No 7000 upwards have been entered in H10

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.

Transmitting Tubes

VACUUM-POWER-TUBE SERVICE

TYPICAL OPERATION — POWER OUTPUT APPROX. WATTS	RCA TYPE
Class A Amplifiers, AF	
0.6	5556
3.8	801A
3.9	2E24
30	845
Class AB_1 Amplifiers, AF[b]	
15[a]	807
15[a]	1625
22[a]	6146
22[a]	6146W
22[a]	6159
22[a]	6159W
22[a]	6883
22[a]	8032
–	7870
–	7801
40[a]	2E26
44	829B
56[a]	807
56[a]	1625
80	6816
80	6884
80	7457
80	7842
80	7843
80	7844
80	8596
82[a]	6146
82[a]	6146A
82[a]	6146W
82[a]	6159
82[a]	6159W
82[a]	6883
82[a]	8032
96[e]	6146B/8298A
96[e]	6159B
96[e]	6883B/8032A/8552
–	8165/4-65A
115	845
190[c]	7271
300[c]	828
–	6155
380[c]	813
410[c]	7094
–	4-125A/4D21

TYPICAL OPERATION — POWER OUTPUT APPROX. WATTS	RCA TYPE
–	4E27A/5-125B
580	7034/4X150A
590	7203/4CX250B
590	7204/4CX250F
–	6156
–	4-250A/5D22
–	8438/4-400A
800	8167/4CX300A
1600	7650
–	8166/4-1000A
–	8168/4CX1000A
–	8239/3X3000F1
–	8170/4CX5000A
31,900	8171/4CX10000D
57,000	8281/4CX15000A
Class AB_2 Amplifiers, AF[b]	
40[c]	6524
40[c]	6850
42[c]	2E24
42[c]	2E26
42[c]	815
72	1624
80[c]	807
80[c]	1625
90[c]	6146
90[c]	6146A
90[c]	6146W
90[c]	6159
90[c]	6159W
90[c]	6883
90[c]	8032
110[c]	6146B/8298A
110[c]	6159B
110[c]	6883B/8032A/8552
140	6816
140	6884
140	7457
140	7842
140	7843
140	7844
140	8596
–	6155
–	4-125A/4D21
–	4E27A/5-125B
630	7034/4X150A

VACUUM-POWER-TUBE SERVICE (Cont'd)

TYPICAL OPERATION POWER OUTPUT APPROX. WATTS	RCA TYPE
–	6156
–	4-250A/5D22
Class B Amplifiers, AF[b]	
45	801A
235[c]	811A
235[c]	812A
250[c]	8005
590[c]	810
600[c]	8000
1640	5786
1650[c]	833A
2400[c]	833A
8800	5762/7C24
10,000	891R
10,500	892R
15,000	889A
15,000	889RA
22,000	892
22,500	207
46,000	880
50,000	9C25
55,000	5771
61,000	9C21
100,000	5671
117,000	5770

TYPICAL OPERATION POWER OUTPUT APPROX. WATTS	TYPICAL OPERATION FREQ. MHz	RCA TYPE
Class B Amplifiers, RF Telephony		
–	3000	7801
–	3000	7870
–	30	5556
5.5	20	837
7.5	60	801A
10.5[a]	125	815
12.5[a]	60	807
12.5[a]	60	1625
20	100	834
36[e]	30	828
40[e]	60	8005
50[e]	30	813
–	120	6155
60[a]	30	810
65[a]	30	8000
–	75	6156
150[a]	30	833A
225[a]	20	833A
400	110	827R
1800	1.6	892R
2000	50	889A
2000	40	889RA
4000	1.6	207
4000	1.6	892
9000	25	880
12,000	1.6	5771
Class B Amplifiers, Television Service		
230	900	6161
250	216	7034/4X150A
300	890	4624
440	216	7203/4CX250B
440	216	7204/4CX250F
–	220	4X500A
1200	900	6181
2800	220	6076
6350	216	5762/7C24
5500	890	8501
12,000	216	6166
12,000	800	6448
14,000	216	6166A/7007
19,000	800	6806
Class C Amplifiers, Plate-Modulated RF Telephony		
1.7	3000	7801
1.7	3000	7870
–	6	5556
9[a]	462	6524
9[a]	462	6850
11	20	837
13.5[a]	125	2E24
13.5[a]	125	2E26
17[a]	200	832A
17	400	7801
17	400	7870

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

VACUUM-POWER-TUBE SERVICE (Cont'd)

TYPICAL OPERATION POWER OUTPUT APPROX. WATTS	TYPICAL OPERATION FREQ. MHz	RCA TYPE
18	60	801A
24	60	1624
28[a]	60	807
28[a]	60	1625
30[a]	125	815
34[a]	60	6146
34[a]	60	6146A
34[a]	60	6146W
34[a]	60	6159
34[a]	60	6159W
34[a]	60	6883
34[a]	60	8032
42[a]	60	6146B/8298A
42[a]	60	6159B
42[a]	60	6883B/8032A/ 8552
–	2500	2C39A
–	2500	2C39WA
–	2500	6897
45	400	6816
45	400	6884
45	400	7457
45	400	7842
45	400	7843
45	400	7844
45	400	8596
50[a]	200	829B
58	100	834
70[a]	200	829B
85[a]	30	812A
88[a]	30	811A
90[a]	60	7271
–	150	8165/4-65A
100[a]	30	828
115[a]	60	8005
120	900	6161
180[a]	60	7094
180[a]	30	813
230	150	7034/4X150A
235	175	7203/4CX250B
235	175	7204/4CX250F
235	175	8167/4CX300A
250[a]	30	810
250[a]	30	8000
–	125	6155
–	75	6156

TYPICAL OPERATION POWER OUTPUT APPROX. WATTS	TYPICAL OPERATION FREQ. MHz	RCA TYPE
600	400	7650
635	30	833A
800	600	4618
800	600	7213
810	160	5786
825	110	827R
950	400	6181
1000	20	833A
–	110	8438/4-400A
–	1000	8166/4-1000A
2700	110	6076
4000	50	889A
4000	40	889RA
–	30	8170/4CX5000A
4200	30	5762/7C24
4500	900	6448
5000	1.6	892R
5500	60	6166
5800	30	8171/4CX10000D
6000	1.6	207
6000	1.6	892
6000	60	6166A/7007
10,000	400	6806
18,000	30	9C25
27,000	25	880
29,000	1.6	5771
38,000	5	9C21
40,000	1.6	5671
45,000	20	5770
Class C Amplifiers, Grid-Modulated RF Telephony		
5.5	20	837
8	60	1624
10.5[a]	125	815
36[a]	30	828
50[a]	30	813
65[a]	30	8000
400	110	827R
Class C Amplifiers, Suppressor-Modulated RF Telephony		
5	20	837
–	75	4E27A/5-125B

VACUUM-POWER-TUBE SERVICE (Cont'd)

TYPICAL OPERATION: POWER OUTPUT APPROX. WATTS	TYPICAL OPERATION: FREQ. MHz	RCA TYPE
Class C Amplifiers, Television Service		
230	900	6161
1200	900	6181
4000	216	5762/7C24
5300	216	8D21
12,000	216	6166
12,000	216	6166A/7007
Class C Amplifiers, RF Telegraphy and FM Telephony		
3.2	3000	7801
3.2	3000	7870
–	30	5556
–	3370	2C40
–	3370	2C40A
–	1500	2C43
–	2500	2C39A
–	2500	2C39WA
–	2500	6897
20[a]	125	2E24
20[a]	125	2E26
22	20	837
25	60	801A
26	200	832A
27	400	7801
27	400	7870
30[d]	175	4604
35	60	1624
40	60	807
40	60	1625
40	1215	6816
40	1215	6884
40	1215	7457
40	1215	7842
40	1215	7843
40	1215	7844
40	1215	8596
44[a]	125	815
46[a]	100	6524
46[a]	100	6850
52[a]	60	6146
52[a]	60	6146A
52[a]	60	6146W/7212
52[a]	60	6159
52[a]	60	6159W/7357
52[a]	60	6883
52[a]	60	8032
63[a]	60	6146B/8298A
63[a]	60	6159B
63[a]	60	6883B/8032A/8552
70	200	829B
75	100	834
85	470	8072
85	470	8462
80	400	8596
90[a]	200	829B
105	1215	8226
130[a]	30	812A
135[a]	30	811A
–	150	8165/4-65A
150	30	828
160	60	7271
170	60	8005
180	900	6161
225	500	8167/4CX300A
235	470	8121
250	500	7203/4CX250B
250	500	7204/4CX250F
255[a]	60	7094
275[a]	30	813
300	470	8122
325	220	5713
340	400	8226
370	150	7034/4X150A
375[a]	30	810
375[a]	30	8000
–	120	6155
–	120	4-125A/4D21
–	75	4E27A/5-125B
375	1215	7650
600	900	6181
1000[a]	20	833A
1000	160	5786
–	75	6156
–	75	4-250A/5D22
–	110	8438/4-400A
–	120	4X500A
1050	110	827R

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

VACUUM-POWER-TUBE SERVICE (Cont'd)

TYPICAL OPERATION		RCA TYPE
POWER OUTPUT APPROX. WATTS	FREQ. MHz	
1350	600	4618
1350	600	7213
1440[a]	30	833A
–	110	8166/4-1000A
–	30	8170/4CX500A
2300	890	4632
5500	900	8501
6500[a]	300	8D21
7000	30	5762/7C24
9000	216	6166
10,000	400	8437
10,000	50	889A
10,000	50	889RA
10,000	1.6	891R
10,000	1.6	892R
10,000	216	6166A/7007
11,000	900	6448
13,500	900	6806
14,000	1.6	892
15,000	1.6	207
16,000	30	8178/4CX10000D
32,500	30	9C25
36,500	110	8281/4CX15000A
40,000	25	880
44,000	25	5771
70,000	1.6	5671
100,000	5	9C21
114,000	20	5770
500,000	0.425	6949, 6949V1
Class C Amplifiers or Oscillators Self-Rectifying		
175[e]	27	811A[f]
200[e]	27	812A
225	30	813
330[e]	50	8005
550[e]	30	8000
835[a]	20	833A
1050	160	5786
1150	30	833A
3350	30	5762/7C24
Class C Amplifiers or Oscillators with Separate Plate Supply		
135	30	811A[f]
135	30	812A[f]
280	30	813
330[e]	27	8005
600[d]	30	8000
1100[a]	30	833A
1150	160	5786
1460	30	833A
5650	30	5762/7C24
CW Oscillator (Magnetron)		
30,000	915	8684
Linear RF Amplifiers Single-Sideband Suppressed Carrier—Two-Tone Modulation		
40	30	7457
40	30	8596
49[a]	30	6146B/8298A
49[a]	30	6159B
49[a]	30	6883B/8032/8552
80	30	8072
80	30	8462
95[a]	60	7271
120	30	811A
170	30	8121
295	30	7203/4CX250B
295	30	7204/4CX250F
380	30	8122
400	175	8167/4CX300A
410	30	4624
680	30	7650
5000	30	4628
25,000	550	6806
600,000	10	6949, 6949V1
Linear RF Amplifiers, Single-Sideband Suppressed Carrier—Single-Tone Modulation		
–	3000	7801
–	3000	7870
40	60	6816
40	60	6884
40	60	7457
40	60	7842

VACUUM-POWER-TUBE SERVICE (Cont'd)

TYPICAL OPERATION: POWER OUTPUT APPROX. WATTS	TYPICAL OPERATION: FREQ. MHz	RCA TYPE
40	60	7843
40	60	7844
41	60	6146A
120	60	811A
95	60	7271
210	60	7094
250	150	7034/4X150A
295	175	7203/4CX250B
295	175	7204/4CX250F
680	30	7650
1250	60	4618
1250	60	7213
–	30	8168/4CX1000A
–	30	8170/4CX5000A
10,600	60	6166
12,000	60	6166A/7007
12,000	550	6448
600,000	10	6949, 6949V1
Linear RF Amplifiers, AM Telephony		
2000	400	4628
2500	400	4635
Linear RF Amplifiers-Particle Acceleration		
kW		
300	475	4612
Plate-Pulsed Amplifiers or Oscillators		
–	3370	2C40A
4.5	1215	7649
14	1250	5946
17	1215	4621
17	1215	8227
39	1215	7651
65	1215	7214
–	500	8184
180	450	2041
300	450	2041
500	440	2054
1500	200	6950
1500	50	4603
1500	50	4603V1
2000	425	6952
2000	425	8587

TYPICAL OPERATION: POWER OUTPUT APPROX. kW	TYPICAL OPERATION: FREQ. MHz	RCA TYPE
2000	425	4616
2000	425	4616V1
2500	440	2054
5000	250	7835
8000	425	4617
10,000	250	7835
Pulsed Oscillator (Klystron)		
21,000	2586	8568
Grid-Pulsed Amplifiers or Oscillators		
2.3	1215	7649
10	1215	4621
10	1215	8227
20	1215	7651
20	1215	7214
100	450	2041
180	450	2041
275	425	4616, 4616V1
1200	30	4603, 4603V1
RF-Frequency Multipliers		
WATTS		
7[a]	Tripler to 462	6524
7[a]	Tripler to 462	6850
140	Doubler to 900	6161
180	Doubler to 600	6161

TYPICAL OPERATION: PEAK POWER OUTPUT APPROX.	TYPICAL OPERATION: PULSE LENGTH µs	RCA TYPE
Pulse Modulators		
3.4 kW	100	6293
40 kW	1.2	3E29
–	–	4610

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

VACUUM-POWER-TUBE SERVICE (Cont'd)

PEAK PLATE AMPERES	RCA TYPE
Voltage Regulators	
0.5	3C33
0.5	4614
1	4600A

RECTIFIERS

MAX. PLATE RATINGS		RCA TYPE
PEAK AMPERES	AVERAGE AMPERES	
Half-Wave, Mercury-Vapor Types[g]		
0.5	0.125	816
1	0.25	866A
2	0.5	866A
5	1.25	872A
5	1.25	8008
6	1.5	575A
6	1.5	673
8.3	1.8	6894
8.3	1.8	6895
10[g]	2.5[g]	575A
10[g]	2.5[g]	673
10	2.5	615/7018
10	2.5	869B
15	2.5	5558
11.5[h]	2.5[g]	6894
11.5[h]	2.5[g]	6895
16	4	5561
20[m]	5[m]	869B
77	6.4	635/7019
40	6.4	5561
40	10	857B
Full-Wave, Mercury-Vapor Types[f]		
10	2.5	604/7014
Half-Wave, Gas Type[g]		
1	0.25	3B28
2	0.5	3B28
Half-Wave, Vacuum Types[g]		
0.04	0.002	5825
0.06	0.0075	2X2A
0.15	0.02	8013A
0.27	0.25	579B
0.75	0.1	8020
0.8	0.13	1616
1	0.25	836

a Intermittent Commercial and Amateur Service.
b Typical power output is for two tubes, except for twin-unit types.
c Not recommended as Oscillator in this class of service.
d Intermittent Commercial and Amateur Service only.
e Two tubes.
f Not recommended as Oscillator in this class of service.
g In phase operation, unless otherwise specified.
h Quadrature operation.

* 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:
1 & 2 - Data 3-Terminal Diagrams

PART 1 DATA

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

RCA Type	Description	Cooling	Filament Heater		Maximum Ratings: Plate			Grid No 2		Grid No 1	
			Volts	Amp	Volts	A	Dissip Watts	Volts	Watts	Volts	mA (Watts)
2C39A	Lighthouse Triode	Forced Air	6.3	1.0	1000	.125	100	—	—	-150	50
2C39WA	Lighthouse Triode-Hi Temp	Forced Air	5.8	1.0	Ref.	MIL-E-1/778E					
2C40	Lighthouse Triode, Hi Freq	Natural	6.3	0.75	450	.022	5.0	—	—	—	—
2C43	Lths Tri Hi Plate Dis	Natural	6.3	0.90	450	.036	10	—	—	—	—
2E24	Quick Heat, Beam Power	Natural	6.3	0.65	600	.085	13.5	200	2.5	-175	3.5
2E26	Beam Pwr Pentode	Natural	6.3	0.80	600	.085	13.5	200	2.5	-175	3.5

PART 1 (CONT'D)

RCA Type	Description	Cooling	Filament Heater		Maximum Ratings						
					Plate			Grid No 2		Grid No 1	
			Volts	Amp	Volts	A	Dissip Watts	Volts	Watts	Volts	mA (Watts)
3C33[a]	Twin Triode	Natural	12.6	1.125	2000 Peak	500 Peak .120 DC	15 each of two units	—	—	-200	7.5 IN
3E29[a]	Twin Beam Power Tube	Natural	6.3/ 12.6	2.25/ 1.125	5750 Peak 5000 DC	10[b] Peak	15[b]	850	3[b] IN	-225	1[b] IN
					Max on: 12 μs	b. both units in parallel	Max Int: 1200 μs				
4-125A/ 4D21	Beam Power Tetrode	Forced Air	5.0	6.5	3000	.225	125	400	20	-500	5W
4-250A/ 5D22	Beam Power Tetrode	Forced Air	5.0	14.5	4000	.350	250	600	35	-500	5W
4E-27A/ 5-125B	Beam Power Pentode	Natural	5.0	7.5	4000	.200	125	750	20	-500	10W
4X500A	Beam Power Tetrode	Forced Air	5.0	13.5	4000	.350	500	500	30	-500	50[c]W
8D21	Twin Tetrode	Water	3.2	125	6000	5.0	6000[c]	1000	400[c]	-1000	650
807	Power Pentode	Natural	6.3	0.90	750	.100	30	300	3.5	-200	5

a. Type **3C33** for **Pulse Regulator Applications.** Type **3E29** for **Pulse Modulator Applications.**
c. Two Tubes.

PART 1 (CONT'D)

RCA Type	Description	Cooling	Filament Heater		Maximum Ratings						
					Plate			Grid No 2		Grid No 1	
			Volt	Amp	Volts	A	Dissip Watts	Volts	Watts	Volts	mA (Watts)
810	Hi Mu Triode	Natural	10.0	4.5	2000	.250	125	—	—	-500	75
813	Hi Gain Beam Power	Natural	10.0	5.0	2250	.225	125	400	22	-300	30
827R	Beam Power Tube	Forced Air	7.5	25	3500	.500	800	1000	150	-500	150
828	Low Freq Pentode	Natural	10	3.25	2000	.150	80	750	23	—	—
829B	Twin Beam Power	Forced Air	6.3	2.25	750	.240	45	250	8	-175	20
830B	Low Freq Triode	Natural	10.0	2.0	1000	.150	60	—	—	-300	30
832A	Twin Beam Pwr Tube	Natural	6.3	1.6	750	.090	15	250	5	-100	6
834	VHF Triode	Natural	7.5	3.1	1250	.100	50	—	—	-400	20
837	Low Freq Pentode	Natural	12.6	0.7	500	.080	12	200	8	-200	8

PART 1 (CONT'D)

RCA Type	Description	Cooling	Filament Heater		Maximum Ratings						
					Plate			Grid No 2		Grid No 1	
			Volts	Amp	Volts	A	Dissip Watts	Volts	Watts	Volts	mA (Watts)
845	Triode	Natural	10.0	3.25	1250	.120	100	—	—	-400	—
860	Tetrode	Natural	10.0	3.25	3000	.150	100	500	10	-800	40
880	Triode	Water	12.6	320	10500	6.0	20k	—	—	-1200	800
891R	Lo Freq Triode	FA[d]	22.0	60	10000	2.0	4k	—	—	-3000	150
892	Lo Freq Triode	Water	22.0	60	15000	2.0	10k	—	—	-3000	400
892R	Lo Freq Triode	FA	22.0	60	12500	2.0	4k	—	—	-3000	400
1624	Beam Power Tube	Natural	2.5	2.0	600	.090	25	300	3.5	-200	5
1625	Beam Power Tube	Natural	12.6	0.45	750	.100	30	300	3.5	-200	5
5556	Lo Freq Triode	Natural	4.5	1.1	350	.040	10	—	—	-150	10

d. Forced Air.

PART (CONT'D)

RCA Type	Description	Cooling	Filament Heater		Maximum Ratings						
					Plate			Grid No 2		Grid No 1	
			Volts	Amp	Volts	A	Dissip Watts	Volts	Watts	Volts	mA (Watts)
5713	Power Triode	FA	3.3	11.5	1500	.30	250	—	—	-250	50
5786	Compact Triode	FA	11.0	12.5	3000	0.5	600	—	—	-500	150
6146 e	Hi Eff Beam Pwr Tube	Natural	6.3	1.25	750	.150	25	250	3	-150	4.0
6155	Beam Power Tube	FA	5.0	6.5	3000	.225	125	400	20	-500	15
6156	Beam Power Tube	FA	5.0	14.1	4000	.350	250	600	35	-500	20
6159	Glass Beam Power Tube	Natural	26.5	0.3	750	.150	25	250	3	-150	4.5
6181	UHF Power Tetrode	FA	120	1.55	2000	1.25	2000	500	40	-300	200
6883 f	Beam Power Tube	Natural	12.6	0.62	750	.150	25	250	3	-150	4.0
6897	Lighthouse Triode	FA	6.3	1.0	1000	125	100	—	—	-150	50
7271	Beam Power Tube	Natural	13.5	1.25	1350	.340	80	425	20	-300	30

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

f *For later version of this type refer to 6883B/8032A/8552 data sheet, located in the TRANSMITTING TUBE SECTION.*

PART 1 (CONT'D)

RCA Type	Description	Cooling	Filament Heater		Maximum Ratings						
					Plate			Grid No 2		Grid No 1	
			Volts	Amp	Volts	A	Dissip Watts	Volts	Watts	Volts	mA (Watts)
8000	Triode	Natural	10.0	4.5	2500	.300	175	—	—	-500	45
8005	Power Triode	Natural	10.0	3.25	1750	.125	75	—	—	-125	25
8032	Beam Power Tube Glass	Natural	13.5	0.58	750	.150	25	250	3.0	-150	4.0
8165/ 4-65A	VHF Power Tetrode	Natural	6.0	3.5	3000	.150	65	400	10	-500	5W
8166/ 4-1000A	VHF Power Tetrode	FA	7.5	21	6000	.700	1000	1000	75	-500	25W
8168/ 4CX1000A	Radial Beam Tetrode	FA	6.0	10.5	3000	1.0	1000	400	12	-60	—
8170/ 4CX5000A	Beam Power Tube	FA	7.5	75	7500	3.000	5000	1500	250	—	75W
8239/ 3X3000F1	Lo Mu Triode	FA	7.5	52	6000	2.500	3000	—	—	—	50W
8438/ 4-400A	Radial Tetrode Beam	FA	5.0	14.5	4000	.350	400	600	35	-500	10W

RCA Type	Prime Service	Amplification or Mu	Max Freq MHz	Physical			Typical Operation		
				Ht In	Dia In	Wt Oz	Freq MHz	Input (mA) Watts	Output Watts
2C39A	UHF Amp	100	2500	2-3/4	1-1/4	2	500	6	40
2C39WA	UHF Amp	—	—	2-3/4	1-1/4	2	—	—	—
2C40	UHF Amp	36	3370	2-9/16	1-5/16	2	—	—	—
2C43	UHF Amp	48	1500	2-11/16	1-5/16	2	—	—	—
2E24	Mobile	7.5	125	3-5/8	1-5/16	3	125	0.2	27
2E26	Hi Power Amp	6.5	125	3-1/2	1-5/16	3	125	0.17	27
3C33	Regulator	11	—	3-1/2	2-3/8	—	—	—	—
3E29	Modulator	9	—	4-1/8	2-3/8	3.5	Pulse: 1.2 μs Duty: .001 %		

PART 2 (CONT'D)

RCA Type	Prime Service	Amplification or Mu	Max Freq MHz	Physical			Typical Operation		
				Ht In	Dia In	Wt Oz	Freq MHz	Input (mA) Watts	Output Watts
4-125A/4D21	VHF Amp	6.2	120	5-1/2	2-7/8	6	120	2.5	375
4-250A/5D22	Hi Pwr VHF Amp	5.1	75	6-1/8	3-1/2	8	75	2.5	1000
4E-27A/5-125B	Hi Pwr Amp	5	75	6	2-3/4	6	75[c]	0.9[c]	375[c]
4X500A	Hi Pwr Amp	6.2	120	4-1/2	2-5/8	28	110	18	1180
8D21	VHF Osc Amp	5	300	12	5-3/4	—	300	500[c]	6500[c]
807	VHF Amp	8	60	5-3/4	2-1/16	3	60	.3	54
810	Hi Gain VHF Amp	36	30	8-1/2	2-1/8R	—	30	19	575
813	VHF Amp	8.5	30	7-1/2	2-9/16	8	30	4.0	375
827R	FM & VHF TV	16	110	6-3/8	4-5/8R	72	110	50	1050

c. Two Tubes.

PART 2 (CONT'D)

RCA Type	Prime Service	Amplification or Mu	Max Freq MHz	Physical			Typical Operation		
				Ht In	Dia In	Wt Oz	Freq MHz	Input (mA) Watts	Output Watts
828	Audio Amp	—	30	7-7/16	2-1/16	—	AF	0	385
829B	VHF Amp	9	200	4-1/8	2-3/8	—	200	0.8	115
830B	RF Amp	25	15	6-11/16	2-1/16	—	15	7	90
832A	VHF Amp	6.5	200	3-3/16	2-5/16	—	200	0.19	26
834	RF Amp	10.5	100	6-7/8	2–11/16	—	100	4.5	75
837	RF Amp	—	20	5-3/4	2-1/16	—	20	0.4	22
845	Modulator	5.3	AF	7-7/8	2-5/16	—	AF	—	115
860	VHF Amp	200	30	8-3/4	4-1/4R	—	30	7	165

PART 2 (CONT'D)

RCA Type	Prime Service	Amplification or Mu	Max Freq MHz	Physical: Ht In	Physical: Dia In	Physical: Wt Oz	Typical Operation: Freq MHz	Typical Operation: Input (mA) Watts	Typical Operation: Output Watts
880	VHF Amp	20	25	11-1/2	7	—	1.5	1500	40k
891R	RF Amp	8.5	1.6	2	6R	—	1.6	310	10k
892	RF Osc	50	1.6	20-1/8	5-9/16R	—	1.6	565	14k
892R	RF Osc	50	1.6	22	6R	—	1.6	495	10k
1624	UHF Amp	—	60	5-3/4	2-1/16	—	60	0.43	35
1625	Freq Mult	8	60	5-3/4	2-1/16	—	60	0.2	50
5556	Lo Freq Triode	8.5	6	5-5/8	2-3/16	—	6	0.25	6.0
5713	VHF Amp	25	220	4-25/32	2-1/16	—	220	8	290
5786	Industrial	32	160	9-3/8	2-7/8	1-1/2 lb	160	36	1000

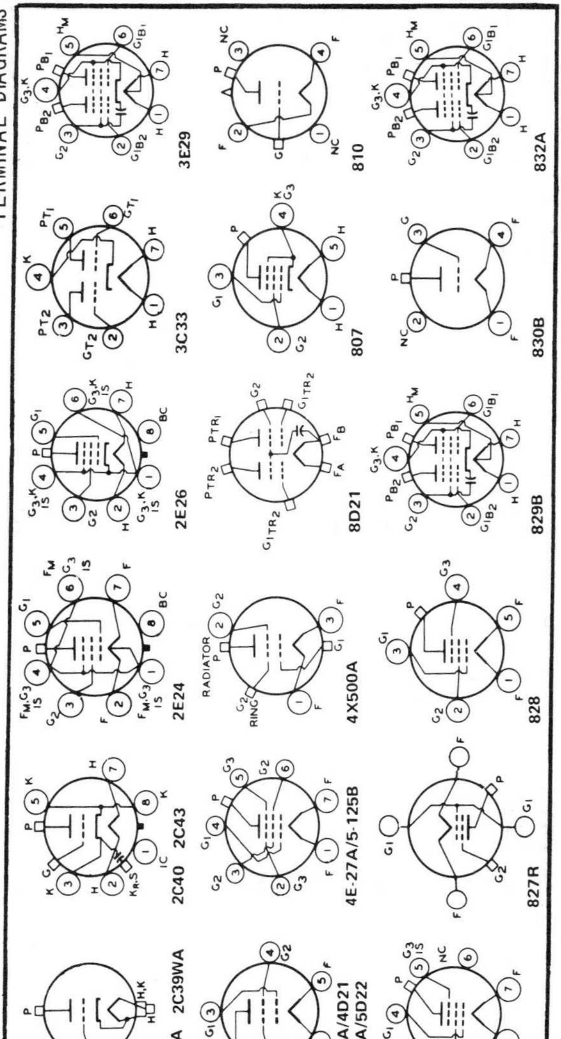
PART 2 (CONT'D)

RCA Type	Prime Service	Amplification or Mu	Max Freq MHz	Physical			Typical Operation		
				Ht In	Dia In	Wt Oz	Freq MHz	Input (mA) Watts	Output Watts
6146A	Amateur	4.5	60	3-3/16	1-21/32	2.3	60	0.2	70
6155	RF Amp	6.2	120	5-3/32	2-7/16	3	120	2.0	375
6156	RF Amp	5.1	75	5-29/32	3-7/16	6	75	3.4	1000
6159	RF Amp	4.5	60	3-13/16	1-21/32	2.3	60	0.2	52
6181	UHF TV	8	900	7-7/16	5	5 lb	900	150	600
6883	RF Amp	4.5	60	3-13/16	1-9/16	2	60	0.2	70
6897	UHF Amp	–	2500	2-3/4	1-1/4	2	500	–	40
7271	RF Amp	8	60	4.75	2.00	3.5	60	90	225

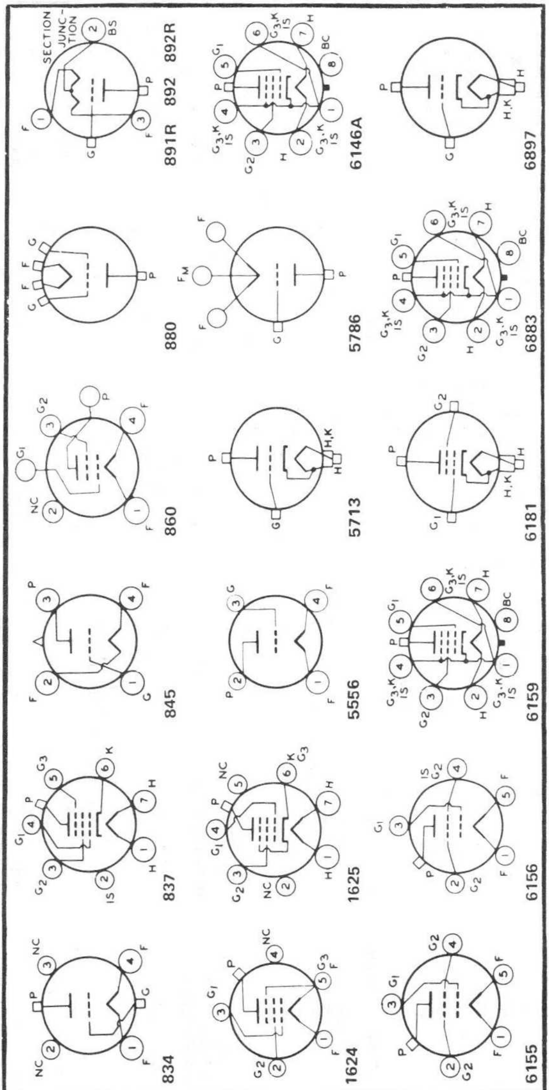
PART 2 (CONT'D)

RCA Type	Prime Service	Amplification or Mu	Max Freq MHz	Physical			Typical Operation		
				Ht In	Dia In	Wt Oz	Freq MHz	Input (mA) Watts	Output Watts
8000	VHF Amp	16.5	30	8-1/2	2-1/8R	—	30	18	575
8005	Oscillator	20	60	6-7/16	5-7/8	—	60	8.5	220
8032	Mobile RF Amp	4.5	60	3-13/16	1-21/32	2.3	60	0.2	70
8165/4-65A	RF Amp	5	50	4-3/16	2-3/8	3.0	50	1.7	280
8166/4-1000A	RF Amp	7	110	9-1/4	5-1/4	1.5 lb	110	15	3400
8168/4CX1000A	Lin RF Amp	—	110	4-3/4	3-3/8	27	—	—	1680
8170/4CX5000A	RF Amp	4.5	30	9-1/8	4-15/16	9.5 lb	—	—	—
8239/3X3000F1	AF Amp	4.8	—	10-1/2	4-3/16	7-1/2 lb	—	0	10k
8438/4-400A	RF Amp	5.1	110	6-3/8	3-9/16	9.0	75	5.8	1100

PART 3 TERMINAL DIAGRAMS

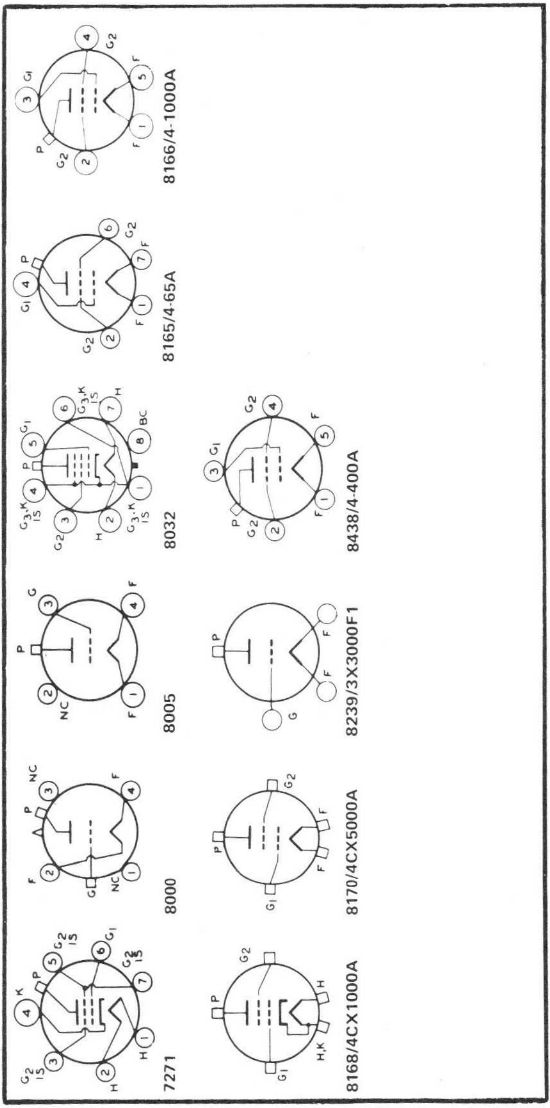


PART 3 (CONT'D)



834
837
845
860
880
891R 892 892R
1624
1625
5556
5713
5786
6146A
6155
6156
6159
6181
6883
6897

PART … (CONT'D)



7271

8000

8005

8032

8165/4-65A

8166/4-1000A

8168/4CX1000A

8170/4CX5000A

8239/3X3000F1

8438/4-400A

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

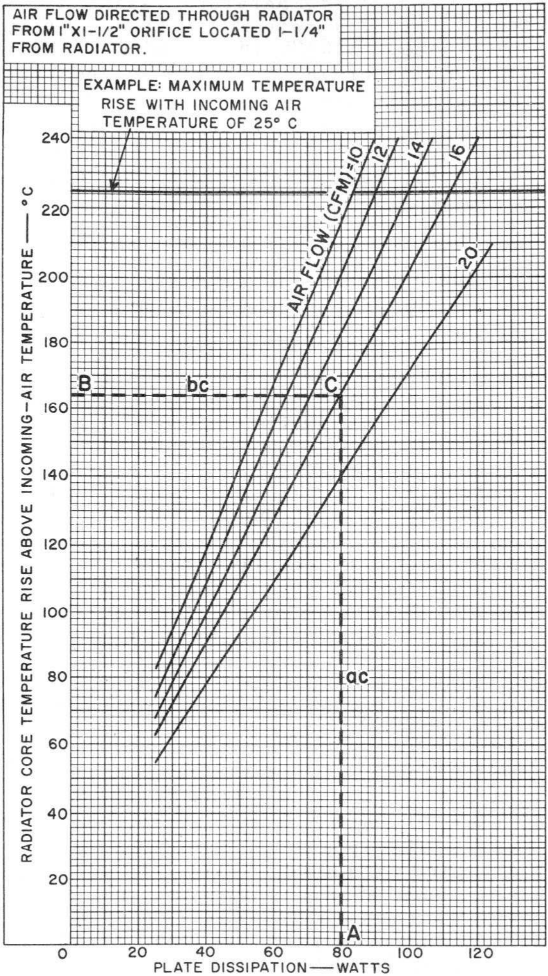


FIG. 1 - EXAMPLE OF TYPICAL COOLING CHARACTERISTICS

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.

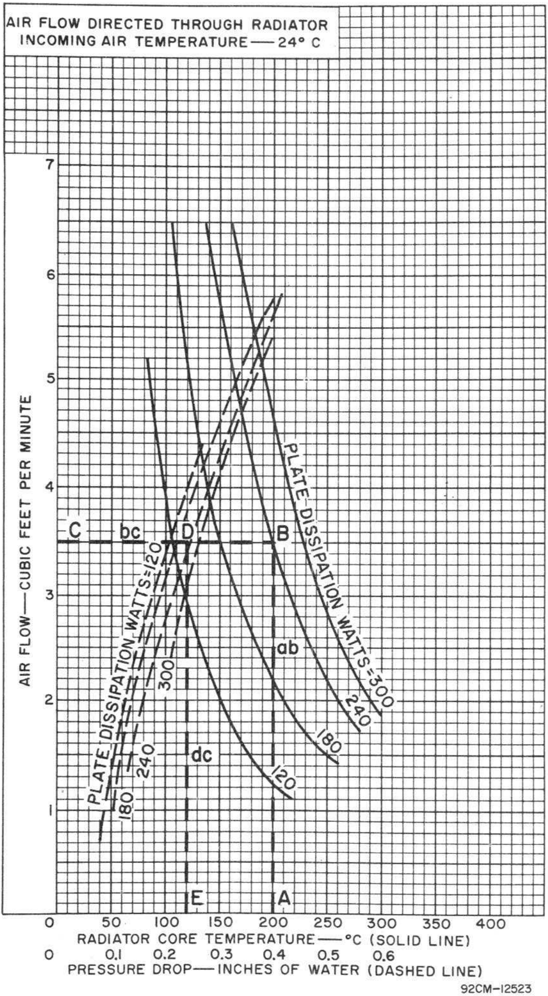


FIG. 2 - EXAMPLE OF TYPICAL COOLING CHARACTERISTICS

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^{o}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 FC75[b]. 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.

RCA Transmitting Tube Operating Considerations

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 hand-set, 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

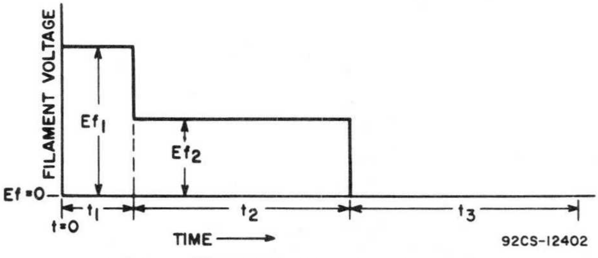


FIG. 3 - FILAMENT VOLTAGE WAVE FORM

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

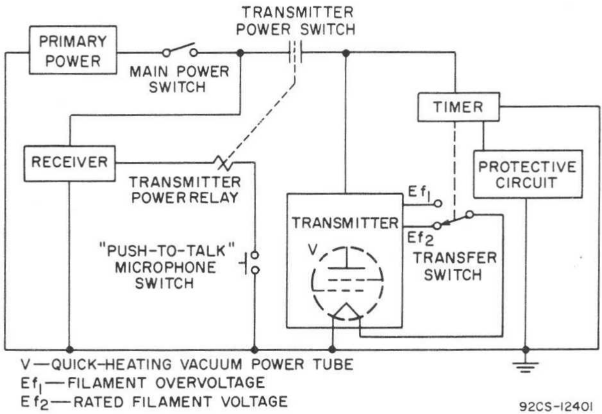


FIG.4 - BASIC RECEIVER-TRANSMITTER WITH AUXILIARY "HOT-SHOT" CIRCUIT

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.

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).

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.

RCA Transmitting Tube Operating Considerations

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.

---

[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.

Cont'd

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
8D21	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

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

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 7.5 20	– – –	– – –	100 75 50
891-R	1.6 7.5 20	– – –	– – –	100 75 50
892	1.6 7.5 20	100 85 76	100 85 75	100 75 50
892-R	1.6 7.5 20	100 85 76	100 75 50	100 75 50
1613	45 60 90	– – –	100 90 85	100 90 85
1614	80 120	– –	100 75	100 75
1619	45 60 90	100 93 85	100 90 77	100 90 77
1624	60 80 125	100 90 75	100 80 55	100 80 55
1625	Same as for Type 807			
1626	30 60 90	– – –	– – –	100 96 93
5713	220	–	–	100
5763	 50 175	 – –	*Volt.* *Input* 100 100 100 80	*Volt.* *Input* 100 100 100 80
5771	 1.6 25 50	 100 100 75	 100 100 75	*Volt.* *Input* 120 112.5 100 75
5786	160	–	100	100
6417	Same as for Type 5763			
8005	60 80 100	100 90 83	100 75 60	100 75 60

9-63

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

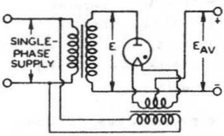


FIG. 1 HALF-WAVE SINGLE-PHASE

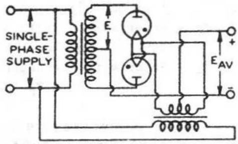


FIG. 2 FULL-WAVE SINGLE-PHASE

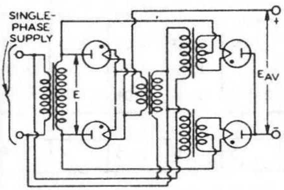


FIG. 3 SERIES SINGLE-PHASE

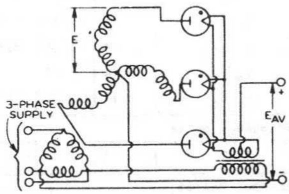


FIG. 4 HALF-WAVE THREE-PHASE

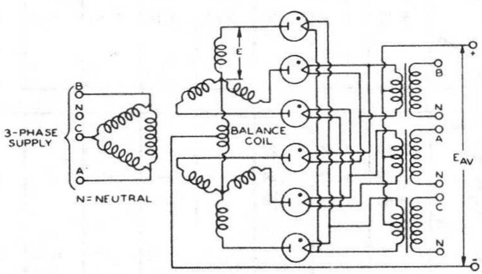


FIG 5 PARALLEL THREE-PHASE (QUADRATURE OPERATION)

92CL-7673A

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

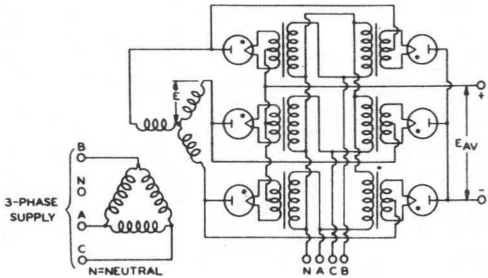


FIG. 6 SERIES THREE-PHASE (QUADRATURE OPERATION)

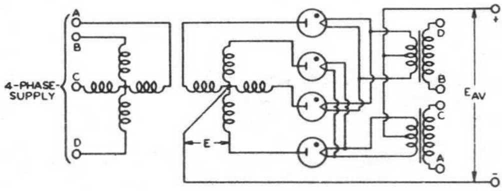


FIG. 7 HALF-WAVE FOUR-PHASE (QUADRATURE OPERATION)

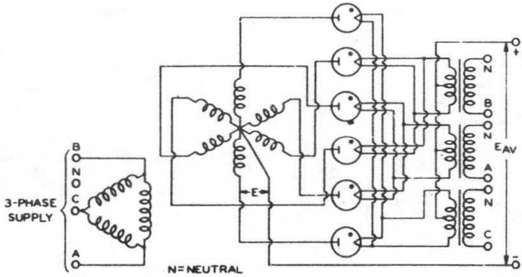


FIG. 8 HALF-WAVE SIX-PHASE (QUADRATURE OPERATION)

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

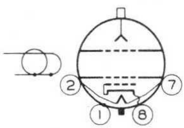
Mechanical:

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.

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 coaxial 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.

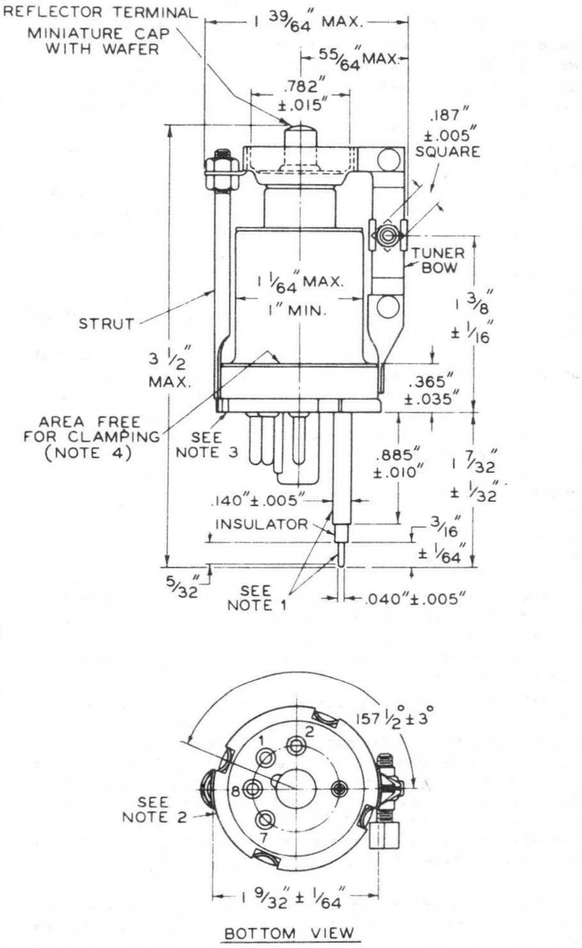
Shielding of the reflector and resonator voltage leads as close to the tube as possible is essential to avoid modulation of the tube output by any external voltages. In addition, the connection to the reflector terminal must be insulated to withstand the total acceleration and reflector voltage. To avoid 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

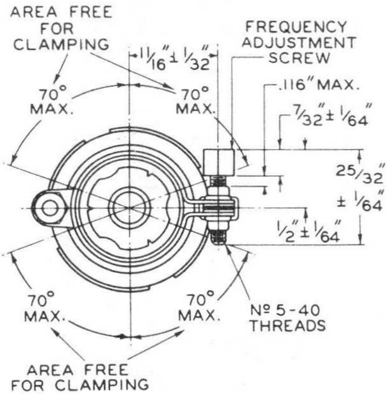
2K26
KLYSTRON



NOV. 15, 1948

CE-6986VA

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".

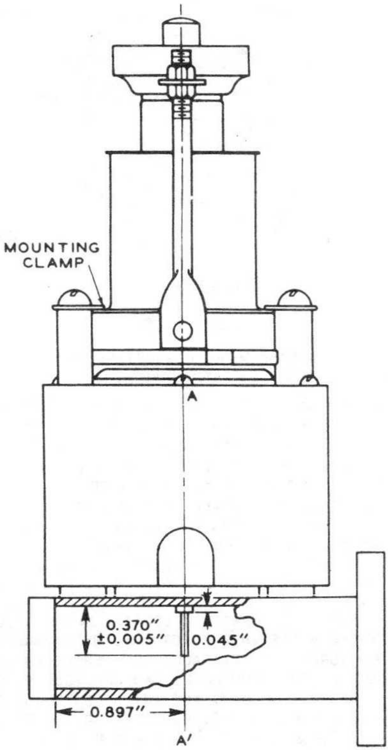
2K26

2K26

KLYSTRON

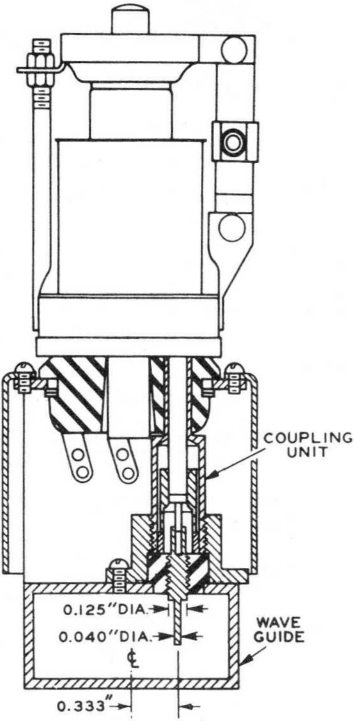
COUPLING ARRANGEMENT

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



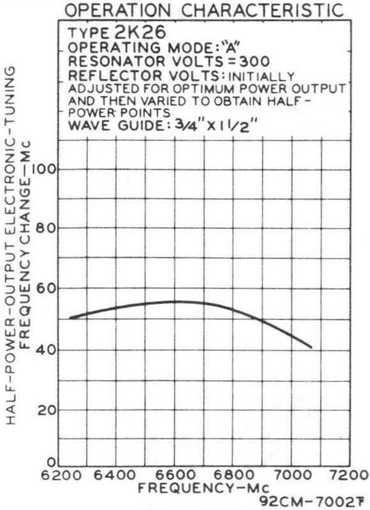
KLYSTRON

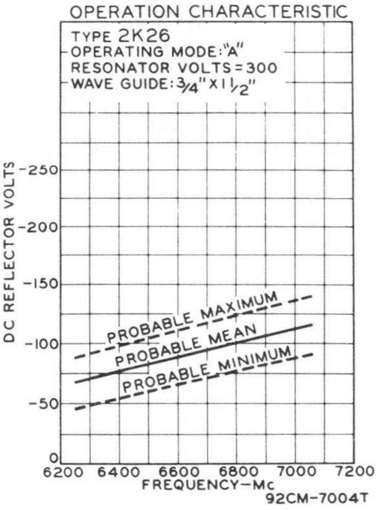
COUPLING ARRANGEMENT (Cont'd)



RCA

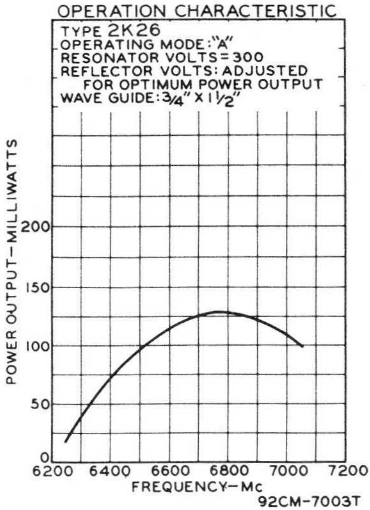
2K26
KLYSTRON





2K26

RCA
2K26
KLYSTRON



RCA

2X2-A

HALF-WAVE VACUUM RECTIFIER

For applications critical as to severe shock and vibration

GENERAL DATA

Electrical:

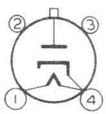
Heater, for Unipotential Cathode:

	Min.	Av.	Max.	
Voltage	2.25	2.50	2.75	ac volts
Current at 2.50 volts	1.55	1.75	1.95	amp

Mechanical:

Mounting Position	Any
Maximum Overall Length	4-17/32"
Seated Length	3-25/32" ± 1/8"
Maximum Diameter	1-9/16"
Dimensional Outline	*See General Section*
Weight (Approx.)	1.3 oz
Bulb	ST-12
Cap	Small (JETEC No.C1-1)
Base	Small-Shell Small 4-Pin (JETEC No.A4-5)
Basing Designation for BOTTOM VIEW	4AB

Pin 1 - Heater
Pin 2 - No Connection
Pin 3 - No Connection



Pin 4 - Heater, Cathode
Cap - Plate

HALF-WAVE RECTIFIER

Maximum Ratings, *Design-Center Values:*

PEAK INVERSE PLATE VOLTAGE	12500 max.	volts
PEAK PLATE CURRENT	60 max.	ma
DC OUTPUT CURRENT	7.5 max.	ma
HOT-SWITCHING TRANSIENT CURRENT, for duration of 0.2 second max.	100 max.	ma
AMBIENT TEMPERATURE	70 max.	oC

Typical Operation:

AC Plate-Supply Voltage (RMS)	5500	volts
Total Effective Plate-Supply Impedance	0.3	megohm
Filter Input Capacitor	0.1	μf
DC Output Current	2	ma
DC Output Voltage (At input to filter)	4500	volts

SHOCK TEST DATA

Impact Acceleration	250 max.	g

This test is performed on a sample lot of tubes from each production run to determine ability of tube to withstand the specified impact acceleration. The tubes are subjected to a total of 3 blows in each of the 3 primary mutually

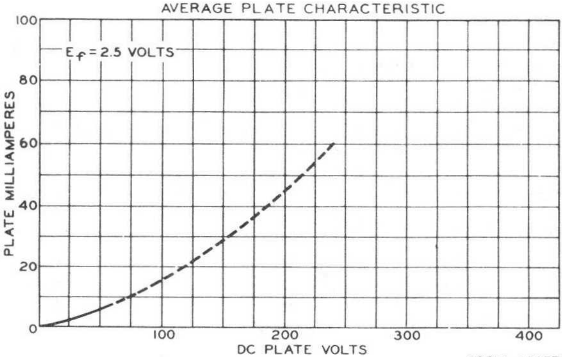
← indicates a change.

