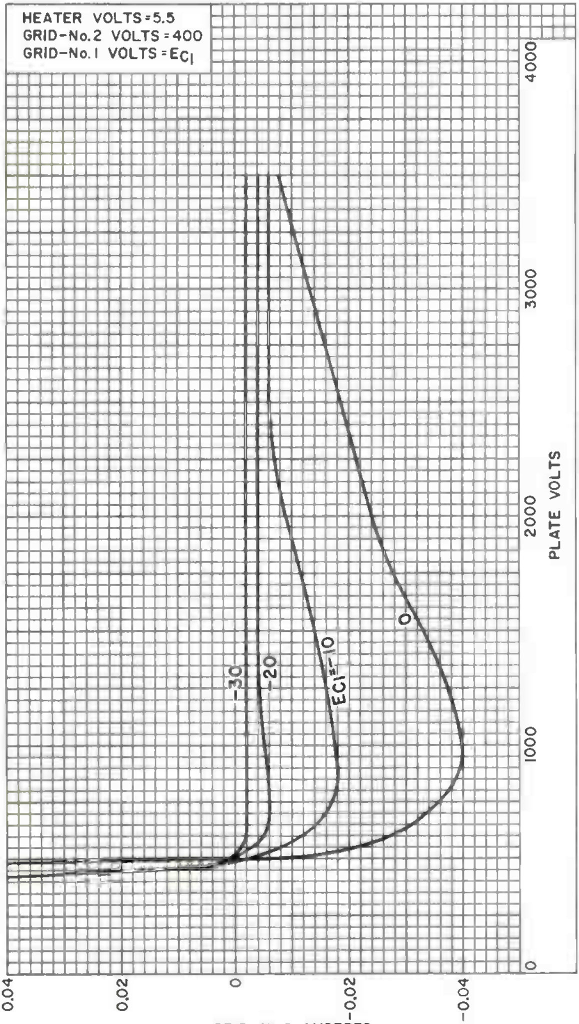


92CM-11100

TYPICAL PLATE CHARACTERISTICS



TYPICAL CHARACTERISTICS



92CM-11103

Beam Power Tube

QUICK-HEATING FILAMENT
90 WATTS CW INPUT (ICAS) UP TO 60 Mc
60 WATTS CW INPUT (ICAS) AT 175 Mc

For Use in Push-to-Talk Mobile and Emergency-Communications Equipment as an RF Power-Amplifier Tube

GENERAL DATA

Electrical:

Filament, Coated:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.65	amp
Heating time	1	sec
Transconductance, for plate volts = 200, grid-No.2 volts = 200, and plate ma. = 100	6000	μmhos
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 200, grid-No.2 volts = 200, and plate ma. = 100	4	
Direct Interelectrode Capacitances:		
Grid No.1 to plate	0.24 max.	μμf
Grid No.1 to filament & grid No.3 & internal shield, grid No.2, and base sleeve	11	μμf
Plate to filament & grid No.3 & internal shield, grid No.2, and base sleeve	8.5	μμf

Mechanical:

Operating Position	Vertical, base down or up, or Horizontal with pins 3 and 7 in vertical plane
Maximum Overall Length	3-13/16"
Seated Length	3-1/8" ± 1/8"
Maximum Diameter	1-21/32"
Bulb	T12
Cap	Small (JEDEC No.C1-1)
Socket	Standard Octal 8-Contact
Base	Small Wafer Octal 8-Pin with "770" Sleeve (JEDEC Group 1, No.B8-150)
Basing Designation for BOTTOM VIEW	7CL

Pin 1 - Filament Tap, Grid No.3, Internal Shield
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

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

Maximum ICAS● Ratings, *Absolute-Maximum Values:*

	Up to 60 Mc	
DC PLATE VOLTAGE	750 max.	volts
DC GRID-No.2 VOLTAGE	250 max.	volts
DC GRID-No.1 VOLTAGE	-150 max.	volts
DC PLATE CURRENT	150 max.	ma
DC GRID-No.1 CURRENT	4 max.	ma
PLATE INPUT	90 max.	watts
GRID-No.2 INPUT	3 max.	watts
PLATE DISSIPATION	25 max.	watts
BULB TEMPERATURE (At hottest point on bulb surface)	220 max.	°C

Typical Operation:

	As amplifier at 175 Mc	
DC Plate Voltage	400	volts
DC Grid-No.2 Voltage*	190	volts
From a series resistor of	18000	ohms
DC Grid-No.1 Voltage♦	-60	volts
From a grid resistor of	30000	ohms
DC Plate Current	150	ma
DC Grid-No.2 Current	11	ma
DC Grid-No.1 Current (Approx.)	2	ma
Driving Power (Approx.)	4.5	watts
Power Output (Approx.)	30	watts

Maximum Circuit Values:

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

▲ 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.

● 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 4604 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, or by combination methods.

♠ When grid No.1 is driven positive and the 4604 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 fixed supply.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Min.	*Max.*	
Filament Current at 6.3 volts ac	0.59	0.71	amp

Direct Interelectrode Capacitances:			
Grid No.1 to plate	–	0.24	μμf
Grid No.1 to filament & grid No.3 & internal shield, grid No.2, and base sleeve	9.5	12.5	μμf
Plate to filament & grid No.3 & internal shield, grid No.2, and base sleeve	7.3	9.5	μμf
Plate Current♠	46	94	ma
Grid-No.2 Current♠	–	5.5	ma
Useful Power Output♣	47	–	watts

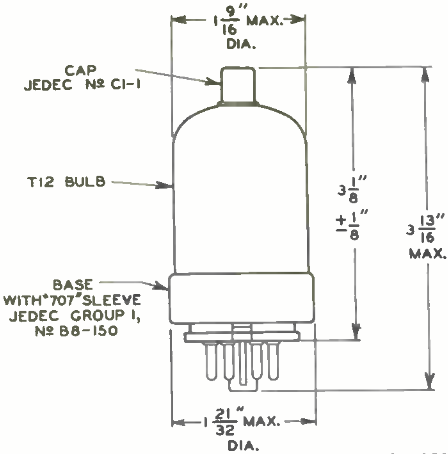
♠ With 6.3 volts ac on filament, dc plate voltage of 300 volts, dc grid-No.2 voltage of 200 volts, and dc grid-No.1 voltage of -26 volts.

♣ In a single-tube, self-excited-oscillator circuit, and with 6.3 volts ac on filament, dc plate voltage of 600 volts, dc grid-No.2 voltage of 200 volts, grid-No.1 resistor of 30,000 ± 10% 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.

OPERATING CONSIDERATIONS

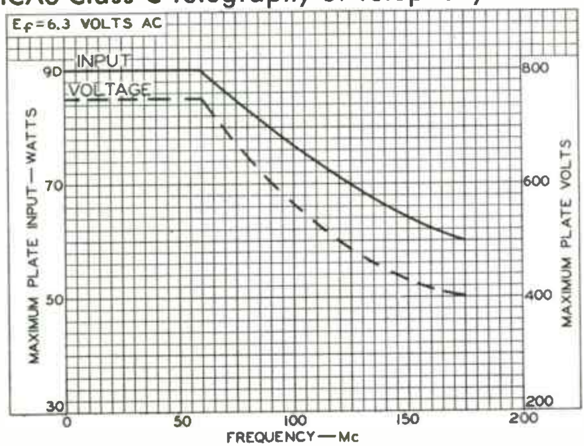
The *bulb* becomes hot during operation. To insure adequate cooling, therefore, it is essential that free circulation of air be provided around the 4604.

The *plate* shows no color when the 4604 is operated at full ratings under ICAS conditions. Connections to the plate should be made with a flexible lead to prevent any strain on the seal at the cap.



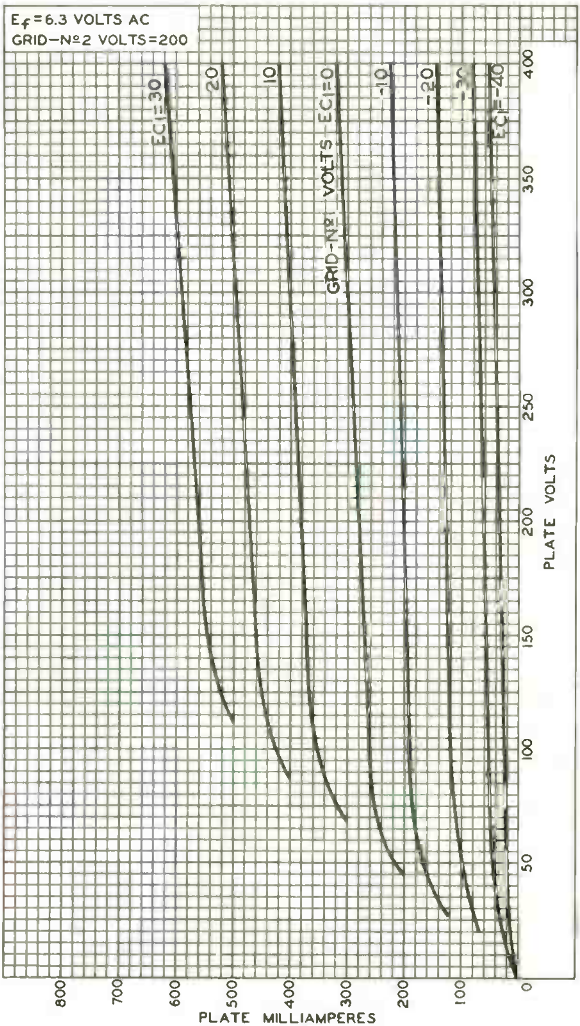
92CS-9625R3

RATING CHART
ICAS Class-C Telegraphy or Telephony Service.



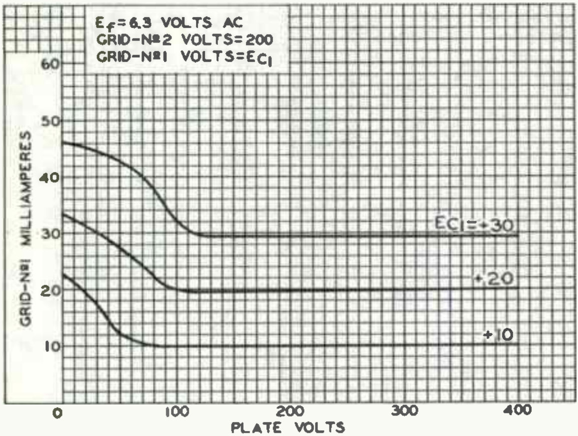
92CS-10817R1

TYPICAL PLATE CHARACTERISTICS

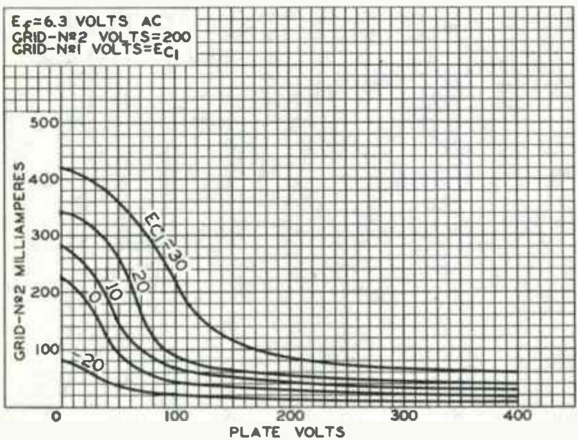


92CM-10813

TYPICAL CHARACTERISTICS



92CS-10814



92CS-10816

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:

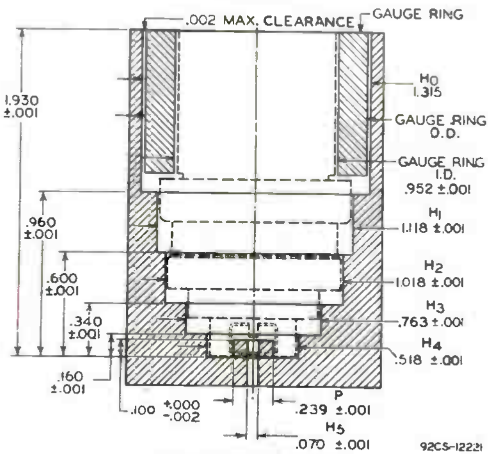
Socket:
For use at frequencies higher than 400 Mc. . . . . See *Mounting Arrangement*

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.

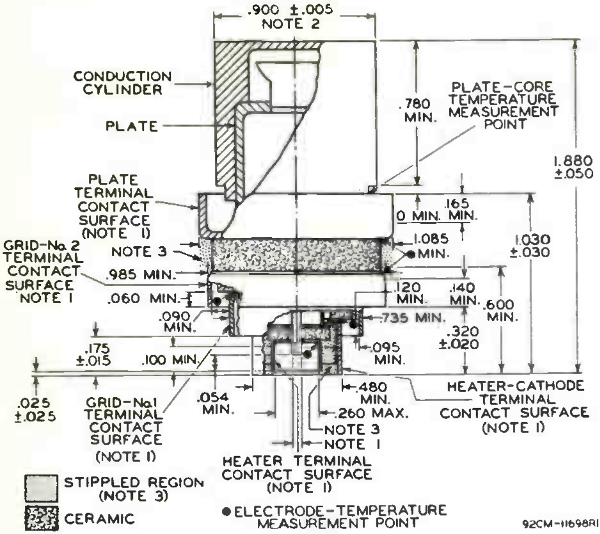
SKETCH G_1



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".



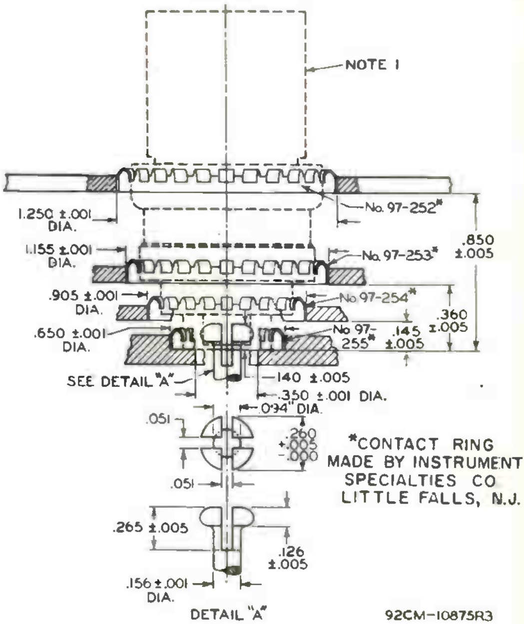
DIMENSIONS IN INCHES

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

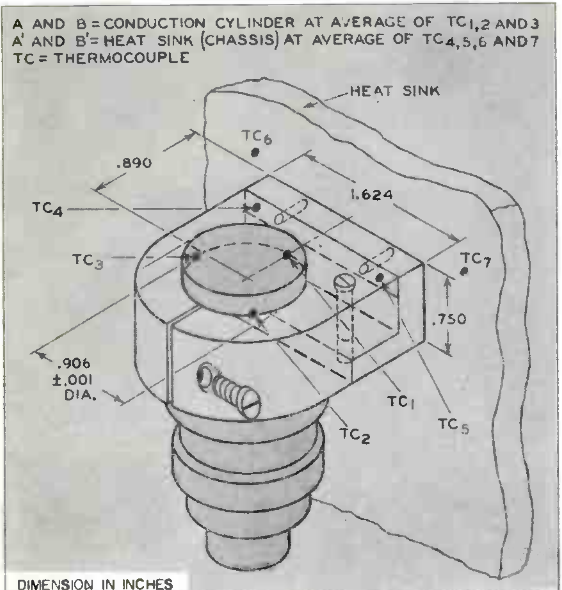


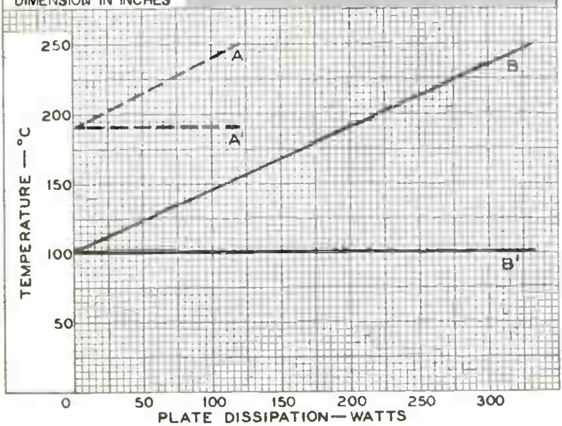
DIMENSIONS IN INCHES

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

Super-Power Beam Power Tube

2-MW SHORT-PULSE POWER, 275-kW LONG-PULSE POWER

PULSE LENGTH TO 2500 MICROSECONDS

LOW FILAMENT POWER FOR AIRBORNE USE

WATER COOLED

For RF-Pulse Power Amplifier at Frequencies from 195 to 600 MHz in Search Radar, Telemetry, and Particle Accelerator Service.

ELECTRICAL

Filamentary Cathode, Multistrand, Matrix-Type, Oxide-Coated—		
Voltage:[a,j]		
Maximum, with dc or 60-Hz ac excitation . .	1.00	V
Maximum, with 400-Hz ac excitation.	1.05	V
Typical, with dc or 60-Hz ac excitation . .	0.95	V
Current:		
Typical operation value at 0.95 volt, with 60-Hz excitation	495	A
Minimum time to reach operating filament voltage.	30	s
Minimum time at normal operating filament voltage before other voltages are applied.	90	s
Mu-Factor, Grid No.2 to Grid No.1.	7	
Direct Interelectrode Capacitances		
Grid No.1 to plate.	0.15 max	pF
Grid No.1 to grid No.2 and cathode.	500	pF
Plate to cathode and grid No.2.	30	pF
Grid No.2 to cathode (including bypass capacitors).	18000 max	pF

MECHANICAL

Operating Position	Tube axis vertical, either end up	
Overall Length	8.62 ± 0.31	in
Maximum Diameter	11.25	in
Weight (Approx.)	38	lb
Terminal Connections	See *Dimensional Outline*	

THERMAL[k,m]

Ceramic-Insulator Temperature.	150 max	°C
Metal-Surface Temperature.	100 max	°C
Minimum Storage Temperature[k]	-65 min	°C

Water Flow

	Typ. Flow g/m	*Absolute Min. Flow g/m*	*Max. Pressure Differential for Typ. Flow*[b] *psi*
Through filament block. . . .	1.2	0.8	18
Through dc cathode block . . .	1.2	0.8	18
Through grid-No.1 block . .	1.2	0.8	14
Through grid No.2 block . .	1.2	0.8	18

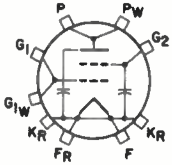
Water Flow (cont'd)

	Typ. Flow g/m	*Absolute Min. Flow g/m*	*Max. Pressure Differential for Typ. Flow*[b] *psi*
Through plate:			
For plated dissipations up to 10 kW (Average) . .	14	12	30
For plate dissipations of 10 kW to 30 kW (Average).	22	20	60

Resistivity of water at 25°C	1 min	MΩ-cm
Water Temperature from any outlet. . . .	70 max	°C
External Gas Pressure[c]	60 max	psi
Water Pressure at an Inlet	100 max	psi

TERMINAL DIAGRAM (Bottom View)

F – Insulated Filament Terminal and Coolant Connection
FR – Uninsulated Filament Terminal for DC Circuit Returns and Coolant Connection
G1 – RF Grid-No.1 Terminal Contact Surface
G1W – DC Grid-No.1 and Coolant Connection
G2 – DC Grid-No.2 and Coolant Connection
KR – RF Cathode Terminal Contact Surface for Circuit Returns
P – RF Plate Terminal Contact Surface
PW – DC Plate and Coolant Connection



PULSED RF AMPLIFIER[n]

For frequencies from 195 to 600 MHz and a maximum "ON" time as specified in any 25000-microsecond interval

Absolute-Maximum Ratings

"ON" time	*15 µs*	*2500 µs*	
Peak Positive-Pulse Plate Voltage[d]	55	–	kV
DC Plate Voltage[e].	25	25	kV
Peak Positive-Pulse Grid-No.2 Voltage[f,g] . .	2.2	2.2	kV
DC or Peak Negative-Pulse Grid-No.1 Voltage.	400	400	V
Peak Plate Current	80	30	A
Peak Grid-No.2 Current	15	2	A
Peak Rectified Grid-No.1 Current	15	2	A
DC Plate Current	0.32	2.5	A
DC Grid-No.2 Current	0.06	0.2	A
DC Grid-No.1 Current	0.06	0.2	A

Absolute-Maximum Ratings (cont'd)

"ON" time	15 µs	2500 µs
Plate Input (Average)	16	70 kW
Plate Dissipation (Average)	8	30 kW

Typical Plate-Pulsed Operation

In Class B service at 425 MHz with a rectangular waveshape pulse of 13 microseconds and a duty factor of 0.004

Peak Positive-Pulse Plate Voltage[d]	50	kV
Peak Positive Pulse Grid-No.2 Voltage[f]	2.1	kV
Peak Negative-Pulse Grid-No.1 Voltage[h]	325	V
Peak Plate Current	75	A
Peak Grid-No.2 Current	8	A
Peak Rectified Grid-No.1 Current	10	A
DC Plate Current	0.3	A
DC Grid-No.2 Current	0.03	A
DC Grid-No.1 Current	0.04	A
Peak Driver Power Output (Approx.)	20	kW
Useful Peak Power Output	2	MW

Typical Grid-Pulsed Operation

In Class B service at the frequencies shown with a rectangular waveshape pulse of 2000 microseconds and a duty factor of 0.06

	At 425 Hz	At 600 Hz	
DC Plate Voltage[e]	20	21	kV
Peak Positive-Pulse Grid-No.2 Voltage[f]	2	2	kV
Peak Negative-Pulse Grid-No.1 Voltage[h]	350	350	V
Peak Plate Current	27	26	A
Peak Grid-No.2 Current	1.6	1.6	A
Peak Rectified Grid-No.1 Current	1.2	1.2	A
DC Plate Current	1.62	1.56	A
DC Grid-No.2 Current	0.096	0.096	A
DC Grid-No.1 Current	0.072	0.072	A
Peak Driver Power Output (Approx.)	2.7	2.7	kW
Useful Peak Power Output	275	250	kW

Maximum Circuit Value

Grid-No.1 Circuit Resistance	500	Ω

[a] Because the filament voltage, when operated near the maximum value, provides emission in excess of any requirements within tube ratings, during life the filament voltage should be reduced to a value that will give adequate but not excessive emission. Careful attention to maintaining the value consistent with adequate emission will result in conserving the life of the tube. The filament voltage should be measured at the respective liquid coolant connections on the tube side of the threads. This procedure is essential for accurate measurement of the filament voltage. At 400 cycles some heating of the filament leads and rf cathode terminal (cathode heater) occurs; this condition is not detrimental to tube operation or tube life.

[b] Measured directly across cooled element for the indicated typical flow.

[c] This pressure is related to the output-cavity pressurization as required to prevent corona or external arc-over.

[d] The magnitude of any spike on the plate voltage pulse should not exceed its peak value by more than 4000 volts, and the duration of any spike when measured at the peak-value level should not exceed 10% of the maximum "ON" time. The output cavity must be pressurized as required to prevent corona or external arc-over at the ceramic insulator.

[e] High speed "fault" protection must be used with all grid-pulsed applications and with all plate-pulsed applications where the pulse length exceeds 20 microseconds.

f The magnitude of any spike on the grid-No.2 voltage pulse should not exceed its peak value by more than 250 volts, and the duration of any spike when measured at the peak-value level should not exceed 10% of the maximum "ON" time.

g A negative dc voltage of 300 volts maximum may be applied to grid No.2 to prevent any tube conduction between pulses.

h The grid-No.1 voltage may be a combination of fixed and self bias obtained from a series grid resistor.

The following footnotes apply to the *RCA Transmitting Tube Operating Considerations* given at front of this section.

j See *Electrical Considerations* - Filament or Heater

k See *Cooling Considerations* - Liquid Cooling

m See *Cooling Considerations* - Forced-Air Cooling

n See *Classes of Service.*

CHARACTERISTICS RANGE VALUES

	Note	*Min*	*Max*	
Filament Current	1	460	530	A
Input Strap-Resonant Frequency . . .	-	230	250	MHz
Output Strap-Resonant Frequency. . .	-	240	260	MHz
Direct Interelectrode Capacitances				
Grid No.1 to plate	2	-	0.15	pF
Grid No.2 to cathode	-	12000	18000	pF

Note 1: At filament voltage of 0.95 volt and ac filament excitation at 60 Hz.

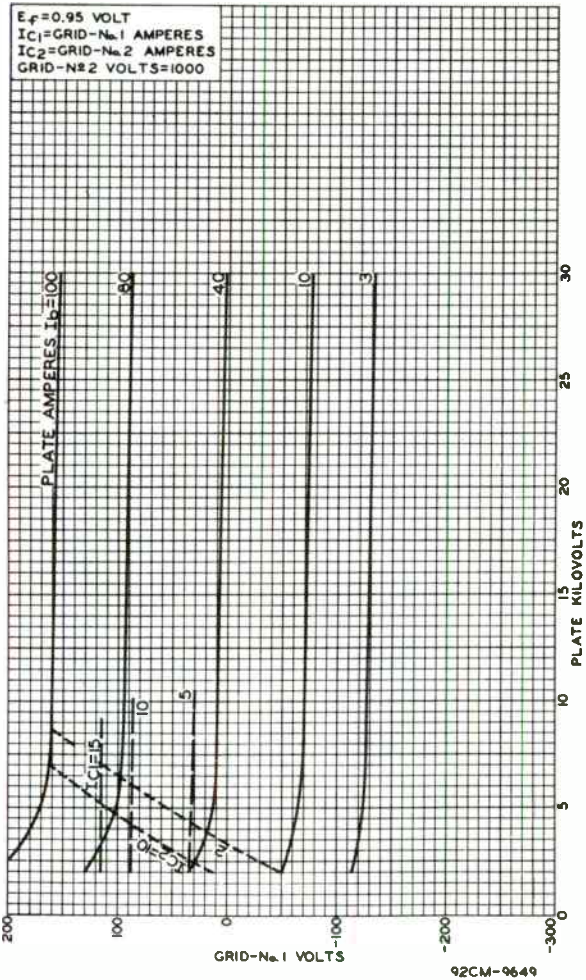
Note 2: Measured with special shield adapter.

FOR ADDITIONAL INFORMATION ON THIS TYPE, WRITE FOR TECHNICAL BULLETIN AND APPLICATION GUIDE FOR RCA SUPER POWER TUBES, ICE-279A AVAILABLE FROM:

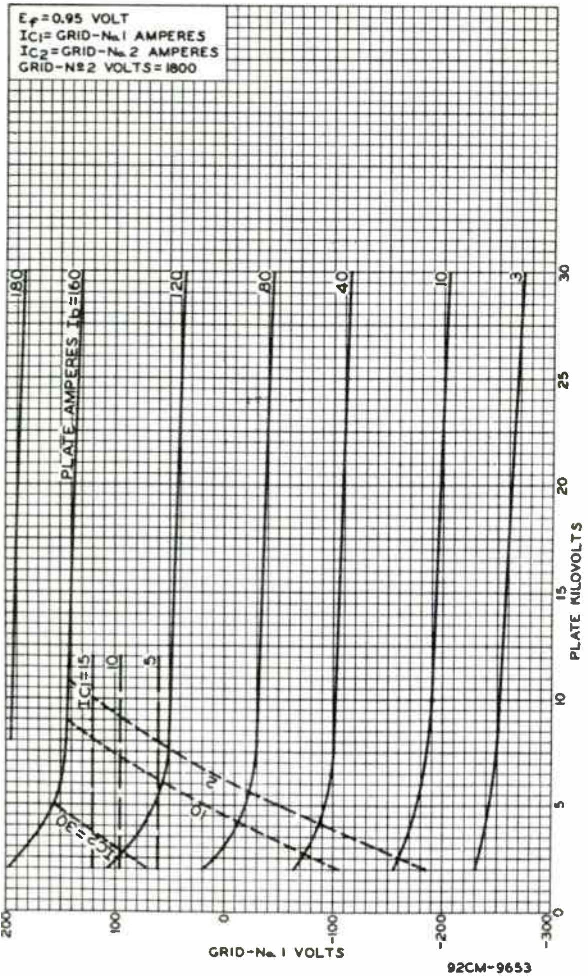
Commercial Engineering
Electronic Components and Devices
Radio Corporation of America
Harrison, New Jersey

Typical Constant-Current Characteristics

FOR GRID-No.2 VOLTAGE = 1000 VOLTS

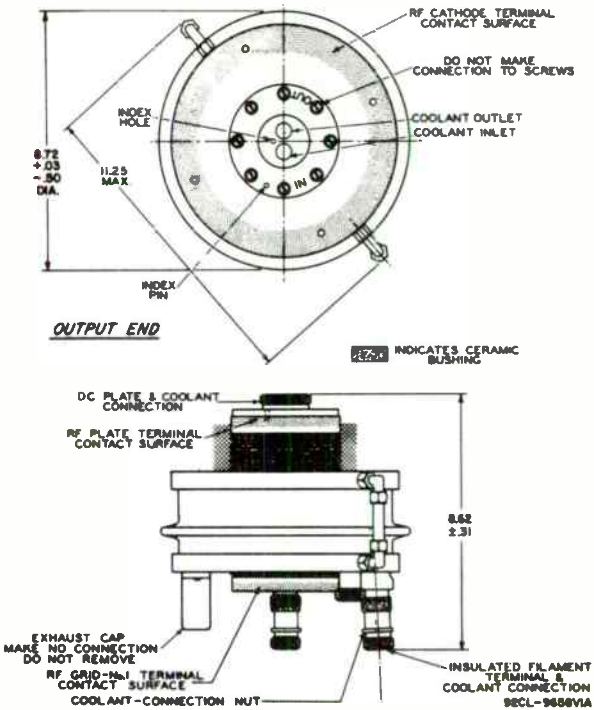


Typical Constant-Current Characteristics
FOR GRID-No.2 VOLTAGE = 1800 VOLTS



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

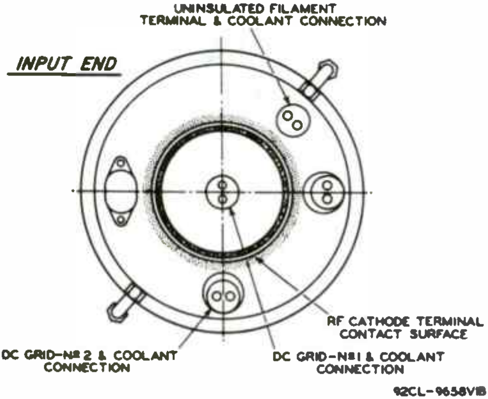
SIMPLIFIED DIMENSIONAL OUTLINE[9]



DIMENSIONS IN INCHES

[9] A detailed Dimensional Outline and associated Gauge Drawings are given in the Technical Bulletin available upon request.

UNINSULATED FILAMENT
TERMINAL & COOLANT CONNECTION



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

Super-Power Beam Power Tube

2-MW SHORT-PULSE POWER, 275-kW LONG-PULSE POWER
PULSE LENGTH TO 2500 MICROSECONDS

LOW FILAMENT POWER WATER COOLED FOR AIRBORNE USE

For RF-Pulse Power Amplifier Frequencies from 195 to 600 MHz

The 4616V1 *is the same as the* 4616 *except the* 4616V1 *does not have a water separator.*

Super-Power Triode

8 MEGAWATTS OF PEAK POWER OUTPUT AT 425 MHz

MATRIX-OXIDE-TYPE CATHODE
LIQUID COOLED

DOUBLE-ENDED TERMINAL CONFIGURATION FOR SYMMETRICAL CIRCUITRY

For RF Power Amplifier in Pulse Service at Frequencies up to 450 MHz

ELECTRICAL

Filamentary Cathode, Multistrand, Matrix-Oxide-Type[k]—

Current (DC):		
Typical operating value	1800	A
Maximum value[a]	2000	A
Maximum value for starting, even momentarily	2000	A
Minimum time to reach operating current	30	s
Minimum time at normal operating current before plate voltage is applied	60	s
Voltage (DC):[b]		
Typical value required to obtain 1800 amperes	1.5	V
Direct Interelectrode Capacitances		
Grid to plate	160	pF
Grid to cathode	1500	pF
Plate to cathode	Less than 1.0	pF

MECHANICAL

Operating Position	Tube axis vertical, either end up
Overall Length	17 max in
Maximum Width	24 max in
Weight	
Uncrated	190 lb
Crated	355 lb
Terminal Connections	(See *Dimensional Outline*)

THERMAL[m,n]

Ceramic-Insulator Temperature	150 max	°C
Metal-Surface Temperature	100 max	°C
Minimum Storage Temperature	-65 min	°C

Water Flow

	Typ. Flow g/m	*Absolute Min. Flow g/m*	*Max. Pressure Differential for Typ. Flow[c] psi*
To plate:			
Total flow for two parallel input and output coolant courses:			
For plate dissipation up to 50 kW (Average)	40	35	4
For plate dissipation of 150 kW (Average)	100	90	25

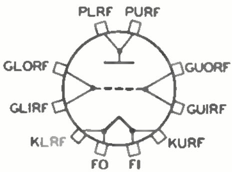
Water Flow (con'd)

	Typ. Flow *g/m*	*Absolute Min. Flow* *g/m*	*Max. Pressure Differential for Typ. Flow*[c] *psi*
To upper grid coolant course	3	2	25
To lower grid coolant course	3	2	25
To grid-cathode coolant course	12	10	6

Resistivity of water at 25°C:		
Through plate and grid coolant courses	1 min	MΩ-cm
Through grid-cathode coolant course	5 min	MΩ-cm
Water temperature from any outlet	70 max	°C
External gas pressure[d,e]	65 max	psig
Maximum watter pressure at any inlet	90 max	psig

TERMINAL DIAGRAM (Bottom View)

FI – Filament Terminal (Inner)
FO – Filament Terminal (Outer)
KURF – Upper RF Cathode Terminal
KLRF – Lower RF Cathode Terminal
GUIRF – Upper RF Grid Input Terminal
GUORF – Upper RF Grid Output Terminal
GLIRF – Lower RF Grid Input Terminal
GLORF – Lower RF Grid Output Terminal
PLRF – Lower RF Plate Terminal
PURF – Upper RF Plate Terminal



PULSED RF AMPLIFIER[p]

Absolute-Maximum Ratings

For a maximum "ON" time of 25 microseconds in any 2500-microsecond interval, for frequencies up to 450 MHz

Peak Positive-Pulse Plate Voltage[f]	40	kV
Peak Negative Grid Voltage	200	V
Peak Plate Current	500	A
Peak Cathode Current[g]	750	A
DC Plate Current	5	A
DC Cathode Current[g]	7.5	A
Plate Input (Average)	200	kW
Plate Dissipation (Average)	150	kW

Typical Plate-Pulsed Operation
With Rectangular Wave Shape in Cathode-Drive Circuit

With duty factor of 0.01 and pulse duration of 25 microseconds

	At 425 MHz		
Peak Positive-Pulse Plate-to-Grid Voltage[f,h]	30000	35000	V
Peak Cathode-to-Grid Voltage[h]	60	70	V
Peak Plate Current	310	400	A
Peak Cathode Current[g]	525	680	A
DC Plate Current	3.1	4	A
DC Cathode Current[g]	5.2	6.8	A

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

Peak Driver Power Output[j]	250	350	kW
Useful Peak Power Output.	5	8	MW

[a] The specified maximum filament current is a maximum rating which should not be exceeded, even momentarily, during operation of the tube. The life of the tube can be conserved by operating the filament at the lowest current which will enable the tube to provide the desired power output. Because the filament when operated near the maximum value usually provides emission in excess of any requirements within the tube ratings, the filament current should be reduced to a value that will give adequate but not excessive emission for any particular application. Good regulation of the filament current is, in general, economically advantageous from the viewpoint of tube life.

[b] Measured between KLRF and KURF (See *Terminal Diagram*).

[c] Measured directly across cooled element for the indicated typical flow.

[d] This pressure is related to the output-cavity pressurization when required to prevent corona or external flash-over.

[e] With the gauge located in an area where the maximum pressure external to the gauge is one atmosphere absolute.

[f] The magnitude of any spike on the plate voltage pulse should not exceed its peak value by more than 10%, and the duration of any spike when measured at the peak-value level should not exceed 5% of the pulse duration.

[g] Peak or average cathode current is the total of the peak or average plate current and the peak or average rectified grid current. (Pulses may not be coincident, hence they may not necessarily be added directly).

[h] Preferably obtained from a cathode bias resistor.

[j] The driver stage is required to supply tube losses, rf circuit losses, and rf power added to the plate circuit. 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.

The following footnotes apply to the *RCA Transmitting Tube Operating Considerations* given at the front of this section.

[k] See *Electrical Considerations* - Filament or Heater.

[m] See *Cooling Considerations* - Forced-Air Cooling.

[n] See *Cooling Considerations* - Liquid Cooling.

[p] See *Classes of Service*.

CHARACTERISTICS RANGE VALUES

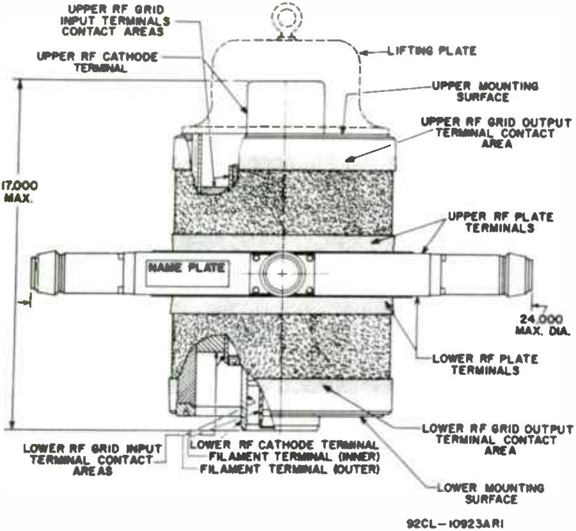
	Note	*Min*	*Max*	
Filament Voltage.	1	1	1.8	V
Input Strap-Resonant Frequency.	-	90	120	MHz
Output Strap-Resonant Frequency	-	240	280	MHz
Direct Interelectrode Capacitances				
Grid to plate	-	120	180	pF
Grid to cathode	-	1250	1700	pF

Note 1: With 1800 amperes through filament.

FOR ADDITIONAL INFORMATION ON THIS TYPE, WRITE FOR TECHNICAL BULLETIN AND APPLICATION GUIDE FOR RCA SUPER POWER TUBES, ICE-279A AVAILABLE FROM:

Commercial Engineering
Electronic Components and Devices
Radio Corporation of America
Harrison, New Jersey

SIMPLIFIED DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

A detailed Dimensional Outline and associated Gauge Drawings are given in the Technical Bulletin available upon request.

Beam Power Tube

FORCED-AIR COOLED
INTEGRAL RADIATOR
MATRIX-TYPE CATHODE

UHF GRID-DRIVE OPERATION
300 WATTS UHF TV OUTPUT AT 890 Mc
410 WATTS PEP OUTPUT AT 30 Mc
DISTRIBUTED AMPLIFIER SERVICE TO 500 Mc

For Use as an RF Power Amplifier in Television and Single-Sideband Suppressed-Carrier Service and as a Broadband UHF Amplifier in Mobile and Stationary Equipment.

Electrical:

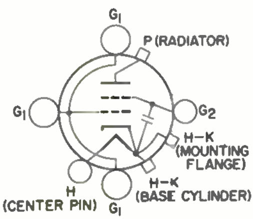
Unipotential Cathode, Matrix-Type[b]:		
Voltage (AC or DC)	6.3	volts
Current at heater volts = 6.3	3.5	amp
Minimum heating time	60	sec
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 450, grid-No.2 volts = 325 and plate amperes = 1.2	12	
Direct Interelectrode Capacitances:		
Grid No.1 to plate	0.062 max.	pf
Grid No.1 to cathode	20	pf
Plate to cathode	6.2 max.	pf
Grid No.1 to grid No.2	19	pf
Grid No.2 to plate	2.2	pf
Grid No.2 to cathode	590 max.	pf

Mechanical:

Operating Position	Any
Maximum Overall Length	2.19"
Maximum Diameter	2.262"
Weight (Approx.)	4.5 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:

Terminal Temperature (Plate, grid No.2, grid No.1, cathode-heater, and heater) . . .	250 max.	°C
Plate-Core Temperature	250 max.	°C

Air Flow[c]:

Through radiator — Adequate air flow to limit the radiator core temperature to 250° C should be delivered by a blower through the radiator before and during the application of plate, grid-No.2, and grid-No.1 voltages.

To Plate, Grid-No.2, Grid-No.1, Cathode, and Heater Terminals — A sufficient quantity of air should be directed at the heater terminal and allowed to flow past each of these terminals so that their temperature does not exceed the specified maximum value of 250° C.

During Standby Operation — Cooling air is required when heater voltage is applied to the tube.

During Shutdown Operation — Air flow should continue for a few minutes after all electrode power is removed.

RF POWER AMPLIFIER — Class B Television Service[d]

Synchronizing-level conditions per tube unless otherwise specified

Maximum CCS Ratings, *Absolute-Maximum Values:*

DC Plate Voltage	2200	volts
DC Grid-No.2 Voltage	400	volts
DC Plate Current	375	ma
DC Grid-No.1 Current	100	ma
Grid-No.2 Input	8	watts
Plate Dissipation	400	watts

Typical CCS Operation in Grid-Drive Circuit:

For frequency of 890 Mc and Bandwidth of 8.5 Mc

DC Plate Voltage	2000	volts
DC Grid-No.2 Voltage	400	volts
DC Grid-No.1 Voltage	−55	volts
DC Plate Current:		
Synchronizing level	350	ma
Pedestal level	260	ma
DC Grid-No.2 Current:		
Synchronizing level	1.3	ma
Pedestal level	1	ma
DC Grid-No.1 Current:		
Synchronizing level	0	ma
Pedestal level	0	ma
Driver Power Output:		
Synchronizing level	30	watts
Pedestal level	17	watts
Output Circuit Efficiency	80	%
Useful Power Output:		
Synchronizing level	300	watts
Pedestal level	170	watts

LINEAR RF POWER AMPLIFIER[d]

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:*

DC Plate Voltage	2200	volts
DC Grid-No.2 Voltage	400	volts
DC Grid-No.1 Voltage	−100	volts

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DC Plate Current at Peak of Envelope	450[a]	ma
DC Grid-No. 1 Current	100	ma
Grid-No. 2 Input	8	watts
Plate Dissipation	400	watts

Maximum Circuit Values:

Grid-No. 1 Circuit Resistance	30000	ohms
Grid-No. 2-Circuit Impedance		See *Note* [e]
Plate-Circuit Impedance		See *Note* [f]

Typical CCS Operation with "Two-Tone Modulation":

	At 30 Mc	
DC Plate Voltage	2000	volts
DC Grid-No. 2 Voltage	400	volts
DC Grid-No. 1 Voltage	-44	volts
Zero-Signal DC Plate Current	100	ma
Effective RF Load Resistance	3200	ohms
DC Plate Current at Peak of Envelope	335	ma
Average DC Plate Current	250	ma
DC Grid-No. 2 Current at Peak of Envelope	20	ma
Average DC Grid-No. 2 Current	13	ma
DC Grid-No. 1 Current	0	ma
Peak-of-Envelope Driver Power Output (Approx.)	0.3	watt
Output-Circuit Efficiency (Approx.)	92	%
Distortion Products Level:		
Third order	30	db
Fifth order	34	db
Useful Power Output (Approx.):		
Average	205	watts
Peak of envelope	410	watts

[a] 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.

[b] See *Electrical Considerations*—Filament or Heater

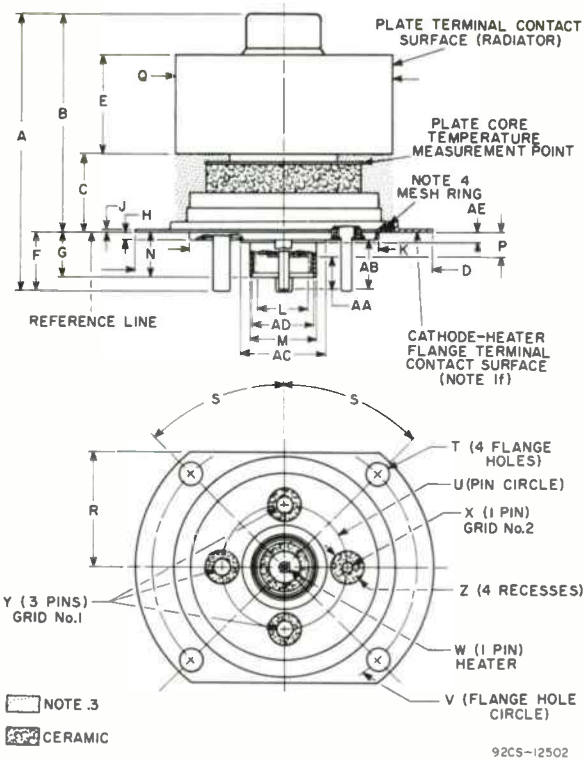
[c] See *Cooling Considerations*—Forced-Air Cooling

[d] See *Classes of Service*

[e] See *Electrical Considerations*—Grid-No. 2 Voltage Supply

[f] See *Electrical Considerations*—Plate Voltage Supply

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

A - 2.19 max.
B - 1.660 ± 0.060
C - 0.610 ± 0.040
D - 2.262 max. dia.
E - 0.710 min.
F - 0.470 max.
G - 0.355 max.
H - 0.065 max.
J - 0.024 max.
K - 1.435 max. dia. Note 1a
L - 0.400 min. dia.
M - 0.500 ± 0.010 Note 1d
N - 0.300 max.
P - 0.200 max.
Q - 1.625 ± 0.015 dia. Note 1e
R - 0.885 max.
S - 45° ± 5°
T - 0.175 ± 0.005 dia.
U - 0.939 dia.
V - 2.000 dia.
W - 0.081 ± 0.002 dia. Note 2b
X - 0.081 ± 0.002 dia. Note 2c
Y - 0.126 ± 0.002 dia. Note 2a
Z - 0.245 min. dia.
AA - 0.200 min.
AB - 0.325 min.
AC - Note 1b
AD - Note 1c
AE - 0.085 max.

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Note 1: Concentricity between the various diameters on the major tube axis is such that the tube will enter a gauge having suitably spaced concentric apertures and posts of the following diameters:

(a) Base seat—1.500

(b) Flared flange of cathode-heater cylinder terminal—0.680

(c) Cathode-heater cylinder terminal (ID)—0.400

(d) Cathode-heater cylinder terminal (OD)—0.525

(e) Radiator—1.660

(f) Cathode-heater flange terminal contact surface—1.760

Note 2: Concentricity of the base pins is such that the tube will enter the gauge in Note 1 having suitably spaced apertures of the following diameters:

(a) Grid-No.1 pins—0.1450

(b) Heater pin—0.0830 (.123 Dia x 82° CSK.)

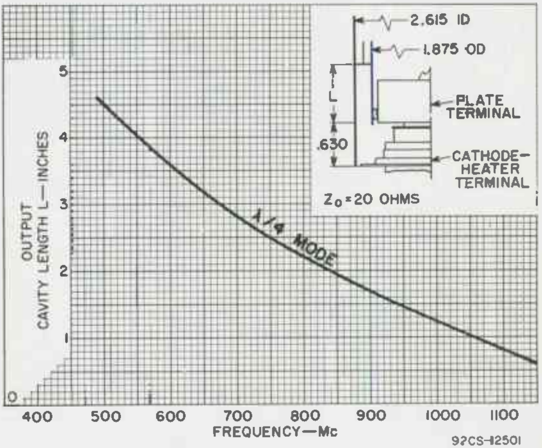
(c) Grid-No.2 pins—0.0930

Note 3: Keep all stippled regions clear. Do not allow contacts or circuit components to protrude into these annular regions.

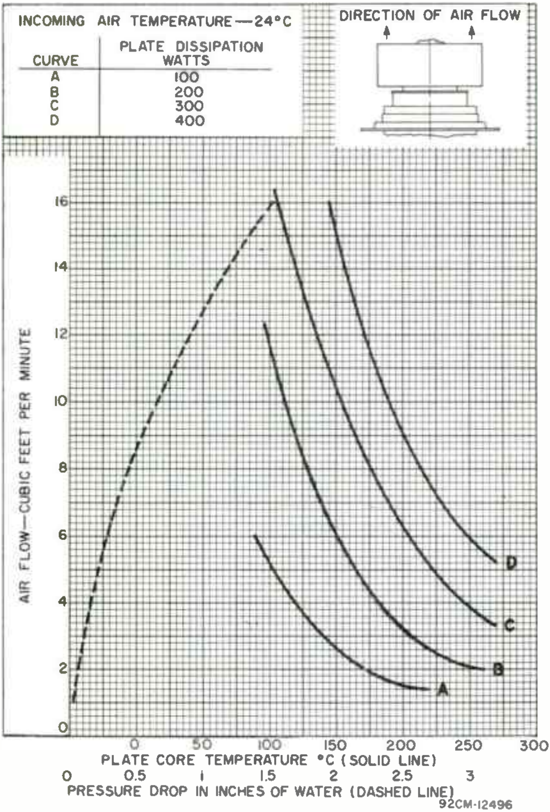
Note 4: RF gasket, such as METEX* No. A2733, or equivalent.

* Metex Electronics Corp., Walnut Ave., Clark, N.J.

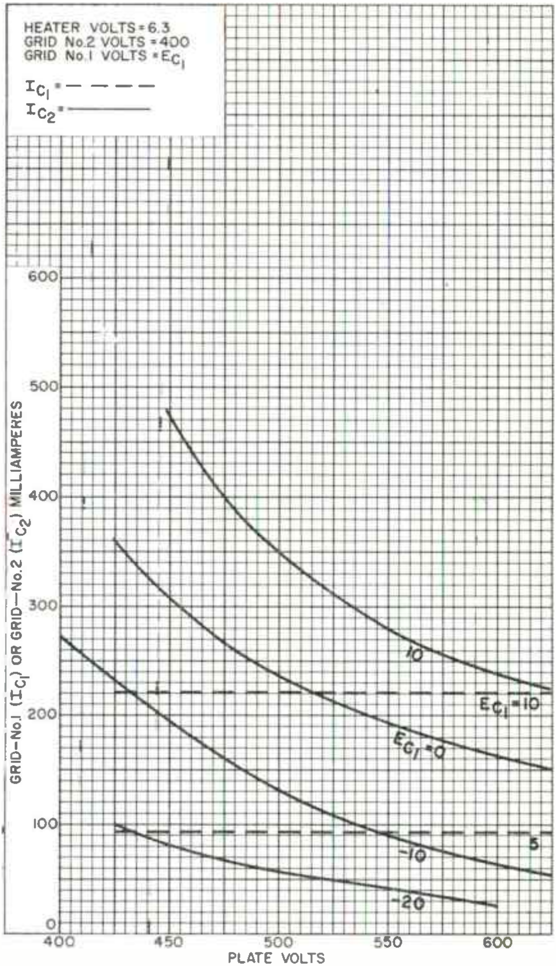
TYPICAL OUTPUT CAVITY TUNING CHARACTERISTICS



TYPICAL COOLING CHARACTERISTICS



TYPICAL CHARACTERISTICS



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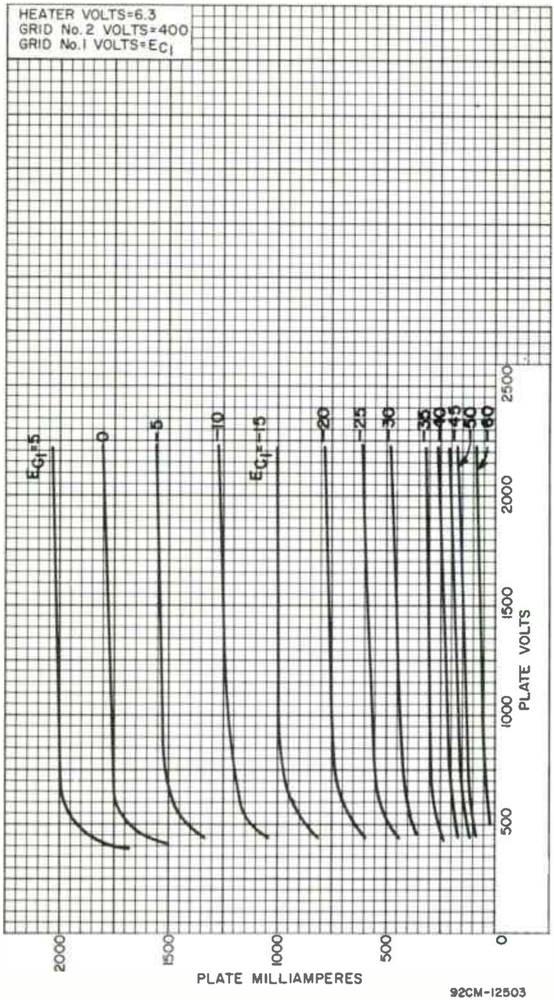
TYPICAL PLATE CHARACTERISTICS



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Beam Power Tube

CERMOLOX®
THORIATED-TUNGSTEN MESH FILAMENT

INTEGRAL LOUVERED-FIN RADIATOR
FORCED-AIR COOLED

For Single-Sideband Service in Stationary and Portable Equipment. Rated as a Linear RF Power Amplifier in Class AB_1 Suppressed Carrier Service. Also Useful as AF Amplifier or Modulator, RF Power Amplifier and Oscillator in Class-C Telephony and Telegraphy and Other Special Services.

ELECTRICAL

Filamentary Cathode, Thoriated-Tungsten Mesh Type

Voltage (ac or dc)[a]	4.5 to 4.75	typ	V
	5.0	max	V
Current:			
Typical value at 4.5 V	125		A
Maximum value for starting, even momentarily	300		A
Cold Resistance	0.005		Ω
Minimum heating time	15		s
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 2000, grid-No.2 volts = 1375, and dc plate amperes = 9	10		
Direct Interelectrode Capacitances			
Grid No.1 to plate[b]	0.60	max	pF
Grid No.1 to filament	60		pF
Plate to filament[bc]	0.11	max	pF
Grid No.1 to grid No.2	65		pF
Grid No.2 to plate	13		pF
Grid No.2 to filament[c]	3.3	max	pF

MECHANICAL

Operating Position	Vertical, either end up
Maximum Overall Length	5.65 in
Maximum Diameter	6.17 in
Terminal Connections	See *Dimensional Outline*
Radiator	Integral part of tube
Weight (Approx.)	10 lb

THERMAL

Terminal Temperature	250	max	°C
Plate, grid No.2, grid No.1, cathode-filament and filament			
Plate-Core Temperature	250	max	°C

See *Dimensional Outline* for temperature-measurement points

Forced-Air Cooling[f]

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 filament, plate, grid-No.2, and grid-No.1 voltages.

Air Flow (Cont'd)

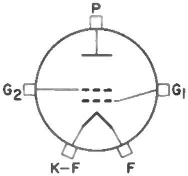
To Plate, Grid-No.2, Grid-No.1, Cathode-Filament, and Filament Terminals — A sufficient quantity of air should be allowed to flow past each of these terminals so that their temperature does not exceed the specified maximum value of 250° C.

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.

TERMINAL DIAGRAM (Bottom View)

G_1 - Grid-No.1-Terminal Contact Surface
G_2 - Grid-No.2-Terminal Contact Surface
F - Filament-Terminal Contact Surface
K,F - Cathode-Filament-Terminal Contact Surface
P - Plate-Terminal Contact Surface



LINEAR RF POWER AMPLIFIER[g]

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

DC Plate Voltage	7500	V
DC Grid-No.2 Voltage	1650	V
DC Grid-No.1 Voltage	-750	V
DC Plate Current at Peak of Envelope	4.0	A
DC Grid-No.1 Current	500	mA
Grid-No.2 Input[h]	150	W
Plate Dissipation	10	kW

Maximum Circuit Values

Grid-No.1-Circuit Resistance (Under any Condition)		
Fixed bias	5000	Ω
Fixed bias (In Class AB_1 operation)	25,000	Ω
Cathode bias	Not recommended	
Grid-No.2 Circuit Impedance	See footnote[h]	
Plate Circuit Impedance	See footnote[j]	

Typical Class AB_1 CCS Operation with "Two-Tone" Modulation

In a grid-drive circuit, at 30 Mc/s

DC Plate Voltage	7000	V
DC Grid-No.2 Voltage	1500	V
DC Grid-No.1 Voltage	-200	V
Zero-Signal DC Plate Current	0.5	A
Effective RF Load Resistance	1200	Ω
DC Plate Current at Peak of Envelope	3	A
Average DC Plate Current	2.15	A
DC Grid-No.2 Current at Peak of Envelope	0.1	A

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Average DC Grid-No.2 Current	0.07	A
Peak-Envelope Driver Power Output (Approx.)	See footnote[d]	
Output Circuit Efficiency (Approx.)	90	%
Useful Power Output (Approx.)		
Average	5000	W
Peak Envelope	10	kW

LINEAR RF POWER AMPLIFIER[f]

AM TELEPHONY SERVICE

Carrier conditions for use with a maximum modulation factor of 1

Maximum CCS Ratings, Absolute-Maximum Values

DC Plate Voltage	7500	V
DC Grid-No.2 Voltage	1650	V
DC Grid-No.1 Voltage	-750	V
DC Plate Current	2	A
DC Grid-No.1 Current	500	mA
Grid-No.2 Input	150	W
Plate Dissipation	10	kW

Typical Class AB₁ CCS Operation

In a cathode drive circuit, at 400 Mc/s

DC Plate Voltage	6500	V
DC Grid-No.2 Voltage	1250	V
DC Grid-No.1 Voltage	-160[e]	V
DC Plate Current	1.4	A
DC Grid-No.2 Current	0.005	A
Driver Power Output	75	W
Output Circuit Efficiency (Approx.)	90	%
Useful Power Output	2000	W

a Measured at tube terminals.

b With external flat metal shield 8 inches in diameter having a center hole 3 inches 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.

c With external flat metal shield 8 inches in diameter having a center hole 2-3/8 inches in diameter. Shield is located in plane of the grid-No.1 terminal, perpendicular to the tube axis, and is connected to grid No.1.

d Driver power output represents circuit losses and is the actual power measured at input to grid-No.1 circuit. The actual power required depends on the operating frequency and the circuit used. The tube driving power is approximately zero watts.

e Typical value for 1 ampere of DC plate current with carrier turned off.

The following footnotes apply to the *RCA Transmitting Tube Operating Considerations* given at front of this section.

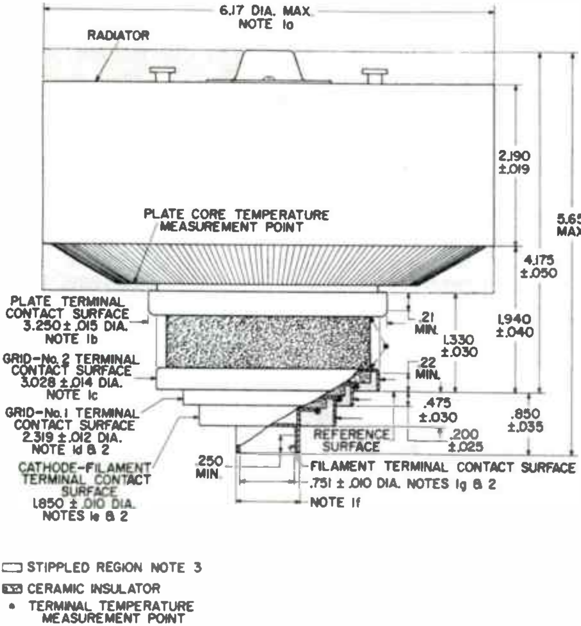
f See *Cooling Considerations*—Forced-Air Cooling.

g See *Classes of Service*.

h See *Electrical Considerations*—Grid-No.2 Voltage Supply

j See *Electrical Considerations*—Plate Voltage Supply

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

Note 1: Concentricity between the various diameters is such that the tube will enter a gauge having suitably spaced concentric apertures and posts of the following diameters:

a. Radiator - 6.241
b. Plate Terminal - 3.288
c. Grid-No.2 Terminal - 3.061
d. Grid-No.1 Terminal - 2.338
e. Cathode-Filament Terminal - 1.878
f. Filament Terminal (OD) - 0.908
g. Filament Terminal (ID) - 0.722

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 cathode-filament 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.

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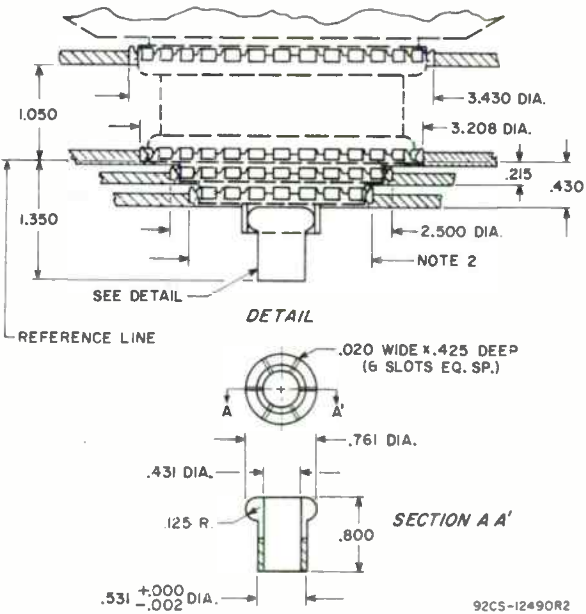
PREFERRED MOUNTING ARRANGEMENT



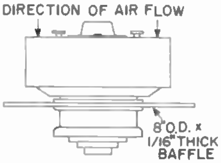
Note 1: Finger stock is No.97-360 made by Instrument Specialties Co., Little Falls, N.J.

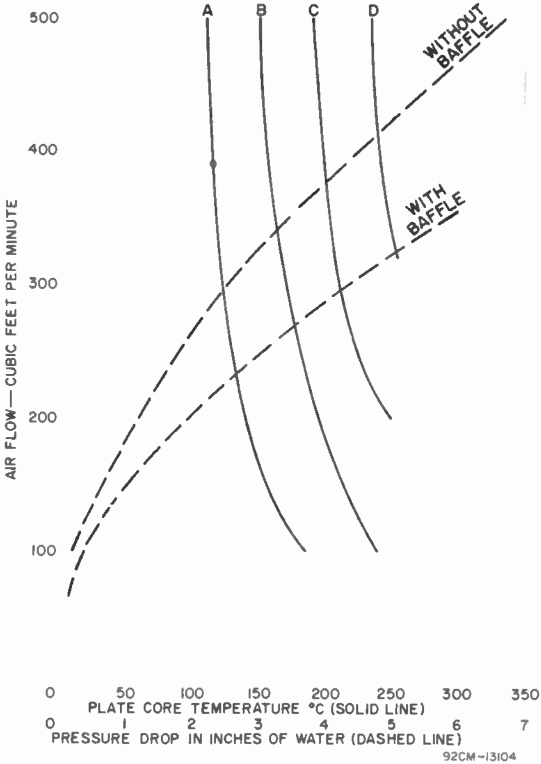
Note 2: Cathode ring dia. is 2.030 inches when using No.97-360 finger stock or 2.080 inches when using No.97-135 finger stock. Made by Instrument Specialties Co., Little Falls, N.J.

Typical Cooling Characteristics

INCOMING AIR TEMPERATURE—25° C

CURVE	PLATE DISSIPATION WATTS
A	4000
B	6000
C	8000
D	10000





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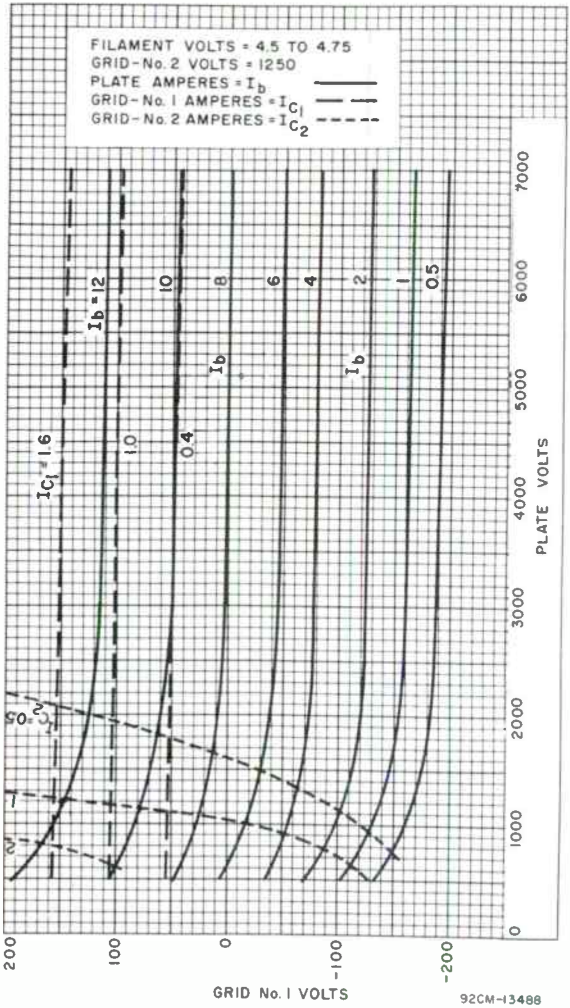
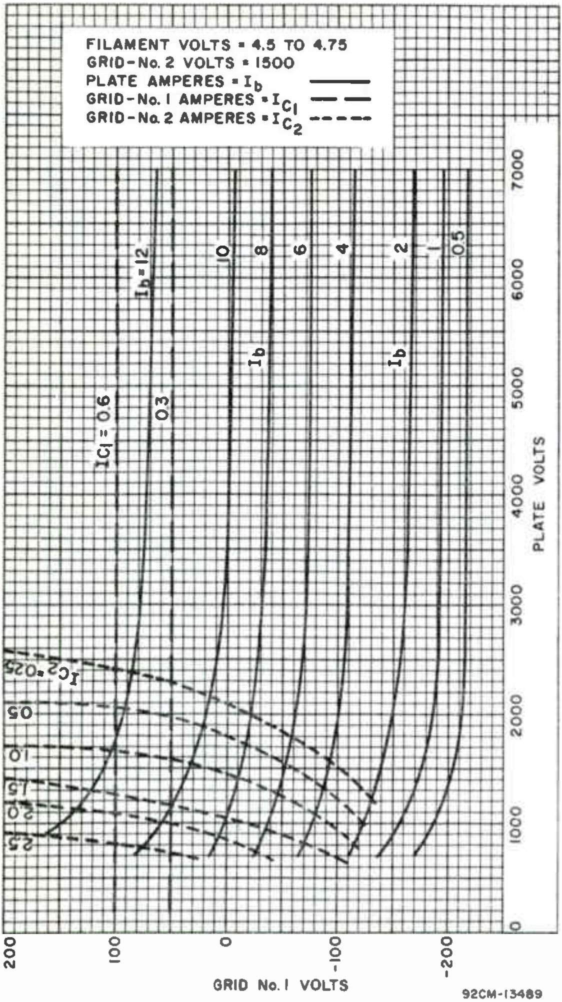
Typical Constant-Current Characteristics

For Grid-No. 2 Voltage = 1250 Volts



Typical Constant-Current Characteristics

For Grid-No.2 Voltage = 1500 Volts



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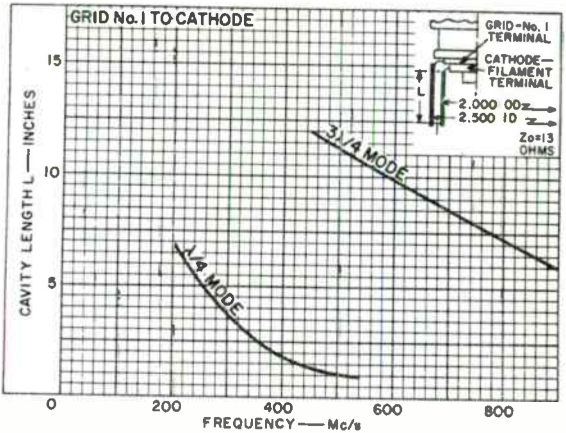
Cavity Tuning Characteristics



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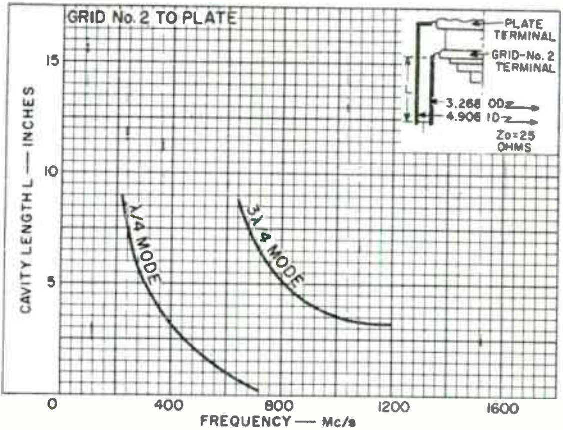

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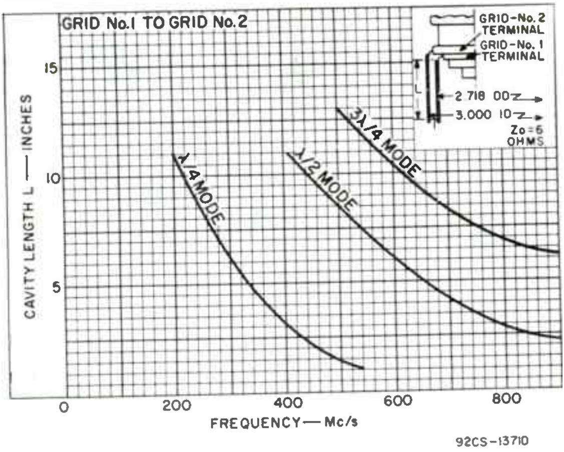
Cavity Tuning Characteristics



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HALF-WAVE MERCURY-VAPOR RECTIFIER

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:	*Min.*	*Av.*	*Max.*	
Voltage	4.75	5.0	5.25	volts
Current at 5 volts	–	4.5	4.9	amp
Cathode:				
Heating Time, before tube conduction	5	–	–	minutes
Tube Voltage Drop	–	15	–	volts
Critical Anode Voltage	–	–	50	volts

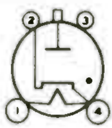
Mechanical:

Mounting Position	Vertical, Base Down
Maximum Overall Length	7"
Seated Length	6-1/4" ± 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 (Anode Return)



Pin 3 – No Conn.

Pin 4 – Heater, Cathode

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	22 °C
Full Load	28 °C

• With heater volts = 4.75 and no heat-conserving enclosure.

← indicates a change

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RCA

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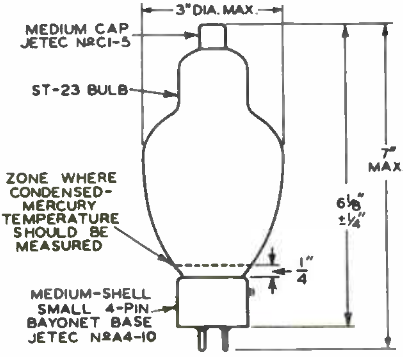
HALF-WAVE MERCURY-VAPOR RECTIFIER

HALF-WAVE RECTIFIER

Maximum Ratings, *Absolute Values: Up to 150 cps*

	Operating Condensed-Mercury Temperature Range		
	30° to 80°C	30° to 60°C	
PEAK INVERSE ANODE VOLTAGE	2000 max.	5000 max.	volts
CATHODE CURRENT:			
Peak	15 max.	15 max.	amp
Average■	2.5 max.	2.5 max.	amp
Fault, for duration of 0.1 second max.	200 max.	200 max.	amp

■ Averaged over any interval of 15 seconds maximum.



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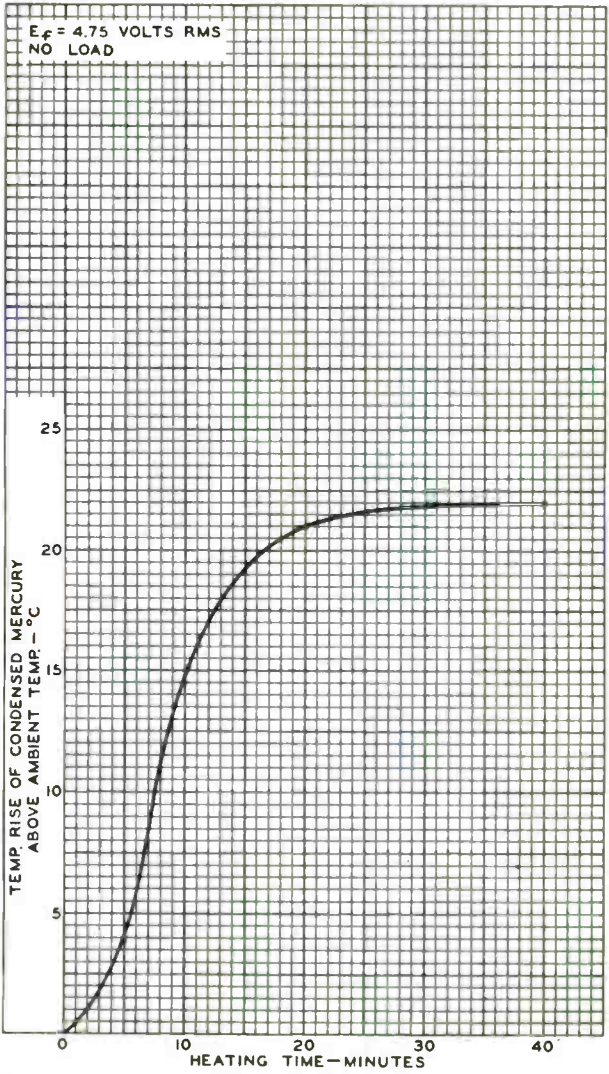
RATE OF RISE OF COND.-MERCURY TEMPERATURE



OCT. 28, 1952

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RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7856

RCA

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HALF-WAVE MERCURY-VAPOR RECTIFIER

DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage*	5	volts
Current	10	amp
Peak Voltage Drop (Approx.)	15	volts

Mechanical:

Mounting Position	Vertical, Base Down
Overall Length	11" ± 1/4 "
Maximum Diameter	3-13/16"
Bulb	ST-30
Cap	3917
Base	Large Metal-Shell Super-Jumbo 4-Pin, Bayonet

Maximum Ratings, Absolute Values:

	Continuous Service	Welder-Control Service	
PEAK INVERSE ANODE VOLTAGE	3000 max.	10000 max.	volts
INSTANTANEOUS ANODE CURRENT:			
Below 25 Cycles	12.8 max.	8 max.	amp
25 Cycles and Higher	40 max.	16 max.	amp
AVERAGE ANODE CURRENT#	6.4 max.	4 max.	amp
SURGE ANODE CURRENT for 0.1 sec. max.	200 max.	80 max.	amp
COND.-MERCURY TEMP. RANGE□	40 - 80	25 - 50	°C

* Heater voltage 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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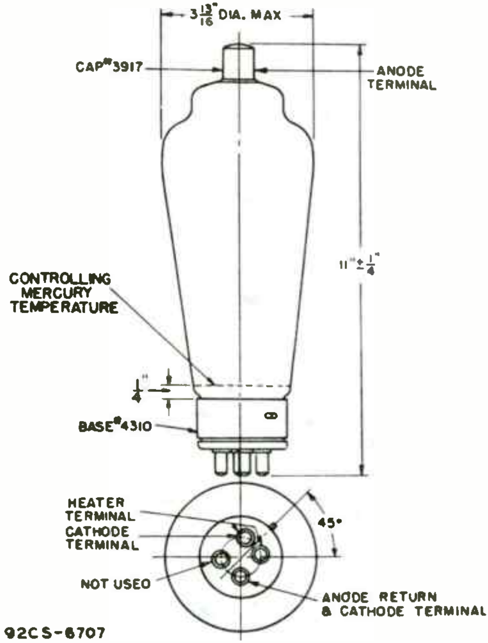
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

TENTATIVE DATA

5561

5561

HALF-WAVE MERCURY-VAPOR RECTIFIER



92CS-6707

RCA

5618
VHF POWER PENTODE

MINIATURE TYPE

GENERAL DATA

Electrical:

Filament, Coated:

Filament Arrangement	*Series**	*Parallel***	
Voltage	6.0 ± 10%	3.0 ± 10%	ac or dc volts
Current	0.23	0.46	amp

Direct Interelectrode Capacitances:°

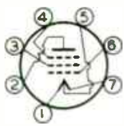
Grid No.1 to Plate	0.24	μμf
Input	7.0	μμf
Output	5.0	μμf

° With no external shield.

Mechanical:

Mounting Position	Vertical, or Horizontal with pins No.1 & No.5 in a horizontal plane
Maximum Overall Length	2-5/8"
Maximum Seated Length	2-3/8"
Length from Base Seat to Bulb Top (excluding tip)	2" ± 3/32"
Maximum Diameter	3/4"
Bulb	T-5-1/2
Base	Small-Button Miniature 7-Pin
Basing Designation for BOTTOM VIEW	7CU

Pin 1 - Filament (-)
Pin 2 - Plate
Pin 3 - Grid No.2
Pin 4 - Grid No.3, Int. Shield



Pin 5 - Filament Mid-Tap
Pin 6 - Grid No.1
Pin 7 - Filament (+)

AF POWER AMPLIFIER & MODULATOR—Class A_1

Maximum ICAS●● Ratings, *Absolute Values*:

DC PLATE VOLTAGE	300 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	125 max.	volts
GRID-No.2 INPUT	2 max.	watts
PLATE DISSIPATION	5 max.	watts

Typical Operation:

Filament Arrangement	*Series**	*Parallel***	
DC Plate Voltage	250	250	volts
DC Grid-No.3 Voltage	0*	0**	volts
DC Grid-No.2 Voltage	75	75	volts
DC Grid-No.1 (Control-Grid) Voltage■	-8	-8	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage	8	8	volts

*,**,●●,■: See next page.

5618
VHF POWER PENTODE

Zero-Signal DC Plate Current . .	16	19	ma
Max.-Signal DC Plate Current . .	17.5	20.5	ma
Zero-Signal DC Grid-No.2 Current	1.5	2.0	ma
Max.-Signal DC Grid-No.2 Current	3.5	4.5	ma
Transconductance	3500	3600	μmhos
Effective Load Resistance (plate to plate). . .	12000	12000	ohms
Total Harmonic Distortion. . . .	10	10	%
Max.-Signal Power Output	1.2	1.4	watts

Circuit Values:

Grid-No.1-Circuit Resistance	5000 min.	ohms
	100000 max.	ohms

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

Maximum ICAS●● Ratings, *Absolute Values*:

DC PLATE VOLTAGE	300 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE.	125 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE. . . .	-125 max.	volts
DC PLATE CURRENT	30 max.	ma
DC GRID-No.1 CURRENT	3 max.	ma
PLATE INPUT.	7.5 max.	watts
GRID-No.2 INPUT.	2 max.	watts
PLATE DISSIPATION.	5 max.	watts

Typical Operation:⊕

	Up to 40 Mc	*At 80 Mc*	
DC Plate Voltage	300	300	volts
DC Grid-No.3 Voltage⊕	0	0	volts
DC Grid-No.2 Voltage□	75	75	volts
	32000	32000	ohms
DC Grid-No.1 Voltage■■ ●	-45	-45	volts
	30000	30000	ohms
	1400	1400	ohms
Peak RF Grid-No.1 Voltage. . . .	65	65	volts
DC Plate Current	25	25	ma
DC Grid-No.2 Current	7	7	ma
DC Grid-No.1 Current (Approx.) .	1.5	1.5	ma
Driving Power (Approx.).	0.2	0.3	watt
Power Output (Approx.) ♦ . . .	5.4	5.2	watts

Circuit Values:

Grid-No.1-Circuit Resistance	5000 min.	ohms
	100000 max.	ohms

♦ Useful power output is approximately 5.0 watts for 40 Mc and 4.5 watts for 80 Mc.

▪, ▪▪, ●●, □, □□, ■, ■■, ⊕: See next page.

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

5618
VHF POWER PENTODE

FREQUENCY MULTIPLIER

Maximum ICAS●● Ratings, *Absolute Values*:

DC PLATE VOLTAGE	300 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	125 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-125 max.	volts
DC PLATE CURRENT	30 max.	ma
DC GRID-No.1 CURRENT	3 max.	ma
PLATE INPUT	7.5 max.	watts
GRID-No.2 INPUT	2 max.	watts
PLATE DISSIPATION	5 max.	watts

Typical Operation:⊕

	Doubler to 80 Mc	*Tripler to 80 Mc*	
DC Plate Voltage	300	300	volts
DC Grid-No.3 Voltage⊕	0	0	volts
DC Grid-No.2 Voltage□	75	75	volts
	41000	41000	ohms
DC Grid-No.1 Voltage♦	-125	-125	volts
	68000	68000	ohms
Peak RF Grid-No.1 Voltage	160	160	volts
DC Plate Current	25	25	ma
DC Grid-No.2 Current	5.5	5.5	ma
DC Grid-No.1 Current (Approx.)	1.85	1.85	ma
Driving Power (Approx.)	0.75	0.75	watt
Power Output (Approx.)◆◆	4.2	3.4	watts

Circuit Values:

Grid-No.1-Circuit Resistance	5000 min.	ohms
	100000 max.	ohms

◆◆ Useful power output is approximately 3.5 watts for doubler service and 2.7 watts for tripler operation.

* For series filament arrangement, filament voltage is applied between pins No.1 and No.7. The grid-No.1 voltage is referred to pin No.1, and grid-No.3 (pin No.4) is connected to pin No.1.

** For parallel filament arrangement, filament voltage is applied between pin No.5 and pins No.1 and No.7 connected together. The grid-No.1 voltage is referred to pin No.5 and grid No.3 (pin No.4) is connected to pin No.5.

●● Intermittent Commercial and Amateur Service.

■ For dc filament supply.

■■ Obtained from a fixed supply or by a grid-No.1 resistor (30000) or cathode resistor (1400).

□ Obtained from a separate source, or from the plate voltage supply with a voltage divider. Series screen resistor of value shown should be used only where the 5618 is employed as a buffer amplifier and is not keyed.

□□ 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.

⊕ Filament may be connected in either parallel or series arrangement. With parallel connection, grid No.3 (pin No.4) is connected to pin No.5; for series operation, connect pin No.4 to pin No.1.

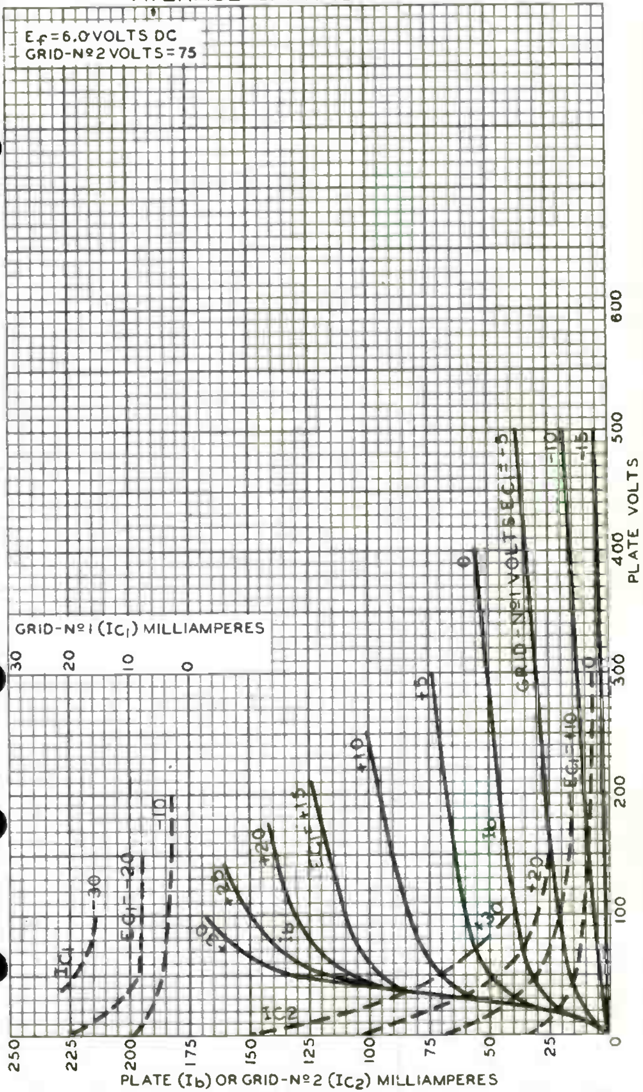
♦ Obtained from a fixed supply, or by a grid-No.1 resistor of value shown.

5618

RCA

5618

AVERAGE CHARACTERISTICS



AUG. 1,1947

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

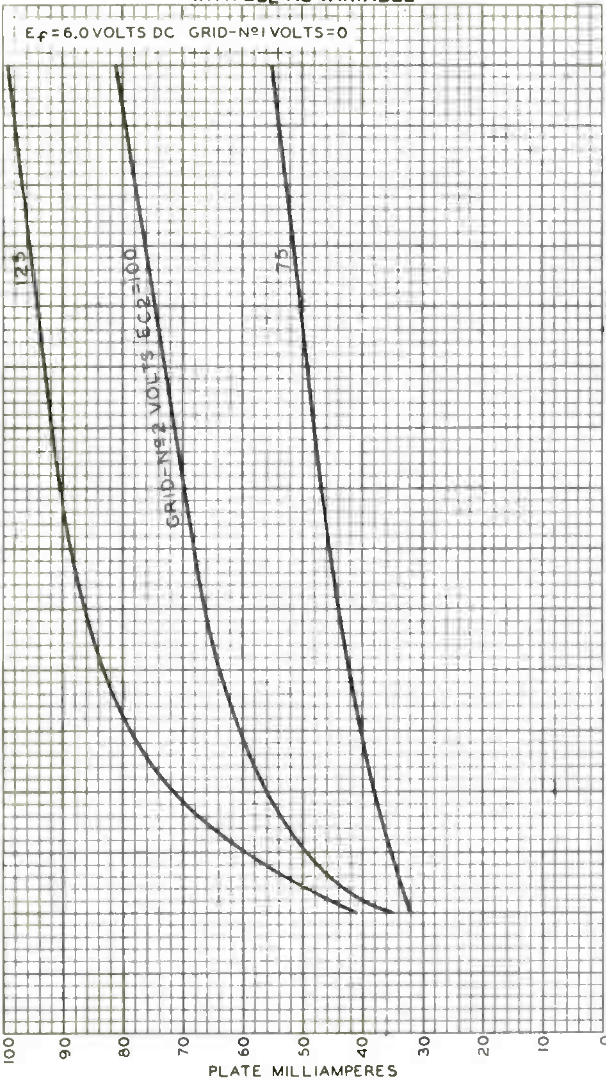
92CM-6881

5618

RCA

5618

AVERAGE PLATE CHARACTERISTICS
WITH E_{C2} AS VARIABLE



AUG. 12, 1947

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6882

Power Triode

FORCED-AIR COOLED

GENERAL DATA

Electrical:

Filament, Multistrand Thoriated Tungsten:

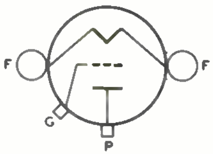
Excitation	Single-Phase AC or DC	
Voltage[a]	11 ± 5%	volts
Current at heater volts = 11	285	amp
Minimum heating time	15	sec
Amplification Factor for grid volts = −50, plate amperes = 2	40	
Direct Interelectrode Capacitances (Approx.):		
Grid to plate	50	μμf
Grid to filament	90	μμf
Plate to filament	1.5	μμf

Mechanical:

Operating Position	Vertical, filament end up
Maximum Overall Length	25"
Maximum Diameter	17"
Weight (Approx.)	228 pounds
Radiator	Integral part of tube
Air Jacket	RCA-241F1

F – Filament

G – Grid



P – Plate

Thermal:

Air Flow:

Through radiator—The specified air flow for various plate dissipations as indicated below should be delivered by a blower vertically upward through the radiator before and during the application of any voltages. Filament power, plate power, and air may be removed simultaneously.

Plate Dissipation	15	20	25	kw
Air Flow	1100	1450	1800	cfm
Static Pressure	0.85	1.5	2.2	in. of water

To filament seals . . . . 10 min. cfm

The specified air flow should be directed from a 1-1/4"-diameter nozzle into the filament header before and during the application of any voltages to limit the temperature of the filament seals to the maximum value.

← Indicates a change.

Input Air Temperature (To radiator)	45 max.		°C
Radiator Temperature	180 max.		°C
Bulb Temperature	180 max.		°C
Seal Temperature (Filament, grid, and plate)	165 max.		°C

AF POWER AMPLIFIER and MODULATOR — Class B

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

DC PLATE VOLTAGE	15000 max.	volts
MAX.-SIGNAL DC PLATE CURRENT[c]	6 max.	amp
MAX.-SIGNAL PLATE INPUT[c]	90 max.	kw
PLATE DISSIPATION[c]	25 max.	kw

Typical Operation:

Values are for 2 tubes

Filament Voltage	10	11	volts
DC Plate Voltage	10200	15000	volts
DC Grid Voltage	-220	-320	volts
Peak AF Grid-to-Grid Voltage	900	1600	volts
Zero-Signal DC Plate Current	0.6	0.6	amp
Max.-Signal DC Plate Current	5.8	10	amp
Effective Load Resistance (Plate to plate)	3600	3320	ohms
Max.-Signal Driving Power (Approx.)[d]	120	600	watts
Max.-Signal Power Output (Approx.)	37	100	kw

PLATE-MODULATED RF POWER AMPLIFIER — Class C Telephony

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

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

DC PLATE VOLTAGE	12500 max.	volts
DC GRID VOLTAGE	-2000 max.	volts
DC PLATE CURRENT	4.5 max.	amp
DC GRID CURRENT	1 max.	amp
PLATE INPUT	55 max.	kw
PLATE DISSIPATION	17 max.	kw

Typical Operation:

At 1.6 Mc

Filament Voltage	10	11	volts
DC Plate Voltage	10200	12500	volts
DC Grid Voltage:[e]			
From a fixed supply of	-1500	-1500	volts
From a grid resistor of	2100	1500	ohms
Peak RF Grid Voltage	2070	2180	volts
DC Plate Current	3.3	4	amp
DC Grid Current (Approx.)	0.72	1	amp
Driving Power (Approx.)[f]	1350	1960	watts
Power Output (Approx.)	28	40	kw

RF POWER AMPLIFIER and OSCILLATOR — Class C Telegraphy

Key-down conditions per tube without modulation[g]

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

DC PLATE VOLTAGE	15000 max.	volts
DC GRID VOLTAGE	-2000 max.	volts
DC PLATE CURRENT	8 max.	amp
DC GRID CURRENT	1 max.	amp
PLATE INPUT	100 max.	kw
PLATE DISSIPATION	25 max.	kw

Typical Operation:

	At 1.6 Mc		
Filament Voltage	10	11	volts
DC Plate Voltage	12500	15000	volts
DC Grid Voltage:[h]			
From a fixed supply of	-1250	-1500	volts
From a cathode resistor of	190	225	ohms
From a grid resistor of	1300	1500	ohms
Peak RF Grid Voltage	1970	2270	volts
DC Plate Current	5.8	6	amp
DC Grid Current (Approx.)	0.95	1	amp
Driving Power (Approx.)[f]	1700	2040	watts
Power Output (Approx.)	55	70	kw

a When the 5671 is operated at less than maximum ratings, the filament voltage may be reduced to 9.75 volts.

b CCS Continuous Commercial Service.

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

d The driving stage should have good regulation and should be capable of supplying considerably more than the required driving power.

e Obtained from a fixed supply, grid resistor, or a combination of both.

f Low frequency driving power is absorbed by the grid and grid resistor and does not include circuit losses. At higher frequencies the power furnished by the driver must be greater because of increased tube and circuit losses.

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

h Obtained from a fixed supply, a cathode resistor, a grid resistor, or from a combination of a fixed supply and self-bias.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN ←

	Note	*Min.*	*Max.*	
Filament Current	1	265	305	amp
Amplification Factor	1,2	35	45	
Direct Interelectrode Capacitances:				
Grid to plate		45	59	μμf
Grid to filament		72	104	μμf
Plate to filament		1.1	1.9	μμf
Plate Voltage	1,3	3200	4200	volts
Plate Voltage	1,4	6700	8700	volts
Grid Voltage	1,5	-310	-490	volts
Grid Voltage	1,6	-	1100	volts

← Indicates a change.

	Note	Min.	Max.	
Peak Cathode Current.	7	50	-	amp
Grid Current.	1,6	-	9.5	amp
Useful Power Output	1,8	59	-	kw

Note 1: With 11 volts ac on filament.

Note 2: With dc grid voltage of -50 volts and dc plate voltage adjusted to give dc plate current of 2 amperes.

Note 3: With dc grid voltage of 0 volts and dc plate voltage adjusted to give dc plate current of 2 amperes.

Note 4: With dc grid voltage of -100 volts and dc plate voltage adjusted to give dc plate current of 2 amperes.

Note 5: With dc plate voltage of 15000 volts and dc grid voltage adjusted to give dc plate current of 50 ma.

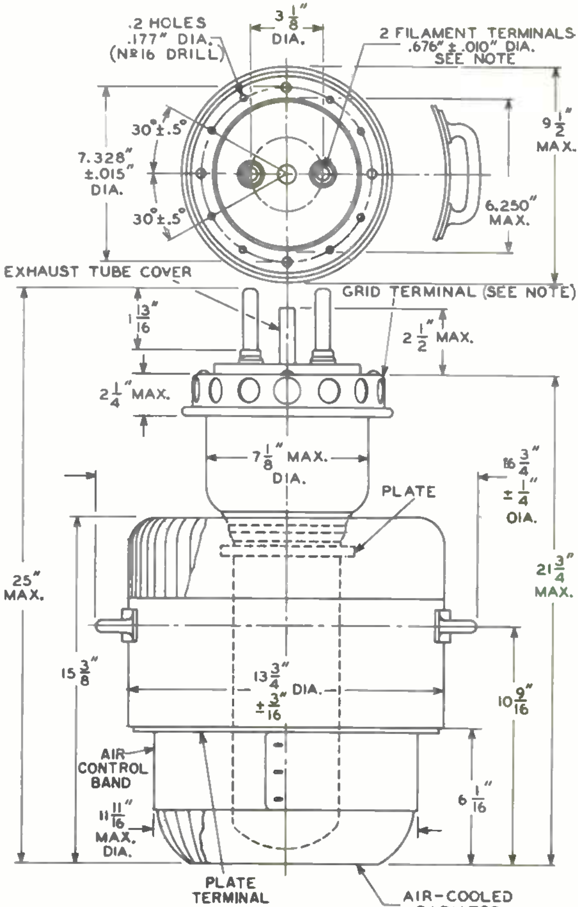
Note 6: With dc plate voltage of 2600 volts and instantaneous grid voltage adjusted to give instantaneous plate current of 35 amperes.

Note 7: Represents the maximum usable cathode current (plate current and grid current) for the tube under any condition of operation.

Note 8: In self-excited oscillator circuit and with dc plate voltage of 15000 volts, dc plate current of 6.6 amperes, dc grid current of 0.8 to 1.0 ampere, grid resistor of 1600 ± 10% ohms, and frequency of 1.6 Mc.

MAXIMUM RATINGS vs OPERATING FREQUENCY

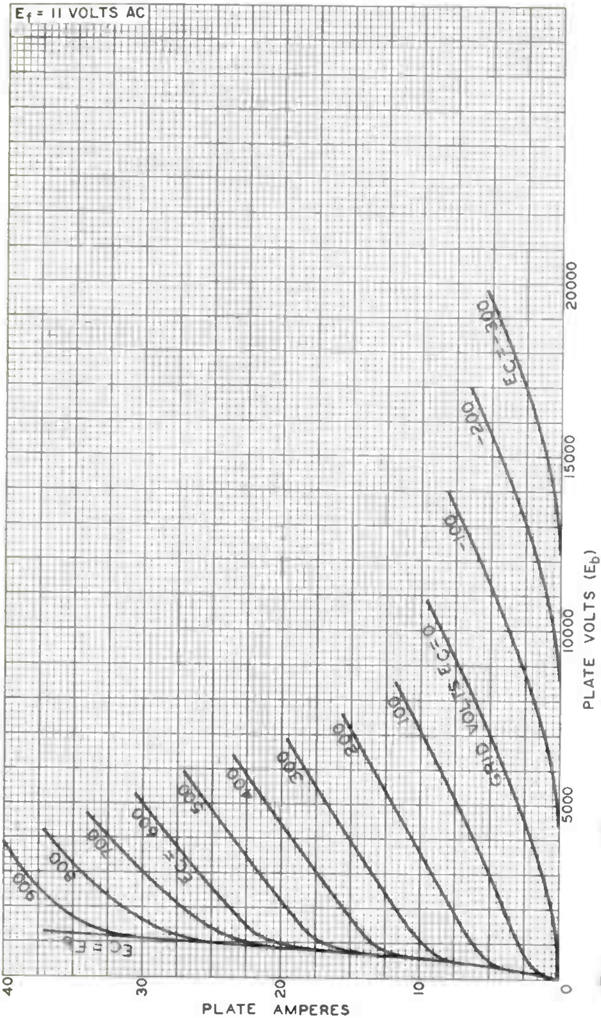
FREQUENCY	10	18	25	Mc
MAXIMUM PERMISSIBLE PERCENTAGE OF MAXIMUM RATED PLATE VOLTAGE AND INPUT:				
Class C Telephony (Plate-Modulated)	100	88	80	%
Class C Telegraphy	100	88	80	%



92CM-6897R3

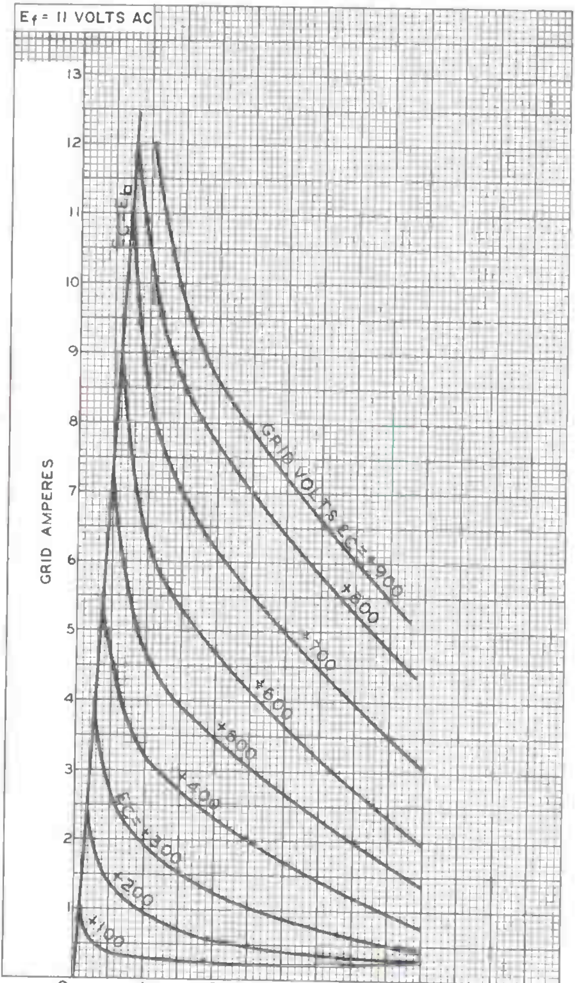
NOTE: FLEXIBLE CONNECTIONS ARE REQUIRED.

TYPICAL PLATE CHARACTERISTICS



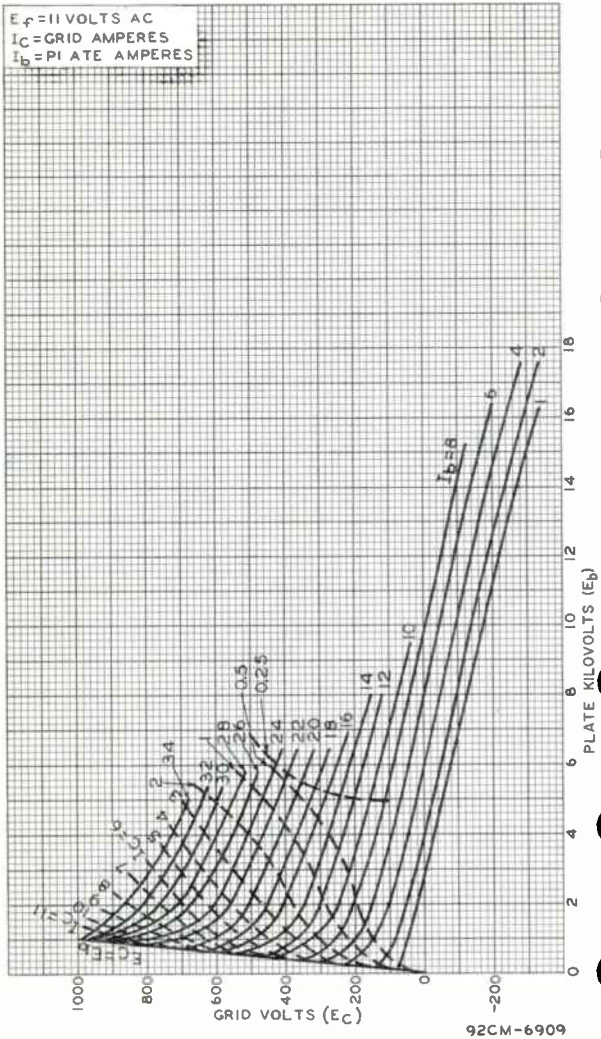
92CM-6899R1

TYPICAL CHARACTERISTICS



92CM-6900

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



5675

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UHF MEDIUM-MU TRIODE

"PENCIL TYPE" FOR GROUNDED-GRID SERVICE

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:

Voltage	6.3	ac or dc volts
Current	0.135	amp

Direct Interelectrode Capacitances:

Grid to Plate	1.3	μμf
Grid to Cathode	2.3	μμf
Plate to Cathode	0.09 max.	μμf

Characteristics, Class A_1 Amplifier:

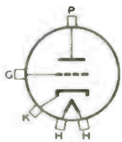
Plate Voltage	135	volts
Cathode-Bias Resistor	68	ohms
Amplification Factor	20	
Plate Resistance	3225	ohms
Transconductance	6200	μmhos
Plate Current	24	ma

Mechanical:

Terminal Connections

H – Heater

K – Cathode



G – Grid

P – Plate

Mounting Position	Any
Dimensions	See Outline Drawing

RF POWER AMPLIFIER & OSCILLATOR – Class C

Maximum Ratings, *Absolute Values*:

DC PLATE VOLTAGE	165 max.	volts
DC GRID VOLTAGE	-90 max.	volts
DC CATHODE CURRENT	30 max.	ma
DC GRID CURRENT	8 max.	ma
PLATE INPUT	5 max.	watts
PLATE DISSIPATION●	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
PLATE-SEAL TEMPERATURE	175 max.	°C

Typical Operation as Grounded-Grid Oscillator at 1700 Mc:*

DC Plate Voltage	120	volts
DC Grid Voltage	-8	volts
From a grid resistor of	2000	ohms

● In applications where the plate dissipation exceeds 2.5 watts, it is important that a large area of contact be provided between the plate cylinder and its lead connector to provide adequate heat conduction.

* At 3000 Mc, and with full ratings, a useful output of approximately 50 milliwatts may be obtained.

FEB. 1, 1950 TENTATIVE DATA

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

5675

UHF MEDIUM-MU TRIODE

DC Plate Current	25	ma
DC Grid Current (Approx.).	4	ma
Power Output (Approx.)	475	mw

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Heater Current	1	0.125	0.145	amp
Grid-to-Plate Capacitance. .	-	1.1	1.5	μμf
Grid-to-Cathode Capacitance.	-	2.0	2.6	μμf
Plate-to-Cathode Capacitance	-	-	0.09	μμf

Note 1: With 6.3 volts ac or dc on heater.

INSTALLATION NOTES

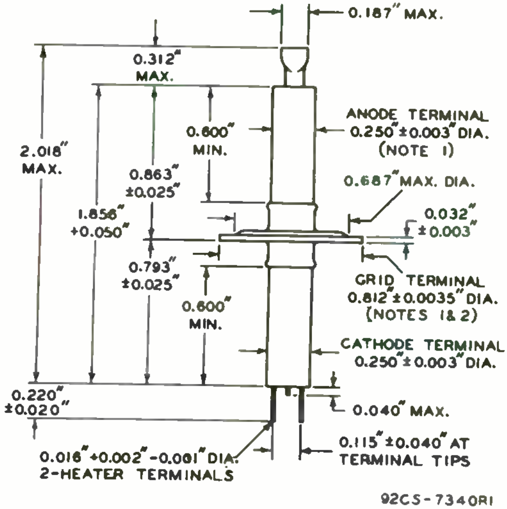
Connections to the cathode cylinder, grid disk, and plate cylinder should be made by flexible spring contacts only. The connectors must make firm, large-surface contact, yet must be sufficiently flexible so that no part of the tube is subjected to strain. Unless this recommendation is observed, the glass-to-metal seals may be damaged.

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

5675

UHF MEDIUM-MU TRIODE



NOTE 1: MAX. ECCENTRICITY OF ℄ (AXIS) OF ANODE TERMINAL OR GRID-TERMINAL FLANGE WITH RESPECT TO THE ℄ (AXIS) OF THE CATHODE TERMINAL IS 0.008".

NOTE 2: 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 0.020".

5675

RCA

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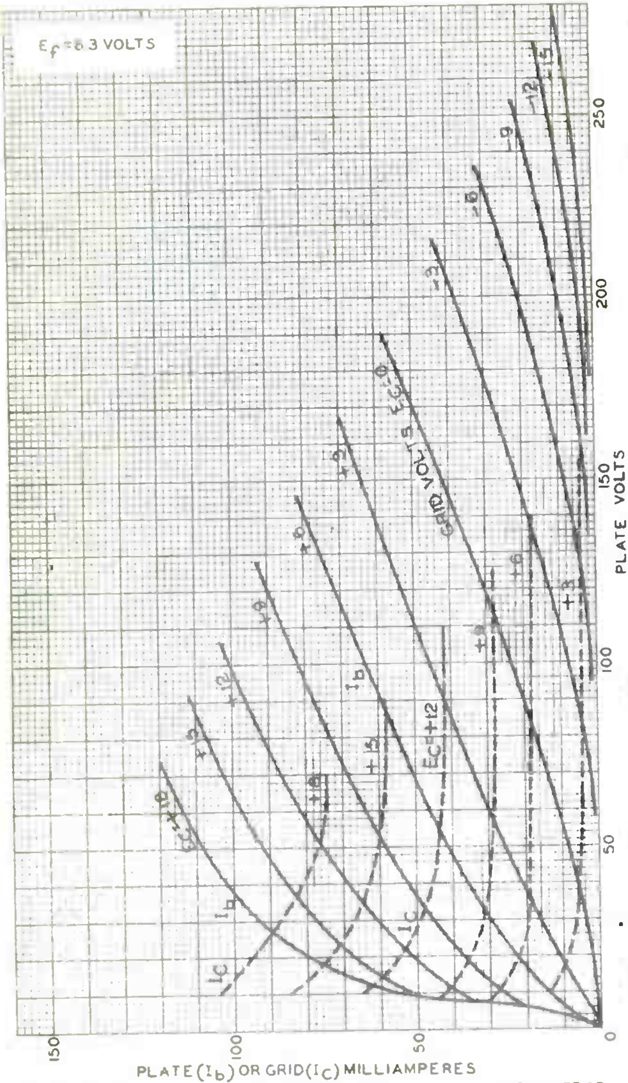
AVERAGE PLATE CHARACTERISTICS



AUG 23, 1949 TUBE DEPARTMENT 92CM-7343

Power Triode

VHF GRID-DRIVE OR CATHODE-DRIVE OPERATION

INTEGRAL RADIATOR
FORCED-AIR COOLED
THORIATED-TUNGSTEN FILAMENT

4000 WATTS CW OUTPUT AT 220 Mc/s
7000 WATTS CW OUTPUT AT 30 Mc/s
6350 WATTS VHF TV OUTPUT AT 216 Mc/s

For Use In VHF Television and CW Service in Stationary and Portable Equipment

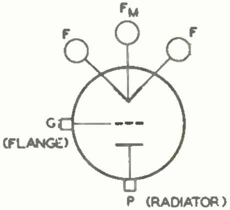
ELECTRICAL

Filamentary Cathode, Thoriated-Tungsten Type[g]		
Voltage (AC or DC)	12.6 typ / 13.2 max	V / V
Current:		
Typical value at 12.6 volts	29	A
For starting, even momentarily	175 max	A
Cold Resistance	0.052	Ω
Heating Time	15 min	s
Amplification Factor	29	
Direct Interelectrode Capacitances		
Grid to plate	18	pF
Grid to filament	19	pF
Plate to filament	0.5	pF

MECHANICAL

Operating Position	Vertical, either end up
Maximum Overall Length	7.12 in
Maximum Diameter (See *Dimensional Outline*)	4.68 in
Weight (Approx.)	6-1/4 lbs
Radiator	Integral part of tube
Terminal Connections (See *Dimensional Outline*)	

F - Filament
F_M - Filament Mid-Tap
G - Grid Terminal (Flange)
P - Plate Terminal (Radiator)



THERMAL

Air Flow[h]

Through Radiator—Adequate air flow to limit the plate-core temperature to 180° C should be delivered by a blower through the radiator before and during the application of all voltages. The flow of incoming air at temperatures up to 45° C are given for various plate dissipations indicated in the following tabulation:

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 grid and Filament terminals . . . . .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 and grid terminals to the specified maximum value.
During standby operation—Cooling air is required when heater voltage is applied to the tube.

Terminal Temperature (Filament, grid, and plate)	180 max	°C
Plate Core Temperature (See *Dimensional Outline*)	180 max	°C
Bulb Temperature (At hottest part)	180 max	°C

AF POWER AMPLIFIER & MODULATOR — CLASS B[j]

Maximum CCS Ratings, Absolute-Maximum Values

DC Plate Voltage	6200	V
Max.-Signal DC Plate Current	1.5	A
Max.-Signal Plate Input	8700	W
→ Plate Dissipation	4000	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

→ RF POWER AMPLIFIER — CLASS B TELEVISION SERVICE[j]

Synchronizing-level conditions per tube unless otherwise specified at frequency of 54 to 216 Mc/s

Maximum CCS Ratings, Absolute-Maximum Values

DC Plate Voltage	4500	V
DC Plate Current	2	A
DC Grid Current (Pedestal level)	0.325	A
Plate Input	9000	W
Plate Dissipation	4000	W

Typical Operation in Cathode-Drive Circuit

Bandwidth of	*10*	*8.5*	*6*	*Mc/s*
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

→ Indicates a change.

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Bandwidth of	10	8.5	6.0 Mc/s	
DC Plate Current				
Synchronizing level	1.8	1.8	2	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

GRID-MODULATED RF POWER AMPLIFIER[j]
CLASS C TELEVISION SERVICE

Synchronizing-level conditions per tube unless otherwise specified. At frequency of 54 to 216 Mc/s

Maximum CCS Ratings, Absolute-Maximum Values

DC Plate Voltage	3700	V
DC Grid Voltage (White level)	-800	V
DC Plate Current	1.9	A
DC Grid Current (Pedestal level)	0.225	A
Plate Input	6500	W
Plate Dissipation	4000	W ←

Typical Operation in Cathode-Drive Circuit

Bandwidth of	8.5 Mc/s	
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

PLATE-MODULATED RF POWER AMPLIFIER — CLASS C TELEPHONY[j]

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

Maximum CCS Ratings, Absolute-Maximum Values

DC Plate Voltage	5000	V
DC Grid Voltage	-1000	V
DC Plate Current	1	A
DC Grid Current	0.3	A
Plate Input	5000	W
Plate Dissipation	2700	W ←

Typical Operation in Grid-Drive Circuit

	Up to 30 Mc/s	At 110 Mc/s	
DC Plate Voltage	4700	4000	V
DC Grid Voltage	-400	-350	V
From a grid resistor of	1425	1460	Ω
Peak RF Grid Voltage[a]	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

	Up to 30 Mc/s	At 110 Mc/s	
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.)[b]	720	600	W
Power Output (Approx.)	4200	3200	W

RF POWER AMPLIFIER & OSCILLATOR — CLASS C TELEGRAPHY[j]
AND
RF POWER AMPLIFIER — CLASS C FM TELEPHONY

Maximum CCS Ratings, Absolute-Maximum Values

DC Plate Voltage	6200	V
DC Grid Voltage	-1000	V
DC Plate Current	1.4	A
DC Grid Current	0.3	A
Plate Input	8700	W
→ Plate Dissipation	4000	W

Typical Operation in Grid-Drive Circuit

	Up to 30 Mc/s	
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 Mc/s	At 110 Mc/s	At 220 Mc/s	
DC Plate Voltage	6000	5000	4300	V

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	Up to 30 Mc/s	At 110 Mc/s	At 220 Mc/s	
DC Grid Voltage				
From a fixed supply of . . .	-550	-1000	-200	V
From a grid resistor of. . .	1900	4100	807	Ω
From a cathode resistor of .	360	740	134	Ω
Peak RF Grid Voltage	875	1350	432	V
DC Plate Current	1.25	1.1	1.25	A
DC Grid Current (Approx.). . .	0.290	0.245	0.25	A
Driving Power (Approx.). . . .	1225	1680	542	W
Power Output (Approx.)	7000	5500	4000	W

SELF-RECTIFYING OSCILLATOR OR AMPLIFIER — CLASS C[j]

Maximum CCS Ratings, Absolute-Maximum Values

AC Plate Voltage (RMS)	7000	V
DC Grid Voltage.	-300	V
DC Plate Current	0.635	A
DC Grid Current.	0.135	A
Plate Input[c]	4900	W
Plate Dissipation.	4000	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.)[d]	60 W
Power Output (Approx.)	3350 W

AMPLIFIER OR OSCILLATOR — CLASS C[j]

With separate, rectified, unfiltered, single-phase, full-wave plate supply

Maximum CCS Ratings, Absolute-Maximum Values

DC Plate Voltage	5600 V
DC Grid Voltage.	-600 V
DC Plate Current	1.25 A
DC Grid Current.	0.270 A
Plate Input[e]	8600 W
Plate Dissipation.	4000 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.)[f]	150 W
Power Output (Approx.)	5650 W

[a] Driver modulated approximately 30%.

[b] Carrier power of driver modulated 100%.

[c] Plate input is 1.11 times the product of the ac voltage (rms) and the dc plate current.

[d] From a self-rectified driver.

← Indicates a change.

[e] Plate input is 1.23 times the product of the dc plate voltage and the dc plate current.

[f] From a driver with a rectified, unfiltered, single-phase, full-wave plate supply.

The following footnotes apply to the *RCA Transmitting Tube Operating Considerations* given at front of this section.

[g] See Electrical Considerations-Filament or Heater.

[h] See Cooling Considerations-Forced-Air Cooling.

[j] See Classes of Service.

RATINGS VS FREQUENCY

FREQUENCY	30	110	220		Mc/s
Maximum Permissible Percentage of Maximum Rated Plate Voltage and Plate Input					
Class B Television Service	Full Ratings—54 to 216 Mc/s				
Class C Television Service	Full Ratings—54 to 216 Mc/s				
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 Service	Full Ratings—54 to 216 Mc/s				
Class C Television Service	Full Ratings—54 to 216 Mc/s				
			Volt.	*Cur.*	
Class C Telephony, Plate-Modulated	100	100	60	83	%
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	%

CHARACTERISTICS RANGE VALUES

	Note	Min	Max	
Filament Current	1	27	31	A
Amplification Factor	1,2	25	33	
Direct Interelectrode Capacitances				
Grid to plate	-	16.5	20.5	pF
Grid to filament	-	15.5	22.5	pF
Plate to filament	-	0.38	0.62	pF

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	Note	Min	Max	
Grid Voltage	1,3	-125	-190	V
Plate Voltage.	1,4	1350	1750	V
Plate Voltage.	1,5	2600	3400	V
Useful Power Output.	1,6	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.

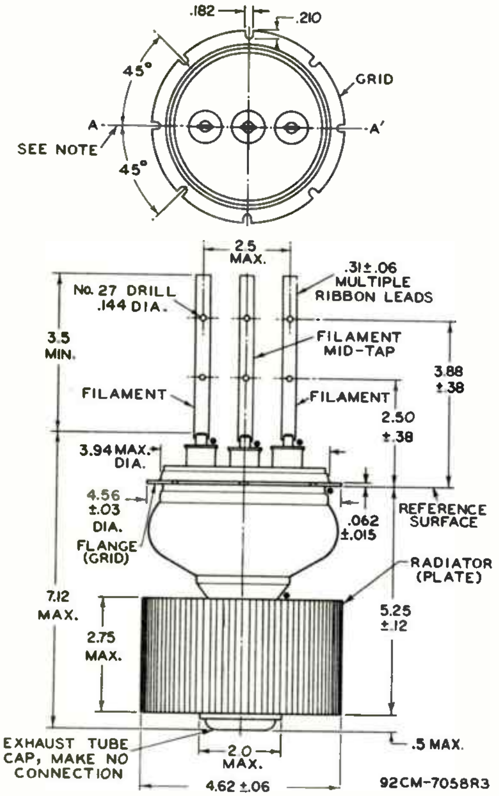
Note 3: With dc plate voltage of 4000 volts, and dc grid voltage adjusted to give dc plate current of 0.05 ampere.

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: 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/s.

DIMENSIONAL OUTLINE

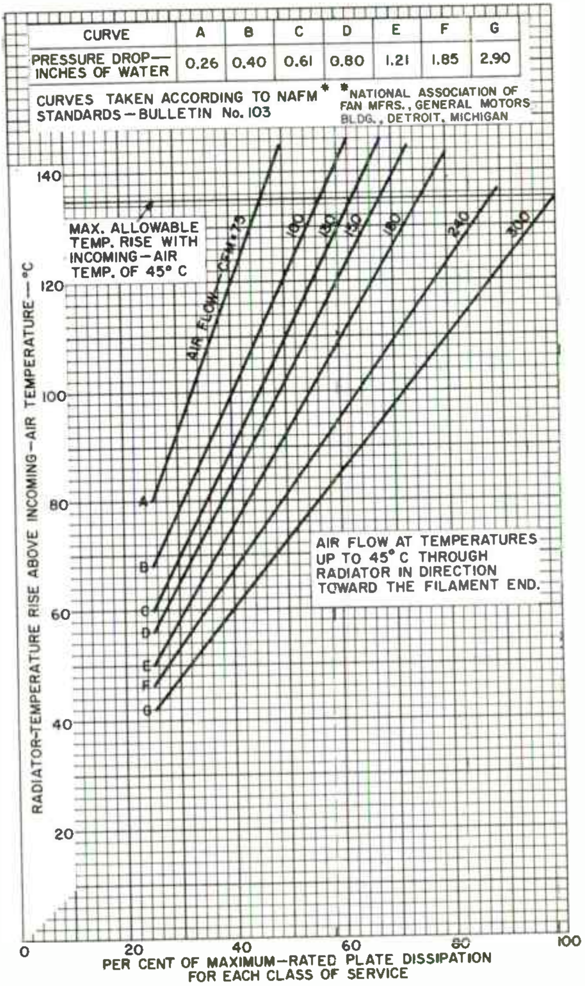


DIMENSIONS IN INCHES

● Temperature Measurement Point.

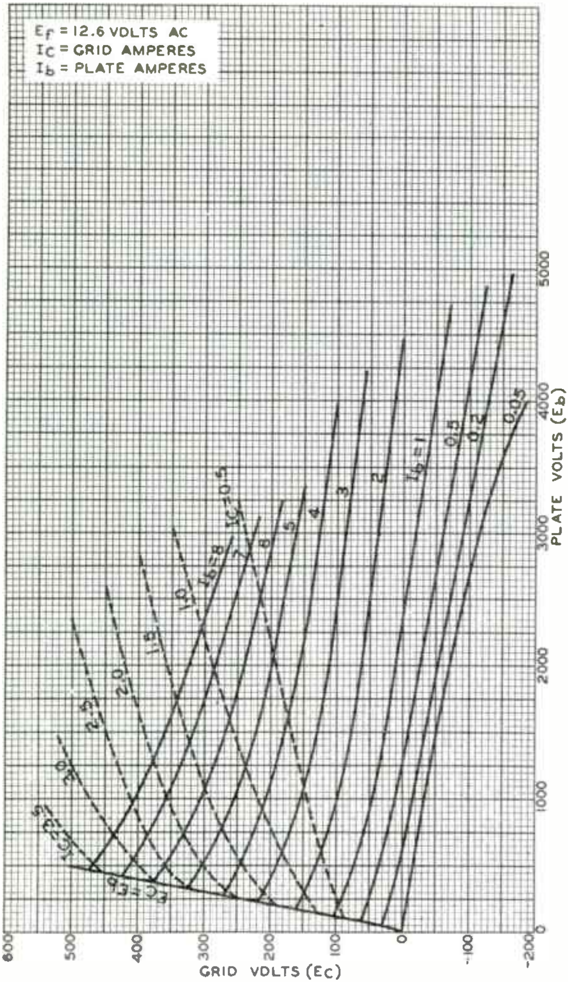
Note: Plane of filament leads will not deviate more than 3-1/2° from plane passing through AA' normal to grid flange.

Typical Cooling Characteristics



92CM—11091R1

Typical Constant-Current Characteristics



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

RCA

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VHF BEAM POWER TUBE

9-PIN MINIATURE TYPE

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:

Voltage	6.0 ± 10% . . .	ac or dc volts
Current	0.75	amp
Transconductance for plate current of 45 ma. . . .	7000	μmhos
Mu-Factor, Grid No.2 to Grid No.1 . .	16	
Direct Interelectrode Capacitances:°		
Grid No.1 to Plate . .	0.3 max.	μμf
Input	9.5	μμf
Output	4.5	μμf

° With no external shield.

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"
Bulb	T-6-1/2
Base	Small-Button Noval 9-Pin (JETEC No.E9-1)
Basing Designation for BOTTOM VIEW	9K

Pin 1 - Plate
Pin 2 - No Connection
Pin 3 - Grid No.3
Pin 4 - Heater

Pin 5 - Heater
Pin 6 - Grid No.2
Pin 7 - Cathode
Pin 8 - Grid No.1
Pin 9 - Grid No.1

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	250 max.	300 max.	volts
DC GRID-No.3 (SUPPRESSOR) VOLTAGE	0 max.	0 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	250 max.	250 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-125 max.	-125 max.	volts
DC PLATE CURRENT	40 max.	50 max.	ma
DC GRID-No.2 CURRENT	15 max.	15 max.	ma
DC GRID-No.1 CURRENT	5 max.	5 max.	ma
PLATE INPUT	10 max.	15 max.	watts
GRID-No.2 INPUT	1.5 max.	1.5 max.	watts
PLATE DISSIPATION	8 max.	12 max.	watts

●,●●: See next page.

TUBE DIVISION
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VHF 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
BULB TEMPERATURE (At hottest point on bulb surface) .	250 max.	250 max.	°C
Typical Operation up to 30 Mc:			
DC Plate Voltage	250	300	
Grid No.3	Connected to cathode at socket		
DC Grid-No.2 Voltage♦ . . .	250	250	volts
DC Grid-No.1 Voltage* . . .	-39	-42.5	volts
From a grid resistor of	39000	18000	ohms
Peak RF Grid-No.1 Voltage .	46.5	53.5	volts
DC Plate Current	40	50	ma
DC Grid-No.2 Current	5.6	6	ma
DC Grid-No.1 Current (Approx.) . . .	1	2.4	ma
Driving Power (Approx.) . .	0.05	0.15	watt
→ Useful Power Output (Approx.)	6.4■	10■	watts

Maximum Circuit Values (CCS or ICAS Conditions):

Grid-No.1-Circuit Resistance . . . . 0.1 max. megohm

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

	CCS●	ICAS●●	
Maximum Ratings, *Absolute Values:*			
DC PLATE VOLTAGE	300 max.	350 max.	volts
DC GRID-No.3 (SUPPRESSOR) VOLTAGE	0 max.	0 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	250 max.	250 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-125 max.	-125 max.	volts
DC PLATE CURRENT	50 max.	50 max.	ma
DC GRID-No.2 CURRENT	15 max.	15 max.	ma
DC GRID-No.1 CURRENT	5 max.	5 max.	ma
PLATE INPUT	15 max.	17 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. 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 DIVISION
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VHF BEAM POWER TUBE

	CCS●	ICAS●●	
GRID-No.2 INPUT	2 max.	2 max.	watts
PLATE DISSIPATION	12 max.	13.5 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
BULB TEMPERATURE (At hottest point on bulb surface). .	250 max.	250 max.	°C

Typical Operation up to 30 Mc:

DC Plate Voltage	300	350	volts
Grid No.3	Connected to cathode at socket		
DC Grid-No.2 Voltage	250	250	volts
DC Grid-No.1 Voltage●	-28.5	-28.5	volts
From a grid resistor of . .	18000	18000	ohms
Peak RF Grid-No.1 Voltage . .	37.5	37	volts
DC Plate Current	50	48.5	ma
DC Grid-No.2 Current	6.6	6.2	ma
DC Grid-No.1 Current (Approx.)	1.6	1.6	ma
Driving Power (Approx.) . . .	0.1	0.1	watt
Useful Power Output (Approx.)	10.3■	12■	watts ←

Typical Operation at 50 Mc:

DC Plate Voltage	300	–	volts
Grid No.3	Connected to cathode at socket		
DC Grid-No.2 Voltage	250	–	volts
DC Grid-No.1 Voltage●	-60	–	volts
From a grid resistor of . .	22000	–	ohms
Peak RF Grid-No.1 Voltage . .	80	–	volts
DC Plate Current	50	–	ma
DC Grid-No.2 Current	5	–	ma
DC Grid-No.1 Current (Approx.)	3	–	ma
Driving Power (Approx.) . . .	0.35	–	watt
Useful Power Output (Approx.)	7■	–	watts ←

Maximum Circuit Values (CCS or ICAS Conditions):

Grid-No.1-Circuit Resistance . . . . . . 0.1 max. megohm

FREQUENCY MULTIPLIER

Maximum CCS● Ratings, *Absolute Values:*

DC PLATE VOLTAGE	300 max.	volts
DC GRID-No.3 (SUPPRESSOR) VOLTAGE	0 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	250 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE . . .	-125 max.	volts
DC PLATE CURRENT	50 max.	ma

● Continuous Commercial Service.

●● Intermittent Commercial and Amateur Service.

●,■: See next page.

← Indicates a change

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VHF BEAM POWER TUBE

DC GRID-No.2 CURRENT	15 max.	ma
DC GRID-No.1 CURRENT	5 max.	ma
PLATE INPUT	15 max.	watts
GRID-No.2 INPUT	2 max.	watts
PLATE DISSIPATION	12 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)	250 max.	°C

Typical Operation:	*Doubler to 175 Mc*	*Tripler to 175 Mc*	
DC Plate Voltage	300	300	volts
Grid No.3	Connected to cathode at socket		
DC Grid-No.2 Voltage	*	*	volts
DC Grid-No.1 Voltage●	-75	-100	volts
From grid resistor of	75000	100000	ohms
Peak RF Grid-No.1 Voltage . . .	95	120	volts
DC Plate Current	40	35	ma
DC Grid-No.2 Current	4	5	ma
DC Grid-No.1 Current (Approx.).	1	1	ma
Driving Power (Approx.)	0.6	0.6	watt
Useful Power Output (Approx.) .	2.1■	1.3■	watts

Maximum Circuit Values (For maximum rated conditions):

→ Grid-No.1-Circuit Resistance . . . . 0.1 max. megohm

→ **CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN**

	Note	*Min.*	*Max.*	
Heater Current	1	0.69	0.81	amp
Grid No.1-Plate Capacitance .	2	-	0.3	μμf
Input Capacitance	2	8.0	11.0	μμf
Output Capacitance	2	3.8	5.2	μμf
Transconductance	1,3	5100	8900	μmhos
Plate Current	1,3	33	57	ma
Grid-No.2 Current	1,3	-	10	ma
Reverse Grid-No.1 Current . .	1,4	-	2	μamp

NOTE 1: With 6 volts ac or dc on heater.

NOTE 2: With no external shield.

NOTE 3: With dc plate voltage of 250 volts, dc grid-No.2 voltage of 250 volts, and dc grid-No.1 voltage of -7.5 volts.

NOTE 4: With dc plate voltage of 250 volts, dc grid-No.2 voltage of 250 volts, dc grid-No.1 voltage of -7.5 volts, and grid-No.1-circuit resistance of 0.1 megohm.

● Obtained from a fixed supply, or by a grid-No.1 resistor of value shown.

■ This value of useful power is measured at load of output circuit.

Data on Operating Frequencies for the 5763 are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY

→ Indicates a change

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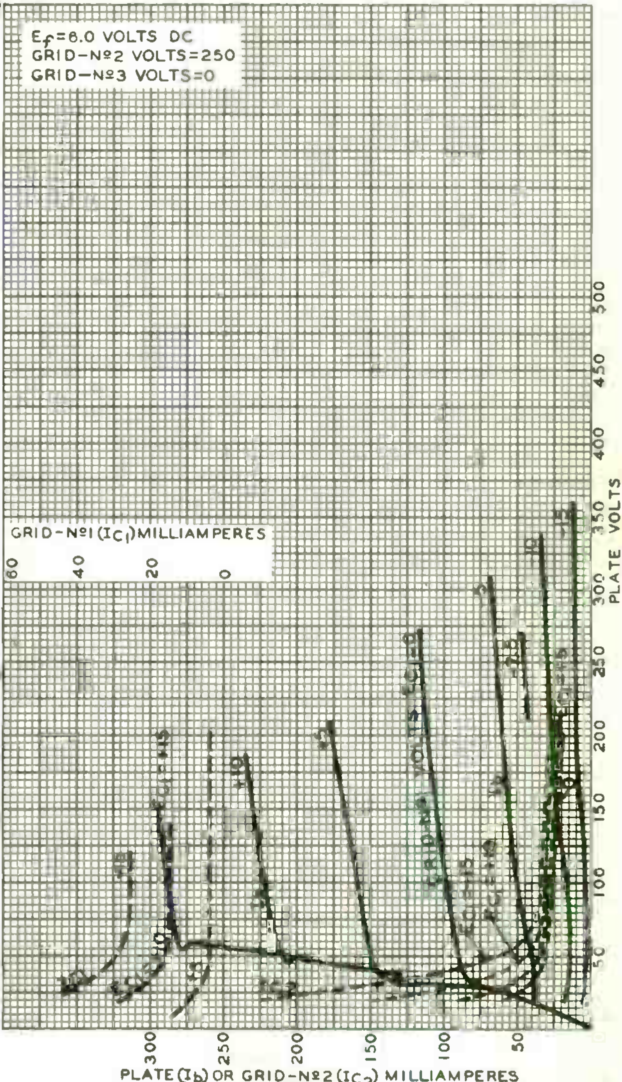
AVERAGE CHARACTERISTICS



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TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7160

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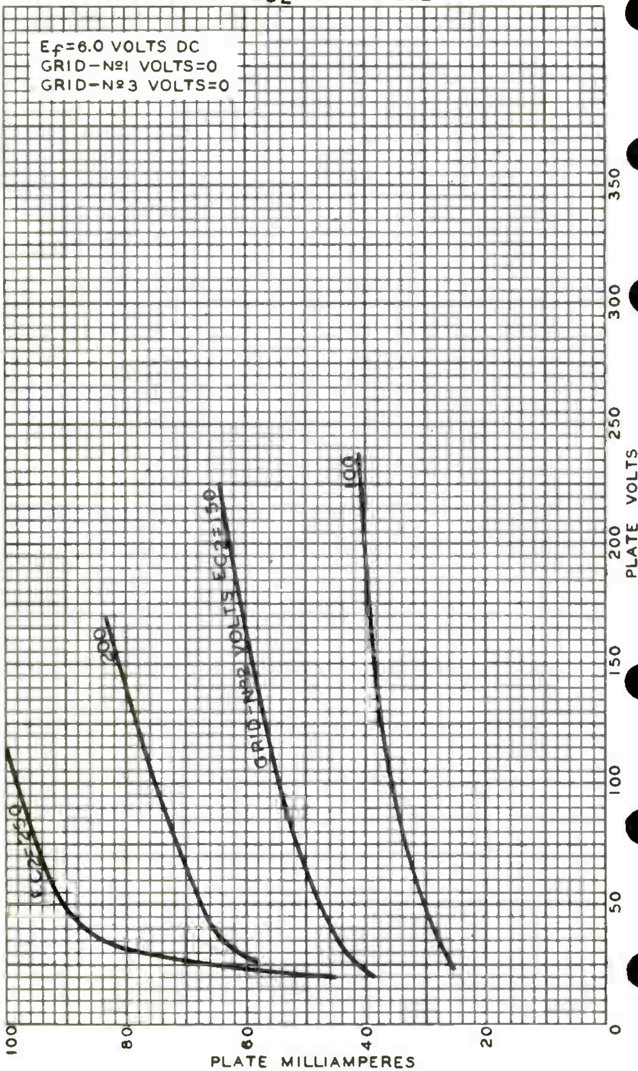
AVERAGE PLATE CHARACTERISTICS
WITH E_{C2} AS VARIABLE



RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

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POWER TRIODE

WATER & FORCED-AIR COOLED, GROUNDED-GRID TYPE

GENERAL DATA

Electrical:

Filament, Multistrand Thoriated-Tungsten:

Excitation . . .	Single Phase AC or DC	
Voltage.	11 ± 0.6	ac or dc volts
Current.	285	amp

Starting Current: It is not necessary to provide means for limiting filament starting current on this type. Full rated filament voltage can be applied safely to the cold filament. ←

Cold Resistance.	0.005	ohm
Minimum Heating Time . .	15	seconds
Amplification Factor . . .	39	

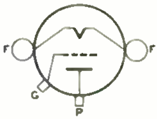
Direct Interelectrode Capacitances (Approx.):

Grid to Plate.	53	$\mu\mu f$
Grid to Filament	89	$\mu\mu f$
Plate to Filament. . . .	1.2	$\mu\mu f$

Mechanical:

Terminal Connections:

F – Filament
G – Grid-Flange Terminal



P – Water-Cooled Plate Terminal

Mounting Position.	Vertical, Filament End Up
Maximum Overall Length	24-1/2"
Maximum Diameter	9-1/2"
Water Flow	20 to 25 gpm

The specified water flow must start before the application of any voltages, and may be removed simultaneously with the filament and plate power.

Air Flow:

To Plate Seal and Bulb:

At frequencies below 1.7 Mc.	Natural	
At frequencies above 1.7 Mc.	Up to 250	cfm

Adequate forced-air cooling should be provided to limit the temperature of the plate seal and bulb to their specified maximum values. The amount of air flow required will increase with the operating frequency. The cooling air should start before the application of any voltages and should be distributed uniformly around the plate seal by means of a suitable air manifold and an air deflector. The air flow may be removed simultaneously with filament and plate power.

To Filament Seals and Grid Seal.	10 min.	cfm

The specified air flow should be directed vertically from a 1-1/4" diameter nozzle into the filament header before and during the application of any voltages. It may be removed simultaneously with filament and plate power.

Outlet Water Temperature	70 max.	°C
Bulb Temperature	180 max.	°C
Seal Temperature (Filament, grid, plate) . .	165 max.	°C

← Indicates a change.

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POWER TRIODE

Components:

Water Jacket	RCA MI-19460
Gasket	RCA MI-27001
Air Manifold	RCA MI-19482-1
Air Deflector	RCA MI-19482-2
Filament Connector (2 required)	RCA MI-19481
Corona Shield	RCA MI-27008
Felt Pad (for corona shield)	RCA MI-27009
Porcelain Insulator	RCA MI-27002
Mounting Clamp	RCA MI-27003
Filament Transformer	RCA-212T1
Current Limiting Reactor	RCA-204R1

AF POWER AMPLIFIER & MODULATOR - Class B

Maximum CCS● Ratings, *Absolute Values*:

DC PLATE VOLTAGE	15000	max.	volts
MAX.-SIGNAL DC PLATE CURRENT*	6	max.	amp
MAX.-SIGNAL PLATE INPUT*	90	max.	kw
PLATE DISSIPATION*	50	max.	kw

Typical Operation:

Values are for 2 tubes

DC Plate Voltage	10200	15000	volts
DC Grid Voltage	-220	-320	volts
Peak AF Grid-to-Grid Voltage	900	1560	volts
Zero-Signal DC Plate Current	0.6	0.6	amp
Max.-Signal DC Plate Current	5.8	12	amp
Effective Load Resistance (Plate-to-plate)	3600	2640	ohms
Max.-Sig. Driving Power (Approx.)#	120	688	watts
Max.-Sig. Power Output (Approx.)	37	117	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.

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	12500	max.	volts
DC GRID VOLTAGE	-2000	max.	volts
DC PLATE CURRENT	5.0	max.	amp
DC GRID CURRENT	1.25	max.	amp
PLATE INPUT	60	max.	kw
PLATE DISSIPATION	33	max.	kw

Typical Operation:

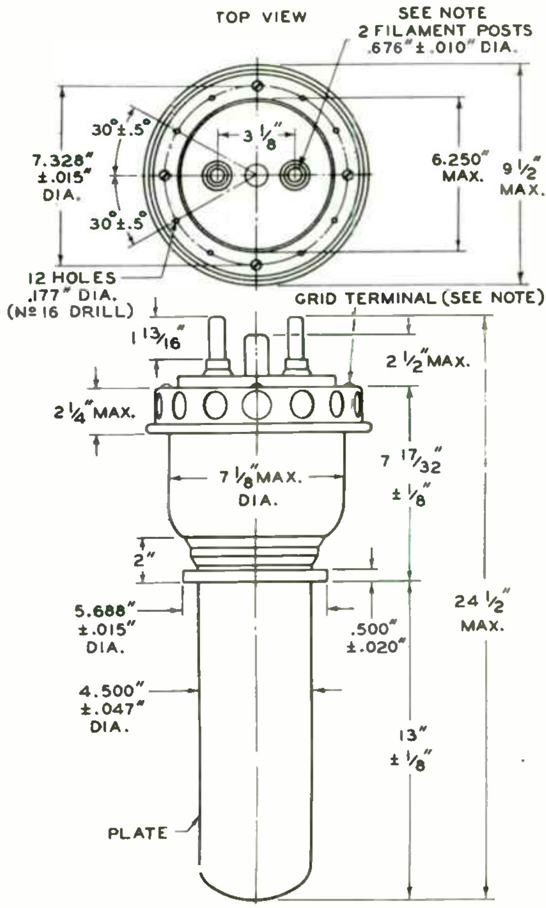
DC Plate Voltage	10200	12500	volts
DC Grid Voltage●	-1500	-1500	volts
	2100	1400	ohms

●, ●: See next page.

RCA

5770

POWER TRIODE



NOTE: FLEXIBLE CONNECTIONS ARE REQUIRED

92CM-7070

5771

RCA 5771

POWER TRIODE

WATER & FORCED-AIR COOLED

GENERAL DATA

Electrical:

Filament, Multistrand Thoriated-Tungsten:

Excitation	Single Phase AC or DC	
Voltage.	7.5 ± 0.4	ac or dc volts
Current.	170	amp

Starting Current: The filament current should never exceed 800 amperes, even momentarily.

Cold Resistance. . . .	0.0055	ohm
Minimum Heating Time .	15	seconds
Amplification Factor . .	20	

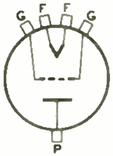
Direct Interelectrode Capacitances (Approx.):

Grid to Plate.	24.5	$\mu\mu f$
Grid to Filament . . .	47	$\mu\mu f$
Plate to Filament. . .	3	$\mu\mu f$

Mechanical:

Terminal Connections:

F - Filament
G - Grid
P - Water-Cooled Plate



Grid terminals are spaced diametrically wider than filament terminals.

Mounting Position.	Vertical, Filament End Up	
Maximum Overall Length	11-5/16"	
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.

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
Filament Transformer	RCA-203T1

AF POWER AMPLIFIER & MODULATOR - Class B

Maximum CCS● Ratings, *Absolute Values:*

DC PLATE VOLTAGE	12500 max.	volts

●: See next page.

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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POWER TRIODE

MAX.-SIGNAL DC PLATE CURRENT*	5 max.	amp
MAX.-SIGNAL PLATE INPUT*	45 max.	kw
PLATE DISSIPATION*	22.5 max.	kw

Typical Operation:

Values are for 2 tubes

DC Plate Voltage	12500	volts
DC Grid Voltage.	-600	volts
Peak AF Grid-to-Grid Voltage	1900	volts
Zero-Signal DC Plate Current	1	amp
Max.-Signal DC Plate Current	6.4	amp
Effective Load Resistance (Plate-to-plate)	4400	ohms
Max.-Signal Driving Power (Approx.)# . . .	430	watts
Max.-Signal Power Output (Approx.)	55	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.

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	12500 max.	volts
DC PLATE CURRENT	4 max.	amp
PLATE INPUT.	33 max.	kw
PLATE DISSIPATION.	22.5 max.	kw

Typical Operation:

DC Plate Voltage	12500	volts
DC Grid Voltage	-625	volts
Peak RF Grid Voltage	625	volts
DC Plate Current	2.4	amp
DC Grid Current□	0	amp
Driving Power (Approx.)■□	1070	watts
Power Output (Approx.)	12	kw

■ 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 CCS● Ratings, *Absolute Values*:

DC PLATE VOLTAGE	10000 max.	volts
DC GRID VOLTAGE.	-1600 max.	volts
DC PLATE CURRENT	4 max.	amp
DC GRID CURRENT.	0.8 max.	amp
PLATE INPUT.	40 max.	kw
PLATE DISSIPATION.	15 max.	kw

●,□: See next page.

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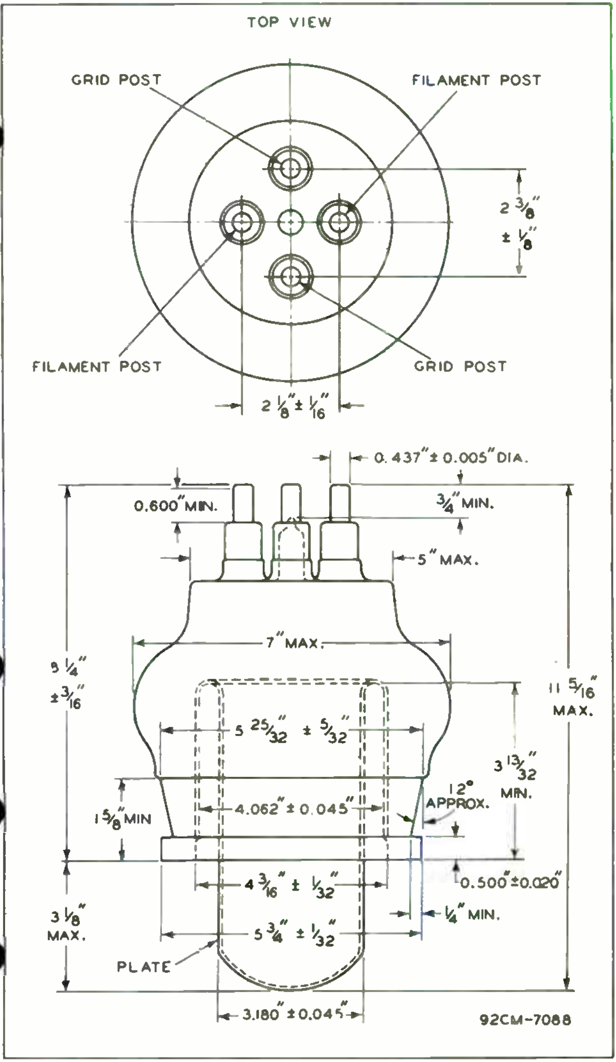
POWER TRIODE



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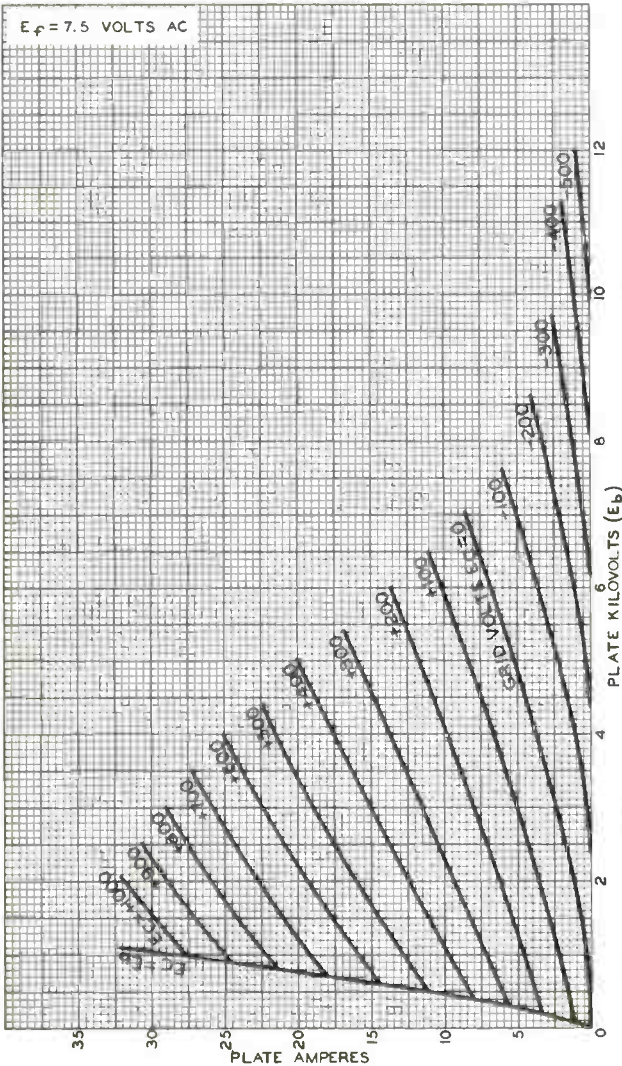
AVERAGE PLATE CHARACTERISTICS



OCTOBER 28,1948

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7106

High-Mu Triode

GLASS-METAL PENCIL TYPE

FAST WARM-UP TIME | **STURDY COAXIAL ELECTRODE STRUCTURE**

For Use in Cathode-Drive Service at Frequencies up to 3000 Mc

The 5876 is the same as the 5876A except for the following items:

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN ←

	Note	Min.	Max.	
Heater Current	1	0.125	0.145	amp
Heater-Cathode Leakage Current:				
Heater negative with respect to cathode	1,2	-	100	μa
Heater positive with respect to cathode	1,2	-	100	μa
Emission Voltage	6	-	14	volts
Plate Current (2)	1,11	-	100	μa

Note 1: With 6.3 volts ac or dc on heater.

Note 2: With 100 volts dc between heater and cathode.

Note 6: With dc voltage on grid and plate which are connected together and adjusted to produce a cathode current of 30 ma. and have 5.5 volts on heater.

Note 11: With dc plate voltage of 250 volts and dc grid voltage of -15 volts.

SPECIAL TESTS & PERFORMANCE DATA

Intermittent Dynamic Life Performance:

This test (similar to MIL-E-1D, paragraph 4.11.3.2) is performed on a sample lot of tubes from each production run to insure high quality of rf performance. Each tube is life-tested in a cavity-type oscillator at 500 ± 15 Mc under the following conditions: Heater voltage of 6.3 volts, plate-supply voltage of 300 volts, cathode resistor is adjusted to give a dc plate current of 25 ma. and value is recorded, plate-circuit load resistance of zero ohms, heater positive with respect to cathode by 100 volts, and plate-seal temperature of 175° C min. Heater voltage is cycled at a rate of 110 minutes on and 10 minutes off.

At the end of 500 hours, the tube will not show permanent shorts or open circuits and will be criticized for the total number of defects in the sample lot and for the number of tubes failing to meet the following limits:

Power Output . . . . 0.2 min. watt

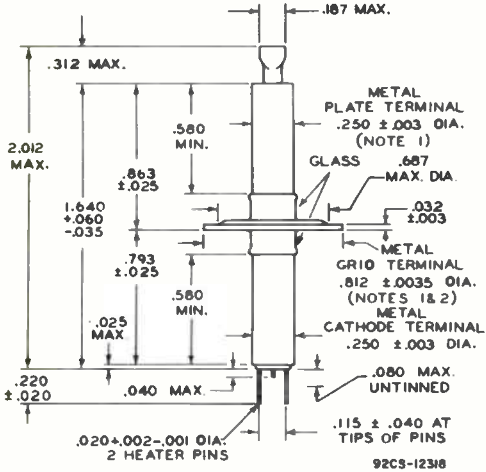
For conditions with 6.3 volts ac or dc on heater, dc plate volts = 200, grid resistor adjusted to give a dc plate current of 18 milliamperes in a cavity-type oscillator operating at 1700 ± 15 Mc.

Shorts and Continuity Test specified in data for type 5876A.

← Indicates a change.

Except for the following, other tests shown under type 5876A are not performed on the 5876:

Low-Frequency Vibration Performance
Shorts and Continuity Test
Glass-Seal-Fracture Test



DIMENSIONS IN INCHES

NOTE 1: MAXIMUM ECCENTRICITY OF CENTER LINE (AXIS) OF PLATE TERMINAL OR GRID-TERMINAL FLANGE WITH RESPECT TO THE CENTER LINE (AXIS) OF THE CATHODE TERMINAL IS 0.008".

NOTE 2: 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 DISTANCE WILL NOT EXCEED 0.020".

→ indicates a change.

High-Mu Triode

GLASS-METAL PENCIL TYPE

FAST WARM-UP TIME — STURDY COAXIAL-ELECTRODE STRUCTURE

For Use in Cathode-Drive Service at Frequencies up to 3000 Mc. The 5876A is Unilaterally Interchangeable with Type 5876.

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:

Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.135	amp
Amplification Factor	56	
Transconductance, for dc plate ma. = 18, dc plate volts = 250	6500	μmhos
Direct Interelectrode Capacitances:[a]		
Grid to plate	1.4	μμf
Grid to cathode	2.4	μμf
Plate to cathode	0.035 max.	μμf

Mechanical:

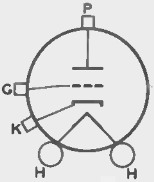
Operating Position . . . . Any

Dimensions and Terminal Connections . . . . See *Dimensional Outline*

Socket for Heater Pins. . Grayhill No.22-3[b], Cinch 54A16325[c], or equivalent

Terminal Connections (See *Dimensional Outline*):

H - Heater
K - Cathode



G - Grid
P - Plate

Thermal:

Plate-Seal Temperature (Measured on plate seal) . . . . 175 max. °C

RF AMPLIFIER — Class A_1

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

For altitudes up to 100,000 feet and frequencies up to 1700 Mc

DC PLATE VOLTAGE	300 max.	volts
DC GRID VOLTAGE	-100 max.	volts
DC PLATE CURRENT	25 max.	ma
PLATE DISSIPATION[e]	6.25 max.	watts

PEAK HEATER-CATHODE VOLTAGE:

Heater negative with respect to cathode	90 max.	volts
Heater positive with respect to cathode	90 max.	volts

Maximum Circuit Values:

Grid-Circuit Resistance	0.5 max.	megohm

RF POWER AMPLIFIER AND OSCILLATOR — Class C Telegraphy

Key-down conditions per tube without amplitude modulation[f]

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

For altitudes up to 100,000 feet and frequencies up to 1700 Mc

DC PLATE VOLTAGE	360 max.	volts
DC GRID VOLTAGE	-100 max.	volts
DC PLATE CURRENT	25 max.	ma
DC GRID CURRENT	8 max.	ma
PLATE INPUT	9 max.	watts
PLATE DISSIPATION[e]	6.25 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 in Cathode-Drive Circuit:

As oscillator

At frequency of	*500*	*1700*	*3000*	*Mc*
DC Plate-to-Grid Voltage	262	252	252	volts
DC Cathode-to-Grid Voltage[g]	12	2	2	volts
DC Plate Current	23	23	25	ma
DC Grid Current (Approx.)	6	3	4	ma
Useful Power Output (Approx.)	3	0.75	0.1	watts

As rf power amplifier at 500 Mc

DC Plate-to-Grid Voltage	326	volts
DC Cathode-to-Grid Voltage[g]	51	volts
DC Plate Current	23	ma
DC Grid Current (Approx.)	7	ma
Driver Power Output (Approx.)	2	watts
Useful Power Output (Approx.)	5	watts

Maximum Circuit Values:

Grid-Circuit Resistance	0.1 max.	megohm

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:*

For altitudes up to 100,000 feet and frequencies up to 1700 Mc

DC PLATE VOLTAGE	275 max.	volts
DC GRID VOLTAGE	−100 max.	volts
DC PLATE CURRENT	22 max.	ma
DC GRID CURRENT	8 max.	ma
PLATE INPUT	6 max.	watts
PLATE DISSIPATION[e]	4.25 max.	watts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	90 max.	volts
Heater positive with respect to cathode	90 max.	volts

Maximum Circuit Values:

Grid-Circuit Resistance	0.1 max.	megohm

FREQUENCY MULTIPLIER

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

For altitudes up to 100,000 feet and frequencies up to 1700 Mc

DC PLATE VOLTAGE	330 max.	volts
DC GRID VOLTAGE	−100 max.	volts
DC PLATE CURRENT	22 max.	ma
DC GRID CURRENT	8 max.	ma
PLATE INPUT	7.5 max.	watts
PLATE DISSIPATION	6.25 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 CCS Operation in Cathode-Drive Circuit:

	Tripler to 480 Mc	*Doubler to 960 Mc*	
DC Plate-to-Grid Voltage	390	370	volts
DC Cathode-to-Grid Voltage[g]	90	70	volts
DC Plate Current	18	17.3	ma
DC Grid Current (Approx.)	6	7	ma
Driver Power Output (Approx.)	2.1	2	watts
Useful Power Output (Approx.)	2.1	2	watts

Maximum Circuit Values:

Grid-Circuit Resistance	0.1 max.	0.1 max.	megohm

[a] Without external shield.
[b] Grayhill, Inc., 561 Hillgrove Avenue, LaGrange, Illinois.
[c] Cinch Manufacturing Company, 1026 South Homan Avenue, Chicago, Illinois.
[d] Continuous Commercial Service.
[e] In applications where the plate dissipation exceeds 2.5 watts, it is important that a large area of contact be provided between the plate cylinder and the connector to provide adequate heat conduction.
[f] 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 grid resistor.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Heater Current	1	0.127	0.143	amp
Direct Interelectrode Capacitances:				
Grid to plate	-	1.2	1.6	μμf
Grid to cathode	-	2.1	2.7	μμf
Plate to cathode	-	-	0.035	μμf
Heater-Cathode Leakage Current:				
Heater negative with respect to cathode	1,2	-	50	μa
Heater positive with respect to cathode	1,2	-	50	μa
Leakage Resistance:				
From grid to plate and cathode connected together	1,3	25	-	megohms
From plate to grid and cathode connected together	1,4	25	-	megohms
Reverse Grid Current	1,5	-	1	μa
Emission Voltage	6	-	10	volts
Amplification Factor	1,7	41	71	
Transconductance	1,7	5150	7850	μmhos
Plate Current (1)	1,7	12.5	23.5	ma
Plate Current (2)	1,8	-	55	μa
Plate Current (3)	1,9	0.5	-	ma
Power Output	1,10	0.285	-	watt

Note 1: With 6.3 volts ac or dc on heater.

Note 2: With 100 volts dc between heater and cathode.

Note 3: With grid 100 volts negative with respect to plate and cathode which are connected together.

Note 4: With plate 300 volts negative with respect to grid and cathode which are connected together.

Note 5: With dc plate voltage of 250 volts, dc grid voltage of -2.5 volts, grid resistor of 0.5 megohm.

Note 6: With dc voltage on grid and plate which are connected together adjusted to produce a cathode current of 30 ma., and with 5.5 volts on heater.

Note 7: With dc plate-supply voltage of 250 volts, cathode resistor of 75 ohms, and cathode bypass capacitor of 1000 μf.

Note 8: With dc plate voltage of 250 volts and dc grid voltage of -12 volts.

Note 9: With dc plate voltage of 250 volts and dc grid voltage of -5 volts.

Note 10: With dc plate voltage of 200 volts, grid resistor adjusted to give a dc plate current of 18 milliamperes in a cavity-type oscillator operating at 1700 ± 15 Mc.

SPECIAL TESTS & PERFORMANCE DATA

Low-Pressure Voltage Breakdown Test:

This test (similar to MIL-E-1D, paragraph 4.9.12.1) is performed on a sample lot of tubes from each production run. Tubes are tested in a chamber at an air pressure equivalent to an altitude of 100,000 feet. Breakdown will not occur when a 60-cycle rms voltage of 500 volts is applied between the plate cylinder and grid flange.

Low-Frequency Vibration Performance:

This test (similar to MIL-E-1D, paragraph 4.9.19.1) is performed on a sample lot of tubes from each production run under the following conditions:

Heater voltage of 6.3 volts, dc plate supply voltage of 250 volts, grid voltage of -2.5 volts, and plate load resistor of 10,000 ohms. The tubes are vibrated in a plane perpendicular to the tube axis at 25 cps at an acceleration of 2.5 g. The rms output voltage across the plate load resistor as a result of vibration of the tube will not exceed 100 millivolts.

High-Frequency Vibration Performance:

This test (similar to MIL-E-1D, paragraph 4.9.19.2) is performed on a sample lot of tubes from each production run. The tube is vibrated perpendicular to its axis, with no voltages applied to the tube. Vibration frequency is 40 to 60 cps and acceleration is 10 g. At the end of this test, tubes will not show temporary or permanent shorts or open circuits and will meet the following limits:

Heater-Cathode Leakage Current.	50 max.	μa
For conditions shown under *Characteristics Range Values Notes 1,2.*		
Low-Frequency Vibration (rms)	100 max.	mv
For conditions shown above under *Low-Frequency Vibration Performance.*		
Transconductance.	5150 min.	μmhos
For conditions shown under *Characteristics Range Values Notes 1,7.*		
Plate Current (2)	55 max.	μa
For conditions shown under *Characteristics Range Values Notes 1,8.*		

Shorts and Continuity Test:

This test (similar to MIL-E-1D, paragraph 4.7.3) is performed on all tubes from each production run. Voltage applied between adjacent elements of the tube under test will be between 20 and 70 volts dc or peak ac. Plate and cathode terminals are tied together and connected to the grid terminal through the shorts test equipment. Tubes are tapped with a rubber tapper three times in each of three mutually perpendicular directions. If a short indication is obtained, the tapping cycle is repeated two times for verification. Acceptance criteria is based on the "Resistance vs. Time Duration" curve shown in paragraph 4.7.7 of MIL-I-D, Amendment 5.

Glass-Seal-Fracture Test:

This test is performed on a sample lot of tubes from each production run. Tubes are placed on supports spaced 15/16" ± 1/64" apart with the grid flange centered between these supports. Tubes will withstand gradual application, perpendicular to tube axis, of a force of 30 pounds upon the grid flange without causing fracture of the glass insulation.

Heater Cycling Life Performance:

This test (similar to MIL-E-1D, paragraph 4.11.7) is performed on a sample lot of tubes from each production run. With 6.3 volts on heater and no voltage on plate and grid, the heater is cycled three minutes on and three minutes off for at least 2000 cycles. At the end of this test, tubes will not show temporary or permanent shorts or open circuits, and will meet the following limits:

Grid-Plate and Cathode
Leakage Resistance. . . . . 25 min. megohms
For conditions shown under *Characteristics Range Values Notes 1,3.*

Heater-Cathode Leakage Current. . . . . 100 max. μa
For conditions shown under *Characteristics Range Values Notes 1,2.*

1-Hour Stability Life Performance:

This test (similar to MIL-E-1D, paragraph 4.11.3.1.a) is performed on a sample lot of tubes from each production run to insure that the tubes have been properly stabilized. Tubes are operated under the following conditions:

Heater voltage of 6.3 volts, plate dissipation of 2 to 2.5 watts. At the end of 1 hour, the change in transconductance value for each tube, referred to its initial transconductance reading, will not exceed 15% of the initial value, for conditions shown under *Characteristics Range Values Notes 1,7.*

50-Hour Survival Life Performance:

This test (similar to MIL-E-1D, paragraph 4.11.3.1.b) is performed on a sample lot of tubes from each production run to insure a low percentage of early inoperatives. Life-test conditions are the same as those specified for *1-Hour Stability Life Performance* except that all voltages are cycled at the rate of 110 minutes on and 10 minutes off. At the end of 50 hours, the tubes are required to meet the following limits:

Power Output . . . . 0.2 min. watt
For conditions shown under *Characteristics Range Values Notes 1,10.*

Plate Current (2) . . . . 100 max. μa
For conditions shown under *Characteristics Range Values Notes 1,8.*

Shorts and Continuity Test specified above.

Intermittent Dynamic Life Performance:

This test (similar to MIL-E-1D, paragraph 4.11.3.2) is performed on a sample lot of tubes from each production run to insure high quality of rf performance. Each tube is life-tested in a cavity-type oscillator at 500 ± 15 Mc under the following conditions:

Heater voltage of 6.3 volts, plate supply voltage of 300 volts, cathode resistor is adjusted to give a dc plate current of 25 ma. and value is recorded, plate-circuit load resistance of zero ohms, heater positive with respect to cathode by 100 volts, and plate-seal temperature of 175° C minimum. Heater voltage is cycled at a rate of 110 minutes on and 10 minutes off. At the end of 500 hours, the tube will not show permanent shorts or open circuits and will be criticized for the total number of defects in the sample lot and for the number of tubes failing to meet the following limits:

Power Output. . . . . 0.2 min. watt
For conditions shown under *Characteristics Range Values Notes 1,10.*

Plate Current (2) . . . . 150 max. μa
For conditions shown under *Characteristics Range Values Notes 1,8.*

Shorts and Continuity Test specified above.

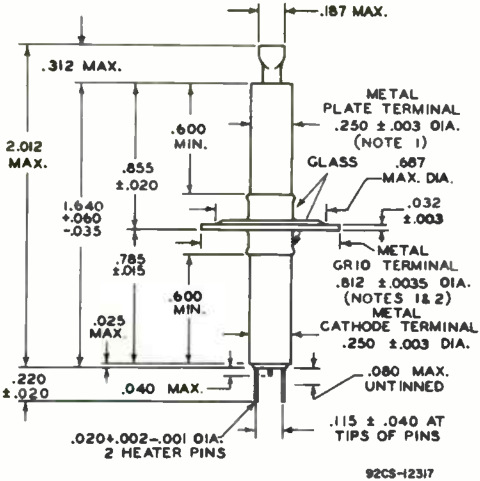
OPERATING CONSIDERATIONS

The *mounting* for this type in coaxial-line, parallel-line, or lumped circuits may support the tube securely by any one of the three terminals. Connections to the other two terminals must be made by contacts with flexible leads.

The *mounting* for this type in cavity-type circuits should preferably support the tube by the grid flange which should make firm contact to the cavity surface.

The *heater* pins of this type should not be soldered to circuit elements. The heat of the soldering operation may crack the glass seals of the heater pins and damage the tube.

The *cathode* should preferably be connected to one side of the heater. When, in some circuit designs, the heater is not connected directly to the cathode, precautions must be taken to hold the peak heater-cathode voltage to the maximum values shown in the tabulated data.



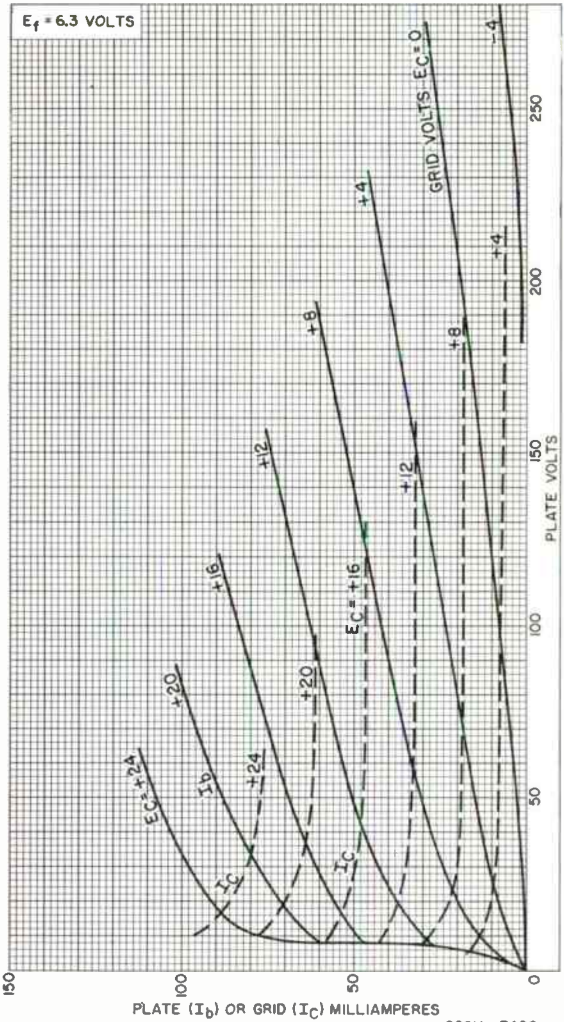
DIMENSIONS IN INCHES

NOTE 1: MAXIMUM ECCENTRICITY OF CENTER LINE (AXIS) OF PLATE TERMINAL OR GRID-TERMINAL FLANGE WITH RESPECT TO THE CENTER LINE (AXIS) OF THE CATHODE TERMINAL IS 0.008".

NOTE 2: 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 DISTANCE WILL NOT EXCEED 0.020".

→ Indicates a change.

AVERAGE CHARACTERISTICS



92CM-7426

Medium-Mu Triode

GLASS-METAL PENCIL TYPE

FAST WARM-UP TIME — STURDY COAXIAL-ELECTRODE STRUCTURE

For Use in Cathode-Drive Service
at Frequencies up to 4000 Mc

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:

Voltage (AC or DC):			
Under transmitting conditions	6.0	+5% −10%	volts
Under standby conditions	6.3	max.	volts
Current at 6.0 volts	0.280		amp
Amplification Factor	27		
Transconductance, for dc plate ma. = 25, dc plate volts = 200	6000		µmhos
Direct Interelectrode Capacitances:[a]			
Grid to plate	1.7		µµf
Grid to cathode	2.4		µµf
Plate to cathode	0.07	max.	µµf

Mechanical:

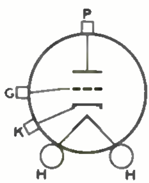
Operating Position . . . . . Any

Dimensions and Terminal Connections . . . . . See *Dimensional Outline*

Socket for Heater Pins . . Grayhill No. 22-3[b], Cinch 54A16325[c], or equivalent

Terminal Connections (See *Dimensional Outline*):

H – Heater
K – Cathode



G – Grid
P – Plate

Thermal:

Plate-Seal Temperature (Measured on plate seal)	175	max.	°C

RF AMPLIFIER — Class A_1

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

For altitudes up to 100,000 feet and frequencies up to 2000 Mc

DC PLATE VOLTAGE	330	max.	volts
DC GRID VOLTAGE	−100	max.	volts

← Indicates a change.