RCA

2X2-A

HALF-WAVE VACUUM RECTIFIER

perpendicular tube planes when tested in the Navy Type, High-Impact (flyweight) Shock Machine. At the end of this test, tubes will not show permanent or temporary shorts or open circuits, and will not be inoperative.



92CM-4507T3

3B28

RCA

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

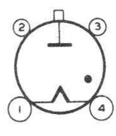
Mechanical:

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.

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

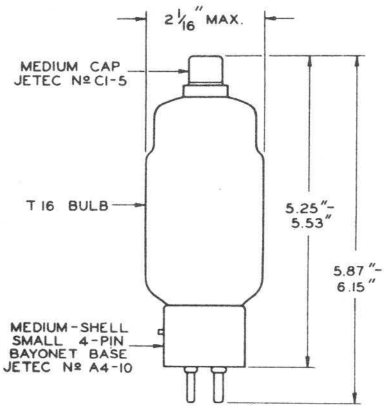
3B28

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

4-400A

Beam Power Tube

FORCED-AIR COOLED

GENERAL DATA

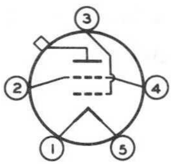
Electrical:

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.

4-400A

→ **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.

RCA

575-A

HALF-WAVE MERCURY-VAPOR RECTIFIER

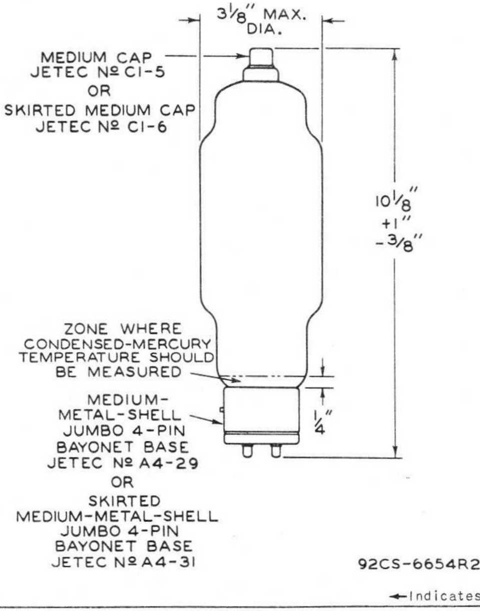
The 575-A is the same as the 673 except for the following items:

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



92CS-6654R2

← Indicates a change.

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

Half-Wave Vacuum Rectifier

HIGH-VOLTAGE, LOW-CURRENT TYPE

GENERAL DATA

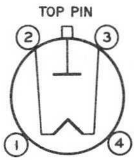
Electrical:

Filament, Thoriated Tungsten:		
Voltage (AC)	2.5 ± 5%	volts
Current at filament volts = 2.5	6	amp

Mechanical:

Operating Position	Vertical, base down or up
Overall Length	7-3/16" ± 1/4"
Maximum Diameter	2-1/8"
Bulb	T16
Plate Terminal	0.050"-Diameter Pin Located at Top of Bulb
Base	Medium-Shell Super-Jumbo 4-Pin (JEDEC No.A4-16)
Basing Designation for BOTTOM VIEW	70

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



Pin 4 - No Internal Connection
TOP PIN - Plate

HALF-WAVE RECTIFIER

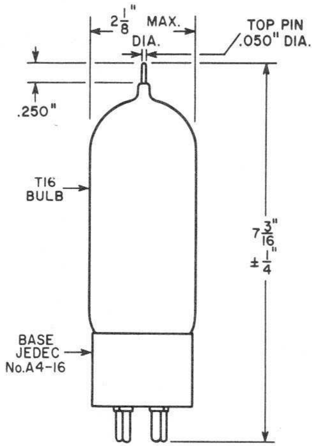
Maximum Ratings, *Absolute-Maximum Values:*

PEAK INVERSE PLATE VOLTAGE	20000 max.	volts
PLATE CURRENT:		
Peak	270 max.	ma
Average	25 max.	ma
AMBIENT TEMPERATURE	50 max.	°C
BULB TEMPERATURE	75 max.	°C

OPERATING CONSIDERATIONS

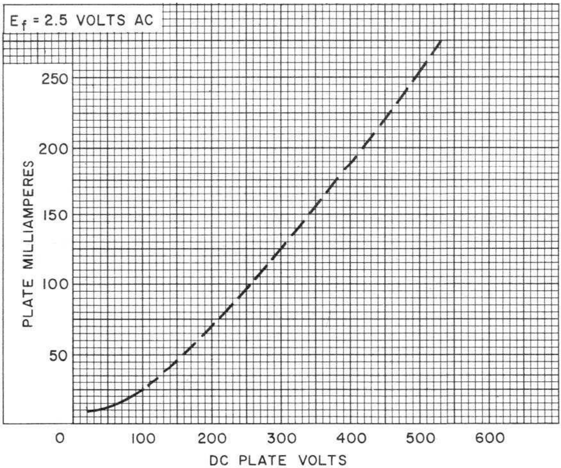
X-Radiation Warning. X radiation is produced when the 579B is operated with a peak inverse plate voltage above 16,000 volts (Absolute-Maximum value). This radiation can constitute a health hazard unless the tube is adequately shielded for X radiation.

← Indicates a change.



92CS-6720R1

AVERAGE PLATE CHARACTERISTIC



92CS-6719R1

Full-Wave Gas and Mercury-Vapor Rectifier

GENERAL DATA

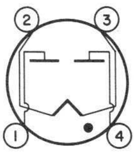
Electrical:[a]

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 $+40^{o}$ and $+90^{o}$ C which corresponds approximately to $+15^{o}$ to $+65^{o}$ C ambient.

Half-Wave Mercury-Vapor Rectifier

GENERAL DATA

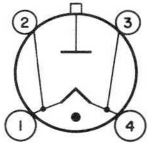
Electrical:[a]

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]

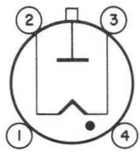
Filament, Coated:		
Voltage (AC)	2.5	volts
Current at 2.5 volts	18 ± 2	amp
Minimum heating time prior to tube conduction	60	sec
Typical Anode Starting Voltage	20	volts
Peak Tube Voltage Drop at anode amperes = 20	9	volts

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.

673

HALF-WAVE MERCURY-VAPOR RECTIFIER

GENERAL DATA

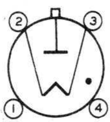
Electrical:

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.

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

RCA

673

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

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

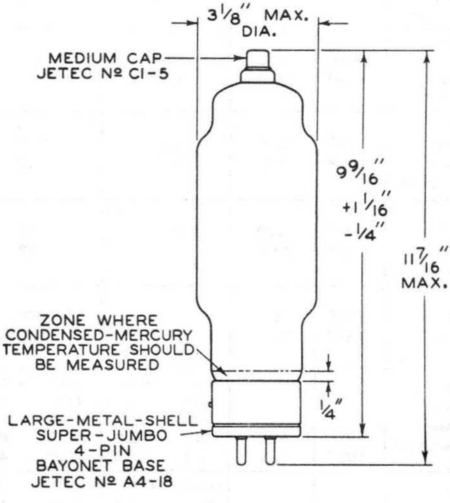
▲ For maximum peak inverse anode voltage of 10,000 volts, and condensed-mercury-temperature range of 20° to 60° C.

673

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.

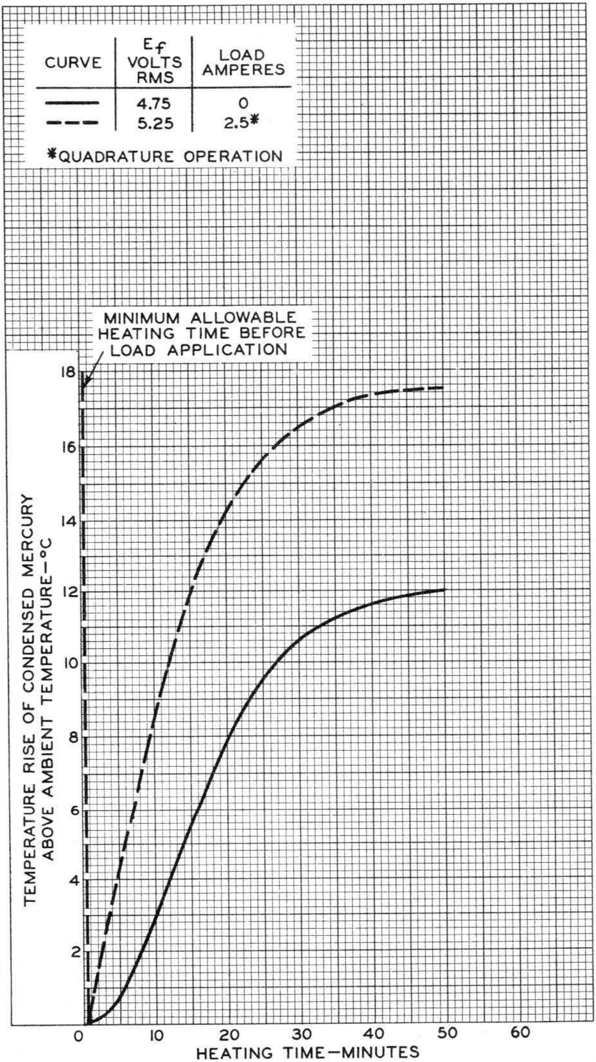


92CS-6655R3

RCA

673

RATE OF RISE OF COND-MERCURY TEMPERATURE



ELECTRON TUBE DIVISION

92CM-8824R1

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

811A

Power Triode

GENERAL DATA

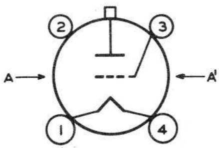
Electrical:

Filament, Thoriated Tungsten:		
Voltage (AC or DC)	6.3	volts
Current	4	amp
Amplification Factor	160	
Direct Interelectrode Capacitances (Approx.):		
Grid to plate	5.6	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.

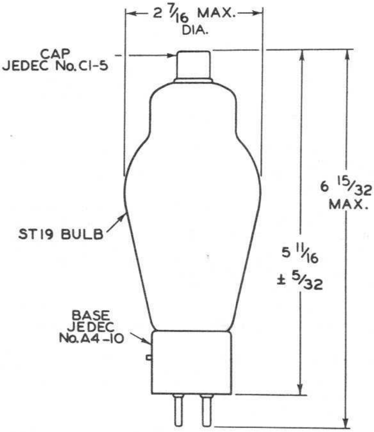
OPERATING CONSIDERATIONS

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

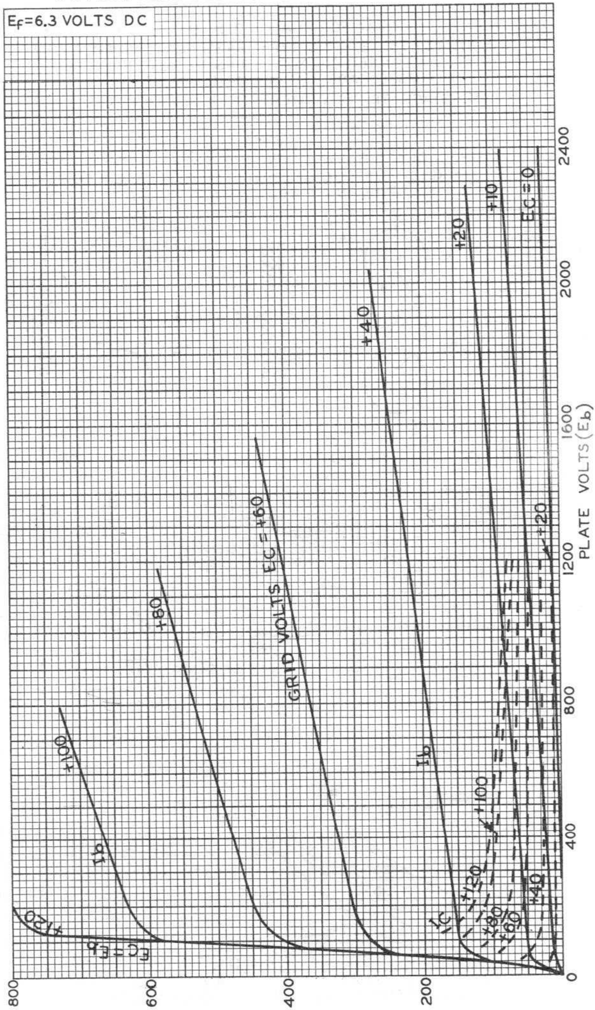
OPERATING FREQUENCY Mc	MAXIMUM PERMISSIBLE PERCENTAGE OF MAXIMUM PLATE VOLTAGE & PLATE INPUT	
	TELEPHONY	TELEGRAPHY
	Class C Plate-Modulated	Class C
30	100	100
60	89	89
80	70	70
100	55	55



92CS-6905R2

ALL DIMENSIONS IN INCHES

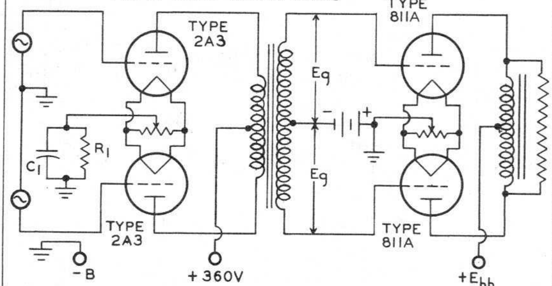
AVERAGE PLATE CHARACTERISTICS

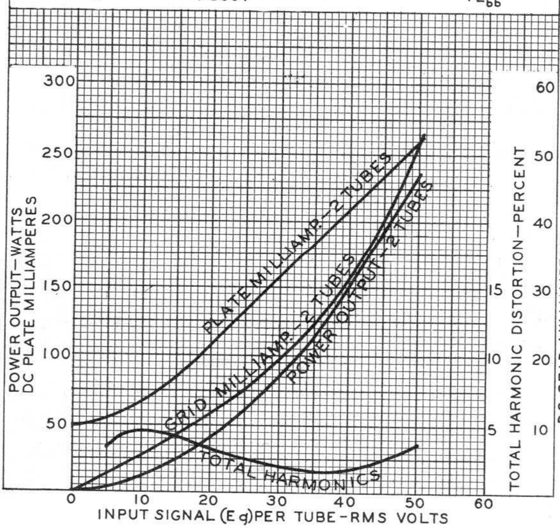


92CM-6075

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 $\frac{\text{PRIMARY}}{\frac{1}{2}\text{ SEC.}} = 6$
OUTPUT: CLASS B – TWO TYPE 811A's; PLATE-SUPPLY VOLTS (E_{bb}) = 1250; DC GRID VOLTS = 0; PLATE-TO-PLATE LOAD = 12 400 OHMS





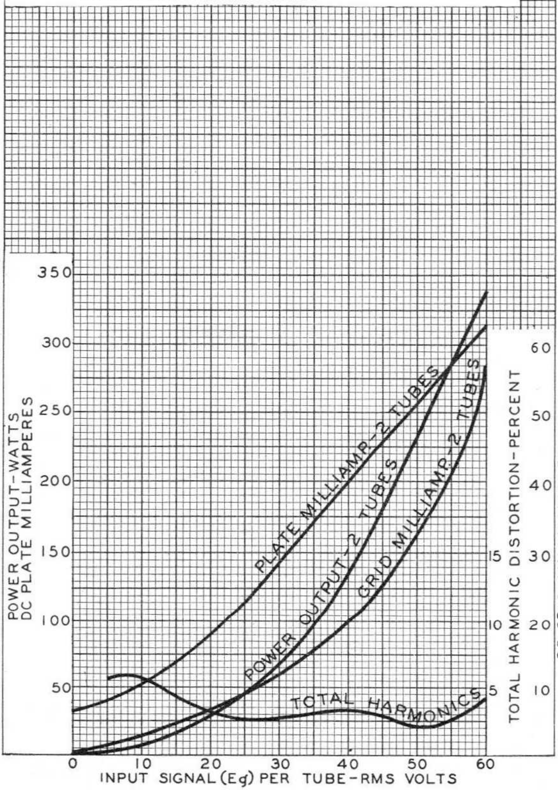
92CM-7138

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 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}) = 1500; DC GRID VOLTS = -4.5; PLATE-TO-PLATE LOAD = 12400 OHMS



92CM-7139

Power Triode

GENERAL DATA

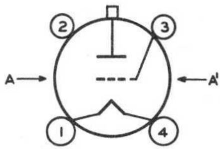
Electrical:

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:

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:

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.

RCA

812-A
POWER TRIODE

SELF-RECTIFYING OSCILLATOR or AMPLIFIER - Class C

Maximum Ratings, *Absolute Values*:

	CCS●	
AC PLATE VOLTAGE (RMS)	1750 max.	volts
DC GRID VOLTAGE	-125 max.	volts
DC PLATE CURRENT	75 max.	ma
DC GRID CURRENT	20 max.	ma
PLATE INPUT	145 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)	1740	volts
Grid Resistor✱	3500	ohms
DC Plate Current	150	ma
DC Grid Current (at full load)	29	ma
Driving Power (Approx.)▲	12	watts
Power Output (Approx.)	200	watts
Useful Power Output (Approx.)- 75% circuit efficiency	150	watts

AMPLIFIER or OSCILLATOR - Class C

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

Maximum Ratings, *Absolute Values*:

	CCS●	
DC PLATE VOLTAGE	1125 max.	volts
DC GRID VOLTAGE	-125 max.	volts
DC PLATE CURRENT	160 max.	ma
DC GRID CURRENT	32 max.	ma
PLATE INPUT§	175 max.	watts
PLATE DISSIPATION	45 max.	watts

Typical Operation:

DC Plate Voltage	1125	volts
Grid Resistor✱	2200	ohms
DC Plate Current	125	ma
DC Grid Current (Approx.)	30	ma
Driving Power (Approx.)§§	5	watts
Power Output (Approx.)	135	watts

● Continuous Commercial Service.
●● Intermittent Commercial and Amateur Service.
For ac filament supply.
✱ Obtained by grid resistor of value shown or by partial self-bias methods.
▲▲ Obtained from a fixed supply, by grid resistor (3000, 4000) or by cath- resistor (530, 590).

□□, ▲, ✠, §, §§: See next page. ← Indicates a change.

812-A

812-A
POWER TRIODE

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

▲ From a self-rectified driver.

● The 812-A can be biased by any convenient method, but the use of a grid resistor is preferred because the bias is automatically varied as the load on the circuit varies. In those applications where grid current and grid voltage may vary widely because of fluctuating loads, it is important to design equipment so that the maximum grid-current and grid-voltage ratings are never exceeded for any load. An approximate rule is to adjust the grid-current and grid-voltage values at full-load to one-half of the corresponding maximum values. This operating condition permits grid-current and grid-voltage values to rise from zero load to twice their full-load values, and usually provides adequate leeway.

§ Power input to plate is 1.23 times the product of DC Plate Voltage and DC Plate Current.

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

NOTE: When the 812-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 1500 volts, a fixed bias of at least -45 volts should be used.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Filament Current	1	3.75	4.25	amp
Amplification Factor	1,2	26	32	
Grid-Plate Capacitance . . .	–	4.8	6.2	μμf
Grid-Filament Capacitance. .	–	4.4	6.4	μμf
Plate-Filament Capacitance .	–	0.58	0.96	μμf
Grid Current	1,3	17	39	ma
Plate Current.	1,4	18	42	ma
Useful Power Output.	1,5	140	–	watts

Note 1: DC filament voltage = 6.3 volts.

Note 2: With dc grid voltage of -30 volts and plate voltage adjusted to give plate current of 30 ma.

Note 3: With dc plate voltage of 200 volts and dc grid voltage of +50 volts.

Note 4: With dc plate voltage of 1250 volts and dc grid voltage of -30 volts.

Note 5: With dc plate voltage of 1500 volts, plate current of 175 ma., grid current of 34 to 50 ma., grid resistor of 3500 ± 10% ohms and frequency of 15 Mc.

Data on operating frequencies for the 812-A are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY

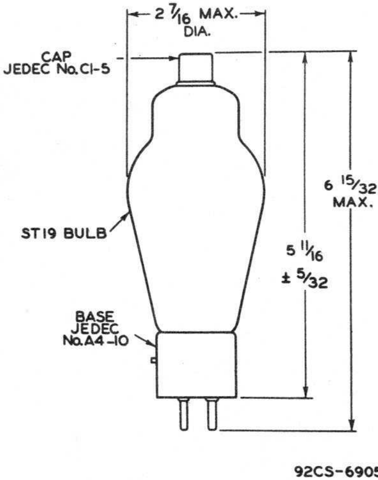
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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.

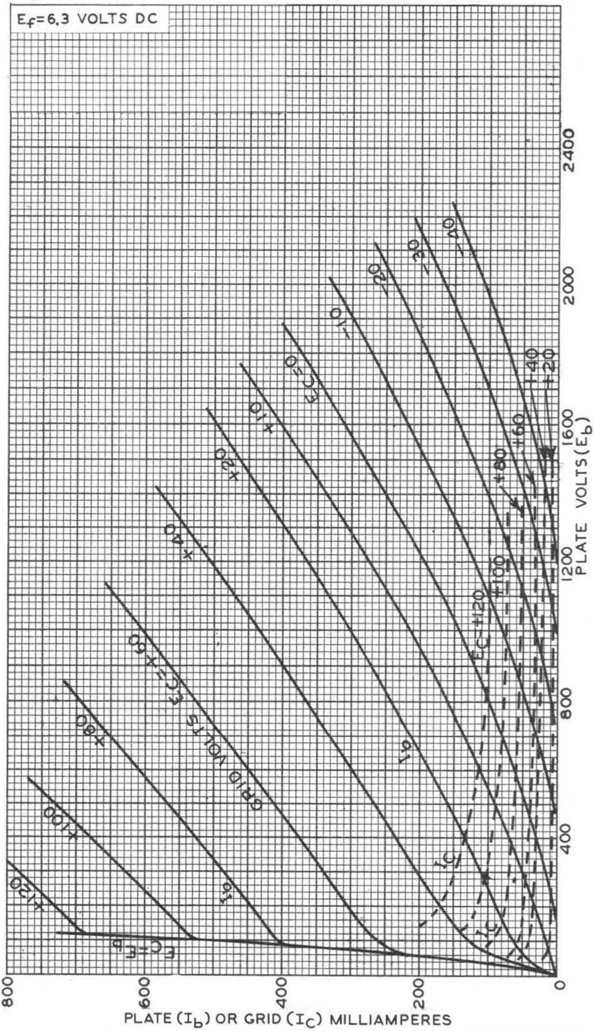
MAXIMUM RATINGS vs OPERATING FREQUENCY

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



ALL DIMENSIONS IN INCHES

AVERAGE PLATE CHARACTERISTICS

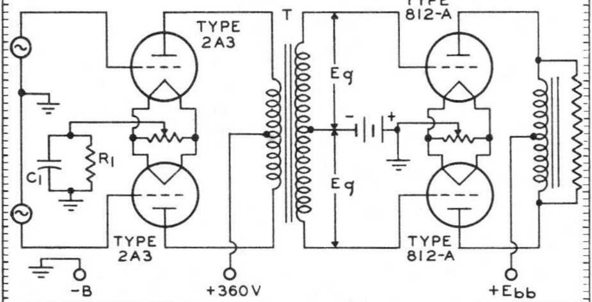


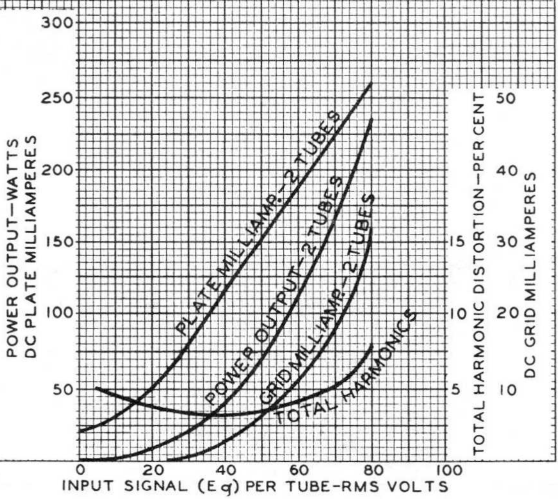
92CM-6074RI

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

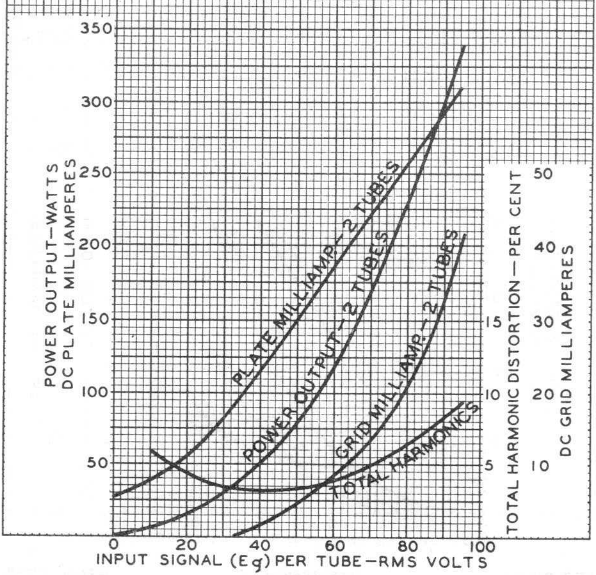
*E_f = 6.3 VOLTS AC FOR 812-A's & 2.5 VOLTS AC FOR 2A3's
CIRCUIT ARRANGEMENT: SAME AS ON DWG. 92CM-6938 UNDER TYPE 812-A

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):

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

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

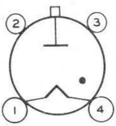
Electrical:

	Min.	*Av.*	*Max.*	
Filament, Coated:				
Voltage.	2.25	2.5	2.75	ac volts
Current at 2.5 volts	–	2	2.2	amp
Heating time at rated voltage.	10	–	–	sec
Peak Tube Voltage Drop (Approx.).	–	15	–	volts

Mechanical:

Operating Position . . . . .Vertical, base down
Maximum Overall Length . . . . 4-11/16"
Seated Length. . . . . 3-15/16" ± 1/8"
Maximum Diameter . . . . 1-9/16"
Weight (Approx.) . . . . 1 oz
Bulb ST12
Cap. . . . . .Small (JETEC No.C1-1)
Socket . . . . .Johnson No.122-224, or equivalent
Base . . . . .Small-Shell Small 4-Pin (JETEC No.A4-5)
Basing Designation for BOTTOM VIEW 4P

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



Pin 4 – Filament, Cathode Shield
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	^{o}C
Full load.	26	^{o}C

← Indicates a change.

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

816

HALF-WAVE MERCURY-VAPOR RECTIFIER

HALF-WAVE RECTIFIER

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

	Operating Condensed-Mercury-Temperature Range 20° to 60° C	
PEAK INVERSE ANODE VOLTAGE	7500 max.	volts
ANODE CURRENT:		
Peak	500 max.	ma
Average#	125 max.	ma
→ Fault, for duration of 0.1 second maximum	5 max.	amp

Averaged over any interval of 30 seconds maximum.

OPERATING CONSIDERATIONS

Shields and rf filter circuits should be provided for the 816 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.

→ Indicates a change.

816

HALF-WAVE MERCURY-VAPOR RECTIFIER

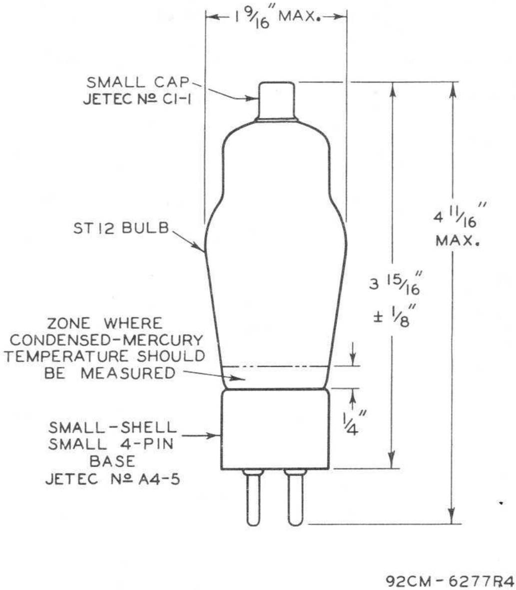
For Circuit Figures, see Front of this Section

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	5300□	2400	0.125		0.3	
Fig. 2 Full-Wave Single-Phase In-Phase Operation	2600□	2400	0.25		0.6	
Fig. 3 Series Single-Phase In-Phase Operation	5300□	4800	0.25		1.2	
Fig. 4 Half-Wave Three-Phase In-Phase Operation	3000□	3600	0.75		2.7	
Fig. 5 Parallel Three-Phase Quadrature Operation	3000□	3600	1.5		5.4	
Fig. 6 Series Three-Phase Quadrature Operation	3000□	7200	0.75		5.4	
Fig. 7 Half-Wave Four-Phase Quadrature Operation	2600□	3500	*Resistive Load* 0.45	*Inductive Load* 0.5	*Resistive Load* 1.55	*Inductive Load* 1.75
Fig. 8 Half-Wave Six-Phase Quadrature Operation	2600□	3600	*Resistive Load* 0.47	*Inductive Load* 0.5	*Resistive Load* 1.7	*Inductive Load* 1.8

□ For maximum peak inverse anode voltage of 7500 volts and condensed-mercury-temperature range of 20° to 60° C.

816

HALF-WAVE MERCURY-VAPOR RECTIFIER



833A

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:

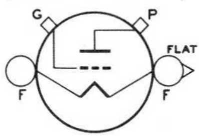
Operating Position . . . . . . Vertical, with filament posts up or down; Horizontal, with plane of electrodes vertical (on edge) ←

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

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

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.

833-A
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

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.

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

833-A

RCA

833-A

POWER TRIODE

AMPLIFIER or OSCILLATOR — Class C

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

NATURAL COOLING

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

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

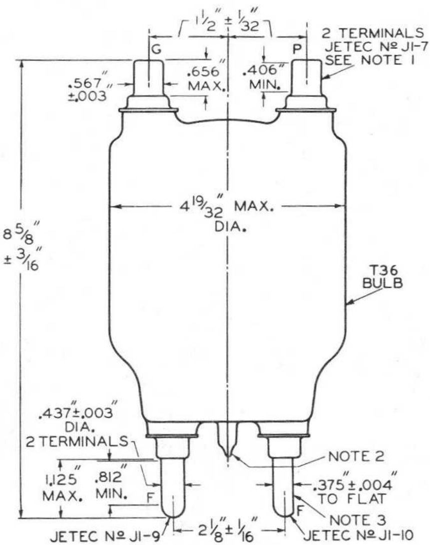
RATINGS vs FREQUENCY WITH FORCED-AIR COOLING

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

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°.

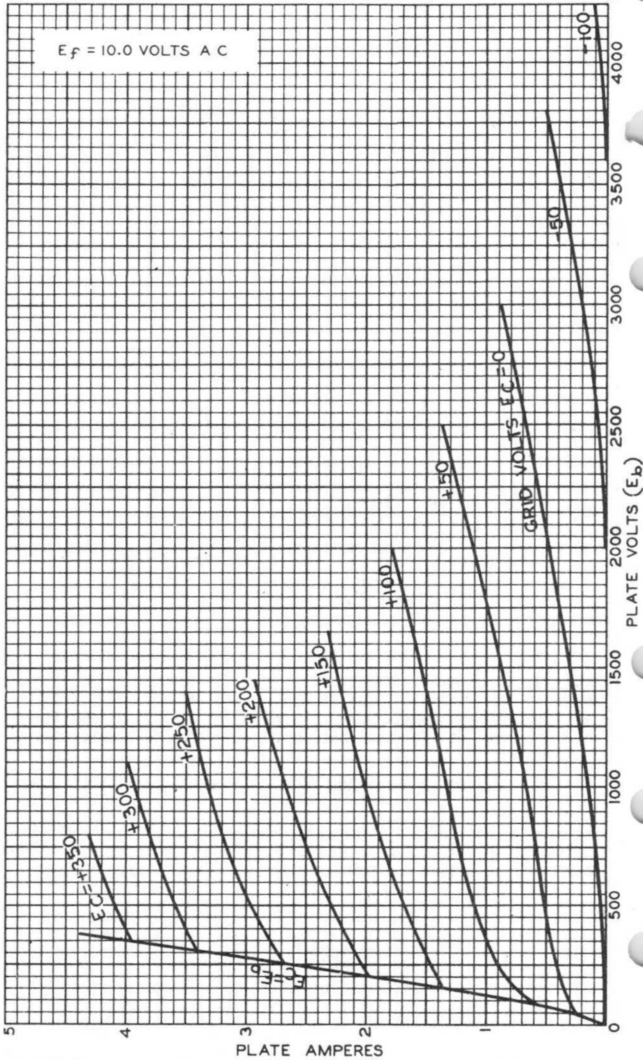
NOTE 2: THE MOUNTING SHOULD PROVIDE LIBERAL CLEARANCE FOR THIS TIP.

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.

833-A

833-A

AVERAGE PLATE CHARACTERISTICS



DEC. 1, 1943

TUBE DEPARTMENT

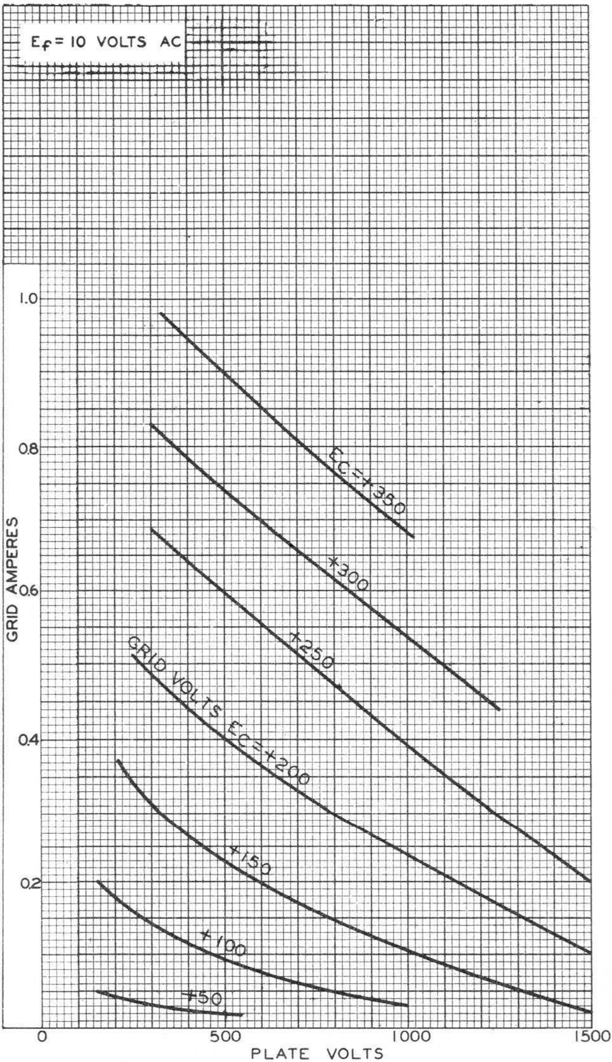
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6196

833-A

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.

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.

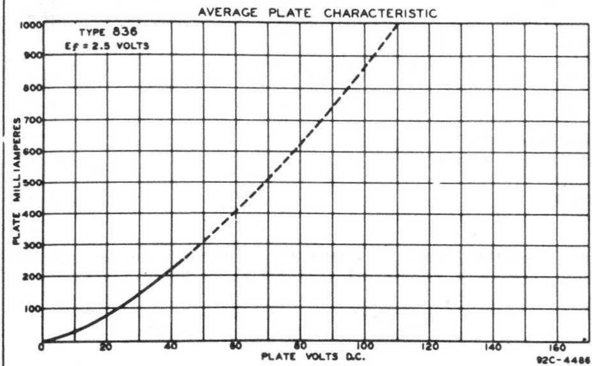
* The cathodes should be allowed to come up to operating temperature before plate current is drawn from the tube. For average conditions the delay is approximately 40 seconds.

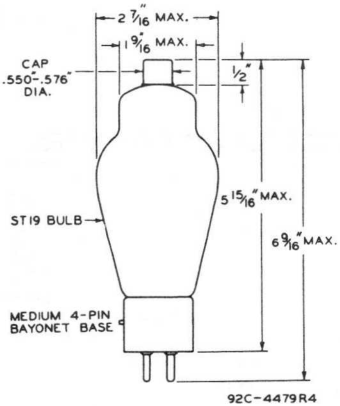
The 836 has two separate cathodes each of which is connected to its respective heater. Plate circuit return should be made to the center-tap of the heater transformer. ←

← Indicates a change.

836

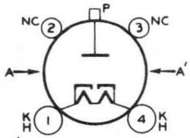
HALF-WAVE HIGH VACUUM RECTIFIER





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

RCA

857-B

HALF-WAVE MERCURY-VAPOR RECTIFIER

GENERAL DATA

Electrical:

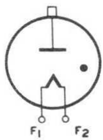
Filamentary Cathode, Coated:

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:

F1 – Filament (Insulated)



F2 – 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.F0-2)

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

857-B

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

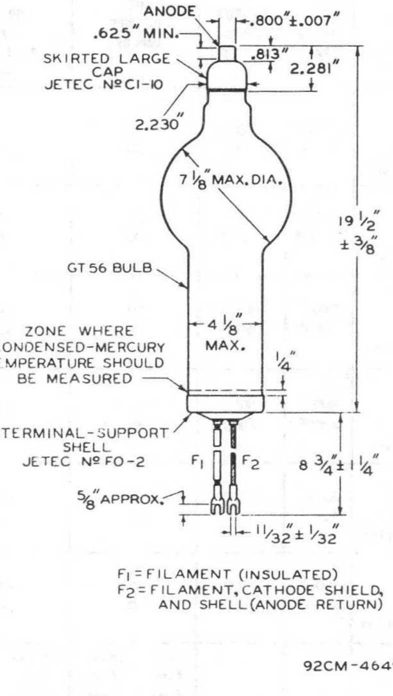
CIRCUIT	MAX. TRANS. SEC. VOLTS (RMS) E	APPROX. DC OUTPUT VOLTS TO FILTER Eav	MAX. DC OUTPUT AMPERES Iav		MAX. DC OUTPUT KW TO FILTER Pdc	
Fig. 1 **Half-Wave** **Single-Phase** In-Phase Operation	15400□ 7000▲	7000 3200	10 10		70 32	
Fig. 2 **Full-Wave** **Single-Phase** In-Phase Operation	7700□ 3500▲	7000 3200	20 20		140 64	
Fig. 3 **Series** **Single-Phase** In-Phase Operation	15400□ 7000▲	14000 6400	20 20		280 128	
Fig. 4 **Half-Wave** **Three-Phase** In-Phase Operation	8900□ 4000▲	10500 4800	30 30		315 144	
Fig. 5 **Parallel** **Three-Phase** Quadrature Operation	8900□ 4000▲	10500 4800	60 60		630 288	
Fig. 6 **Series** **Three-Phase** Quadrature Operation	8900□ 4000▲	21000 9600	30 30		630 288	
Fig. 7 **Half-Wave** **Four-Phase** Quadrature Operation	7700□ 3500▲	10100 4600	*Resistive Load* 36 36	*Inductive Load* 40 40	*Resistive Load* 364 166	*Inductive Load* 404 184
Fig. 8 **Half-Wave** **Six-Phase** Quadrature Operation	7700□ 3500▲	10500 4800	*Resistive Load* 38 38	*Inductive Load* 40 40	*Resistive Load* 399 182	*Inductive Load* 420 192

□ 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.

857-B

HALF-WAVE MERCURY-VAPOR RECTIFIER

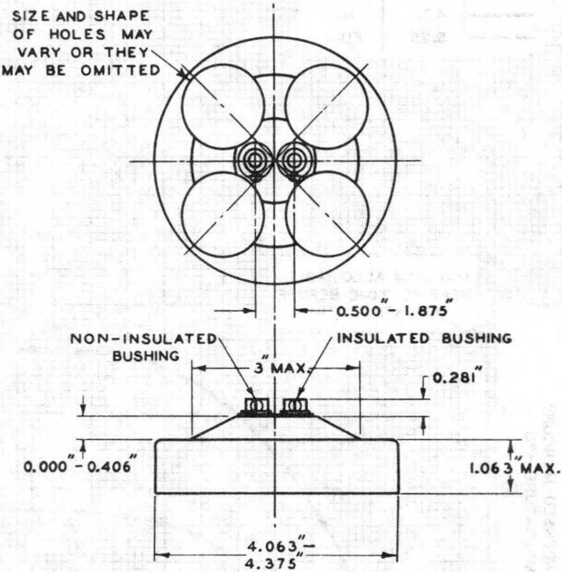


TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

857-B

HALF-WAVE MERCURY-VAPOR RECTIFIER

TERMINAL-SUPPORT SHELL



92CS-4653R2

JETEC No. FO-2
RCA No. 3911

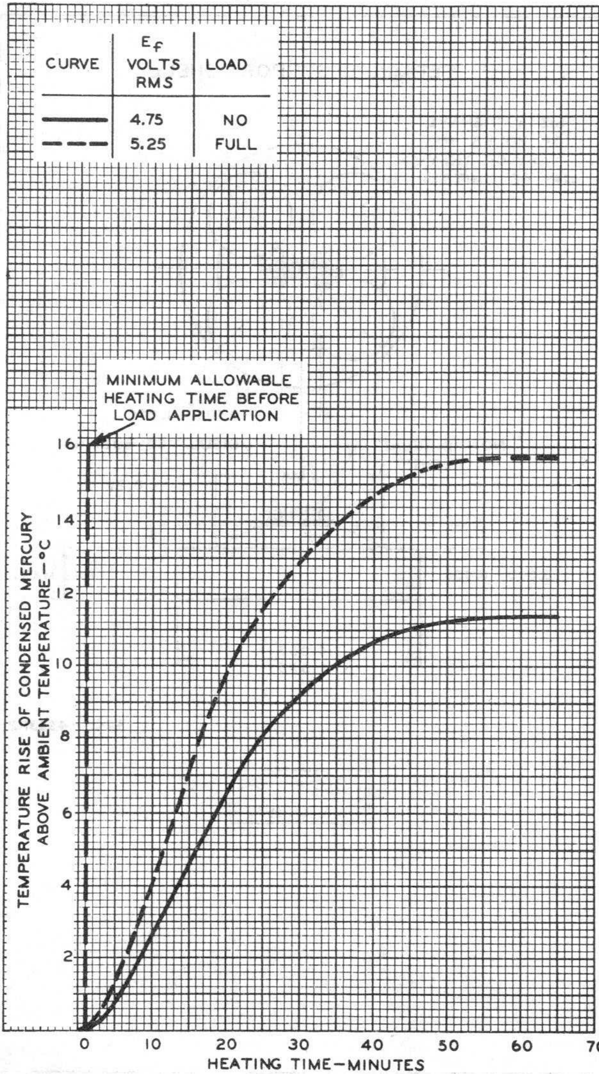
JULY 1, 1955

CE-4653R2

857-B

857-B

RATE OF RISE OF COND.-MERCURY TEMPERATURE



APRIL 16,1951 TUBE DIVISION 92CM-7639
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

866-A

866-A

HALF-WAVE MERCURY-VAPOR RECTIFIER

GENERAL DATA

Electrical:

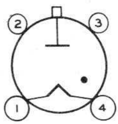
Filament, Coated:

	Min.	Av.	Max.	
Voltage	2.38	2.5	2.62	ac volts
Current at 2.5 volts	–	5	5.4	amp
Heating time at rated voltage	15	–	–	sec
Peak Tube Voltage Drop (Approx.)	–	15	–	volts

Mechanical:

Operating Position . . . . Vertical, base down
Maximum Overall Length . . . . 6-9/16"
Maximum Seated Length. . . . . 5-3/4" ± 3/16"
Maximum Diameter . . . . 2-7/16"
Weight (Approx.) . . . . 3 oz
Bulb ST19
Cap. . . . . Medium (JETEC No.C1-5)
Socket . . . . Johnson No.123-209, or equivalent
Base . . . . Medium-Shell Small 4-Pin with Bayonet (JETEC No.A4-10)
Basing Designation for BOTTOM VIEW 4P

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



Pin 4 – Filament, Cathode Shield
Cap – Anode

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* . . . . 26 °C
Full load▲ . . . . 33 °C

* With 2.38 volts rms on filament, and no heat-conserving enclosure.
▲ With 2.62 volts rms on filament, average anode current = 0.5 ampere, and no heat-conserving enclosure.

← Indicates a change.

RCA

866-A

HALF-WAVE MERCURY-VAPOR RECTIFIER

HALF-WAVE RECTIFIER

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

	Operating Condensed-Mercury-Temperature Range●			
	20° to 80° C	20° to 70° C	20° to 60° C	
PEAK INVERSE ANODE VOLTAGE. .	2500 max.	5000 max.	10000 max.	volts
ANODE CURRENT:				
Peak	2 max.	1 max.	1 max.	amp
Average#	0.5 max.	0.25 max.	0.25 max.	amp
Fault, for duration of 0.1 second maximum. . . .	20 max.	20 max.	20 max.	amp

● Operation at 40° ± 5° C is recommended.

\# Averaged over any interval of 30 seconds maximum.

→

OPERATING CONSIDERATIONS

Shields and rf filter circuits should be provided for the 866-A 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.

→ Indicates a change.

RCA

866-A

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	7000□ 3500▲ 1700*	3200 1600 800	0.25 0.25 0.5	0.8 0.4 0.4
Fig. 2 Full-Wave Single-Phase In-Phase Operation	3500□ 1700▲ 800*	3200 1600 800	0.5 0.5 1	1.6 0.8 0.8
Fig. 3 Series Single-Phase In-Phase Operation	7000□ 3500▲ 1700*	6400 3200 1600	0.5 0.5 1	3.2 1.6 1.6
Fig. 4 Half-Wave Three-Phase In-Phase Operation	4000□ 2000▲ 1000*	4800 2400 1200	0.75 0.75 1.5	3.6 1.8 1.8
Fig. 5 Parallel Three-Phase Quadrature Operation	4000□ 2000▲ 1000*	4800 2400 1200	1.5 1.5 3	7.2 3.6 3.6
Fig. 6 Series Three-Phase Quadrature Operation	4000□ 2000▲ 1000*	9600 4800 2400	0.75 0.75 1.5	7.2 3.6 3.6
Fig. 7 Half-Wave Four-Phase Quadrature Operation	3500□ 1700▲ 800*	4500 2300 1100	*Resistive Load* / *Inductive Load* 0.91 / 1 0.91 / 1 1.82 / 2	*Resistive Load* / *Inductive Load* 4.05 / 4.5 2.07 / 2.3 1.98 / 2.2
Fig. 8 Half-Wave Six-Phase Quadrature Operation	3500□ 1700▲ 800*	4800 2400 1200	*Resistive Load* / *Inductive Load* 0.95 / 1 0.95 / 1 1.9 / 2	*Resistive Load* / *Inductive Load* 4.6 / 4.8 2.3 / 2.4 2.28 / 2.4

□ For maximum peak inverse anode voltage of 10000 volts, and condensed-mercury-temperature range of 20° to 60° C.

▲ For maximum peak inverse anode voltage of 5000 volts, and condensed-mercury-temperature range of 20° to 70° C.

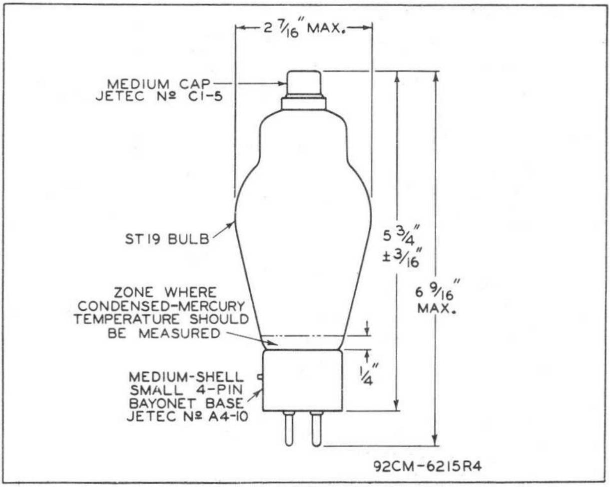
* For maximum peak inverse anode voltage of 2500 volts, and condensed-mercury-temperature range of 20° to 80° C.

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

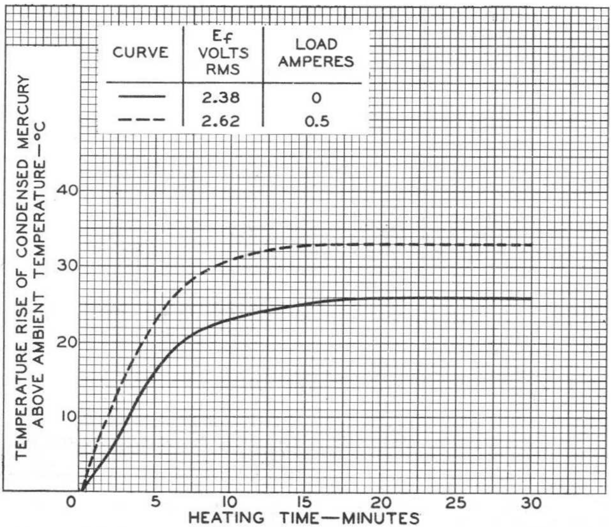
RCA

866-A

HALF-WAVE MERCURY-VAPOR RECTIFIER



RATE OF RISE OF CONDENSED-MERCURY TEMPERATURE



ELECTRON TUBE DIVISION
92CS-9028R1

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

869-B

HALF-WAVE MERCURY-VAPOR RECTIFIER

GENERAL DATA

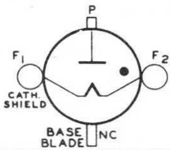
Electrical:

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

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

869B

X-Ray Warning. X-rays are produced when the ~~869-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.

valve

16KV

Cap X

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

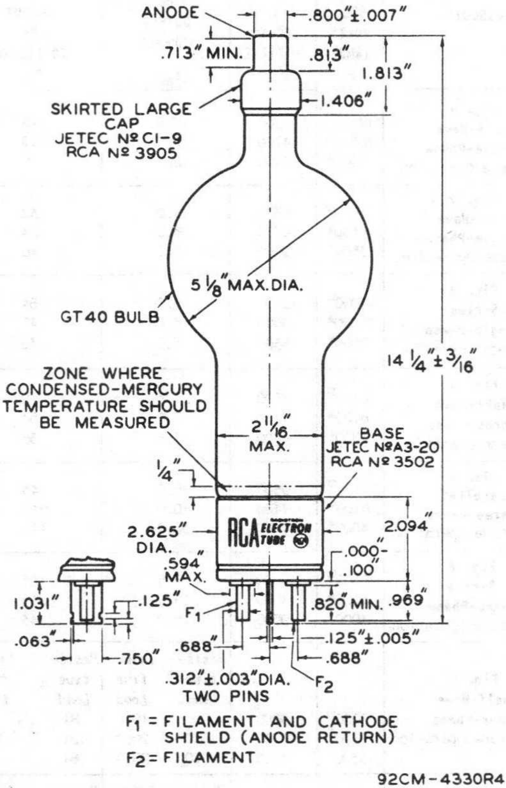
□ For maximum peak inverse anode voltage of 20000 volts, and condensed-mercury-temperature range of 30° to 40°C.