DC PLATE CURRENT	35 max.	ma
PLATE DISSIPATION[e]	7 max.	watts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	90 max.	volts
Heater positive with respect to cathode	90 max.	volts

Maximum Circuit Values:

Grid-Circuit Resistance	0.5 max.	megohm

PLATE-PULSED OSCILLATOR[f] — Class C

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

For altitudes up to 100,000 feet, frequencies up to 4000 Mc, and for a maximum "ON" time[g] of 5 microseconds in any 5000-microsecond interval

PEAK POSITIVE-PULSE PLATE-SUPPLY VOLTAGE[h]	1750 max.	volts
PEAK NEGATIVE-PULSE GRID-BIAS VOLTAGE	150 max.	volts
PEAK PLATE CURRENT FROM PULSE SUPPLY	3 max.	amp
PEAK RECTIFIED GRID CURRENT	1.3 max.	amp
DC PLATE CURRENT	0.003 max.	amp
DC GRID CURRENT	0.0013 max.	amp
PLATE DISSIPATION[e]	6 max.	watts
PULSE DURATION	1.5 max.	μsec

Typical Operation:

In cathode-drive circuit with rectangular wave shape at 3300 Mc, with duty factor[j] of 0.001, and pulse duration of 1 microsecond

Peak Positive-Pulse Plate-Supply Voltage[h]	1750	volts
Peak Negative-Pulse Grid-Bias Voltage	110	volts
From grid resistor of	100	ohms
Peak Plate Current from Pulse Supply	3	amp
Peak Rectified Grid Current	1.1	amp
DC Plate Current	0.003	amp
DC Grid Current	0.0011	amp
Useful Power Output at Peak of Pulse[k] (Approx.)	1200	watts

RF POWER AMPLIFIER AND OSCILLATOR — Class C Telegraphy

Key down conditions per tube without amplitude modulation[m]

Maximum Ratings, *Absolute-Maximum Values:*

For altitudes up to 100,000 feet and frequencies up to 2000 Mc

	CCS[d]	ICAS[n]	
DC PLATE VOLTAGE	320 max.	400 max.	volts
DC GRID VOLTAGE	-100 max.	-100 max.	volts

DC PLATE CURRENT	35 max.	40 max.	ma
DC GRID CURRENT	15 max.	15 max.	ma
PLATE INPUT	11 max.	16 max.	watts
PLATE DISSIPATION[e]	7 max.	8 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 rf power amplifier in cathode-drive circuit

	At 500 Mc		*At 1000 Mc*		
DC Plate-to-Grid Voltage	347	401	330	383	volts
DC Cathode-to-Grid Voltage[p]	47	51	30	33	volts
DC Plate Current	33	35	33	35	ma
DC Grid Current (Approx.)	13	13	12	13	ma
Driver Power Output (Approx.)	2	2.5	1.9	2.4	watts
Useful Power Output (Approx.)	7.5	8.5	5.5	6.5	watts

As oscillator in cathode-drive circuit ←

	At 500 Mc		
DC Plate-to-Grid Voltage	347	401	volts
DC Cathode-to-Grid Voltage[p]	47	51	volts
DC Plate Current	33	35	ma
DC Grid Current (Approx.)	13	13	ma
Useful Power Output (Approx.)	5	6	watts

Maximum Circuit Values:

Grid-Circuit Resistance	0.1 max.	0.1 max.	megohm

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:*

For altitudes up to 100,000 feet and frequencies up to 2000 Mc

	CCS[d]	*ICAS*[n]	
DC PLATE VOLTAGE	260 max.	320 max.	volts
DC GRID VOLTAGE	-100 max.	-100 max.	volts
DC PLATE CURRENT	33 max.	33 max.	ma
DC GRID CURRENT	15 max.	15 max.	ma
PLATE INPUT	8.5 max.	10.5 max.	watts
PLATE DISSIPATION[e]	5 max.	5.5 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

← Indicates a change.

→ **Typical Operation:**

In cathode-drive circuit at 500 Mc

DC Plate-to-Grid Voltage	286	345	volts
DC Cathode-to-Grid Voltage[p]	36	45	volts
DC Plate Current	30	30	ma
DC Grid Current (Approx.)	11	12	ma
Driver Power Output (Approx.)	1.8	2	watts
Useful Power Output (Approx.)	5.5	6.5	watts

Maximum Circuit Values:

Grid-Circuit Resistance	0.1 max.	0.1 max.	megohm

FREQUENCY DOUBLER

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

For altitudes up to 100,000 feet and frequencies up to 2000 Mc

	CCS[d]	*ICAS*[n]	
DC PLATE VOLTAGE	260 max.	320 max.	volts
DC GRID VOLTAGE	-100 max.	-100 max.	volts
DC PLATE CURRENT	33 max.	33 max.	ma
DC GRID CURRENT	12 max.	12 max.	ma
PLATE INPUT	8.5 max.	10.5 max.	watts
PLATE DISSIPATION[e]	6 max.	7.5 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:**

In cathode-drive circuit up to 1000 Mc

DC Plate-to-Grid Voltage	290	350	volts
DC Cathode-to-Grid Voltage[p]	40	50	volts
DC Plate Current	33	33	ma
DC Grid Current (Approx.)	7	8	ma
Driver Power Output (Approx.)	3.2	3.5	watts
Useful Power Output (Approx.)	2.75	3	watts

Maximum Circuit Values:

Grid-Circuit Resistance	0.1 max.	0.1 max.	megohm

[a] Without external shield.

[b] Grayhill, Inc., 561 Hillgrove Avenue, LaGrange, Illinois.

[c] Cinch Manufacturing Company, 1026 South Homan Avenue, Chicago, Illinois.

[d] Continuous Commercial Service.

[e] In applications where the plate dissipation exceeds 2.5 watts, it is important that a large area of contact be provided between the plate cylinder and the connector in order to provide adequate heat conduction.

[f] In this class of service, the heater should be allowed to warm up for a minimum of 60 seconds before plate voltage s applied.

→ indicates a change.

g *"ON"* time is defined as the sum of the duration of all individual pulses which occur during the indicated 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 power 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.

h The magnitude of any spike on the plate voltage pulse should not exceed a value of 2000 volts with respect to cathode and its duration should not exceed 0.01 microsecond measured at the peak-pulse-value level.

j Duty factor is the product of pulse duration and repetition rate. For variable pulse durations and pulse repetition rates, the duty factor is defined as the ratio of time "ON" to total elapsed time in any 5000-microsecond interval.

k The power output at peak of pulse is obtained from the average power output using the duty factor of the peak pulse. This procedure is necessary since the power output pulse duty factor may be less than the applied voltage pulse duty factor because of a delay in the start of rf power output.

m 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 Intermittent Commercial and Amateur Service. No operating or "ON" period exceeds 5 minutes and every "ON" period is followed by an "OFF" or stand by period of at least the same or greater duration.

p Obtained from grid resistor.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN ←

	Note	*Min.*	*Max.*	
Heater Current	1	0.260	0.300	amp
Direct Interelectrode Capacitances:				
Grid to plate	-	1.30	1.80	μμf
Grid to cathode	-	2.05	2.95	μμf
Plate to cathode	-	-	0.07	μμf
Heater-Cathode Leakage Current:				
Heater negative with respect to cathode	1,2	-	200	μa
Heater positive with respect to cathode	1,2	-	500	μa
Leakage Resistance:				
From grid to plate and cathode tied together	1,3	25	-	megohms
From plate to grid and cathode tied together	1,4	25	-	megohms
Reverse Grid Current	1,5	-	1	μa
Emission Voltage	6	-	14	volts
Peak Emission Current	1,7	2.75	-	amp
Amplification Factor	1,8	18	36	
Transconductance	1,8	4800	7200	μmhos
Plate Current (1)	1,8	16	34	ma
Plate Current (2)	1,9	-	55	μa
Power Output	1,10	4.5	-	watts
Power Output at Peak of Pulse	1,11	750	-	watts
Change in Output Frequency	12	-	3	Mc

Note 1: With 6.0 volts ac or dc on heater.

Note 2: With 100 volts dc between heater and cathode.

Note 3: With grid 100 volts negative with respect to plate and cathode which are tied together.

Note 4: With plate 300 volts negative with respect to grid and cathode which are tied together.

← Indicates a change.

Note 5: With dc plate voltage of 200 volts, dc grid voltage of -2.5 volts, grid resistor of 0.1 megohm.

Note 6: With dc voltage on grid and plate which are tied together adjusted to produce a cathode current of 30 ma, and with 5.4 volts on heater.

Note 7: With 150 volts on grid and plate which are connected together, duty factor of 0.001, and pulse duration of 1 microsecond.

Note 8: With dc plate voltage of 200 volts, cathode resistor of 100 ± 10% ohms, and cathode bypass capacitor of 1000 µf.

Note 9: With dc plate voltage of 200 volts, dc grid voltage of -20 volts.

Note 10: With dc plate voltage of 350 volts, cathode resistor adjusted to give a dc plate current of 33 milliamperes in a cavity-type oscillator operating at 500 ± 15 Mc.

Note 11: With peak positive-pulse plate supply voltage of 1750 volts, grid resistor varied to give dc plate current of 3 ma, dc grid current of approximately 1.3 ma, duty factor of 0.001, pulse duration of 1 microsecond, and frequency of 3300 ± 100 Mc.

Note 12: At end of Peak Power Output test, reduce heater voltage to 5.4 volts and note change in output frequency, then increase heater voltage to 6.3 volts and note change in output frequency.

SPECIAL TESTS & PERFORMANCE DATA

Low-Pressure Voltage Breakdown Test:

This test (similar to MIL-E-10, paragraph 4.9.12.1) is performed on a sample lot of tubes from each production run. Tubes are tested in a chamber at an air pressure equivalent to an altitude of 100,000 feet. Breakdown will not occur when a 60-cycle rms voltage of 400 volts is applied between the plate cylinder and grid flange.

Low-Frequency Vibration Performance:

This test (similar to MIL-E-1D, paragraph 4.9.19.1) is performed on a sample lot of tubes from each production run under the following conditions:

Heater voltage of 6.0 volts, dc plate supply voltage of 200 volts, grid voltage of -2.5 volts, and plate load resistor of 10,000 ohms. The tubes are vibrated in a plane perpendicular to the tube axis at 25 cycles per second at an acceleration of 2.5 g. The rms output voltage across the plate load resistor as a result of vibration of the tube will not exceed 100 millivolts.

High-Frequency Vibration Performance:

This test (similar to MIL-E-10, paragraph 4.9.19.2) is performed on a sample lot of tubes from each production run. The tube is vibrated perpendicular to its axis, with no voltages applied to the tube. Vibration frequency is 40 to 60 cps and acceleration is 10 g. At the end of this test, tubes will not show permanent shorts or open circuits.

Shorts and Continuity Test:

This test (similar to MIL-E-10, paragraph 4.7.3) is performed on all tubes from each production run. In this test, a tube is considered inoperative if it shows a permanent or temporary short or open circuit, an air leak, or reverse grid current in excess of 1 microampere for the conditions shown under *Characteristics Range Values, Notes 1,5*.

Glass Seal Fracture Tests:

Fracture tests are performed on sample lots of tubes from each production run.

1. Tubes are placed on supports spaced 15/16" ± 1/64" apart with the grid flange centered between these supports. Tubes will withstand gradual application, perpendicular to the tube axis, of a force of 50 pounds upon the grid flange without causing fracture of the glass insulation.

2. Tubes are held by clamping to the cathode terminal. Tubes will withstand gradual application of a torque of 15 inch-pounds upon the plate terminal without causing fracture of the glass insulation.

100-Hour Dynamic Life Performance:

This test (similar to MIL-E-1D, paragraph 4.11.3.2) is performed on a sample lot of tubes from each production run to insure high quality of rf performance. Each tube is life-tested in a cavity-type oscillator at 3300 ± 100 Mc under the following conditions:

Heater voltage of 6.0 volts, peak positive-pulse plate supply voltage of 1750 volts, grid resistor is adjusted to give a dc plate current of 3 ma., dc grid current of approximately 1.3 ma., duty factor of 0.001, and pulse duration of 1 microsecond.

At the end of 100 hours, the tubes will have a minimum peak pulse power output of 600 watts.

500-Hour Dynamic Life Performance:

This test (similar to MIL-E-1D, paragraph 4.11.3.2) is performed on a sample lot of tubes from each production run to insure high quality of rf performance. Each tube is life-tested in a cavity-type oscillator at 500 ± 15 Mc under the following conditions:

Heater voltage of 6.0 volts, plate supply voltage of 350 volts, cathode resistor is adjusted to give a dc plate current of 33 ma.

At the end of 500 hours, the tubes will have a minimum power output of 3.5 watts.

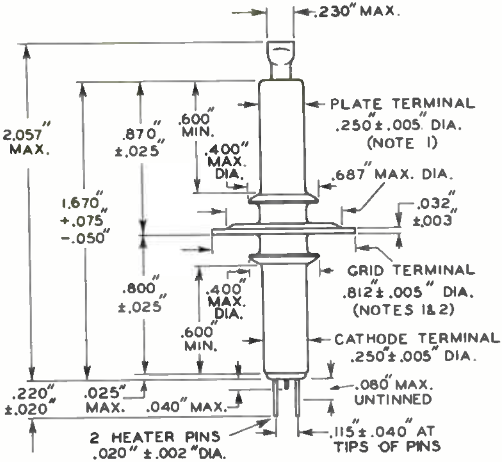
OPERATING CONSIDERATIONS

The *mounting* for this type in coaxial-line, parallel-line, or lumped circuits may support the tube securely by any one of the three terminals. Connections to the other two terminals must be made by contacts with flexible leads.

The *mounting* for this type in cavity-type circuits should preferably support the tube by the grid flange which should make firm contact to the cavity surface.

The *heater pins* of this type should not be soldered to circuit elements. The heat of the soldering operation may crack the glass seals of the heater pins and damage the tube.

The *cathode* should preferably be connected to one side of the heater. When, in some circuit designs, the heater is not connected directly to the cathode, precautions must be taken to hold the peak heater-cathode voltage to the maximum values shown in the tabulated data.



92CS-7419R3

NOTE 1: MAXIMUM ECCENTRICITY OF CENTER LINE (AXIS) OF PLATE TERMINAL OR GRID-TERMINAL FLANGE WITH RESPECT TO THE CENTER LINE (AXIS) OF THE CATHODE TERMINAL IS 0.010".

NOTE 2: 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 0.020".

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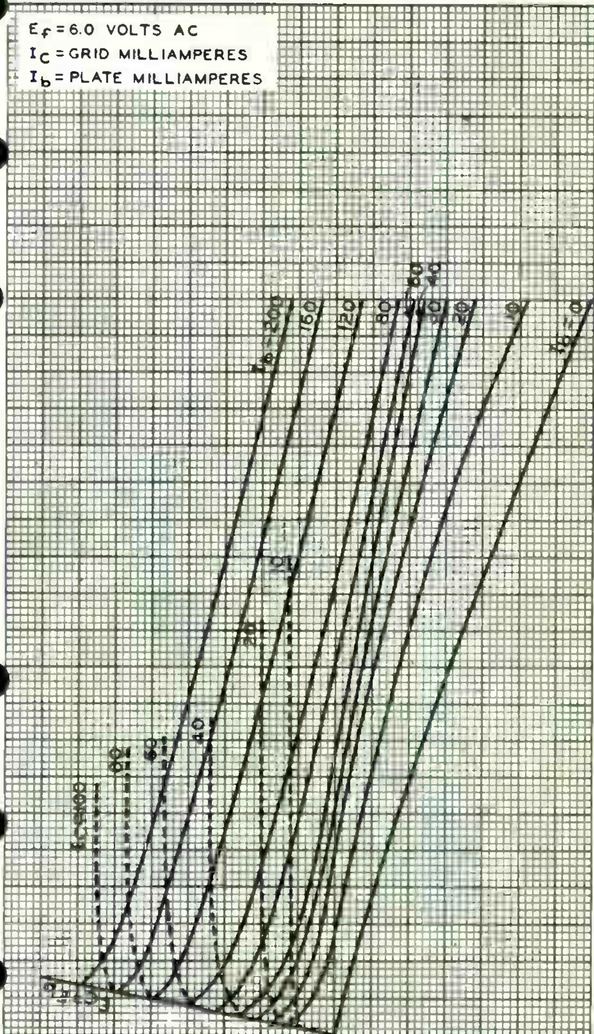
AVERAGE CONSTANT-CURRENT CHARACTERISTICS



JAN. 23, 1952

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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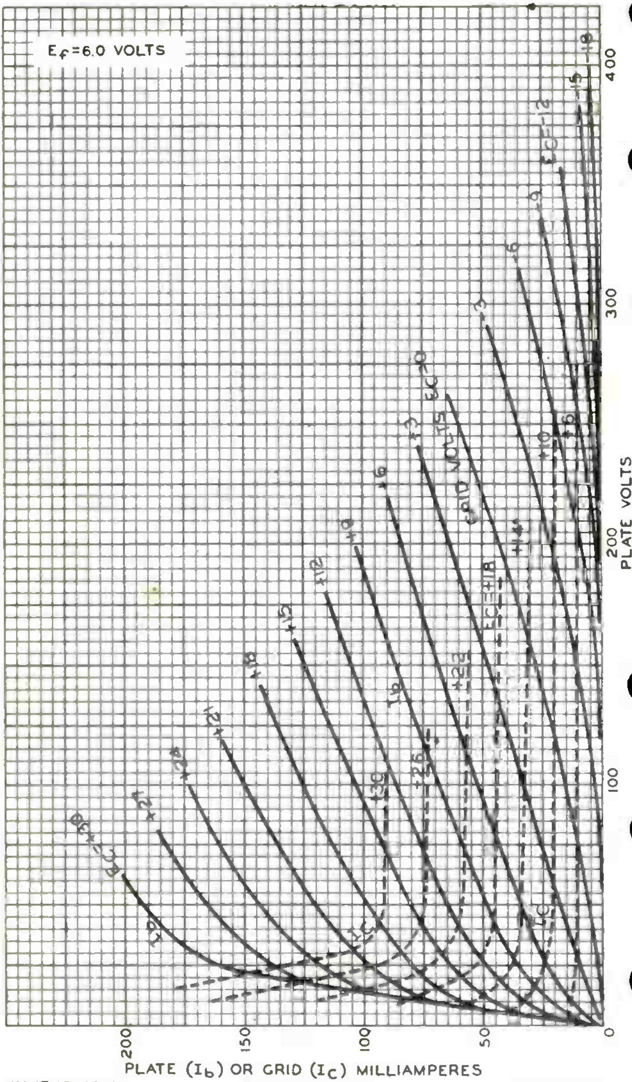
AVERAGE PLATE CHARACTERISTICS



JUNE 13, 1951

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7610

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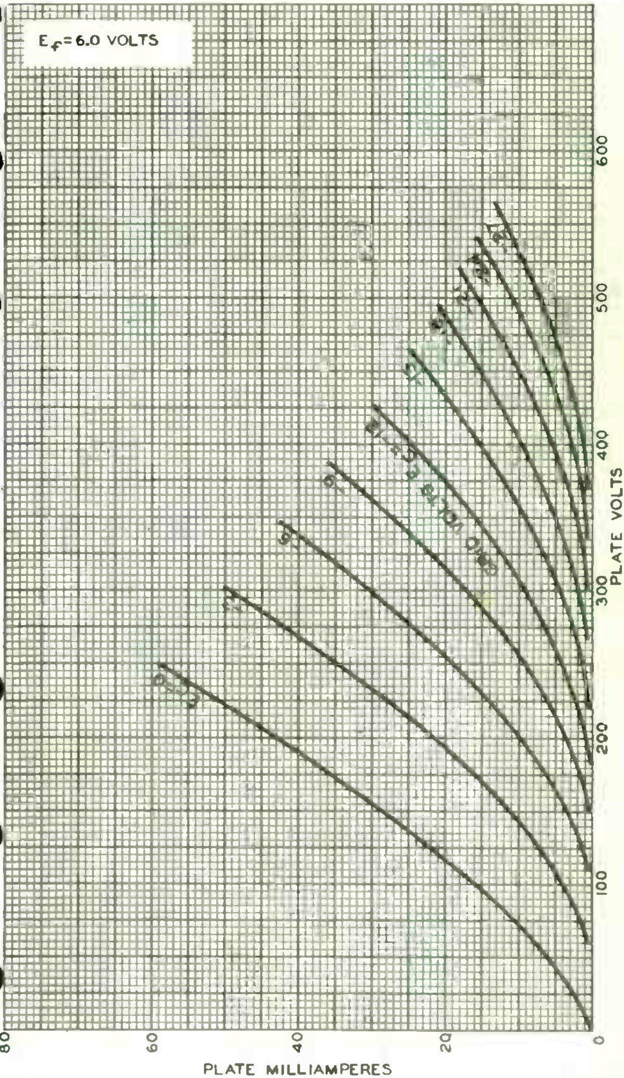
AVERAGE PLATE CHARACTERISTICS



JUNE 13, 1951 TUBE DEPARTMENT 92CM-7483

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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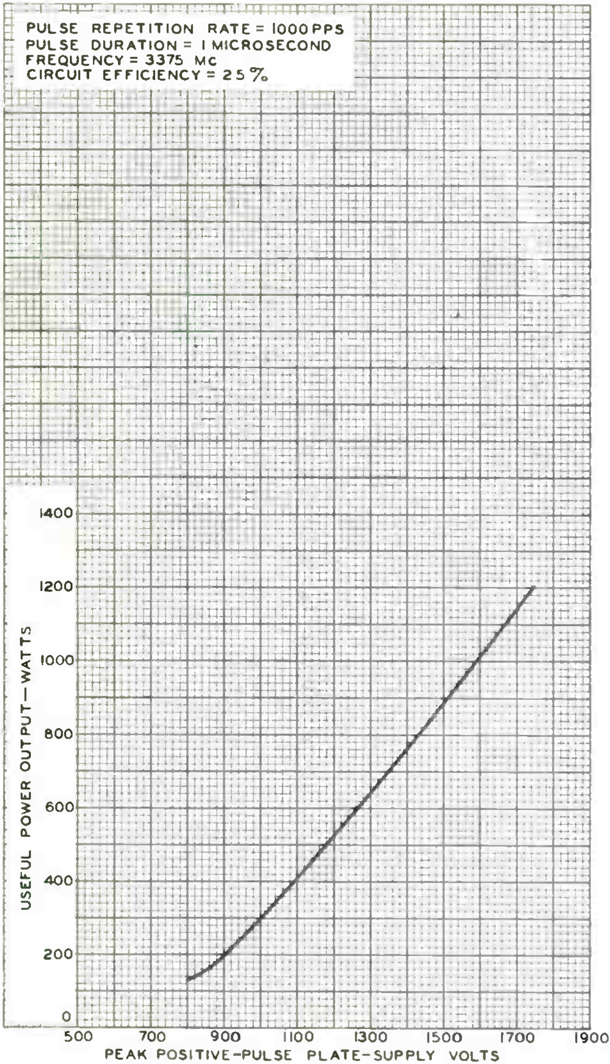
AVERAGE PERFORMANCE CHARACTERISTIC



Power Triode

FORCED-AIR COOLED — GROUNDED-GRID TYPE

For UHF Plate-Pulsed Oscillator and Amplifier Service

GENERAL DATA

Electrical:

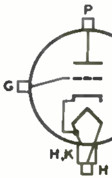
Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3	volts
Current	3.4	amp
Minimum heating time	1	minute
Amplification Factor	25	
Direct Interelectrode Capacitances:		
Grid to plate	6.0	pf
Grid to cathode	11.0	pf
Plate to cathode[a]	0.19 max.	pf

Mechanical:

Operating Position	Any
Overall Length	3-5/16" ± 3/32"
Diameter	1.750" ± 0.010"
Weight (Approx.)	8 oz
Radiator	Integral part of tube
Mounting	Special

Terminal Diagram (See *Dimensional Outline*):

P – Plate
G – Grid



K – Cathode
H – Heater

Thermal:

Air Flow:

The specified air flow for various plate dissipations, as indicated in the tabulation below, should be delivered by a blower onto the respective terminals and seals, and through the radiator before and during the application of any voltages. Heater power, plate power, and air may be removed simultaneously.

Plate Dissipation	150	200	250	watts
Min. Air Flow	5.7	10	16	cfm
Static Pressure	0.16	0.4	0.85	in. of water

The above flow and pressure values are for condition with radiator temperature held constant at 135° C rise above ambient temperature. The air flow must be adequate to limit the temperature of the radiator, grid terminal, cathode terminal, and seals to their respective maximum values.

Radiator Temperature (Measured on core at end adjacent to plate ring)	180 max.	°C
Grid-Terminal Temperature	150 max.	°C

← Indicates a change.

Cathode-Terminal Temperature.	150 max.	°C
Seal Temperature (Plate, grid, and cathode) .	150 max.	°C

PLATE-PULSED OSCILLATOR & AMPLIFIER — Class C

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

For maximum "on" time[b] of	*10 μsec*	*100 μsec*	
PEAK POSITIVE-PULSE PLATE-SUPPLY VOLTAGE.	7500 max.	7500 max.	volts
PEAK NEGATIVE-PULSE GRID-BIAS VOLTAGE	600 max.	600 max.	volts
PEAK PLATE CURRENT FROM PULSE SUPPLY	4.5 max.	3.5 max.	amp
PEAK RECTIFIED GRID CURRENT . .	1 max.	0.75 max.	amp
DC PLATE CURRENT.	0.045 max.	0.250 max.	amp
DC GRID CURRENT	0.010 max.	0.070 max.	amp
→ PLATE INPUT	340 max.	340 max.	watts
PLATE DISSIPATION	250 max.	250 max.	watts

Typical Operation with Rectangular Wave Shape in Oscillator Circuit at 1250 Mc:

With duty factor[c] of 0.01			
Peak Positive-Pulse Plate-Supply Voltage.	5500	7500	volts
Peak Negative-Pulse Grid-Bias Voltage	375	500	volts
Cathode Resistor[d]	100	100	ohms
Peak RF Grid Voltage.	625	850	volts
Peak Plate Current From Pulse Supply	3.5	4.5	amp
Peak Rectified Grid Current	0.25	0.5	amp
DC Plate Current.	0.035	0.045	amp
DC Grid Current	0.0025	0.005	amp
Useful Power Output at Peak of Pulse[e] (Approx.)	8000	14000	watts

a With external shield connected to grid.

b *"ON" time* is defined as the sum of the durations of all the individual pulses which occur during the interval of 1000 microseconds. *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.

c Duty factor is the product of pulse duration and repetition rate. For variable pulse durations and pulse repetition rates, the duty factor is defined as the ratio of time "on" to total elapsed time in any 500-microsecond interval.

d It is recommended that the entire bias be obtained from a cathode resistor. In certain applications, partial grid-resistor bias may be used.

e The power output at peak of pulse is obtained from the average power output using the duty factor of the peak power output pulse. This procedure is necessary since the power output pulse duty factor may be less than the applied voltage pulse duty factor because of a delay in the start of rf power output.

→ Indicates a change.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Heater Current	1	3.05	3.75	amp
Amplification Factor	1,2	18	32	
Grid-Plate Capacitance	–	5.6	6.6	pf
Grid-Cathode Capacitance	–	10.5	12.5	pf
Plate-Cathode Capacitance	3	0.12	0.26	pf
Plate Voltage	1,4	500	850	volts
Plate Voltage	1,5	690	1140	volts
Grid Voltage	1,6	–	–165	volts
Peak Cathode Current	1,7	12	–	amp
Useful Power Output at Peak of Pulse	1,8	12	–	kw

Note 1: With 6.3 volts 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 connected to grid terminal.

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 1600 volts, and dc grid voltage adjusted to give dc plate current of 1 milliampere.

Note 7: Represents the maximum value of cathode current (Plate current and grid current) for the tube under any condition of operation.

Note 8: With peak positive-pulse plate-supply voltage of 7500 volts, cathode-bias resistor of 100 ± 10 per cent ohms, peak plate current from pulse supply of 4.5 amperes, peak rectified grid current of 0.5 ampere, duty factor of 0.01, and frequency of 1250 Mc.

MAXIMUM RATINGS vs OPERATING FREQUENCY

OPERATING FREQUENCY Mc	MAXIMUM PERMISSIBLE PERCENTAGE OF MAXIMUM RATED PLATE VOLTAGE & PLATE INPUT
	Plate-Pulsed Oscillator and Amplifier Service
1300	100
2000	75

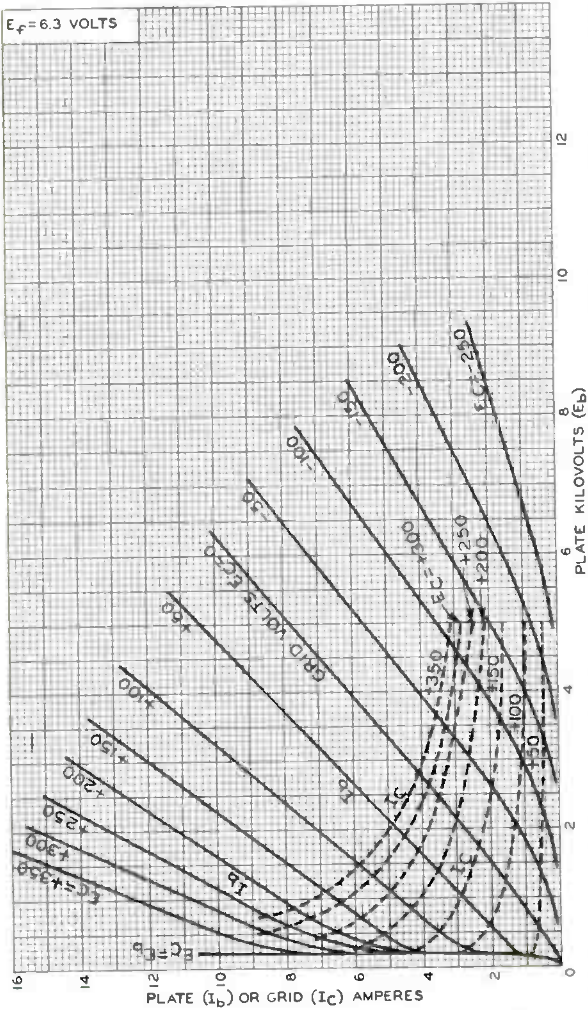
DIMENSIONAL OUTLINE and MOUNTING ARRANGEMENT shown under Type 6161 also apply to the 5946

OPERATING NOTES

Rated heater voltage should be applied for at least one minute to allow the cathode to reach normal operating temperature before voltages are applied to the other electrodes. In circuits where the plate is grounded and the negative pulse is applied to the cathode, the heater supply must be insulated to withstand the peak-positive-pulse plate-supply voltage, and it should also present a minimum amount of capacitance loading to the pulse-supply source.

← Indicates a change.

AVERAGE CHARACTERISTICS



92CM-7555

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6026
OSCILLATOR TRIODE

SUBMINIATURE TYPE

For radiosonde service at 400 Mc

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:

Voltage range*	5.2 to 6.6	ac or dc volts
Current at 6.3 volts	0.2	amp

Direct Interelectrode Capacitances (Approx.):°

Grid to plate	1.3	μμf
Grid to cathode and heater	2	μμf
Plate to cathode and heater	0.42	μμf

Characteristics, Class A_1 Amplifier:

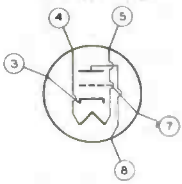
Plate-Supply Voltage	120	volts
Cathode Resistor	220	ohms
Amplification Factor	24	
Plate Resistance (Approx.)	4000	ohms
Transconductance	5900	μmhos
Plate Current	12	ma

Mechanical:

Mounting Position	Any
Maximum Length (Excluding flexible leads)	1-1/2"
Length, Bulb Seat to Bulb Top (Excluding tip)	1.200" ± 0.060"
Maximum Diameter	0.400"
Dimensional Outline	*See General Section*
Bulb	T-3
Leads, Flexible	5
Length	1-1/2" to 1-3/4"
Orientation and diameter	*See Dimensional Outline*

BOTTOM VIEW

Lead 3 - Cathode
Lead 4 - Heater
Lead 5 - Heater



Lead 7 - Grid
Lead 8 - Plate

OSCILLATOR - Class C Telegraphy

Maximum Ratings*, *Absolute Values:*

DC PLATE VOLTAGE	150 max.	volts
DC GRID VOLTAGE	-50 max.	volts
TOTAL CATHODE CURRENT	40 max.	ma

* Heater-voltage range and maximum ratings are established on basis that tube heater will be supplied from batteries in radiosonde and similar applications utilizing equipment designed for extreme compactness and light weight and requiring tube life of only a few hours.

° Without external shield.

← Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

6026

OSCILLATOR TRIODE

DC GRID CURRENT	10 max.	ma
PLATE INPUT	3.3 max.	watts
PLATE DISSIPATION	3 max.	watts
PEAK HEATER-CATHODE VOLTAGE	0 max.	volts

Typical Operation as Oscillator at 400 Mc:

DC Plate Voltage	135	volts
Grid Resistor	1300	ohms
DC Plate Current	20	ma
DC Grid Current (Approx.)	9.5	ma
Useful Power Output	1.25	watts

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Heater Current:				
With 5.2 volts ac on heater	-	0.176	-	amp
With 6.6 volts ac on heater	-	-	0.225	amp
Direct Interelectrode Capacitances:				
Grid to plate	1	1.05	1.55	μμf
→ Grid to cathode and heater	1	1.55	2.45	μμf
→ Plate to cathode and heater	1	0.345	0.495	μμf
Amplification Factor	2	17	31	
Transconductance	3	4200	7600	μmhos
Transconductance	4	4600	8000	μmhos
Plate Current	3	8	16	ma
Plate Current	4	9.5	18.5	ma
Plate Current	5	-	300	μamp

Note 1: Without external shield.

Note 2: With 5.2 or 6.3 volts ac on heater, dc plate-supply volts = 120, and cathode resistor (ohms) = 220.

Note 3: With 5.2 volts ac on heater, dc plate-supply volts = 120, and cathode resistor (ohms) = 220.

Note 4: With 6.3 volts ac on heater, dc plate-supply volts = 120, and cathode resistor (ohms) = 220.

Note 5: With 5.2 volts ac on heater, dc plate-supply volts = 120, dc grid volts = -12, and cathode resistor (ohms) = 220.

OPERATING CONSIDERATIONS

→ It is recommended that the cathode of the 6026 be connected directly to the heater.

The *flexible leads* of the 6026 are usually soldered to the circuit elements. Soldering of the connections should be made as far as possible from the glass button. If this precaution is not followed, the heat of the soldering operation may crack the glass seals and damage the tube.

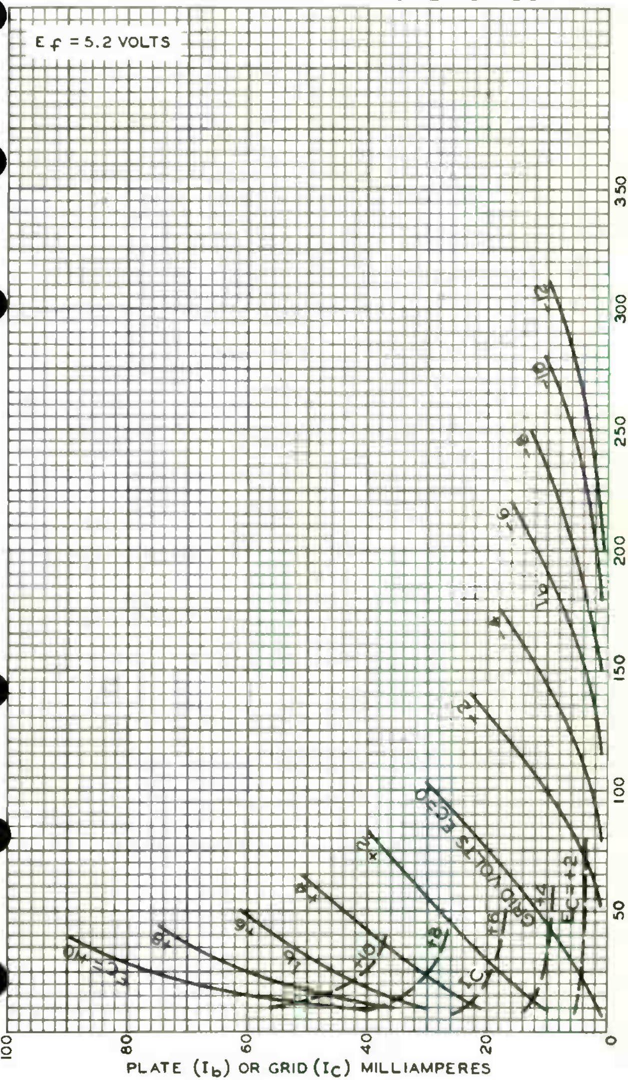
→ Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

6026

AVERAGE PLATE CHARACTERISTICS



APRIL 16, 1951

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7640

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

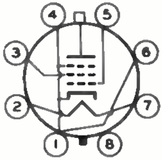
Mechanical:

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)

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[q]	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

Maximum Ratings, *Absolute-Maximum Values up to 60 Mc:*

	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	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

Maximum Ratings, *Absolute-Maximum Values:*

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

	CCS	ICAS	
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:

	CCS		ICAS	
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

	CCS		ICAS		
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:

As amplifier up to 175 Mc

	CCS	ICAS	
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[y] . . . . . 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.

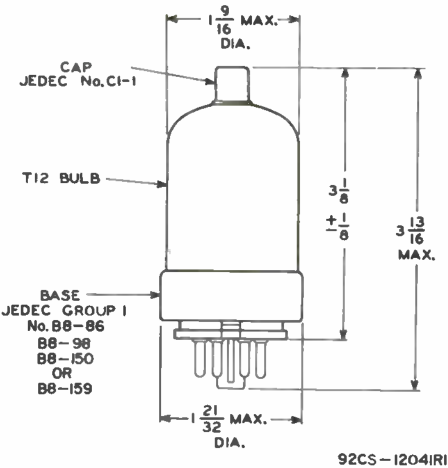
To insure adequate cooling it is essential that free circulation of air be provided around the tube. In most cases, no additional air is required.

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.

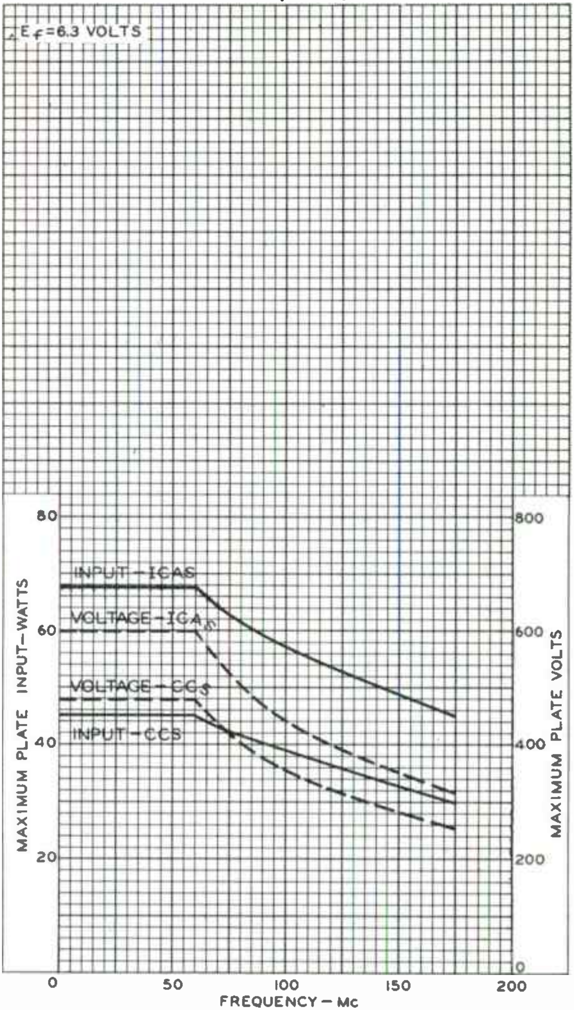
During standby periods in intermittent operation, it is recommended that the heater voltage be maintained at normal operating value when the period is less than 15 minutes, and that it be reduced to 80 per cent of normal when the period is between 15 minutes and 2 hours. For longer periods, the heater 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.



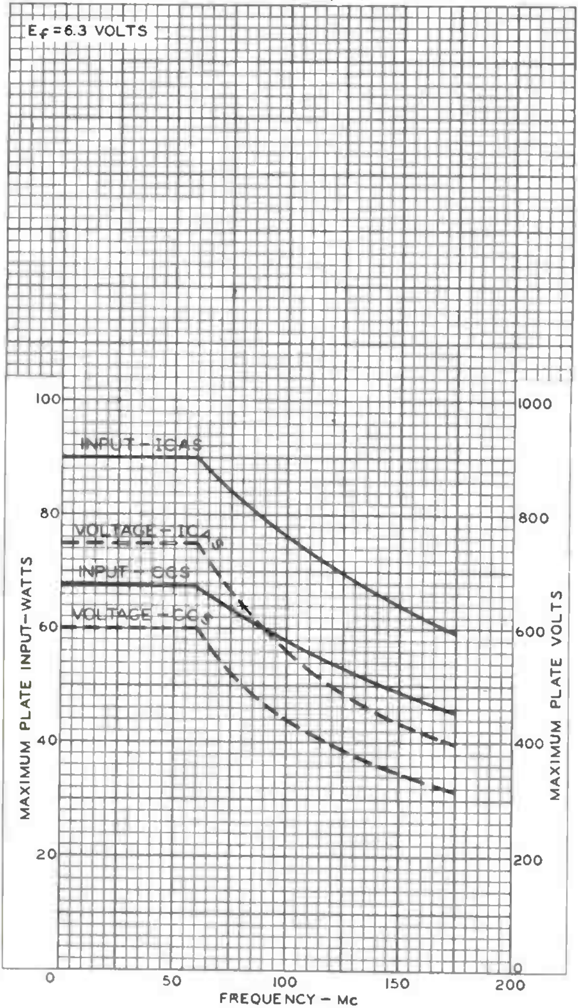
DIMENSIONS IN INCHES

RATING CHART I
Class C Telephony Service



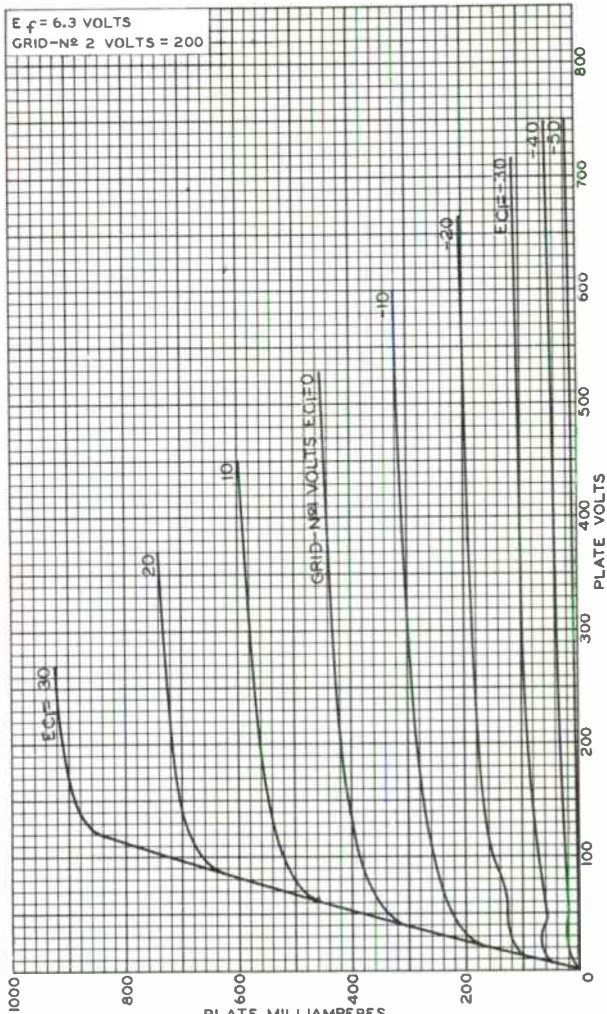
92CM-7712R1

RATING CHART II
Class C Telegraphy Service

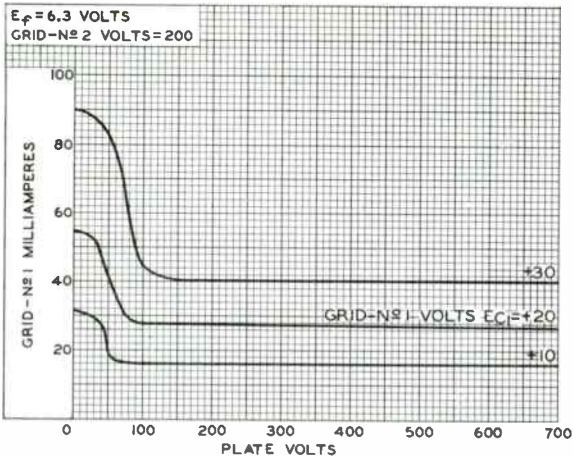


92CM-7709R1

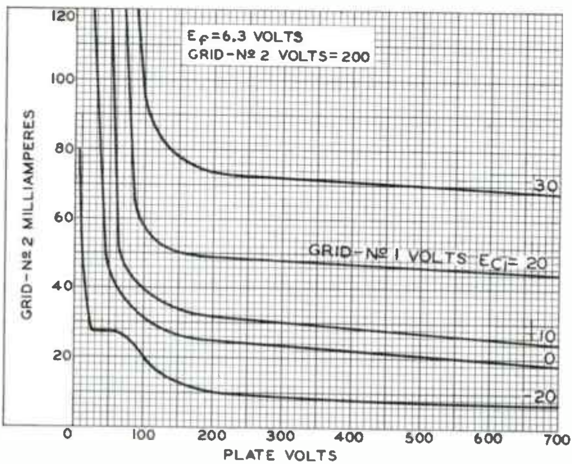
TYPICAL PLATE CHARACTERISTICS



TYPICAL CHARACTERISTICS



92CS-9617



92CS-9618

Beam Power Tube

HIGH POWER SENSITIVITY
RCA "DARK HEATER" WITH 5- TO 8-VOLT RANGE

85 WATTS CW INPUT (ICAS) UP TO 60 Mc

CONTROLLED ZERO-BIAS PLATE CURRENT

50 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 6146B/8298A is Unilaterally Interchangeable with types 6146, 6146A, and 8298.

Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3	volts
Current at heater volts = 6.3	1.125	amp
Minimum heating time	60	sec
(See *Special Performance Data* for heater operation in stationary and mobile equipment)		
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	0.22 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

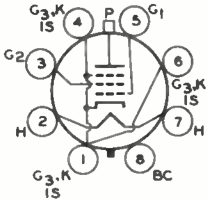
Mechanical:

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)

Bases (Alternates):
- 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. B9-159)

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). . . . . 260 max. °C

AF POWER AMPLIFIER & MODULATOR — Class AB_1[b]

	CCS[c]	*ICAS*[d]	
Maximum Ratings, *Absolute-Maximum Values:*			
DC Plate Voltage	600 max.	750 max.	volts
DC Grid-No.2 Voltage	250 max.	250 max.	volts
Max.-Signal DC Plate Current[e].	175 max.	220 max.	ma
Max.-Signal Plate Input[e] . . .	90 max.	120 max.	watts
Max.-Signal Grid-No.2 Input[e] .	3 max.	3 max.	watts
Plate Dissipation[e]	27 max.	35 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 Push-Pull Operation:

Values are for 2 tubes

DC Plate Voltage	600	750	volts
DC Grid-No.2 Voltage[f].	200	200	volts
DC Grid-No.1 Voltage: With fixed-bias source . . .	-47	-48	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage[g]	94	96	volts
Zero-Signal DC Plate Current .	48	50	ma
Max.-Signal DC Plate Current .	250	250	ma
Max.-Signal DC Grid No.2 Current.	14.8	12.6	ma
Effective Load Resistance (Plate to plate)	5600	7200	ohms
Max.-Signal Driving Power (Approx.).	0	0	watts
Max.-Signal Power Output (Approx.)	96	124	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_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]	175 max.	220 max.	ma
Max.-Signal Plate Input[e]	90 max.	120 max.	watts
Max.-Signal Grid-No.2 Input[e]	3 max.	3 max.	watts
Plate Dissipation[e]	27 max.	35 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 Push-Pull Operation:

Values are for 2 tubes

	CCS		ICAS		
DC Plate Voltage	500	600	600	750	volts
DC Grid-No.2 Voltage[f]	200	200	200	150	volts
DC Grid-No.1 Voltage:					
From fixed-bias source	-46	-48	-47	-39	volts
Peak AF Grid-No.1-to-Grid No.1 Voltage	108	106	114	110	volts
Zero-Signal DC Plate Current	50	40	50	40	ma
Max.-Signal DC Plate Current	308	270	328	294	ma
Max.-Signal DC Grid No.2 Current	26	27	26	28	ma
Max.-Signal DC Grid No.1 Current	2.7	1.3	3.4	7.6	ma
Effective Load Resistance (Plate to plate)	3620	5200	4160	6050	ohms
Max.-Signal Driving Power (Approx.)[k]	0.2	0.7	0.2	0.5	watt
Max.-Signal Power Output (Approx.)	100	110	130	148	watts

Maximum Circuit Values (CCS or ICAS):

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

LINEAR RF POWER AMPLIFIER — Class AB_1
Single-Sideband Suppressed-Carrier Service

Peak envelope conditions for a signal having a minimum peak-to-average power ratio of 2

	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 Plate Current at Peak of Envelope	175 max.	220 max.	ma
Plate Dissipation	27 max.	35 max.	watts
Grid-No.2 Dissipation	3 max.	3 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 with "Two-Tone Modulation":

	At 30 Mc		
DC Plate Voltage	600	750	volts
DC Grid-No.2 Voltage[n]	200	200	volts
DC Grid-No.1 Voltage[n]	-47	-48	volts
Zero-Signal DC Plate Current	24	25	ma
Effective RF Load Resistance	2800	3600	ohms
DC Plate Current at Peak of Envelope	125	125	ma
Average DC Plate Current	86	86	ma
DC Grid-No.2 Current at Peak of Envelope	7.4	6.3	ma
Average DC Grid-No.2 Current	5	3.9	ma
Distortion Products Level:[p]			
Third order	24	26	db
Fifth order	30	31	db
Useful Power Output (Approx.):			
Average	24.5	30.5	watts
Peak envelope	49	61	watts

Maximum Circuit Values:

Grid-No.1 Circuit Resistance under Any Condition:		
With fixed bias	30000 max.	ohms

PLATE-MODULATED RF POWER AMPLIFIER — Class C Telephony

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

	CCS	ICAS	
DC Grid-No.1 Voltage.	-150 max.	-150 max.	volts
DC Plate Current.	145 max.	180 max.	ma
DC Grid-No.1 Current.	3.5 max.	4 max.	ma
Plate Input	60 max.	85 max.	watts
Grid-No.2 Input	2 max.	2 max.	watts
Plate Dissipation	18 max.	23 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:

	CCS	ICAS	
DC Plate Voltage.	475	600	volts
DC Grid-No.2 Voltage[q]	165	175	volts
DC Grid-No.1 Voltage:[r]			
From a grid-No.1 resistor of:			
26000 ohms.	-86	–	volts
27000 ohms.	–	-92	volts
Peak RF Grid-No.1 Voltage . .	106	114	volts
DC Plate Current.	125	140	ma
DC Grid-No.2 Current.	8.5	9.5	ma
DC Grid-No.1 Current (Approx.)	3.3	3.4	ma
Driving Power (Approx.) . . .	0.4	0.5	watt
Power Output (Approx.). . . .	42	62	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

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.	175 max.	220 max.	ma
DC Grid-No.1 Current.	3.5 max.	4 max.	ma
Plate Input	90 max.	120 max.	watts
Grid-No.2 Input	3 max.	3 max.	watts
Plate Dissipation	27 max.	35 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:

	CCS	ICAS	
As amplifier up to 60 Mc			
DC Plate Voltage	600	750	volts
DC Grid-No.2 Voltage[t]	200	200	volts
DC Grid-No.1 Voltage:[u]			
From a grid-No.1 resistor of:			
24000 ohms	-70	-	volts
28000 ohms	-	-77	volts
Peak RF Grid-No.1 Voltage	90	95	volts
DC Plate Current	150	160	ma
DC Grid-No.2 Current	10	10	ma
DC Grid-No.1 Current (Approx.)	2.8	2.7	ma
Driving Power (Approx.)	0.3	0.3	watt
Power Output (Approx.)	63	85	watts

Typical Operation:

As amplifier up to 175 Mc				
DC Plate Voltage	320	400	435	volts
DC Grid-No.2 Voltage[t]	210	220	230	volts
DC Grid-No.1 Voltage:[u]				
From a grid-No.1 resistor of:				
26000 ohms	-52	-	-	volts
30000 ohms	-	-55	-	volts
24000 ohms	-	-	-56	volts
Peak RF Grid-No.1 Voltage	65	67	73	volts
DC Plate Current	170	180	210	ma
DC Grid-No.2 Current	12	12	11	ma
DC Grid-No.1 Current (Approx.)	2	1.9	2.3	ma
Driving Power (Approx.)	2	2	3	watts
Power Output (Approx.)	29	40	50	watts

Maximum Circuit Values (CCS or ICAS):

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

[a] With no 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 30,000 ohms when the tube 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.

n Obtained preferably from a separate, well-regulated source.

p Referenced to either of the two tones and without the use of feedback to enhance linearity.

q 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 tube 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 tube is used in a circuit which is not keyed. Grid-No.2 voltage must not exceed 435 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

Test No.		*Note*	*Min.*	*Max.*	
1.	Direct Interelectrode Capacitances:				
	Grid No.1 to plate	1	–	0.22	pf
	Grid No.1 to cathode & grid No.3 & internal shield, base sleeve, grid No.2, and heater	1	12.0	15.0	pf
	Plate to cathode & grid No.3 & internal shield, base sleeve, grid No.2, and heater	1	7.3	9.5	pf
2.	Plate Current	2	46	94	ma
3.	Zero-Bias Plate Current	3	330	–	ma
4.	Grid-No.2 Current	2	–	5.5	ma

Note 1: With no external shield.

Note 2: With heater voltage of 6.75 volts, dc plate voltage of 400 volts, dc grid-No.2 voltage of 200 volts, and dc grid-No.1 voltage of -34 volts.

Note 3: With heater voltage of 6.75 volts, dc plate voltage of 100 volts, dc grid-No.2 voltage of 200 volts, and dc grid-No.1 voltage of -100 volts. Grid No.1 is square-wave pulsed at 1000 kc to zero volts. Limit value is peak-pulse current.

SPECIAL PERFORMANCE DATA

Stationary Equipment Operation:

	Min.	*Design Center*	*Max.*	
Heater, for Unipotential Cathode:				
Voltage (AC or DC)v	–	6.3	–	volts
Current at 6.3 volts	1.050	–	1.200	amp
Dynamic Grid-No.2 Currentw	–	–	15	ma
Useful Power Outputw	59	–	–	watts

v It is recommended that the design-center heater voltage be 6.3 volts; the heater power supply should not fluctuate more than 10% to insure long life.

w In a single-tube, self-excited oscillator circuit, and with ac heater voltage of 6.3 volts, dc plate voltage of 600 volts, dc grid-No.2 voltage of 200 volts, grid-No.1 resistor of 24,000 ± 10% ohms, dc plate current of 150 max. ma., dc grid-No.1 current of 2.5 to 3 ma., and frequency of 15 Mc.

Mobile Equipment Operation:

	Min.	Design Range	Max.	
Heater, for Unipotential Cathode:				
Voltage (AC or DC)[x]	–	6.0-7.5	–	volts
Current at 6.75 volts.	1.100	–	1.230	amp
Dynamic Grid-No.2 Current[y] . . .	–	–	15	ma
Useful Power Output I[y]	59			watts
Useful Power Output II		See *Note Z*		

Overvoltage Heater Life Tests:

Continuous heater life tests are performed periodically on sample lots of tubes with 8 volts on the heater, all other electrodes "floating". Intermittent heater life tests are performed periodically on sample lots of tubes with 11 volts on the heater, a cycle of 1 minute "ON" and 4 minutes "OFF". After 1000 hours of the continuous heater life test and after 48 hours of the intermittent heater life test, the following tests are performed:

With heater voltage of 6.75 volts and ± 100 dc volts between cathode and heater, the heater-cathode leakage current will not exceed 100 microamperes.

With ac or dc heater voltage of 6.75 volts, grid-No.1 volts = -200 and cathode, grid No.2, and plate grounded, the minimum grid-No.1 leakage resistance will be 10 megohms.

With ac or dc heater voltage of 6.75 volts, plate volts = -200, and cathode grid No.1 and grid No.2 grounded, the minimum plate leakage resistance will be 10 megohms.

x It is recommended that the heater voltage operate within the range of 6.0 to 7.5 volts and within excursions from 5 to 8 volts in battery operation. See *Useful Power Output Test II* and *Overvoltage Tests*.

y In a single-tube, self-excited oscillator circuit, and with ac heater voltage of 6.3 volts, dc plate voltage of 600 volts, dc grid-No.2 voltage of 200 volts, grid-No.1 resistor of 24,000 ± 10% ohms, dc plate current of 150 max. ma., dc grid-No.1 current of 2.5 to 3 ma., and frequency of 15 Mc.

z With conditions in note (y) above, reduce heater voltage to 5 volts. Useful power output will be at least 60% of the power output at heater voltage of 6.3 volts.

OPERATING CONSIDERATIONS

The maximum bulb temperature of 260° 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.

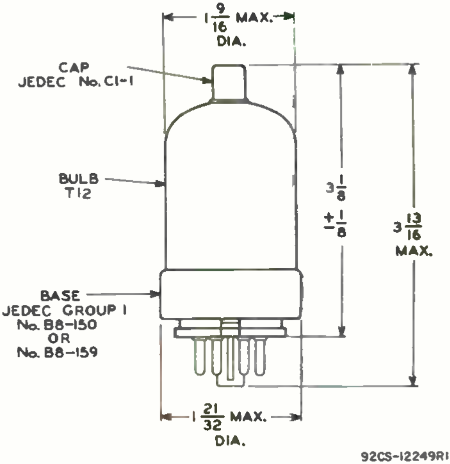
To insure adequate cooling it is essential that free circulation of air be provided around the tube. In most cases, no additional air is required.

The plate shows no color when the 6146B/8298A 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.

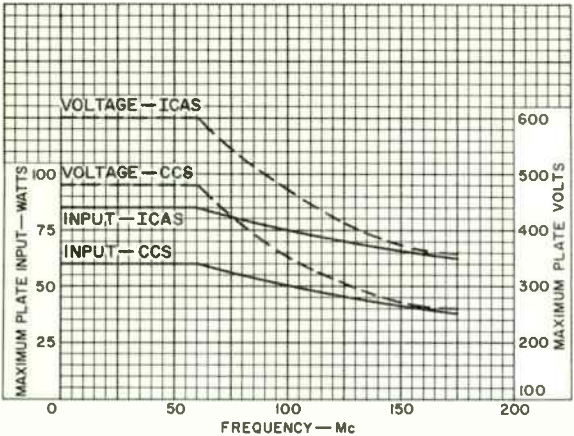
During standby periods in intermittent operation, it is recommended that the heater voltage be maintained at normal operating value when the period is less than 15 minutes, and that it be reduced to 80 per cent of normal when the period is between 15 minutes and 2 hours. For longer periods, the heater 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.



DIMENSIONS IN INCHES

RATING CHART I
Class C Telephony Service



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RATING CHART II
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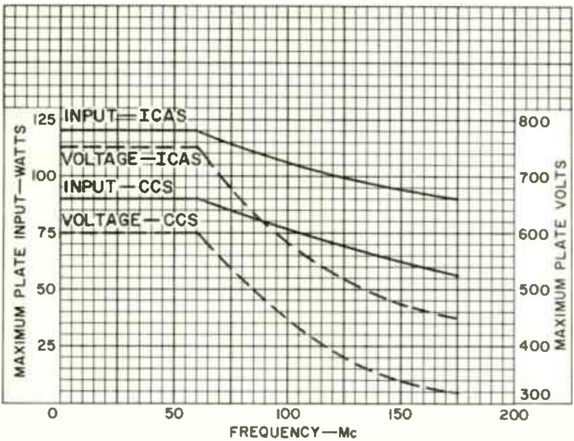
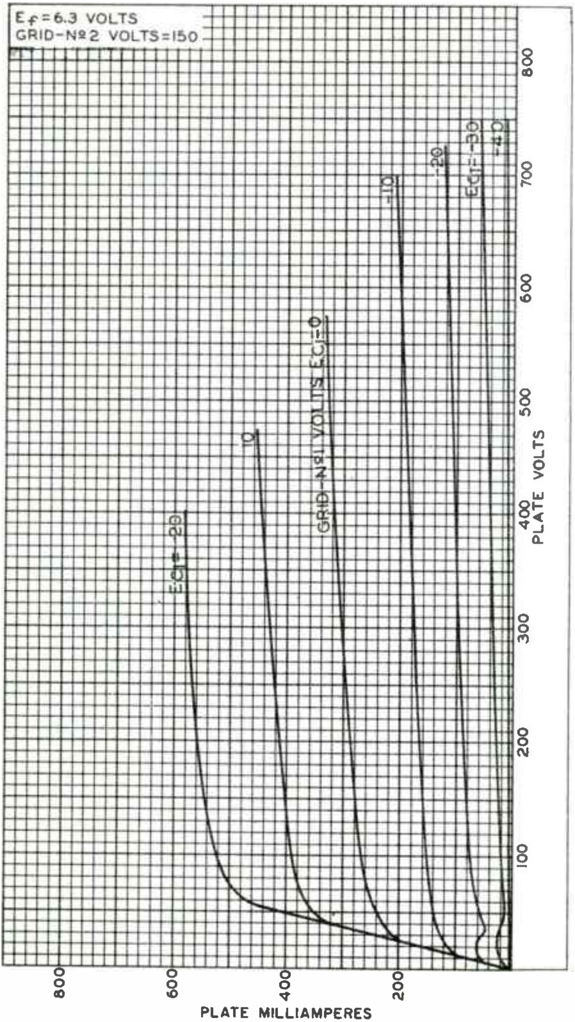


92CS-12243

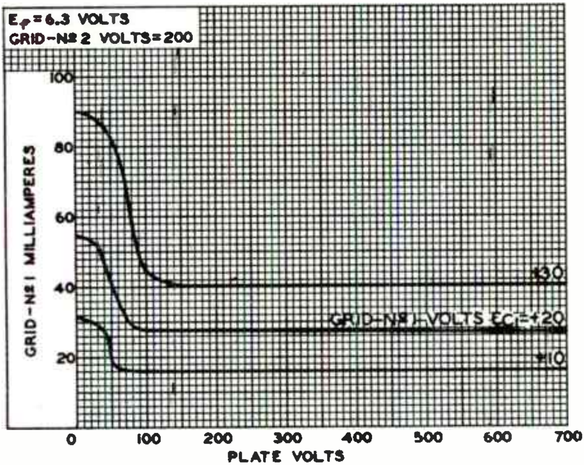
TYPICAL PLATE CHARACTERISTICS

TYPICAL PLATE CHARACTERISTICS



92CM-8145

TYPICAL CHARACTERISTICS



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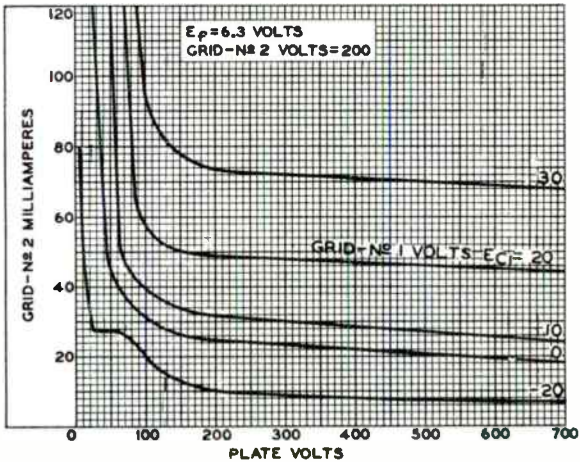
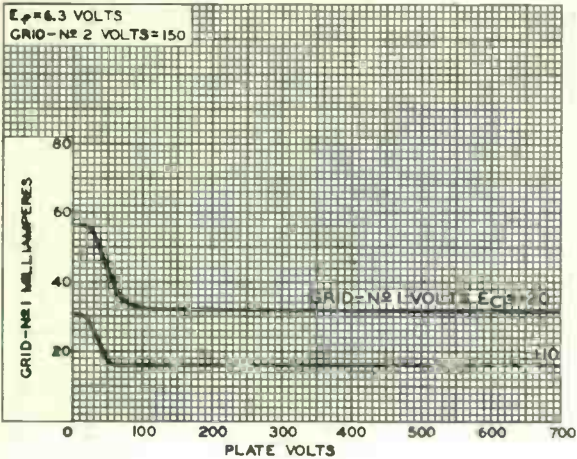


92CS-9618

TYPICAL CHARACTERISTICS



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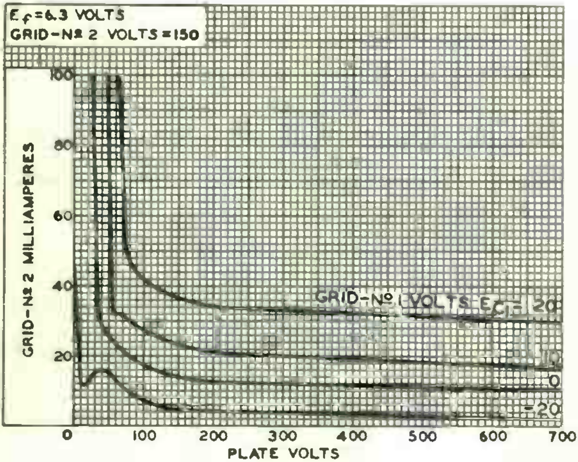
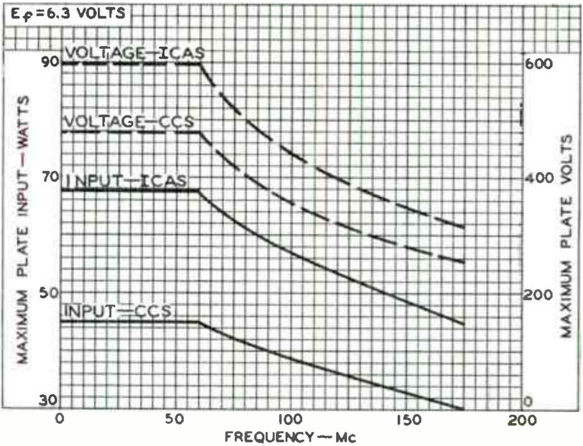


92CS-9620

RATING CHART I
Class C Telephony Service



92CS-9614

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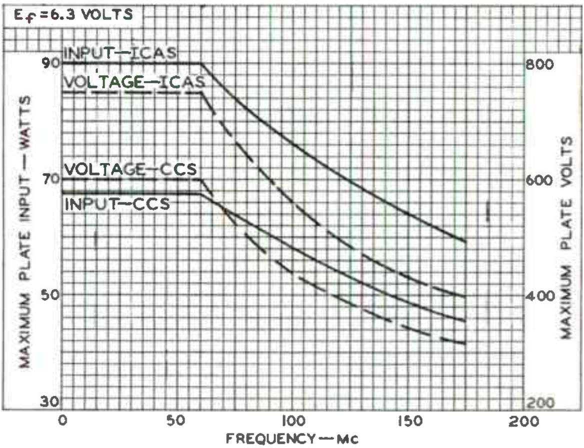
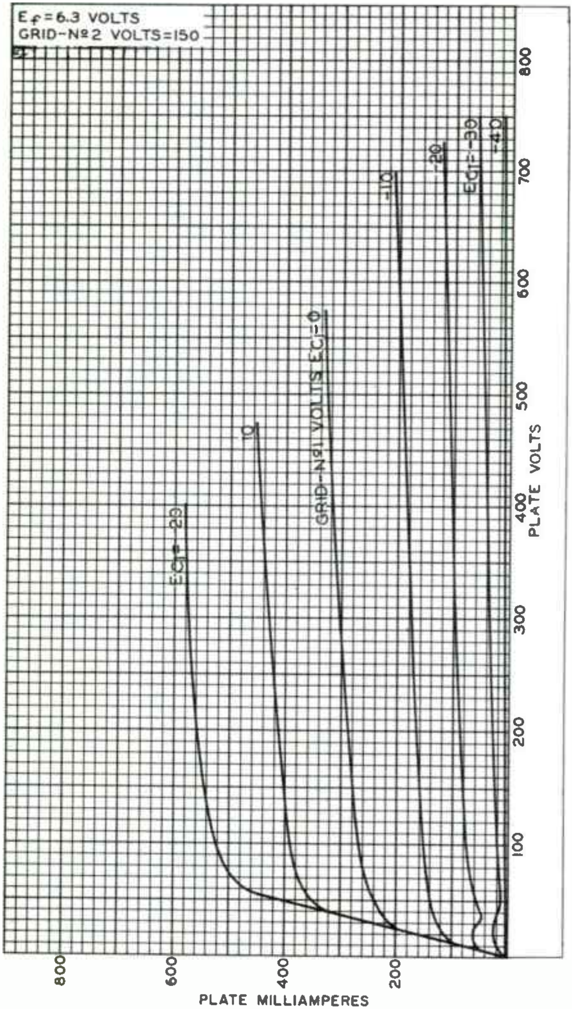


92CS-9615

TYPICAL PLATE CHARACTERISTICS



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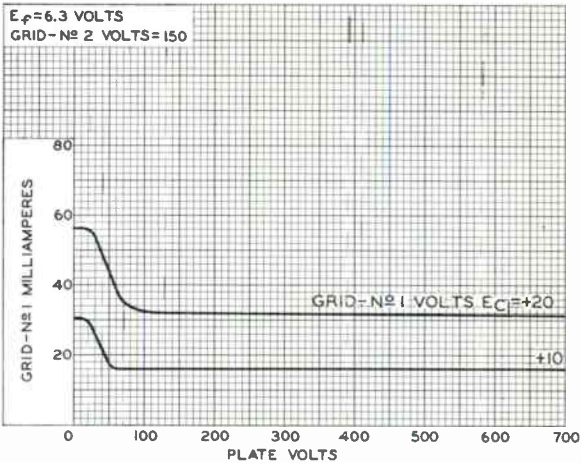
TYPICAL CHARACTERISTICS



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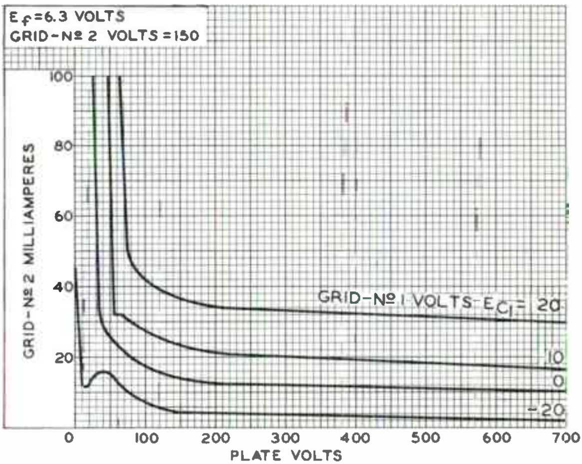
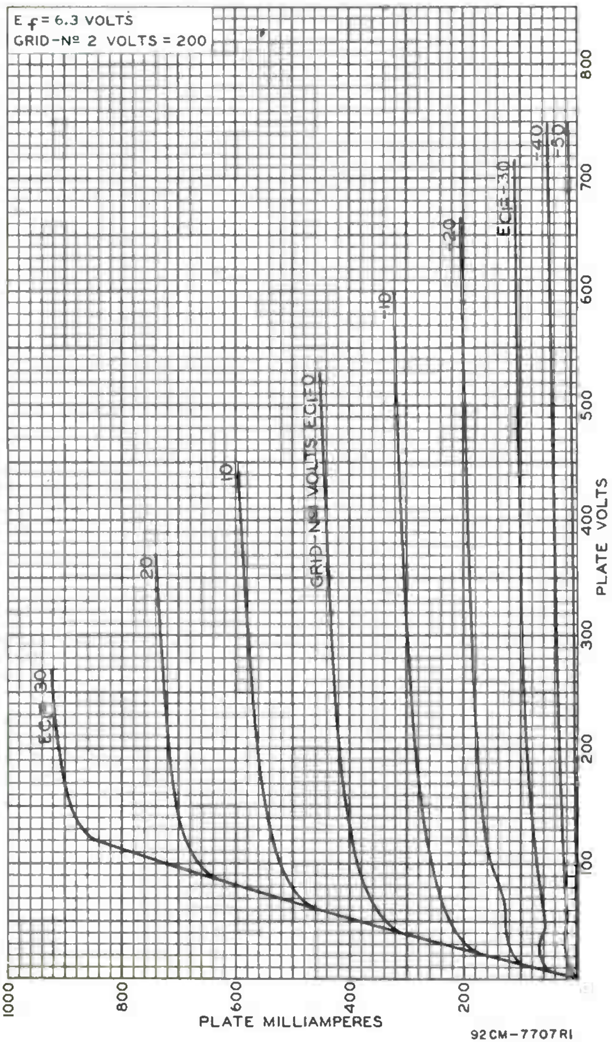


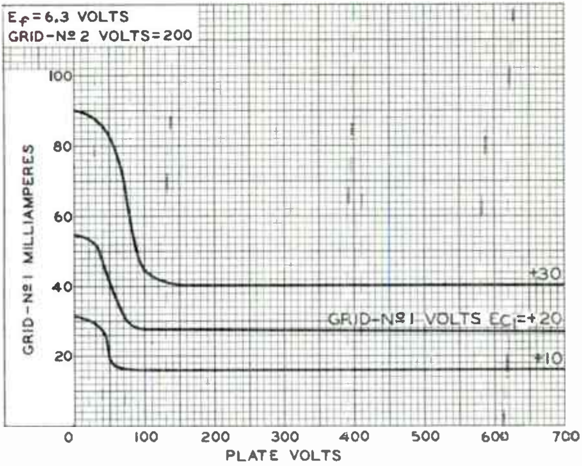
92CS-9620

TYPICAL PLATE CHARACTERISTICS

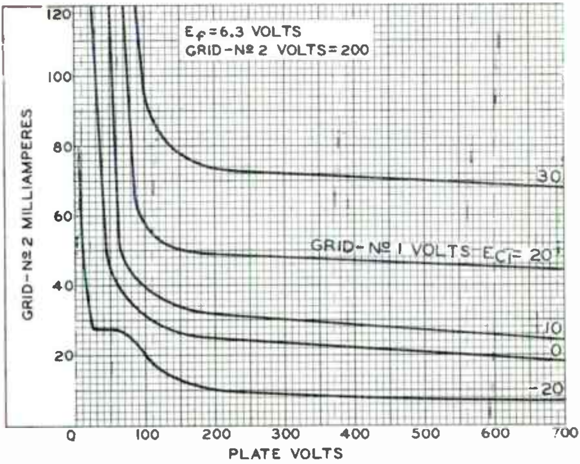


92CM-7707R1

TYPICAL CHARACTERISTICS

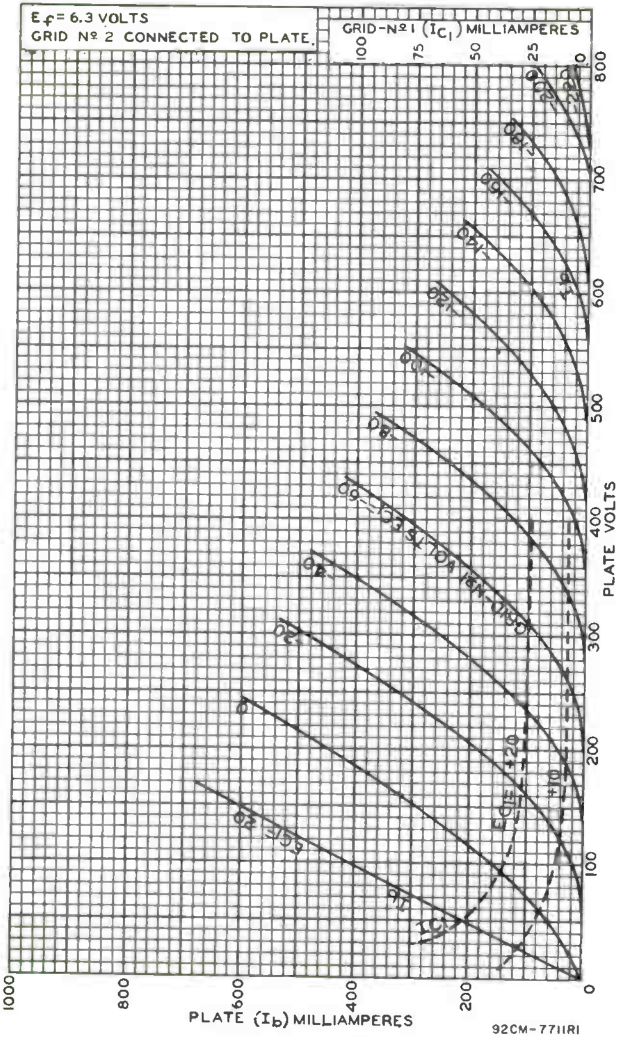


92CS-9617



92CS-9618

TYPICAL CHARACTERISTICS
Triode Connection



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

Maximum Ratings, *Absolute-Maximum Values:*

	CCS	ICAS	
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

	CCS	CCS	ICAS	
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

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
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*.

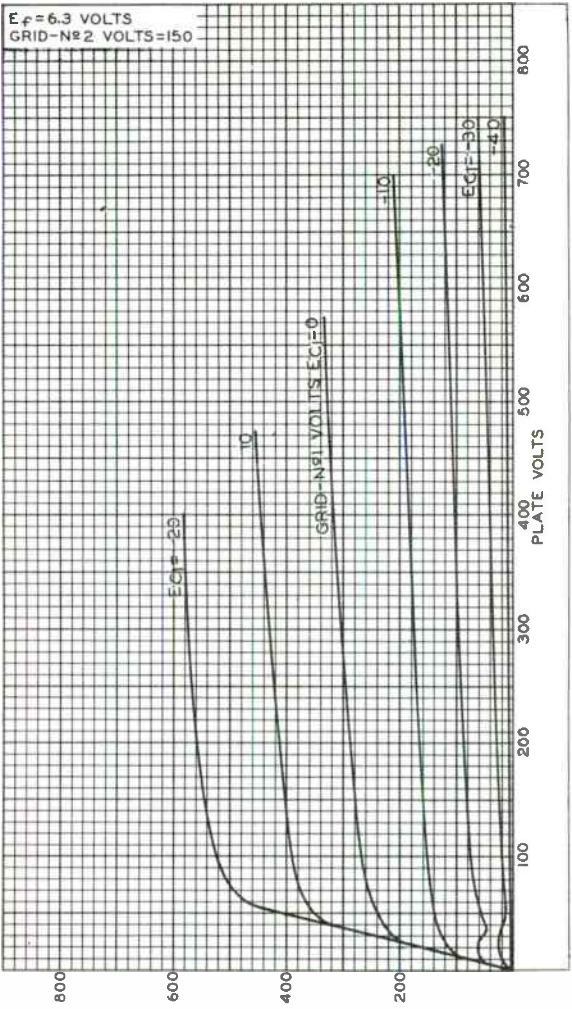
Heater-Cathode Leakage Current . . . . .See *Characteristics Range Values*

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

TYPICAL PLATE CHARACTERISTICS



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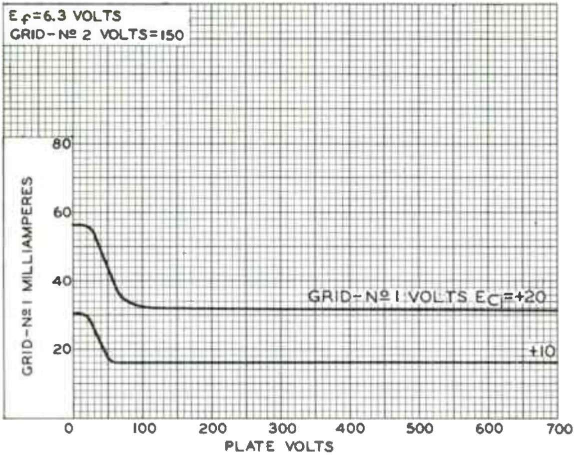
TYPICAL CHARACTERISTICS



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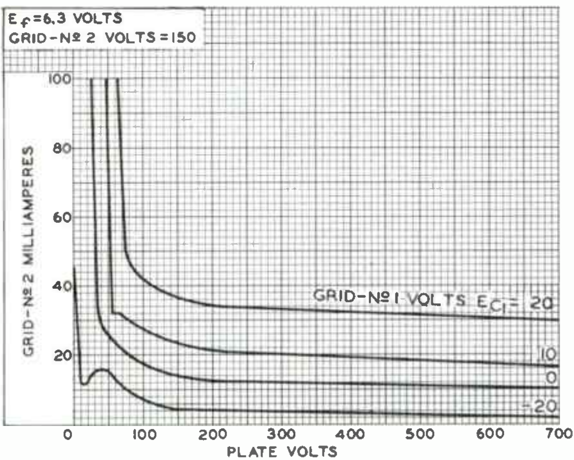

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6146W/7212

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 "77C" 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

AA' = PLANE OF ELECTRODES

Pin 5 - Grid No.1
Pin 6 - Same as Pin 1
Pin 7 - Heater
Pin 8 - Base Sleeve
Cap - Plate

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

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:

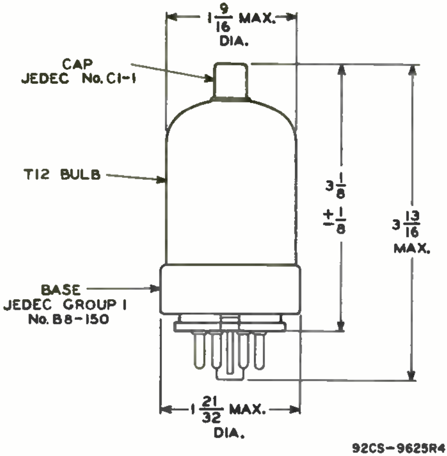
This test is performed on a sample lot of tubes from each production run under the following conditions: Heater volts = 6.3, plate-supply volts = 250, grid-No.2 volts = 200, grid-No.1 voltage varied to give a plate current of 10 milliamperes, plate load resistor (ohms) = 2000, and vibrating frequency 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

Beam Power Tube

HIGH POWER SENSITIVITY
RCA "DARK HEATER" WITH 21- TO 31-VOLT RANGE

85 WATTS CW INPUT (ICAS) UP TO 60 Mc

50 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 6159B is Unilaterally Interchangeable with Types 6159, 6159A.

The 6159B is the same as the 6146B/8298A except for the following items:

Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	26.5	volts
Current at heater volts = 26.5	0.3	amp
Minimum heating time	60	sec
Direct Interelectrode Capacitances:[a]		
Grid No.1 to plate	0.24 max.	pF

[a] With no external shield.

CHARACTERISTICS RANGE VALUES

Test No.		*Note*	*Min.*	*Max.*	
1	Direct Interelectrode Capacitances: Grid-No.1 to plate	1	–	0.24	pF

Note 1: With no external shield.

SPECIAL PERFORMANCE DATA

Stationary Equipment Operation:

	Min.	*Design Center*	*Max.*	
Heater, for Unipotential Cathode:				
Voltage (AC or DC)[v]	–	26.5	–	volts
Current at 26.5 volts	0.28	–	0.32	amp
Useful Power Output[w]	59	–	–	watts

[v] It is recommended that the design-center heater voltage be 26.5 volts; the heater power supply should not fluctuate more than 10% to insure long life.

[w] In a single-tube, self-excited oscillator circuit, and with ac heater voltage of 26.5 volts, dc plate voltage of 600 volts, dc grid-No.2 voltage of 200 volts, grid-No.1 resistor of 24,000 ± 10% ohms, dc plate current of 150 max. ma., dc grid-No.1 current of 2.5 to 3 ma., and frequency of 15 Mc.

Mobile Equipment Operation:

	Min.	*Design Range*	*Max.*	
Heater, for Unipotential Cathode:				
Voltage (AC or DC)[x]	–	24 to 29	–	volts
Current at 26.5 volts.	0.28	–	0.32	amp
Useful Power Output I[y]	59	–	–	watts
Useful Power Output II		See *Note Z*		

x It is recommended that the heater voltage operate within the range of 24 to 29 volts and within excursions from 21 to 31 volts in battery operation. See *Useful Power Output II* and *Overvoltage Tests.*

y In a single-tube, self-excited oscillator circuit, and with ac heater voltage of 26.5 volts, dc plate voltage of 600 volts, dc grid-No.2 voltage of 200 volts, grid-No.1 resistor of 24,000 ± 10% ohms, dc plate current of 150 max. ma., dc grid-No.1 current of 2.5 to 3 ma., and frequency of 15 Mc.

z With conditions in note (y) above, reduce heater voltage to 21 volts. Useful power output will be at least 90% of the power output at heater voltage of 26.5 volts.

Overvoltage Heater Life Tests:

Continuous heater life tests are performed periodically on sample lots of tubes with 31 volts on the heater, all other electrodes "floating". Intermittent heater life tests are performed periodically on sample lots of tubes with 43 volts on the heater, a cycle of 1 minute "ON" and 4 minutes "OFF". After 1000 hours of the continuous heater life test and after 48 hours of the intermittent heater life test, the following tests are performed:

With heater voltage of 26.5 volts and ± 100 dc volts between cathode and heater, the heater-cathode leakage current will not exceed 150 microamperes.

With ac or dc heater voltage of 26.5 volts, grid-No.1 volts = -200 and cathode, grid No.2, and plate grounded, the minimum grid-No.1 leakage resistance will be 10 megohms.

With ac or dc heater voltage of 26.5 volts, plate volts = -200, and cathode grid No.1 and grid No.2 grounded, the minimum plate leakage will be 10 megohms.

Beam Power Tube

HIGH POWER SENSITIVITY

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 6159W/7357 is the same as the 6146W/7212 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.

RCA
6161

UHF POWER TRIODE

DC Grid Current (Approx.):		
Synchronizing Level	0.030	amp
Pedestal Level.	0.010	amp
Driver Power Output (Approx.):♣		
Synchronizing Level	75®	watts
Pedestal Level.	45	watts
Output-Circuit Efficiency (Approx.) . . .	65	per cent
Useful Power Output (Approx.):		
Synchronizing Level	230●●	watts
Pedestal Level.	135●●	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.	1600 max.	volts
DC GRID VOLTAGE (White level)	−300 max.	volts
DC PLATE CURRENT.	0.350 max.	amp
DC GRID CURRENT	0.100 max.	amp
PLATE INPUT	560 max.	watts
PLATE DISSIPATION	250 max.	watts

Typical Operation in Cathode-Drive Circuit at 600 Mc:

Bandwidth♠ of 6 Mc

DC Plate♣-to-Grid Voltage	1600	volts
DC Cathode-to-Grid Voltage:		
Synchronizing Level	100	volts
Pedestal Level	150	volts
White Level	230	volts
Peak RF Cathode-to-Grid Voltage	130	volts
DC Plate Current:		
Synchronizing Level	0.350	amp
Pedestal Level.	0.250	amp
DC Grid Current (Approx.):		
Synchronizing Level	0.040	amp
Pedestal Level.	0.013	amp
Driver Power Output (Approx.):♣		
Synchronizing Level	65#	watts
Output-Circuit Efficiency (Approx.) . . .	89	per cent
Useful Power Output (Approx.):		
Synchronizing Level	325●●	watts
Pedestal Level.	195●●	watts

Typical Operation in Cathode-Drive Circuit at 900 Mc:

Bandwidth♠ of 6 Mc

DC Plate-to-Grid Voltage.	1600	volts

This value includes 24 watts of circuit loss and 36 watts added to plate input.

●,♠,♣,●●,®: see next page.

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DC Cathode-to-Grid Voltage:		
Synchronizing Level	100	volts
Pedestal Level.	150	volts
White Level	230	volts
Peak RF Cathode-to-Grid Voltage	135	volts
DC Plate Current:		
Synchronizing Level	0.350	amp
Pedestal Level.	0.250	amp
DC Grid Current (Approx.):		
Synchronizing Level	0.030	amp
Pedestal Level.	0.010	amp
Driver Power Output (Approx.):♣		
Synchronizing Level	75●	watts
Output-Circuit Efficiency (Approx.) . . .	65	per cent
Useful Power Output (Approx.):		
Synchronizing Level	230●●	watts
Pedestal Level.	135●●	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.	1300	max.	volts
DC GRID VOLTAGE	-300	max.	volts
DC PLATE CURRENT.	0.210	max.	amp
DC GRID CURRENT	0.075	max.	amp
PLATE INPUT	270	max.	watts
PLATE DISSIPATION	167	max.	watts

Typical Operation in Cathode-Drive Circuit at 600 Mc:

DC Plate-to-Grid Voltage	1400	volts
DC Cathode-to-Grid Voltage	150	volts
From grid resistor of	2150	ohms
Peak RF Cathode-to-Grid Voltage	200	volts
DC Plate Current.	0.210	amp
DC Grid Current (Approx.)	0.070	amp
Driver Power Output (Approx.)♣■.	70**	watts
Output-Circuit Efficiency (Approx.) . . .	80	per cent
Useful Power Output (Approx.)	180●●	watts

Typical Operation in Cathode-Drive Circuit at 900 Mc:

DC Plate-to-Grid Voltage.	1400	volts
DC Cathode-to-Grid Voltage	150	volts
From grid resistor of	2150	ohms
Peak RF Cathode-to-Grid Voltage	200	volts

♦ Computed between half-power points and based on tube output capacitance only.

● This value includes 28 watts of circuit loss and 40 watts added to plate input.

** This value includes 18 watts of circuit loss and 40 watts added to plate input.

●,♣,●●,■: See next page.

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DC Plate Current	0.210	amp
DC Grid Current (Approx.).	0.070	amp
Driver Power Output (Approx.)♣■.	75⊕	watts
Output-Circuit Efficiency (Approx.). . . .	60	per cent
Useful Power Output (Approx.).	120●●	watts

RF POWER AMPLIFIER & OSC.--Class C Telegraphy○
and
RF POWER AMPLIFIER--Class C FM Telephony

Maximum CCS● Ratings, ***Absolute Values:***

DC PLATE VOLTAGE	1600 max.	volts
DC GRID VOLTAGE.	-300 max.	volts
DC PLATE CURRENT	0.250 max.	amp
DC GRID CURRENT.	0.075 max.	amp
PLATE INPUT.	400 max.	watts
PLATE DISSIPATION.	250 max.	watts

Typical Operation as Amplifier in Cathode-Drive Circuit at 600 Mc:

DC Plate-to-Grid Voltage	1650	volts
DC Cathode-to-Grid Voltage:		
From fixed supply of	150	volts
From grid resistor of	3000	ohms
From cathode resistor of	500	ohms
Peak RF Cathode-to-Grid Voltage	200	volts
DC Plate Current	0.250	amp
DC Grid Current (Approx.).	0.050	amp
Driver Power Output (Approx.)♣	75▲	watts
Output-Circuit Efficiency (Approx.). . . .	82	per cent
Useful Power Output (Approx.).	270●●	watts

Typical Operation as Amplifier in Cathode-Drive Circuit at 900 Mc:

DC Plate-to-Grid Voltage	1650	volts
DC Cathode-to-Grid Voltage:		
From fixed supply of	150	volts
From grid resistor of.	15000	ohms
From cathode resistor of	575	ohms

⊕ This value includes 23 watts of circuit loss and 40 watts added to plate input.

○ 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.

▲ This value includes 18 watts of circuit loss and 45 watts added to plate input.

■ In cathode-drive, plate-modulated class C rf power amplifier service, the 6161 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.

●,♣,●●: See next page.

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Peak RF Cathode-to-Grid Voltage	200	volts
DC Plate Current	0.250	amp
DC Grid Current (Approx.)	0.010	amp
Driver Power Output (Approx.)♣	80†	watts
Output-Circuit Efficiency (Approx.)	60	per cent
Useful Power Output (Approx.)	180●●	watts

FREQUENCY MULTIPLIER--Class C

Maximum CCS● Ratings, *Absolute Values*:

DC PLATE VOLTAGE	1600 max.	volts
DC GRID VOLTAGE	-300 max.	volts
DC PLATE CURRENT	0.250 max.	amp
DC GRID CURRENT	0.075 max.	amp
PLATE INPUT	400 max.	watts
PLATE DISSIPATION	250 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:			
From fixed supply of	260	175	volts
From grid resistor of	5200	8300	ohms
From cathode resistor of	860	645	ohms
Peak RF Cathode-to-Grid Voltage	300	300	volts
DC Plate Current	0.250	0.250	amp
DC Grid Current (Approx.)	0.050	0.021	amp
Driver Power Output (Approx.)♣	125	100	watts
Output-circuit Effiency (Approx.)	90	80	per cent
Useful Power Output (Approx.)	180●●	140●●	watts

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Heater Current	1	3.05	3.75	amp
Amplification Factor	1,2	20	34	

● Continuous Commerical Service.

♣ 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.

† This value includes 23 watts of circuit loss and 45 watts added to plate input.

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	Note	Min.	Max.	
Grid-Plate Capacitance . . .	-	5.5	6.5	μμf
Grid-Cathode Capacitance . .	-	9.6	12.4	μμf
Plate-Cathode Capacitance. .	3	-	0.32	μμf
Plate Voltage	1,4	550	810	volts
Plate Voltage	1,5	750	1150	volts
Grid Voltage	1,6	-	-165	volts
Peak Cathode Current	1,7	3.2	-	amp
Useful Power Output.	1,8	225	-	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 ma.

Note 3: With external shield, as described under (♦) connected to grid terminal.

Note 4: With dc grid voltage of -10 volts, and dc plate voltage adjusted to give dc plate current of 250 ma.

Note 5: With dc grid voltage of -20 volts, and dc plate voltage adjusted to give dc plate current of 250 ma.

Note 6: With dc plate voltage of 1600 volts, and dc grid voltage adjusted to give dc plate current of 1.0 ma.

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: In a self-excited oscillator circuit and with dc plate voltage of 1600 volts, dc plate current of 250 ma., dc grid current of 50 to 75 ma., grid resistor of 2000 ±10% ohms, and frequency of 15 Mc.

MAXIMUM RATINGS vs OPERATING FREQUENCY

Frequency	900	1200	1400	1650	2000	Mc
MAX. PERMISSIBLE PERCENTAGE OF MAX. RATED PLATE VOLTAGE AND PLATE INPUT:						
Class B Television	100	80	71	62.5	62.5	%
Class C Television, Grid-Modulated	100	80	71	62.5	62.5	%
Class C Telephony, Plate-Modulated	100	80	71	62.5	62.5	%
Class C Telegraphy	100	80	71	62.5	62.5	%
Class C FM Telephony	100	80	71	62.5	62.5	%

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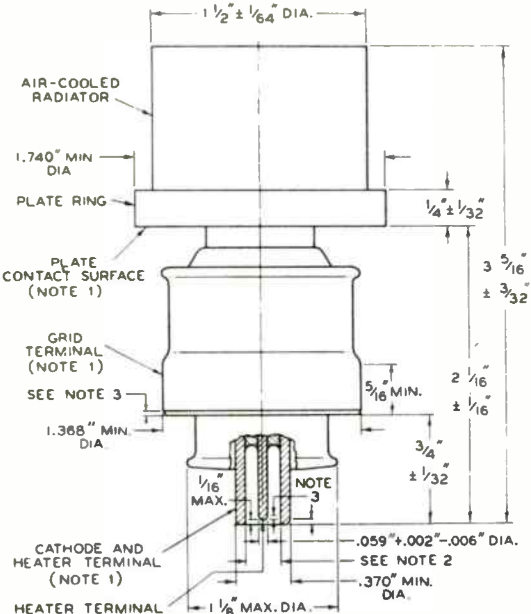

92CM-7704

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 OUTLINE DRAWING, AND SUCCESSIVELY SMALLER DIAMETERS AS SHOWN IN THE SKETCH.

THE PLATE RING WILL BE ENTIRELY ENGAGED BY HOLE H_1, AND THE CONTACT SURFACE OF THE PLATE RING WILL SEAT ON THE SHOULDER BETWEEN HOLES H_1 AND H_2. THE PLANE SURFACE OF THIS SHOULDER IS 90° ± 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 THE 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".

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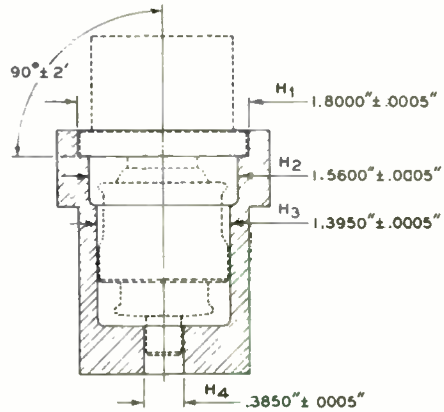
UHF POWER TRIODE

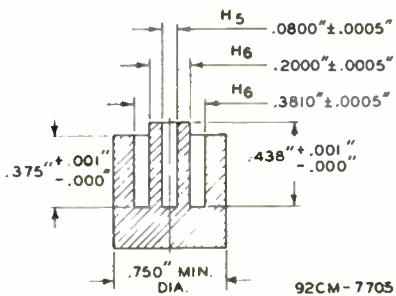
NOTE 2: CONCENTRICITY OF THE HEATER TERMINAL WITH RESPECT TO THE CATHODE TERMINAL IS DETERMINED BY A GAUGE AS SHOWN IN SKETCH G2. THE CYLINDRICAL HOLE H_5 AND THE ANNULAR HOLE H_6 HAVE AXES COINCIDENT WITHIN 0.0005". THE CATHODE TERMINAL AND THE HEATER TERMINAL WILL ENTER THIS GAUGE TO A DEPTH OF 3/8".

NOTE 3: MAY BE ROUNDED OR BEVELED NOT TO EXCEED 1/16".

Sketch G_1



Sketch G_2



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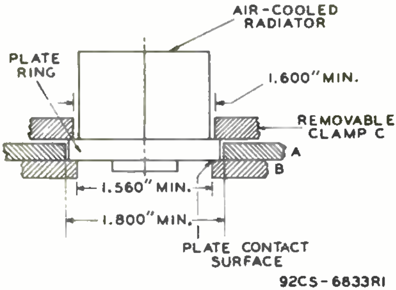
UHF POWER TRIODE

Mounting Arrangement for Use with Coaxial-Line or Cavity Circuits.



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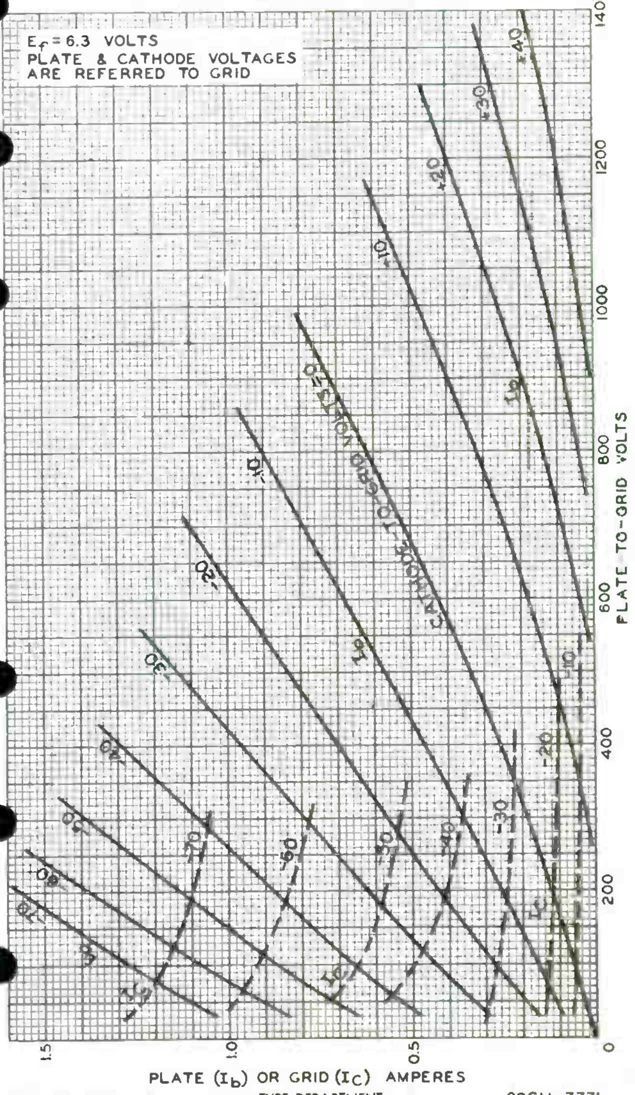
AVERAGE CHARACTERISTICS



Beam Power Tube

FORCED-AIR COOLED — COAXIAL-ELECTRODE STRUCTURE
THORIATED-TUNGSTEN FILAMENT — INTEGRAL RADIATOR
10-KW PLATE DISSIPATION IN CW OR TV SERVICE UP TO 220 Mc

GENERAL DATA

Electrical:

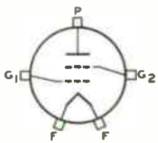
Filament, Multistrand Thoriated Tungsten:		
Voltage (AC or DC)[a]	5 ± 5%	volts
Current at 5 volts	181	amp
Minimum heating time	15	sec
Cold resistance	0.0038	ohm
Mu Factor, Grid No.2 to Grid No.1 for plate volts = 2000, grid-No.2 volts = 1000, and plate amperes = 2	10	
Direct Interelectrode Capacitances:		
Grid No.1 to plate[b]	0.6 max.	μμf
Grid No.1 to filament	42	μμf
Plate to filament[b]	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	11.63"
Maximum Diameter	6.38"
Weight (Approx.)	15 lbs
Radiator	Integral part of tube

Terminal Connections (See *Dimensional Outline*):

G1 – Grid No.1
G2 – 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 tabulation below, 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-terminal end (See *Dimensional Outline*). Filament power, plate power, grid-No.2 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

← Indicates a change.

To grid-No.2 terminal	50 min.	cfm
To grid-No.1 terminal and filament terminals	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 point). . .	180 max.	°C
Seal Temperature:		
Filament, 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

(Voltages are referred to cathode unless otherwise specified)

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

	54 to 216 Mc		
DC PLATE VOLTAGE.	6000[d]	max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE. . . .	2000	max.	volts
DC PLATE CURRENT.	4	max.	amp
PLATE INPUT	22000[d]	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 at 216 Mc:

	Bandwidth[e] 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.	2.6	amp
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.):[f]		
Synchronizing level	800[g]	watts
Pedestal level.	450	watts
Useful Power Output (Approx.):		
Synchronizing level	12000	watts
Pedestal level.	6800	watts

→ Typical Operation in Cathode-Drive Circuit at 216 Mc:

	Bandwidth[e] of 8.5 Mc	
DC Plate-to-Grid-No.1 Voltage	5885	volts
DC Grid-No.2-to-Grid-No.1 Voltage	885	volts

→ Indicates a change.

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.	2.6	amp
DC Grid-No.2 Current (Pedestal level) . .	0.152	amp
DC Grid-No.1 Current (Approx.):		
Synchronizing level	0.202	amp
Pedestal level.	0.11	amp
Driver Power Output (Approx.):[h]		
Synchronizing level	1300[j]	watts
Pedestal level.	700	watts
Useful 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[c] Ratings, ***Absolute-Maximum 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
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 at 216 Mc: ←

	Bandwidth[e] 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

← Indicates a change.

	Bandwidth[e] of 8.5 Mc	
Driver Power Output (Approx.):[f]		
Synchronizing level	800[g]	watts
Pedestal level	425	watts
Useful Power Output (Approx.):		
Synchronizing level	12000	watts
Pedestal level	6800	watts

→ **LINEAR RF POWER AMPLIFIER**

Single-Sideband Suppressed-Carrier Service

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

	Up to 60 Mc		
DC PLATE VOLTAGE	6900	max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	2000	max.	volts
MAX.-SIGNAL DC PLATE CURRENT	2.75	max.	amp
MAX.-SIGNAL DC GRID-No.1 (CONTROL-GRID) CURRENT	0.6	max.	amp
MAX.-SIGNAL PLATE INPUT	18000	max.	watts
MAX.-SIGNAL GRID-No.2 INPUT	400	max.	watts
PLATE DISSIPATION	10000	max.	watts

Typical CCS Class AB_1 and AB_2 "Single-Tone" Operation at 60 Mc:[k]

	Class AB_1	*Class AB_2*	
DC Plate Voltage	6900	6500	volts
DC Grid-No.2 Voltage	1200	1200	volts
DC Grid-No.1 Voltage[m]	-125	-125	volts
Zero-Signal DC Plate Current	0.2	0.2	amp
Zero-Signal DC Grid-No.2 Current	0	0	amp
Effective RF Load Resistance	5400	1200	ohms
Max.-Signal DC Plate Current	0.675	2.75	amp
Max.-Signal DC Grid-No.2 Current	0.035	0.26	amp
Max.-Signal DC Grid-No.1 Current	0	0.08	amp
Max.-Signal Peak RF Grid-No.1 Voltage	125	305	volts
Max.-Signal Driving Power (Approx.)	0	25	watts
Max.-Signal Power Output (Approx.)	2920	10600	watts

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:***[n]

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

→ indicates a change.

Typical Operation in Grid-Drive Circuit: ←

	Up to 60 Mc	
DC Plate Voltage	4700	volts
DC Grid-No.2 Voltage (Modulated 100%)[p]	800	volts
DC Grid-No.1 Voltage[r]	-280	volts
Peak RF Grid-No.1 Voltage	485	volts
DC Plate Current	1.56	amp
DC Grid-No.2 Current	0.217	amp
DC Grid-No.1 Current (Approx.)	0.15	amp
Driver Power Output (Approx.)[f]	180[s]	watts
Useful Power Output (Approx.)	5500	watts

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

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

DC PLATE VOLTAGE	6900	max.	volts
DC GRID-No.2 VOLTAGE	2000	max.	volts
DC GRID-No.1 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: ←

	Up to 60 Mc	*At 216 Mc*		
DC Plate Voltage	6400	5800	5800	volts
DC Grid-No.2 Voltage[u]	1200	1200	1200	volts
DC Grid-No.1 Voltage[v]	-310	-130	-175	volts
Peak RF Grid-No.1 Voltage	560	230	370	volts
DC Plate Current	2.75	1.8	2.6	amp
DC Grid-No.2 Current	0.3	0.1	0.267	amp
DC Grid-No.1 Current (Approx.)	0.14	0.05	0.11	amp
Driver Power Output (Approx.)[f]	75	300[w]	750[x]	watts
Useful Power Output (Approx.)	11600	6000	9000	watts

[a] 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.

[b] 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.

[c] Continuous Commercial Service.

[d] For operation on VHF television channels 2 through 6, DC plate voltage may be increased to 6400 max. volts and plate input may be increased to 24000 maximum watts provided all other ratings are met.

[e] Computed between half-power points and based on tube output capacitance only.

[f] 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.

[g] This value includes 700 watts of rf circuit loss at 216 Mc.

← indicates a change.

h 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 (f).

j This value includes 300 watts of rf circuit loss at 216 Mc, and 900 watts added to plate circuit.

k "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-sideband suppressed-carrier system when a single audio frequency of constant amplitude is applied to the input of the system.

m Adjusted to give indicated zero-signal plate current.

n These ratings hold for operation up to 60 Mc; for ratings at higher frequencies, see *Maximum Ratings vs Operating Frequency* table.

p Obtained preferably from a separate source.

r Obtained preferably from a combination of 365-ohm grid-No.1 resistor and −170-volt fixed bias.

s This value includes 50 watts of rf circuit loss at 30 Mc.

t 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.

u 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.

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

w This value includes 270 watts of rf circuit loss.

x This value includes 675 watts of rf circuit loss.

→ CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Filament Current	1	172	190	amp
Direct Interelectrode Capacitances:				
Grid No.1 to plate	2	-	0.6	μμf
Grid No.1 to filament	3	39	47	μμf
Grid No.1 to grid No.2	3	52	64	μμf
Grid No.2 to plate	3	21.2	25.8	μμf
Plate to filament	2	-	0.08	μμf
DC Grid-No.1 Voltage	1,4	-	-225	volts
Peak Grid-No.1 Current	1,5	-	1.5	amp
Peak Grid-No.1 Voltage	1,5	-	315	volts

Note 1: With 5 volts ac or dc on filament.

Note 2: 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. All other electrodes are grounded.

Note 3: Without shield and all other electrodes grounded.

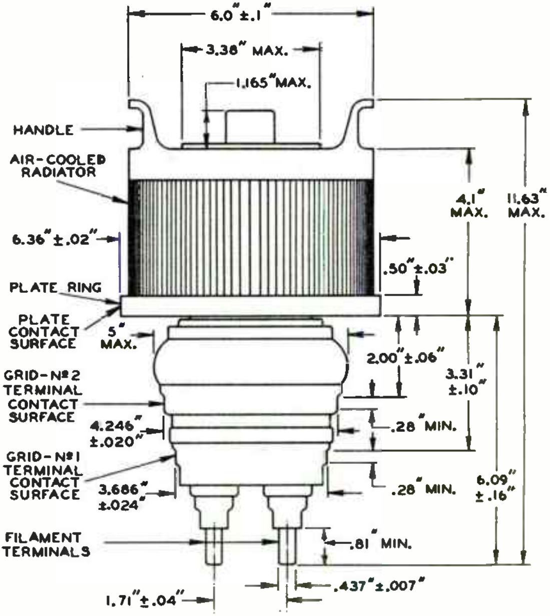
Note 4: With dc plate voltage of 6000 volts, dc grid-No.2 voltage of 1200 volts, and dc plate current of 20 ma.

Note 5: With dc plate voltage of 1500 volts, dc grid-No.2 voltage of 1200 volts, and instantaneous grid-No.1 voltage adjusted to give peak plate current of 11 amp.

→ Indicates a change.

MAXIMUM RATINGS vs OPERATING FREQUENCY ←

FREQUENCY	60	220	Mc
MAXIMUM PERMISSIBLE PERCENTAGE OF MAXIMUM-RATED PLATE VOLTAGE AND PLATE INPUT:			
Class AB Single-Sideband Suppressed-Carrier Service	100	90	%
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	%



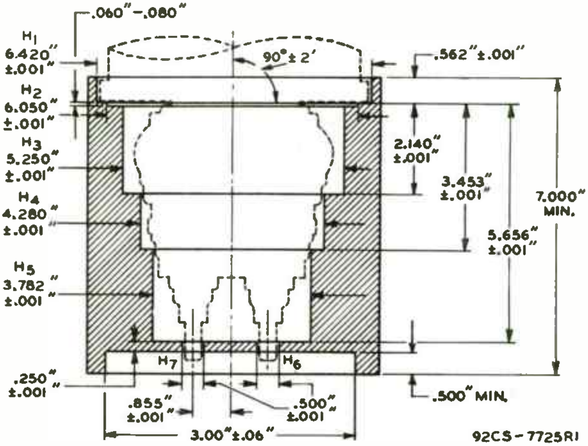
92CM-7716R2

←Indicates a change.

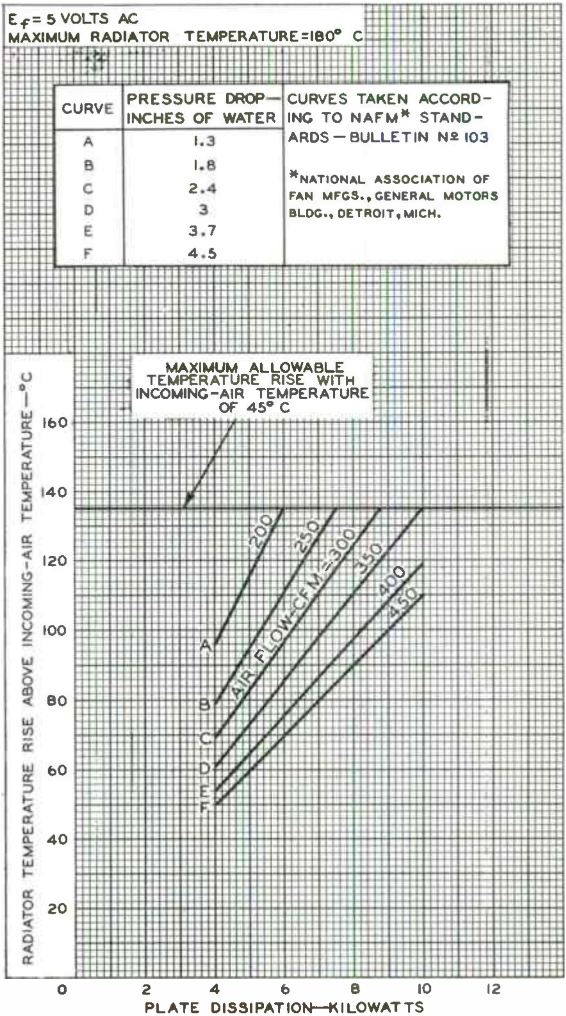
WITH THE CYLINDRICAL SURFACES OF THE GRID-No.2 TERMINAL, GRID-No.1 TERMINAL AND THE FILAMENT TERMINALS CLEAN, SMOOTH, AND FREE OF BURRS, THE TUBE WILL ENTER A GAUGE AS SHOWN IN SKETCH G_1. THE FIVE CYLINDRICAL HOLES H_1, H_2, H_3, H_4, AND H_5 HAVE AXES THAT ARE COINCIDENT WITHIN 0.001" AND HAVE SUCCESSIVELY SMALLER DIAMETERS AS SHOWN. THE CENTER HOLES H_6 AND H_7 ARE LOCATED ON A DIAMETER WITHIN ± 0.001" AND THEIR AXES ARE PARALLEL TO THE AXES OF H_1, H_2, H_3, H_4, AND H_5 WITHIN 0° ± 2'.

THE PLATE RING WILL BE ENTIRELY ENGAGED BY HOLE H_1 AND WILL SEAT ON THE SHOULDER BETWEEN H_1 AND H_2. THE PLANE SURFACE OF THIS SHOULDER IS AT RIGHT ANGLES TO THE AXES OF THE HOLES WITHIN 0° ± 2'. SEATING IS DETERMINED BY FAILURE OF A 0.020" THICKNESS GAUGE TO ENTER MORE THAN 1/16" BETWEEN SHOULDER SURFACE AND PLATE RING. SLOTS ARE PROVIDED TO PERMIT THIS MEASUREMENT.

SKETCH G_1



COOLING REQUIREMENTS

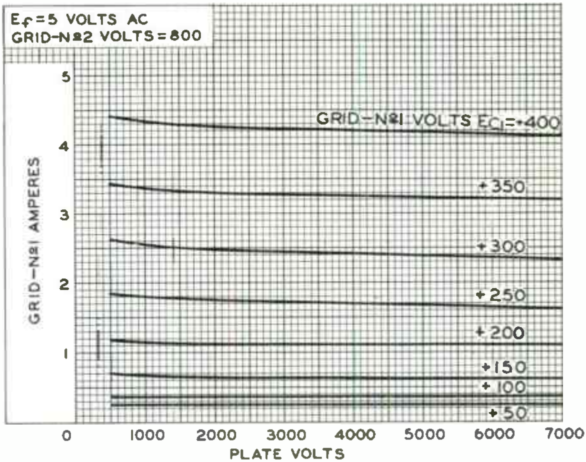


92CM-7728

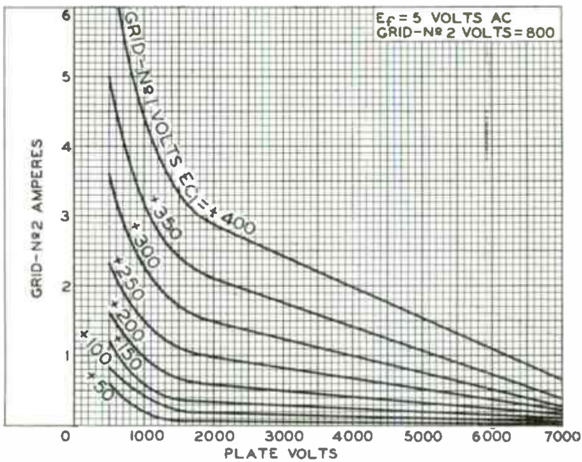
AVERAGE PLATE CHARACTERISTICS

92CM-7736R1

AVERAGE CHARACTERISTICS

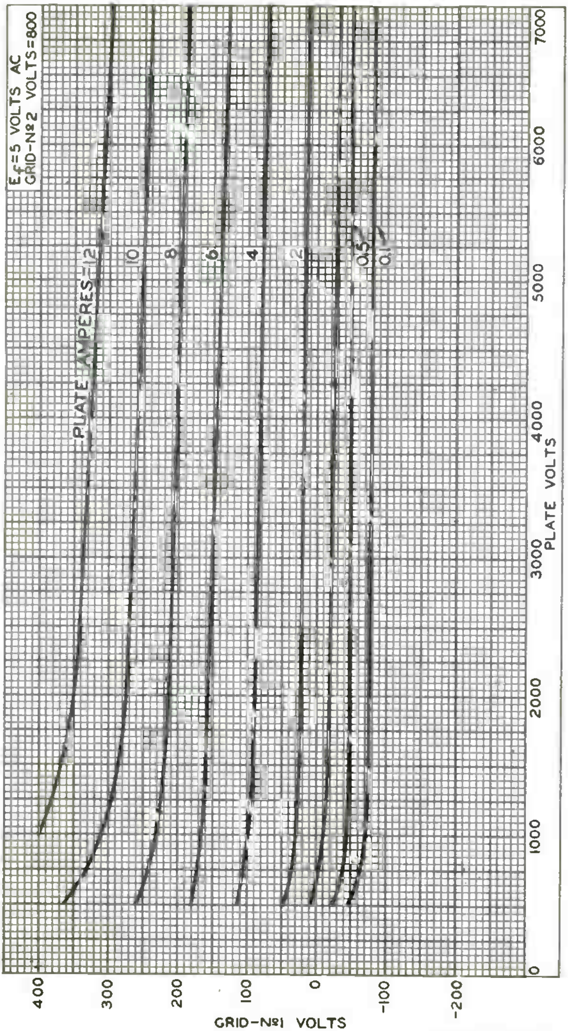


92CS-7744R1



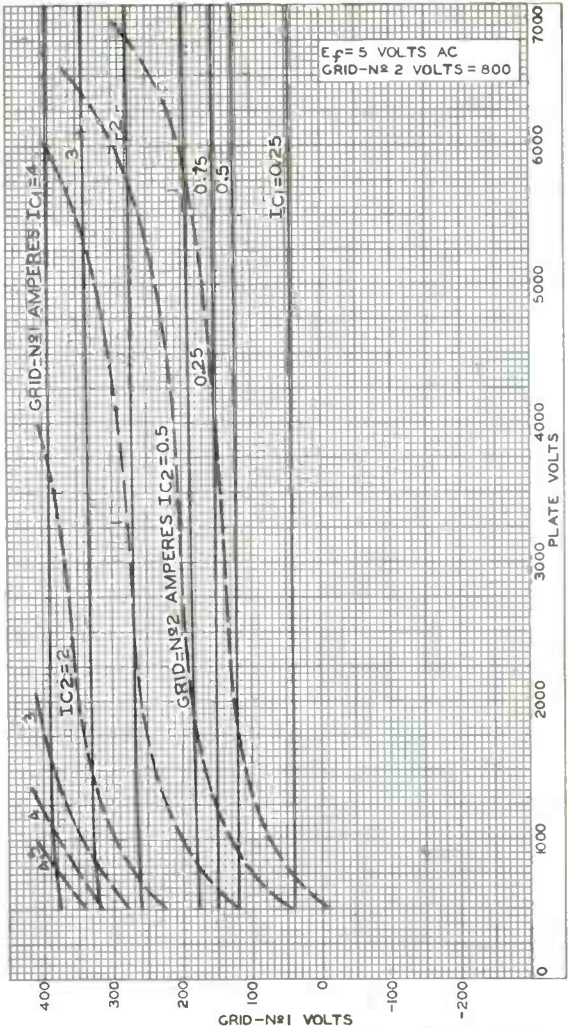
92CS-7743R1

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



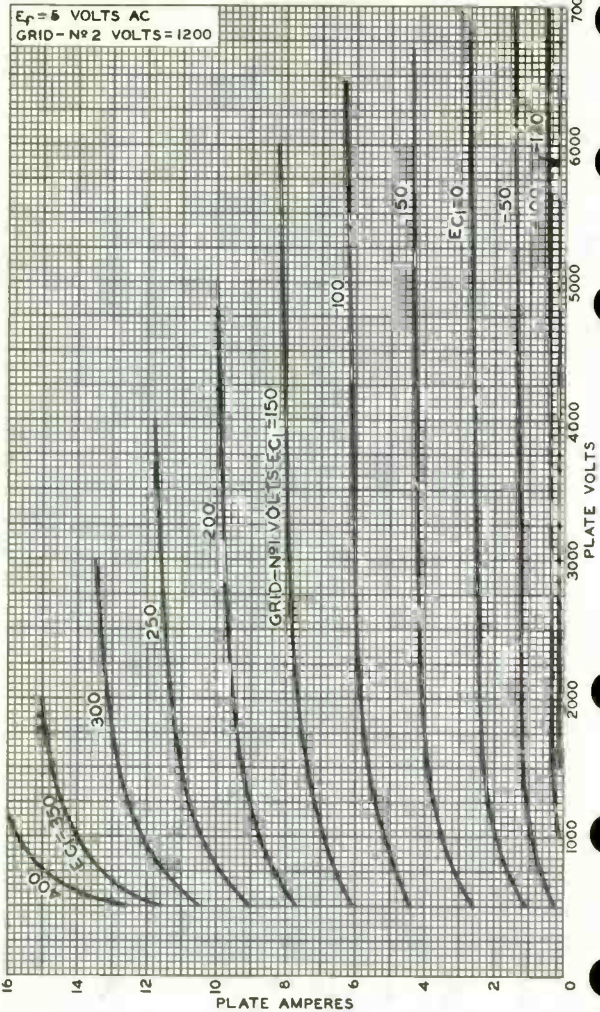
92CM-7737R1

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



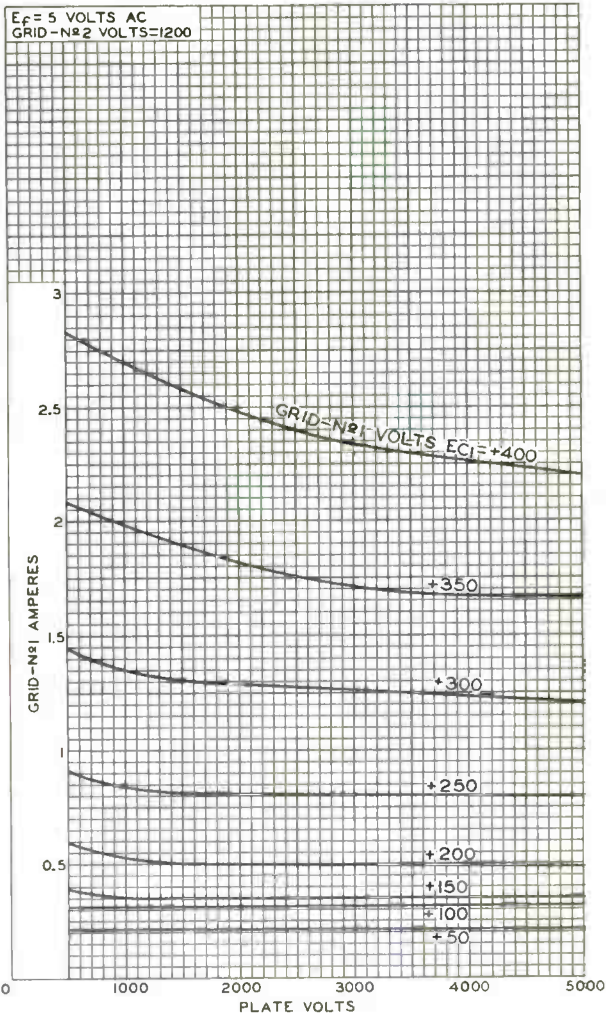
92CM-7738R2

AVERAGE PLATE CHARACTERISTICS



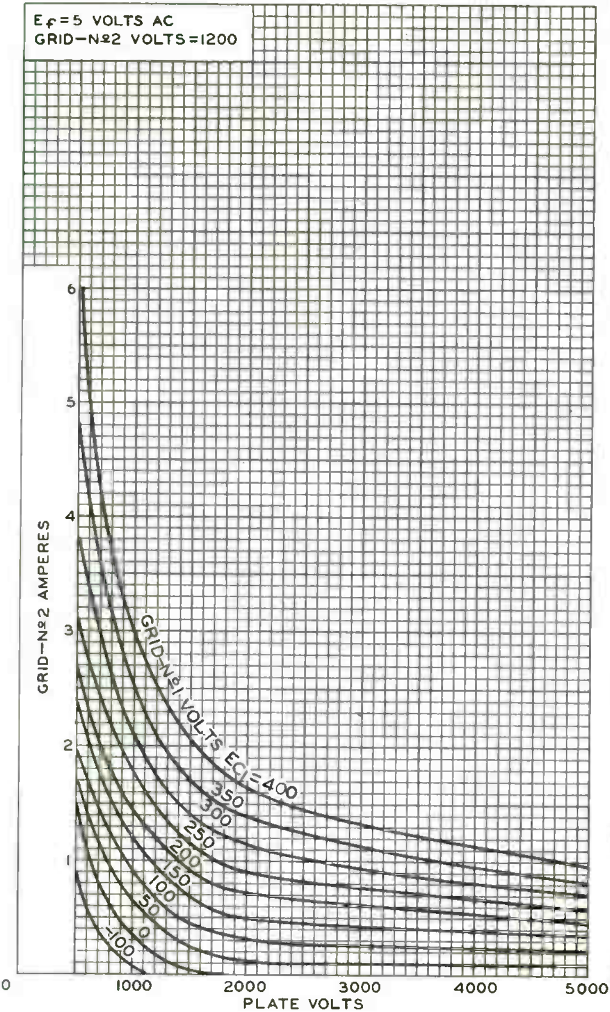
92CM-7735R1

AVERAGE CHARACTERISTICS



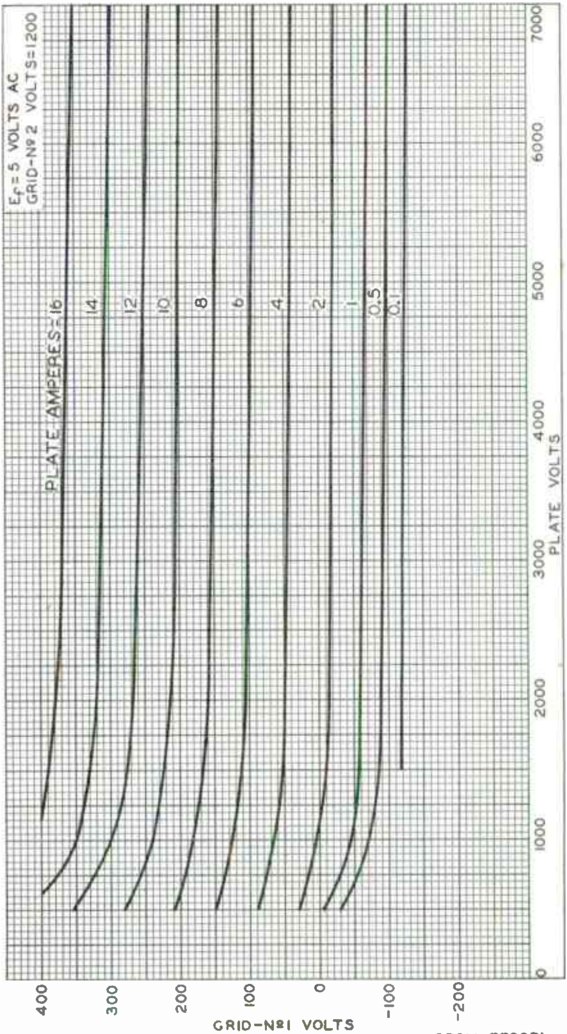
92CM-7740R2

AVERAGE CHARACTERISTICS



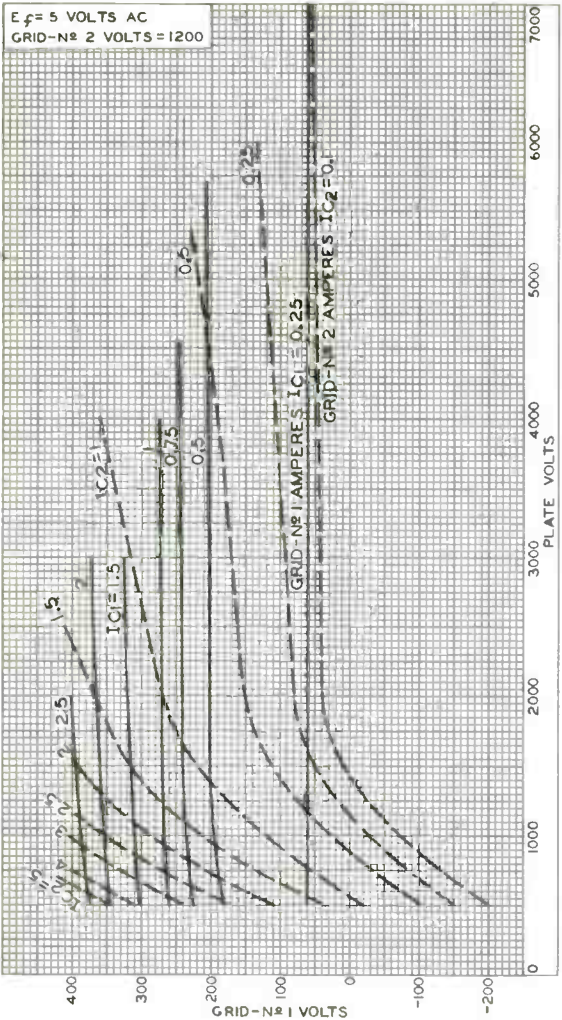
92CM-7739R1

AVERAGE
CONSTANT-CURRENT CHARACTERISTICS



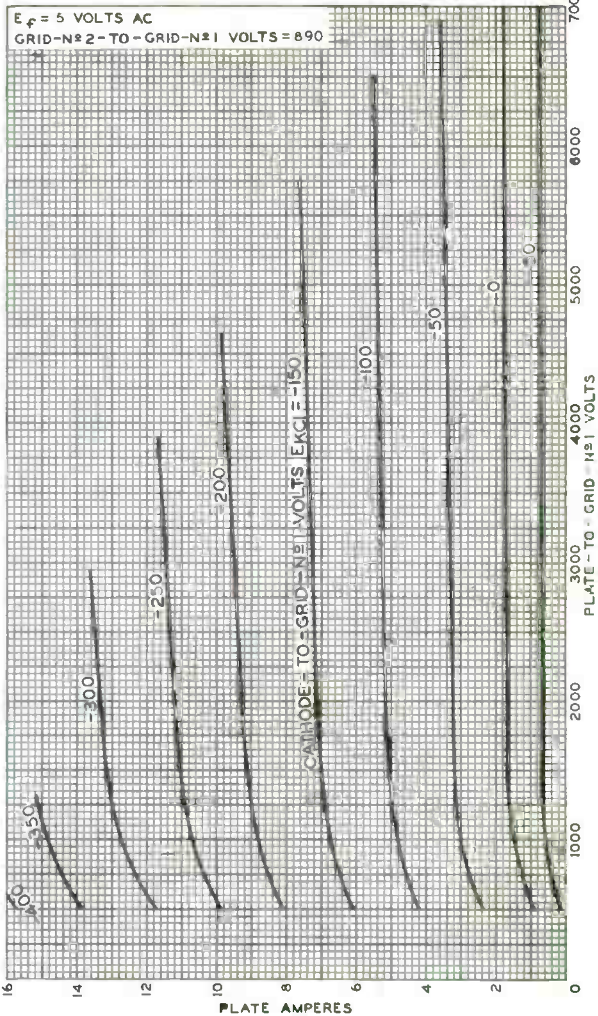
92CM-7733R1

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



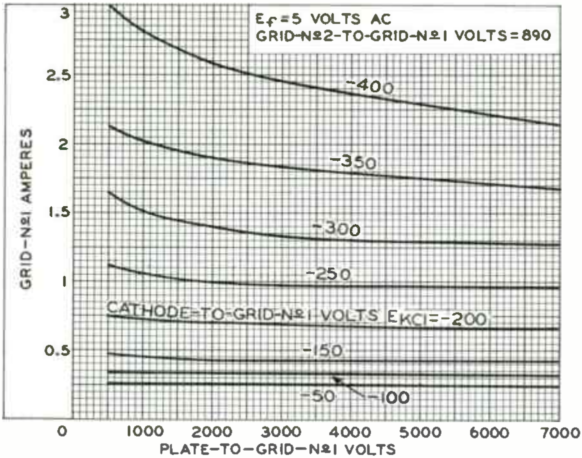
92CM-7730R2

AVERAGE PLATE CHARACTERISTICS
Cathode-Drive Service

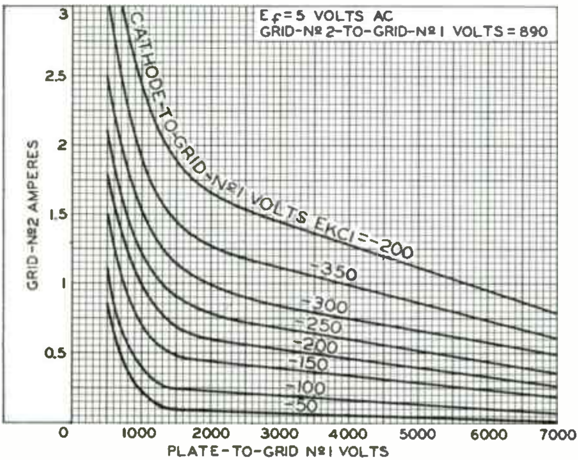


92CM-7750R1

AVERAGE CHARACTERISTICS
Cathode-Drive Service

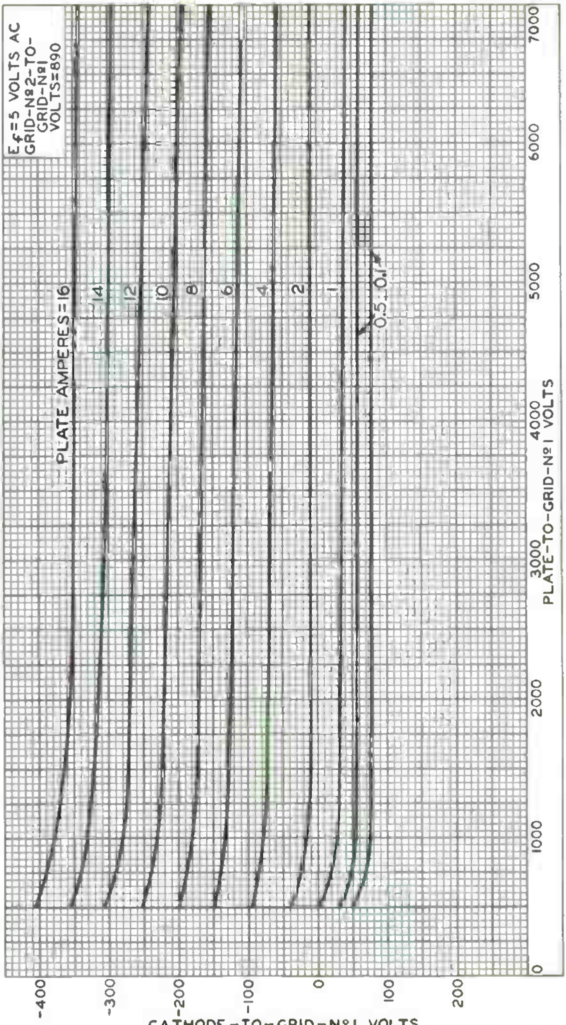


92CS-7746R1



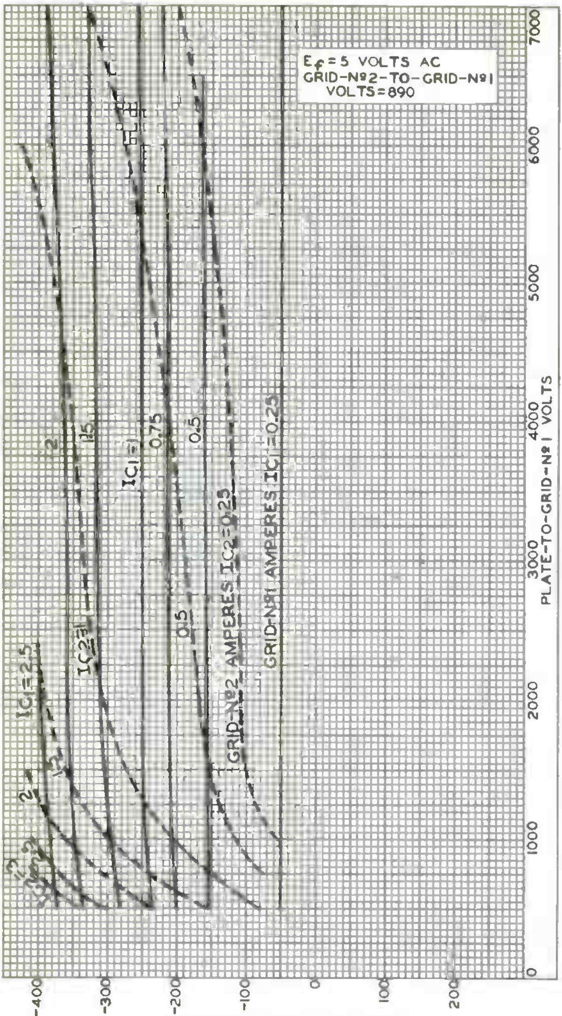
92CS-7752R2

AVERAGE CONSTANT-CURRENT CHARACTERISTICS
Cathode-Drive Service



92CM-7749RI

AVERAGE CONSTANT-CURRENT CHARACTERISTICS
Cathode-Drive Service



92CM-7751R2

Beam Power Tube

FORCED-AIR COOLED

CERAMIC-METAL SEALS — COAXIAL-ELECTRODE STRUCTURE

THORIATED-TUNGSTEN FILAMENT — INTEGRAL RADIATOR

12-KW PLATE DISSIPATION IN CW OR TV SERVICE UP TO 220 Mc

Electrical:

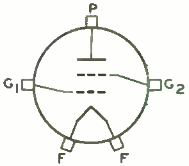
Filament, Multistrand Thoriated Tungsten:		
Voltage (AC or DC)▲	5 ± 5%	volts
Current at heater volts = 5	168	amp ←
Minimum heating time.	15	sec
Cold resistance	0.0038	ohm
Mu Factor, Grid No.2 to Grid No.1 for plate volts = 2000, grid-No.2 volts = 1000, and plate amperes = 2 . . .	10	
Direct Interelectrode Capacitances:		
Grid No.1 to plate●	0.6 max.	pf
Grid No.1 to filament	42	pf
Plate to filament●.	0.08 max.	pf
Grid No.1 to grid No.2.	65	pf ←
Grid No.2 to plate.	22	pf ←

Mechanical:

Operating Position.	Vertical, filament end up or down
Maximum Overall Length.	11.50"
Maximum Diameter.	6.38"
Weight (Approx.).	15 lbs
Radiator.	Integral part of tube

Terminal Diagram (See *Dimensional Outline*):

G1 – Grid No.1
G2 – Grid No.2



P – Plate
F – Filament

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. The air should enter the radiator at its plate-terminal end (See *Dimensional Outline*). Filament power, plate power, grid-No.2 power, and air flow may be removed simultaneously.

Percentage of maximum-rated plate dissipation for each class of service.	100	83	67	50	%
Minimum air flow.	550	350	230	175	cfm
Static pressure	6.6	3	1.6	1	in. of water

← Indicates a change.

To grid-No.2 terminal	50 min.	cfm
To grid-No.1 terminal and filament terminals.	50 min.	cfm
Incoming-Air Temperature.	50 max.	°C
Radiator Temperature (Measured on the core at end away from incoming air) . . .	180 max.	°C
Terminal Temperature: Filament, 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

(Voltages are referred to cathode unless otherwise specified)

Maximum CCS* Ratings, *Absolute-Maximum Values:*

	Up to 220 Mc	
DC PLATE VOLTAGE.	7500 max.	volts
DC GRID-No.2 VOLTAGE.	2000 max.	volts
DC PLATE CURRENT.	4 max.	amp
PLATE INPUT	24000 max.	watts
GRID-No.2 INPUT	400 max.	watts
PLATE DISSIPATION	12000 max.	watts
GRID-No.1 DISSIPATION	300 max.	watts

Typical Operation in Grid-Drive Circuit at 216 Mc:

	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.	2.6	amp
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
Useful Power Output (Approx.):		
Synchronizing level	12000	watts
Pedestal level.	6800	watts

Typical Operation in Cathode-Drive Circuit at 216 Mc:

	Bandwidth♦ of 8.5 Mc	
DC Plate-to-Grid-No.1 Voltage	6400	volts
DC Grid-No.2-to-Grid-No.1 Voltage	800	volts
DC Cathode-to-Grid-No.1 Voltage	90	volts

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Peak RF Cathode-to-Grid-No.1 Voltage:		
Synchronizing level	360	volts
Pedestal level	285	volts
DC Plate Current:		
Synchronizing level	3.65	amp
Pedestal level	2.75	amp
DC Grid-No.2 Current (Pedestal Level)	0.175	amp
DC Grid-No.1 Current (Approx.):		
Synchronizing level	0.24	amp
Pedestal level	0.16	amp
Driver Power Output (Approx.)♣:		
Synchronizing level	1500●	watts
Pedestal level	850	watts
Useful Power Output (Approx.):		
Synchronizing level	14000	watts
Pedestal level	7900	watts

GRID-MODULATED RF POWER AMPLIFIER
Class C Television Service

Synchronizing-level conditions per tube unless otherwise specified

Maximum CCS* Ratings, ***Absolute-Maximum Values:***

	Up to 220 Mc	
DC PLATE VOLTAGE	7500 max.	volts
DC GRID-No.2 VOLTAGE	2000 max.	volts
DC GRID-No.1 VOLTAGE (White Level)	-1000 max.	volts
DC PLATE CURRENT	4 max.	amp
PLATE INPUT	24000 max.	watts
GRID-No.2 INPUT	400 max.	watts
PLATE DISSIPATION	12000 max.	watts
GRID-No.1 DISSIPATION	300 max.	watts

Typical Operation in Grid-Drive Circuit at 216 Mc:

	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
Pedestal level	425	watts

	Bandwidth♦ of 8.5 Mc	
Useful Power Output (Approx.):		
Synchronizing level	12000	watts
Pedestal level	6800	watts

LINEAR RF POWER AMPLIFIER

Single-Sideband Suppressed-Carrier Service

Maximum CCS* Ratings, *Absolute-Maximum Values:*

	Up to 220 Mc	
DC PLATE VOLTAGE	7500 max.	volts
DC GRID-No.2 VOLTAGE	2000 max.	volts
MAX.-SIGNAL DC PLATE CURRENT	2.8 max.	amp
MAX.-SIGNAL DC GRID-No.1 CURRENT	0.6 max.	amp
MAX.-SIGNAL PLATE INPUT	20000 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT	400 max.	watts
PLATE DISSIPATION	12000 max.	watts

Typical CCS Class AB_2 "Single-Tone" Operation at 60 Mc:#

DC Plate Voltage	7000	volts
DC Grid-No.2 Voltage	1200	volts
DC Grid-No.1 Voltage*	-125	volts
Zero-Signal DC Plate Current	0.200	amp
Zero-Signal DC Grid-No.2 Current	0	amp
Effective RF Load Resistance	1350	ohms
Max.-Signal DC Plate Current	2.750	amp
Max.-Signal DC Grid-No.2 Current	0.26	amp
Max.-Signal DC Grid-No.1 Current	0.080	amp
Max.-Signal Peak RF Grid-No.1 Voltage	305	volts
Max.-Signal Driving Power (Approx.)	25	watts
Max.-Signal Power Output (Approx.)	12000	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:*

	Up to 220 Mc	
DC PLATE VOLTAGE	5500 max.	volts
DC GRID-No.2 VOLTAGE	2000 max.	volts
DC GRID-No.1 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	8000 max.	watts

Typical Operation in Grid-Drive Circuit:

	At 60 Mc	
DC Plate Voltage	4800	volts
DC Grid-No.2 Voltage (Modulated 100%)*	800	volts
DC Grid-No.1 Voltage†	-300	volts

Peak RF Grid-No.1 Voltage	550	volts
DC Plate Current	1.8	amp
DC Grid-No.2 Current	0.16	amp
DC Grid-No.1 Current (Approx.)	0.18	amp
Driver Power Output (Approx.)♦	125‡	watts
Useful Power Output (Approx.)	6000	watts

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

Maximum CCS* Ratings, ***Absolute-Maximum Values:***

	Up to 220 Mc	
DC PLATE VOLTAGE	7500 max.	volts
DC GRID-No.2 VOLTAGE	2000 max.	volts
DC GRID-No.1 VOLTAGE	-1000 max.	volts
DC PLATE CURRENT	3 max.	amp
DC GRID-No.1 CURRENT	0.6 max.	amp
PLATE INPUT	20000 max.	watts
GRID-No.2 INPUT	400 max.	watts
PLATE DISSIPATION	12000 max.	watts

Typical Operation in Grid-Drive Circuit:

	At 60 Mc	At 216 Mc	
DC Plate Voltage	6600	7000	volts
DC Grid-No.2 Voltage□	1200	1200	volts
DC Grid-No.1 Voltage◊	-310	-310	volts
Peak RF Grid-No.1 Voltage	560	560	volts
DC Plate Current	2.75	2.75	amp
DC Grid-No.2 Current	0.3	0.3	amp
DC Grid-No.1 Current (Approx.)	0.14	0.14	amp
Driver Power Output (Approx.)♦	95♡	750▲▲	watts
Useful Power Output (Approx.)	12000	10000	watts

▲ 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.

● 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.

* Continuous Commercial Service.

◆ Computed between half-power points and based on tube output capacitance only.

♦ 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-voltages, in components, in initial tube characteristics, and in tube characteristics during life.

♠ This value includes 700 watts of rf-circuit loss at 216 Mc

♣ 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 in footnote (♦).

● This value includes 470 watts of rf-circuit loss at 216 Mc and 1030 watts added to plate circuit.

"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.

* Adjusted to give indicated zero-signal plate current.

● 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 25 watts of rf-circuit loss.

§ 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.

□ 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 6166A/7007 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 20 watts of rf-circuit loss.

▲▲ This value includes 675 watts of rf-circuit loss.

CHARACTERISTICS RANGE VALUES

	Note	*Min.*	*Max.*	
→ Filament Current	1	165	183	amp
Direct Interelectrode Capacitances:				
Grid No.1 to plate	2	-	0.6	pf
Grid No.1 to filament	3	39	47	pf
→ Grid No.1 to grid No.2	3	61.4	73.4	pf
→ Grid No.2 to plate	3	21.0	23.0	pf
Plate to filament	2	-	0.08	pf
DC Grid-No.1 Voltage	1,4	-	-225	volts
Peak Grid-No.1 Current	1,5	-	1.5	amp
Peak Grid-No.1 Voltage	1,5	-	315	volts

Note 1: With 5 volts ac or dc on filament.

Note 2: 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. All other electrodes are grounded.

Note 3: Without shield and all other electrodes grounded.

Note 4: With dc plate voltage of 6000 volts, dc grid-No.2 voltage of 1200 volts, and dc plate current of 20 ma.

Note 5: With dc plate voltage of 1500 volts, dc grid-No.2 voltage of 1200 volts, and instantaneous grid-No.1 voltage adjusted to give peak plate current of 11 amp.

→ Indicates a change.

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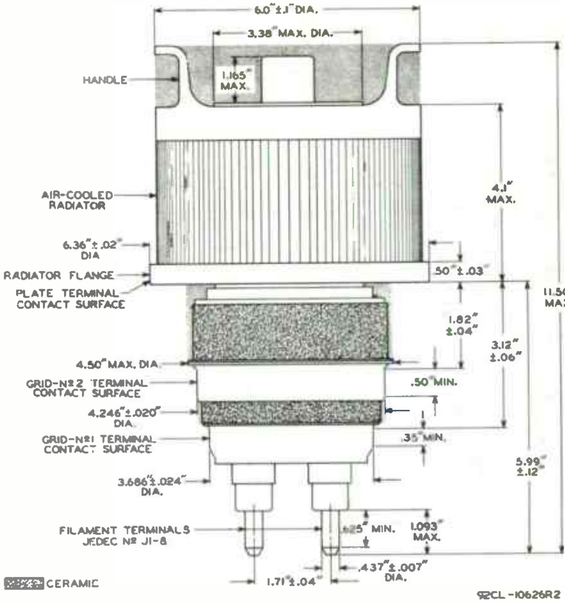
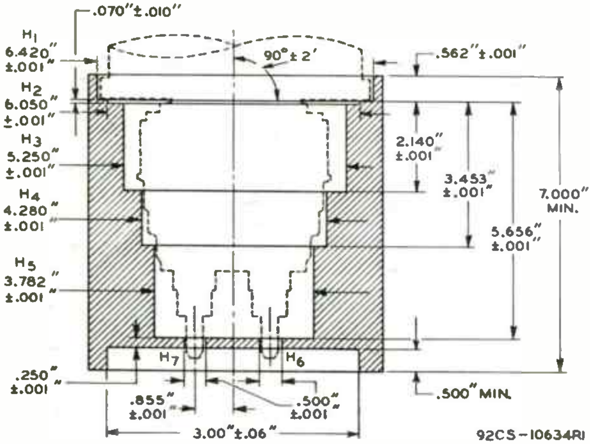


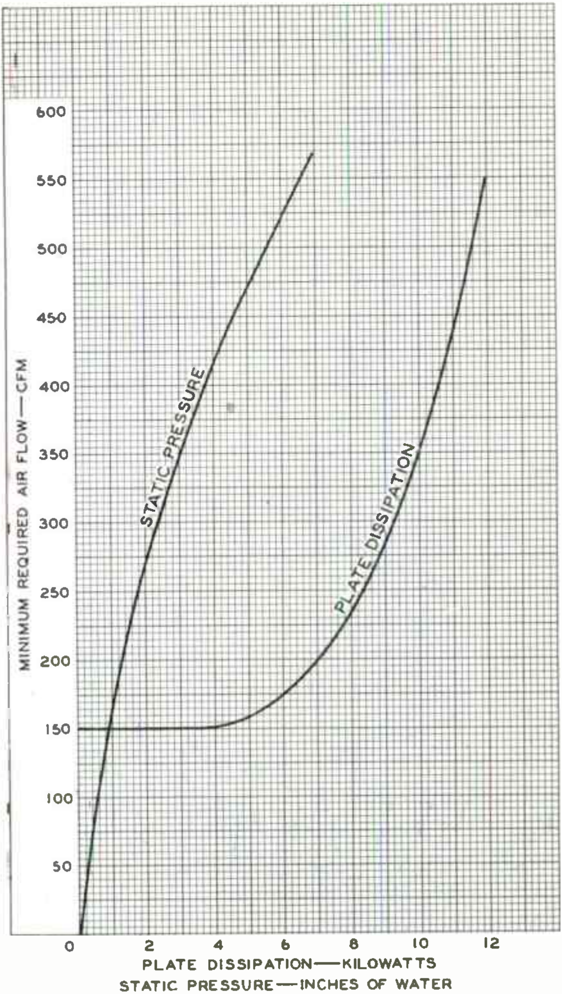
NOTE: WITH THE CYLINDRICAL SURFACES OF THE PLATE TERMINAL, GRID-No.2 TERMINAL, GRID-No.1 TERMINAL, AND FILAMENT TERMINALS CLEAN, SMOOTH, AND FREE OF BURRS, THE TUBE WILL ENTER A GAUGE AS SHOWN IN SKETCH G_1. PROPER ENTRY OF THE TUBE IN THE GAUGE IS OBTAINED WHEN THE PLATE TERMINAL IS ENTIRELY ENGAGED BY HOLE H_1 AND WILL SEAT ON THE SHOULDER BETWEEN H_1 AND H_2. THE PLANE SURFACE OF THIS SHOULDER IS AT RIGHT ANGLES TO THE AXES OF THE HOLES WITHIN $0^\circ \pm 2'$. SEATING IS DETERMINED BY FAILURE OF A 0.020"-THICKNESS GAUGE TO ENTER MORE THAN 1/16" BETWEEN SHOULDER SURFACE AND PLATE TERMINAL. SLOTS ARE PROVIDED TO PERMIT THIS MEASUREMENT. KEEP ALL STIPPLED REGIONS CLEAR. DO NOT ALLOW CONTACTS OR CIRCUIT COMPONENTS TO PROTRUDE INTO THESE ANNULAR VOLUMES.

SKETCH G_1



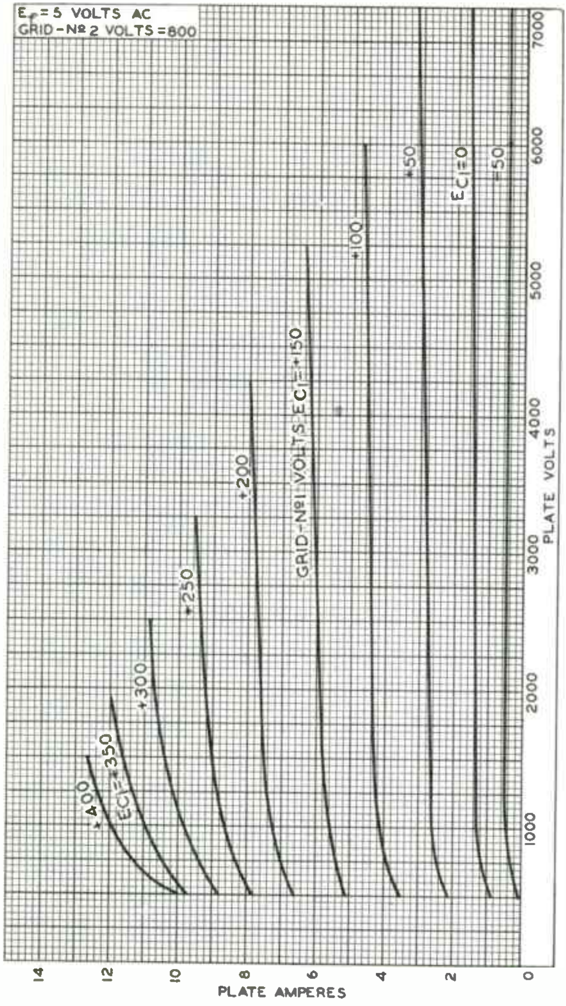
NOTE: THE FIVE CYLINDRICAL HOLES H_1, H_2, H_3, H_4 AND H_5 HAVE AXES COINCIDENT WITHIN 0.001". THE HOLES H_6 AND H_7 HAVE AXES PARALLEL TO THE AXES OF H_1, H_2, H_3, H_4 AND H_5 WITHIN $0^{\circ} \pm 2'$.

COOLING REQUIREMENTS



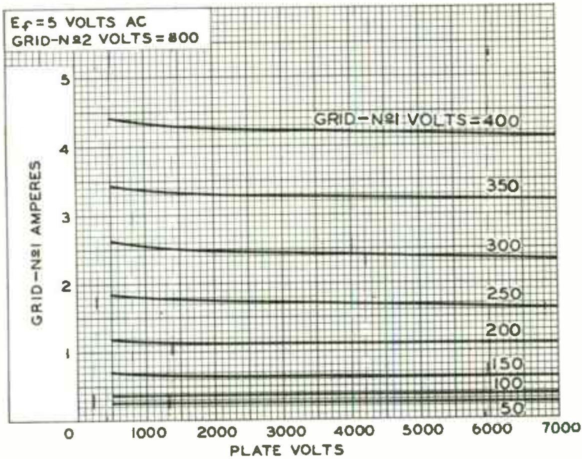
92CM-10785

AVERAGE PLATE CHARACTERISTICS

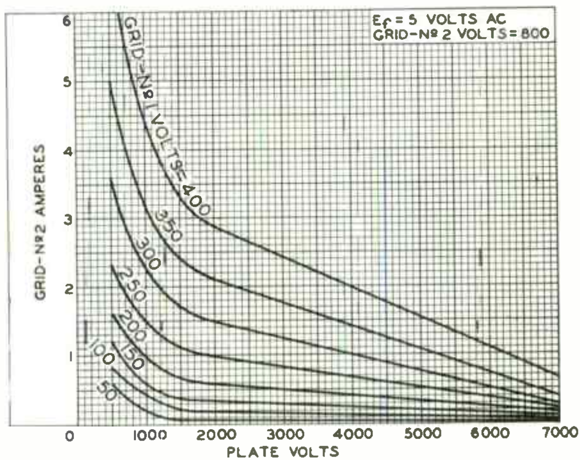


92CM-7736R1

AVERAGE CHARACTERISTICS

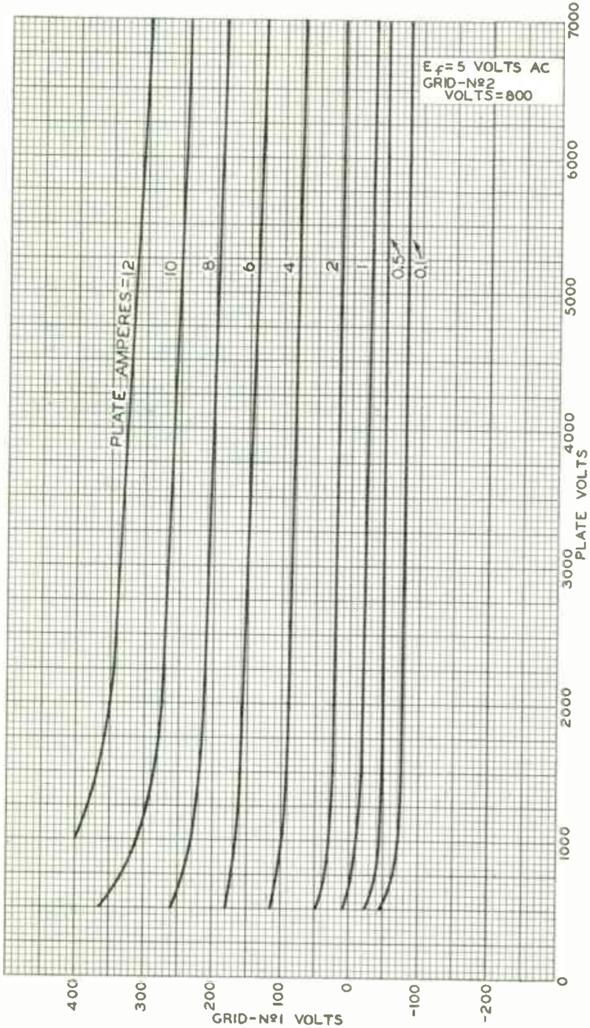


92CS-7744R1



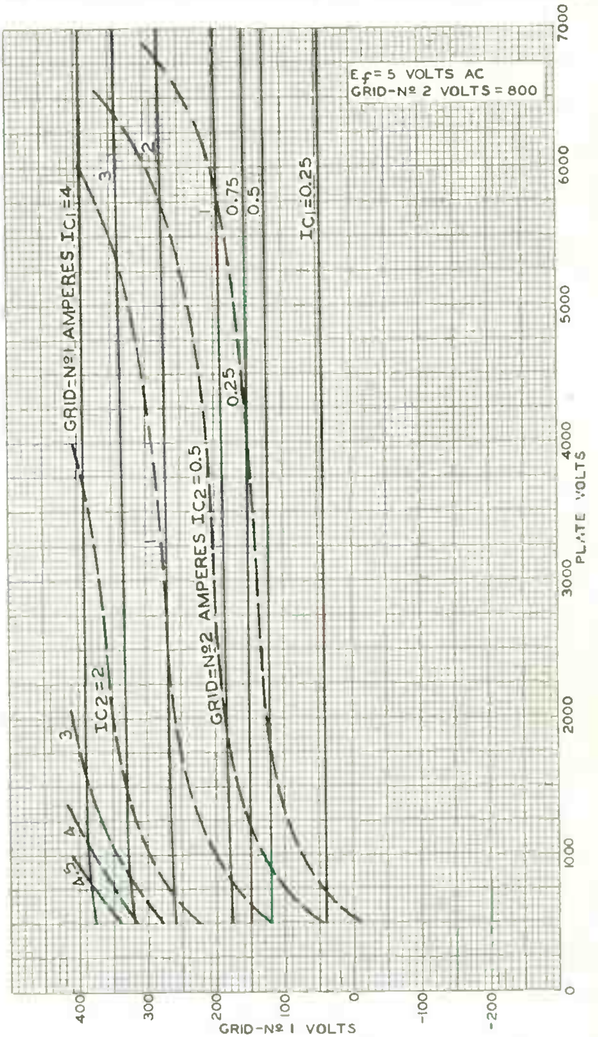
92CS-7743R1

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



92CM-7737R1

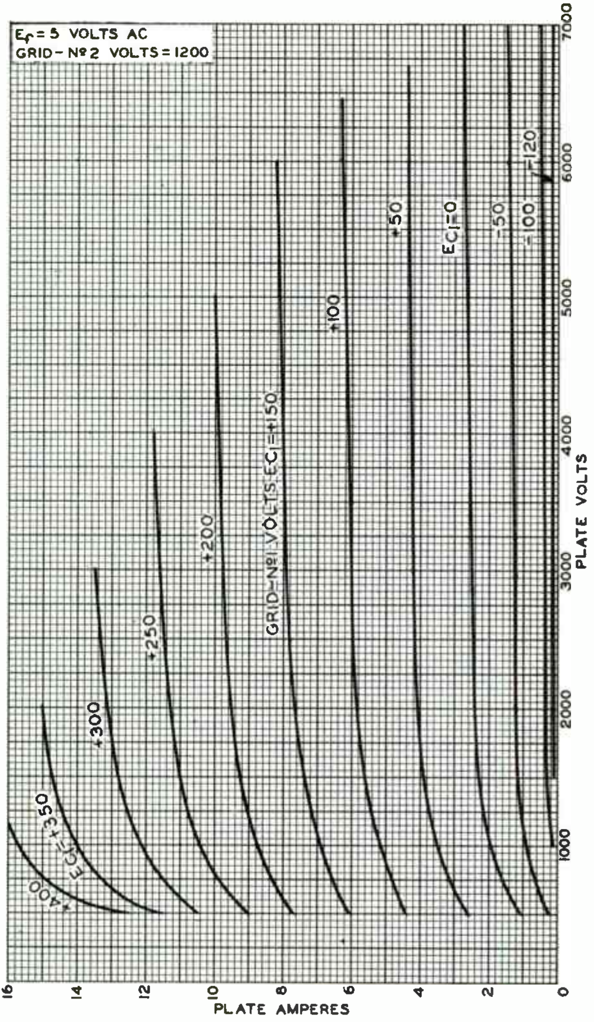
AVERAGE CONSTANT-CURRENT CHARACTERISTICS



92CM-7738R2

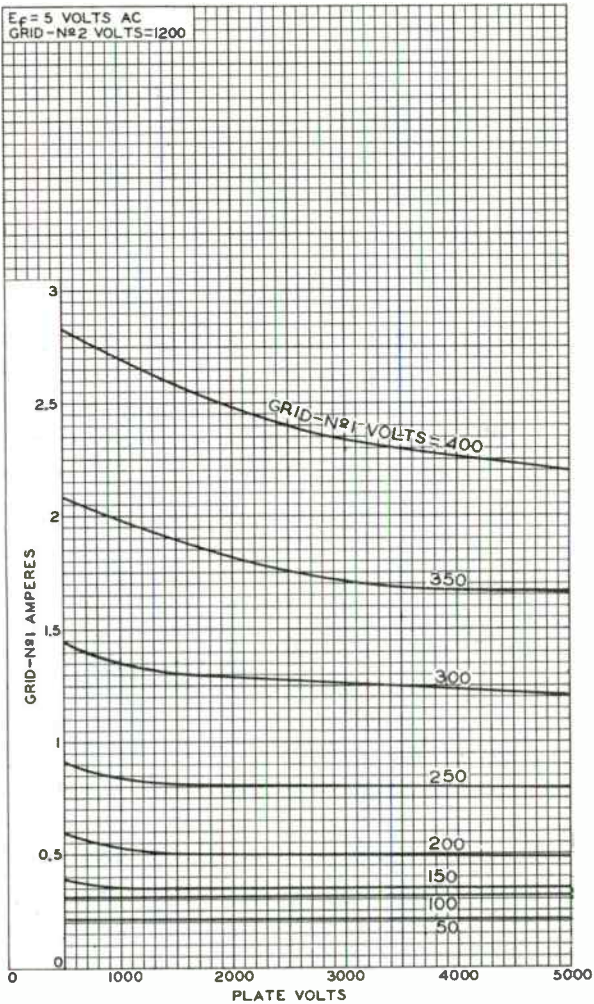
6166-A/7007

AVERAGE PLATE CHARACTERISTICS



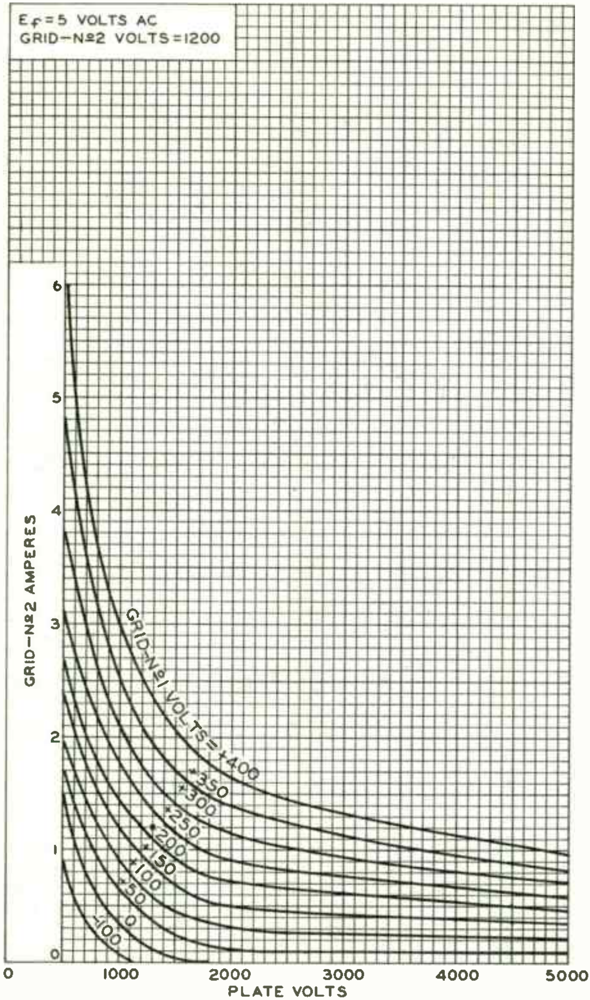
92CM-7735R1

AVERAGE CHARACTERISTICS



92CM-7740R2

AVERAGE CHARACTERISTICS

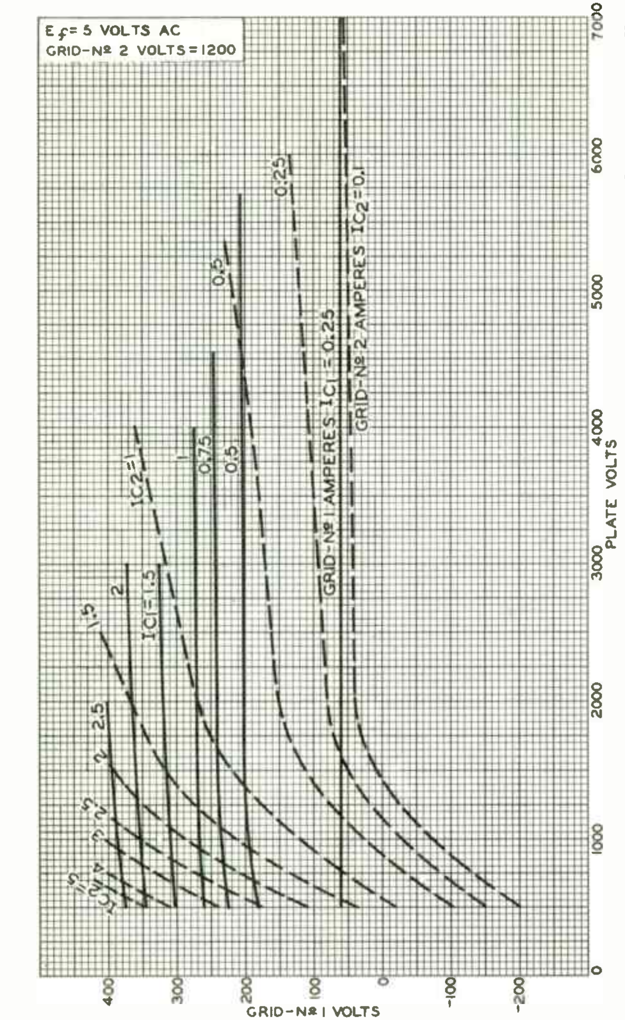


92CM-7739R1

AVERAGE CONSTANT-CURRENT CHARACTERISTICS

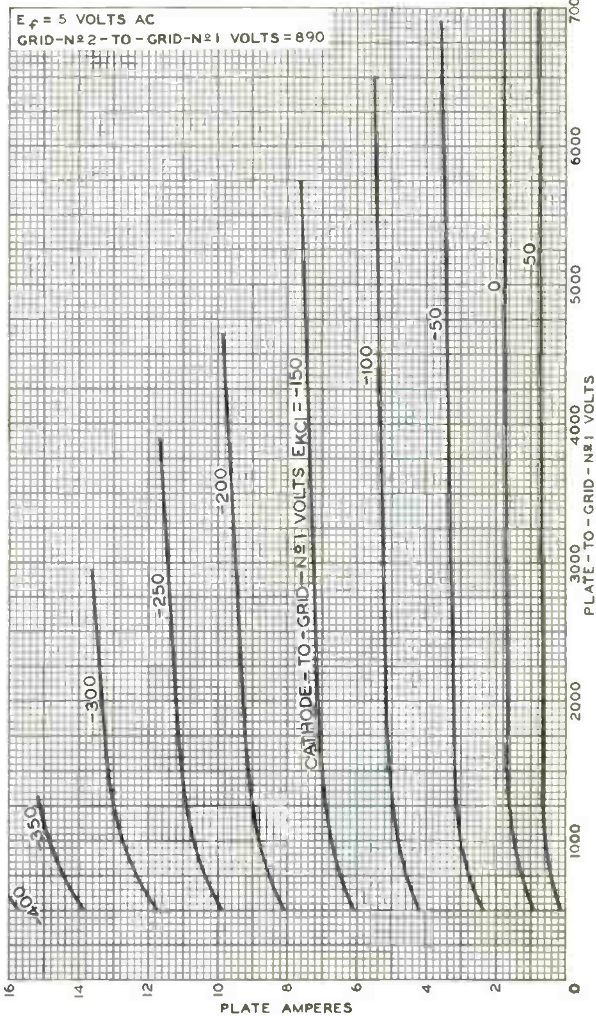
92CM-7733R1

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



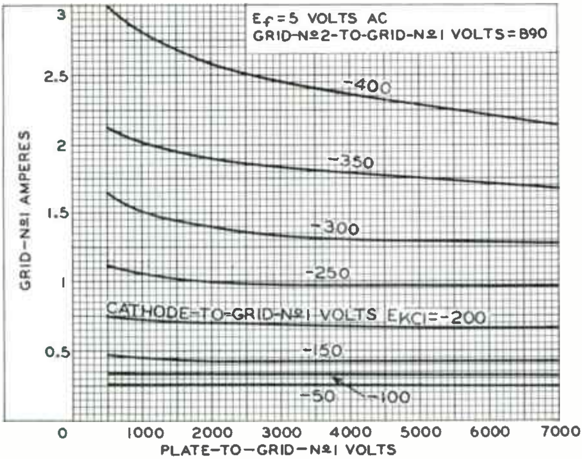
92CM-7730R1

AVERAGE PLATE CHARACTERISTICS
Cathode-Drive Service

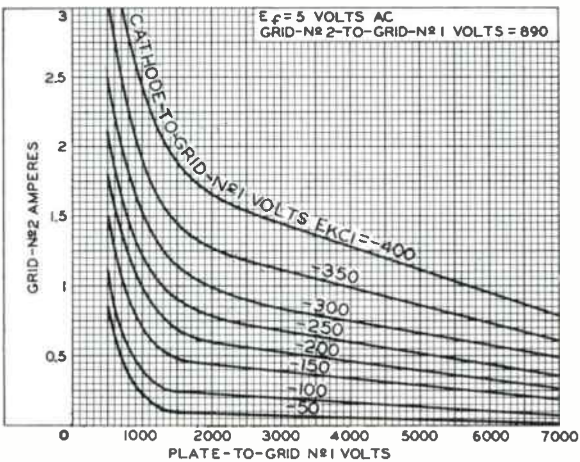


92CM-7750R1

AVERAGE CHARACTERISTICS
Cathode-Drive Service

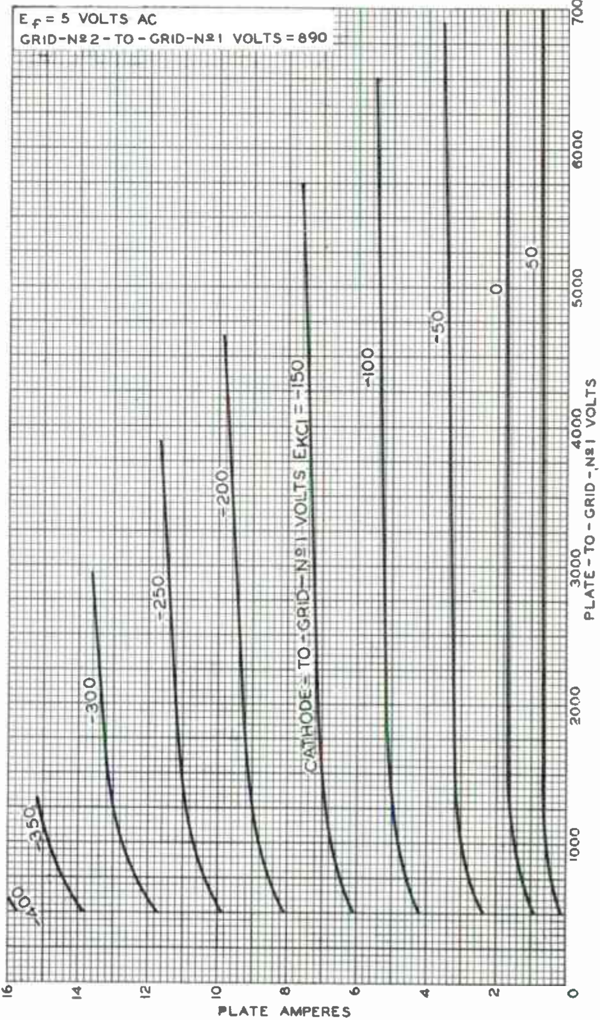


92CS-7746R1



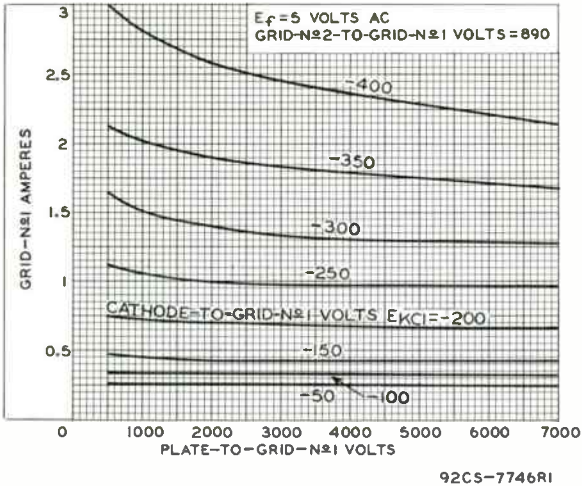
92CS-7752R3

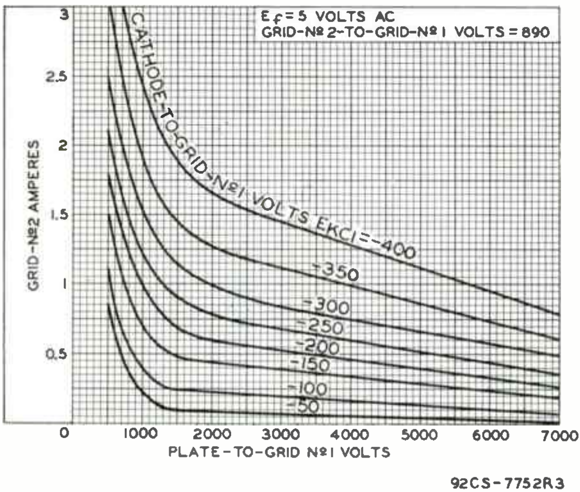
AVERAGE PLATE CHARACTERISTICS
Cathode-Drive Service



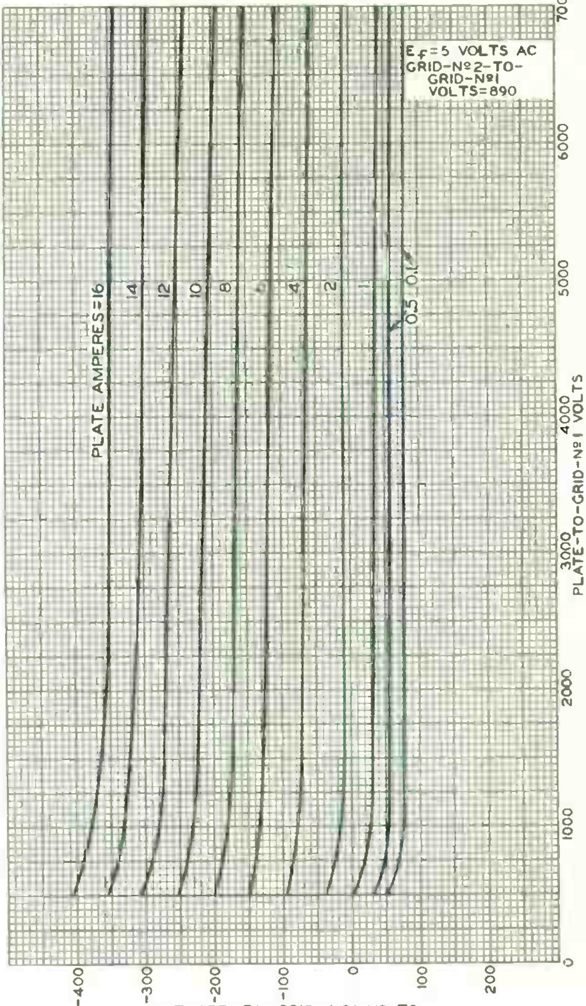
92CM-7750R1

AVERAGE CHARACTERISTICS
Cathode-Drive Service



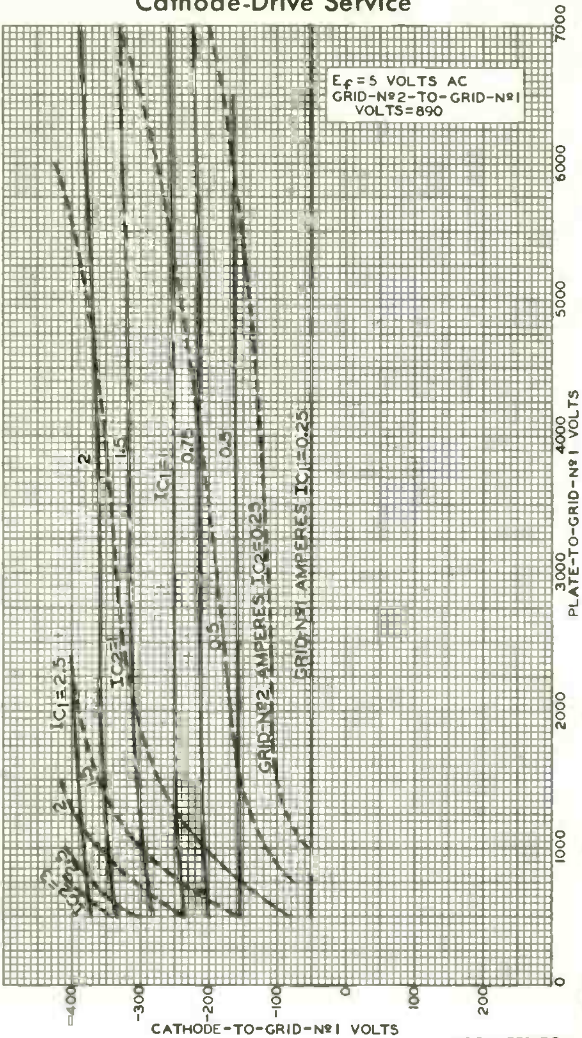


AVERAGE CONSTANT-CURRENT CHARACTERISTICS
Cathode-Drive Service

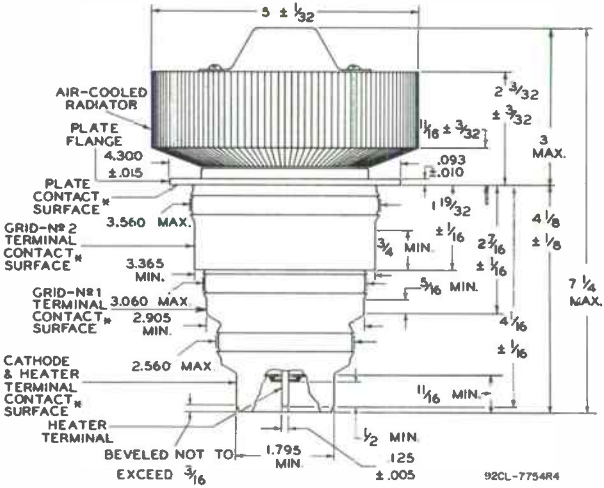


92CM-7749R1

AVERAGE CONSTANT-CURRENT CHARACTERISTICS
Cathode-Drive Service



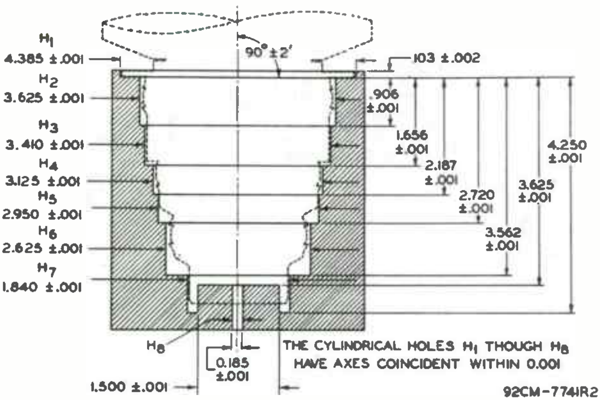
92CM-7751R2



ALL DIMENSIONS IN INCHES

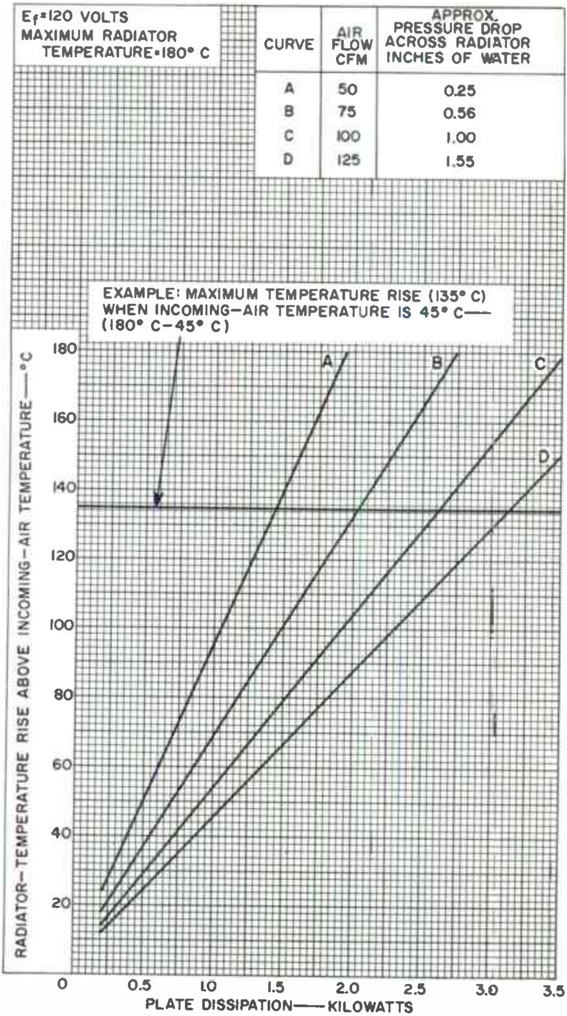
* WITH THE CYLINDRICAL SURFACES OF THE PLATE FLANGE, GRID-No.2 TERMINAL, GRID-No.1 TERMINAL, CATHODE TERMINAL, AND HEATER-PIN TERMINAL CLEAN, SMOOTH, AND FREE OF BURRS, THE TUBE WILL ENTER A GAUGE AS SHOWN IN SKETCH G_1. PROPER ENTRY OF THE TUBE IN THE GAUGE IS OBTAINED WHEN THE PLATE FLANGE IS SEATED 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



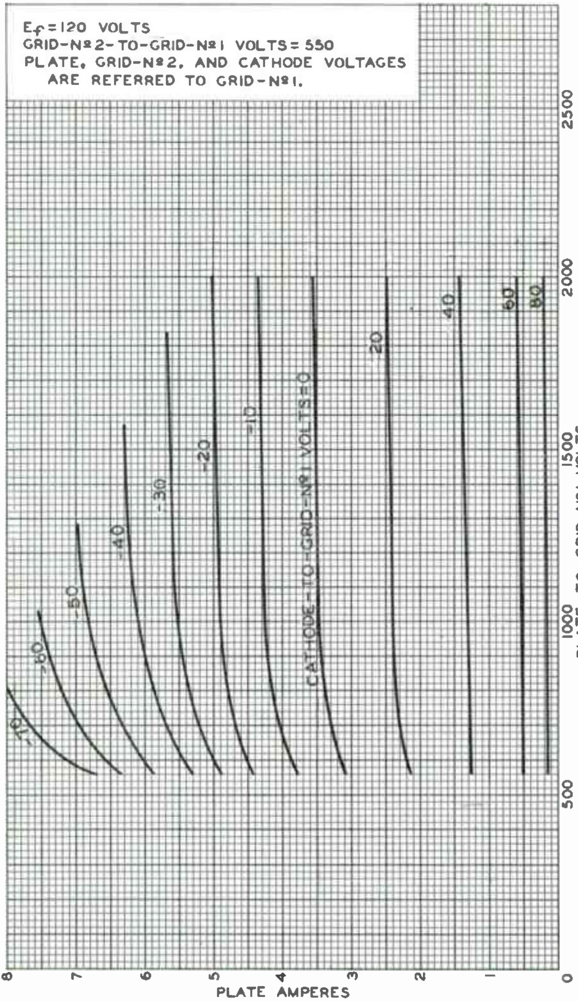
ALL DIMENSIONS IN INCHES

COOLING REQUIREMENTS



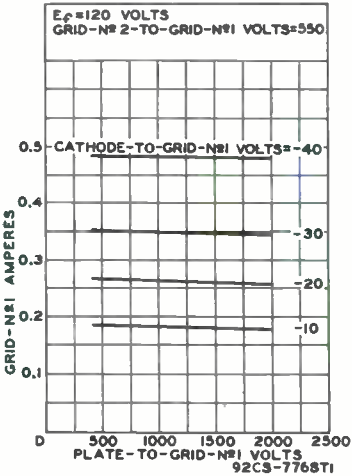
92CM-7767R2

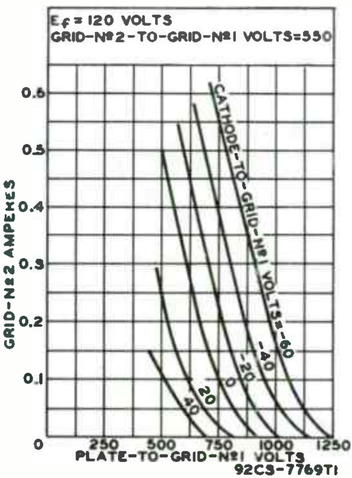
AVERAGE PLATE CHARACTERISTICS
Cathode-Drive Operation



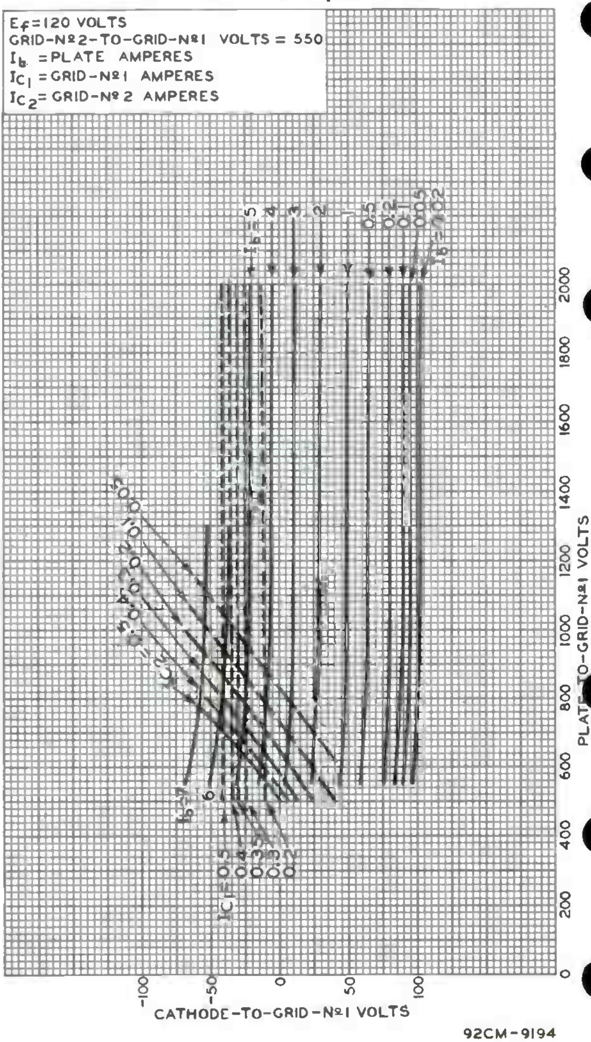
92CM-7766R1

AVERAGE CHARACTERISTICS
Cathode-Drive Operation





AVERAGE CONSTANT-CURRENT CHARACTERISTICS
Cathode-Drive Operation



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UHF MEDIUM-MU TRIODE

"PENCIL TYPE" WITH EXTERNAL PLATE RADIATOR

GENERAL DATA

Electrical:

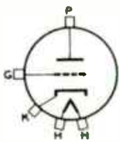
Heater, for Unipotential Cathode:			
Voltage (AC or DC):			
Under Transmitting Conditions	6.0 ± 10%		volts
Under Standby Conditions	6.3 max.		volts
Current at 6.0 Volts	0.280		amp
Amplification Factor	27		
Transconductance, for dc plate current of 27 milliamperes and dc plate voltage of 200 volts	7000		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.

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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.

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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.

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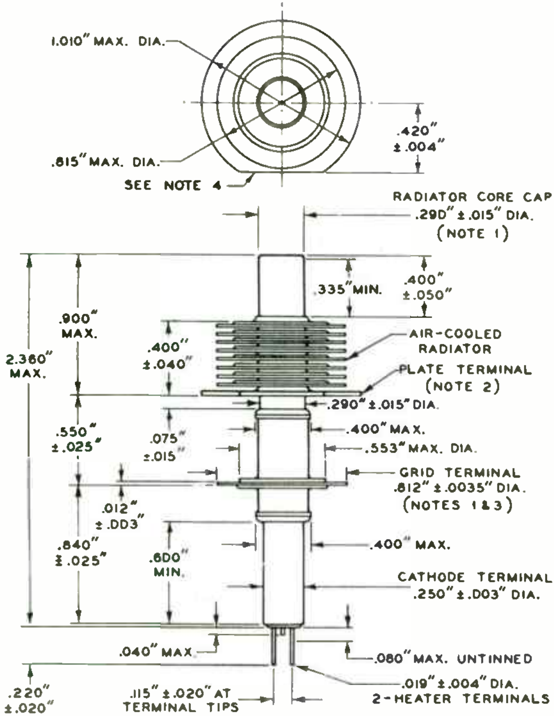
UHF MEDIUM-MU TRIODE

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".

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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°.

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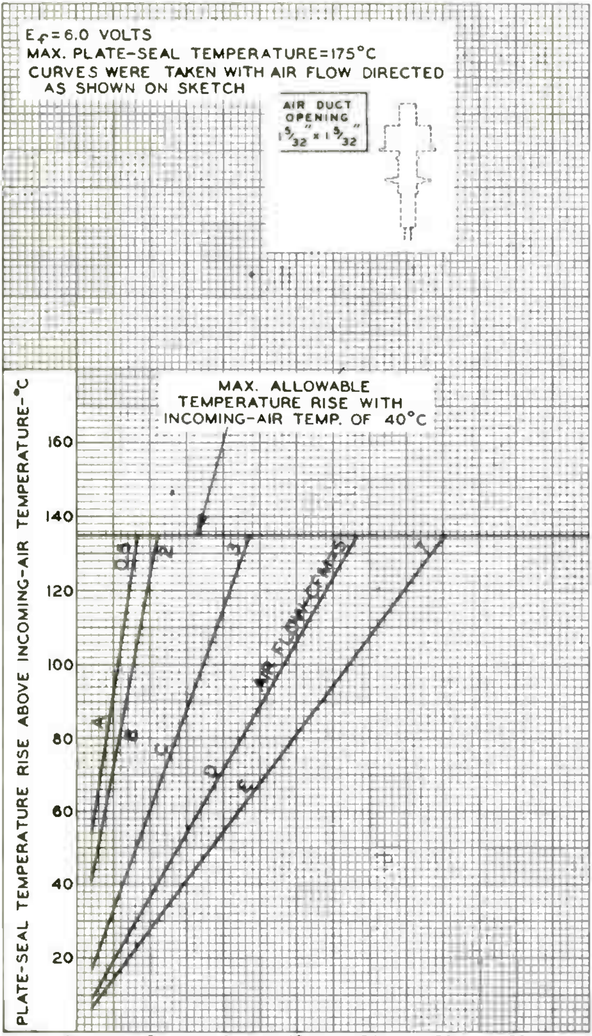
COOLING REQUIREMENTS



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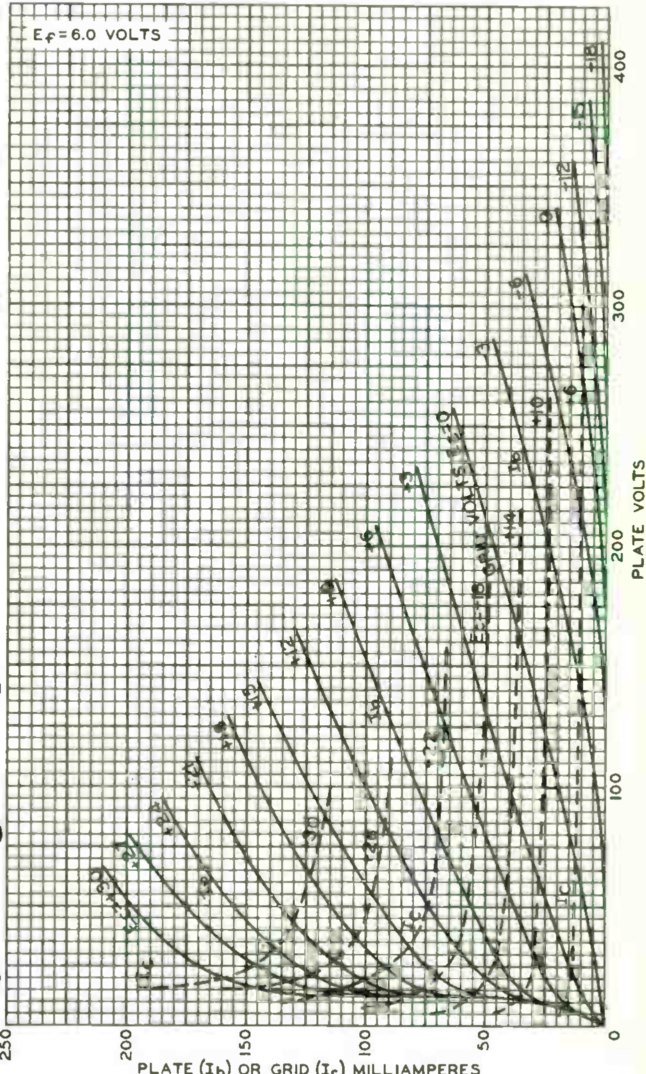
AVERAGE PLATE CHARACTERISTICS



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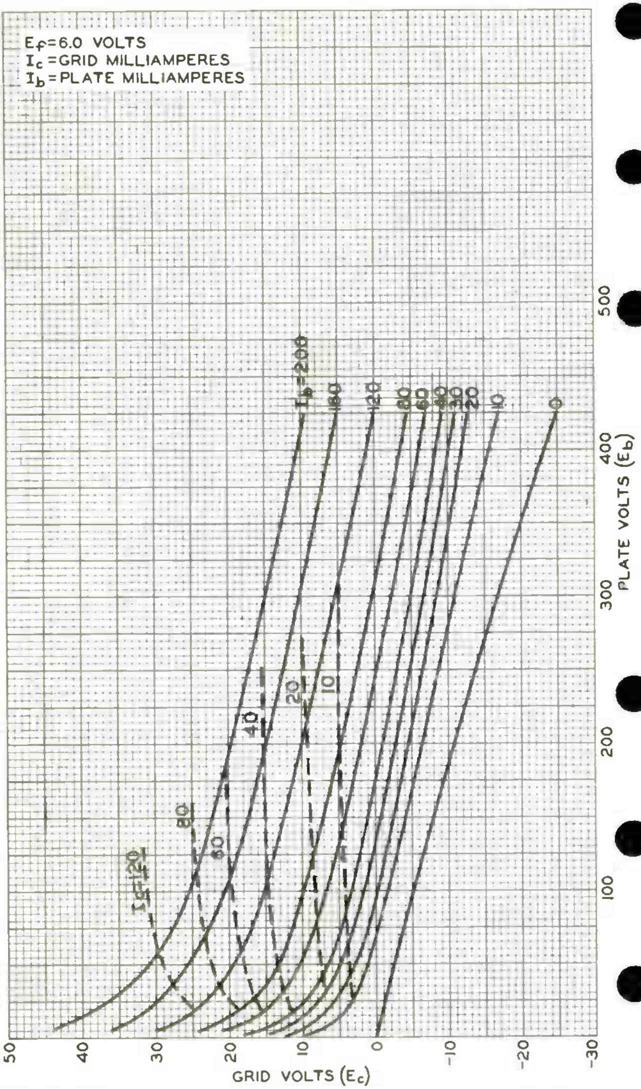
AVERAGE CONSTANT-CURRENT CHARACTERISTICS



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TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8104

Medium-Mu Triode

GLASS-METAL PENCIL TYPE

FAST WARM-UP TIME — INTEGRAL PLATE RADIATOR

For Mobile or Aircraft Applications as a RF-Power Amplifier or Oscillator Tube with Full Input up to 500 Mc and with Reduced Input up to 1700 Mc

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 volts.	0.280	amp
Amplification Factor.	27	
Transconductance, for dc plate ma. = 27 and dc plate volts = 200.	7000	μmhos

Direct Interelectrode Capacitances:

	Without External Shield	*With External Shield*[a]	
Grid to plate	1.7	1.5	μμf
Grid to cathode	2.8	-	μμf
Plate to cathode.	0.08 max.	-	μμf

Mechanical:

Operating Position. . . . . Any

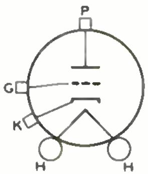
Dimensions and Terminal Connections . . . . See *Dimensional Outline*

Radiator. Integral part of tube

Terminal Connections (See *Dimensional Outline*):

H - Heater

K - Cathode



G - Grid

P - Plate

Cooling:

In many applications, the 6263A 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 Pins. .Grayhill No.22-3[b], Cinch No.54A16325[c], or equivalent

RF POWER AMPLIFIER AND OSCILLATOR — Class C Telegraphy

Key-down conditions per tube without amplitude modulation[d]

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

For altitudes up to 60,000 feet

	CCS[e]	*ICAS*[f]	
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	13.2 max.	22 max.	watts
PLATE DISSIPATION	8 max.	13 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode. . . .	50 max.	50 max.	volts
Heater positive with respect to cathode. . . .	50 max.	50 max.	volts

Typical Operation as Oscillator in Cathode-Drive Circuit:

At 500 Mc

	CCS[e]	*ICAS*[f]	
DC Plate-to-Grid Voltage. . .	330	385	volts
DC Cathode-to-Grid Voltage[g] .	30	35	volts
DC Plate Current.	35	40	ma
DC Grid Current (Approx.) . .	11	14	ma
Useful Power Output (Approx.)	5[h]	7[h]	watts

At 1700 Mc

	CCS[e]	
DC Plate-to-Grid Voltage. . .	270	volts
DC Cathode-to-Grid Voltage[g] .	20	volts
DC Plate Current.	40	ma
DC Grid Current (Approx.) . .	9	ma
Useful Power Output (Approx.)	0.9[h]	watt

Typical Operation as RF Power Amplifier in Cathode-Drive Circuit at 500 Mc:

	CCS[e]	*ICAS*[f]	
DC Plate-to-Grid Voltage. . .	348	408	volts
DC Cathode-to-Grid Voltage[g] .	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[h]	10[h]	watts

Maximum Circuit Values:

Grid-Circuit Resistance . . .	0.1 max.	0.1 max.	megohm

PLATE-MODULATED RF POWER AMPLIFIER — Class C Telephony

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

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

For altitudes up to 60,000 feet

	CCS[e]	*ICAS*[f]	
DC PLATE VOLTAGE.	275 max.	330 max.	volts
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. . . .	50 max.	50 max.	volts
Heater positive with respect to cathode. . . .	50 max.	50 max.	volts

Typical Operation in Cathode-Drive Circuit at 500 Mc:

	CCS[e]	*ICAS*[f]	
DC Plate-to-Grid Voltage. . .	317	372	volts
DC Cathode-to-Grid Voltage[g] .	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[h]	8[h]	watts

Maximum Circuit Values:

Grid-Circuit Resistance . . .	0.1 max.	0.1 max.	megohm

[a] 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.

[b] Grayhill, Inc., 561 Hillgrove Avenue, LaGrange, Illinois.

[c] Cinch Manufacturing Company, 1026 South Homan Avenue, Chicago, Illinois.

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

[e] Continuous Commercial Service.

[f] Intermittent Commercial and Amateur Service. No operating or "ON" period exceeds 5 minutes and every "ON" period is followed by an "OFF" or standby period of at least the same or greater duration.

[g] From a grid resistor, or from a suitable combination of grid resistor and fixed supply or grid resistor and cathode resistor.

[h] This value of useful power is measured at load of output circuit having an efficiency of about 75 per cent.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Heater Current	1	0.265	0.295	amp
Direct Interelectrode Capacitances:				
Grid to plate	-	1.45	1.95	μμf
Grid to cathode	-	2.45	3.35	μμf
Plate to cathode	-	-	0.08	μμf
Reverse Grid Current	1,2	-	0.5	μa
Plate Current (1)	1,3	18	36	ma
Plate Current (2)	1,4	-	55	μa
Amplification Factor	1,3	20	34	
Transconductance	1,3	5600	8400	μmhos
Heater-Cathode Leakage Current:				
Heater negative with respect to cathode	1,5	-	100	μa
Heater positive with respect to cathode	1,6	-	100	μa
Emission Voltage	1,7	-	10	volts
Leakage Resistance:				
From grid to plate and cathode tied together	1,8	25	-	megohms
From plate to grid and cathode tied together	1,9	25	-	megohms
Power Output	1,10	6.5	-	watts
Change in Power Output	11	-	0.5	watt

Note 1: With 6.0 volts ac or dc on heater.

Note 2: With dc plate voltage of 200 volts, dc grid voltage of -2.5 volts, grid resistor of 0.5 megohm.

Note 3: With dc plate supply voltage of 200 volts, cathode resistor of 100 ± 1% ohms, and cathode bypass capacitor of 1000 μf.

Note 4: With dc plate voltage of 200 volts, dc grid voltage of -20 volts.

Note 5: With 50 volts dc between heater and cathode, heater negative with respect to cathode.

Note 6: With 50 volts dc between heater and cathode, heater positive with respect to cathode.

Note 7: With dc voltage on grid and plate which are tied together adjusted to produce a cathode current of 30 ma.

Note 8: With grid 100 volts negative with respect to plate and cathode which are tied together.

Note 9: With plate 300 volts negative with respect to grid and cathode which are tied together.

Note 10: 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 ± 15 Mc and having an efficiency of approximately 75 per cent.

Note 11: At end of Power-Output test, reduce heater voltage to 5.0 volts and note change in power output.

SPECIAL TESTS & PERFORMANCE DATA

Low-Pressure Voltage Breakdown Test:

This test (similar to MIL-E-1D, paragraph 4.9.12.1) is performed on a sample lot of tubes from each production run. Tubes are tested in a chamber at an air pressure equivalent to an altitude of 60,000 feet. Breakdown will not occur when a 60 cycle rms voltage of 500 volts is applied between the plate cylinder and grid flange.

Low-Frequency Vibration Performance:

This test (MIL-E-10, paragraph 4.9.19.1) is performed on a sample lot of tubes from each production run under the following conditions:

Heater voltage of 6.0 volts, dc plate supply voltage of 200 volts, grid voltage of -3 volts, and plate load resistor of 10,000 ohms. The tubes are vibrated in a plane perpendicular to the tube axis at 25 cycles per second at an acceleration of 2.5 g. The rms output voltage across the plate load resistor as a result of vibration of the tube will not exceed 100 millivolts.

High-Frequency Vibration Performance:

This test (similar to MIL-E-1D, paragraph 4.9.19.2) is performed on a sample lot of tubes from each production run. The tube is vibrated perpendicular to its axis, with no voltages applied to the tube. Vibration frequency is 40 to 60 cps and acceleration is 10 g. At the end of this test, tubes will not show temporary or permanent shorts or open circuits and will meet the following limits:

Heater-Cathode Leakage Current. . . . . . 100 max. µa
For conditions shown under *Characteristics Range Values Notes 1,5 and 1,6.*

Low-Frequency Vibration (rms) . . . . . . 100 max. mv
For conditions shown above under *Low-Frequency Vibration Performance.*

Plate Current (2) . . . . 55 max. µa
For conditions shown under *Characteristics Range Values Notes 1,4.*

Shorts and Continuity Test:

This test (MIL-E-10, paragraph 4.7.5) is performed on all tubes from each production run. In this test, a tube is considered inoperative if it shows a permanent or temporary short or open circuit, an air leak, or reverse grid current in excess of 1 microampere for the conditions shown under *Characteristics Range Values, Notes 1,2.*

Glass-Seal Fracture Test:

This test is performed on a sample lot of tubes from each production run. Tubes are placed on supports spaced 15/16" ± 1/64" apart with cathode cylinder resting on one support and plate cylinder resting on the other support at a point between the radiator fins and the plate flange. Tubes will withstand gradual application, perpendicular to tube axis, of a force of 60 pounds upon the grid flange without causing fracture of the glass insulation.

Heater Cycling Life Performance:

This test (similar to MIL-E-1D, paragraph 4.11.7) is performed on a sample lot of tubes from each production run. With 6.0 volts on heater and no voltage on plate and grid, the heater is cycled three minutes on and three minutes off for at least 2000 cycles. At the end of this test, tubes will not show temporary or permanent shorts or open circuits, and are required to meet the following limits:

Grid-Plate and Cathode Leakage Resistance. 25 min. megohms
For conditions shown under *Characteristics Range Values Notes 1,8.*

Heater-Cathode Leakage Current. . . . . . . 150 max. μa
For conditions shown under *Characteristics Range Values Notes 1,5.*

1-Hour Stability Life Performance:

This test (similar to MIL-E-1D, paragraph 4.11.3.1.a) is performed on a sample lot of tubes from each production run to insure that the tubes have been properly stabilized. Tubes are operated under the following conditions: heater voltage of 6.0 volts, plate dissipation of 2.5 to 3 watts. At the end of 1 hour, the change in transconductance value for each tube, referred to its initial transconductance reading, will not exceed 15% of the initial value, for conditions shown under *Characteristics Range Values, Notes 1,3.*

50-Hour Survival Life Performance:

This test (similar to MIL-E-1D, paragraph 4.11.3.1.a) is performed on a sample lot of tubes from each production run to insure a low percentage of early inoperatives. Life-test conditions are the same as those specified for *1-Hour Stability Life Performance* except that all voltages are cycled at the rate of 110 minutes on and 10 minutes off. At the end of 50 hours, the tubes are required to meet the following limits:

Power Output. . . . . 5 min. watts
For conditions shown under *Characteristics Range Values Notes 1,10.*

Plate Current (2) . . . . 100 max. μa
For conditions shown under *Characteristics Range Values Notes 1,4.*

Shorts and Continuity Test specified above.

Intermittent Dynamic Life Performance:

This test (similar to MIL-E-1D, paragraph 4.11.3.2) is performed on a sample lot of tubes from each production run to insure high quality of rf performance. Each tube is life-tested in a cavity-type oscillator at 500 ± 15 Mc under the following conditions:

Heater voltage of 6.0 volts, plate supply voltage of 400 volts, grid resistor is adjusted to give a dc plate current of 40 ma. and value is recorded, cathode resistor of 0 ohms, plate-circuit load resistance of 100 ± 5 ohms, heater positive with respect to cathode by 50 volts, and plate-seal temperature of 175° C min. Heater voltage is cycled at a rate of 110 minutes on and 10 minutes off.

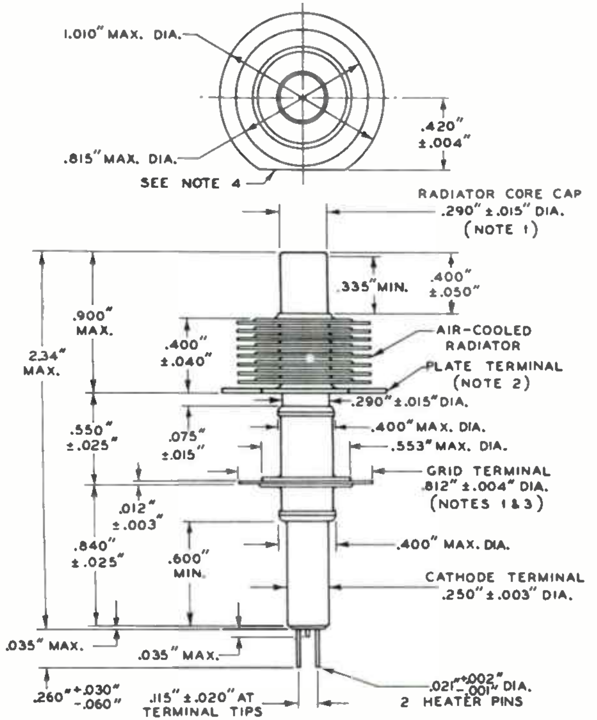
At the end of 500 hours, the tube will not show permanent shorts or open circuits and will be criticized for the total number of defects in the sample lot and for the number of tubes failing to meet the following limits:

Reverse Grid Current.	1 max.	μa
For conditions shown under *Characteristics Range Values Notes 1,2.*		
Power Output.	5 min.	watts
For conditions shown under *Characteristics Range Values Notes 1,10.*		

OPERATING CONSIDERATIONS

The *heater* leads of the 6263A should not be soldered to circuit elements. The heat of the soldering operation may crack the glass seals of the heater pins and damage the tube.

The *cathode* should preferably be connected to one side of the heater. When, in some circuit designs, the heater is not connected directly to the cathode, precautions must be taken to hold the peak heater-cathode voltage to the maximum values shown in the tabulated data.


1.010" MAX. DIA.
.815" MAX. DIA.
SEE NOTE 4
.420" ±.004"
RADIATOR CORE CAP .290" ±.015" DIA. (NOTE 1)
.335" MIN.
.400" ±.050"
.900" MAX.
2.34" MAX.
.400" ±.040"
AIR-COOLED RADIATOR
PLATE TERMINAL (NOTE 2)
.290" ±.015" DIA.
.400" MAX. DIA.
.553" MAX. DIA.
.550" ±.025"
.075" ±.015"
GRID TERMINAL .812" ±.004" DIA. (NOTES 1 & 3)
.012" ±.003"
.840" ±.025"
.600" MIN.
.400" MAX. DIA.
CATHODE TERMINAL .250" ±.003" DIA.
.035" MAX.
.035" MAX.
.260" +.030" -.060"
.115" ±.020" AT TERMINAL TIPS
.021" +.002" -.001" DIA.
2 HEATER PINS
92CS-7999R1

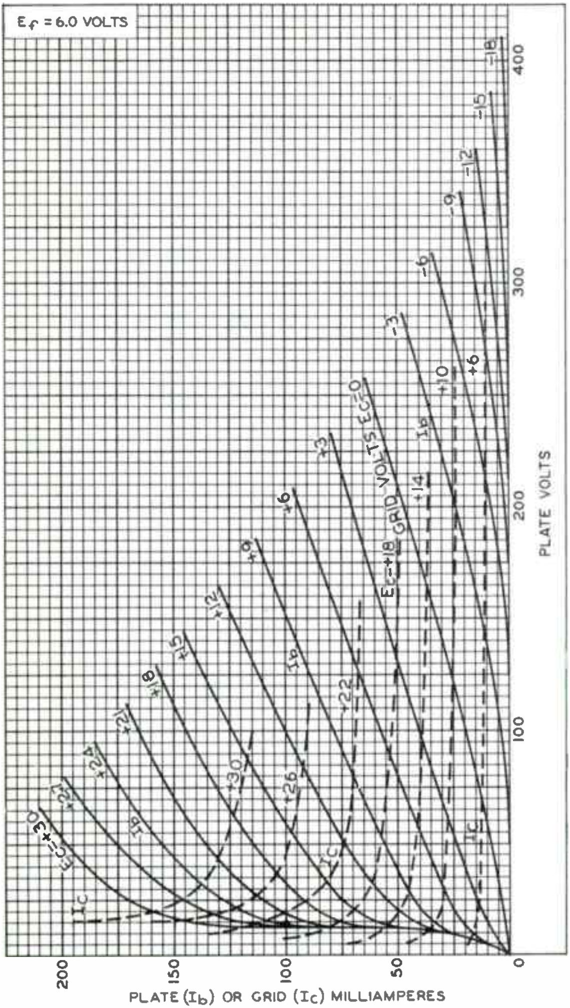
NOTE 1: ECCENTRICITY OF RADIATOR-CORE CAP WITH RESPECT TO THE CATHODE TERMINAL IS ONE-HALF THE TOTAL RUN-OUT DETERMINED BY CHUCKING THE CATHODE TERMINAL 0.050" TO 0.100" FROM CATHODE FLANGE, ROTATING THE TUBE, AND GAUGING THE TOTAL RUN-OUT AT A POINT 0.125" FROM THE END OF THE RADIATOR-CORE CAP. THE ECCENTRICITY WILL NOT EXCEED 0.030".

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 0.025".

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".

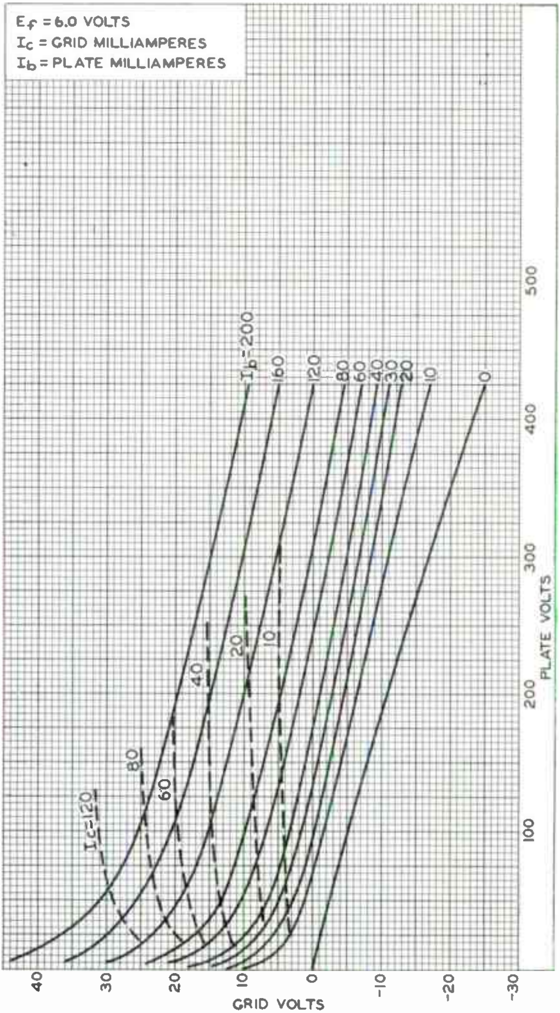
NOTE 4: THE STRAIGHT EDGE ON THE PERIMETER OF THE LARGE FIN (PLATE TERMINAL) IS PARALLEL TO A PLANE THROUGH THE CENTERS OF THE HEATER PINS AT THEIR SEALS WITHIN 15°.

AVERAGE CHARACTERISTICS



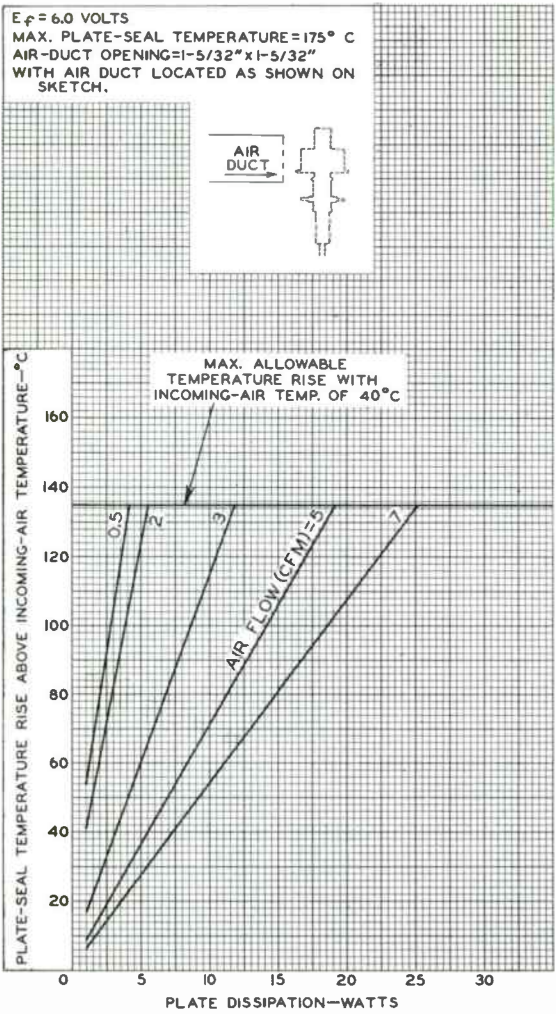
92CM-8103

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



92CM-8104

COOLING REQUIREMENTS



92CM-8120R1

Medium-Mu Triode

GLASS-METAL PENCIL TYPE

FAST WARM-UP TIME **INTEGRAL PLATE RADIATOR**

STURDY COAXIAL-ELECTRODE STRUCTURE

For Mobile or Aircraft Applications as a Frequency-Multiplier, RF-Power-Amplifier, or Oscillator Tube

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:
Voltage (AC or DC):
Under transmitting conditions. . . . . 6 ± 10% volts
Under standby conditions . . . . 6.3 max. volts
Current at 6 volts . . . . 0.28 amp
Amplification Factor 40
Transconductance, for dc plate ma. = 18.5 and dc plate volts = 200 . . . . 6800 μmhos
Direct Interelectrode Capacitances:

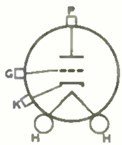
	Without External Shield	*With External Shield*▲	
Grid to plate.	1.75	1.5	μμf
Grid to cathode.	2.95	–	μμf
Plate to cathode	0.07 max.	–	μμf

Mechanical:

Terminal Connections (See *Dimensional Outline*):

H – Heater

K – Cathode



G – Grid

P – Plate

Operating Position . . . . Any
Dimensions and Terminal Connections. . . . . See *Dimensional Outline*
Radiator . . . . Integral part of tube
Cooling:

In many applications, the 6264-A 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 Pins	Grayhill No.22-3, Cinch No.54A16325, or equivalent	

RF POWER AMPLIFIER AND OSCILLATOR — Class C Telegraphy

Key-down conditions per tube without amplitude modulation●

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

For Altitudes up to 60,000 ft

	CCS★	ICAS♦	
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	13.2 max.	22 max.	watts
PLATE DISSIPATION	8 max.	13 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	50 max.	50 max.	volts
Heater positive with respect to cathode	50 max.	50 max.	volts

Typical Operation as Oscillator in Cathode-Drive Circuit:

At 500 Mc

	CCS★	ICAS♦	
DC Plate-to-Grid Voltage	325	380	volts
DC Cathode-to-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

At 1700 Mc

	CCS★	
DC Plate-to-Grid Voltage	263	volts
DC Cathode-to-Grid Voltage♣	13	volts
DC Plate Current	40	ma
DC Grid Current (Approx.)	13	ma
Useful Power Output (Approx.)	1♠	watt

Typical Operation as RF Power Amplifier in Cathode-Drive Circuit at 500 Mc:

	CCS★	ICAS♦	
DC Plate-to-Grid Voltage	342	395	volts
DC Cathode-to-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:

Grid-Circuit Resistance. . . .	0.1 max.	0.1 max.	megohm

FREQUENCY MULTIPLIER

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

For Altitudes up to 60,000 ft

	CCS*	ICAS♦	
DC PLATE VOLTAGE	300 max.	350 max.	volts
DC GRID VOLTAGE.	-125 max.	-140 max.	volts
DC PLATE CURRENT	33 max.	45 max.	ma
DC GRID CURRENT.	25 max.	25 max.	ma
DC CATHODE CURRENT	45 max.	55 max.	ma
PLATE INPUT.	9.9 max.	15.9 max.	watts
PLATE DISSIPATION.	6 max.	9.5 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	50 max.	50 max.	volts
Heater positive with respect to cathode	50 max.	50 max.	volts

Typical Operation as Tripler to 510 Mc in Cathode-Drive Circuit:

	CCS*	ICAS♦	
DC Plate-to-Grid Voltage	410	472	volts
DC Cathode-to-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:

Grid-Circuit Resistance. . . .	0.1 max.	0.1 max.	megohm

▲ 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.

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

* 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%.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Heater Current	1	0.265	0.295	ma
Grid-to-Plate Capacitance. . . .	-	1.5	2	μμf
Grid-to-Cathode Capacitance. . .	-	2.5	3.4	μμf
Plate-to-Cathode Capacitance . .	-	-	0.07	μμf
Reverse Grid Current	1,2	-	0.5	μa

	Note	Min.	Max.	
Plate Current (1).	1,3	13	24	ma
Plate Current (2).	1,4	-	55	μa
Amplification Factor	1,3	30	50	
Transconductance	1,3	5400	8200	μmhos
Heater-Cathode Leakage Current:				
Heater negative with respect to cathode	1,5	-	100	μa
Heater positive with respect to cathode	1,6	-	100	μa
Emission Voltage	1,7	-	10	volts
Leakage Resistance:				
From grid to plate and cathode tied together. . . .	1,8	25	-	megohms
From plate to grid and cathode tied together. . . .	1,9	25	-	megohms
Power Output	1,10	6.5	-	watts
Change in Power Output	11	-	0.5	watt

Note 1: With 6 volts ac or dc on heater.

Note 2: With dc plate voltage of 200 volts, dc grid voltage of -2 volts, grid resistor of 0.5 megohm.

Note 3: With dc plate supply voltage of 200 volts, cathode resistor of 100 ± 1% ohms, and cathode bypass capacitor of 1000 μf.

Note 4: With dc plate voltage of 200 volts, dc grid voltage of -12 volts, cathode resistor of 0 ohms.

Note 5: With 50 volts dc between heater and cathode, heater negative with respect to cathode.

Note 6: With 50 volts dc between heater and cathode, heater positive with respect to cathode.

Note 7: With dc voltage on grid and plate which are tied together adjusted to produce a cathode current of 30 ma.

Note 8: With grid 100 volts negative with respect to plate and cathode which are tied together.

Note 9: With plate 300 volts negative with respect to grid and cathode which are tied together.

Note 10: 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 Mc and having an efficiency of approximately 75 per cent.

Note 11: At end of Power-Oscillation test, reduce heater voltage to 5 volts and note change in power output.

SPECIAL TESTS & PERFORMANCE DATA

Low-Pressure Voltage Breakdown Test:

This test is performed on a sample lot of tubes from each production run. Tubes are tested in a chamber at an air pressure equivalent to an altitude of 60,000 feet. Breakdown will not occur when an rms voltage of 500 volts is applied between the plate cylinder and grid flange.

Low-Frequency Vibration Performance:

This test (MIL-E-ID, paragraph 4.9.19.1) is performed on a sample lot of tubes from each production run under the following conditions:

Heater voltage of 6 volts, dc plate supply voltage of 200 volts, grid voltage of −2 volts, and plate load resistor of 10,000 ohms. The tubes are vibrated in a plane perpendicular to the tube axis at 25 cycles per second at an acceleration of 2.5 g. The rms output voltage across the plate load resistor as a result of vibration of the tube will not exceed 100 millivolts.

High-Frequency Vibration Performance:

This test (similar to MIL-E-10, paragraph 4.9.19.2) is performed on a sample lot of tubes from each production run. The tube is vibrated perpendicular to its axis, with no voltages applied to the tube. Vibration frequency is 40 to 60 cps and acceleration is 10 g. At the end of this test, tubes will not show temporary or permanent shorts or open circuits and will meet the following limits:

Heater-Cathode Leakage Current.	100 max.	μa
For conditions shown under *Characteristics Range Values Notes 1,5 and 1,6.*		
Low-Frequency Vibration (rms)	100 max.	mv
For conditions shown above under *Low-Frequency Vibration Performance.*		
Plate Current (2)	55 max.	μa
For conditions shown under *Characteristics Range Values Notes 1,4.*		

Shorts and Continuity Test:

This test (MIL-E-10, paragraph 4.7.5) is performed on all tubes from each production run. In this test, a tube is considered inoperative if it shows a permanent or temporary short or open circuit, an air leak, or reverse grid current in excess of 1 microampere for the conditions shown under *Characteristics Range Values, Notes 1,2.*

Heater Cycling Life Performance:

This test (similar to MIL-E-10, paragraph 4.11.7) is performed on a sample lot of tubes from each production run. With 6 volts on heater and no voltage on plate and grid, the heater is cycled three minutes on and three minutes off for at least 2000 cycles. At the end of this test, tubes will not show temporary or permanent shorts or opens, and are required to meet the following limits:

Grid-Plate and Cathode Leakage Resistance .	25 min.	megohms
For conditions shown under *Characteristics Range Values Notes 1,8.*		
Heater-Cathode Leakage Current.	150 max.	μa
For conditions shown under *Characteristics Range Values Notes 1,5.*		

1-Hour Stability Life Performance:

This test is performed on a sample lot of tubes from each production run to insure that the tubes have been properly stabilized. Tubes are operated under the following conditions: heater voltage of 6 volts, plate dissipation of 2.5

to 3 watts. At the end of 1 hour, the change in transconductance value for each tube, referred to its initial transconductance reading, will not exceed 15% of the initial value, for conditions shown under *Characteristics Range Values, Notes 1,2*.

50-Hour Survival Life Performance:

This test is performed on a sample lot of tubes from each production run to insure a low percentage of early inoperatives. Life-test conditions are the same as those specified for *1-Hour Stability Life Performance* except that all voltages are cycled at the rate of 110 minutes on and 10 minutes off. At the end of 50 hours, the tubes are required to meet the following limits:

Power Output . . . . 5 min. watts
For conditions shown under *Characteristics Range Values Notes 1,7*.

Plate Current (2). . . . . 100 max. μa
For conditions shown under *Characteristics Range Values Notes 1,3*.

Shorts and Continuity Test specified above.

Intermittent Dynamic Life Performance:

This test is performed on a sample lot of tubes from each production run to insure high quality of rf performance. Each tube is life-tested in a cavity-type oscillator at 500 ± 15 Mc under the following conditions:

Heater voltage of 6 volts, plate supply voltage of 400 volts, grid resistor is adjusted to give a dc plate current of 40 ma. and value is recorded, cathode resistor of 0 ohms, plate-circuit load resistance of 100 ± 5 ohms, heater positive with respect to cathode by 50 volts, and plate-seal temperature of 175° C min. Heater voltage is cycled at a rate of 110 minutes on and 10 minutes off.

At the end of 500 hours, the tube will not show permanent shorts or open circuits and will be criticized for the total number of defects in the sample lot and for the number of tubes failing to meet the following limits:

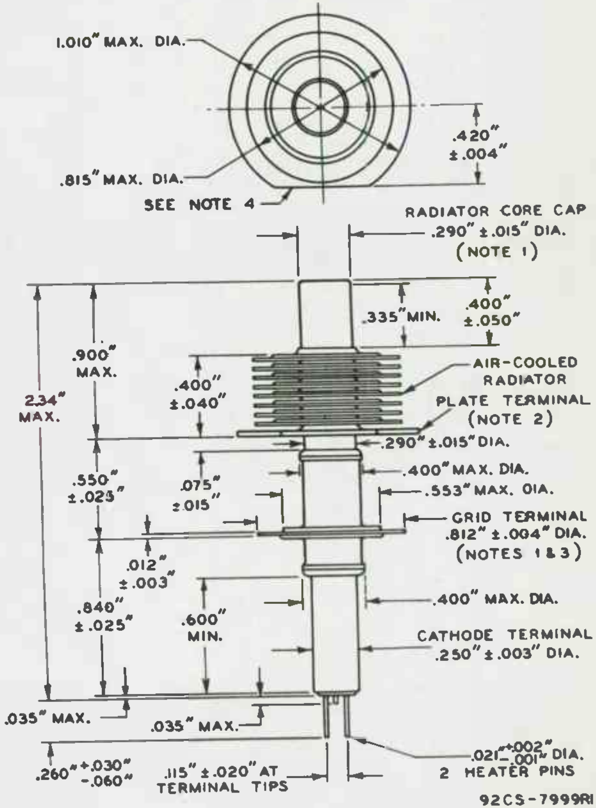
Reverse Grid Current . . . . 1 max. μa
For conditions shown under *Characteristics Range Values Notes 1,2*.

Power Output . . . . 5 min. watts
For conditions shown under *Characteristics Range Values Notes 1,7*.

OPERATING CONSIDERATIONS

The *heater* leads of the 6264-A should not be soldered to circuit elements. The heat of the soldering operation may crack the glass seals of the heater pins and damage the tube.

The *cathode* should preferably be connected to one side of the heater. When, in some circuit designs, the heater is not connected directly to the cathode, precautions must be taken to hold the peak heater-cathode voltage to the maximum values shown in the tabulated data.



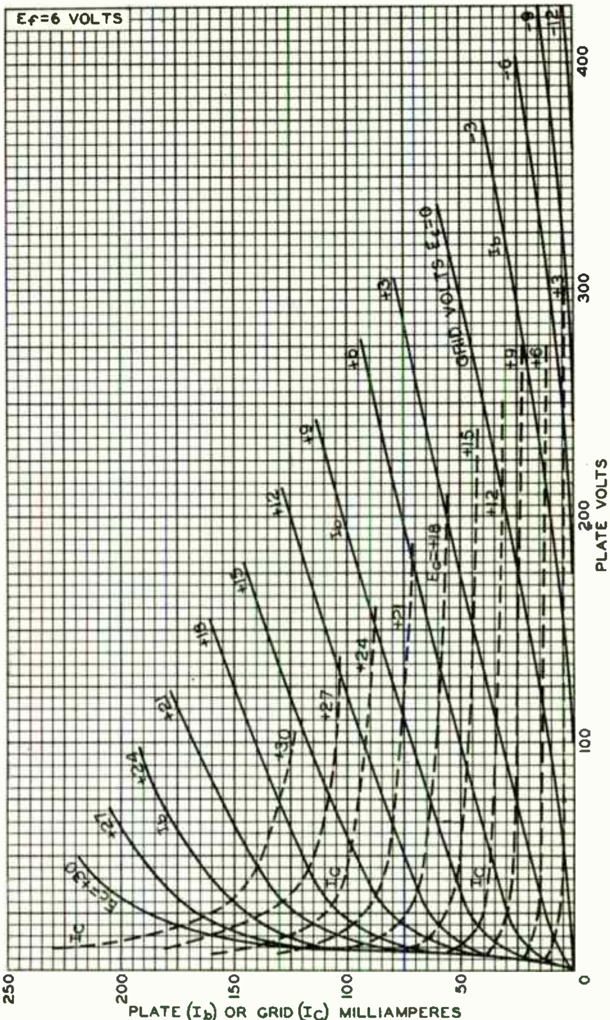
NOTE 1: MAXIMUM ECCENTRICITY OF CENTER LINE (AXIS) OF RADIATOR-CORE CAP OR GRID-TERMINAL FLANGE WITH RESPECT TO THE CENTER LINE (AXIS) OF THE CATHODE TERMINAL IS 0.015".

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 0.025".

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".

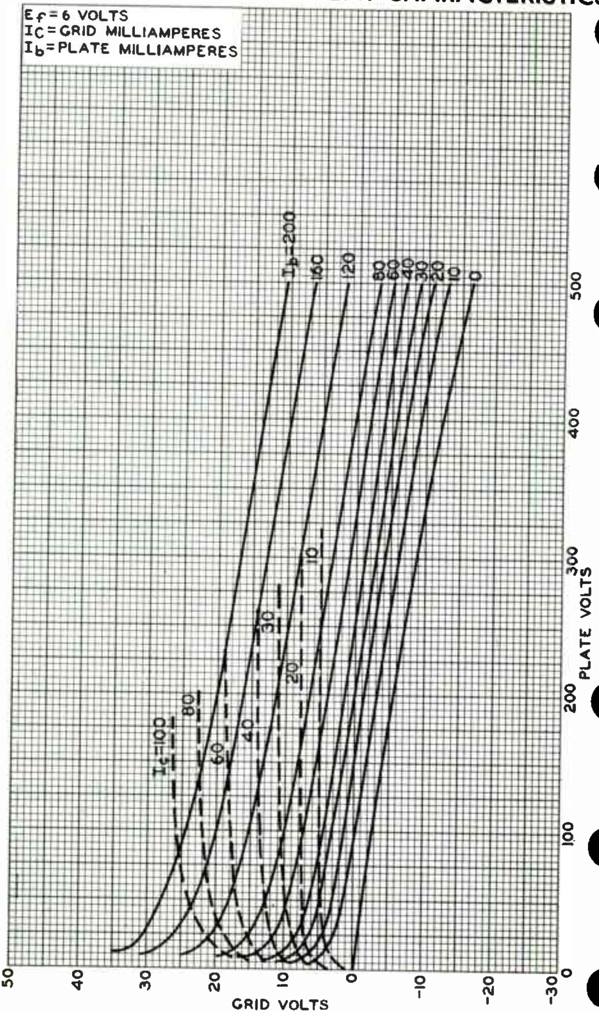
NOTE 4: THE STRAIGHT EDGE ON THE PERIMETER OF THE LARGE FIN (PLATE TERMINAL) IS PARALLEL TO A PLANE THROUGH THE CENTERS OF THE HEATER PINS AT THEIR SEALS WITHIN 15°.

AVERAGE CHARACTERISTICS



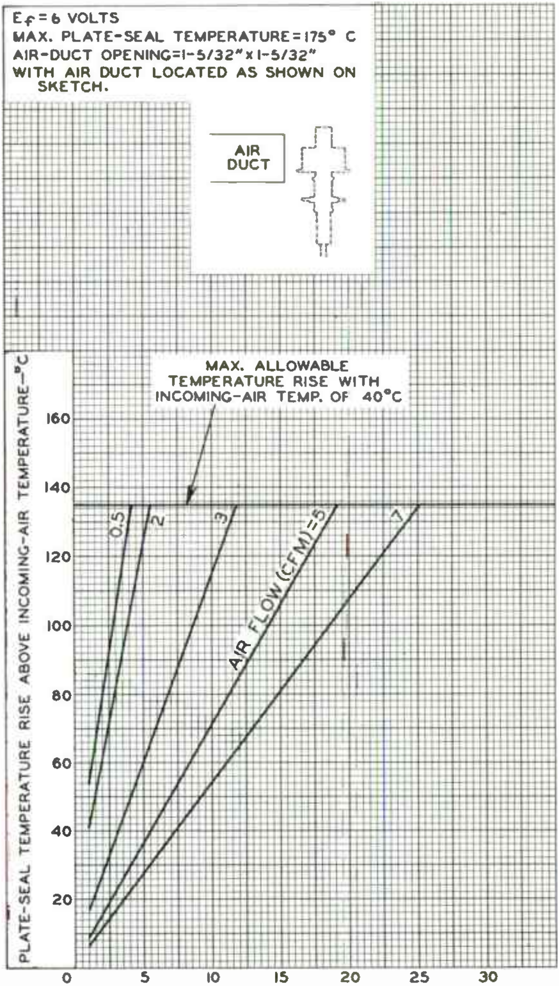
6264-A

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



92CM-8106

COOLING REQUIREMENTS



92CM-8120R1

Beam Power Tube

For Pulse-Modulator Service

GENERAL DATA

Electrical:

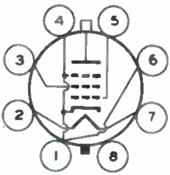
Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at heater volts = 6.3	1.25	amp
Transconductance, for plate volts = 200, grid-No.2 volts = 200, and plate ma. = 100	7000	μmhos
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 200, grid-No.2 volts = 200, and plate ma. = 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
Overall Length	3-13/16" ± 1/8"
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 Micanol (JEDEC Group 1, No.B8-86)
Large-Wafer Octal with External Barriers and Sleeve:
8-Pin Micanol (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

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[d] . . . . . See *Rating Chart I*

← Indicates a change.

INSTANTANEOUS PLATE VOLTAGE . .	115% of DC Plate Supply Volts	
DC GRID-No.2 SUPPLY VOLTAGE[d]	500 max.	volts
→ DC GRID-No.1 SUPPLY VOLTAGE[d]	-300 max.	volts
	Minimum-See *Rating Chart I*	
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 or bulb surface).	200 max.	°C

Typical Operation:

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

Maximum Circuit Values:

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

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

[b] Continuous Commercial Service.

[c] *Duty Factor* for the 6293 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.

→ Indicates a change.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Heater Current.	1	1.175	1.325	amp
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	0	5.5	ma
Peak Plate Current.	1,4	2.4	-	amp

Note 1: With 6.3 volts ac on heater.

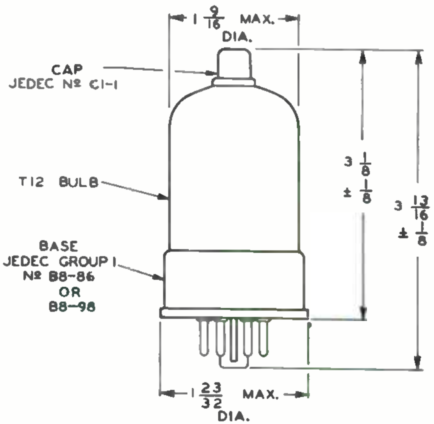
Note 2: With no external shield. Base sleeve (pin No.8) is grounded.

Note 3: With 6.3 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: With the tube in the test circuit (below) under the following conditions: rectangular-wave modulation applied to grid No.1 pulse duration of 1 microsecond approx.; pulse repetition rate of 3000 cps approx.; dc plate supply voltage of 2000 volts; dc grid No.2 supply voltage of 500 volts; dc grid-No.1 supply voltage of -300 volts; peak positive grid-No.1 swing of 100 volts; and load resistance (R_L) of 375 ± 5% ohms, 50 watts, non-inductive.

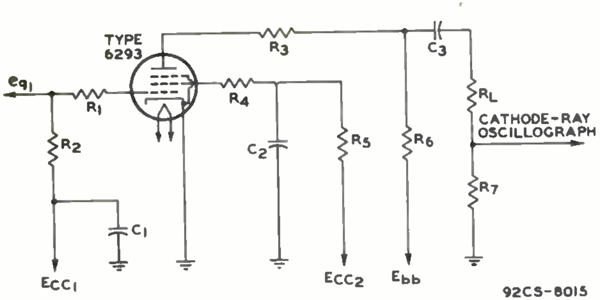
OPERATING CONSIDERATIONS

Plate shows no color when tube is operated at maximum CCS ratings.



ALL DIMENSIONS IN INCHES.

TEST CIRCUIT



C_1: 0.1 μf, 600 v dc
C_2: 2 μf, 600 v dc
C_3: 0.25 μf, 5000 v dc
E_{cc1}: Grid-No.1 Supply Volt.
E_{cc2}: Grid-No.2 Supply Volt.
E_{bb}: Plate Supply Voltage
E_{g1}: Rectangular-Wave Signal Voltage
R_1: 20 ohms, 1 watt, non-inductive
R_2: 3000 ohms, 1 watt
R_3: 10 ohms, 5 watts, non-inductive
R_4: 25 ohms, 1 watt, non-inductive
R_5: 1000 ohms, 1 watt
R_6: 10000 ohms, 50 watts
R_7: 30 ± 1% ohms, non-inductive
R_L: For values, see Typical Operation and Characteristics Range Values (Note 4)

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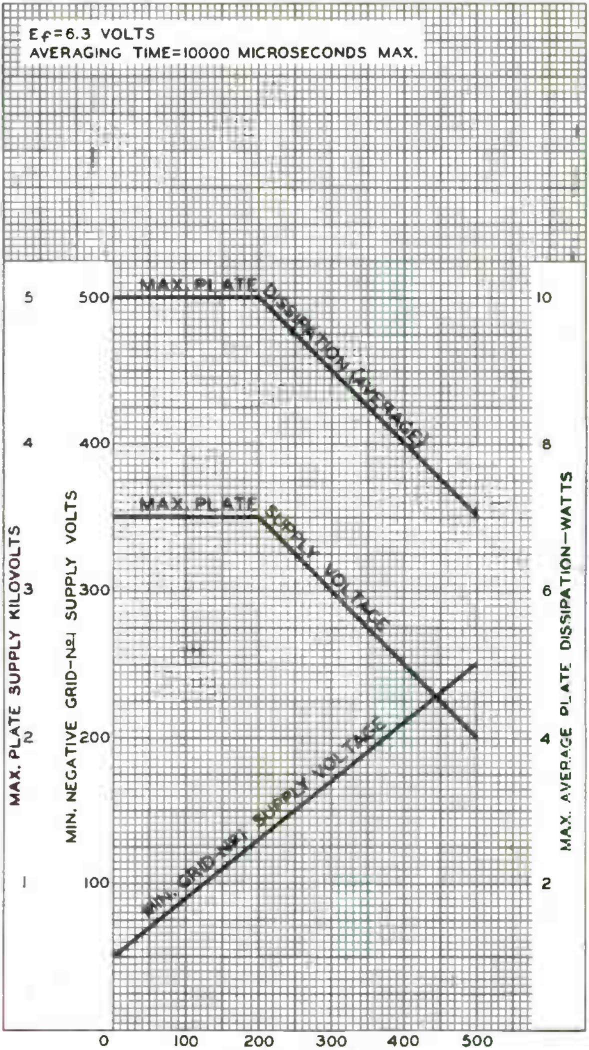
RATING CHART I



JUNE 5, 1953

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8012

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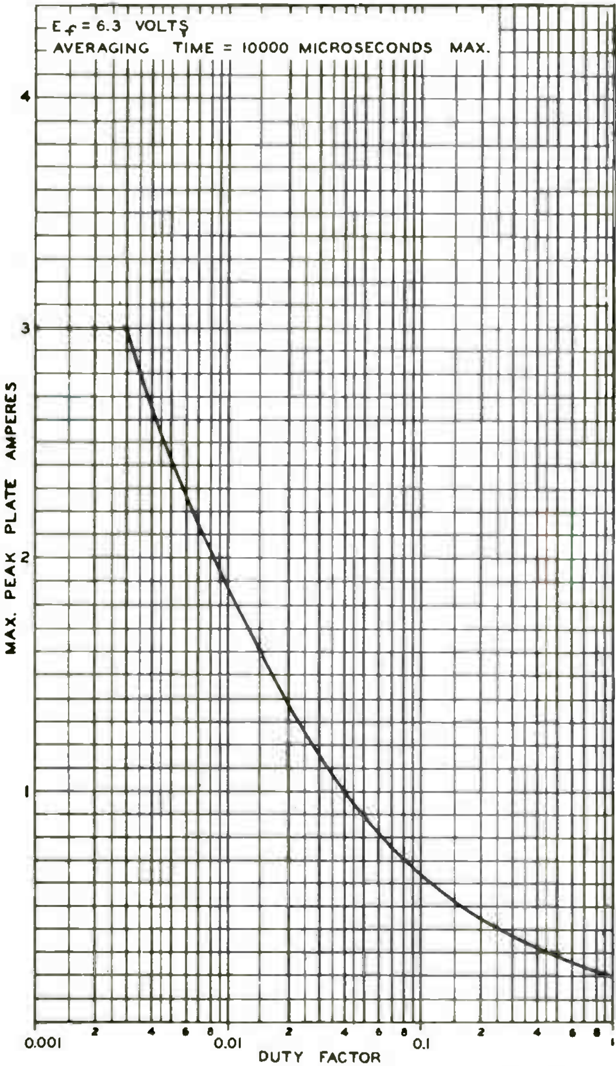
RATING CHART II



JUN. 8, 1953

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RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8014

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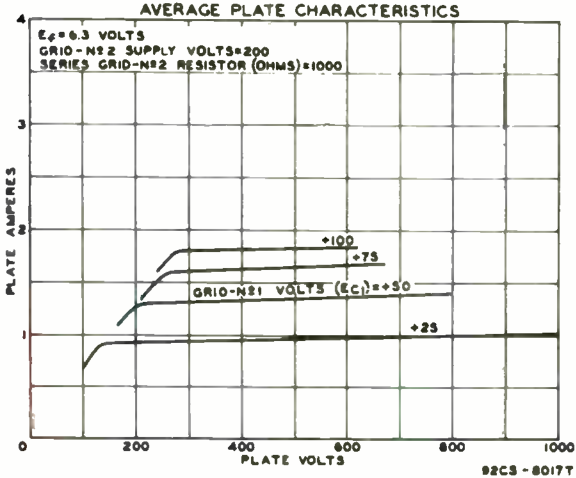
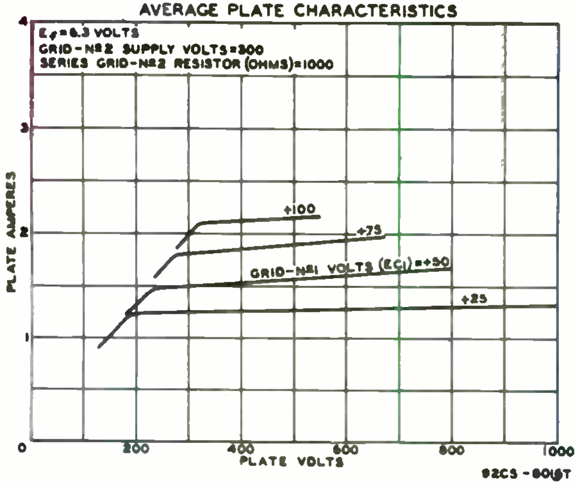
BEAM POWER AMPLIFIER

AVERAGE PLATE CHARACTERISTICS



AVERAGE PLATE CHARACTERISTICS



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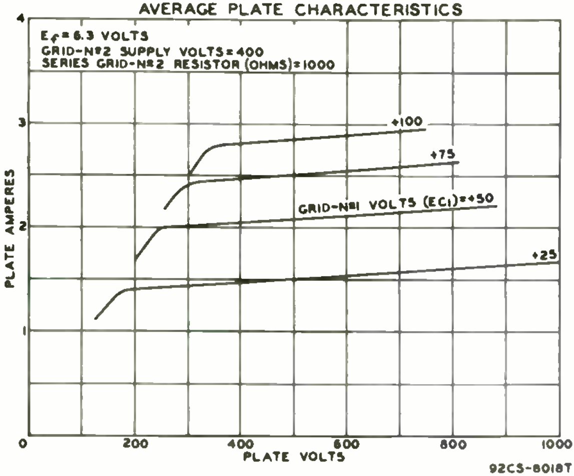
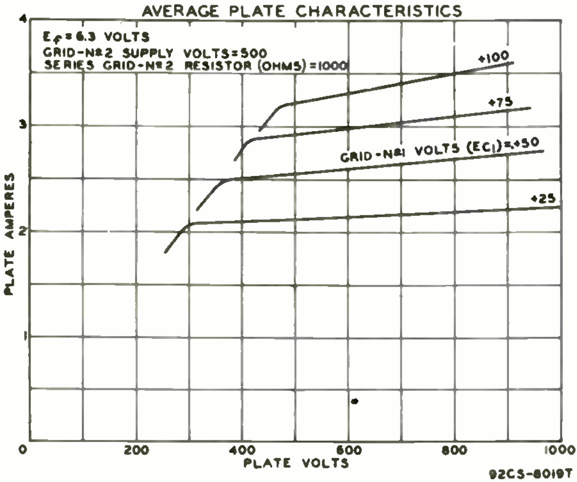
BEAM POWER AMPLIFIER





6417

VHF BEAM POWER TUBE

9 PIN MINIATURE TYPE

Heater, for Unipotential Cathode:

Voltage	12.6 ± 10%	ac or dc volts
Current	0.375	amp

Except for heater rating, the 6417 is the same as the 5763.

With 12.6 volts on heater of the 6417, the minimum heater current is 0.345 ampere and the maximum heater current is 0.405 ampere.

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UHF BEAM POWER TUBE

WATER-COOLED ELECTRODES

GENERAL DATA

Electrical:

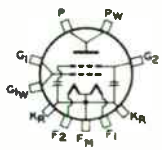
Filament*, 2-Section Multi-strand Thoriated Tungsten:

Voltage per section (AC or DC)	1.35 av. volts 1.50 max. volts
Current per section at 1.35 volts . . .	1000 amp
Starting current per section	Must never exceed 1500 amperes, even momentarily
Cold resistance per section	0.0002 ohm
Minimum heating time	10 seconds
Supply circuits	See Circuits
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 3000, grid-No.2 volts = 800, and plate amperes = 4	6
Direct Interelectrode Capacitances:	
Grid No.1 to plate	0.1 max. μμf
Input	335 μμf
Output	30 μμf
Internal Bypass Capacitors between Grid No.2 and Cathode (Total)	15000 μμf

Mechanical:

Terminal Connections:

F_1 - Fil. Sect. No.1 & Water Conn.
F_2 - Fil. Sect. No.2 & Water Conn.
G_1 - RF Grid-No.1 Term. Contact Surface
G_{1w} - DC Grid-No.1 & Water Conn.
G_2 - DC Grid-No.2 & Water Conn.



For location of respective terminals, see Dimensional Outline

K_R - RF Cath. Term. Contact Surface For Circuit Returns
F_M - Common Point of Fil. Sections & Water Conn.
P - RF Plate Term. Contact Surface
P_W - DC Plate & Water Conn.

Mounting Position	Tube axis vertical, with plate terminal either up or down
Overall Length	7-11/32" + 3/8" - 1/2"
Maximum Diameter	11-3/8"

Air Cooling:

Forced-air cooling of the ceramic bushing at the grid-No.1 seal and at the plate seal is required only if the temperature of the ceramic bushing at either seal exceeds the specified maximum value of 150°C. Under such conditions, provision should be made for blowing air at the ceramic bushings through suitable openings in the coaxial-cylinder cavity circuit.

*: See operating notes on conserving filament life.

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UHF BEAM POWER TUBE

Water Cooling:

Water cooling of the filament-section blocks, rf cathode terminals, grid-No.1 block, grid-No.2 block, and plate is required. The water flow must start before application of any voltage and preferably should continue for several seconds after removal of all voltages. Interlocking of the water flow through each of the cooled elements with all power supplies is recommended to prevent tube damage in case of failure of adequate water flow.

Water Flow:

	Min. gpm	*Typical gpm*	*Pressure Drop● psi*
To Filament-Section-No.1 Block	0.5	0.5	2
		1.2	11
To Filament-Section-No.2 Block	0.5	0.5	2
		1.2	11
To Filament Mid-Tap Block . .	0.5	0.5	2
		1.2	10
To Grid-No.1 Block	0.5	0.5	1
		1.2	6
To Grid-No.2 Block	0.5	0.5	3
		1.2	15
To Plate:			
For plate dissipation of 10 kw . . .	4.5	-	3.5
For plate dissipation of 15 kw . . .	7.5	-	8.5
For plate dissipation of 20 kw . . .	11	-	16
For plate dissipation of 26 kw . . .	14	-	25

Gauge Pressure at Any Inlet	70 max.	psi
Ceramic Bushing Temperature	150 max.	°C
Outlet Water Temperature (Any outlet) . . .	70 max.	°C
Weight (Approx.)	25	lbs

RF POWER AMPLIFIER--Class B Television Service

Synchronizing-level conditions per tube unless otherwise indicated

Maximum CCS● Ratings, *Absolute Values:*

	Up to 1000 Mc	
DC PLATE VOLTAGE	7000 max.	volts
DC PLATE-SUPPLY VOLTAGE	8000 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	1000 max.	volts
DC GRID-No.2-SUPPLY VOLTAGE	1100 max.	volts

● Directly across cooled element for the indicated flow.

●: See next page.

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UHF BEAM POWER TUBE

DC PLATE CURRENT	7 max.	amp
DC GRID-No.1 (CONTROL-GRID) CURRENT	0.5 max.	amp
PLATE INPUT	49000 max.	watts
GRID-No.2 INPUT (Pedestal Level)	600 max.	watts
PLATE DISSIPATION	26000 max.	watts

Typical Operation:	*At 500 Mc*	*At 900 Mc*	
Bandwidth▲ *of*	7	7	*Mc*
DC Plate Voltage	6000	6500	volts
DC Grid-No.2 Voltage	950	950	volts
DC Grid-No.1 Voltage	-140	-140	volts
Peak RF Grid-No.1 Voltage:			
Synchronizing level	160	160	volts
Pedestal level	100	100	volts
DC Plate Current:			
Synchronizing level	6.9	6.8	amp
Pedestal level	5.3	5.2	amp
DC Grid-No.2 Current:			
Synchronizing level	0.75	0.6	amp
Pedestal level	0.35	0.3	amp
DC Grid-No.1 Current (Approx.):			
Synchronizing level	0.13	0.1	amp
Pedestal level	0	0	amp
Driver Power Output (Approx.):♣			
Synchronizing level	600	1000	watts
Pedestal level	350	560	watts
Output-Circuit Efficiency (Approx.)	85	80	per cent
Useful Power Output (Approx.):			
Synchronizing level	15000●●	12000●●	watts
Pedestal level	8400●●	6700●●	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:*

	Up to 1000 Mc	
DC PLATE VOLTAGE	4500 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	1000 max.	volts
PEAK GRID-No.2 VOLTAGE (DC + AC Component)	1200 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-300 max.	volts
DC PLATE CURRENT	4.5 max.	amp
DC GRID-No.1 CURRENT	1 max.	amp
PLATE INPUT	22500 max.	watts

▲ Between the half-power points as measured in the output circuit.

●, ♣, ●●: See next page.

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UHF BEAM POWER TUBE

GRID-No.2 INPUT	400 max.		volts
PLATE DISSIPATION	16500 max.		watts

Typical Operation:

	At 400 Mc	*At 900 Mc*	
DC Plate Voltage	4000	4250	volts
DC Grid-No.2 Voltage•	600	600	volts
DC Grid-No.1 Voltage	-200	-200	volts
Peak RF Grid-No.1 Voltage	210	210	volts
DC Plate Current	4.25	4	amp
DC Grid-No.2 Current	0.65	0.6	amp
DC Grid-No.1 Current (Approx.)	0.3	0.2	amp
Driver Power Output (Approx.)♣	700	1000	watts
Output-Circuit Efficiency (Approx.)	80	75	per cent
Useful Power Output (Approx.)	7250••	4500••	watts

RF POWER AMPLIFIER--Class C Telegraphy□ and RF POWER AMPLIFIER--Class C FM Telephony

Maximum CCS● Ratings, ***Absolute Values:***

	Up to 1000 Mc	
DC PLATE VOLTAGE	7000 max.	volts
DC PLATE-SUPPLY VOLTAGE	8000 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	1000 max.	volts
DC GRID-No.2-SUPPLY VOLTAGE	1100 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-300 max.	volts
DC PLATE CURRENT	6.5 max.	amp
DC GRID-No.1 CURRENT	0.5 max.	amp
PLATE INPUT	45500 max.	watts
GRID-No.2 INPUT	600 max.	watts
PLATE DISSIPATION	26000 max.	watts

Typical Operation:

	At 400 Mc	*At 900 Mc*	
DC Plate Voltage	6500	6500	volts
DC Grid-No.2 Voltage†	800	800	volts
DC Grid-No.1 Voltage††	-140	-140	volts
Peak RF Grid-No.1 Voltage	160	160	volts
DC Plate Current	6	6.3	amp
DC Grid-No.2 Current	0.5	0 4	amp
DC Grid-No.1 Current (Approx.)	0.2	0.15	amp
Driver Power Output (Approx.)♣	400	800	watts
Output-Circuit Efficiency (Approx.)	85	77	per cent
Useful Power Output (Approx.)	14000••	11000••	watts

● Continuous Commercial Service.

♣ Obtained preferably from a separate source.

□,••,•,†,††: See next page.

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UHF BEAM POWER TUBE

□ 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.

♣ 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.

●● This value of useful power is measured at load of output circuit having indicated efficiency.

† 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 6448 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 1100 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.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Filament Current per Section .	1	900	1100	amp
Filament Current per Section .	2	960	1160	amp
Grid-No.1 Voltage	1,3	-	-160	volts
Useful Power Output	1,4	11000	-	watts
Power Gain	1,4,5	10	-	

Note 1: With 1.35 volts ac per section.

Note 2: With 1.5 volts ac per section.

Note 3: With 2-phase excitation of the filament sections, dc plate voltage of 6500 volts, dc grid-No.2 voltage of 800 volts, and dc grid-No.1 voltage adjusted to give a dc plate current of 0.5 ampere.

Note 4: With 2-phase excitation of the filament sections. In rf power amplifier circuit having bandwidth of 7 Mc as defined by the half-power points and with dc plate voltage of 7000 volts, dc grid-No.2 voltage of 800 volts, dc grid-No.1 voltage of -130 volts, drive adjusted to give dc plate current of 6.75 amperes, and frequency of 900 Mc.

Note 5: With driving power measured at input to input-cavity circuit fed by transmission line having voltage-standing-wave ratio not greater than 2. Power gain is ratio of useful power output to driving power.

OPERATING NOTES

Instructions for conserving filament life of the 6448 and for the use of high-speed electronic protective devices with it are given in the technical bulletin. A copy of the technical bulletin for the 6448 will be supplied on request to Commercial Engineering, RCA, Harrison, N.J.

RCA

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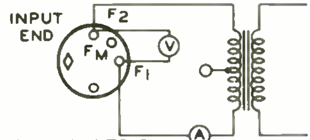
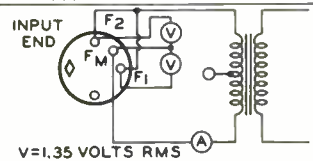
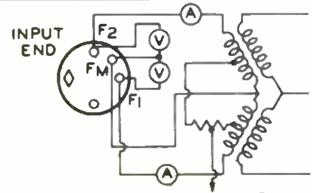
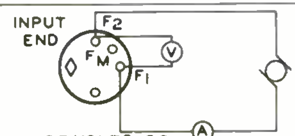
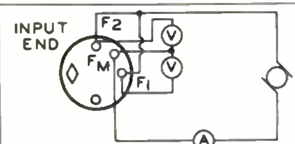
FILAMENT-SUPPLY CIRCUITS

<table>
<tr><td rowspan="2">WITH SINGLE-PHASE AC EXCITATION</td><td>SECTIONS IN SERIES</td><td>

V=2.7 VOLTS RMS
A=1000 AMPERES</td></tr>
<tr><td>SECTIONS IN PARALLEL</td><td>

V=1.35 VOLTS RMS
A=2000 AMPERES</td></tr>
<tr><td colspan="2">WITH TWO-PHASE (QUARTER PHASE) AC EXCITATION</td><td>

Center Tap For Circuit Returns
V=1.35 VOLTS RMS
A=1000 AMPERES</td></tr>
<tr><td rowspan="2">WITH DC EXCITATION</td><td>SECTIONS IN SERIES</td><td>

V=2.7 VOLTS DC
A=1000 AMPERES</td></tr>
<tr><td>SECTIONS IN PARALLEL</td><td>

V=1.35 VOLTS DC
A=2000 AMPERES</td></tr>
<tr><td colspan="3">F_1 = FILAMENT SECTION №1
F_2 = FILAMENT SECTION №2
F_M = COMMON POINT OF FILAMENT SECTIONS
92CM-8249</td></tr>
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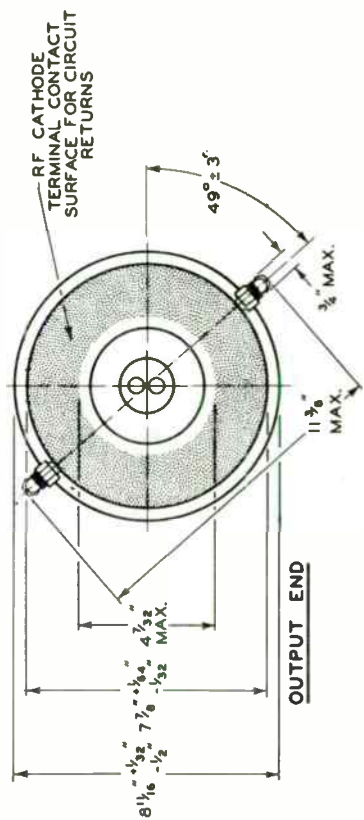
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

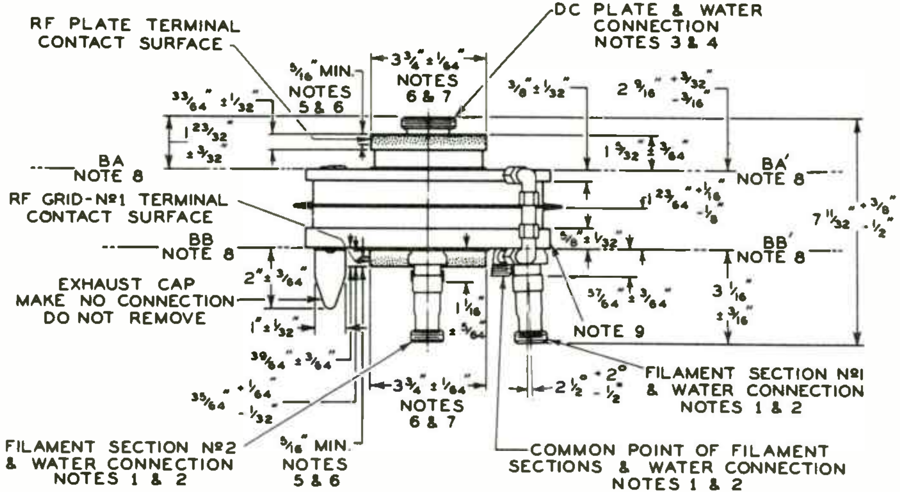
6448

UHF BEAM POWER TUBE



RCA 6448

UHF BEAM POWER TUBE



MAY 3, 1954

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

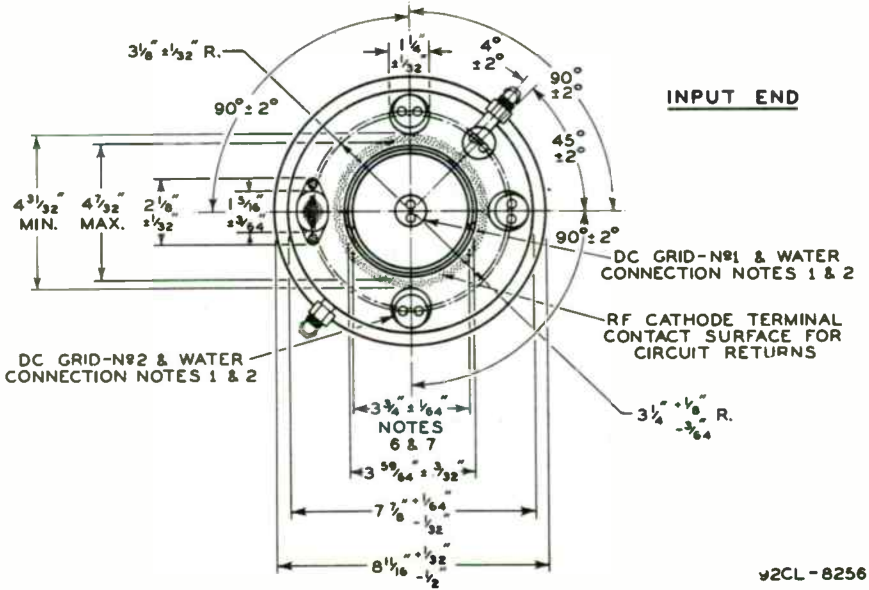
MAY 3, 1954

TUBE DIVISION

UHF BEAM POWER TUBE

6448

RCA



CE-8256C

6448

RCA

6448

UHF BEAM POWER TUBE

NOTE 1: WATER CONNECTIONS FOR FILAMENT SECTIONS No.1 AND No.2, COMMON POINT OF FILAMENT SECTIONS, GRID No.1, AND GRID No.2 HAVE 1" -16 AMERICAN STANDARD THREAD, FREE FIT (CLASS 2), 3/8" LONG, AND 2 HOLES 0.257" - 0.270" DIAMETER SPACED 7/16" ON CENTERS.

NOTE 2: THE HOLES IN THE INDICATED WATER CONNECTIONS OF NOTE 1 WILL ACCEPT THE PINS OF THE PLUG-AND-CYLINDER COMBINATION GAUGE SHOWN IN SKETCH G_1.

NOTE 3: WATER CONNECTION FOR THE PLATE HAS 1-3/4"-16 AMERICAN STANDARD THREAD, FREE FIT (CLASS 2), 3/8" LONG, AND 2 HOLES 0.508"-0.522" DIAMETER SPACED 11/16" ON CENTERS.

NOTE 4: THE HOLES IN THE PLATE WATER CONNECTION WILL ACCEPT THE PINS OF THE PLUG-AND-CYLINDER COMBINATION GAUGE SHOWN IN SKETCH G_2.

NOTE 5: CONTACT LENGTH OF CIRCUIT CONNECTOR IS 5/16" MAX.

NOTE 6: THIS DIAMETER DIMENSION IS HELD ONLY OVER A LENGTH OF 5/16"; OVER REMAINDER OF LENGTH, THE DIAMETER MAY INCREASE TO 3-7/8" MAX.

NOTE 7: THE AXIS OF THE RF PLATE CONTACT SURFACE IS COINCIDENT WITH THE AXIS OF THE RF GRID-No.1 CONTACT SURFACE WITHIN 3/32".

NOTE 8: THE CONTACT SURFACES BA-BA' AND BB-BB' ARE PARALLEL WITHIN 1/16".

NOTE 9: SERIAL NUMBER IS LOCATED ON THIS SURFACE BETWEEN DC GRID-NO.2 AND FILAMENT SECTION No.1 CONNECTIONS.

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RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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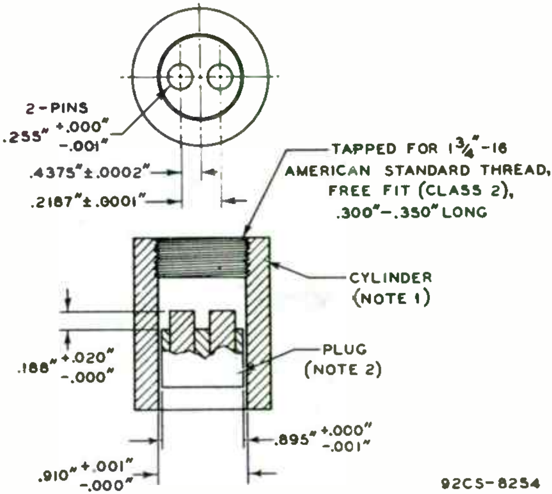
UHF BEAM POWER TUBE

GAUGE SKETCH G_1



92CS-8254

NOTE 1: TAPPED SECTION OF CYLINDER MUST BE CONCENTRIC WITH UNTAPPED SECTION OF CYLINDER WITHIN .002".

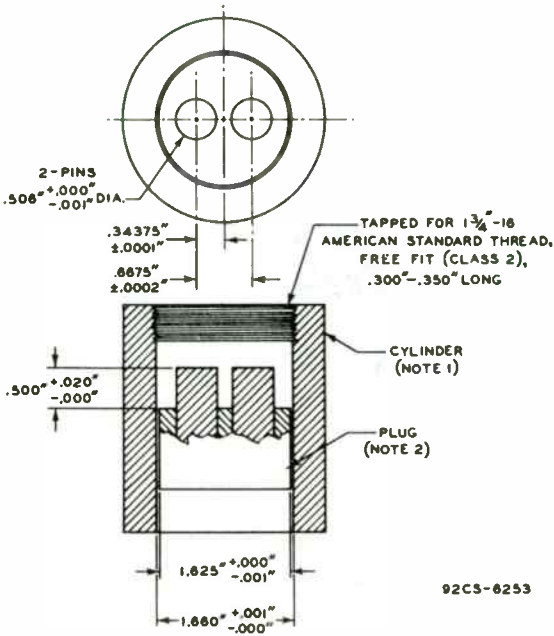
NOTE 2: PLUG SIDES & PIN SIDES MUST BE PARALLEL WITHIN .001".

RCA

6448

UHF BEAM POWER TUBE

GAUGE SKETCH G_2



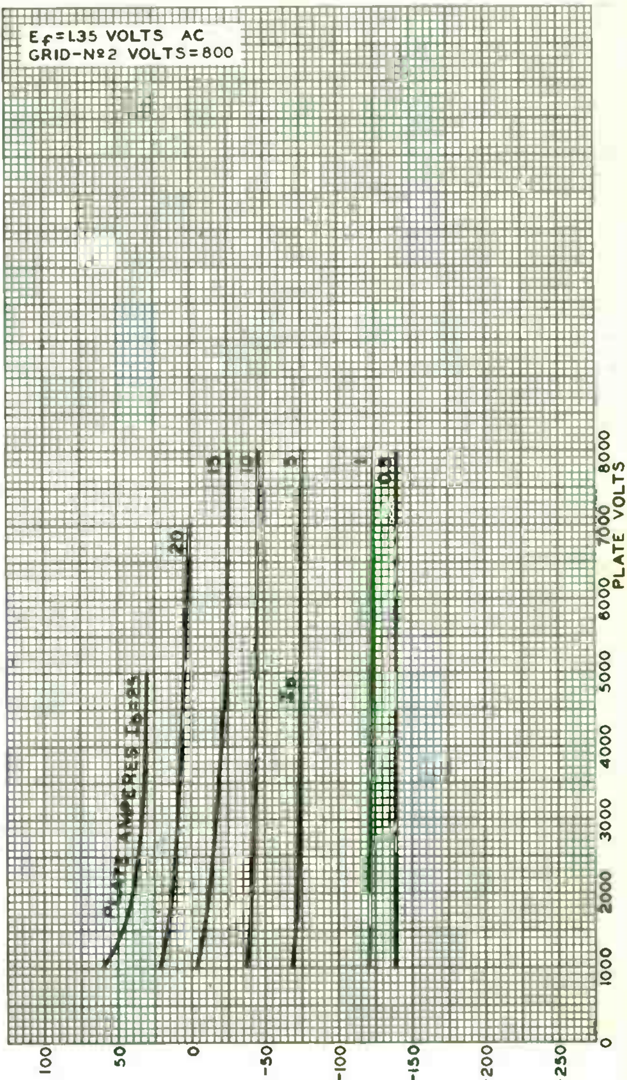
NOTE 1: TAPPED SECTION OF CYLINDER MUST BE CONCENTRIC WITH UNTAPPED SECTION OF CYLINDER WITHIN .002".

NOTE 2: PLUG SIDES & PIN SIDES MUST BE PARALLEL WITHIN .001".

6448

6448

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



FEB. 24,1954

TUBE DIVISION

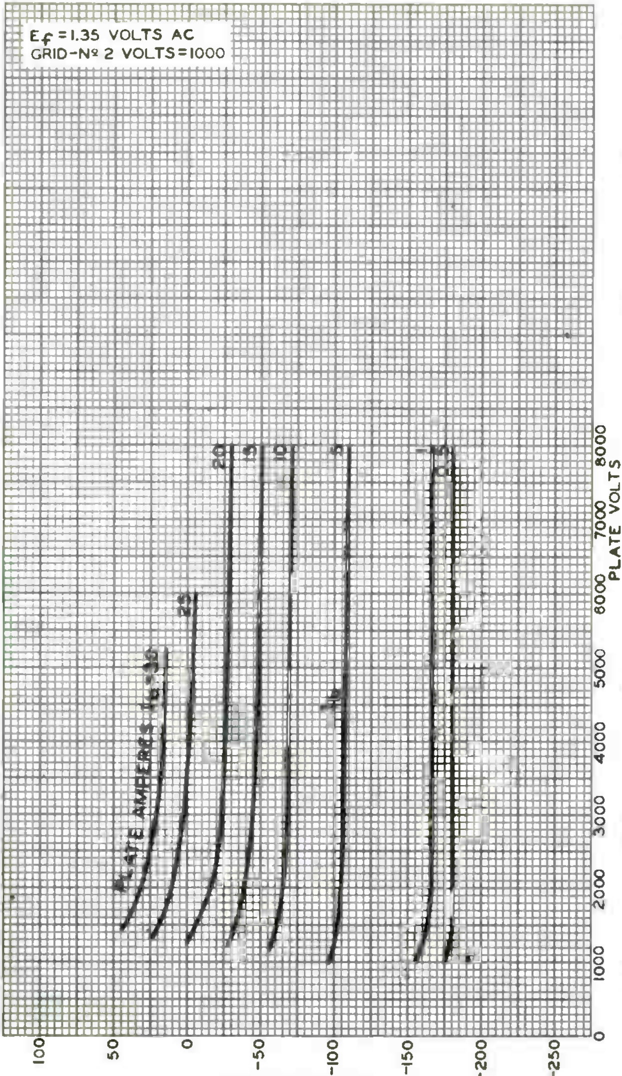
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8252

6448

6448

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



FEB. 24, 1954

TUBE DIVISION

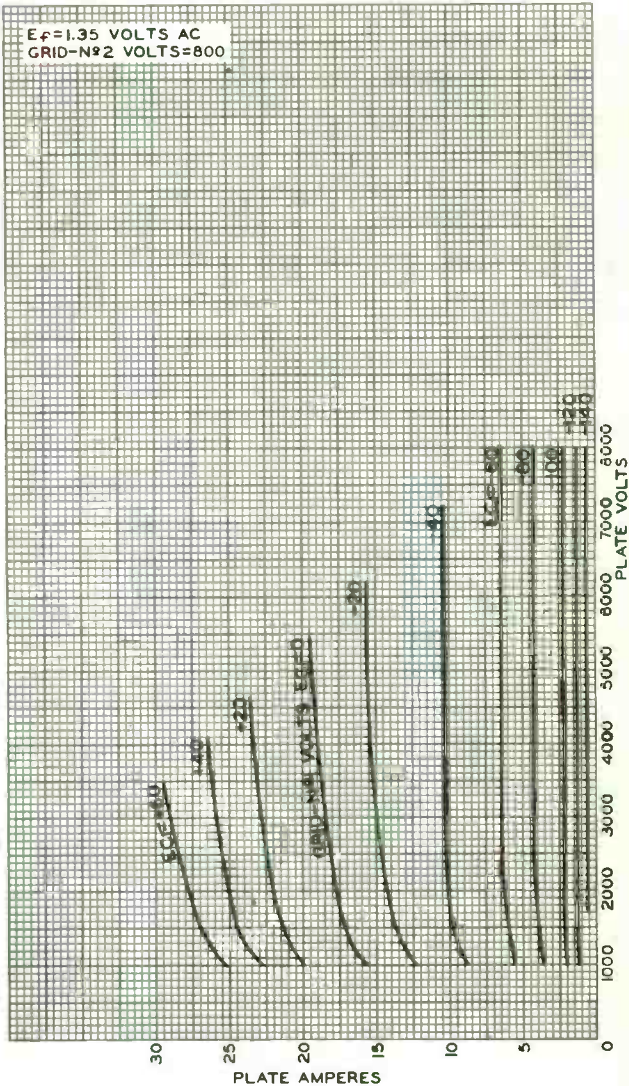
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8255

6448

6448

AVERAGE PLATE CHARACTERISTICS



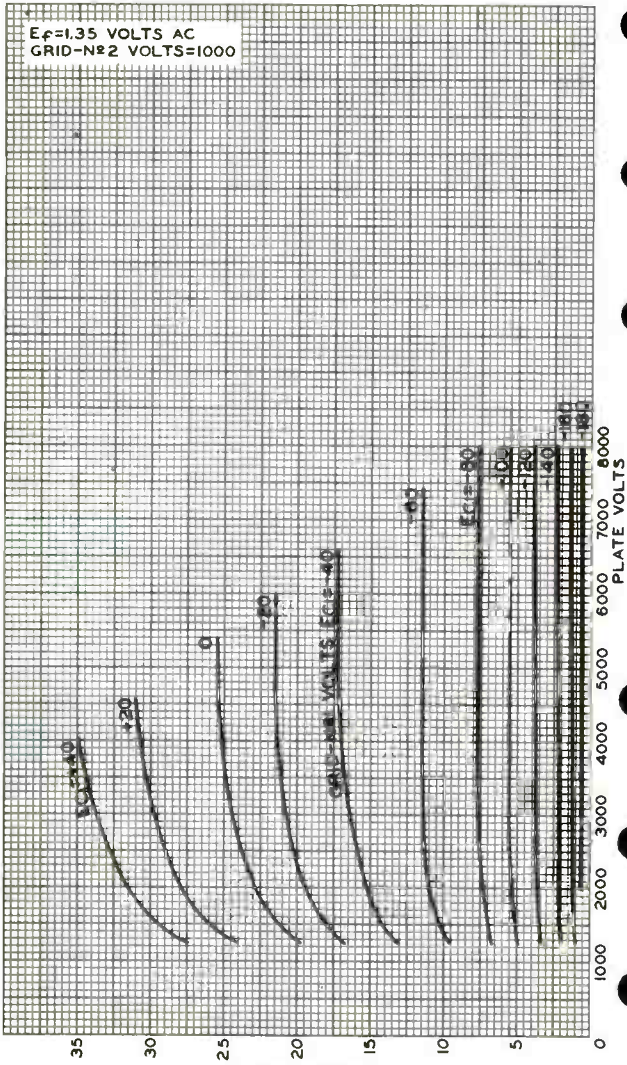
FEB.18,1954 TUBE DIVISION 92CM-8247

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6448

6448

AVERAGE PLATE CHARACTERISTICS



FEB.19,1954

TUBE DIVISION

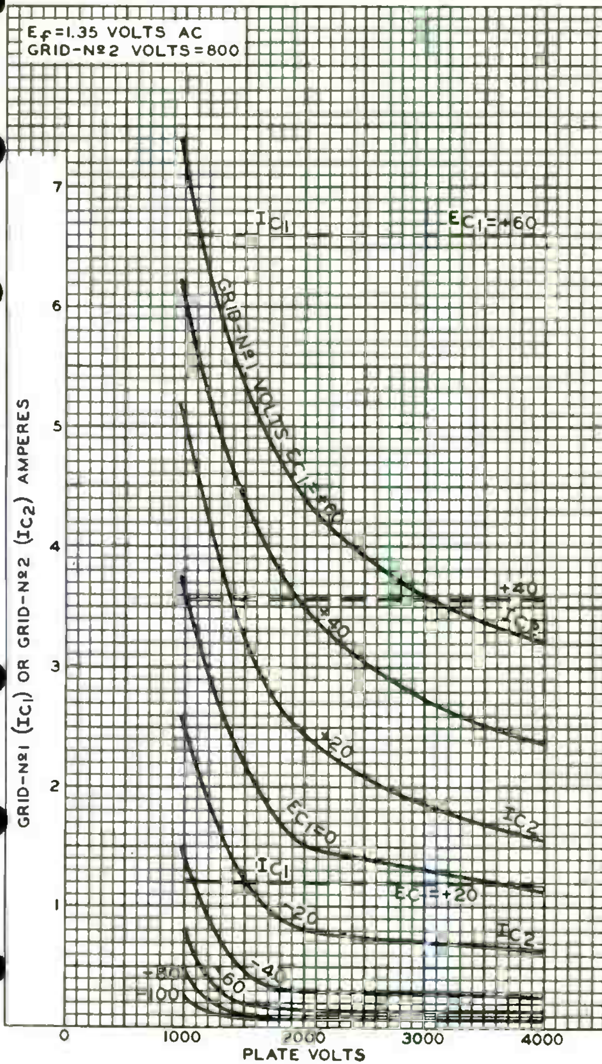
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8248

RCA

6448

AVERAGE CHARACTERISTICS



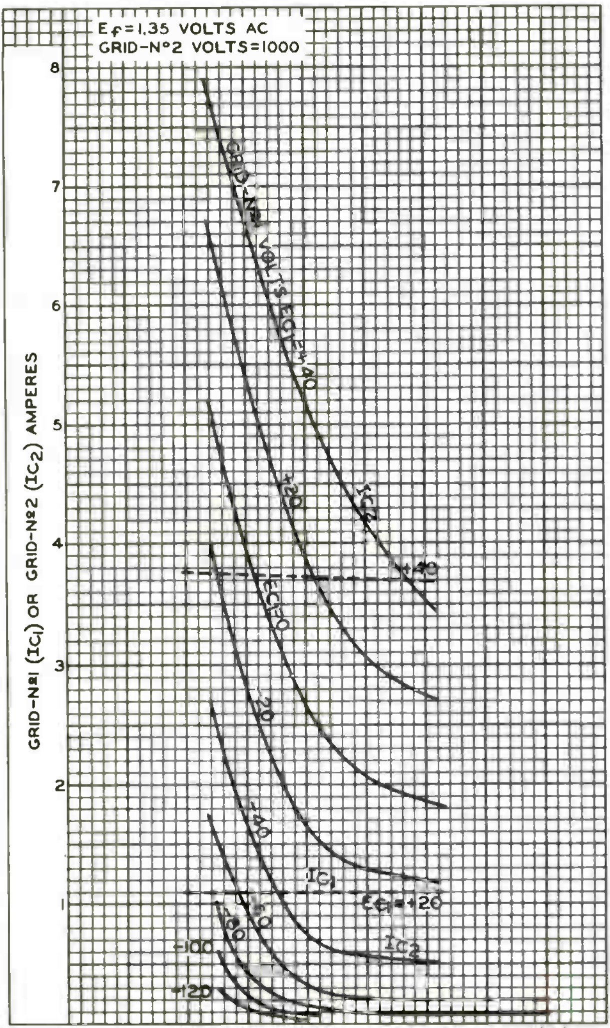
FEB. 17, 1954

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8245

6448

AVERAGE CHARACTERISTICS



FEB.18,1954

TUBE DIVISION

92CM-8246

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6521

6521
MAGNETRON

FORCED-AIR COOLED

Fixed Frequency: 5400 ± 20 Mc

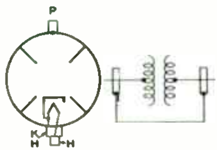
GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage	10 ± 10%	. . . ac or dc volts
Current	3.2	. . . . amp
Starting current: The maximum instantaneous starting current must never exceed 12 amperes, even momentarily.		
Minimum Cathode Heating Time	5	minutes
Frequency	5400 ± 20	Mc
Maximum Frequency Pulling at VSWR of 1.5/1	10	Mc
Maximum Frequency Change with Anode Temperature Change (After warmup)	0.15	Mc/°C

Mechanical:

Dimensions and Terminal Connections:
See Dimensional Outline



H - Heater
K - Cathode
P - Anode

Connector (For heater terminal and heater-cathode terminal) . . . Ucinite* No. 115364 with built-in capacitor, or equivalent

Mounting Position . . . . Any

Air Flow:

To Fins--An air stream should be directed along the cooling fins toward the body of the tube. The stream may be obtained from a rectangular nozzle about 3" x 1-1/2" located so that the plane through the 3" side is parallel with the plane of a cooling fin and so that the nozzle is centered on 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.

Weight (Approx.) . . . . 11-1/2 lbs

PULSED OSCILLATOR SERVICE

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

For Duty Cycle of 0.001 max.

PEAK ANODE VOLTAGE	16 max.	kv
PEAK ANODE CURRENT	16 max.	amp
	10 min.	amp
PEAK POWER INPUT●	256 max.	kw

* Manufactured by Ucinite Division of United-Carr Fastener Corporation, Newtonville 60, Massachusetts.

● For atmospheric pressures greater than 40 centimeters of mercury at 25°C. Operation at pressures lower than 40 centimeters of mercury (altitudes higher than 16000 feet) may result in arcover with consequent damage to the tube.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6521

6521
MAGNETRON

AVERAGE POWER INPUT.	0.256 max.	kw
PULSE DURATION	2.2 max.	µsec
OPERATION TIME IN ANY 100-MICROSECOND INTERVAL	5 max.	µsec
RATE OF RISE OF VOLTAGE PULSE.	120 max.	kv/µsec
	80 min.	kv/µsec
ANODE BLOCK TEMPERATURE.	150 max.	°C
HEATER-CATHODE TERMINAL TEMPERATURE. . .	165 max.	°C
LOAD VOLTAGE STANDING-WAVE RATIO	1.5 max.	

Typical Operation▲ with Load Voltage Standing-Wave Ratio Equal To or Less Than 1.05

With Duty Cycle of 0.0008

Heater Voltage	*See Operating Considerations*	
Magnetic Field	Supplied by permanent magnet integral with tube	
Peak Anode Voltage (Approx.)	15	kv
Peak Anode Current	13.5	amp
Pulse Repetition Rate.	400	cps
Pulse Duration	2	µsec
Maximum RF Bandwidth	1.5	Mc
Peak Power Output.	85	kw

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Heater Current	1	2.8	3.6	amp
Peak Anode Voltage	2	14	16	kv
Peak Power Output.	2,3	75	-	kw
Pulses Missing From Total. . .	2,4	-	0.25	%

Note 1: With 10.0 volts ac on heater.

Note 2: With peak anode current of 13.5 amperes, and heater voltage reduced to 9.1 volts.

Note 3: With peak anode voltage of approximately 15 kilovolts, anode block temperature of approximately 100°C, and maximum VSWR equal to or less than 1.05.

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 at a VSWR of 1.5, and with VSWR phase adjusted to produce maximum instability.

OPERATING CONSIDERATIONS

The *waveguide output flange* is designed for use with a standard 1" x 2" rectangular waveguide such as that designated by RETMA as WR 187, or that having the JAN designation RG-49/U, and mates with flanges such as Airtron■ No.B54626 or equivalent.

▲ 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.

■ Manufactured by Airtron, Inc., Linden, N. J.

6521

MAGNETRON

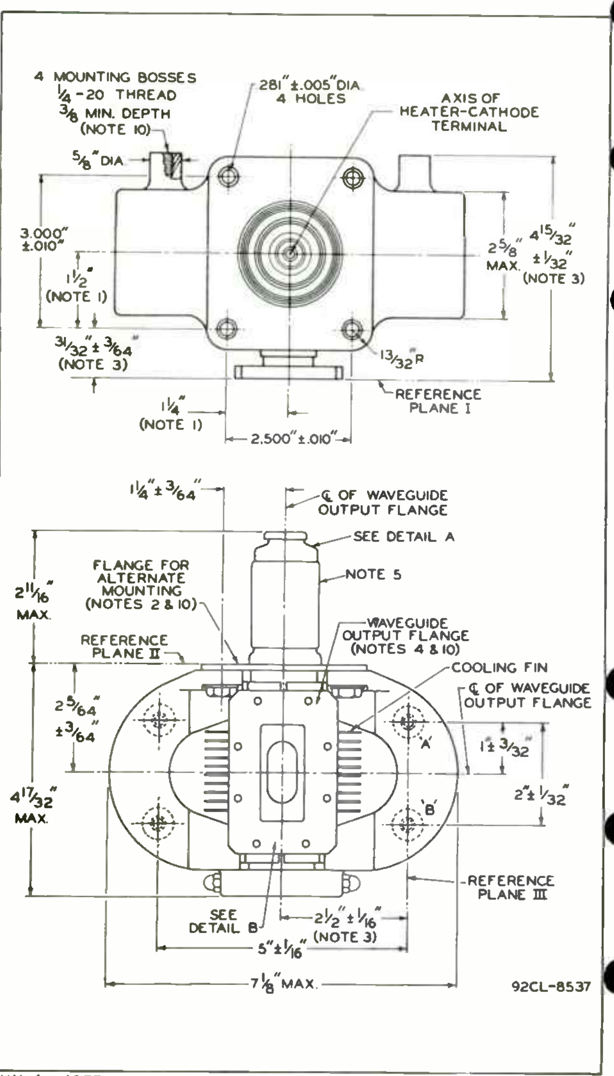
As soon as the 6521 begins to oscillate, the *heater voltage* should be reduced to 9.1 volts when it is operated under the typical operating conditions shown in the tabulated data. For other operating conditions, the heater voltage (E_f) should be reduced depending on the average power input (P_i) to the tube as follows:

P_i *(watts)*	E_f *(volts)*
up to 90	10.0
90 to 130	9.9
130 to 180	9.5
180 to 220	9.1
220 to 256	8.9

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

6521
MAGNETRON



MAY 1, 1955

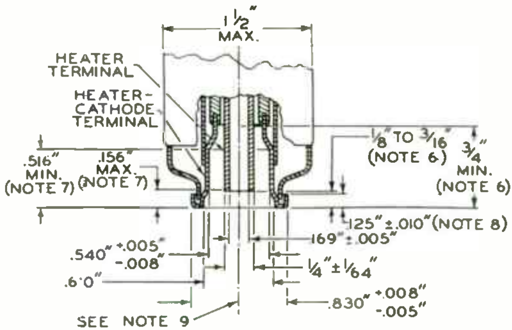
CE-8537A

RCA

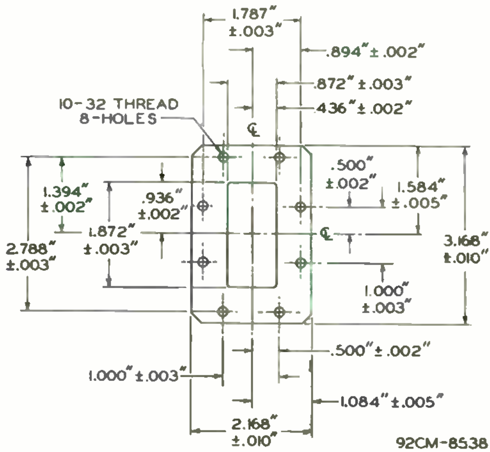
6521

MAGNETRON

DETAIL A



DETAIL B



92CM-8538

Reference plane *I* is defined as that plane against which the waveguide output flange abuts.

Reference plane *II* is defined as that plane perpendicular to reference plane *I* and touching the surface of the flange for alternate mounting.

Reference plane *III* is defined as that plane perpendicular to reference plane *I* and passing through the exact centers of holes 'A' and 'B'.

RCA

6521

MAGNETRON

NOTE 1: 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 *II* at the specified location.

NOTE 2: When resting on a smooth surface, this flange surface shall have a flatness such that a 0.050" thickness gauge 1/8" wide shall not enter between the two surfaces, and it shall be perpendicular to reference plane *I* within ± 2°.

NOTE 3: The tolerances include angular as well as lateral deviations.

NOTE 4: With the waveguide output flange resting on a plane surface, a 0.005" thickness gauge 1/8" wide shall not enter between the two surfaces.

NOTE 5: No part of the tube support fastened to the flange for alternate mounting should extend within the surface of a cylinder whose radius is 3/4" and whose axis is perpendicular to reference plane *II* at the specified location.

NOTE 6: These dimensions define extremities of the 0.169" internal diameter of the cylindrical heater terminal.

NOTE 7: These dimensions define extremities of the 0.540" internal diameter of the cylindrical heater-cathode terminal.

NOTE 8: No part of the connector device for the heater and heater-cathode terminals should bear against the underside of this lip.

NOTE 9: The heater terminal and heater-cathode terminal are concentric within 0.010".

NOTE 10: Connection to the anode may be made through the mounting bosses, the flange for alternate mounting, or the waveguide output flange.

TUBE DIVISION
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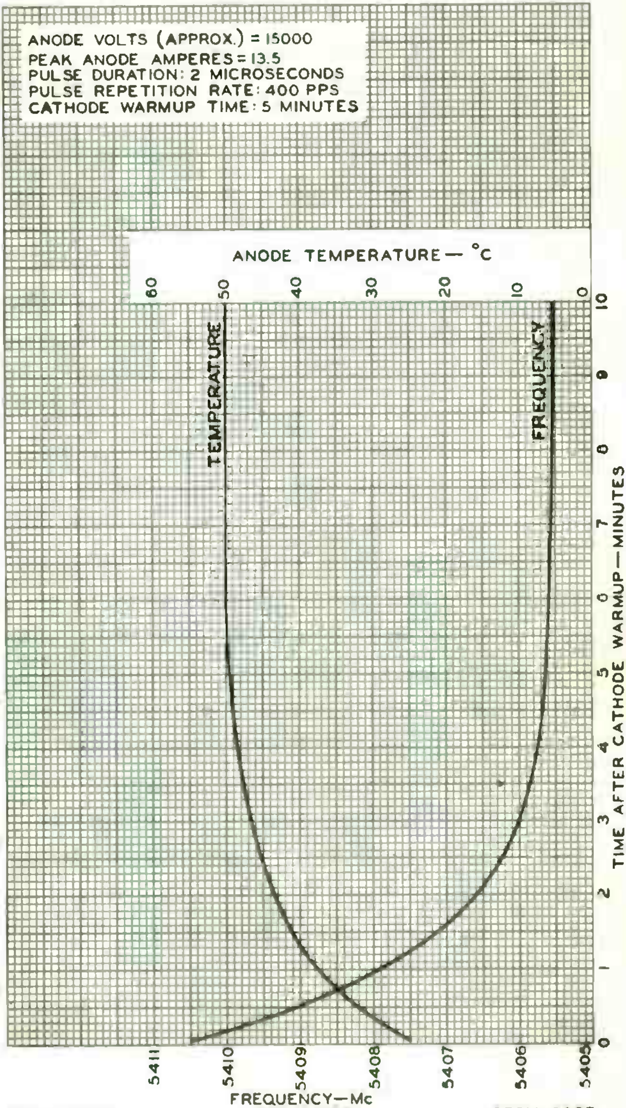
6521

TYPICAL STABILIZATION CHARACTERISTICS



FEB. 4, 1955

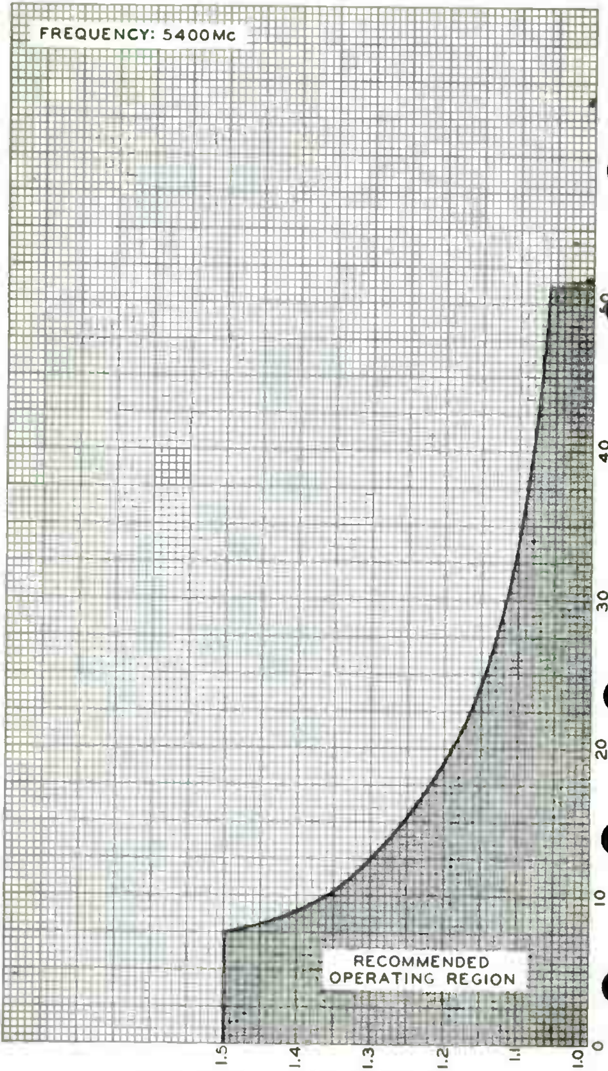
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8527

6521

6521

OPERATING REGION



FEB. 4, 1955

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TUBE DIVISION
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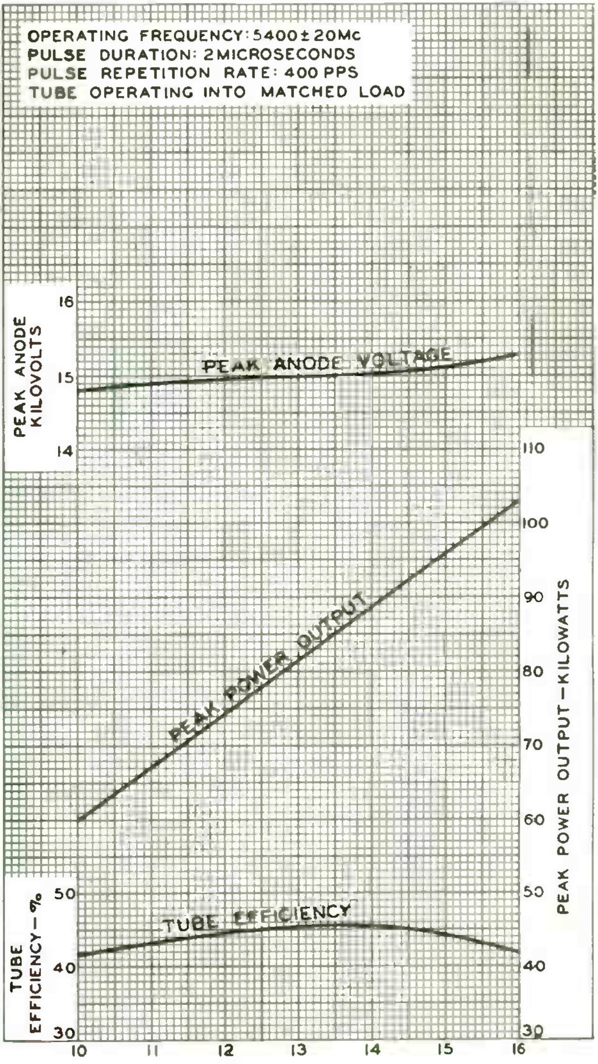
6521

6521

PERFORMANCE CHART



FEB. 8, 1955

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8533

6524

6524

TWIN BEAM POWER TUBE

Useful at frequencies up to 470 Mc

Unless Otherwise Specified, Values are on a Per-Tube Basis

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:
- Voltage . . . . 6.3 ± 10% . . . ac or dc volts
- Current . . . . 1.25 . . . . amp

Transconductance[▲] for dc plate volts = 200, dc grid-No.2 volts = 200, and dc plate ma. = 50 . . 4500 μmhos

Mu-Factor, Grid No.2 to Grid No.1[▲] for dc plate volts = 200, dc grid-No.2 volts = 200, and dc plate ma. = 50 . . . . 8.5

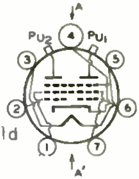
Direct Interelectrode Capacitances:[▲*]
- Grid No.1 to plate . . . . 0.11 max. μμf
- Grid No.1 to cathode & grid No.3 & internal shield, grid No.2 (pins 1 & 7), and heater . . . . 7 μμf
- Plate to cathode & grid No.3 & internal shield, grid No.2 (pins 1 & 7), and heater . . . . 3.4 μμf

Mechanical:

Mounting Position . . . . Any
Maximum Overall Length . . . . 3-9/16"
Seated Length . . . . 3" ± 1/8"
Maximum Diameter . . . . 1-11/16" ←
Bulb . . . . *See Dimensional Outline* ←
Bulb Terminals (Two) . . . . *See Dimensional Outline*
Weight (Approx.) . . . . 3 oz
Base . . . . Medium-Button Septar 7-Pin (JETEC No.E7-20)

BOTTOM VIEW

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



Pin 6 – Grid No.1 of Unit No.1
Pin 7 – Grid No.2
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) . . . . . . 210 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.

▲ Each unit.
* With no external shield.

← Indicates a change.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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RCA 6524

TWIN BEAM POWER TUBE

AF POWER AMPLIFIER & MODULATOR — Class AB_2†

	CCS°	ICAS°°	
Maximum Ratings, ***Absolute Values:***			
DC PLATE VOLTAGE	500 max.	600 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	300 max.	300 max.	volts
DC GRID-No.2 SUPPLY VOLTAGE	400 max.	400 max.	volts
MAX.-SIGNAL DC PLATE CURRENT**	150 max.	150 max.	ma
MAX.-SIGNAL PLATE INPUT**	70 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 CCS Operation:			
DC Plate Voltage	400	500	volts
DC Grid-No.2 Voltage▲▲	200	200	volts
DC Grid-No.1 (Control-Grid) Voltage:			
From fixed-bias source	-23	-26	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage	72	70	volts
DC Plate Current:			
Zero-signal value	25	20	ma
Max.-signal value	145	116	ma
DC Grid-No.2 Current:			
Zero-signal value	0.1	0.1	ma
Max.-signal value	10	10	ma
DC Grid-No.1 Current:			
Max.-signal value	2.4	2.6	ma
Effective Load Resistance (Plate to plate)	7100	11100	ohms
Max.-Signal Driving Power (Approx.)♦	0.1	0.1	watt
Max.-Signal Power Output (Approx.)	39	40	watts
Typical ICAS Operation:			
DC Plate Voltage	500	600	volts
DC Grid-No.2 Voltage▲▲	200	200	volts
DC Grid-No.1 (Control-Grid) Voltage:			
From fixed-bias source	-25	-26	volts

† Subscript 2 indicates that 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.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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TWIN BEAM POWER TUBE

Typical ICAS Operation (Cont'd):

Peak AF Grid-No.1-to-Grid-No.1 Voltage	76	76	volts
DC Plate Current:			
Zero-signal value	25	21	ma
Max.-Signal value	145	135	ma
DC Grid-No.2 Current:			
Zero-signal value	0.1	0.1	ma
Max.-signal value	10	13	ma
DC Grid-No.1 Current:			
Max.-signal value	2.9	3.3	ma
Effective Load Resistance (Plate to plate)	8900	11400	ohms
Max.-Signal Driving Power (Approx.)♦	0.1	0.1	watt
Max.-Signal Power Output (Approx.)	50	57	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance:♦

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

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:***

For max. plate voltage and max. plate input above 100 Mc, see Rating Chart I

	CCS°	*ICAS*°°	
DC PLATE VOLTAGE	400 max.	500 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	300 max.	300 max.	volts
DC GRID-No.2 SUPPLY VOLTAGE	400 max.	400 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-200 max.	-200 max.	volts
DC PLATE CURRENT	125 max.	125 max.	ma
DC GRID-No.1 CURRENT	4 max.	4 max.	ma
PLATE INPUT	45 max.	55 max.	watts
GRID-No.2 INPUT	2 max.	2 max.	watts
PLATE DISSIPATION	13.5 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

▲▲ 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.

°,°°: See next page.

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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6524

TWIN BEAM POWER TUBE

	CCS°	ICAS°°	
Typical Operation up to 100 Mc:			
DC Plate Voltage	400	500	volts
DC Grid-No.2 Voltage (Approx.)♦	200	200	volts
From an adjustable series re-sistor having max. value of	45000	45000■	ohms
DC Grid-No.1 Voltage★.	-61	-61	volts
From combination employing grid resistor of	6200	6200	ohms
with fixed bias of	-45	-45	volts
DC Plate Current	100	100	ma
DC Grid-No.2 Current (Approx.)	7	7	ma
DC Grid-No.1 Current (Approx.)	2.5	2.5	ma
Driving Power (Approx.). . . .	0.2	0.2	watt
Power Output (Approx.)●. . . .	31	40	watts
Typical Operation at 462 Mc:			
DC Plate Voltage	300	300	volts
DC Grid-No.2 Voltage (Approx.)♦	200	240	volts
From an adjustable series re-sistor having max. value of	45000	25000	ohms
DC Grid-No.1 Voltage★.	-60	-60	volts
From combination employing grid resistor of	15000	15000	ohms
with fixed bias of	-45	-45	volts
DC Plate Current	75	95	ma
DC Grid-No.2 Current (Approx.)	4	5.5	ma
DC Grid-No.1 Current (Approx.)	1	1	ma
Driver Power Output (Approx.).	7	7	watts
Useful Power Output (Approx.)●●	9	12	watts
Maximum Circuit Values:			
Grid-No.1-Circuit Resistance‡	30000 max.	30000 max.	ohms

PUSH-PULL RF POWER AMP. & OSCILLATOR--Class C Telegraphy□
and
PUSH-PULL RF POWER AMPLIFIER--Class C FM Telephony

	CCS°	ICAS°°	
Maximum Ratings, *Absolute Values*:			

For max. plate voltage and max. plate input above 100 Mc, see Rating Chart II

DC PLATE VOLTAGE	500 max.	600 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE.	300 max.	300 max.	volts

♦ 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 completed.

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

°, °°, ■, ●, ●●, ‡, □: See next page.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6524

6524

TWIN BEAM POWER TUBE

	CCS°	ICAS°°	
DC GRID-No.2 SUPPLY VOLTAGE . .	400 max.	400 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-200 max.	-200 max.	volts
DC PLATE CURRENT	150 max.	150 max.	ma
DC GRID-No.1 CURRENT	4 max.	4 max.	ma
PLATE INPUT	70 max.	85 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 up to 100 Mc:

DC Plate Voltage	500	600	volts
DC Grid-No.2 Voltage (Approx.)●.	200	200	volts
From an adjustable series resistor having max. value of . .	40000✓	40000✓	ohms
DC Grid-No.1 Voltage■.	-44	-44	volts
From grid resistor of	12000	12000	ohms
From cathode resistor of . . .	330	330	ohms
DC Plate Current	120	120	ma
DC Grid-No.2 Current (Approx.) .	8	8	ma
DC Grid-No.1 Current (Approx.) .	3.7	3.7	ma
Driving Power (Approx.)	0.2	0.2	watt
Power Output (Approx.)●●	46	56	watts

Typical Operation as Amplifier at 462 Mc:●—

DC Plate Voltage	300	300	volts
DC Grid-No.2 Voltage (Approx.)●.	200	250	volts
From an adjustable series resistor having max. value of .	60000	20000	ohms
DC Grid-No.1 Voltage■	-31	-38	volts
From grid resistor of	12000	12000	ohms
From cathode resistor of . . .	240	240	ohms
DC Plate Current	120	150	ma
DC Grid-No.2 Current (Approx.) .	3	6	ma
DC Grid-No.1 Current (Approx.) .	2.6	3.2	ma

● At 100 Mc, useful power output measured at load of output circuit is approximately 29 watts CCS and 36 watts ICAS.

□ 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.

✓ Connected to a 400-volt tap on suitable voltage divider across the plate-supply voltage.

●● At 100 Mc, useful power output measured at load of output circuit is approximately 43 watts CCS and 52 watts ICAS.

●— Typical operation as an oscillator at 462 Mc is the same as that shown for amplifier service except that the useful power output measured at load of output circuit is approximately 9 watts CCS and 13 watts ICAS.

o, oo, ‡, ●●, ●, ■: See next page.

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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6524

TWIN BEAM POWER TUBE

	CCS°	ICAS°°	
Driver Power Output (Approx.) . .	7	7	watts
Useful Power Output (Approx.)●●.	16	20	watts
Maximum Circuit Values:			
Grid-No.1-Circuit Resistance‡. .	30000	30000 max.	ohms

FREQUENCY TRIPLER — Class C

Maximum Ratings, ***Absolute Values:***

For max. plate voltage and max. plate input above 100 Mc, see Rating Chart III

	CCS°	ICAS°°	
DC PLATE VOLTAGE	400 max.	400 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE .	300 max.	300 max.	volts
DC GRID-No.2 SUPPLY VOLTAGE . .	400 max.	400 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-200 max.	-200 max.	volts
DC PLATE CURRENT	100 max.	115 max.	ma
DC GRID-No.1 CURRENT	4 max.	4 max.	ma
PLATE INPUT	36 max.	45 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 Tripler to 462 Mc:

	CCS°	ICAS°°	
DC Plate Voltage	300	300	volts
DC Grid-No.2 Voltage (Approx.)●.	220	250	volts
From an adjustable series resistor having max. value of .	30000	20000	ohms
DC Grid-No.1 Voltage■.	-148	-148	volts
From grid resistor of	51000	51000	ohms
DC Plate Current	90	110	ma
DC Grid-No.2 Current (Approx.) .	5	6.5	ma
DC Grid-No.1 Current (Approx.)	2.9	2.9	ma

‡ When grid No.1 is driven positive, 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.

● 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 6524 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. 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.

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA
6524
TWIN BEAM POWER TUBE

	CCS°	ICAS°°	
Driver Power Output (Approx.) .	4	4	watts
Useful Power Output (Approx.)••.	7	8.5	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance‡‡ .	60000 max.	60000 max.	ohms

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Heater Current	1	1.175	1.325	amp
Mu-Factor, Grid No.2 to Grid No.1 (Each Unit)	1,2	7	10	
Direct Interelectrode Capacitances (Each Unit):				
Grid No.1 to plate	3	-	0.11	μμf
Grid No.1 to cathode & grid No.3 & internal shield, grid No.2 (pins 1 & 7), and heater	3	5.8	8.2	μμf
Plate to cathode & grid No.3 & internal shield, grid No.2 (pins 1 & 7), and heater	3	2.6	4.2	μμf

Note 1: With 6.3 volts ac on heater.

Note 2: With dc plate voltage of 200 volts, dc grid-No.2 voltage of 200 volts, and dc plate current of 50 ma.

Note 3: With no external shield.

° Continuous Commercial Service.

°° Intermittent Commercial and Amateur Service.

•• This value of useful power 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 60000 ohms. If this value is insufficient to provide adequate bias, the additional required bias must be supplied by a cathode resistor or fixed supply.

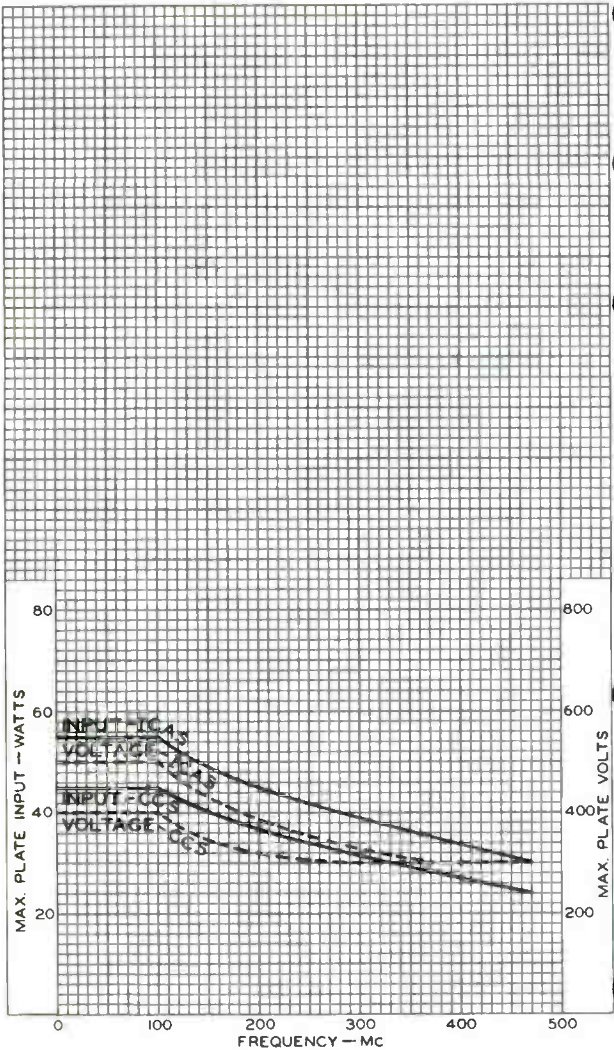
OPERATING CONSIDERATIONS

Shielding of the 6524 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 6524 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.

← Indicates a change.

6524

RATING CHART I
CLASS C TELEPHONY



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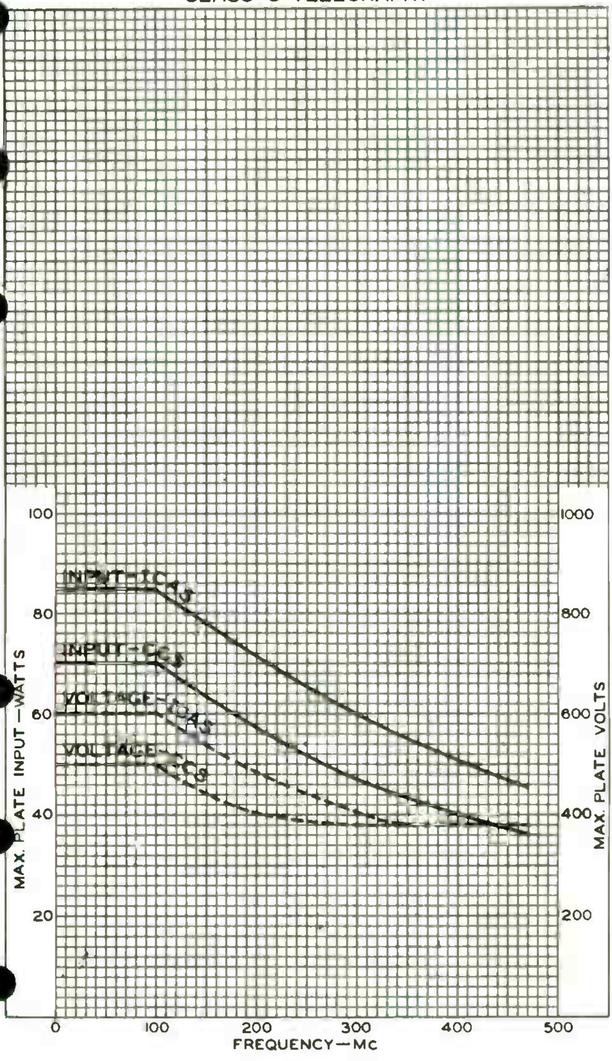
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8347

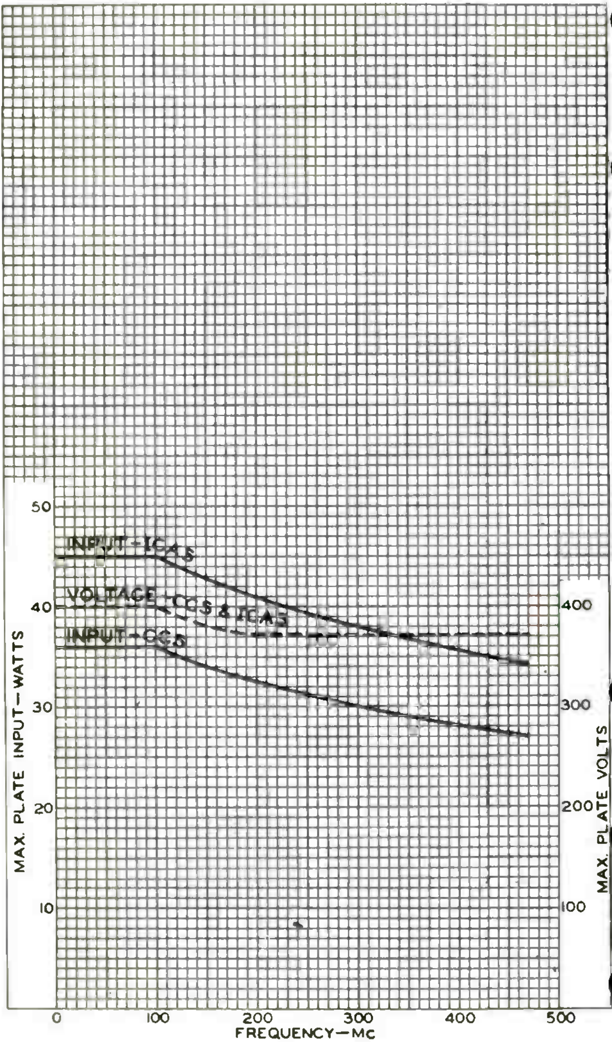
6524

RATING CHART II
CLASS C TELEGRAPHY



JULY 13, 1954 — TUBE DIVISION — RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY — 92CM-8348

6524
RATING CHART III
CLASS C TRIPLER



JULY 13, 1954

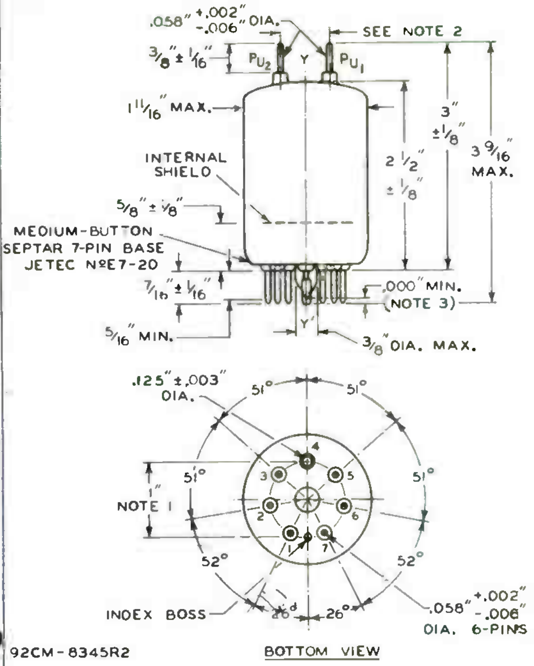
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8349

6524

6524

TWIN BEAM POWER TUBE



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

For Notes, see next page.

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6524

TWIN BEAM POWER TUBE

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'.

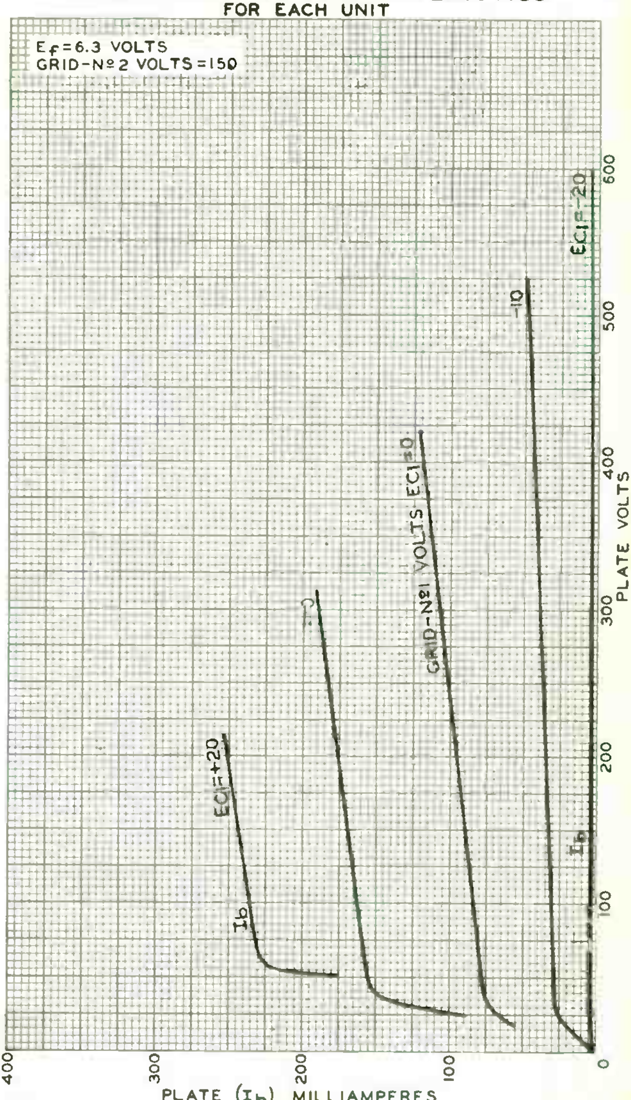
NOTE 2: THE PLATE LEADS WILL ENTER A FLAT-PLATE PLATE-LEAD GAUGE HAVING MINIMUM THICKNESS OF 0.375" AND HAVING TWO HOLES 0.1200" ± 0.0005" WHOSE CENTERS ARE LOCATED AT A DISTANCE OF 0.343" ± 0.001" FROM THE AXIS YY' AND WHOSE AXES ARE PARALLEL TO YY'. THE PLANE THROUGH THESE AXES WILL BE 90° ± 5' FROM 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.

RCA

6524

AVERAGE PLATE CHARACTERISTICS
FOR EACH UNIT



RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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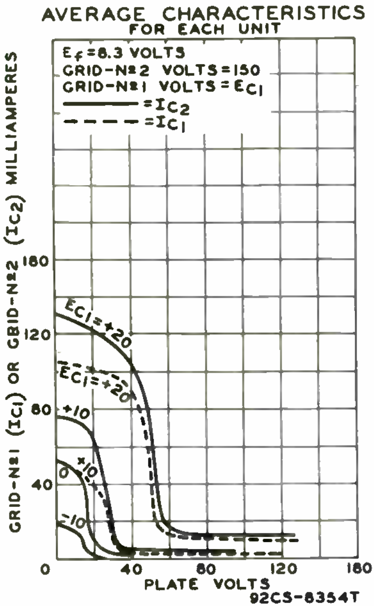
6524

CHARACTERISTICS CURVES



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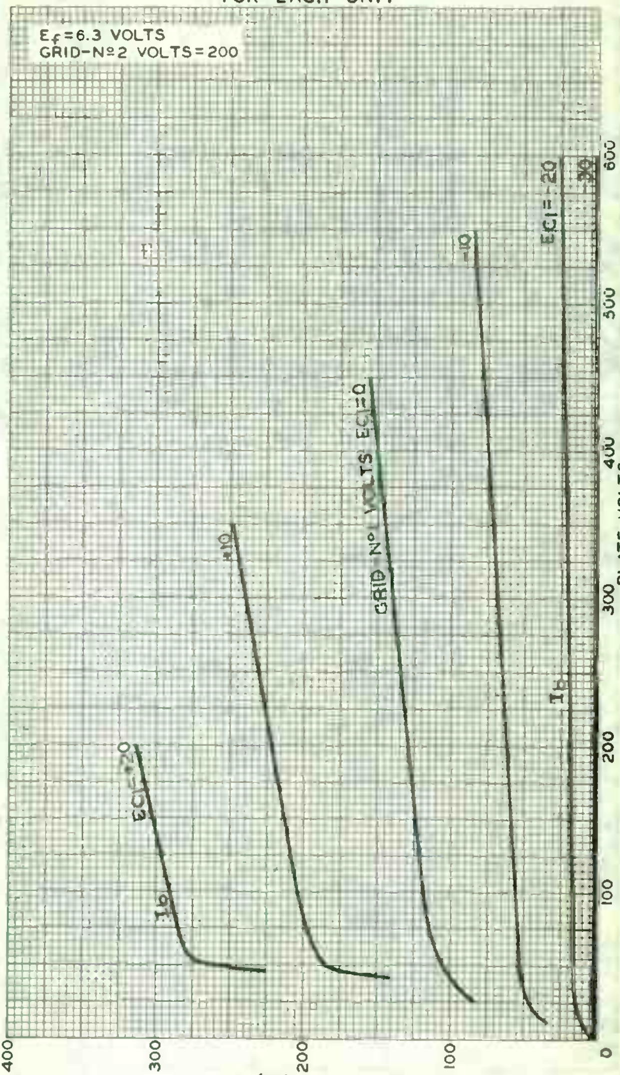
AVERAGE PLATE CHARACTERISTICS
FOR EACH UNIT



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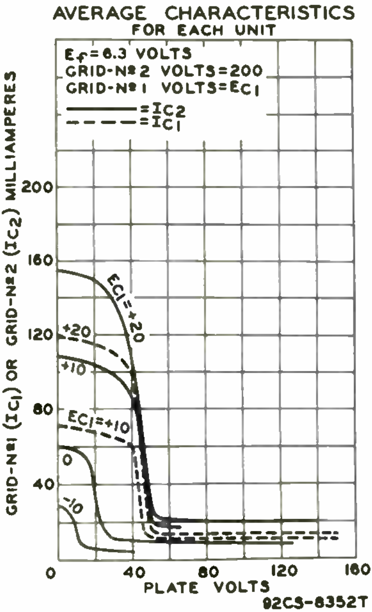
CHARACTERISTICS CURVES

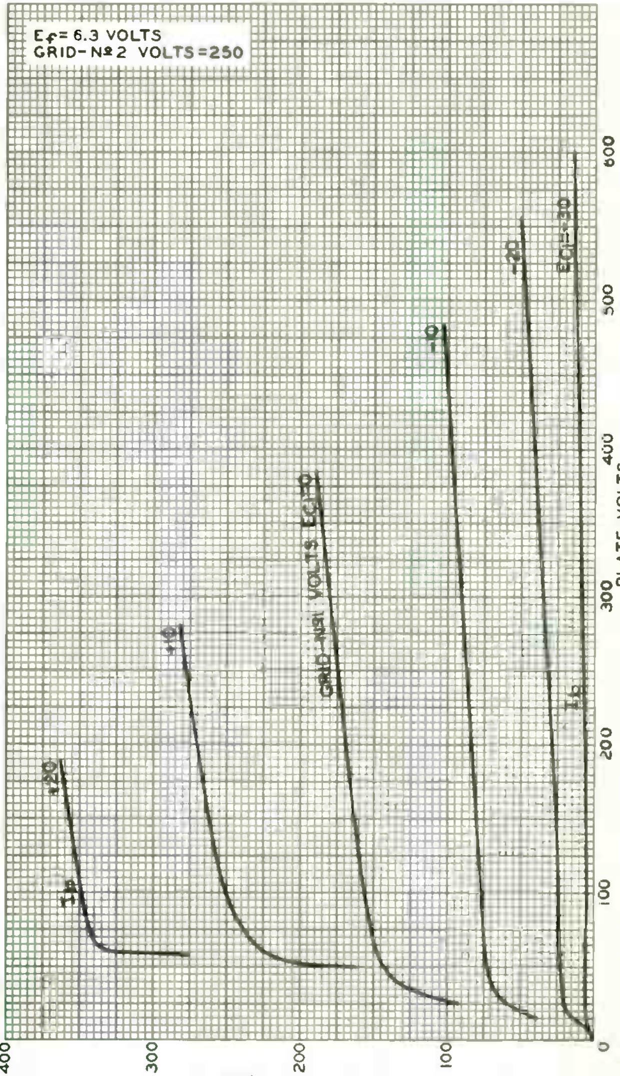


TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6524

6524

AVERAGE PLATE CHARACTERISTICS
FOR EACH UNIT



JULY 15, 1954

TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8351

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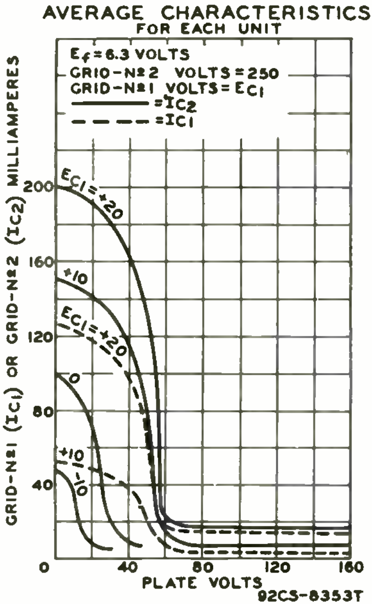
6524

CHARACTERISTICS CURVES



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

Fixed-Tuned Oscillator Triode

PENCIL TYPE WITH INTEGRAL RESONATORS
For Radiosonde Service at 1680 Mc

GENERAL DATA

Electrical:

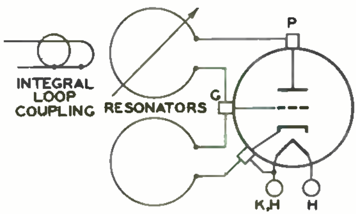
Heater, for Unipotential Cathode:		
Voltage range (AC or DC)	5.2 to 6.6[a]	volts
Current at heater volts = 6.0	0.160	amp
Frequency (Approx.)	1680	Mc
Frequency Adjustment Range	±12[b]	Mc
RF Coaxial Output Terminal:		
Characteristic impedance (Approx.)	50	ohms

Mechanical:

Operating Position	Any
Dimensions	See *Dimensional Outline*
Resonators (Two)	Integral Part of Tube

Terminal Connections (See *Dimensional Outline*):

H - Heater
K - Cathode



G - Grid
P - Plate

FIXED-TUNED OSCILLATOR SERVICE

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

DC PLATE VOLTAGE	120 max.	volts
DC PLATE CURRENT	34 max.	ma
DC GRID CURRENT	8 max.	ma
PLATE INPUT	4 max.	watts
PLATE DISSIPATION	3.6 max.	watts
AMBIENT-TEMPERATURE RANGE	−55 to +75	°C

Operating Frequency Drift:

Maximum Frequency Drift:
For heater voltage range of 5.2 to 6.6 volts, plate voltage range of 95 to 117 volts, and ambient-temperature range of +22° to −40° C . . . +4 to −1 Mc

[a] This range of heater voltage is for radiosonde applications in which the heater is supplied from batteries and in which the equipment design requirements of minimum size, light weight, and high efficiency are the primary considerations even though the average life expectancy of the 6562/5794A in such service is only a few hours.

[b] As supplied, tubes are adjusted to 1680 ± 4 megacycles.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Av.*	*Max.*	
Heater Current.	1	0.135	0.148	0.157	amp
Power Output.	2,4	-	600	-	mw
Power Output.	3,4	300	-	-	mw

Note 1: With 5.2 volts ac on heater.

Note 2: With ac heater voltage of 6.6 volts, dc plate voltage of 117 volts, frequency of 1680 Mc, and grid resistor having resistance value within the range of 1300 to 2400 ohms, such that the dc plate current will not exceed 34 milliamperes. The value used for any individual tube is stamped on the tube and is one of the following standard values: 1300, 1500, 1800, 2200, or 2400 ohms.

Note 3: With ac heater voltage of 5.2 volts, dc plate voltage of 95 volts, frequency of 1680 Mc, and grid-resistor value specified in Note 2 above. When this value of resistance is used, the dc plate current will not exceed 34 milliamperes under the specified operating conditions.

Note 4: Measured with a coaxial-type load having an impedance of approximately 50 ohms and adjusted for a maximum voltage standing wave ratio of 1.1.

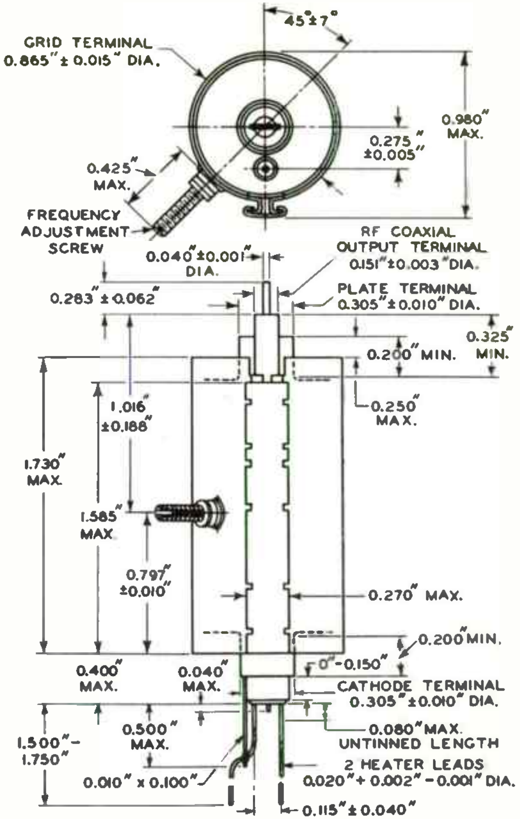
OPERATING CONSIDERATIONS

The *flexible heater leads* of the 6562/5794A 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 (excluding cathode tab). 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 6562/5794A 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 resonators and result in a change of frequency.

The *plate connection* should have a flexible lead which will accommodate variations in the relative position of the plate terminal in individual tubes.

The 6562/5794A 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 counter-clockwise rotation will increase the frequency. The range of adjustment provided by the screw is ± 12 Mc.