▲ 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.

869-B

HALF-WAVE MERCURY-VAPOR RECTIFIER

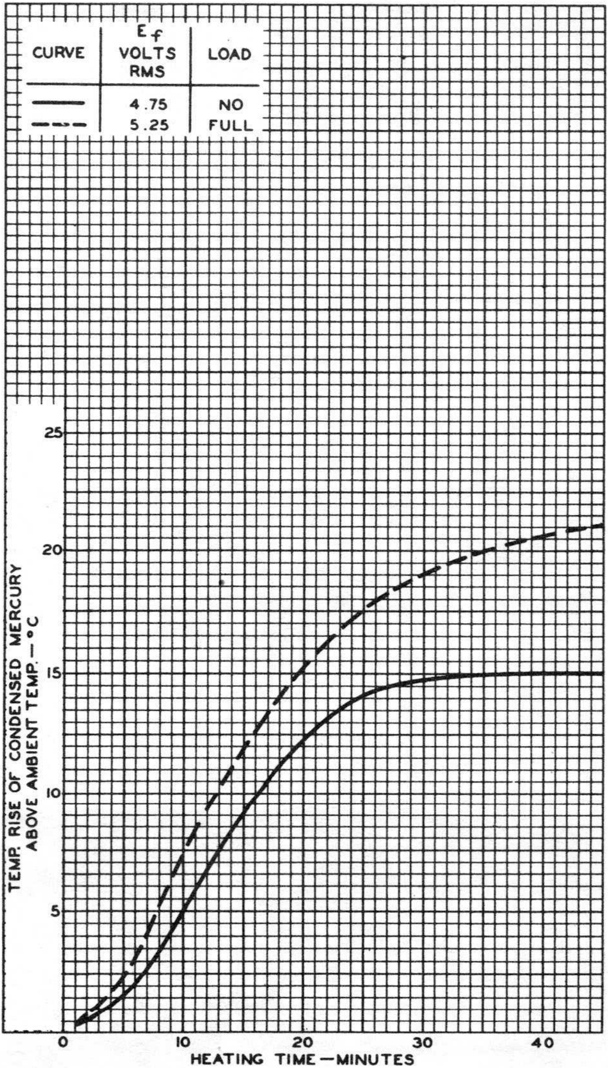


NOV. 1, 1952 CE-4330R4

RCA

869-B

RATE OF RISE OF COND.-MERCURY TEMPERATURE



872-A

HALF-WAVE MERCURY-VAPOR RECTIFIER

GENERAL DATA

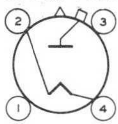
Electrical:

Filament, Coated:	*Min.*	*Av.*	*Max.*	
Voltage	4.75	5	5.25	ac volts
Current at 5 volts	–	7.5	8	amp
Heating time at rated voltage	30	–	–	sec
Peak Tube Voltage Drop (Approx.)	–	10	–	volts

Mechanical:

Operating Position . . . . .Vertical, base down
Overall Length . . . . 8-1/4" ± 1/4"
Maximum Diameter . . . . 2-5/16"
Weight (Approx.) . . . . 7 oz
Bulb T18
Cap. . . . . Medium (JETEC No.C1-5)
Socket . . . . Johnson No.123-211, or equivalent
Base . . . . Medium-Metal-Shell Jumbo 4-Pin with Bayonet (JETEC No.A4-29)
Basing Designation for BOTTOM VIEW 4AT

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



Pin 3 – No Connection
Pin 4 – Filament
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*	14	°C
Full load▲	19	°C

* With 4.75 volts rms on filament, and no heat-conserving enclosure.
▲ With 5.25 volts rms on filament, average anode current = 1.25 amperes, and no heat-conserving enclosure.

← Indicates a change.

RCA

872-A

HALF-WAVE MERCURY-VAPOR RECTIFIER

HALF-WAVE RECTIFIER

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

	Operating Condensed-Mercury-Temperature Range●		
	20° to 70° C	20° to 60° C	
PEAK INVERSE ANODE VOLTAGE	5000 max.	10000 max.	volts
ANODE CURRENT:			
Peak	5 max.	5 max.	amp
Average#	1.25 max.	1.25 max.	amp
→ Fault, for duration of 0.1 second maximum	50 max.	50 max.	amp

● Operation at 40° ± 5° C is recommended.
Averaged over any interval of 15 seconds maximum.

→ OPERATING CONSIDERATIONS

Shields and rf filter circuits should be provided for the 872-A 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.

→ Indicates a change.

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

872-A

872-A

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	7000□ 3500▲	3200 1600	1.25 1.25		4 2	
Fig. 2 **Full-Wave** **Single-Phase** In-Phase Operation	3500□ 1700▲	3200 1600	2.5 2.5		8 4	
Fig. 3 **Series** **Single-Phase** In-Phase Operation	7000□ 3500▲	6400 3200	2.5 2.5		16 8	
Fig. 4 **Half-Wave** **Three-Phase** In-Phase Operation	4000□ 2000▲	4800 2400	3.75 3.75		18 9	
Fig. 5 **Parallel** **Three-Phase** Quadrature Operation	4000□ 2000▲	4800 2400	7.5 7.5		36 18	
Fig. 6 **Series** **Three-Phase** Quadrature Operation	4000□ 2000▲	9600 4800	3.75 3.75		36 18	
Fig. 7 **Half-Wave** **Four-Phase** Quadrature Operation	3500□ 1700▲	4500 2250	*Resistive Load* 4.5 4.5	*Inductive Load* 5 5	*Resistive Load* 20 10	*Inductive Load* 22.5 11.2
Fig. 8 **Half-Wave** **Six-Phase** Quadrature Operation	3500□ 1700▲	4800 2400	*Resistive Load* 4.75 4.75	*Inductive Load* 5 5	*Resistive Load* 22.8 11.4	*Inductive Load* 24 12

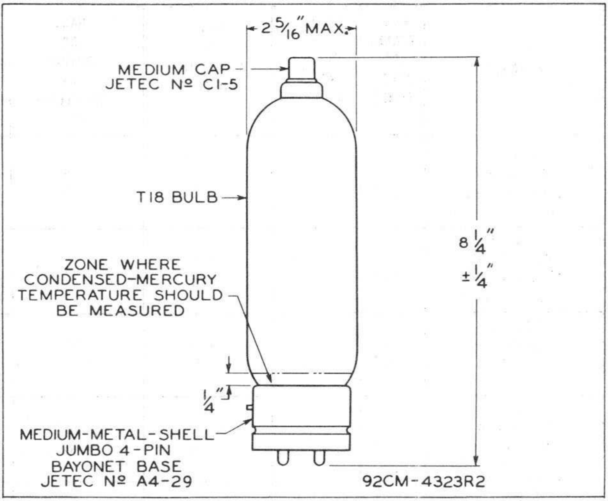
□ For maximum peak inverse anode voltage of 10000 volts and condensed-mercury-temperature range of 20° to 60° C.

▲ For maximum peak inverse anode voltage of 5000 volts and condensed-mercury-temperature range of 20° to 70° C.

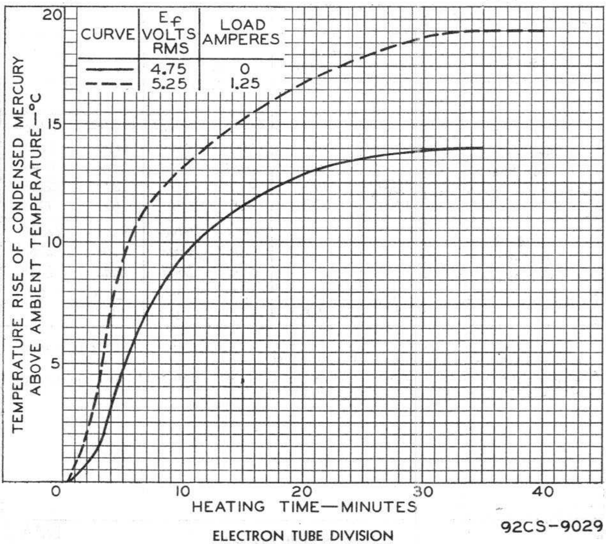
872-A

872-A

HALF-WAVE MERCURY-VAPOR RECTIFIER



RATE OF RISE OF CONDENSED-MERCURY TEMPERATURE



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

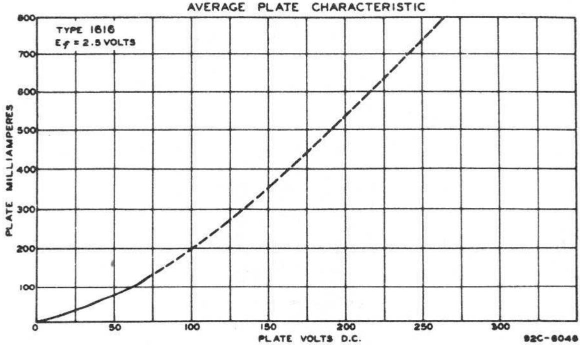
MAXIMUM RATINGS

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.

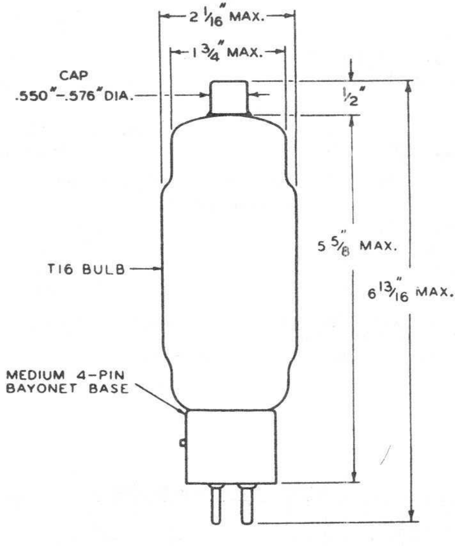
† Should not deviate more than ±5% from the rated value.

AVERAGE PLATE CHARACTERISTIC

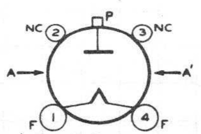


← Indicates a change.

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

RCA RADIOTRON DIVISION
RCA MANUFACTURING COMPANY, INC.

Super-Power Triode

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

CERAMIC-METAL SEALS
DOUBLE-ENDED CONSTRUCTION
COAXIAL-ELECTRODE STRUCTURE

INTEGRAL WATER DUCTS
17.00 INCH MAX. LENGTH
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

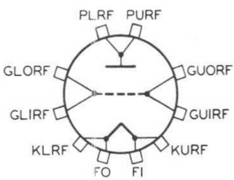


PLATE-PULSED AMPLIFIER—Class B[r]

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

RADIO CORPORATION OF AMERICA
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.

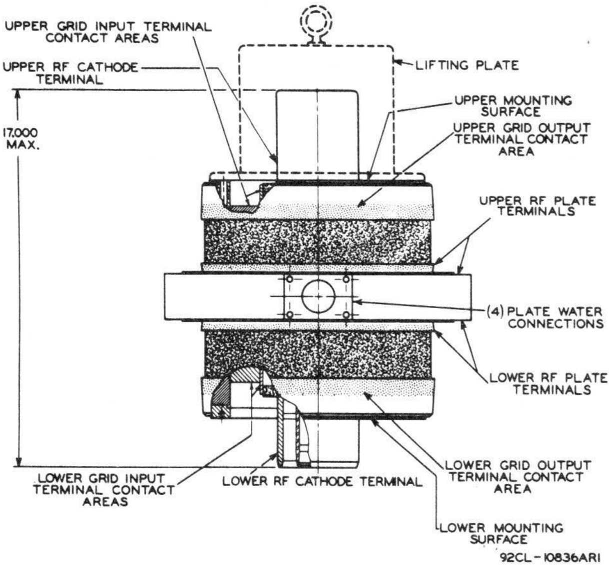
q See *Cooling Considerations* - Liquid Cooling.

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)

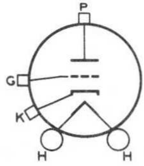


PLATE PULSED SERVICE—CLASS C

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

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] Resdal 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.

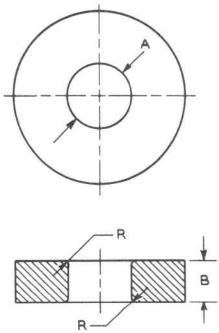
OPERATING CONSIDERATIONS

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

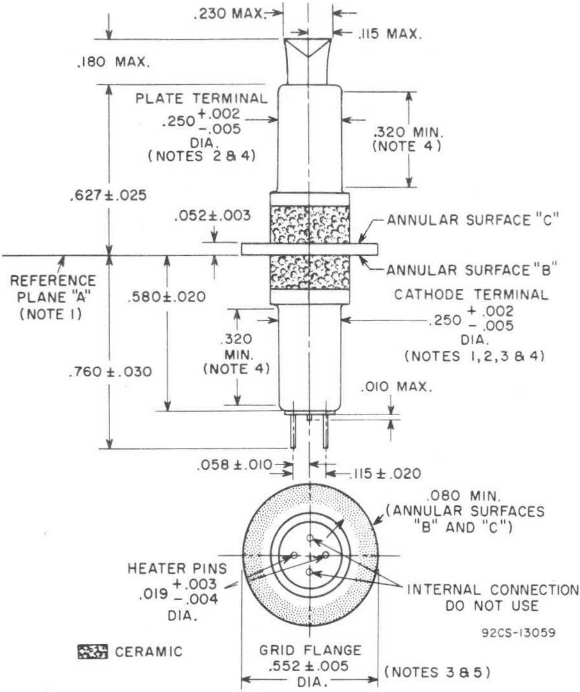
Gauge	Type	Dimension		
		Diameter A	Thickness B	Radius R
G_1-1	Go	0.25200" +0.00000" -0.00007"	0.320" +0.001" -0.000"	0.003" Max
G_1-2	No-Go	0.24500" +0.00007" -0.00000"	-	-
G_3-1	Go	0.55700" +0.00000" -0.00007"	-	-
G_3-2	No-Go	0.54700" +0.00007" -0.00000"	-	-



92CS-10370

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

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".

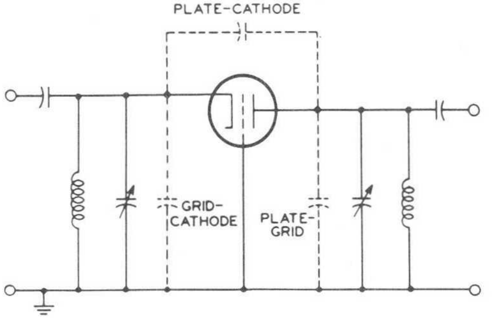
Note 2: The axes of the plate cylinder and cathode cylinder will coincide within 0.010 inch.

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

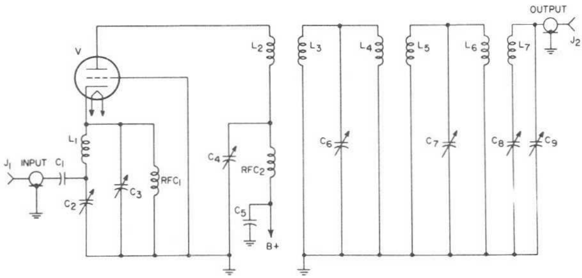
Note 4: The diameter along the 0.320 inch minimum length is measured with "GO" and "NO-GO" ring gauges G1-1 and G1-2, respectively.

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

TYPICAL CATHODE-DRIVE POWER AMPLIFIER CIRCUIT



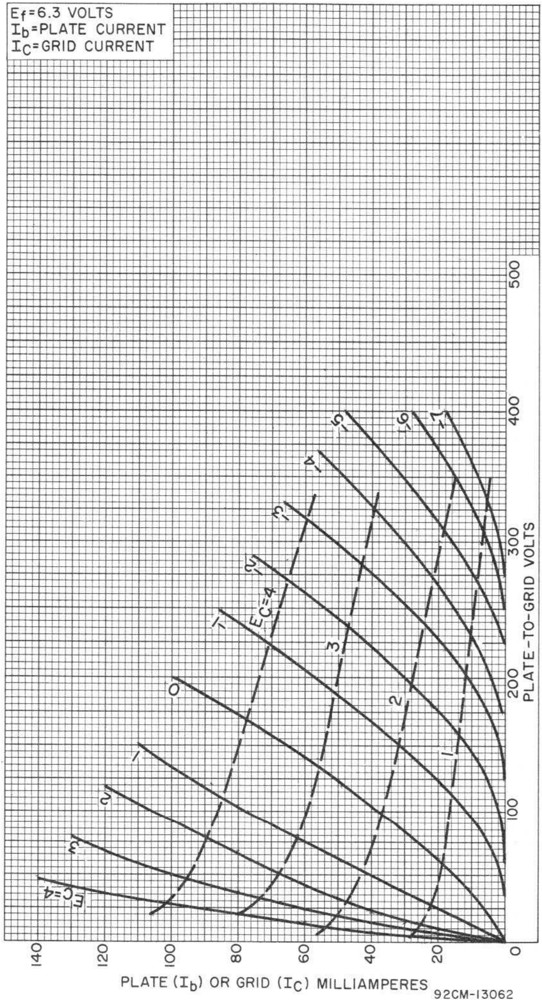
TYPICAL BROADBAND AMPLIFIER CIRCUIT



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: 500 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

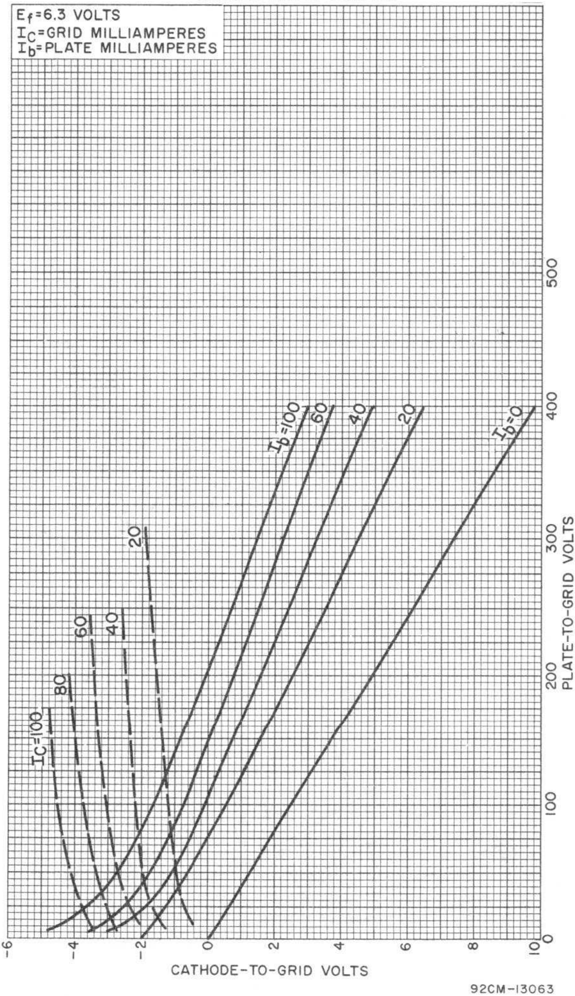
Average Characteristics

CATHODE-DRIVE SERVICE



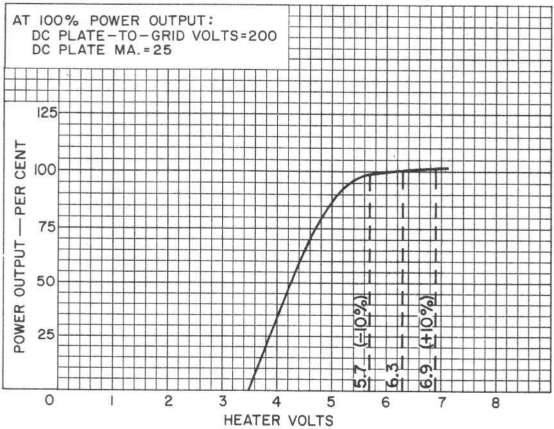
Average Constant-Current Characteristics

CATHODE-DRIVE SERVICE



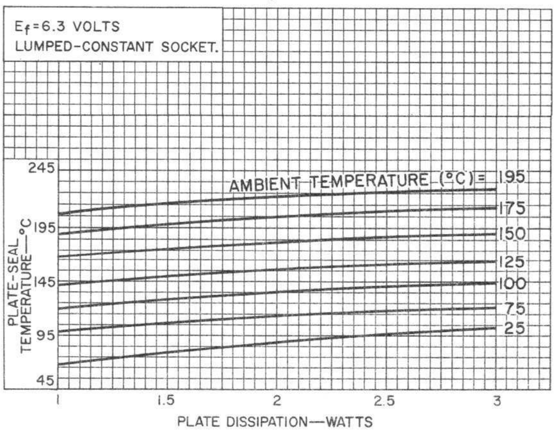
RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

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

4037A

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

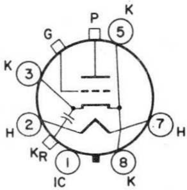
ELECTRICAL

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 A_1 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

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

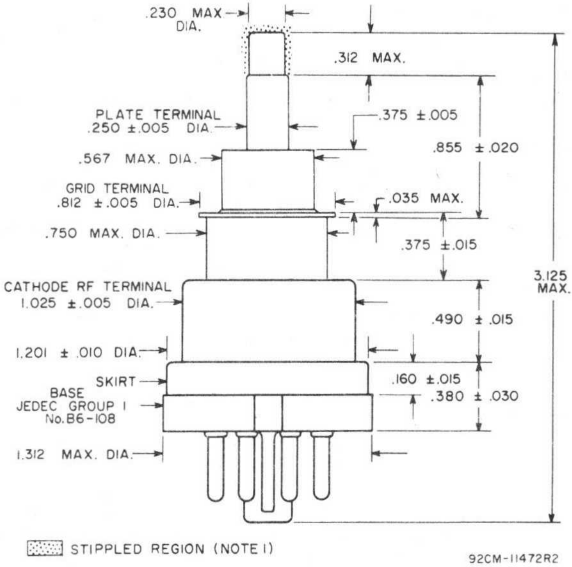
The *maximum plate-seal temperature* of 175° C is a tube rating and is to be observed in the same manner as other ratings. The temperature of the plate seal should be measured on the plate seal. The temperature may be measured with temperature-sensitive paint, such as *Tempilaq*. The latter is made by 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.

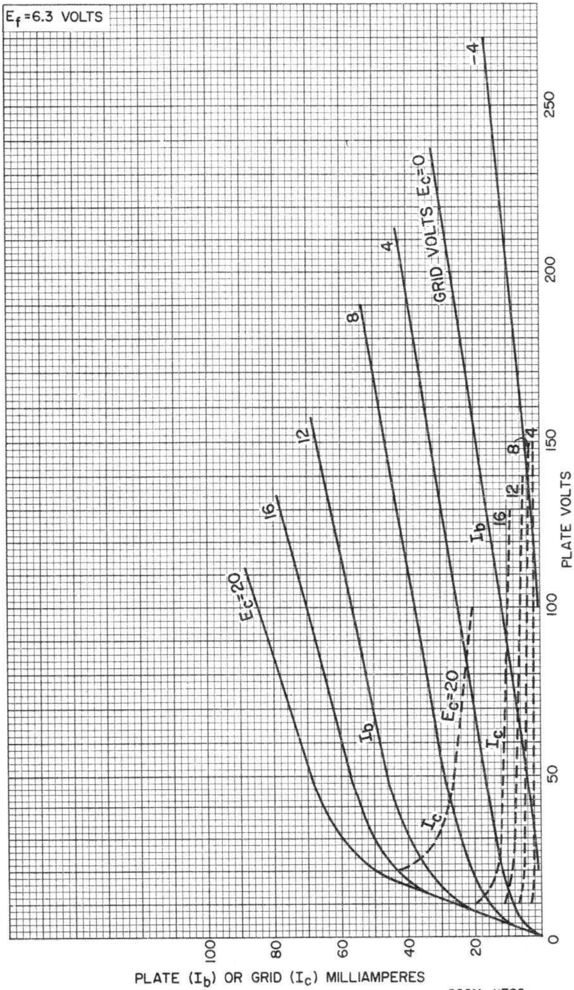
DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

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

Average Characteristics



92CM-11722

Traveling-Wave Tube

Frequency Range 8 to 12 GHz
Integral Periodic-Permanent-Magnet Type

ELECTRICAL

Heater, for Unipotential Cathode:		
Voltage (ac or dc)	6.3 ± 5%	V
Current at 6.3 volts	0.7	A
Starting Current	Must never exceed 4 amperes, even momentarily	
Minimum Cathode Heating Time	3	minutes
Frequency Range	8 to 12	GHz
Cold Insertion Loss	60	dB
Input VSWR	2.5:1 max.	
Output VSWR	2.0:1 max.	
Gain, Small Signal (at 0.1 W output) 8.0 to 12 GHz	34 min.	dB

MECHANICAL

Operating Position	Any	
Maximum Dimensions:		
Overall Length	15 max.	in
Height	3.25 max.	in
Width	2.20 max.	in
Shell Diameter	1.75	in
Connectors:		
RF Input	Type TNC Plug	
RF Output	Special Flange Coupling	
Terminal Leads	See *Dimensional Outline*	
Weight (Approx.)	6.0	lb

RF POWER AMPLIFIER

Maximum Ratings, *Absolute-Maximum Values*

DC Collector Voltage	3000 max.	V
DC Helix Voltage	2950 max.	V
DC Grid-No.2 Voltage	2000 max.	V
DC Collector Current	15 max.	mA
DC Helix Current	2.5 max.	mA
DC Grid-No.2 Current	0.1 max.	mA
RF Power Input	1 max.	mW

Typical Operation at 10 GHz

DC Collector Voltage	3000	V
DC Helix Voltage	2800	V
DC Grid-No.2 Voltage	1800	V
DC Collector Current	12	mA
DC Helix Current	0.5	mA
DC Grid-No.2 Current	0	mA
Input VSWR	2.0:1	
Output VSWR	1.5:1	
RF Power Input	1 to 10	mW
Saturated Power Output	1.5	W

CHARACTERISTICS RANGE VALUES

	Note	*Min.*	*Max.*	
Heater Current	1	0.5	1.1	A
DC Collector Voltage	2,3	2600	3000	V
DC Helix Voltage	2,3	2600	2950	V
DC Grid-No.2 Voltage	3	1600	2000	V
DC Collector Current	3	8	15	mA
DC Helix Current	3	0.1	2.5	mA
DC Grid-No.2 Current	–	0	0.1	mA

Note 1: With heater voltage of 6.3 volts.

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 4041 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 4041 rf power output and the load should have a voltage standing wave ratio (VSWR) no greater than 4:1. With VSWR's in excess of

4:1, oscillations may occur causing permanent damage to the tube. Tubes should not be operated without a termination.

Conduction cooling on the tube is necessary whenever collector current is flowing. Failure to observe this precaution may result in permanent damage to the tube.

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 grid No.2 voltage decays faster than all other voltages (except the heater voltage).

Mounting. The 4041 may be mounted in any position by means of clamps around the specified areas shown on the *Dimensional Outline.*

Electrical connections are made to the 4041 by means of the six leads. These color-coded, flexible, insulated leads are identified on the *Dimensional Outline.* The rf input is made to a type TNC male plug on the tube, the rf output is by means of a flange coupling and a transition piece (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 4041 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.

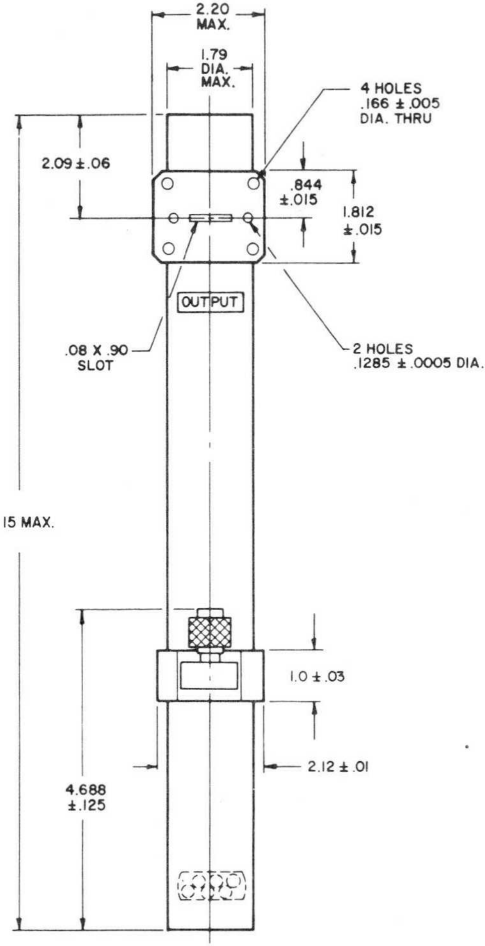
Turn-Off Procedure

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.

FLEXIBLE LEAD COLOR CODE (See Dimensional Outline)

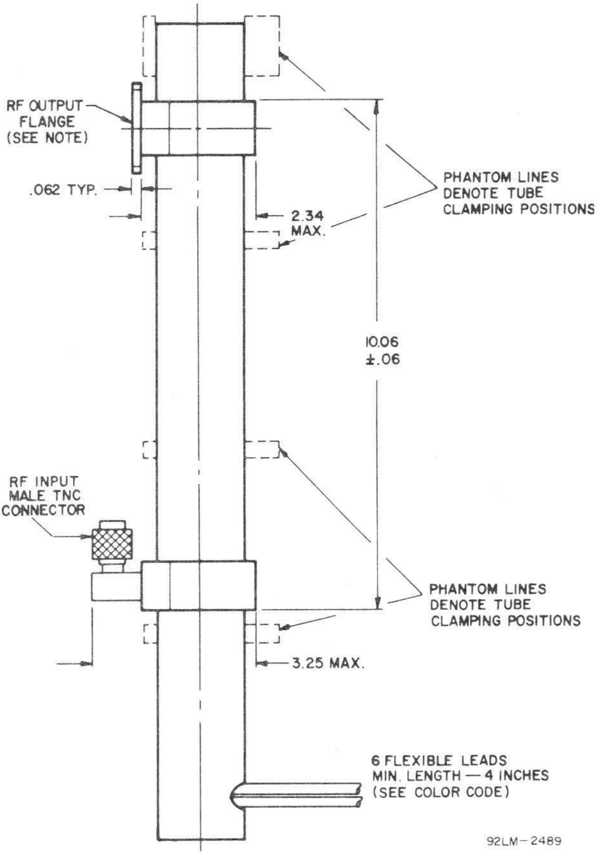
Yellow:	Heater-Cathode
Brown:	Heater
Green:	Grid No. 1
Black:	Collector (Ground)
Orange:	Helix
Blue:	Grid No.2 (Anode)

DIMENSIONAL OUTLINE (Front View)



DIMENSIONS IN INCHES

DIMENSIONAL OUTLINE (Side View)



DIMENSIONS IN INCHES

Note: RF output flange requires use of a transition piece (Waveline Type 60083, or equivalent) if matching to standard waveguide flange.

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 B/U)
RF Output	Type N Plug (UG-18 B/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.

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 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.

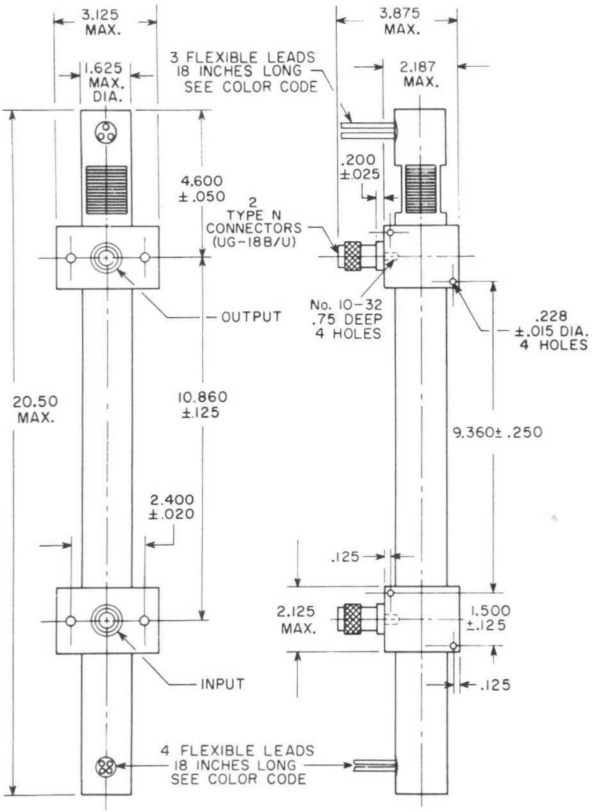
STARTING PROCEDURE

Voltages should be applied to the 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



92CS-12587R1

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

Traveling-Wave Tube

Frequency Range 1.7 to 2.7 GHz
Integral Periodic-Permanent-Magnet Type

ELECTRICAL

Heater, for Unipotential Cathode:		
Voltage (ac or dc)	6.3 ± 5%	V
Current at 6.3 volts	1.75	A
Starting Current	Must never exceed 4 amperes, even momentarily	
Minimum Cathode Heating Time	3	minutes
Frequency Range	1.7 to 2.7	GHz
Cold Insertion Loss	60	dB
Input VSWR	1.8:1 max.	
Output VSWR	1.8:1 max.	
Noise Figure	30 max.	dB
Gain (at 20 W output):		
1.8 to 2.4 GHz	30 min.	dB
2.4 to 2.7 GHz	29 min.	dB
Gain (at 16 W output)		
1.8 to 2.7 GHz	30 min.	dB
Gain (at 17 W output)		
1.7 to 1.8 GHz	29.5 min.	dB
Gain Compression (referenced to 5 W)		
at 10 W output	1 max.	dB
at 20 W output		
1.8 to 2.4 GHz	3 max.	dB
2.4 to 2.7 GHz	4 max.	dB
at 17 W output		
1.7 to 1.8 GHz	4 max.	dB
Phase Sensitivity (with Beam-Voltage Variation)	2 max.	°/V
Bandwidth Flatness (over a 15-MHz segment)	0.02 max.	dB/MHz

MECHANICAL

Operating Position	Any	
Maximum Dimensions:		
Overall Length	19	in
Height	3.88	in
Width	3.12	in
Shell Diameter	3.62	in
Connectors:		
RF Input	Type N Plug (UG-18 B/U)	
RF Output	Type N Plug (UG-18 B/U)	
Terminal Leads	See *Dimensional Outline*	
Weight (Approx.)	6.5	lb

RF POWER AMPLIFIER

Absolute-Maximum Ratings

DC Collector Voltage	3000 max.	V
DC Helix Voltage	2500 max.	V
DC Grid-No.2 Voltage	1700 max.	V
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.	W

Typical Operation at 2.0 GHz

DC Collector Voltage	2200	V
DC Helix Voltage	2200	V
DC Grid-No.2 Voltage	1500	V
DC Collector Current	70	mA
DC Helix Current	0.25	mA
DC Grid-No.2 Current	0.25	mA
Input VSWR	1.5:1	
Output VSWR	1.5:1	
RF Power Input	20	mW
Saturated Power Output	20	W

CHARACTERISTICS RANGE VALUES

	Note	*Min.*	*Max.*	
Heater Current	1	–	2	A
DC Collector Voltage	2,3	1800	2500	V
DC Helix Voltage	2,3	1800	2500	V
DC Grid-No.2 Voltage	3	1150	1600	V
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 voltage of 6.3 volts.

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 4054 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 4054 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 2:1, oscillations may occur causing permanent damage to the tube. Tubes should not be operated without a termination.

Forced-air cooling on 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.

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 milliamperes with grid-No.2 voltage in the range of 200 to 600 volts, then will fall below 2 milliamperes at the proper operating grid-No.2 voltage. The helix supply should have adequate regulation to handle this transient during the turn-on procedure. To protect the tube, it is recommended that an interlock be incorporated in the helix supply to open the circuit if the helix current exceeds 3 milliamperes longer than a few milliseconds.

Mounting. The 4054 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 4054 by means of the five leads. These color-coded, flexible, insulated leads are identified on the *Dimensional*

Outline. The 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 4054 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.

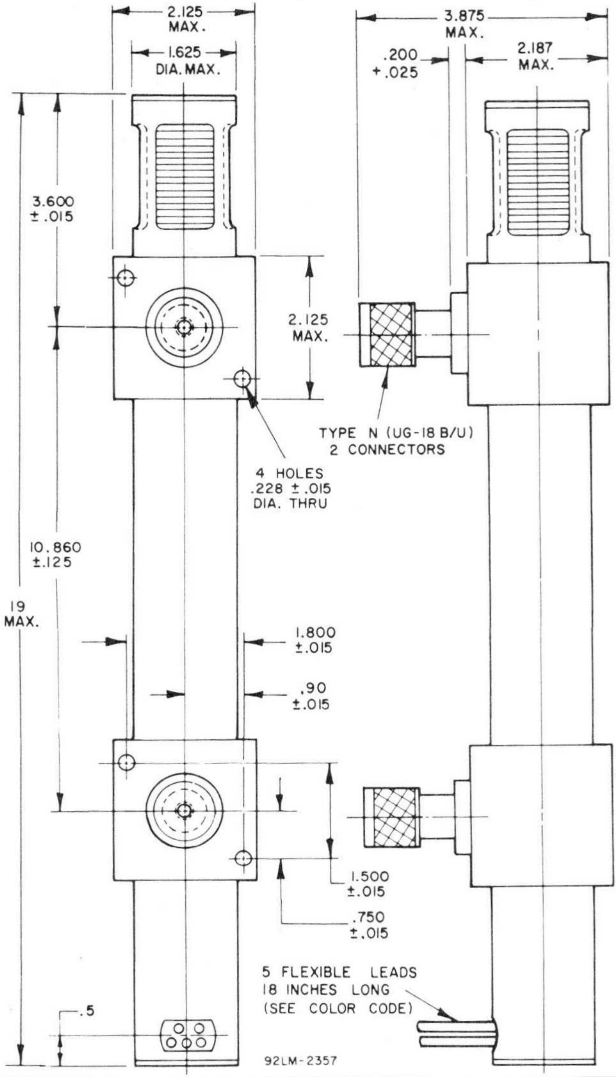
Turn-Off Procedure

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.

FLEXIBLE LEAD COLOR CODE (See Dimensional Outline)

Brown:	Heater
Yellow:	Heater-Cathode
Orange:	Helix
Blue:	Grid No.2 (Anode)
Black:	Collector (Ground)

DIMENSIONAL OUTLINE (Dimensions In Inches)



High-Mu Triode

CERAMIC-METAL PENCIL TUBE
OPERATING FREQUENCIES UP TO 4 GHz AND ABOVE

For Plate-Pulsed Operation as a Power Amplifier, Oscillator, and Frequency Multiplier in Compact Mobile and Aircraft Equipment at Altitudes up to 50,000 Feet without Pressurization

ELECTRICAL

Heater, for Unipotential Cathode		
Voltage (AC or DC)	6.3 ± 10%	V
Current at 6.3 volts	0.295	A
Cathode Warmup Time (Average) to reach 80% of operating power output as rf oscillator or amplifier	5	s
Amplification Factor	70	
Transconductance, for dc plate mA = 35, dc plate volts = 150, and cathode resistor = 11 Ω	35000	μmho
Direct Interelectrode Capacitances[a]		
Grid to plate	2.0	pF
Grid to cathode	5.5	pF
Plate to cathode	0.08 max	pF

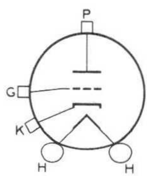
MECHANICAL

Operating Position . . . . Any
Weight . . . . 0.4 oz
Dimensions and Terminal Connections. . . . . See accompanying *Dimensional Outline*

Sockets
Heater-Terminals Connector. . . . . Grayhill[a] No.22-5, or equivalent
Socket for operation up to about 550 MHz (Including heater-terminals connector) . . Jettron[b] No.CD7010, or equivalent

TERMINAL DIAGRAM (Bottom View)

H - Heater
K - Cathode
G - Grid
P - Plate



← Indicates a change.

PLATE-PULSED SERVICE—Class C

Maximum Ratings, Absolute-Maximum Values Up to 4 GHz

For a maximum duty factor of 0.01

	For Altitudes up to 25,000 ft	For Altitudes up to 50,000 ft	
Peak Plate Voltage	3500 max	2000 max	V
Peak Plate Current	3.0 max	3.0 max	A
DC Plate Current	40 max	40 max	mA
DC Grid Current	15 max	15 max	mA
Plate Dissipation[c]	10 max	10 max	W
Peak Heater-Cathode Voltage			
Heater negative with respect to cathode	60 max	60 max	V
Heater positive with respect to cathode	60 max	60 max	V

Typical Operation as Plate-Pulsed Oscillator at 3.3 GHz

With duty factor of 0.001 and pulse duration of 1 μs

Peak Plate Voltage	1750	V
DC Plate Current	3.0	mA
DC Grid Current	1.4	mA
Grid Resistor	2000	Ω
Useful Power Output at Peak of Pulse (Approx.)	1300	W

Typical Operation as a Power Amplifier in Frequency Range of 1 to 1.2 GHz

With duty factor of 0.001 and pulse duration of 7 μs

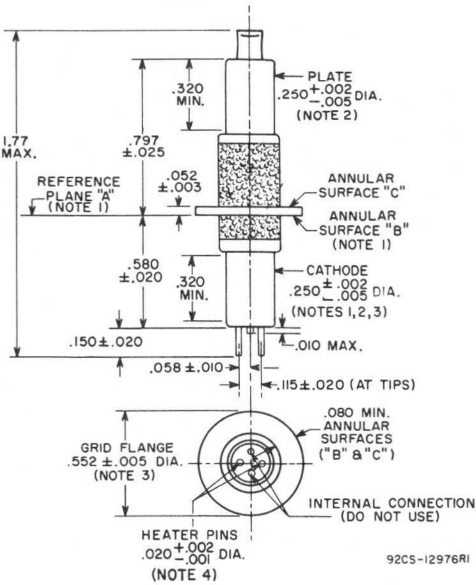
Peak Plate Voltage	1300	V
Peak Plate Current	1.5	A
Peak Driving Power	250	W
Useful Power Output at Peak of Pulse (Approx.)	1000	W

[a] Grayhill, Inc., 561 Hillgrove Ave., La Grange, Ill.

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

[c] When used in a heat sink that will limit the plate-seal temperature to 225° C.

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".

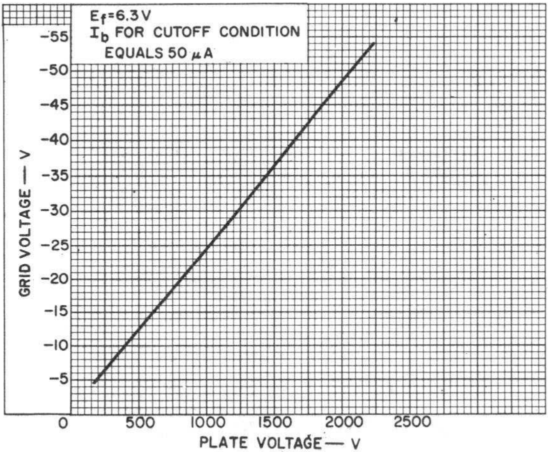
Note 2: The axes of the plate cylinder and cathode cylinder will coincide within 0.010 inch.

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

Note 4: Pin diameter is slightly greater when pretinned. ←

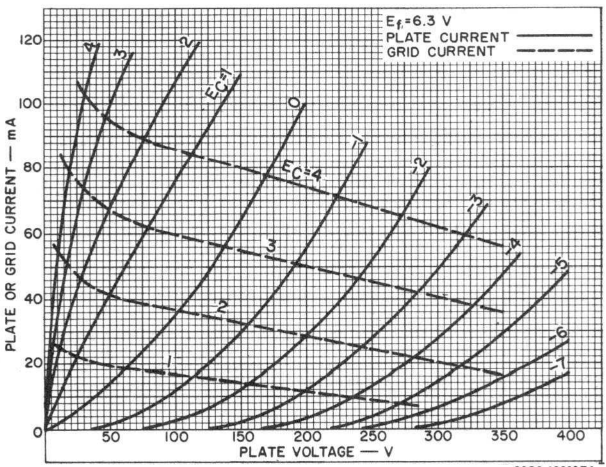
← Indicates a change.

Plate-Current Cutoff Characteristic



92CS-13207

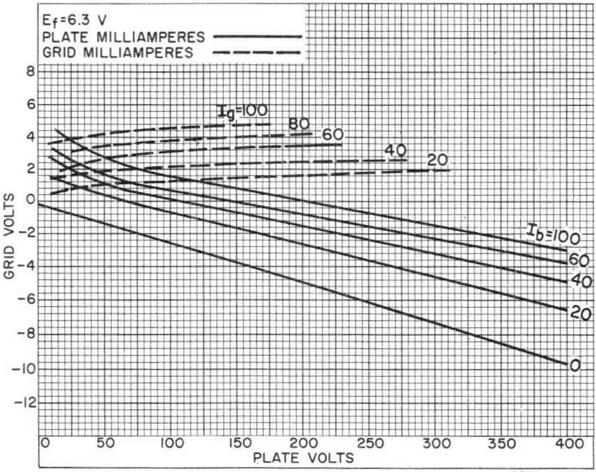
Average Plate and Grid Characteristics



92CS-13208R1

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)

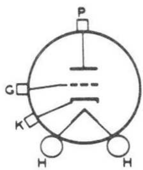


PLATE-PULSED OSCILLATOR[b]—CLASS C

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

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.

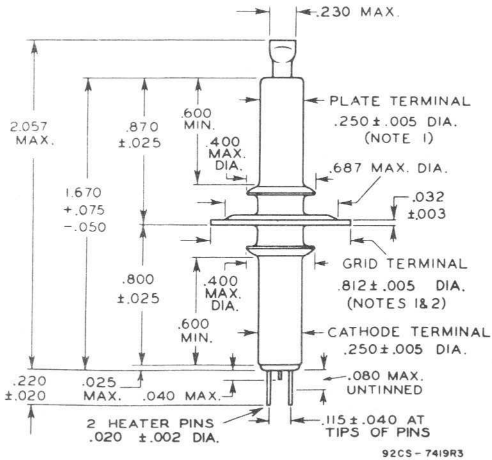
[j] Modulation, essentially negative, may be used if the positive peak of the audio-frequency envelope does not exceed 115 percent of the carrier conditions.

[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



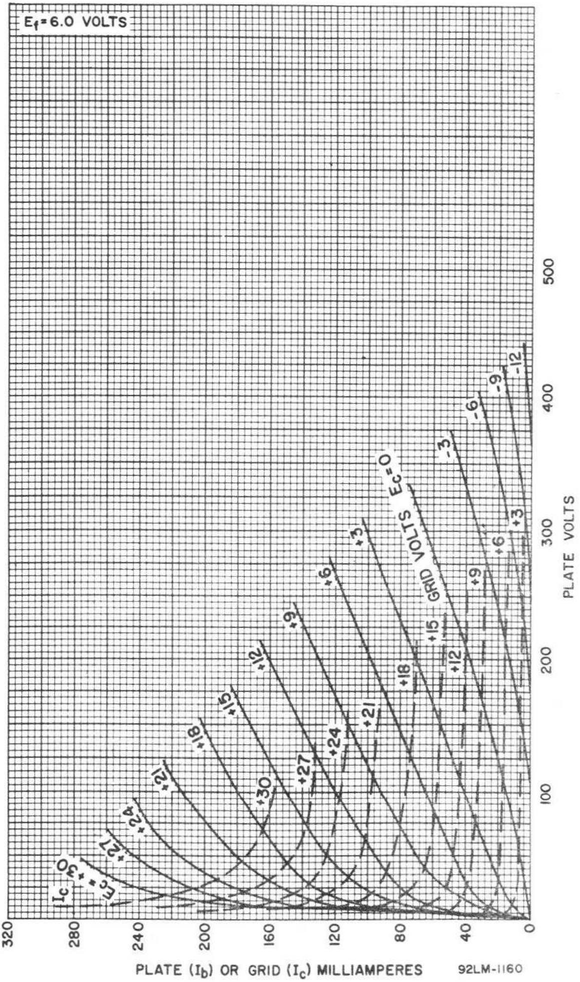
DIMENSIONS IN INCHES

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.

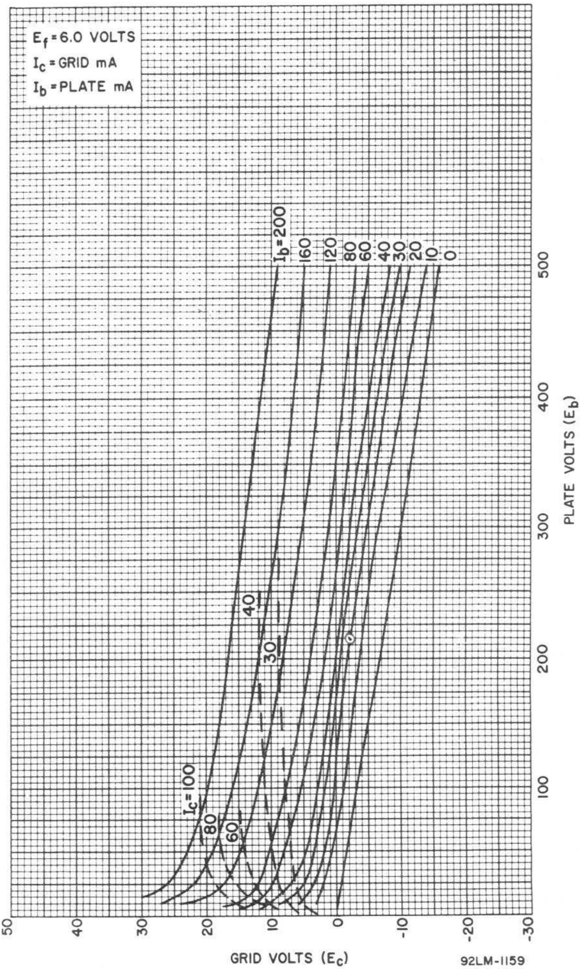
Note 2: Tilt of grid-terminal flange with respect to rotational axis of cathode terminal is determined by chucking the cathode terminal, rotating the tube, and gauging the total travel distance of the grid-terminal flange parallel to the axis of a point approximately 0.020 inch inward from its edge for one complete rotation. The total travel distance will not exceed 0.020 inch.

RADIO CORPORATION OF AMERICA
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 MHz | 500 W PEAK

These Units[a] 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 volts (Total)	0.66 max	A
Frequency	1090	MHz
Tuning Range	±15	MHz
RF Coaxial Output		
Terminal	Mates with female screw-type connector Sealectro No.50-007-0259, Micon No.1002, or equivalent	
Characteristic impedance (approx.)	50	Ω
Output VSWR	1.5:1	
All phase angles		
Change in Peak Power Output During Modulation[b]	0.5 max	dB
Pulse Rise Time (10% to 90%)	0.05-0.10	μs
Pulse Decay Time (90% to 10%)	0.05-0.20	μs
RF Delay Time (measured at 50% of pulse amplitude)	0.25 max	μs
RF Jitter	0.01 max	μs

MECHANICAL

Operating Position	Any
Dimensions and Terminal Connections	See *Dimensional Outlines*
Weight (Approx.)	7 oz

ENVIRONMENTAL

The units will remain stable within ± 2.5 MHz in frequency and ± 3 dB in peak power output (from nominal conditions) under any combination of the following conditions:

Vibration[c]		
5 to 53 Hz	0.1 inch	DA
53 to 500 Hz	±15	g's
Shock	20	g's
Ambient Temperature	-54 to +125	°C
Altitude	30,000	ft
Output VSWR (All phase angles)	1.5:1	
Plate and Heater Voltage Variation	±10	%
Duty Factor (Long term)	0.01	

GRID-PULSED OSCILLATOR—CLASS C

Absolute-Maximum Ratings

For a maximum long-term duty factor[d] of 0.01[e]

DC Plate Voltage (Each Unit)	1100 max	V
Peak Oscillator Grid Current	0.5 max	A
Peak Amplifier Cathode Current	2.0 max	A
Peak Plate Current		
Oscillator	0.7 max	A
Amplifier	1.5 max	A
Plate Dissipation (Total)	18 max	W

← Indicates a change.

Peak Heater-Cathode Voltage

Heater negative with respect to cathode. . . .	60 max	V
Heater positive with respect to cathode. . . .	60 max	V

TYPICAL OPERATION

With Rectangular Wave Shape in Grid-Drive Circuit at 1090 MHz

With duty factor of 0.01 and pulse duration of 0.45 microsecond

DC Plate Voltage. Each unit	1000	V
Oscillator Grid Bias.	-80	V
Amplifier Cathode Bias.	+25	V
DC Plate Current. Total	20	mA
Useful Power Output . . . . At peak of pulse	500	W

[a] The ruggedized oscillator-amplifier combination is built to satisfy all AIMS/FAA (Army Integrated Meteorological Systems) requirements.

[b] With 56 pulses in 100 microsecond interval.

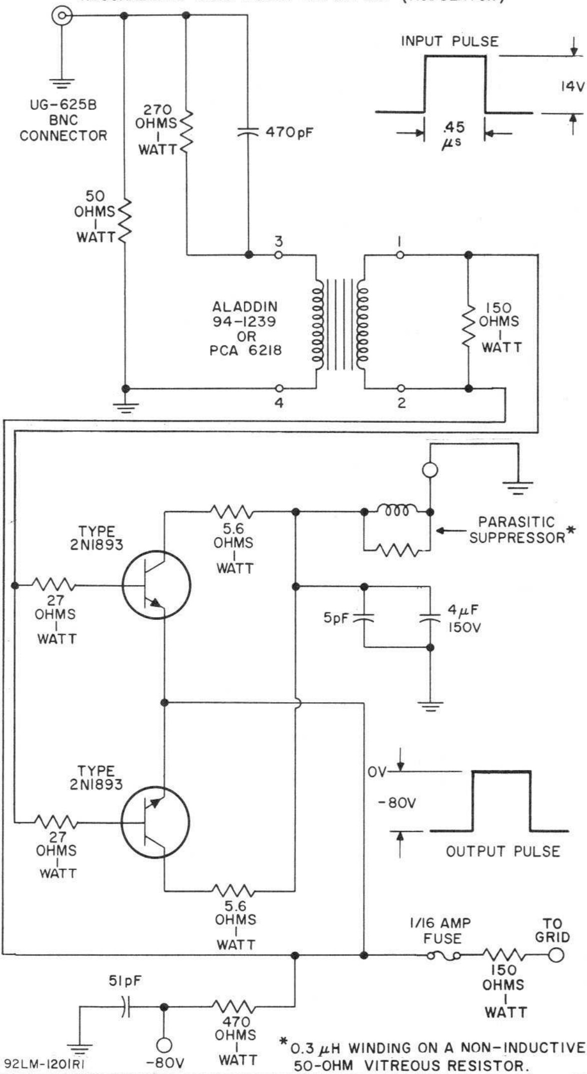
[c] Tested per methods described in MIL-E-5400 and MIL-T-5422.

[d] 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. "*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] This value is for continuous pulsing. The duty factor can be 0.25 for any interval up to 100 microseconds in length as long as the long-term duty factor does not exceed 0.01.

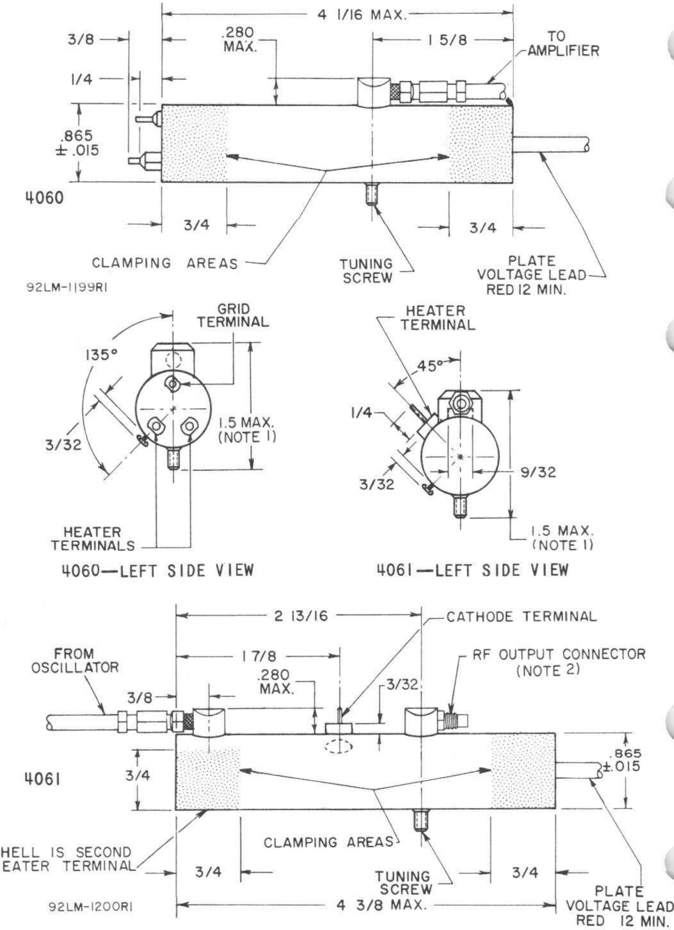
RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

RECOMMENDED GRID-PULSE AMPLIFIER (MODULATOR)



*0.3 μH WINDING ON A NON-INDUCTIVE 50-OHM VITREOUS RESISTOR.

DIMENSIONAL OUTLINE (DIMENSIONS IN INCHES)

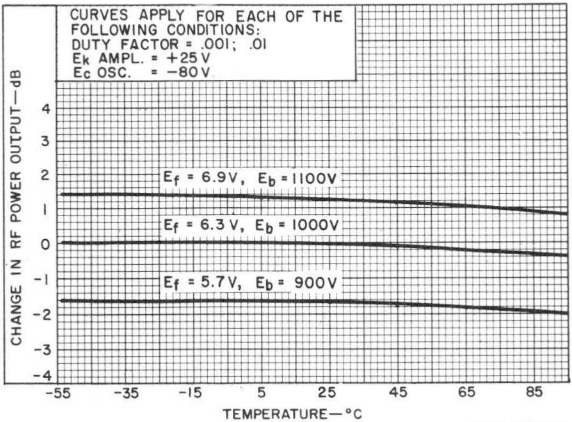


Note 1: When adjusted for operation at 1090 MHz.

Note 2: Mates with female screw-type connector Selectro No.50-007-0259, Micon No.1002, or equivalent.

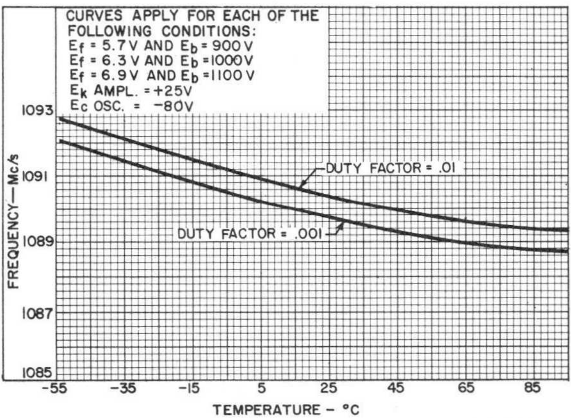
These units are supplied without the mounting brackets; they are also available with brackets upon request.

Typical Change in Power Output vs. Temperature



92LS-1204 R1

Typical Output Frequency vs. Temperature



92LS-1203

High-Mu Triode

CERAMIC-METAL PENCIL TUBE

OPERATING FREQUENCIES UP TO 4 GHz AND ABOVE

For Grid-Pulsed Operation as a Power Amplifier or Oscillator in Compact Mobile and Aircraft Equipment at Altitudes up to 50,000 Feet without Pressurization

ELECTRICAL

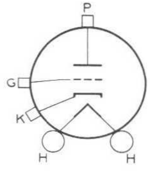
Heater, for Unipotential Cathode		
Voltage (AC or DC)	6.3 ± 10%	V
Current at 6.3 volts	0.295	A
Cathode Warmup Time (Average) to reach 80% of operating plate current		
For conditions: dc plate supply volts = 0, cathode resistor = 0 Ω, load resistor = 10 Ω, heater volts = 6.3	10	s
Amplification Factor	100	
Transconductance, for dc plate mA = 14, dc plate volts = 150, and cathode resistor = 11 Ω	16,000	μS
Direct Interelectrode Capacitances		
Grid to plate	1.75	pF
Grid to cathode and heater	3.9	pF
Plate to cathode and heater	0.08 max	pF

MECHANICAL

Operating Position	Any
Weight (Approx.)	0.4 ounce
Dimensions and Terminal Connections	See accompanying *Dimensional Outline*
Sockets	
Heater-Terminals Connector	Grayhill[a] No.22-5, or equivalent
Socket for operation up to about 550 MHz (Including heater-terminals connector)	Jettron[b] No.CD7010, or equivalent

TERMINAL DIAGRAM (Bottom View)

H - Heater
K - Cathode



G - Grid
P - Plate

GRID-PULSED SERVICE - Class C

Maximum Ratings, Absolute-Maximum Values Up to 4 GHz

For a maximum long-term duty factor of 0.01[c]

DC Plate Voltage	2000 max	V
DC Grid Voltage		
Negative-bias value	200 max	V
Positive value during gating pulse	25 max	V
Peak Plate Current	3.0 max	A
Peak Grid Current	1.5 max	A
Plate Dissipation[d]	10 max	W
Grid Dissipation	0.5 max	W
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode	60 max	V
Heater positive with respect to cathode	60 max	V

Typical Operation with Rectangular Waveshape in Grid-Drive Oscillator Circuit at 1090 MHz

With duty factor of 0.01 and pulse duration of 0.5 microsecond

DC Plate Voltage	1400	V
Grid-Bias Voltage	-80	V
Peak Positive Grid Voltage[e]	20	V
Peak Plate Current	1	A
Useful Power Output at Peak of Pulse	500	W

Typical Operation with Rectangular Waveshape in Grid-Drive Amplifier Circuit at 1090 MHz

With duty factor of 0.005 and pulse duration of 0.5 microsecond

DC Plate Voltage	1000	V
Grid-Bias Voltage	-30	V
Peak Plate Current	1.5	A
Peak Driving Power	150	W
Useful Power Output at Peak of Pulse	600	W

Typical Operation with Rectangular Waveshape in Cathode-Drive Amplifier Circuit at 1090 MHz

With duty factor of 0.01 and pulse duration of 0.5 microsecond

DC Plate Voltage	1000	V
Cathode-Bias Voltage	25	V
Peak Plate Current	1.2	A
Peak Driving Power	180	W
Useful Power Output at Peak of Pulse	600	W

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

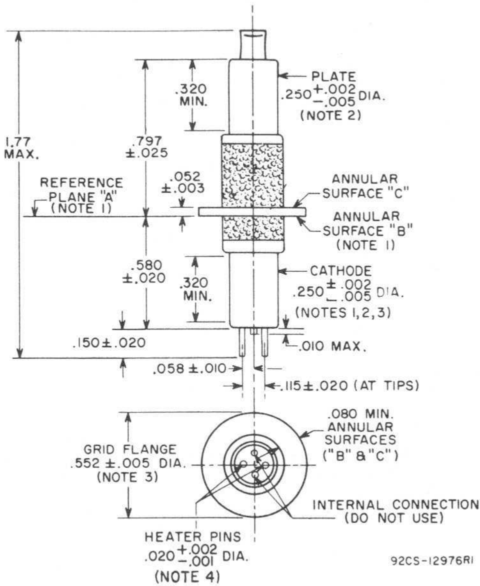
[b] Jettron Products, Inc., 56 Route 10, Hanover, N.J.

[c] This value is for continuous pulsing. The duty factor can be 0.25 for any interval up to 100 microseconds in length as long as the long-term duty factor does not exceed 0.01.

[d] Plate-seal temperature must be limited to 225°C.

[e] Amplitude of grid-drive gating pulse is adjusted to produce this value.

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.

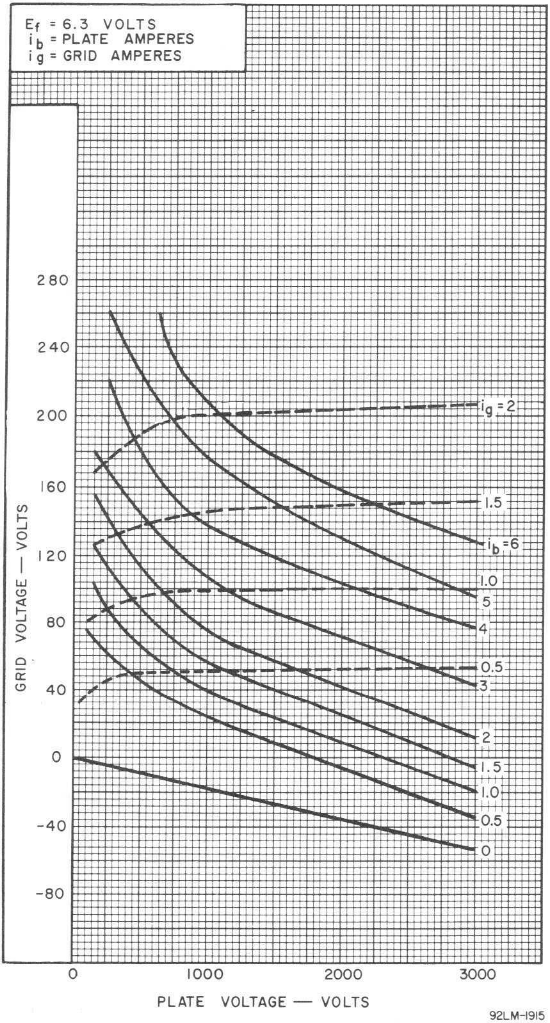
Note 1: With annular surface "B" resting on reference plane "A". The axis of the cathode cylinder will be within 2° of a line perpendicular to reference plane "A".

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.

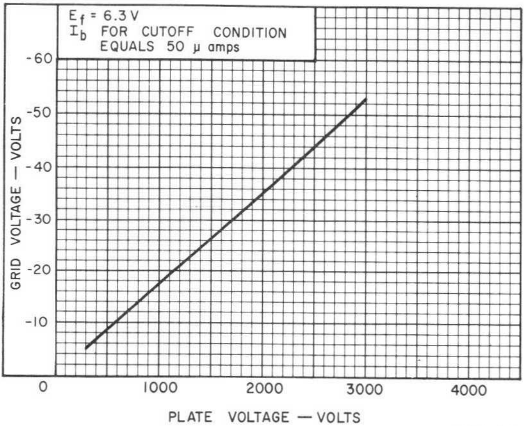
Note 4: Pin diameter is slightly greater when pretinned.

Average Constant-Current Characteristics of Type 4062A in Grid-Pulsed Service



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

Plate-Current Cutoff Characteristic



92LS-1918

Pencil Tube Oscillator

L-Band Cavity Oscillator

ELECTRICAL

Heater, for Unipotential Cathode:

Voltage (AC or DC)	6.3 ± 10%	V
Current at 6.3 volts	0.33 max.	A
Frequency	1090	MHz
Tuning Range	±15	MHz
RF Coaxial Output Terminal	Mates with female snap-on-type connector Sealectro No.51-007-0000, or equivalent	
Characteristic Impedance (Approx.)	50	Ω
Maximum Output VSWR (All phase angles)	1.3:1	

MECHANICAL

Operating Position	Any
Dimensions and Terminal Connections	See Dimensional Outline
Weight (Approx.)	4 oz

ENVIRONMENTAL

The units will remain stable within ± 3 MHz in frequency and – 2 dB in peak power output (from nominal conditions) under any combination of the following conditions:

Operating Temperature	-46 to +71	°C
Altitude	Up to 35,000	ft
Output VSWR (All phase angles)	1.1:1	
Plate and Heater Voltage Variation	±10	%
Duty Factor	Up to 0.01	

GRID-PULSED OSCILLATOR – CLASS C

MAXIMUM RATINGS, Absolute-Maximum Values

For a maximum duty factor[a] of 0.01[c][b]

DC Plate Voltage	1540 max.	V
DC Grid Voltage:		
Negative-bias value	100 max.	V
Positive value during gating pulse	0 max.	V
Peak Plate Current	1.2 max.	A
Peak Grid Current	0.7 max.	A

Plate Dissipation	15 max.	W
Grid Dissipation	1.0 max.	W
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode	60 max.	V
Heater positive with respect to cathode	60 max.	V

Typical Operation with Rectangular Waveshape in Grid-Pulsed Circuit at 1090 MHz

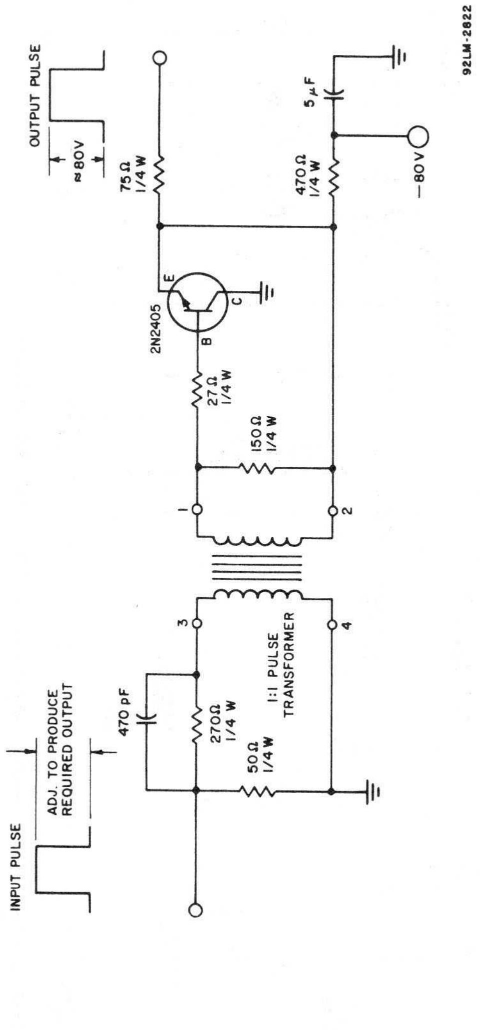
With duty factor of 0.001 and pulse duration of 0.45 microsecond

DC Plate Voltage	1400	V
Grid-Bias Voltage	-80	V
DC Plate Current	1	mA
Useful Power Output at Peak of Pulse	500	W

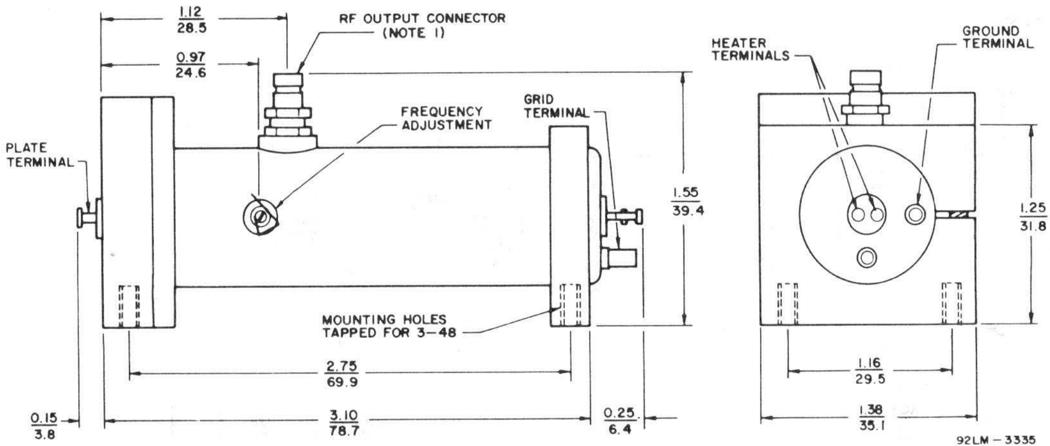
a Duty factor is defined as the product of the pulse duration and repetition rate. For variable pulse durations and pulse repetition rates, the duty factor is defined as the ratio of the "ON" time to total elapsed time in any 500-microsecond interval. "ON" time is defined as the sum of the durations 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. Peak value is defined as the maximum value of a smooth curve through the average of the fluctations over the top portion of the pulse.

b When operated for 10 minutes per hour. For continuous pulsing, the maximum duty factor is 0.005.

RECOMMENDED GRID-PULSE AMPLIFIER (MODULATOR)



DIMENSIONAL OUTLINE



Note 1: Mates with female snap-on-type connector Sealectro No.51-007-0000, or equivalent

Dimensions in $\frac{\textbf{Inches}}{\textbf{mm}}$ unless otherwise noted

The millimeter dimensions are derived from the original inch dimensions (1 inch = 25.4 mm exactly).

Pencil-Tube Oscillator-Amplifier

600W Peak Power Output at 1090 MHz

ELECTRICAL

Heater, for Unipotential Cathode:

Voltage (AC or DC)	6.3 ± 5%	V
Current at 6.3 volts (Total)	0.66 max.	A
Frequency	1090	MHz
Tuning Range	±15	MHz
RF Coaxial Output Terminal	Mates with female screw-type connector Sealectro No.50-007-0000 Micon No.1002, or equivalent	
Characteristic Impedance (Approx.)	50	Ω
Change in Peak Power Output During Modulation[a]	0.5 max.	dB
Pulse Rise Time (10% to 90%)[b]	55-90	ns
Pulse Decay Time (90% to 10%)	60-180	ns
RF Delay Time (measured at 50% of pulse amplitude)	250 max.	ns
RF Jitter	10 max.	ns

MECHANICAL

Operating Position	Any
Dimensions and Terminal Connections	See Dimensional Outline
Total Weight	9 max. oz

ENVIRONMENTAL

The units will remain stable within ± 3 MHz in frequency and ± 3 dB in peak power output (from nominal conditions) under any combination of the following conditions:

Vibration:[c]		
20 to 33 Hz	2	G
33 to 105 Hz	0.036 in	DA
105 to 500 Hz		
Parallel	20	G
Perpendicular	15	G
Shock, 11 ms:[d]	20	G
Case Temperature	-54 to +125	°C
Altitude	Up to 30,000	ft

Output VSWR (All phase angles)	1.5:1	
Plate and Heater Voltage Variation	±5	%
Duty Factor (Long term)	Up to 0.01	

GRID-PULSED OSCILLATOR – CLASS C

MAXIMUM RATINGS, *Absolute-Maximum Values:*

For a maximum long-term duty factor[e] *of 0.01*[f]

DC Plate Voltage (Each Unit)	1050 max.	V
Peak Oscillator Grid Current	0.5 max.	A
Peak Amplifier Cathode Current	2.0 max.	A
Peak Plate Current:		
Oscillator	0.7 max.	A
Amplifier	1.5 max.	A
Plate Dissipation (Total)	18 max.	W
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode	60 max.	V
Heater positive with respect to cathode	60 max.	V

TYPICAL OPERATION WITH RECTANGULAR WAVE SHAPE IN GRID-DRIVE CIRCUIT AT 1090 MHz

With duty factor of 0.01 and pulse duration of 0.45 microsecond

DC Plate Voltage (Each Unit)	1000	V
Oscillator Grid Bias	-80	V
Amplifier Cathode Bias	+25	V
DC Plate Current (Total)	20	mA
Useful Power Output at Peak of Pulse	600	W

a The change in peak power output between the first video pulse and any other video pulse in a pulse train consisting of 56 pulses. The individual pulse width is 0.45 microseconds and the pulse to pulse spacing is 1.45 microseconds.

b The pulse rise time and decay time are measured on an oscilloscope having a bandwidth of 24 MHz and a detector having a bandwidth of 12.4 GHz. If the bandwidth of either the oscilloscope or the detector is less than 15 MHz, the measurements must be corrected to account for changes introduced by the instrumentation.

c Tested per methods described in MIL-STD-202C, Test Method 204A, Test Condition A.

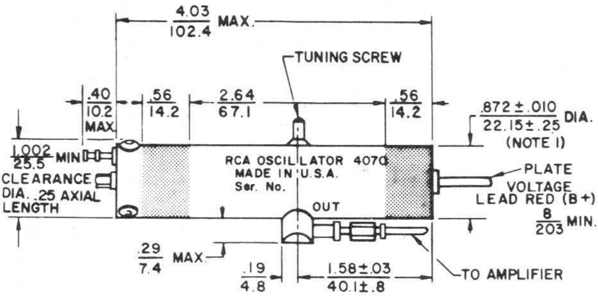
d Tested per methods described in MIL-STD-202C, Test Method 202B.

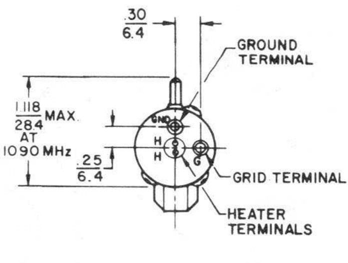
e Duty factor is defined as the product of the pulse duration and repetition rate. For variable pulse durations and pulse repetition rates, the duty factor is defined as the ratio of the "ON" time to total elapsed time in any 2500-microsecond interval. "ON" time is defined as the sum of the durations 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. 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 This value is for continuous pulsing. The duty factor can be 0.25 for any interval up to 100 microseconds in length as long as the long-term duty factor does not exceed 0.01.

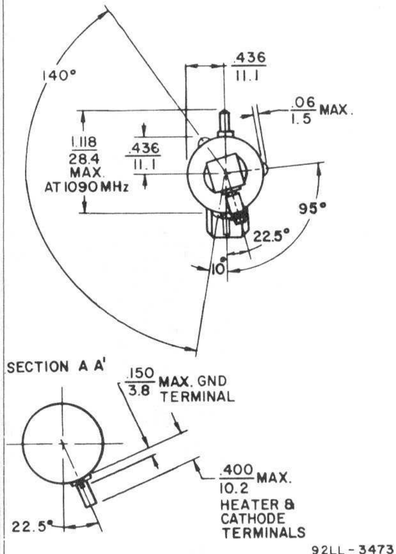
NOTE: See Type 4072 for *Recommended Grid-Pulse Amplifier (Modulator)*

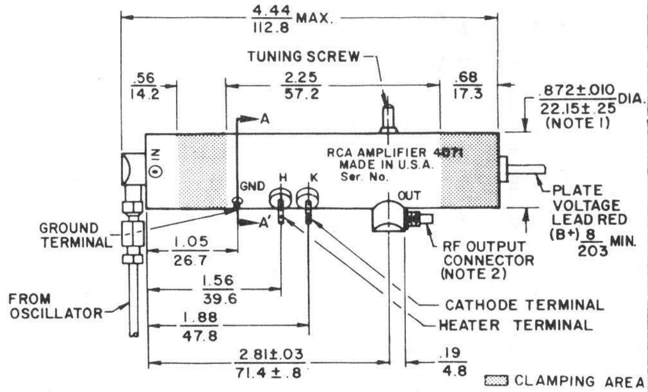
DIMENSIONAL OUTLINE (4070)





DIMENSIONAL OUTLINE (4071)





Note 1: Diameter of shell in clamping areas only.

Note 2: Mates with female screw-type connector Sealectro No.50-007-0000, Micon No.1002, or equivalent.

These units are supplied without the mounting brackets; they are also available with brackets upon request.

Dimensions in $\frac{\text{Inches}}{\text{mm}}$ unless otherwise noted

Pencil Tube Oscillator

L-Band Cavity Oscillator

ELECTRICAL

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	V
Current at 6.3 volts	0.33 max.	A
Frequency	1090	MHz
Tuning Range	±15	MHz
RF Coaxial Output Terminal	Mates with female snap-on-type connector Sealectro No.51-007-0000, or equivalent	
Characteristic Impedance (Approx.)	50	Ω
Maximum Output VSWR (All phase angles)	1.3:1	

MECHANICAL

Operating Position	Any
Dimensions and Terminal Connections	See Dimensional Outline
Weight (Approx.)	4 oz

ENVIRONMENTAL

The units will remain stable within ± 3 MHz in frequency and – 2 dB in peak power output (from nominal conditions) under any combination of the following conditions:

Operating Temperature	-46 to +71	°C
Altitude	Up to 55,000	ft
Output VSWR (All phase angles)	1.1:1	
Plate and Heater Voltage Variation	±10	%
Duty Factor	Up to 0.01	

GRID-PULSED OSCILLATOR – CLASS C

MAXIMUM RATINGS, Absolute-Maximum Values

For a maximum duty factor[b] of 0.01[c]

DC Plate Voltage	1540 max.	V
DC Grid Voltage:		
Negative-bias value	100 max.	V
Positive value during gating pulse	0 max.	V

Peak Plate Current	1.2 max. A
Peak Grid Current	0.7 max. A
Plate Dissipation	15 max. W
Grid Dissipation	1.0 max. W
Peak Heater-Cathode Voltage:	
Heater negative with respect to cathode	60 max. V
Heater positive with respect to cathode	60 max. V

TYPICAL OPERATION WITH RECTANGULAR WAVE SHAPE IN GRID-DRIVE CIRCUIT AT 1090 MHz

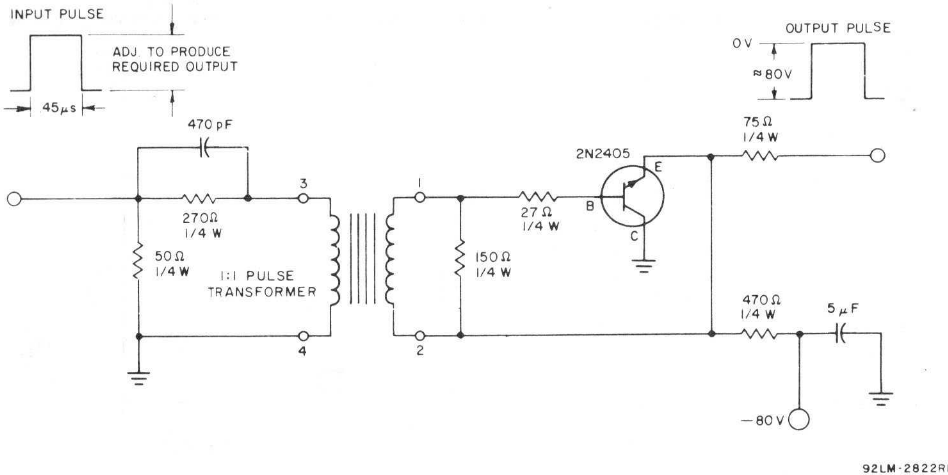
With duty factor of 0.005 and pulse duration of 0.45 microsecond

DC Plate Voltage	1400	V
Grid-Bias Voltage	-80	V
DC Plate Current	1	mA
Useful Power Output at Peak of Pulse	500	W

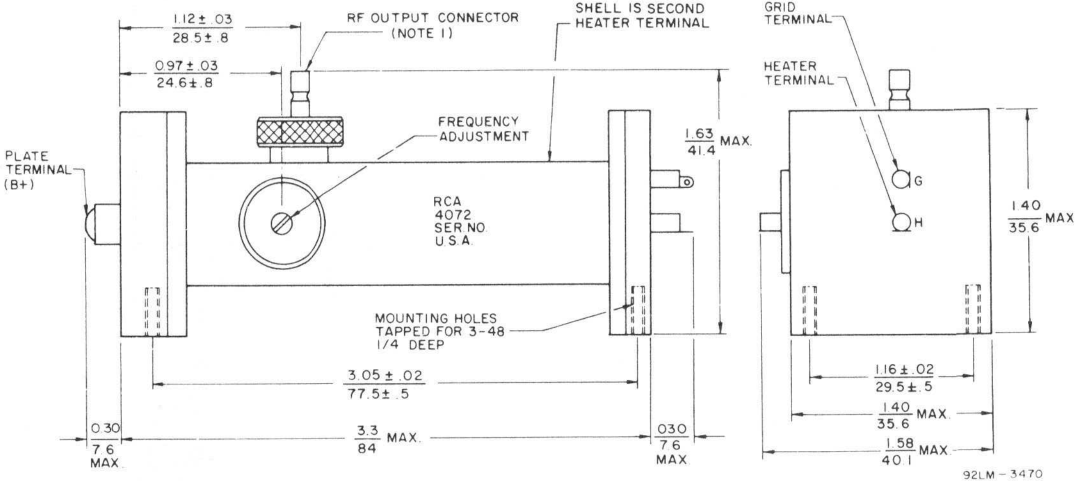
b Duty factor is defined as the product of the pulse duration and repetition rate. For variable pulse durations and pulse repetition rates, the duty factor is defined as the ratio of the "ON" time to total elapsed time in any 2500-microsecond interval. "ON" time is defined as the sum of the durations 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. Peak value is defined as the maximum value as a smooth curve through the average of the fluctuations over the top portion of the pulse.

c When operated for 10 minutes per hour. For continuous pulsing, the maximum duty factor is 0.005.

RECOMMENDED GRID-PULSE AMPLIFIER (Modulator)



DIMENSIONAL OUTLINE



Note 1: Mates with female snap-on-type connector Sealectro No.51-007-0000, or equivalent

Dimensions in $\frac{\textbf{Inches}}{\textbf{mm}}$ unless otherwise noted

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

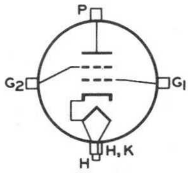
Electrical:

Heater, for Matrix-Type Oxide-Coated Unipotential Cathode:		
Voltage (AC or DC).	5.5 typical	volts
	6.0 max.	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*):

G_1 - Grid No.1
G_2 - Grid No.2
H - Heater



K - Cathode
P - Plate

Thermal:

Terminal Temperature (Plate, grid No.2, grid No.1, cathode, and heater).	250 max.	$^{\circ}$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:

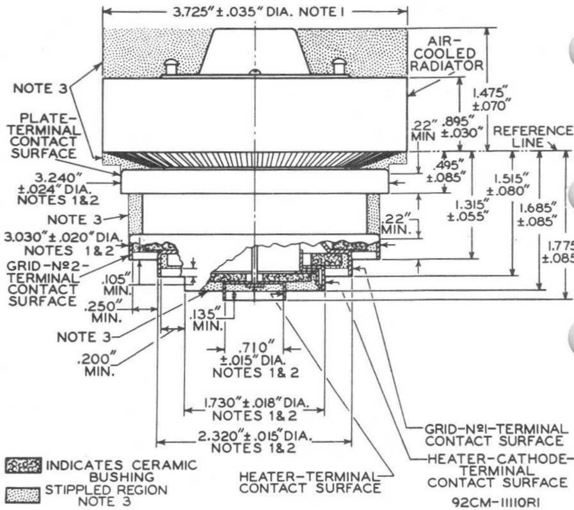
This test is performed on sample lots of tubes to determine the ability of the tube to withstand variable-frequency vibration. With heater voltage of 5.5 volts ac, dc plate supply voltage of 450 volts, dc grid-No.2 supply voltage of 300 volts, and grid-No.1 supply voltage adjusted to give dc plate current 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.

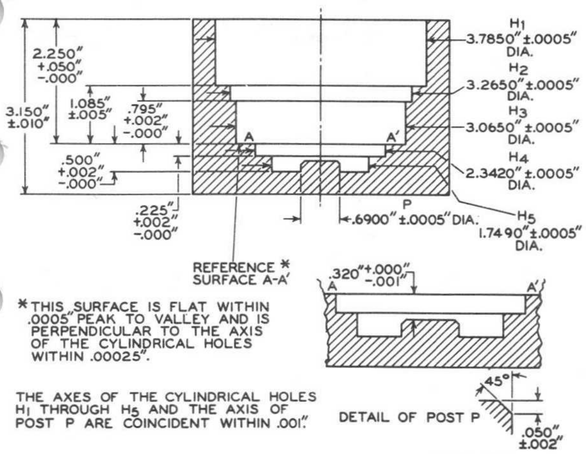


NOTE 1: WITH THE CYLINDRICAL SURFACES OF THE RADIATOR BAND, PLATE TERMINAL, GRID-No.2 TERMINAL, GRID-No.1 TERMINAL, HEATER-CATHODE TERMINAL, AND HEATER TERMINAL CLEAN, SMOOTH, AND FREE OF BURRS, THE TUBE WILL ENTER A GAUGE AS SHOWN IN SKETCH G_1. PROPER ENTRY OF THE TUBE IS OBTAINED WHEN THE GRID-No.2 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

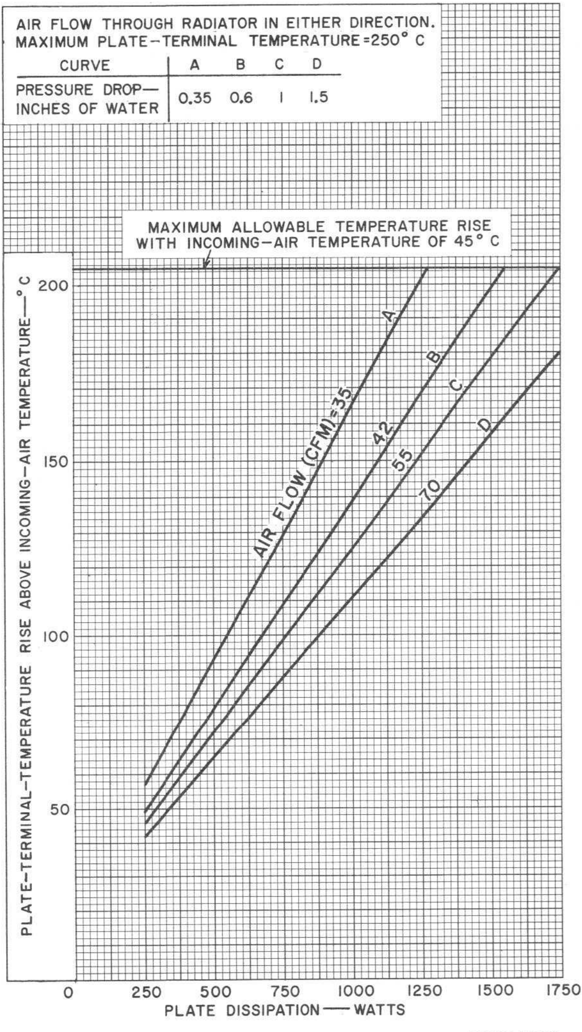


*THIS SURFACE IS FLAT WITHIN .0005" PEAK TO VALLEY AND IS PERPENDICULAR TO THE AXIS OF THE CYLINDRICAL HOLES WITHIN .00025".

THE AXES OF THE CYLINDRICAL HOLES H_1 THROUGH H_5 AND THE AXIS OF POST P ARE COINCIDENT WITHIN .001".

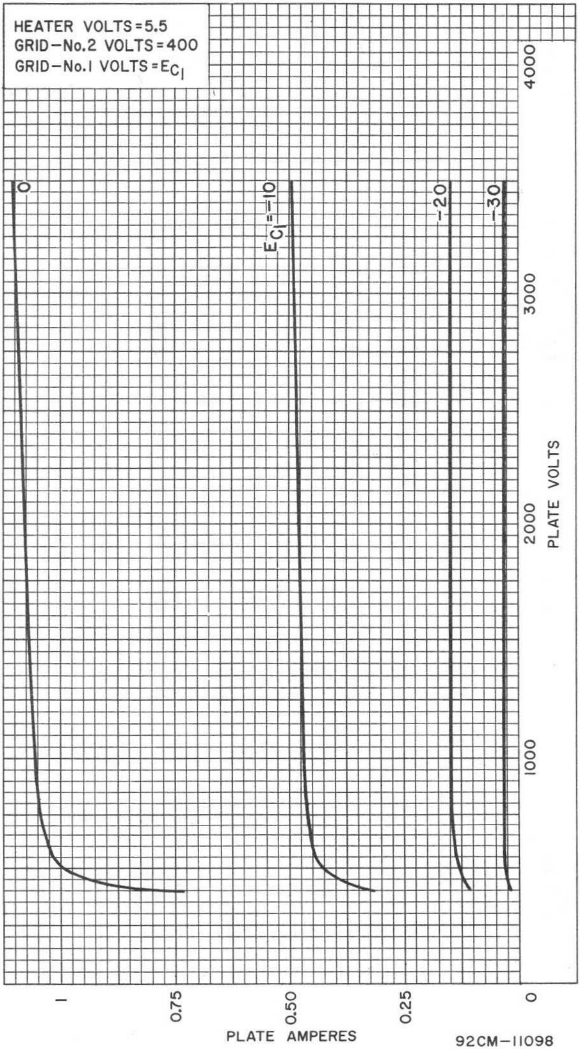
92CM-11109

TYPICAL COOLING REQUIREMENTS



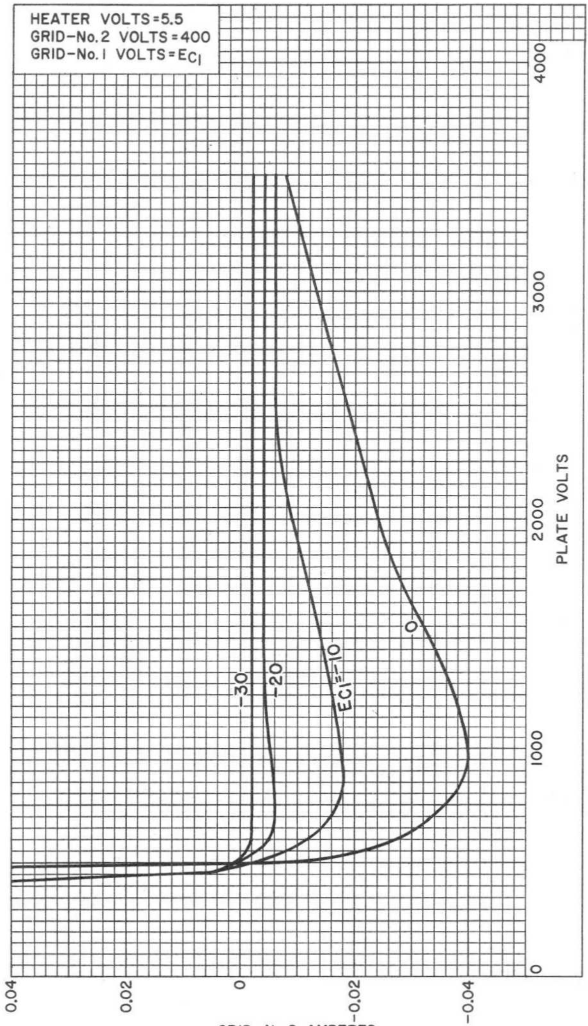
92CM-11100

TYPICAL PLATE CHARACTERISTICS



92CM–11098

TYPICAL CHARACTERISTICS



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

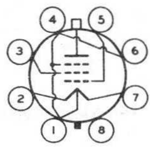
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 200, grid-No.2 volts = 200, and plate ma. = 100 4

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 -29 volts. ◄

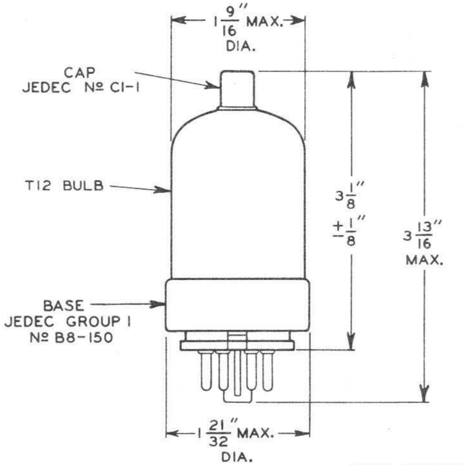
♣ In a single-tube, self-excited-oscillator circuit, and with 6.3 volts ac on filament, dc plate voltage of 600 volts, dc grid-No.2 voltage of 200 volts, grid-No.1 resistor of 30,000 ± 10% ohms, dc plate current of 100 to 112 ma., dc grid-No.1 current of 2 to 2.5 ma., and frequency of 15 Mc.

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.

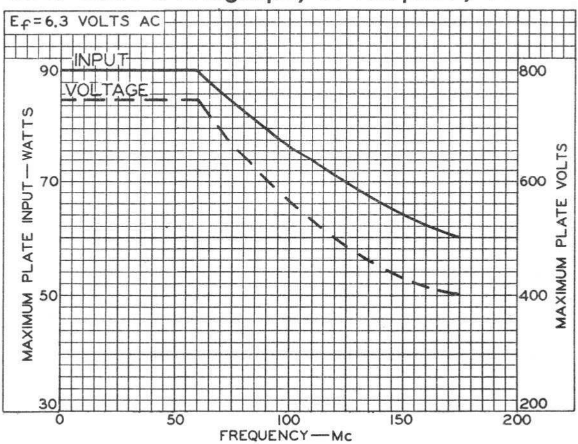
◄ Indicates a change.



92CS-9625R4

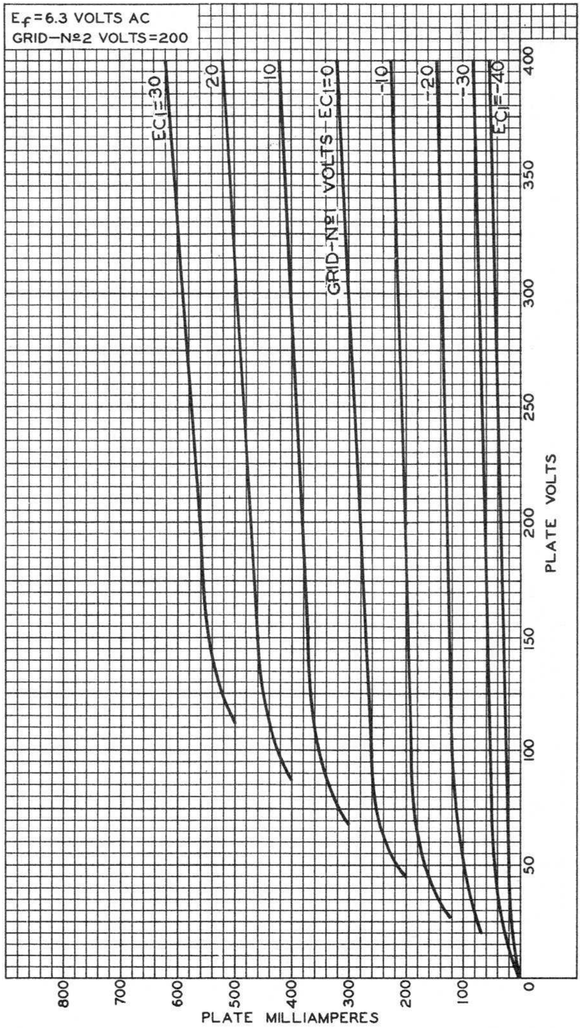
RATING CHART

ICAS Class-C Telegraphy or Telephony Service



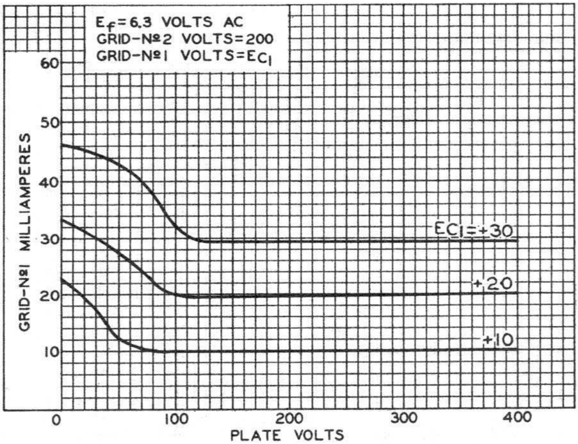
92CS-10817R1

TYPICAL PLATE CHARACTERISTICS

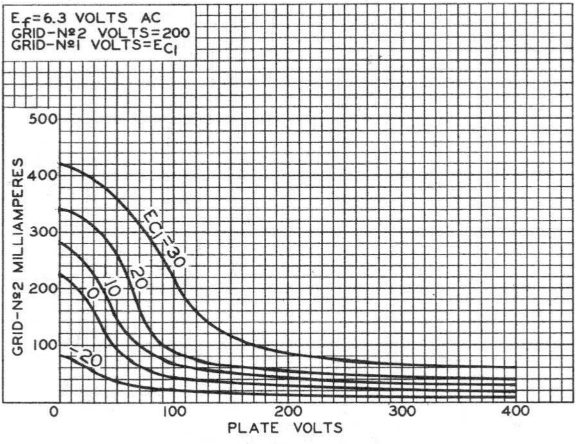


92CM-10813

TYPICAL CHARACTERISTICS



92CS-10814



92CS-10816

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

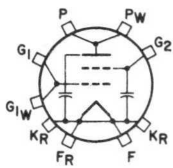
Water Flow (cont'd)

	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
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



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.

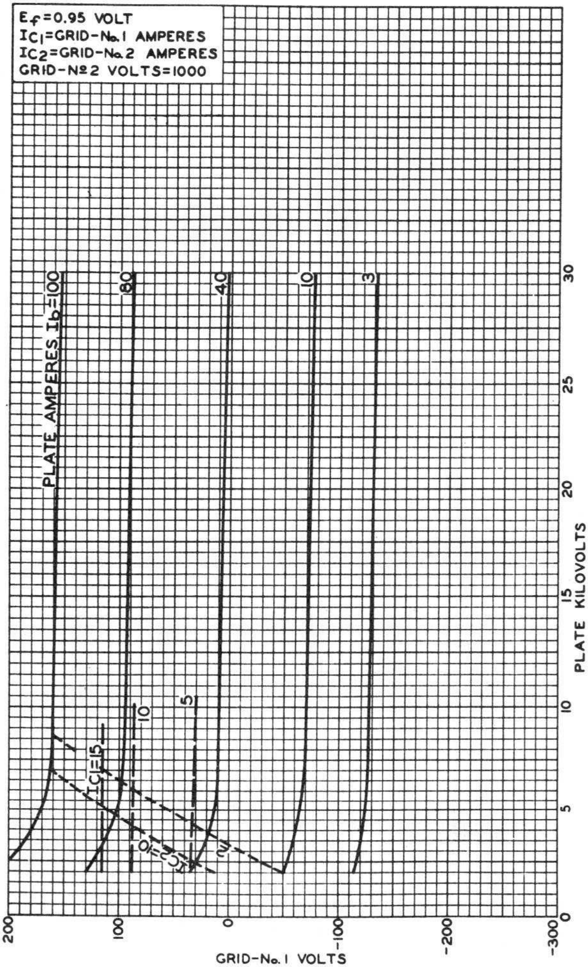
Note 2: Measured with special shield adapter.