45°±7°
GRID TERMINAL
0.865"±0.015" DIA.
0.980" MAX.
0.275"
±0.005"
0.425" MAX.
FREQUENCY ADJUSTMENT SCREW
RF COAXIAL OUTPUT TERMINAL
0.151"±0.003" DIA.
0.040"±0.001" DIA.
0.283"±0.062"
PLATE TERMINAL
0.305"±0.010" DIA.
0.325" MIN.
0.200" MIN.
0.250" MAX.
1.016"
±0.188"
1.730" MAX.
1.585" MAX.
0.797"
±0.010"
0.270" MAX.
0.200" MIN.
0"-0.150"
0.400" MAX.
0.040" MAX.
CATHODE TERMINAL
0.305"±0.010" DIA.
0.500" MAX.
1.500"-
1.750"
0.080" MAX.
UNTINNED LENGTH
2 HEATER LEADS
0.020"+0.002"-0.001" DIA.
0.010" x 0.100"
0.115"±0.040"

92CM-8747R1

6806

BEAM POWER TUBE

COAXIAL-ELECTRODE STRUCTURE
CERAMIC-METAL SEALS
LOW DRIVE REQUIREMENTS

WATER-COOLED ELECTRODES
INTEGRAL WATER DUCTS
28-KW TV OUTPUT AT 550 Mc

For use at frequencies from 225 to 1000 Mc

GENERAL DATA

Electrical:

Filament, 2-Section Multistrand Thoriated Tungsten:

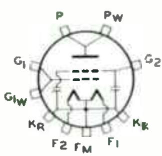
Voltage* per section (AC or DC) . . .	1.25 min.°	volts
	1.35 typical	volts
	1.50 max.	volts
Current per section at 1.35 volts . .	1000	amp
Starting current per section	Must never exceed 1200 amperes, even momentarily	
Cold resistance per section.	0.00025	ohm
Minimum heating time	30	sec
Mu-Factor, Grid No.2 to Grid No.1 (Approx.) for plate volts = 9300, grid-No.2 volts = 950, and plate amperes = 4.3.	8	
Direct Interelectrode Capacitances:		
Grid No.1 to plate	0.1 max.	μμf
Grid No.1 to filament and grid No.2.	365	μμf
Plate to filament and grid No.2. . .	30	μμf
Internal Bypass Capacitors between Grid No.2 and Cathode (Approx., total)	18000	μμf

Mechanical:

Operating Position	Tube axis vertical, with plate terminal either up or down
Overall Length	7.59" + 0.38" − 0.50"
Maximum Diameter	11.38"
Weight (Approx.)	28 lbs

Terminal Connections *(See Dimensional Outline)*:

F_1 – Fil. Sect. No.1 & Water Conn.
F_2 – Fil. Sect. No.2 & Water Conn.
G_1 – RF Grid-No.1 Term. Contact Surface
G_{1W} – DC Grid-No.1 & Water Conn.
G_2 – DC Grid-No.2 & Water Conn.
K_R – RF Cath. Term. Contact Surface For RF Circuit Returns



F_M – Common Point of Fil. Sections for DC Circuit Returns, Ground, & Water Conn.
P – RF Plate Term. Contact Surface
P_W – DC Plate & Water Conn.

°,*: See next page.

← Indicates a change.

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

RCA

6806

BEAM POWER TUBE

Air Cooling:

Forced-air cooling of the ceramic bushing at the grid-No.1 seal and at the plate seal may be required in order to limit the temperature of the ceramic bushing at either seal to the specified maximum value of 150° C. Under such conditions, provision should be made for blowing air at the ceramic bushings through suitable openings in the coaxial-cylinder cavity circuit.

Water Cooling:

Water cooling of the filament-section blocks, rf cathode terminals, grid-No.1 block, grid-No.2 block, and plate 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 cooled elements with all power supplies is recommended to prevent tube damage in case of failure of adequate water flow.

Water Flow:

	Absolute Min. Flow *gpm*	*Typical Flow* *gpm*	*Pressure*♣ *Differential for Typical Flow* *psi*
Through filament-section-No.1 block.	0.5	1.2	17 max.
Through filament-section-No.2 block.	0.5	1.2	17 max.
Through filament-common-point connection. . . .	0.5	1.2	11 max.
Through grid-No.1 block .	0.5	1.2	9 max.
Through grid-No.2 block .	0.5	1.2	17 max.
Through plate in direction shown on *Dimensional Outline:*			
For plate dissipation up to 16 kw	12	14	25 av. 31 max.
For plate dissipation of 20 kw.	14	16	32 av. 40 max.
For plate dissipation of 32 kw.	20	22	60 av. 75 max.

Gauge Pressure at Any Inlet Except Plate Inlet.	70 max.	psi
Gauge Pressure at Plate Inlet	100 max.	psi
Ceramic-Bushing Temperature	150 max.	°C
Outlet-Water Temperature (Any outlet)	70 max.	°C
Min. Plate-Water-Column Resistance. . . .	4 megohms per kv of dc plate voltage at 25° C	

○,★,♣: See next page.

RCA

6806

BEAM POWER TUBE

LINEAR RF POWER AMPLIFIER

Class AB Single-Sideband Suppressed-Carrier Service

Crest of modulation conditions

Maximum CCS● Ratings, *Absolute Values:*§

	225 to 1000 Mc	
DC PLATE VOLTAGE	9000 max.	volts
DC PLATE-SUPPLY VOLTAGE	10000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	1250 max.	volts
DC GRID-No.2 SUPPLY VOLTAGE	1350 max.	volts
MAX.-SIGNAL DC PLATE CURRENT	7 max.	amp
MAX.-SIGNAL PLATE INPUT	60000 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT	750 max.	watts
PLATE DISSIPATION	35000 max.	watts

Typical CCS Operation:

	At 550 Mc●	
DC Plate Voltage	8000	volts
DC Grid-No.2 Voltage♦	1200	volts
DC Grid-No.1 (Control-grid) Voltage	-115	volts
Zero-Signal DC Plate Current	2.5	amp
Max.-Signal DC Plate Current	6	amp
Zero-Signal DC Grid-No.2 Current (Approx.)	0.15	amp
Max.-Signal DC Grid-No.2 Current (Approx.)	0.35	amp
Max.-Signal DC Grid-No.1 Current (Approx.)	0	amp
Max.-Signal Driver Power Output (Approx.)♣	90	watts
Output-Circuit Efficiency (Approx.)	90	%
Max.-Signal Useful Power Output (Approx.)	15000●●	watts

RF POWER AMPLIFIER — Class B Television Service

Synchronizing-level conditions per tube unless otherwise indicated

Maximum CCS● Ratings, *Absolute Values:*§

	225 to 1000 Mc	
DC PLATE VOLTAGE	9000 max.	volts
DC PLATE-SUPPLY VOLTAGE	10000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	1100 max.	volts
DC GRID-No.2-SUPPLY VOLTAGE	1200 max.	volts
DC PLATE CURRENT	8.25 max.	amp
DC GRID-No.1 (CONTROL-GRID) CURRENT	0.5 max.	amp

o,★,♣,●,§,●,♦,♣,●●: See next page.

← Indicates a change.

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	225 to 1000 Mc	
PLATE INPUT	70000 max.	watts
GRID-No.2 INPUT (For black picture)*	750 max.	watts
PLATE DISSIPATION (For black picture)*	36000 max.	watts

Typical CCS Operation:	*At 550 Mc*●	*At 800 Mc*	
Bandwidth▲ *of*	7	7	*Mc*
DC Plate Voltage.	8500	8000	volts
DC Grid-No.2 Voltage. . . .	1000	1000	volts
DC Grid-No.1 Voltage. . . .	-140	-140	volts
Peak RF Grid-No.1 Voltage:			
Synchronizing level . . .	180	180	volts
Blanking level.	140	140	volts
DC Plate Current:			
Synchronizing level . . .	8	7.8	amp
Blanking level.	5.8	5.6	amp
DC Grid-No.2 Current (Approx.):			
Synchronizing level . . .	0.75	0.75	amp
Blanking level.	0.55	0.55	amp
DC Grid-No.1 Current (Approx.):			
Synchronizing level . . .	0.4	0.35	amp
Blanking level.	0.15	0.13	amp
Driver Power Output (Approx.):♣			
Synchronizing level . . .	800#	1000##	watts
Blanking level.	450	550	watts
Output-Circuit Efficiency (Approx.)	90	85	%
Useful Power Output (Approx.):			
Synchronizing level . . .	28000●●	19000●●	watts
Blanking level.	17000●●	11500●●	watts

PLATE-MODULATED RF POWER AMPLIFIER — Class C Telephony

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

Maximum CCS● Ratings, *Absolute Values:*§

	225 to 1000 Mc	
DC PLATE VOLTAGE.	5500 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE.	1000 max.	volts
PEAK GRID-No.2 VOLTAGE (DC + max. modulation swing)	1350 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-250 max.	volts

o, ★, ◆, ●, §, ●, ♁, ♣, ●●, *, ▲, #, ##: See next page.

→ Indicates a change.

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	225 to 1000 Mc	
DC PLATE CURRENT	4.5 max.	amp
DC GRID-No.1 CURRENT	1 max.	amp
PLATE INPUT	25000 max.	watts
GRID-No.2 INPUT	500 max.	watts
PLATE DISSIPATION	17000 max.	watts

Typical CCS Operation:▲▲

	At 400 Mc	
DC Plate Voltage	5000	volts
DC Grid-No.2 Voltage♠	800	volts
DC Grid-No.1 Voltage	-180	volts
Peak RF Grid-No.1 Voltage	210	volts
DC Plate Current	4.25	amp
DC Grid-No.2 Current (Approx.)	0.4	amp
DC Grid-No.1 Current (Approx.)	0.1	amp
Driver Power Output (Approx.)♣♣	300	watts
Output-Circuit Efficiency (Approx.)	90	%
Useful Power Output (Approx.)	10000●●	watts

RF POWER AMPLIFIER — Class C Telegraphy□

and

RF POWER AMPLIFIER — Class C FM Telephony

Maximum CCS● Ratings, *Absolute Values:*§

	225 to 1000 Mc	
DC PLATE VOLTAGE	9000 max.	volts
DC PLATE-SUPPLY VOLTAGE	10000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	1100 max.	volts
DC GRID-No.2 SUPPLY VOLTAGE	1200 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-250 max.	volts
DC PLATE CURRENT	7 max.	amp
DC GRID-No.1 CURRENT	0.5 max.	amp
PLATE INPUT	60000 max.	watts
GRID-No.2 INPUT	750 max.	watts
PLATE DISSIPATION	35000 max.	watts

Typical CCS Operation:

	At 400 Mc	*At 900 Mc*	
DC Plate Voltage	8500	7500	volts
DC Grid-No.2 Voltage†	1000	1000	volts
DC Grid-No.1 Voltage††	-175	-175	volts
Peak RF Grid-No.1 Voltage	215	235	volts
DC Plate Current	6.75	6.8	amp
DC Grid-No.2 Current (Approx.)	0.5	0.55	amp

← Indicates a change.

○,★,✱,●,§,●,♠,♣,●●,✳,▲,#,##,▲▲,♣♣,□,†,††: See next page.

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BEAM POWER TUBE

	At 400 Mc	At 900 Mc	
DC Grid-No.1 Current (Approx.).	0.2	0.25	amp
Driver Power Output (Approx.)♣♣.	300	750	watts
Output-Circuit Efficiency (Approx.).	90	80	%
Useful Power Output (Approx.).	25000●●	13500●●	watts

★ To avoid undue thermal stresses in the filament, it is essential that the filament voltage be raised gradually to operating value in not less than 30 seconds. When the filament voltage is removed, it should be reduced gradually from the normal operating value to zero voltage in not less than 30 seconds.

o Minimum operating value. The life of the tube can be conserved by operating the filament at the lowest power, within the operating filament-voltage range, which will enable the tube to provide the desired power output. Because the filament when operated near the maximum value provides emission in excess of any requirements within the tube ratings, the filament power must be reduced to a value that will give adequate but not excessive emission for any particular application. Good regulation of the filament power supply is in general economically advantageous from the viewpoint of tube life. During standbys, the filament may be operated at 1.08 volts.

♦ Directly across cooled element at water connection for the indicated typical flow.

● Continuous Commercial Service.

§ Maximum voltage ratings apply for pressures down to 25 inches of mercury (altitudes up to 5000 feet) at 25° C.

● In the vicinity of 550 Mc, it may be necessary to provide means for balancing out a circumferential $TE_{1,1}$ mode.

♠ Obtained preferably from a separate source.

♣ The driver stage is required to supply tube losses, rf-circuit losses, and rf "swamping-power" losses. "Swamping" may be required in practical circuit design to obtain the desired input-circuit bandwidth. 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.

●● This value of useful power is measured at load with output circuit having indicated efficiency.

* Continuous blanking level + sync pulses.

▲ Between the half-power points as measured in the output circuit.

This value includes 300 watts of rf "swamping power".

This value includes 100 watts of rf "swamping power".

▲▲ For 100% modulation of plate voltage, and 50% modulation of grid-No.2 voltage.

♣♣ 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.

□ 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 6806 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 1200 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.

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BEAM POWER TUBE

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Filament Current per Section. .	1	950	1050	amp
Filament Current per Section. .	2	985	1095	amp
Filament-Current Differential Between Sections.	1	-	30	amp
Filament-Voltage Differential Between Sections.	3	-	0.075	volt
Grid-No.1 Voltage	1,4	-	-180	volts
Useful Power Output:				
Class B Television Service— Synchronizing-level conditions.	1,5	27000	-	watts
Class C Telegraphy— Key-down conditions	1,6	22000	-	watts
Power Gain.	1,5,6,7	40	-	

Note 1: With 1.35 volts rms per filament section.

Note 2: With 1.5 volts rms per filament section.

Note 3: With 1000 amperes per filament section.

Note 4: With 2-phase excitation of the filament sections, dc plate volts = 8500, dc grid-No.2 volts = 1000, and dc grid-No.1 voltage adjusted to give a dc plate current of 0.25 ampere.

Note 5: With 2-phase excitation of the filament sections. In rf power amplifier circuit having a bandwidth of 7 Mc as defined by the half-power points and with dc plate volts = 8750, dc grid-No.2 volts = 1000, dc grid-No.1 voltage adjusted to give a zero-signal dc plate current of 0.25 ampere, drive adjusted to give synchronizing-level dc plate current of 8 amperes, and frequency (Mc) = 550.

Note 6: With 2-phase excitation of the filament sections. In rf power amplifier circuit, and with dc plate volts = 8500, dc grid-No.2 volts = 1000, dc grid-No.1 voltage adjusted to give a zero-signal dc plate current of 0.25 ampere, drive adjusted to give dc plate current of 7 amperes, and frequency (Mc) = 550.

Note 7: With driving power measured at input to input-cavity circuit fed by transmission line having voltage-standing-wave ratio not greater than 1.5. Power gain is ratio of useful power output to driving power.

← Indicates a change.

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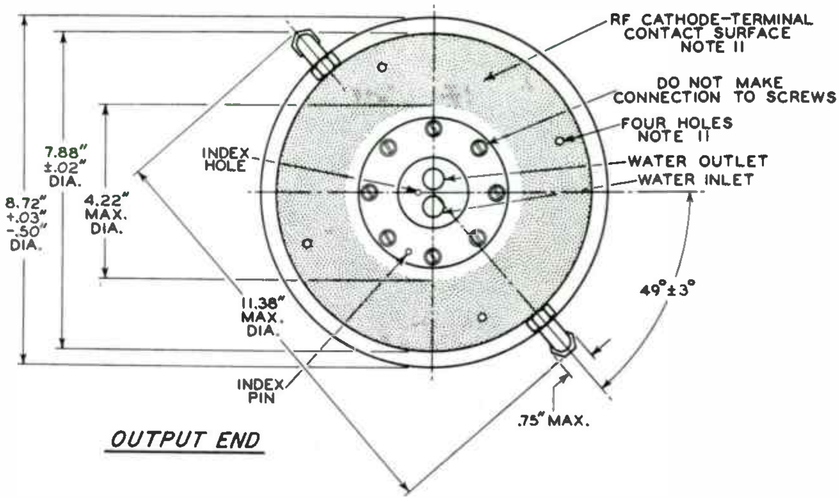
6806 BEAM POWER TUBE



OUTPUT END

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CE-8840R2A

BEAM POWER TUBE

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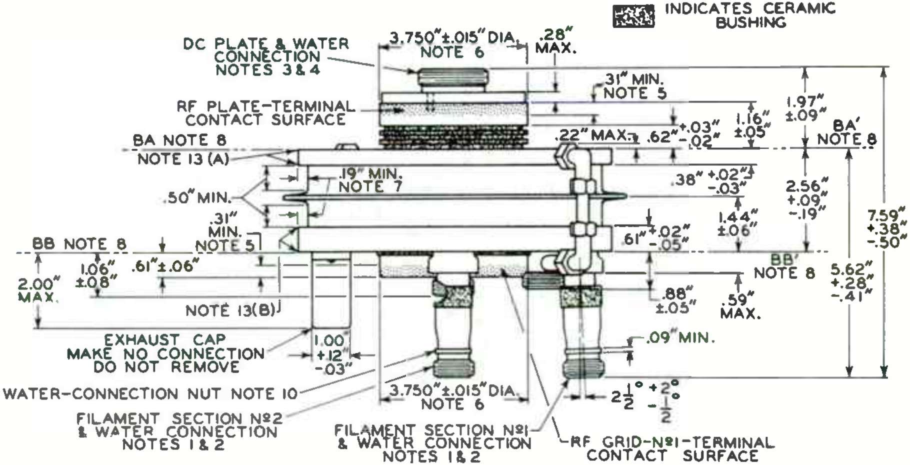

2-59

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CE-8840R2B

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BEAM POWER TUBE

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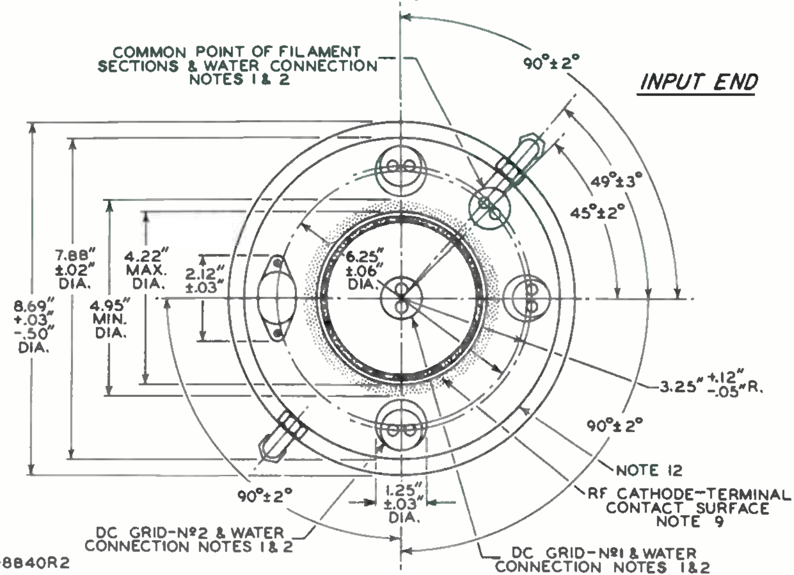
2-59



92CL-8840R2

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BEAM POWER TUBE

NOTE 1: TERMINAL HAS 1" - 16 UNIFIED THREAD CLASS 2A FIT, 0.38" LONG AND 2 HOLES 0.258" - 0.270" DIAMETER SPACED 0.438" ON CENTERS.

NOTE 2: THE HOLES IN THE FILAMENT, GRID-No.1, AND GRID-No.2 WATER-TERMINAL CONNECTIONS WILL ACCEPT THE PINS OF THE PLUG-AND-CYLINDER COMBINATION GAUGE G_1.

NOTE 3: THE WATER CONNECTION FOR THE PLATE HAS 1-3/4" - 16 UNIFIED EXTRA FINE THREAD, CLASS 2A FIT, 0.38" LONG, 2 HOLES 0.508" - 0.522" DIAMETER SPACED 0.688" ON CENTERS AND AN INDEX HOLE 0.160" MAX. DIAMETER SPACED 0.344" FROM THE CENTER OF THE TERMINAL.

NOTE 4: THE HOLES IN THE PLATE WATER CONNECTION WILL ACCEPT THE PINS OF THE PLUG-AND-CYLINDER COMBINATION GAUGE G_2.

NOTE 5: PRESSURE FROM CIRCUIT CONTACTS SHOULD BE EXERTED ONLY OVER 0.31" MAX. LENGTH OF DESIGNATED CONTACT AREAS OF THE PLATE OR GRID-No.1 TERMINALS.

NOTE 6: THE DIAMETER DIMENSION IS HELD ONLY OVER A LENGTH OF 0.31" MIN.

NOTE 7: THIS DIMENSION APPLIES OVER A LENGTH OF 0.50" MIN. AS INDICATED.

NOTE 8: THE CONTACT SURFACES, BA-BA' AND BB-BB', ARE PARALLEL WITHIN 0.06".

NOTE 9: CONTACT OF THE INPUT-END RF CATHODE TERMINAL SHOULD NOT BE MADE AT A DIAMETER SMALLER THAN 4.22".

NOTE 10: TO PREVENT EXCESSIVE STRESS ON THE CERAMIC SEAL, A 15/16" OPEN-END WRENCH MUST BE USED TO PERMIT GRIPPING THE TERMINAL WHEN REMOVING OR TIGHTENING THE WATER CONNECTORS.

NOTE 11: CONTACT OF THE OUTPUT-END RF CATHODE TERMINAL SHOULD NOT BE MADE AT A DIAMETER SMALLER THAN 4.22". THE PRESSURE EXERTED FOR THIS RF CONTACT SHOULD BE LIMITED TO THAT NECESSARY FOR GOOD ELECTRICAL CONTACT. THE MECHANICAL FORCE FOR THE CAVITY SUPPORT SHOULD BE MADE AT A DIAMETER NOT LESS THAN 4.22". ON THE OUTPUT-END RF CATHODE TERMINAL, THERE ARE FOUR EQUALLY SPACED 0.188"-DIAMETER HOLES ON A CIRCLE HAVING DIAMETER OF 6.75". THESE HOLES ARE FOR TUBE MANUFACTURING PURPOSES ONLY. ATTENTION IS CALLED TO THE EXISTENCE OF THESE HOLES SO THAT EQUIPMENT DESIGNERS CAN AVOID MAKING ELECTRICAL CONTACT AT POINTS WHICH ARE COINCIDENT WITH THESE HOLES. MECHANICAL CLAMPING DEVICES FOR THE OUTPUT CAVITY SHOULD BE DESIGNED SO AS TO EXERT THEIR CLAMPING FORCE ACROSS THE OUTER EDGE OF THE OUTPUT-HEADER FLANGE.

NOTE 12: SERIAL NUMBER IS LOCATED ON THIS SURFACE BETWEEN DC GRID-No.2 AND FILAMENT-SECTION-No.1 CONNECTIONS.

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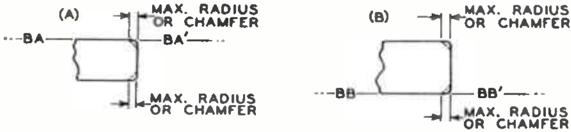
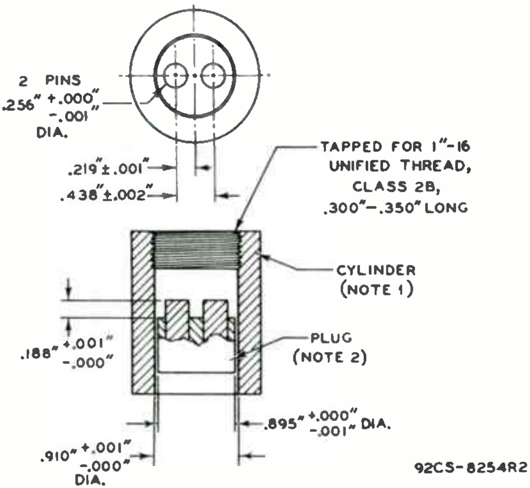
NOTE 13: CORNERS MAY BE ROUNDED OR CHAMFERED, AS INDICATED IN (A) AND (B), NOT TO EXCEED 0.05".



GAUGE G_1



NOTE 1: TAPPED SECTION OF CYLINDER MUST BE CONCENTRIC WITH UNTAPPED SECTION OF CYLINDER WITHIN .002".

NOTE 2: PLUG SIDES & PIN SIDES MUST BE PARALLEL WITHIN .001".

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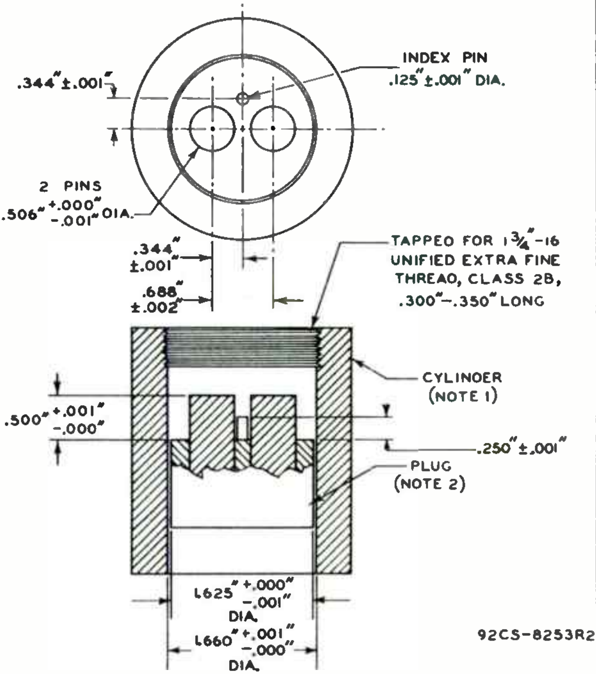
GAUGE G_2



NOTE 1: TAPPED SECTION OF CYLINDER MUST BE CONCENTRIC WITH UNTAPPED SECTION OF CYLINDER WITHIN .002".

NOTE 2: PLUG SIDES & PIN SIDES MUST BE PARALLEL WITHIN .001".

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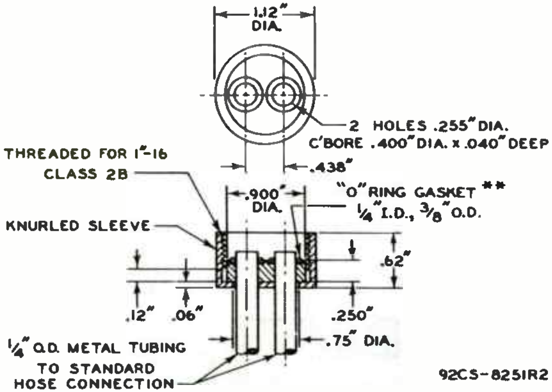
BEAM POWER TUBE

TYPICAL FITTING LAYOUT FOR ALL WATER CONNECTIONS OTHER THAN THAT FOR PLATE



** DWG. Nº 24849-5, GARLOCK PACKING CO., PALMYRA, N.Y.

For essential design tolerances, see Gauge G_1

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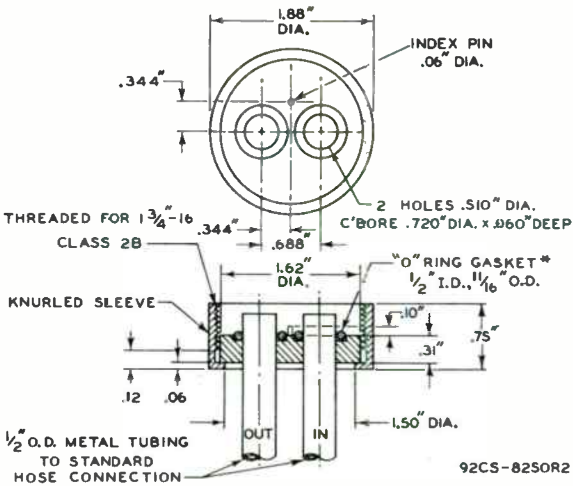
TYPICAL FITTING LAYOUT FOR PLATE WATER CONNECTION



*DWG. No 24849-10, GARLOCK PACKING CO., PALMYRA, N.Y.

For essential design tolerances, see Gauge G_2

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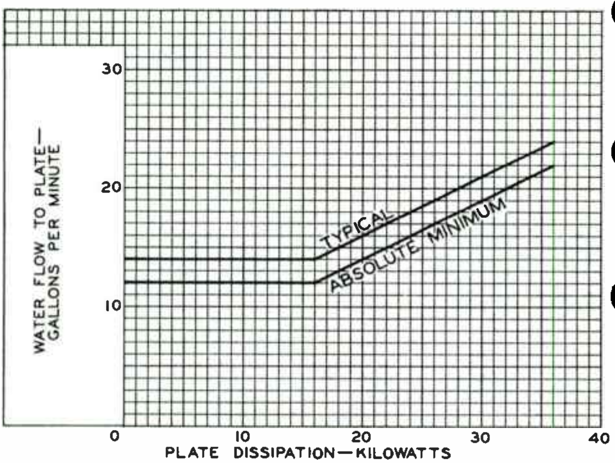
PLATE COOLING REQUIREMENTS



92CS-8929

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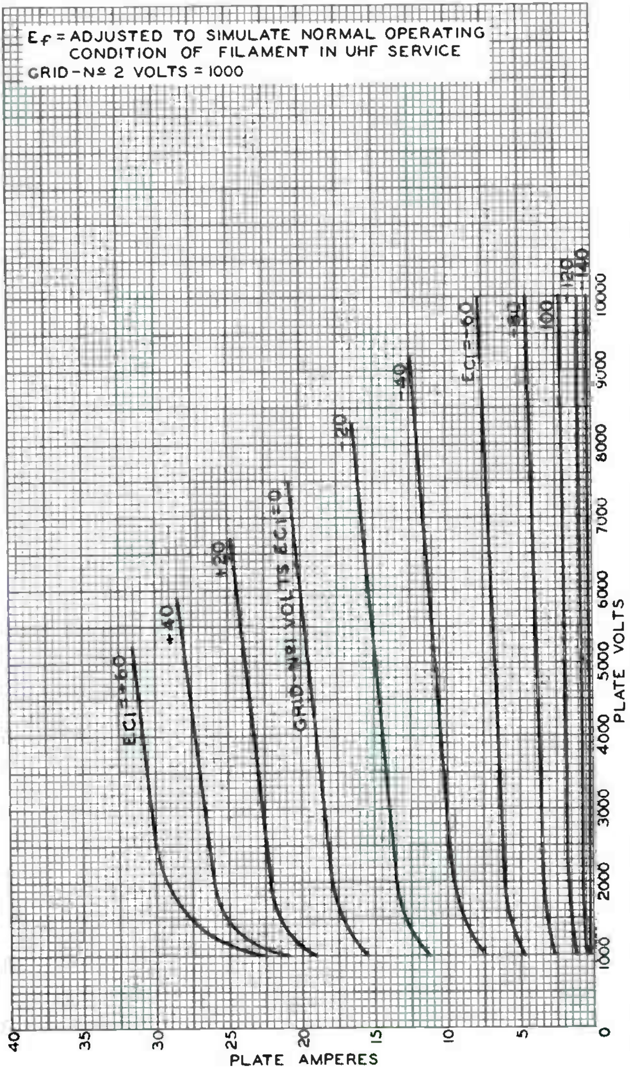
TYPICAL PLATE CHARACTERISTICS



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92CM-8899

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TYPICAL CONSTANT-CURRENT CHARACTERISTICS

ELECTRON TUBE DIVISION

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92CL-8901

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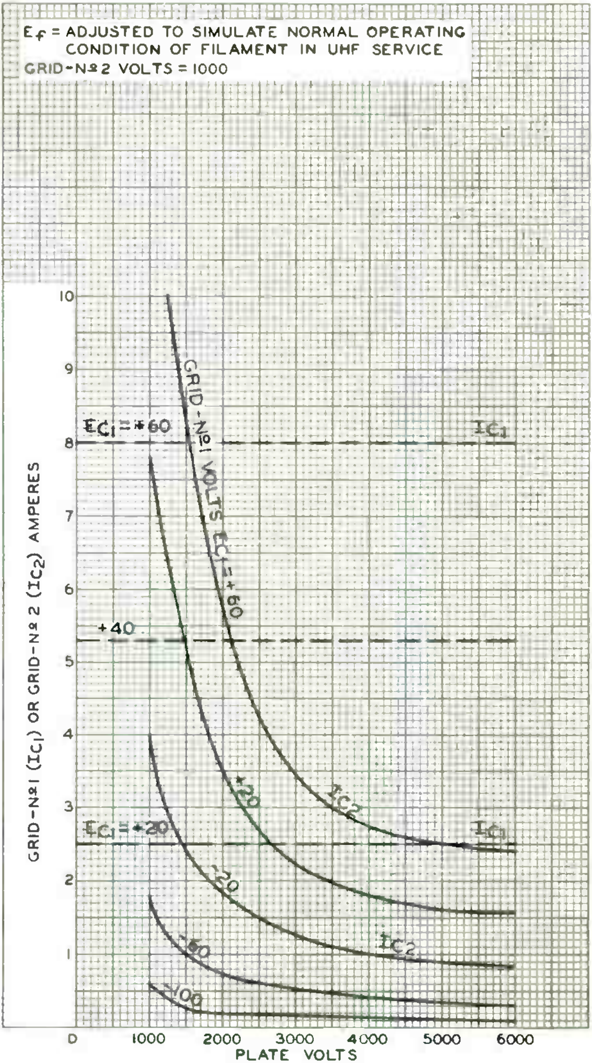
TYPICAL CHARACTERISTICS



Beam Power Tube

COAXIAL-ELECTRODE STRUCTURE
CERAMIC-METAL SEALS
UNIPOTENTIAL CATHODE

FORCED-AIR COOLED
INTEGRAL RADIATOR
180 WATTS CW INPUT UP TO 1215 Mc

For Use at Frequencies up to 2000 Mc

GENERAL DATA

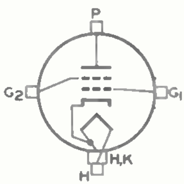
Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)[a]	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:[b]		
Grid No.1 to plate.	0.065 max.	pf
Grid No.1 to cathode & heater	14.0	pf
Plate to cathode & heater	0.015 max.	pf
Grid No.1 to grid No.2.	17.0	pf
Grid No.2 to plate.	4.4	pf
Grid No.2 to cathode & heater	0.4 max.	pf

Mechanical:

Operating Position. . . . . Any
Overall Length. . . . . 1.38" ± 0.05" ←
Greatest Diameter . . . . 1.250" ± 0.015"
Weight (Approx.). . . . . 2 oz
Radiator. . . . . Integral part of tube
Socket:
For use up to about 400 Mc:
For socket to be used with the 6816 consult manufacturers such as J-V-M Microwave Company, 9300 W. 47th St., Brookfield, Ill., E. F. Johnson Company, Waseca, Minn.; Collins Radio Co., 855 35th St. N., Cedar Rapids, Iowa, and Jettron Products, Route 10, Hanover, N.J.
For use at higher frequencies:
See *Mounting Arrangement.*
Terminal Diagram (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

← Indicates a change.

Thermal:

Plate, Grid No.2, Grid No.1, Cathode, and Heater Temperature[v]	250 max.	°C
Radiator Core Temperature[v]	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 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 the 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 terminals 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

AF POWER AMPLIFIER & MODULATOR — Class AB$_1$[c]

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

DC PLATE VOLTAGE	1000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	300 max.	volts
MAX.-SIGNAL DC PLATE CURRENT[e]	180 max.	ma
MAX.-SIGNAL PLATE INPUT[e]	180 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT[e]	4.5 max.	watts
PLATE DISSIPATION[e]	115 max.	watts

Typical CCS Operation:

Values are for 2 tubes

DC Plate Voltage	650	850	volts
DC Grid-No.2 Voltage[f]	300	300	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[g]	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:[h]

For fixed-bias operation	30000 max.	ohms
For cathode-bias operation	Not recommended	

AF POWER AMPLIFIER & MODULATOR — Class AB_2[j]

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

DC PLATE VOLTAGE	1000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	300 max.	volts
MAX.-SIGNAL DC PLATE CURRENT[e]	180 max.	ma
MAX.-SIGNAL DC GRID-No.1 (CONTROL-GRID) CURRENT[e]	30 max.	ma
MAX.-SIGNAL PLATE INPUT[e]	180 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT[e]	4.5 max.	watts
PLATE DISSIPATION[e]	115 max.	watts

Typical CCS Operation:

Values are for 2 tubes

DC Plate Voltage	650	850	volts
DC Grid-No.2 Voltage[f]	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.)[k]	0.3	0.3	watt
Max.-Signal Power Output (Approx.)	85	140	watts

LINEAR RF POWER AMPLIFIER

Single-Sideband Suppressed-Carrier Service

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

	Up to 1215 Mc	
DC PLATE VOLTAGE	1000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	300 max.	volts
MAX.-SIGNAL DC PLATE CURRENT	180 max.	ma
MAX.-SIGNAL DC GRID-No.1 (CONTROL-GRID) CURRENT	30 max.	ma
MAX.-SIGNAL PLATE INPUT	180 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT	4.5 max.	watts
PLATE DISSIPATION	115 max.	watts

Typical CCS Class AB_1 "Single-Tone" Operation:[m]

	Up to 60 Mc		
DC Plate Voltage	650	850	volts
DC Grid-No.2 Voltage[f]	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	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[d] Ratings, *Absolute-Maximum Values:*

	Up to 1215 Mc	
DC PLATE VOLTAGE	800 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	300 max.	volts
DC GRID-No.1 (CONTROL-GRID) 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	3 max.	watts
PLATE DISSIPATION	75 max.	watts

Typical CCS Operation:

	At 400 Mc		
DC Plate Voltage	400	700	volts
DC Grid-No.2 Voltage[n]	200	250	volts
DC Grid-No.1 Voltage[p]	-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.)[q]	2	3	watts
Useful Power Output (Approx.)	16	45	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under any condition	30000[r] max.	ohms

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

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

	Up to 1215 Mc	
DC PLATE VOLTAGE	1000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	300 max.	volts
DC GRID-No.1 (CONTROL-GRID) 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	4.5 max.	watts
PLATE DISSIPATION	115 max.	watts

Typical CCS Operation:

	At 400 Mc		At 1215 Mc	
DC Plate Voltage	400	900	900	volts
DC Grid-No.2 Voltage[t]	200	300	300	volts
DC Grid-No.1 Voltage[u]	-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.)[q]	3	3	5	watts
Useful Power Output (Approx.)	23	80	40	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance
under any condition . . . . 30000[r] max. ohms

[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] Measured with special shield adapter.

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

[d] Continuous Commercial Service.

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

[f] Preferably obtained from a fixed supply.

[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 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.

[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. 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.

[m] "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.

[n] Obtained preferably from a separate source modulated along with the plate supply.

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

[q] 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.

[r] If this value is insufficient to provide adequate bias, the additional required bias must be supplied by a cathode resistor or fixed supply.

[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% of the carrier conditions.

[t] Obtained preferably from a fixed supply, or from the plate-supply voltage with a voltage divider.

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

[v] See *Dimensional Outline* for temperature measurement points.

CHARACTERISTICS RANGE VALUES

	Note	Min.	Max.	
Heater Current	1	1.84	2.26	amp
Direct Interelectrode Capacitances:				
Grid No.1 to plate	2	-	0.065	pf
Grid No.1 to cathode & heater	2	11.8	15.2	pf
Plate to cathode & heater	2	-	0.015	pf
→ Grid No.1 to grid No.2	2	15.9	19.2	pf
Grid No.2 to plate	2	4.0	5.0	pf
Grid No.2 to cathode & heater	2	-	0.40	pf
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	1,6	-	400	peak volts
Interelectrode Leakage Resistance	7	1.0	-	megohm
Useful Power Output	8	80	-	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 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.

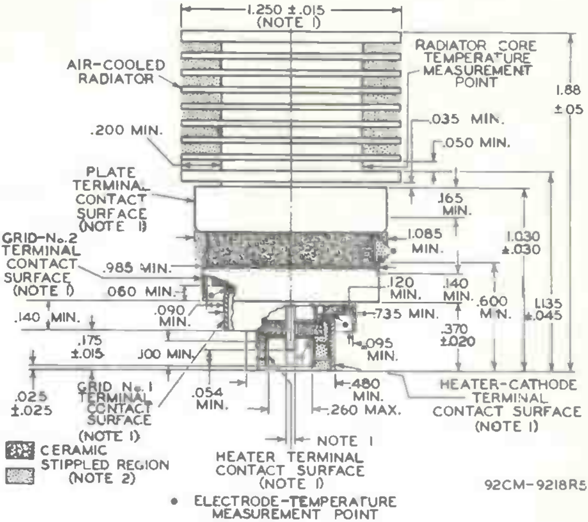
Note 5: With plate and grid-No.2 floating and dc grid No.1 voltage of +2 volts.

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 1000 volts, dc grid-No.2 voltage of 300 volts, grid-No.1 resistor adjustable between 0 and 10000 ohms, dc plate current of 180 ma. maximum, dc grid-No.1 current of 30 ma. maximum, and driver power output of 3 watts.

→ Indicates a change.

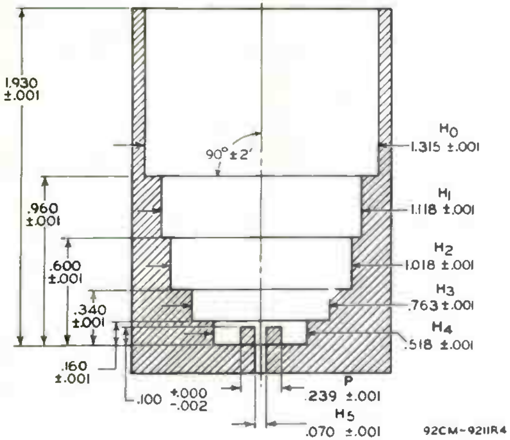


DIMENSIONS IN INCHES

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 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.

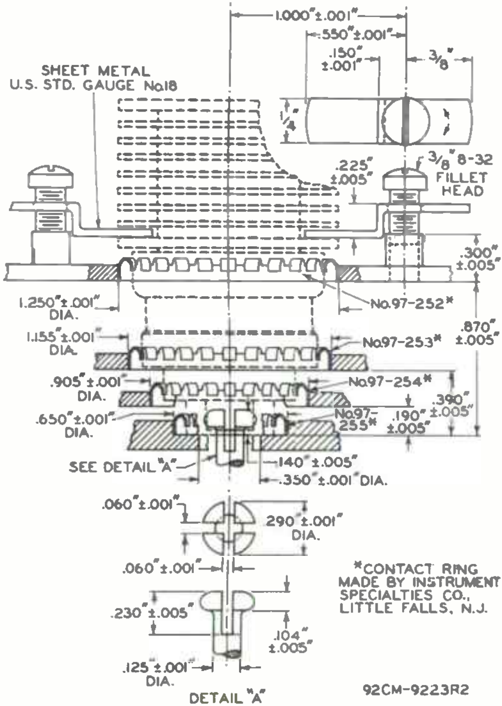
SKETCH G_1



DIMENSIONS IN INCHES

THE AXES OF THE CYLINDRICAL HOLES H_0 THROUGH H_5 AND THE AXIS OF POST P ARE COINCIDENT WITHIN 0.001".

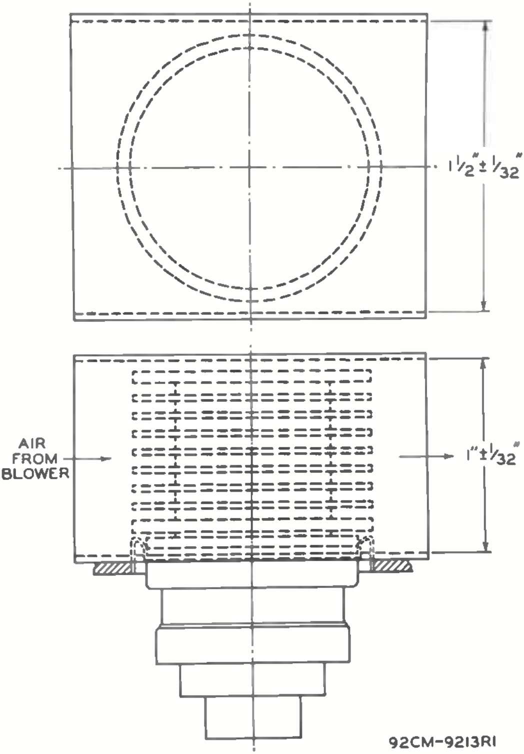
SUGGESTED MOUNTING ARRANGEMENT & LAYOUT OF ASSOCIATED CONTACTS



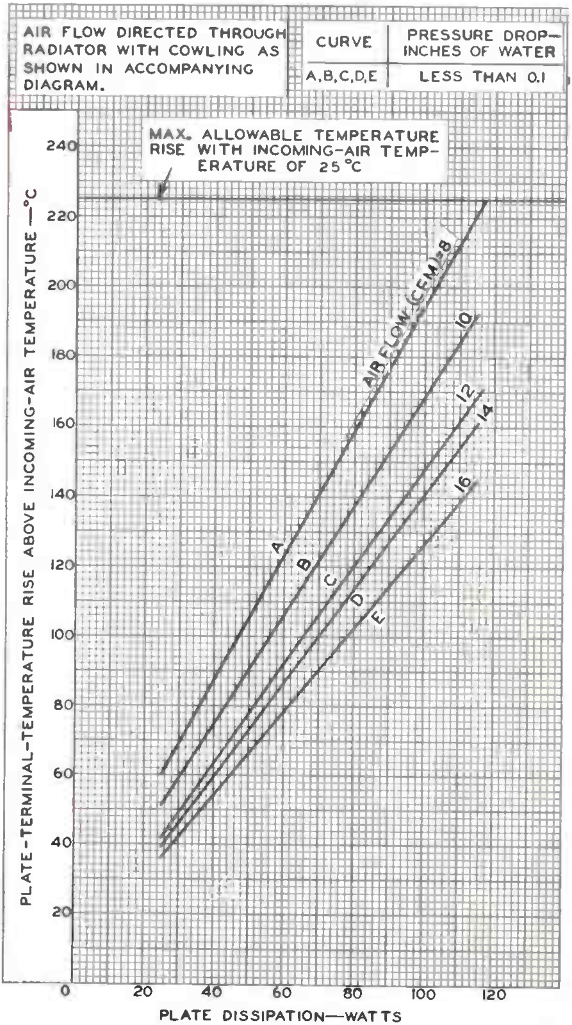
*CONTACT RING MADE BY INSTRUMENT SPECIALTIES CO., LITTLE FALLS, N.J.

92CM-9223R2

RECOMMENDED COWLING
FOR DIRECTING AIR FLOW THROUGH RADIATOR

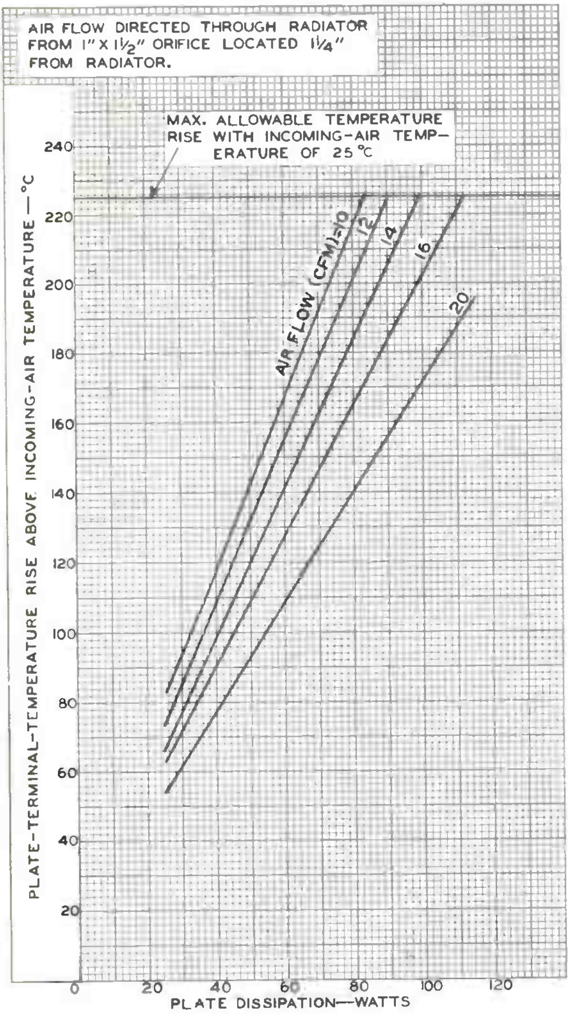


TYPICAL COOLING REQUIREMENTS
With Cowling



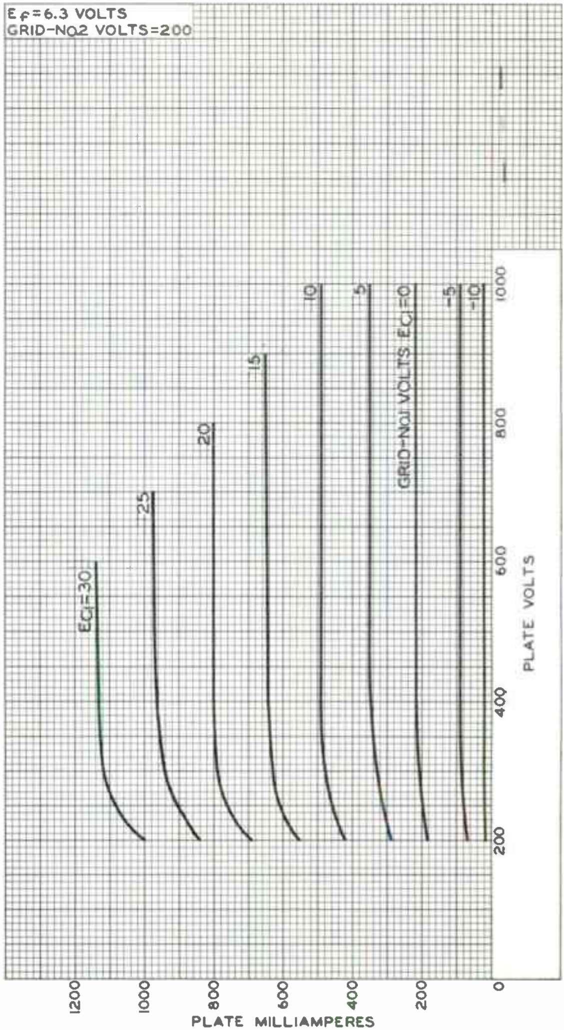
92CM-9219R1

TYPICAL COOLING REQUIREMENTS
Without Cowling



92CM-9220R1

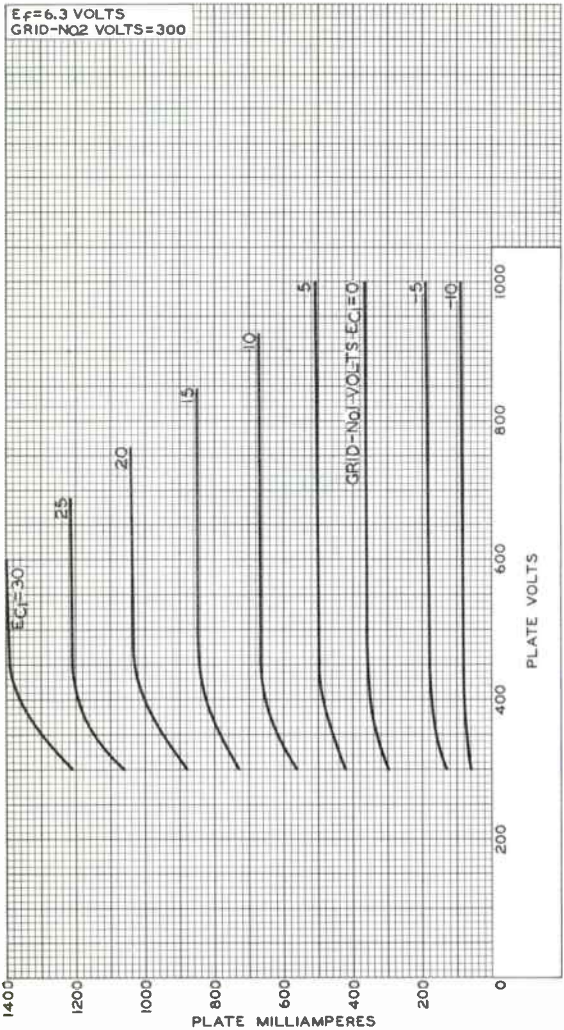
TYPICAL PLATE CHARACTERISTICS



92CM-9228R2

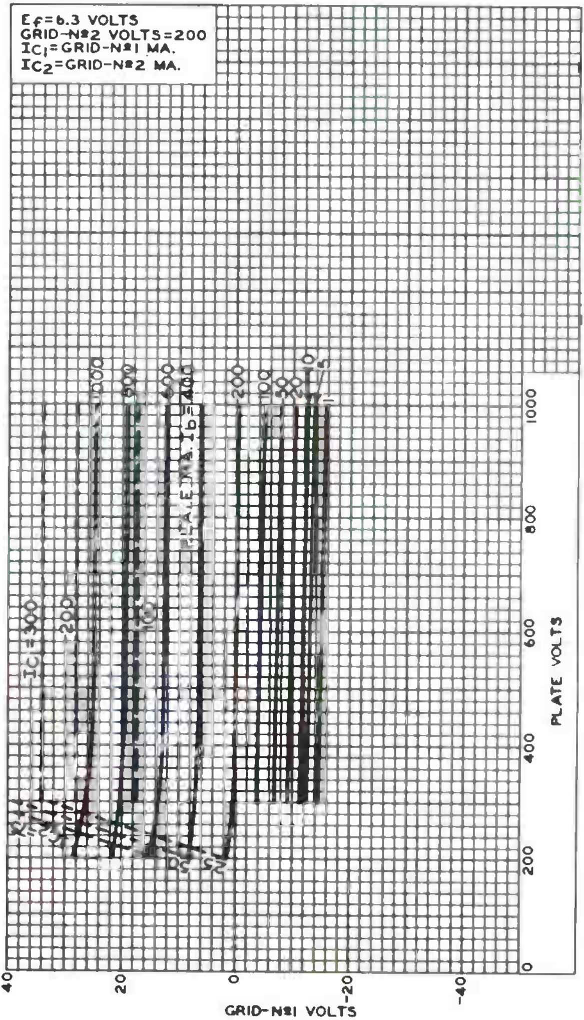
6816

TYPICAL PLATE CHARACTERISTICS



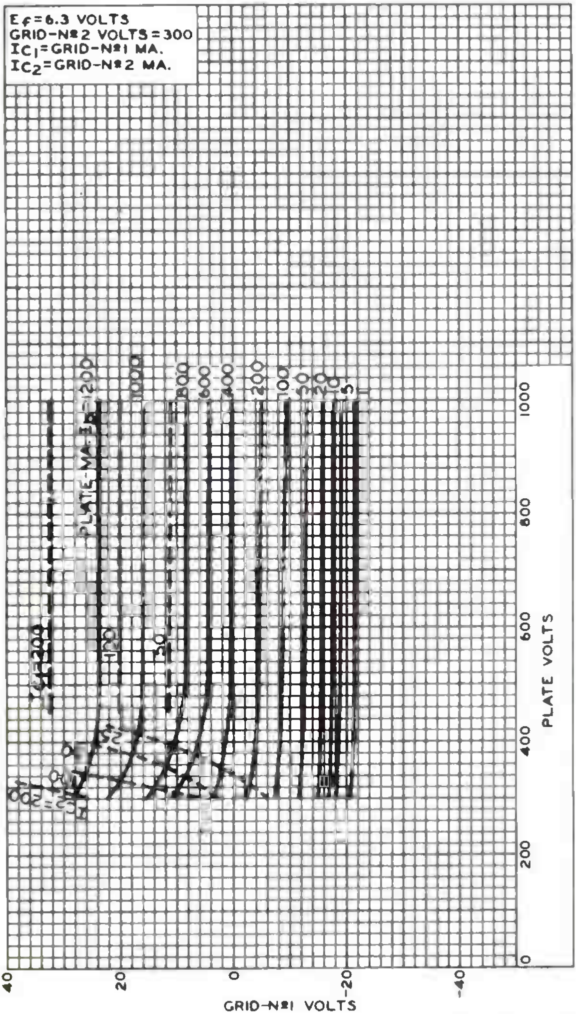
92CM-9222R1

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



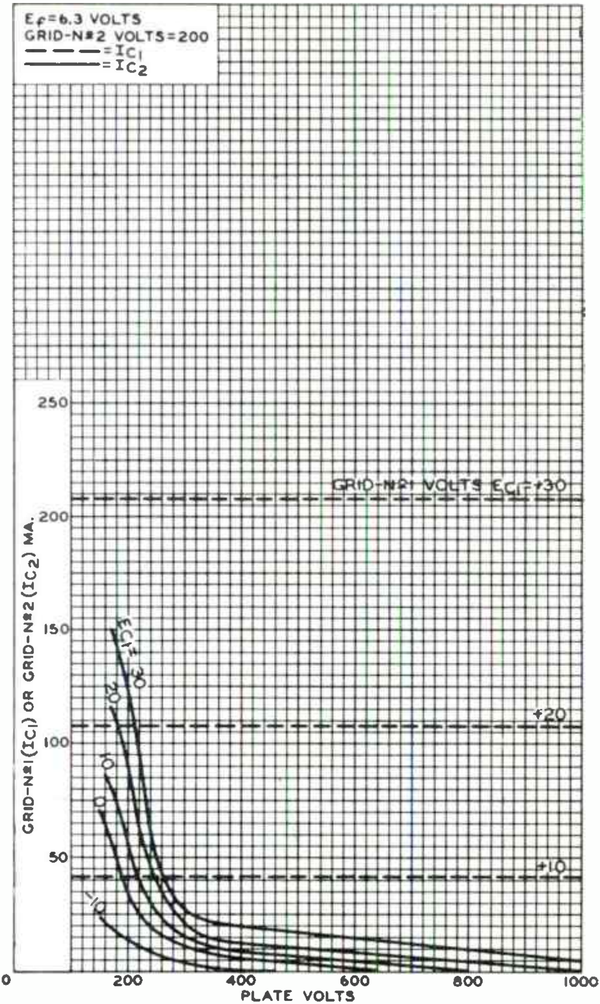
92CM-9233R1

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



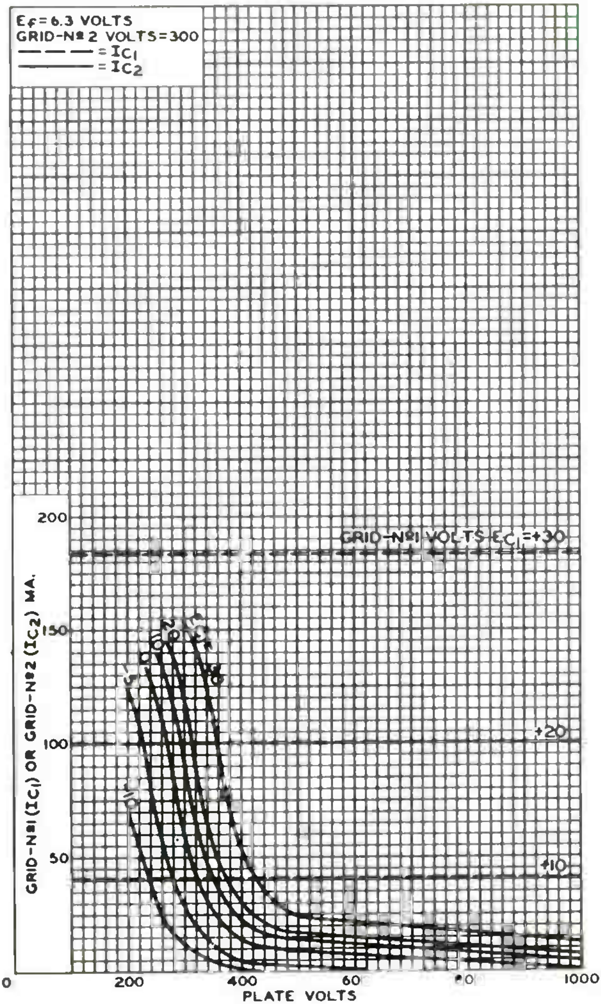
92CM-9232R1

TYPICAL CHARACTERISTICS



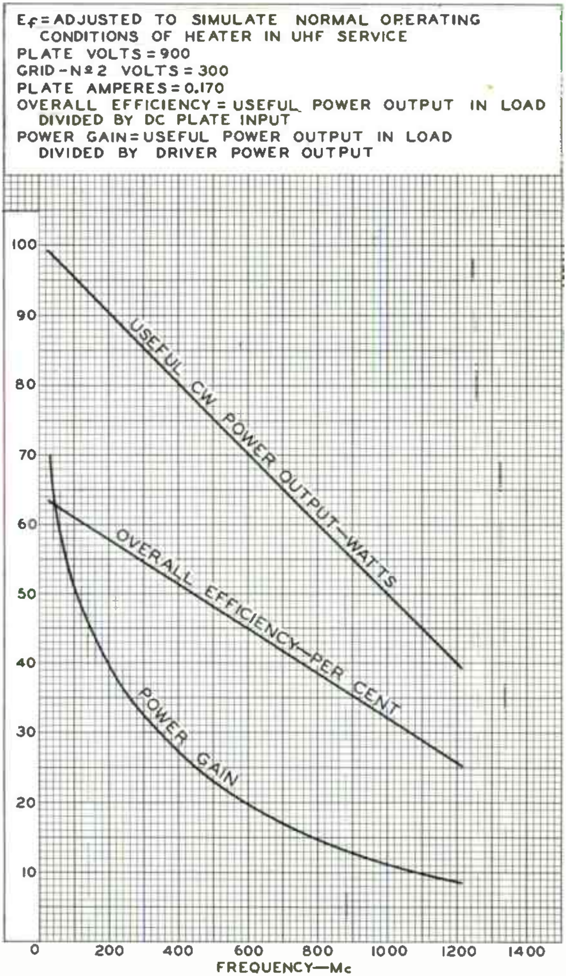
92CM-9224R1

TYPICAL CHARACTERISTICS



92CM-9225R2

TYPICAL PERFORMANCE CHARACTERISTICS In Class C Telegraphy or Class C FM Telephony Amplifier Service



92CM-9221

RCA

6850

TWIN BEAM POWER TUBE

Useful at frequencies up to 470 Mc

The 6850 is the same as the 6524 except for the following items:

Heater, for Unipotential Cathode:
- Voltage. . . . . 12.6 ± 10% . . . ac or dc volts
- Current. . . . . 0.625 . . . . amp

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Heater Current	1	0.588	0.663	amp

Note 1: With 12.6 volts ac on heater.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

6861

TRAVELING-WAVE TUBE

LOW-NOISE AMPLIFIER TYPE

Useful over frequency range of 2700 to 3500 Mc

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:

Voltage	5	ac or dc volts
Current at 5 volts	0.65	amp

Starting current: The maximum instantaneous starting current must never exceed 4 amperes, even momentarily.

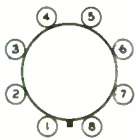
Minimum Cathode Heating Time	1	minute
Frequency Range	2700 to 3500	Mc
Cold Insertion Loss	80	db

Mechanical:

Operating Position	Any
Cooling	Natural
Maximum Overall Length	19-3/8"
Metal-Shell Diameter	1.375" ± 0.005"
Weight (Approx.)	1-1/2 lbs
Collector-Terminal Connector	Birnbach No.403 Banana Jack
RF Connectors:	
Input terminal	Type N UG-18B/U Plug
Output terminal	Type N UG-18B/U Plug
Base	Octal 8-Pin

BOTTOM VIEW

Pin 1 - Grid No.1
Pin 2 - No Connection
Pin 3 - Helix
Pin 4 - Grid No.4



Pin 5 - Grid No.3
Pin 6 - Grid No.2
Pin 7 - Heater
Pin 8 - Heater, Cathode

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

DC COLLECTOR VOLTAGE	500 max.	volts
DC HELIX VOLTAGE	500 max.	volts
DC GRID-No.4 VOLTAGE	500 max.	volts
DC GRID-No.3 VOLTAGE	300 max.	volts
DC GRID-No.2 VOLTAGE	75 max.	volts
DC GRID-No.1 VOLTAGE	20 max.	volts
DC COLLECTOR CURRENT	500 max.	μa
DC HELIX CURRENT	5 max.▲	μa
MAGNETIC FIELD STRENGTH	400 min.●	gausses
PEAK RF POWER INPUT	100 max.	watts
AVERAGE RF POWER INPUT	0.4 max.	watt
METAL-SHELL TEMPERATURE (At hottest point)	175 max.	°C

▲ During alignment of the tube in the magnetic-focusing field, the helix current may exceed this value for short periods, but should never exceed 25 μa.

●: See next page.

← Indicates a change.

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

6861

6861

TRAVELING-WAVE TUBE

Typical Operation at 3100 Mc:

DC Collector Voltage	400	volts
DC Helix Voltage	375	volts
DC Grid-No.4 Voltage	200	volts
DC Grid-No.3 Voltage	40	volts
DC Grid-No.2 Voltage (Approx.)	20	volts
DC Grid-No.1 Voltage	0	volts
DC Collector Current	150	μa
DC Helix Current	0.5	μa
DC Grid-No.4 Current, DC Grid-No.3 Current, DC Grid-No.2 Current, DC Grid-No.1 Current	each less than 1	μa
Magnetic-Field Strength†	525 ± 5%	gausses
Gain (Low level)	25	db
Power Output (Saturated)	1	mw
Noise Figure	6.5	db

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Heater Current	1	0.45	0.85	amp
Input VSWR (Non-operating)	2	-	1.7	
Output VSWR (Non-operating)	2	-	2	
DC Helix Voltage	3	350	390	volts
→ DC Grid-No.4 Voltage	3	160	275	volts
→ DC Grid-No.3 Voltage	3	20	50	volts
Saturated Power Output	3	0.25	-	mw
Gain	3	20	-	db
Noise Figure	3	-	7	db

Note 1: With heater voltage of 5 volts.

Note 2: Measured at specified connector over the frequency range of 2700 to 3500 Mc.

Note 3: Adjusted for optimum noise figure with a magnetic field of 525 gausses, signal frequency of 3100 Mc, and heater voltage of 5 volts.

OPERATING CONSIDERATIONS

The *magnetic field* required for focusing the electron beam of the 6861 may be obtained from a solenoid or permanent magnet capable of providing a uniform field of 525 gausses over the length of the tube axis starting 2 inches from the groove near the base end of the metal shell and continuing for at least 9 inches along the tube axis.

• This value of field strength will focus the electron beam, but noise figure will not be optimum.

† For RCA Solenoid Type MW-4900.

→Indicates a change.

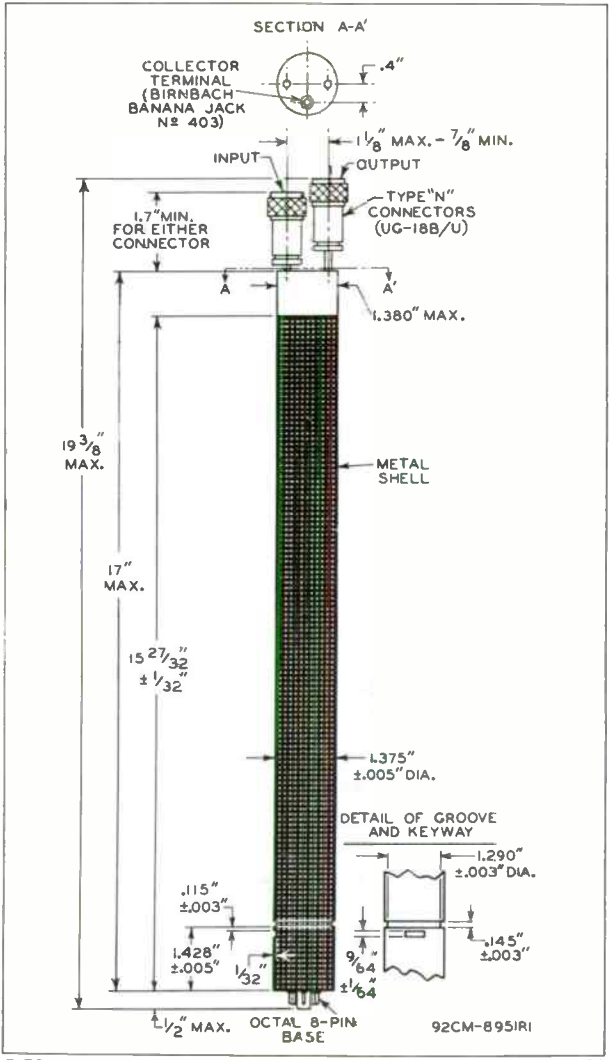
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

6861

6861

TRAVELING-WAVE TUBE

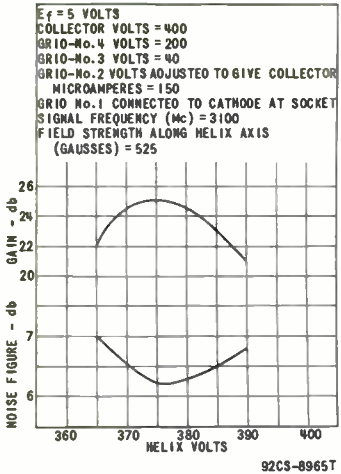


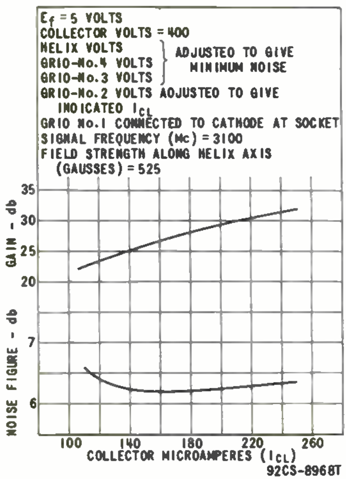
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6861

6861

NOISE-FIGURE CHARACTERISTICS





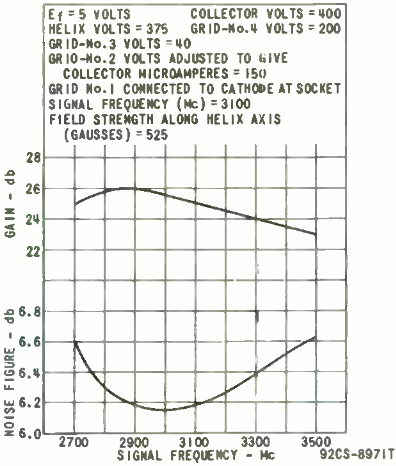
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

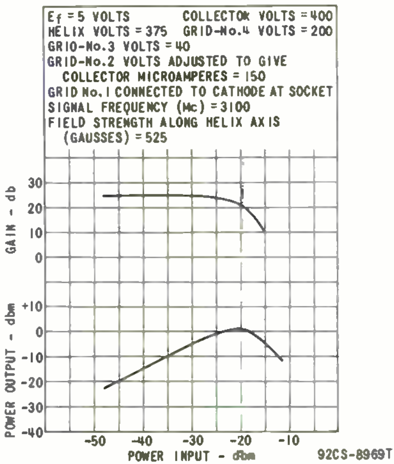
6861

TRAVELING-WAVE TUBE

NOISE-FIGURE CHARACTERISTICS



SATURATION CHARACTERISTICS

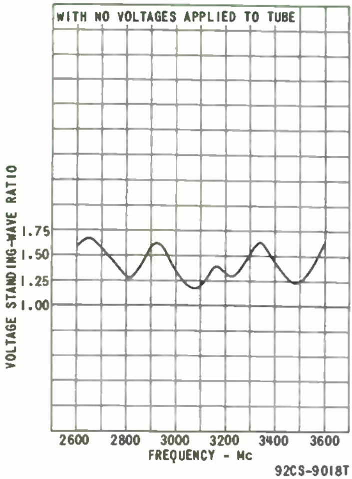


TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

6861

INPUT-MATCHING CHARACTERISTIC



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

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.

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

6865-A

6865-A
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.

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

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:

$$P_i \text{ up to 450 watts:} \quad E_f = 13.75\left(1 - \frac{P_i}{450}\right) \text{ volts}$$

$$P_i \text{ greater than 450 watts:} \quad E_f = 0 \text{ volts}$$

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.

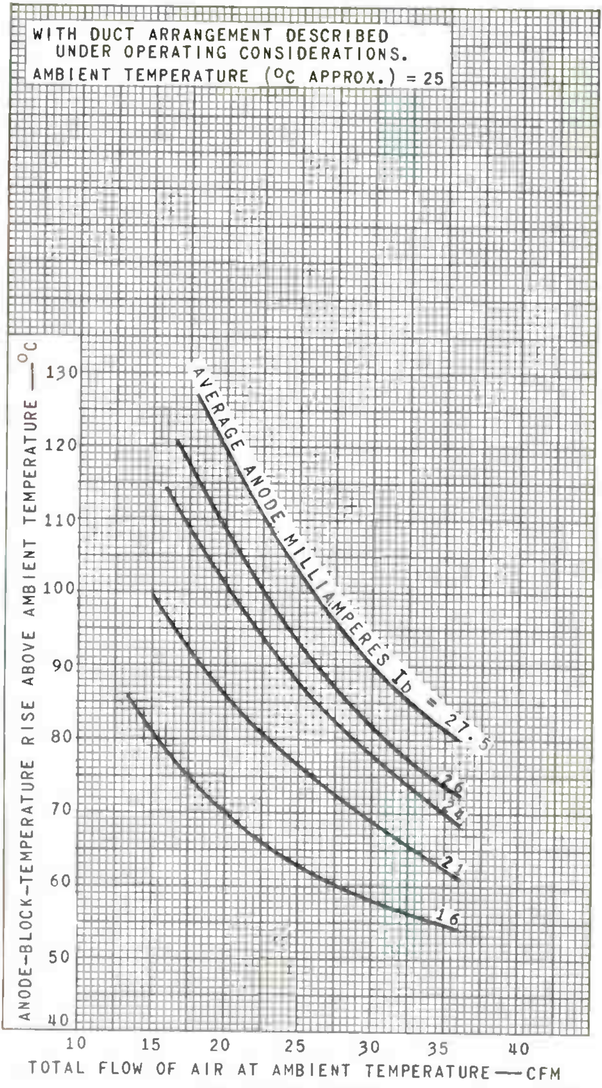
Tuning is accomplished by turning the tuning knob until the setting of the micrometer-type indicator is reached which corresponds to the desired frequency, as determined from the calibration chart prepared for and affixed to each tube. Then lock the tuning knob by tightening the locking nut. For precise 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.

RCA

6865-A

TYPICAL COOLING REQUIREMENTS



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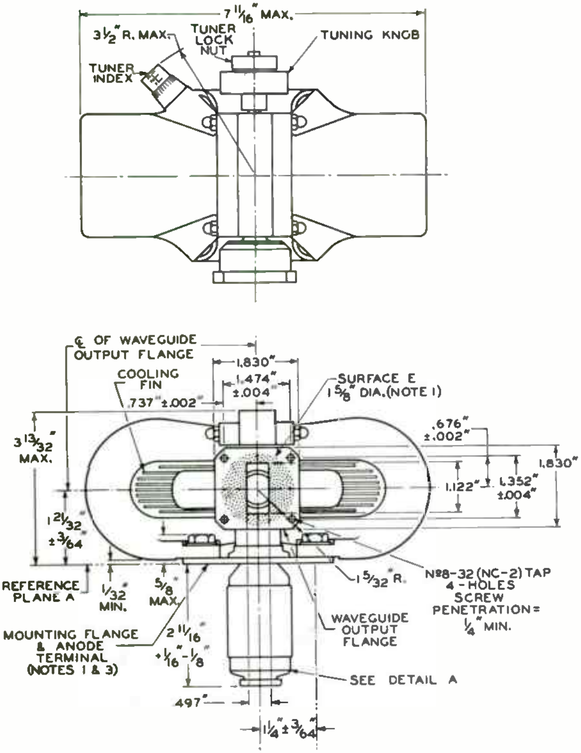

RCA

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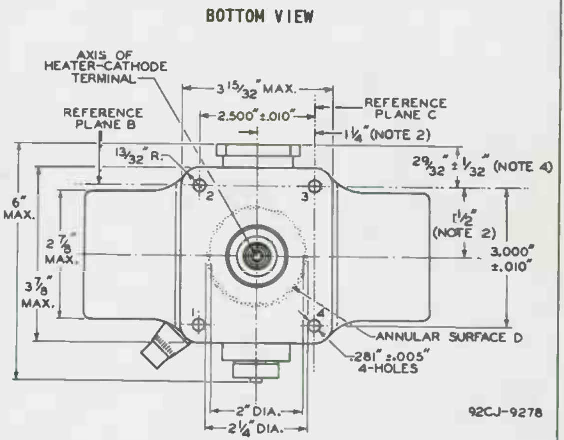
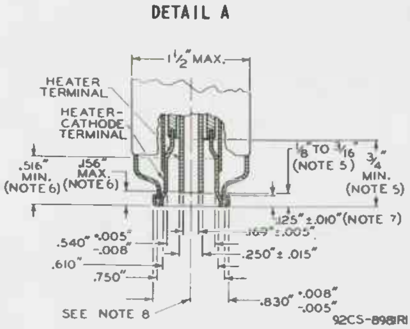
MAGNETRON





RCA

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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.

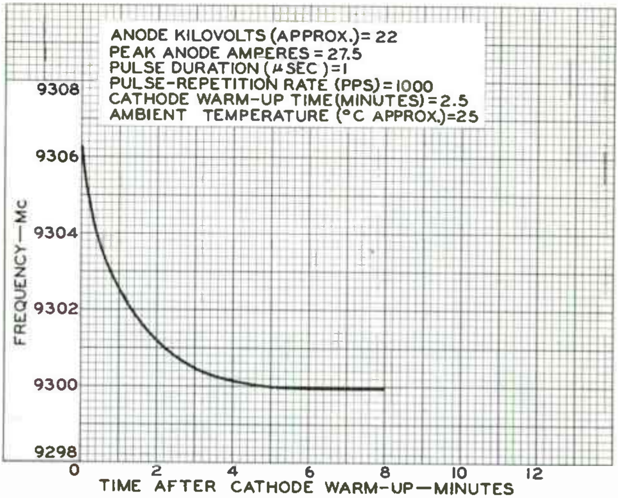
NOTE 7: NO PART OF THE CONNECTOR DEVICE FOR THE HEATER AND HEATER-CATHODE TERMINALS SHOULD BEAR AGAINST THE UNDER-SIDE OF THIS LIP.

NOTE 8: THE HEATER TERMINAL AND THE HEATER-CATHODE TERMINAL ARE CONCENTRIC WITHIN 0.010".

6865-A

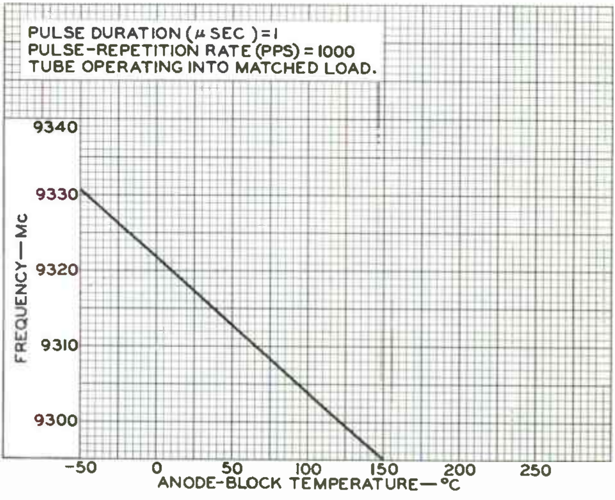
6865-A

TYPICAL STABILIZATION CHARACTERISTIC



92CS-8941R1

TYPICAL THERMAL-FACTOR CHARACTERISTIC



92CS-9285R1

6865-A

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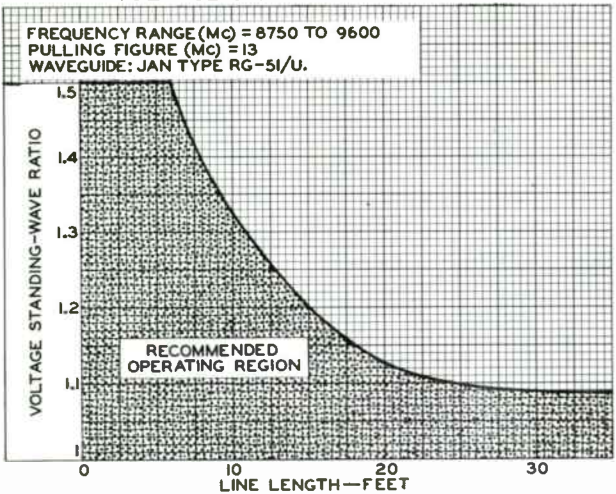
6865-A

EFFECT OF LENGTH OF TRANSMISSION LINE BETWEEN OUTPUT FLANGE AND LOAD ON ALLOWABLE VOLTAGE STANDING-WAVE RATIO



92CS-8944R1

TYPICAL PERFORMANCE CURVES

92CS-9286R1

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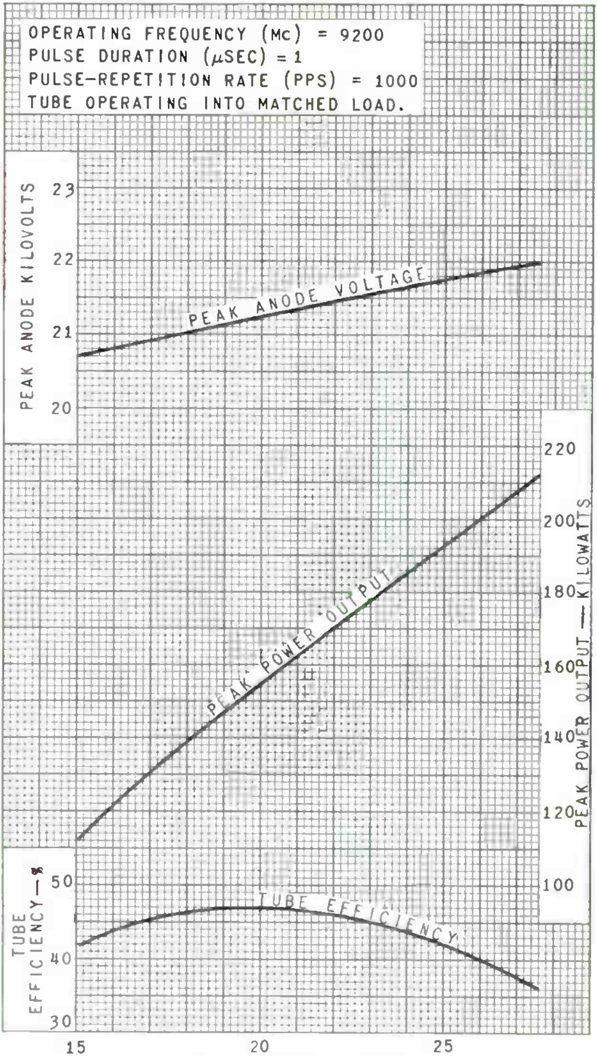
TYPICAL PERFORMANCE CURVES



92CS-8945R1

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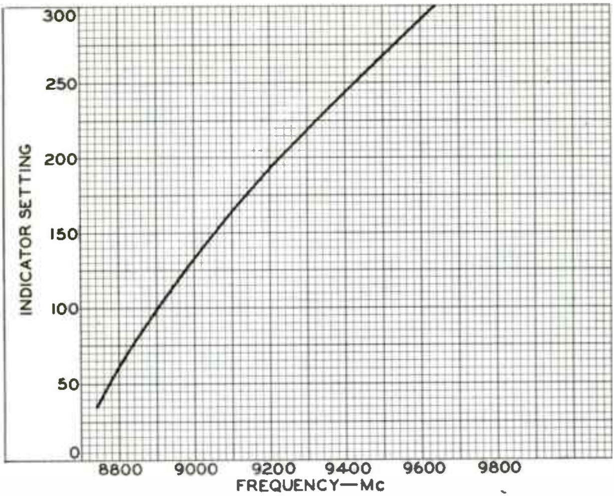
6865-A

REPRESENTATIVE TUNING CHARACTERISTIC



92CS-8943

Beam Power Tube

HIGH POWER SENSITIVITY
RCA "DARK HEATER" WITH 12- TO 15-VOLT RANGE

85 WATTS CW INPUT (ICAS) UP TO 60 Mc
CONTROLLED ZERO-BIAS PLATE CURRENT

50 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 6883B/8032A/8552 is Unilaterally Interchangeable with types 6883, 6883A, and 8032.

The 6883B/8032A/8552 is the same as the 6146B/8298A except for the following items:

Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	12.6	volts
Current at heater volts = 12.6	0.562	amp
Minimum heating time	60	sec
Direct Interelectrode Capacitances:[a]		
Grid No.1 to plate	0.24 max.	pf

[a] With no external shield.

CHARACTERISTICS RANGE VALUES

Test No.		*Note*	*Min.*	*Max.*	
1	Direct Interelectrode Capacitances: Grid No.1 to plate	1	–	0.24	pf

Note 1: With no external shield.

SPECIAL PERFORMANCE DATA

Stationary Equipment Operation:

	Min.	*Design Center*	*Max.*	
Heater, for Unipotential Cathode:				
Voltage (AC or DC)[v]	–	12.6	–	volts
Current at 12.6 volts	0.525	–	0.600	amp ←
Useful Power Output[w]	59	–	–	watts

[v] It is recommended that the design-center heater voltage be 12.6 volts; the heater power supply should not fluctuate more than 10% to insure long life.

[w] In a single-tube, self-excited oscillator circuit, and with ac heater voltage of 12.6 volts, dc plate voltage of 600 volts, dc grid-No.2 voltage of 200 volts, grid-No.1 resistor of 24,000 ± 10% ohms, dc plate current of 150 max. ma., dc grid-No.1 current of 2.5 to 3 ma., and frequency of 15 Mc.

← Indicates a change.

Mobile Equipment Operation:

	Min.	Design Range	Max.	
Heater, for Unipotential Cathode:				
Voltage (AC or DC)[x]	–	12-15	–	Volts
→ Current at 13.5 volts	0.550	–	0.620	amp
Useful Power Output I[y]	59	–	–	watts
Useful Power Output II		See *Note Z*		

[x] It is recommended that the heater voltage operate within the range of 12.0 to 15.0 volts and within excursions from 10 to 15 volts in battery operation. See *Useful Power Output Test II* and *Overvoltage Tests.*

[y] In a single-tube, self-excited oscillator circuit, and with ac heater voltage of 12.6 volts, dc plate voltage of 600 volts, dc grid-No.2 voltage of 200 volts, grid-No.1 resistor of 24,000 ± 10% ohms, dc plate current of 150 max. ma., dc grid-No.1 current of 2.5 to 3 ma., and frequency of 15 Mc.

[z] With conditions in note (y) above, reduce heater voltage to 10 volts. Useful power output will be at least 90% of the power output at heater voltage of 12.6 volts.

Overvoltage Heater Life Tests:

Continuous heater life tests are performed periodically on sample lots of tubes with 16 volts on the heater, all other electrodes "floating". Intermittent heater life tests are performed periodically on sample lots of tubes with 22 volts on the heater, a cycle of 1 minute "ON" and 4 minutes "OFF". After 1000 hours of the continuous heater life test and after 48 hours of the intermittent heater life test, the following tests are performed:

With heater voltage of 13.5 volts and ± 100 dc volts between cathode and heater, the heater-cathode leakage current will not exceed 100 microamperes.

With ac or dc heater voltage of 13.5 volts, grid-No.1 volts = -200 and cathode, grid No.2, and plate grounded, the minimum grid-No.1 leakage resistance will be 10 megohms.

With ac or dc heater voltage of 13.5 volts, plate volts = -200, and cathode grid No.1 and grid No.2 grounded, the minimum plate leakage will be 10 megohms.

→ Indicates a change.

Beam Power Tube

COAXIAL-ELECTRODE STRUCTURE
CERAMIC-METAL SEALS
UNIPOTENTIAL CATHODE

FORCED-AIR COOLED
INTEGRAL RADIATOR
180 WATTS CW INPUT UP TO 1215 Mc

For Use at Frequencies up to 2000 Mc

The 6884 is the same as the 6816 except for the following items:

Heater, for Unipotential Cathode:

Voltage (AC or DC)[a]	26.5 ± 10%	volts
Current at heater volts = 26.5	0.52	amp

[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.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Heater Current.	1	0.45	0.57	amp
Useful Power Output	8	80	–	watts

Note 1: With 26.5 volts ac or dc on heater.

Note 8: In a single-tube, grid-driven coaxial-cavity class C amplifier circuit at 400 Mc and for conditions with 24.0 volts ac or dc on heater, dc plate voltage of 1000 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.

← Indicates a change.

6894

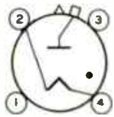
HALF-WAVE MERCURY-VAPOR RECTIFIER

The 5894 is the same as the 6895 except for the following items:

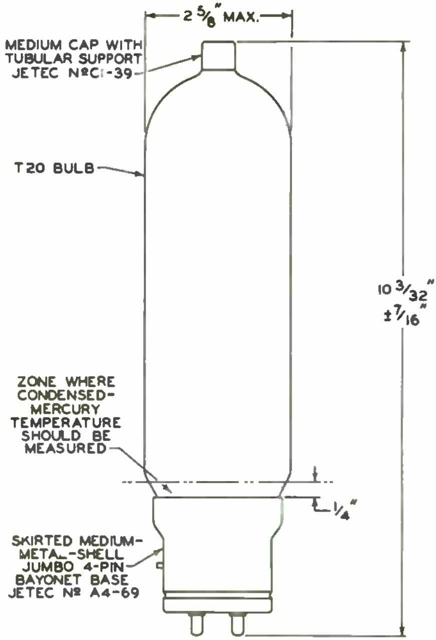
Mechanical:

Overall Length. . . . . 10-3/32" ± 7/16"
Socket. . . . . Johnson No.123-211, or equivalent
Base. . . . . .Skirted Medium-Metal-Shell Jumbo 4-Pin with Bayonet (JETEC No.A4-69)
Basing Designation for BOTTOM VIEW. 4AT

Pin 1 - No Connection
Pin 2 - Filament, Cathode Shield



Pin 3 - No Connection
Pin 4 - Filament
Cap - Anode



92CM-9229

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6895

HALF-WAVE MERCURY-VAPOR RECTIFIER

GENERAL DATA

Electrical:

Filament, Coated:
- Voltage . . . . 5 . . . . ac volts
- Current at 5 volts . . . . 10 . . . . .amp
- Minimum heating time at ratec voltage . . . . 30 . . . . .sec

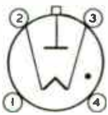
Peak Tube Voltage Drop . . . *See Characteristics Range Values*

Mechanical:

Mounting 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 with Tubular Support (JETEC No.C1-39)
Cap Connector. . . . . Millen No.36011, or equivalent
Socket . . . . .Johnson No.123-206, or equivalent
Base . . . . .Large-Shell Super-Jumbo 4-Pin with Bayonet (JETEC No.A4-88), or Large-Metal-Shell Super-Jumbo 4-Pin with Bayonet (JETEC No.A4-18)

Basing Designation for BOTTOM VIEW 2P

Pin 1 - No Connection
Pin 2 - Filament, Cathode Shield



Pin 3 - Filament
Pin 4 - No 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* . . . . 13 °C
- Full load▲ . . . . 18.5 °C

* With 4.75 volts rms on filament, and no heat-conserving enclosure.

▲ With 5.25 volts rms on filament, quadrature operation, average cathode amperes = 2.5, and no heat-conserving enclosure.

TUBE DIVISION
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6895

HALF-WAVE MERCURY-VAPOR RECTIFIER

HALF-WAVE RECTIFIER — In-Phase Operation●

Maximum Ratings, *Absolute 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★ . . .	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■

Maximum Ratings, *Absolute 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★ . . .	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

CHARACTERISTICS RANGE VALUES# FOR EQUIPMENT OESIGN

	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.

● Filament voltage in phase with anode voltage.

★ Averaged over any period of 20 seconds maximum.

■ Filament voltage out of phase (60° to 120°) with anode voltage.

Throughout tube life.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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HALF-WAVE MERCURY-VAPOR RECTIFIER

For Circuit Figures, see Front of this Section

<table>
<tr><th rowspan="2">CIRCUIT</th><th rowspan="2">MAX. TRANS. SEC. VOLTS (RMS)
E</th><th rowspan="2">APPROX. DC OUTPUT VOLTS TO FILTER
E_{av}</th><th colspan="2">MAX. DC OUTPUT AMPERES
I_{av}</th><th colspan="2">MAX. DC OUTPUT KW TO FILTER
P_{dc}</th></tr>
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<tr><td>Fig. 1
Half-Wave
Single-Phase
In-Phase Operation</td><td>14000□
10600▲
7000*</td><td>6300
4700
3200</td><td colspan="2">1.8
1.8
1.8</td><td colspan="2">11.5
8.5
5.5</td></tr>
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Full-Wave
Single-Phase
In-Phase Operation</td><td>7000□
5300▲
3500*</td><td>6300
4700
3200</td><td colspan="2">3.6
3.6
3.6</td><td colspan="2">23
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11</td></tr>
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Series
Single-Phase
In-Phase Operation</td><td>14000□
10600▲
7000*</td><td>12700
9500
6300</td><td colspan="2">3.6
3.6
3.6</td><td colspan="2">46
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22</td></tr>
<tr><td>Fig. 4
Half-Wave
Three-Phase
In-Phase Operation</td><td>8100□
6100▲
4000*</td><td>9500
7100
4700</td><td colspan="2">5.4
5.4
5.4</td><td colspan="2">51
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25</td></tr>
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Parallel
Three-Phase
Quadrature Operation</td><td>8100□
6100▲
4000*</td><td>9500
7100
4700</td><td colspan="2">15.0
15.0
15.0</td><td colspan="2">143
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Series
Three-Phase
Quadrature Operation</td><td>8100□
6100▲
4000*</td><td>19000
14200
9500</td><td colspan="2">7.5
7.5
7.5</td><td colspan="2">143
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Half-Wave
Four-Phase
Quadrature Operation</td><td rowspan="2">7000□
5300▲
3500*</td><td rowspan="2">9000
6700
4500</td><td>Resistive Load</td><td>Inductive Load</td><td>Resistive Load</td><td>Inductive Load</td></tr>
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45</td><td>90
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Half-Wave
Six-Phase
Quadrature Operation</td><td rowspan="2">7000□
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3500*</td><td rowspan="2">9500
7100
4700</td><td>Resistive Load</td><td>Inductive Load</td><td>Resistive Load</td><td>Inductive Load</td></tr>
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11
11</td><td>11.5
11.5
11.5</td><td>105
78
52</td><td>110
81
55</td></tr>
</table>

□ For maximum peak inverse anode voltage of 20000 volts, and condensed-mercury-temperature range of 20 to 50 °C.

▲ For maximum peak inverse anode voltage of 15000 volts, and condensed-mercury-temperature range of 20 to 55 °C.

* For maximum peak inverse anode voltage of 10000 volts, and condensed-mercury-temperature range of 20 to 60 °C.

TUBE DIVISION
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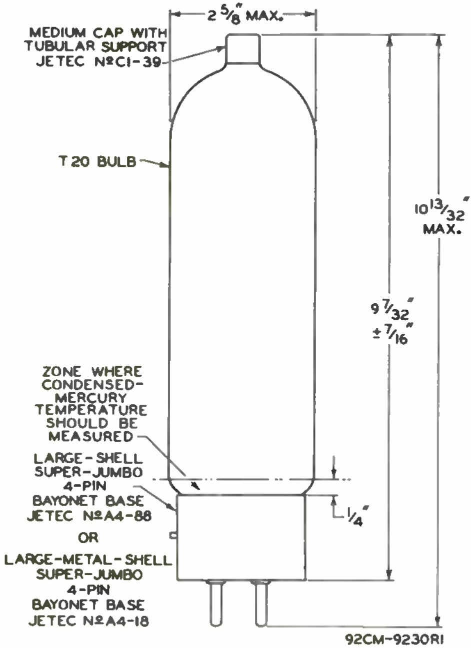
6895

HALF-WAVE MERCURY-VAPOR RECTIFIER

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.



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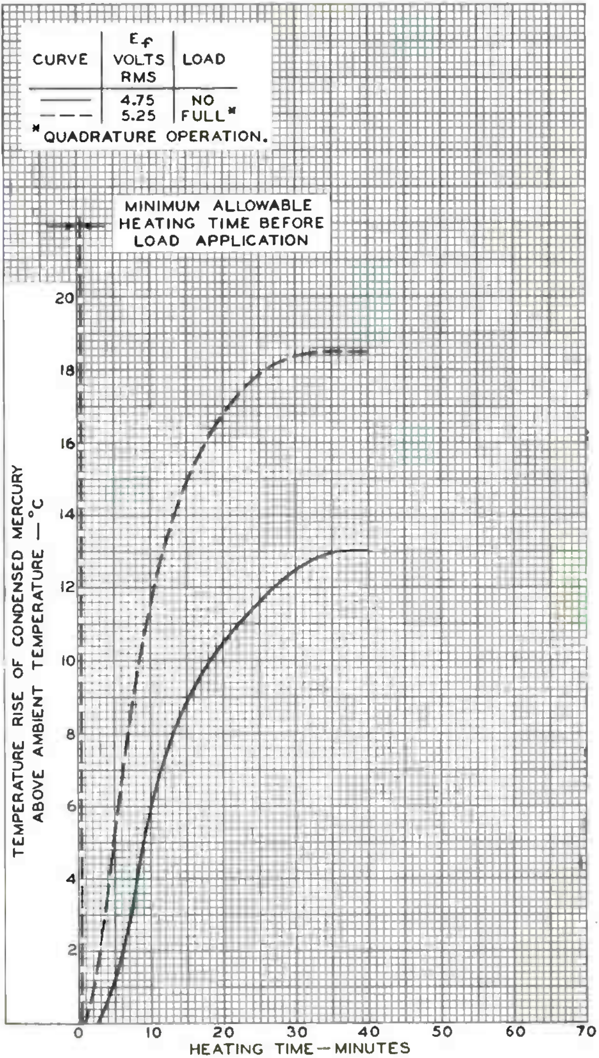
6895

RATE OF RISE OF COND.-MERCURY TEMPERATURE



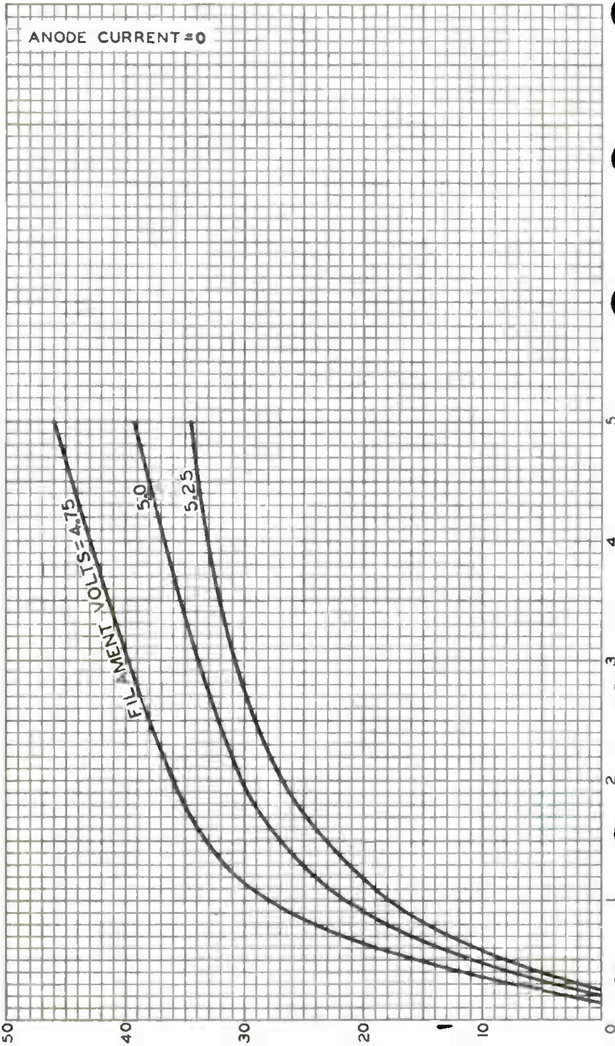
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9217

RCA

6895

FILAMENT REHEATING TIME REQUIRED
AFTER POWER-SUPPLY INTERRUPTION



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8300

6949

RCA 6949

SUPER-POWER SHIELDED-GRID BEAM TRIODE

COAXIAL-ELECTRODE STRUCTURE — WATER-COOLED ELECTRODES
500-KW CW POWER OUTPUT — INTEGRAL WATER DUCTS

Useful with full input up to 75 Mc

GENERAL DATA

Electrical:

Filament, Multistrand Thoriated Tungsten:

Voltage (Single-phase AC or DC)	7.3 min. / 7.8 max.	volts / volts
Current at 7.3 volts.	1040	amp
Current at 7.8 volts.	1130	amp
Starting current.	Must never exceed 1700 amperes, even momentarily	
Cold resistance	0.0013	ohm
Minimum heating time.	60	seconds
Amplification Factor, for dc grid volts = -50 and dc plate voltage adjusted to give dc plate current of 10 amperes	60	

Direct Interelectrode Capacitances:

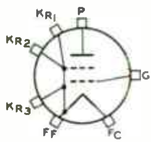
Grid to plate	12	$\mu\mu$f
Grid to filament.	1300	$\mu\mu$f
Plate to filament	160	$\mu\mu$f

Mechanical:

Operating Position.	Vertical, with lifting ring up
Maximum Overall Length.	40"
Maximum Diameter.	10.06"
Weight (Approx.).	140 lbs

Terminal Connections *(See Dimensional Outline)*:

F_C - Filament Cylindrical Terminal
F_F - Filament Flange Terminal
K_{R_1} - Output-Circuit-Return Terminal
P - Plate Terminal



K_{R_2} - Flange Input-Circuit-Return Terminal
K_{R_3} - Cylindrical Input-Circuit-Return Terminal
G - Grid Terminal

Air Cooling:

It is important that the temperature of any external part of the tube should not exceed 150° C. In general, forced-air cooling of the ceramic bushings will not be required unless the 6949 is used in cavity-type circuits or in a confined space without free circulation of air. Under such conditions, provision should be made for blowing an adequate quantity of air at the ceramic bushings to limit their temperature to 150° C. Forced-air cooling of the output-

ELECTRON TUBE DIVISION
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SUPER-POWER SHIELDED-GRID BEAM TRIODE

circuit-return terminal (K_{R_1}) and the flange input-circuit-return terminal (K_{R_2}) may be necessary to prevent exceeding the maximum temperature rating of 150° C, particularly at vhf frequencies.

Water Cooling:
Water cooling of the beam-forming cylinder, grid-terminal, and the plate is required. The water flow must start before application of any voltages and preferably should continue for several minutes after removal of all voltages. Interlocking of the water flow for each of the cooled elements with all power supplies is recommended to prevent tube damage in case of failure of adequate water flow. The use of distilled water is essential.

Water Flow:

	Absolute Min. Flow gpm	*Typical Flow gpm*	*Pressure Drop*● *for Typical Flow psi*	*Max. Gauge Pressure*□ *psi*
To plate (In direction shown on *Dimensional Outline*):				
For plate dissipation up to 125 kw. . . .	40	44	18	100
For plate dissipation of 260 kw	60	66	35	100
For plate dissipation of 330 kw	70	77	48	100
For plate dissipation of 400 kw	80	88	65	100
To grid-terminal connector	1	-	-	-
To beam-forming cylinder.	7	8	9	50

Outlet Water Temperature (Any outlet) . . 70 max. °C
Minimum Plate-Water-Column Resistance . 1/2 megohm per kv of dc plate voltage
Ceramic-Bushing Temperature . . . . 150 max. °C
Metal-Surface Temperature . . . . 150 max. °C

Fittings:

Fittings for the plate and beam-forming-cylinder water connections may be obtained from the Breco Division, Perfecting Service Co., 332 Atando Ave., Charlotte 6, North Carolina, USA.

●,□: See next page.

RCA

6949
SUPER-POWER SHIELDED-GRID BEAM TRIODE

LINEAR RF POWER AMPLIFIER
Single-Sideband Suppressed-Carrier Service
Crest of modulation conditions

Maximum CCS● Ratings, *Absolute Values:*

For altitudes up to 5,000 feet and frequencies up to 75 Mc

DC PLATE VOLTAGE	20000 max.	volts
MAX.-SIGNAL DC PLATE CURRENT	60 max.	amp
MAX.-SIGNAL PLATE INPUT	1100000 max.	watts
MAX.-SIGNAL DC GRID CURRENT	1.5 max.	amp
PLATE DISSIPATION (Average)	400000 max.	watts

Typical CCS Class B Operation at 10 Mc:

DC Plate Voltage	18000	volts
DC Grid Voltage (Approx.)*	-300	volts
Zero-Signal DC Plate Current	5	amp
Effective RF Load Resistance	170	ohms
"Single-Tone" Operation:⊕		
Max.-signal dc plate current	57	amp
Max.-signal dc grid current	0.35	amp
Max.-signal peak rf grid voltage	1900	volts
Max.-signal driving power (Approx.)	10000**	watts
Max.-signal power output (Approx.)	600000	watts
"Two-Tone" Operation:♠♠		
Average dc plate current	37	amp
Average dc grid current	0.22	amp
Peak envelope rf grid voltage	1900	volts
Average power output (Approx.)	300000	watts
Peak envelope power output (Approx.)	600000	watts

RF POWER AMPLIFIER — Class C Telegraphy##
and
RF POWER AMPLIFIER — Class C FM Telephony

Maximum CCS● Ratings, *Absolute Values:*

For altitudes up to 5,000 feet and frequencies up to 75 Mc

DC PLATE VOLTAGE	20000 max.	volts
DC GRID VOLTAGE	-1000 max.	volts
DC PLATE CURRENT	50 max.	amp
DC GRID CURRENT	1.5 max.	amp
PLATE INPUT	1000000 max.	watts
PLATE DISSIPATION	400000 max.	watts

Typical CCS Operation at 425 Kc:

DC Plate Voltage	17500	volts
DC Grid Voltage▲	-625	volts
Peak RF Grid Voltage	2000	volts
DC Plate Current	40	amp
DC Grid Current	1	amp

●,□,●,*,⊕,**,♠♠,##,▲: See next page.

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

RCA

6949

SUPER-POWER SHIELDED-GRID BEAM TRIODE

Driving Power (Approx.)♦.	2000	watts
Useful Power Output (Approx.) . . .	500000	watts

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Filament Current.	1	870	1100	amp
Amplification Factor.	1,2	48	74	
Direct Interelectrode Capacitances:				
Grid to plate	–	–	20	$\mu\mu$f
Grid to filament.	–	1150	1550	$\mu\mu$f
Plate to filament	–	140	170	$\mu\mu$f

Note 1: With 7.3 volts ac on filament.

Note 2: For dc grid volts = –50 and dc plate voltage adjusted to give dc plate current of 10 amperes.

♣ Directly across cooled element for the indicated typical flow.

□ At tube inlets.

● Continuous Commercial Service.

* Obtained from a fixed supply. Value should be adjusted to give indicated value of zero-signal plate current.

⊕ "Single-Tone" operation refers to that class of amplifier service in wh ch 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.

** Includes tube losses, circuit losses, and "swamping power" losses.

♦♦ "Two-Tone" operation refers to the simultaneous amplification of the two equal-amplitude, radio-frequency signals resulting from modulation of a single-sideband, suppressed-carrier transmitter by two audio-frequency signals of equal amplitude. The data shown for "Two-Tone" modulation refer to the case in which the peak amplitude of the resultant rf grid signal is equal to the "Max.-Signal Peak RF Grid-No.1 Voltage" as specified under "Single-Tone" modulation.

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 from fixed supply.

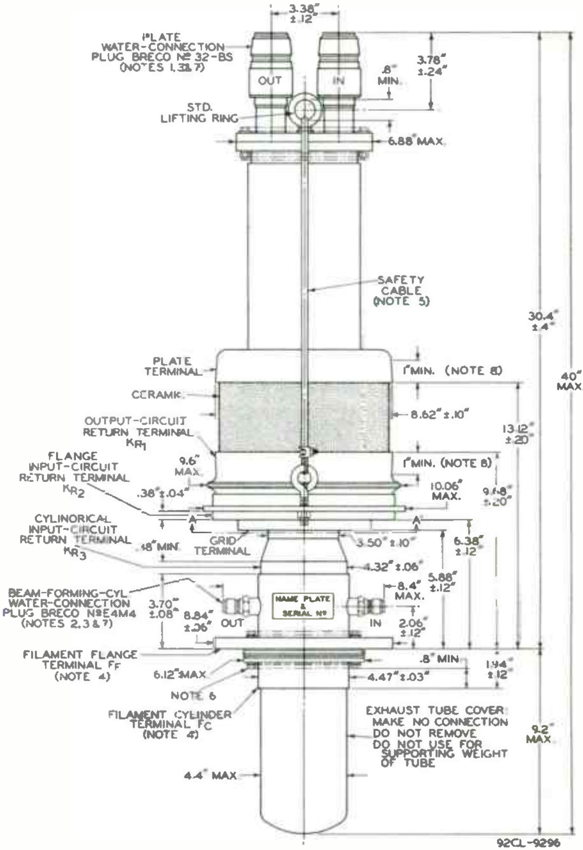
♦ Additional driving power is required at frequencies where circuit losses become significant.

OPERATING CONSIDERATIONS

A *high-speed, electronic protective device* must be used to remove the plate voltage within a few microseconds in the event of abnormal operation such as internal arcing. The protective device employed to remove the plate voltage in any installation must be approved by the RCA Electron Tube Division. In addition, the grid circuit should be provided with overload relays which will act to remove within a period of 0.1 second all grid power in the event of excessive grid-current flow. Inquiries concerning a high-speed, electronic protective device for removal of plate voltage from the 6949 may be addressed to Commercial Engineering, Electron Tube Division, RCA, Harrison, N.J.

6949
SUPER-POWER SHIELDED-GRID BEAM TRIODE

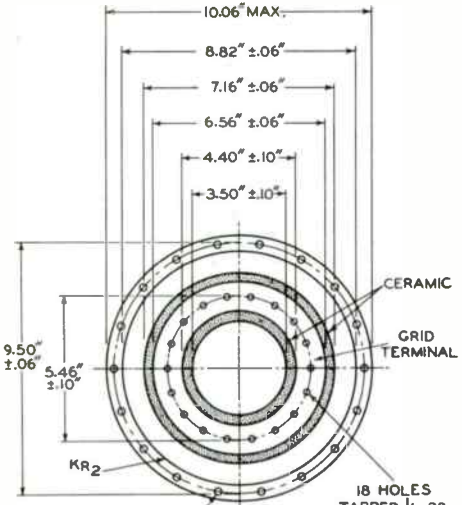
The 6949 can be operated with maximum ratings at frequencies up to 75 Mc and with reduced ratings to higher frequencies. The capabilities of the 6949 for operation at higher frequencies and at higher powers have not yet been determined but requests for information on specific applications will be welcomed.



Notes 1 to 8: See next page.

RCA

6949
SUPER-POWER SHIELDED-GRID BEAM TRIODE



92CM-9295

SECTION A-A'

NOTE 1: SOCKET No.412-8S 1-1/2" FOR THIS PLUG MAY BE OBTAINED FROM BRECO DIVISION, PERFECTING SERVICE CO., 332 ATANDO AVE., CHARLOTTE 6, N.C.

NOTE 2: SOCKET No.4EF4 1/2" (WITH FEMALE PIPE-THREAD CONNECTION) OR SOCKET No.4EM4 1/2" (WITH MALE PIPE-THREAD CONNECTION) MAY BE OBTAINED FROM SUPPLIER INDICATED IN NOTE 1.

NOTE 3: DIRECTION OF WATER FLOW THROUGH TUBE MUST BE IN DIRECTION INDICATED BY MARKINGS AT WATER CONNECTIONS.

NOTE 4: USE FOR FILAMENT POWER ONLY. INPUT-CIRCUIT RETURN SHOULD BE MADE TO BOTH INPUT-CIRCUIT-RETURN TERMINALS (K_{R_2} & K_{R_3}); OUTPUT-CIRCUIT RETURN SHOULD BE MADE TO OUTPUT-CIRCUIT-RETURN TERMINAL (K_{R_1}).

NOTE 5: REMOVE THIS CABLE BEFORE OPERATING TUBE AND KEEP CABLE FOR FUTURE TUBE HANDLING.

NOTE 6: DO NOT TAMPER WITH THESE BOLTS.

Notes 7 & 8: See next page.

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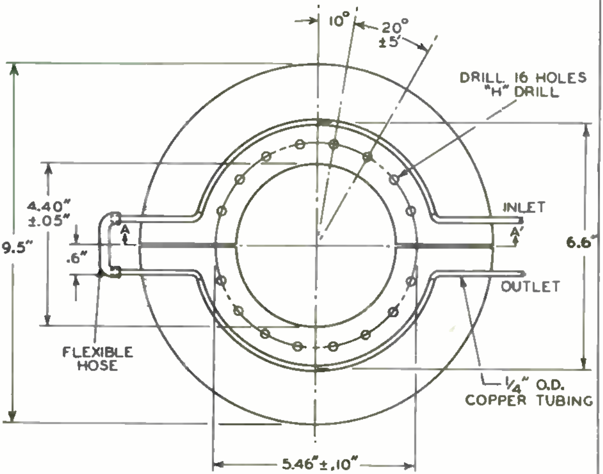
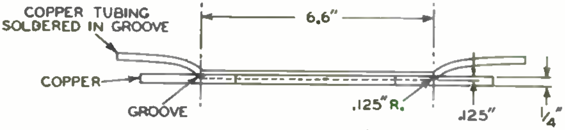
SUPER-POWER SHIELDED-GRID BEAM TRIODE

NOTE 7: INLET WATER CONNECTIONS (IN) ARE BOTH ON SAME SIDE OF TUBE AND TO THE RIGHT WHEN TUBE IS VIEWED WITH NAME PLATE TOWARD OBSERVER.

NOTE 8: THIS AREA IS SUBJECT TO A MAXIMUM TAPER OF 0.060" TO THE INCH. THE MAXIMUM DIAMETER ALONG THIS TAPER WILL BE ON THE END TOWARD THE CERAMIC.

DETAILS OF SUGGESTED WATER-COOLED GRID-TERMINAL CONNECTOR



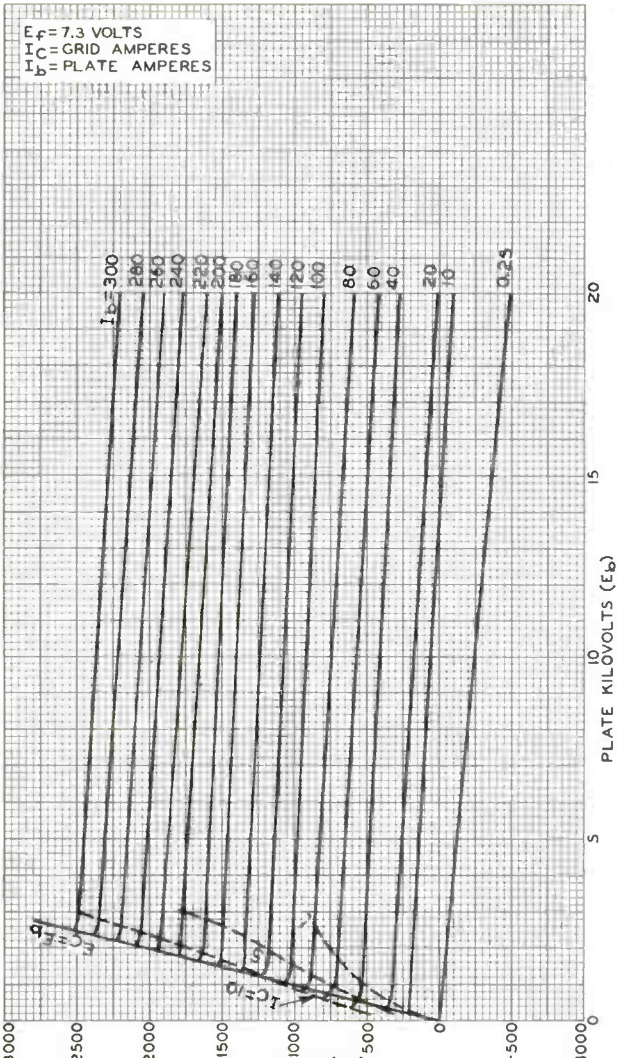


VIEW AT A-A'

92CM-9294

RCA 6949

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



ELECTRON TUBE DIVISION

92CM-9305

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

Beam Power Tube

2 MEGAWATTS PEAK POWER OUTPUT IN SHORT-PULSE SERVICE AT 425 Mc

PULSE LENGTH TO 15 MICROSECONDS

LOW FILAMENT POWER FOR AIRBORNE USE

LIQUID COOLED

For Grid-Driven, Plate-Pulsed Amplifier Applications at Frequencies from 174 to 600 Mc

Electrical:

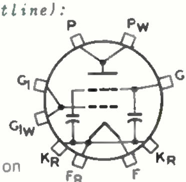
Filamentary Cathode, Multistrand, Matrix-Type, Oxide-Coated:

Voltage:[a]		
Maximum, with dc or 60 cps ac excitation	1.00	volt
Maximum, with 400 cps ac excitation	1.05	volts
Typical, with dc or 60 cps ac excitation	0.95	volt
Current:		
Typical operation value at 0.95 volt, with 60 cps excitation	495	amp
Minimum time to reach operating filament voltage	30	seconds
Minimum time at normal operating filament voltage before other voltages are applied	90	seconds
Mu-Factor, Grid No.2 to Grid No.1	7	
Direct Interelectrode Capacitances:		
Grid No.1 to plate	0.15 max.	pf
Grid No.1 to grid No.2 and cathode	500	pf
Plate to cathode and grid No.2	30	pf
Grid No.2 to cathode (Including bypass capacitors)	18000 max.	pf

Mechanical:

Operating Position	Tube axis vertical, either end up
Overall Length	8.62" ± 0.31"
Maximum Diameter	11.25"
Weight (Approx.)	38 lbs

Terminal Connections (See *Dimensional Outline*):



F - Insulated Filament Terminal and Coolant Connection
F_R - Uninsulated Filament Terminal for DC Circuit Returns and Coolant Connection
G_1 - RF Grid-No.1 Terminal Contact Surface
G_{1W} - DC Grid-No.1 and Coolant Connection
G_2 - DC Grid-No.2 and Coolant Connection
K_R - RF Cathode Terminal Contact Surface for Circuit Returns
P - RF Plate Terminal Contact Surface
P_W - DC Plate and Coolant Connection

← Indicates a change.

Thermal:

Ceramic-Insulator Temperature	150 max.	°C
Metal-Surface Temperature	100 max.	°C
Minimum Storage Temperature, without cooling liquid in coolant ducts	-65 min.	°C
External Gas Pressure[b]	60 max.	psia

Air Cooling for Insulators and Contact Areas:

It is important that the temperature of any external part of the tube not exceed the value specified. In general, forced-air cooling of the *ceramic insulators and the adjacent contact areas* may be required if the tube is used in a confined space without free circulation of air. Under such conditions, provision should be made for blowing an adequate quantity of air across the ceramic insulators and adjacent terminal areas to limit their maximum temperature to the value specified.

Liquid Cooling:

Liquid cooling of the filament block, dc cathode block, grid-No.1 block, grid-No.2 block, and plate is required. When tube operation under low ambient temperatures is required, the recommended coolant is inert liquid FC75 (Made by the Fluorochemical Division, Minnesota Mining and Manufacturing Co., 900 Bush Avenue, St. Paul 6, Minnesota) but ethylene glycol mixed with water in the proportion of 60% ethylene glycol to 40% water by weight can be used. When the environmental temperature permits, the coolant may be water; the use of distilled water or filtered deionized water is essential. The liquid flow must start before application of any voltages and preferably should continue for several seconds after removal of all voltages. Interlocking of the liquid flow through each of the cooled elements with all power supplies is recommended to prevent tube damage in case of failure of adequate liquid flow.

Flow:

Liquid Pressure at any outlet	100 max.	psi

Water Flow:

	Absolute Min. Flow *gpm*	*Typical Flow* *gpm*	*Max. Pressure Differential for Typical Flow*[c] *psi*
Through Filament block	0.5	0.8	8
Through dc cathode block	0.5	0.8	8
Through grid-No.1 block	0.5	0.8	6
Through grid-No.2 block	0.5	0.8	8
Through plate:			
For plate dissipations up to 5 kw (Av.)	5	7	5
For plate dissipations of 5kw to 8 kw (Av.)	8	10	10

Resistivity of Water at 25° C	1 min.	megohm-cm

	Absolute Min. Flow gpm	Typical Flow gpm	Max. Pressure Differential for Typical Flow[c] psi
Water Temperature from any outlet	70 max.		°C
Storage Temperature	See footnote d		
FC75 Flow:			
Through filament block	1.0	1.2	20
Through dc cathode block	1.0	1.2	20
Through grid-No.1 block	1.0	1.2	14
Through grid-No.2 block	1.0	1.2	20
Through plate:			
For plate dissipation up to 5 kw (Average)	10	12	20
For plate dissipations of 5 kw to 8 kw (Average)	20	24	80
Outlet-Liquid FC75 Temperature from any outlet	70 max.		°C
Storage Temperature with liquid FC75 in Coolant Courses	-65 min.		°C
Liquid FC75 Temperature for Tube Operation	-25 min.		°C
Ethylene-Glycol-Water Solution Flow:			
Through filament block	1.0	1.2	18
Through dc cathode block	1.0	1.2	18
Through grid-No.1 block	1.0	1.2	12
Through grid-No.2 block	1.0	1.2	18
Through plate in direction shown on *Dimensional Outline:*			
For plate dissipation up to 5 kw (Average)	6	8	7
For plate dissipations of 5 kw to 8 kw (Average)	16	18	40
Outlet-Solution Temperature from any outlet	60 max.		°C
Min. Plate-Solution-Column Resistance at 25° C.	10 min.		megohms
Storage Temperature with Solution in Coolant Courses	-45 min.		°C
Solution Temperature for Tube Operation	-20 min.		°C

PULSED RF AMPLIFIER

For frequencies from 174 to 600 Mc, and a maximum "ON" time as specified in any 3000-microsecond interval.

Maximum Ratings, *Absolute-Maximum Values:*

"ON" Time	*15 μsec*	*70 μsec*	
Peak Positive-Pulse Plate Voltage[a]	55000 max.	30000 max.	volts

"ON" Time	15 µsec	70 µsec	
Peak Positive-Pulse Grid-No.2 Voltage[f,g]	2200 max.	2200 max.	volts
DC or Peak Negative-Pulse Grid-No.1 Voltage	400 max.	400 max.	volts
Peak Plate Current	80 max.	30 max.	amp
Peak Grid-No.2 Current	15 max.	3 max.	amp
Peak-Rectified Grid-No.1 Current	15 max.	3 max.	amp
DC Plate Current	0.320 max.	0.500 max.	amp
DC Grid-No.2 Current	0.060 max.	0.060 max.	amp
DC Grid-No.1 Current	0.060 max.	0.060 max.	amp
Plate Input (Average)	16000 max.	9000 max.	watts
Plate Dissipation (Average)	8000 max.	5000 max.	watts

Typical Plate-Pulsed Operation:

In Class B service at 425 Mc with a rectangular waveshape pulse.

Pulse width	13 µsec	60 µsec	
Duty factor	0.004	0.018	
Peak Positive-Pulse Plate Voltage[e]	50000	19000	volts
Peak Positive-Pulse Grid-No.2 Voltage[f]	1800	1700	volts
Peak Negative-Pulse Grid-No.1 Voltage[h]	325	250	volts
Peak Plate Current	75	25	amp
Peak Grid-No.2 Current	8	1	amp
Peak Rectified Grid-No.1 Current	10	0.5	amp
DC Plate Current	0.3	0.45	amp
DC Grid-No.2 Current	0.03	0.02	amp
DC Grid-No.1 Current	0.04	0.01	amp
Peak Driver Power Output (Approx.)	20000	2000	watts
Useful Peak Power Output	2000000	225000	watts

[a] Because the filament, when operated near the maximum voltage value, provides emission in excess of any requirements within tube ratings, during operation of the tube, the filament voltage should be reduced to a value that will give adequate but not excessive emission. Careful attention to maintaining the value of filament voltage consistent with adequate emission will conserve tube life. The filament voltage should be measured at the filament liquid coolant connections on the tube side of the threads. This procedure is essential for accurate measurement of the filament voltage. At 400 cycles some heating of the filament leads and rf cathode terminal (cathode header) occurs; this condition is not detrimental to tube operation or tube life.

[b] This pressure is related to the output-cavity pressurization as required to prevent corona or external arc-over.

[c] Measured directly across cooled element for the indicated typical flow.

[d] The tube coolant ducts must be free of water before storage or shipment of the tube to prevent damage from freezing.

[e] The magnitude of any spike on the plate voltage pulse should not exceed its peak value by more than 4000 volts, and the duration of any spike when measured at the peak-value level should not exceed 10% of the maximum "ON" time. The output cavity must be pressurized as required to prevent corona or external arc-over at the ceramic insulator.

[f] The magnitude of any spike on the grid-No.2 voltage pulse should not exceed its peak value by more than 250 volts, and the duration of any spike when measured at the peak-value level should not exceed 10% of the maximum "ON" time.

[g] A negative dc voltage of 300 volts maximum may be applied to grid No.2 to prevent any tube conduction between pulses.

[h] The grid-No.1 voltage may be a combination of fixed and self bias obtained from a series grid resistor.

CHARACTERISTICS RANGE VALUES

	Note	*Min.*	*Max.*	
Filament Current.	j	460	530	amp
Input Strap-Resonant Frequency. . . .	k	222	250	Mc
Output Strap-Resonant Frequency . . .	k	230	250	Mc
Direct Interelectrode Capacitances:				
Grid No.1 to plate.	m	-	0.15	pf
Grid No.2 to cathode.	-	10000	18000	pf

[j] At filament voltage of 0.95 volt and ac filament excitation at 60 cps.

[k] The frequency range of the sweep generator is varied to produce the resonance curve observed on the oscilloscope and the UHF Marker Oscillator frequency is varied so that the pip is observed at the peak of the resonance curve. The resonant frequency is read on the frequency meter.

[m] Measured with special shield adapter.

COOLING CONSIDERATIONS

System

The liquid-cooling system consists, in general, of a source of cooling liquid, a liquid regeneration loop, a heat exchanger, a feed-pipe system which carries the liquid to the filament section blocks, to the filament common-point connection, to the grid-No.1 block, to the grid-No.2 block, and to the plate connections of the tube, and provision for interlocking the liquid flow through each of the cooling courses with the power supplies.

It is essential that the insulating tubing between the cooling-system piping and each of the cooling courses have good insulating qualities and be of sufficient length to minimize leakage currents and/or electrolysis effects. The minimum plate liquid column resistance should be 10 megohms at 25° C.

The piping system must be arranged so that direction of coolant flow through the plate coolant connection is in accord with the markings on the plate coolant connection (see *Dimensional Outline*) to insure adequate cooling. Through each of the other coolant connections, the liquid flow may be in either direction. Series or parallel arrangement of the coolant ducts is permissible so long as the specified flow, pressure, and outlet temperature ratings are observed. *Caution: The feed-pipe system should be so designed that all of the cooling liquid indicated by the flow meter at each outlet passes through the associated coolant duct within the tube, and is not shunted inadvertently by any other path.*

A test as to proper design and functioning of the feed-pipe system can be made by plugging the inlet and outlet holes of the fitting at each cooling connection.

Under these conditions, and with all voltages removed from the tube, no liquid flow should be indicated by the flowmeter for any connection when the coolant valve is fully opened.

Precautions

Proper functioning of the coolant system is of the utmost importance. Even a momentary failure of the liquid flow will damage the tube. In fact, without coolant, the heat of the filament alone is sufficient to cause serious harm. It is, therefore, necessary to provide a method of preventing operation of the tube in case the coolant supply should fail. This may be done by the use of coolant-flow interlocks which open the power supplies when the flow through any element is insufficient or ceases. The coolant flow must start before application of any voltages and preferably should continue for several seconds after removal of all voltages.

The absolute minimum coolant flow required through the filament section blocks, the filament common-point connections, the grid-No.1 block the grid-No.2 block, and to the plate together with pressure differentials across the cooled elements, is given in the tabulated data. The use of an outlet coolant thermometer and a coolant flow meter at each of the outlets is recommended. Under no circumstances should the temperature of the coolant from any outlet ever exceed the maximum value given for the coolant in the tabulated data.

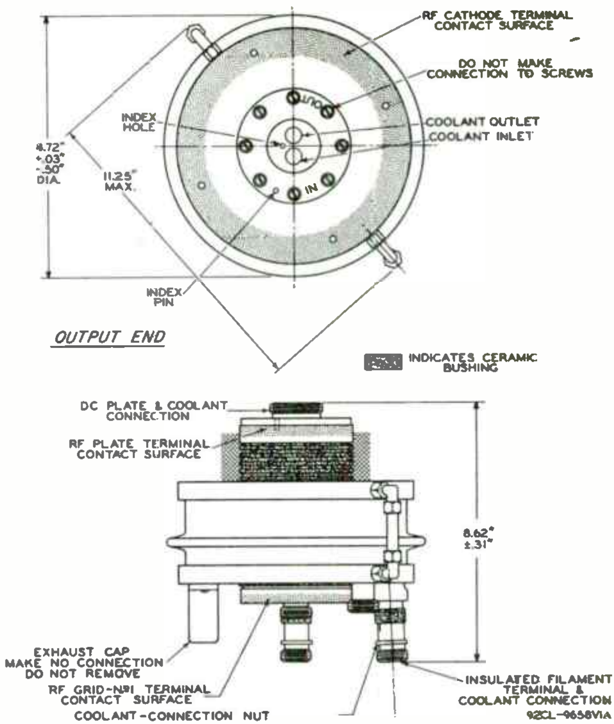
In spite of the usual precautions taken to eliminate contamination of the coolant by oil, dust, etc., some impurities are likely to enter the fluid. The use of a strainer with at least 60-mesh screen is recommended in the coolant supply line as near to the tube as possible to trap any foreign particles likely to impair the coolant flow through the tube ducts. Also, a regeneration loop followed by a submicron filter should be employed. For example, a regeneration loop having a 10-to-20-gallon-per-hour capacity will ordinarily be adequate for use with a cooling system containing about 20 gallons.

When the tube is used in equipment under conditions such that the ambient temperature is below 0° C, precautions should be taken to prevent freezing of the water in the tube ducts.

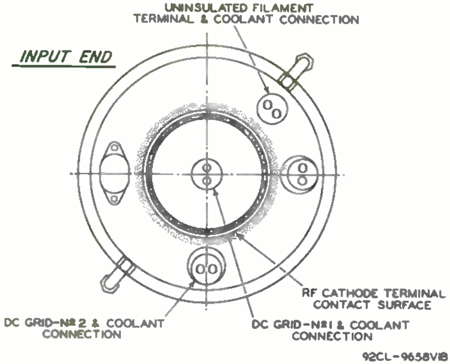
FOR ADDITIONAL INFORMATION ON THIS TYPE INCLUDING INPUT AND OUTPUT CAVITY DRAWINGS, WRITE FOR TECHNICAL BULLETIN AVAILABLE FROM:

Commercial Engineering
Electronic Components and Devices
Radio Corporation of America
Harrison, New Jersey

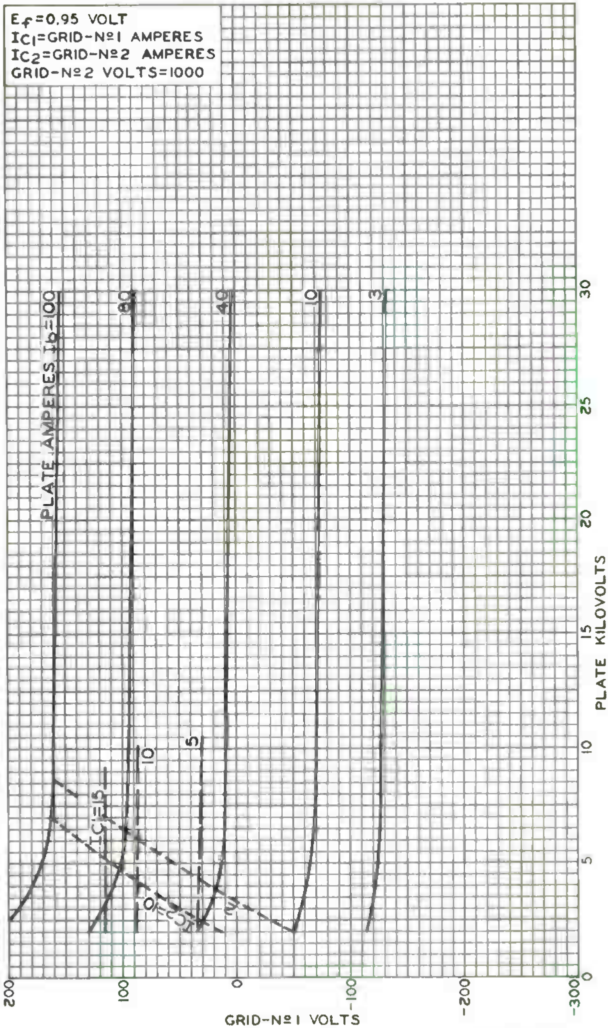
SIMPLIFIED DIMENSIONAL OUTLINE[r]



[r] A detailed Dimensional Outline and associated Gauge Drawings are given in the Techrical Bulletin available upon request.

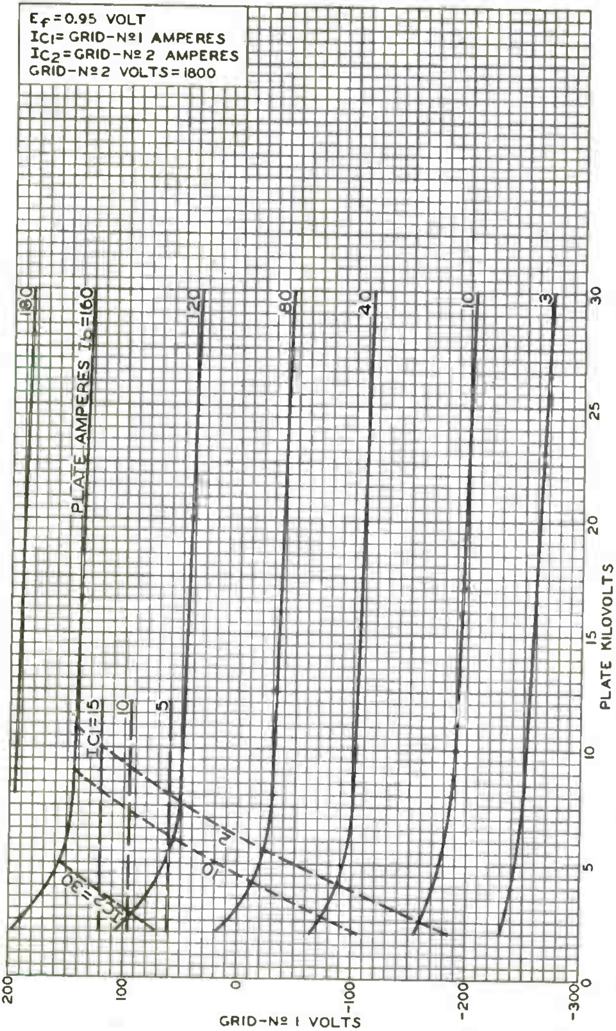

UNINSULATED FILAMENT TERMINAL & COOLANT CONNECTION
INPUT END
RF CATHODE TERMINAL CONTACT SURFACE
DC GRID-No. 2 & COOLANT CONNECTION
DC GRID-No. 1 & COOLANT CONNECTION
92CL-9658V1B

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM-9649

TYPICAL
CONSTANT-CURRENT CHARACTERISTICS



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

7008

7008
MAGNETRON

SERVO-TUNABLE TYPE

FORCED-AIR COOLED INTEGRAL MAGNET

For use as a pulsed oscillator at frequencies between 8500 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 Catnode Heating Time . . . 2.5 minutes

Frequency. . . . . 8500 to 9600 Mc

Maximum Frequency Pulling at VSWR of 1.5. . . . . 15 Mc

Mechanical:

Operating Position . . . . Any

Dimensions . . . . *See Dimensional Outline*

Air Flow:

Through Ducts--An air stream should be directed through each of the cooling ducts provided on 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

Servo-Drive Shaft with Associated Calibrated Indicator:
- Revolutions (Approx.) to cover full range of 8500 to 9600 Mc 160
- Maximum Torque (Absolute) at tuning-range stops. . . . . 192 oz-in.
- Typical Torque between -55° and +150° C (Approx.). . . . . 6 oz-in.

Weight (Approx.) . . . . 13 lbs

PULSED-OSCILLATOR SERVICE

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

For duty cycle up to 0.0011 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	2.75 max.	µsec

•: See next page.

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

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RATE OF RISE OF VOLTAGE PULSE:		
For pulse duration of 1 μsec or less	225 max. / 70 min.	kv/μsec / kv/μsec
For pulse duration greater than 1 μsec.	200 max. / 70 min.	kv/μsec / kv/μsec
ANODE-BLOCK TEMPERATURE.	150 max.	°C
HEATER-CATHODE-TERMINAL TEMPERATURE. . . .	165 max.	°C
LOAD-VOLTAGE STANDING-WAVE RATIO	1.5 max.	

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	4000	cps
Pulse Duration	2.5	0.25	μsec
RF Bandwidth with worst phasing of 1.5 VSWR.	0.5	5	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° C and 150° C. . .	0.2	0.2	Mc/°C
Servo-Drive-Shaft Torque	6	6	oz-in.
Frequency Deviation due to tuning backlash.	8	8	Mc
Peak Power Output (Approx.). . .	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	2.8	3.5	amp
Peak Anode Voltage	2	20	23	kv
Peak Power Output.	3	180	-	kw
Pulses Missing from Total. . . .	4,5	-	0.25	%

Notes 1 to 5: See next page.

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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 0.25 microsecond, load-voltage standing-wave ratio of 1.5 adjusted in phase to produce maximum instability. For heater voltage, *see Operating Considerations.*

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 7008 should be accomplished by means of the mounting flange which may be positioned to operate the tube in any orientation. This flange is made to permit use of the 7008 in applications requiring a pressure sea . 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. Captive 1/4" - 20 bolts are provided at the corners of the mounting flange for mounting the magnetron. These four mounting bolts are held in position during shipment of the 7008 by plastic sleeving which also serves to protect the bolt threads.

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

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A conduit should be attached to each of the inlet-air duct flanges provided on the tube. The conduits should be made of flexilbe, non-magnetic material. Rubber hose or stainless-steel hose is suitable. Fastening of the conduits requires two non-magnetic 6-32 screws at each duct. Adequate flow of cooling air should be provided through the ducts 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.

A mechanical drive may be connected to the drive shaft of the 7008 by using a flexible coupling drilled for a 3/16"-diameter shaft and held in place by a setscrew. When the magnetron is installed in radar equipment which has a frequency index dependent upon rotation of the drive shaft, both the index and the 7008 tuner indicator should be adjusted to the same frequency before the drive coupling is connected to the drive shaft.

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 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 7008 begins to oscillate, the heater voltage (E_f) should be reduced in accordance with the following formulas, deperding on the average power input (P_i) to the tube:

$$P_i \text{ up to 450 watts:} \quad E_f = 13.75\left(1 - \frac{P_i}{450}\right) \text{ volts}$$

$$P_i \text{ greater than 450 watts:} \quad E_f = 0 \text{ volts}$$

When the 7008 is oscillating, the cathode is subjected to considerable electron bombardment which raises the temperature of the cathode. The magnitude of such heating is a

* Manufactured by Ucinite Division of United-Carr Fastener Corporation, Newtonville 60, Massachusetts.

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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 the magnitude of the transient voltages which may develop across the heater. This capacitor may be incorporated in the design of the connector for the heater terminal and heater-cathode terminal.

The *anode-circuit return* should be made to the *heater-cathode terminal.* If the anode-circuit return is made to the heater terminal, all of the anode current will flow through the heater and may cause heater burnout.

The *frequency of the 7008 may be preset* by turning the drive shaft until the setting of the indicator is reached corresponding to the desired frequency. For precise tuning adjustment, the final indicator setting should be approached using a counterclockwise direction of rotation which is the direction of increasing frequency.

Revolutions of the servo-drive shaft are not indicated directly by the indicator. Approximately 160 revolutions of the drive shaft are required to tune through the 8500-to-9600-Mc range. A tuning rate of 200 megacycles per second can be achieved. Typical servo-drive-shaft torque is 6 ounce-inches throughout the temperature range of -55° to 150° C. Mechanical stops are provided at each end of the tuning range. Torque applied to these stops and the starting torque must not exceed 192 ounce-inches (1 foot-pound) including inertial effects.

Our engineers are ready to assist you in circuit applications of the RCA-7008. For further information, write to Commercial Engineering, RCA, Harrison, New Jersey, giving complete details as to the proposed service.

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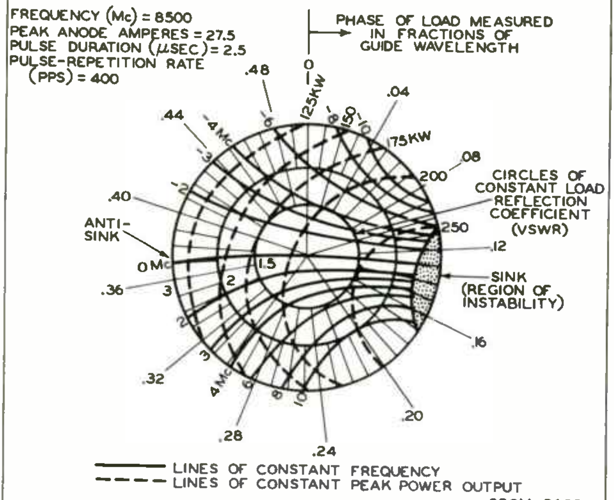
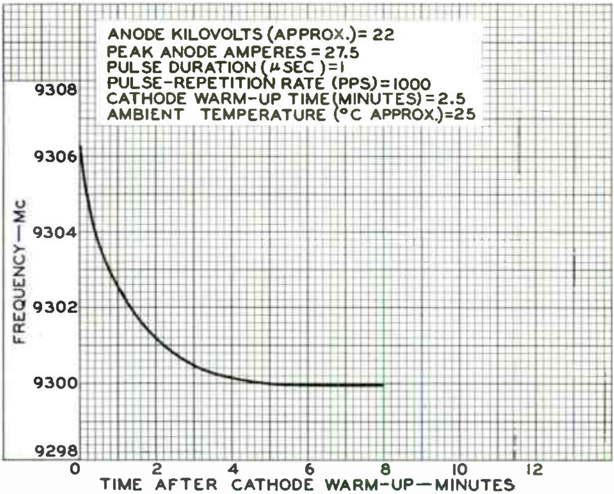
MAGNETRON

RIEKE DIAGRAM



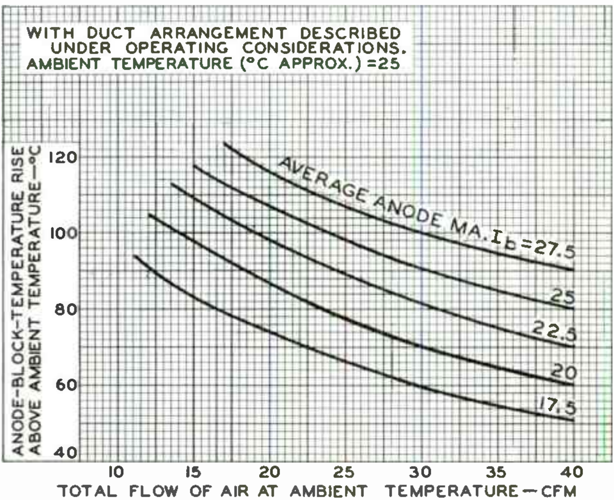
92CM-9629

TYPICAL STABILIZATION CHARACTERISTIC



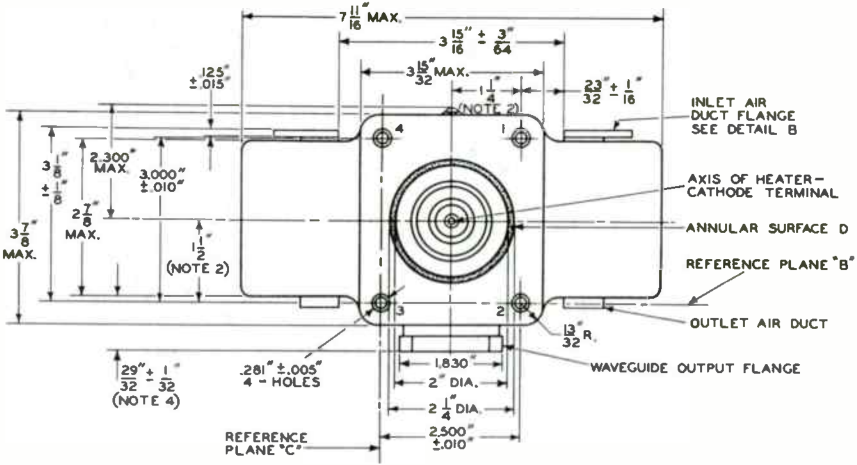
92CS-8941R1

TYPICAL COOLING REQUIREMENTS



92CS-9472R1

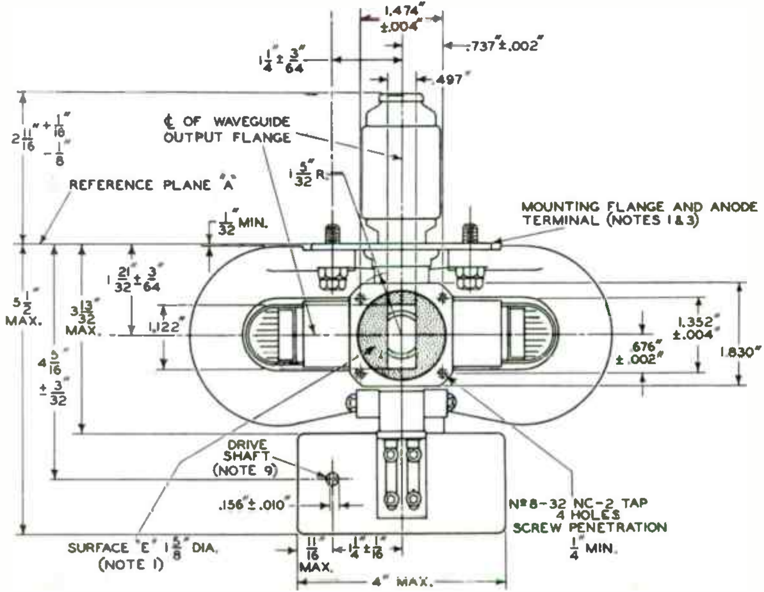
RCA 7008 MAGNETRON



TOP VIEW

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

FRONT VIEW


1.474" ±.004"
.737" ±.002"
1 1/4 ± 3/64
.497"
2 11/16" + 1/16" − 1/8"
℄ OF WAVEGUIDE OUTPUT FLANGE
1 5/32" R.
REFERENCE PLANE "A"
1/32" MIN.
MOUNTING FLANGE AND ANODE TERMINAL (NOTES 1 & 3)
1 21/32 ± 3/64
5 1/2" MAX.
3 13/32" MAX.
1.122"
1.352" ±.004"
.676" ±.002"
1.830"
4 5/16" ± 3/32"
DRIVE SHAFT (NOTE 9)
.156" ±.010"
Nº 8-32 NC-2 TAP 4 HOLES SCREW PENETRATION 1/4" MIN.
SURFACE "E" 1 5/8" DIA. (NOTE 1)
11/16" MAX.
1 1/4 ± 1/16
4" MAX.

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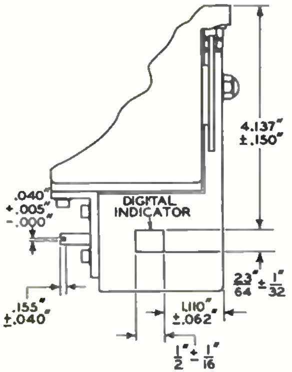
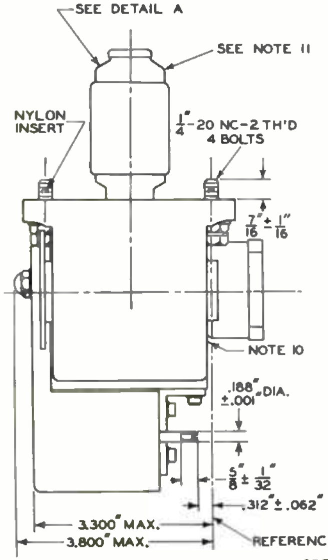
PARTIAL RIGHT-SIDE VIEW



LEFT-SIDE VIEW



92CJ-9470

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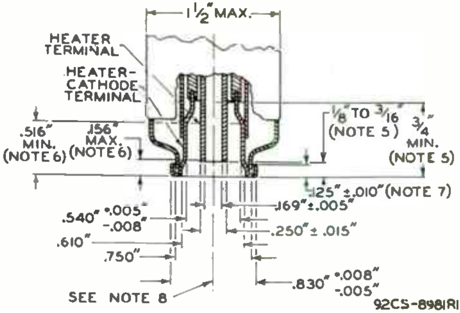
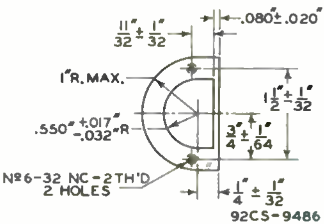
DETAIL A



DETAIL B



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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 WHICH HAVE THE SPECIFIED BOLTS INSERTED THROUGH THEM.

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 WHICH HAVE THE SPECIFIED BOLTS INSERTED THROUGH THEM.

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 ANNULAR 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 WITH 0.010".

NOTE 9: CLOCKWISE ROTATION OF DRIVE SHAFT DECREASES FREQUENCY.

NOTE 10: ANODE TEMPERATURE MEASURED AT JUNCTION OF WAVEGUIDE AND ANODE BLOCK.

NOTE 11: TEMPERATURE OF HEATER-CATHODE TERMINAL MEASURED HERE.

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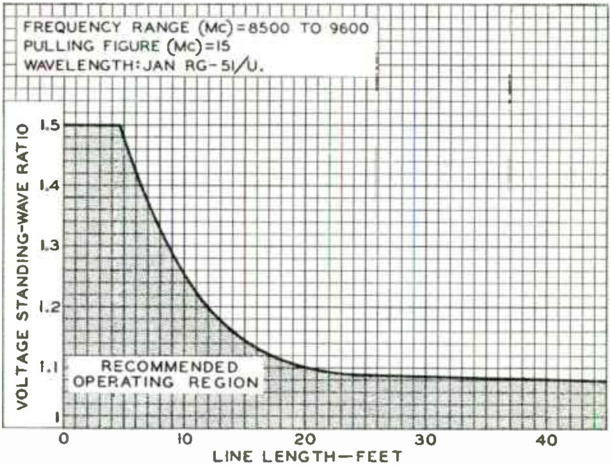
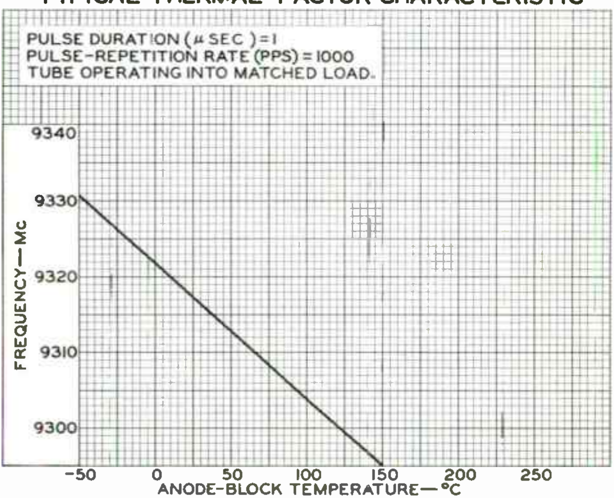
7008

EFFECT OF LENGTH OF TRANSMISSION LINE BETWEEN OUTPUT FLANGE AND LOAD ON ALLOWABLE VOLTAGE STANDING-WAVE RATIO



92CS-9469R1

TYPICAL THERMAL-FACTOR CHARACTERISTIC

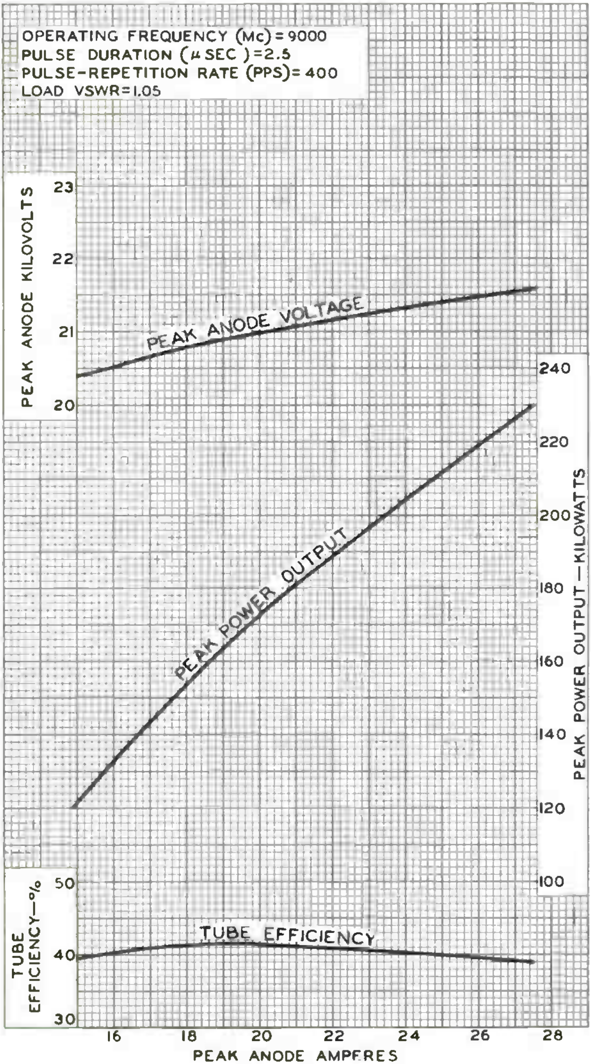


92CS-9285R1

7008

7008

TYPICAL PERFORMANCE CURVES



ELECTRON TUBE DIVISION

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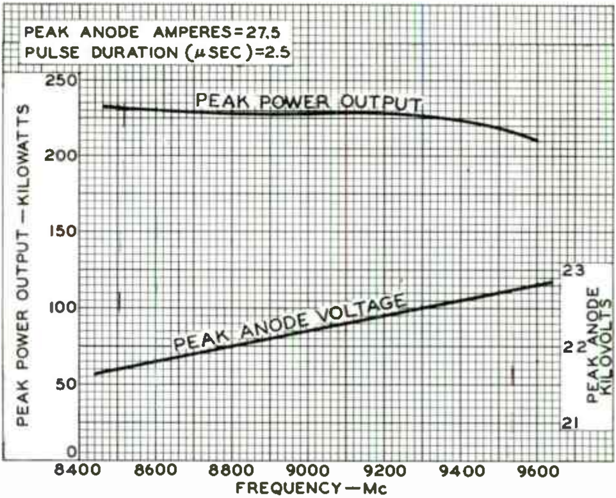
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

7008

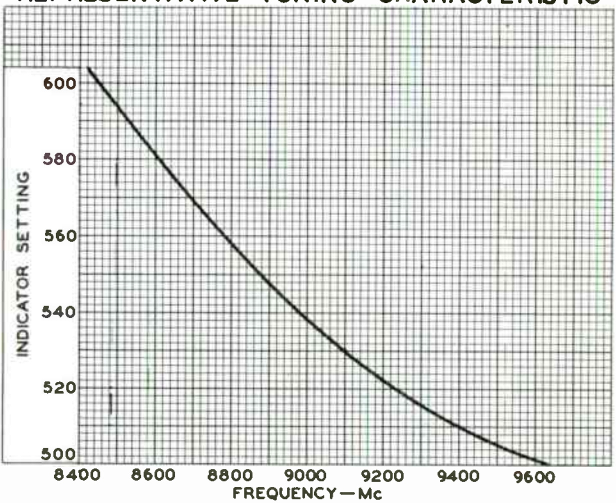
7008

TYPICAL PERFORMANCE CURVES



92CS-9471R1

REPRESENTATIVE TUNING CHARACTERISTIC



92CS-9466

7034/4X150A

Beam Power Tube

FORCED-AIR COOLED

COAXIAL-ELECTRODE STRUCTURE — 370 WATTS CW OUTPUT UP TO 150 Mc
UNIPOTENTIAL CATHODE — 140 WATTS CW OUTPUT AT 500 Mc
COMPACT DESIGN — INTEGRAL RADIATOR

For Use at Frequencies up to 500 Mc

GENERAL DATA

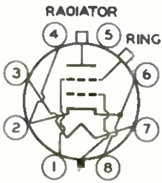
Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)[a]	6.0 ± 10%	volts
Current at heater volts = 6.0	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	5	
Direct Interelectrode Capacitances:[b]		
Grid No.1 to plate	0.03	μμf
Grid No.1 to cathode, grid No.2, and heater	16	μμf
Plate to cathode, grid No.2, and heater	4.4	μμf

Mechanical:

Operating Position	Any
Maximum Overall Length	2.404"
Maximum Seated Length	1.850"
Maximum Diameter	1.640"
Weight (Approx.)	4 oz
Radiator	Integral part of tube
Socket	Air-System Socket, such as Johnson No.124-110-1[c] (Supplied with Air Chimney)
Base	Special 8-Pin

BOTTOM VIEW



Pin 1 – Grid No.2[d]
Pin 2 – Cathode
Pin 3 – Heater
Pin 4 – Cathode
Pin 5 – Do Not Use
Pin 6 – Cathode
Pin 7 – Heater
Pin 8 – Cathode
Base Index Plug – Grid No.1
Radiator – Plate
Ring Terminal[e] – 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, glass 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 5.6 cfm

← Indicates a change.

through the system is required. The corresponding pressure drop is 0.45 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.

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 5.3 cfm must pass through the radiator. The corresponding pressure drop is 0.28 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	200 max.	°C
Temperature of Base Seals and Grid-No.2 Seal	175 max.	°C

AF POWER AMPLIFIER & MODULATOR — Class AB_1 [f]

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

DC PLATE VOLTAGE	2000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	400 max.	volts
MAX.-SIGNAL DC PLATE CURRENT[h]	250 max.	ma
GRID-No.2 INPUT[h]	12 max.	watts
PLATE DISSIPATION[h]	250 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:

Values are for 2 tubes

DC Plate Voltage	800	1000	1500	2000	volts
DC Grid-No.2 Voltage	300	300	300	300	volts
DC Grid-No.1 (Control-Grid) Voltage	-40	-43	-50	-50	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage	80	86	100	100	volts
Zero-Signal DC Plate Current	210	165	100	100	ma
Max.-Signal DC Plate Current	435	450	456	470	ma
Zero-Signal DC Grid-No.2 Current	0	0	0	0	ma
Max.-Signal DC Grid-No.2 Current	76	52	42	36	ma

Effective Load Resistance (Plate to plate)	4400	4250	6570	8760	ohms
Max.-Signal Driving Power (Approx.)	0	0	0	0	watts
Max.-Signal Power Output (Approx.)	170	230	400	580	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance (Per tube)	0.1 max.	megohm

AF POWER AMPLIFIER & MODULATOR — Class AB_2[j]

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

DC PLATE VOLTAGE	2000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	400 max.	volts
MAX.-SIGNAL DC PLATE CURRENT[h]	250 max.	ma
GRID-No.2 INPUT[h]	12 max.	watts
PLATE DISSIPATION[h]	250 max.	watts
GRID-No.1 (CONTROL-GRID) INPUT	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:

Values are for 2 tubes

DC Plate Voltage	800	1000	1500	2000	volts
DC Grid-No.2 Voltage	300	300	300	300	volts
DC Grid-No.1 Voltage	-40	-45	-50	-50	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage	90	98	106	106	volts
Zero-Signal DC Plate Current	210	166	100	100	ma
Max.-Signal DC Plate Current	500	493	500	500	ma
Zero-Signal DC Grid-No.2 Current	0	0	0	0	ma
Max.-Signal DC Grid-No.2 Current	80	58	46	36	ma
Effective Load Resistance (Plate to plate)	3140	3950	5970	8100	ohms
Max.-Signal Driving Power (Approx.)	0.15	0.15	0.2	0.2	watt
Max.-Signal Power Output (Approx.)	215	270	440	630	watts

RF POWER AMPLIFIER — Class B Television Service

Synchronizing-level conditions per tube unless otherwise specified

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

	54 to 216 Mc	
DC PLATE VOLTAGE	1250 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	400 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-250 max.	volts
DC PLATE CURRENT (AVERAGE)[k]	250 max.	ma

GRID-No.2 INPUT	12 max.	watts
GRID-No.1 INPUT	2 max.	watts
PLATE DISSIPATION	250 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 bandwidth of 5 Mc			
DC Plate Voltage.	750	1000	1250	volts
DC Grid-No.2 Voltage.	300	300	300	volts
DC Grid-No.1 Voltage.	-60	-65	-70	volts
Peak RF Grid-No.1 Voltage:				
Synchronizing level	85	95	100	volts
Pedestal level.	65	70	75	volts
DC Plate Current:				
Synchronizing level	335	330	305	ma
Pedestal level.	245	240	230	ma
DC Grid-No.2 Current:				
Synchronizing level	50	45	45	ma
Pedestal level.	20	15	10	ma
DC Grid-No.1 Current:				
Synchronizing level	15	20	25	ma
Pedestal level.	4	4	4	ma
Driver Power Output (Approx.):[i]				
Synchronizing level	7	8	9	watts
Pedestal level.	4.25	4.7	5.5	watts
Useful Power Output (Approx.):				
Synchronizing level	135	200	250	watts
Pedestal level.	75	110	140	watts

→ **LINEAR RF POWER AMPLIFIER**

Single-Sideband Suppressed-Carrier Service

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

	Up to 150 Mc		*Up to 500 Mc*	
	CCS[g]	*ICAS*[■]	*CCS*[g]	
DC PLATE VOLTAGE. .	2000 max.	2250 max.	1250 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	400 max.	400 max.	400 max.	volts
MAX.-SIGNAL DC PLATE CURRENT . .	250 max.	280 max.	250 max.	ma
GRID-No.2 INPUT . .	12 max.	12 max.	12 max.	watts
PLATE DISSIPATION .	250 max.	250 max.	300 max.	watts
PEAK HEATER-CATHODE VOLTAGE:				
Heater negative with respect to cathode. . .	150 max.	150 max.	150 max.	volts
Heater positive with respect to cathode. . .	150 max.	150 max.	150 max.	volts

→ indicates a change.

Typical Class AB_1 "Single-Tone" Operation up to 150 Mc:[n] ←

		CCS[g]		ICAS[■]	
DC Plate Voltage	1000	1500	1800	2000	volts
DC Grid-No.2 Voltage[p]	300	300	300	300	volts
DC Grid-No.1 (Control-Grid) Voltage	-50	-50	-50	-48	volts
Zero-Signal DC Plate Current	50	50	50	60	ma
Zero-Signal DC Grid-No.2 Current	0	0	0	0	ma
Effective RF Load Resistance	1860	3280	4140	4270	ohms
Max.-Signal DC Plate Current	225	225	225	250	ma
Max.-Signal DC Grid-No.2 Current	11	11	11	9	ma
Max.-Signal Peak RF Grid-No.1 Voltage	50	50	50	48	volts
Max.-Signal Driving Power (Approx.)	0	0	0	0	watts
Max.-Signal Power Output (Approx.)	115	200	250	290	watts

Maximum Circuit Values (CCS or ICAS):

Grid-No.1-Circuit Resistance under Any Condition:
With fixed bias . . . . 25000 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

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

	Up to 150 Mc	150 to 500 Mc	
DC PLATE VOLTAGE	1600 max.	1000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	300 max.	300 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-250 max.	-250 max.	volts
DC PLATE CURRENT	200 max.	200 max.	ma
GRID-No.2 INPUT	10 max.	10 max.	watts
GRID-No.1 INPUT	2 max.	2 max.	watts
PLATE DISSIPATION	165 max.	165 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	150 max.	150 max.	volts
Heater positive with respect to cathode	150 max.	150 max.	volts

Typical CCS Operation:

	Up to 150 Mc		
DC Plate Voltage	1200	1600	volts
DC Grid-No.2 Voltage (Modulated approx. 55%)[q]	250	250	volts

← Indicates a change.

DC Grid-No.1 Voltage[r]	-118	-118	volts
Peak AF Grid-No.2 Voltage (For 100% modulation)	180	200	volts
Peak RF Grid-No.1 Voltage	136	136	volts
DC Plate Current	200	200	ma
DC Grid-No.2 Current	23	23	ma
DC Grid-No.1 Current (Approx.)	5	5	ma
Driving Power (Approx.)	2	3	watts
Power Output (Approx.)	150	230	watts

At 165 Mc

DC Plate Voltage	400	600	800	1000	volts
DC Grid-No.2 Voltage (Modulated approx. 55%)[q]	250	250	250	250	volts
DC Grid-No.1 Voltage	-90	-95	-100	-105	volts
Peak AF Grid-No.2 Voltage (For 100% modulation)	140	150	160	170	volts
Peak RF Grid-No.1 Voltage	110	120	120	125	volts
DC Plate Current	200	200	200	200	ma
DC Grid-No.2 Current	40	35	25	20	ma
DC Grid-No.1 Current (Approx.) . .	7	8	10	15	ma
Driving Power (Approx.)	1	1	1.5	2	ma
Power Output (Approx.)	55	80	100	140	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under Any Condition	25000 max.	ohms

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

Maximum CCS[9] Ratings, ***Absolute-Maximum Values:***

	Up to 150 Mc	150 to 500 Mc	
DC PLATE VOLTAGE	2000 max.	1250 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	300 max.	300 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-250 max.	-250 max.	volts
DC PLATE CURRENT	250 max.	250 max.	ma
GRID-No.2 INPUT	12 max.	12 max.	watts
GRID-No.1 INPUT	2 max.	2 max.	watts
PLATE DISSIPATION	250 max.	250 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	150 max.	150 max.	volts
Heater positive with respect to cathode	150 max.	150 max.	volts

Typical CCS Operation:

Up to 150 Mc

DC Plate Voltage	1500	2000	volts
DC Grid-No.2 Voltage	250	250	volts

DC Grid-No.1 Voltage			-88	-88	volts
Peak RF Grid-No.1 Voltage			110	110	volts
DC Plate Current			250	250	ma
DC Grid-No.2 Current			24	24	ma
DC Grid-No.1 Current (Approx.)			8	8	ma
Driving Power (Approx.)			1.5	2.5	watts
Power Output (Approx.)			260	370	watts

At 165 Mc

DC Plate Voltage	600	750	1000	1250	volts
DC Grid-No.2 Voltage	250	250	250	250	volts
DC Grid-No.1 Voltage	-75	-80	-80	-90	volts
Peak RF Grid-No.1 Voltage	91	96	95	106	volts
DC Plate Current	200	200	200	200	ma
DC Grid-No.2 Current	37	37	31	20	ma
DC Grid-No.1 Current (Approx.)	11	11	10	11	ma
Driving Power (Approx.)	1	1	1	1.2	watts
Power Output (Approx.)	85	110	150	195	watts

At 500 Mc with coaxial cavity

DC Plate Voltage	600	800	1000	1250	volts
DC Grid-No.2 Voltage	250	250	250	280	volts
DC Grid-No.1 Voltage	-110	-110	-110	-115	volts
DC Plate Current	170	200	200	200	ma
DC Grid-No.2 Current	6	7	7	5	ma
DC Grid-No.1 Current (Approx.)	6	10	10	10	ma
Driver Power Output (Approx.)[l]	15	20	25	30	watts
Useful Power Output (Approx.)	50	95	120	140	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under Any Condition . . . . 25000 max. ohms

[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 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.