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

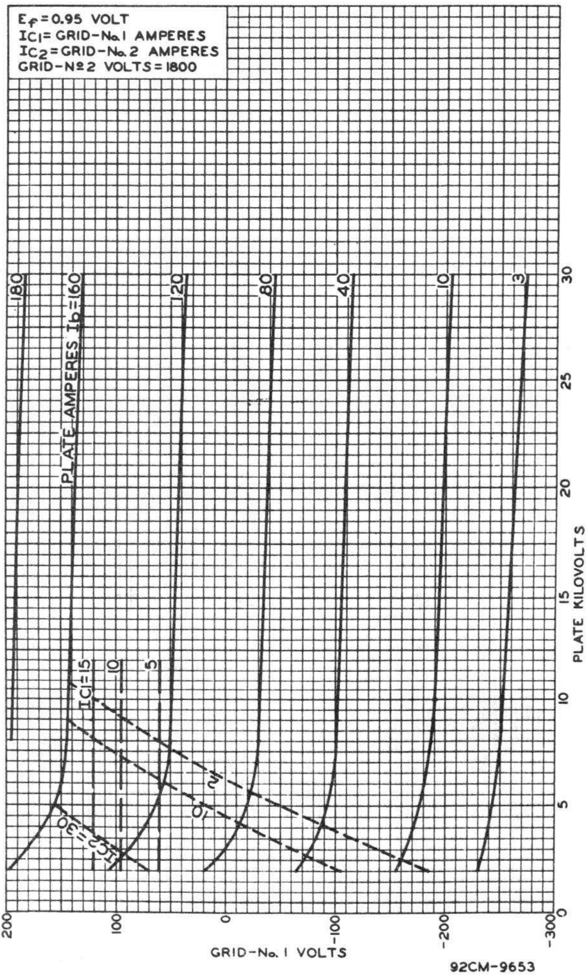
FOR GRID-No.2 VOLTAGE = 1000 VOLTS



92CM-9649

Typical Constant-Current Characteristics

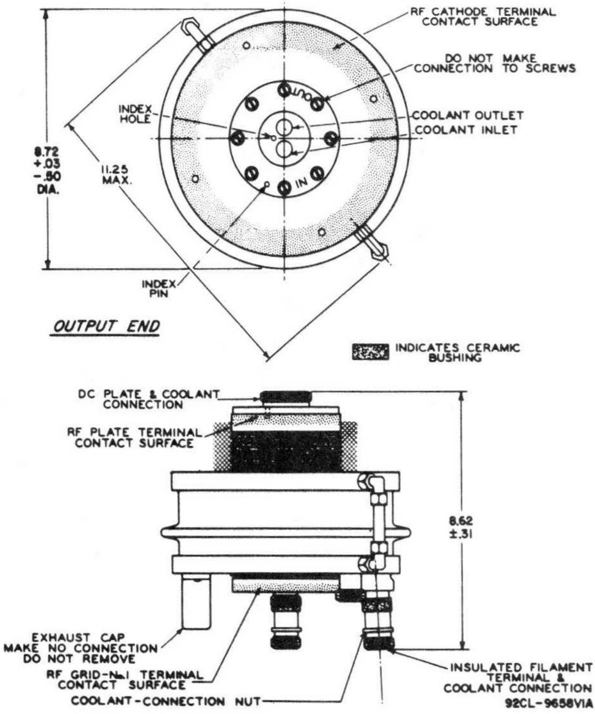
FOR GRID-No.2 VOLTAGE = 1800 VOLTS



92CM-9653

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

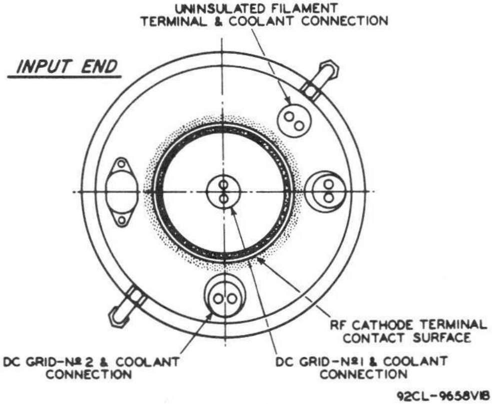
SIMPLIFIED DIMENSIONAL OUTLINE[g]



DIMENSIONS IN INCHES

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

UNINSULATED FILAMENT
TERMINAL & COOLANT CONNECTION



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)

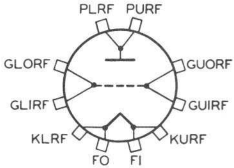
	Typ. Flow g/m	*Absolute Min. Flow g/m*	*Max. Pressure Differential for Typ. Flow[c] psi*
To upper grid coolant course	3	2	25
To lower grid coolant course	3	2	25
To grid-cathode coolant course	12	10	6

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

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

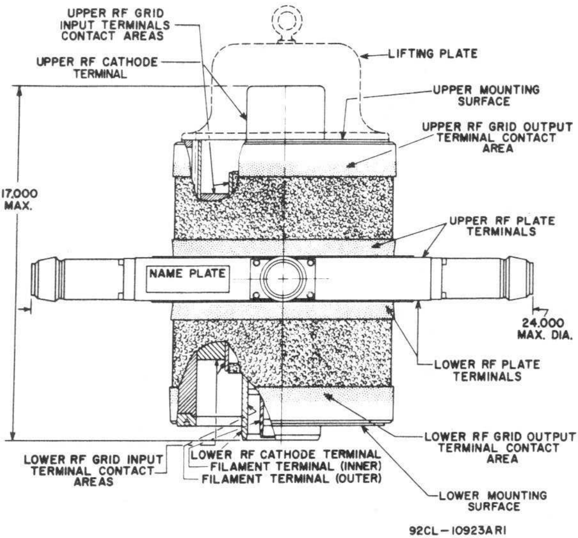
	Note	*Min*	*Max*	
Filament Voltage.	1	1	1.8	V
Input Strap-Resonant Frequency.	-	90	120	MHz
Output Strap-Resonant Frequency	-	240	280	MHz
Direct Interelectrode Capacitances				
Grid to plate	-	120	180	pF
Grid to cathode	-	1250	1700	pF

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[r]



DIMENSIONS IN INCHES

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

Beam Power Tube

MATRIX-TYPE CATHODE CERMOLOX FORCED-AIR COOLED

1350 Watts CW Power Output at 600 MHz

For Use at Frequencies up to 1215 MHz as a Linear RF Power Amplifier in Single-Sideband Suppressed-Carrier Service, as a Plate-Modulated RF Power Amplifier in Class C Telephony Service, as an RF Power Amplifier and Oscillator in Class C Telegraphy Service, and as an RF Power Amplifier in Class C FM Telephony Service.

ELECTRICAL

Heater, for Matrix-Type Oxide-Coated Unipotential Cathode[d]		
Voltage (AC or DC)	5.5 typ	V
	6.0 max	V
Current at 5.5 volts	17.3	A
Minimum Heating Time	5	minutes
Mu-Factor, Grid No.2 to Grid No.1	17	
For plate volts = 2500, grid No.2 volts = 600, and plate mA = 600		
Direct Interelectrode Capacitances		
Grid No.1 to plate[a]	0.181 max	pF
Grid No.1 to cathode & heater	42	pF
Plate to cathode & heater[a,b]	0.017 max	pF
Grid No.1 to grid No.2	55	pF
Grid No.2 to plate	12	pF
Grid No.2 to cathode & heater[b]	1.4 max	pF

MECHANICAL

Operating Position	Any
Maximum Overall Length	3.34 in
Maximum Diameter	3.75 in
Terminal Connections	See *Dimensional Outline*
Radiator	Integral part of tube
Weight (Approx.)	2 lb

THERMAL

Terminal Temperature	250 max	°C
Plate, grid No.2, grid No.1, cathode, and heater		
Plate-Seal Temperature	250 max	°C

See *Dimensional Outline* for temperature-measurement points

Forced-Air Cooling[e]

Air Flow:

Through radiator – Adequate air flow to limit the plate-seal temperature to 250°C should be delivered by a blower, such as Rotron[c] AXIMAX 2, KS-408 or equivalent, through the radiator before and during the application of heater, plate, grid-No.2, and grid-No.1 voltages. See graph, Typical Cooling Characteristics.

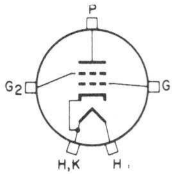
To Plate, Grid-No.2, Grid-No.1, Heater-Cathode, and Heater Terminals – A sufficient quantity of air should be allowed to flow past each of these terminals so that their temperature does not exceed the specified maximum value of 250°C.

During Standby Operation - Cooling air is required to the Heater-Cathode and Heater Terminals when only heater 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
H - Heater-Terminal Contact Surface
H,K - Heater-& Cathode-Terminal Contact Surface
P - Plate-Terminal Contact Surface



LINEAR RF POWER AMPLIFIER, CLASS AB_1[f]

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 Values

	Up to 1215 MHz	
DC Plate Voltage	3000	V
DC Grid-No.2 Voltage	1000	V
Max.-Signal DC Plate Current	1.0	A
Max.-Signal DC Grid-No.1 Current	0.2	A
Max.-Signal Plate Input	2500	W
Max.-Signal Grid-No.2 Input	50	W
Plate Dissipation	1500	W

Maximum Circuit Values

Grid-No.1 Circuit Resistance Under Any Condition		
With fixed bias	5000	Ω
With fixed bias (in Class AB_1 operation)	Not recommended	
With cathode bias	Not recommended	
Grid-No.2 Circuit Impedance	See footnote g	
Plate Circuit Impedance	See footnote h	

Typical CCS Class AB_1 "Single-Tone" Operation

	Up to 60 MHz		
DC Plate Voltage	2250	2250	V
DC Grid-No.2 Voltage	700	700	V
DC Grid-No.1 Voltage	-50	-50	V
Zero-Signal DC Plate Current	0.2	0.2	A
Zero-Signal DC Grid-No.2 Current	0	0	A
Effective RF Load Resistance	1100	1100	Ω
Max.-Signal DC Plate Current	0.9	1.0	A
Max.-Signal DC Grid-No.2 Current	0.045	0.045	A
Max.-Signal DC Grid-No.1 Current	0	0	A
Max.-Signal Peak RF Grid-No.1 Voltage	50	50	V
Max.-Signal Driving Power (Approx.)	0	0	W
Max.-Signal Power Output (Approx.)	1000	1250	W

PLATE-MODULATED RF POWER AMP.-Class C Telephony[f]

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

Maximum CCS Ratings, Absolute Values

	Up to 1215 MHz	
DC Plate Voltage	2500	V
DC Grid-No.2 Voltage	1000	V
DC Grid-No.1 Voltage	-300	V
DC Plate Current	0.85	A
DC Grid-No.1 Current	0.2	A
Plate Input	1700	W
Grid-No.2 Input	35	W
Plate Dissipation	1000	W

Maximum Circuit Value

Grid-No.1-Circuit Resistance
Under any condition . . . . . 5000 Ω

Typical CCS Operation

In a Grid-Drive Circuit at 600 MHz

DC Plate Voltage	2500	2500	V
DC Grid-No.2 Voltage	500	500	V
DC Grid-No.1 Voltage	-75	-75	V
DC Plate Current	0.9	1.0	A
DC Grid-No.2 Current	0.02	0.02	A
DC Grid-No.1 Current (Approx.)	0.07	0.07	A
Output Circuit Efficiency (Approx.)	90	90	%
Driver Power Output (Approx.)	70	75	W
Useful Power Output (Approx.)	1050	1350	W

Maximum Circuit Value

Grid-No.1-Circuit Resistance
Under any condition . . . . . 5000 Ω

RF POWER AMPLIFIER & OSC. - Class C Telegraphy[f]

and

RF POWER AMPLIFIER - Class C FM Telephony[f]

Maximum CCS Ratings, Absolute Values

	Up to 1215 MHz	
DC Plate Voltage	3000	V
DC Grid-No.2 Voltage	1000	V
DC Grid-No.1 Voltage	-300	V
DC Plate Current	1.0	A
DC Grid-No.1 Current	0.2	A
Plate Input	2500	W
Grid-No.2 Input	50	W
Plate Dissipation	1500	W

Typical CCS Operation

In a Grid-Drive Circuit at 600 MHz

DC Plate Voltage	1800	2000	V
DC Grid-No.2 Voltage	500	500	V
DC Grid-No.1 Voltage	-75	-75	V
DC Plate Current	0.75	0.83	A
DC Grid-No.2 Current	0.015	0.015	A
DC Grid-No.1 Current (Approx.)	0.04	0.04	A
Driver Power Output (Approx.)	50	55	W
Useful Power Output (Approx.)	650	800	W

Characteristics Range Values

	Note	*Min*	*Max*	
1. Heater Current	1	16.3	18.2	A
2. Direct Interelectrode Capacitances				
Grid No.1 to plate	2	-	0.181	pF
Grid No.1 to cathode & heater	-	37	46	pF
Plate to cathode & heater	2,3	-	0.017	pF
Grid No.1 to grid No.2	-	46	62	pF
Grid No.2 to plate	-	9.9	13.1	pF
Grid No.2 to cathode & heater	3	-	1.4	pF
3. Mu-Factor, Grid No.2 to Grid No.1	1,4	8	24	
4. Cutoff Grid-No.1 Voltage	1,5	-	-140	V
5. Grid-No.2 Current	1,6	-28	12	mA
6. Useful Power Output	1,7	1000	-	W
7. Low-Frequency Vibration	1,8	-	500	mV
8. High-Frequency Vibration	9	(See Note 9)		

Note 1: With 5.5 volts ac on heater.

Note 2: With external flat metal shield having diameter of 8", at 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.

Note 3: 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.

Note 4: With dc plate voltage of 2500 volts, dc grid-No.2 voltage of 600 volts, and dc grid-No.1 voltage adjusted to give a plate current of 0.6 ampere.

Note 5: With dc plate voltage of 3000 volts, dc grid-No.2 voltage of 1000 volts, and dc grid-No.1 voltage adjusted to give a plate current of 20 mA.

Note 6: With dc plate voltage of 2500 volts, dc grid-No.2 voltage of 500 volts, and dc grid-No.1 voltage adjusted to give a plate current of 0.6 ampere.

Note 7: In a CW cathode-driven amplifier circuit at 600 MHz and for conditions: dc plate voltage at 2500 volts, dc grid-No.2 voltage of 700 volts, and dc grid-No.1 voltage adjusted to give a plate current of 1.0 ampere.

Note 8: As specified in MIL-E-IE Test Method 1031, and with plate voltage of 450 volts, grid-No.2 voltage of 300 volts, grid-No.1 voltage varied to give a plate current of 10 mA, and plate load resistor of 2000 ohms.

Note 9: As specified in MIL-E-IE Test Method 1031.

[a] With external 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.

[b] 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.

[c] Rotron Mfg. Co., Inc., Woodstock, N. Y.

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

[d] See *Electrical Considerations* — Filament or Heater.

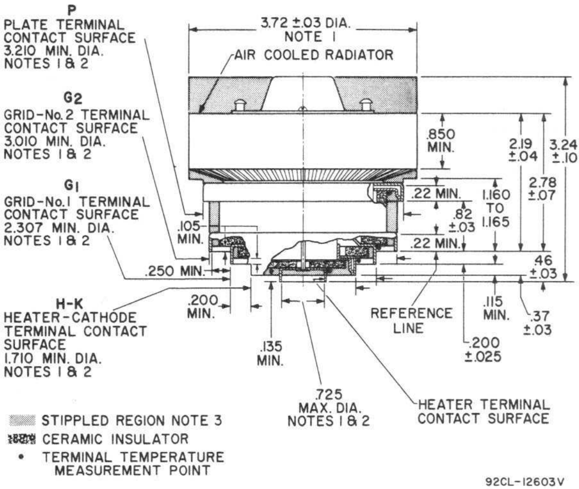
[e] See *Cooling Considerations* — Forced-Air Cooling.

[f] See *Classes of Service*.

[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 Band - 3.7805

b. Plate Terminal - 3.2605

c. Grid-No.2 Terminal - 3.0605

d. Grid-No.1 Terminal - 2.3375

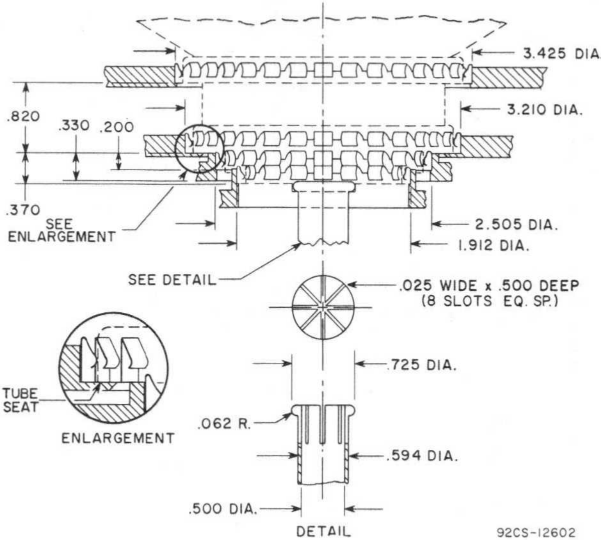
e. Heater-Cathode Terminal - 1.7445

f. Heater Terminal - 0.6945

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 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 is associated diameter.

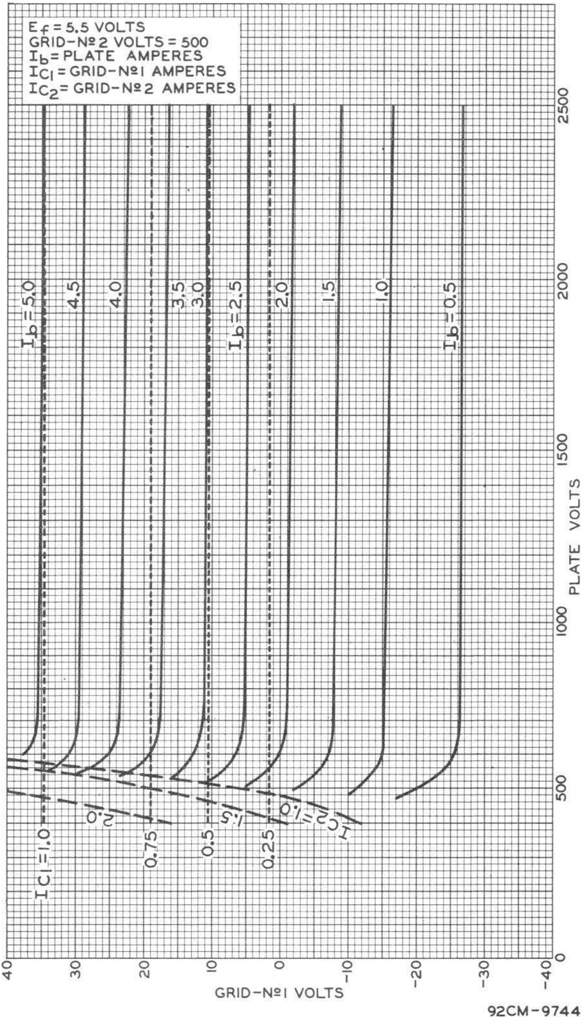
PREFERRED MOUNTING ARRANGEMENT[i]



Only the fixed method of mounting is recommended. The fixed method offers simpler design and construction with resulting lower cost. It especially simplifies the associated hollow-cylinder cavity construction, if used. On the other hand, it requires greater finger stock accommodation. As used here, accommodation is defined as the amount of flexing required by the fingers of the finger contact strip to accept tubes at all the extremes of mechanical variation. Accommodation, which must be provided for in the fixed method, is determined from the *Dimensional Outline* and its associated notes. It may be calculated as the difference between the minimum terminal diameter on the *Dimensional Outline* (maximum finger opening) and the associated concentricity gauge aperture opening in the appropriate note (minimum finger opening).

Typical Constant-Current Characteristics

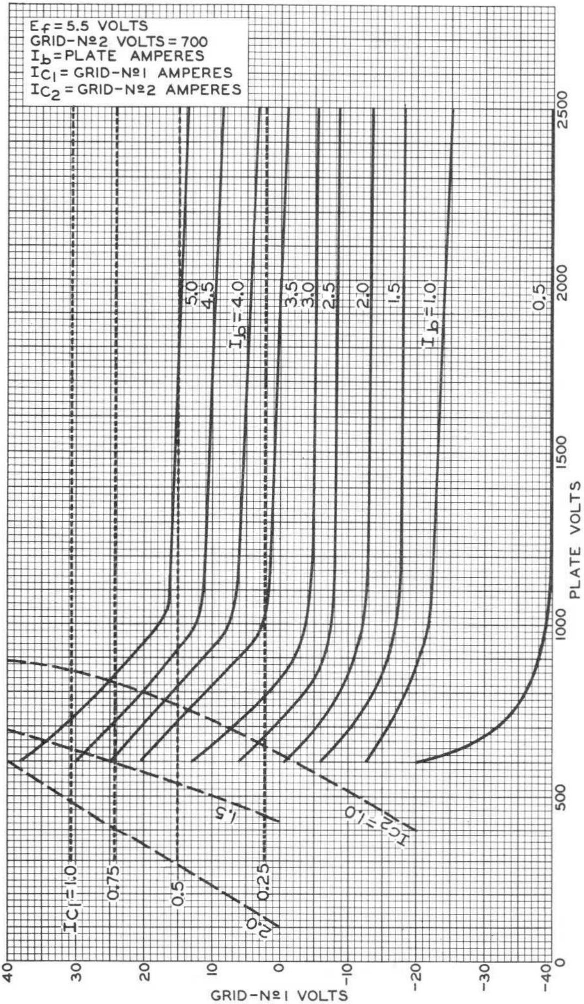
With Grid-No.2 Volts =500



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

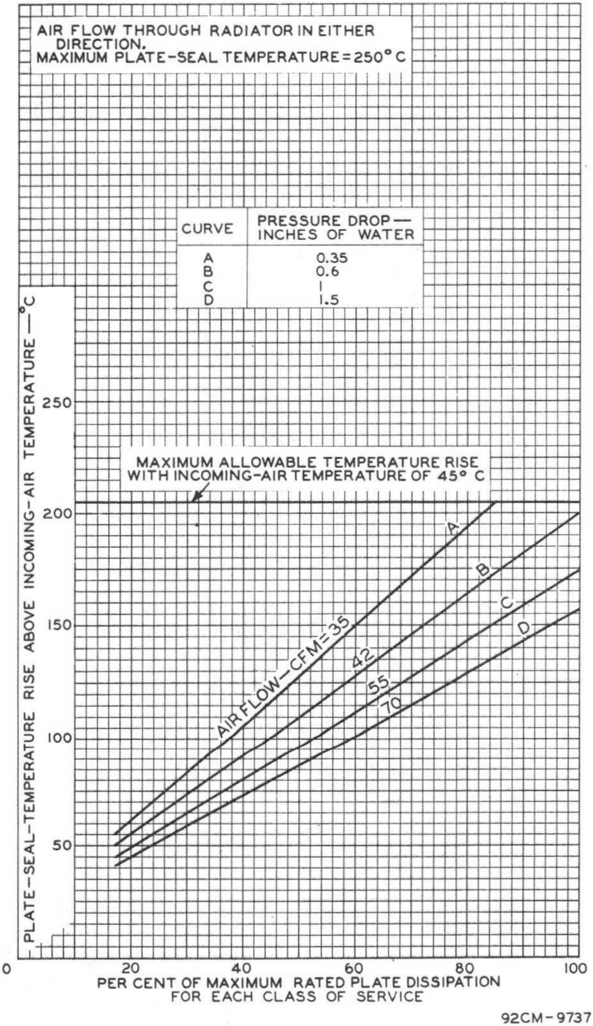
Typical Constant-Current Characteristics

With Grid-No.2 Volts =700



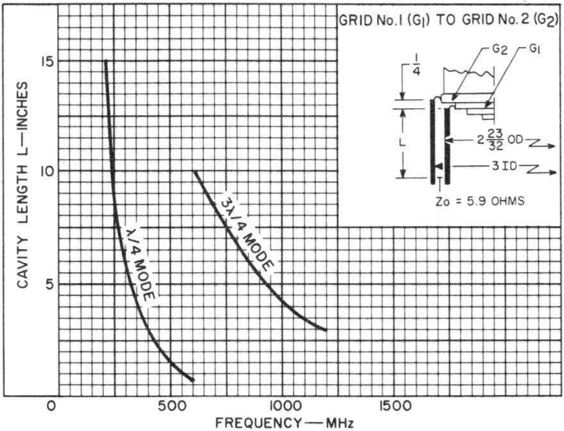
92CM-9752

Typical Cooling Characteristics

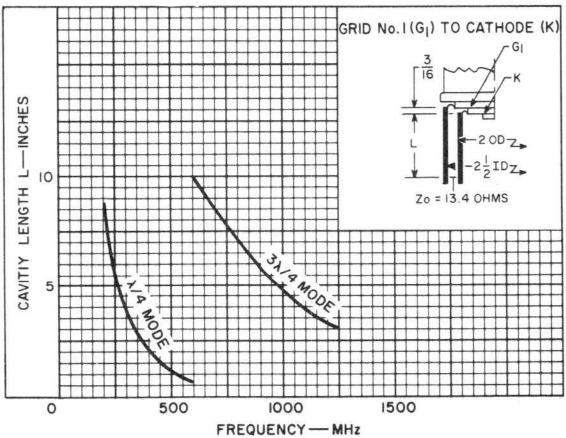


RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

Tuning Characteristics

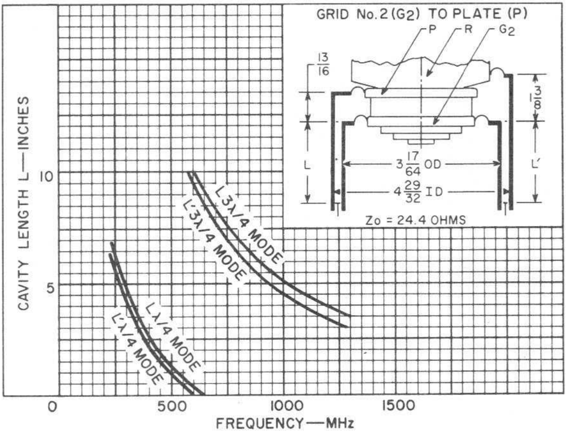


92CS-14801



92CS-14802

Tuning Characteristics



92CS-14803

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

Beam Power Tube

CERMOLOX	**17 kW Pulsed RF Output**
Matrix Cathode	**Full Input to 1215 MHz**
Forced-Air Cooled	**UHF Pulsed RF Amplifier**

For Use In Airborne, Shipboard, Mobile, Stationary Equipment

ELECTRICAL

Heater[a]

Type	Matrix, Oxide Coated Unipotential Cathode	
Voltage (ac or dc)	6.3	V
Current at 6.3 V	3.2	A
Minimum heating time	60	s

MAXIMUM RATINGS, Absolute-Maximum Values

For frequencies up to 1215 MHz and for a maximum "ON" time as specified in any 1000-microsecond interval.

Peak Positive-Pulse Plate Voltage	7000	V
DC Plate Voltage	4000	V
DC or Peak Positive-Pulse Grid-No. 2 Voltage	1000	V
Negative Pulse Grid-No. 1 Voltage	200	V
DC Plate Current During Pulse With 5-microsecond "ON" time	6	A
DC Plate Current With 5-microsecond "ON" time	0.050	A
Plate Dissipation (Average)	125	W
Useful Peak Power Output With 5-microsecond "ON" time	17000	W

MECHANICAL

Operating Position	Any
Weight (Approx.)	2 oz (0.06 kg)

THERMAL[b]

Seal Temperature	250 max.	°C
Radiator Core	250 max.	°C

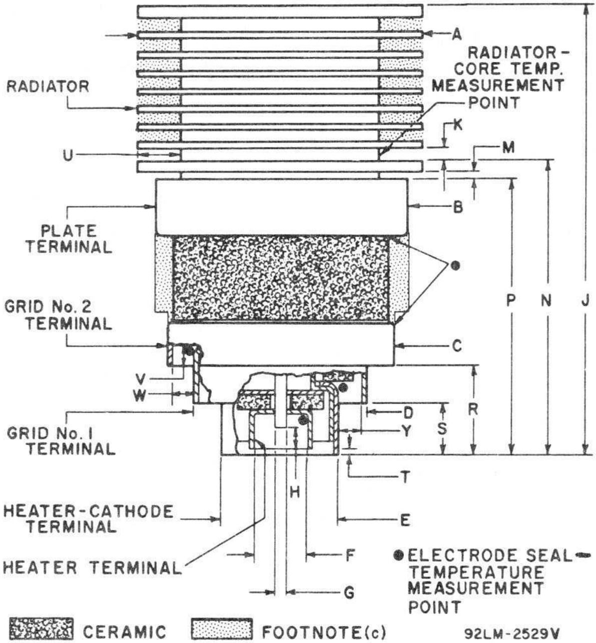
[a]See *Electrical Considerations-Filament or Heater,* under *RCA Transmitting Tube Operating Considerations* given at front of this section.

[b]See *Dimensional Outline* for temperature measurement points.

[c]Keep all stippled regions clear. Do not allow contacts or circuit components to protrude into these annular regions.

Detailed performance and application information is available through your RCA Sales Office, Distributor, or write to RCA Commercial Engineering, Harrison, N.J. 07029.

DIMENSIONAL OUTLINE



DIMENSION	INCHES	MILLIMETERS	DIMENSION	INCHES	MILLIMETERS
A Dia.	1.250 ±.015	31.75 ± .38	M	0.035 Min.	0.89 Min.
B Dia.	1.100 ±.015	27.94 ±.38	N	1.335 ±.045	33.91 ±1.14
C Dia.	1.000 ±.015	25.40 ±.38	P	1.230 ±.030	31.22 ±.76
D Dia.	0.750 ±.015	19.05 ±.38	R	0.370 ±.020	9.40 ±.50
E Dia.	0.500 +.017 −.020	12.70 +.43 −.50	S	0.175 ±.015	4.45 ±.38
			T	0.025 ±.025	0.64 ±.63
F Dia.	0.250 ±.010	6.35 ±.25	U	0.200 Min.	5.08 Min.
G Dia.	0.070 Max.	1.78 Max.	V	0.060 Min.	1.52 Min.
H	0.054 Min.	1.37 Min.	W	0.090 Min.	2.29 Min.
J	2.080 ±.050	52.8 ±1.2	X	0.120 Min.	3.05 Min.
K	0.050 Min.	1.27 Min.	Y	0.095 Min.	2.41 Min.

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:

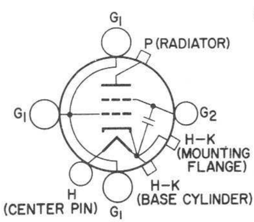
Unipotential Cathode, Matrix-Type[b]:		
Voltage (AC or DC)	6.3	volts
Current at heater volts = 6.3	3.5	amp
Minimum heating time	60	sec
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 450, grid-No.2 volts = 325 and plate amperes = 1.2	12	
Direct Interelectrode Capacitances:		
Grid No.1 to plate	0.062 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

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

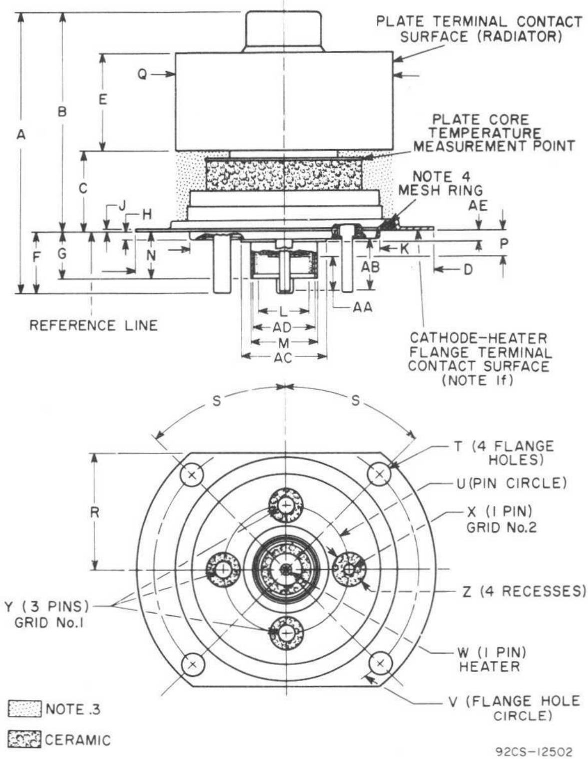
[c] See *Cooling Considerations*—Forced-Air Cooling

[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 - $45^{\circ} \pm 5'$
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.

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.)

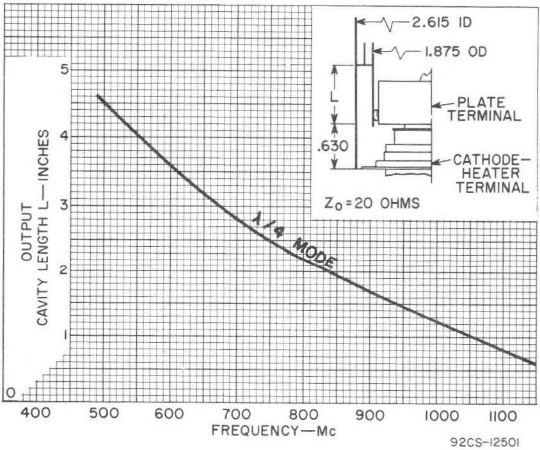
(c) Grid-No.2 pins—0.0930

Note 3: Keep all stippled regions clear. Do not allow contacts or circuit components to protrude into these annular regions.

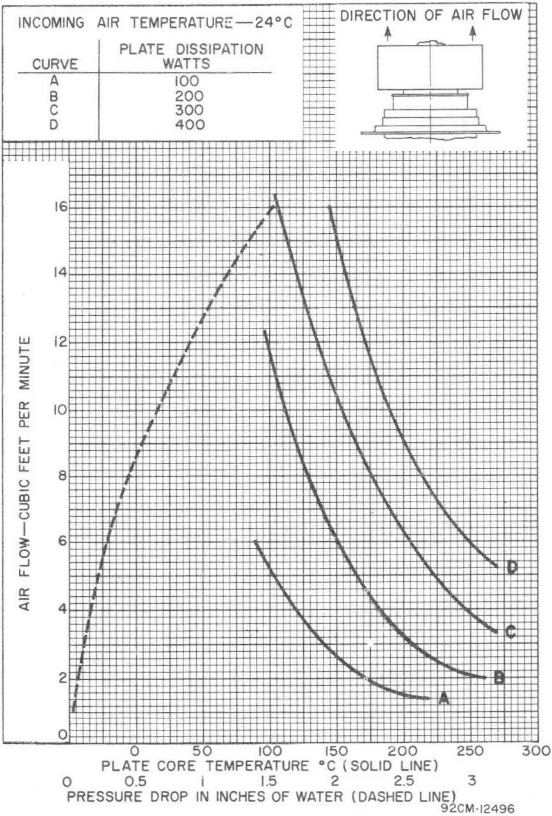
Note 4: RF gasket, such as METEX* No.A2733, or equivalent.

* Metex Electronics Corp., Walnut Ave., Clark, N.J.

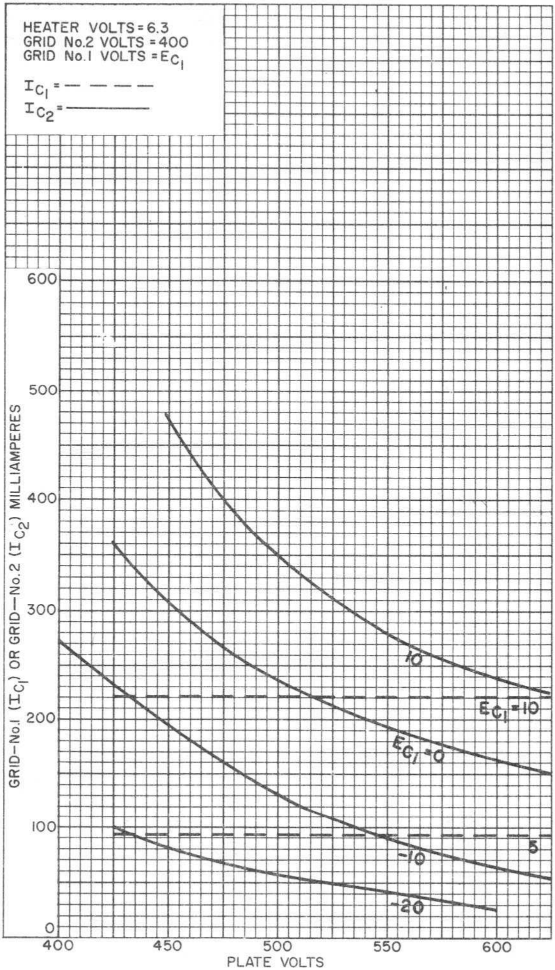
TYPICAL OUTPUT CAVITY TUNING CHARACTERISTICS



TYPICAL COOLING CHARACTERISTICS

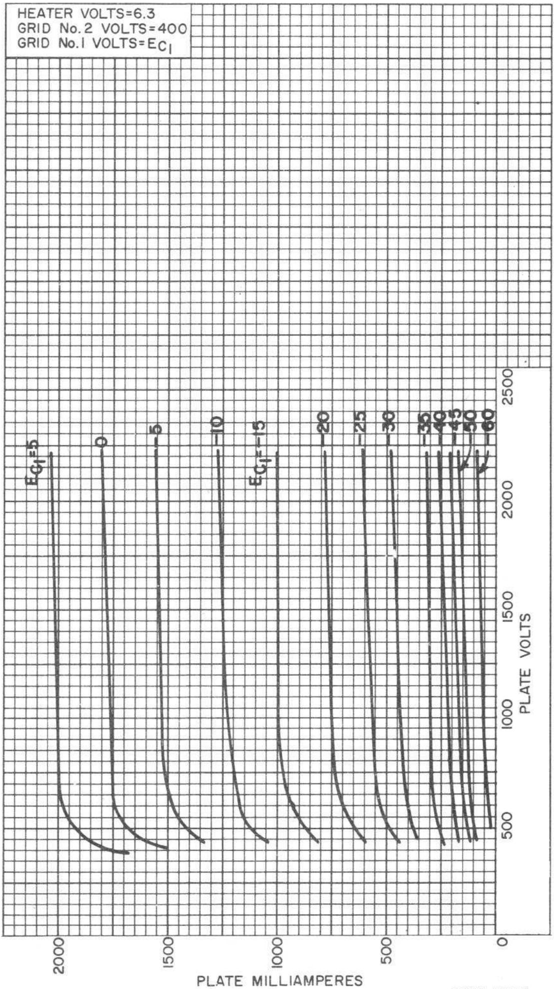


TYPICAL CHARACTERISTICS



92CM-12504

TYPICAL PLATE CHARACTERISTICS



92CM-12503

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

Beam Power Tube

CERMOLOX **Matrix Cathode** **13 kV, 30 Amp.**
Ruggedized **Pulse Modulator** **Conduction Cooled**

ELECTRICAL

Heater[a] for Matrix Type, Oxide-Coated Unipotential Cathode:

Voltage (ac or dc)	5.5	V
Current at 5.5 volts	17.3	A
Minimum heating time	180	s
Mu-Factor, grid No. 1 to grid No. 2	16	

MAXIMUM RATINGS, Absolute-Maximum Values

DC Plate Voltage	13	kV
Instantaneous Peak Plate Voltage (Pulse duration < 0.1 s)	17	kV
DC Peak Pulsed-Grid-No. 2 Voltage	1000	V
DC Grid-No. 1 Voltage	−300	V
Peak Positive-Pulse Grid-No. 1 Voltage	100	V
Peak Plate Current	30[c]	A
DC Plate Current	1.5	A
Plate Dissipation (Average)	1.5	kW

MECHANICAL

Operating Position	Any
Weight (Approx.)	1-1/2 lb (0.68 kg)

THERMAL [b]

Terminal Temperature (All Terminals) . . . . 250 Max. °C

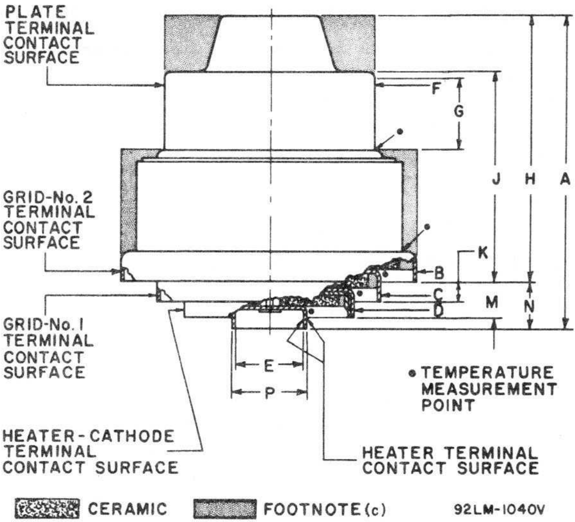
[a] See *Electrical Considerations—Filament or Heater,* under *RCA Transmitting Tube Operating Considerations* given at front of this section.

[b] See *dimensional outline* for temperature measurement points.

[c] Keep all stippled regions clear. Do not allow contacts or circuit components to protrude into these annular volumes.

Detailed performance and application information is available through your RCA Sales Office, Distributor, or write to RCA Commercial Engineering, Harrison, N.J. 07029.

DIMENSIONAL OUTLINE



DIMENSION	INCHES	MILLIMETERS
A	3.31 Max.	84.1 Max.
B Dia.	3.020 ±.010	76.71 ± .25
C Dia.	2.317 ±.010	58.85 ± .25
D Dia.	1.717 ±.007	43.61 ± .18
E Dia.	0.713 ±.012	18.11 ± .30
F Dia.	2.265 ±.003	57.53 ± .08
G	0.725 Min.	18.42 Min.
H	2.780 ±.040	70.61 ±1.02
J	2.185 ±.030	55.50 ± .76
K	0.200 ±.025	5.08 ± .64
M	0.370 ±.030	9.40 ± .76
N	0.460 ±.030	11.68 ± .64
P Dia.	0.755 ±.010	19.18 ± .25

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 AB₁ 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[b,c]	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 (Plate, grid No.2, grid No.1, cathode-filament and filament)	250	max	°C
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)

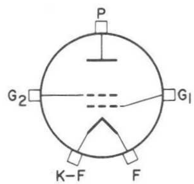
To Plate, Grid-No.2, Grid-No.1, Cathode-Filament, and Filament Terminals — A sufficient quantity of air should be allowed to flow past each of these terminals so that their temperature does not exceed the specified maximum value of 250° C.

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

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 AB_1 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.

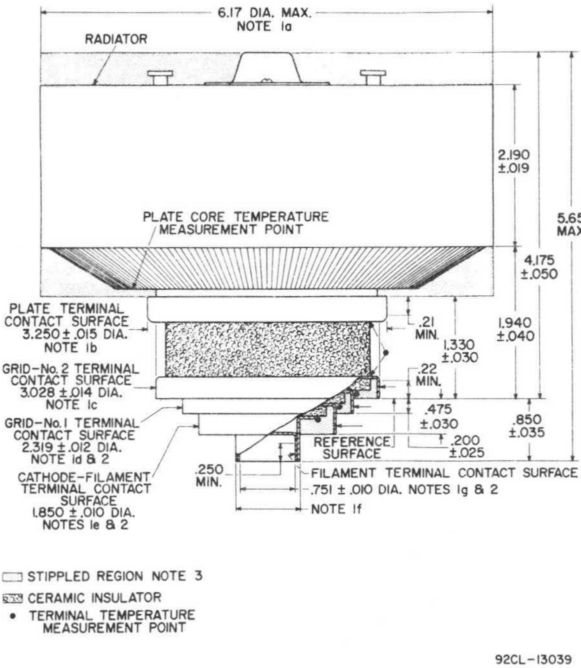
[f] See *Cooling Considerations*—Forced-Air Cooling.

[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:

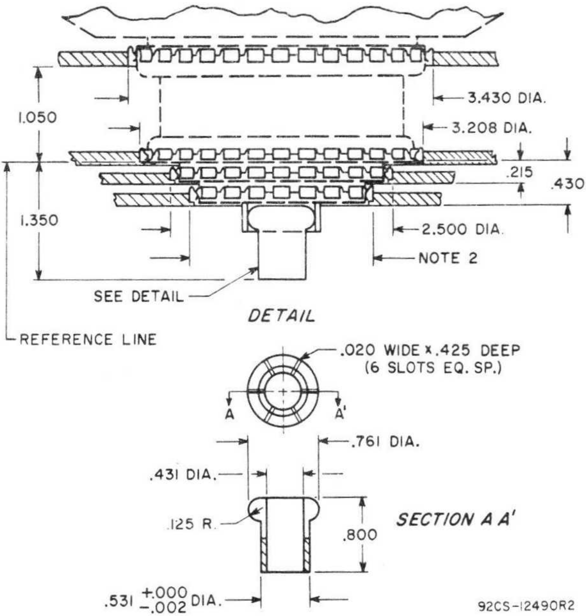
- a. Radiator - 6.241
- b. Plate Terminal - 3.288
- c. Grid-No.2 Terminal - 3.061
- d. Grid-No.1 Terminal - 2.338
- e. Cathode-Filament Terminal - 1.878
- f. Filament Terminal (OD) - 0.908
- g. Filament Terminal (ID) - 0.722

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.

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

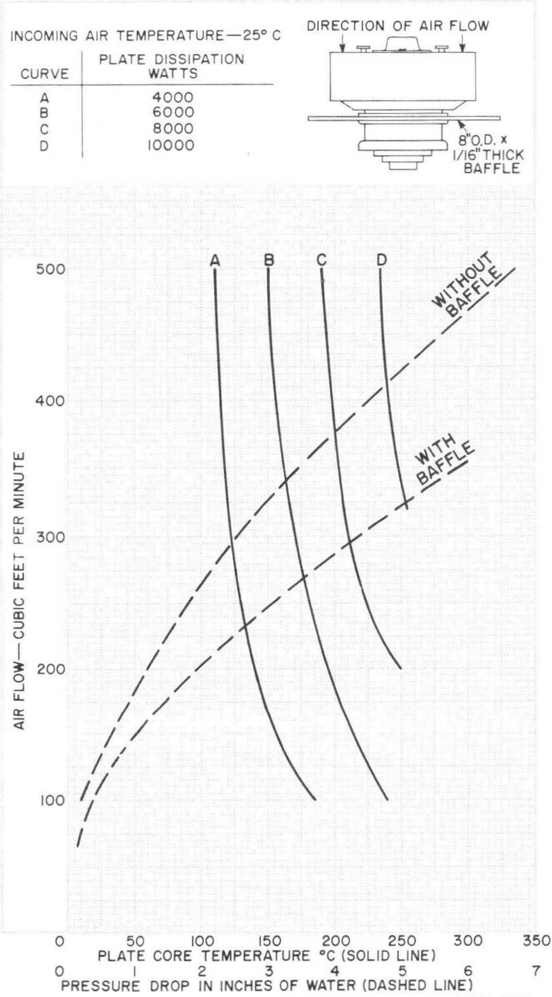
PREFERRED MOUNTING ARRANGEMENT



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.

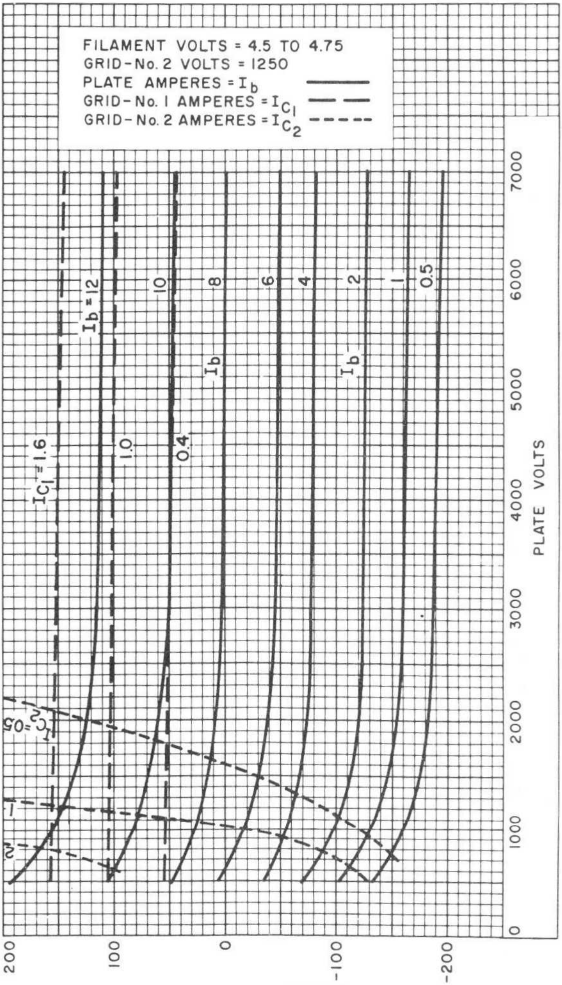
Typical Cooling Characteristics



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

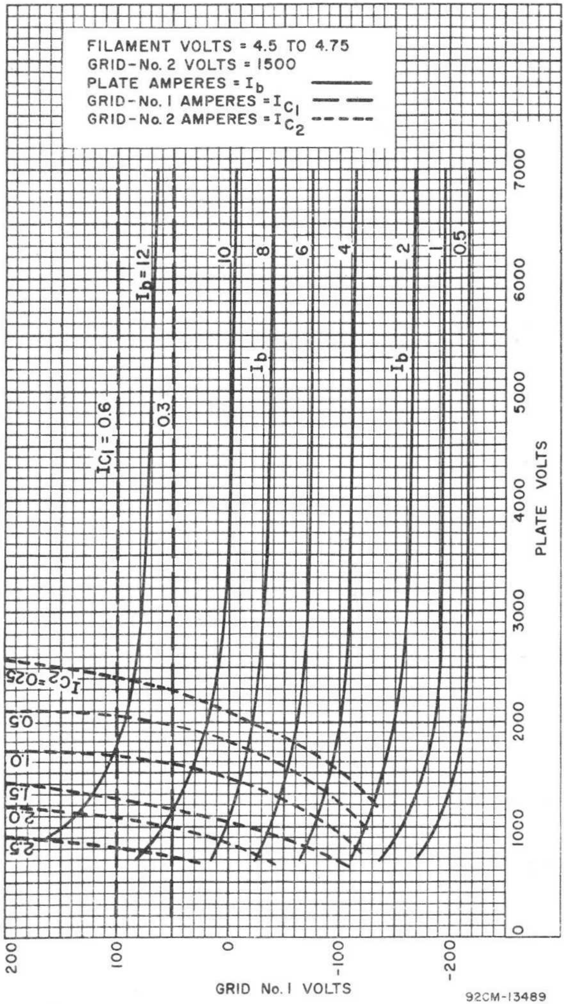
Typical Constant-Current Characteristics

For Grid-No. 2 Voltage = 1250 Volts



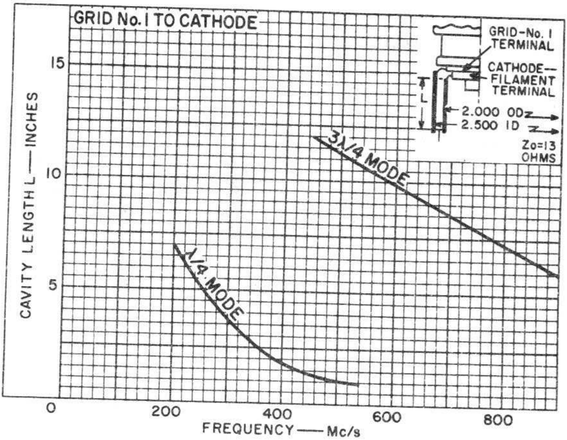
Typical Constant-Current Characteristics

For Grid-No.2 Voltage = 1500 Volts

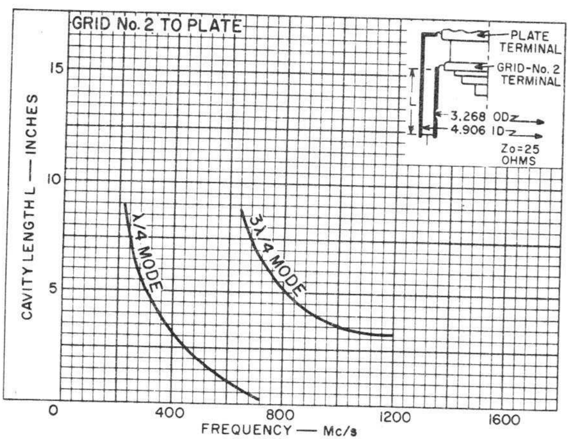


RADIO CORPORATION OF AMERICA
Electronic Components and Devices
Harrison, N. J.

Cavity Tuning Characteristics

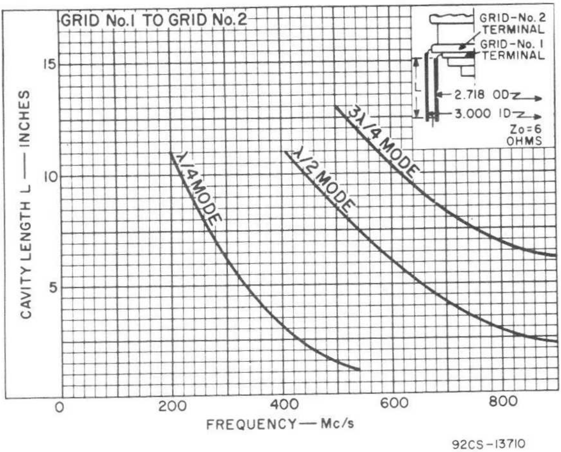


92CS-13708



92CS-13709

Cavity Tuning Characteristics



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

Beam Power Tube

CERMOLOX **17 kV, 40 Amperes** **Ruggedized**
Matrix Cathode **Pulse Modulator** **Conduction Cooled**

ELECTRICAL

Heater[a], for Matrix-Type Oxide-Coated Unipotential Cathode:		
Voltage (ac or dc)	22 ± 2	V
Current at 22 volts	12.6	A
Minimum heating time	180	s
Mu-Factor, grid No.2 to grid No.1	6	

MAXIMUM CSS RATINGS, Absolute-Maximum Values

DC Plate Voltage	17[b]	kV
Instantaneous Peak Plate Voltage . . . . (Pulse duration < 0.1 s)	22[b]	kV
DC Peak Pulsed Grid-No.2 Voltage	2000	V
DC Grid No.1 Voltage	-600	V
Peak Positive-Pulse Grid No.1 Voltage	150	V
Peak Plate Current	40[c]	A
DC Plate Current	5	A
Plate Dissipation (Average)	7.5	kW

MECHANICAL

Operating Position	Any
Weight (Approx.)	5 lb (2.3 kg)

THERMAL[b]

Terminal Temperature (All terminals)	250 max. °C
Plate-Core Temperature	250 max. °C

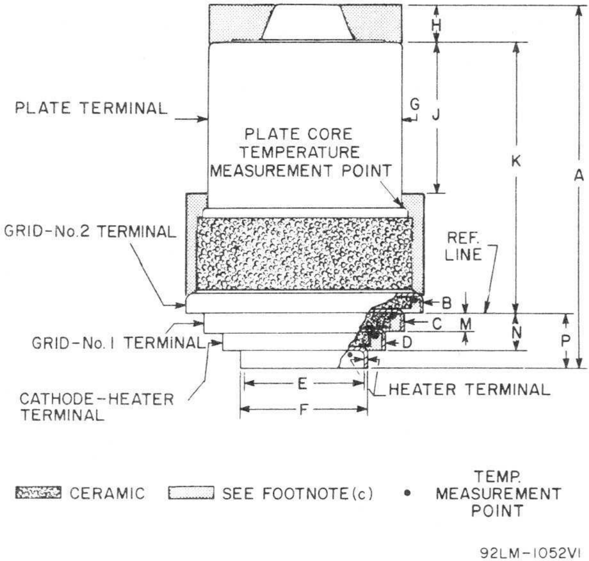
[a] See *Electrical Considerations* — Filament or Heater under RCA *Transmitting Tube Operating Considerations* given at front of this section.

[b] See *dimensional outline* for temperature measurement points.

[c] Keep all stippled regions clear. Do not allow contacts or circuit components to protrude into these annular regions.

Detailed performance and application information is available through your RCA Sales Office, Distributor, or write to RCA Commercial Engineering, Harrison, N.J. 07029.

DIMENSIONAL OUTLINE



DIMENSION	INCHES	MILLIMETERS
A	6.175 Max.	156.85 Max.
B Dia.	3.905 ± .015	99.19 ± .38
C Dia.	3.305 ± .015	83.95 ± .38
D Dia.	2.695 ± .015	68.45 ± .38
E Dia.	1.973 ± .007	49.21 ± .18
F Dia.	2.095 ± .015	53.21 ± .38
G Dia.	3.201 + .002 − .001	81.305 + .051 − .025
H	0.590 ± .010	14.99 ± .25
J	2.593 Min.	65.86 Min.
K	4.470 ± .030	113.54 ± .76
M	0.320 ± .020	8.13 ± .51
N	0.630 ± .020	16.00 ± .51
P	0.940 ± .020	23.88 ± .51

Beam Power Tube

CERMOLOX
Oxide-Coated Cathode
Forced-Air Cooled
Linear RF Power Amplifier

Ruggedized
80 Watts CW Power Output at 400 MHz
40 Watts CW Power Output at 1215 MHz

ELECTRICAL

Heater for Matrix-Type, Oxide-Coated, Unipotential Cathode:

Voltage (ac or dc)	26.5 ± 10%	V
Current at 26.5 volts	0.54	A
Minimum heating time	60	s
Mu-Factor, Grid No.2 to Grid No.1	18	

MAXIMUM CCS RATINGS, Absolute-Maximum Values

	Up to 1215 MHz	
DC Plate Voltage	1000	V
DC Grid-No.2 Voltage	300	V
DC Grid-No.1 Voltage	–100	V
DC Plate Current	200	mA
Plate Dissipation	150	W

MECHANICAL

Operating Position	Any
Weight (Approx.)	(0.06 kg) 2 oz

THERMAL[a]

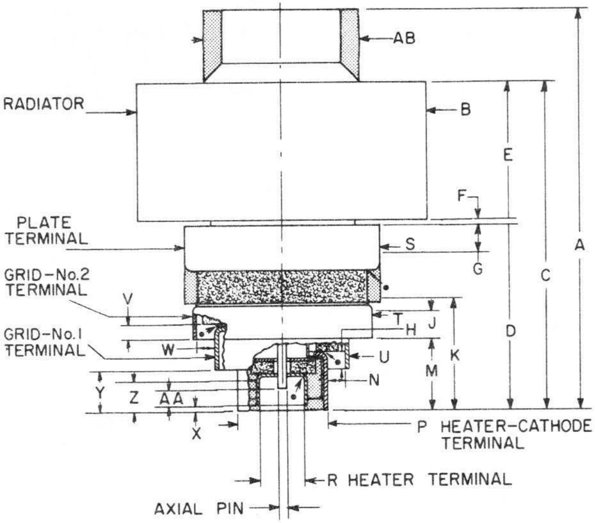
Terminal Temperature (Plate, grid No.2, grid No.1, cathode, and heater)	250 max. °C
Plate-Core Temperature	250 max. °C

a See *Dimensional Outline* for temperature measurement points.

b Keep all stippled regions clear. Do not allow contacts or circuit components to protrude into these annular volumes.

Detailed performance and application information is available through your RCA Sales Office, Distributor, or write to RCA Commercial Engineering, Harrison, NJ 07029.

DIMENSIONAL OUTLINE



SEE FOOTNOTE (b)
CERAMIC
• TEMPERATURE MEASURMENT POINT

92LM-2327V

DIMENSION	INCHES	MILLIMETERS
A	2.270 Max.	57.66 Max.
B Dia.	1.625±.015Max	41.28±.38Max.
C	1.840 ± .032	46.74 ± .81
D	1.030 ± .030	26.16 ± .76
E	0.750 ± .015	19.05 ± .38
F	0.030 Min.	0.76 Min.
G	0.165 Min.	4.19 Min.
H	0.120 Min.	3.05 Min.
J	0.140 Min.	3.56 Min.
K	0.600 Min.	15.24 Min.
M	0.370 ± .020	9.40 ± .51
N	0.095 Min.	2.14 Min.

DIMENSION	INCHES	MILLIMETERS
P Dia.	0.480 Min.	12.19 Min.
R Dia.	0.260 Max.	6.60 Max.
S Dia.	1.085 Min.	27.56 Min.
T Dia.	0.985 Min.	25.02 Min.
U Dia.	0.735 Min.	18.67 Min.
V	0.060 Min.	1.52 Min.
W	0.090 Min.	2.29 Min.
X	0.025 ± .025	0.64 ± .64
Y	0.175 ± .015	4.45 ± .38
Z	0.100 Min.	2.54 Min.
AA	0.054 Min.	1.37 Min.
AB Dia.	0.85 Max.	21.6 Max.

Beam Power Tube

CERMOLOX

Broadband UHF Operation
2300 w CW Output at 890 MHz

Matrix Cathode
Forced-Air Cooled

ELECTRICAL

Heater:		
Type	Matrix Oxide Coated Unipotential Cathode	
Voltage	5.5 typ. / 6.0 max.	V / V
Current at 5.5 V	31	A
Instantaneous Starting Current	90 max.	A
Minimum Heating Time	180	s
Mu-factor (Grid No.2 to Grid No.1)	14	

MAXIMUM CCS RATINGS, Absolute-Maximum Values

DC Plate Voltage	7000	V
DC Grid-No.2 Voltage	1000	V
DC Grid-No.1 Voltage	−250	V
DC Plate Current	3	A
Plate Dissipation	5000	W

MECHANICAL

Operating Position	Any
Weight (Approx.)	6 lb (2.7 kg)

THERMAL[a]

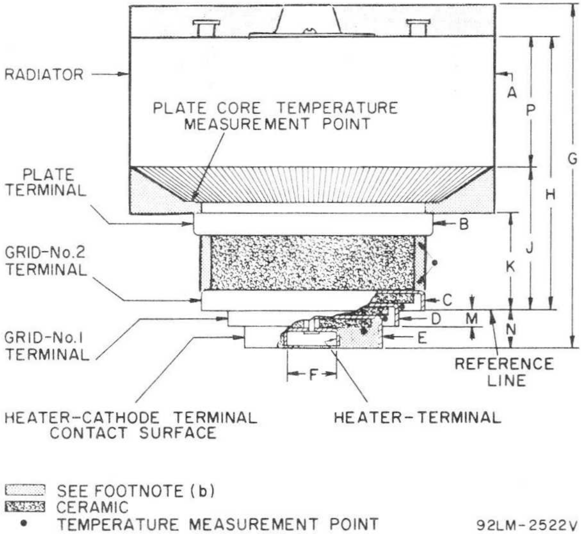
Seal Temperatures (Plate, Grid No.2, Grid No.1 Heater-Cathode, Heater)	250 max.	°C
Plate Core Temperature	250 max.	°C

[a] See *Dimensional Outline* for temperature measurement points.

[b] Keep all stippled regions clear. Do not allow contacts or circuit components to intrude into these annular regions.

Detailed performance and application information is available through your RCA Sales Office, Distributor, or write to RCA Commercial Engineering, Harrison, NJ 07029.

DIMENSIONAL OUTLINE



DIMENSION	INCHES	MILLIMETERS
A Dia.	4.57 Max.	116.1 Max.
B Dia.	3.250 ±.015	82.55 ±.38
C Dia.	3.028 ±.014	76.91 ±.35
D Dia.	2.319 ±.012	58.90 ±.30
E Dia.	1.850 ±.010	44.99 ±.25
F Dia.	0.725 Max.	18.42 Max.
G	4.70 Max.	119.4 Max.
H	4.140 ±.050	105.2 ±1.2
J	1.620 ±.040	41.15 ±1.01
K	1.330 ±.030	33.78 ±.76
M	0.200 ±.025	5.08 ±.63
N	0.475 ±.030	12.07 ±.76
P	1.945 ±.015	49.40 ±.38

Beam Power Tube

- CERMOLOX®
- Compact, Ruggedized
- Hard Tube Modulator
- 7000 Volts Peak
- 8.0 Amperes Peak
- Nanosecond Switching Time

General Data

Electrical:

Heater for Unipotential Cathode:

Voltage[a] (AC or DC)	6.0	typ.	V
	6.4	max.	V
Current @ 6.0 volts	7.6		A
Minimum heating time	120		s
Mu-Factor[b] (Grid No.1 to grid No.2)	6.6		

Direct Interelectrode Capacitances:[c]

Grid No.1 to plate	0.12	max.	pF
Grid No.1 to cathode	30		pF
Plate to cathode	0.011	max.	pF
Grid No.1 to grid No.2	38		pF
Grid No.2 to plate	5.3		pF

Mechanical:

Operating Position				Any
Maximum Overall Length	(69.1 mm)	2.72		in
Greatest Diameter	(45.3 mm)	1.77		in
Temperature (All seals & plate core)		250	max.	°C
Weight (Approx.)	(0.17 kg)	6		oz
Terminal Connections				See Outline Drawing

Pulse Modulator Service[d]

Maximum CCS Ratings, Absolute-Maximum Values:

Instantaneous Peak Plate Voltage[e] (Pulse duration 0.1 s)	7000	max.	V
DC Plate Voltage	5000	max.	V
DC Grid-No.2 Voltage	1200	max.	V
DC Grid-No.1 Voltage	−250	max.	V
Peak Positive Grid-No.1 Voltage	150	max.	V
Peak Plate Current[f]	8	max.	A
DC Plate Current	.500	max.	A

Grid-No.2 Input (Average)	20	max.	W
Grid-No.1 Input (Average)	8	max.	W
Plate Dissipation (Average)[g]	600	max.	W

Typical Operation:

With rectangular wave shape pulses, duty factor of 0.05 and pulse duration of 2 microseconds.

DC Plate Voltage	3000	V
Instantaneous Peak Plate Voltage	7000	V
DC Grid-No.2 Voltage	800	V
DC Grid-No.1 Voltage	−120	V
Peak Positive Grid-No.1 Voltage	25	V
Peak Plate Current	8	A
DC Plate Current	0.4	A
DC Grid-No.2 Current	0.012	A
DC Grid-No.1 Current	0.050	A
Load Resistance	225	Ω
Plate Dissipation (Average)	480	W
Useful DC Power Output at Peak of Pulse	14,400	W

[a] See V.A.3 of 1CE-300. Heater voltage should be adjusted to the typical value initially, and then reduced to a lower value that will provide satisfactory performance. The life of the cathode can be conserved by adjusting to the lowest heater value that will give the desired performance.

[b] For plate voltage = 500 V, grid-No.2 voltage = 350 V, and plate current = 0.24 A.

[c] Measured with special shield adaptor.

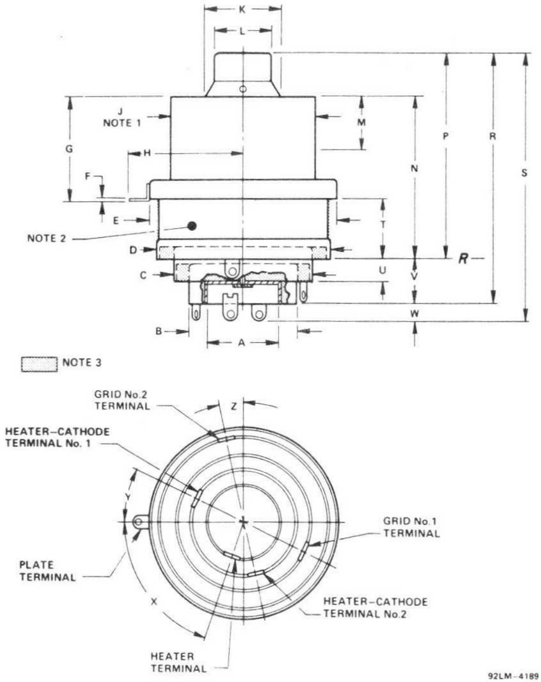
[d] See Section VC of 1CE-300.

[e] An insulating fluid or pressurization may be required to prevent external tube arcing. The insulating fluid must be determined to be compatible with the tube for the particular application.

[f] The value of peak plate current shown applies to duty factors up to 0.05; for higher duty factors, the peak plate current must be reduced as shown in the Peak Plate Current Rating Chart.

[g] Maximum plate dissipation is a function of the maximum plate input efficiency of the class of service, and the effectiveness of the cooling system. The value of maximum plate dissipation shown is a practical value which can be achieved. In all cases of operation, sufficient cooling must be provided to prevent the terminal and plate core temperatures from exceeding their maximum values. When longer life expectancy and more consistent performance are desirable, operation at reduced temperatures is recommended.

Dimensional Outline



Note 1: Dimension "H" is maintained over the distance "M" with a finish of better than 32 microns.

Note 2: Ceramic.

Note 3: Keep all stippled regions clear.*

*Dimensions are in inches unless otherwise stated. Metric equivalents in parentheses are given for information only and are based on 1 inch = 25.4 mm.

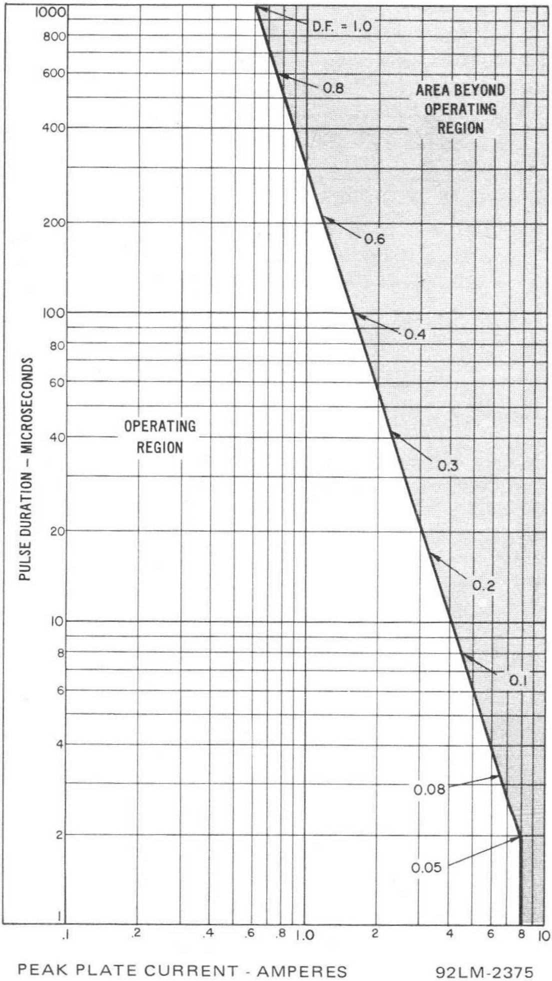
See next page for dimensions.

Dimensional Outline (Continued)

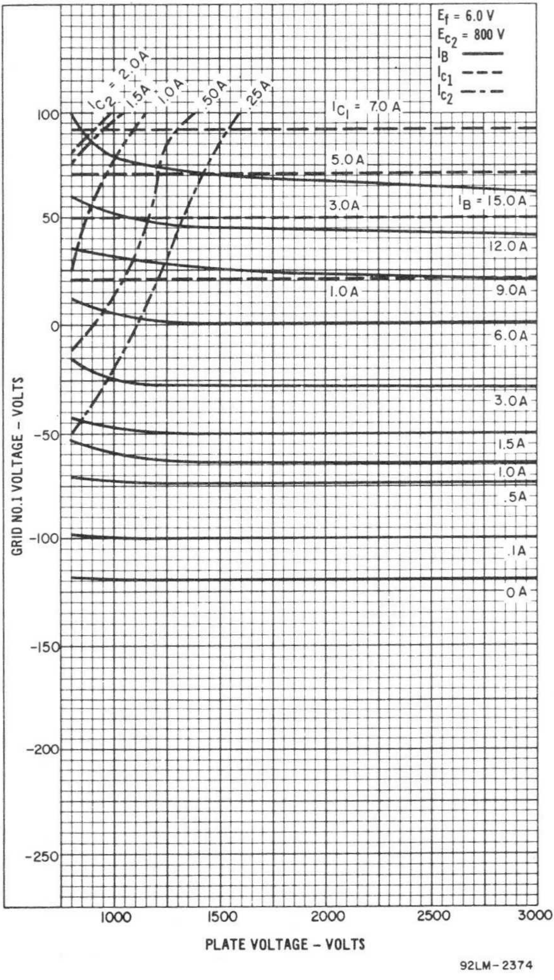
Tabulated Dimensions*

Dimension		
A Dia.	0.660 ± .010	(16.76 ± .25)
B Dia.	1.000 ± .010	(25.40 ± .25)
C Dia.	1.300 ± .010	(33.02 ± .25)
D Dia.	1.600 ± .010	(40.64 ± .25)
E Dia.	1.755 ± .010	(44.58 ± .25)
F	0.020 Ref.	(0.51 Ref.)
G	1.150 Max.	(29.21 Max.)
H Radius	1.130 Max.	(28.70 Max.)
J Dia.	1.300 ± .002	(33.020 ± .051)
K Dia.	0.855 Max.	(21.72 Max.)
L Dia.	0.573 Max.	(14.55 Max.)
M	0.700 Min.	(17.78 Min.)
N	1.595 ± .035	(40.5 ± .9)
P	2.000 ± .045	(50.8 ± 1.1)
R	2.400 Ref.	(60.96 Ref.)
S	2.72 Max.	(69.1 Max.)
T	0.575 ± .025	(14.61 ± .64)
U	0.200 ± .020	(5.08 ± .51)
V	0.400 ± .020	(10.16 ± .51)
W	0.250 Ref.	(6.35 Ref.)
X	60° Ref.	
Y	30° Ref.	
Z	15° Ref.	

Peak Plate Current Rating



Constant Current Characteristics



Beam Power Tube

CERMOLOX

High Gain RF Power Amplifier
Matrix Cathode
Forced-Air Cooled

2500 Watts Carrier Output at 400 MHz
10 kW PEP
16 dB Gain

ELECTRICAL

Heater:

Type	Matrix-Type Oxide Coated Unipotential Cathode	
Voltage (ac or dc)	22 ± 2	V
Current at 22 volts	12.6	A
Minimum heating time	180	s
Mu-Factor (Grid No.2 to Grid No.1)	20	

MAXIMUM CCS RATINGS, Absolute-Maximum Values:

	Up to 500 MHz	
DC Plate Voltage	7000	V
DC Grid-No.2 Voltage	1200	V
DC Plate Current	2.0	A
Plate Dissipation	10	kW

MECHANICAL

Operating Position	Any
Weight (Approx.)	12 lb (5.4 kg)

THERMAL[a]

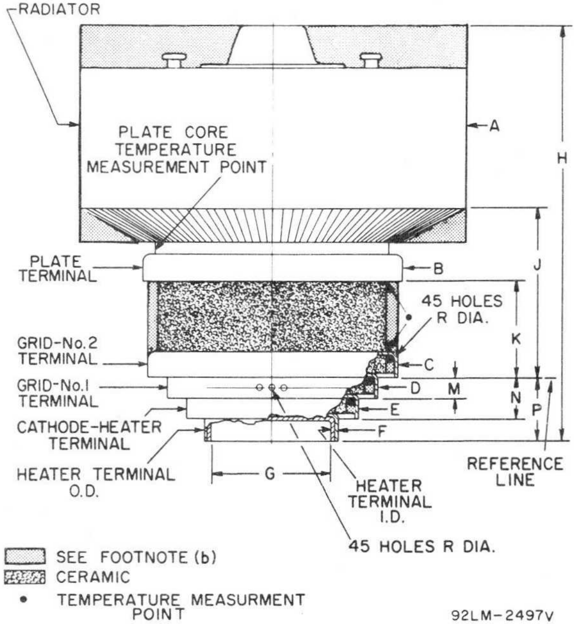
Terminal Temperature (Plate, heater-cathode, and heater)	250 max. °C
Grid No.2 and Grid No.1	200 max. °C
Plate-Core Temperature	250 max. °C

[a] See *Dimensional Outline* for temperature measurement points.

[b] Keep all stippled regions clear. In general do not allow contacts to intrude into these annular regions.

Detailed performance and application information is available through your RCA Sales Office, Distributor, or write to RCA Commercial Engineering, Harrison, NJ 07029.

DIMENSIONAL OUTLINE



DIMENSION	INCHES	MILLIMETERS
A Dia.	6.130 ±.040	55.70 ±1.02
B Dia.	4.190 ±.020	106.43 ±.51
C Dia.	3.915 ±.015	99.44 ±.38
D Dia.	3.315 ±.015	84.20 ±.38
E Dia.	2.700 ±.020	68.58 ±.51
F Dia.	2.100 ±.015	53.34 ±.38
G Dia.	1.975 ±.010	50.17 ±.25
H	6.500 Max.	165.1 Max.
J	2.650 ±.025	67.31 ±.64
K	1.625 ±.025	41.28 ±.64
M	0.340 ±.030	8.64 ±.76
N	0.660 ±.038	6.76 ±.97
P	1.000 ±.030	25.40 ±.76
R Dia.	0.089 Nom.	2.26 Nom.

Beam Power Tube

Matrix-type Unipotential Cathode

Liquid Cooled — **410 Watts PEP Output at 30 MHz**

UHF Grid-Drive Operation

300 Watts UHF TV Output at 890 MHz

Distributed Amplifier Service to 500 MHz

ELECTRICAL

Heater, Unipotential Matrix Type:

Voltage (ac or dc)	6.3	V
Current at 6.3 volts	3.5	A
Minimum heating time	60	s
Mu-Factor, (grid No.2 to grid No.1)	12	

MECHANICAL

Operating Position	Any
Weight (Approx.)	8 oz (0.23 kg)

THERMAL

Terminal Temperature	250 max. °C
Cathode-Heater Flange	125 max. °C
Plate Seal Temperature	250 max. °C

See *Dimensional Outline* for Temperature Measurement Points

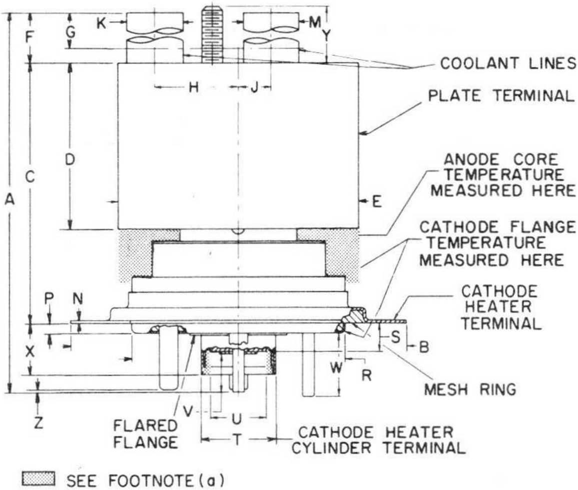
MAXIMUM CCS RATINGS, Absolute-Maximum Values:

DC Plate Voltage	2200	V
DC Grid No.2 Voltage	400	V
DC Grid No.1 Voltage	–100	V
DC Plate Current (Class A Service)	600	mA
Plate Dissipation	1000	W

[a] Keep all stippled regions clear. Do not allow contacts or circuit components to intrude upon these regions.

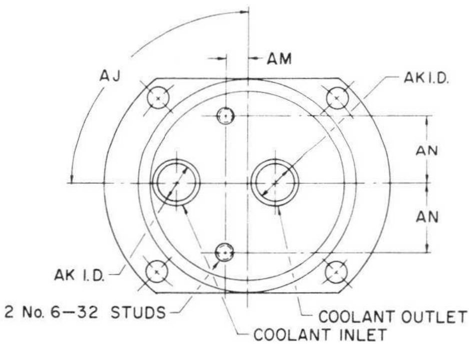
Detailed performance and application information is available through your RCA Sales Office Distributor, or by writing to RCA Commercial Engineering, Harrison, NJ 07029.

DIMENSIONAL OUTLINE (Front View)



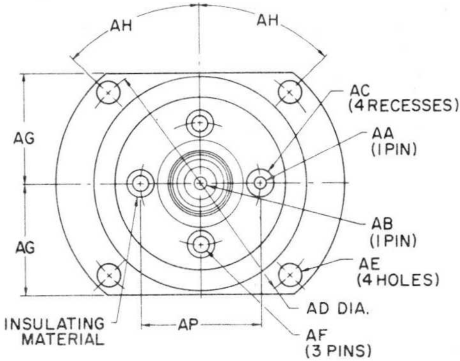
92LM-2512V

DIMENSIONAL OUTLINE (Top View)



92LS-2517V

DIMENSIONAL OUTLINE (Bottom View)



DIMENSION	INCHES	MILLIMETERS
A	3.330 Max.	84.6 Max.
B Dia.	2.262 Max.	57.45 Max.
C	1.745 ± .025	44.32 ± .64
D	1.130 ± .010	28.70 ± .25
E Dia.	1.625 ± .015	4.128 ± .38
F	0.437 ± .010	1.11 ± .25
G	0.875 Min.	22.23 Min.
H	0.560 ± .020	14.22 ± .51
J	0.220 ± .020	5.59 ± .51
K Dia.	0.375 Nom.	9.53 Nom.
M Dia.	0.375 Nom.	9.53 Nom.
N	0.022 ± .002	0.56 ± .05
P	0.058 + .007 − .008	1.47 + .18 − .20
R Dia.	1.425 ± .010	36.20 ± .25
S	0.200 Max.	5.08 Max.
T Dia.	0.500 ± .010	12.70 ± .25
U Dia.	0.400 Min.	10.16 Min.
V	0.250 Min.	6.35 Min.

DIMENSION	INCHES	MILLIMETERS
W	0.425 Max.	10.80 Max.
X	0.337 +.018 −.017	8.56 +.46 −.43
Y	0.380 ±.020	9.65 ±.51
Z	0.060 Max.	1.12 Max.
AA Dia.	0.081 ±.002	2.06 ±.05
AB Dia.	0.081 ±.002	2.06 ±.05
AC Dia.	0.245 Min.	6.22 Min.
AD Dia.	2.000 ±.010	50.8 ±.25
AE Dia.	0.175 ±.005	4.45 ±.13
AF Dia.	0.126 ±.002	3.20 ±.05
AG	0.868 +.017 −.018	22.05 +.43 −.46
AH	$45^{\circ} \pm 5'$	–
AJ	$90^{\circ} \pm 3^{\circ}$	–
AK	0.378 ±.003	9.60 ±.08
AM	0.171 ±.010	4.34 ±.25
AN	0.562 ±.010	14.27 ±.25
AP	0.950 ±.011	24.13 ±.28

Beam Power Tube

CERMOLOX

RF Power Amplifier and Oscillator to 1215 MHz

Matrix-Type Cathode	340 Watts CW Power Output at 400 MHz
105 Watts CW Power Output at 1215 MHz	Conduction Cooled

ELECTRICAL

Heater for Matrix-Type Oxide-Coated Unipotential Cathode:		
Voltage (ac or dc)	6.3	V
Current at 6.3 volts	3.2	A
Minimum heating time	60	s
Mu-Factor, Grid No.2 to Grid No.1	18	

MAXIMUM CCS RATINGS, Absolute-Maximum Values:

	Up to 1215 MHz	
DC Plate Voltage	2500	V
DC Grid-No.2 Voltage	400	V
DC Grid-No.1 Voltage	–200	V
DC Plate Current	250	mA
Plate Dissipation	300	W

MECHANICAL

Operating Position	Any
Weight (Approx.)	4 oz (0.1 kg)

THERMAL

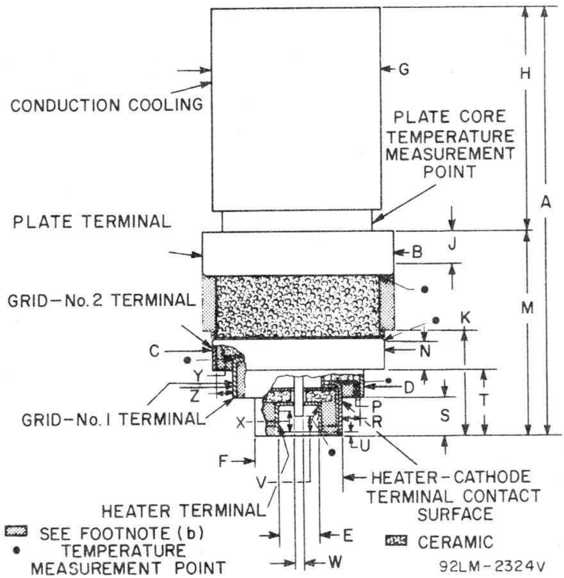
Terminal Temperature (Plate, grid No.2, grid No.1, cathode and heater)	250 max. °C
Plate-Core Temperature	250 max. °C

[a] See *Dimensional Outline* for Temperature Measurement Points.

[b] Keep all stippled regions clear. Do not allow contacts or circuit components to protrude into these annular regions.

Detailed performance and application information is available through your RCA Sales Office, Distributor, or write to RCA Commercial Engineering, Harrison, NJ 07029.

DIMENSIONAL OUTLINE



DIMENSION	INCHES	MILLIMETERS	DIMENSION	INCHES	MILLIMETERS
A	2.650 ±.090	67.31 ± 2.29	N	0.140 Min.	3.56 Min.
B Dia.	1.085 Min.	27.56 Min.	P	0.120 Min.	3.05 Min.
C Dia.	0.985 Min.	25.02 Min.	R	0.095 Min.	2.41 Min.
D Dia.	0.735 Min.	18.67 Min.	S	0.175 ±.015	4.45 ± .38
E Dia.	0.260 Max.	6.60 Max.	T	0.370 ±.020	9.40 ± .51
F Dia.	0.480 Min.	12.19 Min.	U	0.025 ±.025	0.64 ± .64
G Dia.	0.990 ±.005	25.15 ± .13	V	0.054 Min.	1.37 Min.
H	1.355 Min.	34.42 Min.	W	0.070 Max.	1.78 Max.
J	0.165 Min.	4.19 Min.	X	0.100 Min.	2.54 Min.
K	0.600 Min.	15.24 Min.	Y	0.060 Min.	13.24 Min.
M	1.230 ±.030	31.24 ± .76	Z	0.090 Min.	22.86 Min.

Beam Power Tube

CERMOLOX
Ruggedized
Pulse Modulator

Matrix Cathode
13 kV, 20 Amperes
Conduction Cooled

ELECTRICAL

Heater:		
Type . . . . Matrix Oxide-Coated Unipotential Cathode		
Voltage (ac or dc)	5.5 typ.	V
	6.0 max.	V
Current at 5.5 volts	17.3	A
Minimum heating time	180	s
Mu-Factor, Grid No.2 to Grid No.1	17	

MAXIMUM RATINGS, Absolute-Maximum Values:

DC Plate Voltage	13	kV
Instantaneous Peak Plate Voltage (pulse duration < 0.1 s)	20	kV
DC Grid-No.2 Voltage	1000	V
DC Grid-No.1 Voltage	-300	V
Peak Positive Pulse Grid-No.1 Voltage	100	V
Peak Plate Current	30	A
DC Plate Current	1.5	A
Plate Dissipation (Average)	1.5	kW

MECHANICAL

Operating Position	Any
Weight (Approx.)	2 lb (0.91 kg)

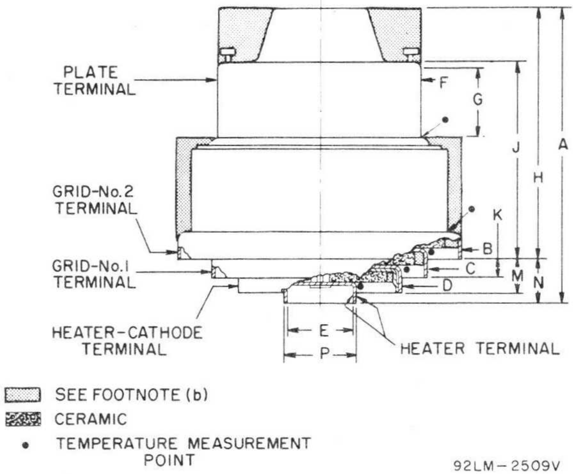
THERMAL

Terminal Temperature (Plate, grid No.2 grid No.1, cathode and heater)	250 max. °C
Plate-Seal Temperature	250 max. °C

[a] See *Dimensional Outline* for temperature measurement points.
[b] Keep all stippled clear. Do not allow contacts or circuit components to protrude into these annular volumes.

Detailed performance and application information is available through your RCA Sales Office, Distributor, or write to RCA Commercial Engineering, Harrison, NJ 07029.

DIMENSIONAL OUTLINE



DIMENSION	INCHES	MILLIMETERS
A	3.31 Max.	84.1 Max.
B Dia.	3.020 ±.010	76.71 ±.25
C Dia.	2.317 ±.010	58.85 ±.25
D Dia.	1.717 ±.007	43.61 ±.18
E Dia.	0.713 ±.012	18.11 ±.30
F Dia.	2.266 ±.001	57.56 ±.03
G	0.725 Min.	18.42 Min.
H	2.780 ±.040	70.61 ±1.02
J	2.185 ±.030	55.50 ±.76
K	0.200 ±.025	5.08 ±.64
M	0.370 ±.030	9.40 ±.76
N	0.460 ±.030	11.68 ±.76
P Dia.	0.755 ±.010	19.18 ±.25

RF Power Amplifier Tetrodes

- CW Ouput up to 250 kW (4647), 500 kW (4648)
- Pulsed Output up to: 500 kW peak (4647)
  1000 kW peak (4648)
- Full Input to 1000 MHz (Each Type)
- Power Gain up to 28 dB (Each Type)

General Data

Electrical:

		Type 4647	4648	
Filament[a]				
Type		Multistrand Thoriated Tungsten		
Current, dc operating,	Typ.	840	1600	A
	Max.	860	1640	A
Starting Current (Must never exceed even momentarily)	Max.	1000	2000	A
Voltage at 840 A	Typ.	3.7	3.7	V
Minimum Heating Time to Reach Operating Voltage		60	60	s
Minimum Heating Time at Operating Voltage Before Applying Plate Voltage		60	60	s
Mu-Factor (grid No.2 to grid No.1)		9	9	
Direct Interelectrode Capacitances:				
Grid No.1 to plate		0.3	0.6	pF
Grid No.1 to grid No.2 and cathode		680	1200	pF
Plate to cathode and grid No.2		85	85	pF
Grid No.2 to cathode		130	140	pF
Grid No.2 to grid No.1		425	775	pF
Grid No.1 to cathode		255	425	pF

Mechanical (Each Type)

Operating Attitude	Tube axis vertical, either end up		
Overall Length, Maximum	(470 mm)	18.5	in
Maximum Diameter	(296 mm)	11.65	in
Terminal Connections	See Dimensional Outline		
Weight (approx.) Uncrated	(34.0 kg)	75	lb
Crated	(122.5 kg)	270	lb

Thermal (Each Type)

Maximum Ceramic-Insulator Temperature	150	°C
Maximum Metal-Surface Temperature	100	°C

Minimum Storage Temperature[b]	−65	°C
Maximum External Gas Pressure[c] Absolute	60	psi
	4.2	kg/cm^2

Cooling:

It is important that the temperature of the individual parts of the tube not exceed the value specified.

Air Cooling

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. Interlocking of the air flow with all power supplies is recommended to prevent tube damage in case of failure of adequate air flow.

Liquid Cooling:[d]

Liquid cooling of the filament, filament ground, grid No.1, grid No.2, and plate is required. 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.

Liquid Pressure at any inlet, Maximum Gauge	100 lbs/in^2 (7.0 kg/cm^2)
Resistivity of water @ 25° C, Minimum	1.0 megohm-cm
Water Temperature from any outlet, Maximum	70 °C

Pulsed RF Amplifier[f]

For frequencies up to 100 MHz and a maximum "ON" time[g] of 2500 μs in any 40,000-microsecond interval

Maximum Ratings, Absolute-Maximum Values:

	4647	4648		
Peak Positive-Pulse Plate Voltage[h]	32	32	max.	kV
Peak Positive-Pulse Grid-No.2 Voltage[j,k]	1500	1500	max.	V
DC or Peak Negative-Pulse Grid-No.1 Voltage	400	400	max.	V
Peak Plate Current	28	55	max.	A
Peak Grid-No.2 Current	2.0	4.0	max.	A
Peak Rectified Grid-No.1 Current	2.5	5.0	max.	A
DC Plate Current	1.7	3.4	max.	A

	4647	4648	
DC Grid-No.2 Current	120	250	max. mA
DC Grid-No.1 Current	150	310	max. mA
Plate Dissipation[m] (Average)	20	40	max. kW

Typical Plate-Pulsed Operation:

In Class B service at 425 kHz with a rectangular waveshape pulse at a duty factor[g] of 0.06 and a pulse duration[g] of 2000 microseconds.

	4647	4648	
Peak Positive-Pulse Plate Voltage[h]	30	30	kV
Peak Positive-Pulse Grid-No.2 Voltage[j]	1400	1400	V
Peak Negative-Pulse Grid-No.1 Voltage[n]	225	225	V
Peak Plate Current	25	50	A
Peak Grid-No.2 Current	1.3	2.5	A
Peak Rectified Grid-No.1 Current	2.5	5.0	A
DC Plate Current	1.5	3.0	A
DC Grid-No.2 Current	80	150	mA
DC Grid-No.1 Current	150	300	mA
Peak Driver Power Output (approx.)	750	1500	W
Output Circuit Efficiency (approx.)	95	95	%
Useful Peak Power Output	500	1000	kW

RF Power Amplifier[f] — Class C Telegraphy and RF Power Amplifier[f] — Class C FM Telephony

Maximum CCS Ratings, Absolute-Maximum Values: Up to 100 MHz

	4647	4648	
DC Plate Voltage	22	22	max. kV
DC Grid-No.2 Voltage	1400	1400	max. V
DC Grid-No.1 Voltage	–400	–400	max. V
DC Plate Current	23	45	max. A
Plate Dissipation[m]	125	250	max. kW
Grid-No.2 Dissipation[m]	1.8	3.5	max. kW
Grid-No.1 Dissipation[m]	1.5	3.0	max. kW

Typical CCS Operation: At 425 kHz

	4647	4648	
DC Plate Voltage	20	20	kV
DC Grid-No.2 Voltage	1200	1200	V
DC Grid-No.1 Voltage	–225	–225	V
Peak RF Grid-No.1 Voltage	285	285	V
DC Plate Current	19	38	A

	4647	4648	
DC Grid-No.2 Current	0.8	1.3	A
DC Grid-No.1 Current	1.8	3.5	A
Driver Power (approx.)	500	1000	W
Circuit Efficiency (approx.)	95	95	%
Useful Power Output (approx.)	250	500	kW

Plate-Modulated RF Power Amplifier[f] – Class C Telephony

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

Maximum CCS Ratings, Absolute-Maximum Values: Up to 100 MHz

	4647	4648		
DC Plate Voltage	16	16	max.	kV
DC Grid-No.2 Voltage	1100	1100	max.	V
DC Grid-No.1 Voltage	–400	–400	max.	V
DC Plate Current	13	25	max.	A
Plate Dissipation[m]	75	150	max.	kW
Grid-No.2 Dissipation[m]	1.3	2.5	max.	kW
Grid-No.1 Dissipation[m]	1.3	2.5	max.	kW

Typical Operation

At 425 kHz

	4647	4648	
DC Plate Voltage	14	14	kV
DC Grid-No.2 Voltage	1000	1000	V
DC Grid-No.1 Voltage	–250	–250	V
Peak RF Grid-No.1 Voltage	280	280	V
DC Plate Current	11	22	A
DC Grid-No.2 Current	.700	1.3	A
DC Grid-No.1 Current	1.3	2.5	A
Driver Power Output (approx.)	375	750	W
Output-Circuit Efficiency (approx.)	95	95	%
Useful Power Output (approx.)	100	200	kW

a The filament, when operated near its maximum current is capable of providing emission in excess of service requirements for which the tube is rated. To extend the filament life, it is recommended that the filament current be reduced to a value that will give adequate but not excessive emission. For accurate measurement it is essential that the filament voltage be measured at the respective coolant terminals on the tube side of the coupling thread.

b The tube coolant ducts must be free of water before storage or shipment of the tube to prevent damage from freezing.

c The external gas pressure is related to the output cavity pressurization required to prevent corona or external arc-over.

d For additional information on liquid cooling see Section IV of the "Application Guide for RCA Power Tubes" 1CE-279A.

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

f See *RCA Transmitting Tube Operating Considerations*, CLASSES OF SERVICE given at front of this section.

g Refer to 1CE-279A for definitions.

h The magnitude of any spike on the plate voltage pulse should not exceed the peak value of the plate voltage pulse 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 circuit may require pressurization to prevent corona or external arc-over at the ceramic insulator.

j The magnitude of any spike on the grid-No.2 voltage pulse should not exceed the peak value of the grid-No.2 voltage pulse 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.

k A negative dc voltage of 300 volts maximum may be applied to grid No.2 to prevent any tube conduction between pulses.

m Determined by calorimeter measurements. Power specified includes intercepted power radiated from the filaments.

n The grid-No.1 voltage may be a combination of fixed and self bias obtained from a series grid resistor.

Handling (Each Type)

General information for handling RCA large power tubes is given in Section II-D of RCA's "Application Guide for RCA Power Tubes", 1CE-279A. During shipment the tube is suspended by springs in a crate. An AJ2195 Lifting Adaptor, featuring a 1.0-inch I.D. eyebolt, must be attached to the tube before removing it from the shipping crate. The use of a hoist capable of lifting a weight of 100 lbs is recommended for the uncrating operation.

Uncrating Instructions (Each Type)

The following is the recommended procedure for removing this tube from its shipping crate.

1. Cut the two metal bands which close the crate. Remove the two "ball" seals. Disengage the two hasps and remove the crate lid.
2. Open the two drop flaps on the sides of the crate.
3. Cut the wires threaded through the four wing nuts that secure the wooden mounting plate for the tube to the spring supported frame. Unscrew and remove the wing nuts and washers. Save the wing nuts and washers for Step 8.
4. Cut open the top of plastic bag enclosing the tube. Attach the AJ2195 Lifting Adaptor to the ground surface ring surrounding the grid-No.1 terminal using four 10-32 bolts.
5. Connect a hoist to the eyebolt of the lifting fixture. Raise the tube and wooden mounting plate from the crate.
6; Remove the wooden mounting plate from the tube by cutting and removing the safety wire and then unscrewing the four cap screws. Do not drop the wooden mounting plate.
7. Remove the plastic bag from the tube.
8. Reattach the wooden mounting plate to the spring supported frame using the washers and wing nuts from Step 3. Replace the crate lid. Retain the crate for future tube shipment or storage.

Tube Mounting (Each Type)

It is recommended that the tube be mounted with the axis vertical and either end up. In either case, support the weight of the tube on or by the indicated mounting surface shown on the tube outline drawing. Eight equally spaced 1/4-28 tapped holes on a 9.25-inch (23.5 mm) dia. bolt circle are provided in this surface for securing the tube in place.

If the tube is to be mounted with the input end up, the tube may be placed directly into the operating position with the hoist setup of Step 7 of the Uncrating Instructions. After mounting, the AJ2195 Lifting Adaptor should be removed from the tube and stored for future use.

If the tube is to be mounted with the output end up special care must be taken when turning it around. The recommended procedure is as follows:

1. Lift tube using the Lifting Adaptor AJ2195.
2. Attach a 15-inch diameter mounting plate to the tube mounting surface. This plate shall have two eye-bolts 180° apart in a horizontal plane. Use all eight mounting holes. See accompanying *Mounting Plate and Lifting Recommendation.*
3. Set tube down resting on mounting plate.
4. Remove the Lifting Adaptor AJ2195.
5. Lift tube using the eye-bolts on the mounting plate. It is important that the tube be held steady while being raised.
6. Carefully turn tube end for end.
7. Set tube down on stand so that it will be suspended from the mounting plate.

Cooling Considerations (Each Type)

Consult Section IV of 1CE-279A for general recommendations on liquid cooling.

The weight of the coolant hoses must be externally supported to insure against applying excessive mechanical stress to the tube.

Anode Coolant Separator (Each Type)

The AJ2196 Plate Coolant Separator was designed as an accesory for this tube and must be ordered as a separate item. Unless ordered, the tube will be delivered without a water separator. The coolant separator shall be installed in accordance with the following procedure.

1. Visually inspect the coolant separator and tube anode water cavity to assure that they are clean and free of particles. Caution: Do not clean the anode coolant fins mechanically.
2. Place a clean, lubricant-free "O" ring (uniform size No. 237) in the moat on the anode flange.
3. Carefully insert the AJ2196 Plate Coolant Separator into the anode cavity so as not to damage the anode coolant fins along the side of the anode cavity. Note: No force is required to insert the separator. After the coolant separator has been completely inserted rotate it, if necessary, to line up the clearance holes in the separator with the tapped holes in the anode flange.
4. Secure the separator in place with eight 1/4-20 NC x 5/8-inch long stainless steel, binding-head screws.

Coolant Course Inspection (Each Type)

Please consult Section IV-D of 1CE-279A for instructions on "Inspection of Coolant Courses" and Section IV-E for instructions on "Cleaning Coolant Courses." Attention is directed especially to the anode coolant fins which are soft and easily damaged. Do not attempt to clean these fins by mechanical methods.

Electrical Considerations (Each Type)

Please consult 1CE-279A. Attention is directed to Section III-B for the design of electrical connections and to Section VI for general electrical considerations.

Electrical requirements unique to this tube include the following items:

A. Filament

A dc filament supply is required. Filament excitation with an ac supply may generate mechanical resonances in the cathode structure.

The dc electrical filament connections must be made as follows: the positive lead is connected to the filament terminal and coolant connection on the input end of the tube using the AJ2198 connector. The negative lead is connected to the dc filament ground terminal on the output end of the tube using all eight 1/4-28 tapped holes.

B. RF Driver

The value of drive power given under typical operation represents the approximate drive power required at the specified operating frequency. The driver stage should be designed to provide an excess of power over that indicated to take care of variations in line voltage and initial tube characteristics, changes in components, and tube characteristics during life, and transmission line mismatches.

The input impedance of this tube may vary over a considerable range. The exact range is a function of the grid bias and input rf voltage swing. In instances where the input rf voltage swing exceeds the bias level, the input impedance of the tube will decrease considerably. This change in input drive impedance may limit the input drive voltage unless the circuit designer utilizes a low impedance bias supply and driver circuit. The RF input circuit should be connected between the RF-Grid-No.1 terminal and the RF Input Cathode Terminal. **Caution: The RF Input Cathode terminal is at filament potential and must never be connected directly to the Grid-No.1 terminal or ground.** For drive circuit recommendations, please consult your RCA representative or RCA Large Power Tube Application Engineering, Lancaster, PA 17604.

C. Control Grid and Screen Grid

Due to power radiation from the filament and secondary electron emission, the control and screen grid power dissipation will be higher than that indicated by the voltage-current product for each grid. The actual dissipations must be measured calorimetrically by measuring the electrode inlet and outlet water temperatures and the coolant flow. For temperatures measured in ^{o}C and for water flow in GPM, the dissipation may be calculated using the equation:

Power Dissipation in kW = 0.264 (GPM) $(T_{out} - T_{in})$

X-Radiation Warning
X-radiation may be produced when operating this tube. For each installation, the X-radiation must be checked and shields provided if the radiation level exceeds safe limits.