[c] Available from E.F. Johnson Co., Waseca, Minn.

[d] For use at lower frequencies.

[e] For use at higher frequencies.

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

[g] Continuous Commercial Service.

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

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

[k] Averaged over any frame.

[l] 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 values to take care of variations in line voltage, in components, in initial tube characteristics, and in tube characteristics during life.

[m] Intermittent Commercial and Amateur Service.

[n] "Single-Tone" operation refers to that class of amplifier service in which the grid-No.2 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.

p Preferably obtained from a fixed supply.

q The dc grid-No.2 voltage must be modulated approximately 55% in phase with the plate modulation in order to obtain 100% modulation of the 7034/4X150A. The use of a series grid-No.2 resistor or reactor may not give satisfactory performance and is therefore not recommended.

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

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% of the carrier conditions.

→ CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Heater Current.	1	2.3	2.9	amp
Direct Interelectrode Capacitances:				
Grid No.1 to plate.	2	–	0.05	$\mu\mu$f
Grid No.1 to cathode, grid No.2, and heater.	2	14.5	17.0	$\mu\mu$f
Plate to cathode, grid No.2, and heater.	2	4.0	4.8	$\mu\mu$f
Grid-No.1 Voltage	1,3,4,5	-32	-46	volts
Grid-No.2 Current	1,3,4,5	-5	3	ma
Power Output.	4,5,6	100	–	watts

Note 1: With 6.0 volts on heater.

Note 2: 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.

Note 3: With dc plate volts = 1000, dc grid-No.2 volts = 300, and grid-No.1 voltage adjusted to give plate current of 150 milliamperes.

Note 4: With forced-air cooling as specified under GENERAL DATA for *Air-System Socket*.

Note 5: Heater voltage must be applied for at least 30 seconds before application of other voltages.

Note 6: With heater volts = 5.5, dc plate volts = 1000, dc grid-No.2 volts = 250, dc grid-No.1 volts = -90, maximum dc grid-No.1 milliamperes = 20, grid-No.1 signal voltage adjusted to give dc plate current of 200 milliamperes, and a frequency of 475 Mc.

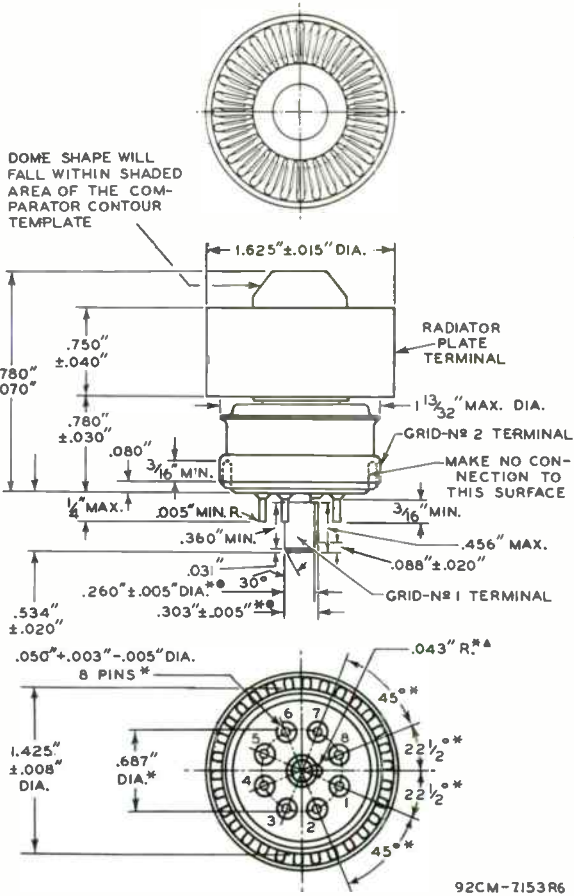
SPECIAL PERFORMANCE DATA

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

→ Indicates a change.



GRID-No. I PLUG DIMENSIONS ARE MEASURED BY THE USE OF THE SERIES OF GAUGES SHOWN IN SKETCHES G_1 AND G_2. IN THE FOLLOWING INSTRUCTIONS FOR THE USE OF THESE GAUGES, "GO" INDICATES THAT THE ENTIRE GRID-No. I PLUG KEY WILL ENTER THE GAUGE; AND "NO-GO" INDICATES THAT THE GRID-No. I PLUG KEY WILL NOT ENTER THE GAUGE MORE THAN 1/16". INSTRUCTIONS FOR THE USE OF THE GAUGES FOLLOW:

▲, ●, *: See next page.

▲ GAUGES G_1-1, G_1-2, G_1-3, AND G_1-4:

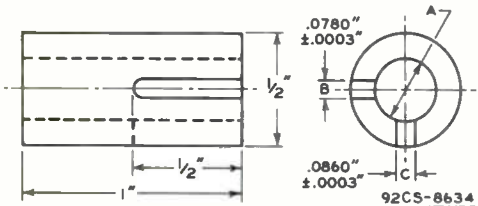
USING ONLY SLOT C, TRY THESE GAUGES IN NUMERICAL ORDER UNTIL ONE IS FOUND THAT WILL ACCEPT THE ENTIRE GRID-No. 1 PLUG. USING THE FIRST GAUGE THUS FOUND, IT WILL NOT BE POSSIBLE TO INSERT THE GRID-No. 1 PLUG IN SLOT B.

● GAUGES G_2-1, G_2-2, AND G_3-3:

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.

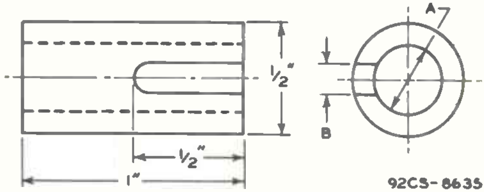
* BASE-PIN POSITIONS ARE HELD TO TOLERANCES SUCH THAT THE ENTIRE LENGTH OF THE PINS WILL, WITHOUT UNDUE FORCE, PASS INTO AND DISENGAGE FROM THE FLAT-PLATE GAUGE SHOWN IN SKETCH G_3.

GAUGE SKETCH G_1



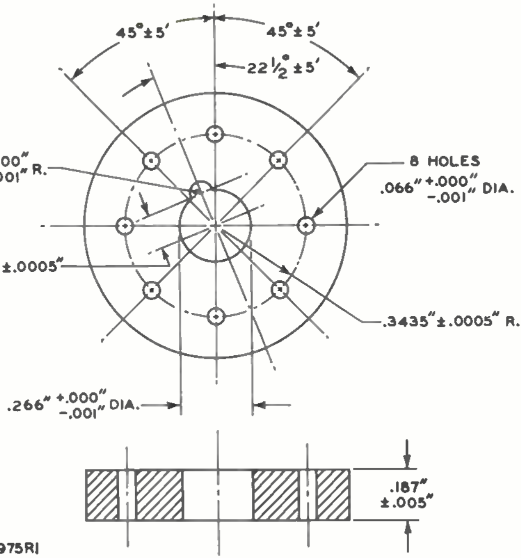
Gauge	Dimension A
G_1-1	.2575" + .DODD" − .DDD5"
G_1-2	.2600" + .0D00" − .0005"
G_1-3	.2625" + .0000" − .0005"
G_1-4	.2650" + .0000" − .0005"

GAUGE SKETCH 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

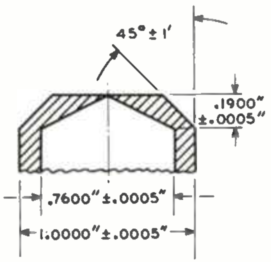
GAUGE SKETCH G_3



92CS-7975R1

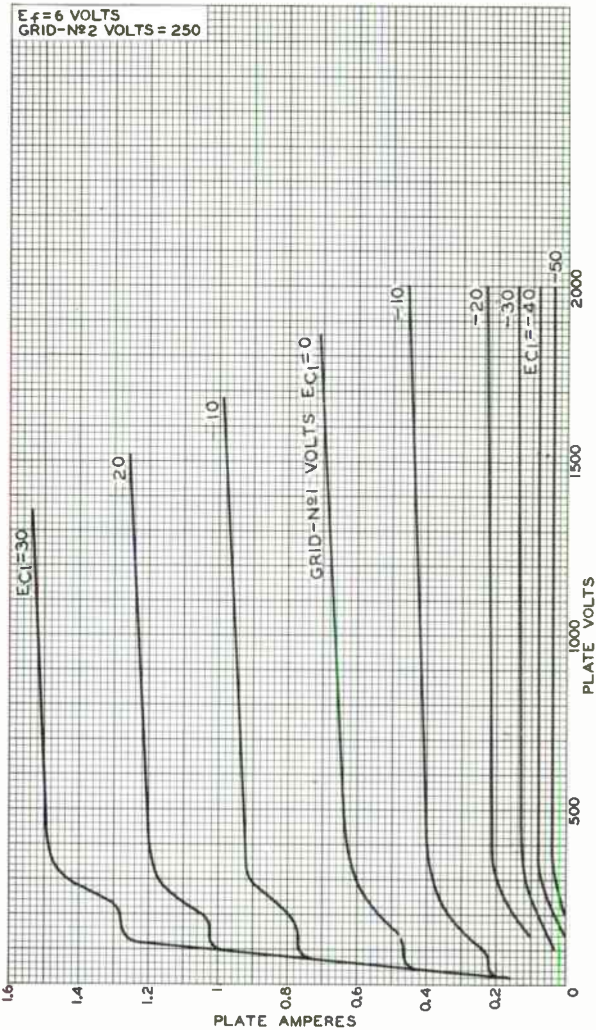
TOLERANCES ARE NOT CUMULATIVE

COMPARATOR CONTOUR TEMPLATE



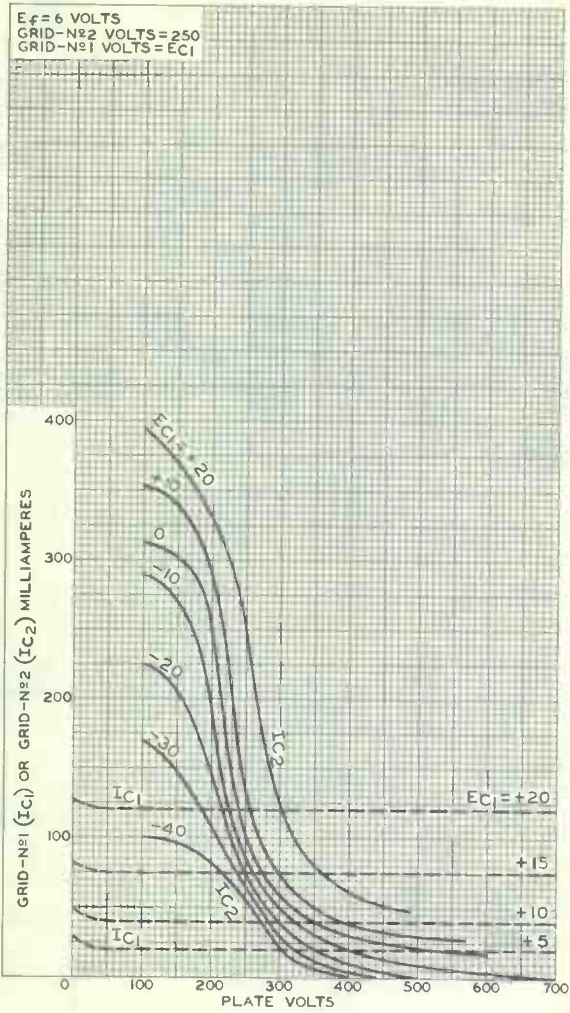
92CS-10554R1

TYPICAL PLATE CHARACTERISTICS



92CM-9755

TYPICAL CHARACTERISTICS

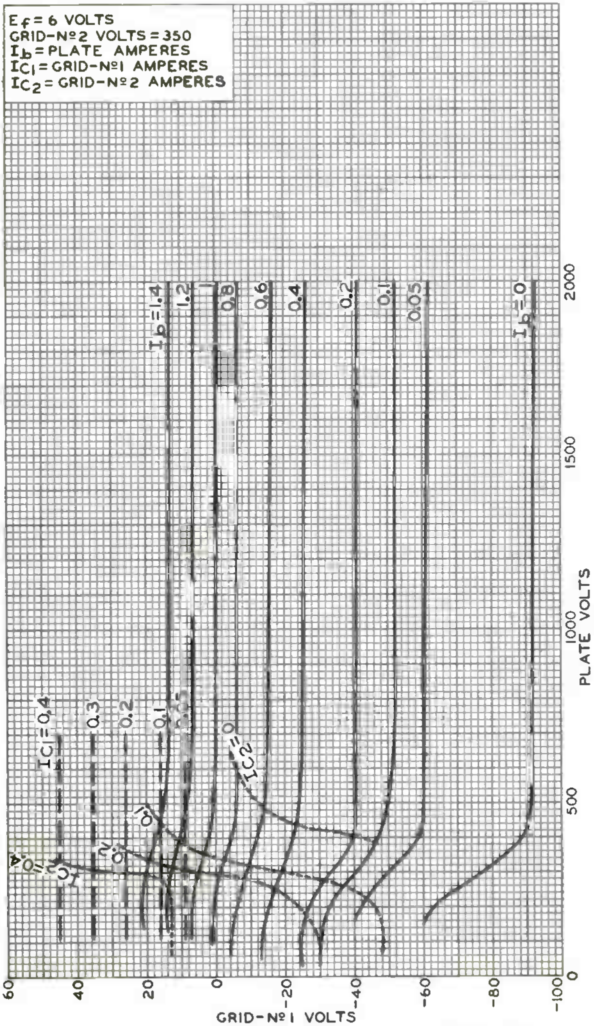


92CM-9756

TYPICAL CONSTANT-CURRENT CHARACTERISTICS

92CM-9760

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM—9761

7035/4X150D

Beam Power Tube

FORCED-AIR COOLED

COAXIAL-ELECTRODE STRUCTURE — 370 WATTS CW OUTPUT UP TO 150 Mc
UNIPOTENTIAL CATHODE — 140 WATTS CW OUTPUT AT 500 Mc
COMPACT DESIGN — INTEGRAL RADIATOR

For Use at Frequencies up to 500 Mc

The 7035/4X150D is the same as the 7034/4X150A except for the following items:

Heater, for Unipotential Cathode:

Voltage (AC or DC)[a]	26.5 ± 10%	volts
Current at heater volts = 26.5.	0.58	amp

[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.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN ←

	Note	*Min.*	*Max.*	
Heater Current.	1	0.50	0.62	amp
Direct Interelectrode Capacitances:				
Grid No.1 to plate.	2	-	0.05	μμf
Grid No.1 to cathode, grid No.2, and heater.	2	14.5	17.0	μμf
Plate to cathode, grid No.2, and heater.	2	4.0	4.8	μμf
Grid-No.1 Voltage	1,3,4,5	-32	-46	volts
Grid-No.2 Current	1,3,4,5	-5	3	ma
Power Output.	4,5,6	100	-	watts

Note 1: With 26.5 volts on heater.

Note 2: With cylindrical shield having inside diameter of 1-13/16" completely surrounding radiator, and insulated from the top and sides of it by a 1/16" thickness of insulating material; and with a cylindrical shield having inside diameter of 1.460" and length of 5/16" surrounding the grid-No.2 ring terminal and insulated from it. Both shields are connected to ground.

Note 3: With dc plate volts = 1000, dc grid-No.2 volts = 300, and grid-No.1 voltage adjusted to give plate current of 150 milliamperes.

Note 4: With forced-air cooling as specified under GENERAL DATA for *Air-System Socket*.

Note 5: Heater voltage must be applied for at least 30 seconds before application of other voltages.

Note 6: With heater volts = 24.5, dc plate volts = 1000, dc grid-No.2 volts = 250, dc grid-No.1 volts = -90, maximum dc grid-No.1 milliamperes = 20, grid-No.1 signal voltage adjusted to give dc plate current of 200 milliamperes, and a frequency of 475 Mc.

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 = 29.1, no voltage on other elements,

← Indicates a change.

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

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:

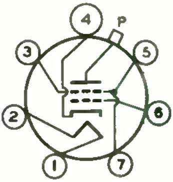
Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	2.85	amp
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 300, grid-No.2 volts = 300, and plate ma = 150.	7	
Direct Interelectrode Capacitances (Approx.):[a]		
Grid No.1 to plate	0.6	μμf
Grid No.1 to grid No.2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

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[b] or 122-248[b], 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_1[c]

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

	CCS[d]	ICAS[e]	
DC PLATE VOLTAGE	1500 max.	2000 max.	volts
DC GRID-No.2 VOLTAGE	400 max.	400 max.	volts
MAX.-SIGNAL DC PLATE CURRENT[f]	350 max.	350 max.	ma
MAX.-SIGNAL PLATE INPUT[f]	300 max.	400 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT[f]	20 max.	20 max.	watts
PLATE DISSIPATION[f]	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:

Values are for 2 tubes

	CCS[d]	ICAS[e]	
DC Plate Voltage	1500	2000	volts
DC Grid-No.2 Voltage[g]	400	400	volts
DC Grid-No.1 Voltage[h]	-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_1[c]
Single-Sideband Suppressed-Carrier Service

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

Up to 60 Mc

	CCS[d]	ICAS[e]	
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
MSX.-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
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 for "Single-Tone Modulation":[j]

	At 60 Mc		
DC Plate Voltage	1500	2000	volts
DC Grid-No.2 Voltage[g]	400	400	volts
DC Grid-No.1 Voltage[h]	-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[k]	250[k]	watts

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

High-Mu Triode Connection[m]

	CCS[d]	*ICAS*[e]	
Maximum Ratings, *Absolute-Maximum Values:*			
	Up to 60 Mc		
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"[j]		
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.)[h]	15	15	watts
Output-Circuit Efficiency (Approx.)	90	90	%
Max.-Signal Useful Power Output (Approx.)	160[k]	210[k]	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:***

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

	CCS[d]	*ICAS*[e]	
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[p]	400	400	volts
DC Grid-No.1 Voltage[q]	-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.)[n,r]	5	5	watts
Output-Circuit Efficiency (Approx.)	90	90	%
Useful Power Output (Approx.)	165[k]	240[k]	watts

At 175 Mc

DC Plate Voltage	700	820	volts
DC Grid-No.2 Voltage[p]	400	400	volts
DC Grid-No.1 Voltage[q]	-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.)[n,r]	8	8	watts
Output-Circuit Efficiency (Approx.)	85	85	%
Useful Power Output (Approx.)	105[k]	135[k]	watts

Maximum Circuit Values:

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

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

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

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

	CCS[d]	*ICAS*[e]	
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
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

	CCS[d]		*ICAS*[e]	
DC Plate Voltage	1000	1250	1500	volts
DC Grid-No.2 Voltage[y]	400	400	400	volts
DC Grid-No.1 Voltage[v]	-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.)[n,r]	4	4	4	watts
Output-Circuit Efficiency (Approx.)	90	90	90	%
Useful Power Output (Approx.)	215[k]	255[k]	340[k]	watts

At 175 Mc

DC Plate Voltage	665	875	1000	volts
DC Grid-No.2 Voltage[y]	400	400	400	volts

DC Grid-No. 1 Voltage[v]	-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.)[n]	8	7	8	watts
Output-Circuit Efficiency (Approx.).	85	85	85	%
Useful Power Output (Approx.).	130[k]	170[k]	215[k]	watts

Maximum Circuit Values:

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

[a] Without external shield.

[b] 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.

[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 fixed supply.

[h] Obtained from a fixed supply.

[j] "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.

[k] This value of useful power is measured at load of output circuit having indicated efficiency.

[m] Grids No. 1 and No. 2 connected together.

[n] 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.

[p] 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.

[q] 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.

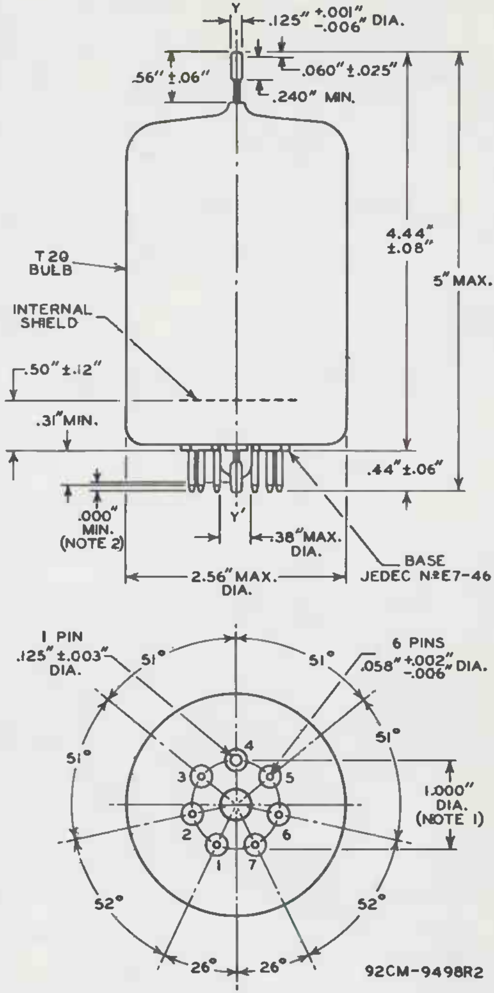
[r] Indicated values are for operation at 60 Mc. Less driver power output is required at frequencies below 60 Mc.

[s] 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.

[t] 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.

[u] 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.

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


Y
.125" +.001" -.006" DIA.
.56" ±.06"
.060" ±.025"
.240" MIN.
T20 BULB
INTERNAL SHIELD
4.44" ±.08"
5" MAX.
.50" ±.12"
.31" MIN.
.44" ±.06"
.000" MIN. (NOTE 2)
Y'
.38" MAX. DIA.
BASE JEDEC No. E7-46
2.56" MAX. DIA.
1 PIN .125" ±.003" DIA.
6 PINS .058" +.002" -.006" DIA.
51°
51°
51°
51°
52°
52°
26°
26°
1.000" DIA. (NOTE 1)
1
2
3
4
5
6
7

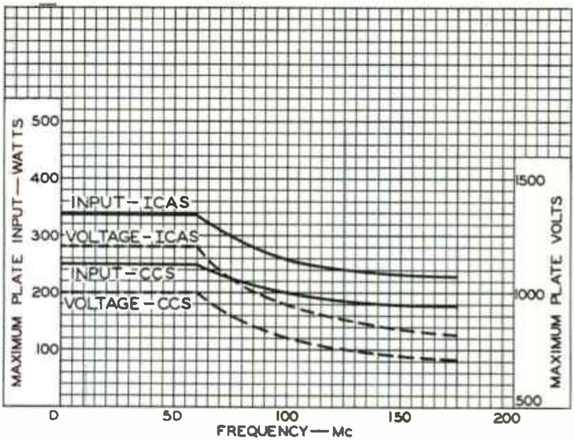
92CM-9498R2

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" DIAMETER 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'.

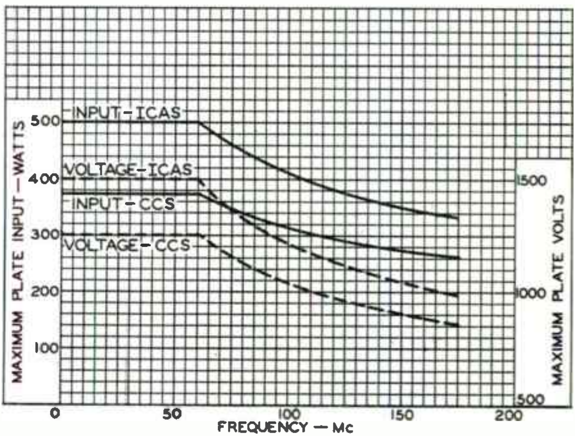
NOTE 2: EXHAUST TIP WILL NOT EXTEND BEYOND THE PLANE WHICH PASSES THROUGH THE ENDS OF THE THREE LONGEST PINS.

RATING CHART I
Class C Telephony Service



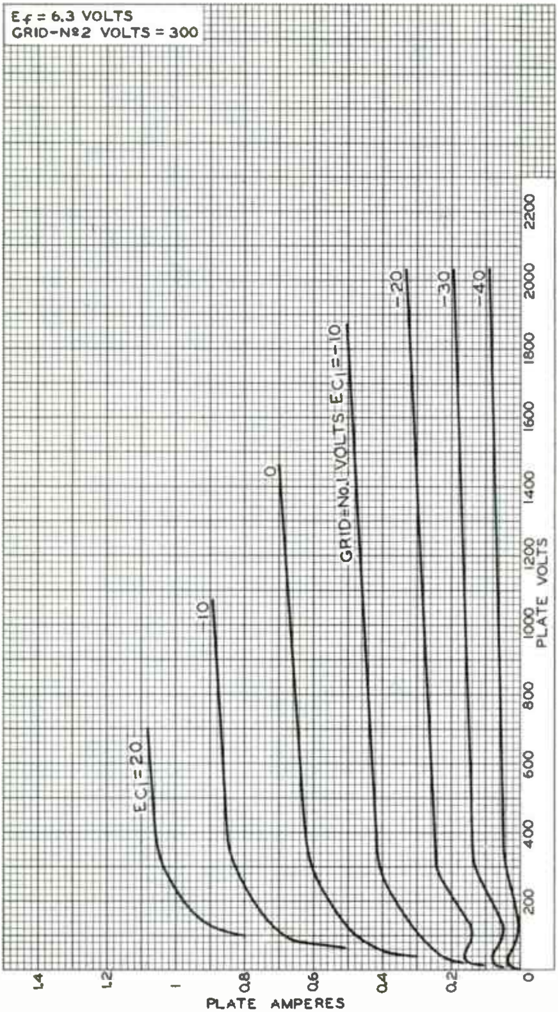
92CS-9492

RATING CHART II
Class C Telegraphy Service



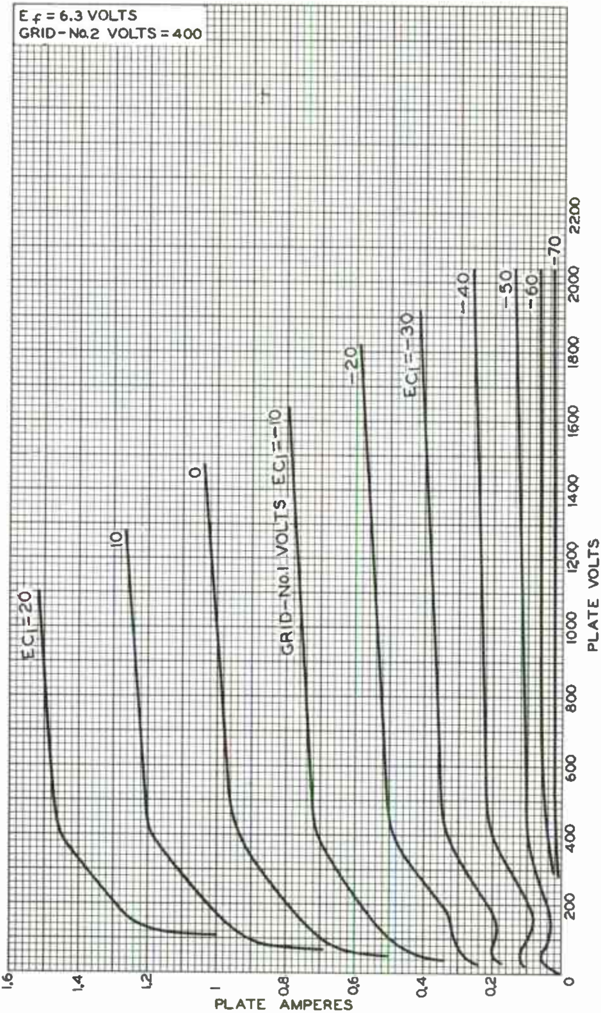
92CS-9491

TYPICAL PLATE CHARACTERISTICS



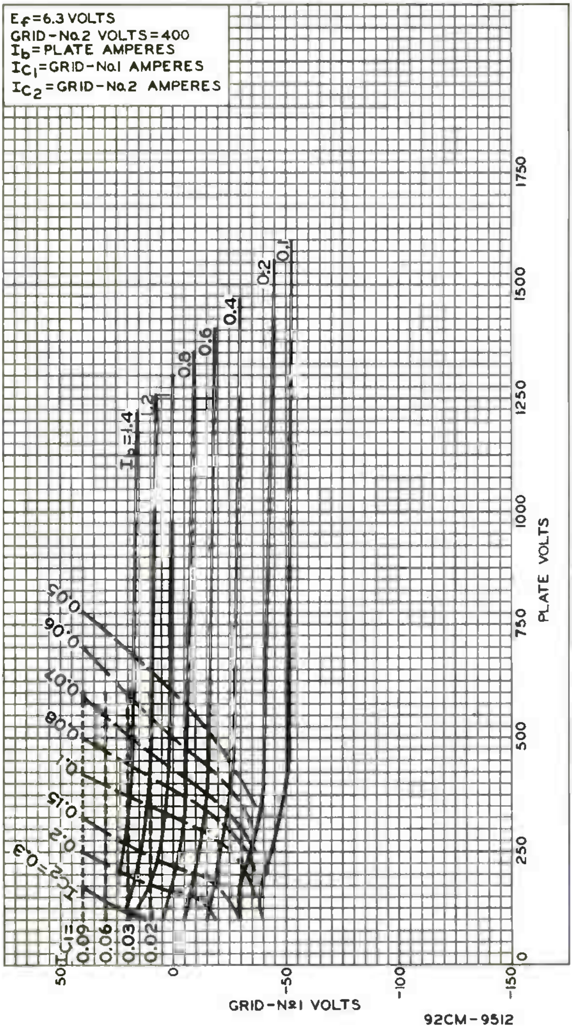
92CM-9511

TYPICAL PLATE CHARACTERISTICS

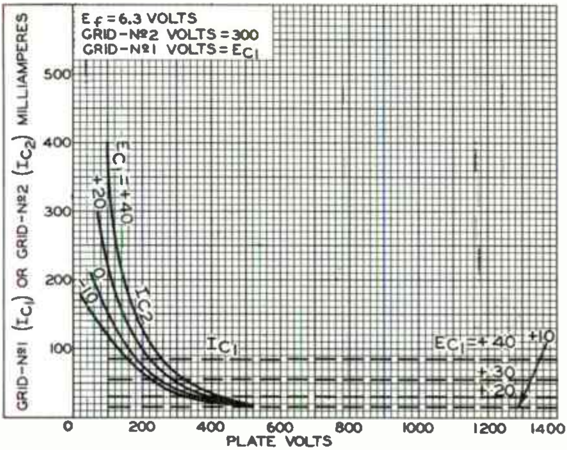


92CM-9502R1

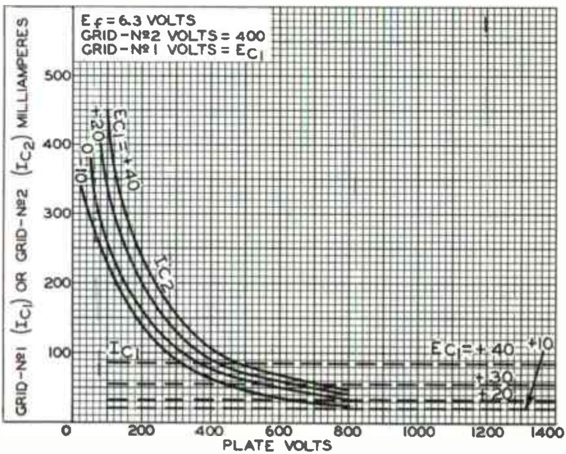
AVERAGE CONSTANT-CURRENT CHARACTERISTICS



TYPICAL CHARACTERISTICS

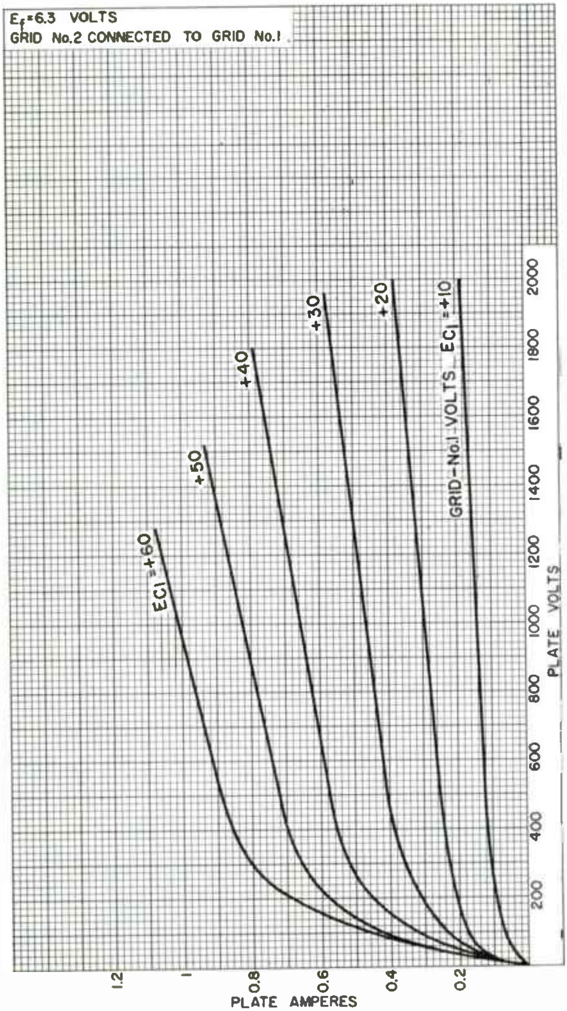


92CS-9501R1



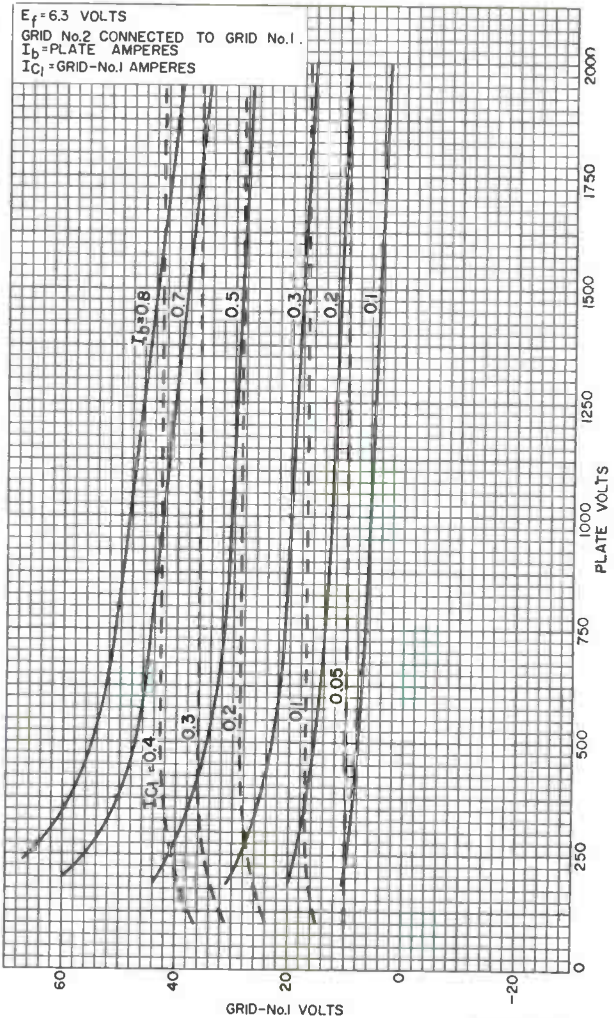
92CS-9500R1

TYPICAL PLATE CHARACTERISTICS
Triode Connection



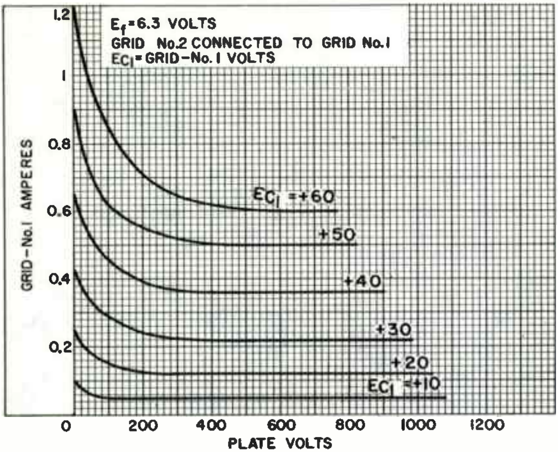
92CM-11045R1

TYPICAL CONSTANT-CURRENT CHARACTERISTICS
Triode Connection



92CM-11047R1

TYPICAL CHARACTERISTICS
Triode Connection



92CS-11046R1

Magnetron

TUNABLE TYPE

FORCED-AIR COOLED — **INTEGRAL MAGNET**

For Pulsed-Oscillator Applications at Frequencies between 8500 and 9600 Mc

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	13.75 ± 10%	volts
Current at heater volts = 13.75	3.15	amp
Starting current	Must never exceed 12 amperes, even momentarily	
Minimum Cathode Heating Time	2.5	minutes
Frequency	8500 to 9600	Mc
Maximum Frequency Pulling at VSWR of 1.5	15	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

Heater & Heater-Cathode Connector with built-in capacitor . . . . Jettron No.9000-C[a] or Ucinite No.115364[b]

Tuning Shaft with Associated Calibrated Indicator:

Revolutions (Approx.) to cover full range of 8500 to 9600 Mc	8-1/2
Maximum torque (Absolute) at tuning-range stops	200 oz-in.
Typical torque between -55° and +150° C (Approx.)	50 oz-in.

Weight (Approx.) . . . . 12 lbs

PULSED OSCILLATOR

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

For duty factor up to 0.0011 maximum

PEAK ANODE VOLTAGE	23 max.	kv
PEAK ANODE CURRENT	27.5 max.	amp
PEAK POWER INPUT[c]	630 max.	kw
AVERAGE POWER INPUT	0.63 max.	kw
PULSE DURATION	2.6 max.	μsec

RATE OF RISE OF VOLTAGE PULSE	200 max. / 70 min.	kv/μsec / kv/μsec
ANODE-BLOCK TEMPERATURE	150 max.	°C
HEATER-CATHODE-TERMINAL TEMPERATURE	165 max.	°C
LOAD-VOLTAGE STANDING-WAVE RATIO	1.5 max.	

Typical Operation:[d]

With load-voltage standing-wave ratio equal to or less than 1.05, except as noted, and with duty factor 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	4000	pps
Pulse Duration	2.5	0.25	μsec
RF Bandwidth with worst phasing of 1.5 VSWR	0.5	5	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° C and 150° C	0.2	0.2	Mc/°C
Servo-Drive-Shaft Torque	6	6	oz-in.
Frequency Deviation due to tuning backlash	8	8	Mc
Peak Power Output (Approx.)	230	230	kw

[a] Manufactured by Jettron Products, Hanover, New Jersey.

[b] Manufactured by Ucinite Division of United-Carr Fastener Corporation, Newtonville 60, Massachusetts.

[c] 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.

[d] 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	3.3	amp
Peak Anode Voltage	2	20	23	kv
Peak Power Output	3	200	-	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 0.25 microsecond, and load-voltage standing-wave ratio of 1.5 adjusted in phase to produce maximum instability. For heater voltage, see *Operating Considerations*.

OPERATING CONSIDERATIONS

The *high voltage at which the 7111 is operated is very dangerous.* Great care should be taken in the design of apparatus to prevent the operator from coming in contact with the high voltage. 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.

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.

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. The two streams are provided from two 3/4"-diameter ducts placed 1/2" to 3/4" from the fins.

After the *heater voltage* is raised gradually 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 high-voltage pulses are applied, the heater voltage (E_f) should preferably be reduced in accordance with the following formula, depending on the average power input (P_i) to the tube:

$$P_i \text{ up to 450 watts: } E_f = 13.75\left(1 - \frac{P_i}{450}\right) \text{ volts}$$

$$P_i \text{ greater than 450 watts: } E_f = 0 \text{ volts}$$

In those cases where this type is used as replacement for the fixed-frequency type 4J50, it is permissible to apply the following formula which is specified for reducing the heater voltage on the 4J50.

$$P_i \text{ up to 100 watts: } E_f = 13.75 \text{ volts}$$

$$P_i \text{ greater than 100 watts: } E_f = 14\left(1 - \frac{P_i}{1120}\right) \text{ volts}$$

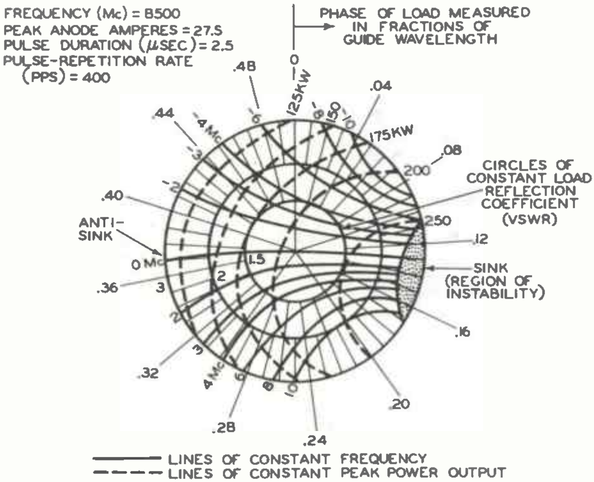
For *standby operation*, during which the high-voltage pulses are not applied to the tube, the heater voltage should be restored to 13.75 volts.

Tuning is accomplished by pushing in on the knurled tuning knob and turning it until the desired setting of the calibrated indicator is reached. Releasing the knob allows a spring to disengage it from the tuning mechanism. The design of the 7111 provides an essentially constant operating frequency without requiring a positive mechanical lock even though the tube is subjected to vibration.

For precise tuning adjustment, the final indicator setting should be approached using the same direction of rotation of the tuning shaft. There is little frequency drift after changing tuner setting.

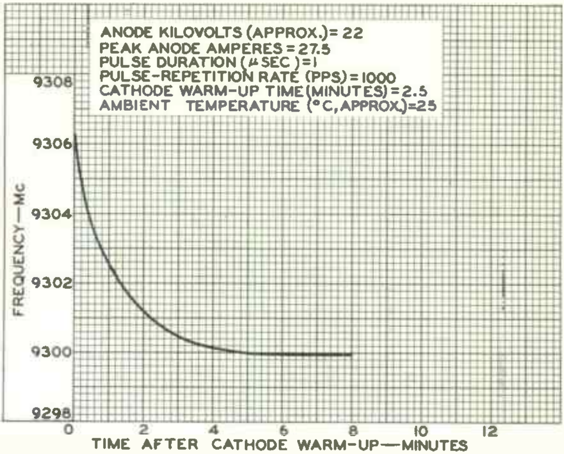
Our engineers are ready to assist you in circuit applications of the RCA-7111. For further information, write to Commercial Engineering, RCA, Harrison, New Jersey, giving complete details as to the proposed service.

RIEKE DIAGRAM



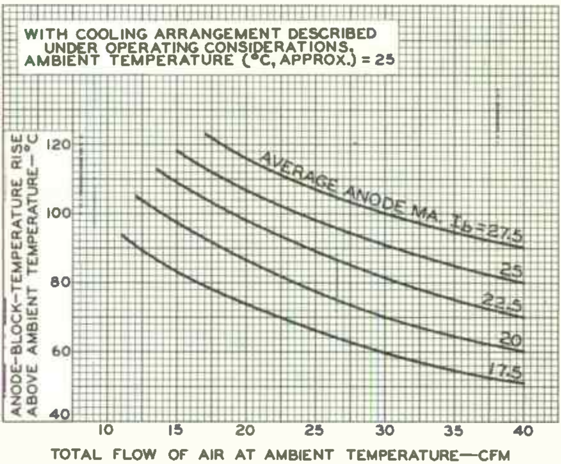
92CM-9629

TYPICAL STABILIZATION CHARACTERISTIC

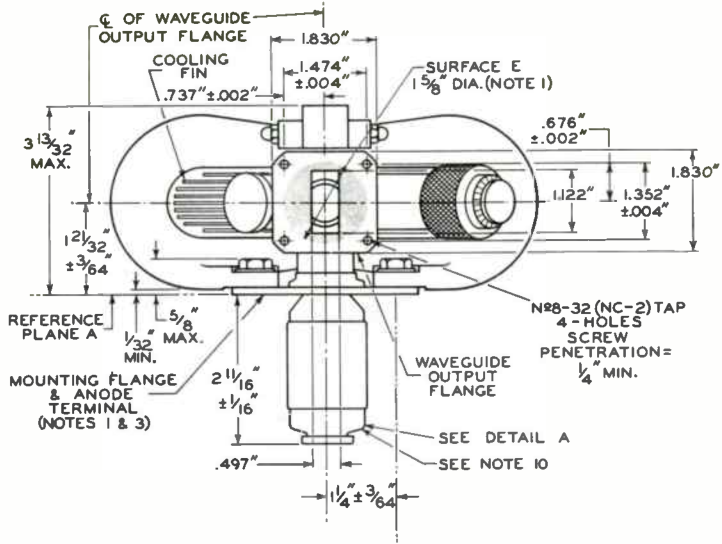


92CS-8941R1

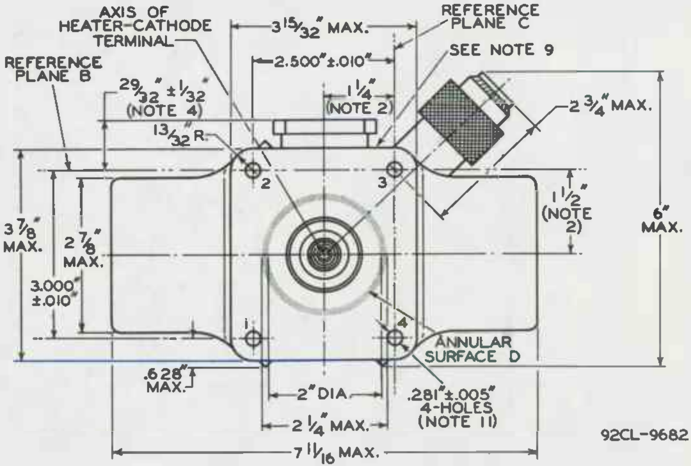
TYPICAL COOLING REQUIREMENTS



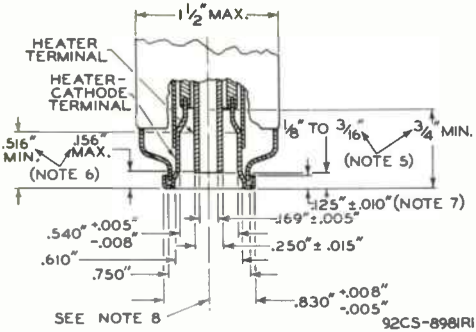
92CS-9688R1



℄ OF WAVEGUIDE OUTPUT FLANGE
1.830"
COOLING FIN
1.474" ±.004"
SURFACE E 1 5/8" DIA. (NOTE 1)
.737"±.002"
3 13/32" MAX.
.676" ±.002"
1.830"
1.122"
1.352" ±.004"
1 21/32" ±3/64"
Nº8-32 (NC-2) TAP 4-HOLES SCREW PENETRATION= 1/4" MIN.
REFERENCE PLANE A
5/8" MAX.
1/32" MIN.
MOUNTING FLANGE & ANODE TERMINAL (NOTES 1 & 3)
2 11/16" ±1/16"
WAVEGUIDE OUTPUT FLANGE
SEE DETAIL A
.497"
SEE NOTE 10
1 1/4" ± 3/64"


AXIS OF
HEATER-CATHODE
TERMINAL
3 15/32" MAX.
REFERENCE
PLANE C
2.500"±.010"
SEE NOTE 9
REFERENCE
PLANE B
29/32" ± 1/32"
(NOTE 4)
1 1/4"
(NOTE 2)
2 3/4" MAX.
13/32" R.
2
3
1 1/2"
(NOTE 2)
6"
MAX.
3 7/8"
MAX.
2 7/8"
MAX.
3.000"
±.010"
1
4
ANNULAR
SURFACE D
.628"
MAX.
2" DIA.
.281"±.005"
4-HOLES
(NOTE 11)
2 1/4" MAX.
7 11/16 MAX.
92CL-9682

DETAIL A



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.

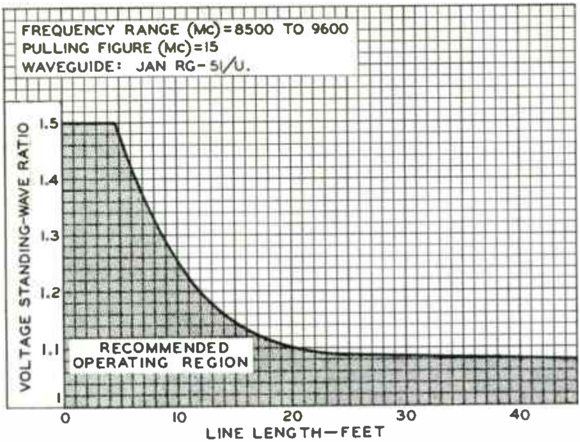
NOTE 8: THE HEATER TERMINAL AND THE HEATER-CATHODE TERMINAL ARE CONCENTRIC WITHIN 0.010".

NOTE 9: ANODE TEMPERATURE MEASURED AT JUNCTION OF WAVEGUIDE AND ANODE BLOCK.

NOTE 10: CATHODE TEMPERATURE MEASURED HERE.

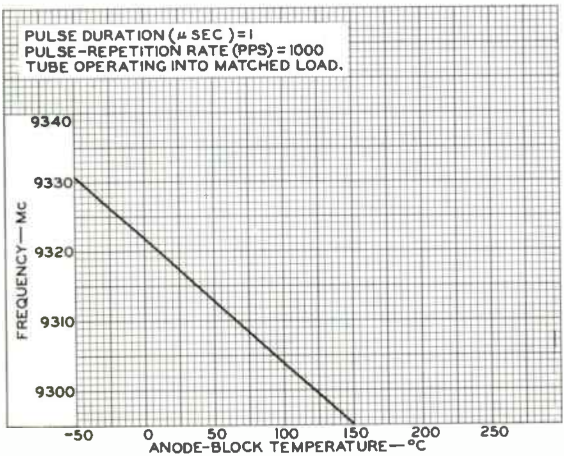
NOTE 11: THE ENDS OF THE MOUNTING STUDS MUST NOT PENETRATE THROUGH THE MOUNTING HOLES MORE THAN 1-3/32" FROM THE MOUNTING-FLANGE SURFACE.

EFFECT OF LENGTH OF TRANSMISSION LINE BETWEEN OUTPUT FLANGE AND LOAD ON ALLOWABLE VOLTAGE STANDING-WAVE RATIO



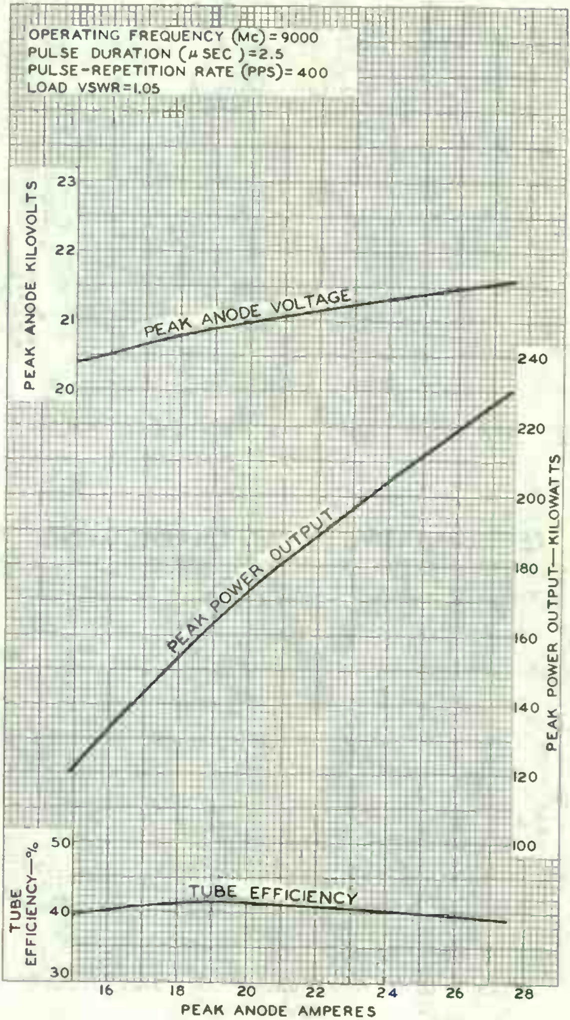
92CS-9469R1

TYPICAL THERMAL-FACTOR CHARACTERISTIC



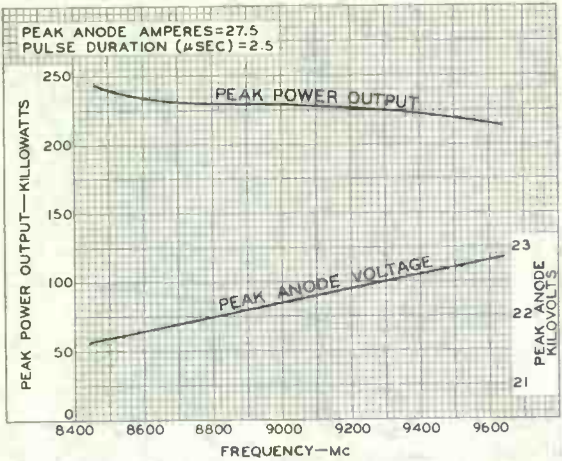
92CS-9285R1

TYPICAL PERFORMANCE CHARACTERISTICS



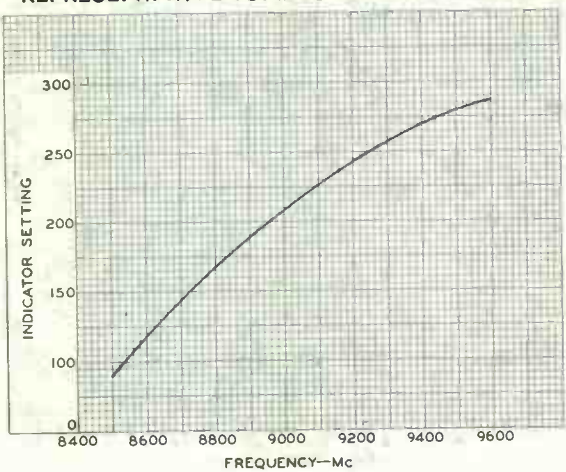
92CM-9468R1

TYPICAL PERFORMANCE CHARACTERISTICS



92CS-9690

REPRESENTATIVE TUNING CHARACTERISTIC



92CS-9691

Beam Power Tube

FORCED-AIR COOLED

CERAMIC-METAL SEALS	400 WATTS CW OUTPUT TO 175 Mc
COAXIAL-ELECTRODE STRUCTURE	250 WATTS CW OUTPUT AT 500 Mc
COMPACT DESIGN	INTEGRAL RADIATOR

For Use at Frequencies up to 500 Mc

The 7203 is unilaterally interchangeable with the 4X250B and bilaterally interchangeable with the 4CX250B.

GENERAL DATA

Electrical:

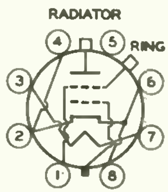
Heater, for Unipotential Cathode:		
Voltage (AC or DC)[a]	6.0 ± 10%	volts
Current at heater volts = 6.0	2.6	amp
Minimum heating time.	30	sec
Mu-Factor, Grid No.2 to Grid No.1, for grid-No.2 volts = 300 and grid-No.2 ma. = 50.	5.0	
Direct Interelectrode Capacitances:[b]		
Grid No.1 to plate.	0.03	μμf
Grid No.1 to cathode, grid No.2, and heater.	16.0	μμf
Plate to cathode, grid No.2, and heater.	4.4	μμf

Mechanical:

Operating Position.	Any
Maximum Overall Length.	2.464"
Maximum Seated Length	1.91"
Maximum Diameter.	1.640"
Weight (Approx.).	4 oz
Radiator.	Integral part of tube
Socket.	Air-System Socket, such as SK-600[c] and SK-606 Air Chimney[c]; or 124-110-1[d] (Supplied with Air Chimney)
Base.	Special 8-Pin

BOTTOM VIEW

Pin 1 - Grid No.2[e]
Pin 2 - Cathode
Pin 3 - Heater
Pin 4 - Cathode
Pin 5 - Do Not Use
Pin 6 - Cathode
Pin 7 - Heater



Pin 8 - Cathode
Base Index Plug - Grid No.1
Radiator - Plate
Ring Terminal[f] - 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

← Indicates a change.

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 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

AF POWER AMPLIFIER & MODULATOR — Class AB_1[g]

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

DC PLATE VOLTAGE	2000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	400 max.	volts
MAX.-SIGNAL DC PLATE CURRENT[j]	250 max.	ma
GRID-No.2 INPUT[j]	12 max.	watts
PLATE DISSIPATION[j]	250 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:

Values are for 2 tubes

DC Plate Voltage	1000	1500	2000	volts
DC Grid-No.2 Voltage	350	350	350	volts
DC Grid-No.1 (Control-grid) Voltage	-55	-55	-55	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage	94	94	94	volts
Zero-Signal DC Plate Current	166	166	166	ma
Max.-Signal DC Plate Current	500	500	500	ma

Zero-Signal DC Grid-No.2 Current	0	0	0	ma
Max.-Signal DC Grid-No.2 Current (Approx.)	10	8	8	ma
Effective Load Resistance (Plate to plate).	3300	6000	8700	ohms
Max.-Signal Driving Power (Approx.)	0	0	0	watts
Max.-Signal Power Output (Approx.)	220	400	590	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance (Per tube) . 0.1 max. megohm

RF POWER AMPLIFIER — Class B Television Service

Synchronizing-level conditions per tube unless otherwise specified

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

	54 to 216 Mc	
DC PLATE VOLTAGE.	2000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE. . . .	400 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE . . .	-250 max.	volts
DC PLATE CURRENT (AVERAGE)[k]	250 max.	ma
GRID-No.2 INPUT	12 max.	watts
GRID-No.1 INPUT	2 max.	watts
PLATE DISSIPATION	250 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 bandwidth of 5 Mc			
DC Plate Voltage.	1000	1500	2000	volts
DC Grid-No.2 Voltage.	350	350	350	volts
DC Grid-No.1 Voltage.	-60	-65	-70	volts
Peak RF Grid-No.1 Voltage:				
Synchronizing level	65	71	76	volts
Pedestal level.	52	57	62	volts
DC Plate Current:				
Synchronizing level	355	360	360	ma
Pedestal level.	250	250	250	ma
DC Grid-No.2 Current:				
Synchronizing level	27	29	29	ma
Pedestal level.	4	0	0	ma
DC Grid-No.1 Current:				
Synchronizing level	2	5	5	ma
Pedestal level.	0	0	0	ma
Driving Power (Approx.):[l]				
Synchronizing level	0.4	1.2	1.2	watts
Pedestal level.	0	0	0	watts
Power Output (Approx.):				
Synchronizing level	160	300	440	watts
Pedestal level.	90	170	250	watts

LINEAR RF POWER AMPLIFIER
Single-Sideband Suppressed-Carrier Service

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

	Up to 500 Mc	
DC PLATE VOLTAGE	2000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	400 max.	volts
MAX.-SIGNAL DC PLATE CURRENT	250 max.	ma
GRID-No.2 INPUT	12 max.	watts
PLATE DISSIPATION	250 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 Class AB_1 "Single-Tone" Operation:[m]

At frequencies up to 175 Mc

DC Plate Voltage	1000	1500	2000	volts
DC Grid-No.2 Voltage[n]	350	350	350	volts
DC Grid-No.1 (Control-grid) Voltage	-55	-55	-55	volts
Zero-Signal DC Plate Current	83	83	83	ma
Zero-Signal DC Grid-No.2 Current	0	0	0	ma
Effective RF Load Resistance	1650	3000	4350	ohms
Max.-Signal DC Plate Current	250	250	250	ma
Max.-Signal DC Grid-No.2 Current	5	4	4	ma
Max.-Signal Peak RF Grid-No.1 Voltage	47	47	47	volts
Max.-Signal Driving Power (Approx.)	0	0	0	watts
Max.-Signal Power Output (Approx.)	110	200	295	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under any condition:

For fixed-bias operation	25000 max.	ohms
For cathode-bias operation	Not recommended	

→ Typical CCS Operation with "Two-Tone Modulation":[p]

At 30 Mc

DC Plate Voltage	1000	1500	2000	volts
DC Grid-No.2 Voltage[n]	350	350	350	volts
DC Grid-No.1 Voltage[q]	-55	-55	-55	volts
Zero-Signal DC Plate Current	83	83	83	ma
Effective RF Load Resistance	1650	3000	4350	ohms
DC Plate Current at Peak of Envelope	250	250	250	ma
Average DC Plate Current	175	175	175	ma
DC Grid-No.2 Current at Peak of Envelope	30	30	30	ma

→ indicates a change.

Average DC Grid-No.2 Current	6	9.5	15	ma
Average DC Grid-No.1 Current	0	0	0	ma
Peak-Envelope Driver Power (Approx.)	1	1	1	watt
Output-Circuit Efficiency (Approx.)	95	95	95	%
Distortion Products Level:[r]				
Third Order	29	29	30	db
Fifth Order	40	38	35	db
Useful Power Output (Approx.):[s]				
Average	55	100	147.5	watts
Peak Envelope	110	200	295	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under any condition:

For fixed-bias operation	25000 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[f] Ratings, ***Absolute-Maximum Values:***

	Up to 500 Mc	
DC PLATE VOLTAGE	1500 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	300 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-250 max.	volts
DC PLATE CURRENT	200 max.	ma
GRID-No.2 INPUT	8 max.	watts
GRID-No.1 INPUT	2 max.	watts
PLATE DISSIPATION	165 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 frequencies up to 175 Mc			
DC Plate Voltage	500	1000	1500	volts
DC Grid-No.2 Voltage (Modulated approx. 55%)[t]	250	250	250	volts
DC Grid-No.1 Voltage[u]	-100	-100	-100	volts
Peak RF Grid-No.1 Voltage	113	113	113	volts
DC Plate Current	200	200	200	ma
DC Grid-No.2 Current	32	31	31	ma
DC Grid-No.1 Current (Approx.)	6	6	6	ma
Driving Power (Approx.)1	0.7	0.7	0.7	watt
Power Output (Approx.)	50	140	235	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under any condition	25000 max.	ohms

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

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

	Up to 500 Mc	
DC PLATE VOLTAGE	2000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	300 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-250 max.	volts
DC PLATE CURRENT	250 max.	ma
GRID-No.2 INPUT	12 max.	watts
GRID-No.1 INPUT	2 max.	watts
PLATE DISSIPATION	250 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 frequencies up to 175 Mc				
DC Plate Voltage	500	1000	1500	2000	volts
DC Grid-No.2 Voltage	250	250	250	250	volts
DC Grid-No.1 Voltage	-90	-90	-90	-90	volts
Peak RF Grid-No.1 Voltage	109	109	109	109	volts
DC Plate Current	250	250	250	250	ma
DC Grid-No.2 Current	48	45	36	30	ma
DC Grid-No.1 Current (Approx.)	12	12	11	11	ma
Driving Power (Approx.)	1	1	1	1	watt
Power Output (Approx.)	65	180	290	400	watts

	At frequency of 500 Mc with coaxial cavity	
DC Plate Voltage	2000	volts
DC Grid-No.2 Voltage	300	volts
DC Grid-No.1 Voltage	-90	volts
DC Plate Current	250	ma
DC Grid-No.2 Current	10	ma
DC Grid-No.1 Current (Approx.)	25	ma
Driver Power Output (Approx.)[1]	18	watts
Useful Power Output (Approx.)	250	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under any condition	25000 max.	ohms

[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 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.

[c] Available from Eitel-McCullough, Inc., San Bruno, California.

[d] Available from E. F. Johnson Co., Waseca, Minnesota.

[e] For use at lower frequencies.

[f] For use at higher frequencies.

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

[h] Continuous Commercial Service.

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

k Averaged over any frame.

l 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 values to take care of variations in line voltage, in components, in initial tube characteristics, and in tube characteristics during life.

m "Single-Tone" operation refers to that class of amplifier service in which the grid-No.2 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.

n Preferably obtained from a fixed supply.

p "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.

q Obtained from a fixed supply.

r Without the use of feedback to enhance linerity.

s Measured at load of output circuit having indicated efficiency.

t The dc grid-No.2 voltage must be modulated approximately 55% in phase with the plate modulation in order to obtain 100% modulation of the 7203. The use of a series grid-No.2 resistor or reactor may not give satisfactory performance and is therefore not recommended.

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

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% of the carrier conditions.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Heater Current	1	2.3	2.9	amp
Direct Interelectrode Capacitances:				
Grid No.1 to plate	2	-	0.06	μμf ←
Grid No.1 to cathode, grid No.2, and heater	2	14.2	17.2	μμf
Plate to cathode, grid No.2, and heater	2	4.0	4.8	μμf
Grid-No.1 Voltage	1,3,4,5	-32	-46	volts
Grid-No.2 Current	1,3,4,5	-7	3	ma
Useful Power Output	4,5,6	225	-	watts

Note 1: With 6.0 volts on heater.

Note 2: 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.

Note 3: With dc plate volts = 1000, dc grid-No.2 volts = 300, and grid-No.1 voltage adjusted to give plate current of 150 ma.

Note 4: With Forced-Air Cooling as specified under GENERAL DATA—*Air-System Socket*.

Note 5: Heater-voltage must be applied for at least 30 seconds before application of other voltages.

Note 6: With heater volts = 5.5, dc plate volts = 2000, dc grid-No.2 volts = 300, dc grid-No.1 volts = -90, dc grid-No.1 ma. = 25 maximum, grid-No.1 signal voltage adjusted to produce dc plate current of 250 ma., and coaxial-cavity amplifier-circuit operating frequency (Mc) = 475.

← Indicates a change.

SPECIAL TESTS & PERFORMANCE DATA

Interelectrode Leakage:

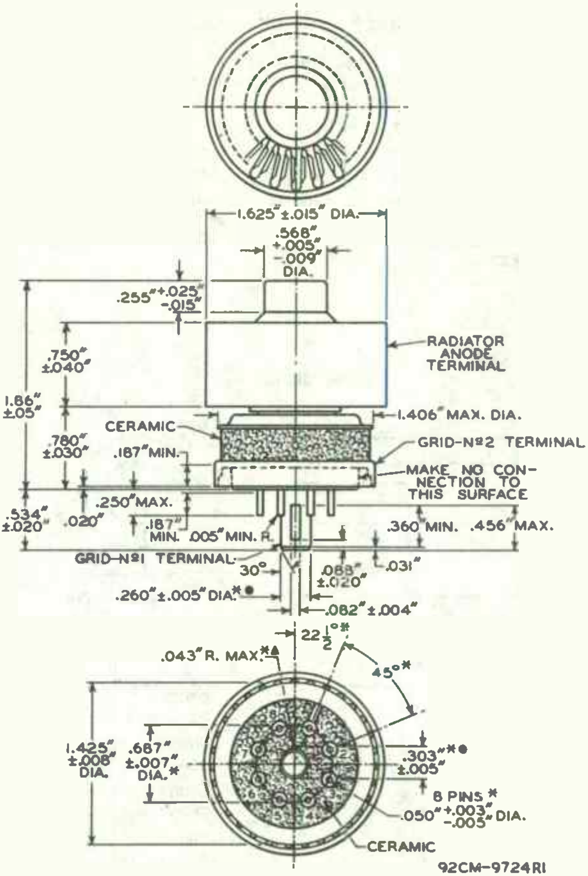
This test is destructive and is performed on a sample lot of tubes from each production run under the following conditions: ac heater volts = 6.6, no voltage on other elements, and specified forced-air cooling for *Air-System Socket*. At the end of 500 hours, with tube at 25° C, and with no voltage applied 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 7203 should be of a type (such as is 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 means of 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.



GRID-No. 1-PLUG DIMENSIONS ARE MEASURED BY THE USE OF THE SERIES OF GAUGES SHOWN IN SKETCHES 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:

▲,●,*: See next page.

▲ GAUGES G_1-1, G_1-2, G_1-3, AND G_1-4:

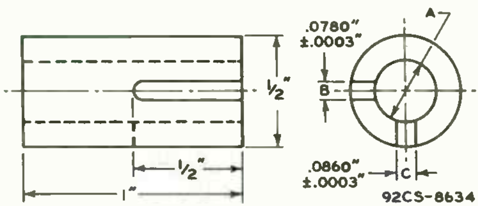
USING ONLY SLOT C, TRY THESE GAUGES IN NUMERICAL ORDER UNTIL ONE IS FOUND THAT WILL ACCEPT THE ENTIRE GRID-No. 1 PLUG. USING THE FIRST GAUGE THUS FOUND, IT WILL NOT BE POSSIBLE TO INSERT THE GRID-No. 1 PLUG IN SLOT B.

● 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.

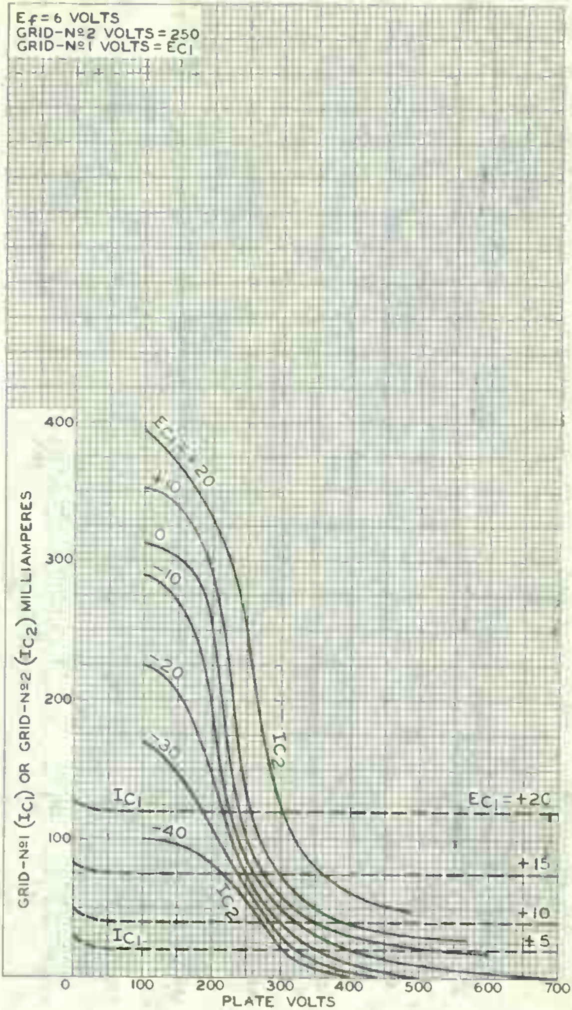
* BASE-PIN POSITIONS ARE HELD TO TOLERANCES SUCH THAT THE ENTIRE LENGTH OF THE PINS WILL, WITHOUT UNDUE FORCE, PASS INTO AND DISENGAGE FROM THE FLAT-PLATE GAUGE SHOWN IN SKETCH G_3.

GAUGE SKETCH G_1



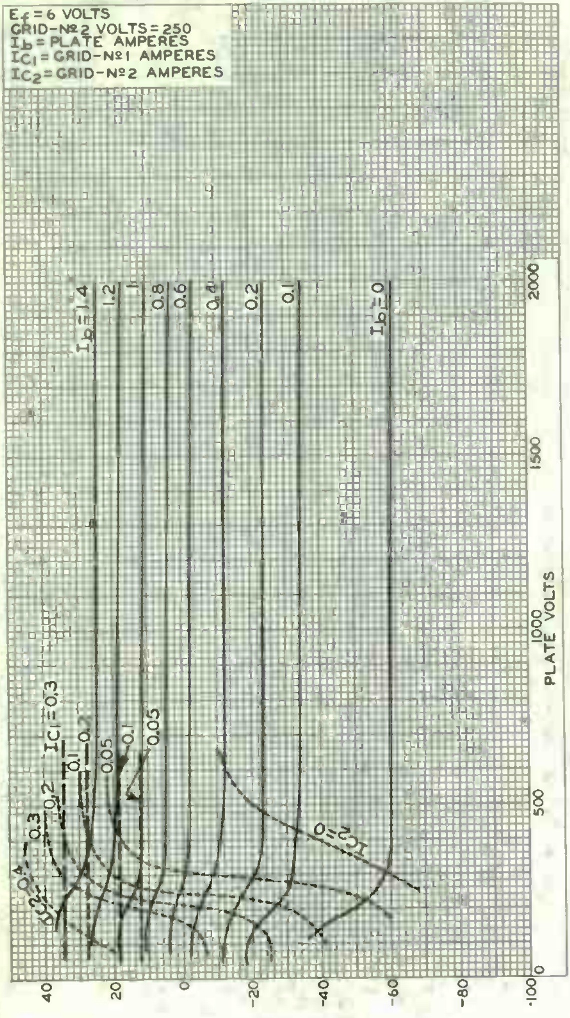
Gauge	Dimension A
G_1-1	.2575" $^{+.0000"}_{-.0005"}$
G_1-2	.2600" $^{+.0000"}_{-.0005"}$
G_1-3	.2625" $^{+.0000"}_{-.0005"}$
G_1-4	.2650" $^{+.0000"}_{-.0005"}$

TYPICAL CHARACTERISTICS

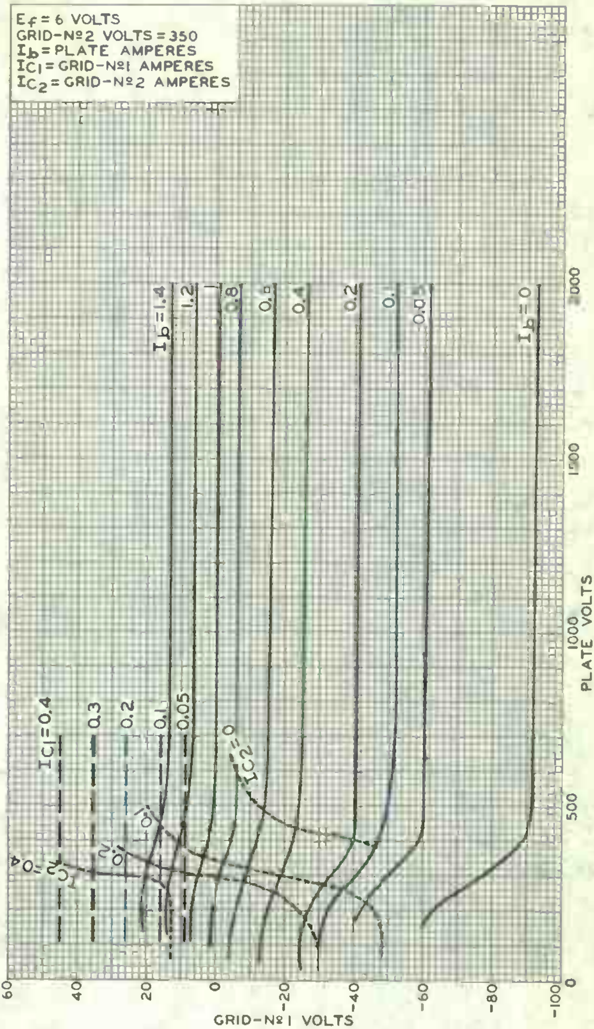


92CM-9756

TYPICAL CONSTANT-CURRENT CHARACTERISTICS

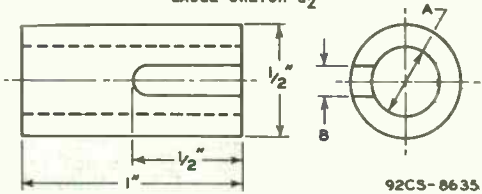


TYPICAL CONSTANT-CURRENT CHARACTERISTICS



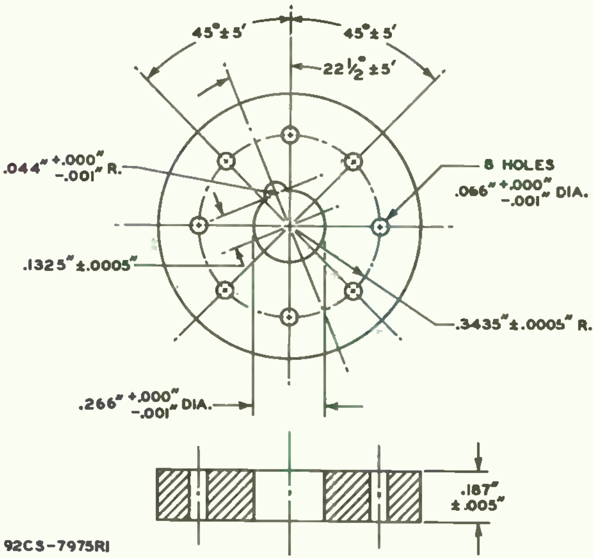
92CM-9761

GAUGE SKETCH G_2



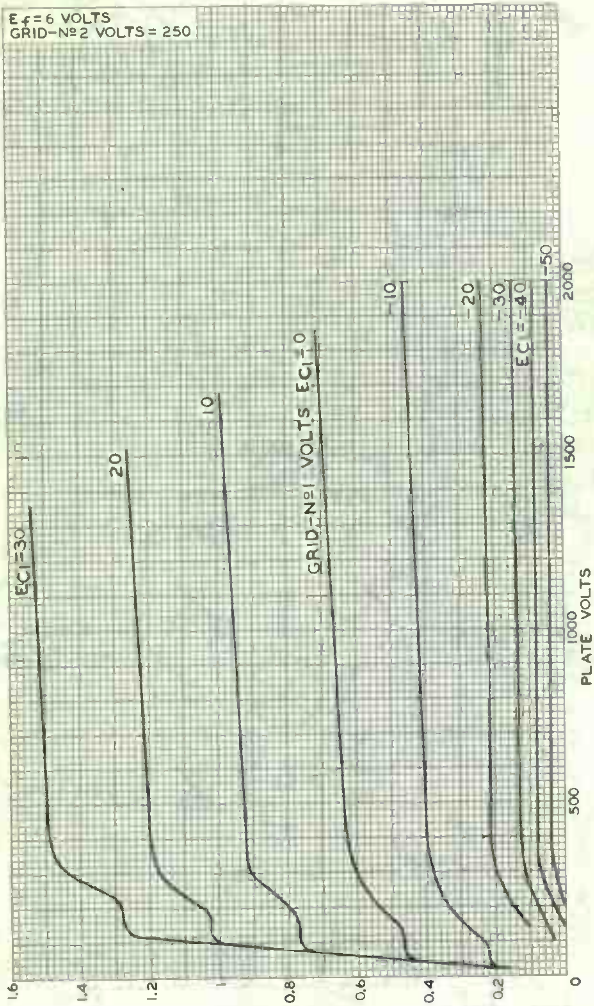
Gauge	Dimension	
	A	B
G_2-1	.2550" + .0000" − .0005"	.125"
G_2-2	.2980" + .0000" − .0005"	none
G_2-3	.3080" + .0000" − .0005"	none

GAUGE SKETCH G_3



TOLERANCES ARE NOT CUMULATIVE

TYPICAL PLATE CHARACTERISTICS



92CM-9755

Beam Power Tube

FORCED-AIR COOLED

CERAMIC-METAL SEALS — 400 WATTS CW OUTPUT TO 175 Mc
COAXIAL-ELECTRODE STRUCTURE — 250 WATTS CW OUTPUT AT 500 Mc
COMPACT DESIGN — INTEGRAL RADIATOR

For Use at Frequencies up to 500 Mc

The 7204 is unilaterally interchangeable with the 4X250F and bilaterally interchangeable with the 4CX250F. ←

The 7204 is the same as the 7203/4CX250B except for the following items:

Heater, for Unipotential Cathode:
Voltage (AC or DC)[a] . . . . 26.5 ± 10% volts
Current at heater volts = 26.5. . . . . . 0.58 amp

[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.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Heater Current	1	0.50	0.62	amp
Direct Interelectrode Capacitances:				
Grid No.1 to plate	2	-	0.06	μμf ←
Grid No.1 to cathode, grid No.2, and heater	2	14.2	17.2	μμf
Plate to cathode, grid No.2, and heater	2	4.0	4.8	μμf
Grid-No.1 Voltage	1,3,4,5	-32	-46	volts
Grid-No.2 Current	1,3,4,5	-7	3	ma
Useful Power Output	4,5,6	225	-	watts

Note 1: With 26.5 volts on heater.

Note 2: 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.

Note 3: With dc plate volts = 1000, dc grid-No.2 volts = 300, and grid-No.1 voltage adjusted to give plate current of 150 ma.

Note 4: With Forced-Air Cooling as specified under GENERAL DATA — *Air-System Socket*.

Note 5: Heater voltage must be applied for at least 30 seconds before application of other voltages.

Note 6: With heater volts = 24.3, dc plate volts = 2000, dc grid-No.2 volts = 300, dc grid-No.1 volts = -90, dc grid-No.1 ma. = 25 maximum, grid-No.1 signal voltage adjusted to produce dc plate current of 250 ma., and coaxial-cavity amplifier-circuit operating frequency (Mc) = 475.

SPECIAL TESTS & PERFORMANCE DATA

Interelectrode Leakage:

This test is destructive and is performed on a sample lot of tubes from each production run under the following condi-

← Indicates a change.

tions; ac heater volts = 29.1, 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

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

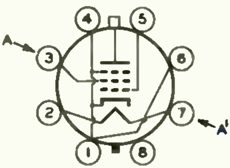
Electrical:

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 ←

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

* 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.

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:∞♣

For fixed-bias operation	0.1 max.	megohm
For cathode-bias operation	Not recommended	

AF POWER AMPLIFIER & MODULATOR — Class AB_1†

Triode Connection§

Maximum Ratings, ***Absolute Values:***

	CCS●	*ICAS*●●	
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

	CCS	CCS	ICAS	
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

*, †, ●, ●●, **, ▲, ∞, ♣, §, °: See next page.

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	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:°°✱

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

*,†,●,●●,**,▲,°°,✱,§,°,✱,#: See next page.

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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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	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

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

*,†,•,••,**,▲,∞,♣,§,o,♠,#,♦,♦,★,‡,■: See next page.

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	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

	CCS		ICAS		
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

	CCS	ICAS	
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.

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	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.

∞ 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.

○ 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.

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■ 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:

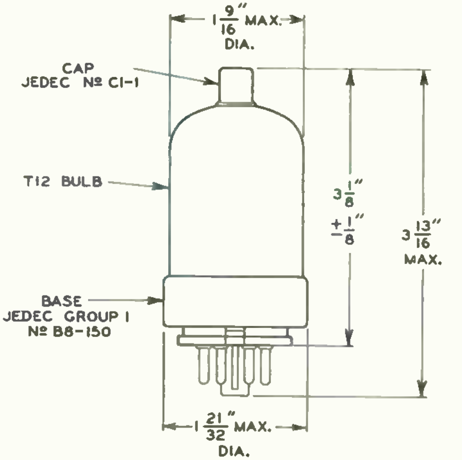
This test is performed on a sample lot of tubes from each production run under the following conditions: Heater volts = 6.3, plate-supply volts = 250, grid-No.2 volts = 200, grid-No.1 voltage varied to give a plate current of 10 milliamperes, plate load resistor (ohms) = 2000, and vibrating frequency 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):

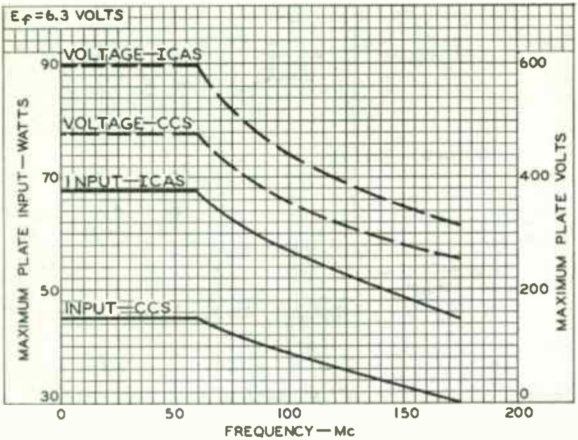
This test is performed on a sample lot of tubes from each production run. Tubes are vibrated in each of 3 positions, perpendicular and parallel to major axis of the tube, and parallel to longitudinal axis of the tube, through the frequency range from 50 to 120 cycles per second at a fixed acceleration 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 № C1-1
T12 BULB
BASE JEDEC GROUP 1 № B8-150
3 1/8" ± 1/8"
3 13/16" MAX.
1 21/32" MAX. DIA.

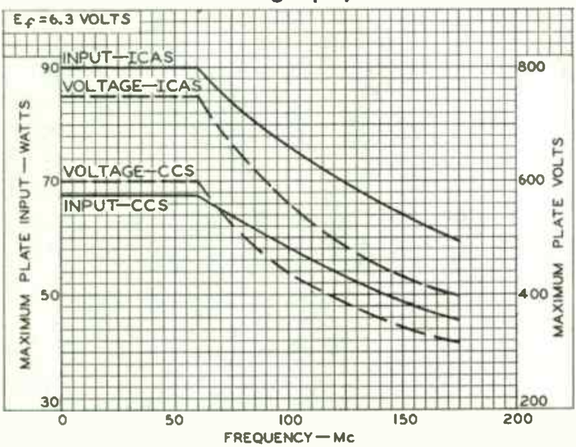
92CS-9625R4

RATING CHART I
Class C Telephony Service



92CS-9614

RATING CHART II
Class C Telegraphy Service

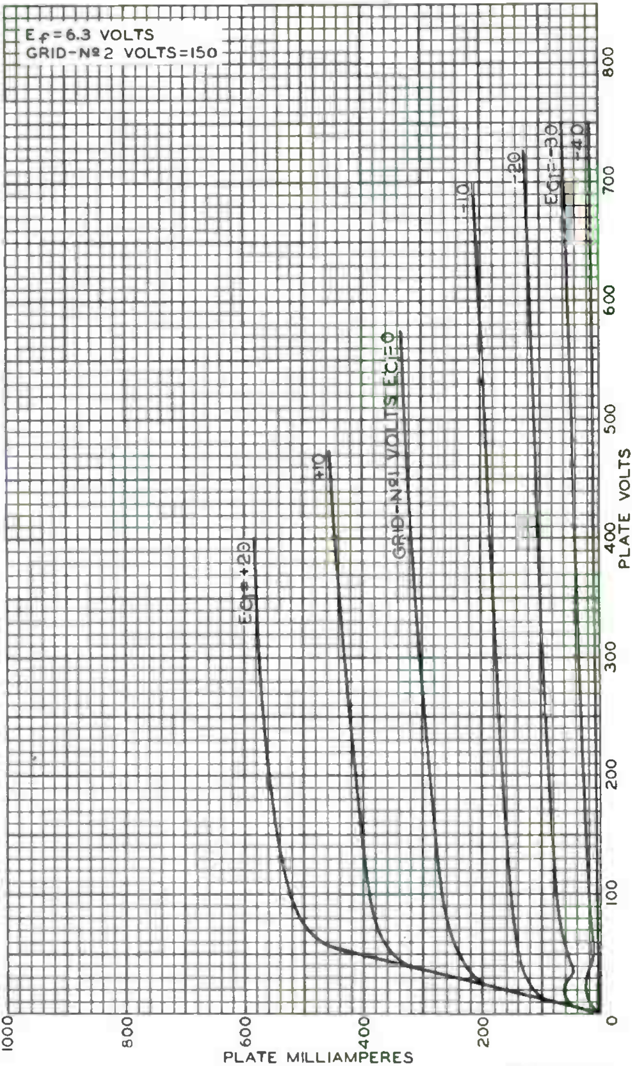


92CS-9615

RCA

7212

AVERAGE PLATE CHARACTERISTICS



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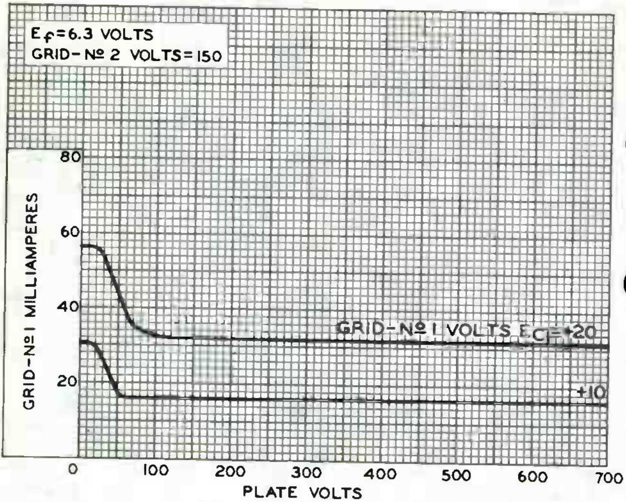
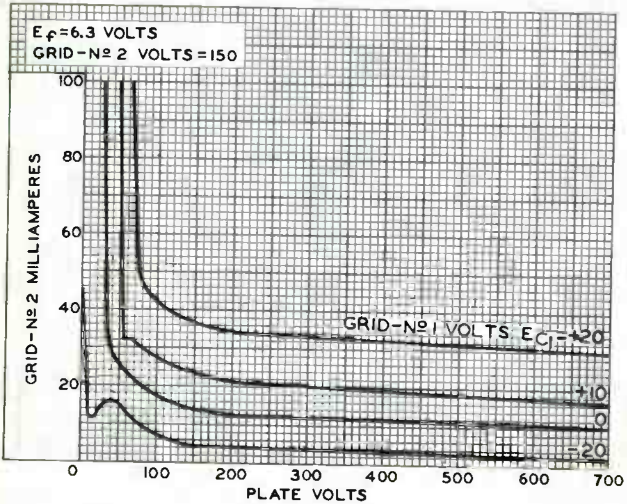
7212

AVERAGE CHARACTERISTICS



92CS-9619



92CS-9620

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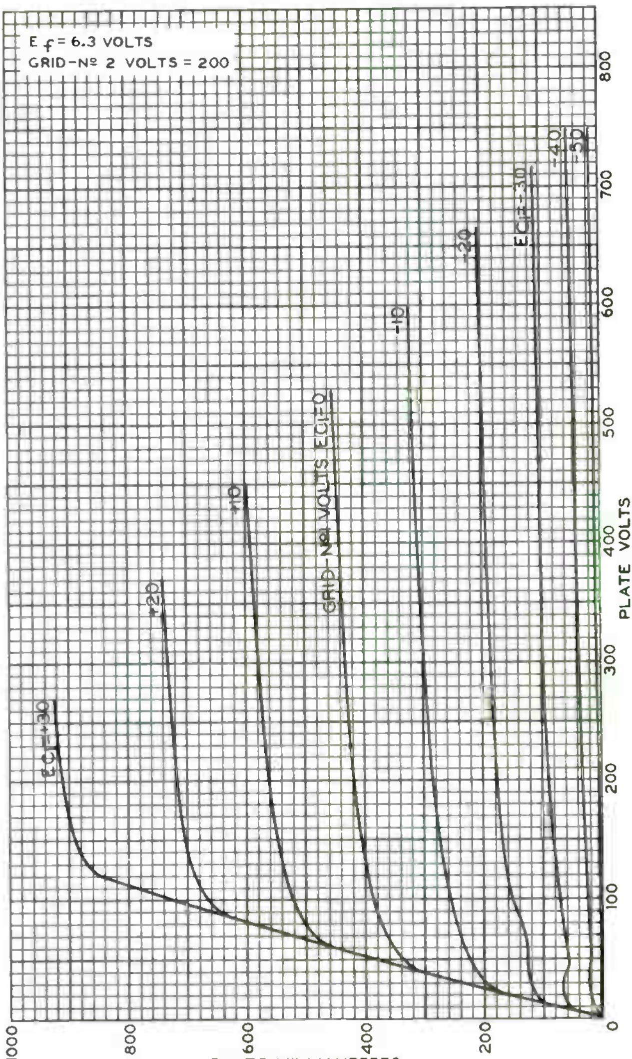
7212

7212

AVERAGE PLATE CHARACTERISTICS



92CM-7707R1

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7212

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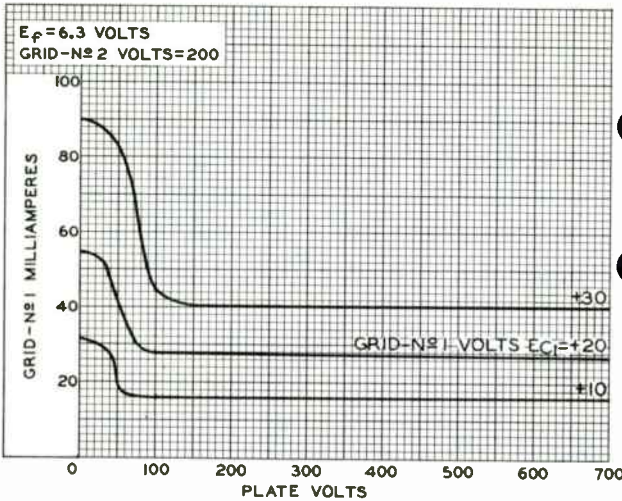
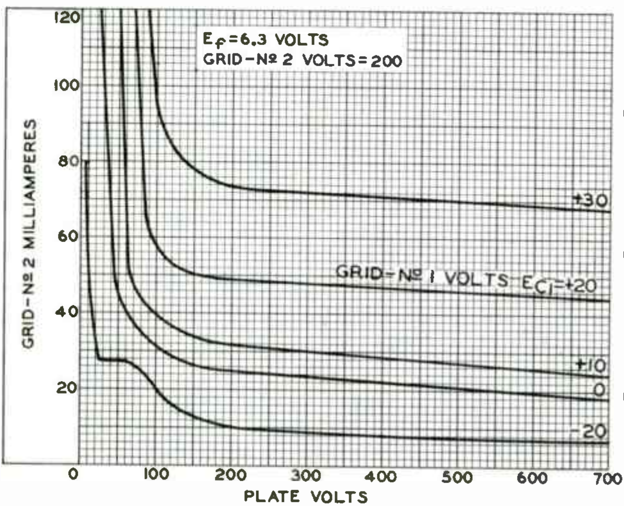
AVERAGE CHARACTERISTICS



92CS-9617

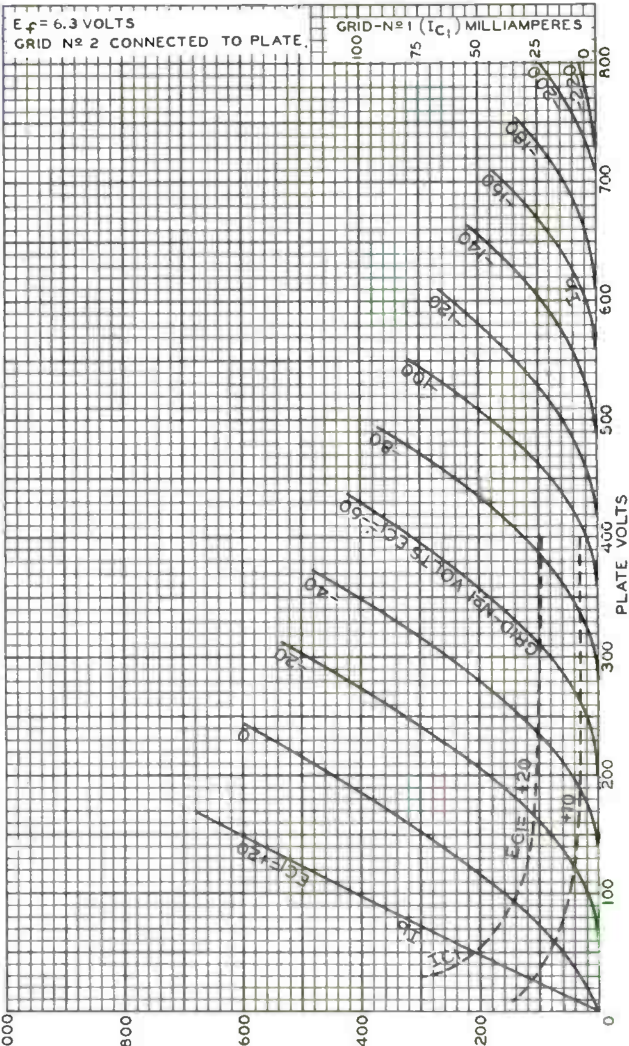


92CS-9618

7212

7212

AVERAGE CHARACTERISTICS
TRIODE CONNECTION



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92CM-7711R1

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7213

BEAM POWER TUBE

CERAMIC-METAL SEALS — COAXIAL-ELECTRODE STRUCTURE
UNITIZED-ELECTRODE DESIGN — INTEGRAL RADIATOR
FORCED-AIR COOLED — 2500 WATTS CW INPUT
MATRIX-TYPE, OXIDE-COATED, UNIPOTENTIAL CATHODE

Useful with full ratings at frequencies up to 1215 Mc

GENERAL DATA

Electrical:

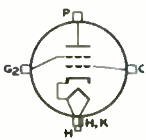
Heater, for Matrix-Type, Oxide-Coated, Unipotential Cathode:

Voltage (AC or DC)♦	5.5 typical / 6 max.	volts / volts
Current at 5.5 volts	17.5	amp
Minimum heating time at 5.5 volts. .	5	minutes
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 2500, grid-No.2 volts = 600, and plate ma. = 600 . .	17	
Direct Interelectrode Capacitances:		
Grid No.1 to plate*	0.17 max.	μμf
Grid No.1 to cathode & heater. . . .	42	μμf
Plate to cathode & heater*,**	0.014 max.	μμf
Grid No.1 to grid No.2	55	μμf
Grid No.2 to plate	16	μμf
Grid No.2 to cathode & heater** . . .	1.4 max.	μμf

Mechanical:

Operating Position . . . . Any
Overall Length . . . . 3.24" ± 0.10"
Greatest Diameter *(See Dimensional Outline)*. . 3.70" ± 0.05"
Weight (Approx.) . . . . 2 lbs
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

Air Flow:

Through radiator--Adequate air flow to limit the plate-seal temperature to 250° C should be delivered by a blower through the radiator before and during the application of heater, plate, grid-No.2, and grid-No.1 voltages. Typical values of air flow directed through the radiator versus

♦,*,**: See next page.

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percentage of maximum rated plate dissipation for each class of service are shown in accompanying Typical-Cooling-Requirements curves. Plate power, grid-No.2 power, heater power, and air flow may be removed simultaneously.

To grid-No.2, grid-No.1, cathode, and heater seals--A sufficient quantity of air should be directed at the heater terminal and allowed to flow past each of these seals so that its temperature does not exceed the specified maximum value of 250° C. An air flow of 10 cfm is usually adequate.

Seal Temperature (Plate, grid No.2, grid No.1, cathode, and heater)	250 max.	°C

LINEAR RF POWER AMPLIFIER
Single-Sideband Suppressed-Carrier Service

Maximum CCS● Ratings, *Absolute Values:*

	Up to 1215 Mc	
DC PLATE VOLTAGE	2500 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	1000 max.	volts
MAX.-SIGNAL DC PLATE CURRENT	1 max.	amp
MAX.-SIGNAL DC GRID-No.1 (CONTROL-GRID) CURRENT	0.2 max.	amp
MAX.-SIGNAL PLATE INPUT	2500 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT	50 max.	watts
PLATE DISSIPATION	1500 max.	watts

Typical CCS Class AB_1 "Single-Tone" Operation:♠♠

	Up to 60 Mc		
DC Plate Voltage	2250	2500	volts
DC Grid-No.2 Voltage▲	700	700	volts
DC Grid-No.1 Voltage	-50	-50	volts
Zero-Signal DC Plate Current	0.2	0.2	amp
Zero-Signal DC Grid-No.2 Current	0	0	amp
Effective RF Load Resistance	1100	1100	ohms
Max.-Signal DC Plate Current	0.9	1	amp
Max.-Signal DC Grid-No.2 Current	0.45	0.45	amp
Max.-Signal DC Grid-No.1 Current	0	0	amp
Max.-Signal Peak RF Grid-No.1 Voltage	50	50	volts
Max.-Signal Driving Power (Approx.)	0	0	watts
Max.-Signal Power Output (Approx.)	1000	1250	watts

PLATE-MODULATED RF POWER AMPLIFIER — Class C Telephony

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

Maximum CCS● Ratings, *Absolute Values:*

	Up to 1215 Mc	
DC PLATE VOLTAGE	2000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	1000 max.	volts

♠,*,**,●,♠♠,▲: See next page.

BEAM POWER TUBE

	Up to 1215 Mc	
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-300 max.	volts
DC PLATE CURRENT	0.85 max.	amp
DC GRID-No.1 CURRENT	0.2 max.	amp
PLATE INPUT	1700 max.	watts
GRID-No.2 INPUT	35 max.	watts
PLATE DISSIPATION	1000 max.	watts

Typical CCS Operation:

In grid-drive circuit at 600 Mc			
DC Plate Voltage	1800	2000	volts
DC Grid-No.2 Voltage••	500	500	volts
DC Grid-No.1 Voltage*	-30	-30	volts
DC Plate Current	0.75	0.83	amp
DC Grid-No.2 Current	0.015	0.015	amp
DC Grid-No.1 Current (Approx.)	0.04	0.04	amp
Driver Power Output (Approx.)■	50	55	watts
Useful Power Output (Approx.)	650†	800†	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under any condition	5000‡ max.	ohms

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

Maximum CCS• Ratings, ***Absolute Values***

	Up to 1215 Mc	
DC PLATE VOLTAGE	2500 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	1000 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-300 max.	volts
DC PLATE CURRENT	1 max.	amp
DC GRID-No.1 CURRENT	0.2 max.	amp
PLATE INPUT	2500 max.	watts
GRID-No.2 INPUT	50 max.	watts
PLATE DISSIPATION	1500 max.	watts

Typical CCS Operation:

In grid-drive circuit at 600 Mc			
DC Plate Voltage	2250	2500	volts
DC Grid-No.2 Voltage•	500	500	volts
DC Grid-No.1 Voltage••	-30	-30	volts
DC Plate Current	0.9	1	amp
DC Grid-No.2 Current	0.02	0.02	amp
DC Grid-No.1 Current (Approx.)	0.07	0.07	amp
Driver Power Output (Approx.)■	70	75	watts
Useful Power Output (Approx.)	1050†	1350†	watts

♣, *, **, •, ♣♣, ▲, ●●, ★, ■, †, ‡, □, •, ••: See next page.

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Maximum Circuit Values:

Grid-No.1-Circuit Resistance under any condition. . . . . 5000‡ 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.

* With external, flat, metal shield having diameter of 8", and center hole approximately 3" in diameter provided with spring fingers that connect the shield to grid-No.2 terminal. Shield is located in plane of grid-No.2 terminal perpendicular to the tube axis.

** With external, flat, metal shield having diameter of 8", and center hole approximately 2-3/8" in diameter provided with spring fingers that connect the shield to grid-No.1 terminal. Shield is located in plane of grid-No.1 terminal perpendicular to the tube axis.

● Continuous Commercial Service.

♦♦ "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.

▲ Preferably obtained from a fixed supply.

●● 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 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 in load of output circuit.

‡ 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 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.

SPECIAL PERFORMANCE DATA

Design samples of the 7213 have been subjected to the following tests without adverse effects.

Variable-Frequency Vibration Performance:

This test was performed (per MIL-E-1C°, paragraph 4.9.20.3) under the following conditions: heater volts = 5.5, plate-supply volts = 450, grid-No.2 volts = 300, grid-No.1 voltage varied to give a plate current of 10 milliamperes, and plate load resistor (ohms) = 2000. The tubes were vibrated in each of 3 positions through frequency range from 10 to 50 to 10 cycles per second. The vibrating frequency had a fixed amplitude of 0.040 inch (total excursion of 0.080 inch).

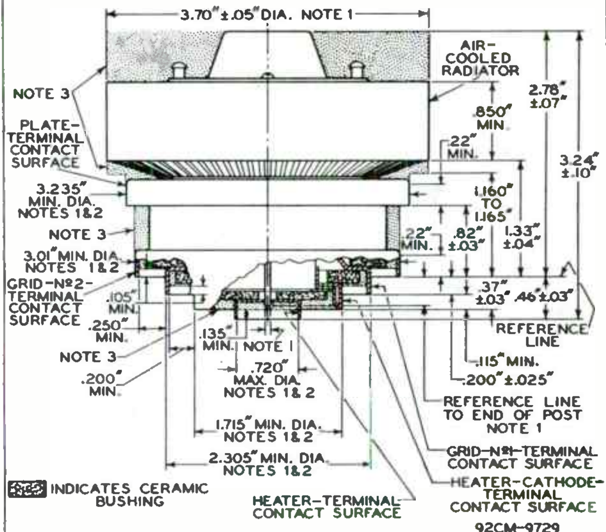
° Military Specification, Electron Tubes and Crystal Rectifiers, 3 October 1955.

BEAM POWER TUBE

During the test, the tubes did not show an rms output voltage across the plate load resistor in excess of 250 millivolts. At the end of this test, the tubes did not show tap or permanent interelectrode shorts or defects that would cause the tubes to be inoperable. The tubes exhibited no pronounced mechanical resonance during this test.

Fatigue Performance:

In this test (per MIL-E-1C, paragraph 4.9.20.6), the tubes were rigidly mounted and subjected to 2.5 g vibrational acceleration at 25 cycles per second for 32 hours in each of three positions with heater volts = 5.5. At the end of this test, the tubes did not show permanent or temporary shorts or open circuits, and passed all electrical tests.



NOTE 1: WITH THE CYLINDRICAL SURFACES OF THE RADIATOR BAND, 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. PROPER ENTRY OF THE TUBE IS OBTAINED WHEN THE GRID-No. 2 TERMINAL IS SEATED ON THE SHOULDER A-A'. THE TUBE IS PROPERLY SEATED ON THE SHOULDER WHEN A 0.010"-THICKNESS GAUGE 1/8" WIDE WILL NOT ENTER MORE THAN 1/16" BETWEEN THE SHOULDER SURFACE AND THE GRID-No. 2

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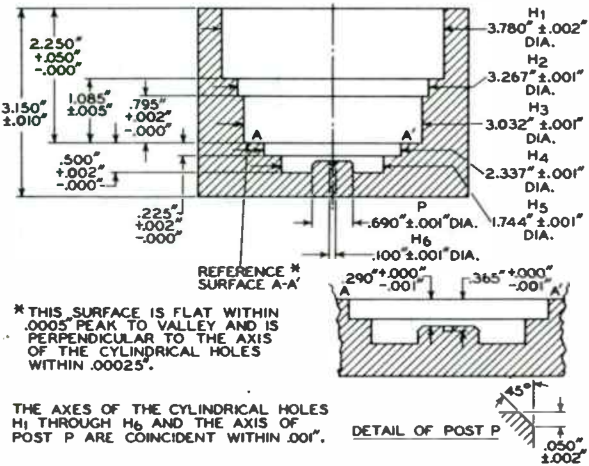
BEAM POWER TUBE

TERMINAL. THE GAUGE IS PROVIDED WITH SLOTS TO PERMIT MAKING MEASUREMENT OF SEATING OF GRID-No.2 TERMINAL ON SHOULDER A-A'.

NOTE 2: THE DIAMETER OF EACH TERMINAL IS HELD TO INDICATED VALUES ONLY OVER THE INDICATED MINIMUM LENGTH OF ITS CONTACT SURFACE.

NOTE 3: KEEP ALL STIPPLED REGIONS CLEAR. DO NOT ALLOW CONTACTS OR CIRCUIT COMPONENTS TO PROTRUDE INTO THESE ANNULAR VOLUMES.

GAUGE SKETCH G_1



92CM-9735

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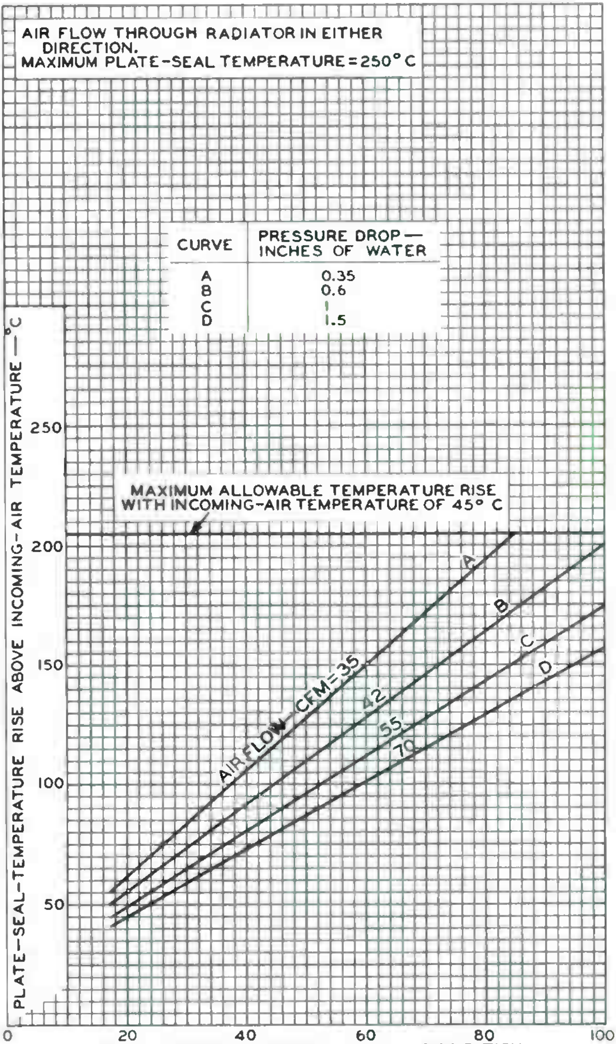
7213

TYPICAL COOLING REQUIREMENTS



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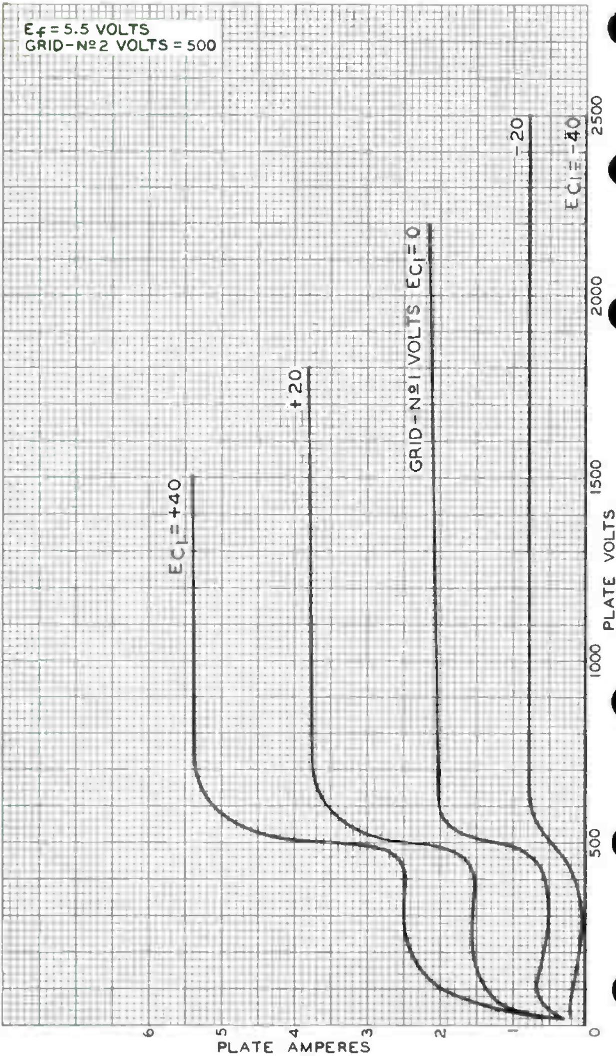
TYPICAL PLATE CHARACTERISTICS



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92CM-9738

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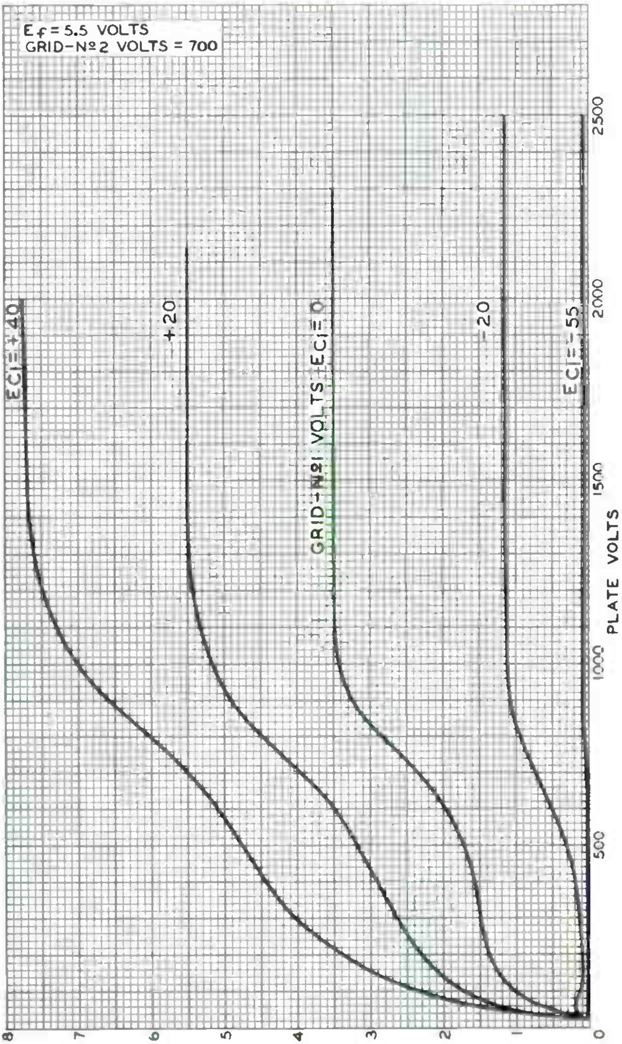
7213

TYPICAL PLATE CHARACTERISTICS



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92CM-9753

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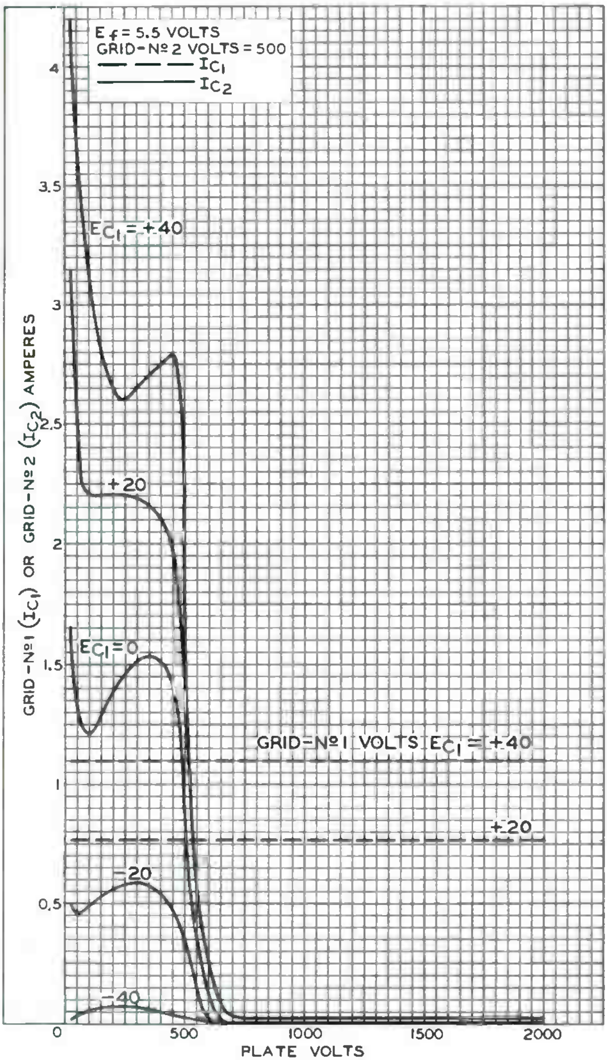
7213

TYPICAL CHARACTERISTICS



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RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9740

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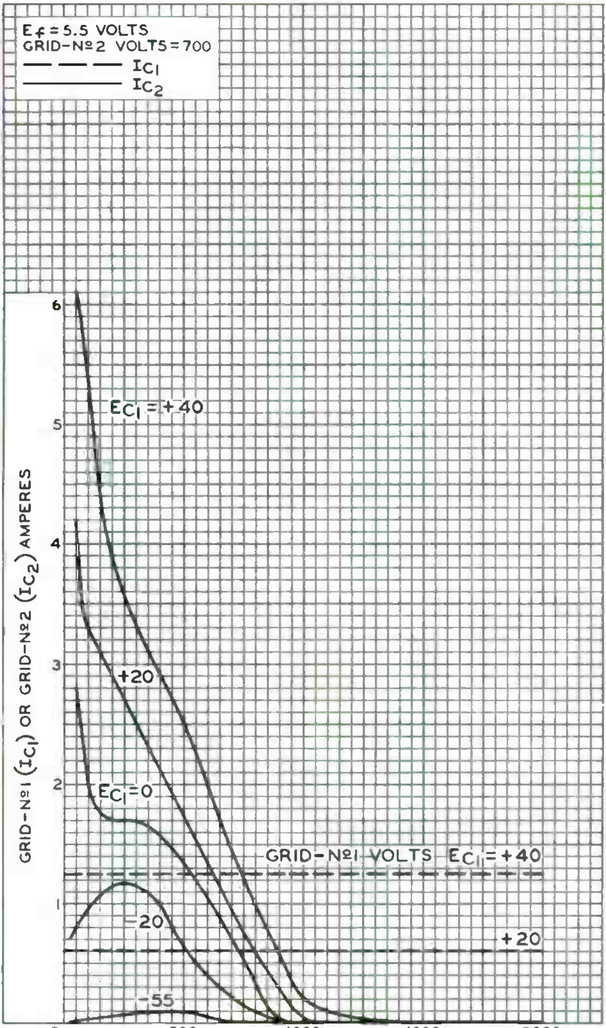
7213

TYPICAL CHARACTERISTICS



ELECTRON TUBE DIVISION 92CM-9754

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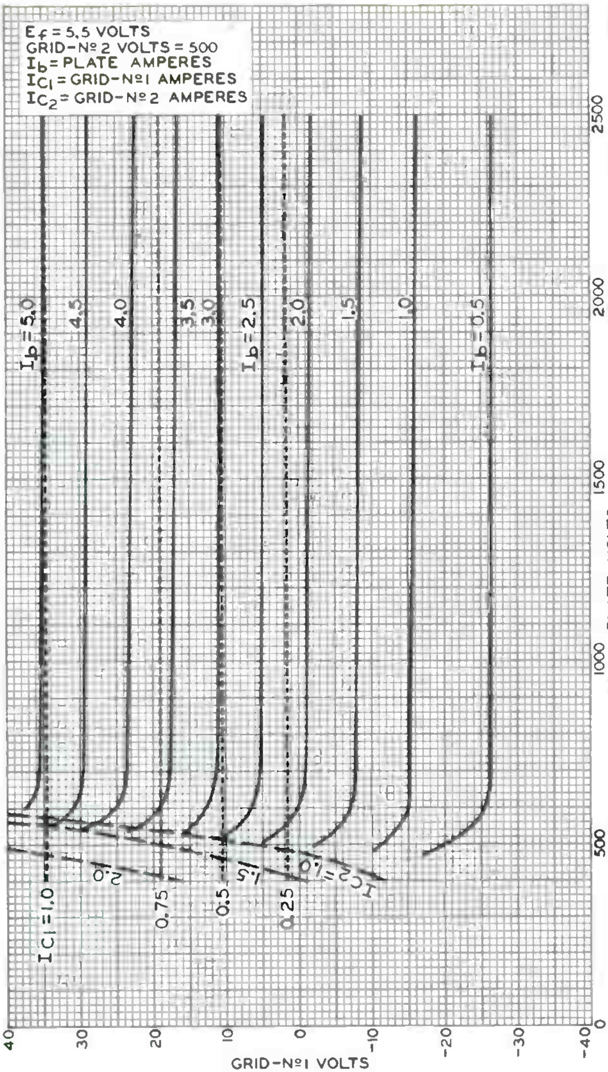
7213

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



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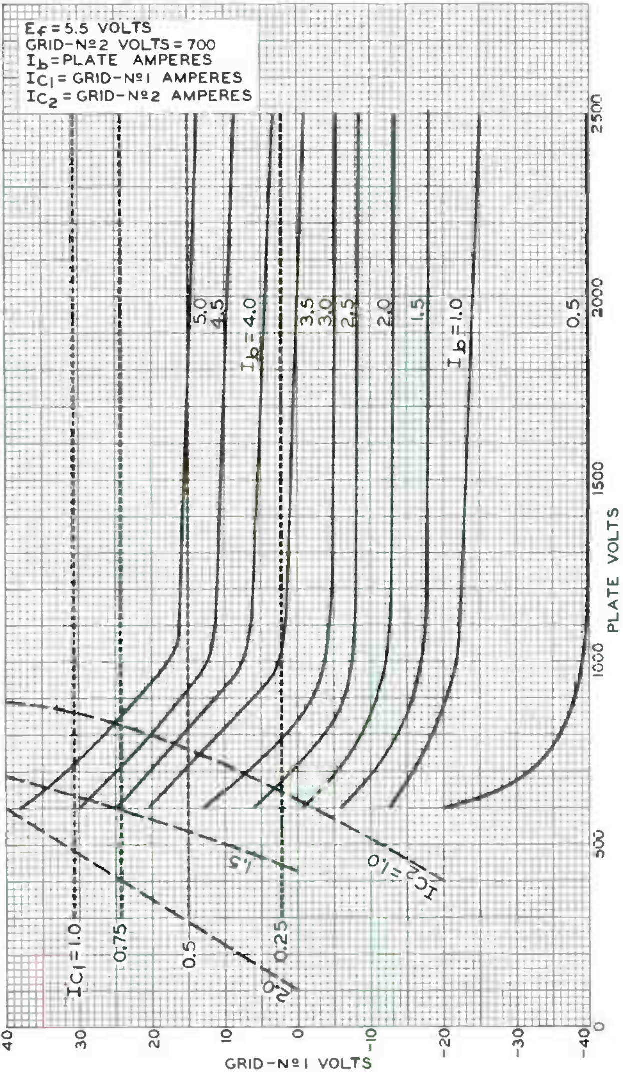
7213

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



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RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9752

7214

7214

BEAM POWER TUBE

CERAMIC-METAL SEALS
UNITIZED-ELECTRODE DESIGN
FORCED-AIR COOLED
COAXIAL-ELECTRODE STRUCTURE
INTEGRAL RADIATOR
180 KW PEAK-PULSE POWER
MATRIX-TYPE, OXIDE-COATED, UNIPOTENTIAL CATHODE

For pulsed rf amplifier service with full ratings at frequencies up to 1215 Mc

GENERAL DATA

Electrical:

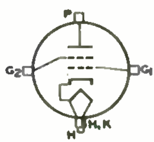
Heater, for Matrix-Type, Oxide-Coated, Unipotential Cathode:		
Voltage (AC or DC)♦	5.5 typical	volts
	6 max.	volts
Current at 5.5 volts	17.5	amp
Minimum heating time at 5.5 volts	5	minutes
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 2500, grid-No.2 volts = 600, and plate ma. = 600	19	
Direct Interelectrode Capacitances:		
Grid No.1 to plate*	0.17 max.	μμf
Grid No.1 to cathode & heater	42	μμf
Plate to cathode & heater*,**	0.014 max.	μμf
Grid No.1 to grid No.2	55	μμf
Grid No.2 to plate	17	μμf
Grid No.2 to cathode & heater**	1.4 max.	μμf

Mechanical:

Operating Position	Any
Overall Length	3.24" ± 0.10"
Greatest Diameter *(See Dimensional Outline)*	3.72" ± 0.03"
Weight (Approx.)	2 lbs
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



Air Flow:

Through radiator—Adequate air flow to limit the plate seal temperature to 250° C should be delivered by a blower through the radiator before and during the application of heater, plate, grid-No.2, and grid-No.1 voltages. Typical

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values of air flow directed through the radiator versus percentage of maximum rated plate dissipation for each class of service are shown in accompanying Typical-Cooling-Requirements curves. Plate power, grid-No.2 power, heater power, and air flow may be removed simultaneously.

To grid-No.2, grid-No.1, cathode, and heater seals—A sufficient quantity of air should be directed at the heater terminal and allowed to flow past each of these seals so that its temperature does not exceed the specified maximum value of 250° C. An air flow of 10 cfm is usually adequate.

Seal Temperature (Plate, grid No.2, grid No.1, cathode, and heater)	250 max.	°C

GRID-PULSED RF AMPLIFIER

Maximum CCS● Ratings, *Absolute-Maximum Values:*

For maximum "on" time# of 10 microseconds

	Up to 1215 Mc	
DC PLATE VOLTAGE	5000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	1200 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-300 max.	volts
DC PLATE CURRENT DURING PULSE	18 max.	amp
DC PLATE CURRENT	0.2 max.	amp
GRID-No.2 INPUT (Average)	50 max.	watts
GRID-No.1 INPUT (Average)	30 max.	watts
PLATE DISSIPATION (Average)	1500 max.	watts

Typical Operation:

In class C cathode-drive circuit with rectangular-wave pulses at 1215 Mc and with duty factor▲ of 0.01

DC Plate Voltage	4500	volts
DC Grid-No.2 Voltage	1000	volts
DC Grid-No.1 Voltage	-80	volts
DC Plate Current during pulse	11	amp
DC Plate Current	0.11	amp
DC Grid-No.2 Current	0.005	amp
DC Grid-No.1 Current	0.01	amp
Driver Power Output at peak of pulse (Approx.)■	4.5	kw
Useful Power Output at peak of pulse (Approx.)	20	kw

PLATE- AND SCREEN-PULSED RF AMPLIFIER

Maximum CCS● Ratings, *Absolute-Maximum Values:*

For maximum "on" time# of 10 microseconds

	Up to 1215 Mc	
PEAK POSITIVE-PULSE PLATE VOLTAGE	10000 max.	volts
PEAK POSITIVE-PULSE GRID-No.2 (SCREEN-GRID) VOLTAGE	1200 max.	volts

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BEAM POWER TUBE

DC GRID-No.1 (CONTROL-GRID) VOLTAGE. . . .	-300	max.	volts
DC PLATE CURRENT DURING PULSE.	18	max.	amp
DC PLATE CURRENT	0.2	max.	amp
GRID-No.2 INPUT (Average).	50	max.	watts
GRID-No.1 INPUT (Average).	30	max.	watts
PLATE DISSIPATION (Average).	1500	max.	watts

Typical Operation:

In class C cathode-drive circuit with rectangular-wave pulses at 1215 Mc and with duty factor▲ *of 0.01*

Peak Positive-Pulse Plate Voltage. .	9000	10000	volts
Peak Positive-Pulse Grid-No.2 Voltage.	1000	1000	volts
DC Grid-No.1 Voltage	-80	-80	volts
DC Plate Current during pulse. . . .	16	18	amp
DC Plate Current	0.16	0.18	amp
DC Grid-No.2 Current	0.008	0.009	amp
DC Grid-No.1 Current	0.014	0.016	amp
Driver Power Output at peak of pulse (Approx.)■.	10	11	kw
Useful Power Output at peak of pulse (Approx.)	50	65	kw

♦ 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 diameter of 8", and center hole approximately 3" in diameter provided with spring fingers that connect the shield to grid-No.2 terminal. Shield is located in plane of grid-No.2 terminal perpendicular to the tube axis.

•• With external, flat, metal shield having diameter of 8", and center hole approximately 2-3/8" in diameter provided with spring fingers that connect the shield to grid-No.1 terminal. Shield is located in plane of grid-No.1 terminal perpendicular to the tube axis.

● Continuous Commercial Service.

* *"On" time* is defined as the sum of the durations of all the individual pulses which occur during any 1000-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.

▲ *Duty factor* for the 7214 is defined as the "on" time in microseconds divided by 1000 microseconds.

■ The driver stage is required to supply tube losses, rf-circuit losses, and in cathode-drive circuits, the 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.

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BEAM POWER TUBE

SPECIAL TESTS & PERFORMANCE DATA

Design samples of the 7214 have been subjected to the following tests without adverse effects.

Variable-Frequency Vibration Performance:

This test was performed (per MIL-E-1D♦, paragraph 4.9.20.3) under the following conditions: Heater voltage of 5.5 volts, plate supply voltage of 450 volts, grid-No. 2 voltage of 300 volts, grid-No. 1 voltage varied to give a plate current of 10 milliamperes, and plate load resistor of 2000 ohms. The tubes were vibrated in each of 3 positions through frequency range from 10 to 50 cycles per second and back to 10 cycles per second. The vibrating frequency had a fixed amplitude of 0.040 inch (total excursion of 0.080 inch). During the test, the tubes did not show an rms output voltage across the plate load resistor in excess of 250 millivolts.

At the end of this test, the tubes did not show tap or permanent interelectrode shorts or defects that would cause the tubes to be inoperable. The tubes exhibited no pronounced mechanical resonance during this test.

Fatigue Test:

In this test (per MIL-E-1D, paragraph 4.9.20.6), the tubes were rigidly mounted and subjected to 2.5 g vibrational acceleration at 25 cycles per second for 32 hours in each of three positions with 5.5 volts applied to the heater. At the end of this test, the tubes did not show permanent or temporary shorts or open circuits, and passed all electrical tests.

OPERATING CONSIDERATIONS

The *maximum seal 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. The latter is made by the Tempil Corporation, 132 W. 22nd Street, New York 11, New York in the form of liquid and stick.

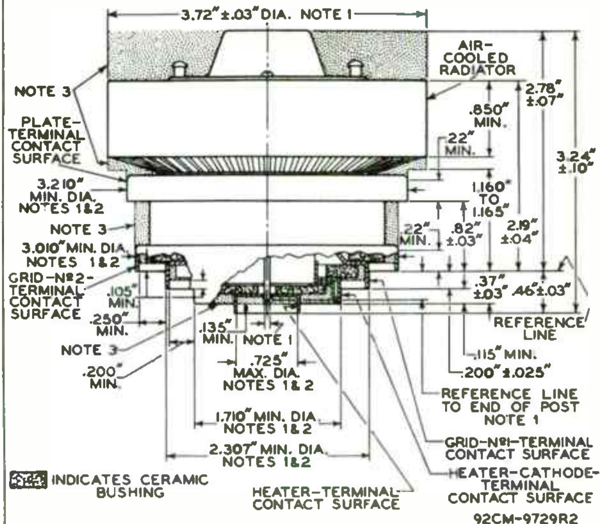
The rated plate and grid-No. 2 voltages of this tube are extremely dangerous to the user. Great care should be taken during the adjustment of circuits. The tube and its associated apparatus, especially all parts which may be at high potential above ground, should be housed in a protective enclosure. 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.

♦ 31 March 1958. Military Specification, Electron Tubes and Crystal Rectifiers.

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA
7214

BEAM POWER TUBE



NOTE 1: WITH THE CYLINDRICAL SURFACES OF THE RADIATOR BAND, 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. PROPER ENTRY OF THE TUBE IS OBTAINED WHEN THE GRID-No.2 TERMINAL IS SEATED ON THE SHOULDER A-A'. THE TUBE IS PROPERLY SEATED ON THE SHOULDER WHEN A 0.010"-THICKNESS GAUGE 1/8" WIDE WILL NOT ENTER MORE THAN 1/16" BETWEEN THE SHOULDER SURFACE AND THE GRID-No.2 TERMINAL. THE GAUGE IS PROVIDED WITH SLOTS TO PERMIT MAKING MEASUREMENT OF SEATING OF GRID-No.2 TERMINAL ON SHOULDER A-A'.

NOTE 2: THE DIAMETER OF EACH TERMINAL IS HELD TO INDICATED VALUES ONLY OVER THE INDICATED MINIMUM LENGTH OF ITS CONTACT SURFACE.

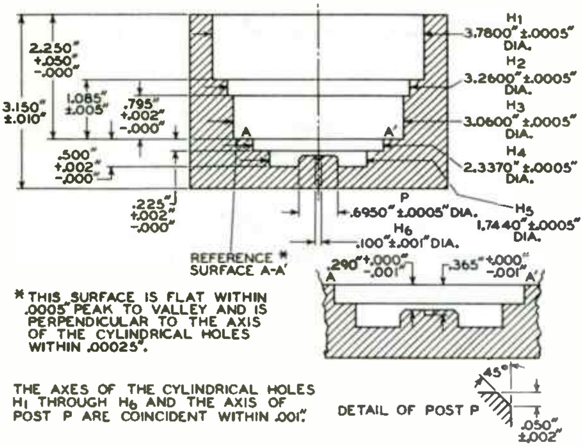
NOTE 3: KEEP ALL STIPPLED REGIONS CLEAR. DO NOT ALLOW CONTACTS OR CIRCUIT COMPONENTS TO PROTRUDE INTO THESE ANNULAR VOLUMES.

RCA

7214

BEAM POWER TUBE

GAUGE SKETCH G_1



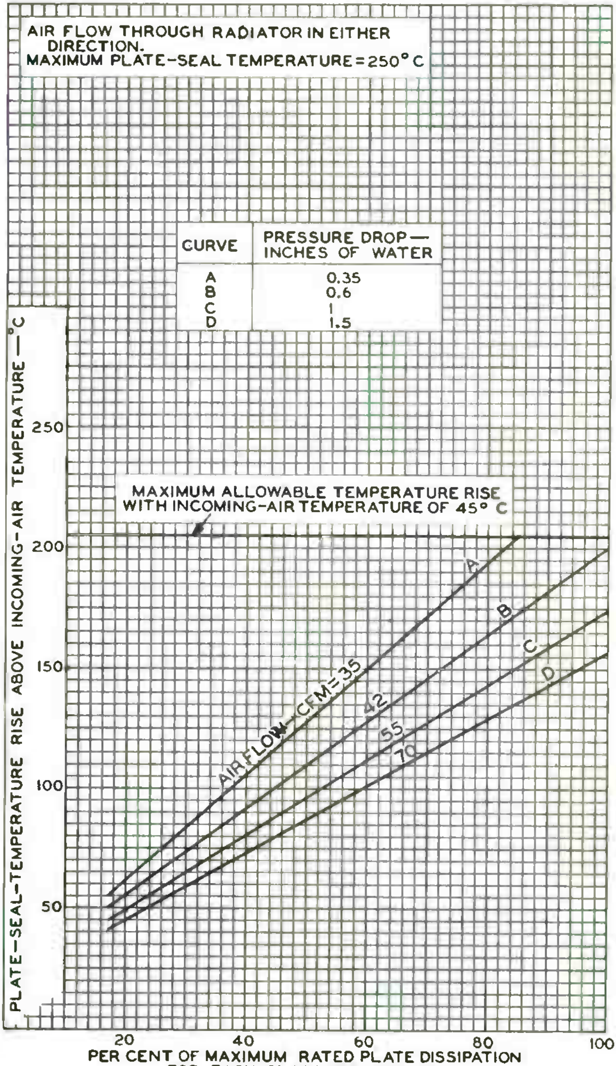
* THIS SURFACE IS FLAT WITHIN .0005" PEAK TO VALLEY AND IS PERPENDICULAR TO THE AXIS OF THE CYLINDRICAL HOLES WITHIN .00025".

THE AXES OF THE CYLINDRICAL HOLES H_1 THROUGH H_6 AND THE AXIS OF POST P ARE COINCIDENT WITHIN .001".

92CM-9735R1

RCA
7214

TYPICAL COOLING REQUIREMENTS



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

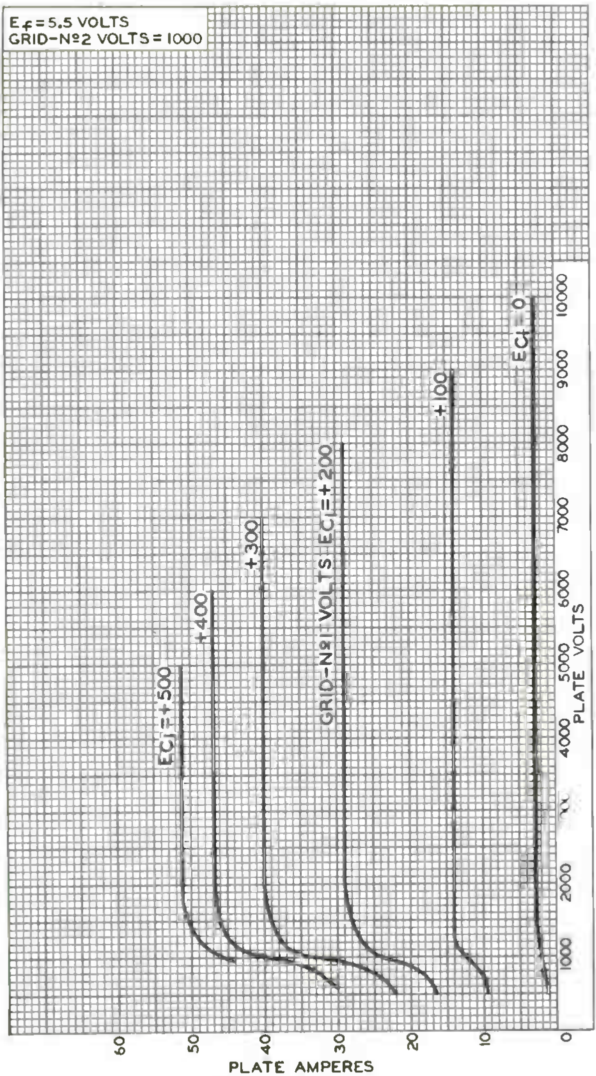
92CM-9737

7214

RCA

7214

TYPICAL PLATE CHARACTERISTICS



ELECTRON TUBE DIVISION

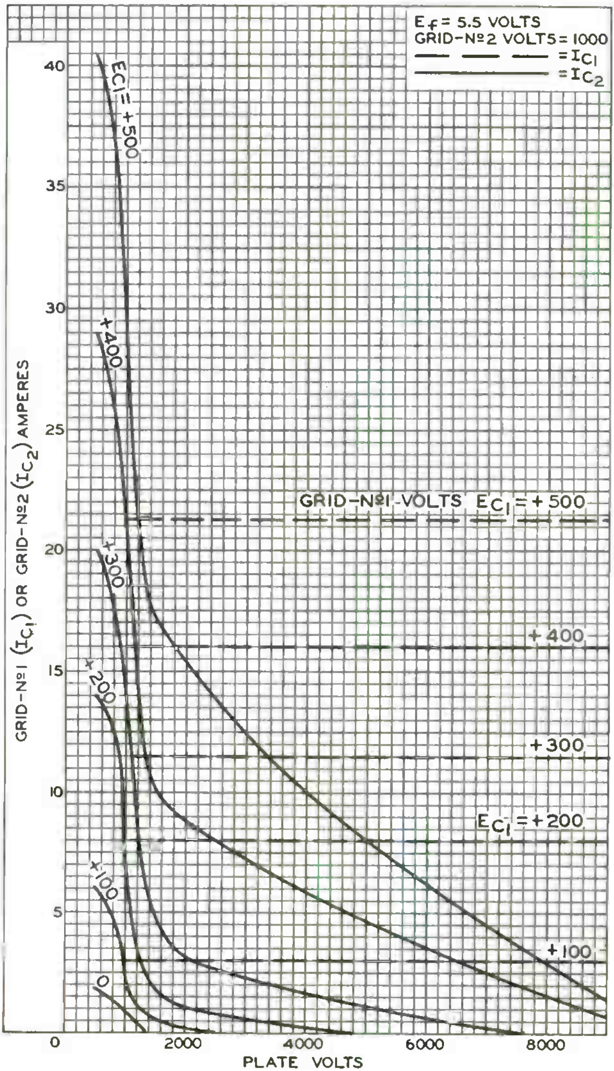
92CM-10186

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

7214

TYPICAL CHARACTERISTICS



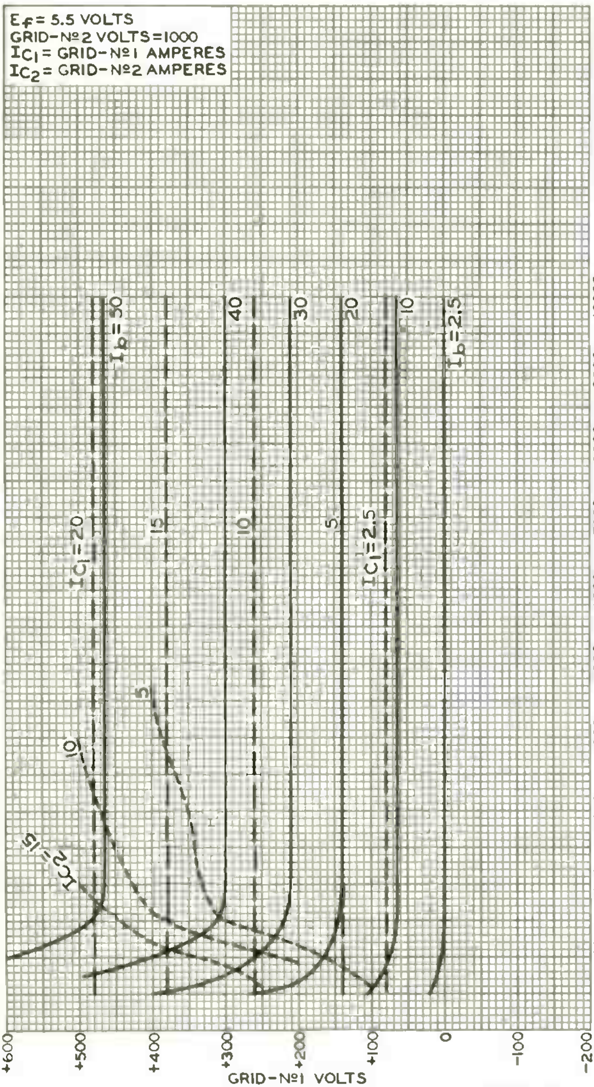
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-10185

7214

7214

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



ELECTRON TUBE DIVISION

92CM-10184

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

7357

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.

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

Beam Power Tube

For Pulse-Modulator Service under Severe Shock and Vibration

GENERAL DATA

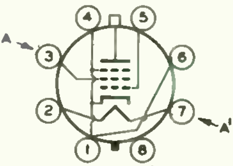
Electrical:

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 ←

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

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_{g_1}) 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 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 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

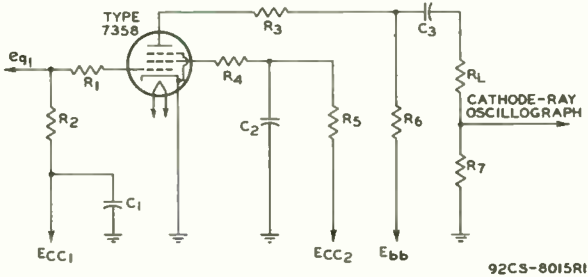
The *bulb* becomes hot during operation. To insure adequate cooling, therefore, it is essential that free circulation of air be provided around the 7358.

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.

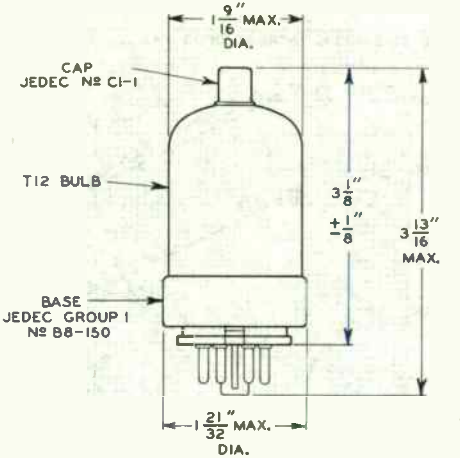
The *accompanying test circuit* requires the use of damping resistors to suppress oscillations which may be caused by the rectangular-wave signal. These resistors should be non-inductive and they should be placed as close as possible to the socket terminals.

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.

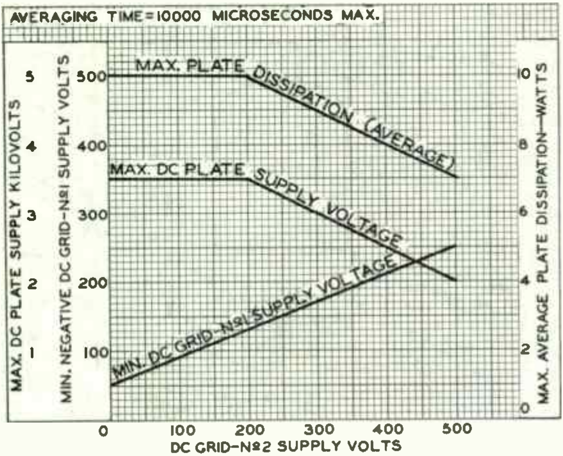
E_{cc_1}: Grid-No.1 Supply Voltage.
E_{cc_2}: Grid No.2 Supply Voltage.
E_{bb}: Plate Supply Voltage.
e_{g_1}: Rectangular-Wave Signal Voltage.
R_5: 1000 ohms, 1 watt.
R_6: 10,000 ohms, 50 watts.
R_7: 30 ± 1% ohms, 5 watts, non-inductive.
R_L: For values, See *Typical Operation and Characteristics Range Values (Note 5)*.



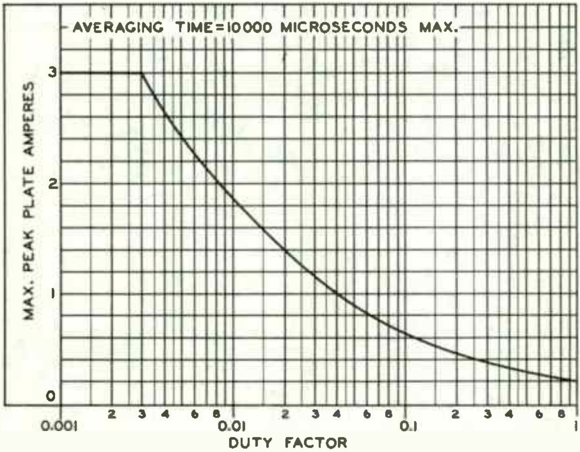
$1\frac{9}{16}$" MAX. DIA.
CAP JEDEC Nº C1-1
T12 BULB
BASE JEDEC GROUP 1 Nº B8-150
$3\frac{1}{8}$" $\pm\frac{1}{8}$"
$3\frac{13}{16}$" MAX.
$1\frac{21}{32}$" MAX. DIA.

92CS-9625R4

RATING CHART I

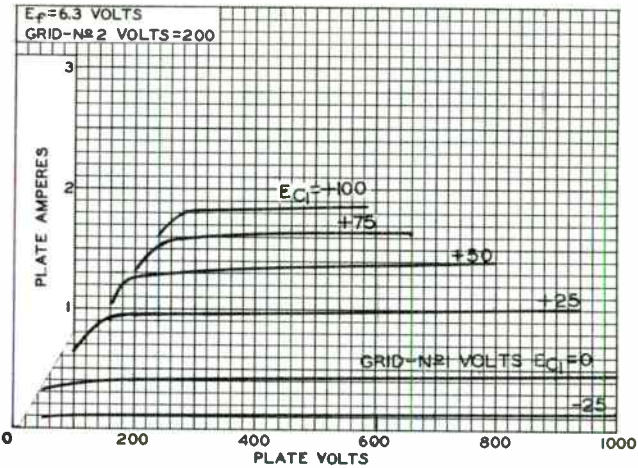


RATING CHART II



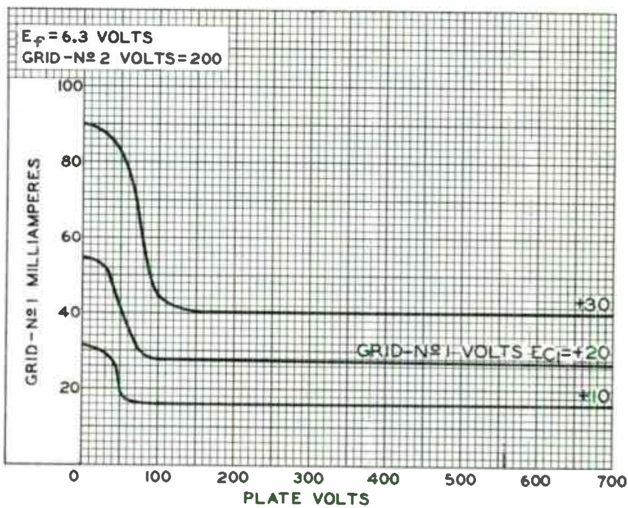
7358

TYPICAL PLATE CHARACTERISTICS



92CS-10124

TYPICAL CHARACTERISTICS



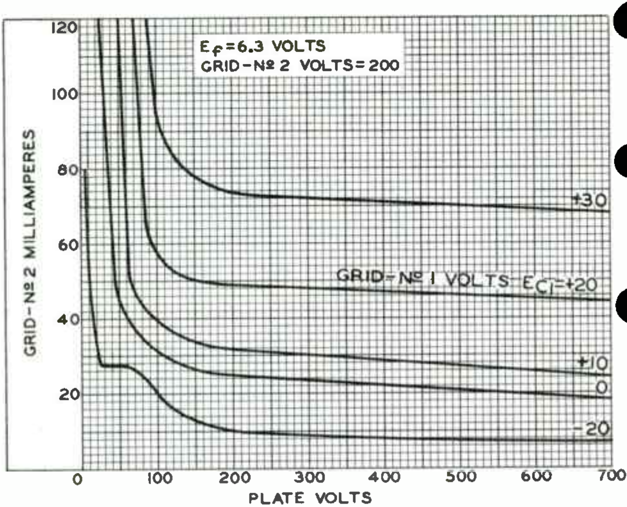
92CS-9617

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

7358

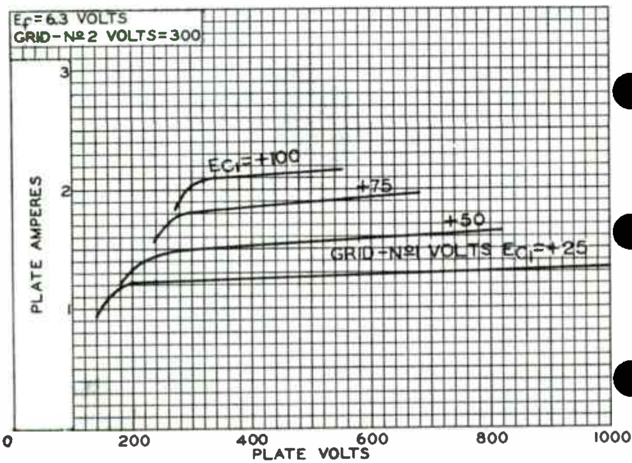
7358

TYPICAL CHARACTERISTICS



92CS-9618

TYPICAL PLATE CHARACTERISTICS



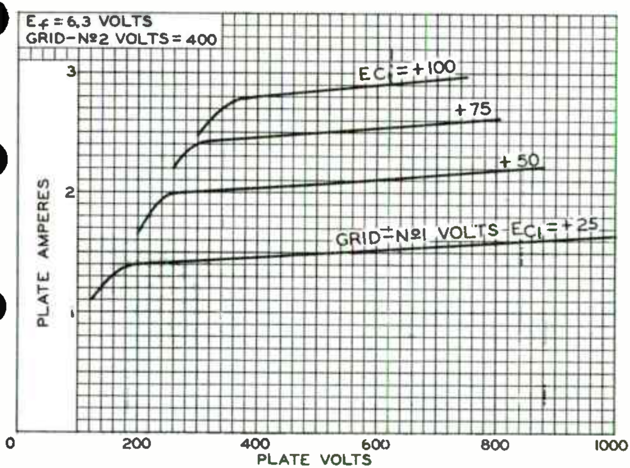
92CS-10125

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

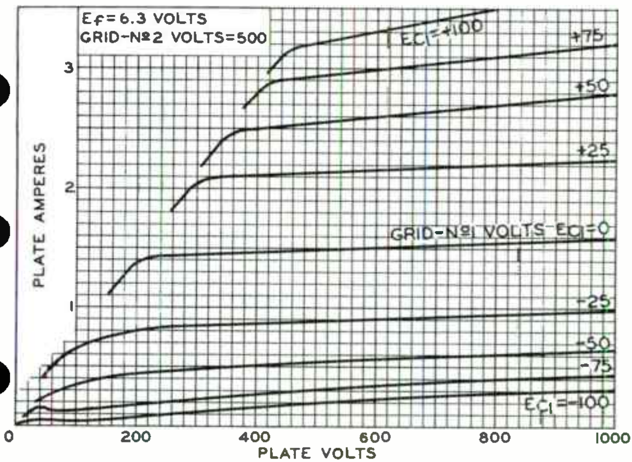
RCA

7358

TYPICAL PLATE CHARACTERISTICS



92CS-10131

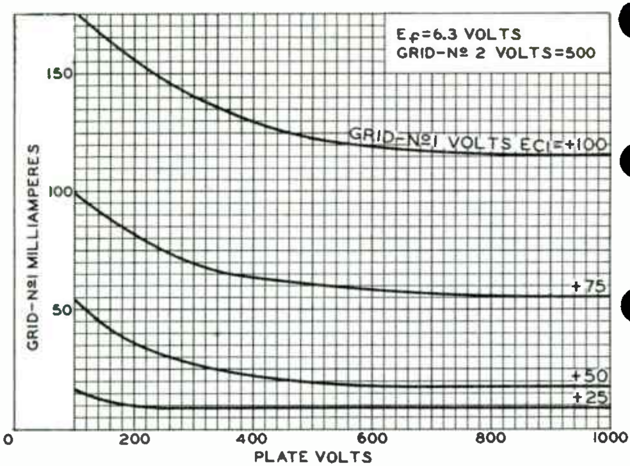


92CS-10127

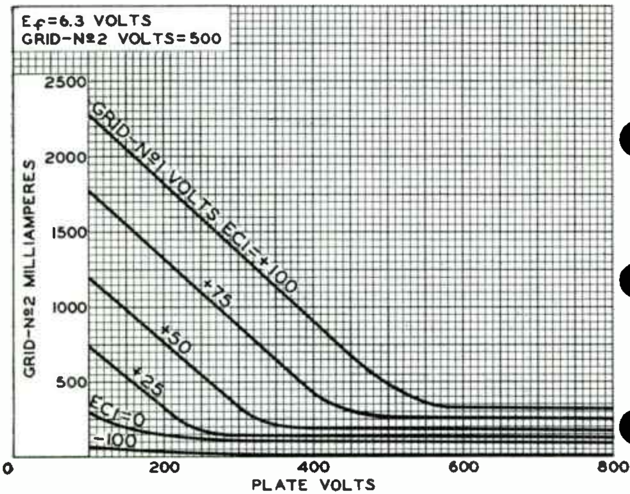
7358

7358

TYPICAL CHARACTERISTICS



92CS-10129



92CS-10130

ELECTRON TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

Beam Power Tube

CERAMIC-METAL SEALS
"ONE-PIECE" ELECTRODE DESIGN
FORCED-AIR COOLED
COAXIAL-ELECTRODE STRUCTURE
INTEGRAL RADIATOR
180 WATTS CW INPUT UP TO 1215 Mc/s
MATRIX-TYPE, OXIDE-COATED, UNIPOTENTIAL CATHODE

For Use at Frequencies up to 2000 Mc/s under Severe Shock and Vibration

ELECTRICAL

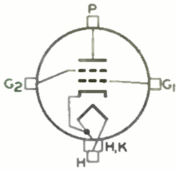
Heater		
For Matrix-Type, Oxide-Coated, Unipotential Cathode:		
Voltage (AC or DC)[a]	6.3 ± 10%	V
Current at heater volts = 6.3	3.2	A
Minimum heating time	60	s
Mu-Factor (Grid No.2 to Grid No.1)	18	
Plate volts = 250, grid-No.2 volts = 250, and plate mA = 100		
Direct Interelectrode Capacitances[b]		
Grid No.1 to plate	0.065 max	pF
Grid No.1 to cathode & heater	14	pF
Plate to cathode & heater	0.019 max	pF
Grid No.1 to grid No.2	19	pF
Grid No.2 to plate	4.5	pF
Grid No.2 to cathode & heater	1.3 max	pF

MECHANICAL

Operating Position	Any
Maximum Overall Length	1.930 in ←
Maximum Diameter (See *Dimensional Outline*)	1.265 in
Weight (Approx.)	2 oz
Radiator	Integral part of tube
Socket	
For frequencies up to about 400 Mc/s	Footnote c
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

Plate, Grid No.2, Grid No.1, Cathode, and Heater Temperature	250 max	°C
Radiator-Core Temperature	250 max	°C

← Indicates a change.

Air Flow[x]

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* 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 normally required when only heater voltage is applied to the tube. Plate power, grid-No.2 power, heater power, and air flow may be removed simultaneously.

At Sea Level — Cooling requirements with air flow directed across the radiator with cowling may be met by use of the following blowers and associated motors manufactured by Rotron Mfg. Co., Inc., Woodstock, N.Y., 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 (c/s)	60	60	400	400
Voltage (V)	115	220	115	200
For 80% Plate Dissipation:				
Blower Model No.	KS-202	AS-202	AXIMAX I	AXIMAX I
Motor Model No.	92AS	323JS	464YS	499JS
Phase (φ)	1	3	1	3
Frequency (c/s)	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 (c/s)	60	60	400	400
Voltage (V)	115	220	115	200

AF POWER AMPLIFIER & MODULATOR — CLASS AB_1[d,y]

Maximum CCS[e] Ratings, Absolute-Maximum Values

DC Plate Voltage	1000	V
DC Grid-No.2 (Screen-Grid) Voltage	300	V
Max.-Signal DC Plate Current[f]	180	mA
Max.-Signal Plate Input[f]	180	W
Max.-Signal Grid-No.2 Input[f]	4.5	W
Plate Dissipation[f]	115	W

Typical CCS Operation

Values are for 2 tubes

DC Plate Voltage	650	850	V
DC Grid-No.2 Voltage[g]	300	300	V
DC Grid-No.1 (Control-grid) Voltage. From fixed-bias source	-15	-15	V
Peak AF Grid-No.1-to-Grid-No.1 Voltage[h]	30	30	V

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	Ω
Max.-Signal Driving Power (Approx.)	0	0	W
Max.-Signal Power Output (Approx.)	50	80	W

Maximum Circuit Values

Grid-No.1-Circuit Resistance		
Under any condition:[j]		
For fixed-bias operation	30000	Ω
For cathode-bias operation	Not recommended	

AF POWER AMPLIFIER & MODULATOR — CLASS AB_2[k,y]

Maximum CCS[e] Ratings, Absolute-Maximum Values

DC Plate Voltage	1000	V
DC Grid-No.2 (Screen-Grid) Voltage	300	V
Max.-Signal DC Plate Current[f]	180	mA
Max.-Signal DC Grid-No.1 (Control-Grid) Current[f]	30	mA
Max.-Signal Plate Input[f]	180	W
Max.-Signal Grid-No.2 Input[f]	4.5	W
Plate Dissipation[f]	115	W

Typical CCS Operation

Values are for 2 tubes

DC Plate Voltage	650	850	V
DC Grid-No.2 Voltage[g]	300	300	V
DC Grid-No.1 Voltage (From fixed-bias source)	-15	-15	V
Peak AF Grid-No.1-to-Grid-No.1 Voltage	46	46	V
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	Ω
Max.-Signal Driving Power (Approx.)[m]	0.3	0.3	W
Max.-Signal Power Output (Approx.)	85	140	W

LINEAR RF POWER AMPLIFIER — CLASS AB_1[y]

SINGLE-SIDEBAND SUPPRESSED-CARRIER SERVICE

Peak envelope conditions for a signal having a minimum peak-to-average power ratio of 2

Maximum CCS[e] Ratings, Absolute-Maximum Values

	Up to 1215 Mc/s	
DC Plate Voltage	1000	V
DC Grid-No.2 (Screen-Grid) Voltage	300	V
Max.-Signal DC Plate Current	-100	mA
DC Plate Current at Peak of Envelope	250[n]	mA

	Up to 1215 Mc/s	
Max.-Signal DC Grid-No. 1 (Control-Grid) Current	30	mA
Max.-Signal Plate Input	180	W
Max.-Signal Grid-No. 2 Input	4.5	W
Plate Dissipation	115	W

Typical CCS Class AB_1 "Single-Tone" Operation[p]

	Up to 60 Mc/s		
DC Plate Voltage	650	850	V
DC Grid-No. 2 Voltage[g]	300	300	V
DC Grid-No. 1 Voltage	-15	-15	V
Zero-Signal DC Plate Current	40	40	mA
Zero-Signal DC Grid-No. 2 Current	0	0	mA
Effective RF Load Resistance	2165	3500	Ω
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	V
Max.-Signal Driving Power (Approx.)	0	0	W
Max.-Signal Power Output (Approx.)	25	40	W

Typical CCS Operation with "Two-Tone" Modulation

	At 30 Mc/s		
DC Plate Voltage	650	850	V
DC Grid-No. 2 Voltage	300	300	V
DC Grid-No. 1 Voltage	-18.5	-18.5	V
Zero-Signal DC Plate Current	40	40	mA
Effective RF Load Resistance	2200	3500	Ω
DC Plate Current at Peak of Envelope	100	100	mA
Average DC Plate Current	75	75	mA
DC Grid-No. 2 Current at Peak of Envelope	8.2	4.2	mA
Average DC Grid-No. 2 Current	3.6	1.7	mA
Peak-Envelope Driver Power Output (Approx.)	0.5	0.5	W
Output-Circuit Efficiency (Approx.)	90	90	%
Distortion Products Level			
Third Order	35	30	dB
Fifth Order	40	36	dB
Useful Power Output (Approx.)			
Average	12.5	20	W
Peak envelope	25	40	W

Maximum Circuit Values

Grid-No. 1-Circuit Resistance (Under any condition)		
For fixed bias	25000	Ω
For fixed-bias operation (Class AB_1)	100000	Ω
For cathode-bias operation	Not recommended	

PLATE-MODULATED RF POWER AMPLIFIER — CLASS C TELEPHONY[y]

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

Maximum CCS[e] Ratings, Absolute-Maximum Values

	Up to 1215 Mc/s	
DC Plate Voltage	800	V
DC Grid-No. 2 (Screen-Grid) Voltage	300	V

	Up to 1215 Mc/s	
DC Grid-No.1 (Control-Grid) Voltage. . .	-100	V
DC Plate Current	150	mA
DC Grid-No.1 Current	30	mA
Plate Input.	120	W
Grid-No.2 Input[z]	3	W
Plate Dissipation.	75	W

Typical CCS Operation

	At 400 Mc/s		
DC Plate Voltage	400	700	V
DC Grid-No.2 Voltage[q].	200	250	V
DC Grid-No.1 Voltage[r].	-20	-50	V
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.)[s]	2	3	W
Useful Power Output (Approx.).	16	45	W

Maximum Circuit Values

Grid-No.1-Circuit Resistance . . . . 30000[t] Ω
Under any condition

RF POWER AMPLIFIER & OSCILLATOR — CLASS C TELEGRAPHY[u,y]
and
RF POWER AMPLIFIER — CLASS C FM TELEPHONY[y]

Maximum CCS[e] Ratings, Absolute-Maximum Values

	Up to 1215 Mc/s	
DC Plate Voltage	1000	V
DC Grid-No.2 (Screen-Grid) Voltage	300	V
DC Grid-No.1 (Control-Grid) Voltage. . . .	-100	V
DC Plate Current	180	mA
DC Grid-No.1 Current	30	mA
Plate Input.	180	W
Grid-No.2 Input.	4.5	W
Plate Dissipation.	115	W

Typical CCS Operation

	At 400 Mc/s		At 1215 Mc/s	
DC Plate Voltage	400	900	900	V
DC Grid-No.2 Voltage[v].	200	300	300	V
DC Grid-No.1 Voltage[w].	-35	-30	-22	V
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.)[s] . . .	3	3	5	W
Useful Power Output (Approx.).	23	80	40	W

Maximum Circuit Values

Grid-No.1-Circuit Resistance . . . . 30000[r] Ω
Under any condition

[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 Measured with special shield adapter.

c For socket to be used with the 7457, 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.

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

e Continuous Commercial Service.

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

g Preferably obtained from a fixed supply.

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 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.

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. To minimize distortion, the effective resistance per grid-No.1 circuit of the AB_2 stage should be held to a low value. For this purpose, the use of transformer coupling is recommended.

n 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 180 mA. During short periods of Circuit Adjustment under "Single-Tone" conditions, the average plate current may be as high as 250 mA.

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 source modulated along with the plate supply.

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

s 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.

t If this value is insufficient to provide adequate bias, the additional required bias must be supplied by a cathode resistor or fixed supply.

u 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.

v Obtained preferably from a fixed supply, or from the plate supply voltage with a voltage divider.

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

The following footnotes apply to the *RCA Transmitting Tube Operating Considerations* given at front of this section.

x See *Cooling Considerations* – Forced-Air Cooling.

y See *Classes of Service*.

z See *Electrical Considerations*-Grid-No.2 Voltage Supply.

CHARACTERISTICS RANGE VALUES

Item No.		*Note*	*Min*	*Max*	
1.	Heater Current	1	2.90	3.55	A
2.	Direct Interelectrode Capacitances . .				
	Grid No.1 to plate	2	-	0.065	pF
	Grid No.1 to cathode & heater . .	2	11.8	15.2	pF
	Plate to cathode & heater. . . .	2	-	0.019	pF
	Grid No.1 to grid No.2	2	17.3	21.9	pF

Item No.		*Note*	*Min*	*Max*	
	Grid No.2 to plate.	2	4	5.1	pF
	Grid No.2 cathode & heater . .	2	-	1.30	pF
3.	Grid-No.1 Voltage.	1,3	-6	-18	V
4.	Reverse Grid-No.1 Current. . . .	1,3	-	-20	μA
5.	Grid-No.2 Current.	1,3	-8	+2	mA
6.	Peak Emission.	1,4	-	400 peak	V
7.	Interelectrode Leakage Resistance. .	5	1	-	MΩ
8.	Useful Power Output.	6	80	-	W

Note 1: With 6.3 volts ac or dc on heater.