Protection Circuitry (Each Type)

Protection circuits serve a three-fold purpose; safety of personnel; protection for the tube in the event of abnormal circuit operation; and protection of the tube circuits in the event of abnormal tube operation.

Large power tubes require protective devices to insure against high voltage shocks, rf radiation, loss of coolant flow, inadequate warm-up, etc. A full treatment of protective requirements is covered in Section VI.B of the "Application Guide for RCA Power Tubes" 1CE-279.

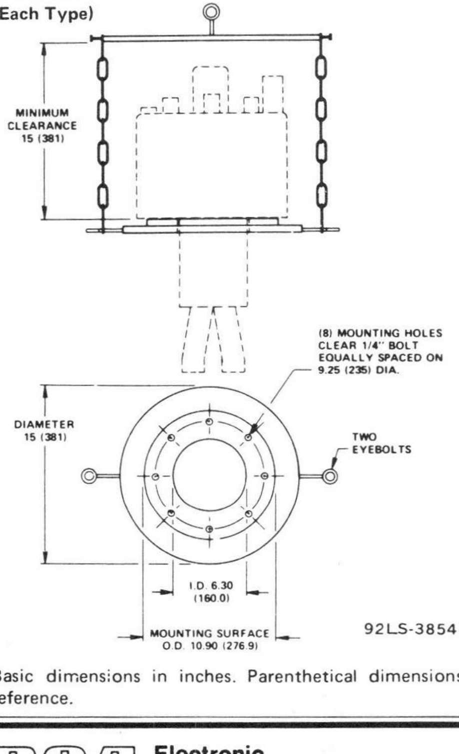
Filament, Grid No. 1 and Grid No. 2 (Type 4647)
Flow and Pressure Drop Characteristics for Water

Coolant Course	Flow				Max. Press. Diff. for typ. flow[e]	
	Abs. min.		Typ. flow			
	gpm	cc/s	gpm	cc/s	psi	kg/cm^2
Filament	1.5	95	2.0	126	15	1.05
Filament Ground	1.5	95	2.0	126	15	1.05
Grid No.1	1.5	95	2.0	126	17	1.19
Grid No.2	1.5	95	2.0	126	15	1.05

Filament, Grid No. 1 and Grid No. 2 (Type 4648) Flow and Pressure Drop Characteristics for Water

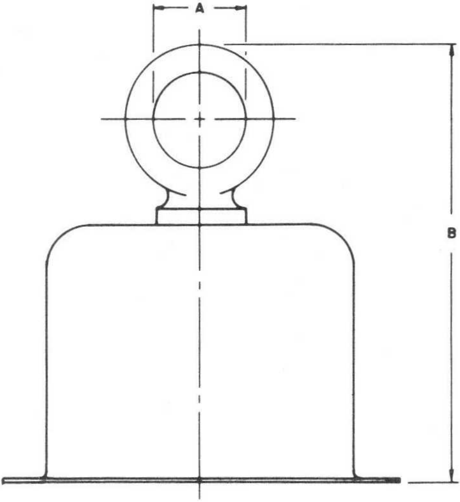
Coolant Course	Flow				Max. Press. Diff. for typ. flow[e]	
	Abs.		Typ. flow			
	gpm	cc/s	gpm	cc/s	psi	kg/cm^2
Filament	2.0	126	2.5	158	20	1.40
Filament Ground	2.0	126	2.5	158	20	1.40
Grid No.1	2.0	126	2.5	158	23	1.61
Grid No.2	2.0	126	2.5	158	20	1.40

MOUNTING PLATE AND LIFTING RECOMMENDATION (Each Type)



Basic dimensions in inches. Parenthetical dimensions in mm for reference.

LIFTING ADAPTER AJ2195 (Each Type)



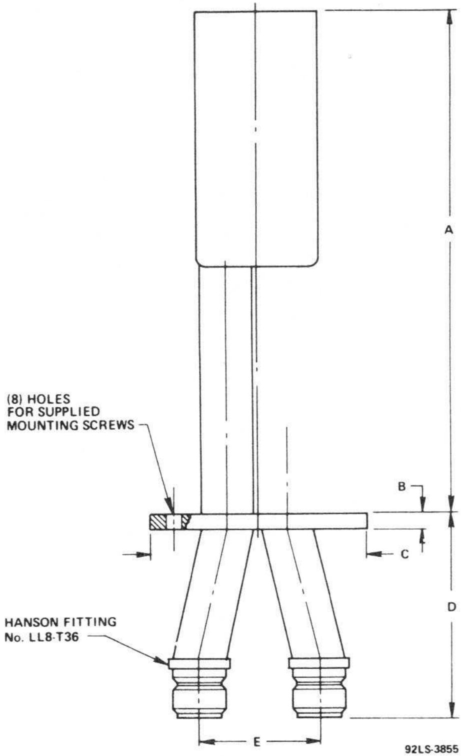
92LS-2638R1

Tabulated Dimensions*

Dimension	Inches	Millimeters
A Dia.	0.88 Min.	22.3 Min.
B	5.0 Max.	127 Max.

*Basic dimensions are in inches. Metric dimensions are derived from the basic inch dimension (1 inch = 25.4 mm)

PLATE COOLANT SEPARATOR AJ2196 (Each Type)

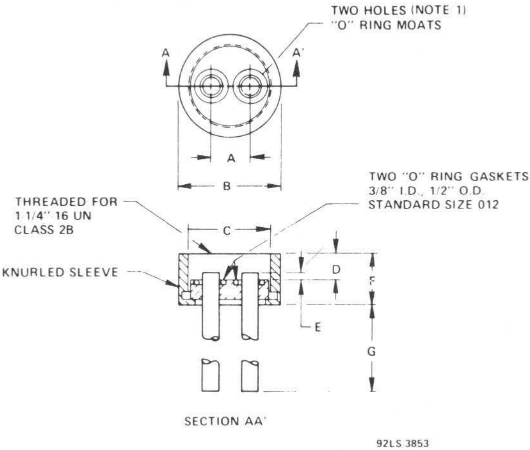


Tabulated Dimensions*

Dimension	Inches	Millimeters
A	10.95 Max.	278.1 Max.
B	0.35 ± .02	8.89 ± .51
C Dia.	5.20 ± .01	32.08 ± .25
D	5.5 Max.	139 Max.
E	2.60 ± .20	66.1 ± 5.1

*Basic dimensions are in inches. Metric dimensions are derived from the basic inch dimension (1 inch = 25.4 mm).

COOLANT CONNECTOR AJ2197 (Each Type)



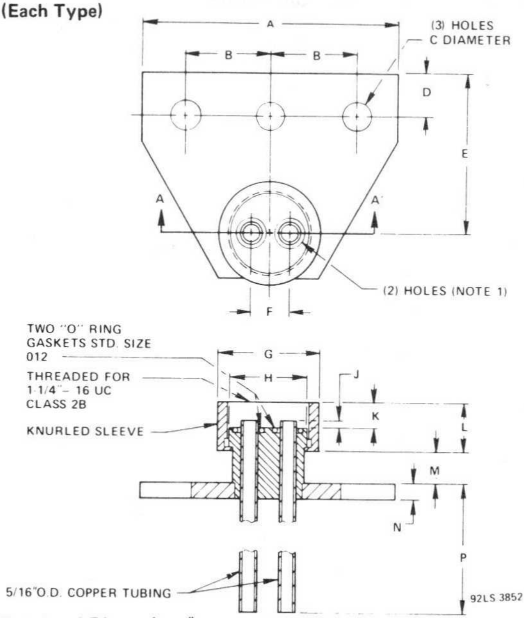
Tabulated Dimensions*

Dimension	Inches	Millimeters
A	0.53	13.5
B Dia.	1.50	38.1
C Dia.	1.15	29.2
D	0.38	9.6
E	0.12	3.0
F	0.69	17.5
G	3.32 Min.	84.3 Min.

Note 1— "O" Ring Moat has an OD of 0.485" (12.32 mm) and a depth of 0.05" (1.3 mm)

*Basic dimensions are in inches. Metric dimensions are derived from the basic inch dimension (1 inch = 25.4 mm).

FILAMENT ELECTRICAL AND COOLANT CONNECTOR AJ2198 (Each Type)

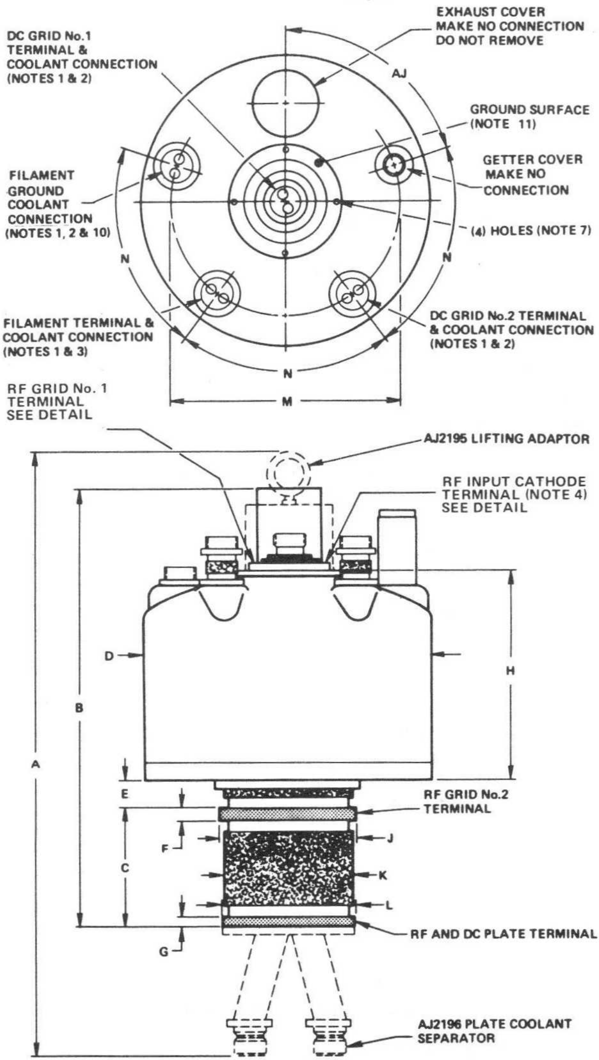


Tabulated Dimensions*

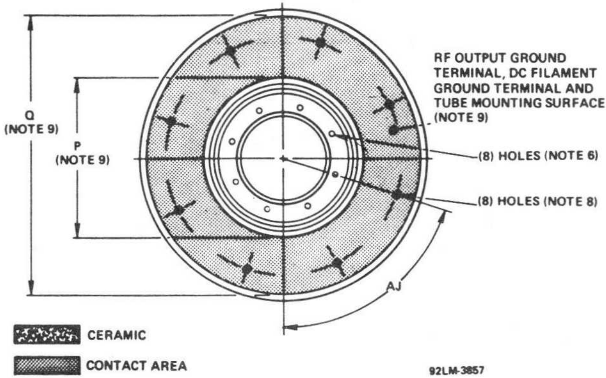
Dimension	Inches	Millimeters
A	3.75	95.3
B	1.25	31.7
C	0.39	9.9
D	0.62	15.7
E	2.37	60.2
F	0.53	13.5
G	1.50	38.1
H	1.15	29.2
J	0.12	3.0
K	0.38	9.6
L	0.69	17.5
M	0.69	17.5
N	0.25	6.4
P	2.62 Min.	66.7 Min.

Note 1— Moat for "O" ring has an OD of 0.485 inch (12.3 mm) and a depth of 0.05 inch (1.3 mm).

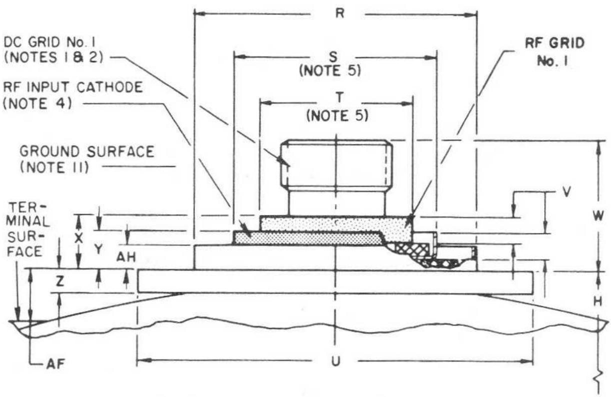
DIMENSIONAL OUTLINE (Each Type)



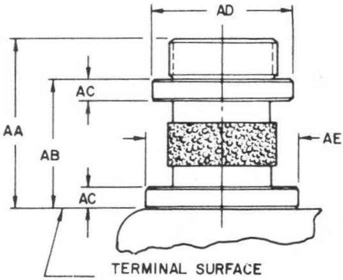
DIMENSIONAL OUTLINE (Bottom View)



DETAIL OF RF INPUT CATHODE AND RF GRID NO. 1 TERMINAL, CONTACT SURFACES AND DC GRID NO. 1 TERMINAL

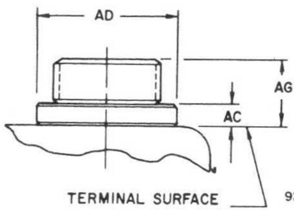


Detail of Filament and DC Grid No.2 Terminals



92LS–2640

Detail of Filament Ground Terminal



92LS–2641

Notes for Dimensional Outline

1. Terminal is 1-1/4" dia. threaded 0.5" (12.7 mm) long with 16 UN class 2A thread. It has two holes 0.312" 0.324" (7.92–8.23 mm) diameter spaced 0.531" (13.49 mm) on centers.
2. Terminal will accept coolant connector AJ2197.
3. Terminal will accept filament electrical and coolant connector AJ2198.
4. The RF Input Cathode Terminal is at filament potential. Do not ground.
5. This diameter dimension is held only over length of V.
6. Eight (8) holes tapped 1/4"-20 NC equally spaced on a 4.20" (106.7 mm) diameter bolt circle.
7. Four (4) holes tapped 10-32 NF to a minimum depth of .20" (5.1 mm) equally spaced on a 4.20" ± .03" (106.68 ± .76 mm) diameter bolt circle.
8. Eight (8) holes, tapped 1/4"-28 NF to a minimum depth of

.30" (7.6 mm) equally spaced on a 9.25" ± .03" (234.95 ± .76 mm) diameter bolt circle.

9. Contact should not be made at a diameter smaller than 6.30" (160.0 mm) nor greater than 10.90" (276.9 mm).

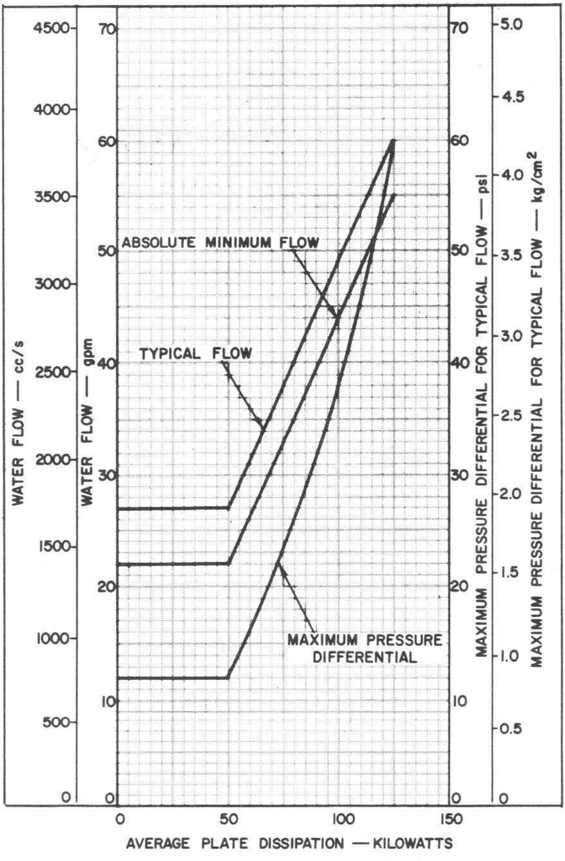
10. Make no electrical connections.

11. Ground surface is used to attach Lifting Adaptor AJ2195 and may be used during operation to support input circuit components at ground potential.

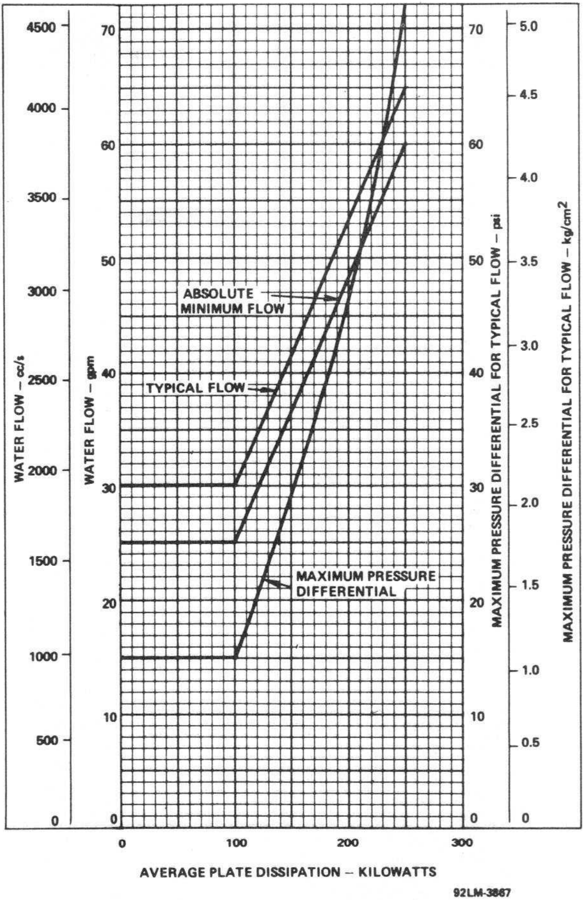
Tabulated Dimensions for Dimensional Outline

Dimension	Inches	Millimeters	Degrees
A	26.0 max.	660 max.	
B	18.5 max.	470 max.	
C	4.84 ± .02	122.94 ± .51	
D Dia.	11.65 max.	295.9 max.	
E	1.07 ± .03	27.18 ± .76	
F	0.52 ± .01	13.21 ± .25	
G	0.42 ± .01	10.67 ± .25	
H	8.35 ± .10	212.1 ± 2.5	
J Dia.	5.50 ± .01	139.70 ± .25	
K Dia.	5.12 ± .10	130.0 ± 2.5	
L Dia.	5.25 ± .01	133.35 ± .25	
M Dia.	9.10 ± .08	231.1 ± 2.0	
N	–	–	$72^{o} \pm 3^{o}$
P Dia.	6.30 max.	160.0 max.	
Q Dia.	10.90 min.	276.9 min.	
R Dia.	3.30 max.	83.9 max.	
S Dia.	2.319 ± .012	58.90 ± .30	
T Dia.	1.725 ± .015	43.82 ± .38	
U	4.50 ± .02	114.30 ± .51	
V	0.24 min.	6.1 min.	
W	1.47 ± .06	37.3 ± 1.5	
X	0.63 ± .06	16.00 ± 1.52	
Y	0.46 ± .06	11.68 ± 1.52	
Z	0.22 ± .02	5.59 ± .51	
AA	2.00 ± .05	50.8 ± 1.3	
AB	1.50 ± .04	38.10 ± 1.02	
AC	0.25 ± .02	6.35 ± .51	
AD Dia.	1.62 ± .02	41.15 ± .51	
AE Dia.	1.74 ± .02	44.20 ± .51	
AF	0.62 ± .10	15.7 ± 2.5	
AG	0.75 ± .05	19.0 ± 1.3	
AH	0.45 max.	11.4 max.	
AJ			$72^{o} \pm 5^{o}$

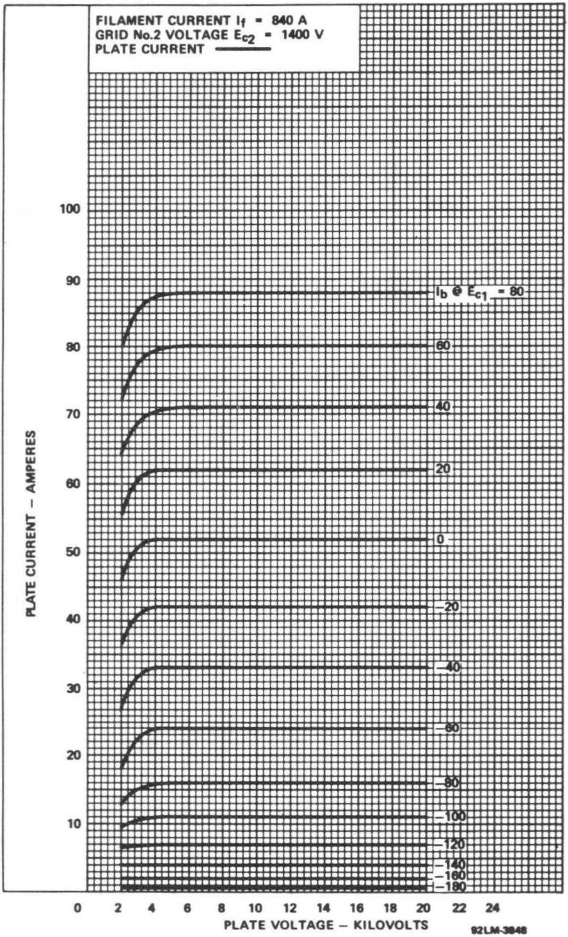
COOLING CHARACTERISTICS (Type 4647)



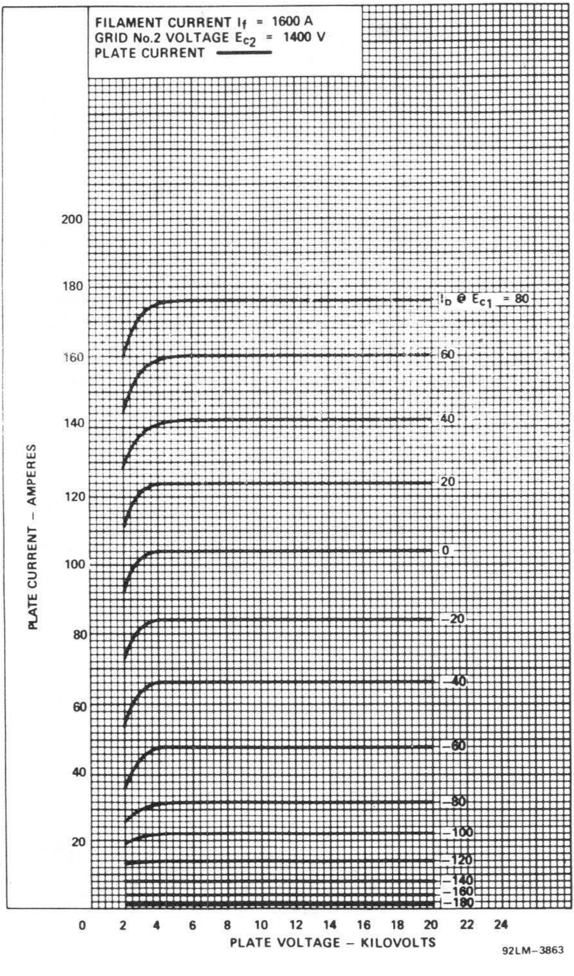
COOLING CHARACTERISTICS (Type 4648)



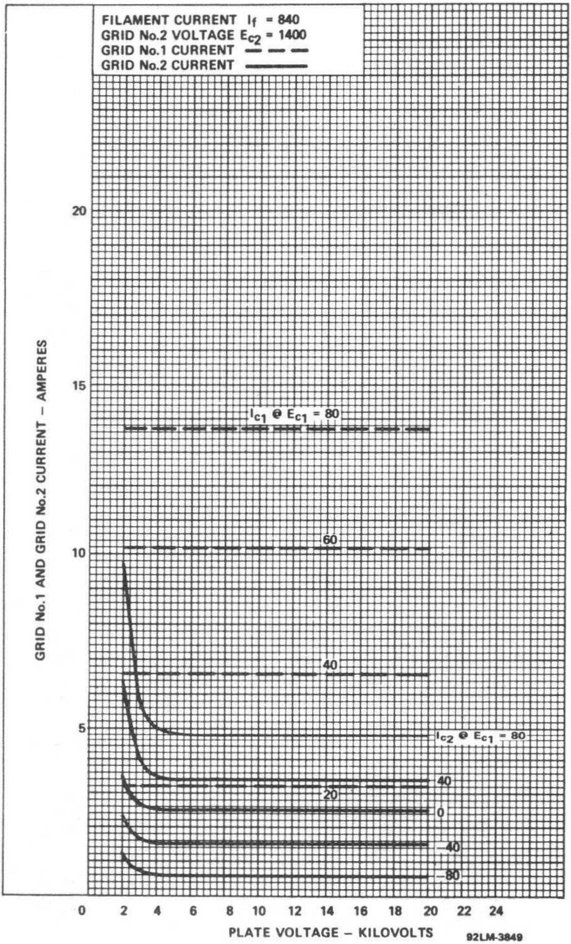
TYPICAL PLATE CHARACTERISTICS (E_{c2} = 1400 V)
(Type 4647)



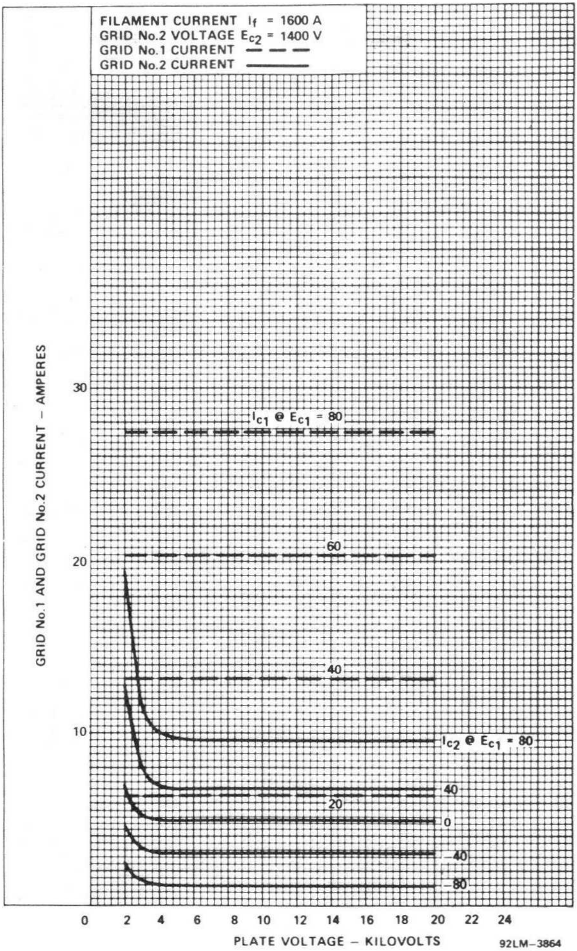
TYPICAL PLATE CHARACTERISTICS (E_{c_2} = 1400 V) (Type 4648)



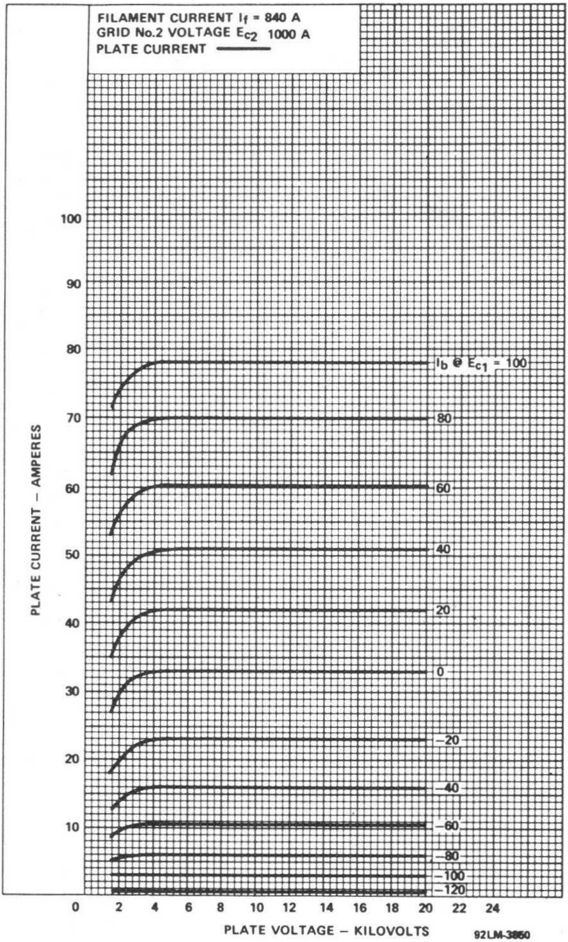
TYPICAL CHARACTERISTICS (E_{c_2} = 1400 V)
(Type 4647)



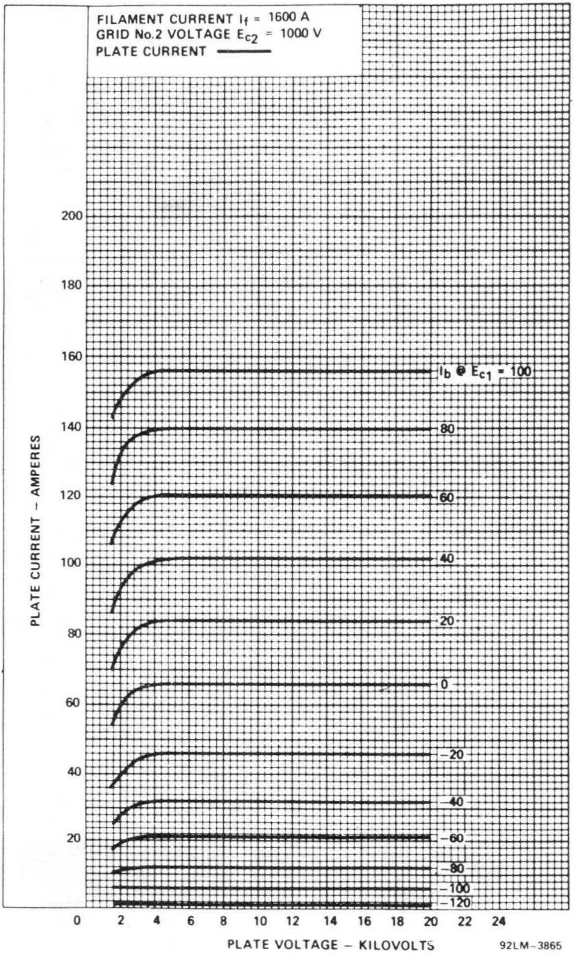
TYPICAL CHARACTERISTICS (E_{c_2} = 1400 V)
(Type 4748)



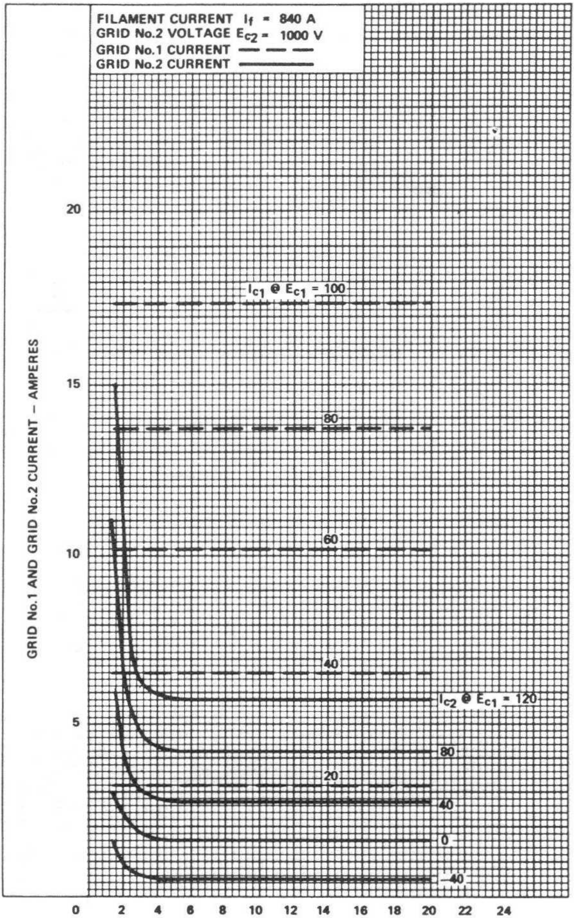
TYPICAL PLATE CHARACTERISTIC (E_{c_2} = 1000 V)
(Type 4647)



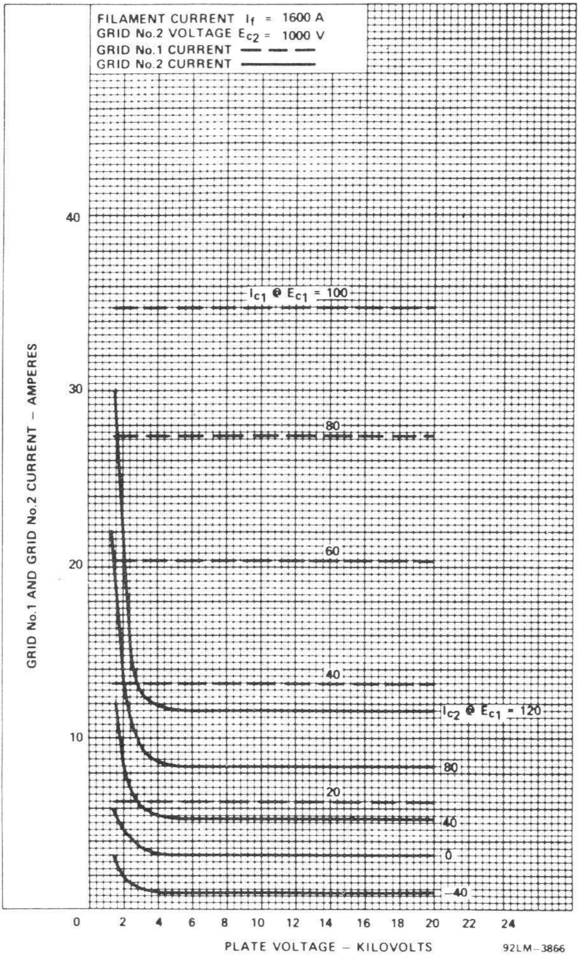
TYPICAL PLATE CHARACTERISTIC (E_{c_2} = 1000 V)
(Type 4648)



TYPICAL CHARACTERISTICS (E_{c_2} = 1000 V)
(Type 4647)



TYPICAL CHARACTERISTICS (E_{c_2} = 1000 V) (Type 4648)



Beam Power Tube

CERMOLOX

Ruggedized — **Full Input to 400 MHz**
1000 Watts PEP Output — **Matrix Cathode**
37 dB Open-Loop Third Order Distortion

ELECTRICAL

Heater-Cathode:		
Type	Unipotential, Oxide Coated, Matrix	
Voltage (ac or dc)	5.5 typ.-5.8 max.	V
Current at 5.5 V	17.3	A
Surge Current (RMS) (Under any conditions)	50 max.	A
Minimum Heating Time	180	s
Mu Factor (Grid No.1 to Grid No.2)	7	

MAXIMUM CCS RATINGS, Absolute-Maximum Values:

	Up to 400 MHz	
DC Plate Voltage	3500 max.	V
DC Grid-No.2 Voltage	1000 max.	V
DC Plate Current at Peak of Envelope	1.25 max.	A
Grid-No.2 Input	50 max.	W
Plate Dissipation	1.5 max.	kW

MECHANICAL

Operating Position	Any
Weight (Approx.)	2 lb (0.9 kg)

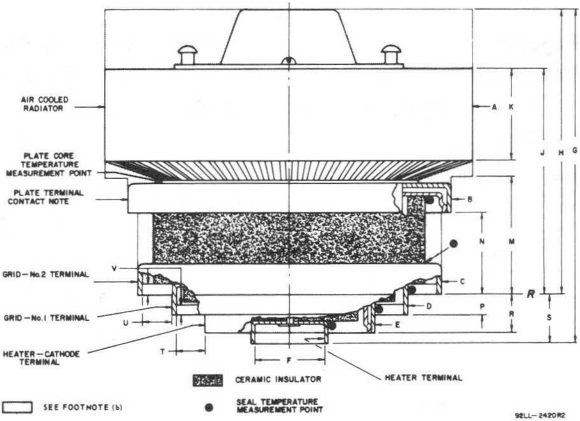
THERMAL[a]

Seal Temperature (Plate, Grid No.1, Grid No.2 Cathode-Heater, and Heater)	250 max.	°C
Plate-Core Temperature	250 max.	°C

[a] See *Dimensional Outline* for temperature measurement points.
[b] Keep all strippled regions clear. Do not allow contacts or circuit components to protrude into these annular regions.

Detailed performance and application information is available through your RCA Sales Office, Distributor, or write to RCA Commercial Engineering, Harrison, N.J. 07029.

DIMENSIONAL OUTLINE



DIMENSION	INCHES	MILLIMETERS
A Dia.	3.72 ±.03	94.49 ±.76
B Dia.	3.210 Min.	81.54 Min.
C Dia.	3.010 Min.	76.45 Min.
D Dia.	2.307 Min.	58.60 Min.
E Dia.	1.710 Min.	43.41 Min.
F Dia.	0.725 Max.	18.41 Max.
G	3.24 ±.10	82.3 ±2.5
H	2.78 ±.07	70.61 ±1.78
J	2.19 ±.04	55.63 ±1.02
K	0.85 Min.	21.59 Min.
M	$1.160 ^{+.005}_{-.000}$	$29.464 ^{+.127}_{-.000}$
N	0.82 ±.03	20.83 ±.76
P	0.200 ±.025	5.08 ±.63
R	0.37 ±.03	9.40 ±.76
S	0.46 ±.03	11.68 ±.76
T	0.200 Min.	5.08 Min.
U	0.250 Min.	6.35 Min.
V	0.105 Min.	2.66 Min.

Beam Power Tube

Quick-Heating Filament | **High Power Sensitivity**

90 Watts CW Input (ICAS) up to 60 MHz
60 Watts CW Input (ICAS) at 175 MHz
For use as an rf power amplifier in communications equipment

ELECTRICAL

Filament, Coated:

Voltage (AC or DC)	1.6 ± 10%	V
Current at 1.6 volts	3.2	A
Heating time	1	s
Transconductance[a]	6000	μmho
Mu-Factor[a], Grid No.2 to Grid No.1	4	

Direct Interelectrode Capacitances:

Grid No.1 to plate	0.24 max.	pF
Grid No.1 to filament & grid No.3 & internal shield, base sleeve and grid No.2	11	pF
Plate to filament & grid No.3 & internal shield, base sleeve and grid No.2	8.5	pF

MECHANICAL

Operating Position	Vertical, or horizontal with plane of pins 3 and 7 vertical
Maximum Overall Length	3-13/16"
Seated Length	3-1/8" ± 1/8"
Maximum Diameter	1-21/32"
Bulb	T-12
Cap	Small (JEDEC No.C1-1)
Base	Small wafer octal 8-pin with sleeve (JEDEC Group 1, No.B8-150)
Bulb Temperature (At hottest point)	220 max. °C

RF POWER AMPLIFIER & OSC. – CLASS C TELEGRAPHY[b] AND RF POWER AMPLIFIER – CLASS C FM TELEGRAPHY

Maximum ICAS Ratings, *Absolute-Maximum Values:*

	Up to 60 MHz	
DC Plate Voltage	750 max.	V
DC Grid-No.2 Voltage	250 max.	V

DC Grid-No.1 Voltage	-150 max.	V
DC Plate Current	150 max.	mA
DC Grid-No.1 Current	4 max.	mA
Plate Input	90 max.	W
Grid-No.2 Input	3 max.	W
Plate Dissipation	25 max.	W

Typical Operation as Amplifier at 175 MHz

DC Plate Voltage	400	V
DC Grid-No.2 Voltage[c]	190	V
From a series resistor of	18000	Ω
DC Grid-No.1 Voltage[d]	-60	V
From a grid resistor of	30000	Ω
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	W
Power Output (Approx.)	30	W

Maximum Circuit Values:

Grid-No.1 Circuit Resistance	30000 max.	Ω

[a] For plate volts = 200 V, grid No.2 volts = 200 V, and plate current = 100 mA.

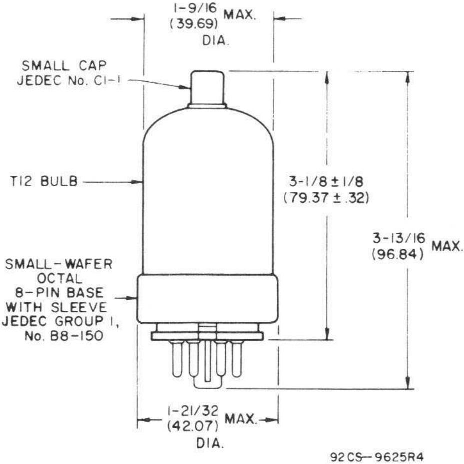
The following footnotes apply to the *RCA Transmitting Tube Operating Considerations* given at front of this section.

[b] See *Classes of Service.*

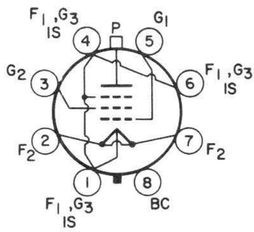
[c] See *Electrical Considerations* - Grid-No.2 Voltage Supply.

[d] See *Electrical Considerations* - Grid-No.1 Voltage Supply.

DIMENSIONAL OUTLINE – Dimensions In Inches (mm)



TERMINAL DIAGRAM (Bottom View)



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

C Band Klystron

- Gang Tuned Cavities
- Air Cooled
- High Efficiency
- High Power Gain
- Compact
- Sturdy

Frequency . . . . 4.4 to 5.0 GHz

ELECTRICAL

Cathode . . . . Indirectly-heated Tungsten Dispenser Cathode

Filament:

Voltage	6.5 ± 0.5	V
Current at 6.5 V	7.6	A
Maximum current	8.2	A
Warmup time (min.)	180	s

MECHANICAL

Mounting Position			Any
Length (max.)	(393 mm)	15.5	in
Width (max.)	(267 mm)	10.5	in
Weight (approx.)	(17.2 kg)	38	lb
In commercial pack	(18.1 kg)	40	lb
In military pack	(22.5 kg)	50	lb

THERMAL

Collector Temperature (max.)	260	^oC
Body Temperature (max.)	150	^oC
Tuner Fin Temperature (max.)	150	^oC
Electron Gun Potting		
Insulation temperature (max.)	250	^oC
Storage temperature (min.)	-65	^oC

Cooling

Forced air flow across the collector, body, and tuner, is required. Typical air requirements for operation with 20^o C ambient air temperature at sea level are:

	Min Reg Air Flow lb/min	Min Reg Air Flow kg/min	Max Press-Drop in H_2O	Max Press-Drop cm H_2O
Collector	7.5	3.4	2.0	5.1
Body & Tuners	0.85	0.38	0.75	1.9

PERFORMANCE

Maximum CW Ratings, Absolute-Maximum Values:

DC Beam Voltage	8.5	kV
DC Beam Current	600	mA
DC Body Current	60	mA
Surge Current	25	A
Load VSWR	2.0:1	
Input VSWR	2.0:1	

Typical CW Operation:

High Efficiency Tuned

Frequency	**4.4 GHz**	**5.0 GHz**	
DC Beam Voltage	7.5	7.5	kV
DC Beam Current	490	490	mA

High Efficiency Tuned

Frequency	**4.4 GHz**	**5.0 GHz**	
DC Body Current	10.0	10.0	mA
RF Power Output	1.45	1.30	kW
Bandwidth (3 dB)	8.0	10.0	MHz
Efficiency	39.0	35.0	%
Gain	44.0	44.0	dB
Drive	50.0	50.0	mW
Load VSWR	1.05:1	1.05:1	–
Input VSWR	1.3:1	1.3:1	–

High Gain Tuned

Frequency	**4.4 GHz**	**5.0 GHz**	
DC Beam Voltage	7.5	7.5	kV
DC Beam Current	490	490	mA
DC Body Current	10.0	10.0	mA
RF Power Output	1.30	1.15	kW
Bandwidth (3 dB)	6.0	8.0	MHz
Efficiency	35.0	31.0	%
Gain	51.0	51.0	dB
Drive	10.0	10.0	mW
Load VSWR	1.05:1	1.05:1	–
Input VSWR	1.3:1	1.3:1	–

Broadband Tuned

Frequency	4.4 GHz	5.0 GHz	
DC Beam Voltage	7.5	7.5	kV
DC Beam Current	490	490	mA
DC Body Current	10.0	10.0	mA
RF Power Output	1.35	1.25	kW
Bandwidth (3 dB)	13.0	19.0	MHz
Efficiency	36.0	33.0	%
Gain	41.0	41.0	dB
Drive	100.0	100.0	mW
Load VSWR	1.05:1	1.05:1	–
Input VSWR	1.3:1	1.3:1	–

GENERAL INFORMATION

Installation and Operation

No installation or operation should be attempted without first consulting the Installation and Operating Instructions shipped with each tube or available on request from Super Power Marketing, RCA, Lancaster, PA.

RCA reference publications required for the installation and operation of this device include the following:

Data Sheet – RCA-4658
Application Note AN 4213
Application Guide 1CE-279A

These publications are available as a complete packet – request PWR 543 "Applications Information for the RCA-4658 klystron."

Personnel Safety

The high voltages and microwave radiations from this device can be dangerous to life. High voltage shielding and interlock precautions must be taken and all rf connections must be tightly closed and rf terminals shielded.

Packaging

Two types of packaging are available with these tubes; Commercial Pack and Military Pack. The customer specifies the desired type.

The Commercial Pack is made of nesting carboard cartons with the inner carton shock-mounted. The Military Pack complies with MIL-S-4473C for air shipment. It uses a hermetically-sealed metal container which protects the tube and serves to shield the area surrounding the pack from stray magnetic fields set up by the klystron focusing magnet.

In shipment, the tube is enclosed in a polyethylene bag to prevent dust and other particles from collecting in the waveguide or tuning system. It is recommended that the tube be stored in the bag and in the shipping container when not in use. Dust or other unwanted particles in the waveguide can cause arcing during operation and subsequent tube destruction.

Cooling

Air ducts must be provided to connect to the top of the collector and the tuner cooling duct. See Outline Drawing.

Mounting

Four holes are provided in the gun-end of the focusing magnet for mounting purposes. Only non-magnetic studs should be used.

Thermocouple

A thermocouple mounted on the collector provides a signal output for excessive collector temperature. This output is used to operate protective circuitry.

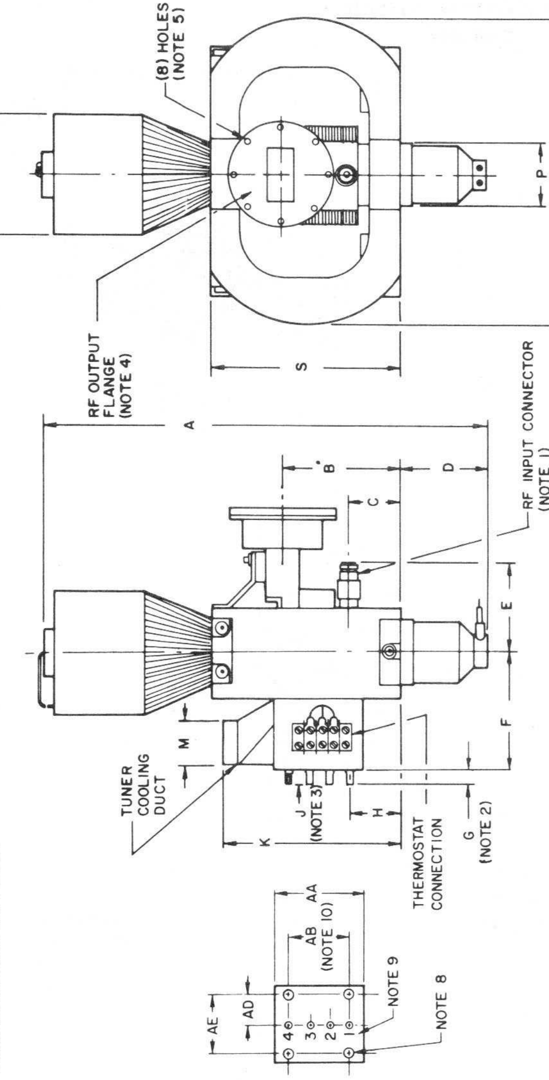
Tuning

Tuning is accomplished by a single knob which "gang-tunes" all four cavities simultaneously. The second, third and output cavities may be individually trimmed for optimizing the tube performance at any frequency within the tube operating band. See Outline Drawing.

Protection Circuits

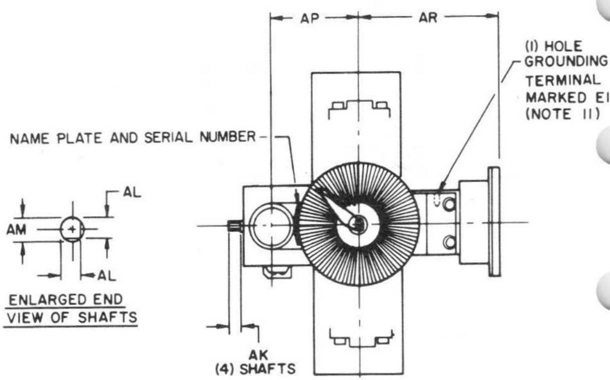
Protection circuits serve a threefold purpose: safety of personnel, protection of the tube and protection of tube circuits. Consult Application Guide 1CE-279A for complete information on protection circuits.

DIMENSIONAL OUTLINE

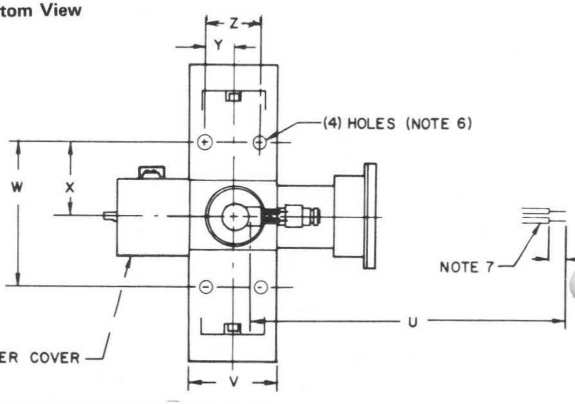


DIMENSIONAL OUTLINE

(Top View)



Bottom View



TABULATED DIMENSIONS for the Outline Drawing

Dimension Reference	Specified Values Inches		Millimeters	
A	15.5	max.	393.7	max.
B	4.06	±.12	103.1	±3.0
C	1.80	±.12	45.7	±3.0
D	3.5	max.	88.9	max.
E	3.00	±.06	76.2	±1.5
F	3.80	±.12	96.5	±3.0

TABULATED DIMENSIONS (Cont'd)

G	0.68	± .05	17.3	± 1.3
H	1.80	± .09	45.7	± 2.3
J	0.68	+ .15 - .10	17.3	+3.8 - 2.5
K	6.25	max.	158.8	max.
M	1.50	± .03	38.1	± .8
N Dia.	4.12	± .03	101.6	± .8
P Dia.	2.130	± .015	54.10	± .38
R	10.5	max.	266.7	max.
S	6.5	± .5	165.0	± 13.0
T	0.50	± .12	12.7	± 3.0
U	15.00	± .25	381.0	± 6.0
V	3.25	max.	82.55	max.
W	5.00	± .06	127.0	± 1.5
X	2.50	± .06	63.5	± 1.5
Y	1.00	± .06	25.4	± 1.5
Z	2.00	± .06	50.8	± 1.5
AA	3.00	± .06	76.2	± 1.5
AB	2.10	± .02	53.34	± .51
AD	1.00	± .03	25.4	± .8
AE	2.00	± .03	50.8	± .8
AK	0.440	± .010	11.18	± .25
AL	0.230	± .005	5.84	± .13
AM Dia.	0.249	± .002	6.325	± .051
AP	3.00	± .06	76.2	± 1.5
AR	4.75	± .12	120.6	± 3.0

NOTES FOR OUTLINE DRAWINGS

1. Mates with Type "N" Connector UG-21 B/U or equivalent.
2. Dimension applies to Shaft No.1 only.
3. Dimension applies to Shafts No,'s 2, 3, and 4 only.
4. Mates with UG-149 A/U or equivalent.
5. Holes 10-32 UNF-2B equally spaced on 3.250" ± .032" (82.6 ± .8 mm) dia. circle.
6. Holes 0.437" ± .062" (11.1 ± 1.6 mm) thru (One side only).