Note 2: Measured with special shield adapter.

Note 3: With dc plate volts = 1000, dc grid-No.2 volts = 300, and dc grid-No.1 voltage adjusted to give a dc plate current of 115 mA.

Note 4: For conditions with heater volts = 6.3; grid No.1, grid No.2, and plate tied together; and pulse-voltage source connected between plate and cathode. Pulse duration (microseconds) = 2, pulse-repetition frequency (pps) = 60, and duty factor of 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 5: Under conditions with tube at 20° to 30°C for at least 38 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 6:** In a single-tube, grid-driven coaxial-cavity class-C-amplifier circuit at 400 Mc/s for conditions with 5.7 volts ac or dc on heater, dc plate volts = 1000, dc grid-No.2 volts = 300, dc plate mA = 180 maximum, dc grid-No.1 mA = 30 maximum, and driver power output (watts) = 3.

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 resonances. Design details of mountings used by the RCA Electronic Components and Devices to perform these tests may be obtained from RCA Commercial Engineering, Harrison, New Jersey, on request.

50 g, 11-Millisecond Shock Test

This test is performed on a sample lot of tubes from each production run 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, 4, 7, and 8 under *Characteristics Range Values*.

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 will not show permanent or temporary shorts or open circuits, and are required to meet the limits for items 1, 3, 4, 7, and 8 under *Characteristics Range Values*.

→ Indicates a change.

5-to-2000 c/s Variable Frequency and Cycling 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 volts = 6.3 ac or dc, dc plate supply volts = 300, dc grid-No.2 volts = 250, 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 cycle consisting of:

a. 5-to-10 c/s with fixed double amplitude of 0.080 inch ± 10%.
b. 10-to-15 c/s at fixed acceleration of 0.41 g ± 10%.
c. 15-to-75 c/s with fixed double amplitude of 0.036 inch ± 10%.
d. 75-to-2000 c/s at fixed acceleration of 10 g ± 10%.

During the above vibration test, tubes will not show an rms output voltage in excess of 15 volts across the plate load resistor in the 5-to-2000 cycle range. At the end of this test, tubes are required to meet the limits for items 1, 3, 4, 7, and 8 under *Characteristics Range Values*.

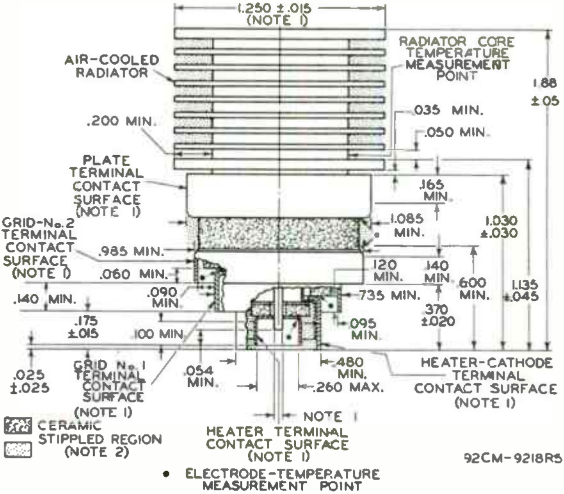
OPERATING CONSIDERATIONS

A suggested *mounting arrangement* for the 7457 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 rated plate and grid-No.2 voltages of this tube are extremely dangerous to the user. 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.

DIMENSIONAL OUTLINE

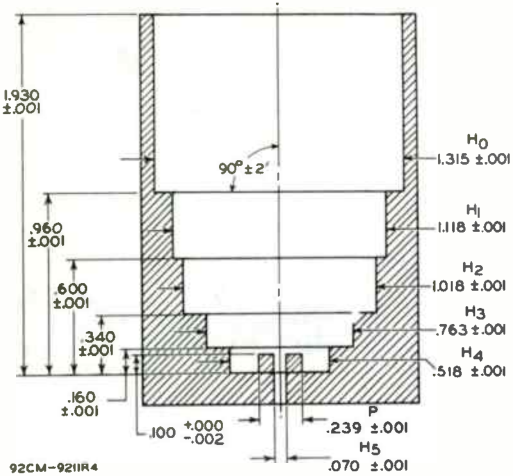


DIMENSIONS IN INCHES

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 G1. The tube is properly seated in the gauge when a 0.010 inch-thickness gauge 1/8 inch wide will not enter between the heater-cathode terminal and the bottom surface of H4. The gauge is provided with a slot to permit making measurement of seating of heater-cathode terminal on bottom of hole H4.

Note 2: Keep all stippled regions clear. Do not allow contacts or circuit components to protrude into these annular volumes.

SKETCH G_1

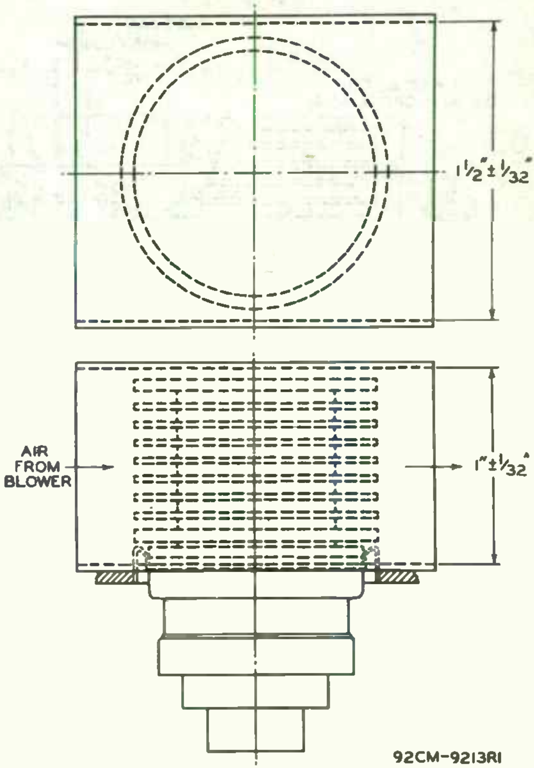


The axes of the cylindrical holes H_0 through H_5 and the axes of post P are coincident within 0.001 inch.

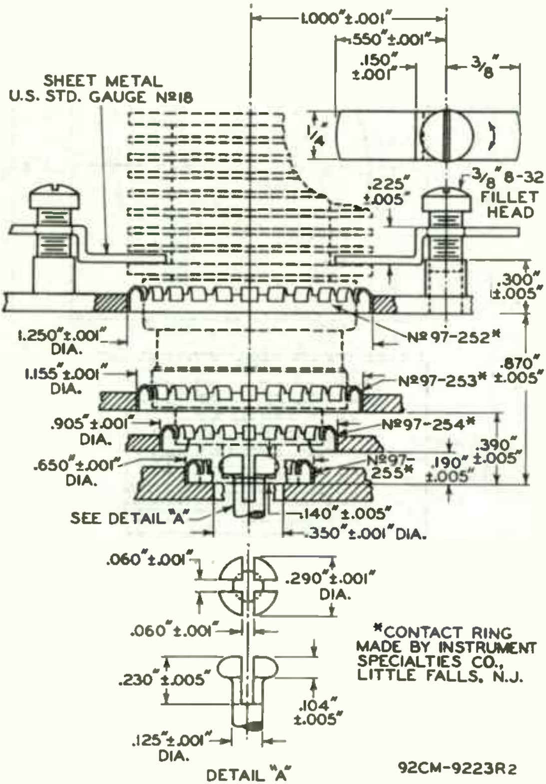
→Indicates a change.

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

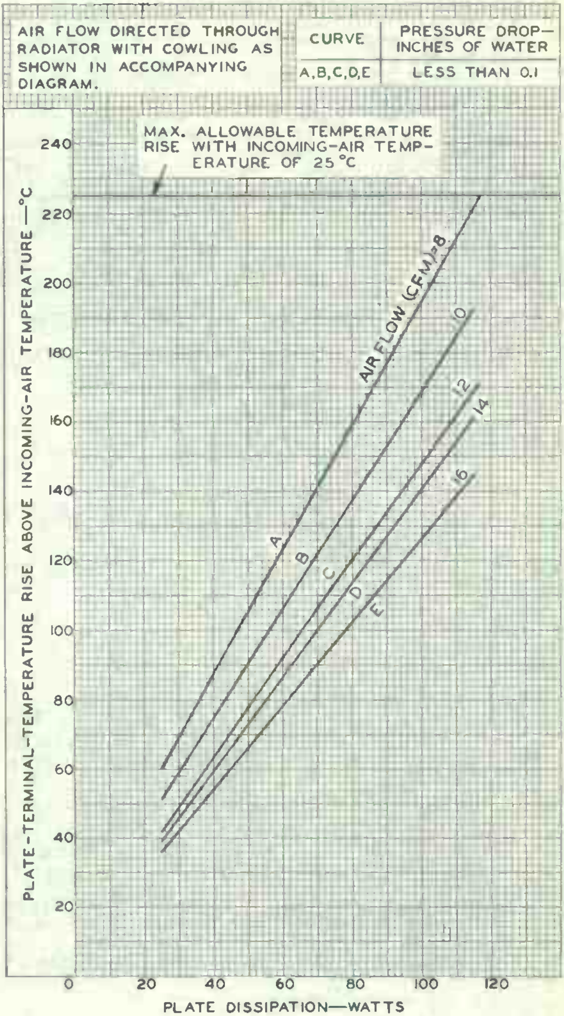
RECOMMENDED COWLING
FOR DIRECTING AIR FLOW THROUGH RADIATOR



SUGGESTED MOUNTING ARRANGEMENT & LAYOUT OF ASSOCIATED CONTACTS

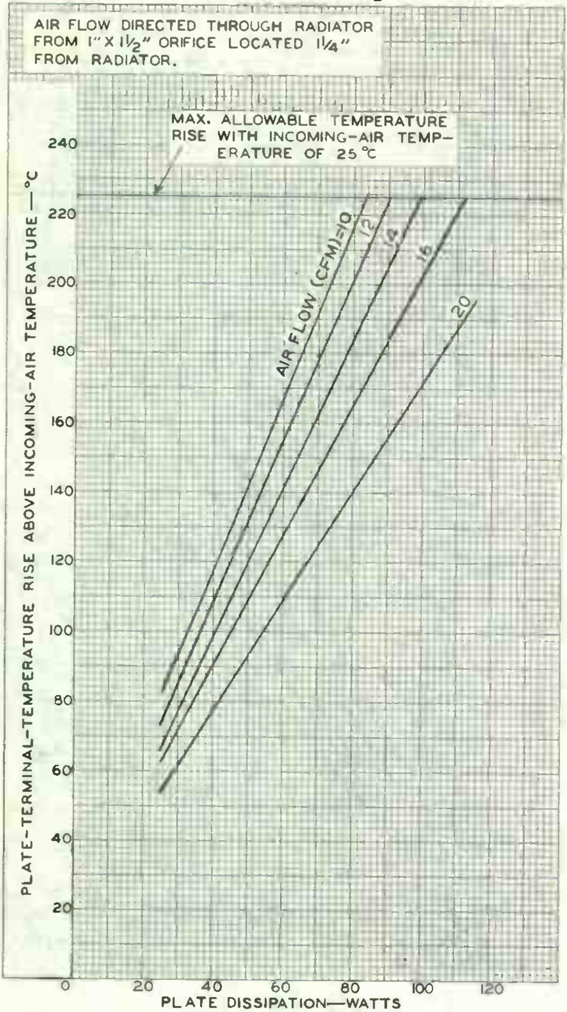


TYPICAL COOLING REQUIREMENTS
With Cowling



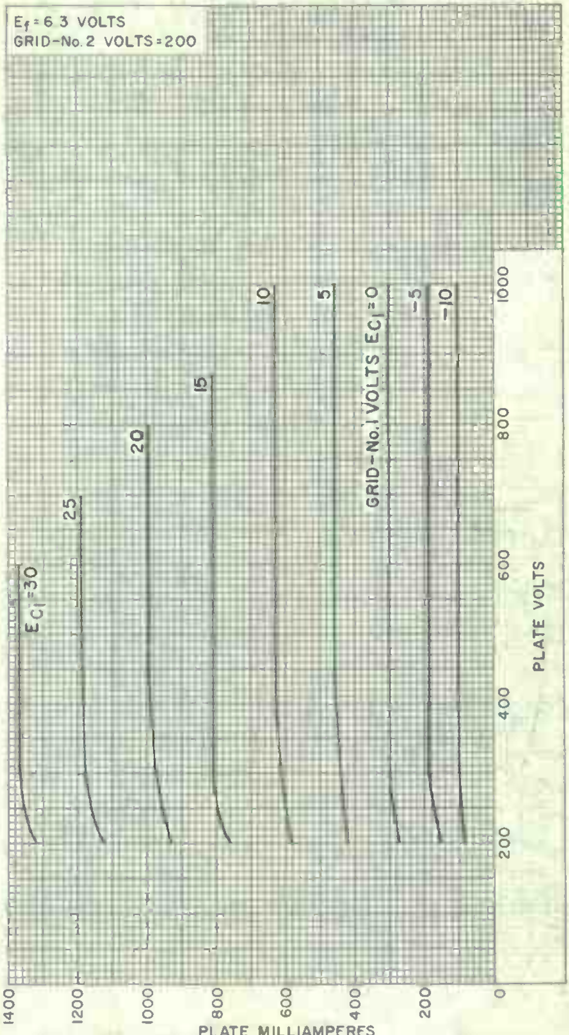
92CM-9219R1

TYPICAL COOLING REQUIREMENTS
Without Cowling



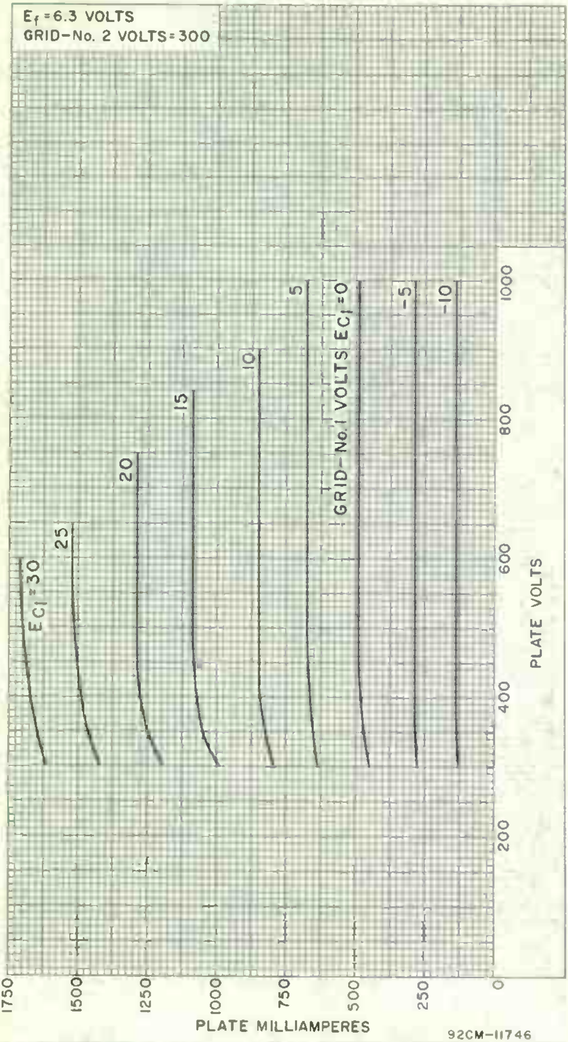
92CM-9220R1

TYPICAL PLATE CHARACTERISTICS



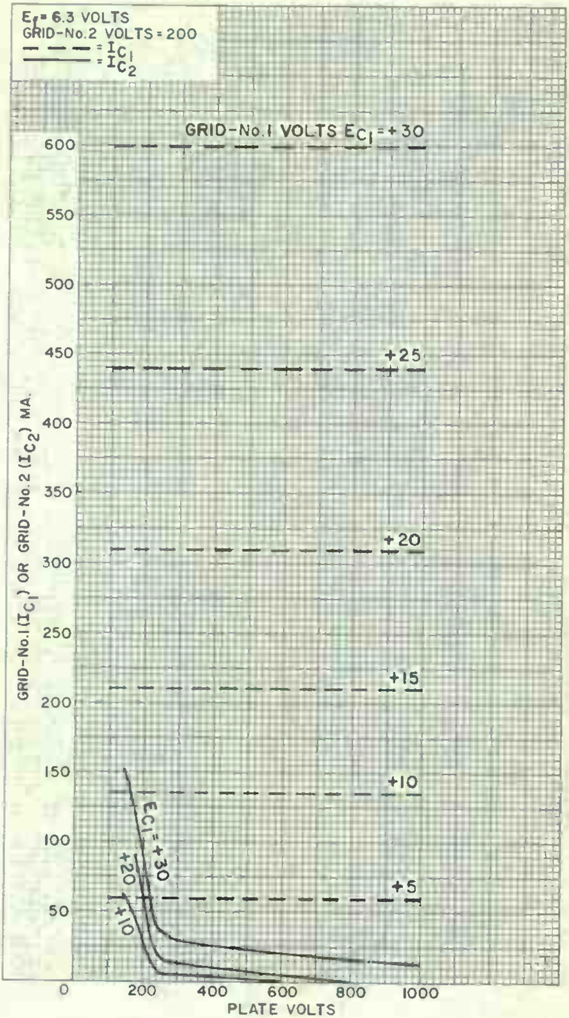
92CM-11744

TYPICAL PLATE CHARACTERISTICS



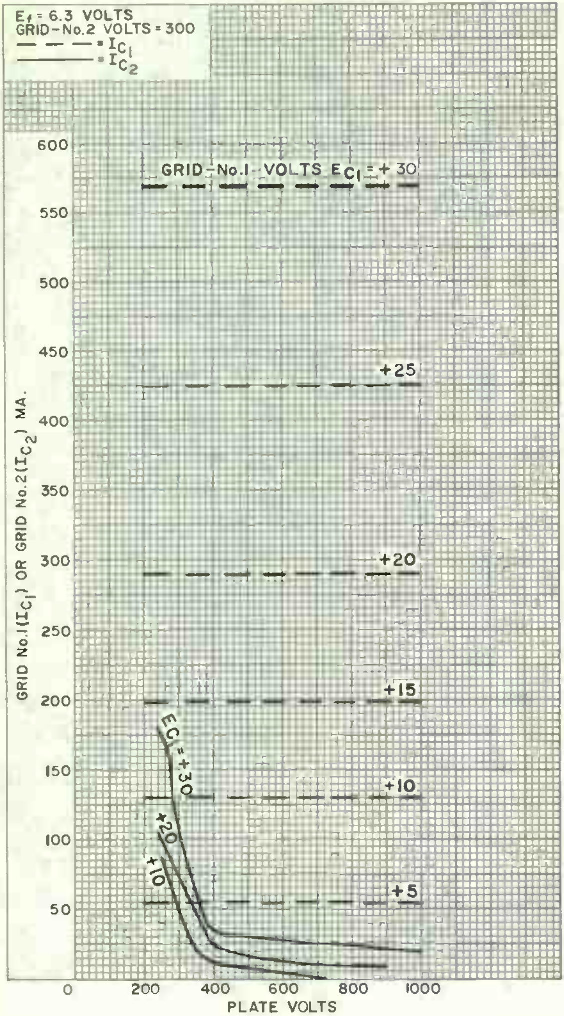
92CM-11746

TYPICAL CHARACTERISTICS



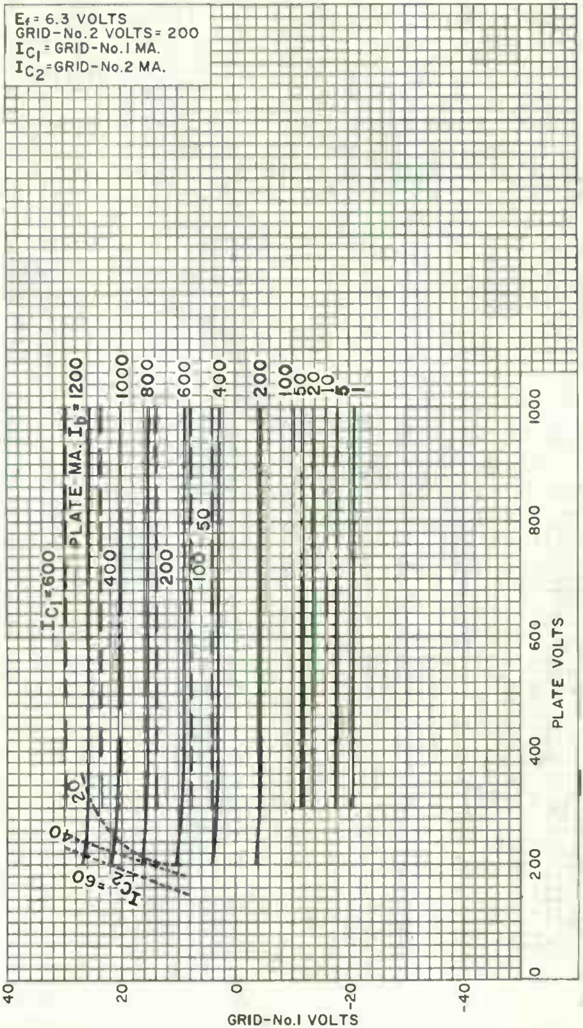
92CM-11747

TYPICAL CHARACTERISTICS



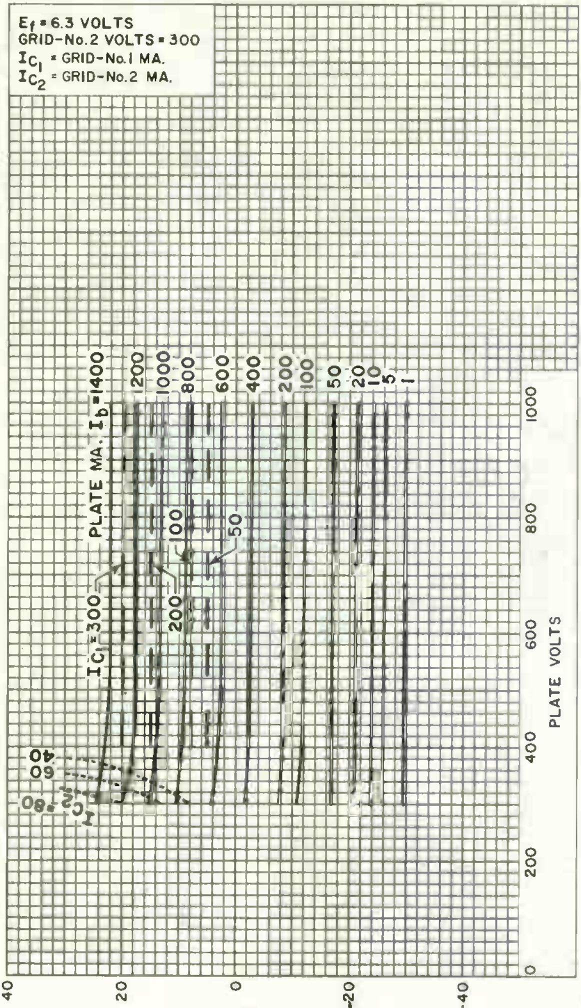
92CM-11748

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



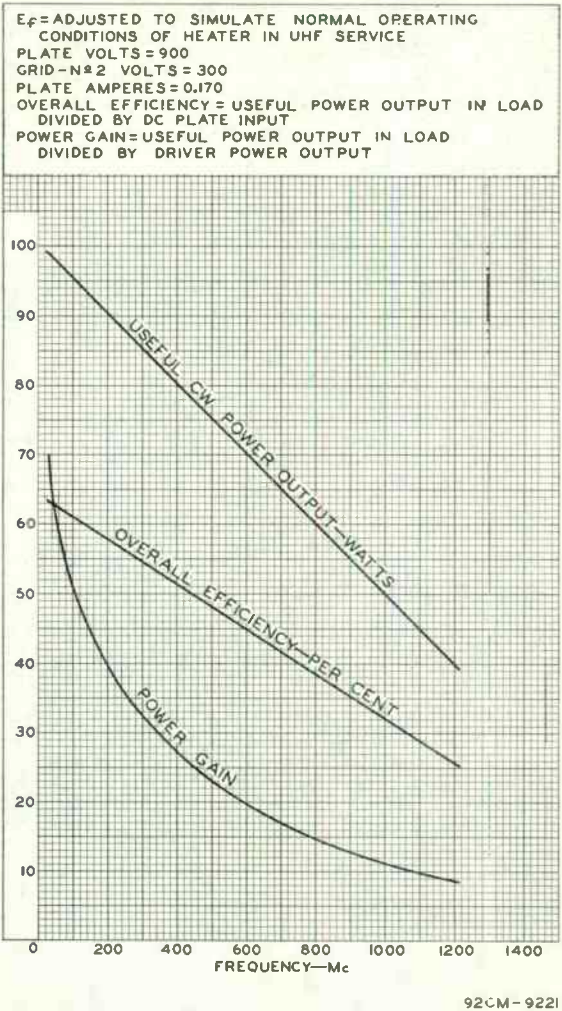
92CM-11745

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM-11749

TYPICAL PERFORMANCE CHARACTERISTICS
In Class C Telegraphy or Class C FM Telephony Amplifier Service



Tunable Oscillator Triode

PENCIL TYPE WITH INTEGRAL RESONATORS

For Radiosonde Service at Frequencies between 1660 and 1700 Mc

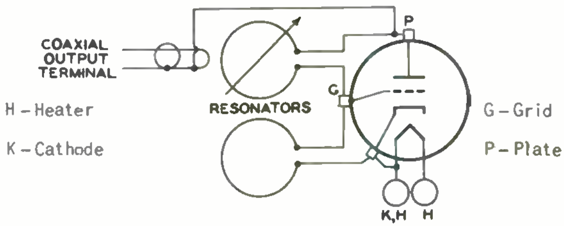
GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage range (AC or DC)	5.2 to 6.6▲	volts
Current at 6 volts	0.16	amp
Frequency (Approx.).	1680●	Mc
Tuning Range	1660 to 1700	Mc
RF Coaxial Output Terminal:		
Characteristic impedance (Approx.) .	50	ohms
Tuning Screws (2):		
Maximum Torque (Absolute) at tuning-range stops.	6.5	oz-in.

Mechanical:

Operating Position . . . . .Any
Dimensions . . . . .See *Dimensional Outline*
Tunable Resonators (2) . . . . .Integral part of tube
Weight (Approx.) . . . . 0.8 oz
Terminal Connections (See *Dimensional Outline*):



UHF OSCILLATOR — Class C

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

At frequencies between 1660 and 1700 Mc and altitudes up to 100,000 feet

DC PLATE-TO-GRID VOLTAGE	130 max.	volts
DC PLATE CURRENT	34 max.	ma
DC GRID CURRENT.	8 max.	ma
PLATE INPUT.	4 max.	watts
PLATE DISSIPATION.	3.6 max.	watts
AMBIENT-TEMPERATURE RANGE.	-55 to +75	°C

Typical Operation as Cathode-Driven Oscillator:

At frequency of	*1660*	*1680*	*1700*	*Mc*
Heater Voltage	6	6	6	volts
DC Plate-to-Grid Voltage	124.5	124	123	volts

At frequency of	*1660*	*1680*	*1700*	*Mc*
DC Cathode-to-Grid Voltage	7.5	6.75	6	volts
From grid resistor of.	1500	1500	1500	ohms
DC Cathode Current	35	31.5	32	ma
DC Grid Current.	5	4.5	6	ma
Useful Power Output (Approx.). . . .	575	575	475	mw

Circuit Values:

Grid-Circuit Resistance.	2400 max.	ohms
	1300 min.	ohms

▲ This range of heater voltage is for radiosonde applications in which the heater is supplied from batteries and in which the equipment design requirements of minimum size, light weight, and high efficiency are the primary considerations even though the average life expectancy of the 7533 in such service is only a few hours.

● As supplied, tubes are adjusted to 1680 ± 4 Mc.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Heater Current	1	0.135	0.157	amp
Grid Resistor.	2	1300	2400	ohms
Useful Power Output (1).	3	250	–	mw
Plate Current (1).	4	–	34	ma
Useful Power Output (2).	5	250	–	mw
Plate Current (2).	6	–	34	ma
Useful Power Output (3).	7	270	–	mw

Note 1: With 5.2 volts on heater.

Note 2: With heater voltage of 6.6 volts, dc plate supply voltage of 117 volts, plate load resistor of 50 ohms, frequency adjusted to 1660 +3 −1 Mc., output VSWR of 1.1 maximum, and grid resistor adjusted to give plate current as close as possible to, but not exceeding 33 ma. Record Grid-Resistor value.

Note 3: With frequency and grid-resistor value of Note 2, decrease heater voltage and plate supply voltage to 5.2 volts and 95 volts, respectively, and measure Useful Power Output.

Note 4: With heater voltage of 6.6 volts, plate supply voltage of 117 volts, plate load resistor of 50 ohms, using same value of grid resistor as determined in Note 2, frequency adjusted to 1700 +1 −3 Mc., and output VSWR of 1.1 maximum.

Note 5: Same as Note 4, except heater voltage and plate supply voltage are 5.2 volts and 95 volts, respectively.

Note 6: Same as Note 4, except frequency is adjusted to 1680 ± 4 Mc with VSWR of 1.1 maximum.

Note 7: Same as Note 6, except heater voltage and plate supply voltage values are 5.2 volts and 95 volts, respectively.

SPECIAL TESTS & PERFORMANCE DATA

Low-Pressure Voltage Breakdown Test:

This test (similar to MIL-E-1D, paragraph 4.9.12.1) is performed on a sample lot of tubes from each production run. Tubes are tested in a chamber at an air pressure equivalent to an altitude of 100,000 feet. Arcing will not occur when an rms voltage of 200 volts is applied between the plate terminal and the grid terminal and heater-cathode terminal tied together.

High-Frequency Vibration Performance:

This test (similar to MIL-E-1D, paragraph 4.9.19.2) is performed on a sample lot of tubes from each production run. The tube is vibrated in two planes, parallel and perpendicular respectively to its axis, with no voltages applied to the tube. Vibration frequency is 50-to-60 cps and acceleration is 10 g. At the end of this test, tubes will not show temporary or permanent shorts or open circuits.

Shorts and Continuity Test:

This test (similar to MIL-E-1D, paragraph 4.7.5) is performed on all tubes from each production run. In this test, a tube is considered inoperative it it shows a permanent or temporary short or open circuit.

Temperature-Frequency Performance:

This test is performed on a sample lot of tubes from each production run to determine the ability of this tube type to maintain the oscillator frequency without significant change when ambient temperature and operating voltages are reduced gradually during a given time interval. Tube under test is operated with a heater voltage of 5.6 volts, dc plate supply voltage of 117 volts, plate load resistor of 50 ohms, oscillator frequency of 1680 ± 4 Mc, output VSWR of 1.1 maximum, dc plate current of not more than 34 ma. obtained by adjusting the value of the grid resistor between 1300 and 2400 ohms, and at an ambient temperature of approximately 22° C for a period of 5 minutes. Record Oscillator Frequency. The ambient temperature is then gradually reduced to -40° C during a 30-minute operating period. Both the heater voltage and plate supply voltage are reduced simultaneously so that during the final 15-minute interval of this test period the heater voltage is 5.2 volts and the plate supply voltage is 95 volts. Any change in frequency will not be more than +4 Mc or -1 Mc from the recorded initial test value. The rate of frequency change during this test will not exceed 2 Mc in any 15-second interval.

5-Hour Radiosonde Life Performance:

This test is performed on a sample lot of tubes from each production run under conditions of maximum-rated plate dissipation to insure excellent performance in radiosonde applications. Each tube tested is operated for 5 hours under the following conditions: heater voltage of 6.6 volts, dc plate supply voltage of 117 volts, plate load resistor of 50 ohms, dc plate current of 34 ma., obtained by adjusting the grid-resistor value between 1300 and 2400 ohms, oscillator frequency of 1680 ± 4 Mc and output VSWR of 1.1 maximum. At the end of 5 hours, the tubes will not show permanent shorts or open circuits, and will meet the following limits:

Useful Power Output (3) . . . . 210 min. mw

For conditions shown under *Characteristics Range Values, Notes 6,7.*

Change in Useful Power
Output (3) From Initial Value . . . . 30 max. %
For conditions shown under *Characteristics Range Values*, *Notes 6,7*.

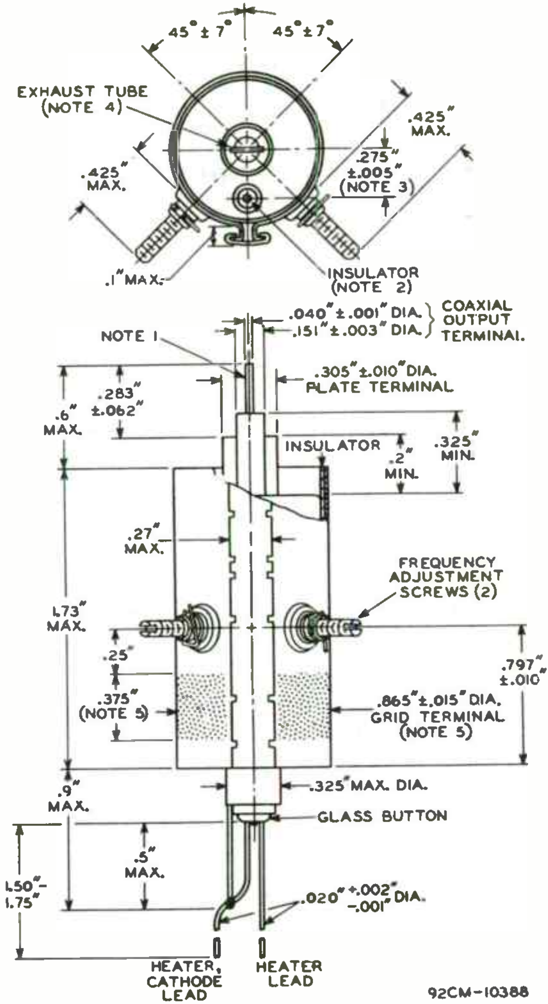
OPERATING CONSIDERATIONS

The *flexible heater leads* of the 7533 may be soldered to the circuit elements, but not closer than 3/4" from the surface of the glass button. Otherwise the heat of the soldering operation may crack the glass button and damage the tube.

Support for the 7533 should be provided by a suitable clamp around the metal shell of the tube, preferably in the indicated zone shown on the *Dimensional Outline*. Care must be taken to avoid clamping so tightly as to cause distortion of the resonator cavity with resultant change in operating frequency.

Connections to the grid terminal and to the plate terminal should be made by means of spring contacts only. Under no circumstances should connections be soldered to these terminals.

Accurate frequency adjustment in the 1660-to-1700-Mc operating range together with minimum frequency drift, may be obtained by using both tuning screws. Alternately turn each tuning screw not more than one-half turn at a time, in a clockwise direction to lower the frequency. Repeat this procedure until the desired lower frequency adjustment is reached. To reach a higher frequency, follow the same procedure except that the tuning screws are turned in a counterclockwise direction.


45° ± 7°
45° ± 7°
EXHAUST TUBE (NOTE 4)
.425" MAX.
.425" MAX.
.275" ±.005" (NOTE 3)
.1" MAX.
INSULATOR (NOTE 2)
.040" ±.001" DIA.
.151" ±.003" DIA.
COAXIAL OUTPUT TERMINAL
NOTE 1
.305" ±.010" DIA. PLATE TERMINAL
.283" ±.062"
.6" MAX.
.325" MIN.
INSULATOR
.2" MIN.
.27" MAX.
FREQUENCY ADJUSTMENT SCREWS (2)
1.73" MAX.
.25"
.797" ±.010"
.375" (NOTE 5)
.865" ±.015" DIA. GRID TERMINAL (NOTE 5)
.325" MAX. DIA.
.9" MAX.
GLASS BUTTON
.5" MAX.
1.50"-1.75"
.020" +.002" -.001" DIA.
HEATER, CATHODE LEAD
HEATER LEAD
92CM-10388

NOTE 1: THE AXES OF THE INNER AND OUTER CONDUCTORS OF THE COAXIAL OUTPUT TERMINAL COINCIDE WITHIN 0.010".

NOTE 2: THE END OF THE INSULATOR IN THE COAXIAL OUTPUT TERMINAL ALIGNS WITH THE EDGE OF THE OUTER CONDUCTOR (0.151" ± 0.003" DIAMETER) WITHIN 0.005".

NOTE 3: DISTANCE BETWEEN CENTER LINE OF PLATE TERMINAL AND CENTER LINE OF INNER CONDUCTOR (0.040" ± 0.001" DIAMETER).

NOTE 4: ORIENTATION OF PINCH-OFF IS NOT CONTROLLED.

NOTE 5: STIPPLED REGION (WHICH EXTENDS AROUND TUBE) INDICATES RECOMMENDED CLAMPING AND CONTACT AREA.

High-Mu Triode

CERAMIC-METAL PENCIL TYPE

FAST WARM-UP TIME — STURDY COAXIAL-ELECTRODE STRUCTURE

For Use at Frequencies up to 5000 Mc in Cathode-Drive Circuits 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	0.225	amp
Cathode Warm-Up Time (Average) to reach 80% of operating plate current for dc plate supply volts = 80, grid volts = 0, cathode resistor (ohms) = 0, load resistor (ohms) = 10, heater volts = 6.3	10	sec
Amplification Factor	70	
Transconductance for dc plate ma. = 14, dc plate volts = 125, and cathode resistor (ohms) = 50	16000	μmhos
Direct Interelectrode Capacitances:[a]		
Grid to plate	2.4	μμf
Grid to cathode and heater	4.4	μμf
Plate to cathode and heater	0.04 max.	μμf
Heater to cathode	2.6	μμf
Cathode to plate	0.04 max.	μμf
Cathode to grid and heater	7.0	μμf
Plate to grid and heater	2.4	μμf

Mechanical:

Operating Position . . . . Any

Dimensions . . . . See *Dimensional Outline*

Weight (Approx.) . . . . 0.3 oz

Sockets:

Heater-terminals connector . . . . Amerac[b] No.1018-88[c], Grayhill[d] No.22-5, or equivalent

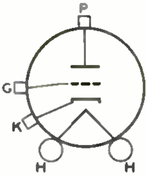
Socket for operation up to about 550 Mc (Including heater-terminals connector) . . . . Jettron[e] No.CD7010, or equivalent

Cavities (Including heater-terminals connector) . . . . Amerac No.1718 (for 4150 Mc), J-V-M[f] No.D-7980 Series, Resdel[g] No.10 Series, or equivalent

← Indicates a change.

Terminal Connections (See *Dimensional Outline*):

H - Heater
K - Cathode



G - Grid
P - Plate

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

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

At frequencies up to 5000 Mc and altitudes:

	Up to 80,000 feet	*Between 80,000 and 100,000 feet*	
DC PLATE VOLTAGE	250 max.	200 max.	volts
DC GRID VOLTAGE	−50 max.	−50 max.	volts
DC CATHODE CURRENT	25 max.	25 max.	ma
DC GRID CURRENT	6 max.	6 max.	ma
PLATE DISSIPATION	2.5 max.	2.5 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	50 max.	50 max.	volts
Heater positive with respect to cathode	50 max.	50 max.	volts
PLATE-SEAL TEMPERATURE	225 max.	225 max.	°C

Typical CCS[j] Operation in Cathode-Drive Circuit:

As oscillator

	At 500 Mc	*At 1000 Mc*	*At 2000 Mc*	*At 3000 Mc*	*At 4150 Mc*	*At 5000 Mc*	
DC Plate-to-Grid Voltage	205	203	151	125	200	200	volts
DC Cathode-to-Grid Voltage	5	3	1	0.1	0.26	-	volts
From a grid resistor of	1000	600	250	500	130	100	ohms
DC Cathode Current	21	24	24	20	23	25	ma
DC Grid Current	5	5	4	0.2	2	-	ma
Useful Power Output (Approx.)	1.6	1.3	0.5	0.15	0.1	0.03	watts

→ indicates a change.

As amplifier

	At 500 Mc	At 1000 Mc	
DC Plate-to-Grid Voltage.	204	185	volts
DC Cathode-to-Grid Voltage.	4	10	volts
From a grid resistor of	800	2000	ohms
DC Cathode Current.	21	24	ma
DC Grid Current	5	5	ma
Driver Power Output (Approx.)	0.2	0.2	watt
Useful Power Output (Approx.)	2.2	1.4	watts

Maximum Circuit Values:

Grid-Circuit Resistance . . . . 0.25 max. megohm

FREQUENCY DOUBLER — Class C

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

At frequencies up to 2000 Mc and altitudes:

	Up to 80,000 feet	Between 80,000 and 100,000 feet	
DC PLATE VOLTAGE.	250 max.	200 max.	volts
DC GRID VOLTAGE	-50 max.	-50 max.	volts
DC CATHODE CURRENT.	22 max.	22 max.	ma
DC GRID CURRENT	6 max.	6 max.	ma
PLATE DISSIPATION	2.5 max.	2.5 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode. . . .	50 max.	50 max.	volts
Heater positive with respect to cathode. . . .	50 max.	50 max.	volts
PLATE-SEAL TEMPERATURE. . . .	225 max.	225 max.	°C

Typical CCS[j] Operation in Cathode-Drive Circuit:

	Up to 550 Mc		Up to 1000 Mc		
DC Plate-to-Grid Voltage. . .	193	207	218	181	volts
DC Cathode-to-Grid Voltage. .	18	7	18	6	volts
From a grid resistor of . .	3600	2300	3600	2000	ohms
DC Cathode Current.	20	18	21	19	ma
DC Grid Current	5	3	5	3	ma
Driver Power Output (Approx.)	0.8	0.2	0.8	0.2	watt
Useful Power Output (Approx.)	1.3	0.75	0.9	0.4	watts

Maximum Circuit Values:

Grid-Circuit Resistance . . . . 0.25 max. megohm

← Indicates a change.

→ FREQUENCY TRIPLER — Class C

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

At frequencies up to 2000 Mc and altitudes:

	Up to 80,000 feet	*Between 80,000 and 100,000 feet*	
DC PLATE VOLTAGE.	250 max.	200 max.	volts
DC GRID VOLTAGE	-50 max.	-50 max.	volts
DC CATHODE CURRENT.	20 max.	20 max.	ma
DC GRID CURRENT	6 max.	6 max.	ma
PLATE DISSIPATION	2.5 max.	2.5 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode. . . .	50 max.	50 max.	volts
Heater positive with respect to cathode. . . .	50 max.	50 max.	volts
PLATE-SEAL TEMPERATURE. . . .	225 max.	225 max.	°C

Typical CCS[j] Operation in Cathode-Drive Circuit:

Up to 645 Mc

DC Plate-to-Grid Voltage.	202	240	volts
DC Cathode-to-Grid Voltage.	27	15	volts
From a grid resistor of	9000	25000	ohms
DC Cathode Current.	19	13	ma
DC Grid Current	3	0.6	ma
Driver Power Output (Approx.) . . .	0.6	0.2	watt
Useful Power Output (Approx.) . . .	0.7	0.4	watt

Up to 1000 Mc

DC Plate-to-Grid Voltage.	205	185	volts
DC Cathode-to-Grid Voltage.	30	10	volts
From a grid resistor of	10000	14000	ohms
DC Cathode Current.	19	12	ma
DC Grid Current	3	0.7	ma
Driver Power Output (Approx.) . . .	0.6	0.2	watt
Useful Power Output (Approx.) . . .	0.4	0.15	watt

Maximum Circuit Values:

Grid-Circuit Resistance . . . . 0.25 max. megohm

[a] Without external shield.

[b] Amerac, Inc., Dunham Road, Beverly, Massachusetts.

[c] For use with cavities.

[d] Grayhill, Inc., 561 Hillgrove Avenue, LaGrange, Illinois.

[e] Jettron Products, Inc., 56 Route 10, Hanover, N.J.

[f] J-V-M Microwave Co., 9300 W. 47th St., Brookfield, Illinois. Indicated No. applies to a series of cavities covering range from 220 to 3500 Mc.

[g] Resdel Engineering Corp., 330 South Fair Oaks Avenue, Pasadena, California. This series of cavities covers the range from 215 to 2325 Mc.

[h] 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.

[j] Continuous Commercial Service.

→ Indicates a change.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN ←

	Note	Min.	Max.	
Heater Current	1	0.205	0.245	amp
Direct Interelectrode Capacitances:				
Grid to plate	-	1.5	2.7	μμf
Grid to cathode	-	3.6	5.0	μμf
Plate to cathode	-	-	0.04	μμf
Heater-Cathode Leakage Current:				
Heater negative with respect to cathode	1,2	-	30	μa
Heater positive with respect to cathode	1,3	-	30	μa
Leakage Resistance:				
From grid to plate and cathode connected together	1,4	100	-	megohms
From plate to grid and cathode connected together	1,5	100	-	megohms
Reverse Grid Current	1,5	-	0.3	μa
Emission Voltage	7	-	4	volts
Amplification Factor	1,8	55	85	
Transconductance	1,8	12500	19500	μmhos
Plate Current (1)	1,8	9	19	ma
Plate Current (2)	1,9	-	50	μa
Power Output	1,10	1.7	-	watts
Change in Power Output	1,11	-	0.2	watt

Note 1: With 6.3 volts ac or dc on heater.

Note 2: With 60 volts dc between heater and cathode, heater negative with respect to cathode.

Note 3: With 60 volts dc between heater and cathode, heater positive with respect to cathode.

Note 4: With grid 100 volts negative with respect to plate and cathode which are connected together.

Note 5: With plate 300 volts negative with respect to grid and cathode which are connected together.

Note 6: With dc plate voltage of 200 volts, dc grid voltage of -2 volts, grid resistor of 0.5 megohm.

Note 7: With dc voltage on grid and plate which are connected together adjusted to produce a cathode current of 30 ma., and with 5.5 volts on heater.

Note 8: With dc plate supply voltage of 125 volts, cathode resistor of 50 ohms, and cathode bypass capacitor of 1000 μf.

Note 9: With dc plate voltage of 125 volts and dc grid voltage of -5 volts.

Note 10: In a single-tube, cathode-drive amplifier circuit operating at a frequency of approx. 550 ± 10 Mc. and with dc plate to cathode voltage of 250 volts, input-signal power of 0.2 watt, and dc grid voltage adjusted to produce a dc plate current of 20 ma.

Note 11: Reduce heater voltage to 5.7 volts. Change in Power-Output value from that obtained with 6.3 volts on heater will not exceed indicated value.

← Indicates a change.

→ SPECIAL TESTS & PERFORMANCE DATA

Low-Pressure Voltage-Breakdown Test:

This test (similar to MIL-E-1D, paragraph 4.9.12.1) is performed on a sample lot of tubes every 90 days. Tubes are tested in a chamber at an air pressure equivalent to an altitude of 100,000 feet. Breakdown will not occur when a 60-cycle rms voltage of 300 volts is applied between the plate cylinder and grid flange.

Low-Frequency Vibration Performance:

This test (similar to MIL-E-1D, paragraph 4.9.19.1) is performed on a sample lot of tubes from each production run under the following conditions: Heater voltage of 6.3 volts, dc plate supply voltage of 125 volts, cathode resistor of 50 ohms, and plate load resistor of 10,000 ohms. The tubes are vibrated in a plane perpendicular to the tube axis at 40 cycles per second at an acceleration of 10 g. The rms output voltage across the plate load resistor as a result of vibration of the tube will not exceed 100 millivolts.

At the end of this test, the tubes will not show permanent shorts or open circuits and will meet the following test limit:

Heater Current.	300 max.	ma

For conditions shown under *Characteristics Range Values, Note 1.*

Variable-Frequency Vibration Performance:

This test (similar to MIL-E-1D, paragraph 4.9.20.3) is performed on a sample lot of tubes from each production run. Tube operating conditions are the same as for *Low-Frequency Vibration Performance.* The tubes are vibrated perpendicular to the major axis through a frequency range from 5 to 500 cps and back. From 5 to 50 cps, the tubes are vibrated at a constant displacement of 0.0400 ± 0.0025 inch. From 50 to 500 cps, the tubes are vibrated at a constant acceleration of 10 ± 2 g. Total time to complete a sweep cycle is 10 ± 5 minutes. During the test, the tubes will not show an rms output voltage across the plate load resistor in excess of 150 millivolts.

Each tube is vibrated for 60 seconds at the frequency which gives maximum vibrational noise output. If, at the end of 60 seconds, the vibrational noise output is still increasing, the test is continued until there is no further increase.

The rms output voltage across the plate load resistor as a result of the vibration of the tube will not exceed the specified limit at any time during the test.

At the end of the test, the tubes will not show permanent shorts or open circuits and will meet the following test limit:

Heater Current.	300 max.	ma

For conditions shown under *Characteristics Range Values, Note 1.*

→ Indicates a change.

Shock Test:

This test (similar to MIL-E-1D, paragraph 4.9.20.5) is performed on a sample lot of tubes from each production run. Tubes are held rigid and are subjected in three different positions to an impact acceleration of 500 g, 5 blows in each position.

At the end of this test, tubes will not show permanent shorts or open circuits and will meet the following limits:

Heater Current.	300 max.	ma
For conditions shown under *Characteristics Range Values, Note 1.*		
Heater-Cathode Leakage Current. . . .	60 max.	μa
For conditions shown under *Characteristics Range Values, Notes 1,3.*		
Low-Frequency Vibration Output. . . .	200 max.	mv
For conditions shown above under *Low-Frequency Vibration Performance.*		
Change in Transconductance.	-20 max.	%
From initial value for conditions shown under *Characteristics Range Values, Notes 1,8.*		

Fatigue Vibration Test:

This test (similar to MIL-E-1D, paragraph 4.9.20.6) is performed on a sample lot of tubes from each production run. Tubes are rigidly mounted and subjected to 2.5 g vibrational acceleration in two positions (X1, Y1) for 32 hours each. At the end of this test, tubes are required to meet the limits specified for the *Shock Test.*

Shorts and Continuity Test:

This test (similar to MIL-E-1D, paragraph 4.7.3) is performed on all tubes from each production run. Voltage applied between adjacent elements of the tube under test will be between 20 and 70 volts dc or peak ac. Plate and cathode terminals are tied together and connected to the grid terminal through the shorts test equipment. Tubes are tapped with a rubber tapper three times in each of three mutually perpendicular directions. If a short indication is obtained, the tapping cycle is repeated two times for verification. Acceptance criteria is based on the "Resistance vs. Time Duration" curve shown in paragraph 4.7.7 of MIL-E-1D, Amendment 5.

At the end of this test, the tubes will not show permanent shorts or open circuits and will meet the following limit:

Heater Current.	300 max.	ma
For conditions shown under *Characteristics Range Values, Note 1.*		

Ceramic-Seal-Fracture Test:

This test is performed on a sample lot of tubes every 90 days. With cathode- and plate-cylinder-supports spaced 15/16" ± 1/64", and with the grid flange centered between these supports, the tubes will withstand the gradual application of a force of 30 pounds, perpendicular to the axis of the tubes, upon the grid flange, without causing fracture of the ceramic insulation.

Seal Strain Test:

This test (similar to MIL-E-1D, paragraph 4.9.6.3) is performed on a sample lot of tubes every 90 days. Tubes are tested by first immersing in water having a temperature of at least 97° C for at least 15 seconds and then immersing immediately in water at not more than 5° C for 5 seconds. After drying for 48 hours at room temperature, the tubes will meet the following test limit:

Heater Current. . . . . 300 max. ma
For conditions shown under *Characteristics Range Values, Note 1.*

Heater-Cycling Life Performance:

This test (similar to MIL-E-1D, paragraph 4.11.7) is performed on a sample lot of tubes from each production run. With 6.3 volts on heater and no voltage on plate or grid, the heater is cycled three minutes on and three minutes off for at least 2000 cycles.

At the end of this test, tubes will not show permanent shorts or open circuits and are required to meet the following limits:

Heater Current. . . . . 300 max. ma
For conditions shown under *Characteristics Range Values, Note 1.*

Heater-to-Cathode Leakage Current . . 60 max. μa
For conditions shown under *Characteristics Range Values, Notes 1,3.*

Grid-to-Cathode Leakage Resistance. . 50 min. megohms
For conditions shown under *Characteristics Range Values, Notes 1,4.*

1-Hour Stability Life Performance:

This test (similar to MIL-E-1D, paragraph 4.11.3.1a) is performed on a sample lot of tubes from each production run to insure that the tubes have been properly stabilized. Tubes are operated under the following conditions:

Heater voltage of 6.3 volts, plate supply voltage of 215 volts, and cathode resistor of 150 ohms.

At the end of 1 hour, the change in transconductance value for each tube, referred to its initial transconductance reading, will not exceed 15% of the initial value, for conditions shown under *Characteristics Range Values, Notes 1,8.*

In addition, the tubes will not show permanent shorts or open circuits and will meet the following limit:

Heater Current. . . . . 300 max. ma
For conditions shown under *Characteristics Range Values, Note 1.*

100-Hour Survival Life Performance:

This test (similar to MIL-E-1D, paragraph 4.11.3.1b) is performed on a sample lot of tubes from each production run to insure a low percentage of early inoperatives. Life-test conditions are the same as those specified for *1-Hour Stability Life Performance* except that all voltages are cycled at the rate of 110 minutes on and 10 minutes off.

At the end of 100 hours, the tubes will not show permanent shorts or open circuits and will meet the following limits:

Heater Current.	300 max.	ma
For conditions shown under *Characteristics Range Values, Note 1.*		
Transconductance.	9000 min.	μmhos
For conditions shown under *Characteristics Range Values, Notes 1,8.*		
Plate Current (2)	50 max.	μa
For conditions shown under *Characteristics Range Values, Notes 1,9.*		

500- and 1000-Hour Dynamic Life Performance:

This test (similar to MIL-E-1D, paragraph 4.11.3.2) is performed on a sample lot of tubes from each production run to insure high-quality rf performance. Each tube is life-tested as a class C amplifier in special cavity at 550 ± 10 Mc under the following conditions: Heater voltage of 6.3 volts; plate supply voltage of 250 volts; cathode resistor adjusted to give plate current of 25 ma.; and grid-circuit resistance adjusted to give grid current of 6 ma., heater positive with respect to cathode by 67.5 volts, and plate-seal temperature of 225° C. Heater voltage is cycled at a rate of 110 minutes on and 10 minutes off.

At the end of 500 hours, the tubes will not show permanent shorts or open circuits, and will be criticized for total number of tubes failing to pass the following limits:

Heater Current.	300 max.	ma
For conditions shown under *Characteristics Range Values, Note 1.*		
Leakage Resistance:		
From grid to plate and cathode connected together. . . .	60 min.	megohms
From plate to grid and cathode connected together. . . .	60 min.	megohms
For conditions shown under *Characteristics Range Values, Notes 1,4, and 1,5.*		
Power Output.	1.5 min.	watts
For conditions shown under *Characteristics Range Values, Notes 1,10.*		

At the end of 1000 hours, the tubes will not show permanent shorts or open circuits and will be criticized for total number of tubes failing to pass the following limits:

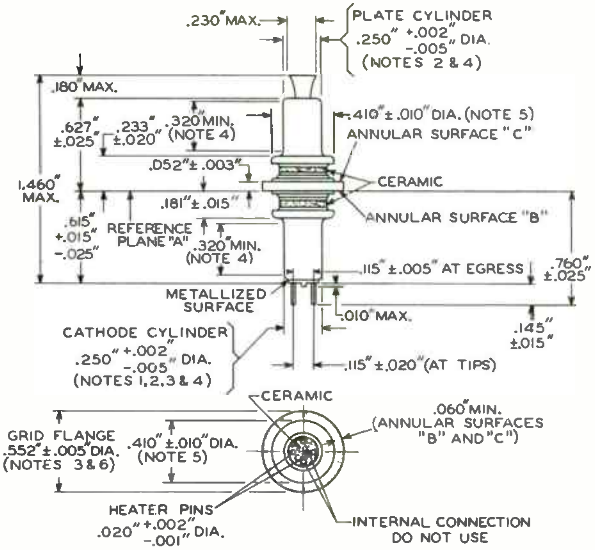
Heater Current.	300 max.	ma
For conditions shown under *Characteristics Range Values, Note 1.*		

Power Output. . . . . 1.3 min. watts
For conditions shown under *Characteristics Range Values*, *Notes 1,10*.

OPERATING CONSIDERATIONS

Connections to the cathode cylinder, grid flange, and plate cylinder should be made by flexible spring contacts. The connectors should make firm, large-surface contact, yet must be sufficiently flexible to insure that no part of the tube is subjected to excessive strain.

The *cathode* should preferably be connected to one side of the heater. When, in some circuit designs, the heater is not connected directly to the cathode, precautions must be taken to hold the peak heater-cathode voltage to the maximum-rated values shown in the tabulated data.



92CM-10274R1

REFERENCE PLANE "A" IS DEFINED AS THAT PLANE AGAINST WHICH ANNULAR SURFACE "B" OF THE GRID FLANGE ABUTS.

ANNULAR SURFACE "B" IS ON THE SIDE OF THE GRID FLANGE TOWARD THE CATHODE CYLINDER.

ANNULAR SURFACE "C" IS ON THE SIDE OF THE GRID FLANGE TOWARD THE PLATE CYLINDER.

NOTE 1: WITH ANNULAR SURFACE "B" RESTING ON REFERENCE PLANE "A", THE AXIS OF THE CATHODE CYLINDER WILL BE WITHIN 2° OF A LINE PERPENDICULAR TO REFERENCE PLANE "A".

NOTE 2: THE AXES OF THE PLATE CYLINDER AND CATHODE CYLINDER WILL COINCIDE WITHIN 0.010".

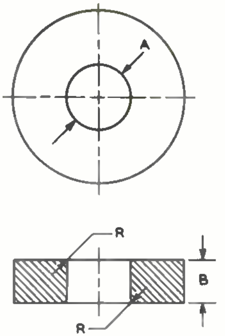
NOTE 3: THE AXES OF THE CATHODE CYLINDER AND GRID FLANGE WILL COINCIDE WITHIN 0.005".

NOTE 4: THE DIAMETER ALONG THE 0.320" MINIMUM LENGTH IS MEASURED WITH "GO" AND "NO-GO" RING GAUGES G_1-1 AND G_1-2, RESPECTIVELY.

NOTE 5: THIS DIAMETER IS MEASURED WITH "GO" AND "NO-GO" GAUGES G_2-1 AND G_2-2, RESPECTIVELY.

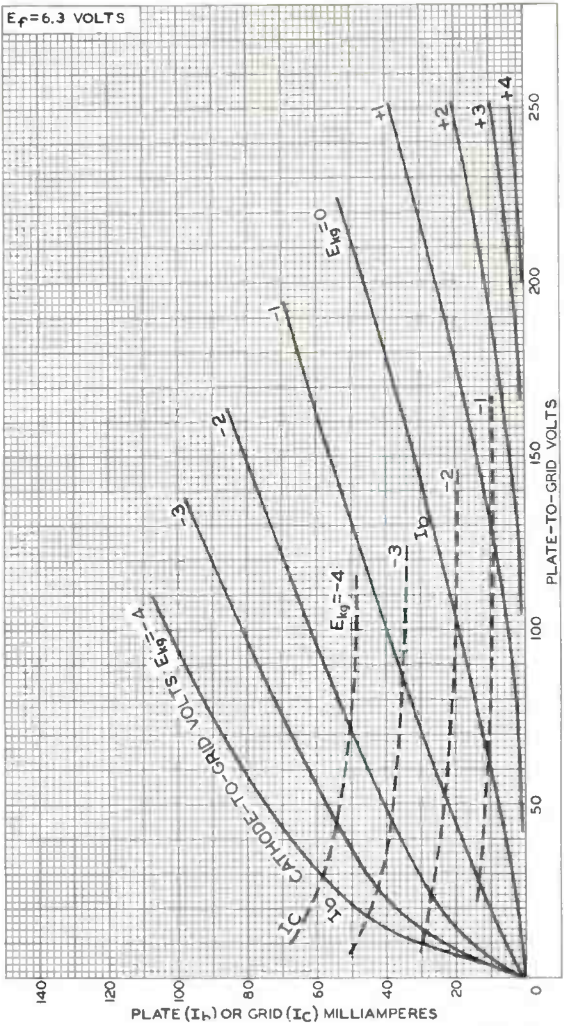
NOTE 6: THIS DIAMETER IS MEASURED WITH "GO" AND "NO-GO" GAUGES G_3-1 AND G_3-2, RESPECTIVELY.

GAUGES



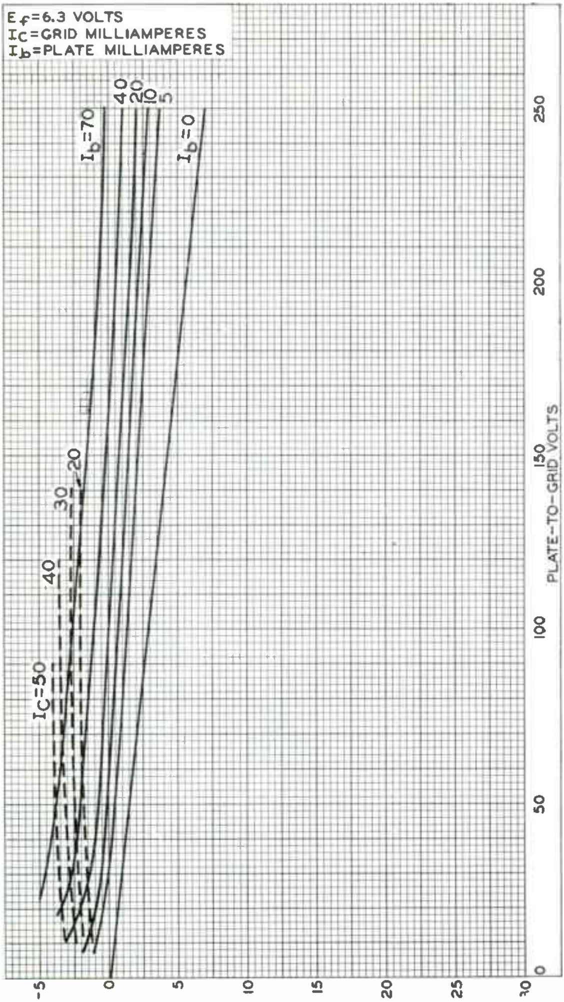
Gauge	Type	Dimension		
		Diameter A	Thickness B	Radius R
G_1-1	GO	0.25200" +0.00000" −0.00007"	0.320" +0.001" −0.000"	0.003" MAX.
G_1-2	NO-GO	0.24500" +0.00007" −0.00000"	–	–
G_2-1	GO	0.42000" +0.00000" −0.00007"	–	–
G_2-2	NO-GO	0.40000" +0.00007" −0.00000"	–	–
G_3-1	GO	0.55700" +0.00000" −0.00007"	–	–
G_3-2	NO-GO	0.54700" +0.00007" −0.00000"	–	–

AVERAGE CHARACTERISTICS
Cathode-Drive Service



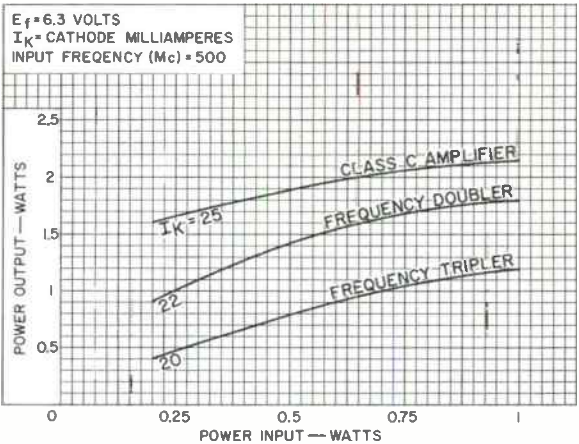
92CM-10262

AVERAGE CONSTANT-CURRENT CHARACTERISTICS
Cathode-Drive Service

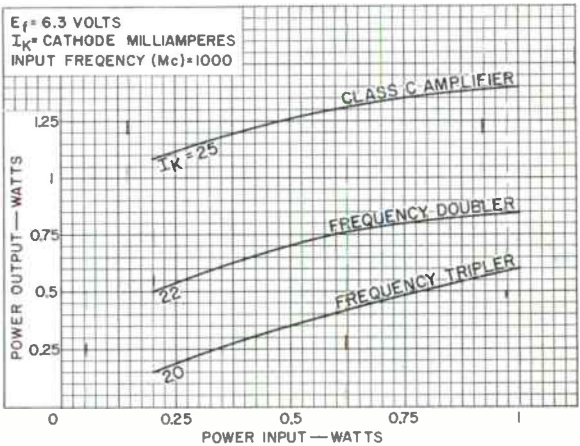


92CM-10263R1

TYPICAL POWER-OUTPUT CHARACTERISTICS
Cathode-Drive Service



92CS-11625R1



92CS-11626R1

TYPICAL POWER-OUTPUT CHARACTERISTICS
With Variation in Heater Voltage
Cathode-Drive Service

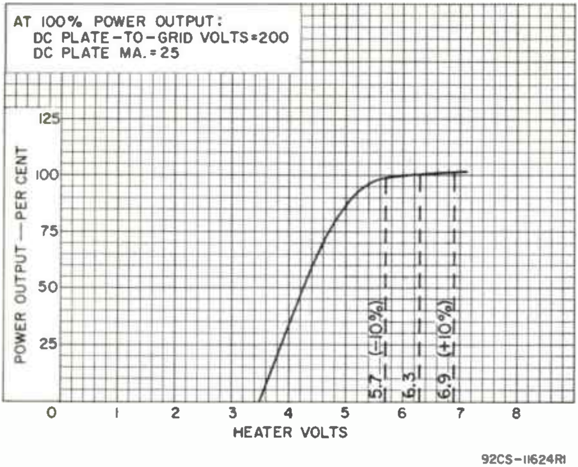
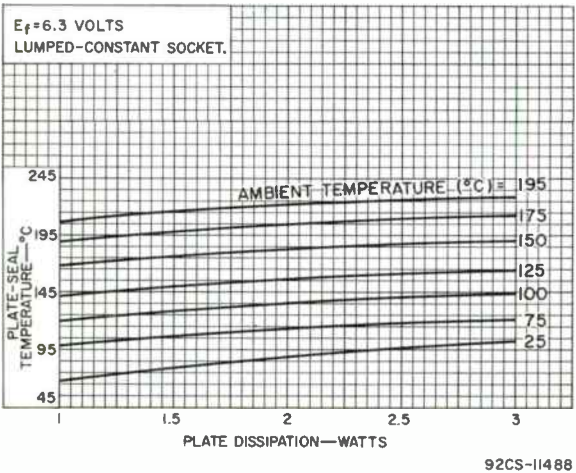


PLATE-SEAL-TEMPERATURE CHARACTERISTICS



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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:

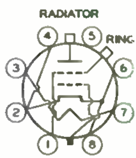
Heater, for Unipotential Cathode:		
Voltage (AC or DC)§	6 ± 10%	volts
Current at 6 volts.	2.6	amp
Minimum heating time.	30	sec
Mu-Factor, Grid No.2 to Grid No.1, for grid-No.2 volts = 300 and grid-No.2 ma. = 50.	4	
Direct Interelectrode Capacitances (Approx.):o		
Grid No.1 to plate.	0.03	μμf
Grid No.1 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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RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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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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BEAM POWER TUBE

	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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BEAM POWER TUBE

	At 30 Mc	At 500 Mc	
Effective RF Load Resistance. .	3050	3050	ohms
Driver Power Output (Approx.)°°	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.

○ 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.

°° 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:○				
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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BEAM POWER TUBE

	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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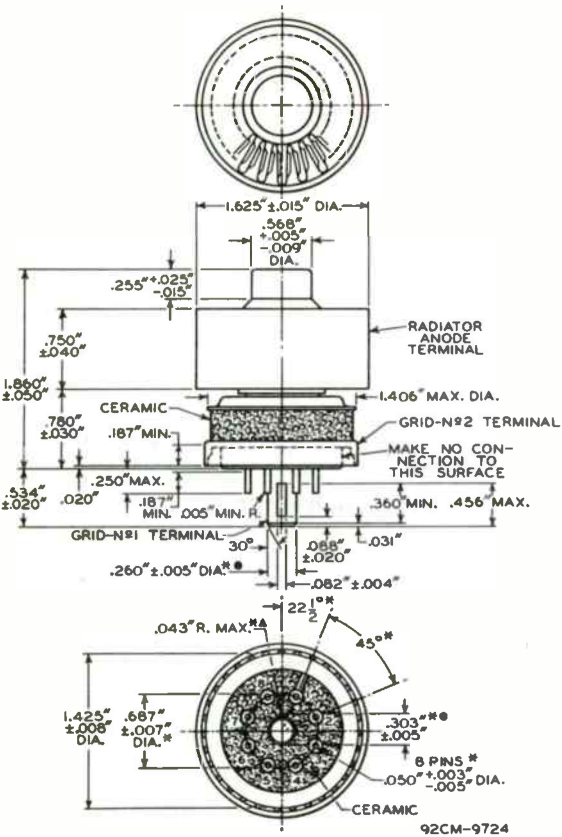
BEAM POWER TUBE



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BEAM POWER TUBE

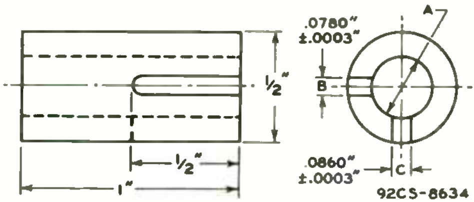
GRID-No. 1-PLUG DIMENSIONS ARE MEASURED BY GAUGES G_1 AND G_2. IN THE FOLLOWING INSTRUCTIONS FOR THE USE OF THESE GAUGES, "GO" INDICATES THAT THE ENTIRE GRID-No. 1-PLUG KEY WILL ENTER THE GAUGE; AND "NO-GO" INDICATES THAT THE GRID-No. 1-PLUG KEY WILL NOT ENTER THE GAUGE MORE THAN 1/16". INSTRUCTIONS 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



92CS-8634

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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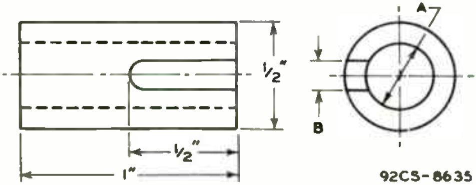
BEAM POWER TUBE

GAUGE G_2



92CS-8635

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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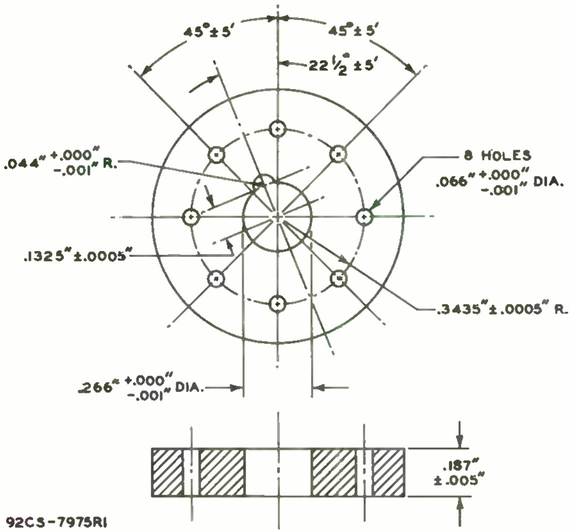
BEAM POWER TUBE

GAUGE G_3



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TOLERANCES ARE NOT CUMULATIVE

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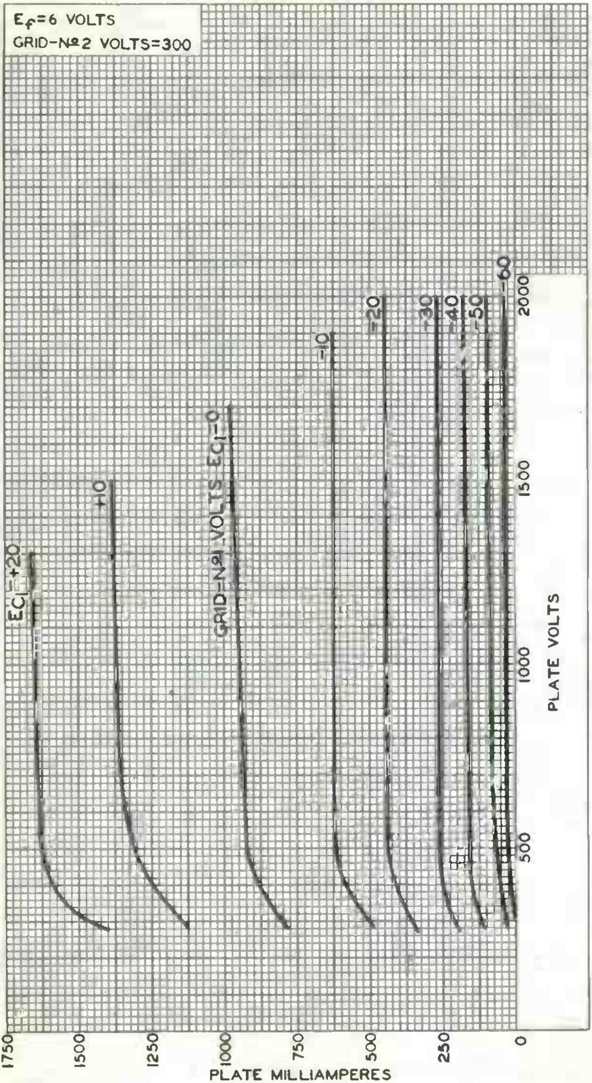
TYPICAL PLATE CHARACTERISTICS



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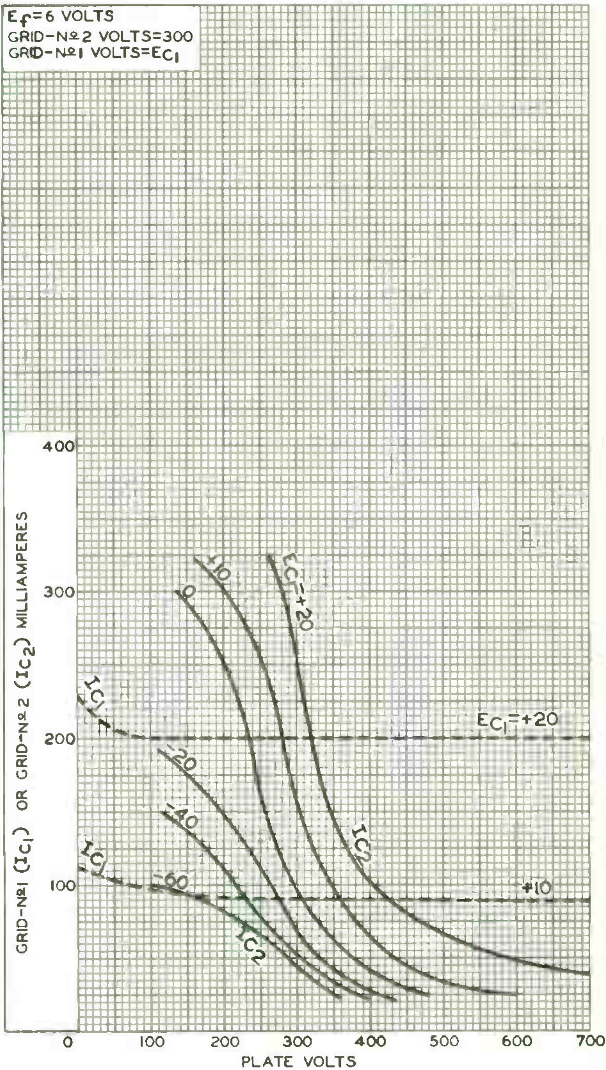
TYPICAL CHARACTERISTICS



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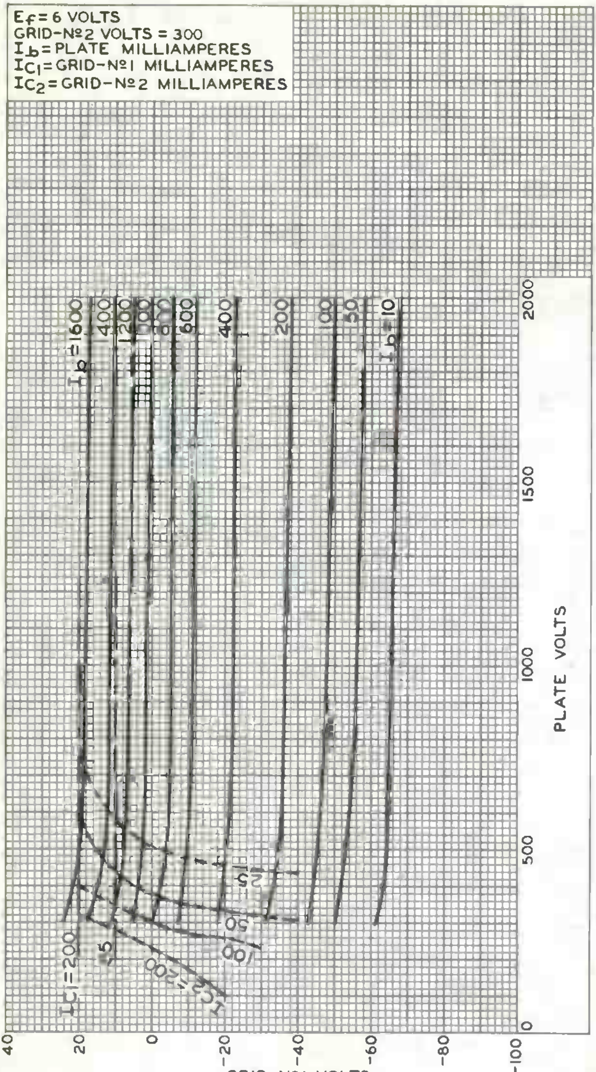
TYPICAL CONSTANT-CURRENT CHARACTERISTICS



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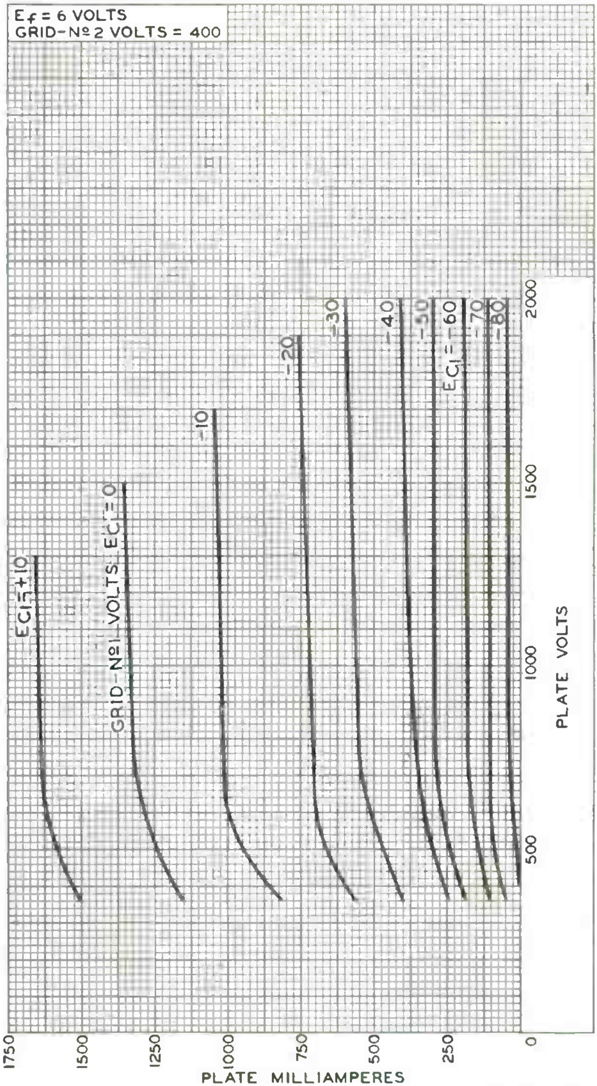
TYPICAL PLATE CHARACTERISTICS



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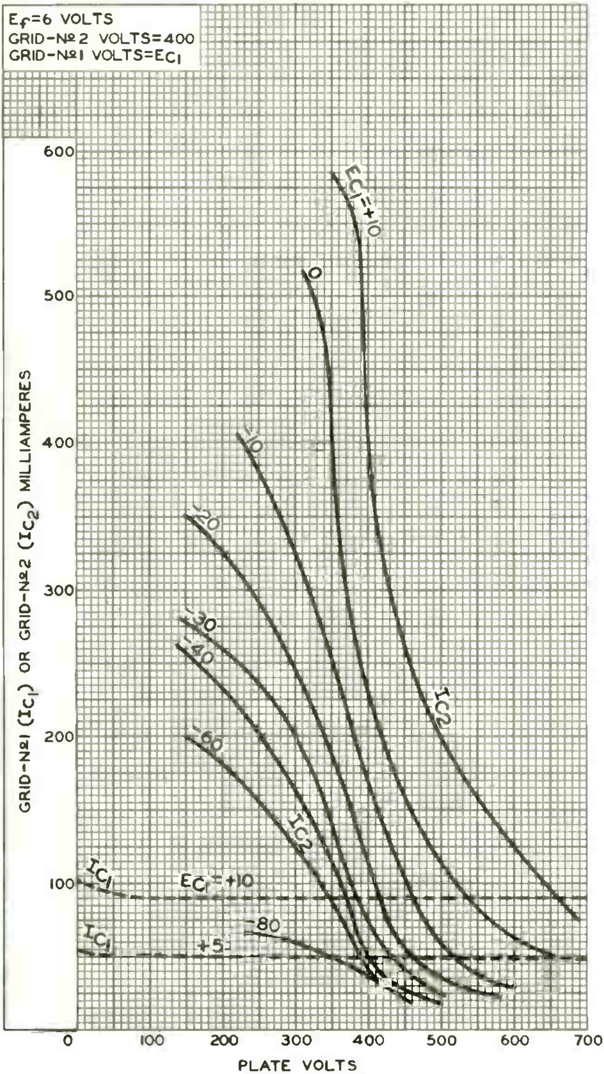
TYPICAL CHARACTERISTICS



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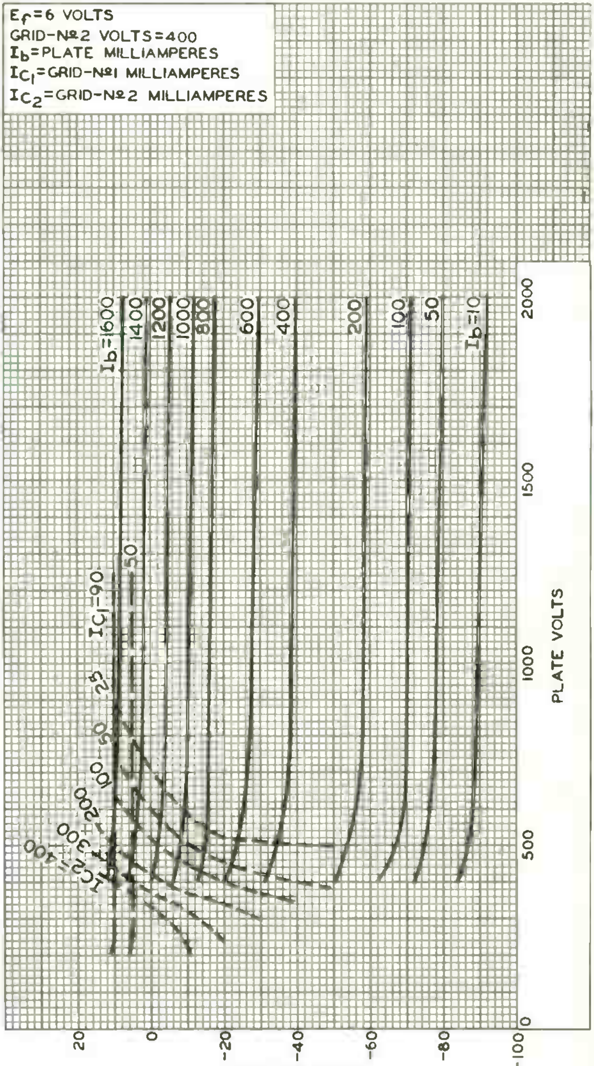
TYPICAL CONSTANT-CURRENT CHARACTERISTICS



ELECTRON TUBE DIVISION

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92CM-10336

Traveling-Wave Tube

HELIX-TRANSMISSION-LINE TYPE

FREQUENCY RANGE
1700-2300 Mc (S-Band)

INTEGRAL PERIODIC-PERMANENT-MAGNET TYPE

For Use as an Output Amplifier in Radio Relay Systems

Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 5%	volts
Current at heater volts = 6.3	1.75	amp
Starting Current	Must never exceed 4 amperes, even momentarily	
Minimum Cathode Heating Time	3	minutes
Frequency Range	1700 to 2300	Mc
Cold Insertion Loss	60	db
Thermostatic Switch:		
Current rating:		
At 125 volts ac		6 amp
At 240 volts ac		3 amp

Mechanical:

Operating Position	Any
Operating Altitude	10000 feet
Maximum Overall Length	20-1/2"
Maximum Height	3-7/8"
Maximum Width	3-1/8"
Maximum Shell Diameter	1-5/8"
Weight (Approx.)	6-1/2 pounds
Connectors:	
RF Input	Type N Plug (UG-18 B/U)
RF Output	Type N Plug (UG-18 B/U)
Terminal Leads	Spade Lugs (Amphenol[a] No.32419, or equivalent)

Thermal:

Collector Temperature[b]	225 max.	°C
Ambient Temperature	-30 to +70	°C
Air Flow into Radiator	25 min.	cfm

RF POWER AMPLIFIER

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

DC Collector Voltage	3000 max.	volts
DC Helix Voltage	2500 max.	volts
DC Grid-No.2 Voltage	1700 max.	volts
DC Collector Current	80 max.	ma
DC Helix Current	3 max.	ma
DC Grid-No.2 Current	0.2 max.	ma
RF Power Input	5 max.	watts

Typical Operation at 2000 Mc:

DC Collector Voltage	2000	volts
DC Helix Voltage	2250	volts

DC Grid-No.2 Voltage	1450	volts
DC Collector Current	70	ma
DC Helix Current	0.8	ma
DC Grid-No.2 Current	0.1	ma
Input VSWR	1.2:1	
Output VSWR	1.4:1	
RF Power Input	30	mw
Saturated Power Output	20	watts

[a] Amphenol Electronics Corporation, 1830 South 54th Avenue, Chicago 50, Illinois.

[b] The thermostatic switch will open when collector temperature exceeds 225° C.

CHARACTERISTICS RANGE VALUES

	Note	*Min.*	*Max.*	
Heater Current	1	–	2	amp
DC Collector Voltage	2,3	1650	2400	volts
DC Helix Voltage	3	1900	2400	volts
DC Grid-No.2 Voltage	3	1150	1600	volts
DC Collector Current	3	60	75	ma
DC Helix Current	3	–	1.1	ma
DC Grid-No.2 Current	–	–	0.2	ma
Input VSWR	–	–	1.4:1	
Output VSWR	–	–	1.5:1	
Saturated Power Output	–	18	–	watts

Note 1: With heater volts = 6.3.

Note 2: Normally the collector voltage is 250 volts below the helix voltage, but may be equal to the helix voltage or any value between these points.

Note 3: Specific operating value is supplied with each tube.

OPERATING CONSIDERATIONS

The *magnetic field* required to focus the electron beam in the 7642 is supplied by integral periodic permanent magnets. Although the periodic-magnet structure is difficult to demagnetize and has little stray field, care should be taken to prevent the presence of any appreciable external transverse magnetic field which might cause defocusing of the electron beam within the tube. Magnetic material should be kept at least eight inches away from the tube.

Impedance match between the 7642 rf power output and the load should have a voltage standing wave ratio (VSWR) no greater than 2:1. With VSWR's in excess of this value, oscillations may occur causing permanent damage to the tube. Tubes should not be operated without a termination.

Forced-air cooling of the collector is necessary whenever collector current is flowing. Failure to observe this precaution may result in permanent damage to the tube. It is recommended that the forced-air cooling be applied when the heater power is applied.

A thermostatic switch is mounted on the collector of the 7642 which opens when the collector temperature exceeds a safe limit. It is recommended that the thermostatic switch be used in an interlock circuit in the power supply for the collector, helix, and grid-No.2 voltages. The thermostatic switch will carry 6 amperes at 125 volts ac or 3 amperes at 240 volts ac.

The power supply should incorporate a helix-current overload protective device to prevent damage to the tube in the event of loss of collector voltage. Such a condition would cause the entire electron beam current to flow to the helix and thereby overheat that electrode. If it is desired to remove all voltages by a single control, the time-constant values of the power supply should be chosen so that the helix voltage decays faster than the collector voltage.

As the grid-No.2 voltage increases from zero to the operating value, the helix current may reach as high as 10 ma in the vicinity of 200 to 600 volts on grid No.2, then will fall below 2 ma at the proper operating grid-No.2 voltage. The helix supply should have adequate regulation to handle this transient during the turn-on procedure. In order to protect the tube, the helix supply should also have an interlock to open the circuit if the helix current exceeds 3 ma longer than a few milliseconds.

Mounting. The 7642 may be mounted in any position by means of bolts through either set of holes in the two mounting blocks.

Electrical connections are made to the 7642 by means of the seven leads with spade type lugs. These color-coded, flexible, insulated leads are identified on the *Dimensional Outline*. RF input and output connections are made to type N plugs (UG-18 B/U) on the tube (see *Dimensional Outline*). The collector is connected to the capsule and is normally grounded.

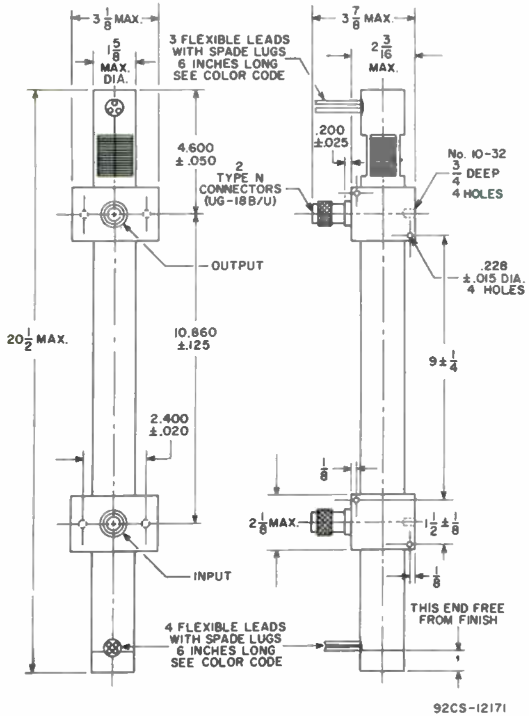
The rated values for collector voltage, helix voltage, and grid-No.2 voltage are high enough to be dangerous to the user. Care should be taken during adjustment of circuits, especially when exposed circuit parts are at a high dc potential.

STARTING PROCEDURE

Voltages should be applied to the 7642 in the following sequence: Apply the heater voltage and allow tube to warm-up for 3 minutes minimum. Then apply the collector voltage as specified on the tube label. Next, apply the helix voltage as specified on the tube label. Finally, increase the grid-No.2 voltage in a few milliseconds to obtain the collector current specified on the tube label. The three power supplies can be controlled by one switch provided there is a sufficient delay in application of the grid-No.2 voltage to allow the collector and helix voltages to stabilize first.

TURN-OFF PROCEDURE

To turn off the tube, remove the electrode voltages in the following sequence. First reduce the grid-No.2 voltage, then remove the helix voltage, collector voltage, and heater voltage in that order. The three power supplies can be controlled by one switch provided the grid-No.2 voltage decays faster than the collector and helix voltages.



DIMENSIONS IN INCHES

COLOR CODE OF LEADS

HEATER. . . . . Brown
HEATER, CATHODE, GRID No.1. . .Yellow
HELIX . . . . .Orange
GRID No.2 . . . . .Blue
COLLECTOR, SHELL. . . . . Black
THERMOSTATIC SWITCH (2) . . . . White

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

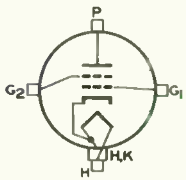
Direct Interelectrode Capacitances:[a]

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	$\mu\mu$f
	Grid No.1 to cathode & heater.	2	11.8	15.2	$\mu\mu$f
	Plate to cathode & heater . .	2	-	0.019	$\mu\mu$f
	Grid No.1 to grid No.2. . . .	2	17.3	21.9	$\mu\mu$f
	Grid No.2 to plate.	2	5.8	6.8	$\mu\mu$f
	Grid No.2 to cathode & heater.	2	-	1.3	$\mu\mu$f
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%.

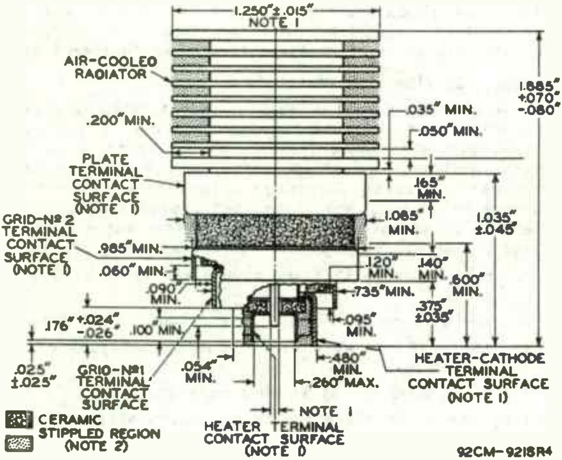
During the above vibration tests, tubes will not show an rms output voltage in excess of 15 volts across the plate load resistor in the 5-to-2000 cps range. At the end of this test, tubes are required to meet the limits for items 1, 3, 5, 8, 9, and 10 under *Characteristics Range Values for Equipment 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.

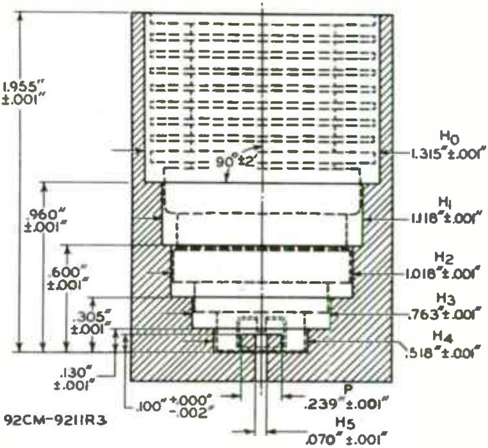
The maximum-rated plate and grid-No.2 voltages of this tube are extremely dangerous. Great care should be taken during the adjustment of circuits. The tube and its associated apparatus, especially all parts which may be at high potential above ground, should be housed in a protective enclosure. The protective 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.

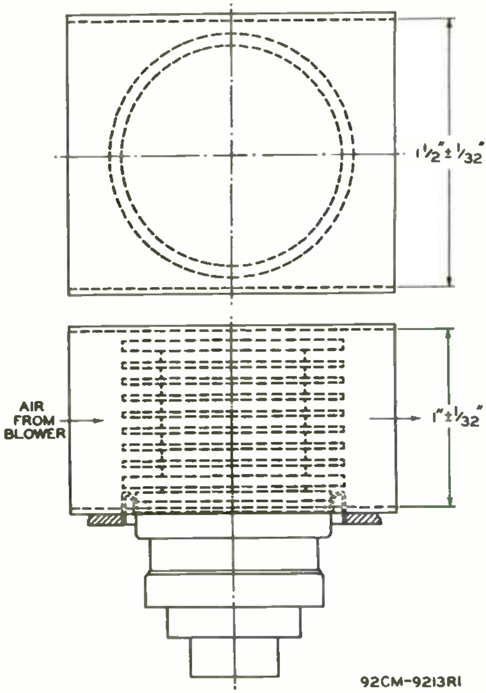
NOTE 2: KEEP ALL STIPPLED REGIONS CLEAR. DO NOT ALLOW CONTACTS OR CIRCUIT COMPONENTS TO PROTRUDE INTO THESE ANNULAR VOLUMES.

SKETCH G_1

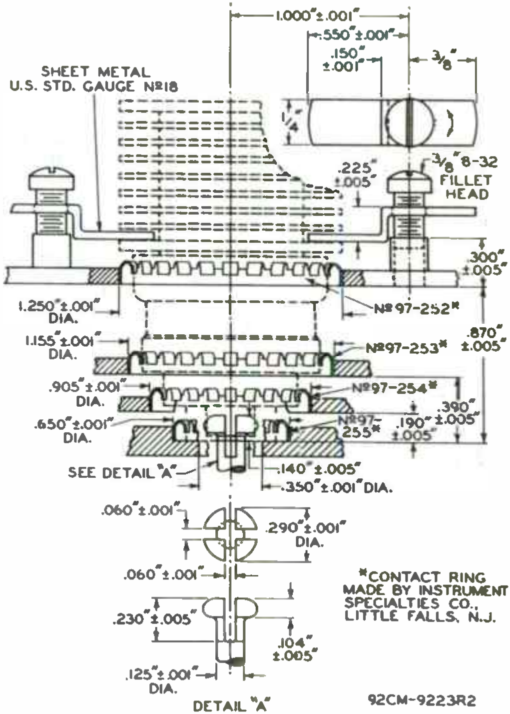


THE AXES OF THE CYLINDRICAL HOLES H_0 THROUGH H_5 AND THE AXES OF POST P ARE COINCIDENT WITHIN 0.001".

RECOMMENDED COWLING FOR DIRECTING AIR FLOW THROUGH RADIATOR



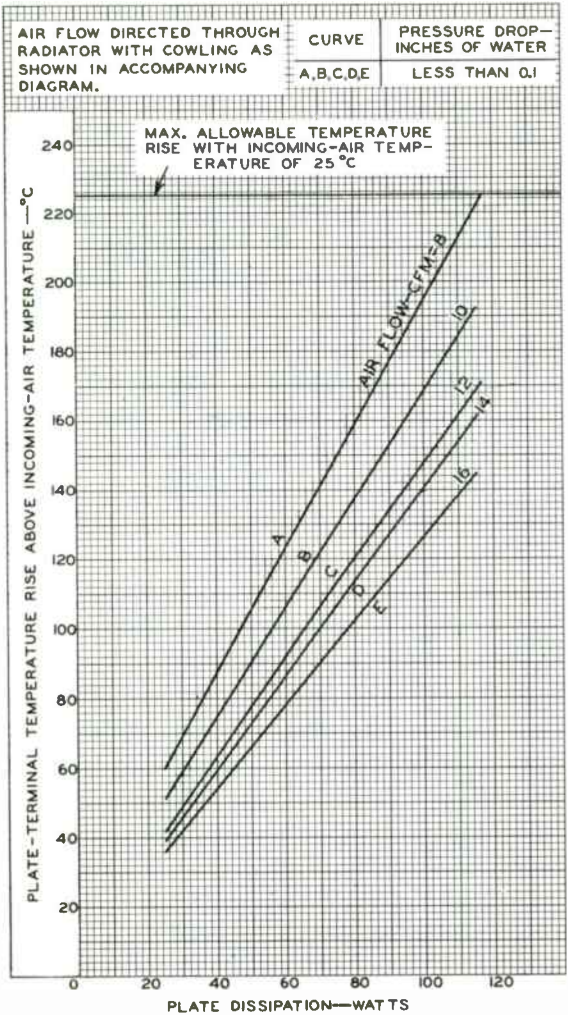
SUGGESTED MOUNTING ARRANGEMENT
& LAYOUT OF ASSOCIATED CONTACTS



*CONTACT RING MADE BY INSTRUMENT SPECIALTIES CO., LITTLE FALLS, N.J.

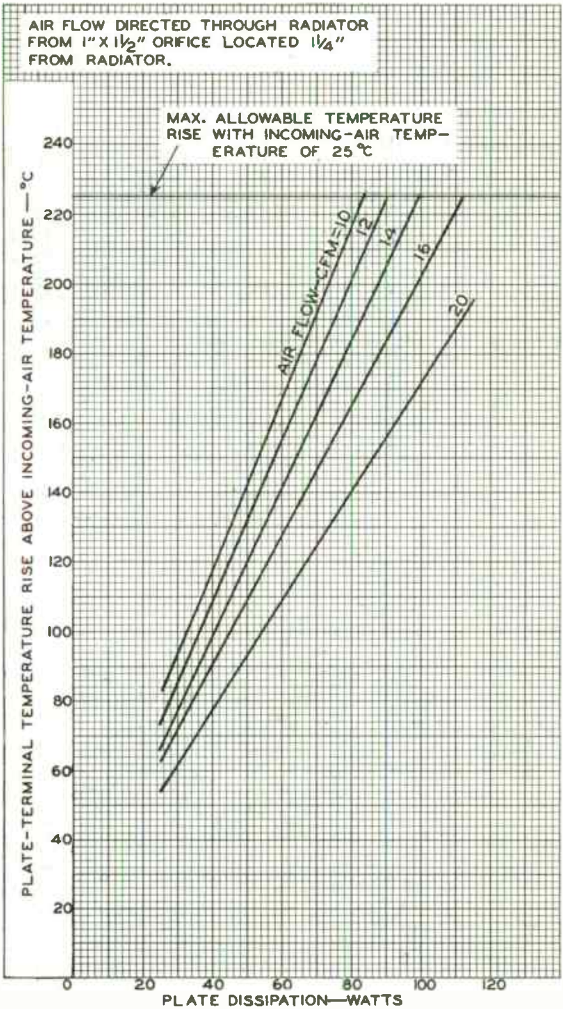
92CM-9223R2

TYPICAL COOLING REQUIREMENTS
With Cowling



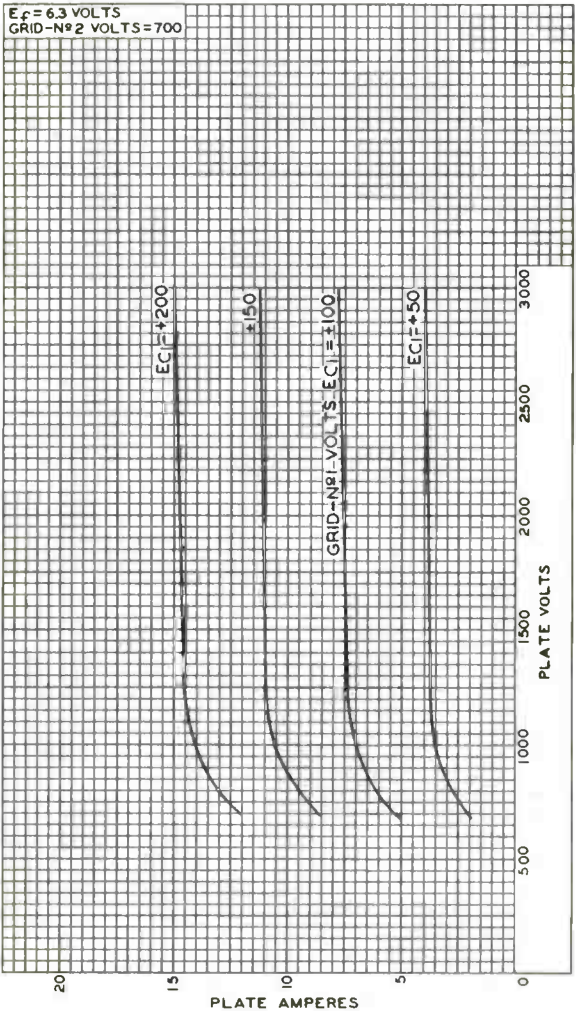
92CM-9219R1

TYPICAL COOLING REQUIREMENTS
Without Cowling



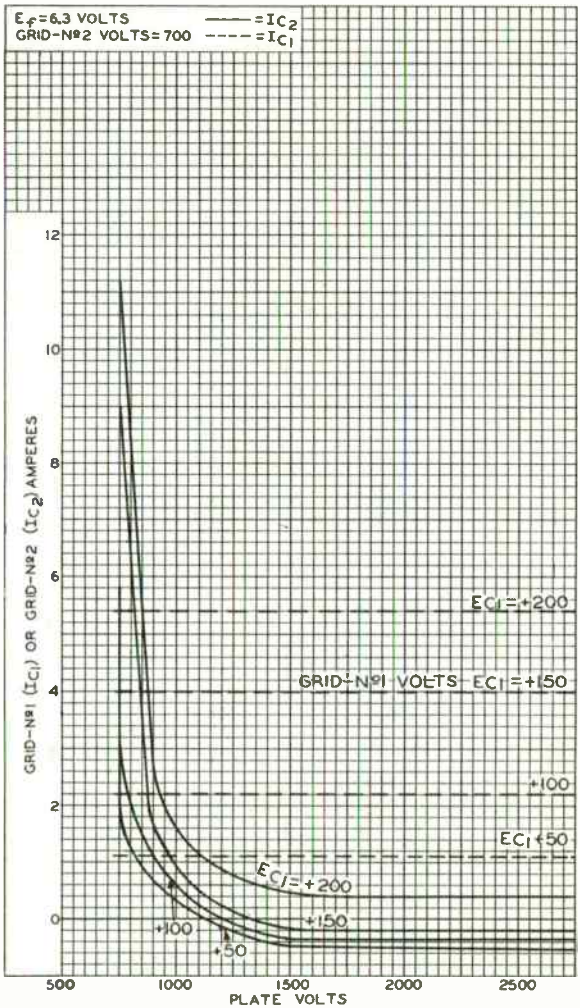
92CM-9220R1

TYPICAL PLATE CHARACTERISTICS



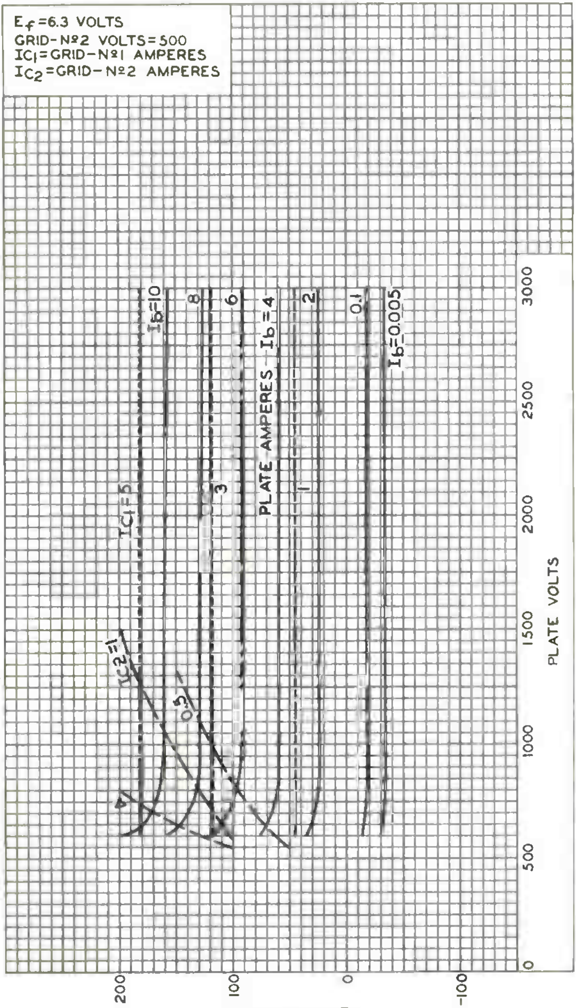
92CM-10649R1

TYPICAL CHARACTERISTICS



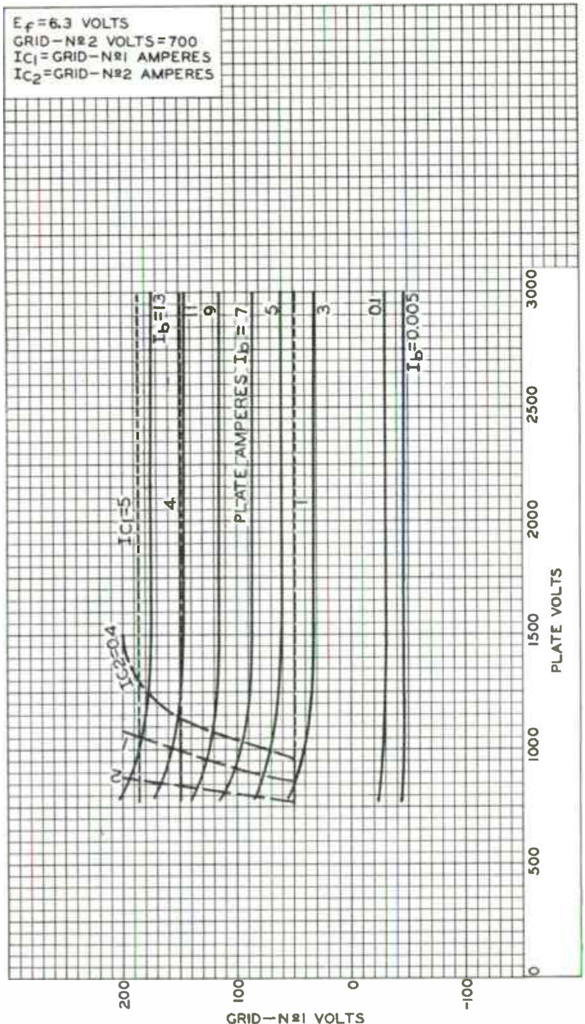
92CM-10653

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM-10650

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM-10651

Beam Power Tube

CERAMIC-METAL SEALS
"ONE-PIECE" ELECTRODE DESIGN
FORCED-AIR COOLED
COAXIAL-ELECTRODE STRUCTURE
INTEGRAL RADIATOR
1250-WATTS CW INPUT UP TO 1215 Mc
MATRIX-TYPE, OXIDE-COATED, UNIPOTENTIAL CATHODE

For Use under Severe Shock and Vibration

GENERAL DATA

Electrical:

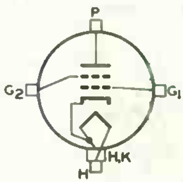
Heater, for Matrix-Type, Oxide-Coated, Unipotential Cathode:		
Voltage (AC or DC)[a]	6.3 ± 10%	volts
Current at heater volts = 6.3	7.85	amp
Minimum heating time	120	sec
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 225, grid-No.2 volts = 225, and plate ma. = 100	13	
Direct Interelectrode Capacitances:[b]		
Grid No.1 to plate	0.11 max.	μμf
Grid No.1 to cathode & heater	29	μμf
Plate to cathode & heater	0.011 max.	μμf
Grid No.1 to grid No.2	37	μμf
Grid No.2 to plate	5.3	μμf
Grid No.2 to cathode & heater	1.1 max.	μμf

Mechanical:

Operating Position	Any
Overall Length	2.34" ± 0.06"
Greatest Diameter (See *Dimensional Outline*)	2.06" ± 0.03"
Weight (Approx.)	3/4 lb
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



Air Flow:

Air flow may be removed simultaneously with all voltages.

Through radiator—Adequate air flow to limit the plate-core temperature to 250° C should be delivered by a blower through the radiator during the application of plate, grid-No.2, and grid-No.1 voltages. Typical values

← Indicates a change.

of air flow directed through the radiator to maintain the plate core (See *Dimensional Outline*) at 250° C with an incoming air temperature of 25° C and with no restrictions at the plate-contact flange are:

Plate Dissipation (watts)	Air Flow (cubic ft/min)	Static Pressure (inches of water)
100	2	0.04
300	4	0.14
600	11	0.66
700	16	0.96

To grid-No.2, grid-No.1, cathode, and heater terminals— A sufficient quantity of air should be directed at the heater terminal and allowed to flow past each of these terminals so that no terminal temperature exceeds the specified maximum value of 250° C. An air flow of 2.5 cfm is usually adequate. Forced-air cooling of heater and cathode terminals is usually required during stand-by (heater only) operation.

Plate-Core Temperature	250 max.	°C
Terminal Temperature (Plate, Grid No.2, Grid No.1, Cathode, and Heater)	250 max.	°C

AF POWER AMPLIFIER & MODULATOR

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

DC PLATE VOLTAGE	3000 max.	volts
DC GRID-No.2 VOLTAGE	1200 max.	volts
MAX.-SIGNAL DC PLATE CURRENT[d]	500 max.	ma
MAX.-SIGNAL GRID-No.1 CURRENT[d]	100 max.	ma
MAX.-SIGNAL PLATE INPUT[d]	1500 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT[d]	25 max.	watts
PLATE DISSIPATION[d]	600 max.	watts

Typical CCS Push-Pull Operation:

Values are for 2 tubes

DC Plate Voltage	2700	3000	volts
DC Grid-No.2 Voltage[e]	450	450	volts
DC Grid-No.1 Voltage from fixed-bias source	-40	-40	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage	80	80	volts
Zero-Signal DC Plate Current	200	200	ma
Max.-Signal DC Plate Current	900	1000	ma
Zero-Signal DC Grid-No.2 Current	0	0	ma
Max.-Signal DC Grid-No.2 Current	6	5	ma
Effective Load Resistance (Plate to plate)	6000	6400	ohms
Max.-Signal Driving Power (Approx.)	0	0	watts
Max.-Signal Power Output (Approx.)	1400	1600	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under any condition:

With fixed bias	15000 max.	ohms
With cathode bias	Not recommended	

LINEAR RF POWER AMPLIFIER

Single-Sideband Suppressed-Carrier Service

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

	Up to 1215 Mc	
DC PLATE VOLTAGE	2500 max.	volts
DC GRID-No.2 VOLTAGE	1200 max.	volts
MAX.-SIGNAL DC PLATE CURRENT	500 max.	ma
MAX.-SIGNAL DC GRID-No.1 CURRENT	100 max.	ma
MAX.-SIGNAL PLATE INPUT	1250 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT	25 max.	watts
PLATE DISSIPATION	600 max.	watts

Typical CCS "Single-Tone"[f] Operation: ←

	In grid-drive circuit at 30 Mc		
DC Plate Voltage	2250	2500	volts
DC Grid-No.2 Voltage[c]	450	450	volts
DC Grid-No.1 Voltage[c]	37	37	volts
Zero-Signal DC Plate Current	160	160	ma
Zero-Signal DC Grid-No.2 Current	0	0	ma
Effective RF Load Resistance	2500	2700	ohms
Max.-Signal DC Plate Current	450	500	ma
Max.-Signal DC Grid-No.2 Current	4	4	ma
Max.-Signal DC Grid-No.1 Current[g]	0.05	0.05	ma
Output-Circuit Efficiency (Approx.)	90	90	%
Max.-Signal Driver Power Output[h] (Approx.)	1	1	watt
Max.-Signal Useful Power Output (Approx.)	580[j]	680[j]	watts

Typical CCS Operation with "Two-Tone Modulation"[k] ←

	In grid-drive circuit at 30 Mc		
DC Plate Voltage	2250	2500	volts
DC Grid-No.2 Voltage[c]	450	450	volts
DC Grid-No.1 Voltage[c]	-37	-37	volts
Zero-Signal DC Plate Current	160	160	ma
Effective RF Load Resistance	2500	2700	ohms
DC Plate Current at peak of envelope	450	500	ma
Average DC Plate Current	315	350	ma
DC Grid-No.2 Current at peak of envelope	3	4	ma
Average DC Grid-No.2 Current	1.8	2.5	ma
Average DC Grid-No.1 Current	0.005	0.005	ma
Peak-Envelope Driver Power (Approx.)	1	1	watt
Output-Circuit Efficiency (Approx.)	90	90	%
Distortion Products Level:[l]			
Third Order	-31	-31	db
Fifth Order	-36	-36	db
Useful Power Output (Approx.):			
Average	290	340	watts
Peak Envelope	580[j]	680[j]	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under any condition:		
For fixed-bias operation	15000 max.	ohms
For cathode-bias operation	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

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

	Up to 1215 Mc	
DC PLATE VOLTAGE	2000 max.	volts
DC GRID-No.2 VOLTAGE	1200 max.	volts
DC GRID-No.1 VOLTAGE	-250 max.	volts
DC PLATE CURRENT	500 max.	ma
DC GRID-No.1 CURRENT	100 max.	ma
PLATE INPUT	1000 max.	watts
GRID-No.2 INPUT	17 max.	watts
PLATE DISSIPATION	400 max.	watts

Typical CCS Operation:

In cathode-drive[m] circuit at 400 Mc

DC Plate Voltage	1800	2000	volts
DC Grid-No.2 Voltage[n]	400	400	volts
DC Grid-No.1 Voltage[p]	-45	-35	volts
DC Plate Current	450	500	ma
DC Grid-No.2 Current	6	8	ma
DC Grid-No.1 Current (Approx.)	15	12	ma
Output-Circuit Efficiency (Approx.)	80	80	%
Driver Power Output (Approx.)[q]	35	35	watts
Useful Power Output (Approx.)	500[j]	600[j]	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under any condition	15000 max.	ohms

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

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

	Up to 1215 Mc	
DC PLATE VOLTAGE	2500 max.	volts
DC GRID-No.2 VOLTAGE	1200 max.	volts
DC GRID-No.1 VOLTAGE	-250 max.	volts
DC PLATE CURRENT	500 max.	ma
DC GRID-No.1 CURRENT	100 max.	ma
PLATE INPUT	1250 max.	watts
GRID-No.2 INPUT	25 max.	watts
PLATE DISSIPATION	700 max.	watts

Typical CCS Operation:

In cathode-drive[m] circuit at 400 Mc

DC Plate Voltage	2250	2500	volts
DC Grid-No.2 Voltage[s]	400	400	volts
DC Grid-No.1 Voltage	-45	-35	volts
DC Plate Current	450	500	ma
DC Grid-No.2 Current	7	8	ma

DC Grid-No.1 Current (Approx.)	10	12	ma
Output-Circuit Efficiency (Approx.)	80	80	%
Driver Power Output (Approx.)[q]	30	35	watts
Useful Power Output (Approx.)	650[j]	800[j]	watts

In cathode-drive[m] circuit at 1215 Mc

DC Plate Voltage	2500	volts
DC Grid-No.2 Voltage[s]	400	volts
DC Grid-No.1 Voltage	-50	volts
DC Plate Current	500	ma
DC Grid-No.2 Current	6	ma
DC Grid-No.1 Current (Approx.)	10	ma
Output-Circuit Efficiency (Approx.)	70	%
Driver Power Output (Approx.)[q]	80	watts
Useful Power Output (Approx.)	375[j]	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under any condition:

For fixed-bias operation	15000 max. ohms
For cathode-bias operation	Not recommended

[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] Measured with special shield adapter.

[c] Continuous Commercial Service.

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

[e] Preferably obtained from a fixed supply.

[f] "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.

[g] 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.

[h] Driver power output represents circuit losses and is actual power measured at the input to grid-No.1 circuit used. The tube driving power is zero watts.

[j] This value of useful power is measured in load of output circuit.

[k] "Two-Tone-Modulation" operation refers to that class of amplifier service in which the input consists of two monofrequency rf signals having equal peak amplitude.

[l] With maximum signal output used as a reference, and without the use of feedback to enhance linearity.

[m] Cathode is at dc ground potential.

[n] Obtained preferably from a separate source modulated along with the plate supply.

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

[q] Driver power output includes circuit losses and feed-through power. It is the actual power measured at input to drive circuit.

[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 a fixed supply, or from the plate supply voltage with a voltage divider.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Heater Current	1	7.4	8.3	amp
Direct Interelectrode Capacitances:				
Grid No.1 to plate	2	-	0.11	μμf
Grid No.1 to cathode & heater	2	26	32	μμf
Plate to cathode & heater	2	-	0.011	μμf
Grid No.1 to grid No.2	2	34	41	μμf
Grid No.2 to plate	2	4.3	6.3	μμf
Grid No.2 to cathode & heater	2	-	1.1	μμf
Reverse Grid-No.1 Current	1,3	-	-50	μa
Peak Emission Current	1,4	80	-	amp
Interelectrode Leakage Resistance	5	8	-	megohms
Grid-No.1 Cutoff Voltage	1,6	-	-87	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 2500 volts, dc grid-No.2 voltage of 400 volts, and dc grid-No.1 voltage adjusted to give a dc plate current of 240 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 of 850 peak volts connected between plate and cathode. Pulse duration is 2 microseconds, pulse-repetition frequency is 60 pps, and duty factor is 0.00012. Read peak emission current after 1 minute.

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 8 megohms.

Note 6: With dc plate voltage of 2500 volts, dc grid-No.2 voltage of 400 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 resonances. Design details of mountings used by the RCA Electron Tube Division to perform these tests may be obtained from RCA Commercial Engineering, Harrison, N.J., on request.

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 will not show permanent or temporary shorts or open circuits.

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

→ Indicates a change.

positions in a High-Impact Shock Machine and are subjected to five blows in each position. At the end of this test, tubes will not show permanent or temporary shorts or open circuits.

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 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 cycle consisting of:

a. 5-to-10 cps with fixed double amplitude of 0.080 inch ± 10%.

b. 10-to-15 cps at fixed acceleration of 0.41 g ± 10%.

c. 15-to-105 cps with fixed double amplitude of 0.036 inch ± 10%.

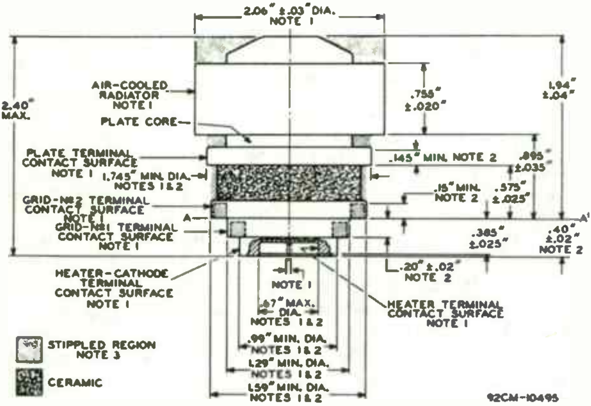
d. 105-to-2000 cps at fixed acceleration of 20 g ± 10%.

At the end of this test, tubes will not show permanent or temporary shorts or open circuits.

OPERATING CONSIDERATIONS

A suggested *mounting arrangement* for the 7650 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.

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.

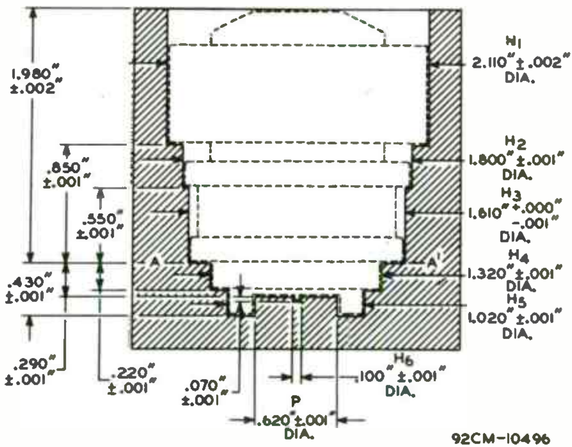


NOTE 1: WITH THE CYLINDRICAL SURFACES OF THE RADIATOR BAND, PLATE TERMINAL, GRID-No.2 TERMINAL, GRID-No.1 TERMINAL, HEATER-CATHODE TERMINAL, AND HEATER TERMINAL CLEAN, SMOOTH, AND FREE OF BURRS, THE TUBE WILL ENTER A GAUGE AS SHOWN IN SKETCH G_1. PROPER ENTRY OF THE TUBE IS OBTAINED WHEN THE GRID-No.2 TERMINAL IS SEATED ON THE SHOULDER A-A′. THE TUBE IS PROPERLY SEATED ON THE SHOULDER WHEN A 0.010" THICKNESS GAUGE 1/8" WIDE WILL NOT ENTER MORE THAN 1/16" BETWEEN THE SHOULDER SURFACE AND THE GRID-No.2 TERMINAL. THE GAUGE IS PROVIDED WITH SLOTS TO PERMIT MAKING MEASUREMENT OF SEATING OF GRID-No.2 TERMINAL ON SHOULDER A-A′.

NOTE 2: THE DIAMETER OF EACH TERMINAL IS HELD TO INDICATED VALUES ONLY OVER THE INDICATED MINIMUM LENGTH OF ITS CONTACT SURFACE.

NOTE 3: KEEP ALL STIPPLED REGIONS CLEAR. DO NOT ALLOW CONTACTS OR CIRCUIT COMPONENTS TO PROTRUDE INTO THESE ANNULAR VOLUMES. DIAMETERS OF STIPPLED AREAS ABOVE AIR-COOLED RADIATOR, PLATE-TERMINAL CONTACT SURFACE, AND GRID-No.2-TERMINAL CONTACT SURFACE SHALL NOT BE GREATER THAN ITS ASSOCIATED DIAMETER.

SKETCH G_1

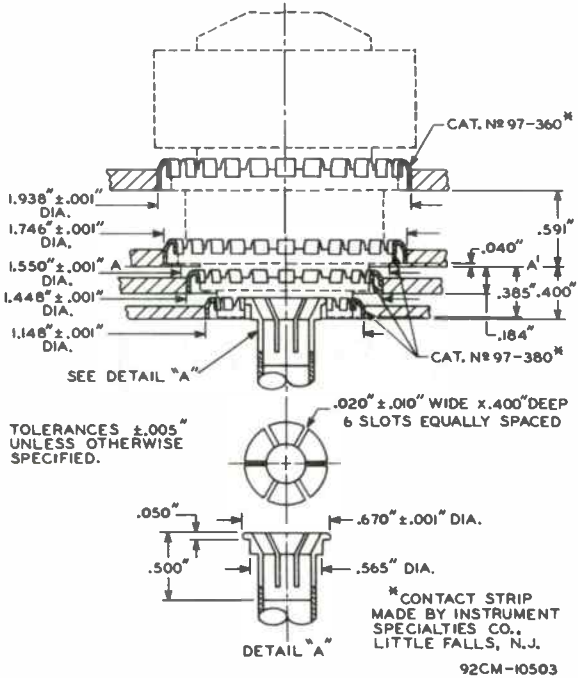


92CM-10496

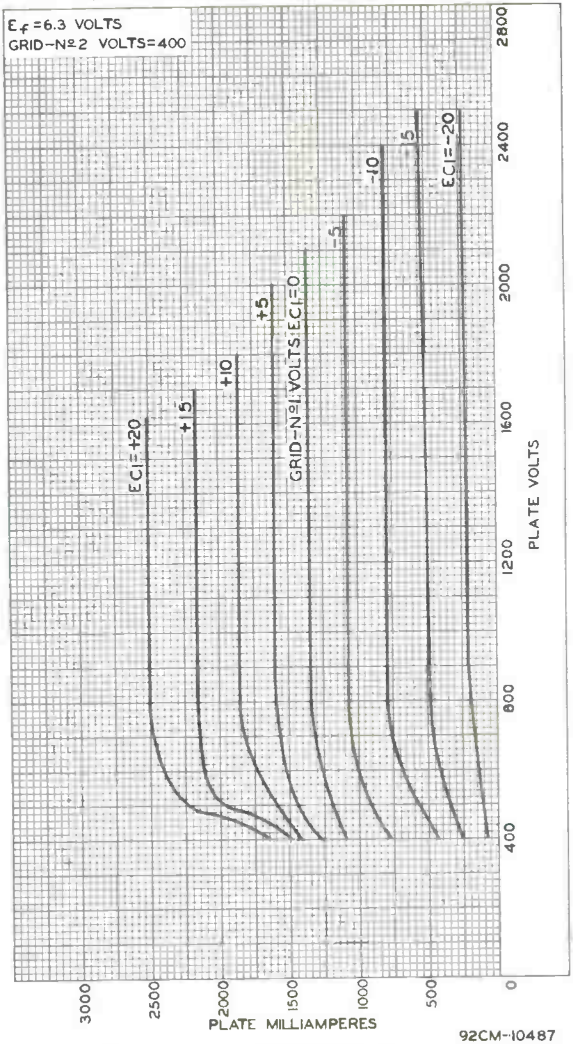
SURFACE A-A' IS FLAT WITHIN 0.0005" PEAK TO VALLEY AND IS PERPENDICULAR TO THE AXIS OF THE CYLINDRICAL HOLES WITHIN 0.00025".

THE AXES OF THE CYLINDRICAL HOLES H_1 THROUGH H_6 AND THE AXIS OF POST P ARE COINCIDENT WITHIN 0.001".

SUGGESTED MOUNTING ARRANGEMENT
& LAYOUT OF ASSOCIATED CONTACTS

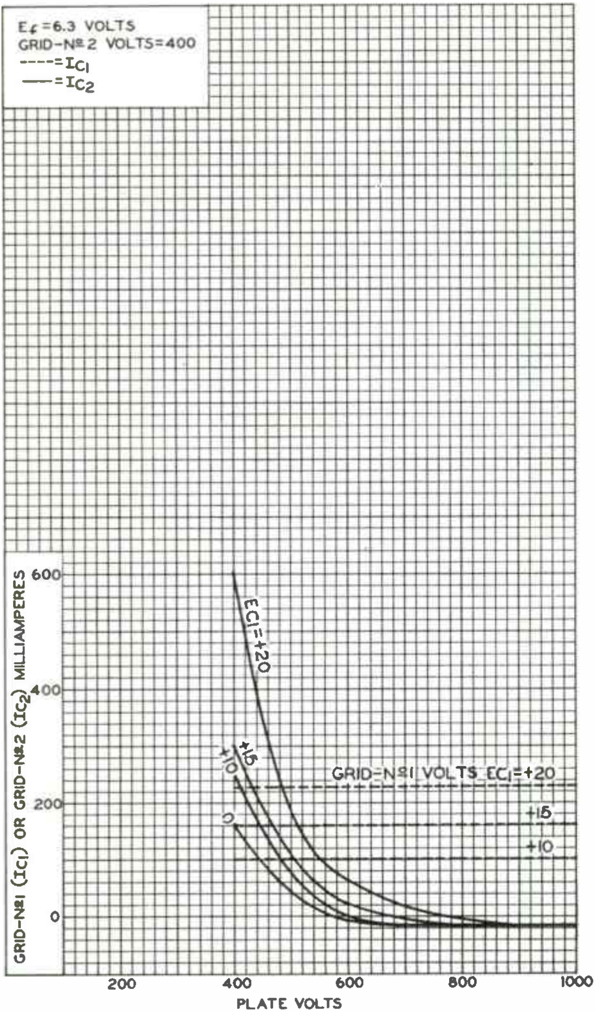


TYPICAL PLATE CHARACTERISTICS



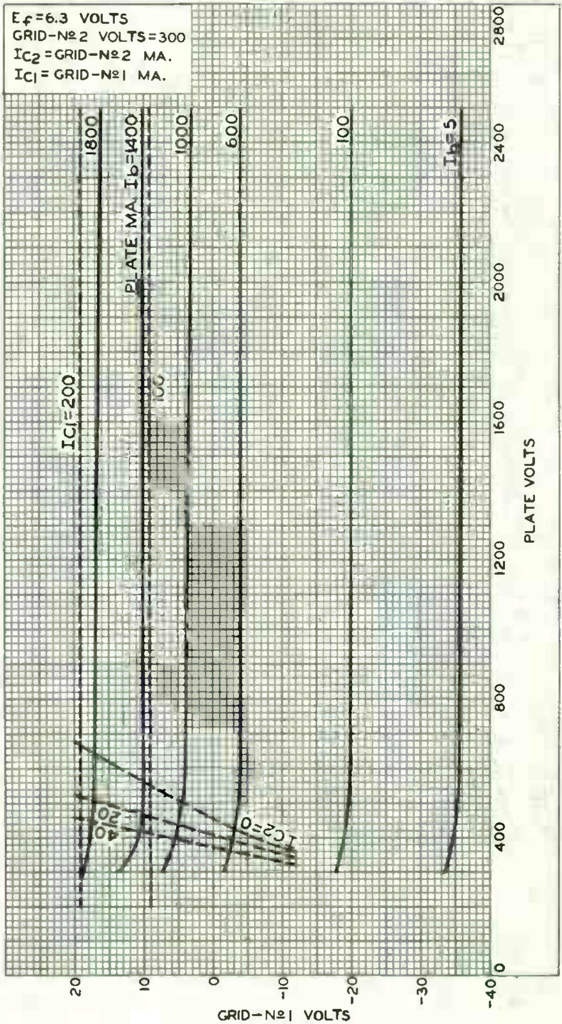
92CM-10487

TYPICAL CHARACTERISTICS



92CM-10488

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM-10493R1

TYPICAL CONSTANT-CURRENT CHARACTERISTICS

92CM-10494

Beam Power Tube

CERAMIC-METAL SEALS — COAXIAL-ELECTRODE STRUCTURE
"ONE-PIECE" ELECTRODE DESIGN — INTEGRAL RADIATOR
FORCED-AIR COOLED — 27-KW PEAK-PULSE POWER INPUT UP TO 1215 Mc
MATRIX-TYPE, OXIDE-COATED, UNIPOTENTIAL CATHODE

For Use 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	7.5	amp
Minimum heating time	120	sec

Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 225, grid-No.2 volts = 225, and plate ma. = 100 13

Direct Interelectrode Capacitances:[a]

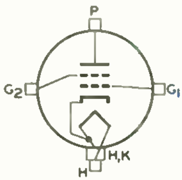
Grid No.1 to plate	0.13 max.	$\mu\mu$f
Grid No.1 to cathode & heater	29	$\mu\mu$f
Plate to cathode & heater	0.01 max.	$\mu\mu$f
Grid No.1 to grid No.2	38	$\mu\mu$f
Grid No.2 to plate	6.5	$\mu\mu$f
Grid No.2 to cathode & heater	0.8 max.	$\mu\mu$f

Mechanical:

Operating Position	Any
Overall Length	2.34" ± 0.06"
Greatest Diameter (See *Dimensional Outline*)	2.06" ± 0.03"
Weight (Approx.)	3/4 lb
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

Air Flow:

Air flow may be removed simultaneously with all voltages.

Through radiator—Adequate air flow to limit the plate-core temperature to 250° C should be delivered by a blower through the radiator during the application of heater, plate, grid-No.2, and grid-No.1 voltages. Typical values of air flow directed through the radiator to maintain the plate core (See *Dimensional Outline*) at 250° C with an incoming air temperature of 25° C and with no restrictions at the plate-contact flange are:

Plate Dissipation (watts)	Air Flow (cubic ft/min)	Static Pressure (inches of water)
100	2	0.04
300	4	0.14
600	11	0.66

To Grid-No.2, Grid-No.1, Cathode, and Heater Terminals—
A sufficient quantity of air should be directed at the heater terminal and allowed to flow past each of these terminals so that no terminal temperature exceeds the specified maximum value of 250° C. An air flow of 2.5 cfm is usually adequate. Forced-air cooling of heater and cathode terminals is usually required during standby (heater only) operation.

Plate-Core Temperature.	250 max.	°C
Terminal Temperature (Plate, Grid No.2, Grid No.1, Cathode, and Heater)	250 max.	°C

GRID-PULSED RF AMPLIFIER and GRID-AND-SCREEN-PULSED RF AMPLIFIER

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

For maximum "on" time[c] of 10 microseconds

	Up to 1215 Mc	
→ DC PLATE VOLTAGE.	5000 max.	volts
DC GRID-No.2 VOLTAGE.	1200 max.	volts
DC GRID-No.1 VOLTAGE.	-250 max.	volts
DC PLATE CURRENT DURING PULSE	9 max.	amp
DC PLATE CURRENT.	0.5 max.	amp
GRID-No.2 INPUT (Average)	25 max.	watts
GRID-No.1 INPUT (Average)	10 max.	watts
PLATE DISSIPATION (Average)	600 max.	watts

Typical Operation:

In grid-pulsed cathode-drive[d] circuit with rectangular-wave pulse at 1215 Mc and with duty factor[e] of 0.01

DC Plate Voltage.	3600	4000	volts
→ Peak-Positive Grid-No.2 Voltage	800	1000	volts
DC Grid-No.1 Voltage.	-100	-120	volts
DC Plate Current during pulse	8	9	amp
DC Plate Current.	0.19	0.2	amp
DC Grid-No.2 Current.	0.005	0.006	amp
DC Grid-No.1 Current.	0.02	0.02	amp
Output-Circuit Efficiency (Approx.) . .	80	80	%
Driver Power Output at peak of pulse (Approx.)[f]	5.2	6.3	kw
Useful Power Output at peak of pulse (Approx.).	15[g]	20[g]	kw

→ indicates a change.

In grid-and-screen-pulsed cathode-drive[d] circuit with rectangular-wave pulses at 1215 Mc with duty factor[e] of 0.01

DC Plate Voltage	3600	4000	volts
Peak Positive-Pulse Grid-No.2 Voltage	800	1000	volts
DC Grid-No.1 Voltage	0	0	volts
DC Plate Current during pulse	8	9	amp
DC Plate Current	0.145	0.165	amp
DC Grid-No.2 Current	0.003	0.006	amp
DC Grid-No.1 Current	0.017	0.017	amp
Output-Circuit Efficiency (Approx.)	80	80	%
Driver Power Output at peak of pulse (Approx.)[f]	2.4	2.9	kw
Useful Power Output at peak of pulse (Approx.)	11[g]	15[g]	kw

PLATE-AND-SCREEN-PULSED RF AMPLIFIER

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

For maximum "on" time[c] of 10 microseconds

	Up to 1215 Mc	
PEAK POSITIVE-PULSE PLATE VOLTAGE	8000 max.	volts
PEAK POSITIVE-PULSE GRID-No.2 VOLTAGE	1200 max.	volts
DC GRID-No.1 VOLTAGE	-250 max.	volts
DC PLATE CURRENT DURING PULSE	9 max.	amp
DC PLATE CURRENT	0.12 max.	amp
GRID-No.2 INPUT (Average)	25 max.	watts
GRID-No.1 INPUT (Average)	10 max.	watts
PLATE DISSIPATION (Average)	600 max.	watts

Typical Operation:

In cathode-drive[d] circuit with rectangular-wave pulses at 1215 Mc and with duty factor[e] of 0.01

Peak Positive-Pulse Plate Voltage	7200	8000	7200	8000	volts
Peak Positive-Pulse Grid-No.2 Voltage	800	1000	800	1000	volts
DC Grid-No.1 Voltage	0	0	-75	-80	volts
DC Plate Current during pulse	8	9	8	9	amp
DC Plate Current	0.09	0.1	0.09	0.1	amp
DC Grid-No.2 Current	0.003	0.008	0.003	0.004	amp
DC Grid-No.1 Current	0.015	0.016	0.019	0.02	amp
Output-Circuit Efficiency (Approx.)	80	80	80	80	%
Driver Power Output at peak of pulse (Approx.)[f]	1.8	2.2	4.5	5.3	kw
Useful Power Output at peak of pulse (Approx.)	22[g]	28[g]	30[g]	39[g]	kw

[a] Measured with special shield adapter.
[b] Continuous Commercial Service.
[c] "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.

d Cathode is at dc ground potential.

e *Duty factor* is defined as the ratio of "on" time to total elapsed time in any 1000-microsecond interval.

f Driver power output includes circuit losses and feed-through power. It is actual power measured at input to tube drive circuit. It will vary with frequency of operation and driver circuitry.

g This value of useful power is measured in load of output circuit.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Heater Current	1	6.9	8.3	amp
Direct Interelectrode Capacitances:				
Grid No.1 to plate	2	-	0.13	μμf
Grid No.1 to cathode & heater	2	26	32	μμf
Plate to cathode & heater	2	-	0.01	μμf
Grid No.1 to grid No.2	2	35	42	μμf
Grid No.2 to plate	2	5.5	7.5	μμf
Grid No.2 to cathode & heater	2	-	0.8	μμf
Reverse Grid-No.1 Current	1,3	-	-50	μa
Peak Emission Voltage	1,4	-	850	volts
Interelectrode Leakage Resistance	5	8	-	megohms
➔ Grid-No.1 Cutoff Voltage	1,6	-	-170	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 2500 volts, dc grid-No.2 voltage of 400 volts, and dc grid-No.1 voltage adjusted to give a dc plate current of 240 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 80 amperes is obtained. After 1 minute at this value, the voltage-pulse amplitude will not exceed 850 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 8 megohms.

Note 6: With dc plate voltage of 2500 volts, dc grid-No.2 voltage of 400 volts, and a 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 resonances. Design details of mountings used by the RCA Electron Tube Division to perform these tests may be obtained from RCA Commercial Engineering, Harrison, N. J., 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 will not show permanent or temporary shorts or open circuits.

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 will not show permanent or temporary shorts or open circuits.

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 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 cycle 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-105 cps with fixed double amplitude of 0.036 inch ± 10%.

d. 105-to-2000 cps at fixed acceleration of 20 g ± 10%.

At the end of this test, tubes will not show permanent or temporary shorts or open circuits.

OPERATING CONSIDERATIONS

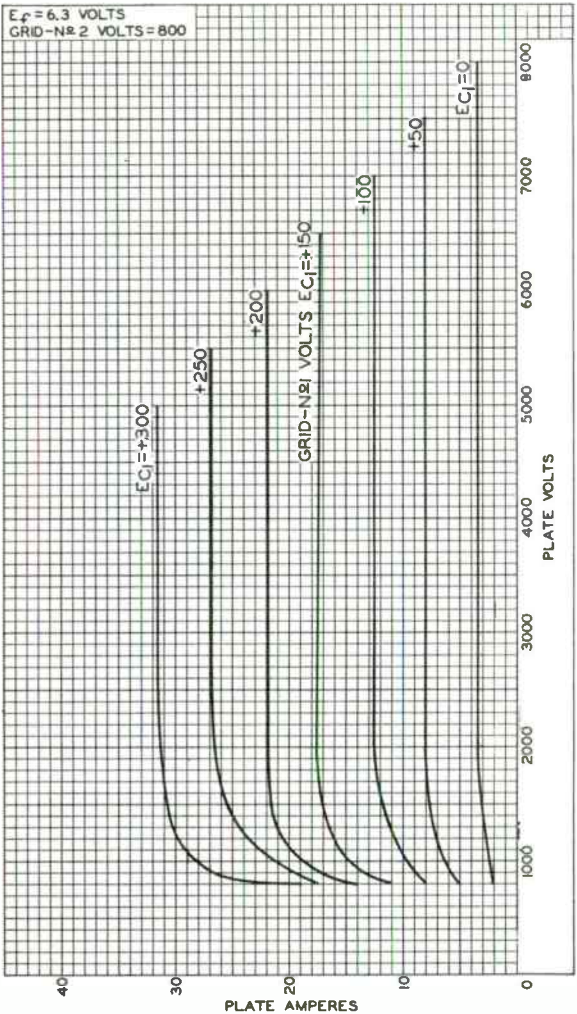
A suggested *mounting arrangement* for the 7651 is shown in the accompanying drawing along with a layout of the associated contacts. Flexible connectors are required for the plate, grid-No.2, grid-No.1, cathode, and heater contact surfaces.

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.

← indicates a change.

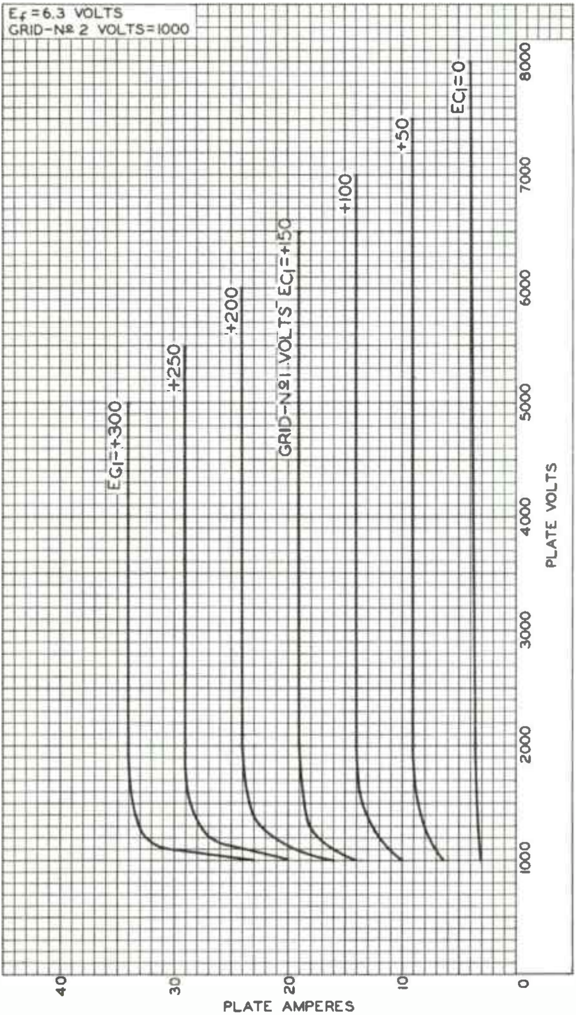
DIMENSIONAL OUTLINE,
GAUGE DRAWING, and
SUGGESTED MOUNTING ARRANGEMENT
& LAYOUT OF ASSOCIATED CONTACTS
shown under Type 7650 also apply to the 7651

TYPICAL PLATE CHARACTERISTICS



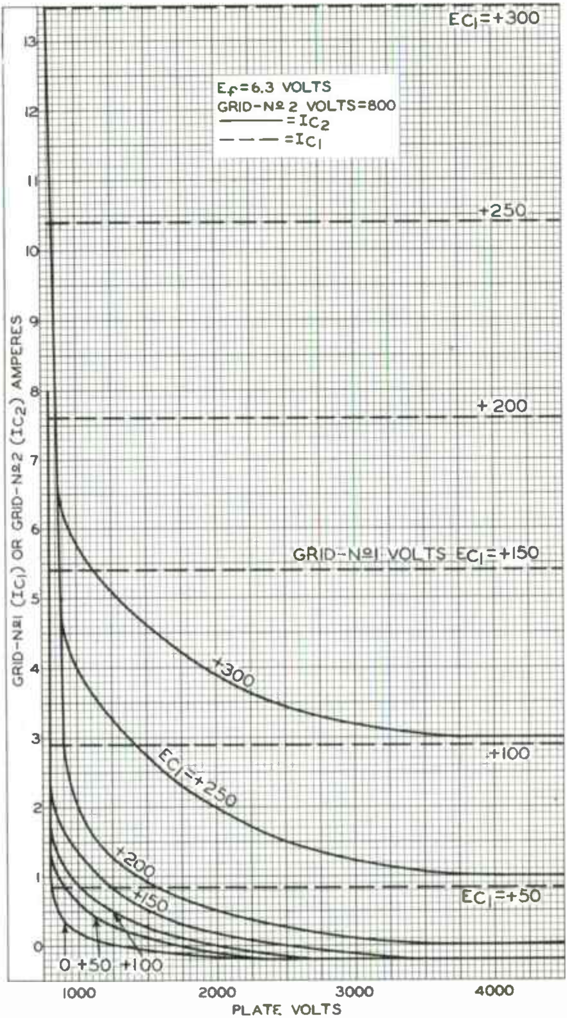
92CM-10492

TYPICAL PLATE CHARACTERISTICS



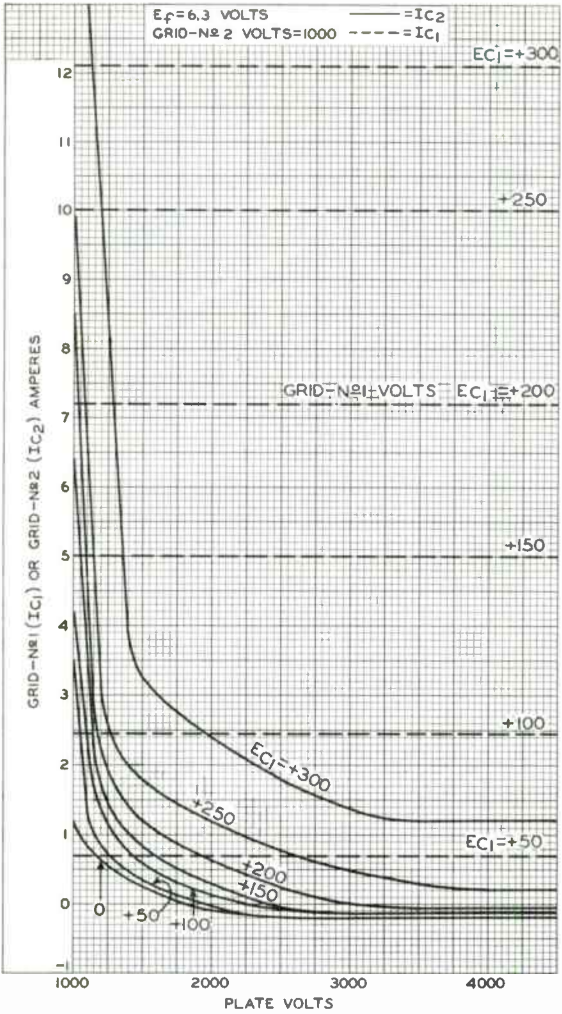
92CM-10491

TYPICAL CHARACTERISTICS



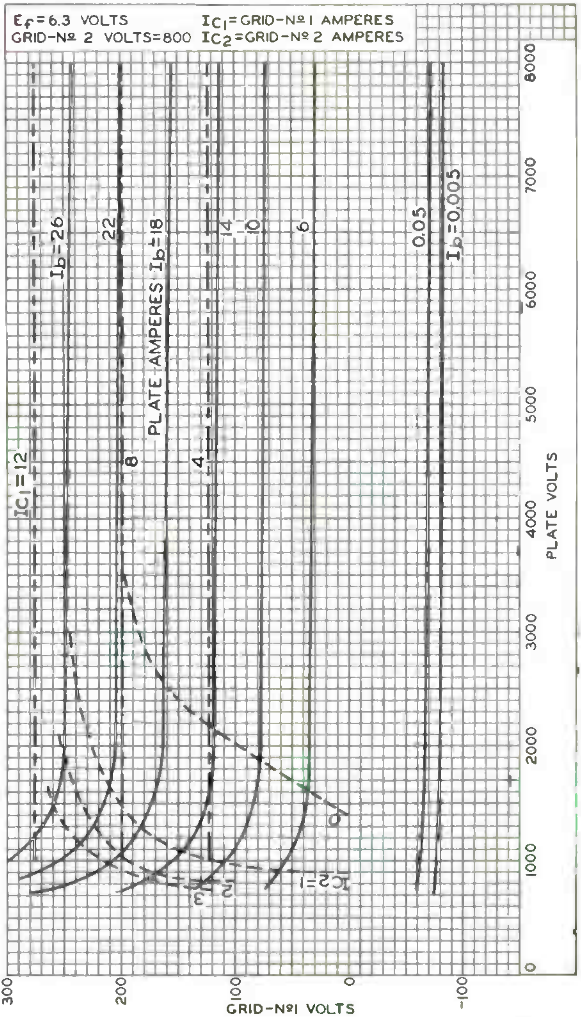
92CM-10502

TYPICAL CHARACTERISTICS



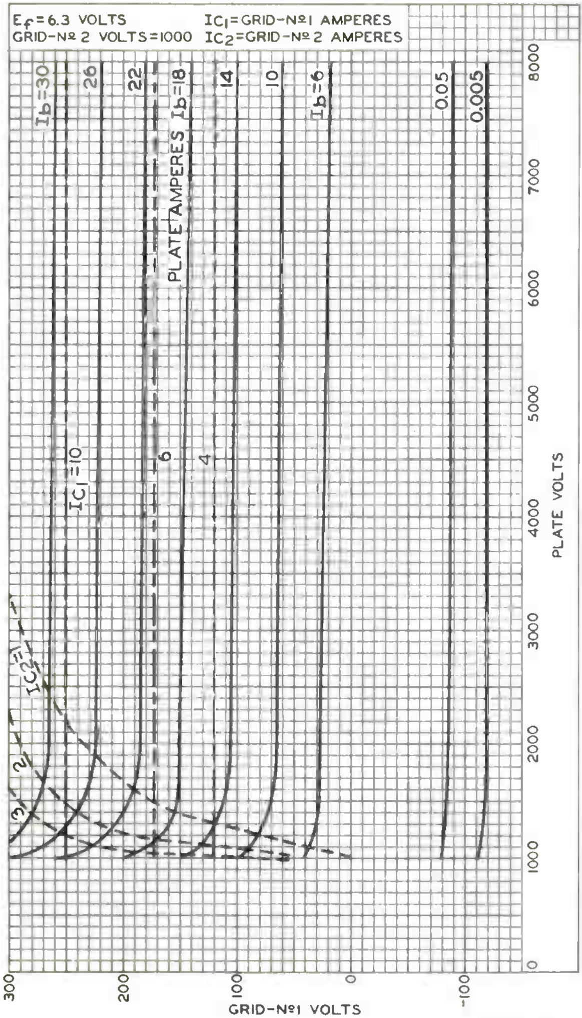
92CM-10501R1

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM-10490R1

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM-10489R1

Beam Power Tube

CERAMIC-METAL SEALS	52.5-WATTS CW INPUT
"ONE-PIECE" ELECTRODE DESIGN	27-WATTS CW OUTPUT AT 400 Mc
CONDUCTION COOLED	15-WATTS CW OUTPUT AT 1200 Mc
COAXIAL-ELECTRODE STRUCTURE	3.2-WATTS CW OUTPUT AT 3000 Mc

UNIPOTENTIAL CATHODE

GENERAL DATA

Electrical:

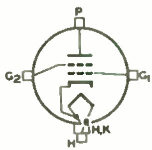
Heater, for Unipotential Cathode:		
Voltage (AC or DC)[a]	12.6 ± 10%	volts
Current at 12.6 volts	0.5	amp
Minimum heating time	40	sec
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 250, grid-No.2 volts = 250, and plate ma. = 35	30	
Direct Interelectrode Capacitances:[b]		
Grid No.1 to plate	0.025 max.	μμf
Grid No.1 to cathode & heater	9.5	μμf
Plate to cathode & heater	0.004 max.	μμf
Grid No.1 to grid No.2	17	μμf
Grid No.2 to plate	2.2	μμf
Grid No.2 to cathode & heater	0.18 max.	μμf

Mechanical:

Operating Position	Any
Maximum Overall Length	1.195"
Greatest Diameter (See *Dimensional Outline*)	0.740"
Weight (Approx.)	0.5 oz

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:

Terminal Temperature (Plate, grid No.2, grid No.1, cathode, and heater)	250 max.	°C

Cooling, Conduction:

The plate terminal must be thermally coupled to a constant-temperature device (heat sink—solid or liquid) to limit the plate terminal to the specified maximum value of 250° C. The grid-No.2, grid-No.1, cathode, and heater terminals may also require coupling to the heat sink to limit their respective terminal temperature to the specified maximum value of 250° C.

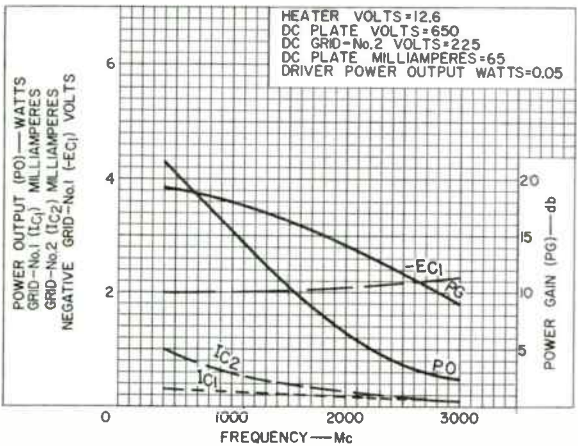
RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy
and
RF POWER AMPLIFIER — Class C FM Telephony

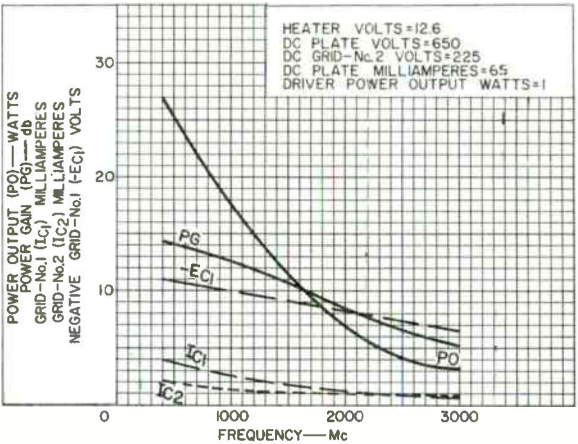
Maximum CCS[c] Ratings, *Absolute-Maximum Values:*

DC PLATE VOLTAGE	750	max.	volts
DC GRID-No.2 VOLTAGE	250	max.	volts
DC GRID-No.1 VOLTAGE	-100	max.	volts
DC PLATE CURRENT	70	max.	ma
DC GRID-No.1 CURRENT	15	max.	ma
PLATE INPUT	52.5	max.	watts
GRID-No.2 INPUT	2	max.	watts
PLATE DISSIPATION	d		

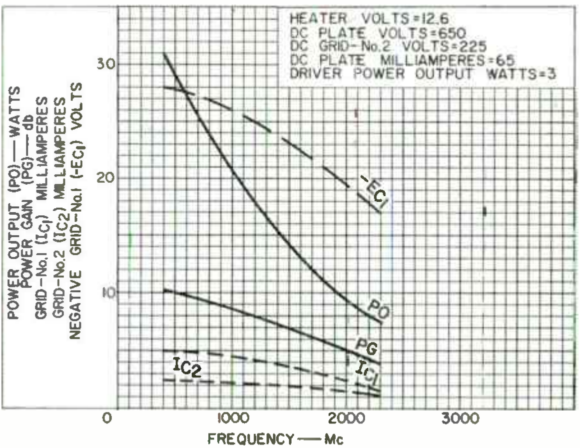
Typical CCS Operation in Cathode-Drive Circuit:

Shown Graphically in the following three Charts 92CS-10945, -10944, and -10942





92CS-10944



92CS-10942

PLATE-MODULATED RF POWER AMPLIFIER — Class C Telephony

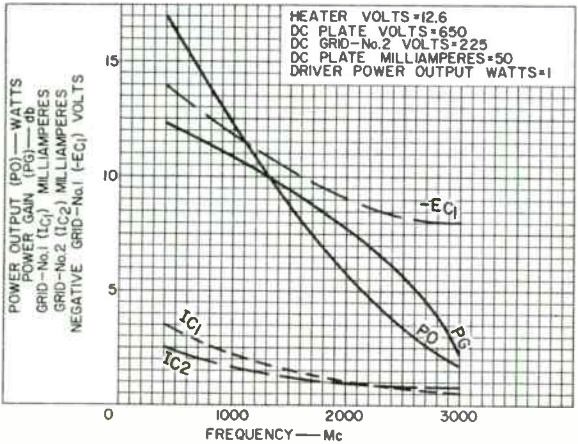
Carrier conditions per tube for use with a maximum modulation factor of 1

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

DC PLATE VOLTAGE	750	max.	volts
DC GRID-No.2 VOLTAGE	250	max.	volts
DC GRID-No.1 VOLTAGE	-100	max.	volts
DC PLATE CURRENT	60	max.	ma
DC GRID-No.1 CURRENT	15	max.	ma
PLATE INPUT	45	max.	watts
GRID-No.2 INPUT	2	max.	watts
PLATE DISSIPATION	d		

Typical CCS Operation in Cathode-Drive Circuit:

Shown Graphically in the following Chart 92CS-10943



92CS-10943

AF POWER AMPLIFIER & MODULATOR and LINEAR RF POWER AMPLIFIER Single-Sideband Suppressed-Carrier Service

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

DC PLATE VOLTAGE	750	max.	volts
DC GRID-No.2 VOLTAGE	250	max.	volts
MAX.-SIGNAL DC PLATE CURRENT[e]	70	max.	ma
MAX.-SIGNAL DC GRID-No.1 CURRENT[e]	15	max.	ma
MAX.-SIGNAL PLATE INPUT[e]	52.5	max.	watts

MAX.-SIGNAL GRID-No.2 INPUT[e]	2	max.	watts
PLATE DISSIPATION[e]	d		

RF POWER AMPLIFIER — Class B Telephony

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

DC PLATE VOLTAGE	750	max.	volts
DC GRID-No.2 VOLTAGE	250	max.	volts
DC PLATE CURRENT	35	max.	ma
DC GRID-No.1 CURRENT	8	max.	ma
PLATE INPUT	52.5	max.	watts
GRID-No.2 INPUT	2	max.	watts
PLATE DISSIPATION	d		

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under any condition	30000	max.[f]	ohms

[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] Measured with special shield adapter.

[c] Continuous Commercial Service.

[d] 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*.

[e] Averaged over any audio-frequency cycle of sine-wave form for *AF Power Amplifier & Modulator Service*.

[f] If this value is insufficient to provide adequate bias, the additional required bias must be supplied by a cathode resistor or fixed supply.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Heater Current	1	0.44	0.54	amp
Direct Interelectrode Capacitances:				
Grid No.1 to plate	2	-	0.025	μμf
Grid No.1 to cathode & heater	2	8.5	10.3	μμf
Plate to cathode & heater	2	-	0.004	μμf
Grid No.1 to grid No.2	2	14	20.6	μμf
Grid No.2 to plate	2	2.1	2.5	μμf
Grid No.2 to cathode & heater	2	-	0.18	μμf
Grid-No.1 Voltage	1,3	-1	-10	volts
Grid-No.1 Cutoff Voltage	1,4	-	-25	volts
Grid-No.2 Current	1,3	-3	2	ma
Positive Grid-No.1 Voltage	1,5	0	14	volts
Transconductance	1,6	7500	-	μmhos

Note 1: With 12.6 volts ac or dc on heater.

Note 2: Measured with special shield adapter.

Note 3: With dc plate voltage of 750 volts, dc grid-No.2 voltage of 250 volts, and dc grid-No.1 voltage adjusted to give a dc plate current of 35 ma.

Note 4: With dc plate voltage of 750 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 dc plate voltage of 300 volts, dc grid-No.2 voltage of 250 volts, and dc grid-No.1 voltage of -100 volts. Rectangular pulses, pulse duration of 4500 to 5000 microseconds and pulse-repetition frequency of 10 to 12 pps. The positive-pulse grid-No.1 voltage is adjusted to give a plate current of 300 ma. at leading edge of pulse.

Note 6: With dc plate voltage of 300 volts, dc grid-No.2 voltage of 150 volts, dc grid-No.1 voltage adjusted to give a dc plate current of 35 ma.

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 high thermal conductivity.

Thermal conductivity[9] may be calculated from the equation:

$$K = \frac{W}{A \dfrac{(T_2 - T_1)}{L}} \qquad (1)$$

where:

- K = thermal conductivity of the material
- W = power transfer in watts
- A = area measured at right angles to the direction of the flow of heat in square inches
- T_1, T_2 = temperature in degrees Centigrade of planes or surfaces under consideration
- L = length of heat path in inches through coupling material to produce temperature gradient

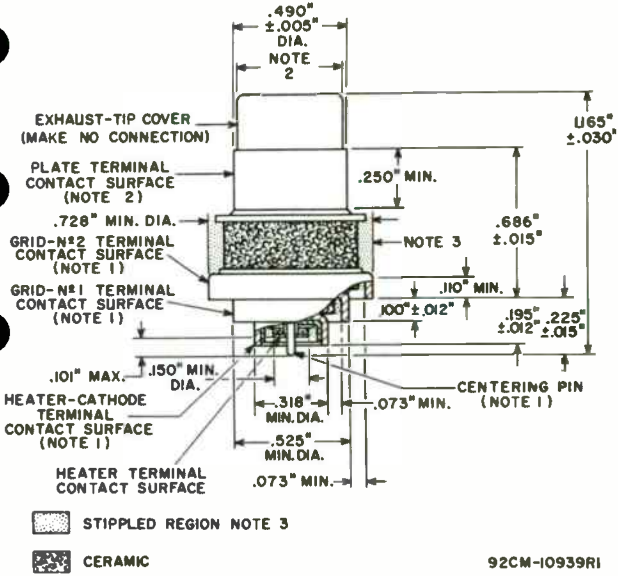
[9] Thermal conductivity is defined as the time rate of transfer of heat by conduction, through unit thickness, across unit area for unit difference of temperature. It is measured in watts per square inch for a thickness of one inch and a difference of temperature of 1° C.

For a given system Equation (1) must be integrated to consider changes in area (A) dependent on the coupling configuration and changes in thermal conductivity (K) dependent on various coupling materials and interfaces. Equation (1) may now be reduced to the following:

$$K_S = \frac{W_p}{T_2 - T_1} \qquad (2)$$

where:

- K_S = thermal conductance of the system
- W_p = maximum permissible plate dissipation in watts
- T_2 = temperature in degrees Centigrade at tube terminal
- T_1 = temperature in degrees Centigrade of heat sink

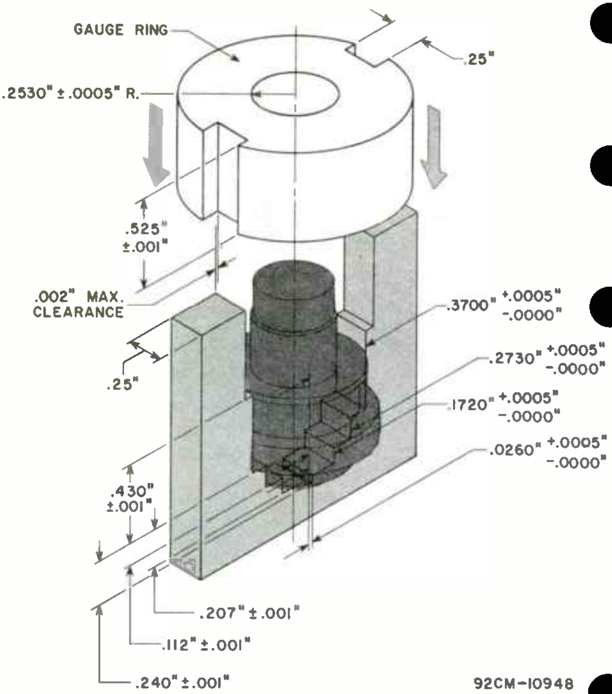


NOTE 1: WITH THE CYLINDRICAL SURFACES OF THE GRID-No.2 TERMINAL, GRID-No.1 TERMINAL, HEATER-CATHODE TERMINAL, AND CENTERING PIN CLEAN, SMOOTH, AND FREE OF BURRS, THE TUBE WILL ENTER A GAUGE AS SHOWN IN SKETCH G_1.

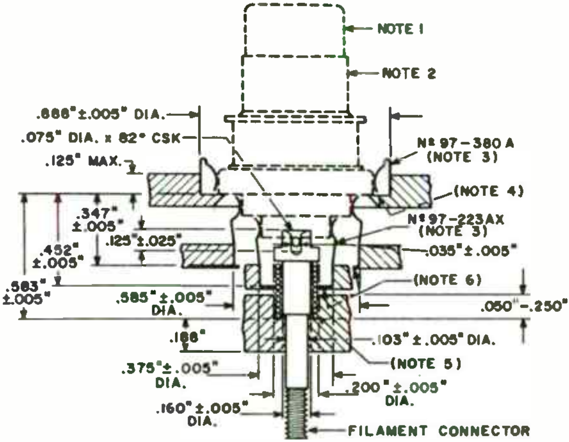
NOTE 2: WITH THE TUBE SEATED IN GAUGE AND WITH THE PLATE TERMINAL CLEAN, SMOOTH, AND FREE OF BURRS, THE GAUGE RING WILL SLIP OVER PLATE TERMINAL SHOWN IN SKETCH G_1 AND NOT EXTEND ABOVE GAUGE. THE TUBE WILL ROTATE 360° FREELY AND WILL NOT EXTEND ABOVE GAUGE RING.

NOTE 3: KEEP ALL STIPPLED REGIONS CLEAR. DO NOT ALLOW CONTACTS OR CIRCUIT COMPONENTS TO PROTRUDE INTO THESE ANNULAR VOLUMES.

SKETCH G_1


GAUGE RING
.25"
.2530" ±.0005" R.
.525"
±.001"
.002" MAX.
CLEARANCE
.3700" +.0005" -.0000"
.2730" +.0005" -.0000"
.25"
.1720" +.0005" -.0000"
.0260" +.0005" -.0000"
.430"
±.001"
.207" ±.001"
.112" ±.001"
.240" ±.001"
92CM-10948

SUGGESTED MOUNTING ARRANGEMENT
& LAYOUT OF ASSOCIATED CONTACTS



NOTE 1: MAKE NO CONNECTION.

NOTE 2: 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 PLATE TERMINAL AND THE REMAINING CONTACT TERMINALS.

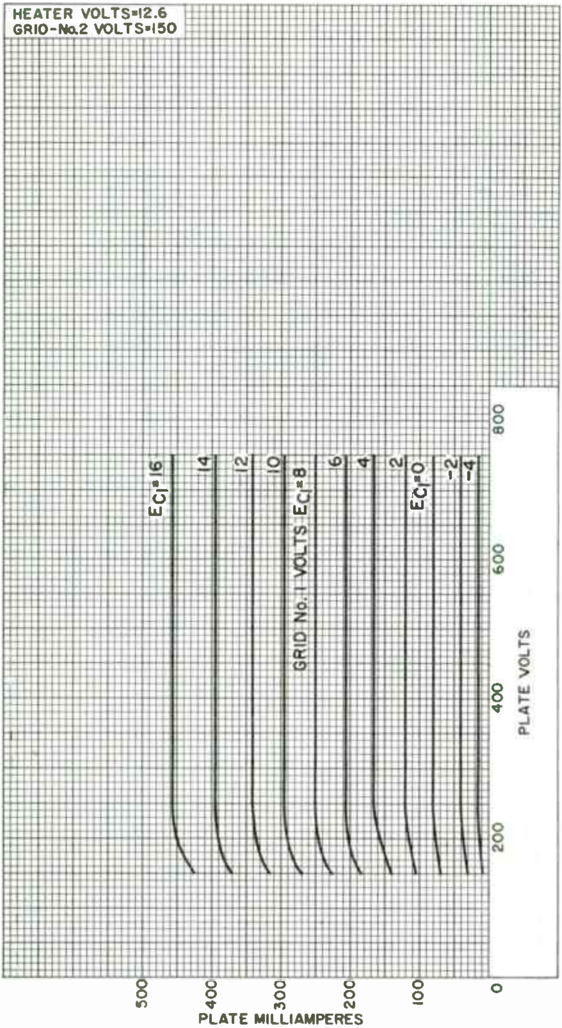
NOTE 3: MADE BY INSTRUMENTS SPECIALTIES COMPANY, LITTLE FALLS, NEW JERSEY.

NOTE 4: SEAT TUBE SUCH THAT GRID-No.2 TERMINAL EDGE MAKES A POSITIVE STOP ON SHOULDER.

NOTE 5: SPRING IS 0.600 INCH IN LENGTH AND 30 TURNS PER INCH OF 0.015-INCH-DIAMETER STEEL MUSIC WIRE.

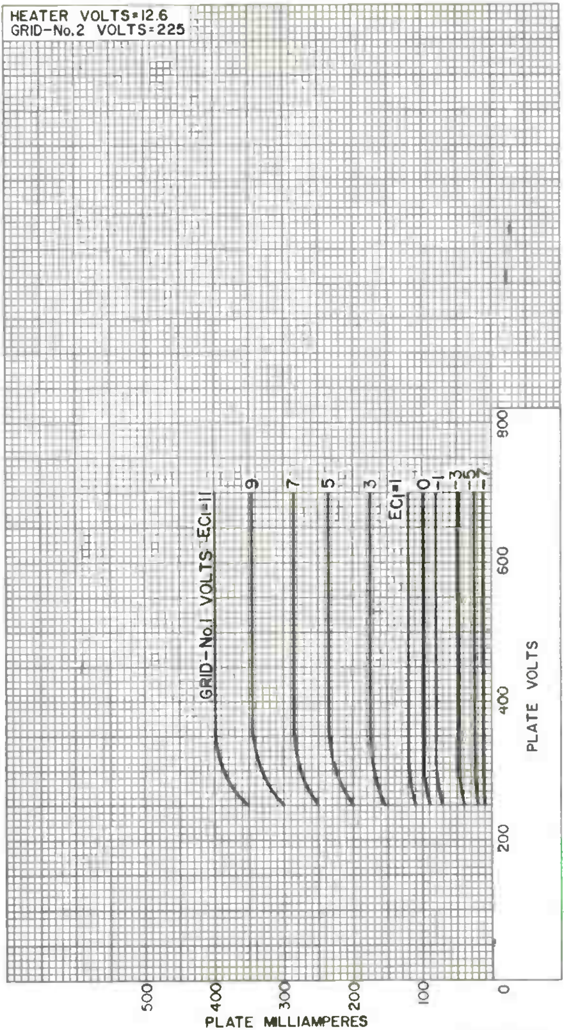
NOTE 6: FINGER STOCK TO SEAT ON 0.013-INCH LIP.

TYPICAL PLATE CHARACTERISTICS



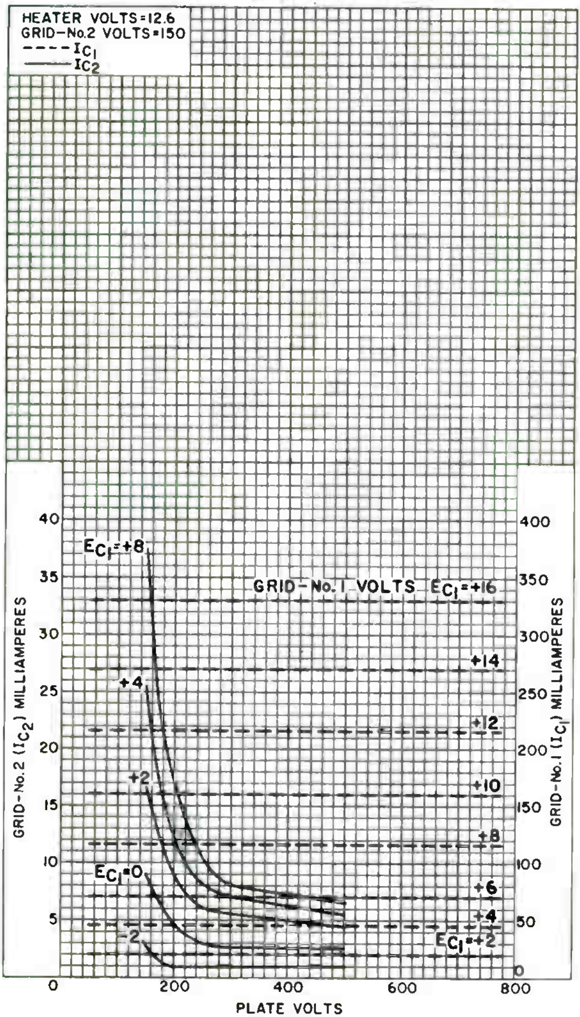
92CM-10949

TYPICAL PLATE CHARACTERISTICS



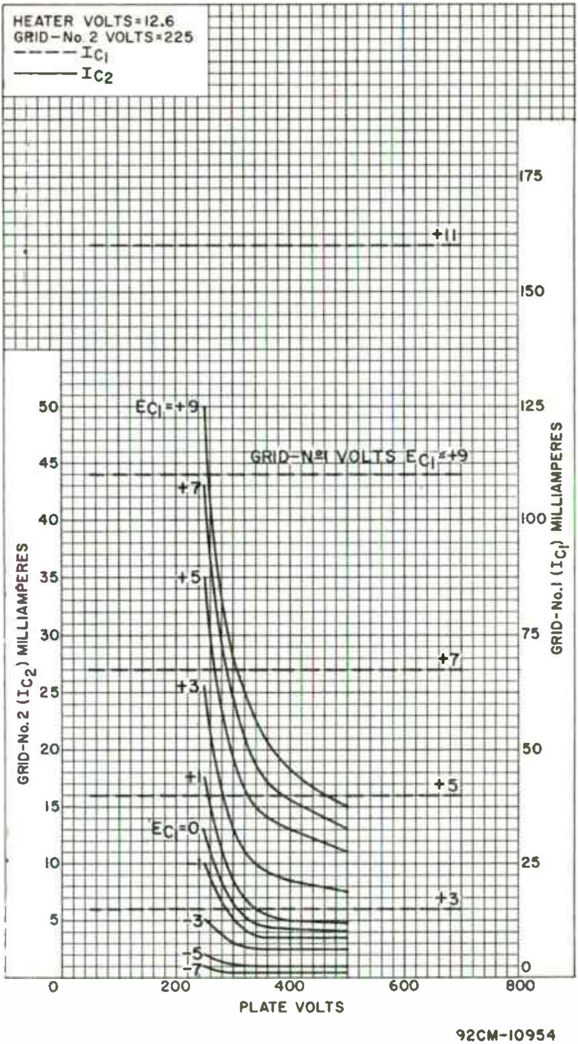
92CM-10951

TYPICAL CHARACTERISTICS

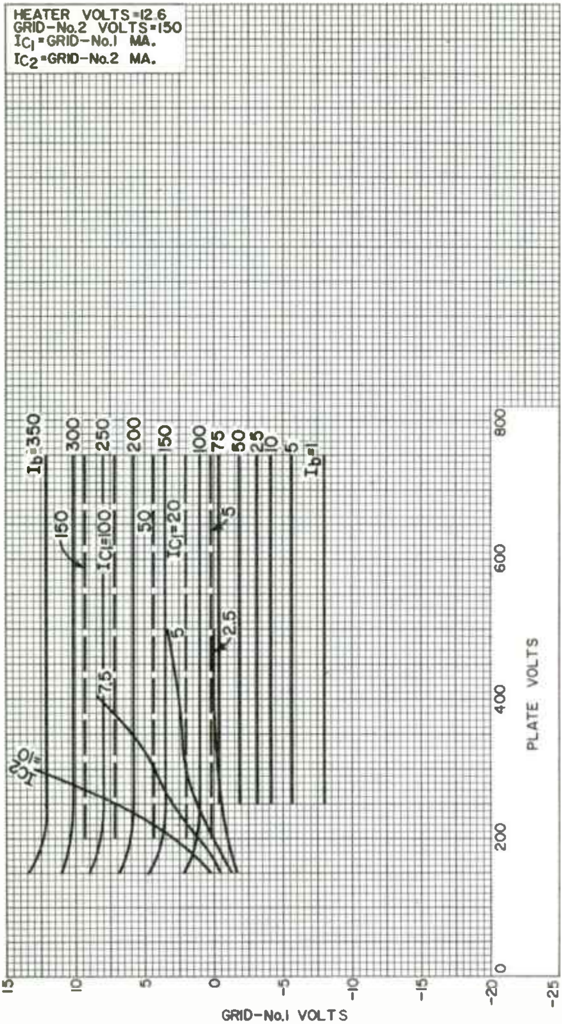


92CM-10950

TYPICAL CHARACTERISTICS

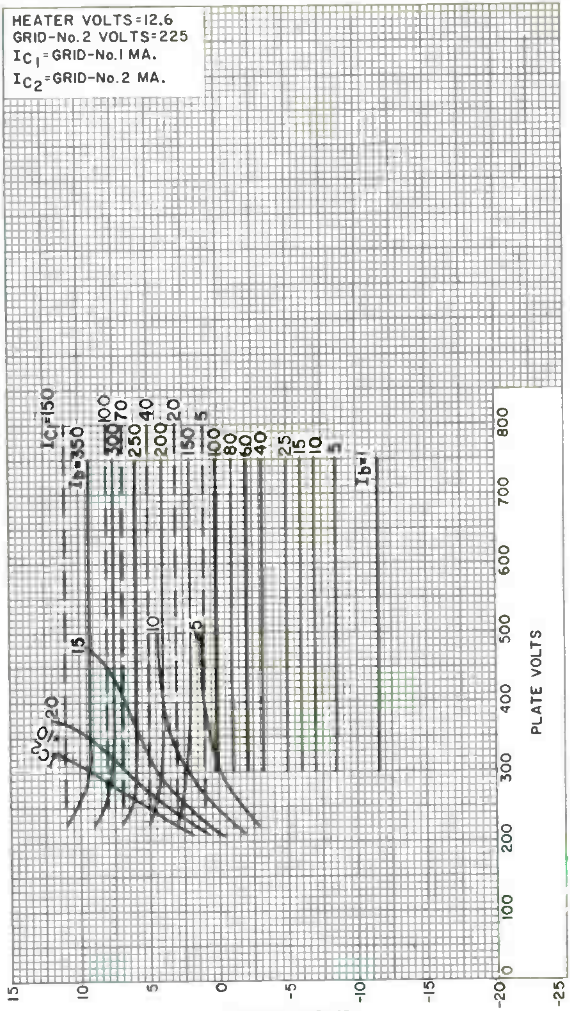


TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM-10952

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM-10958

Super-Power Triode

10 MW SHORT-PULSE POWER, 5 MW LONG-PULSE POWER

CERAMIC-METAL SEALS
DOUBLE-ENDED CONSTRUCTION
COAXIAL-ELECTRODE STRUCTURE
INTEGRAL WATER DUCTS
17.00 INCHES MAX. LENGTH
24.00 INCHES MAX. DIAMETER

WATER COOLED

For Use as a Plate-Pulsed Amplifier at Frequencies up to 300 MHz for Long Range Search Radar, Pulsed Transmission in Communications Service, and Particle Accelerator Service.

ELECTRICAL

Filamentary Cathode Multistrand Thoriated Tungsten[m]—

Current (DC):		
Typical operating value	6600[a]	A
Maximum value	7000[a]	A
Maximum value for starting even momentarily	2000	A
Minimum time to reach operating current	30	s
Minimum time at normal operating current before plate voltage is supplied	60	s
Voltage (DC):[b]		
Typical range value for prescribed operating current	3.1 to 4.2	V
Maximum value under any condition	4.65	V
Direct Interelectrode Capacitances		
Grid to plate	150	pF
Grid to cathode	1600	pF
Plate to cathode	less than 1.0	pF

MECHANICAL

Operating Position	Tube axis vertical, either end up	
Overall Length	17.00 max	in
Maximum Diameter	24.00 max	in
Terminal Connections	See *Dimensional Outline*	
Weight		
Uncrated	190	lb
Crated	355	lb

THERMAL[n,p]

Ceramic-Bushing Temperature	150 max	°C
Metal-Surface Temperature	150 max	°C
Minimum Storage Temperature	-65 min	°C

Water Flow

	Typ. Flow g/m	*Absolute Min. Flow g/m*	*Pressure Differential for Typ. Flow*[c] *psi*
To plate, total flow for two parallel input and output coolant courses:			
For plate dissipation up to 50 kW (Average)	40	35	5
For plate dissipation of 150 kW (Average)	100	90	30

Water Flow (cont'd)

	Typ. Flow g/m	*Absolute Min. Flow g/m*	*Pressure Differential for Typ. Flow*[c] *psi*
For plate dissipation of 300 kW (Average)	160	150	45
To upper grid coolant course. .	3	2	25 max
To lower grid coolant course. .	3	2	25 max
To grid-cathode coolant course	35	30	30 max

Resistivity of water at 25° C:		
Plate and grid water	1 min	MΩ-cm
Grid-cathode water.	5 min	MΩ-cm
Water temperature from any outlet	70 max	°C
External gas pressure[d].	65 max	psig
Gauge pressure at an inlet[d]	90 max	psig

TERMINAL DIAGRAM (Bottom View)

GUORF – Upper RF Grid Output Terminal
GLIRF – Lower RF Grid Input Terminal
GLORF – Lower RF Grid Output Terminal
PLRF – Lower RF Plate Terminal
PURF – Upper RF Plate Terminal
FI – Filament Terminal (Inner)
FO – Filament Terminal (Outer)
KURF – Upper RF Cathode Terminal
KLRF – Lower RF Cathode Terminal
GUIRF – Upper RF Grid Input Terminal

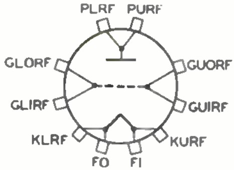


PLATE-PULSED AMPLIFIER—Class B[q]

For frequencies up to 300 MHz, and a maximum "ON" time[e] *of 2200 microseconds in any 34000-microsecond interval*

Absolute-Maximum Ratings

Peak Positive-Pulse Plate Voltage[f]	40	kV
Peak Negative Grid Voltage	250	V
Peak Plate Current	300	A
Peak Cathode Current[g].	600	A
DC Plate Current	19.5	A
DC Cathode Current[g].	39	A
Plate Input (Average).	487	kW
Plate Dissipation (Average).	300	kW

Typical Operation

In a cathode drive circuit, with rectangular-waveshape pulses, with duty factor[h] *of 0.06 pulse duration of 2000 microseconds, and at a frequency of 250 MHz*

Peak Positive-Pulse Plate-to-Grid Voltage[f]	34	kV
Peak Cathode-to-Grid Voltage[j].	100	V
Peak Plate Current	265	A

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

Peak Cathode Current[g]	400	A
DC Plate Current	15.6	A
DC Cathode Current[g]	25	A
Peak Driver Power Output[k]	150	kW
Useful Power Output at Peak of Pulse (Approx.)	5	MW

Absolute-Maximum Ratings

For frequencies up to 300 MHz and a maximum "ON" time[e] of 25 microseconds in any 2500-microsecond interval

Peak Positive-Pulse Plate Voltage[f]	65	kV
Peak Negative Grid Voltage	500	V
Peak Plate Current	325	A
Peak Cathode Current[g]	500	A
DC Plate Current	3.25	A
DC Cathode Current[g]	5.5	A
Plate Input (Average)	212	kW
Plate Dissipation (Average)	150	kW

Typical Operation

In a cathode-drive circuit, with rectangular-waveshape pulses, at 250 MHz with duty factor[h] of 0.006, and pulse of 25 microseconds

Peak Positive-Pulse Plate-to-Grid Voltage[f]	60	34	kV
Peak Cathode-to-Grid Voltage[j]	300	100	V
Peak Plate Current	280	260	A
Peak Cathode Current[g]	430	400	A
DC Plate Current	2.8	2.6	A
DC Cathode Current[g]	5	4.5	A
Peak Driver Power Output[k]	200	150	kW
Useful Power Output at Peak of Pulse (Approx.)	10	5	MW

CHARACTERISTICS RANGE VALUES

	Min	Max	
Input Strap-Resonant Frequency	90	140	MHz
Output Strap-Resonant Frequency	240	280	MHz

[a] The specified maximum filament current is a maximum rating which should not be exceeded, even momentarily, during operation of the tube. The life of the tube can be conserved by operating the filament at the lowest current which will enable the tube to provide the desired power output. Because the filament when operated near the maximum value usually provide emission in excess of any requirements within the tube ratings, the filament current should be reduced to a value that will give adequate but not excessive emission for any particular application. Good regulation of the filament current is, in general, economically advantageous from the viewpoint of the tube life.

[b] Measured between KLRF and KURF (See *Terminal Diagram*).

[c] Measured directly across cooled element for the indicated typical flow.

[d] With the gauge located in an area where the maximum pressure external to the gauge is one atmosphere absolute.

[e] "ON" time is defined as the sum of the duration of all individual pulses which occur during the indicated interval. *Pulse duration* is defined as the time interval between the two points on the pulse at which the instantaneous value is 50% of the peak power 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.

[f] The magnitude of any spike on the plate voltage pulse should not exceed its peak value by more than 10%, and the duration of any spike when measured at the peak-value level should not exceed 5% of the pulse duration as defined in note(e). 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.

[g] Peak or average cathode current is the total of the peak or average plate current and the peak or average rectified grid current. (Pulses are not coincident, hence they cannot be added arithmetically).

[h] Duty factor is the product of the pulse duration and repetition rate.

[j] Preferably obtained from a cathode bias resistor.

[k] The driver stage is required to supply tube losses, rf circuit losses, and rf power added to the plate circuit. 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.

The following footnotes apply to the *RCA Transmitting Tube Operating Considerations* given at the front of this section.

[m] See *Electrical Considerations* - Filament or Heater.

[n] See *Cooling Considerations* - Forced-Air Cooling.

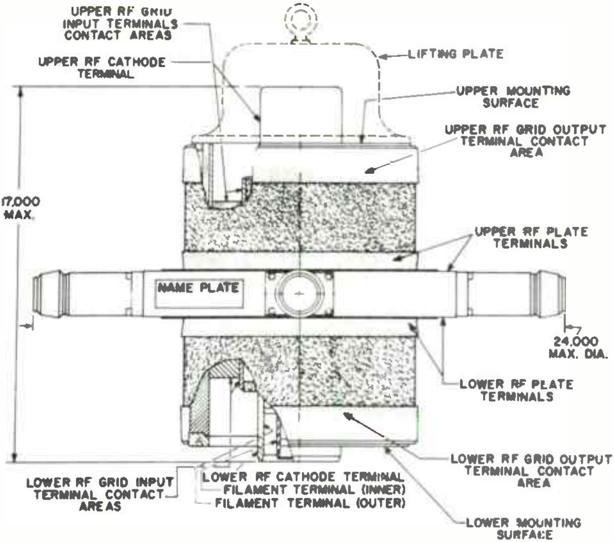
[p] See *Cooling Considerations* - Liquid Cooling.

[q] See *Classes of Service*.

FOR ADDITIONAL INFORMATION ON THIS TYPE, WRITE FOR TECHNICAL BULLETIN AND APPLICATION GUIDE FOR RCA SUPER POWER TUBES, ICE-279A AVAILABLE FROM:

Commercial Engineering
Electronic Components and Devices
Radio Corporation of America
Harrison, New Jersey

SIMPLIFIED DIMENSIONAL OUTLINE



92CL-10923AR1

DIMENSIONS IN INCHES

A detailed Dimensional Outline and associated Gauge Drawings are given in the Technical Bulletin available upon request.

Beam Power Tube

CERAMIC-METAL SEALS
"ONE-PIECE" ELECTRODE DESIGN
CONDUCTION COOLED

COAXIAL-ELECTRODE STRUCTURE
INTEGRAL CONDUCTION CYLINDER
180-WATTS CW 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:

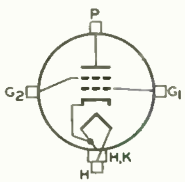
Heater, for Matrix-Type, Oxide-Coated, Unipotential Cathode:		
Voltage (AC or DC)▲	6.3 ± 10%	volts
Current at heater volts = 6.3	3.2	amp ←
Minimum heating time	60	sec
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 250, grid-No.2 volts = 250, and plate ma. = 100	18	
Direct Interelectrode Capacitances:●		
Grid No.1 to plate	0.065 max.	μμf
Grid No.1 to cathode & heater	14	μμf
Plate to cathode & heater	0.019 max.	μμf
Grid No.1 to grid No.2	19	μμf
Grid No.2 to plate	4.5	μμf
Grid No.2 to cathode & heater	1.3 max.	μμf

Mechanical:

Operating Position	Any
Overall Length	1.885" + 0.70" − 0.80"
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

← Indicates a change.

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.

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♠	4.5	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#	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♠	4.5	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	4.5	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	3	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	4.5	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 7842, consult manufacturers such as J-V-M Microwave Company, 9300 West 47th Street, Brookfield, Illinois; E.F. Johnson Company, Waseca, Minnesota; 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.	
→ 1. Heater Current	1	2.90	3.55	amp
2. 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	-	0.019	μμf
Grid No.1 to grid No.2	2	17.3	21.9	μμf
Grid No.2 to plate	2	4	5.1	μμf
Grid No.2 to cathode & heater	2	-	1.3	μμf
→ 3. Grid-No.1 Voltage	1,3	-6	-18	volts
4. Reverse Grid-No.1 Current	1,3	-	-20	μa
5. Grid-No.2 Current	1,3	-8	2	ma
6. Peak Emission Voltage	1,4	-	400	volts
7. Interelectrode Leakage Resistance	5	1	-	megohm
8. Useful Power Output	6	80	-	watts

Note 1: With 6.3 volts ac or dc on heater.

Note 2: Measured with special shield adapter.

Note 3: With dc 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: 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 10 amperes is obtained. After 1 minute at this value, the voltage-pulse amplitude will not exceed 400 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 adjacent 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 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 1000 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.

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 resonances. Design details of mountings used by the RCA Electron Tube Division to perform these tests may be obtained from RCA Commercial Engineering, Harrison, N.J., on request.

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-

→ Indicates a change.

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, 4, 7, and 8 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, 4, 7, and 8 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 0.080 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 cycle range. At the end of this test, tubes are required to meet the limits for items 1, 3, 4, 7, and 8 under *Characteristics Range Values for Equipment Design.*

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.

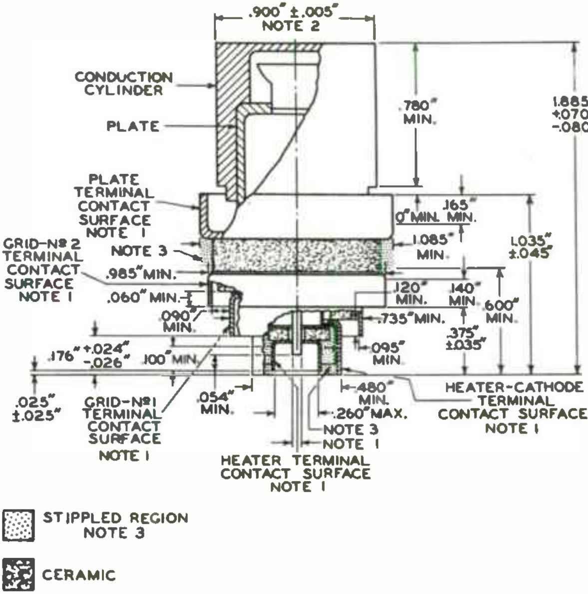
The maximum plate dissipation may be calculated from the equation:

$$W = KA\frac{(T_2 - T_1)}{L}$$

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 inrh for a thickness of one inch and a difference of temperature of 1° C.



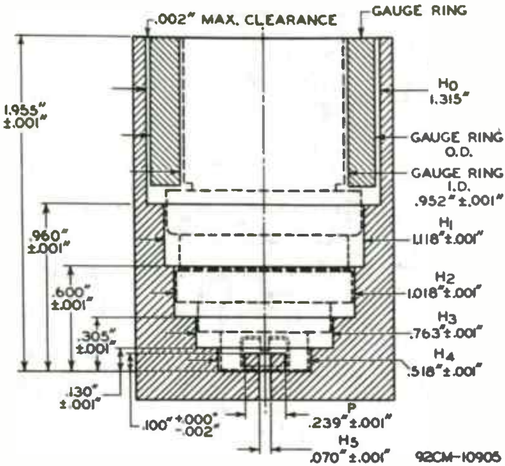
92CM-9218R4

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.

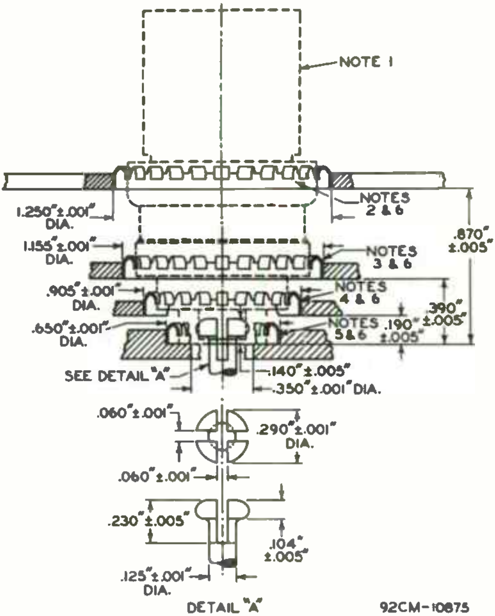
SKETCH G_1



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.

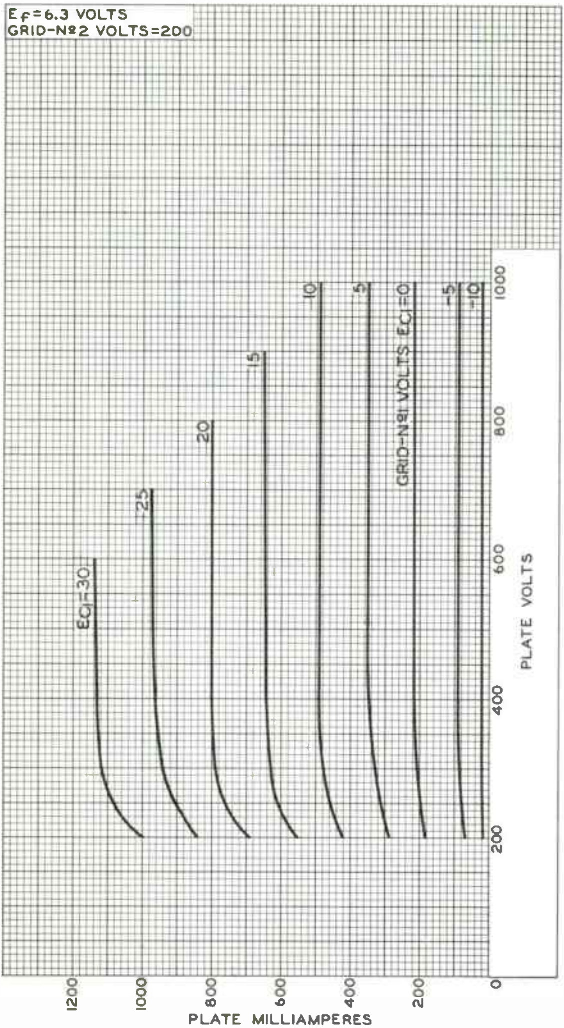
NOTE 3: CONTACT RING No. 97-253 OR FINGER STOCK No. 97-380.

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.

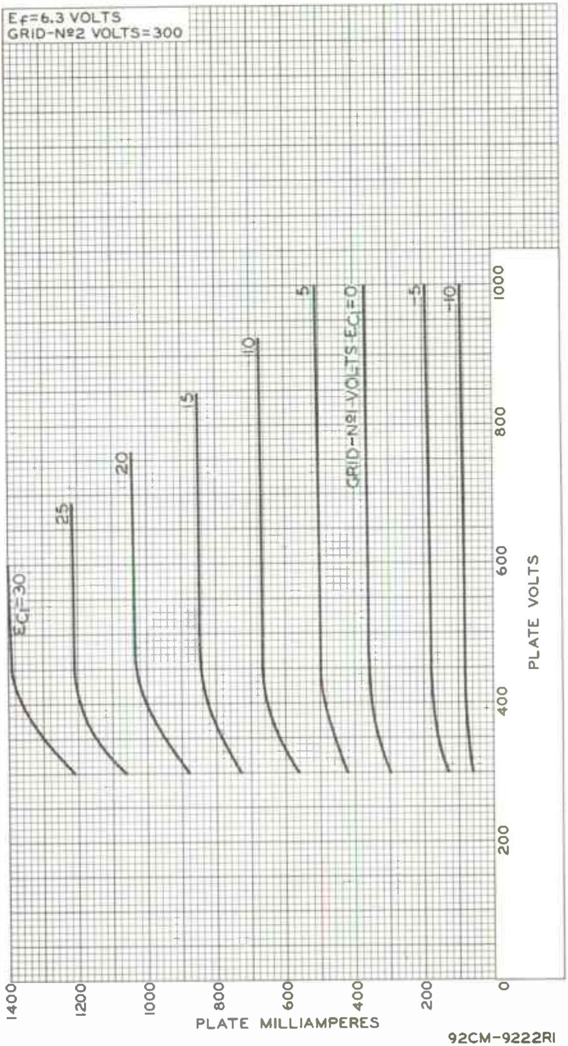
NOTE 6: THE SPECIFIED CONTACT RING OF PREFORMED FINGER STOCK AND FINGER STOCK No. 97-380 PROVIDE ADEQUATE ELECTRICAL CONTACT, BUT THE FINGER STOCK No. 97-380 IS LESS SUSCEPTIBLE TO BREAKAGE THAN THE SPECIFIED CONTACT RING. BOTH TYPES ARE MADE BY INSTRUMENTS SPECIALTIES COMPANY, LITTLE FALLS, NEW JERSEY.

TYPICAL PLATE CHARACTERISTICS

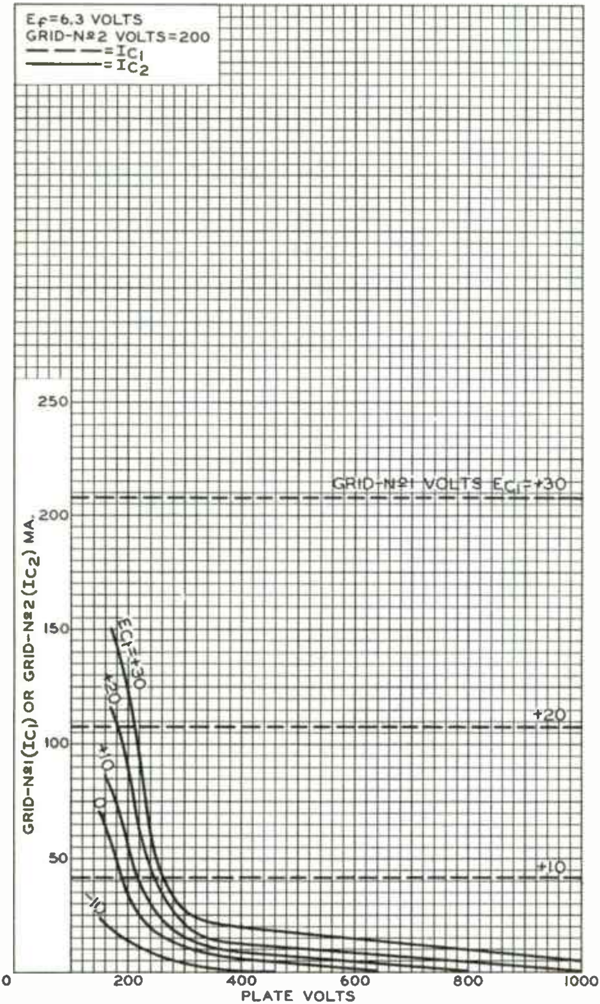


92CM-9228R2

TYPICAL PLATE CHARACTERISTICS

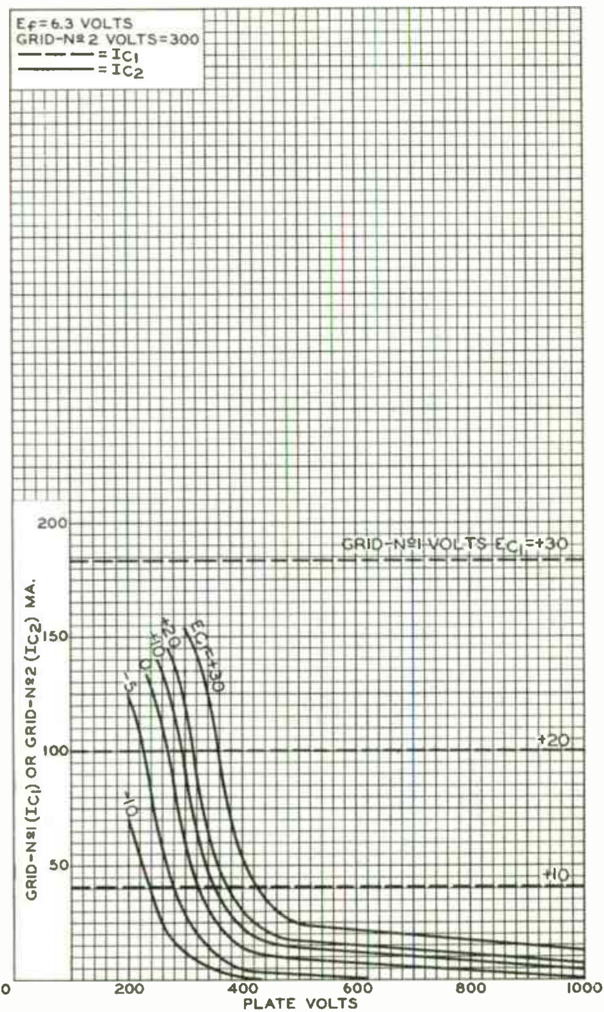


TYPICAL CHARACTERISTICS



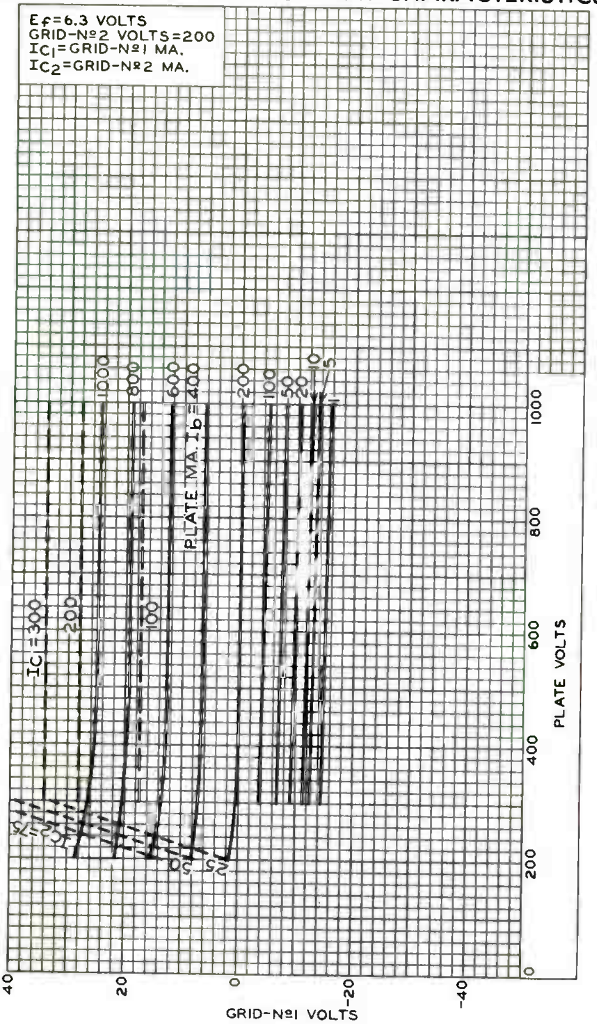
92CM-9224R1

TYPICAL CHARACTERISTICS



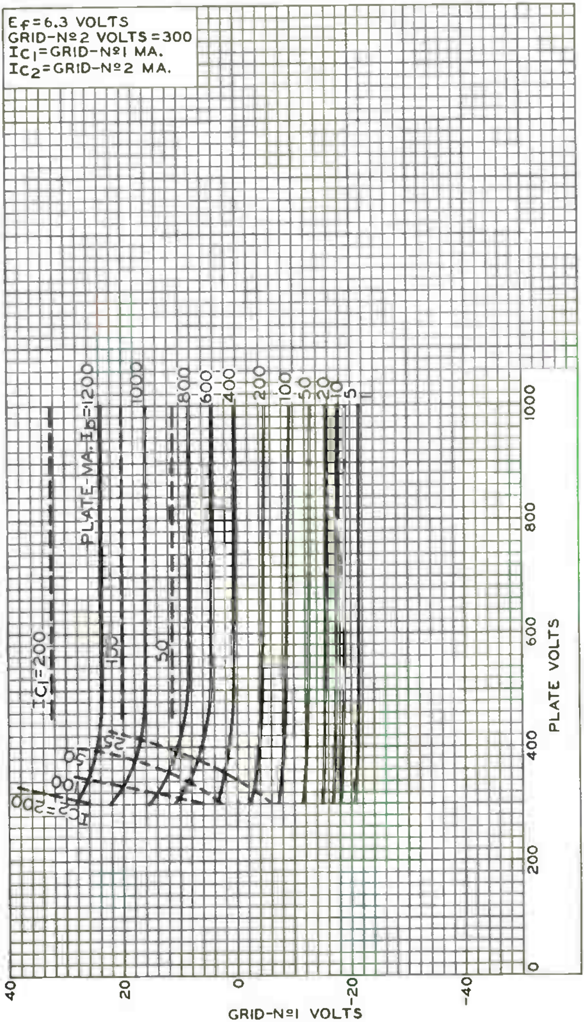
92CM-9225R2

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM-9233R1

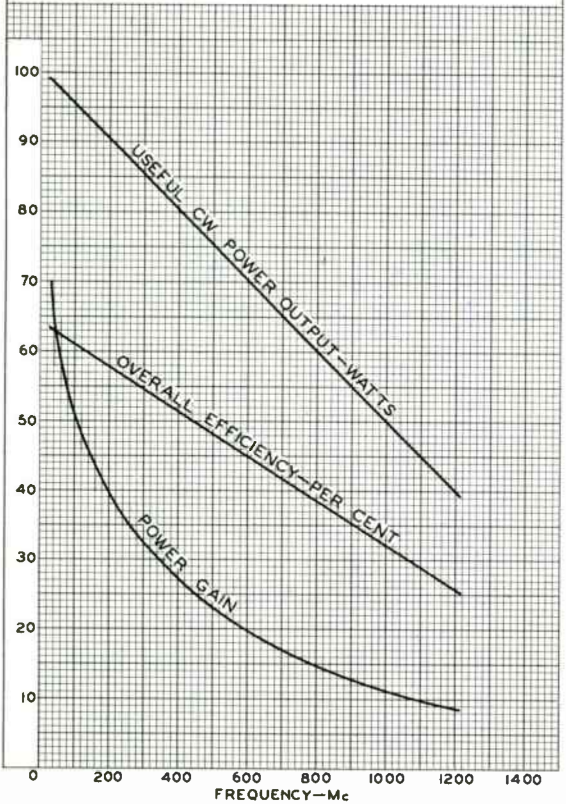
TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM-9232R1

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-No 2 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

Beam Power Tube

CERAMIC-METAL SEALS
UNIPOTENTIAL CATHODE
CONDUCTION COOLING

COAXIAL-ELECTRODE STRUCTURE
INTEGRAL CONDUCTION CYLINDER
180 WATTS CW INPUT UP TO 1215 Mc

For Use at Frequencies up to 2000 Mc

The 7843 is the same as the 7844 except for the following items:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)[a]	26.5 ± 10%	volts
Current at heater volts = 26.5.	0.52	amp

[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.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Heater Current.	1	0.45	0.57	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	-6.5	-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

Note 1: With 26.5 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.

← Indicates a change.

Note 8: In a single-tube, grid-driven, coaxial-cavity class-C-amplifier circuit at 400 Mc and for conditions with 24 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.

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

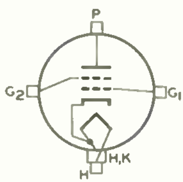
Electrical:

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*):

G₁ - Grid-No.1-Terminal Contact Surface
G₂ - 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 AF 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.

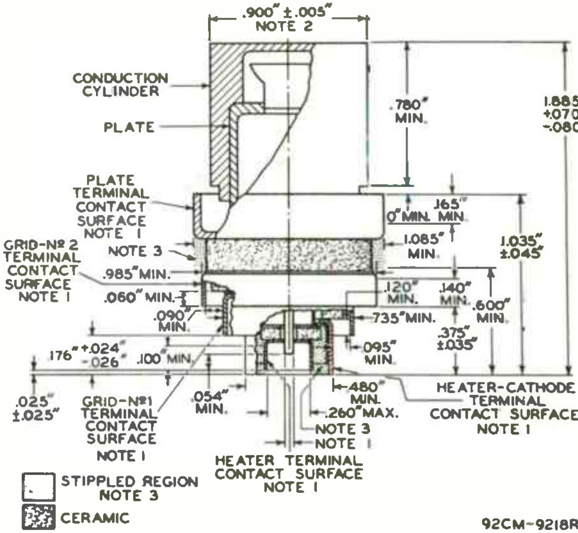
The maximum plate dissipation may be calculated from the equation:

$$W = KA\,\frac{(T_2 - T_1)}{L}$$

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.



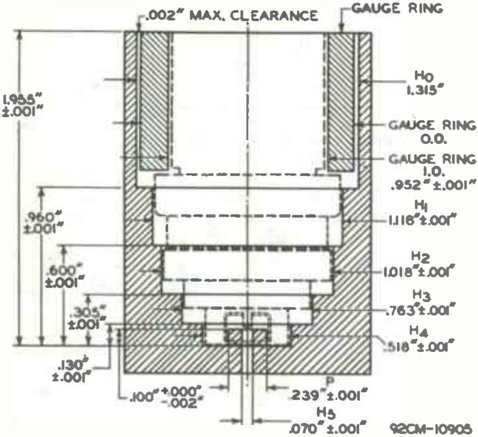
92CM-9218R4

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.

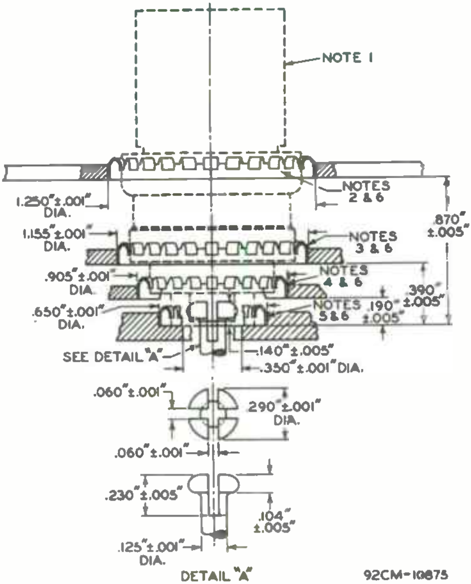
SKETCH G_1



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.

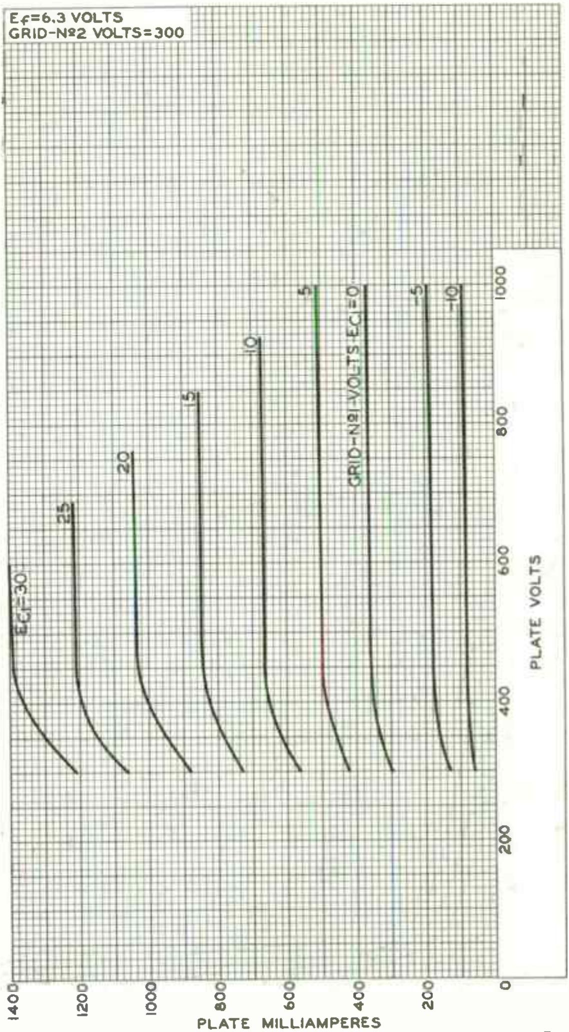
NOTE 5: CONTACT RING No.97-255 OR FINGER STOCK No.97-380.

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

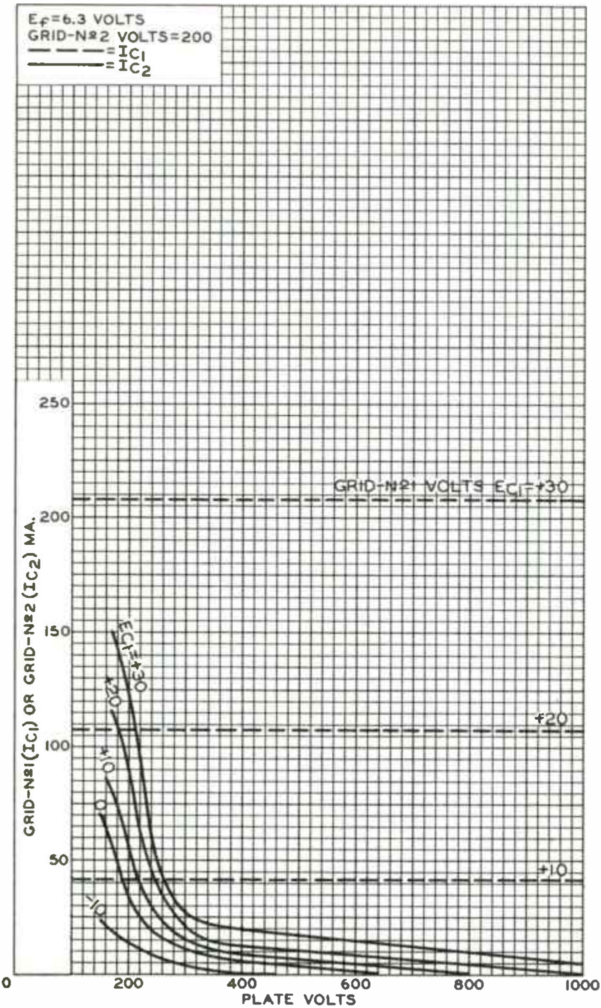
92CM-9228R2

TYPICAL PLATE CHARACTERISTICS



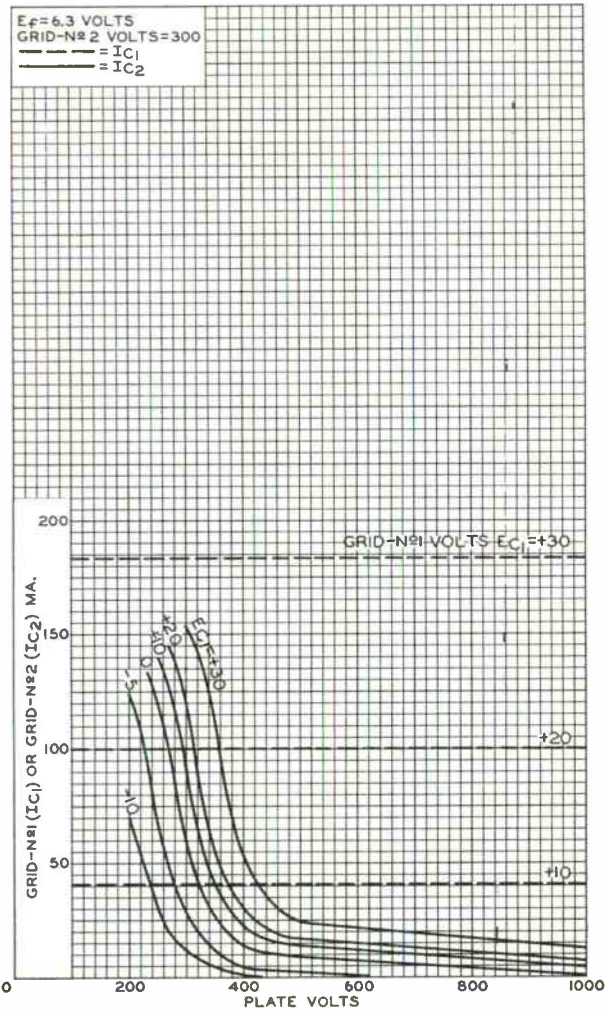
92CM-9222R1

TYPICAL CHARACTERISTICS



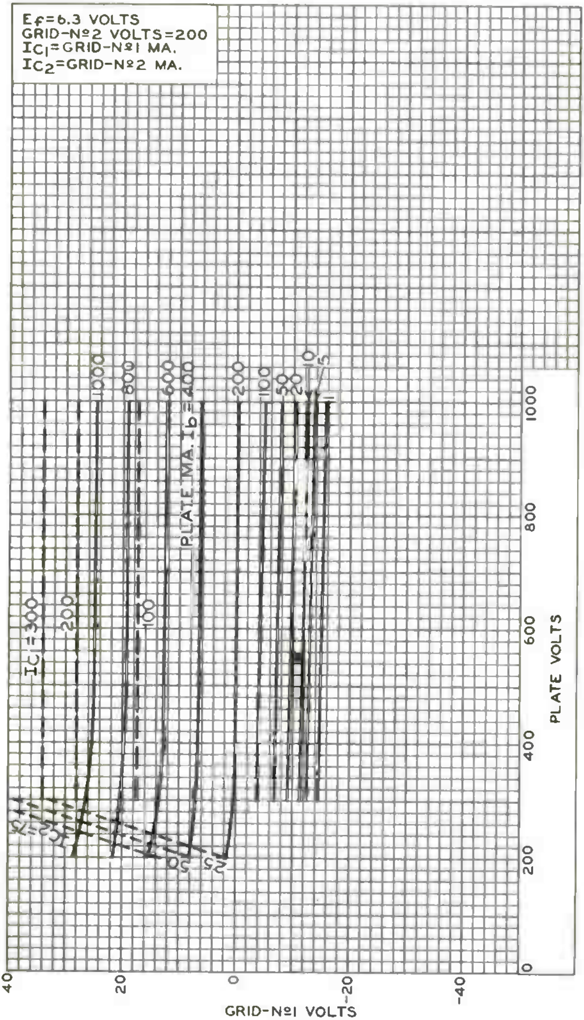
92CM-9224R1

TYPICAL CHARACTERISTICS



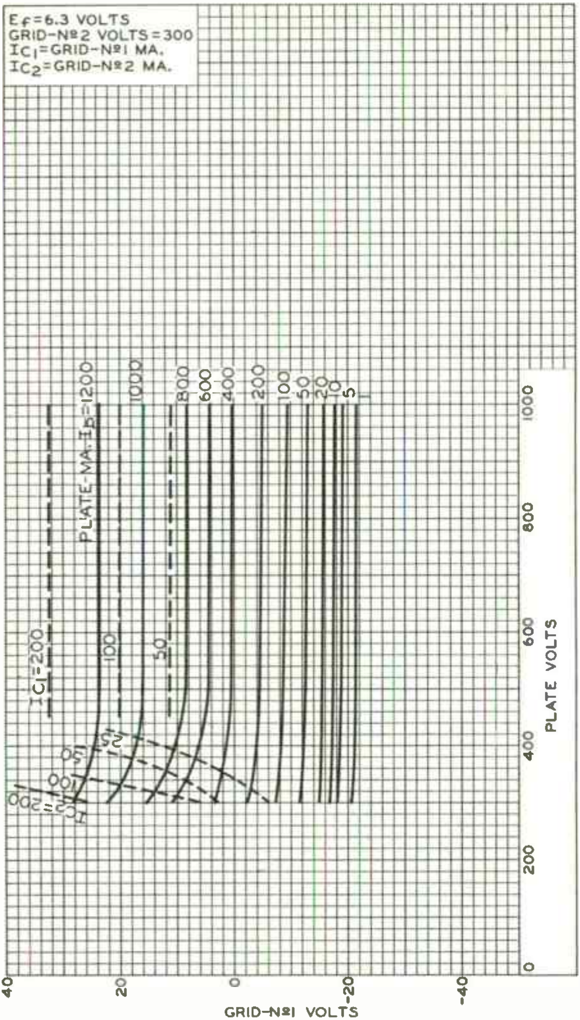
92CM-9225R2

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



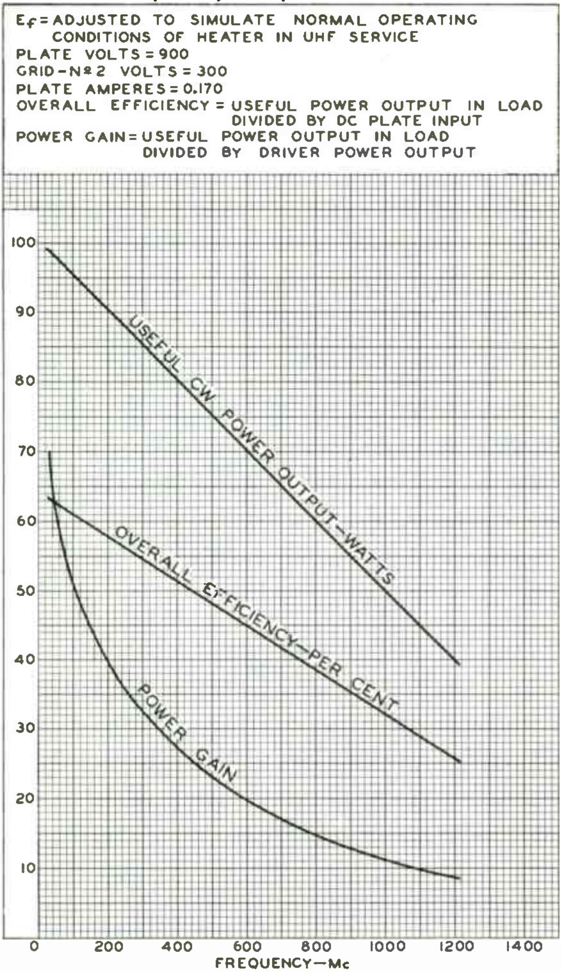
92CM-9233R1

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM-9232R1

TYPICAL PERFORMANCE CHARACTERISTICS
In Class C Telegraphy or Class C FM Telephony Amplifier Service



92CM-9221

Beam Power Tube

CERAMIC-METAL SEALS	52.5-WATTS CW INPUT
"ONE-PIECE" ELECTRODE DESIGN	27-WATTS CW OUTPUT AT 400 Mc
CONDUCTION COOLED	15-WATTS CW OUTPUT AT 1200 Mc
COAXIAL-ELECTRODE STRUCTURE	3.2-WATTS CW OUTPUT AT 3000 Mc

UNIPOTENTIAL CATHODE

The 7870 is the same as the 7801 except for the following items:

Heater, for Unipotential Cathode:

Voltage (AC or DC)[a]	6.3 ± 10%	volts
Current at heater volts = 6.3	1	amp

[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.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Heater Current	1	0.88	1.1	amp ←
Direct Interelectrode Capacitances:				
Grid No.1 to plate	2	-	0.025	μμf
Grid No.1 to cathode & heater . .	2	8.5	10.3	μμf
Plate to cathode & heater	2	-	0.004	μμf
Grid No.1 to grid No.2	2	14	20.6	μμf
Grid No.2 to plate	2	2.1	2.5	μμf
Grid No.2 to cathode & heater . .	2	-	0.18	μμf
Grid-No.1 Voltage	1,3	-1	-10	volts
Grid-No.1 Cutoff Voltage	1,4	-	-25	volts
Grid-No.2 Current	1,3	-3	2	ma
Positive Grid-No.1 Voltage	1,5	0	14	volts
Transconductance	1,6	7500	-	μmhos

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 750 volts, dc grid-No.2 voltage of 250 volts, and dc grid-No.1 voltage adjusted to give a dc plate current of 35 ma.

Note 4: With dc plate voltage of 750 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 dc plate voltage of 300 volts, dc grid-No.2 voltage of 250 volts, and dc grid-No.1 voltage of -100 volts. Rectangular pulses, pulse duration of 4500 to 5000 microseconds and pulse-repetition frequency of 10 to 12 pps. The positive-pulse grid-No.1 voltage is adjusted to give a plate current of 300 ma. at leading edge of pulse.

Note 6: With dc plate voltage of 300 volts, dc grid-No.2 voltage of 150 volts, dc grid-No.1 voltage adjusted to give a dc plate current of 35 ma.

← Indicates a change.

8008

8008

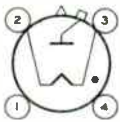
HALF-WAVE MERCURY-VAPOR RECTIFIER

The 8008 is the same as the 872-A except for the following items:

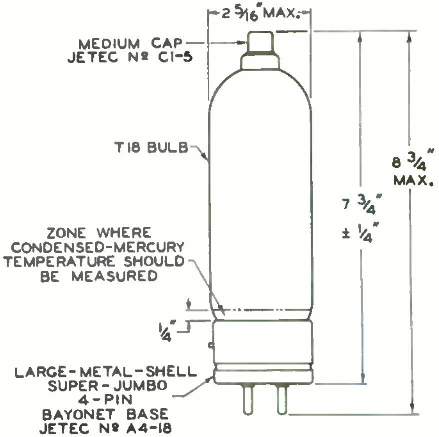
Mechanical:

Maximum Overall Length . . . . 8-3/4"
Seated Length. . . . . 7-3/4" ± 1/4" ←
Weight (Approx.) . . . . 6.8 oz ←
Base . . . . Large-Metal-Shell Super-Jumbo 4-Pin with Bayonet (JETEC No. A4-18) ←
Basing Designation for BOTTOM VIEW . . . . 2P ←

Pin 1 - No Connection
Pin 2 - Filament, Cathode Shield



Pin 3 - Filament
Pin 4 - No Connection
Cap - Anode



92CM-6299R3

← indicates a change.

8025-A

U-H-F TRANSMITTING TRIODE

The 8025-A supersedes the Type 8025.

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	3.0	μμf
Grid to Filament	2.7	μμf
Plate to Filament	0.4	μμf

Mechanical:

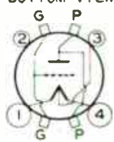
Mounting Position . . . . Vertical Only: Base up or down

Cooling—Requirements are indicated under MAXIMUM RATINGS for each class of service. *Natural Cooling* means that adequate free circulation of air around the tube is necessary. When *Forced-Air Cooling* is required, an air flow from a fan should be directed on the bulb.

Maximum Overall Length	4-15/16"
Maximum Seated Length	4-5/16"
Greatest Radius	1-1/64" ± 1/16"
Bulb	T-8
Caps (Four)	Saddle Skirted Miniature, with Nub
Base	Small 4-Pin, Micanol

Basing Designation for BOTTOM VIEW 3M

Pin 1 – Filament
Pin 2 – No Con.
Pin 3 – Filament Mid-Tap
Pin 4 – Filament
G – Grid
P – Plate



G CAPS NEARER BASE
P CAPS 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:*

	Forced-Air Cooling *CCS*▲	*Natural Cooling* *ICAS*▲	
D-C PLATE VOLTAGE	1000 max.	1000 max.	volts
D-C GRID VOLTAGE	-200 max.	-200 max.	volts
D-C PLATE CURRENT	65 max.	65 max.	ma.
PLATE INPUT	60 max.	50 max.	watts
PLATE DISSIPATION	40 max.	30 max.	watts

Typical Operation:

D-C Plate Voltage	1000	volts
D-C Grid Voltage□	-135	volts
	2500	ohms

□: See next page. ▲,**: See end of tabulation.

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

8025-A

U-H-F TRANSMITTING TRIODE

(continued from preceding page)

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

□ 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*:

	Forced-Air Cooling CCS▲	*Natural Cooling ICAS*▲	
D-C PLATE VOLTAGE	800 max.	800 max.	volts
D-C GRID VOLTAGE	-200 max.	-200 max.	volts
D-C PLATE CURRENT	65 max.	65 max.	ma.
D-C GRID CURRENT	20 max.	20 max.	ma.
PLATE INPUT	50 max.	33 max.	watts
PLATE DISSIPATION	27 max.	20 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*:

	Forced-Air Cooling CCS▲	*Natural Cooling ICAS*▲	
D-C PLATE VOLTAGE	1000 max.	1000 max.	volts
D-C GRID VOLTAGE	-200 max.	-200 max.	volts
D-C PLATE CURRENT	80 max.	80 max.	ma.
D-C GRID CURRENT	20 max.	20 max.	ma.
PLATE INPUT	75 max.	50 max.	watts
PLATE DISSIPATION	40 max.	30 max.	watts

#, ▲, *: See end of tabulation.

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

8025-A

U-H-F TRANSMITTING TRIODE

(continued from preceding page)

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

** The filament is center-tapped and the center lead is brought out to the No.3 pin. 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.

▲ CCS = Continuous Commercial Service; ICAS = Intermittent Commercial and Amateur Service.

* Subject to wide variations as explained on sheet TUBE RATINGS in General Section.

° Obtained from fixed supply, or grid resistor (6400), or by cathode resistor (1400). When the 8025-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.

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

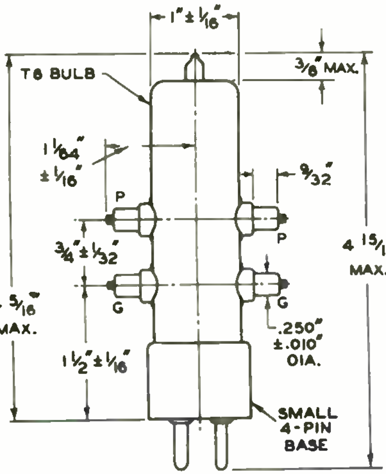
The 8025-A may be operated with maximum ratings at frequencies up to 500 megacycles, but as the frequency is raised, the efficiency and power output fall off. At 600 megacycles an efficiency of about 35% can be expected. Since the efficiency at 600 megacycles is relatively low, the plate of the 8025-A has been designed to have an unusually high dissipation rating.

Data on operating frequencies for the 8025-A are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY.

Curves for the 8025-A are the same as those for the 8012-A.

8025-A

U-H-F TRANSMITTING TRIODE



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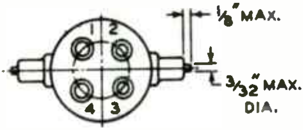


BOTTOM VIEW

℄ OF EACH CAP SHALL NOT DEVIATE MORE THAN 3° FROM PLANE NORMAL TO THE PLANE OF PINS NO. 1 & NO. 4 AND PASSING THROUGH CENTER OF BOTTOM OF BASE.

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

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

Beam Power Tube

CERAMIC-METAL SEALS — **COAXIAL-ELECTRODE STRUCTURE**
CONDUCTION COOLED — **UNIPOTENTIAL CATHODE**

For Use in Low-Voltage Mobile Equipment at Frequencies up to 500 Mc

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage range (AC or DC)[a]	12.0 to 15.0	volts
Current (Approx.) at 13.5 volts	1.3	amp
Minimum heating time	60	sec
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 250, grid-No.2 volts = 200, plate amperes = 1.2	11	
Direct Interelectrode Capacitances:[b]		
Grid No.1 to plate	0.13 max.	μμf
Grid No.1 to cathode	16	μμf
Plate to cathode	0.011	μμf
Grid No.1 to grid No.2	22	μμf
Grid No.2 to plate	6.5	μμf
Grid No.2 to cathode	3.2	μμf
Cathode to heater	3.4	μμf

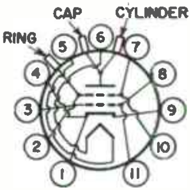
Mechanical:

Operating Position	Any
Maximum Overall Length	2.26"
Seated Length	1.920" ± 0.065"
Diameter	1.426" ± 0.010"
Weight (Approx.)	2 oz
Socket	Mycalex[c] No.CP464-2, or equivalent
Base	Large-Wafer Elevenar 11-Pin with Ring (JEDEC No.E11-81)

Terminal Connections (See *Dimensional Outline*):

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



CAP - Plate-Terminal Connection
CYLINDER - Plate-Terminal Contact Surface
RING[d] - Grid-No.2 Terminal Contact Surface

Thermal:

Terminal Temperature (All terminals)	250 max.	°C
Plate Core Temperature (See *Dimensional Outline*)	250 max.	°C

Cooling, Conduction:

The plate-terminal (cylinder) must be thermally coupled to a constant temperature device (heat-sink—solid or liquid) to limit the plate terminal to the specified maximum value of 250° C. The grid No.2, grid No.1, cathode, and heater terminals may also require coupling to the heat sink to limit their respective terminal temperature to the specified maximum value of 250° 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:*

	Up to 500 Mc		
DC PLATE VOLTAGE	2200	max.	volts
DC GRID-No.2 VOLTAGE	400	max.	volts
DC GRID-No.1 VOLTAGE	-100	max.	volts
DC PLATE CURRENT AT PEAK OF ENVELOPE	450[e]	max.	ma
DC GRID-No.1 CURRENT	100	max.	ma
PLATE DISSIPATION	100[f]	max.	watts
GRID-No.2 DISSIPATION	8	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	
DC Plate Voltage	700	volts
DC Gr'd-No.2 Voltage[g]	250	volts
DC Grid-No.1 Voltage[g]	-20	volts
Zero-Signal DC Plate Current	100	ma
Effective RF Load Resistance	1420	ohms
DC Plate Current:		
Peak of envelope	205	ma
Average	150	ma
DC Grid-No.2 Current:		
Peak of envelope	16	ma
Average	10	ma
Average DC Grid-No.1 Current	1[h]	ma
Peak-of-Envelope Driver Power Output (Approx.)[j]	0.3	watt
Output-Circuit Efficiency (Approx.)	95	%
Distortion Products Level:[k]		
Third order	30	db
Fifth order	35	db
Useful Power Output (Approx.):		
Peak of envelope	80[m]	watts
Average	40[m]	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under any condition:		
With fixed bias	25000 max.	ohms
With fixed bias (In Class-AB_1 operation)	100000 max.	ohms
With cathode bias	Not recommended	
Grid-No.2-Circuit Impedance	10000	ohms
Plate-Circuit Impedance	n	

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

Maximum CCS Ratings, ***Absolute-Maximum Values:***

	Up to 500 Mc		
DC PLATE VOLTAGE	2200	max.	volts
DC GRID-No.2 VOLTAGE	400	max.	volts
DC GRID-No.1 VOLTAGE	−100	max.	volts
DC PLATE CURRENT	300	max.	ma
DC GRID-No.1 CURRENT	100	max.	ma
GRID-No.2 DISSIPATION	8	max.	watts
PLATE DISSIPATION	100[f]	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:

In grid-drive circuit at frequency of	*50*		*175*		*470*	*Mc*
DC Plate Voltage	500	700	500	700	700	volts
DC Grid-No.2 Voltage	160	175	200	200	200	volts
DC Grid-No.1 Voltage	-10	-10	-30	-30	-30	volts
DC Plate Current	300	300	300	300	300	ma
DC Grid-No.2 Current	25	25	30	20	10	ma
DC Grid-No.1 Current	50	50	40	40	20	ma
Driver Power Output (Approx.)[p]	1.2	1.2	3	3	5	watts
Useful Power Output:						
Typical	85[■]	110[■]	70[■]	105[■]	85[■]	watts
For minimum useful-power output see *Characteristics Range Values, Test*	*No.8*		*No.9*		*No.10*	

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under any condition:		
With fixed bias	25000 max.	ohms
Grid-No.2-Circuit Impedance	10000 max.	ohms
Plate-Circuit Impedance	n	

[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, heater volts = 12.5 (Approx.).

[b] Measured with special shield adapter.

[c] Mycalex Corporation of America, 125 Clifton Boulevard, Clifton, New Jersey.

[d] For use at higher frequencies.

[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.

[f] Maximum plate dissipation is limited by the maximum plate core temperature and the cooling system to maintain tube operation below the specified maximum plate core temperature. With simple low-cost cooling techniques, maximum plate dissipation may be only about 100 watts; with more sophisticated cooling techniques, maximum plate dissipation may be as high as 300 watts.

[g] Obtained preferably from a separate, well-regulated source.

[h] 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.

[j] Driver power output represents circuit losses and is the actual power measured at input to grid-No.1 circuit. The actual power required depends on the operating frequency and the circuit used. The tube driving power is approximately zero watts.

[k] With maximum signal output used as a reference, and without the use of feedback to enhance linearity.

[m] The value of useful power is measured at load of output circuit.

[n] The tube should see an effective plate supply impedance which limits the peak current through the tube under surge conditions to 15 amperes.

[p] Driver power output includes circuit losses and is the actual power measured at the input to the grid circuit. It will vary depending upon the frequency of operation and the circuit used.

CHARACTERISTICS RANGE VALUES

Test No.		Note	Min.	Max.	
1.	Heater Current	1	1.15	1.45	amp
2.	Direct Interelectrode Capacitances:	2			
	Grid No.1 to plate . .	-	-	0.13	μμf
	Grid No.1 to cathode .	-	14.3	17.7	μμf
	Plate to cathode . . .	-	0.0065	0.0155	μμf
	Grid No.1 to grid No.2	-	19.8	24.2	μμf
	Grid No.2 to plate . .	-	5.7	7.1	μμf
	Grid No.2 to cathode .	-	2.6	3.6	μμf
	Cathode to heater. . .	-	2.5	4.1	μμf
3.	Grid-No.1 Voltage. . . .	1,3	-8	-19	volts
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 amp
7.	Interelectrode Leakage Resistance	5	1	-	megohm
8.	Useful Power Output. . .	1,6	90	-	watts
9.	Useful Power Output. . .	1,7	85	-	watts
10.	Useful Power Output. . .	1,8	75	-	watts
11.	Cutoff Grid-No.1 Voltage	1,9	-	-44	volts

Note 1: With 13.5 volts ac or dc on heater.

Note 2: Measured with special shield adapter.

Note 3: With dc plate voltage of 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 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 CW grid-driven, conduction-cooled amplifier circuit at 50 Mc and for conditions: dc plate voltage of 700 volts, grid-No.1 voltage of -10 volts, driver power output of 1.2 watts, and grid-No.2 voltage varied to obtain a plate current of 300 ma.

Note 7: In a CW grid-driven, conduction-cooled amplifier circuit at 175 Mc and for conditions: dc plate voltage of 700 volts, grid-No.1 voltage of -30 volts, driver power output of 3 watts, and grid-No.2 voltage varied to obtain a plate current of 300 ma.

Note 8: In a CW grid-driven, conduction-cooled amplifier circuit at 470 Mc and for conditions: dc plate voltage of 700 volts, grid-No.1 voltage of -30 volts, driver power output of 5 watts, and grid-No.2 voltage varied to obtain a plate current of 300 ma.

Note 9: With dc plate voltage of 700 volts, dc grid-No.2 voltage of 250 volts, and dc grid-No.1 voltage varied to obtain a plate current of 5 ma.

COOLING CONSIDERATIONS

The conduction-cooling system consists, in general, of a constant temperature device (heat sink) and suitable heat-flow path (coupling device) between the heat sink and tube. Primary consideration of the system should be given to the design of a heat-flow path (coupling device) with high thermal conductivity.

Thermal conductivity[q] may be calculated from the equation:

$$K = \frac{W}{A\,\dfrac{(T_2 - T_1)}{L}} \qquad (1)$$

where;

K = thermal conductivity of the material

W = power transfer in watts

A = area measured at right angles to the direction of the flow of heat in square inches

T_1, T_2 = temperature in degrees Centigrade of planes or surfaces under consideration

L = length of heat path in inches through coupling material to produce temperature gradient

[q] 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.

For a given system Equation (1) must be integrated to consider changes in area (A) dependent on the coupling configuration and changes in thermal conductivity (K) dependent on various coupling materials and interfaces. Equation (1) may now be reduced to the following:

$$K_S = \frac{W_P}{T_2 - T_1} \qquad (2)$$

where;

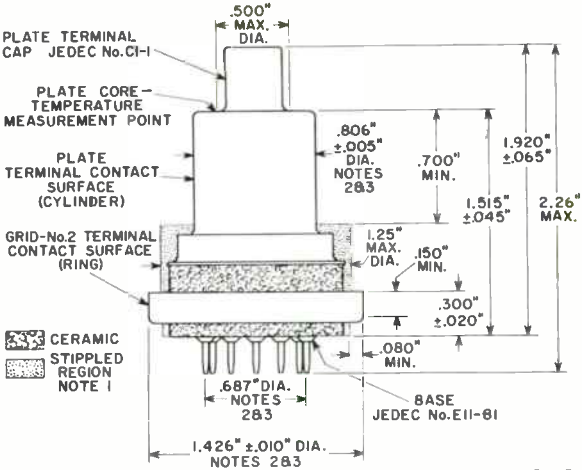
K_S = thermal conductance of the system

W_P = maximum permissible plate dissipation in watts

T_2 = temperature in degrees Centigrade at tube terminal

Note: *This value may never exceed the specified maximum rating for terminal temperature.*

T_1 = temperature in degrees Centigrade of heat sink



92CS-11306R1

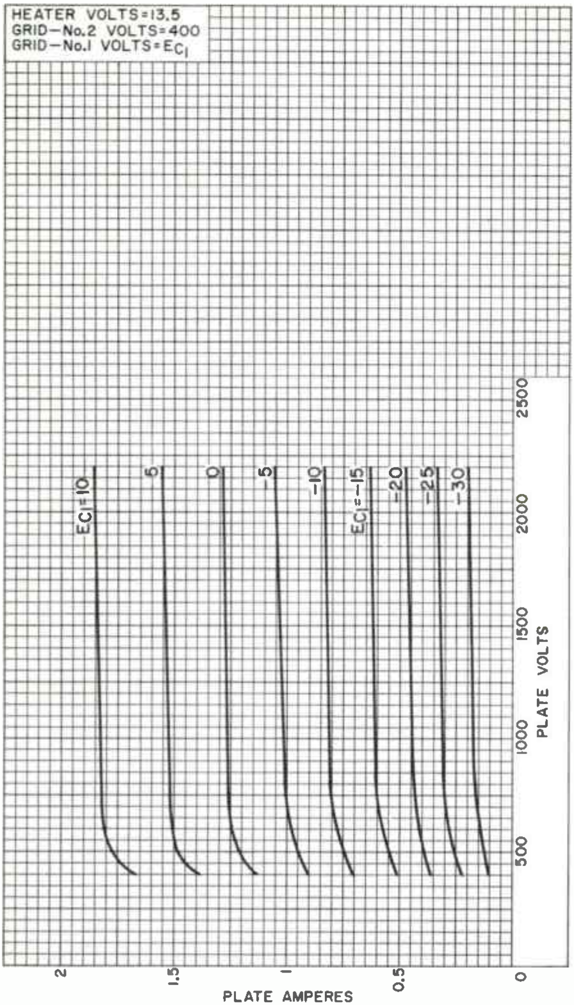
NOTE 1: KEEP ALL STIPPLED REGIONS CLEAR. DO NOT ALLOW CONTACTS OR CIRCUIT COMPONENTS TO PROTRUDE INTO THESE ANNULAR VOLUMES.

NOTE 2: THE DIAMETERS OF THE PLATE TERMINAL CONTACT SURFACE, GRID-No.2 TERMINAL CONTACT SURFACE, AND PIN CIRCLE TO BE CONCENTRIC WITHIN THE FOLLOWING VALUES OF MAXIMUM FULL INDICATOR READING:

Plate Terminal Contact Surface
to Grid-No.2 Terminal Contact Surface. . . . . 0.030"
Plate Terminal Contact Surface
to Pin Circle. . . . . 0.040"
Grid-No.2 Terminal Contact Surface
to Pin Circle. . . . . 0.030"

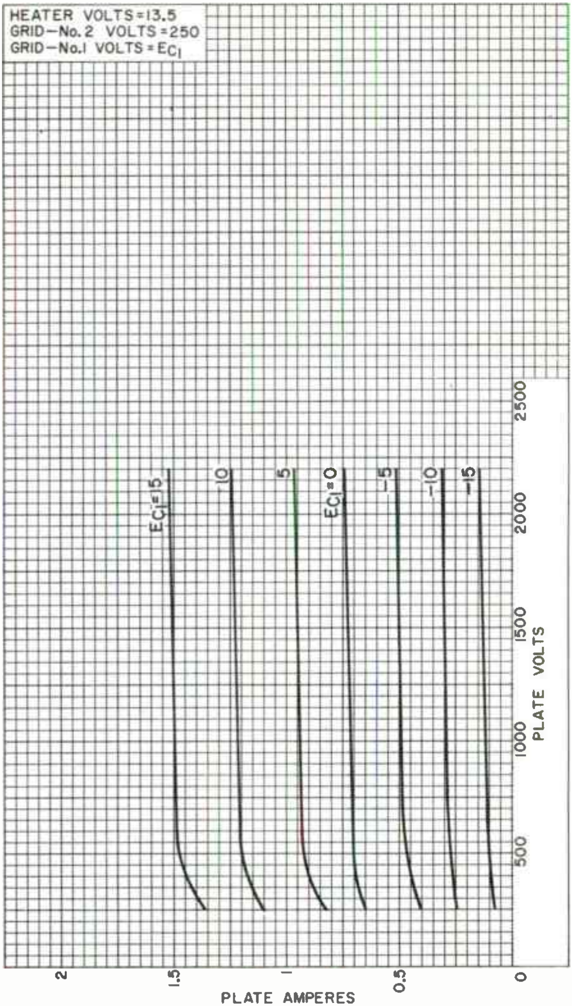
NOTE 3: THE FULL INDICATOR READING IS THE MAXIMUM DEVIATION IN RADIAL POSITION OF A SURFACE WHEN THE TUBE IS COMPLETELY ROTATED ABOUT THE CENTER OF THE REFERENCE SURFACE. IT IS A MEASURE OF THE TOTAL EFFECT OF RUN-OUT AND ELLIPTICITY.

TYPICAL PLATE CHARACTERISTICS



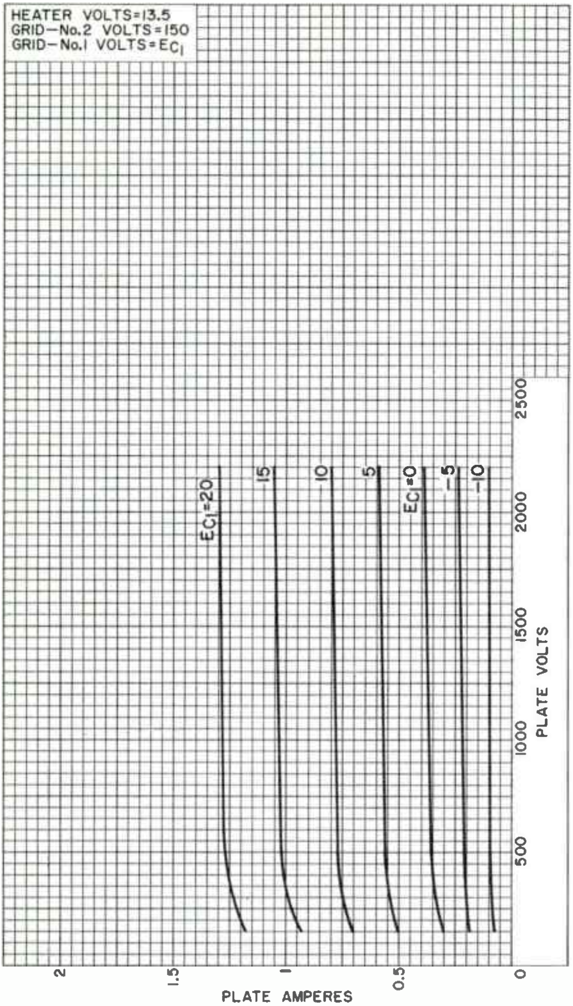
92CM—11290

TYPICAL PLATE CHARACTERISTICS



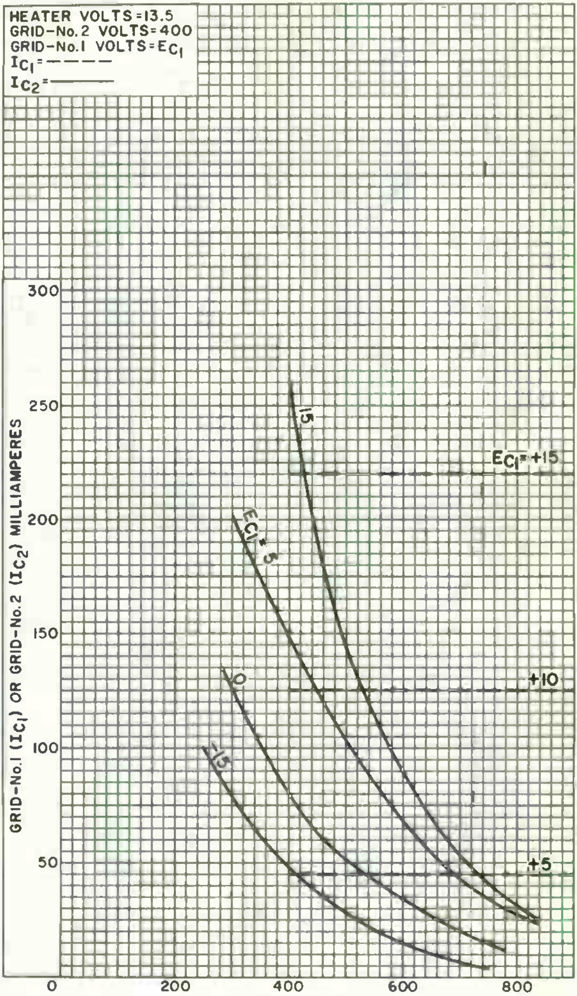
92CM—11288

TYPICAL PLATE CHARACTERISTICS



92CM–11289

TYPICAL CHARACTERISTICS



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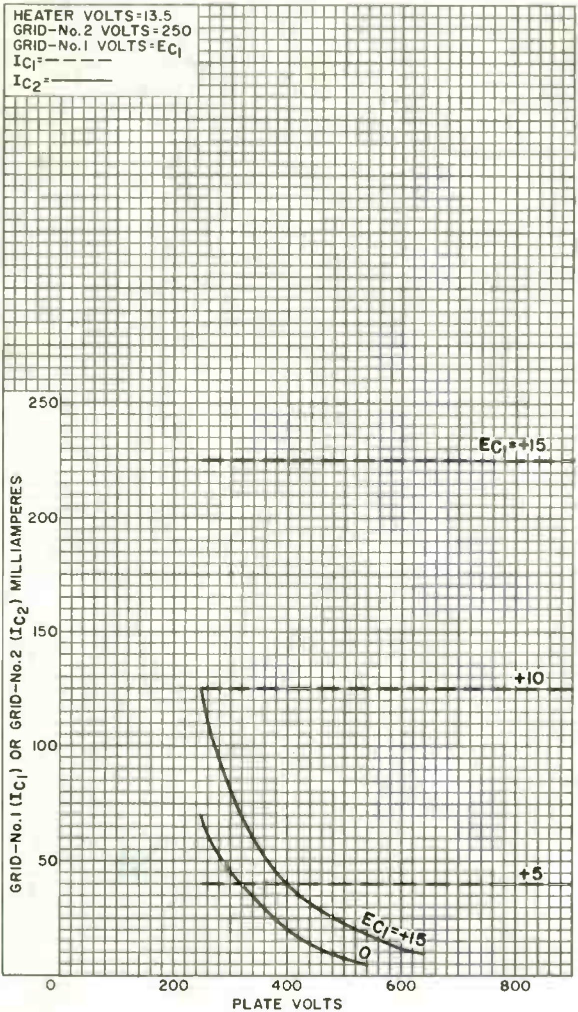
TYPICAL CHARACTERISTICS



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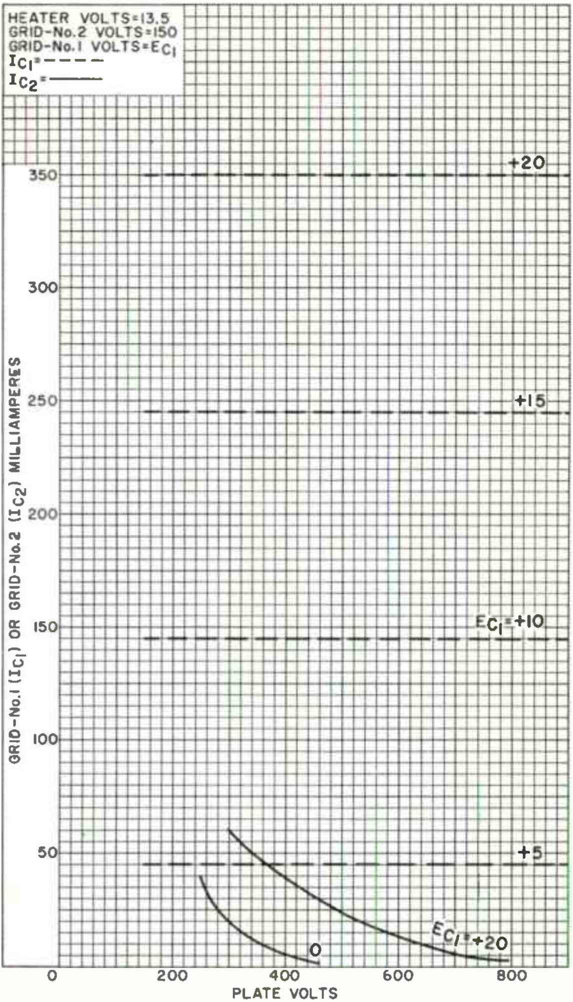
TYPICAL CHARACTERISTICS



92CM-11292

Beam Power Tube

FORCED-AIR COOLED

CERAMIC-METAL SEALS	170 WATTS PEP OUTPUT AT 30 Mc
COAXIAL-ELECTRODE STRUCTURE	235 WATTS CW OUTPUT AT 470 Mc
UNIPOTENTIAL CATHODE	INTEGRAL RADIATOR

Full Ratings at Frequencies up to 500 Mc

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)[a]	13.5 ± 10%	volts
Current at 13.5 volts	1.3	amp
Minimum heating time.	60	sec
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 450, grid No.2 volts = 325, plate amperes = 1.2. . .	12	
Direct Interelectrode Capacitances:[b]		
Grid No.1 to plate.	0.13 max.	μμf
Grid No.1 to cathode.	16	μμf
Plate to cathode.	0.011	μμf
Grid No.1 to grid No.2.	22	μμf
Grid No.2 to plate.	6.5	μμf
Grid No.2 to cathode.	3.2	μμf
Cathode to heater	3.4	μμf

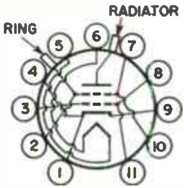
Mechanical:

Operating Position. . . . . Any
Maximum Overall Length. . . . . 2.196"
Seated Length . . . . 1.850" ± 0.065"
Diameter. . . . . 1.426" ± 0.010"
Weight (Approx.). . . . . 3 oz
Socket. . . . . .Mycalex[c] No.CP464-2, or equivalent
Base. . . . . Large-Wafer Elevenar 11-Pin with Ring (JEDEC No.E11-81)

Terminal Connections (See *Dimensional Outline*):

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[d] - Grid-No.2 Terminal Contact Surface

Thermal:

Terminal Temperature (All terminals). .	250 max.	°C
Radiator Core Temperature (See *Dimensional Outline*)	250 max.	°C

Air Flow:
See accompanying *Typical Cooling Requirements* curve.

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:***

	Up to 500 Mc		
DC PLATE VOLTAGE.	2200	max.	volts
DC GRID-No.2 VOLTAGE.	400	max.	volts
DC GRID-No.1 VOLTAGE.	-100	max.	volts
DC PLATE CURRENT AT PEAK OF ENVELOPE.	450[e]	max.	ma
DC GRID-No.1 CURRENT.	100	max.	ma
PLATE DISSIPATION	150	max.	watts
GRID-No.2 DISSIPATION	8	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		
DC Plate Voltage.	1000	1500	volts
DC Grid-No.2 Voltage[f]	250	250	volts
DC Grid-No.1 Voltage[f]	-20	-20	volts
Zero-Signal DC Plate Current.	100	100	ma
Effective RF Load Resistance.	2270	3800	ohms
DC Plate Current:			
Peak of envelope.	210	210	ma
Average	160	160	ma
DC Grid-No.2 Current:			
Peak of envelope.	10	10	ma
Average	7	7	ma
Average DC Grid-No.1 Current.	0.05[g]	0.05[g]	ma
Peak-of-Envelope Driver Power Output (Approx.)[h]	0.3	0.3	watt
Output-Circuit Efficiency (Approx.) .	90	85	%
Distortion Products Level:[j]			
Third order	35	35	db
Fifth order	40	40	db
Useful Power Output (Approx.):			
Peak of envelope.	110[k]	170[k]	watts
Average	55[k]	85[k]	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under any condition:			
With fixed bias	25000	max.	ohms
With fixed bias (In Class AB_1 operation).	100000	max.	ohms
With cathode bias	Not recommended		
Grid-No.2-Circuit Impedance	10000	max.	ohms
Plate-Circuit Impedance	[m]		

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

Maximum CCS Ratings, ***Absolute-Maximum Values:***

	Up to 500 Mc	
DC PLATE VOLTAGE.	2200 max.	volts
DC GRID-No.2 VOLTAGE.	400 max.	volts
DC GRID-No.1 VOLTAGE.	−100 max.	volts
DC PLATE CURRENT.	300 max.	ma
DC GRID-No.1 CURRENT.	100 max.	ma
GRID-No.2 DISSIPATION	8 max.	watts
PLATE DISSIPATION	150 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:

In grid-drive circuit at frequency of	*50*			*470*			*Mc*
DC Plate Voltage.	700	1000	1500	700	1000	1500	volts
DC Grid-No.2 Voltage	175	200	200	200	200	200	volts
DC Grid-No.1 Voltage	-10	-30	-30	-30	-30	-30	volts
DC Plate Current.	300	300	300	300	300	300	ma
DC Grid-No.2 Current	25	20	20	10	10	5	ma
DC Grid-No.1 Current	50	40	40	30	30	30	ma
Driver Power Output (Approx.)[n].	1.2	2	2	5	5	5	watts
Useful Power Output.	120[k]	175[k]	275[k]	100[p]	165[p]	235[p]	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under any condition:		
With fixed bias	25000 max.	ohms
Grid-No.2-Circuit Impedance	10000 max.	ohms
Plate-Circuit Impedance	■	

[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, heater volts = 12.5 (Approx.).

[b] Measured with special shield adapter.

[c] Mycalex Corporation of America, 125 Clifton Boulevard, Clifton, New Jersey.

[d] For use at higher frequencies.

[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.

[f] Obtained preferably from a separate, well regulated source.

[g] 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.

[h] Driver power output represents circuit losses and is the actual power measured at input to grid-No.1 circuit. The actual power required depends on the operating frequency and the circuit used. The tube driving power is approximately zero watts.

[j] With maximum signal output used as a reference, and without the use of feedback to enhance linearity.

[k] This value of useful power is measured at load of output circuit.

[m] The tube should see an effective plate supply impedance which limits the peak current through the tube under surge conditions to 15 amperes.

[n] Driver power output includes circuit losses and is the actual power measured at the input to the grid circuit. It will vary depending upon the frequency of operation and the circuit used.

[p] Measured in a typical coaxial-cavity circuit.

CHARACTERISTICS RANGE VALUES

Test No.	*Note*	*Min.*	*Max.*	
1. Heater Current	1	1.15	1.45	amp
2. Direct Interelectrode Capacitances:	2			
Grid No.1 to plate . .	-	-	0.13	μμf
Grid No.1 to cathode .	-	14.3	17.7	μμf
Plate to cathode . . .	-	0.0065	0.0155	μμf
Grid No.1 to grid No.2.	-	19.8	24.2	μμf
Grid No.2 to plate . .	-	5.7	7.1	μμf
Grid No.2 to cathode .	-	2.6	3.6	μμf
Cathode to heater. . .	-	2.5	4.1	μμf
3. Grid-No.1 Voltage. . . .	1,3	-8	-19	volts
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 amp
7. Interelectrode Leakage Resistance	5	1	-	megohm

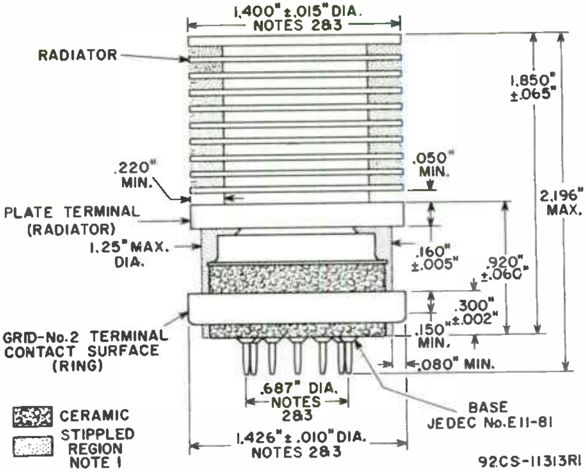
Note 1: With 13.5 volts ac or dc on heater.

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 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.



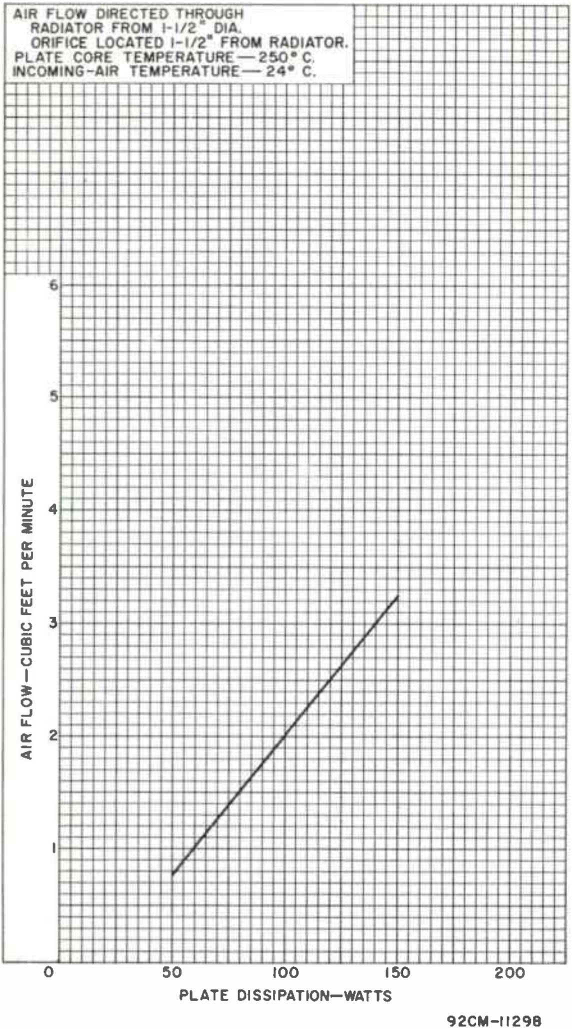
NOTE 1: KEEP ALL STIPPLED REGIONS CLEAR. DO NOT ALLOW CONTACTS OR CIRCUIT COMPONENTS TO PROTRUDE INTO THESE ANNULAR VOLUMES.

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:

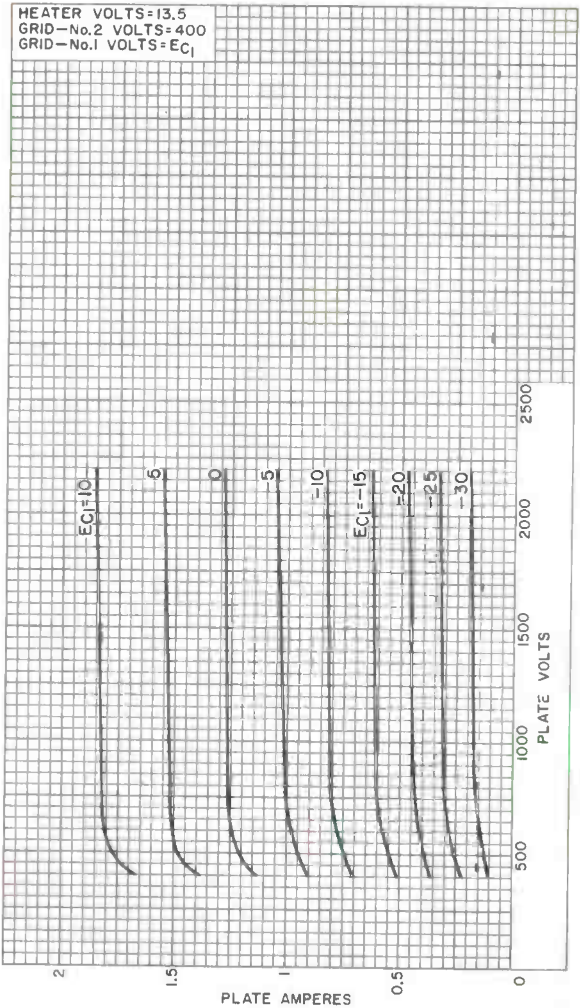
Radiator to Grid-No.2 Terminal Contact Surface	0.030" max.
Radiator to Pin Circle	0.040" max.
Grid-No.2 Terminal Contact Surface to Pin Circle	0.030" max.

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 RUN-OUT AND ELLIPTICITY.

TYPICAL COOLING REQUIREMENTS

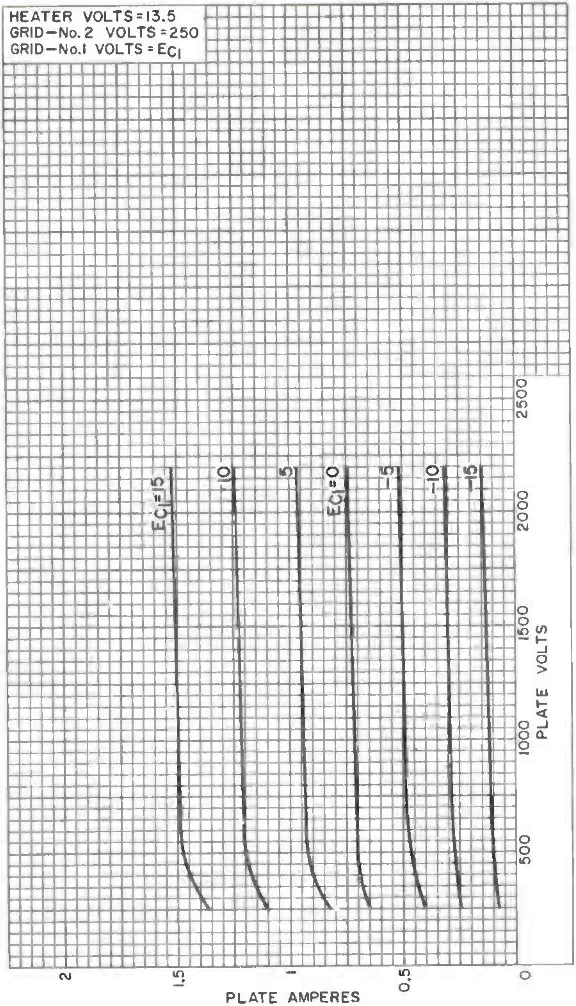


TYPICAL PLATE CHARACTERISTICS



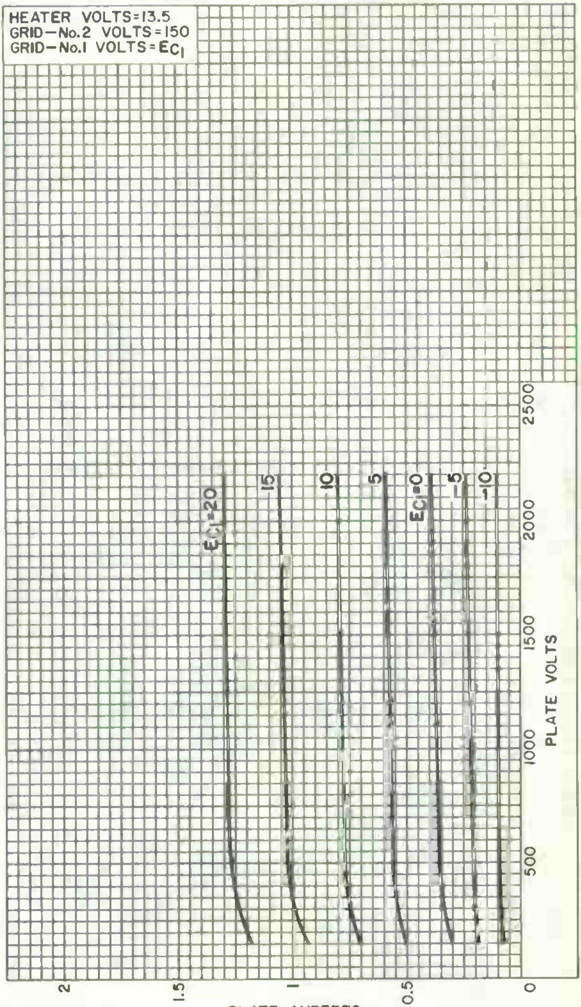
92CM—11290

TYPICAL PLATE CHARACTERISTICS



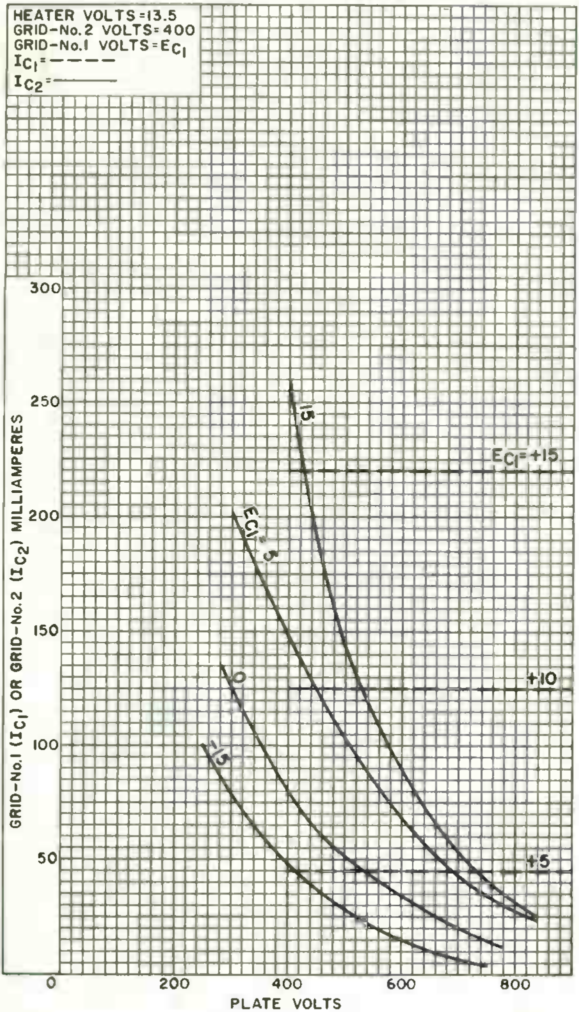
92CM—11288

TYPICAL PLATE CHARACTERISTICS



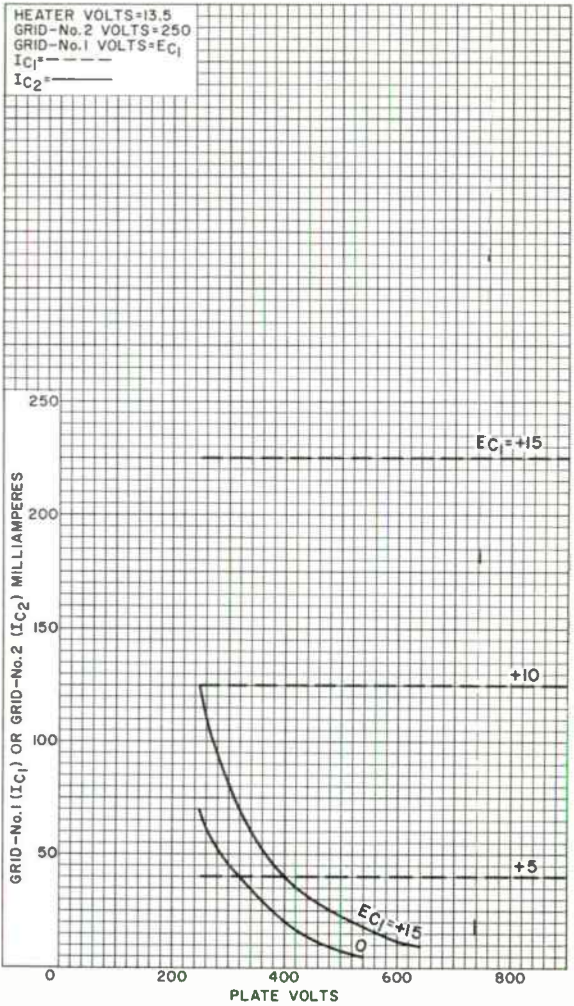
92CM—11289

TYPICAL CHARACTERISTICS



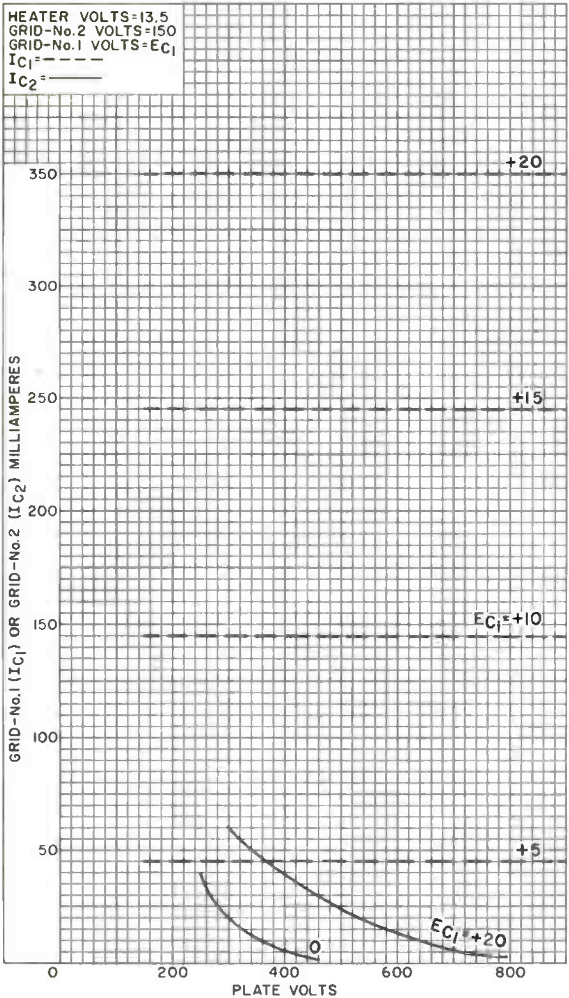
92CM-11293R1

TYPICAL CHARACTERISTICS



92CM-11291

TYPICAL CHARACTERISTICS



92CM-11292

Beam Power Tube

FORCED-AIR COOLED

CERAMIC-METAL SEALS
COAXIAL ELECTRODE STRUCTURE
UNIPOTENTIAL CATHODE

380 WATTS PEP OUTPUT AT 30 Mc
300 WATTS CW OUTPUT AT 470 Mc
INTEGRAL RADIATOR

Full Ratings up to 500 Mc

GENERAL DATA

Electrical:

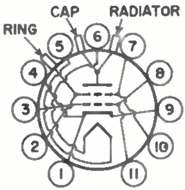
Heater, for Unipotential Cathode:		
Voltage (AC or DC)[a]	13.5 ± 10%	volts
Current at 13.5 volts	1.3	amp
Minimum heating time	60	sec
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 450, grid-No.2 volts = 325, plate amperes = 1.2	12	
Direct Interelectrode Capacitances:[b]		
Grid No.1 to plate	0.13 max.	μμf
Grid No.1 to cathode	16	μμf
Plate to cathode	0.011	μμf
Grid No.1 to grid No.2	22	μμf
Grid No.2 to plate	6.5	μμf
Grid No.2 to cathode	3.2	μμf
Cathode to heater	3.4	μμf

Mechanical:

Operating Position	Any
Maximum Overall Length	2.26"
Seated Length	1.920" ± 0.065"
Diameter	1.625" ± 0.015"
Weight (Approx.)	3.5 oz
Socket	Mycalex[c] No.CP464-2, or equivalent
Base	Large-Wafer Elevenar 11-Pin with Ring (JEDEC No.E11-81)

Terminal Connections (See *Dimensional Outline*):
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
CAP - Plate Terminal
RADIATOR - Plate Terminal
RING[d] - Grid-No.2 Terminal Contact Surface

Thermal:

Terminal Temperature (All terminals)	250 max.	°C
Radiator Core Temperature (See *Dimensional Outline*)	250 max.	°C

Air Flow:
See accompanying *Typical Cooling Requirements* curve.

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:*

	Up to 500 Mc		
DC PLATE VOLTAGE	2200	max.	volts
DC GRID-No.2 VOLTAGE	400	max.	volts
DC GRID-No.1 VOLTAGE	-100	max.	volts
DC PLATE CURRENT AT PEAK OF ENVELOPE	450[e]	max.	ma
DC GRID-No.1 CURRENT	100	max.	ma
PLATE DISSIPATION	400	max.	watts
GRID-No.2 DISSIPATION	8	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	
DC Plate Voltage	2000	volts
DC Grid-No.2 Voltage[f]	400	volts
DC Grid-No.1 Voltage[f]	-35	volts
Zero-Signal DC Plate Current	100	ma
Effective RF Load Resistance	3050	ohms
DC Plate Current:		
Peak of envelope	335	ma
Average	250	ma
DC Grid-No.2 Current:		
Peak of envelope	10	ma
Average	7	ma
Average DC Grid-No.1 Current	0.05[g]	ma
Peak-of-Envelope Driver Power Output (Approx.)[h]	0.3	watt
Output-Circuit Efficiency (Approx.)	90	%
Distortion Products Level:[j]		
Third order	29	db
Fifth order	32	db
Useful Power Output (Approx.):		
Peak of envelope	380[k]	watts
Average	190[k]	watts

Maximum Circuit Values:

Grid-No.1 Circuit Resistance under any condition:			
With fixed bias	25000	max.	ohms
With fixed bias (In Class-AB_1 operation)	100000	max.	ohms
With cathode bias	Not recommended		
Grid-No.2-Circuit Impedance	10000	max.	ohms
Plate-Circuit Impedance	m		

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

Maximum CCS Ratings, ***Absolute-Maximum Values:***

	Up to 500 Mc	
DC PLATE VOLTAGE	2200 max.	volts
DC GRID-No.2 VOLTAGE	400 max.	volts
DC GRID-No.1 VOLTAGE	-100 max.	volts
DC PLATE CURRENT	300 max.	ma
DC GRID-No.1 CURRENT	100 max.	ma
GRID-No.2 DISSIPATION	8 max.	watts
PLATE DISSIPATION	400 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:

	In grid-drive circuit at 50 Mc				
DC Plate Voltage	700	1000	1500	2000	volts
DC Grid-No.2 Voltage	175	200	200	200	volts
DC Grid-No.1 Voltage	-10	-30	-30	-30	volts
DC Plate Current	300	300	300	300	ma
DC Grid-No.2 Current	25	20	20	20	ma
DC Grid-No.1 Current	50	40	40	30	ma
Driver Power Output (Approx.)[n]	1.2	2	2	2	watts
Useful Power Output	120[k]	175[k]	275[k]	375[k]	watts
	In grid-drive circuit at 470 Mc				
DC Plate Voltage	700	1000	1500	2000	volts
DC Grid-No.2 Voltage	200	200	200	200	volts
DC Grid-No.1 Voltage	-30	-30	-30	-30	volts
DC Plate Current	300	300	300	300	ma
DC Grid-No.2 Current	10	10	5	5	ma
DC Grid-No.1 Current	30	30	30	30	ma
Driver Power Output (Approx.)[n]	5	5	5	5	watts
Useful Power Output	100[p]	165[p]	235[p]	300[p]	watts

Maximum Circuit Values:

Grid-No.1 Circuit Resistance under any condition:		
With fixed bias	25000 max.	ohms
Grid-No.2-Circuit Impedance	10000 max.	ohms
Plate-Circuit Impedance	m	

[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, heater volts = 12.5 (approx.).

[b] Measured with special shield adapter.

[c] Mycalex Corporation of America, 125 Clifton Boulevard, Clifton, New Jersey.

[d] For use at higher frequencies.

[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.

f Obtained preferably from a separate, well-regulated source.

g 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.

h Driver power output represents circuit losses and is the actual power measured at input to grid No.1 circuit. The actual power required depends on the operating frequency and the circuit used. The tube driving power is approximately zero watts.

j With maximum signal output used as a reference, and without the use of feedback to enhance linearity.

k This value of useful power is measured at load of output circuit.

m The tube should see an effective plate supply impedance which limits the peak current through the tube under surge conditions to 15 amperes.

n Driver power output includes circuit losses and is the actual power measured at the input to the grid circuit. It will vary depending upon the frequency of operation and the circuit used.

p Measured in a typical coaxial-cavity circuit.

CHARACTERISTICS RANGE VALUES

Test No.		*Note*	*Min.*	*Max.*	
1.	Heater Current.	1	1.15	1.45	amp
2.	Direct Interelectrode				
	Capacitances:	2			
	Grid No.1 to plate. . .	-	—	0.13	μμf
	Grid No.1 to cathode. .	-	14.3	17.7	μμf
	Plate to cathode. . . .	-	0.0065	0.0155	μμf
	Grid No.1 to grid No.2.	-	19.8	24.2	μμf
	Grid No.2 to plate. . .	-	5.7	7.1	μμf
	Grid No.2 to cathode. .	-	2.6	3.6	μμf
	Cathode to heater . . .	-	2.5	4.1	μμf
3.	Grid-No.1 Voltage	1,3	-8	-19	volts
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 amp
7.	Interelectrode Leakage				
	Resistance.	5	1	—	megohm

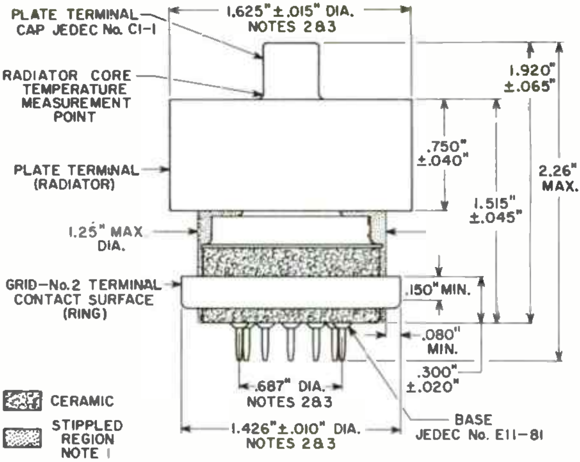
Note 1: With 13.5 volts ac or dc on heater.

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 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.



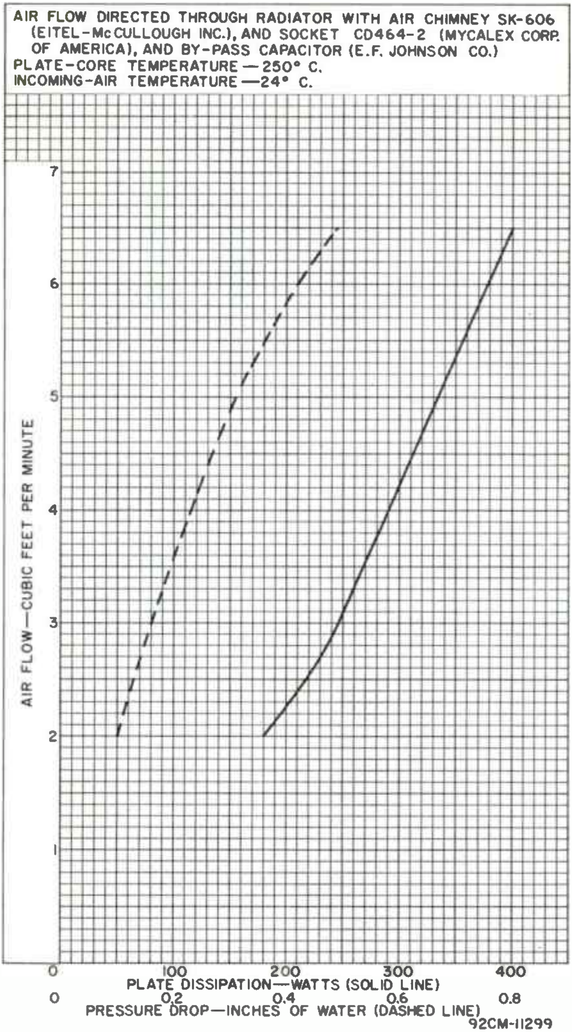
NOTE 1: KEEP ALL STIPPLED REGIONS CLEAR. DO NOT ALLOW CONTACTS OR CIRCUIT COMPONENTS TO PROTRUDE INTO THESE ANNULAR VOLUMES.

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:

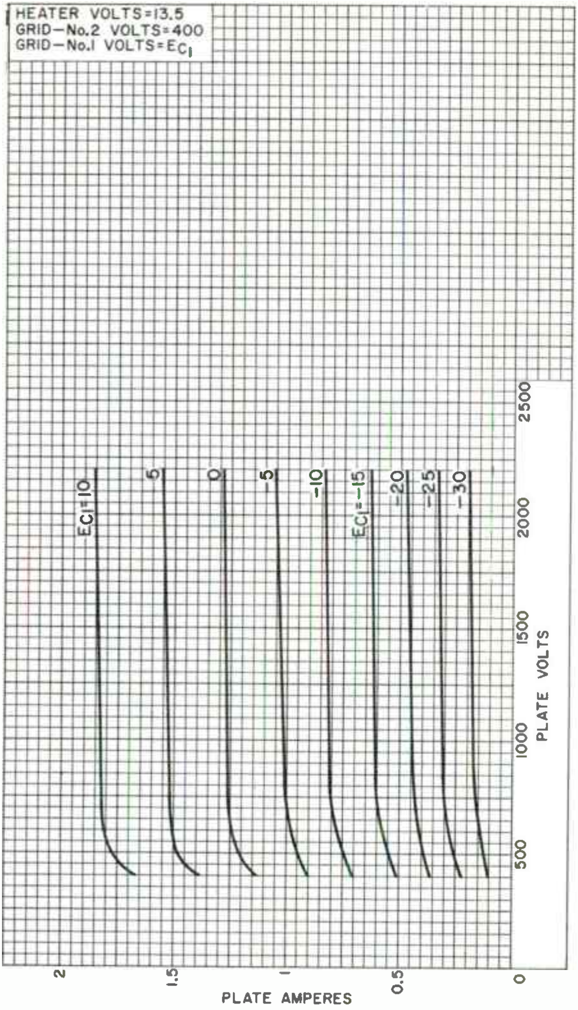
Radiator to Grid-No.2 Terminal Contact Surface. . . . . 0.030" max.
Radiator to Pin Circle. . . . . 0.040" max.
Grid-No.2 Terminal Contact Surface to Pin Circle . . . . 0.030" max.

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 RUN-OUT AND ELLIPTICITY.

TYPICAL COOLING REQUIREMENTS

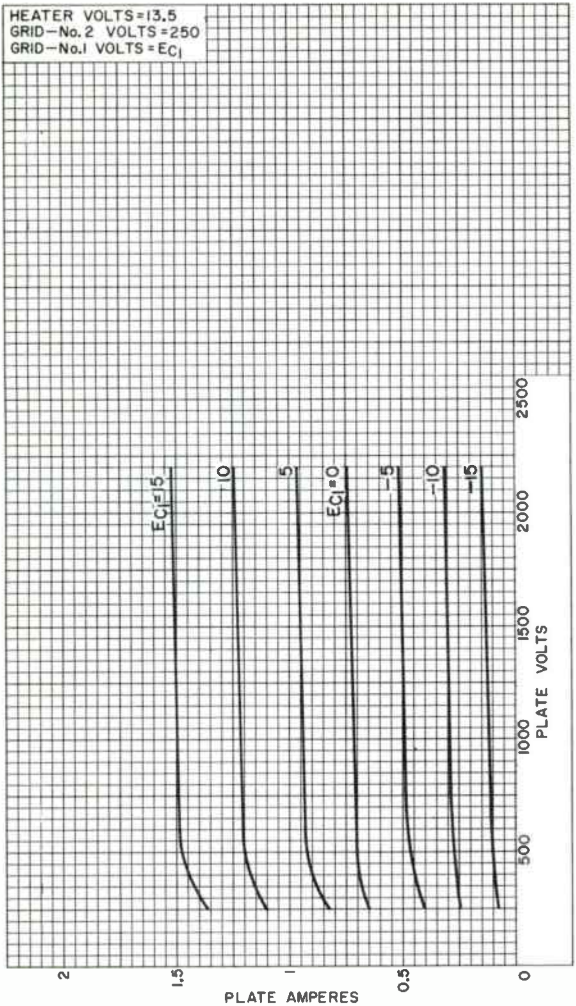


TYPICAL PLATE CHARACTERISTICS



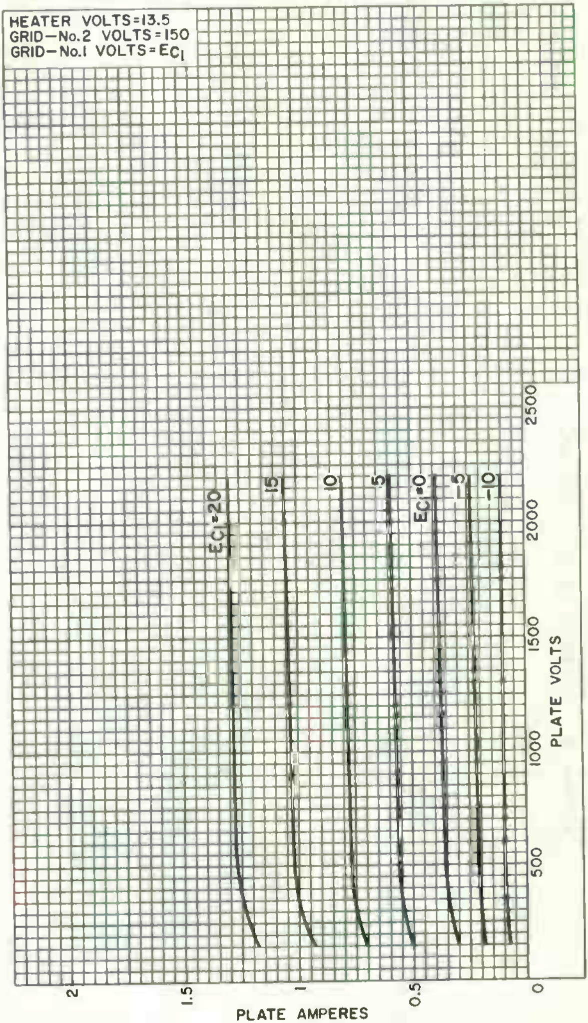
92CM—11290

TYPICAL PLATE CHARACTERISTICS



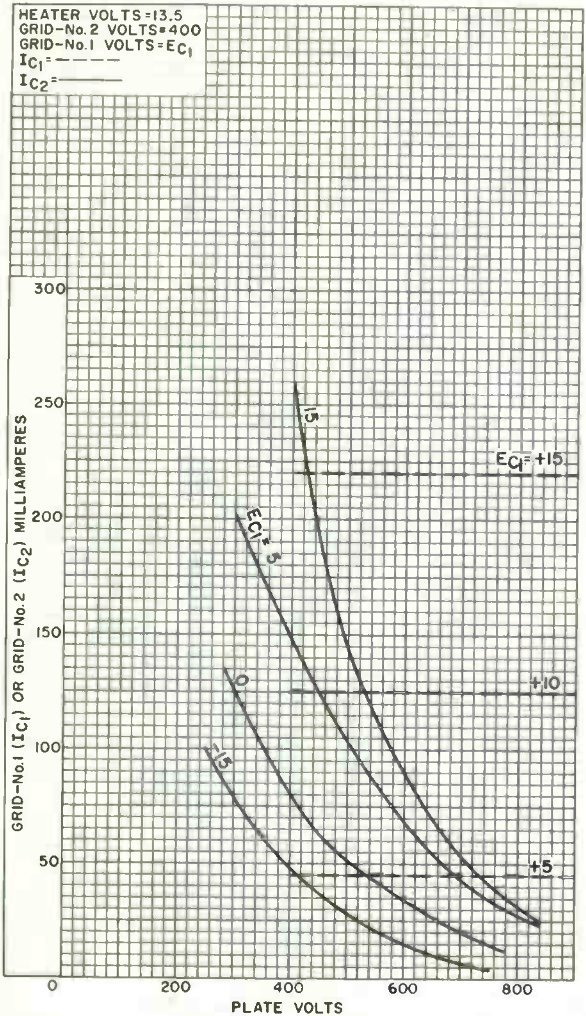
92CM-11288

TYPICAL PLATE CHARACTERISTICS



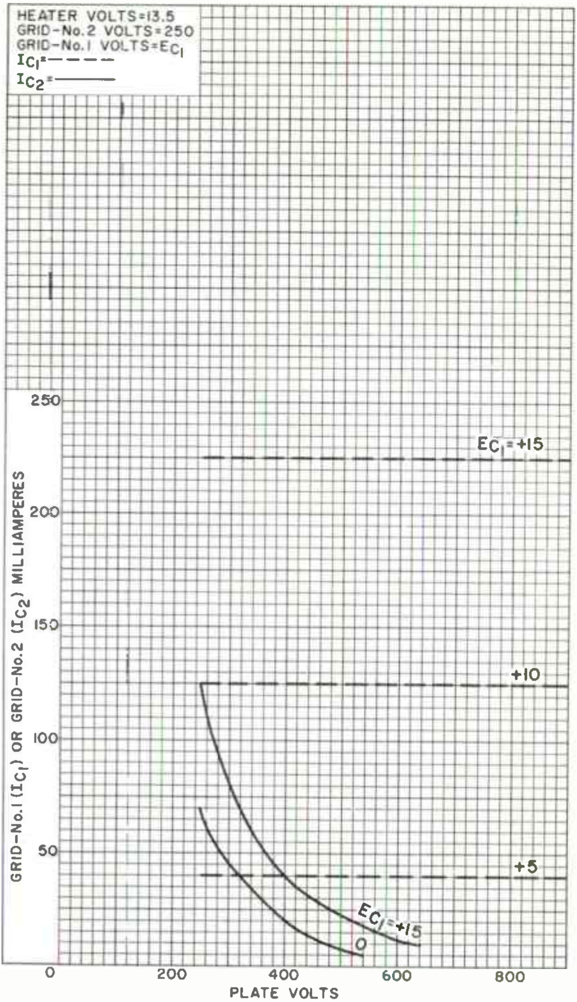
92CM—11289

TYPICAL CHARACTERISTICS



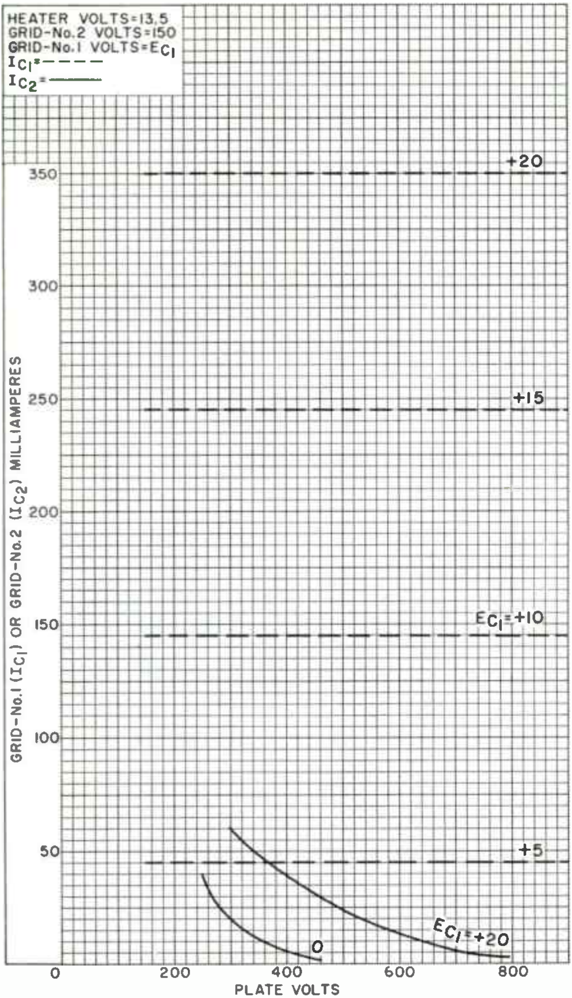
92CM-11293R1

TYPICAL CHARACTERISTICS



92CM-11291

TYPICAL CHARACTERISTICS



92CM-11292

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:

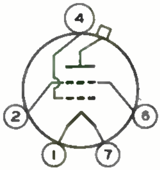
	Min.	*Av.*	*Max.*	
Filament, Thoriated Tungsten:				
Voltage (AC or DC)	-	6[a]	-	volts
Current at filament volts = 6 . .	3.2		3.8	amp
Mu-Factor, Grid No.2 to Grid No.1 .	5	-	7	
Direct Interelectrode Capacitances (Approx.):				
Grid No.1 to plate	-	-	0.12	pf
Grid No.1 to filament and grid No.2.	6	-	8.5	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

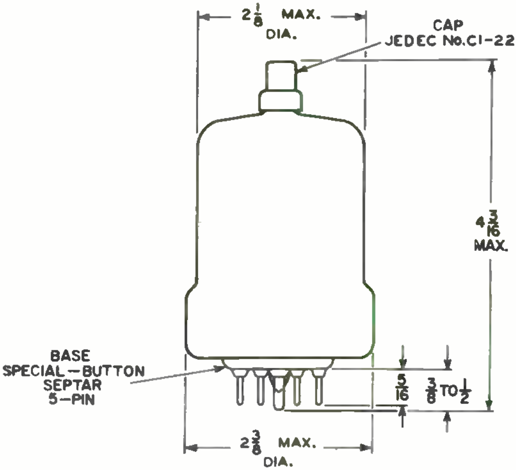
DC PLATE VOLTAGE	2500 max.	volts
DC GRID-No.2 VOLTAGE	400 max.	volts
DC GRID-No.1 VOLTAGE	-500 max.	volts
DC PLATE CURRENT	120 max.	ma
GRID-No.2 INPUT	10 max.	watts
GRID-No.1 INPUT	5 max.	watts
PLATE DISSIPATION	45 max.	watts

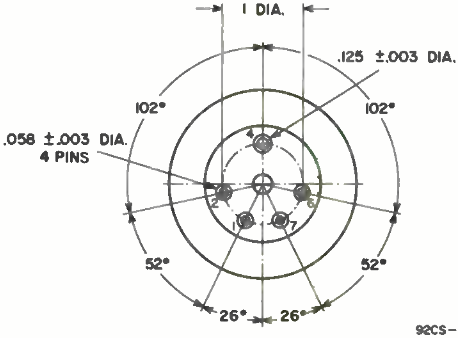
[a] The filament voltage, as measured at the filament pins, should be 6.0 volts. For long life, excursions from this value should not exceed ± 5 per cent.

[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

8168/4CX1000A

Beam Power Tube

FORCED-AIR COOLED

GENERAL DATA

Electrical:

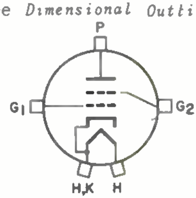
	Min.	*Av.*	*Max.*	
Heater, for Unipotential Cathode:				
Voltage (AC or DC). . . .	-	6 ± 5%	-	volts
Current at 6 volts. . . .	9.5		11.5	amp
Heating Time.	3	-	-	minutes
Transconductance.	-	37000	-	μmhos
Direct Interelectrode Capacitances (Approx.)[a]:				
Grid No.1 to plate. . . .	-	-	0.02	pf
Grid No.1 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

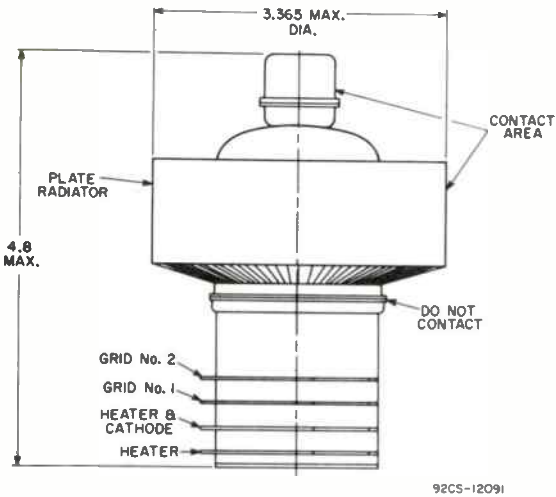
AF POWER AMPLIFIER & MODULATOR — Class AB_1[b]
and
LINEAR RF POWER AMPLIFIER
Single-Sideband Suppressed-Carrier Service

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

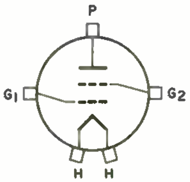
Electrical:

	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

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:***

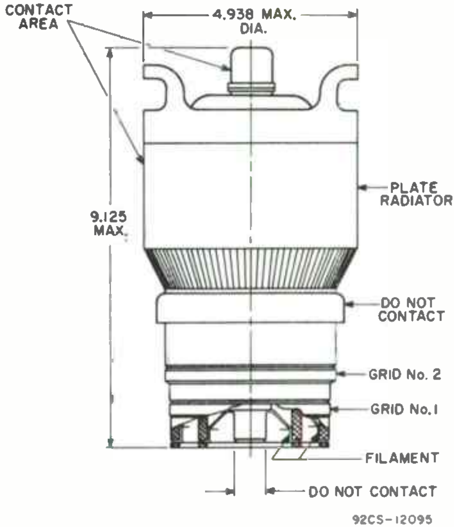
At frequencies up to 30 Mc

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

Power Triode

NUVISTOR TYPE

ALL-CERAMIC-AND-METAL CONSTRUCTION

For Class C RF Power Amplifier and Oscillator Service, DC Pulse-Amplifier and Frequency-Multiplier Tube Applications, Including Use in Equipment in which Ability to Withstand Severe Mechanical Shock and Vibration, Compactness, and Exceptional Uniformity of Characteristics are Primary Requirements.

Electrical:

Heater Characteristics and Ratings:

Voltage (AC or DC)	6.3 ± 0.6	volts
Current at 6.3 volts	0.160	amp
Peak heater-cathode voltage (CCS[a] or ICAS[b] conditions):		
Heater negative with respect to cathode	100 max.	volts
Heater positive with respect to cathode	100 max.	volts

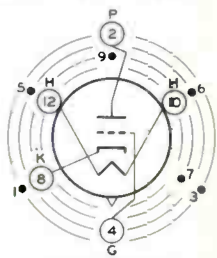
Direct Interelectrode Capacitances (Approx.):

Grid to plate	2.2	pf
Input: G to (K,S,H)	4.2	pf
Output: P to (K,S,H)	1.6	pf
Cathode to plate	0.26	pf
Heater to cathode	1.5	pf

Mechanical:

Operating Position	Any
Type of Cathode	Coated Unipotential
Maximum Overall Length	0.800"
Maximum Seated Length	0.625"
Maximum Diameter	0.440"
Weight (Approx.)	1.9 grams
Envelope	Metal Shell MT4
Socket	See *Socket & Connector Information for RCA Nuvistor Tubes* at front of this Section
Base	Medium Ceramic-Wafer Twelvar 5-Pin (JEDEC No.E5-65)
Basing Designation for BOTTOM VIEW	12AQ

Pin 1[c] – Do Not Use
Pin 2 – Plate
Pin 3[c] – Do Not Use
Pin 4 – Grid
Pin 5[c] – Do Not Use
Pin 6[c] – Do Not Use
Pin 7[c] – Do Not Use
Pin 8 – Cathode
Pin 9[c] – Do Not Use
Pin 10 – Heater
Pin 11 – Omitted
Pin 12 – Heater



INDEX = LARGE LUG
● = SHORT PIN; IC — DO NOT USE

Characteristics, Class A1 Amplifier:

DC Plate Supply Voltage	75	150	volts
Grid Supply Voltage	0	0	volts
Cathode Resistor	100	560	ohms
Amplification Factor	35	30	
Plate Resistance (Approx.)	2700	5000	ohms
Transconductance	13000	6000	μmhos
Plate Current	11.5	7	ma
Grid Voltage (Approx.) for plate μa = 10	-6.5	-15	volts

RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy[d]

and

RF POWER AMPLIFIER — Class C FM Telephony

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

For operation at frequencies up to 250 Mc

	CCS	ICAS	
DC Plate Supply Voltage	400[e] max.	400[e] max.	volts
DC Plate Voltage	250[e] max.	300[e] max.	volts
DC Grid Voltage:			
Negative-bias value	100 max.	100 max.	volts
Positive-bias value	0 max.	0 max.	volts
Peak-Positive Grid Voltage	5 max.	5 max.	volts
DC Cathode Current	25 max.	30 max.	ma
DC Grid Current	5 max.	6 max.	ma
Plate Dissipation	1.5 max.	1.8 max.	watts

Typical CCS Operation:

As rf power amplifier in cathode-drive circuit at 160 Mc

DC Plate-to-Grid Voltage	155	volts
DC Cathode-to-Grid Voltage	14	volts
From a grid resistor of	2700	ohms
DC Cathode Current	21	ma
DC Grid Current	5	ma
Driver Power Output (Approx.)	0.4	watt
Useful Power Output (Approx.)	1.55[f]	watts

As rf oscillator at 160 Mc

DC Plate Voltage	100	volts
DC Grid Voltage	-3.4	volts
From a grid resistor of	1500	ohms
DC Cathode Current	18	ma
DC Grid Current	2.5	ma
Useful Power Output (Approx.)	0.8[f]	watt

Maximum Circuit Values:

Grid-Circuit Resistance (CCS or ICAS conditions):[g]
For fixed-bias or cathode-bias operation . . 50000 max. ohms

FREQUENCY MULTIPLIER

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

For operation at frequencies up to 250 Mc

	CCS		ICAS		
DC Plate Supply Voltage	400[e]	max.	400[e]	max.	volts
DC Plate Voltage	250[e]	max.	250[e]	max.	volts
DC Grid Voltage:					
Negative-bias value	200	max.	200	max.	volts
Positive-bias value	0	max.	0	max.	volts
Peak-Positive Grid Voltage	5	max.	5	max.	volts
DC Cathode Current	20	max.	24	max.	ma
DC Grid Current	3	max.	4	max.	ma
Plate Dissipation	1.3	max.	1.5	max.	watts

Typical CCS Operation:

As a doubler from 80 to 160 Mc

DC Plate Voltage	125	volts
DC Grid Voltage	-70	volts
From a grid resistor of	18000	ohms
DC Cathode Current	22	ma
DC Grid Current	4	ma
Driver Power Output (Approx.)	0.25	watt
Useful Power Output (Approx.)	0.85[f]	watt

Maximum Circuit Values:

Grid-Circuit Resistance (CCS or ICAS conditions):[g]
For fixed bias or cathode-bias operation . 50000 max. ohms

DC PULSE AMPLIFIER

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

Peak Positive-Pulse Plate Voltage	500[e]	max.	volts
DC Plate Voltage	250[e]	max.	volts
DC Grid Voltage:			
Negative-bias value	100	max.	volts
Positive-bias value	0	max.	volts
Peak Positive Grid Voltage	5	max.	volts
DC Grid Current	5	max.	ma
DC Cathode Current	18	max.	ma
Peak Cathode Current:			
For duty factors up to 1 per cent	250	max.	ma
For duty factors between 1 and 50 per cent	See *Pulse Rating Chart*		
Plate Dissipation	1	max.	watt

Maximum Circuit Values:

Grid-Circuit Resistance:[g]

For fixed-bias operation	0.5	max.	megohm
For cathode-bias operation	1	max.	megohm

[a] Continuous Commercial Service.

[b] Intermittent Commercial and Amateur Service. No operating or "ON" period exceeds 5 minutes and every "ON" period is followed by an "OFF" or stand-by period of the same or greater duration.

[c] Pins 1,3,5,6,7, and 9 are of a length such that their ends do not touch the socket insertion plane.

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 per cent of the carrier conditions.

e Under no circumstances should this absolute-maximum value be exceeded. For high-altitude operation the maximum permissible plate supply voltage and plate voltage for the 8203 are dependent on atmospheric pressure. See accompanying graph of *Low-Pressure Voltage-Breakdown Characteristics of Nuvistor Triode Base.*

f Measured at load of output circuit.

g For operation at metal-shell temperature of 150° C. For operation at other metal-shell temperatures, see accompanying *Grid-Circuit Resistance Rating Chart.* Metal-shell temperatures are measured in Zone "A" as shown on accompanying *Dimensional Outline.*

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Heater Current	1	0.150	0.170	amp
Direct Interelectrode Capacitances:				
Grid to plate	2	1.8	2.6	pf
Input: G to (K,S,H)	2	3.8	4.6	pf
Output: P to (K,S,H)	2	1.4	1.8	pf
Cathode to plate	2	0.20	0.32	pf
Heater to cathode	2	1.2	1.8	pf
Plate Current (1)	1,3	5.0	9.5	ma
Plate Current (2)	1,4	-	50	μa
Transconductance	1,3	4000	8000	μmhos
Reverse Grid Current	1,5	-	0.1	μa
AC Emission	6,7	10	-	ma
Amplification Factor	1,3	20	40	
Heater-Cathode Leakage Current:				
Heater negative with respect to cathode	1,8	-	5	μa
Heater positive with respect to cathode	1,8	-	5	μa
Leakage Resistance:				
Between grid and all other electrodes tied together	1,9	1000	-	megohms
Between plate and all other electrodes tied together	1,10	1000	-	megohms
Useful Power Output	1,11	0.9	-	watt
Peak Cathode Emission Current (Pulsed)	1,12	250	-	ma

Note 1: With ac or dc heater volts = 6.3.

Note 2: Measured in accordance with EIA Standard RS-191-A.

Note 3: With dc plate supply volts = 150, dc grid supply volts = 0, cathode resistor (ohms) = 560, cathode-bypass capacitor (μf) = 1000, and metal shell connected to ground.

Note 4: With dc plate volts = 150, dc grid volts = -15, and metal shell connected to ground.

Note 5: With dc plate supply volts = 100, dc grid supply volts = 1.7, grid-circuit resistance (megohm) ≤ 1 (the internal resistance of the current meter used for this measurement), and metal shell connected to ground.

Note 6: With ac or dc heater volts = 5.5.

Note 7: With dc plate supply volts = 50, dc grid supply volts = -5.7, 60-cps grid-signal volts (rms) = 7.5, dc resistance of transformer secondary winding in grid circuit ≤ 2 ohms, grid-voltage-supply bypass capacitor (μf) = 1000, and metal shell connected to ground. AC emission is measured as the dc component of plate current at these conditions.

Note 8: With dc heater-cathode volts = 100.

Note 9: With grid 100 volts negative with respect to all other electrodes tied together, and metal shell connected to ground.

Note 10: With plate 300 volts negative with respect to all other electrodes tied together, and metal shell connected to ground.

Note 11: Measured at load in 250-Mc rf amplifier circuit with dc plate supply volts = 150, grid resistor (ohms) = 4700, driver power output (milliwatts) = 350, and plate milliamperes = 20.

Note 12: With dc plate supply volts = 250 and dc grid supply volts = -20. The grid is driven with pulse voltage, as follows: peak volts between grid and negative end of cathode resistor = 5, pulse repetition rate = 1000, pulse duration = 10 μs, pulse rise time ≤ 1 μs, and time of fall ≤ 1 μs. Peak cathode current is measured with a high impedance oscilloscope or equivalent device connected across a 1-ohm cathode resistor.

SPECIAL TESTS

Shock:

Peak Impact Acceleration . . . . 1000 g

This test is performed on a sample lot of tubes to determine the ability of the tube to withstand the specified Peak Impact Acceleration. Tubes are held rigid in each of four positions (X_1, X_2, Y_1, and Y_2) in a Navy Type, High-Impact (Flyweight) Shock Machine, and, with tube electrode voltages applied, are subjected to 20 blows (5 in each position) at the specified Peak Impact Acceleration.

At the end of this test, tubes are criticized for Shorts and Continuity, Change in Transconductance, Reverse Grid Current, Heater-Cathode Leakage Current, and Variable-Frequency Vibration.

Variable-Frequency Vibration:

This test is performed on a sample lot of tubes operated under the conditions specified in CHARACTERISTICS RANGE VALUES for Transconductance, 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 of 3000 to 15000 cycles per second with a constant vibrational acceleration of 1g. During the test, tube must not show an rms output voltage across the plate-load resistor in excess of:

25 millivolts over the frequency range of 3000 to 6000 cps
500 millivolts over the frequency range of 6000 to 15000 cps

Post-Impact and Post-Sweep-Frequency Fatigue Vibration limits:

35 millivolts over the frequency range of 3000 to 6000 cps
700 millivolts over the frequency range of 6000 to 15000 cps

Sweep-Frequency Fatigue Vibration:

This test is performed on a sample lot of tubes with only heater voltage of 6.3 volts applied. During operation, the tube is rigidly mounted and is vibrated through the frequency range of 5 to 500 cps and back to 5 cps. One such vibration sweep cycle takes approximately 15 minutes. The tubes are vibrated for a period of 3 hours along each of 3 mutually perpendicular axes for a total of 9 hours. The longitudinal axis of the tube is coincident with one of the 3 axes. The vibrations are applied as follows:

a From 5 to 50 cps with a constant peak-to-peak displacement of 0.080 inch.
b From 50 to 500 cps with a constant acceleration of 10 g.
c From 500 to 50 cps and then to 5 cps follows the procedure shown in *a* and *b*, but in reverse.

At the end of this test, tubes are criticized for Shorts and Continuity, Change in Transconductance, Reverse Grid Current, Heater-Cathode Leakage Current, and Vibration-Frequency-Vibration.

Low-Pressure Voltage Breakdown:

This test is performed on a sample lot of tubes to determine the ability of the tube to withstand high-altitude (low-air-pressure) conditions. Tubes are operated with 250 rms volts applied between the plate and all other electrodes and metal shell connected together. The tubes must not break down or show evidence of corona when subjected to air pressure equivalent to an altitude of 100,000 feet (8.0 ± 0.5 mm Hg):

Shorts and Continuity:

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 (Specifications for this tapper will be supplied on request). The areas of acceptance and rejection for this test are shown in the accompanying graph, *Shorts-Test Acceptance Limits*. Tubes are criticized for permanent or temporary shorts and open circuits.

Intermittent Conduction Life (1000 hours):

This test is performed on a sample lot of tubes from each production run to assure the high quality of individual tubes and to prevent epidemic failures due to excessive changes in tube characteristics. Tubes are operated with heater voltage of 6.3 volts cycled 110 minutes on and 10 minutes off, and plate dissipation = 1.5 watts (approx.), at a shell temperature of 150° C.

Tubes are criticized at 2 hours, 20 hours, and 100 hours for Inoperatives[h] and Transconductance, and at 500 hours and 1000 hours for Inoperatives[h] and Useful Power Output at 250 Mc.

Oscillator Life (1000 hours):

This test is performed on a sample lot of tubes to assure satisfactory operation of the tube as a 250-Mc oscillator. Tubes are operated with heater volts = 6.3 and plate dissipation = 1.4 watts.

Tubes are criticized at 500 and 1000 hours for Inoperatives[h] and Useful Power Output at 250 Mc.

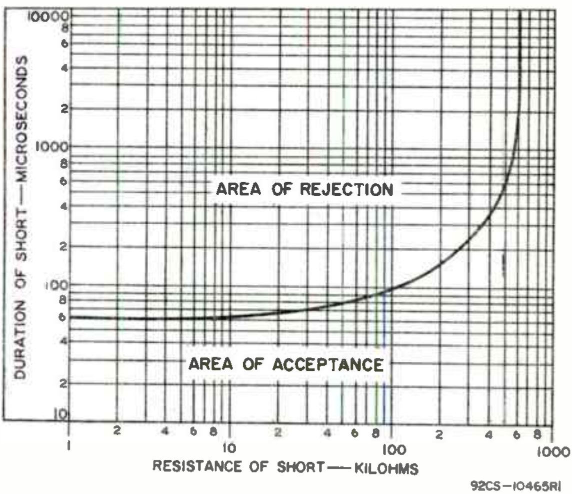
Grid Pulse Life (1000 hours):

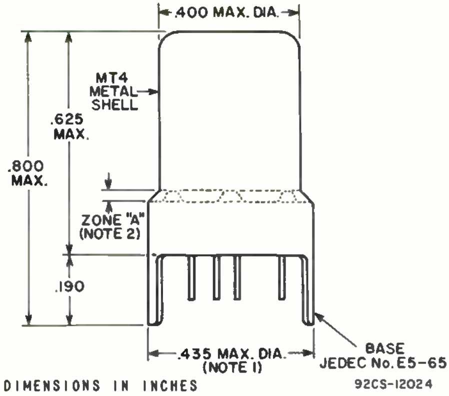
This test is performed on a sample lot of tubes from each production lot. Tubes are operated with heater voltage of 6.3 volts cycled 110 minutes on and 10 minutes off, dc plate supply volts = 300, dc grid supply volts = −20, grid resistor (ohms) = 47, and plate-load resistor (ohms) = 330. The grid is driven with pulse voltage, as follows: peak grid-to-cathode volts = 5, pulse repetition rate = 1000, pulse duration = 10 μs, pulse rise time $\leq$ 1 μs, and time of fall $\leq$ 2 μs.

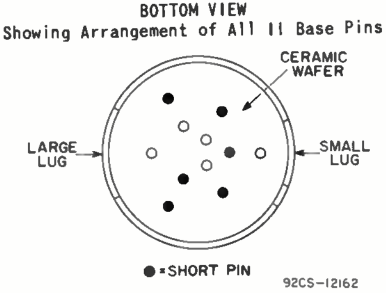
Tubes are tested at 500 hours and 1000 hours for Inoperatives[h] and Peak Cathode Emission Current (Pulsed).

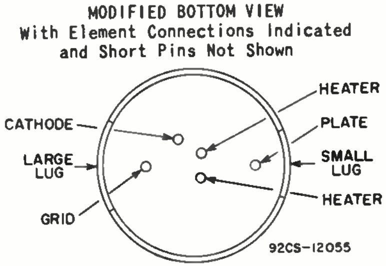
[h] An inoperative is defined as a tube having a discontinuity, permanent short, or air leak.

SHORTS-TEST ACCEPTANCE LIMITS





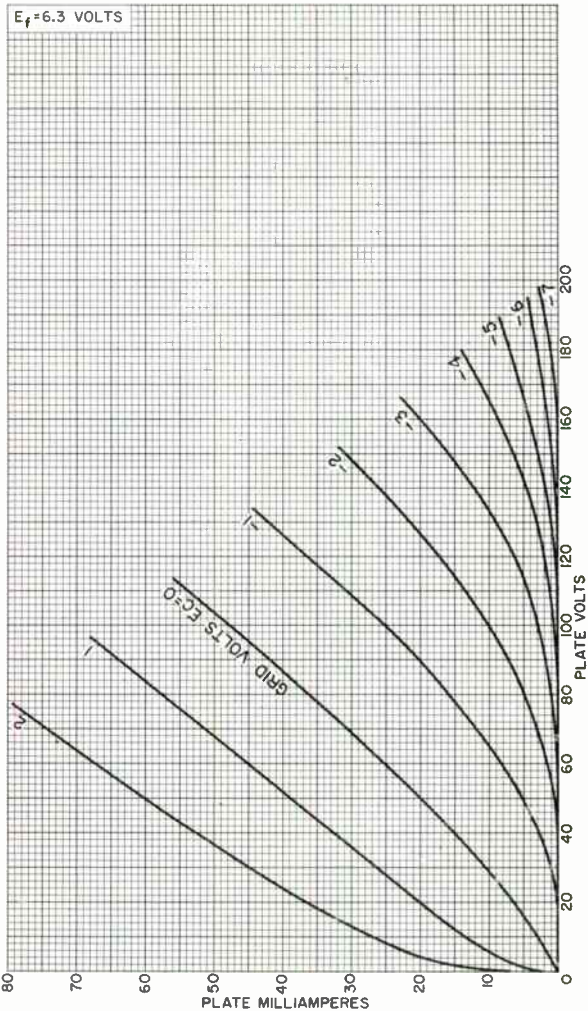




Note 1: Maximum outside diameter of 0.440" is permitted along 0.190" lug length.

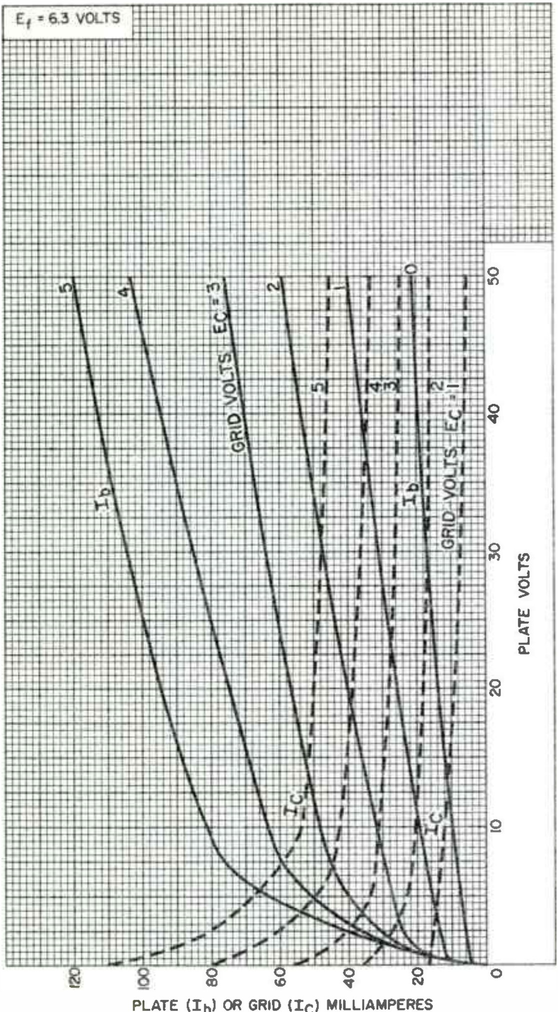
Note 2: Metal-shell temperature should be measured in zone "A".

AVERAGE PLATE CHARACTERISTICS



92CM-12508

AVERAGE CHARACTERISTICS



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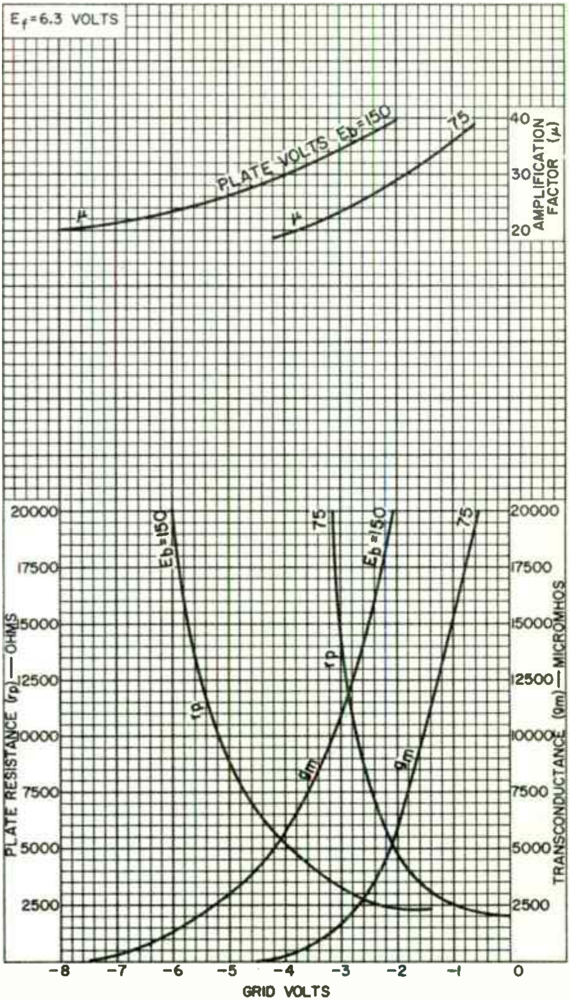
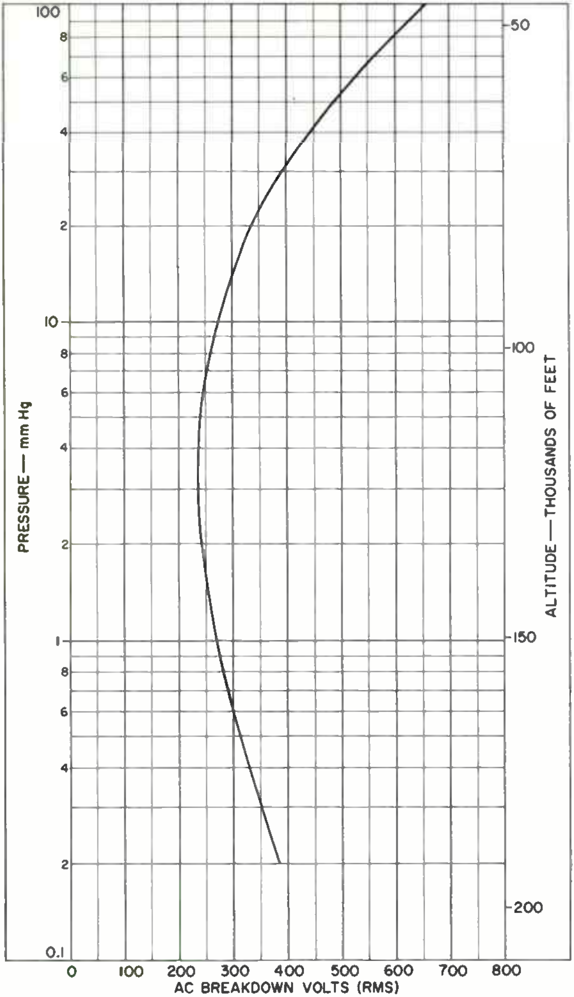
AVERAGE CHARACTERISTICS



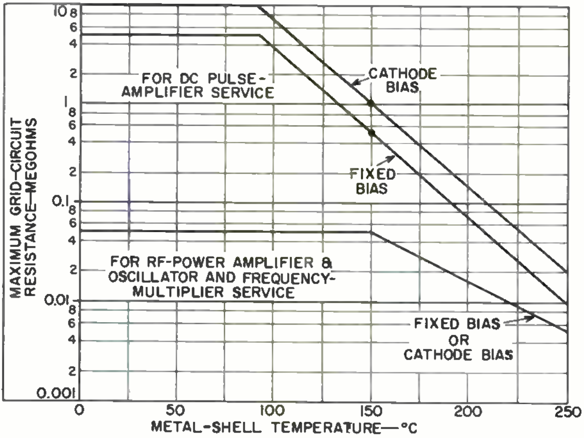
92CM-12507

LOW-PRESSURE VOLTAGE-BREAKDOWN CHARACTERISTICS OF NUVISTOR TRIODE BASE



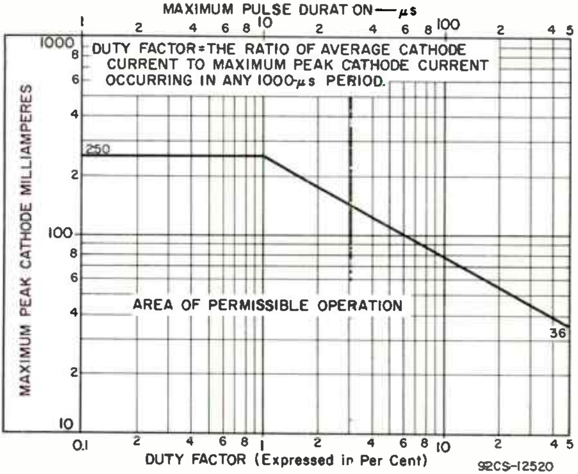
92CM-12509

GRID-CIRCUIT-RESISTANCE RATING CHART



92CS-12521

PULSE RATING CHART



92CS-12520

Beam Power Tube

CERMOLOX®

FORCED-AIR COOLED	HIGH GAIN-BANDWIDTH PRODUCTS
INTEGRAL RADIATOR	340 WATTS CW POWER OUTPUT AT 400 Mc
MATRIX-TYPE CATHODE	105 WATTS CW POWER OUTPUT AT 1215 Mc

For Compact Aircraft, Mobile, and Stationary Equipment Applications in the UHF Frequency Range

GENERAL DATA

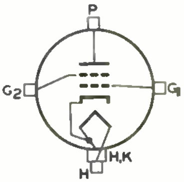
Electrical:

Heater, for Matrix-Type, Oxide-Coated, Unipotential Cathode:			
Voltage (AC or DC)[a]	6.3		volts
Current at heater volts = 6.3	3.2		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:[b]			
Grid No.1 to plate.	0.065	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.	3.2		pf
Grid No.2 to cathode & heater	1.30	max.	pf

Mechanical:

Operating Position. . . . . Any
Overall Length. . . . . 2.620" ± 0.090"
Greatest Diameter (See *Dimensional Outline*) . 1.625" ± 0.015"
Weight (Approx.). . . . . 4 oz
Radiator. . . . . Integral part of tube
Terminal Connections (See *Dimensional Outline*):

G1 - Grid-No.1-Terminal Contact Surface
G2 - 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 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 versus plate dissipation are shown in accompanying *Typical-Cooling-Requirements* curve.

To Plate, Grid-No.2, Grid-No.1, Cathode, and Heater Terminals — A sufficient quantity of air should be directed at the heater terminal and allowed to flow past 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-2501	AS-2501	AXIMAX 1	AXIMAX 1
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-201	AS-201	AXIMAX 1	AXIMAX 1
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 1	AXIMAX 1
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

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

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

DC PLATE VOLTAGE	2500 max.	volts
DC GRID-No.2 VOLTAGE	400 max.	volts
DC GRID-No.1 VOLTAGE	-200 max.	volts
DC PLATE CURRENT	250 max.	ma
DC GRID-No.1 CURRENT	30 max.	ma
GRID-No.2 INPUT[e]	10 max.	watts
PLATE DISSIPATION	300 max.	watts

Typical CCS Operation:

In cathode-drive circuit			
Frequency	*400*	*1215*	*Mc*
DC Plate Voltage	2500	1250	volts
DC Grid-No.2 Voltage	250	300	volts
DC Grid-No.1 Voltage[f]	-15	-30	volts
DC Plate Current	250	250	ma
DC Grid-No.2 Current	2	1	ma
DC Grid-No.1 Current	15	7	ma
Driver Power Output (Approx.)[g]	5	10	watts
Output-Circuit Efficiency	90	60	%
Useful Power Output[h]	340[j]	105	watts

Maximum Circuit Values:

Grid-No.1 Circuit Resistance	30000 max.	ohms
Grid-No.2 Circuit Impedance	10000 max.	ohms
Plate Circuit Impedance	k	

[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] Continuous Commercial Service.

[e] See *Operating Considerations under Grid No.2.*

[f] Obtained preferably from fixed supply and grid-No.1 resistor. Sufficient voltage should be provided from fixed supply to protect the tube in case of drive loss.

[g] Driver power output includes circuit losses and is the actual power measured at the input to the grid circuit. It will vary depending upon the frequency of operation and the circuit used.

[h] Measured in a typical coaxial-cavity circuit.

[j] For Minimum Useful Power Output value, see *Characteristics Range Values, Test No.8.*

[k] See *Operating Considerations under Precautions.*

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	-	0.065	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	2.7	3.7	pf
Grid No.2 to cathode & heater	2	-	1.30	pf
3. Grid-No.1 Voltage	1,3	-6.5	-20.5	volts
4. Grid-No.1 Cutoff Voltage	1,4	-	-65	volts
5. Reverse Grid-No.1 Current	1,3	-	-20	μa
6. Grid-No.2 Current	1,3	-8	+2	ma

Test No.	*Note*	*Min.*	*Max.*	
7. Interelectrode Leakage Resistance:				
Between plate and all other electrodes	5	10	-	megohms
Between any two electrodes except plate. . .	5	1	-	megohm
8. Useful Power Output.	6	300	-	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 120 ma.

Note 4: With dc plate voltage of 2500 volts, dc grid-No.2 voltage of 400 volts, and dc grid-No.1 voltage adjusted to give a dc plate current of 2.5 ma.

Note 5: 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 6: In a single-tube, cathode-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 2500 volts and driver power output of 5 watts, dc grid-No.2 voltage of 250 volts, grid-No.1 voltage and tuning circuit are adjusted for maximum power output with plate current not to exceed 250 ma and grid-No.1 current not to exceed 20 ma.

OPERATING CONSIDERATIONS

Heater

The heater of the 8226 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 supply voltage which will give the desired performance. Good regulation of the heater supply voltage is, in general, economically advantageous from the viewpoint of tube life; in no case should the voltage fluctuations be more than 5%. This recommendation is particularly applicable at the higher operating frequencies.

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 negative dc current as well as normal values of 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 currents of the order of one-tenth the required plate current.

Standby Operation

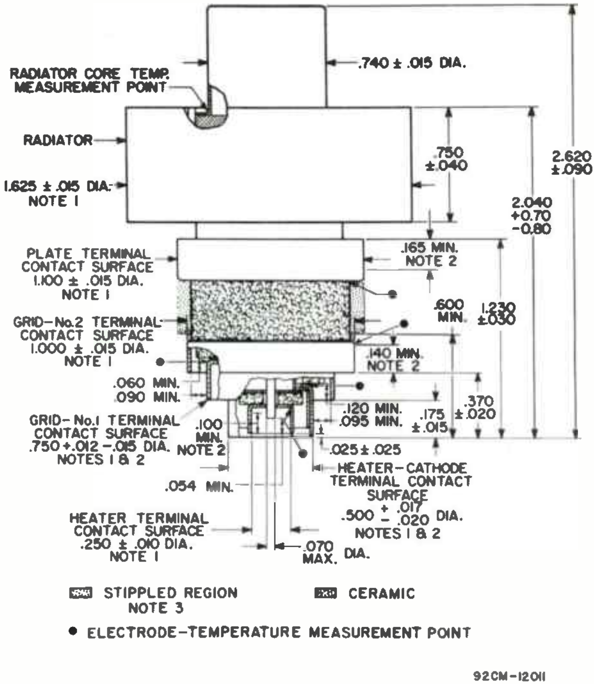
During long or frequent standby periods, the 8226 may be operated at decreased heater voltage to conserve life. It is recommended that the heater voltage be reduced to 80% of normal during standby periods up to 2 hours. For longer periods, the heater voltage should be turned off.

Precautions

In beam power tubes with closely spaced electrodes, such as the 8226, extremely high voltage gradients occur even with moderate tube operating voltages. Any arc-over 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.



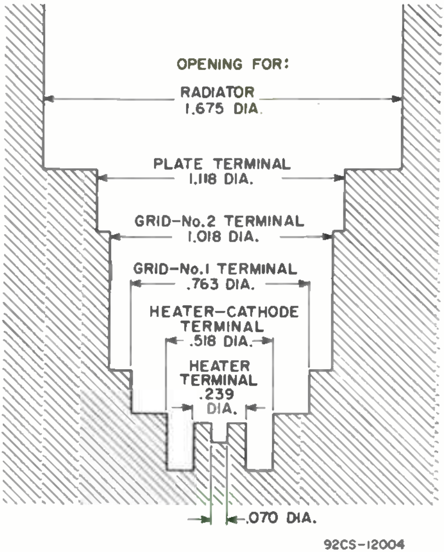
ALL DIMENSIONS IN INCHES

NOTE 1: SEE *SKETCH G1* FOR THE MAXIMUM DIAMETRICAL SPACE REQUIRED BY THE 8226 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.

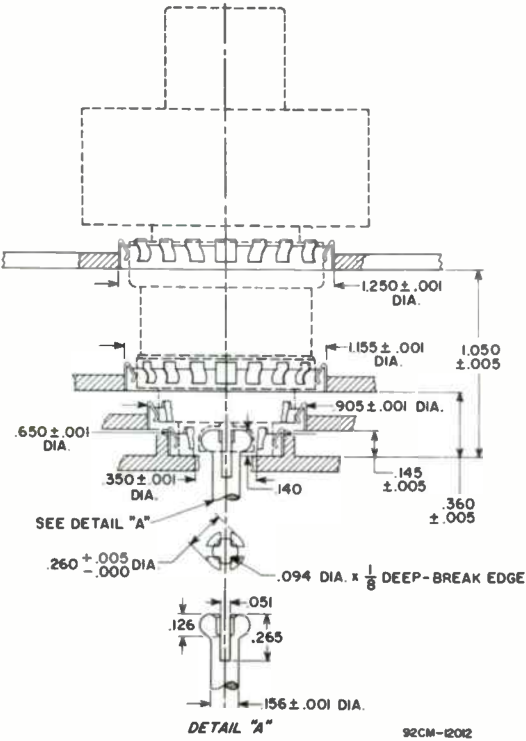
NOTE 3: KEEP ALL STIPPLED REGIONS CLEAR. DO NOT ALLOW CONTACTS OR CIRCUIT COMPONENTS TO PROTRUDE INTO THESE ANNULAR REGIONS.

SKETCH G1



ALL DIMENSIONS IN INCHES

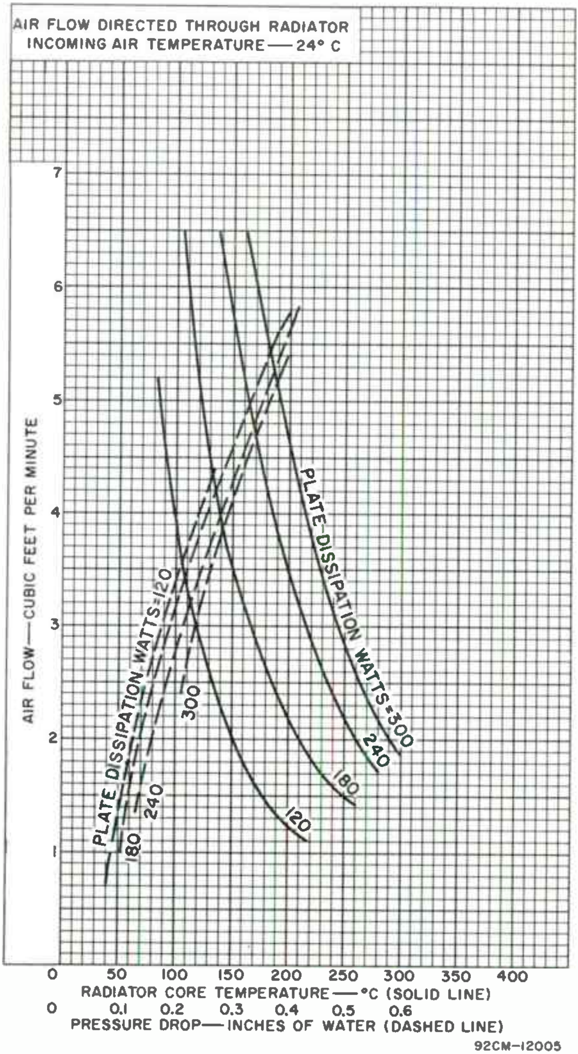
PREFERRED MOUNTING ARRANGEMENT
& LAYOUT OF ASSOCIATED CONTACTS



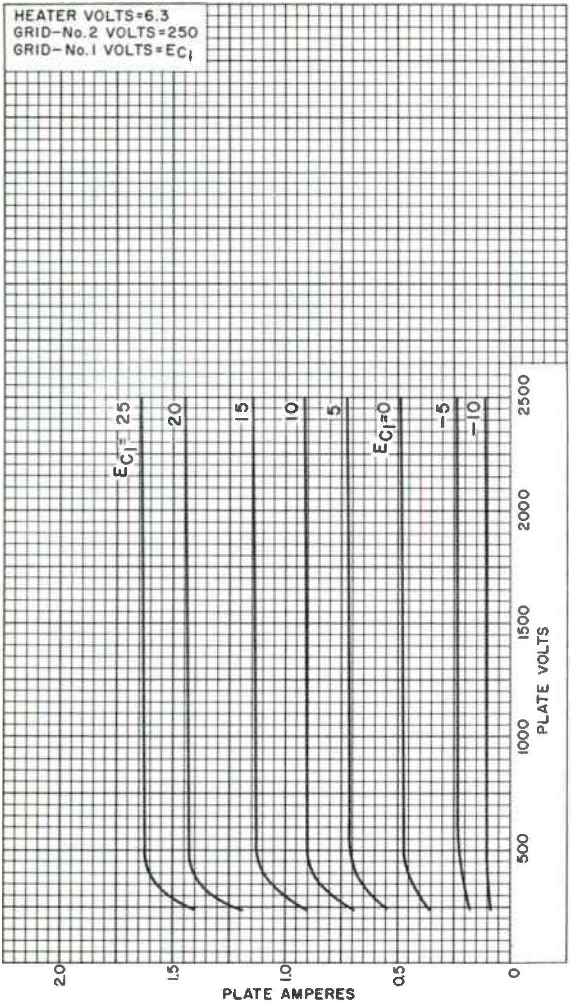
ALL DIMENSIONS IN INCHES

NOTE: ALL FINGER STOCK (No.97-380) MADE BY INSTRUMENT SPECIALTIES COMPANY, LITTLE FALLS, NEW JERSEY.

TYPICAL COOLING REQUIREMENTS

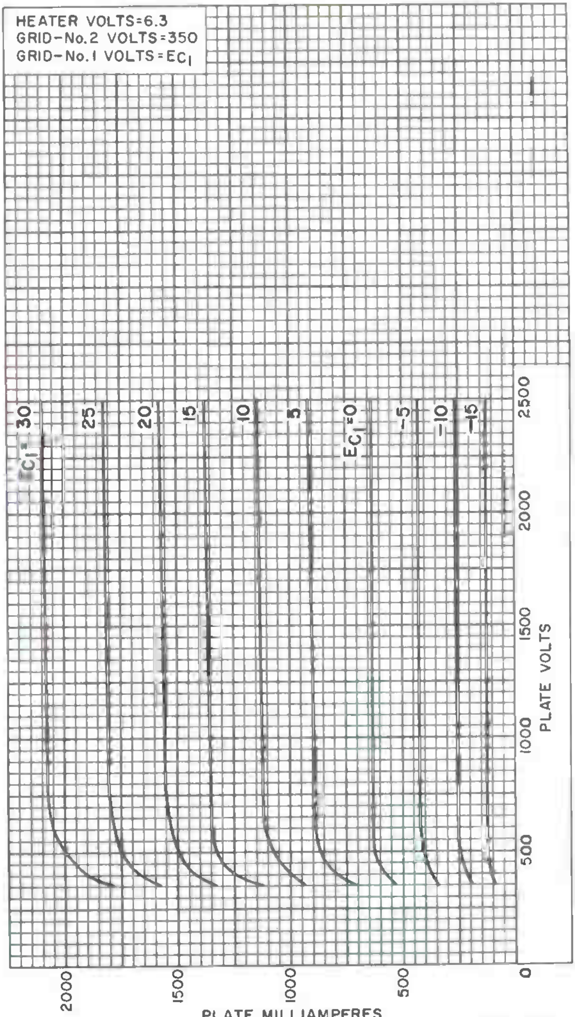


TYPICAL PLATE CHARACTERISTICS

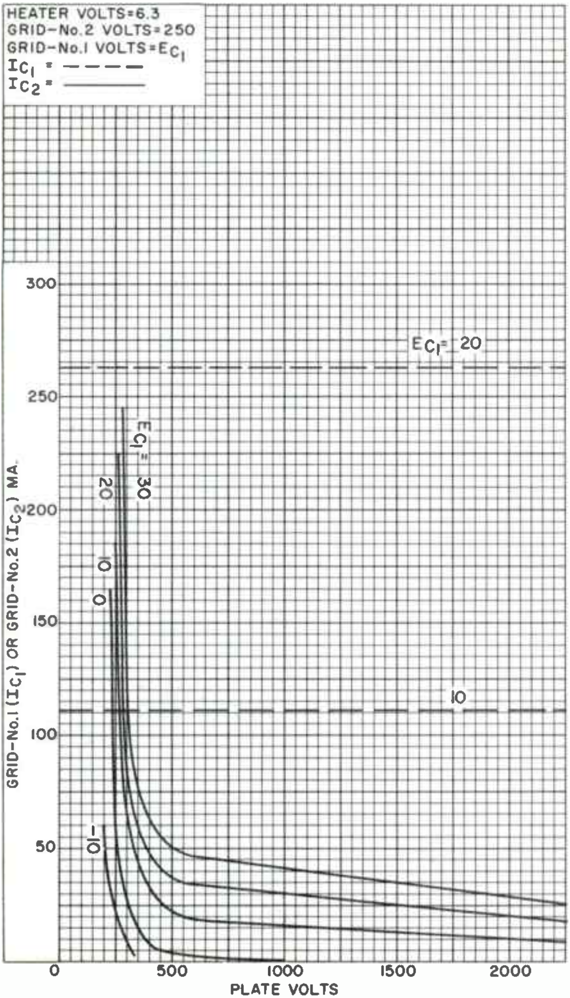


92CM-12006

TYPICAL PLATE CHARACTERISTICS

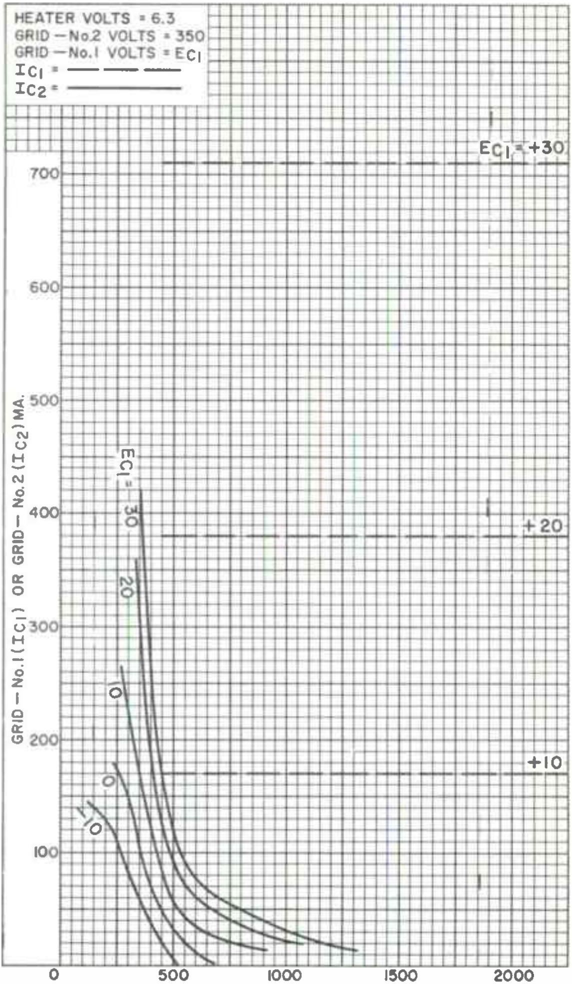


TYPICAL CHARACTERISTICS



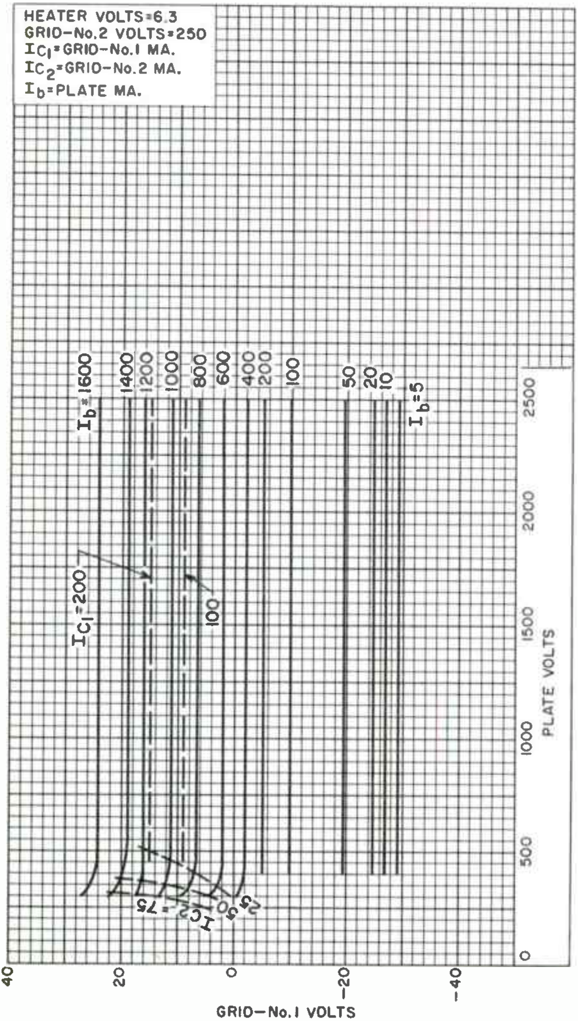
92CM-12016

TYPICAL CHARACTERISTICS



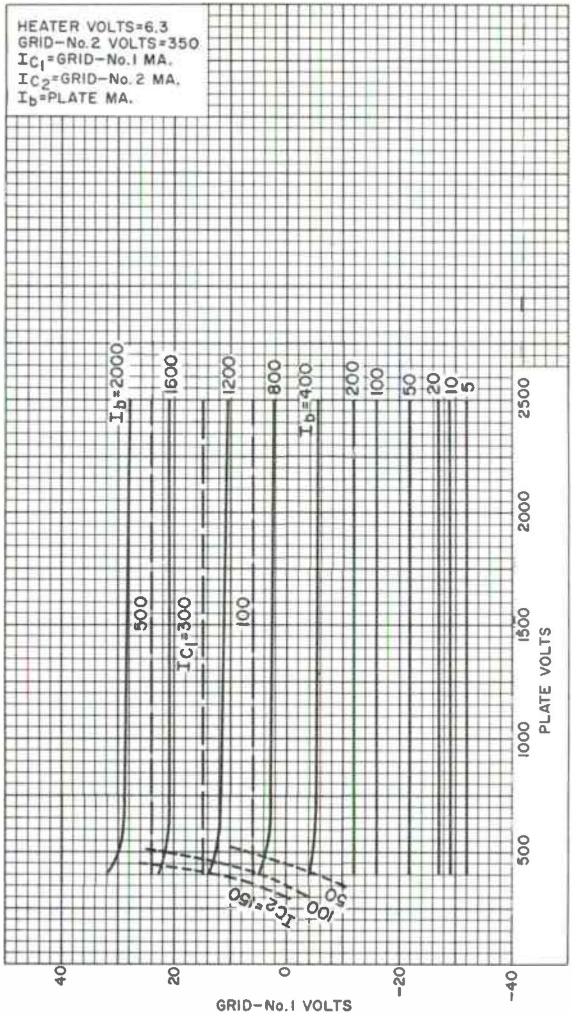
92CM—12013

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM-12015

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM-12007

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:

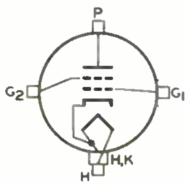
Operating Position	Any
Overall Length	2.445" ± 0.075"
Greatest Diameter (See *Dimensional Outline*)	1.250" ± 0.015"
Weight (Approx.)	2 oz
Radiator	Integral part of tube

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 1	AXIMAX 1
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 1	AXIMAX 1
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 1	AXIMAX 1
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]	170000	watts

Maximum Circuit Values:

Grid-No. 1 Circuit Resistance	30000 max.	ohms
Grid-No. 2 Circuit Impedance	10000 max.	ohms
Plate Circuit Impedance	h	

[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

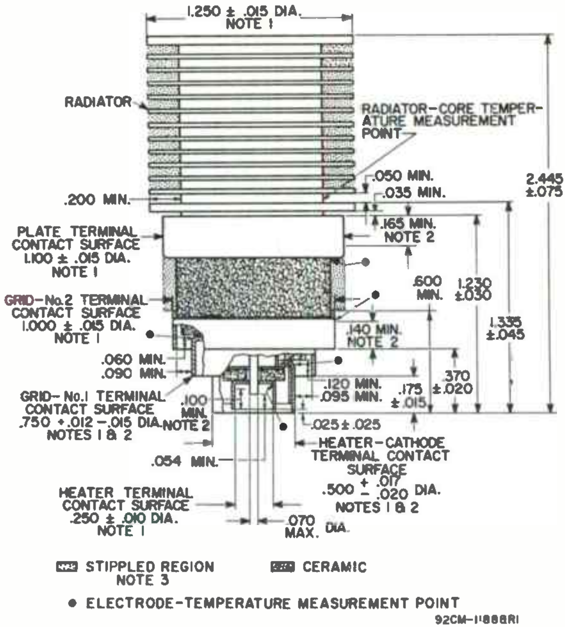
During long or frequent standby periods, the 8227 may be operated at decreased heater voltage to conserve life. It is recommended that the heater voltage be reduced to 80% of normal during standby periods up to 2 hours. For longer periods, the heater voltage should be turned off.

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.



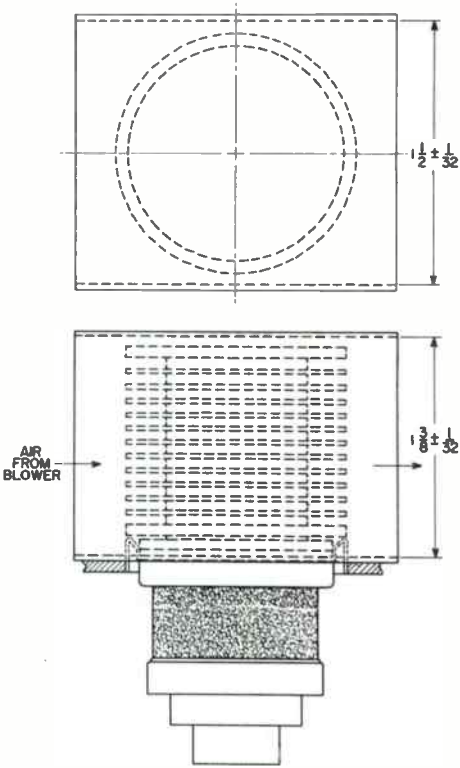
ALL DIMENSIONS IN INCHES

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.

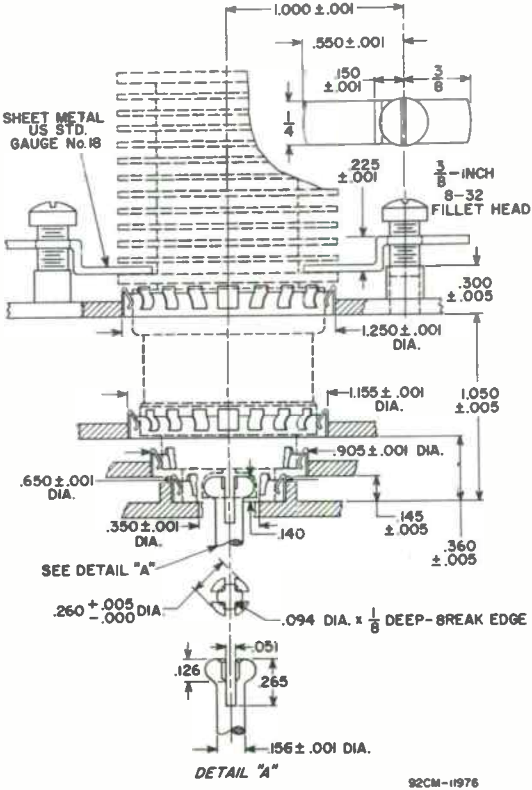
NOTE 3: KEEP ALL STIPPLED REGIONS CLEAR. DO NOT ALLOW CONTACTS OR CIRCUIT COMPONENTS TO PROTRUDE INTO THESE ANNULAR REGIONS.

RECOMMENDED COWLING
FOR DIRECTING AIR FLOW ACROSS RADIATOR



ALL DIMENSIONS IN INCHES

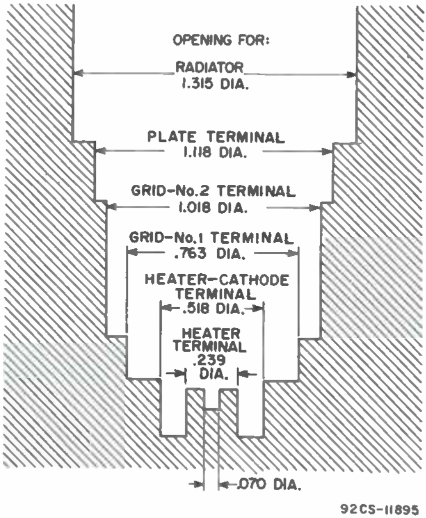
PREFERRED MOUNTING ARRANGEMENT
& LAYOUT OF ASSOCIATED CONTACTS



ALL DIMENSIONS IN INCHES

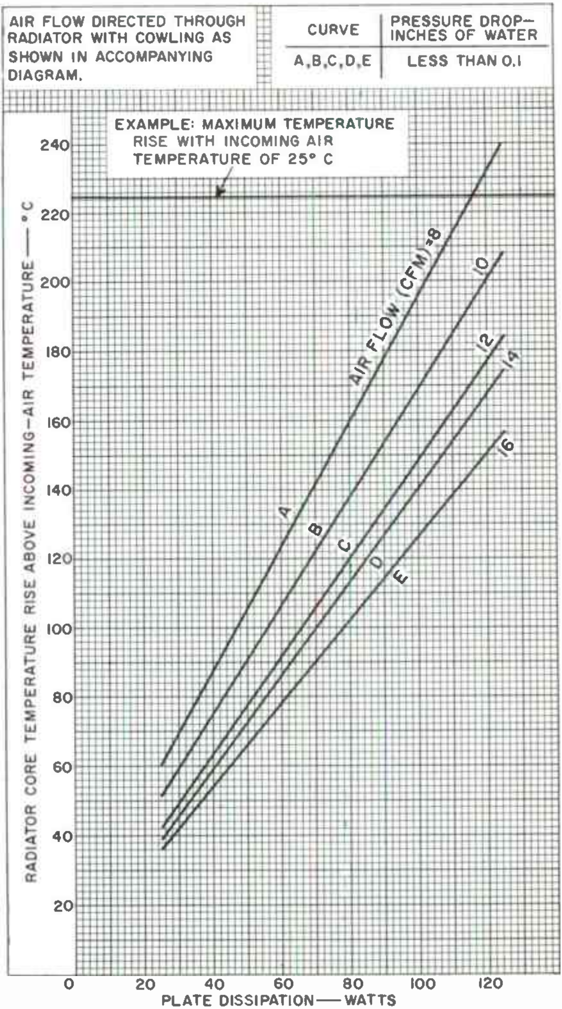
NOTE: ALL FINGER STOCK (No. 97-380) MADE BY INSTRUMENT SPECIALTIES COMPANY, LITTLE FALLS, NEW JERSEY.

SKETCH G1



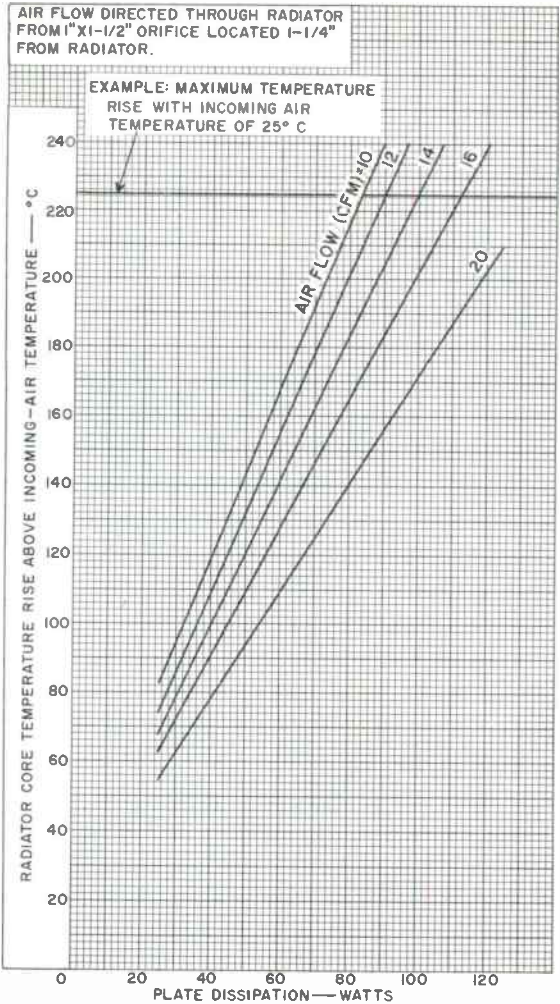
ALL DIMENSIONS IN INCHES

TYPICAL COOLING REQUIREMENTS
With Cowling



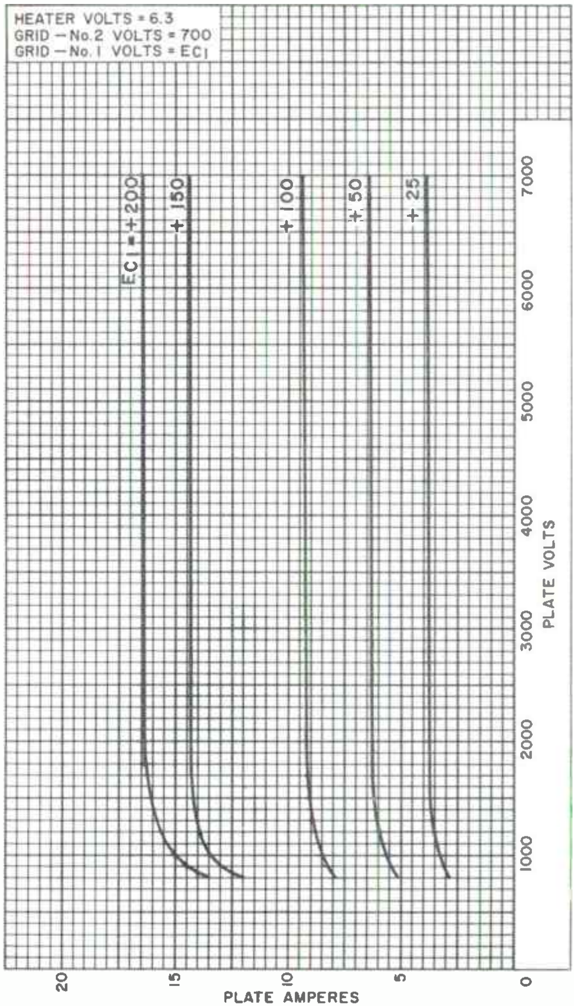
92CM-11999

TYPICAL COOLING REQUIREMENTS
Without Cowling



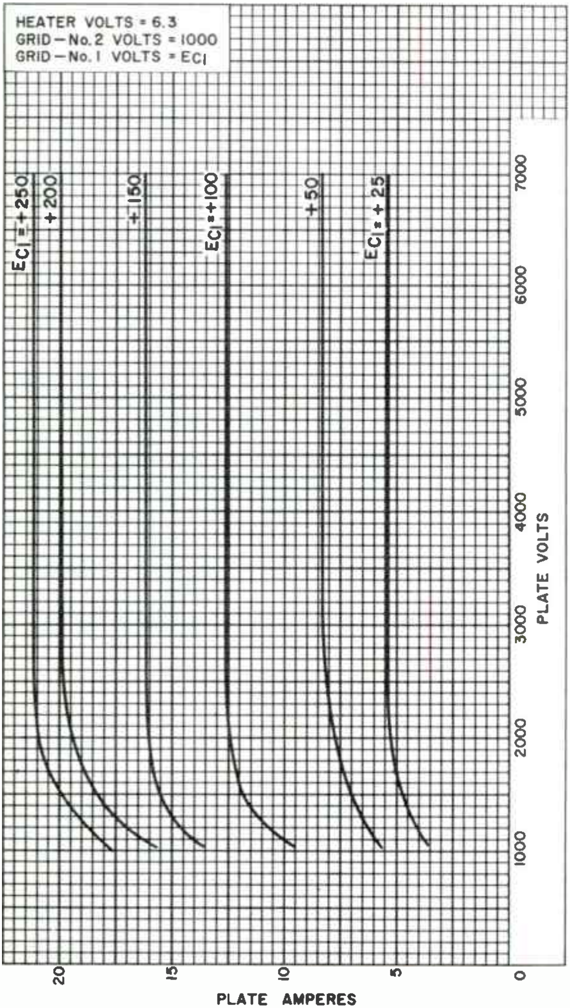
92CM-12000

TYPICAL PLATE CHARACTERISTICS



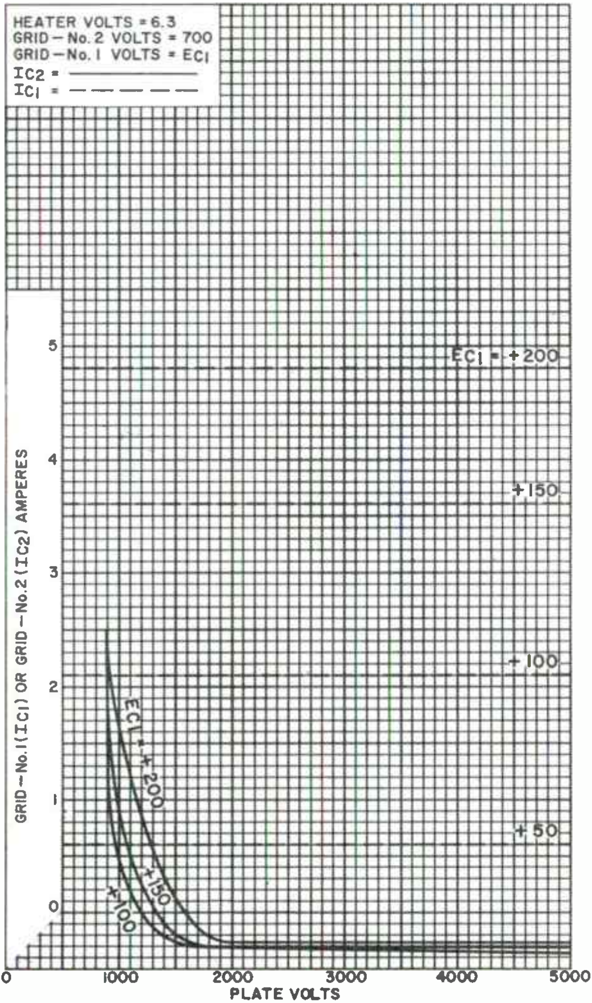
92CM–11883

TYPICAL PLATE CHARACTERISTICS



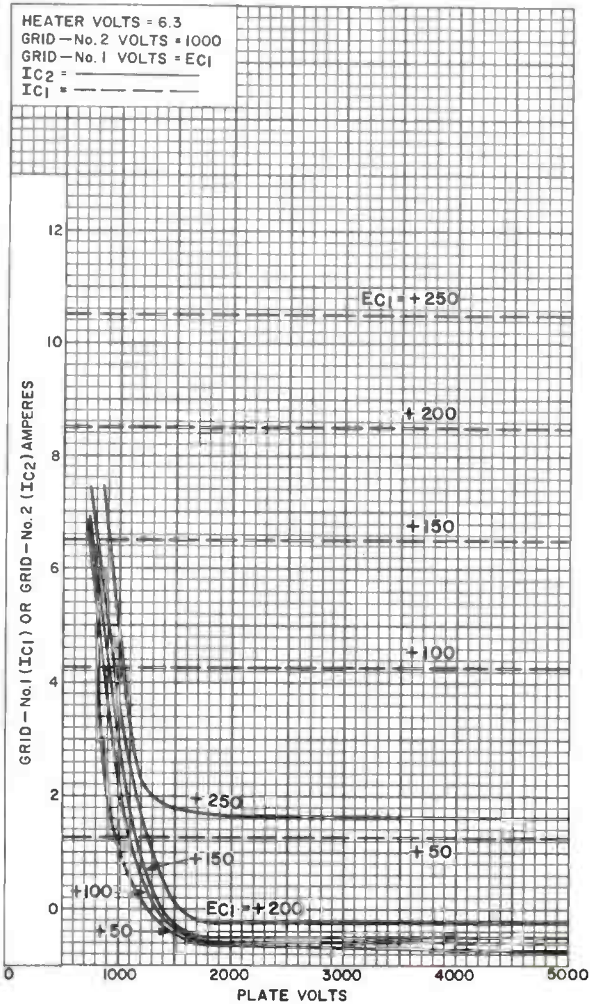
92CM—11889

TYPICAL CHARACTERISTICS



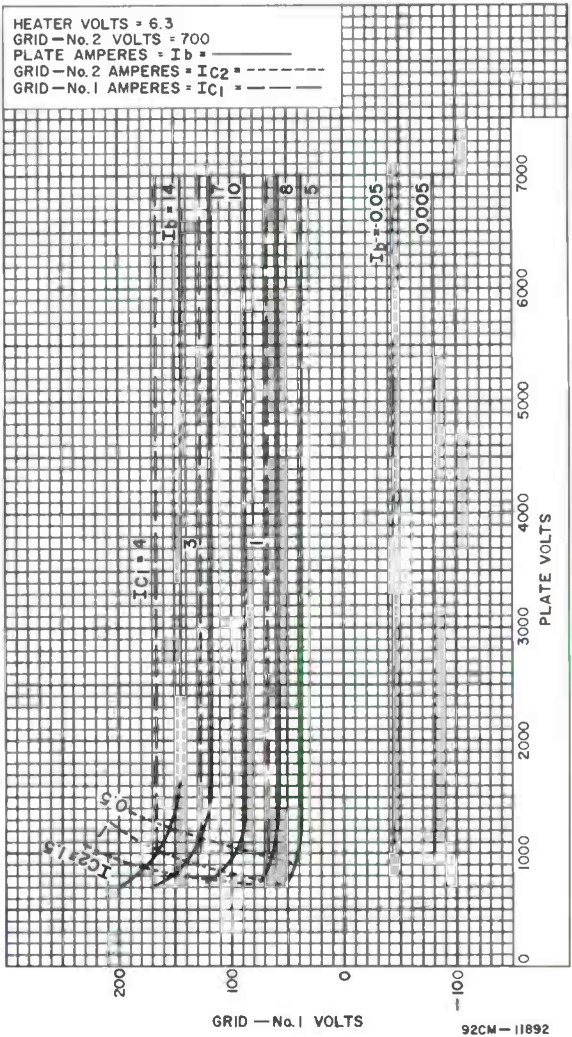
92CM-11884

TYPICAL CHARACTERISTICS

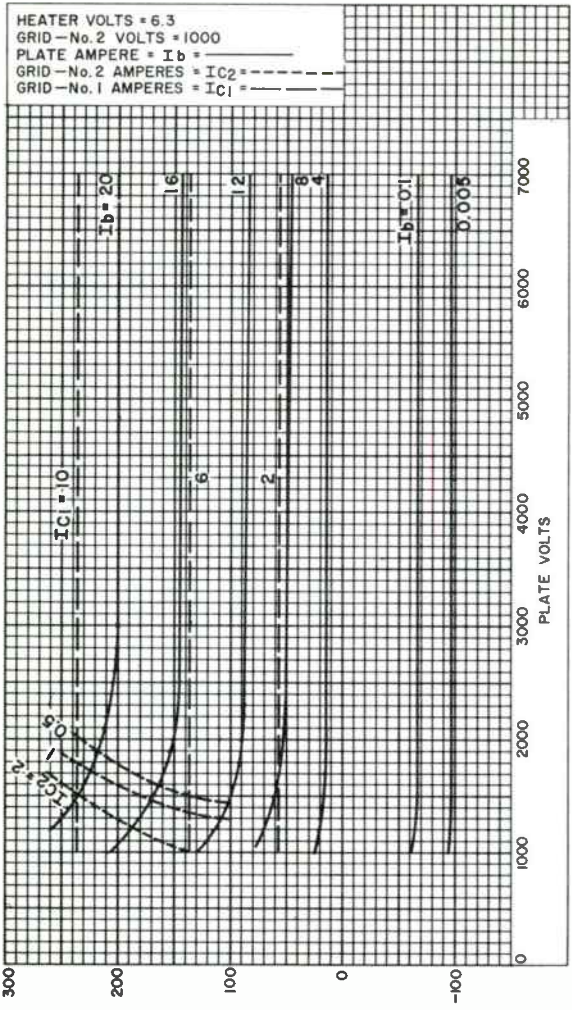


92CM—11891

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM-11890

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.

8239/3X3000F1

Low-Mu Triode

FORCED-AIR COOLED

GENERAL DATA

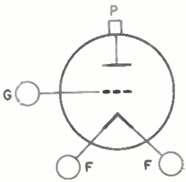
Electrical:

	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:

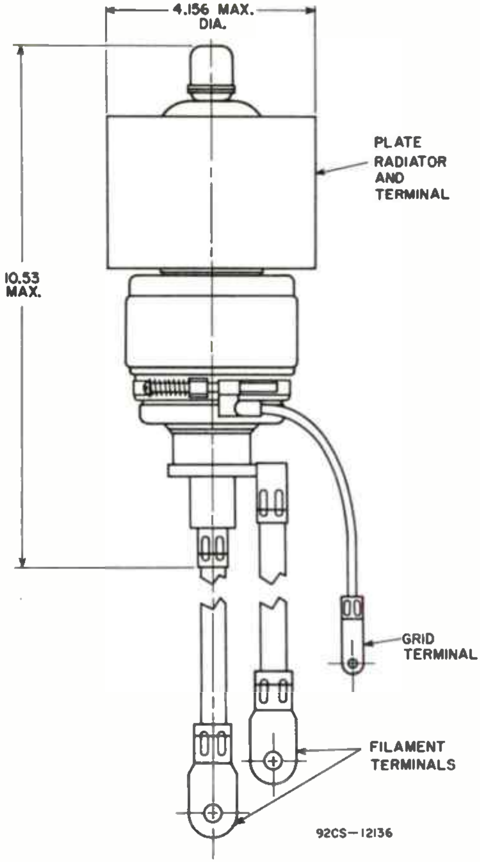
Seal Temperatures	150	max.	°C
Plate Core Temperature.	150	max.	°C
Air Flow	160	min.	cfm
Static Pressure	3.6	in. of water	

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.



DIMENSIONS IN INCHES

Traveling-Wave Tube

HELIX-TRANSMISSION-LINE TYPE
FREQUENCY RANGE, 2320-2680 Mc
LOW-NOISE AMPLIFIER TYPE

NF = 4.5 db
31-db GAIN
SOLENOID FOCUSING

For Use in Input Stage of Radar, Scatter Propagation, and Other Microwave Receivers, and in IF Amplifiers

Electrical:

Heater, for Unipotential Cathode:

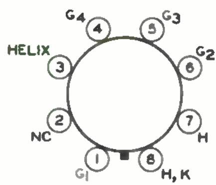
Voltage (AC or DC)	5.0 ± 5%	volts
Current at heater volts = 5.0	0.65	amp
Starting current	Must never exceed 4 amperes, even momentarily	
Minimum cathode heating time	1	minute
Frequency range	2320 to 2680	Mc
Minimum cold insertion loss	60	db

Mechanical:

Operating Position	Any
Cooling	Natural
Maximum Overall Length	19.50"
Shell Diameter	1.375" ± 0.005"
Weight	1.5 lbs
Collector-Terminal Connector[a]	Special Banana Jack
RF Connectors:[b]	
Input terminal	Type N UG-18B/U Plug
Output terminal	Type N UG-18B/U Plug
Base	Octal 8-Pin

BOTTOM VIEW

Pin 1 - Grid No. 1
Pin 2 - No Connection
Pin 3 - Helix
Pin 4 - Grid No. 4
Pin 5 - Grid No. 3
Pin 6 - Grid No. 2
Pin 7 - Heater
Pin 8 - Heater, Cathode



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

DC Collector Voltage	800	max.	volts
DC Helix Voltage	500	max.	volts
DC Grid-No. 4 Voltage	500	max.	volts
DC Grid-No. 3 Voltage	300	max.	volts
DC Grid-No. 2 Voltage	75	max.	volts
DC Grid-No. 1 Voltage	20	max.	volts
DC Collector Current	500	max.	μa
DC Helix Current	5[c]	max.	μa
DC Cathode Current	500	max.	μa
Magnetic Field Strength	650[d]	min.	gauss

RF Power Input:			
Peak	500	max.	watts
Average	1.0	max.	watts
Metal-Shell Temperature			
(At hottest point)	175	max.	°C

Typical Operation at 2500 Mc:

DC Collector Voltage	600	volts
DC Helix Voltage	375	volts
DC Grid-No.4 Voltage	325	volts
DC Grid-No.3 Voltage	70	volts
DC Grid-No.2 Voltage (Approx.)	10	volts
DC Grid-No.1 Voltage	10	volts
DC Collector Current	150	μa
DC Helix Current	0.5	μa
DC Grid-No.4 Current DC Grid-No.3 Current DC Grid-No.2 Current DC Grid-No.1 Current	each less than 1 μa	
Magnetic Field Strength	850[e]	gauss
Gain (Low level)	31	db
Power Output (Saturated)	1.0	mw
Noise Figure	4.5	db

[a] Connection to the collector terminal may be made with a banana-type plug similar to a Raytheon Test Jack 27-1594G21 fitted with an insulator from HH Smith Type 211 banana plug.

[b] Both rf-input and rf-output terminals employ semi-rigid 50-ohm coaxial lines.

[c] During alignment of the tube in the magnetic focusing field, the helix current may exceed this value for short periods, but should never exceed 10 μa.

[d] This value of field strength will focus the electron beam, but noise figure will not be optimum.

[e] Typical peak value for RCA Solenoid, Type MW4901 (See *Characteristics of RCA-MW4901 Solenoid*).

CHARACTERISTICS RANGE VALUES

	Note	*Min.*	*Max.*	
Heater Current	1	0.45	0.85	amp
Input VSWR:				
Non-operating	2,3	-	1.3	
Operating	1,4	-	1.5	
Output VSWR:				
Non-operating	2	-	1.5	
Operating	1,4	-	3	
DC Helix Voltage	1,4	335	405	volts
DC Grid-No.4 Voltage	1,4	150	400	volts
DC Grid-No.3 Voltage	1,4	25	100	volts
Saturated Power Output	1,4	1.0	-	mw
Small-Signal Gain	1,4	28	34	db
Noise Figure	1,4	-	5.0	db

Note 1: With heater voltage of 5.0 volts.

Note 2: With no electrode voltages applied.

Note 3: Any tube having a non-operating input VSWR higher than 1.3 but less than 1.5 may be considered acceptable if the operating VSWR is less than 1.5.

Note 4: With electrode voltages and magnetic focusing field adjusted for minimum noise figure at 2500 Mc.

OPERATING CONSIDERATIONS

The *rated values for collector voltage, helix voltage, grid-No.4 voltage, and grid-No.3 voltage are high enough to be dangerous to the user.* Care should be taken during adjustment of circuits, especially when exposed circuit parts are at high dc potential.

The *power supply* for the 8379 should be capable of holding ripple voltage sufficiently low to prevent phase distortion, and should have adequate regulation to prevent a change in operating conditions which might increase the noise figure. Provision should be made for monitoring helix current, collector current, and cathode current.

The rated *heater voltage* of 5.0 volts should be applied for at least 1 minute to allow the cathode to reach normal operating temperature before voltages are applied to the other electrodes.

The *magnetic field* required for focusing the electron beam of the 8379 may be obtained from a solenoid such as the RCA-MW4901 or equivalent. The field must have a distribution as shown in *Characteristics of RCA-MW4901 Solenoid.* A uniform field provided by a solenoid or permanent magnet of at least 800 gauss starting 2 inches from the groove near the base end of the metal shell and continuing for at least nine inches along the tube axis can provide equivalent focusing.

Initial Alignment Procedure

Apply rated heater voltage to the 8379 for one minute. Then connect operating voltages as shown under *Typical Operation* to all other tube electrodes except grid No.2. Grid-No.2 voltage may then be applied, and increased until cathode current reaches approximately 50 microamperes.

If the tube is incorrectly aligned within the magnetic field, some of the beam current will be drawn to the helix and increase the helix current. The axial alignment of the 8379 within the magnetic focusing field should then be adjusted to produce a minimum value of helix current. Grid-No.2 voltage should then be increased until collector current is approximately 150 microamperes. Readjust alignment of the tube and magnetic focusing field until a minimum value of helix current is again obtained. Helix current of the 8379 when properly aligned in the magnetic focusing field is usually less than one microampere. Collector current should be checked to see if it is essentially the same as cathode current. Such a condition is another indication that the tube is properly aligned in the magnetic field. If a solenoid is used to supply the magnetic focusing field, check the solenoid current and readjust it, if necessary, to obtain the specified field-strength value.

The above alignment procedure need not be repeated so long as the adjustments are not disturbed.

Lowest-Noise-Figure Adjustment Procedure

In order to operate the 8379 at the lowest noise figure, it is necessary to adjust the electrode voltages as follows: With the 8379 connected in its circuit, and with either noise input or signal input, adjust the helix voltage to give maximum output at the operating frequency. This value of helix voltage simultaneously produces optimum tube gain and lowest noise figure. Next, with no input signal, vary dc grid-No.1, grid-No.3, and grid-No.4 supply voltages alternately until the receiver output reaches a minimum value. The voltages are now adjusted to operate the 8379 at its lowest noise figure for the particular frequency to which the equipment is tuned. If the strength of the magnetic focusing field changes, it will be necessary to repeat the above adjustment procedure with regard to grid-No.1, grid-No.3, and grid-No.4 voltage.

Preamplifier in Radar Receivers

In the usual type of radar system, a portion of the transmitter pulse leaks through the TR tube to the crystal mixer in the receiver, overloads the crystal, and gradually impairs its performance. If, however, the crystal is preceded by the 8379 in a preamplifier stage, the traveling-wave tube serves as a crystal-protection device because of its saturation characteristic. See accompanying *Saturation Characteristics* curve. From this curve, it will be noted that the saturated power output of the 8379 is about 1 milliwatt which will not harm the crystal. Therefore, the spike-leakage limit of the TR tube can be eased and thus eliminate the need for supplying "keep-alive" voltage to the TR tube. Furthermore, the ability of the 8379 to withstand an rf peak power input of as much as 500 watts or an average power input of as much as 1 watt makes it possible to employ a TR tube with lower attenuation.

Additional advantages offered by the 8379 in a preamplifier stage include: (1) reduction of the overall noise figure of the radar receiver; (2) improved receiver recovery time; (3) better TR tube life, and (4) reduction of local oscillator radiation. All of these advantages contribute to improved radar-system operation.

Phase-Sensitive Applications

When the 8379 is used in phase-sensitive radar system or in a microwave relay system where frequency-modulated information is amplified, even a small amount of phase distortion

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

can adversely affect performance. The following table shows for each tube electrode the values of rms ripple voltage which will cause a peak-to-peak change in rf phase of approximately 1 degree.

Tube Electrode	Typical Operating DC Volts	Approx. RMS Ripple Volts For Peak-to-Peak Phase Shift of 1°
Grid No.1	10	0.1
Grid No.2	10	0.1
Grid No.3	70	0.5
Grid No.4	325	3.5
Helix	375	0.024
Collector	600	6.7

For the RCA Solenoid Type MW4901 operated at 90 volts dc, a peak-to-peak change in rf phase of approximately 1° will be caused by an rms ripple voltage of 7.7 volts.

Input Matching Considerations

In general, the *voltage standing wave ratio* (VSWR) will increase as the electron-beam current of the tube is increased. This "hot VSWR" is a direct function of gain and can be attributed to reflections of the amplified wave at a discontinuity along the slow-wave structure. In contrast, the VSWR with no voltages applied to the tube, is referred to as the "cold VSWR". This "cold VSWR" determines the transfer of input signal energy to the helix and, therefore, the noise figure of the 8379 is not degraded by the "hot VSWR". In general, it will be found that when the input to the 8379 is adjusted for optimum matching under "cold" conditions, the same adjustment will provide optimum matching under "hot" conditions. A typical input matching characteristic is given in the accompanying curve for the 8379 under "cold" conditions.

Notes On Associated Microwave Circuitry.

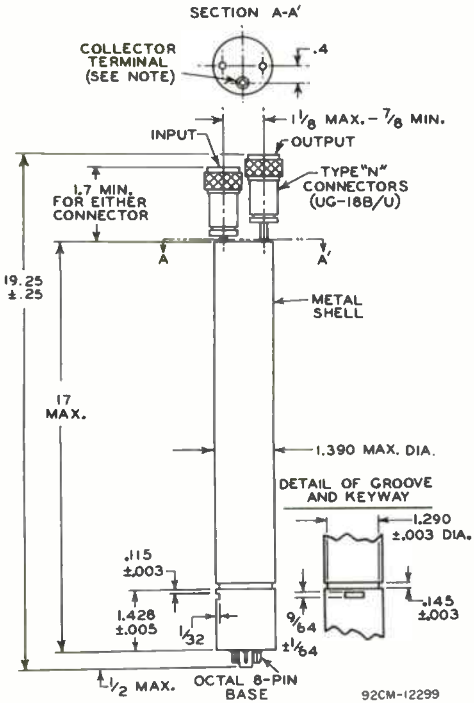
A low-noise traveling-wave tube used in a superheterodyne circuit will cause a 3 db degradation in noise figure unless a filter is used at the output of the traveling-wave tube to remove noise generated at the image frequency.

Whenever the output of the 8379 is connected to a filter, signals in the reject band of the filter are reflected back into the tube. As these signals travel back through the tube, they suffer little attenuation until they are absorbed by the attenuator. Should there be appreciable reflection from the attenuator or another discontinuity inside the traveling-wave tube, oscillations may occur, depending on the gain within the tube from the attenuator or discontinuity to the output end of the tube.

The 8379 is designed to be short-circuit stable, i.e., the power reflected from a short-circuited output termination will be insufficient to cause oscillation when the 8379 is operating at a normal value of beam current. If the beam current is increased sufficiently above this value, the gain of the tube will increase until oscillation takes place.

When a high-gain microwave amplifier tube such as the traveling-wave tube is employed, special care must be taken to prevent distortion of oscillations resulting from feedback through circuitry external to the tube. Some types of filters may show satisfactory attenuation characteristics in and near the frequency band of interest. However, oscillations can still occur due to "holes" in the filter characteristic at frequencies outside the band of interest. Attenuation of filters should therefore be checked over wide bands and the holes, if any, can be filled by supplementary, simple filters.

DIMENSIONAL OUTLINE

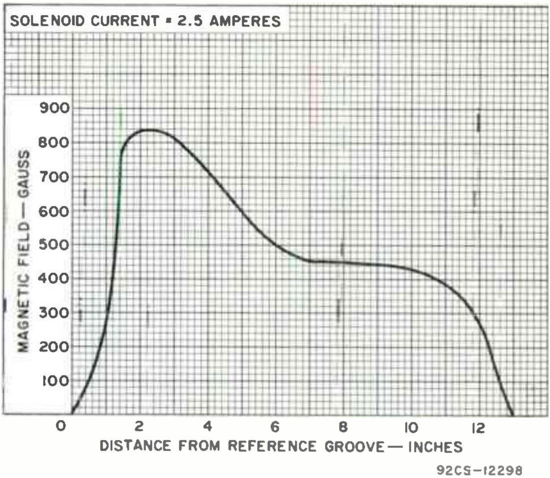


DIMENSIONS IN INCHES

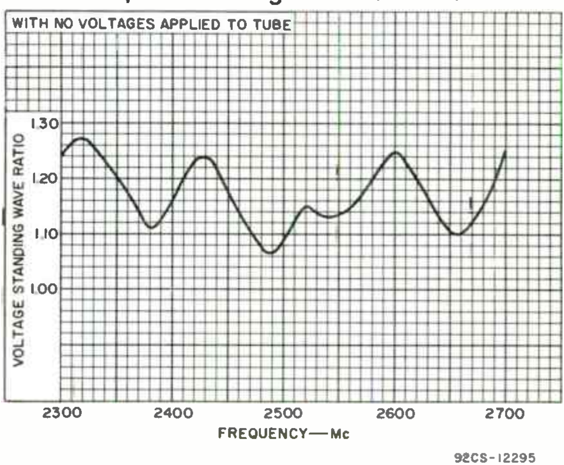
Note: Special Banana Jack—Mates with Raytheon Test Jack 27-1594G21 fitted with an insulator from an HH Smith Type 211 Banana Plug.

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

Characteristics of RCA-MW4901 Solenoid

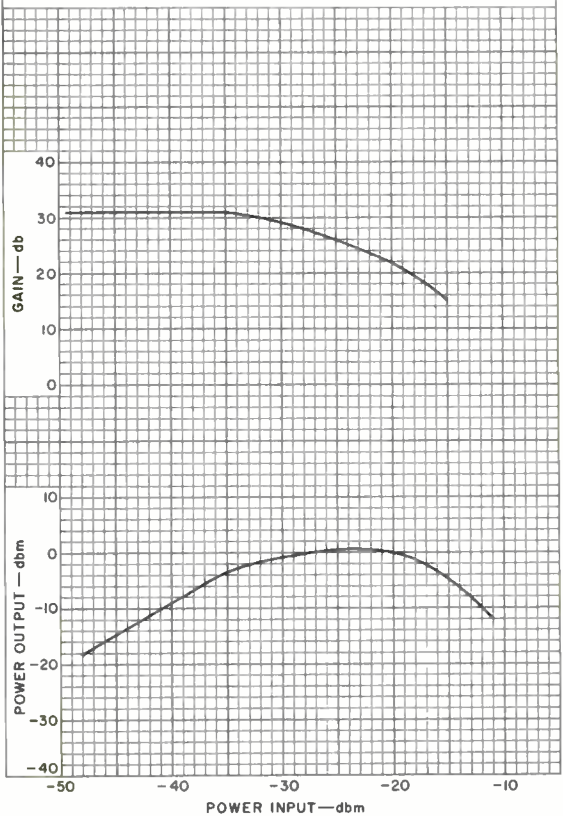


Input-Matching Characteristic



Saturation Characteristics

E_f = 5 VOLTS
COLLECTOR VOLTS = 600
HELIX VOLTS = 375
GRID-No. 4 VOLTS = 325
GRID-No. 3 VOLTS = 70
GRID-No. 2 VOLTS ADJUSTED TO GIVE COLLECTOR MICROAMPERES = 150
GRID-No. 1 VOLTS = 10
SIGNAL FREQUENCY (Mc) = 2500
FIELD STRENGTH ALONG HELIX AXIS (GAUSS) = 850



92CM-12296

Beam Power Tube

CERMOLOX®

FORCED-AIR COOLED
INTEGRAL RADIATOR
THORIATED-TUNGSTEN MESH FILAMENT

HIGH GAIN-BANDWIDTH PRODUCTS
10000 WATTS CW POWER OUTPUT
AT 400 Mc

For Compact Aircraft, Mobile, and Stationary Equipment Applications in the UHF Frequency Range

Electrical:

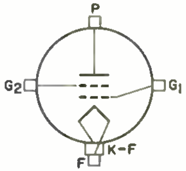
Filamentary Cathode, Thoriated-Tungsten Cylindrical-Mesh Type:		
Voltage (AC or DC)	8.5 typ.	volts
	9.0 max.	volts
Current:		
Typical value at 8.5 volts	88	amp
Maximum value for starting, ever momentarily	300	amp
Minimum heating time	15	sec
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 7000, grid-No.2 volts = 1350, and plate ma. = 500	30	
Direct Interelectrode Capacitances:		
Grid No.1 to plate[a]	0.4 max.	pf
Grid No.1 to filament	86	pf
Plate to filament[a]	0.07 max.	pf
Grid No.1 to grid No.2	88	pf
Grid No.2 to plate	20	pf
Grid No.2 to filament[a]	1.5 max.	pf

Mechanical:

Operating Position	Any
Maximum Overall Length	6.188"
Maximum Diameter (See *Dimensional Outline*)	6.170"
Weight (Approx.)	12 lbs.
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
F - Filament-Terminal Contact Surface



K-F - Cathode-Filament Terminal Contact Surface
P - Plate-Terminal Contact Surface

Thermal:

Terminal Temperature (Plate, grid No.2, grid No.1, cathode-filament, and filament)	250 max.	°C
Plate-Core Temperature	250 max.	°C

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 filament, plate, grid-No.2, and grid-No.1 voltages. Typical values of air flow directed through the radiator are shown in accompanying *Typical-Cooling-Requirements* curve as a function of plate dissipation.

To Plate, Grid-No.2, Grid-No.1, Cathode-Filament, and Filament Terminals — A sufficient quantity of air should be allowed to flow past each of these terminals so that their temperature does not exceed the specified maximum value of 250° C.

During Standby Operation — Cooling air is required to the Cathode-Filament and Filament Terminals 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.

At Sea Level — Cooling requirements as shown in accompanying *Typical-Cooling-Requirements* curve, may be met by use of the following blowers and associated motors manufactured by Rotron Mfg. Co., Inc., Woodstock, N.Y., or equivalent:

For 100% Plate Dissipation:				
Blower Model No.	AS-704	KS-704	-	PS-606
Motor Model No.	255JS	452AS	-	209JS
Phase (φ)	3	1	-	3
Frequency (cps)	60	60	-	400
Voltage (v)	208	115	-	115
For 80% Plate Dissipation:				
Blower Model No.	AS-601	KS-601	PS-4502	PS-4502
Motor Model No.	266JS	413AS	358AS	209JS
Phase (φ)	3	1	1	3
Frequency (cps)	60	60	400	400
Voltage (v)	208	115	115	115
For 60% Plate Dissipation:				
Blower Model No.	AS-4506	KS-4506	PS-3503	NS-301
Motor Model No.	139JS	364AS	450AS	587JS
Phase (φ)	3	1	1	3
Frequency (cps)	60	60	400	400
Voltage (v)	208	115	115	115

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

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

For frequencies up to 500 Mc

DC Plate Voltage	7000 max.	volts
DC Grid-No.2 Voltage	1500 max.	volts

DC Grid-No.1 Voltage	-150 max.	volts
DC Plate Current	4 max.	amp
DC Grid-No.1 Current	1.2 max.	amp
Grid-No.1 Input[c]	150 max.	watts
Grid-No.2 Input[c]	300 max.	watts
Plate Dissipation	10000 max.	watts

Typical CCS Operation:

In Cathode-Drive Circuit at 400 Mc

DC Plate Voltage	6500	volts
DC Grid-No.2 Voltage[d]	1200	volts
DC Grid-No.1 Voltage[e]	-30	volts
DC Plate Current	3.5	amp
DC Grid-No.2 Current	0.05	amp
DC Grid-No.1 Current	0.53	amp
Driver Power Output[f] (Approx.)	600	watts
Output-Circuit Efficiency	78	%
Useful Power Output	10000	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	5000 max.	ohms
Grid-No.2-Circuit Impedance	g	
Plate-Circuit Impedance	h	

[a] See *Characteristics Range Values, Test No.2.*

[b] Continuous Commercial Service.

[c] Grid input represents the power dissipated in the grid electrode. The grid input is not necessarily the product of the dc grid voltage and the "metered" grid current. For example, see *Grid No.2* under *Operating Considerations.*

[d] Obtained from a fixed supply.

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

[f] 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.

[g] See *Grid No.2* under *Operating Considerations.*

[h] See *Plate* under *Operating Considerations.*

CHARACTERISTICS RANGE VALUES

Test No.	*Note*	*Min.*	*Max.*	
1. Filament Current	1	84	92	amp
2. Direct Interelectrode Capacitances:				
Grid No.1 to plate	2	-	0.4	pf
Grid No.1 to filament	-	78	94	pf
Plate to filament	2,3	-	0.07	pf
Grid No.1 to grid No.2	-	80	96	pf
Grid No.2 to plate	-	18	22	pf
Grid No.2 to filament	3	-	1.5	pf
3. Peak Grid-No.1 Voltage	1,4	-	125	volts

Note 1: With 8.5 ac volts on filament.

Note 2: With external flat metal shield 8" in diameter having a center hole 4" 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.

Note 3: With external flat metal shield 8" in diameter having a center hole 3-3/8" in diameter. Shield is located in plane of the grid-No.1 terminal, perpendicular to the tube axis, and is connected to grid No.1.

Note 4: With dc plate voltage of 1750 volts, dc grid-No.2 voltage of 1200 volts, and instantaneous grid-No.1 voltage adjusted to give peak plate current of 10 amperes.

OPERATING CONSIDERATIONS

Filament

The rated filament voltage of 8.5 volts should be applied for 15 seconds to allow the cathode to reach normal operating temperature before voltages are applied to other electrodes.

The life of the cathode can then be conserved by adjusting to the lowest nominal filament supply voltage which will give the desired performance. Good regulation of the filament supply voltage about this value is, in general, economically advantageous from the view-point of tube life. The supply regulation should not exceed ± 5%. This recommendation is particularly applicable at the higher operating frequencies.

Temperature

The maximum plate core or terminal 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 W. 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 can not be accurately determined. Operation similar to conditions given under *Typical Operation* in 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 negative dc current as well as normal values of 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 currents of the order of one-tenth the required plate current.

Plate

In beam power tubes with closely spaced electrodes, such as the 8437, extremely high voltage gradients occur even with moderate tube operating voltages. Any arc-over 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.

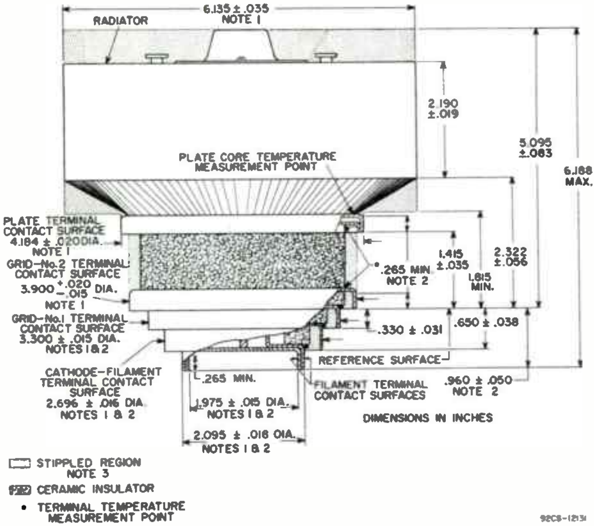
Standby Operation

During long or frequent standby periods, the 8437 may be operated at decreased filament voltage to conserve life. It is recommended that the filament voltage be reduced to 80% of normal during standby periods up to 2 hours. For longer periods, the filament voltage should be turned off.

Precautions

Protective devices should be used to protect the plate and grid No.2 against overload. Excessive plate-current flow and resultant over-heating of the tube can be prevented by connection of the common ground lead of the plate circuit 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.

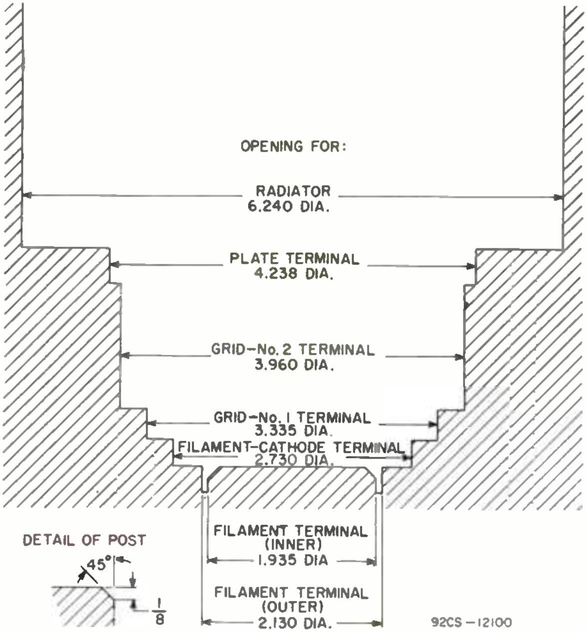


NOTE 1: SEE *SKETCH G1* FOR THE MAXIMUM DIAMETRICAL SPACE REQUIRED BY THE 8437 BASED UPON THE DIAMETER AND ECCENTRICITY OF RADIATOR BAND AND OF EACH RING TERMINAL.

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 FILAMENT, CATHODE-FILAMENT, AND GRID-No. 1 TERMINALS EXTENDS FROM THE EDGE OF ITS TERMINAL TO THE PLANE COINCIDENT WITH THE EDGE OF THE ADJACENT LARGER TERMINAL.

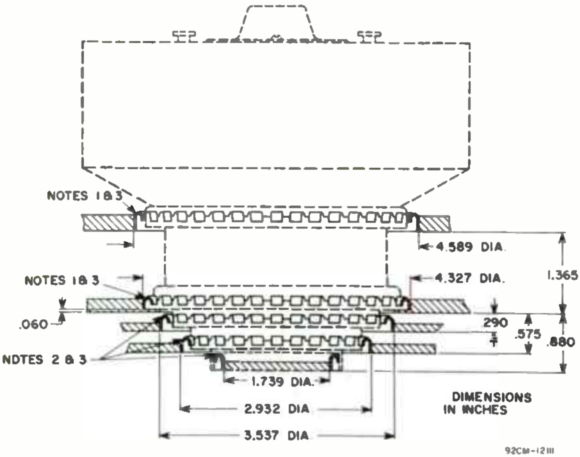
NOTE 3: KEEP ALL STIPPLED REGIONS CLEAR. DO NOT ALLOW CONTACTS OR CIRCUIT COMPONENTS TO PROTRUDE INTO THESE ANNULAR REGIONS.

SKETCH G1



DIMENSIONS IN INCHES

PREFERRED MOUNTING ARRANGEMENT
& LAYOUT OF ASSOCIATED CONTACTS

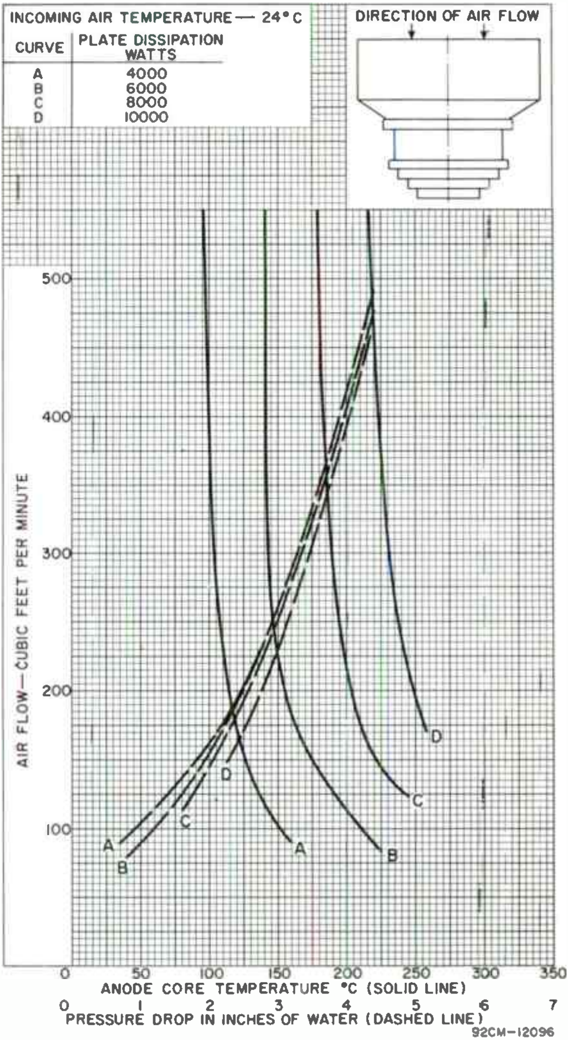


NOTE 1: FINGER STOCK No.97-310.

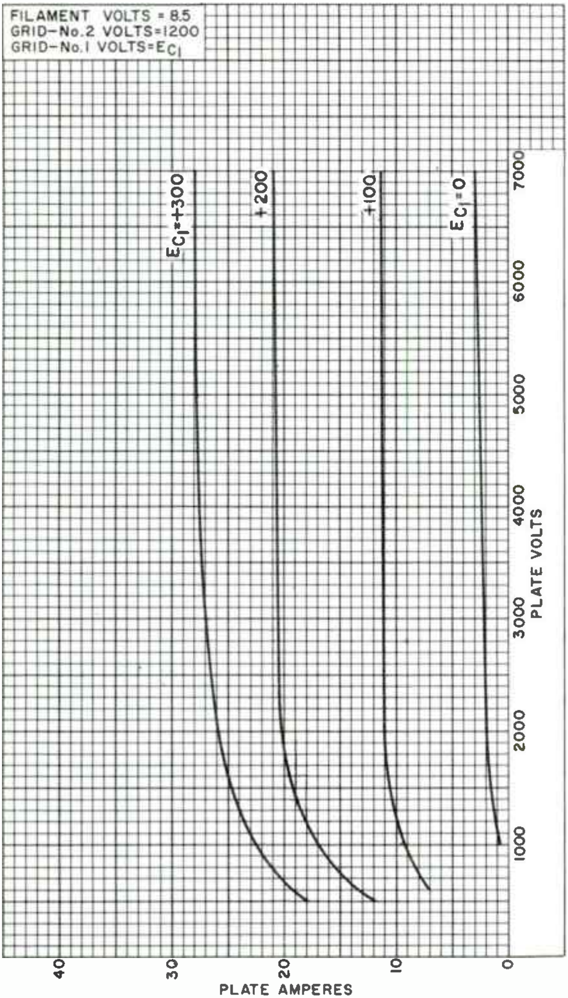
NOTE 2: FINGER STOCK No.97-139.

NOTE 3: SPECIFIED FINGER STOCK IS MADE BY INSTRUMENT SPECIALTIES CO., LITTLE FALLS, N.J.

TYPICAL COOLING REQUIREMENTS

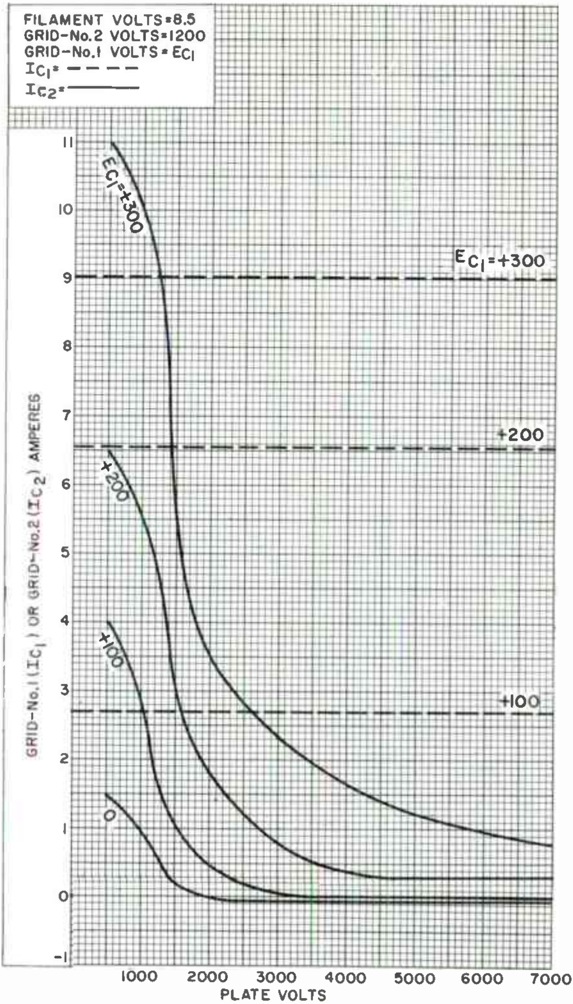


TYPICAL PLATE CHARACTERISTICS



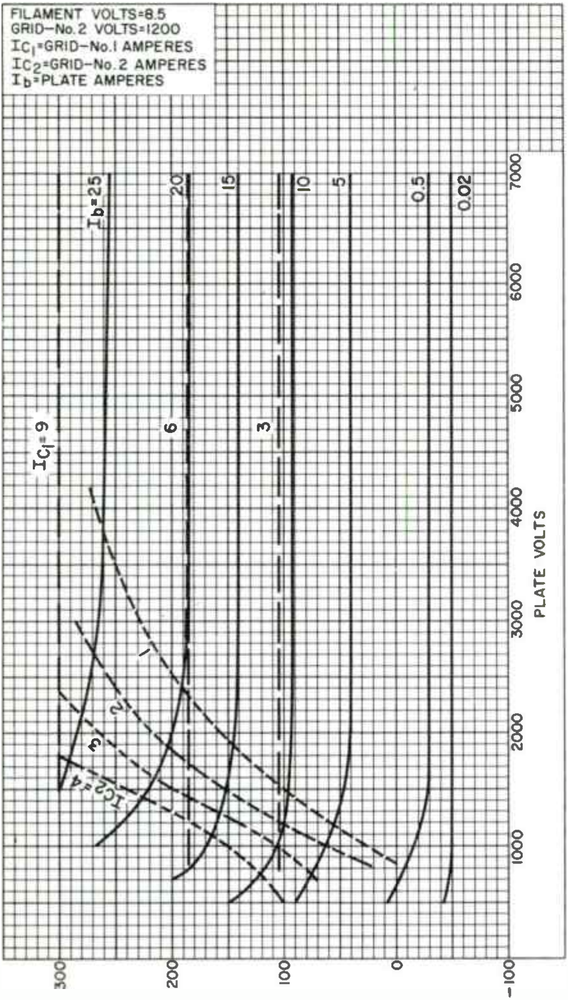
92CM-12098

TYPICAL CHARACTERISTICS



92CM-12101R1

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



Beam Power Tube

LESS THAN 1-SECOND WARM-UP
FOR USE IN LOW-VOLTAGE MOBILE
EQUIPMENT UP TO 500 Mc

COAXIAL-ELECTRODE STRUCTURE
CERAMIC-METAL SEALS
CONDUCTION COOLED

For Use as an RF Power Amplifier, Oscillator, Regulator, Distributed Amplifier, or Linear RF Power Amplifier in Mobile or Stationary Equipment

Electrical:

Filamentary Cathode, Woven-Wire-Mesh Type, Oxide-Coated:		
Voltage (AC or DC)	2.9	volts
Current at 2.9 volts	4.6	amp
Minimum heating time	less than 1[a]	sec
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 250, grid-No.2 volts = 200, and plate amperes = 1.2	11	
Direct Interelectrode Capacitances:[b]		
Grid No.1 to plate	0.13 max.	pf
Grid No.1 to cathode	16	pf
Plate to cathode	0.03 max.	pf
Grid No.1 to grid No.2	22	pf
Grid No.2 to plate	7	pf
Grid No.2 to cathode	3	pf

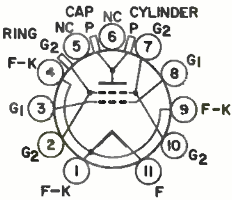
Mechanical:

Operating Position	Any
Maximum Overall Length	2.26"
Seated Length	1.920" ± 0.065"
Diameter	1.426" ± 0.010"
Weight (Approx.)	2 oz
Socket	E. F. Johnson Co.[c] No.124-311-100, Mycalex[d] No.CP464-2, or equivalent
Grid-No.2 Bypass Capacitor	E. F. Johnson Co.[c] No.124-113-1, or equivalent
Base	Large-Wafer Elevenar 11-Pin with Ring (JEDEC No.E11-81)

Terminal Connections *(See Dimensional Outline)*:

BOTTOM VIEW

Pin 1 - Filament-Cathode
Pin 2 - Grid No.2
Pin 3 - Grid No.1
Pin 4 - Same as Pin 1
Pin 5 - No Internal Connection
Pin 6 - No Internal Connection
Pin 7 - Grid No.2
Pin 8 - Grid No.1
Pin 9 - Same as Pin 1
Pin 10 - Grid No.2
Pin 11 - Filament
Cap - Plate-Terminal Connection
Cylinder - Plate-Terminal Contact Surface
Ring[e] - Grid No.2 Terminal Contact Surface



Thermal:

Terminal Temperature (All Terminals)	250 max.	°C
Plate Core Temperature (See *Dimensional Outline*)	250 max.	°C

Cooling, Conduction:

The plate terminal must be thermally coupled to a constant temperature device (heat sink—solid or liquid) to limit the plate terminal temperature to the specified maximum value of 250° C. The grid-No.2, grid-No.1, and filament terminals may also require coupling to the heat sink to limit their respective terminal temperature to the specified maximum value of 250° 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:*

	Up to 500 Mc		
DC Plate Voltage	2200	max.	volts
DC Grid-No.2 Voltage	400	max.	volts
DC Grid-No.1 Voltage	−100	max.	volts
DC Plate Current at Peak of Envelope	450[f]	max.	ma
DC Grid-No.1 Current	100	max.	ma
Plate Dissipation	100[g]	max.	watts
Grid No.2 Input	8	max.	watts

Typical CCS Operation with "Two-Tone Modulation":

	At 30 Mc	
DC Plate Voltage	700	volts
DC Grid-No.2 Voltage[h]	250	volts
DC Grid-No.1 Voltage[h]	−20	volts
Zero-Signal DC Plate Current	100	ma
Effective RF Load Resistance	1420	ohms
DC Plate Current at Peak of Envelope	205	ma
Average DC Plate Current	150	ma
DC Grid-No.2 Current at Peak of Envelope	16	ma
Average DC Grid-No.2 Current	10	ma
Average DC Grid-No.1 Current	1.0[j]	ma
Peak-Envelope Driver Power Output (Approx.)[k]	0.3	watt
Output-Circuit Efficiency (Approx.)	95	%
Distortion Products Level:[m]		
Third order	30	db
Fifth order	35	db
Useful Power Output (Approx.):		
Average	40[n]	watts
Peak envelope	80[n]	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance Under Any Condition:		
With fixed bias	25000 max.	ohms
With fixed bias (In Class AB_1 operation)	100000 max.	ohms
With cathode bias	Not recommended	
Grid-No.2 Circuit Impedance	10000	ohms
Plate Circuit Impedance	p	

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

Maximum CCS Ratings, *Absolute-Maximum Values:*

	Up to 500 Mc	
DC Plate Voltage	2200 max.	volts
DC Grid-No.2 Voltage	400 max.	volts
DC Grid-No.1 Voltage	-100 max.	volts
DC Plate Current	300 max.	ma
DC Grid-No.1 Current	100 max.	ma
Grid-No.2 Input	8 max.	watts
Plate Dissipation	100[g] max.	watts

Typical CCS Operation:

In Grid-Drive Circuit at 50 Mc			
DC Plate Voltage	500	700	volts
DC Grid-No.2 Voltage	160	175	volts
DC Grid-No.1 Voltage	-10	-10	volts
DC Plate Current	300	300	ma
DC Grid-No.2 Current	25	25	ma
DC Grid-No.1 Current	50	50	ma
Driver Power Output (Approx.)[q]	1.2	1.2	watts
Useful Power Output	85[n]	110[n]	watts

In Grid-Drive Circuit at 175 Mc			
DC Plate Voltage	500	700	volts
DC Grid-No.2 Voltage	200	200	volts
DC Grid-No.1 Voltage	-30	-30	volts
DC Plate Current	300	300	ma
DC Grid-No.2 Current	30	20	ma
DC Grid-No.1 Current	40	40	ma
Driver Power Output (Approx.)[q]	3	3	watts
Useful Power Output	70[n]	105[n]	watts

In Grid-Drive Circuit at 470 Mc		
DC Plate Voltage	700	volts
DC Grid-No.2 Voltage	200	volts
DC Grid-No.1 Voltage	-30	volts
DC Plate Current	300	ma
DC Grid-No.2 Current	10	ma
DC Grid-No.1 Current	20	ma

In Grid-Drive Circuit at 470 Mc

Driver Power Output (Approx.)[q]	5	watts
Useful Power Output	85[n]	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance Under Any Condition: With fixed bias	25000 max.	ohms
Grid-No.2 Circuit Impedance	10000 max.	ohms
Plate Circuit Impedance	[p]	

[a] The heating time required for adequate cathode emission is a function of the filament voltage and the impedance of the filament-voltage supply. It may be drastically reduced by employing a suitably designed overvoltage control circuit.

[b] Measured with special shield adapter.

[c] E.F.Johnson Co., 1921 10th Ave. S.W., Waseka, Minnesota.

[d] Mycalex Corp. of America, 125 Clifton Blvd. Clifton, N.J.

[e] For use at higher frequencies.

[f] 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.

[g] Maximum plate dissipation is limited by the maximum plate core temperature and the cooling system to maintain tube operation below the specified maximum plate core temperature. With simple low-cost cooling techniques, maximum plate dissipation may be only about 100 watts; with more sophisticated cooling techniques, maximum plate dissipation may be as high as 300 watts.

[h] Obtained preferably from a separate well-regulated source.

[j] 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.

[k] Driver power output represents circuit losses and is the actual power measured at input to grid-No.1 circuit. The actual power required depends on the operating frequency and the circuit used. The tube driving power is approximately zero watts.

[m] Referenced to either of the two tones, and without the use of feedback to enhance linearity.

[n] This value of useful power is measured at load of output circuit.

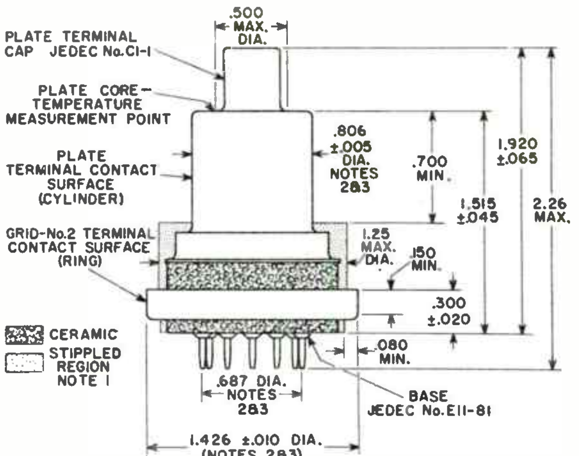
[p] The tube should see an effective plate supply impedance which limits the peak-current through the tube under surge conditions to 15 amperes.

[q] Driver power output includes circuit losses and is the actual power measured at the input to the grid circuit. It will vary depending upon the frequency of operation and the circuit used.

CHARACTERISTICS RANGE VALUES

	Note	*Min.*	*Max.*	
1. Filament Current	1	3.6	5.6	amp
2. Direct Interelectrode Capacitances:				
Grid No.1 to plate	2	-	0.13	pf
Grid No.1 to cathode	2	14	18.5	pf
Plate to cathode	2	-	0.03	pf
Grid No.1 to grid No.2	2	18	24	pf
Grid No.2 to plate	2	5.7	8.0	pf
Grid No.2 to cathode	2	2.0	4.0	pf
3. Grid-No.1 Voltage	1,3	-6	-24	volts
4. Grid-No.2 Current	1,3	-7	+8	ma

Note 1: With 2.9 volts (AC or DC) on filament.
Note 2: Measured with special shield adapter.
Note 3. With dc plate voltage of 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.



DIMENSIONS IN INCHES

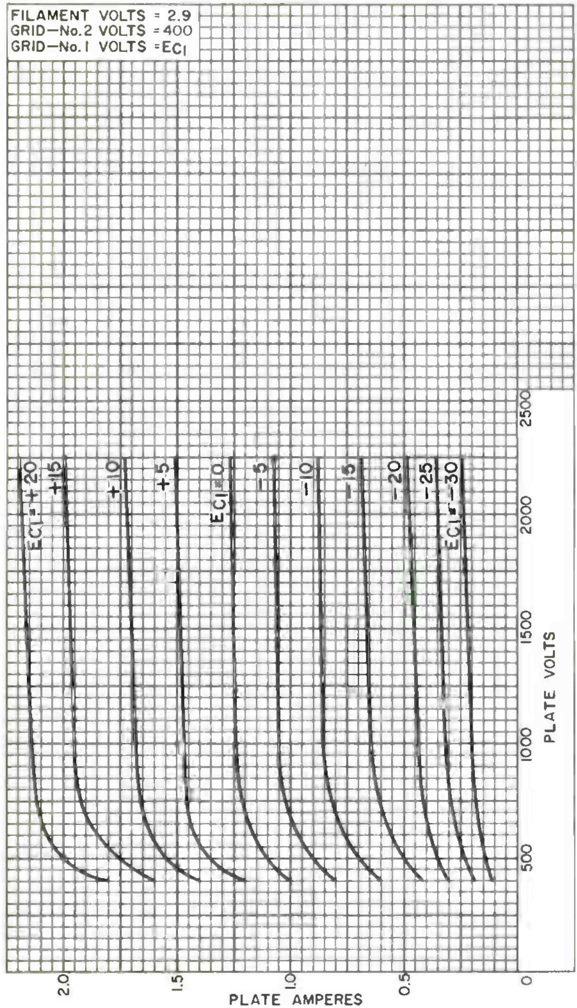
Note 1: Keep all stippled regions clear. Do not allow contacts or circuit components to protrude into these annular volumes.

Note 2: The diameters of the plate terminal contact surface, grid-No.2 terminal contact surface, and pin circle to be concentric within the following values of maximum full indicator reading:

Plate terminal contact surface to grid-No.2 terminal contact surface. . . . . 0.030"
Plate terminal contact surface to pin circle. . . . . 0.040"
Grid-No.2 terminal contact surface to pin circle. . . . . 0.030"

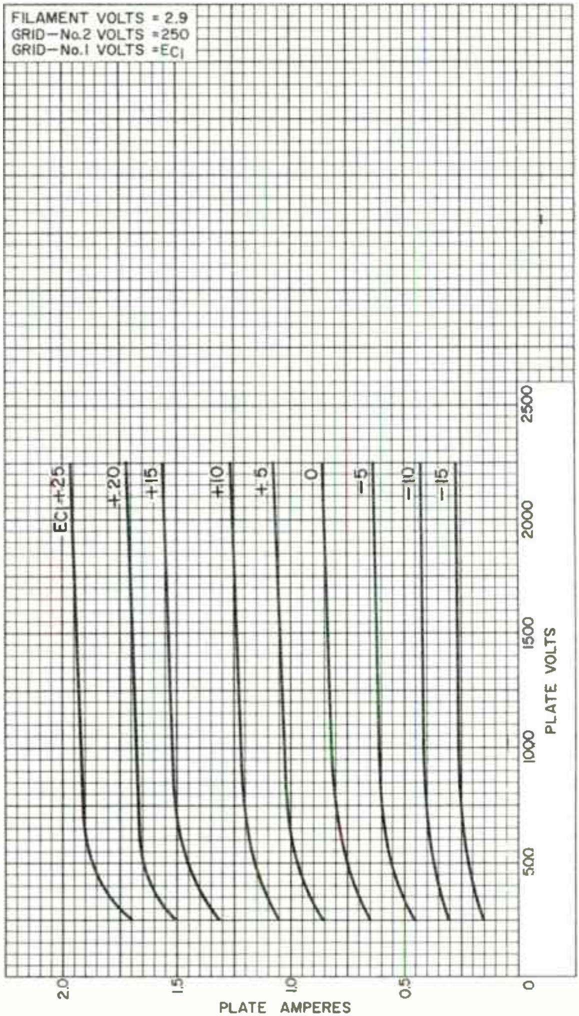
Note 3: The full indicator reading is the maximum deviation in radial position of a surface when the tube is completely rotated about the center of the reference surface. It is a measure of the total effect of run-out and ellipticity.

TYPICAL PLATE CHARACTERISTICS
At a Constant Grid-No.2 Voltage of 400 Volts

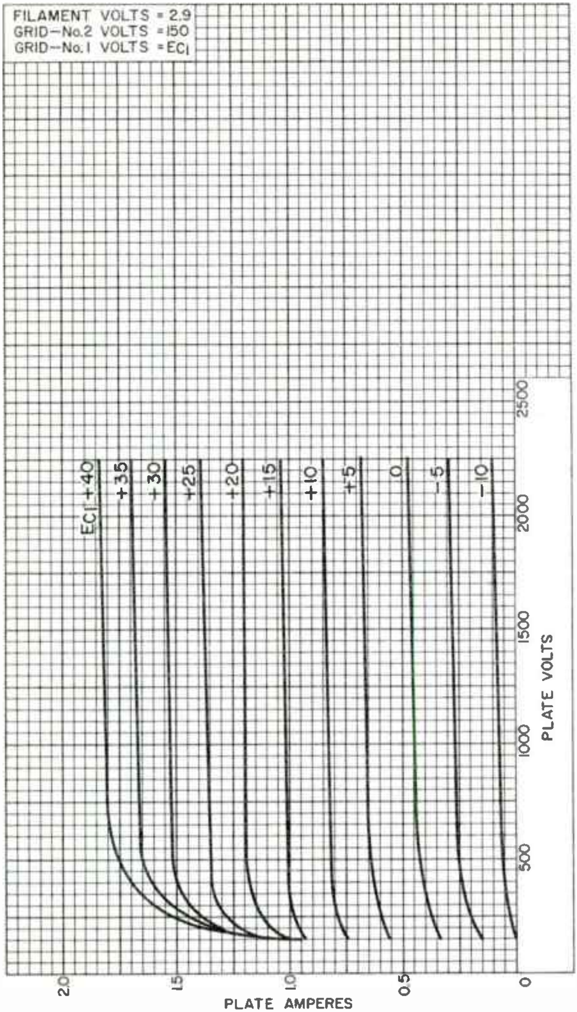


92CM—12225

TYPICAL PLATE CHARACTERISTICS
At a Constant Grid-No.2 Voltage of 250 Volts

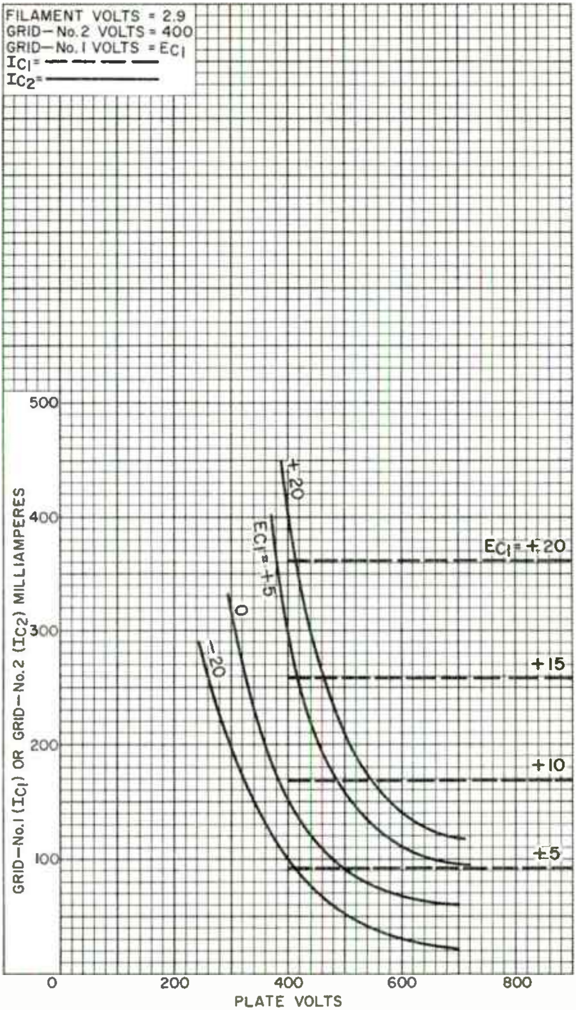


TYPICAL PLATE CHARACTERISTICS
At a Constant Grid-No.2 Voltage of 150 Volts



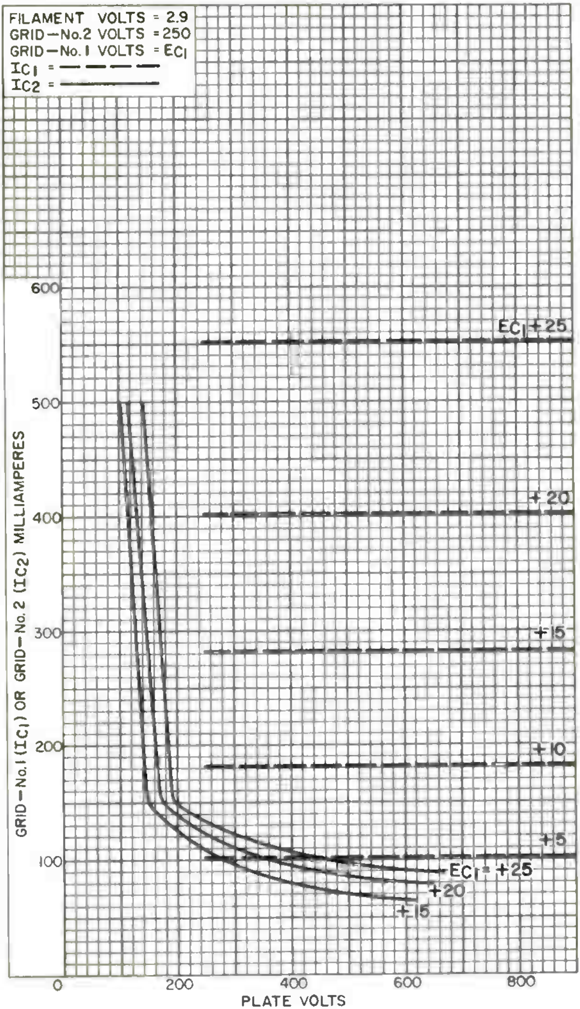
92CM—12234

TYPICAL CHARACTERISTICS
At a Constant Grid-No.2 Voltage of 400 Volts



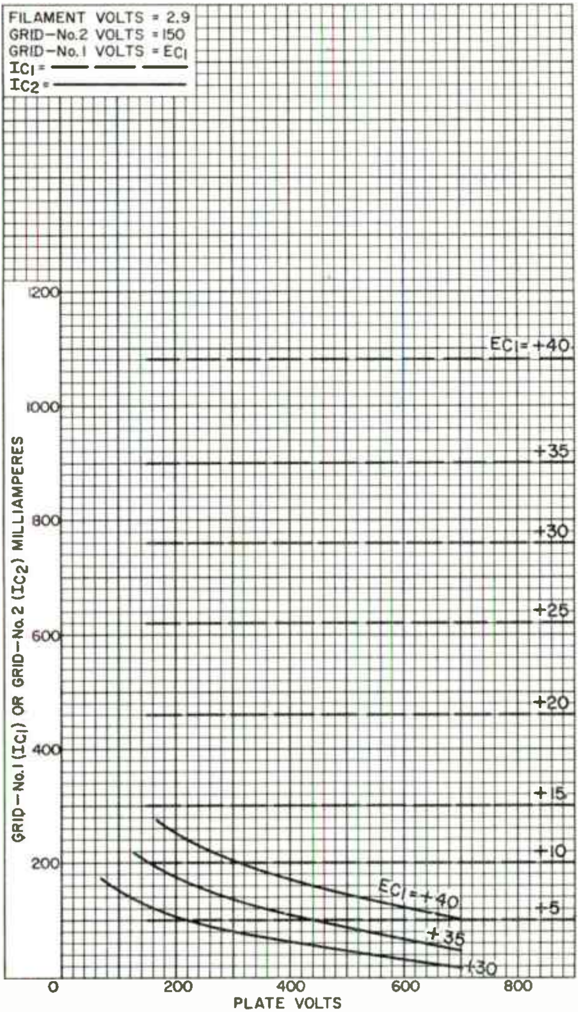
92CM-12226

TYPICAL CHARACTERISTICS
At a Constant Grid-No.2 Voltage of 250 Volts



92CM—12229

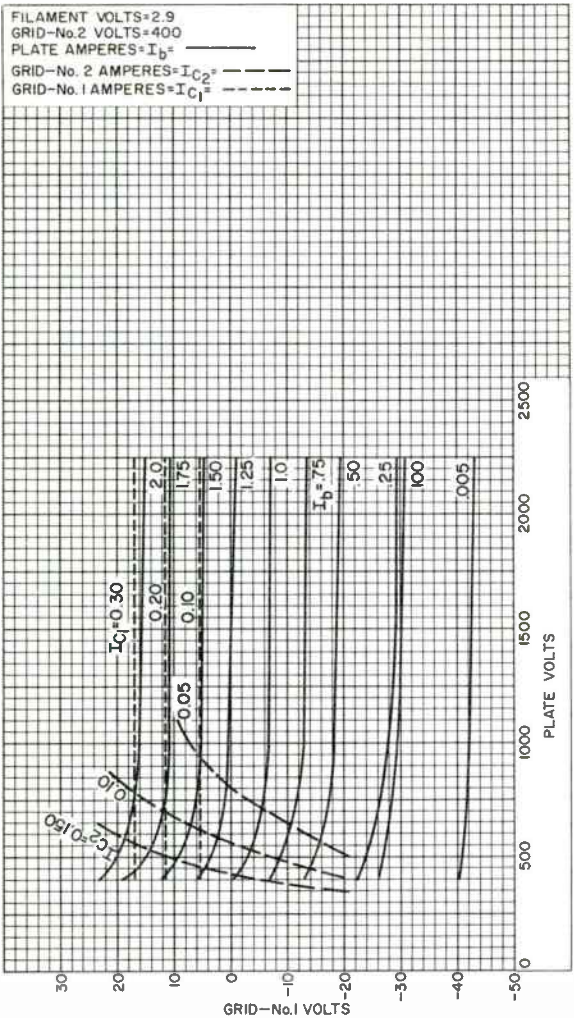
TYPICAL CHARACTERISTICS
At a Constant Grid-No.2 Voltage of 150 Volts



92CM–12241

8462

TYPICAL CONSTANT-CURRENT CHARACTERISTICS
At a Constant Grid-No.2 Voltage of 400 Volts



92CM-12227

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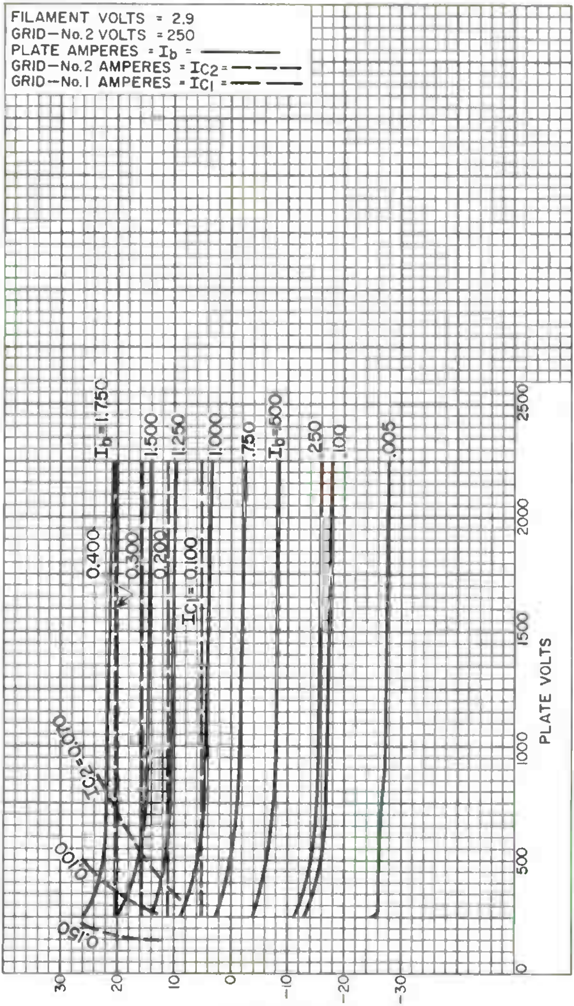
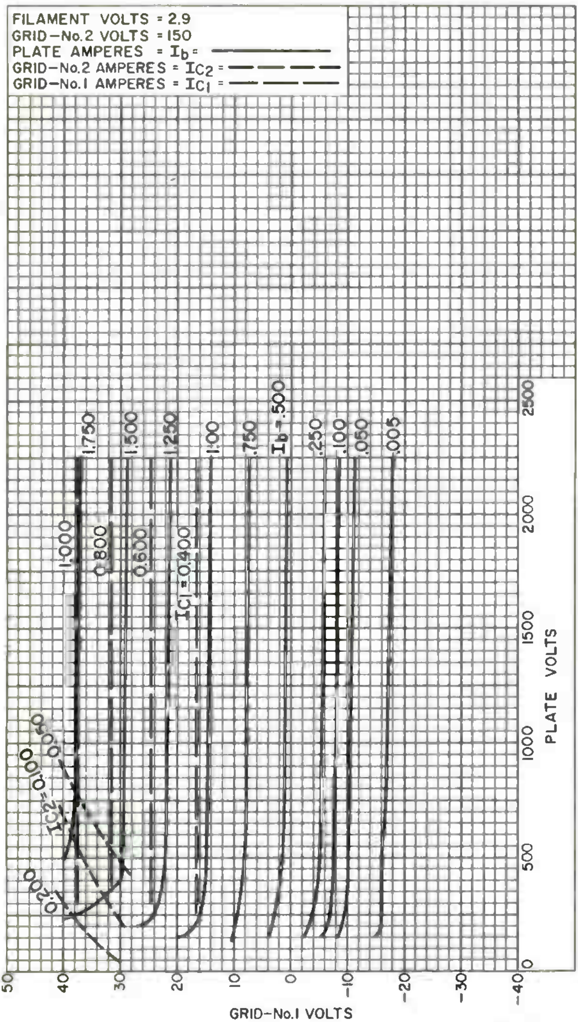
Electronic Components and Devices Harrison, N. J.

TYPICAL CONSTANT-CURRENT CHARACTERISTICS
At a Constant Grid-No.2 Voltage of 250 Volts



92CM-12233

TYPICAL CONSTANT-CURRENT CHARACTERISTICS
At a Constant Grid-No.2 Voltage of 150 Volts



Beam Power Tube

CERMOLOX® — THORIATED-TUNGSTEN MESH FILAMENT
INTEGRAL LOUVERED-FIN RADIATOR — FORCED-AIR COOLED

5500 WATTS UHF TV OUTPUT AT 890 Mc
5500 WATTS CW OUTPUT AT 900 Mc

Also Useful in Applications Intended for UHF TV Service in Stationary and Portable Equipment, such as AF Power Amplifiers or Modulators, Plate-Modulated RF Power Amplifiers in Class-C Telephony Service, AM or Single-Sideband Linear RF Power Amplifiers, Hard-Tube Modulators, Pulsed-RF Amplifiers, Regulators, or other Special Services

Electrical:

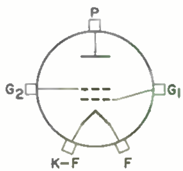
Filamentary Cathode, Thoriated Tungsten Mesh Type:[c]			
Voltage (AC or DC)	4.5	typ.	volts
	5.0	max.	volts
Current:			
At 4.5 volts	125	typ.	amp
For starting, even momentarily	300	max.	amp
Cold resistance	0.005		ohm
Minimum heating time	15		sec
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 1200, grid-No.2 volts = 900, and plate amperes = 8	16		
Direct Interelectrode Capacitances:			
Grid No.1 to plate[a]	0.32	max.	pf
Grid No.1 to filament	65		pf
Plate to filament[a,b]	0.040	max.	pf
Grid No.1 to grid No.2	70		pf
Grid No.2 to plate	13		pf
Grid No.2 to filament[b]	2.0	max.	pf

Mechanical:

Operating Position	Vertical, either end up
Maximum Overall Length	5.65"
Maximum Diameter (See *Dimensional Outline*)	6.17"
Weight (Approx.)	10 lbs
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
F - Filament-Terminal Contact Surface



K-F - Cathode-Filament Terminal Contact Surface
P - Plate-Terminal Contact Surface

Thermal:

Terminal Temperature (Plate, grid No.2, grid No.1, cathode-filament and filament)	250 max.	°C
Plate-Core Temperature	250 max.	°C

Air Flow:[d]

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 filament, plate, grid-No.2, and grid-No.1 voltages.

To Plate, Grid-No.2, Grid-No.1, Cathode-Filament, and Filament Terminals — A sufficient quantity of air should be allowed to flow past each of these terminals so that their temperature does not exceed the specified maximum value of 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.

RF POWER AMPLIFIER — Class B Television Service[c]

Synchronizing-level conditions per tube unless otherwise specified

Maximum CCS Ratings, ***Absolute-Maximum Values:***

DC Plate Voltage	7000	volts
DC Grid-No.2 Voltage	1500	volts
DC Plate Current	4	amp
Plate Dissipation	10000	watts
Grid-No.2 Input	150	watts
Grid-No.1 Input	100	watts

Typical CCS Operation:

In a cathode-drive circuit at 890 Mc and bandwidth of 8.5 Mc

DC Plate Voltage	5700	volts
DC Grid-No.2 Voltage	1000	volts
DC Grid-No.1 Voltage	-40	volts
DC Plate Current:		
Synchronizing level	2.9	amp
Pedestal level	2.2	amp
DC Grid-No.2 Current:		
Synchronizing level	0.015	amp
Pedestal level	0.011	amp
DC Grid-No.1 Current:		
Synchronizing level	0.375	amp
Pedestal level	0.275	amp
Driver Power Output:		
Synchronizing level	600	watts
Pedestal level	335	watts
Output Circuit Efficiency	80	%

Useful Power Output:

Synchronizing level	5500	watts
Pedestal level	3100	watts

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

Maximum CCS Ratings, ***Absolute-Maximum Values:***

DC Plate Voltage	7000	volts
DC Grid-No.2 Voltage	1500	volts
DC Grid-No.1 Voltage	-100	volts
DC Plate Current	3	amp
DC Grid-No.1 Current	0.55	amp
Grid-No.1 Input[f]	100	watts
Grid-No.2 Input[g]	150	watts
Plate Dissipation	10000	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	5000	ohms
Grid-No.2-Circuit Impedance	See Note g	
Plate-Circuit Impedance	See Note h	

Typical CCS Operation:

In Cathode-Drive Circuit at 900 Mc

DC Plate Voltage	5700	volts
DC Grid-No.2 Voltage	1000	volts
DC Grid-No.1 Voltage	-85	volts
DC Plate Current	2.7	amp
DC Grid-No.2 Current	0.025	amp
DC Grid-No.1 Current	0.200	amp
Driver Power Output	900	watts
Output-Circuit Efficiency	72	%
Useful Power Output	5500	watts

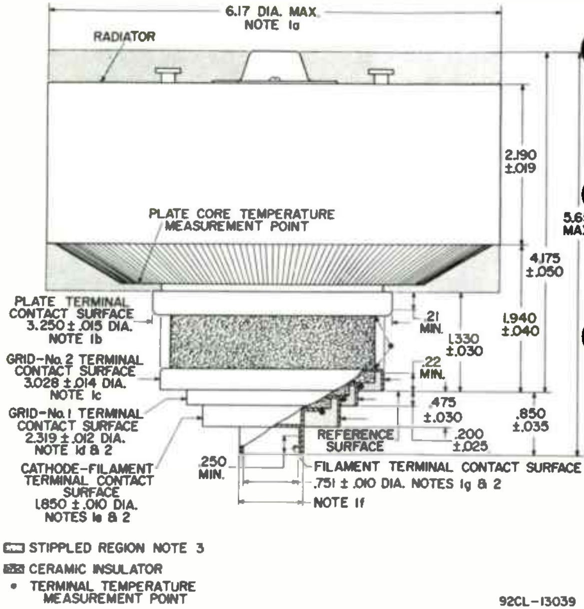
[a] With external flat metal shield 8" in diameter having a center hole 3" in diameter. Shield is located in plane of the grid-No.2 terminal, perpendicular to the tube axis, and is connected to grid No.2.

[b] With external flat metal shield 8" in diameter having a center hole 2-3/8" in diameter. Shield is located in plane of the grid-No.1 terminal, perpendicular to the tube axis, and is connected to grid No.1.

The following footnotes apply to the *RCA Transmitting Tube Operating Considerations* given at front of this section.

[c] See *Electrical Considerations* — Filament or Heater.
[d] See *Cooling Considerations* — Forced-Air Cooling.
[e] See *Classes of Service*.
[f] See *Electrical Considerations* — Grid-No.1 Voltage Supply.
[g] See *Electrical Considerations* — Grid-No.2 Voltage Supply.
[h] See *Electrical Considerations* — Plate Voltage Supply.

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

Note 1: Concentricity between the various diameters is such that the tube will enter a gauge having suitably spaced concentric apertures and posts of the following diameters:

a. Radiator - 6.240
b. Plate Terminal - 3.288
c. Grid-No.2 Terminal - 3.061
d. Grid-No.1 Terminal - 2.338
e. Cathode-Filament Terminal - 1.878
f. Filament Terminal (OD) - 0.908
g. Filament Terminal (ID) - 0.722

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 filament, cathode-filament, 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.

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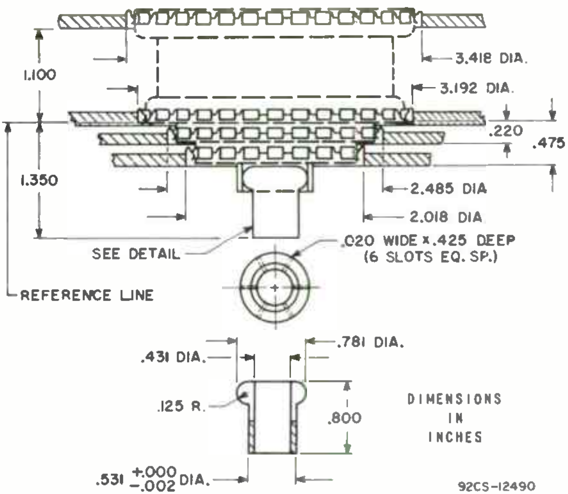
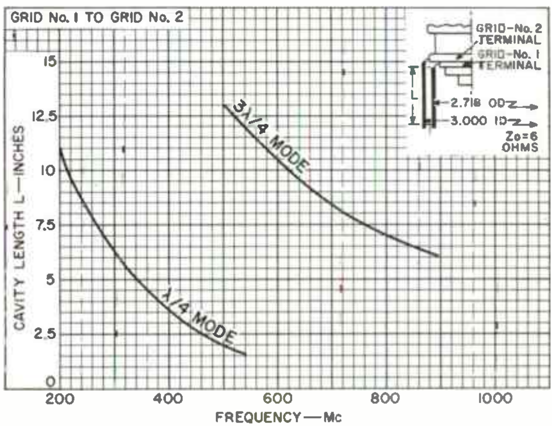
Electronic Components and Devices Harrison, N. J.

PREFERRED MOUNTING ARRANGEMENT

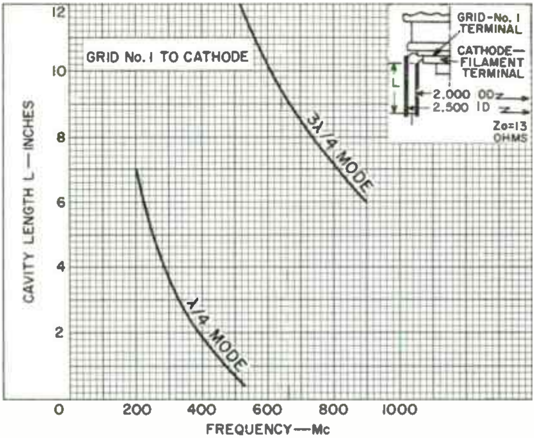


Note: All finger stock No.97-380, made by Instrument Specialties Co., Little Falls, N.J.

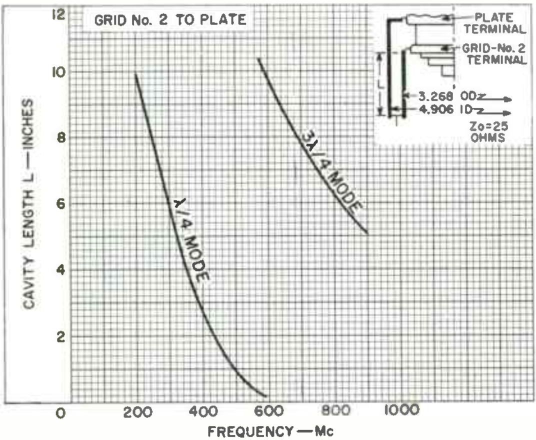
CAVITY TUNING CHARACTERISTICS



CAVITY TUNING CHARACTERISTICS



92CS-13033



92CS-13034

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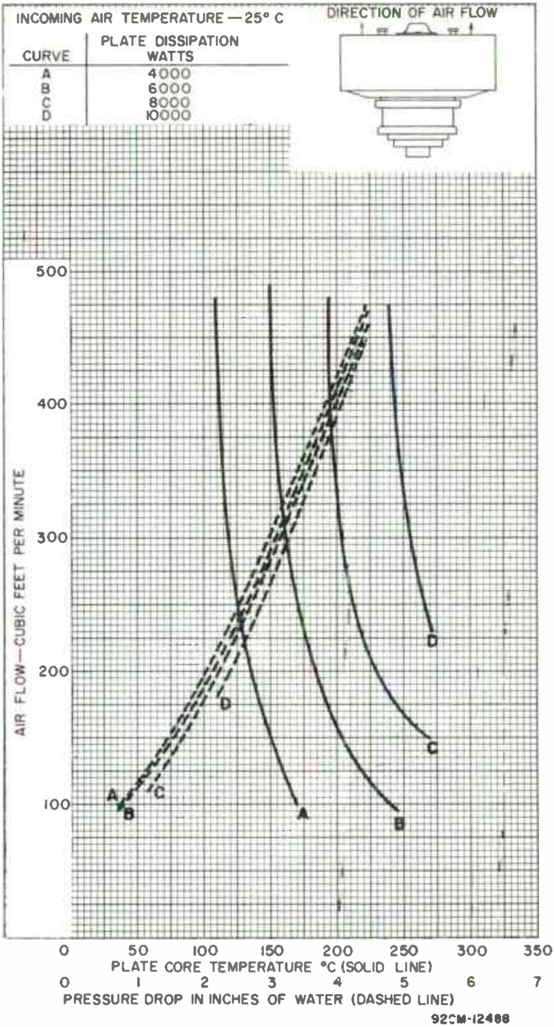
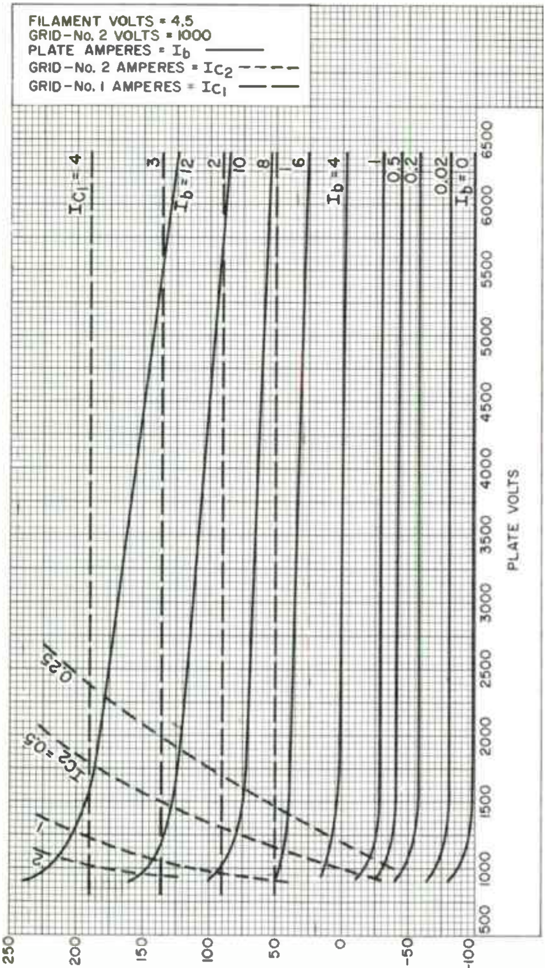
TYPICAL COOLING CHARACTERISTICS



TYPICAL CONSTANT-CURRENT CHARACTERISTICS



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

Super-Power Klystron

FIVE-RESONATOR, FIXED-TUNED, MAGNETICALLY-FOCUSED WATER-COOLED TYPE
21-MEGAWATT PEAK PULSE OUTPUT AT 2856 Mc/s

For RF-Pulsed Amplifier in S-Band Linear Accelerator Service

ELECTRICAL

Heater, for Matrix-Type Oxide-Coated Unipotential Cathode		
Voltage (AC or DC)	15	V
See accompanying *Electrical Considerations*		
Current:		
Typical value at 15 volts	14	A
Starting value, even momentarily	30 max	A
Cold resistance	0.15	Ω
Heating time (Minimum)	20	min
At normal operating current before applying beam voltage		
Pump	Sputter Ion Type	
See accompanying *Electrical Considerations*		
Direct Interelectrode Capacitances		
Anode to cathode	42	pF
Anode to cathode	50	pF
With corona shield and in permanent magnet		
Frequency (Center)	2856	Mc/s
Phase Sensitivity to Beam Voltage	6 deg/per cent of beam-voltage change	

MECHANICAL

Operating Position	Vertical, cathode end down
Maximum Overall Length	49.7 in
Maximum Diameter	See accompanying *Dimensional Outline*
Cooling Connections	
Inlet	1/2 in — 14MPT
Outlet	1/2 in — 14MPT
Circuit Connections	
Beam and heater voltage terminals	See accompanying *Dimensional Outline*
RF input	Mates with UG-573/U male
RF output	Mates to Waveguide WR284 with RCA-AJ2121 Male Waveguide Flange
Sputter ion pump voltage	Mates with No.924-0715[a] High Voltage Connector
Weight (Approx.)	
Without magnets	150 lb
With electromagnet and lead X-radiation shields attached	1100 lb
With permanent magnet and lead X-radiation shields attached	1625 lb

THERMAL

Metal Surface Temperature

At O-ring groove on cathode cylinder.	100 max	°C
All other metal surfaces.	150 max	°C
Ambient Oil Temperature . . . . Electron-gun-assembly bath	100 max	°C
Window Band Temperature . . . . Through 10-32 NF tapped hole in window cover to accommodate thermocouple	90 max	°C
Temperature-Measurement Points.	See accompanying *Dimensional Outline*	

Oil Immersion

Oil immersion of the electron gun assembly is required. The tube must be lowered into an oil bath to the level shown on the *Dimensional Outline*. The oil bath must be of sufficient volume to limit the surface of the electron gun assembly to a temperature below 100° C. Transformer oil with high insulating properties, such as GE10C[b] or equivalent, must be used.

Water Cooling[f]

Water cooling of the internal structure is required. The water flow must start before application of any voltage in order to purge the system of bubbles and should continue for several minutes after removal of voltage. Interlocking of the water flow with the power supply is recommended to prevent tube damage in case of failure of adequate water flow.

Water Flow

For Collector Dissipation	Typ. Flow	Absolute Min. Flow	Max. Pressure Differential for Typ. Flow
kW	gpm	gpm	psi
of 78	11	10	30

Resistivity of water at 25° C	1 min	MΩ-cm
Water temperature at outlet	70 max	°C
Max. water pressure at inlet.	100 max	psi

PULSED RF AMPLIFIER[g]

Absolute-Maximum Ratings

For a maximum dc pulse "ON" time of 3.2 microseconds in any 2700-microsecond interval, and rf load vacuum pressure of 10^{-7} Torr.

Peak Beam Voltage[c].	260	kV
Peak Inverse Beam Voltage	50	kV
Peak Beam Current	270	A
Peak Input Beam Power	68	MW
Average Input Beam Power.	78	kW

Typical Operation

With rectangular waveshape pulses, rf pulse duty factor of 0.0009, rf pulse duration of 2.5 μs centered within a dc pulse duration of 3.2 μs, and at a frequency of 2856 Mc/s.

Peak Beam Voltage	250	200	kV
Peak Beam Current	250	170	A
Driving Power Output	105	150	W
At peak of pulse[d]			
Useful Power Output	21[e]	12[e]	MW
At peak of pulse			
Power Gain	53	49	dB
Phase Modulation			
By heater magnetic field	0.14	0.1	deg
By change in beam voltage	6	5.5	deg/%
Amplitude Modulation	0.12	0.05	%
By noise and heater magnetic field			

Maximum Circuit Value

Load VSWR 1.5:1

[a] Varian Associates, 611 Hansen Way, Palo Alto 2, Calif.
[b] Manufactured by General Electric Co.
[c] The magnitude of any spike on the beam voltage pulse should not exceed its peak value by more than 5%, and the duration of the spike when measured at the peak value level should not exceed 0.15 μs.
[d] Input VSWR at the tube input connection must not exceed 1.5:1.
[e] At a load VSWR not exceeding 1.2:1.

The following footnotes apply to the *RCA Transmitting Tube Operating Considerations* given at front of this section.

[f] See *Cooling Considerations* — Liquid Cooling. For more detailed information on cooling systems see *Application Guide for RCA Super Power Tubes*, ICE-279A. A copy of this guide may be obtained by writing to RCA, Commercial Engineering, Harrison, N.J.
[g] See *Classes of Service*.

CHARACTERISTICS RANGE VALUES

	Note	Min	Max	
Heater Current	1	13	15	A
Peak Beam Current	1,2	237	263	A

Note 1: With 15 volts ac or dc on heater.
Note 2: With beam voltage of 250 kilovolts.

ACCESSORIES

For RCA-8568 SUPER-POWER KLYSTRON

The following tabulated accessories are shown in position on the accompanying Assembly Drawing

RCA Type No.	Description
AJ2106	Set of X-radiation Shields (Includes AJ2107 through AJ2113)
AJ2107	Upper Collector X-radiation Shield
AJ2108	Lower Collector X-radiation Shield
AJ2109	Outlet Water Pipe X-radiation Shield

RCA Type No.	Description
AJ2110	Window X-radiation Shield
AJ2111	Waveguide X-radiation Shield
AJ2112	Inlet Water Pipe X-radiation Shield
AJ2113	Aluminium "Spool" Casting X-radiation Shield
AJ2114	Permanent Magnet
AJ2115	Corona Shield
AJ2116	Sputter-Ion-Pump Magnet and Bracket Assembly
AJ2117	Electromagnet
AJ2119	Aluminum Waveguide-Flange Gasket
AJ2120	Copper Waveguide-Flange Gasket
AJ2121	Male Waveguide Flange
AJ2122	O-ring, uniform dash number 441 Buna N
AJ2123	Waveguide-Flange Hardware (Includes 10 sets of 3/8-16 x 2-1/4 hex head bolts, 3/8-16 nuts, and 0.625 OD x 0.390 ID x 1/16 washers)

OPERATING CONSIDERATIONS

ELECTRICAL

X-Radiation Warning

Because the 8568 is designed to be operated at peak voltages as high as 260 kilovolts, shielding of the tube for X-radiation is necessary to protect against possible injury to operating personnel.

A set of X-radiation shields to reduce X-radiation to a level not to exceed 3 milliroentgens/hour at a distance of 36 inches from the major tube axis is available as an accessory, RCA-AJ2106. The shields are available individually or in a set.

Heater Voltage

The life of the cathode can be conserved by adjusting to the lowest heater supply voltage that will give the desired performance. In a klystron, however, the heater voltage must not be reduced to a level that will cause an excessive reduction in beam current; otherwise, the cathode may be damaged.

A recommended procedure for adjusting heater voltage during life for maximum life expectancy is as follows:

1. Set the heater voltage at the recommended value.
2. Set the beam voltage at the maximum operating voltage during adjustment.
3. Reduce the heater voltage in 0.5-volt steps with 20-minute stabilization periods between each step.
4. Monitor the beam current continually.

CAUTION

With the beam voltage held constant, the beam current must never drop more than three amperes. If the three-ampere drop is exceeded, TURN OFF BEAM VOLTAGE IMMEDIATELY.

5. Lower the heater voltage until the beam current is reduced two amperes.
6. Increase heater voltage approximately ten percent of the minimum value of heater voltage noted in step 5 above. If the heater voltage supply is regulated, increase heater voltage approximately five percent of the minimum value of heater voltage noted in step 5 above.

Sputter Ion Pump

The sputter ion pump on the 8558 is a variant of the RCA-VC2119; the only difference is in the vacuum system connection.

The RCA-VX2201 Control Unit is a power supply designed especially for the VC2119 Series sputter ion pumps

PM Magnetic Field

For applications using permanent-magnet-focused 8568's, care must be taken that the magnetic field is not distorted by effects of other ferromagnetic materials. In general, such materials should be located at least three feet from the magnet.

MECHANICAL

Handling

Raise the tube and magnet by using a hoist attached to three eyebolts on the top flange of the magnet, or by three eyebolts which can be screwed into the 1/2"-13 tapped holes located on the top flange of the aluminum "spool" casting. See *Dimensional Outline* for eyebolt locations.

CAUTION

Do not rest the tube on the corona shield or heater contact.

Rest the tube in an appropriate stand on the lower side of the bottom flange of the aluminum "spool" casting. The tube can also rest on the three locating "buttons" when so equipped.

Mounting

For equipment design, the tube is mounted by resting the lower side of the bottom flange of the aluminum "spool" casting on the focusing magnet.

Connections

The output waveguide of the 8568 contains an rf window to close the vacuum envelope of the tube.

CAUTION

External pressure (load side) applied to the rf window must not exceed 10^{-7} Torr during operation, otherwise the tube may be damaged.

In certain cases, it may be desirable to pressurize rather than evacuate to load side of the window to prevent damage to the tube.

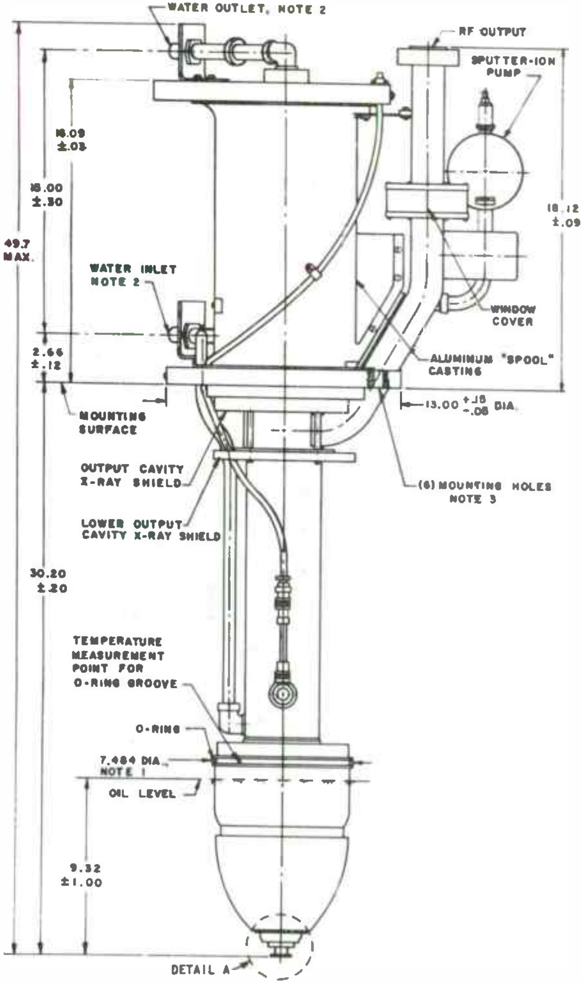
The window must be kept clean of any foreign material. When the load waveguide is not connected to the tube, the plastic cover supplied for shipping should be used to cover the tube waveguide flange.

A male waveguide flange, RCA-AJ2121, a non-reusable gasket, RCA-AJ2119 (aluminum) or RCA-AJ2120 (copper), and ten sets of nuts, bolts, and washers, RCA-AJ2123, can be used to provide a vacuum-tight waveguide seal. The nuts should be evenly tightened, with a torque wrench in increments of 1/8 to 1/4 turn each cycle. The final torque muat not exceed 100 pound-inches. The copper gasket should be selected if the oxidation rate of the aluminum is excessive. Power supply voltage connections to the tube are made with a corona shield, RCA-AJ2115.

FOR ADDITIONAL INFORMATION ON THIS TYPE, WRITE FOR TECHNICAL BULLETIN AND APPLICATION GUIDE FOR RCA SUPER POWER TUBES, 1CE-279A AVAILABLE FROM:

Commercial Engineering
Electronic Components and Devices
Radio Corporation of America
Harrison, New Jersey

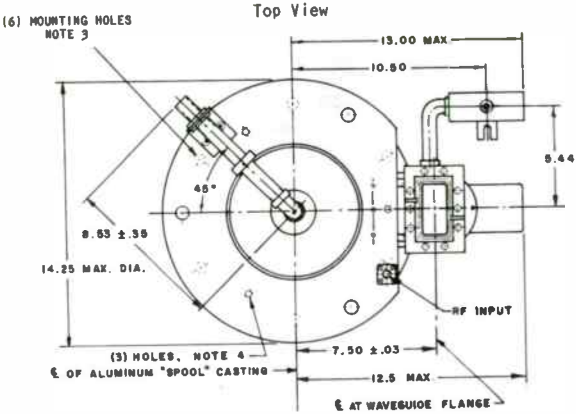
DIMENSIONAL OUTLINE
Side View



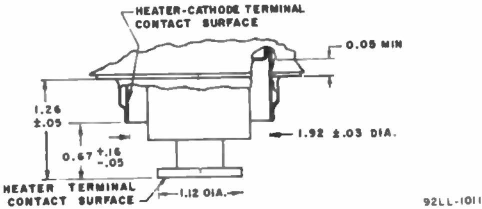
DIMENSIONS IN INCHES

DIMENSIONAL OUTLINE

Top View



Detail A



DIMENSIONS IN INCHES

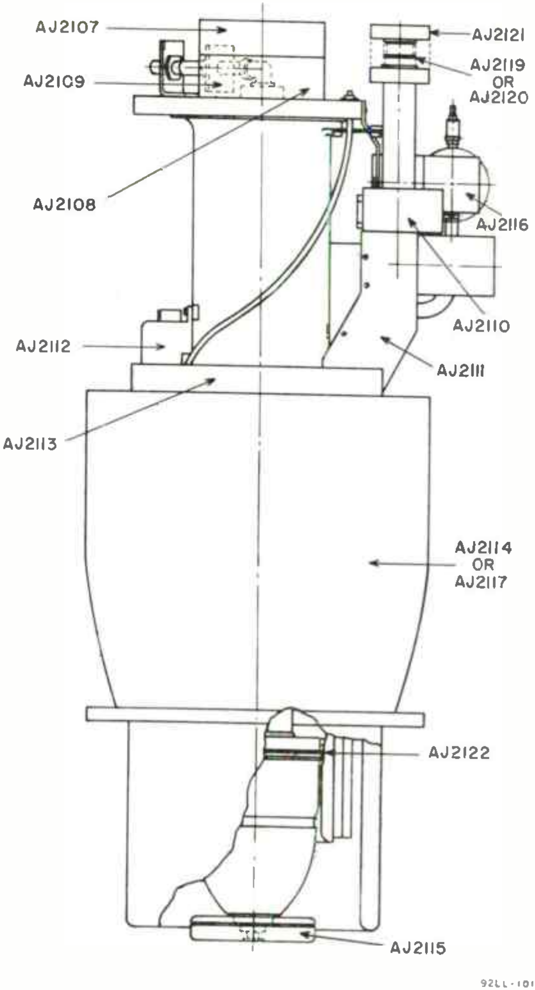
Note 1: Recommended diameter of O-ring sealing surface.

Note 2: 1/2-14 external American Standard taper pipe thread (Male).

Note 3: Six (6) mounting holes, 9/16 inch diameter through the 13.00-inch diameter flange. Equally spaced on a bolt circle of 11.56 inch diameter.

Note 4: Three (3) holes, 1/2-13 NC, equally spaced on a bolt circle of 10.00 inches for lifting eyebolts.

ASSEMBLY DRAWING



Super-Power Beam Power Tube

2 MEGAWATTS PEAK POWER OUTPUT IN
SHORT-PULSE SERVICE AT 425 MHz

PULSE LENGTH
TO 15 MICROSECONDS

LOW FILAMENT POWER
FOR AIRBORNE USE

LIQUID COOLED

For Grid-Driven, Plate-Pulsed Amplifier Applications at Frequencies from 174 to 600 MHz in Long-Range Search Radar and in Pulsed Communications Applications

The 8587 is the same as the 6952 except for the following items:

MECHANICAL

Overall Length. . . . . 9.19 ± 0.31 in

COOLING CONSIDERATIONS[a]

To inspect the plate coolant course: (1) Remove the 8 screws from the plate terminal. Lift the plate-terminal assembly carefully out of the tube. This assembly should come out easily. (2) Remove the O-ring from the moat. (3) Inspect the internal structure of the plate coolant course with the aid of a convenient light source.

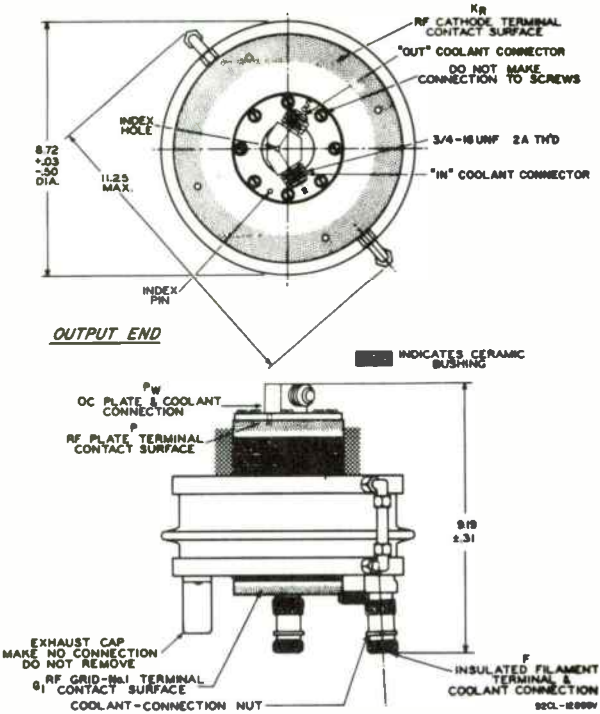
(a) When water or ethylene-glycol-water solution is used, the plate-terminal assembly may stick in (1) above due to excessive deposit build-up. If so, clean the plate coolant course before further attempting to remove the assembly. In (3) above determine if there is a flaky or adherent deposit on the structure. If a deposit is observed, it should be removed. Such a deposit generally consists of copper oxide (usually black) which can be removed by cleaning as above.

(b) When liquid coolant FC75 is used, determine if there are any particles. Remove any particles. In general, the metal surface of the coolant course should not exhibit any heavy deposits or oxide coatings.

(4) Replace the O-ring in the moat. Orient the plate-terminal assembly so that it is in its original position (refer to the index pin of the tube for orientation) and then seat it. Replace the 8 screws. Tighten the screws in succession until snug.

[a] See *Cooling Considerations-Liquid Cooling*, under *RCA Transmitting Tube Operating Considerations* given at front of this section.

SIMPLIFIED DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

A detailed Dimensional Outline and associated Gauge Drawings are given in the Technical Bulletin available upon request.

FOR ADDITIONAL INFORMATION ON THIS TYPE INCLUDING INPUT AND OUTPUT CAVITY DRAWINGS, WRITE FOR TECHNICAL BULLETIN AND APPLICATION GUIDE FOR RCA SUPER POWER TUBES, ICE-279A, AVAILABLE FROM:

Commercial Engineering
Electronic Components and Devices
Radio Corporation of America
Harrison, New Jersey

Beam Power Tube

CERMOLOX® RUGGEDIZED TYPE — INTEGRAL RADIATOR
FORCED-AIR COOLED — 40 WATTS CW POWER OUTPUT AT 1215 Mc/s
MATRIX-TYPE, OXIDE-COATED, UNIPOTENTIAL CATHODE

For Use in Compact Aircraft, Mobile, and Stationary Equipment

The 8596 is the same as the 7457 except for the following items:

MECHANICAL

Maximum Overall Length . . . . 2.036 in
Maximum Diameter . . . . 1.327 in

THERMAL

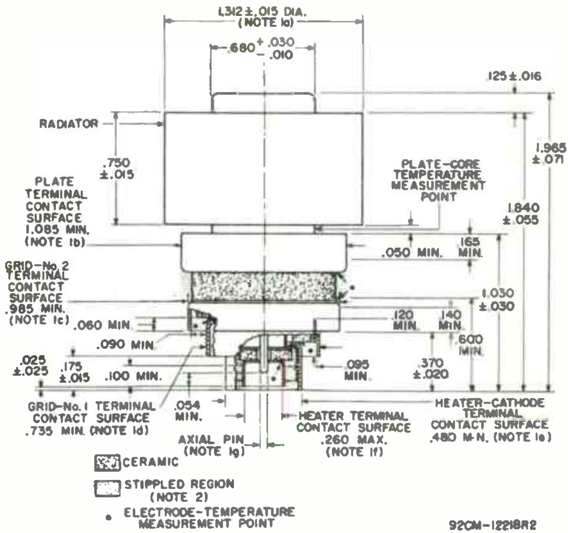
Plate, Grid No.2, Grid No.1, Cathode, and
Heater Temperature . . . . 250 max °C
Plate-Core Temperature . . . . 250 max °C

CHARACTERISTICS RANGE VALUES

	Note	Min	Max	
Zero Bias Plate Current	1,7	390	-	mA

NOTE 7: With dc plate volts = 300, dc grid-No.2 volts = 150, dc grid No.1 volts = 0.

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

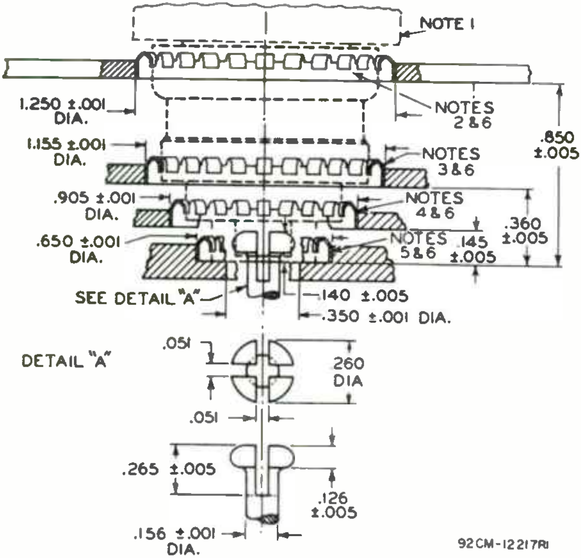
For notes, see next page.

NOTE 1: The following diametrical space requirements accommodate the concentricity of the cylindrical surfaces of the radiator band, axial pin, and each electrode terminal:

a. Radiator Band - 1.376 inch
b. Plate Terminal - 1.119 inch
c. Grid-No.2 Terminal - 1.019 inch
d. Grid-No.1 Terminal - 0.764 inch
e. Heater-Cathode Terminal - 0.519 inch
f. Heater Terminal - 0.238 inch
g. Axial Pin - 0.071 inch

NOTE 2: Keep all stippled regions clear. Do not allow contacts or circuit components to protrude into these annular volumes.

PREFERRED MOUNTING ARRANGEMENT
and 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 radiator 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 Co., Little Falls, N. J.

Power Triode

NUVISTOR TYPE

ENVIRONMENTAL TESTS — LIFE TEST

For Cathode-Drive, Low-Level Class-C RF-Power-Amplifier, Oscillator, or Frequency-Multiplier Applications to 1.2 Gc/s in Aircraft, Industrial, Military, and Other Equipment Operating Under Conditions of Severe Shock and Vibration.

ELECTRICAL CHARACTERISTICS

Bogey Values

Heater Voltage (AC or DC)	E_f	6.3	V
Heater Current at Ef = 6.3 V. . . .	I_f	150	mA
Heater Input.	P_f	0.95	W
Direct Interelectrode Capacitances			
Without external shield			
Input: K to (G,S,H).	c_i	6.0	pF
Output: P to (G,S,H)	c_o	1.2	pF
Heater to cathode	c_{hk}	1.4	pF

Class A₁ Amplifier

For following characteristics, see Conditions

Amplification Factor.	μ	60	70	
Plate Resistance (Approx.).	r_p	6300	5400	Ω
Transconductance.	g_m	9500	13000	μmho
DC Plate Current.	I_b	9	11.5	mA
Cutoff DC Grid Voltage for				
I_b = 10 μA	$E_{c(co)}$	-	-5	V

Conditions

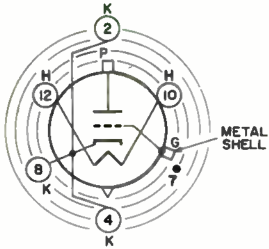
Heater Voltage.	E_f	6.3	6.3	V
Plate Supply Voltage.	E_{bb}	150	110	V
Grid Supply Voltage	E_{cc}	0	0	V
Cathode Resistor.	R_k	150	47	Ω

MECHANICAL CHARACTERISTICS

Operating Position.	Any
Type of Cathode	Coated Unipotential
Minimum Overall Length (l_m).	0.985 in
Maximum Seated Length (l_{sm})	0.780 in
Maximum Diameter (d_m)	0.440 in
Weight (Approx.).	2.2 g
Dimensional Outline	JEDEC No.4-6
Envelope.	JEDEC MT4
Top Cap[a].	Small (JEDEC C1-44)
Base[b]	Medium-Ceramic-Wafer Twelvar 5-Pin (JEDEC E5-79)

Basing Designation for BOTTOM VIEW. 12CT

Pin 2 – Cathode
Pin 4 – Cathode
Pin 7[c] – Do Not Use
Pin 8 – Cathode
Pin 10 – Heater
Pin 12 – Heater
Metal Shell – Grid
Top Cap – Plate



INDEX = LARGE LUG
• = SHORT PIN—IC

ABSOLUTE MAXIMUM RATINGS

For Low-Level Class-C RF-Power-Amplifier, Oscillator, or Frequency-Multiplier Tube Operation at frequencies up to 1.2 Gc/s

		CCS[d]	*ICAS*[e]	
Plate Supply Voltage	E_{bb}	500	500	V
DC Plate Voltage	E_b	250	300	V
Grid Voltage				
Peak positive value	e_{cm}	4	5	V
DC positive value	E_c	0	0	V
DC negative value	E_c	-100	-100	V
Peak Heater-Cathode Voltage .	e_{hkm}	±100	±100	V
Heater Voltage, AC or DC. . .	E_f	5.7 to 6.9	5.7 to 6.9	V
Instantaneous Voltage . . . . Between top cap or base pins and metal shell		See *Breakdown-Voltage Characteristics* Curve		
Average Grid Current.	$I_{c(av)}$	5	6	mA
Average Cathode Current . . .	$I_{k(av)}$	25	30	mA
Plate Dissipation	P_b	2.5	2.7	W
Envelope Temperature.	T_E	200	200	°C

MAXIMUM CIRCUIT VALUES

		CCS	*ICAS*	
Grid-Circuit Resistance	$R_g(ckt)$			
For fixed-bias or cathode-bias operation:				
For $T_E \leq 150°$ C		50	50	kΩ
For $T_E > 150°$ C		See *Grid-Circuit-Resistance Rating Chart*		

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Electronic Components and Devices Harrison, N. J.

TYPICAL OPERATION — CCS

As Cathode-Drive RF Power Amplifier

Frequency	f	1	1.2	Gc/s
Heater Voltage	E_f	6.3	6.3	V
DC Plate-to-Grid Voltage	E_{bg}	180	180	V
DC Cathode-to-Grid Voltage	E_{kg}	5.5	5.5	V
From grid resistor of	R_g	1200	1200	Ω
Average Plate Current	$I_{b(av)}$	20	20	mA
Average Grid Current	$I_{c(av)}$	4.5	4	mA
Driving Power (Approx.)	P_g	150	250	mW
Useful Power Output (Approx.)[g]	P_o	1.4	1.2	W

As RF Oscillator

Frequency	f	1	Gc/s
Heater Voltage	E_f	6.3	V
DC Plate Voltage	E_b	180	V
DC Grid Voltage	E_c	-5.5	V
From grid resistor of	R_g	1200	Ω
Average Plate Current	$I_{b(av)}$	21	mA
Average Grid Current	$I_{c(av)}$	4.5	mA
Useful Power Output (Approx.)[g]	P_o	1.25	W

As Cathode-Drive Frequency Doubler

Output Frequency	f_o	1	Gc/s
Heater Voltage	E_f	6.3	V
DC Plate-to-Grid Voltage	E_{bg}	180	V
DC Cathode-to-Grid Voltage	E_{kg}	8.5	V
From grid resistor of	R_g	1200	Ω
Average Plate Current	$I_{b(av)}$	18.5	mA
Average Grid Current	$I_{c(av)}$	3	mA
Driving Power (Approx.)	P_g	300	mW
Useful Power Output (Approx.)[g]	P_o	0.7	W

[a] Designed to mate with "1/4-inch" connector generally available from your local RCA Distributor.

[b] Designed to mate with Cinch Mfg. Co. socket No.133 65 10 041, Cinch-Jones Sales-Division Distributor socket Designation SNS-3, or equivalent.

[c] Pin 7 is of a length such that its end does not touch the socket insertion plane.

[d] Continuous Commercial Service.

[e] Intermittent Commercial and Amateur Service. No operating or ON period exceeds 5 minutes and every ON period is followed by an OFF or standby period of the same or greater duration.

[f] Measured on metal shell in Zone "A" (See *Dimensional Outline*).

[g] Measured at load.

INITIAL CHARACTERISTICS LIMITS

	Note	*Min*	*Max*	
Heater Current	1	140	160	mA
Direct Interelectrode Capacitances	2			
Cathode to plate	-	-	0.046	pF
Input: K to (G,S,H)	-	5.0	7.0	pF
Output: P to (G,S,H)	-	0.9	1.5	pF
Heater to cathode	-	1.1	1.7	pF
Amplification Factor	3	50	90	

	Note	Min	Max	
Transconductance (1)	4	7500	11500	μmho
Transconductance (2)	3	10500	15500	μmho
Plate Current (1)	4	6.5	11.5	mA
Plate Current (2)	3	8.5	14.5	mA
Cutoff Plate Current	5	-	50	μA
Useful Power Output	6	1.1	-	W
Total Grid Current	7	-	-0.1	μA
Heater-Cathode Leakage Current	8	-	±5	μA
Leakage Resistance				
Between grid and all other electrodes connected together	9	5	-	GΩ
Between plate and all other electrodes connected together	10	10	-	GΩ
Inoperatives	11	✓		

Note 1: With E_f = 6.3 V.

Note 2: Measured without external shield.

Note 3: With E_f = 6.3 V, E_{bb} = 110 V, E_{cc} = 0 V, R_k = 47 Ω, C_k = 1000 μf.

Note 4: With E_f = 6.3 V, E_{bb} = 150 V, E_{cc} = 0 V, R_k = 150 Ω, C_k = 1000 μf.

Note 5: With E_f = 6.3 V, E_b = 150 V, E_c = -7 V.

Note 6: Measured at load in cathode-drive rf-power-amplifier circuit with f = 1 Gc/s, E_f = 6.3 V, E_{bg} = 175 V, E_{kg} = 6 V from R_g = 1200 Ω, $I_{b(av)}$ = 23 mA max, $I_{c(av)}$ = 5 mA max, P_g = 150 mW, circuit tuned for maximum $P_{o(useful)}$.

Note 7: With E_f = 6.3 V, E_b = 150 V, E_{cc} = -1.3 V, R_g = 0 Ω.

Note 8: With E_f = 6.3 V, E_{hk} = ±100 V.

Note 9: With E_f = 6.3 V, $E_{g\text{-}all}$ = -100 V.

Note 10: With E_f = 6.3 V, $E_{p\text{-}all}$ = -300 V.

Note 11: Tubes are criticized for Shorts, Discontinuities, and Air Leaks.

ENVIRONMENTAL TESTS

High-Impact, Short-Duration Shock

Peak Impact Acceleration	1000	g
Duration of approximate half-sine-wave mechanical-shock pulse	0.8 ± 0.2	ms

Operating Conditions during Test

E_f = 6.3 V, E_{bb} = 150 V, E_{cc} = -1.3 V, R_g = 50 kΩ, E_{hk} = 100 V

Post-Shock Limits and Rejection Criteria	Min	Max	
$\Delta 1 g_m$	-	±15	%
I_c	-	-0.1	μA
I_{hk}	-	±10	μA
E_{Rpm} (Variable-Frequency-Vibration Test Limits) over vibration-frequency range of:			
3 to 6 kc/s	-	100	mV
6 to 15 kc/s	-	1000	mV
Tap and Permanent Shorts, and Discontinuities		✓	

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Low-Impact, Long-Duration Shock

Peak Impact Acceleration	50	g
Duration of approximate half-sine-wave mechanical-shock pulse	11 ± 2	ms

Condition during Test
No tube-element voltages are applied.

Post-Shock Limits and Rejection Criteria
Same as those specified above for the High-Impact, Short-Duration Shock Test

Sweep-Frequency-Vibration Fatigue

Vibration-Frequency Range (Overall)	5 to 500 to 5	c/s
Peak Displacement (5 to 50 and 50 to 5 c/s)	0.040	in
Peak-to-peak value	0.080	in
Peak Vibrational Acceleration (50 to 500 to 50 c/s)	10	g
Period of 1 sweep cycle (Approx.) (5 to 500 to 5 c/s)	15	m
Duration of Test (Overall)	9	h
Along each of 3 mutually perpendicular axes	3	h

Operating Condition during Test
E_f = 6.3 V

Post-Sweep-Frequency-Vibration-Fatigue Limits and Rejection Criteria
Same as those specified above for the High-Impact, Short-Duration Shock Test

Variable-Frequency Vibration

Vibration-Frequency Range (Overall)	3 to 15	kc/s
Peak Vibrational Acceleration in X_1 position	1	g
Period of 1 sweep cycle (3 to 15 kc/s)	7	s

Operating Conditions during Test
E_f = 6.3 V, E_{bb} = 150 V, E_{cc} = 0 V, R_k = 150 Ω, R_p = 2 kΩ

Limits

	Min	*Max*	
E_{Rpm} over vibration-frequency range of:			
3 to 6 kc/s	-	80	mV
6 to 15 kc/s	-	700	mV

LIFE TESTS

Heater Cycling

Duration of Test	2000	cycles

Operating Conditions
E_f = 8.5 V cycled 1 minute ON and 2 minutes OFF, E_{hk} = −180 V continuously ON

Rejection Criteria
Heater-cathode shorts, and heater and cathode discontinuities

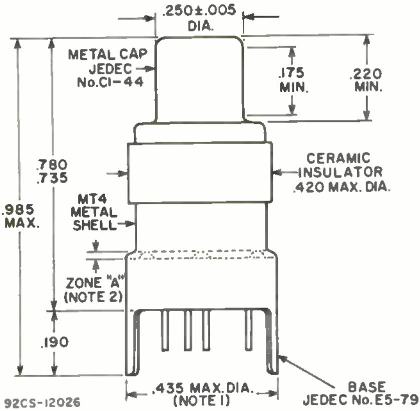
Intermittent Operation (2, 20, 100, 500, and 1000 Hours)

Operating Conditions

E_f = 6.3 cycled 110 minutes ON and 10 minutes OFF,
E_{bb} = 150 V, E_{cc} = 0 V, R_g = 50 kΩ, P_b = 2.4 W,
T_E = 150° C min

End-Point Limits At	2 and 20		100		500		1000		h
	Min	Max	Min	Max	Min	Max	Min	Max	
1gm	-	-	6700	-	-	-	-	-	µmho
Δ1gm/t.	-	±10	-	-	-	-	-	-	%
Po(useful). . .	-	-	-	-	1.0	-	0.9	-	W
Ic.	-	-	-	-0.2	-	-	-	-	µA

DIMENSIONAL OUTLINE
JEDEC No.4-6

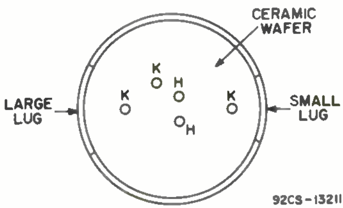


DIMENSIONS IN INCHES

Note 1: Maximum outside diameter of 0.440" is permitted along 0.190" lug length.

Note 2: Envelope temperature should be measured in zone "A".

MODIFIED BOTTOM VIEW
With Element Connections Indicated
and Short Pin Not Shown



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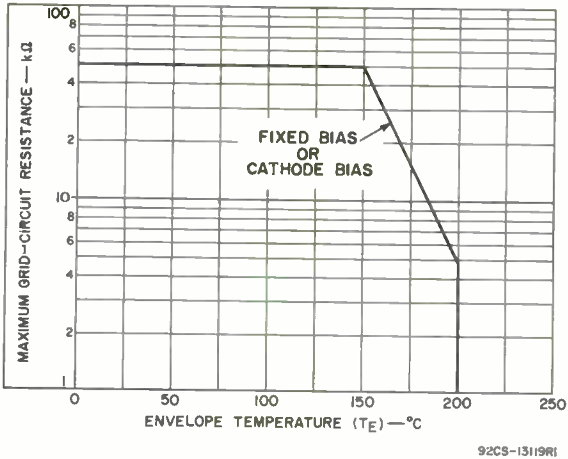
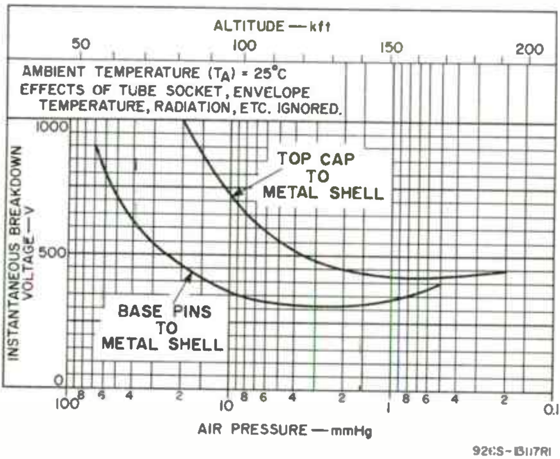
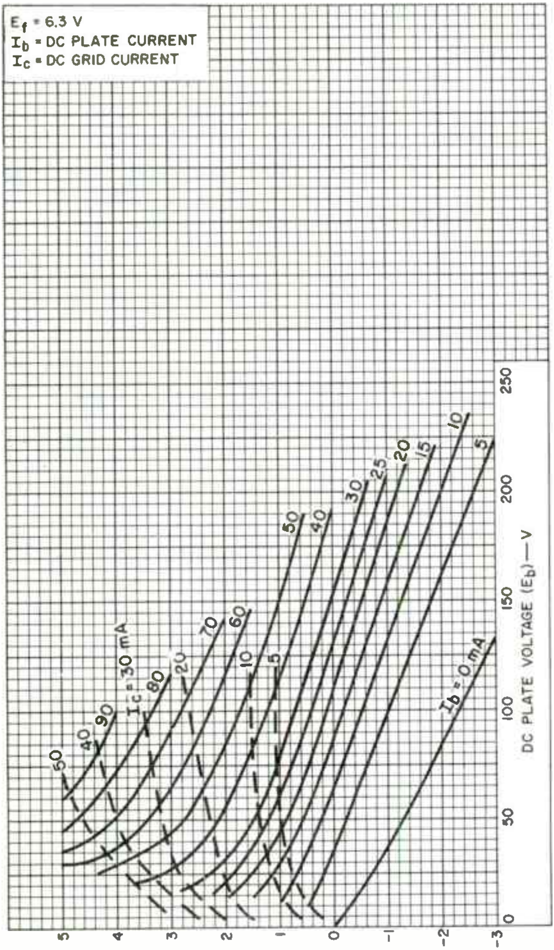
Grid-Circuit-Resistance Rating Chart



Breakdown-Voltage Characteristics



Typical Constant-Current Characteristics



92CM-13220

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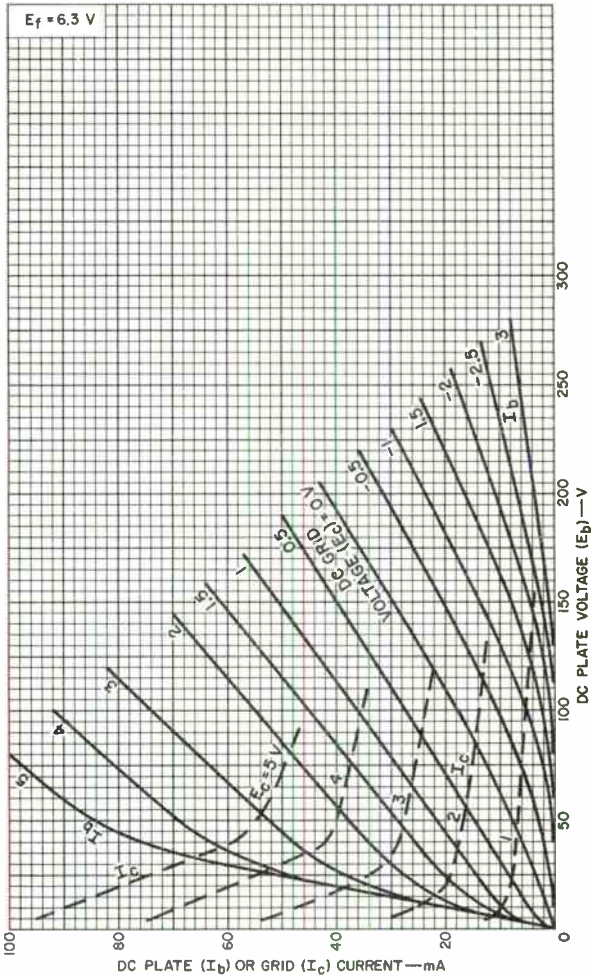
Typical Characteristics



92CM-13219

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

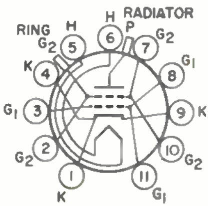
Base — Large Wafer Elevenar 11-Pin with Ring (JEDEC No.E11-81)

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 30 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

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 pow[er] ratio less than 2, such as is obtained in "Single-Tone" operation, i[s] 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 volta[ge] of 250 volts, and dc grid-No.1 voltage adjusted to gi[ve] 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 a[t] this value, the current-pulse amplitude will not be le[ss] 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 volta[ge] of 250 volts, and dc grid-No.1 voltage varied to obtai[n] a plate current of 5 mA.

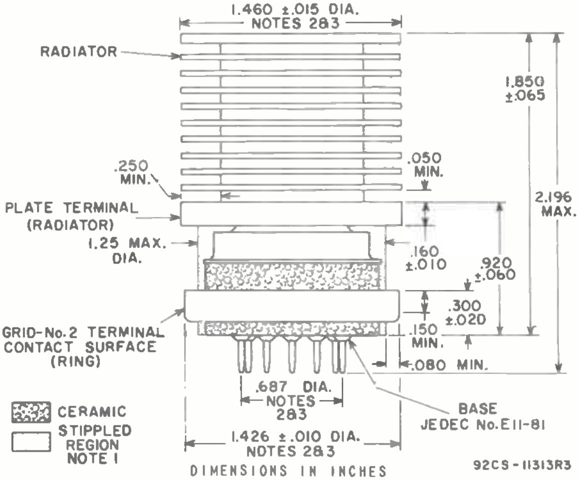
OPERATING CONSIDERATIONS

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.

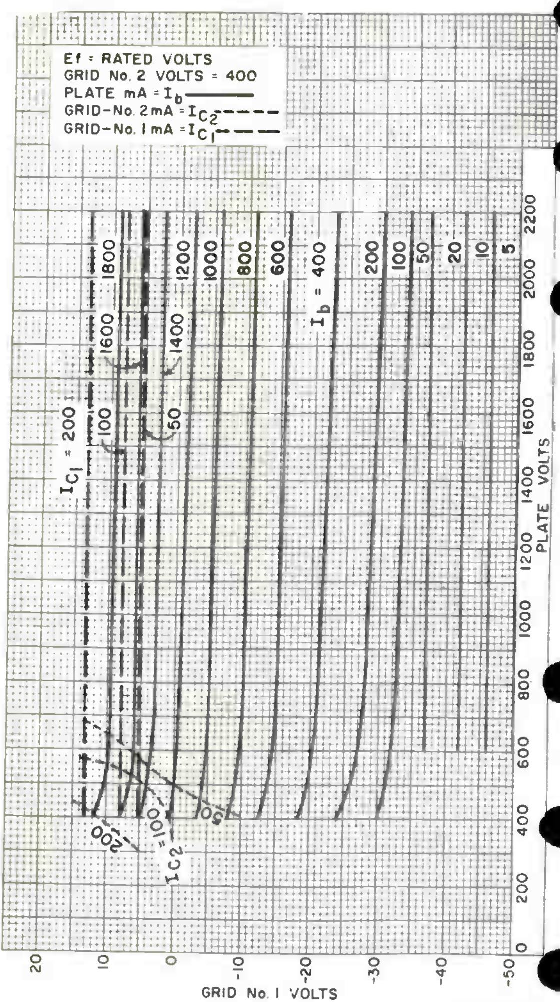
Note 2: The diameters of the radiator, grid-No. 2 terminal contact surface, and pin circle to be concentric within the following values of maximum full indicator reading:

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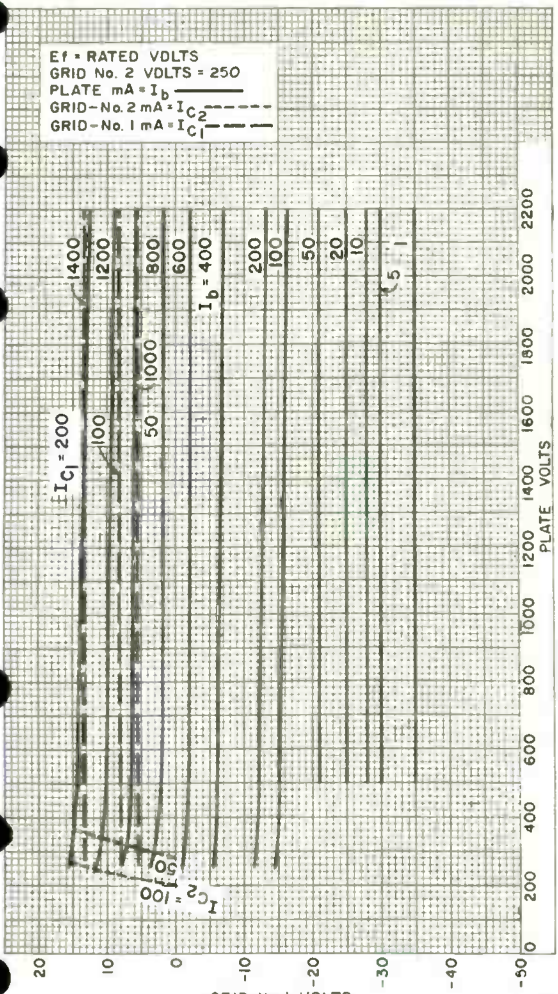
RADIO CORPORATION OF AMERICA
Electronic Components and Devices
Harrison, N. J.

Typical Constant-Current Characteristics

For Grid-No. 2 Voltage = 250 Volts



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Typical Constant-Current Characteristics

For Grid-No. 2 Voltage = 150 Volts

Typical Cooling Characteristics