7. High-Voltage Lead Designation
Heater Lead – Yellow
Heater-Cathode Lead – White

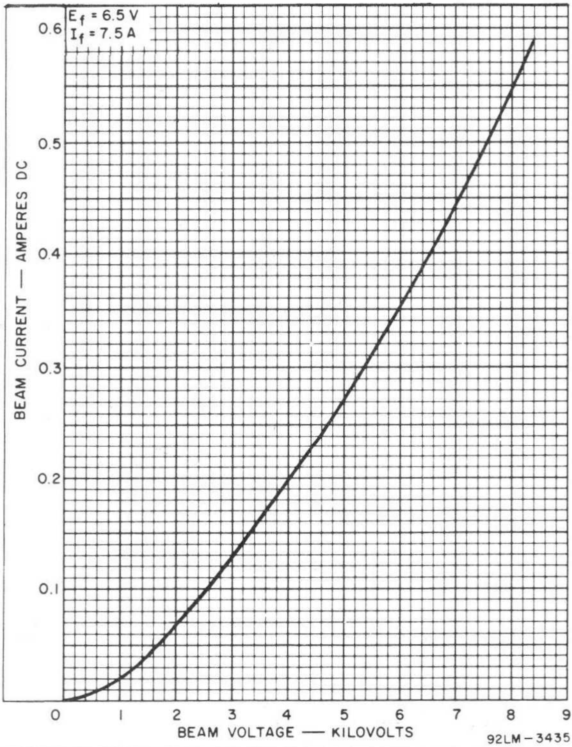
8. Thru-holes checked with gauge.

9. Three spaces between shafts are 0.70" ± .03" (17.8 ± .8 mm) and add to 2.100" (53.34 mm). Shafts are numbered as shown.

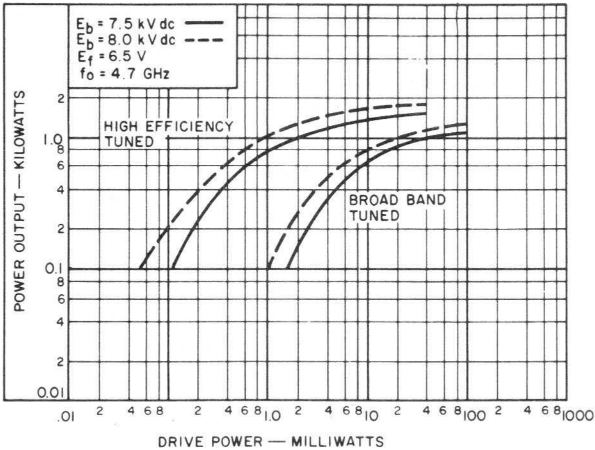
10. Tolerance for this dimension applies to location of four 0.201" (5.11 mm) holes.

11. Hole #6-32 UNC-2B, 0.25" (6.35 mm) minimum depth.

BEAM CURRENT CHARACTERISTIC CURVE

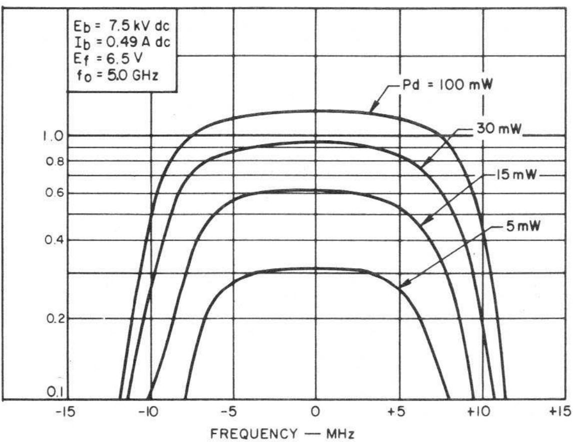


GAIN CHARACTERISTIC CURVE



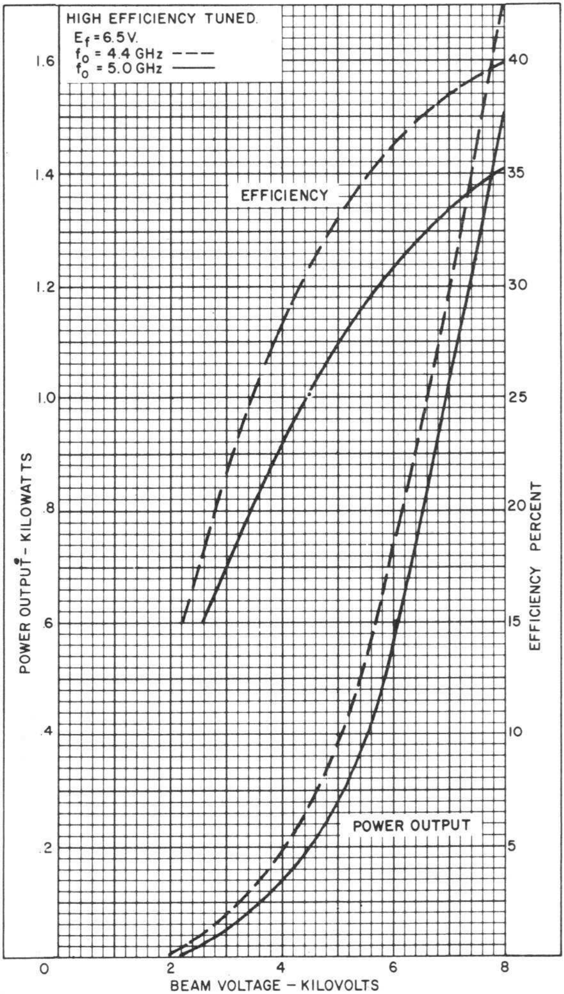
92LS-3436

BANDWIDTH CHARACTERISTIC CURVE



92LS-3500

OUTPUT CHARACTERISTIC CURVE



92LM-3357

4659, 4660

C Band Klystrons

5.0 Kilowatts Pulsed Power Output
High Efficiency – High Power Gain
Compact – Sturdy
Gang-Tuned Cavities
Air Cooled

ELECTRICAL

Cathode .... Indirectly-Heated Tungsten Dispenser Cathode

Filament

Voltage	6.5 ± 0.5 V
Current (at 6.5 V)	7.6 A
Current (maximum)	8.2 A
Warm-Up Time	180 s

MECHANICAL

Mounting Position		Any
Length (maximum)	(393 mm)	15.5 in
Width (maximum)	(267 mm)	10.5 in
Weight (approx.)		
Uncrated	(17.2 kg)	38 lb
In commercial pack	(18.1 kg)	40 lb
In military pack	(22.5 kg)	50 lb

THERMAL

Collector Temperature (maximum)	260 °C
Body Temperature (maximum)	150 °C
Tuner Fin Temperature (maximum)	150 °C
Electron Gun Temperature	
Insulation (maximum)	250 °C
Storage (minimum)	-65 °C

Cooling: Forced air flow across the collector, body and tuner is required.
Typical air-flow requirements
(20° C at sea level pressure)

	Min. Air Flow		Max. Press Drop	
	lbs/min.	kg/min.	in H_2O	cm H_2O
Collector ..	7.5	3.4	2.0	5.1
Body and Tuner	0.85	0.38	0.75	1.9

Typical Rating as a Pulsed RF Amplifier

MAXIMUM RATINGS, *Absolute-Maximum Values:*

Pulsed Beam Voltage	14.0 max.	kV
Pulsed Beam Current	1.6 max.	A
Pulse Width	500	μsec
Duty	0.2	%

TYPICAL PULSED OPERATION

Frequency	4.7	GHz
Pulsed Beam Voltage	12.0	kV
Pulsed Beam Current	1.4	A
Pulsed Power Output*	5.0	kW
Power Gain	50.0	dB
Efficiency	30.0	%
Pulse Width	5.0	μsec
Duty	0.2	%

*A waveguide transformer was used to optimize the power output at the stated frequency

GENERAL INFORMATION

Installation and Operation

No installation or operation should be attempted prior to consulting the Installation and Operating instructions shipped with each tube or available upon request from Super Power Tube Marketing, RCA Lancaster, PA 17604.

RCA reference publications helpful for installation and operation include the following:

Data Sheet – RCA 4659, RCA 4660
Application Note – AN 4213
Application Guide – 1CE-279

These publications are available as complete packets— Request PWR-544, "Application Information for the RCA 4569 Klystron."
Request PWR-545, "Application Information for the RCA 4660 Klystron."

Personnel Safety

The high voltages and microwave radiations from these devices can be dangerous to life. High voltage shielding and interlock precautions must be taken and all rf connections must be tightly closed and rf terminals shielded.

These devices, in operation, may produce X-Radiation which can constitute a health hazard. Shielding or other precautions may be required.

Packaging

Two types of packaging are available with these tubes; Commercial Pack and Military Pack. The customer specifies the desired type.

The Commercial Pack is made of nesting, cardboard cartons with the inner carton shock-mounted. The Military Pack complies with MIL-S-4473C for air shipment. It uses an hermetically-sealed, metal container which protects the tube and serves to shield the surrounding area from stray magnetic fields set up by the klystron focusing magnet.

During shipment, the tube is enclosed in a polyethylene bag to prevent dust and other particles from collecting in the waveguide or tuning systems. It is recommended that the tube be stored in the bag and in the shipping container when not in use. Dust or other unwanted particles in the waveguide can cause arcing during operation and subsequent tube destruction.

Cooling

Air ducts must be provided to connect to the top of the collector and the tuner cooling duct. See the Outline Drawing.

Mounting

Four holes are provided in the gun end of the focusing magnet for mounting purposes. Only non-magnetic studs should be used.

Thermocouple

A thermocouple, mounted on the collector, provides a signal which will indicate excessive collector temperature. This output can be used to operate protective circuitry.

Tuning

Tuning is accomplished by a single knob which gang tunes all four cavities simultaneously. The second, third and output cavities may be individually trimmed for optimizing the tube performance at any frequency within the tube operating band. See Outline Drawing.

Protection Circuits

Protection circuits serve a three fold purpose: safety of personnel, protection of the tube, and protection of the circuits. Consult "Application Guide" 1CE-279 for complete information on protection circuits.

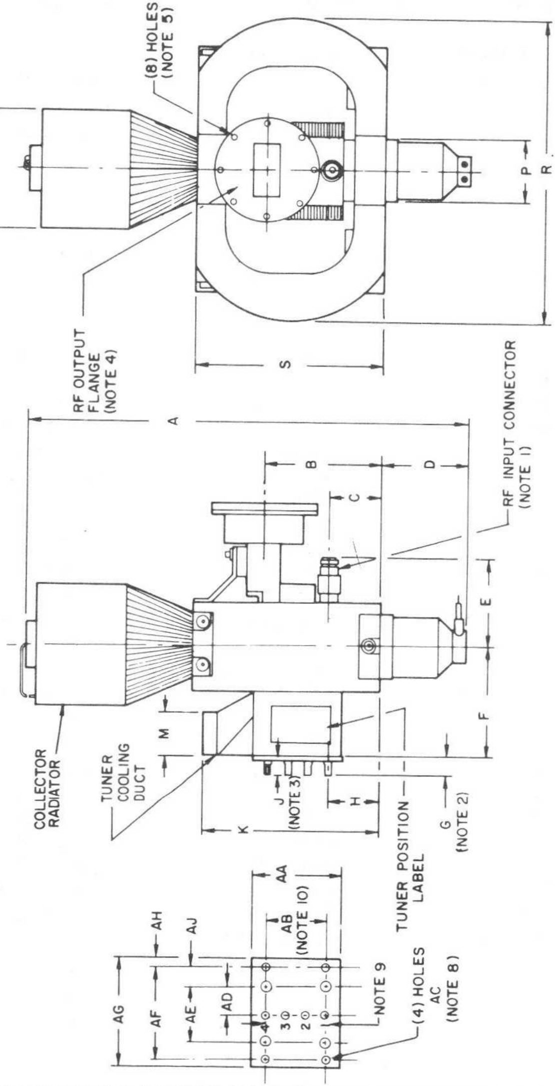
NOTES FOR OUTLINE DRAWINGS (BOTH TYPES)

1. Mates with Type "N" Connector UG-21 B/U or equivalent.
2. Dimension applies to Shaft No.1 only.
3. Dimension applies to Shafts No.'s 2, 3, and 4 only.
4. Mates with UG-149 A/U or equivalent.
5. Holes 10-32 UNF-2B equally spaced on 3.250" ± .032" (82.6 ± .8 mm) dia. circle.
6. Holes 0.437" ± .062" (11.1 ± 1.6 mm) thru (One side only).
7. High-Voltage Lead Designation
Heater Lead – Yellow
Heater-Cathode Lead – White
8. Thru-holes checked with gauge.
9. Three spaces between shafts are 0.70" ± .03" (17.8 ± .8 mm) and add to 2.100" (53.34 mm). Shafts are numbered as shown.
10. Tolerance for this dimension applies to location of four 0.201" (5.11 mm) holes.
11. Hole #6-32 UNC-2B, 0.25" (6.35 mm) minimum depth.

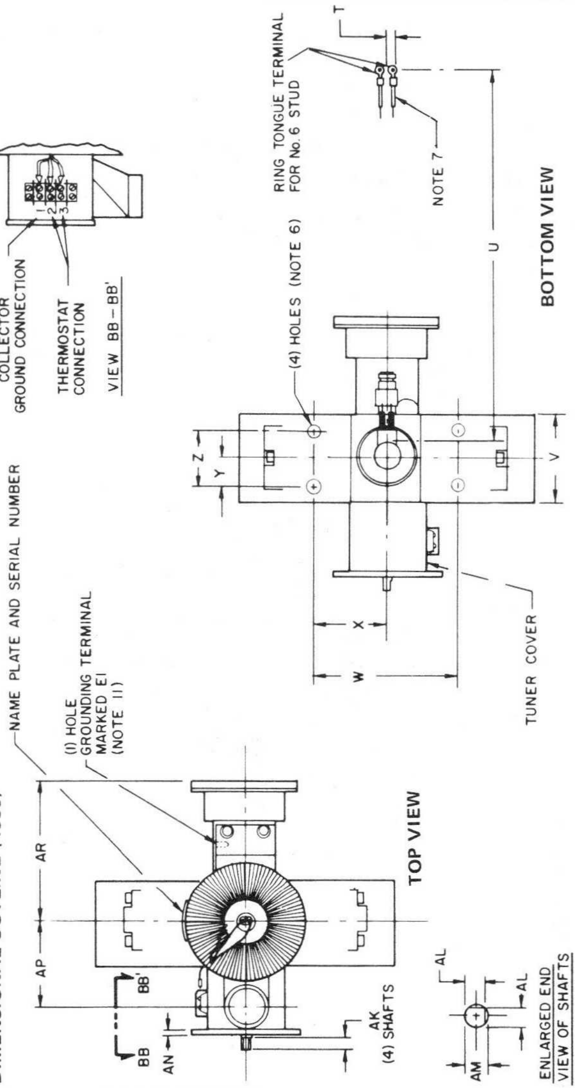
TABULATED DIMENSIONS FOR THE OUTLINE DRAWING (4659)

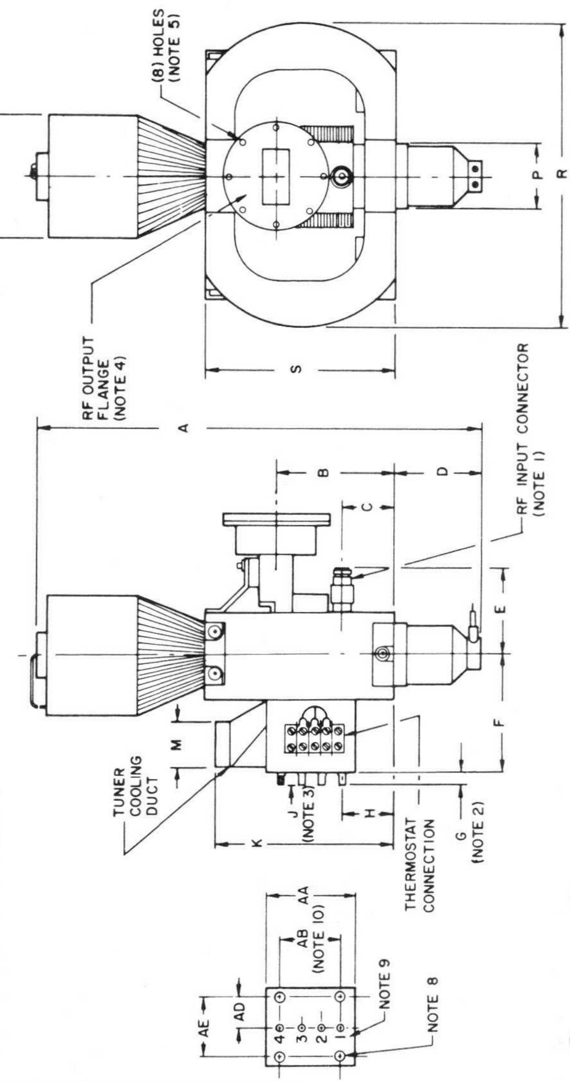
Dimension Reference	Specified Values Inches	Millimeters
A	15.5 max.	393.7 max.
B	4.06 ± .12	103.1 ± 3.0
C	1.80 ± .12	45.7 ± 3.0
D	3.5 max.	88.9 max.
E	3.00 ± .06	76.2 ± 1.5
F	3.80 ± .12	96.5 ± 3.0
G	0.68 ± .05	17.3 ± 1.3
H	1.80 ± .09	45.7 ± 2.3
J	$0.68\ ^{+.15}_{\ \ .10}$	$17.3\ ^{+3.8}_{-2.5}$
K	6.25 max.	158.8 max.
M	1.50 ± .03	38.1 ± .8
N Dia.	4.12 ± .03	101.6 ± .8
P Dia.	2.130 ± .015	54.10 ± .38
R	10.5 max.	266.7 max.
S	6.5 ± .5	165 ± 13.0
T Dia.	0.250 ±.015	6.35 ± .38
U	13.50 ± .25	343.0 ± 6.0
V	3.25 max.	82.55 max.
W	5.00 ± .06	127.0 ± 1.5
X	2.50 ± .06	63.5 ± 1.5
Y	1.00 ± .06	25.4 ± 1.5
Z	2.00 ± .06	50.8 ± 1.5
AA	3.00 ± .06	76.2 ± 1.5
AB	2.10 ± .02	53.34 ± .51
AC	0.201 ± .010	5.11 ± .25
AD	1.00 ± .03	25.4 ± .8
AE	2.00 ± .03	50.8 ± .8
AF	3.25 ± .02	82.55 ± .51
AG	3.75 ± .03	95.3 ± .8
AH	0.25 ± .03	6.4 ± .8
AJ	0.62 ± .03	15.8 ± .8
AK	0.440 ± .010	11.18 ± .25
AL	0.230 ± .005	5.84 ± .13
AM Dia.	0.249 ± .002	6.325 ± .051
AN	0.125 ± .030	3.2 ± .8
AP	3.00 ± .06	76.2 ± 1.5
AR	4.75 ± .12	120.6 ± 3.0

DIMENSIONAL OUTLINE (4659)

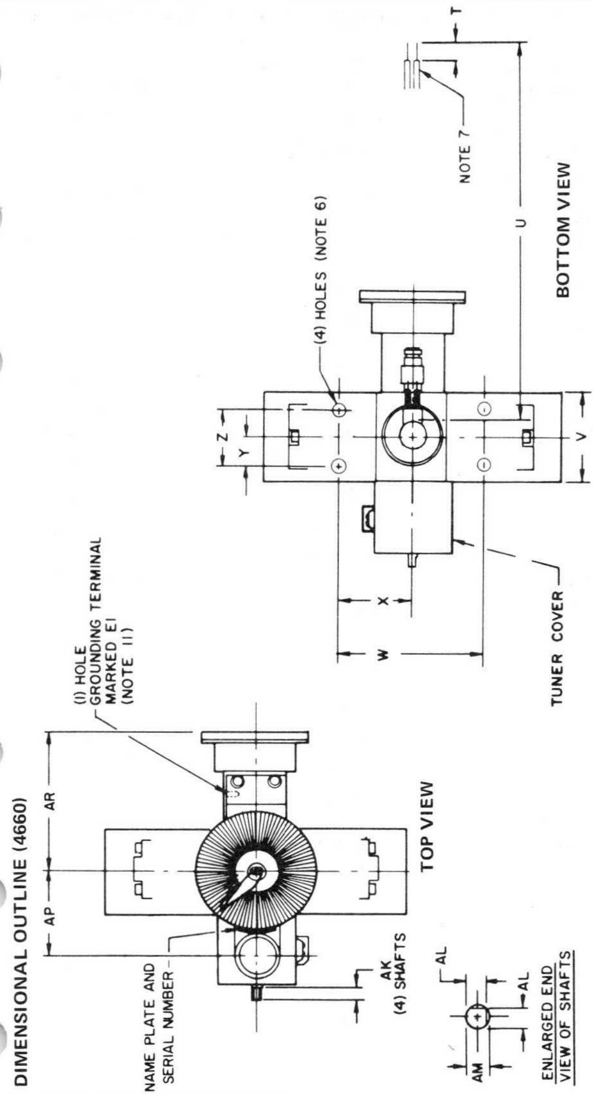


DIMENSIONAL OUTLINE (4659)





DIMENSIONAL OUTLINE (4660)


DIMENSIONAL OUTLINE (4660)
NAME PLATE AND
SERIAL NUMBER
(I) HOLE
GROUNDING TERMINAL
MARKED EI
(NOTE 11)
AP
AR
TOP VIEW
AK
(4) SHAFTS
AL
AL
AM
ENLARGED END
VIEW OF SHAFTS
(4) HOLES (NOTE 6)
Z
Y
X
W
V
U
T
NOTE 7
TUNER COVER
BOTTOM VIEW

TABULATED DIMENSIONS FOR THE OUTLINE DRAWING (4660)

Dimension Reference	Specified Values Inches	Millimeters
A	15.5 max.	393.7 max.
B	4.06 ± .12	103.1 ± 3.0
C	1.80 ± .12	45.7 ± 3.0
D	3.5 max.	88.9 max.
E	3.00 ± .06	76.2 ± 1.5
F	3.80 ± .12	96.5 ± 3.0
G	0.68 ± .05	17.3 ± 1.3
H	1.80 ± .09	45.7 ± 2.3
J	$0.68^{+.15}_{-.10}$	$17.3^{+3.8}_{-2.5}$
K	6.25 max.	158.8 max.
M	1.50 ± .03	38.1 ± .8
N Dia.	4.12 ± .03	101.6 ± .8
P Dia.	2.130 ± .015	54.10 ± .38
R	10.5 max.	266.7 max.
S	6.5 ± .5	165 ± 13.0
T	0.50 ± .12	12.7 ± 3.0
U	15.00 ± .25	381.0 ± 6.0
V	3.25 max.	82.55 max.
W	5.00 ± .06	127.0 ± 1.5
X	2.50 ± .06	63.5 ± 1.5
Y	1.00 ± .06	25.4 ± 1.5
Z	2.00 ± .06	50.8 ± 1.5
AA	3.00 ± .06	76.2 ± 1.5
AB	2.10 ± .02	53.34 ± .51
AD	1.00 ± .03	25.4 ± .8
AE	2.00 ± .03	50.8 ± .8
AK	0.440 ± .010	11.18 ± .25
AL	0.230 ± .005	5.84 ± .13
AM Dia.	0.249 ± .002	6.325 ± .051
AP	3.00 ± .06	76.2 ± 1.5
AR	4.75 ± .12	120.6 ± 3.0

Beam Power Tube

Cermolox
Ruggedized

Forced-Air Cooled
Full Input to 400 MHz

ELECTRICAL

Heater-Cathode:

Type	Unipotential, Oxide Coated, Matrix Type	
Voltage[a] (AC or DC)	5.5 typ.	V
	5.8 max.	V
Current (@ 5.5 V)	17.3	A
Minimum heating time	180	s
Mu Factor[b] (Grid No.1 to Grid No.2)	6.5	

Direct Interelectrode Capacitances:

Grid No.1 to plate[c]	0.14	pF
Grid No.1 to Cathode-Heater	38	pF
Plate to Cathode-Heater[c]	0.02	pF
Grid No.1 to Grid No.2	52	pF
Grid No.2 to Plate	13	pF
Grid No.2 to Cathode-Heater[c]	1.4	pF

MECHANICAL

Operating Position	Any
Maximum Length	(98.0 mm) 3.86 in
Greatest Diameter	(94.7 mm) 3.73 in
Terminal Connection	See Dimensional Outline
Radiator	Integral part of tube
Weight (Approx.)	(0.9 kg) 2 lb

Sockets may be obtained from:

Erie Technological Products, Inc.
644 West 12th Street, Erie, PA 16512

Jettron Products Incorporated
56 Route 10, Hanover, NJ 07936

THERMAL

Ceramic-Metal Interface Temperature[d] (Plate, grid No.1, grid No.2, cathode-heater, and heater)	250 max. °C
Plate Core Temperature[d]	250 max. °C

LINEAR RF POWER AMPLIFIER[e]
AM TELEPHONY SERVICE, CLASS AB

Carrier conditions for use with a maximum modulation factor of 1.0

Maximum CCS Ratings, *Absolute-Maximum Values:*

DC Plate Voltage[f]	3500	max.	V
DC Grid-No.2 Voltage[g]	1000	max.	V
DC Grid-No.1 Voltage[h]	-300	max.	V
DC Plate Current	700	max.	mA
Grid-No.2 Input	50	max.	W
Plate Dissipation	1500	max.	W

Calculated CCS Operation as a Class AB_1 Amplifier:

In a cathode-drive circuit at 400 MHz with an output circuit bandwidth of 4.5 MHz[j].

DC Plate Voltage	2600	V
DC Grid-No.2 Voltage	550	V
DC Grid-No.1 Voltage[k]	-75	V
DC Plate Current	490	mA
DC Grid-No.2 Current	-15	mA
DC Grid-No.1 Current	0	mA
Drive Power (Approx.)	18	W
Output Circuit Eff. (Approx.)	90	%
Useful Power Output	280	W

RF POWER AMPLIFIER & OSCILLATOR—CLASS C TELEGRAPHY[e] AND RF POWER AMPLIFIER – CLASS C FM TELEPHONY[e]

Maximum CCS Ratings, *Absolute-Maximum Values:*

	up to 400 MHz		
DC Plate Voltage[f]	3500	max.	V
DC Grid-No.2 Voltage[g]	1000	max.	V
DC Grid-No.1 Voltage[h]	-300	max.	V
DC Plate Current	1.25	max.	A
DC Grid-No.1 Current	0.2	max.	A
Grid-No.2 Input[g]	50	max.	W
Plate Dissipation	1500	max.	W

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	5000 max. Ω
Grid-No.2-Circuit Impedance	See note **g**
Plate-Circuit Impedance	See note **f**

Calculated CCS Operation:

In a cathode-drive circuit at 400 MHz with an output circuit bandwidth of 4.4 MHz[j].

DC Plate Voltage	2600	V
DC Grid-No.2 Voltage	550	V
DC Grid-No.1 Voltage[m]	-85	V
DC Plate Current	900	mA
DC Grid-No.2 Current	-10	mA
DC Grid-No.1 Current	5	mA
Drive Power (Approx.)	70	W
Output Circuit Eff. (Approx.)	90	%
Useful Power Output	1160	W

b For: plate voltage = 2500 V
grid No.2 voltage = 600 V
plate current = 600 mA

c With special shield adapter.

d See Dimensional Outline for temperature measurement points.

j Computed between half-power points using two times tube capacity.

k Adjust for zero-signal DC plate current of 0.2 A.

m Adjust for zero-signal DC plate current of 0.1 A.

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

a See *Electrical Considerations* — Filament or Heater.
e See *Classes of Service*
f See *Electrical Considerations* — Plate Voltage Supply
g See *Electrical Considerations* — Grid No. 2 Voltage Supply
h See *Electrical Considerations* — Grid No. 1 Voltage Supply

OUTLINE TABULATED DIMENSIONS*

Dimensions	Value	
	Inches	Millimeters
A Dia.	3.70 ±.03	93.98 ±.76
B Dia.	3.210 min.	81.54 min.
C Dia.	3.010 min.	76.45 min.
D Dia.	2.307 min.	58.60 min.
E Dia.	1.700 min.	43.18 min.
F Dia.	0.725 max.	18.41 max.
G	3.76 ±.10	95.5 ±2.5
H	3.30 ±.10	83.8 ±2.5
J	1.65 ±.03	41.91 ±.76
M	0.200 ±.025	5.08 ±.64
N	0.37 ±.03	9.40 ±.76
P	0.46 ±.03	11.68 ±.76
R	0.250 min.	6.35 min.
S	0.105 min.	2.67 min.
T	0.200 min.	5.08 min.
U	0.620 min.	15.75 min.
V	2.71 ±.10	68.8 ±2.5

OUTLINE NOTES

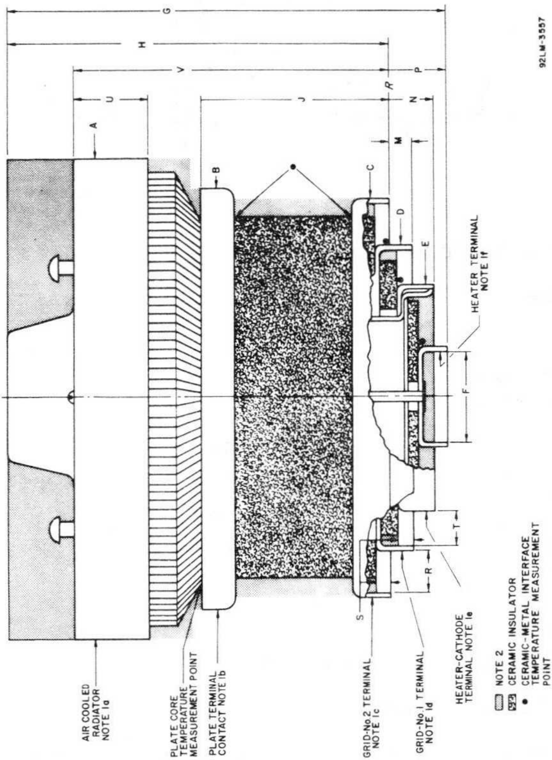
Note 1: The contact distance* indicated is the minimum uniform length as measured from the edge of the terminal.

Terminal	Dimensional Value	
	Inches	Millimeters
1.a Radiator	0.620	15.75
1.b Plate	0.220	5.59
1.c Grid No.2	0.220	5.59
1.d Grid No.1	0.175	4.45
1.e Heater-Cathode	0.115	2.92
1.f Heater	0.135	3.43

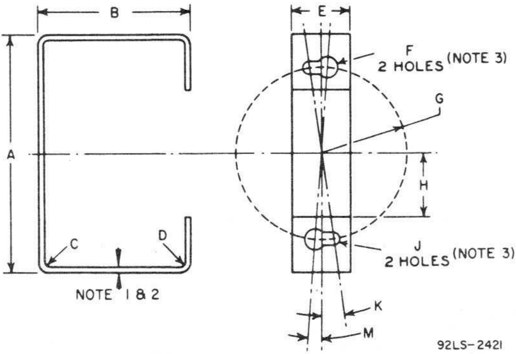
Note 2: Keep all stippled regions clear. In general do not allow contacts to protrude into these annular regions. If special connectors are required which may intrude on these regions, contact RCA Power Tube Application Engineering, Lancaster, PA, for guidance.

*Basic dimensions are in inches unless otherwise specified. Metric dimensions are derived from the basic inch dimensions (One inch = 25.4 mm).

DIMENSIONAL OUTLINE



TUBE EXTRACTOR – SUGGESTED DESIGN



TABULATED DIMENSIONS*

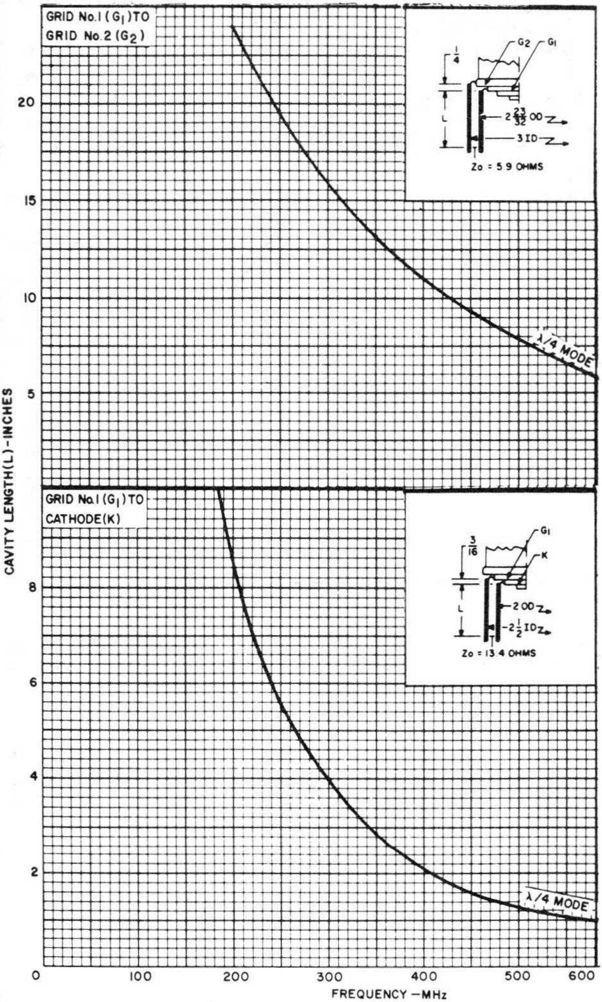
Dim.		Values	
A		2.8	(71.)
B		1.8	(46.)
C	Radius	0.06	(1.5)
D	Radius	0.06	(1.5)
E		0.7	(18.)
F	Dia.	0.250	(6.35)
G	Radius	1.015	(25.78)
H		0.75	(19.)
J	Dia.	0.140	(3.56)
K		8.3°	0.145 radians
M		4.5°	0.078 radians

Notes:

1. Material 1/16" thick cold rolled steel.
2. Round all edges
3. Slot between holes

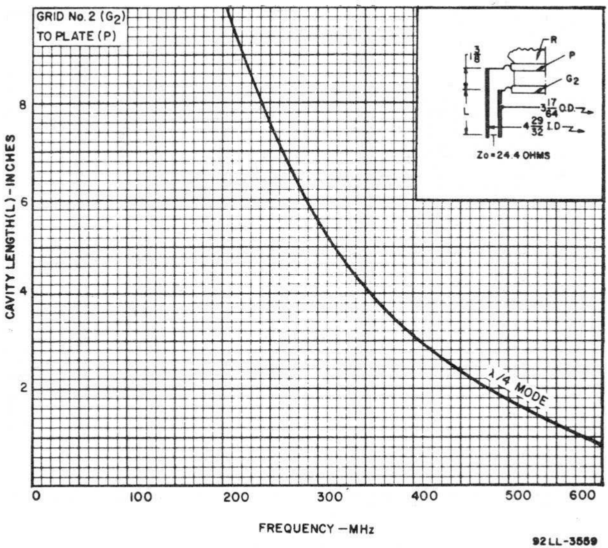
*Dimensions are in inches unless otherwise stated. Dimensions in parentheses are in millimeters and are derived from the basic inch dimensions (1 inch = 25.4 mm).

ELECTRODE CAVITY TUNING CHARACTERISTICS



92LL-3559

ELECTRODE CAVITY TUNING CHARACTERISTICS



Detailed performance and application information is available through your RCA Sales Office Distributor, or write to RCA Commercial Engineering, Harrison, N. J. 07029

UHF Power Amplifier

Ruggedized | **Forced-Air Cooled**

300 W CW Output at 470 MHz
380 W PEP Output at 30 MHz

ELECTRICAL

Heater, for Unipotential Cathode:		
Voltage (AC or DC)[a]	13.5	V
Current at 13.5 volts	1.3	A
Minimum heating time	60	s
Mu-Factor, (Grid No.2 to Grid No.1)[b]	12	
Direct Interelectrode Capacitances:[c]		
Grid No.1 to plate	0.15 max.	pF
Grid No.1 to cathode	16	pF
Plate to cathode	0.01	pF
Grid No.1 to grid No.2	24	pF
Grid No.2 to plate	7.0	pF
Grid No.2 to cathode	2.7	pF
Cathode to heater	3.3	pF

MECHANICAL

Operating Position	Any
Maximum Overall Length	(57.40 mm) 2.26″
Seated Length	(48.8 ± 1.7 mm) 1.920″ ± 0.065″
Greatest Diameter	(41.28 ± .38 mm) 1.625″ ± 0.015″
Base	Large-Wafer Elevenar 11-Pin with Ring (JEDEC No.E11-81)
Socket	Erie[d] No.9802-000 and 9804-000, Johnson[e] No.124-311-100 or equivalent
Grid No.2 Bypass Capacitor	Erie No.2943-002, Johnson No.124-121, or equivalent
Weight (Approx.)	3.5 oz

THERMAL

Terminal Seal Temperature[g] (All Terminals)	250 max. °C
Radiator Core Temperature[g]	250 max. °C

Air Flow:

See *Typical Cooling Requirements curves and Forced-Air Cooling*

LINEAR RF POWER AMPLIFIER

Single-Sideband Suppressed-Carrier Service[h]

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 MHz		
DC Plate Voltage	2200	max.	V
DC Grid-No.2 Voltage	400	max.	V
DC Grid-No.1 Voltage	-100	max.	V
DC Plate Current at Peak of Envelope	450[k]	max.	mA
DC Grid-No.1 Current	100	max.	mA
Plate Dissipation	400	max.	W
Grid-No.2 Dissipation	8	max.	W
Peak Heater-Cathode Voltage:			
Heater negative with respect to cathode	150	max.	V
Heater positive with respect to cathode	150	max.	V

MAXIMUM CIRCUIT VALUES

Grid-No.1 Circuit Resistance Under Any Condition:[m]			
With fixed bias	25000	max.	Ω
With fixed bias (in Class AB_1 operation)	100000	max.	Ω
With cathode bias	Not recommended		
Grid-No.2 Circuit Impedance[n]	1000	max.	Ω
Plate Circuit Impedance[j]	See Note p		

TYPICAL CCS OPERATION AT 30 MHz WITH "TWO-TONE MODULATION"

	AB_1	
DC Plate Voltage	2000	V
DC Grid-No.2 Voltage	400	V
DC Grid-No.1 Voltage	-35	V
Zero-Signal DC Plate Current	100	mA
Effective RF Load Resistance	3050	Ω
DC Plate Current at Peak of Envelope	335	mA
Average DC Plate Current	250	mA
DC Grid-No.2 Current at Peak of Envelope	10	mA
Average DC Grid-No.2 Current	7	mA

DC Grid-No.1 Current at Peak of Envelope	0.05[r]	mA
Peak-Envelope Driver Power Output (Approx.)	0.3	W
Output-Circuit Efficiency (Approx.)	90	%
Distortion Products Level:		
Third order	29[s]	dB
Fifth order	32	dB
Useful Power Output (Approx.):		
Average	190	W
Peak envelope	380	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 MHz		
DC Plate Voltage	2200	max.	V
DC Grid-No.2 Voltage	400	max.	V
DC Grid-No.1 Voltage	-100	max.	V
DC Plate Current	300	max.	mA
DC Grid-No.1 Current	100	max.	mA
Grid-No.2 Dissipation	8	max.	W
Plate Dissipation	400	max.	W
Peak Heater-Cathode Voltage:			
Heater negative with respect to cathode	150	max.	V
Heater positive with respect to cathode	150	max.	V

MAXIMUM CIRCUIT VALUES

Grid-No.1 Circuit Resistance Under Any Condition:			
With fixed bias	25000	max.	Ω
Grid-No.2 Circuit Impedance	10000	max.	Ω
Plate Circuit Impedance	See Note p		

TYPICAL CCS OPERATION

In Grid-Drive Circuit at 50 MHz					
DC Plate Voltage	700	1000	1500	2000	V
DC Grid-No.2 Voltage	175	200	200	200	V
DC Grid-No.1 Voltage	-10	-30	-30	-30	V
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.)	1.2	2	2	2	W
Useful Power Output	120	175	275	375	W
In Grid-Drive Circuit at 470 MHz					
DC Plate Voltage	700	1000	1500	2000	V
DC Grid-No.2 Voltage	200	200	200	200	V
DC Grid-No.1 Voltage	-30	-30	-30	-30	V
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.)	5	5	5	5	W
Useful Power Output	100	165	235	300	W

PLATE-MODULATED RF POWER AMPLIFIER – CLASS C TELEPHONY[h]

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

MAXIMUM CCS RATINGS, *Absolute-Maximum Values:*

	Up to 500 MHz		
DC Plate Voltage	1800	max.	V
DC Grid-No.2 Voltage	400	max.	V
DC Grid-No.1 Voltage	-100	max.	V
DC Plate Current	250	max.	mA
DC Grid-No.1 Current	100	max.	mA
Grid-No.2 Input	5	max.	W
Plate Dissipation	280	max.	W

a Because the cathode is subjected to back bombardment as the frequency is increased with resultant increase in temperature, the heater voltage should, for optimum life, be reduced to a value such that at the heater voltage obtained at minimum supply voltage conditions (all other voltages constant) the tube performance just starts to show some degradation; e.g., at 470 MHz heater volts = 12.5 (approx.).

b For plate voltage = 450 V
Grid No.2 voltage = 325 V
Plate current = 1.2 A

c Measured with special shield adapter.

d Erie Technological Products, Inc., 645 West 12th Street, Erie, PA 16501

e E.F. Johnson Co., 1921 10th Ave., S.W. Waseca, MN 56093 g See Dimensional Outline for Temperature Measurement Points.

h See *RCA Transmitting Tube Operating Considerations - CLASSES OF SERVICE* given at the front of this section.

j The tube shall see an effective plate-supply impedance of no less than 750 ohms. A fault current limiting resistor of no less than 15 ohms is to be used between the output filter capacitance and the tube plate. The plate-supply-output-filter capacitance is to be no greater than 10 μF.

k 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.

m A fault current limiting resistor of no less than 20 ohms is to be used between the bias supply output filter capacitance and the tube grid-No.1. The bias supply output filter capacitance is to be no greater than 150 μF.

n A fault current limiting resistor of no less than 320 ohms is to be used between the screen output filter capacitance and the tube screen. The screen supply output filter capacitance is to be no greater than 80 μF.

p The tube should see an effective plate supply impedance which limits the peak current through the tube under surge conditions to 15 amperes.

r 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.

s The value of third order distortion product level shown may be improved by approximately 5 dB by utilizing an unbypassed, non-inductive 20-ohm resistor between the cathode and ground; a slight increase in drive power will be required.

CHARACTERISTICS RANGE VALUES

	Note	Min.	Max.	
1. Heater Current	1	1.15	1.45	A
2. Direct Interelectrode Capacitances:				
Grid No.1 to plate	2	–	0.15	pF
Grid No.1 to cathode	2	14.6	18.0	pF
Plate to cathode	2	0.004	0.016	pF
Grid No.1 to grid No.2	2	20.0	26.5	pF
Grid No.2 to plate	2	6.3	7.7	pF

Grid No.2 to cathode	2	2.1	4.1	pF
Cathode to heater	2	2.5	4.1	pF
3. Grid-No.1 Voltage	1,3	-19	-10	V
4. Interelectrode Leakage Resistance	4	50	–	MΩ
5. Zero Bias Plate Current	1,5	1.0	1.8	A

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: 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 1.0 megohm, will be no less than the valve specified.

Note 5: With dc plate voltage of 450 volts, dc grid No.2 voltage of 400 volts, dc grid No.1 voltage of -100 volts, grid drive voltage to zero. With pulse duration of 4500 to 5000 μs and pulse repetition frequency is 10 to 12 pps.

FORCED-AIR COOLING

AIR FLOW:

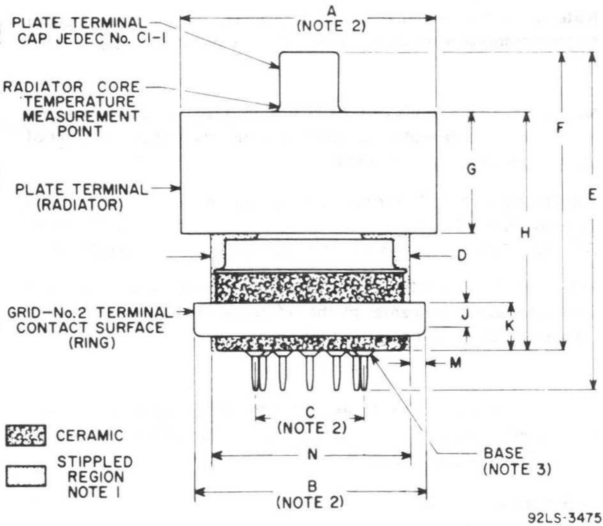
Through radiator – Adequate air flow to limit the plate-core temperature to 250° C should be delivered by a blower through the radiator before and during the application of filament, plate, grid-No.2, and grid No.1 voltages.

For a plate dissipation of 310 watts, approximately four and one half cubic feet of air per minute at an incoming temperature of 24° C is required in accordance with the air flow characteristics as shown in the chart.

During Shutdown Operation – Air flow should continue for a few minutes after all electrode power is removed.

For further information on forced-air cooling, see *RCA Transmitting Tube Operating Considerations at front of this section.*

DIMENSIONAL OUTLINE



TABULATED DIMENSIONS*

	Inches	Millimeters
A Dia.	1.625 ± .015	41.28 ± .38
B Dia.	1.426 ± .010	36.22 ± .25
C Dia.	0.687 ref.	17.45 ref.
D Dia.	1.25 max.	31.75 max.
E	2.26 max.	57.40 max.
F	1.920 ± .065	48.8 ± 1.7
G	0.750 ± .040	19.0 ± 1.0
H	1.515 ± .045	38.5 ± 1.1
J	0.150 min.	3.81 min.
K	0.300 ± .020	7.62 ± .51
M	0.080 min.	2.03 min.
N	1.200 max.	30.48 max.

*Basic dimensions are in inches. Metric dimensions are in millimeters and are derived from the inch dimensions (1 inch = 25.4 mm).

NOTES FOR DIMENSIONAL OUTLINE

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

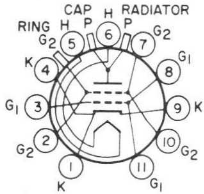
Note 2: The diameters of the radiator, grid-No.2 ring terminal contact, and pin circle shall be concentric within the following values of the maximum full indicator reading:

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.

The full indicator reading is the deviation of a surface when the tube is rotated about the center of the reference. It is a measure of the total effect of run-out and ellipticity.

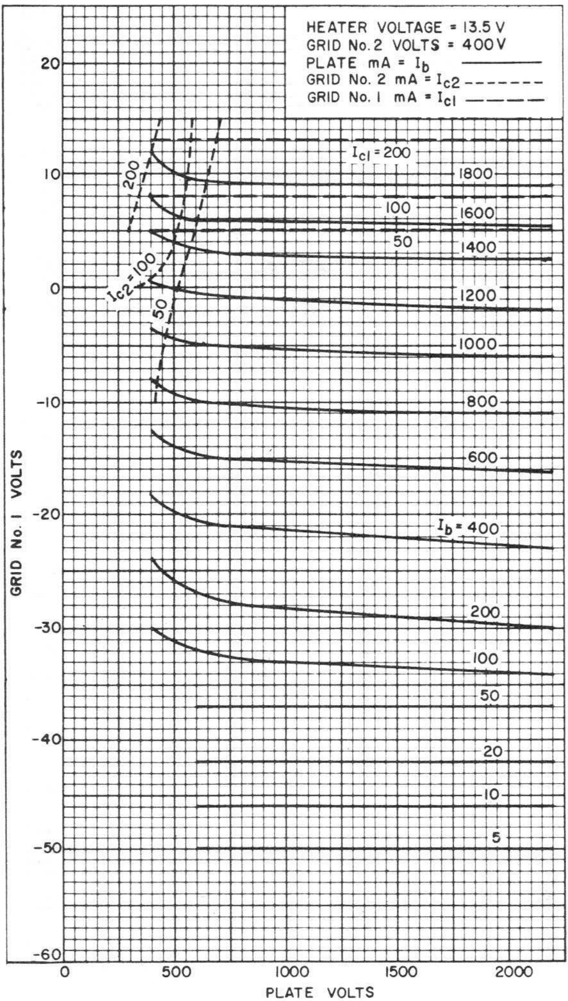
Note 3: Base conforms to specification of the Large Wafer, Elevenar, Eleven pin with ring Base No.JEDEC No.E11-81. It may be checked with Gauge JEDEC No.GE11-1.

TERMINAL DIAGRAM
(Bottom View)



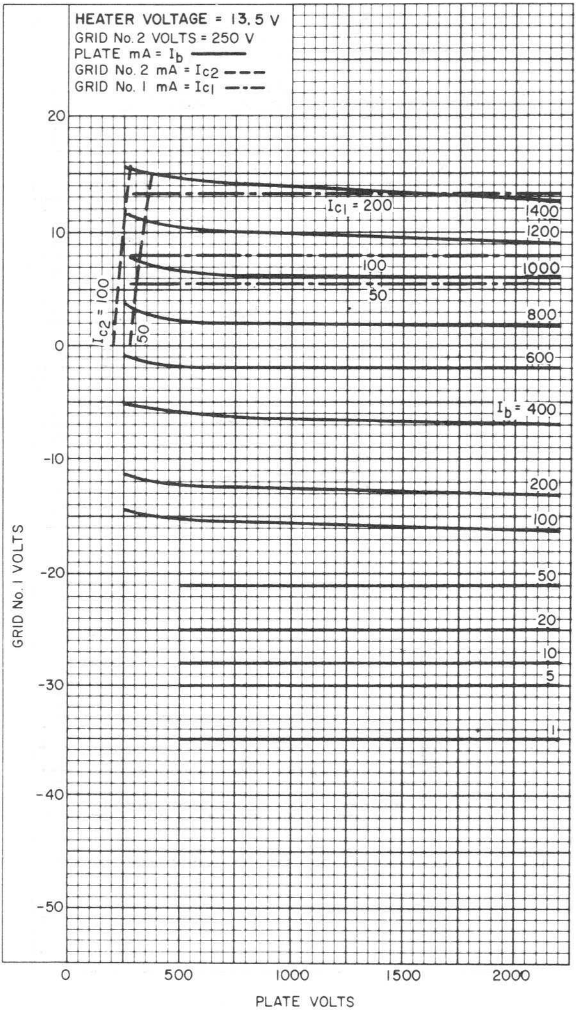
Pin 1: Cathode
Pin 2: Grid No.2
Pin 3: Grid No.1
Pin 4: Cathode
Pin 5: Heater
Pin 6: Heater
Pin 7: Grid No.2
Pin 8: Grid No.1
Pin 9: Cathode
Pin 10: Grid No.2
Pin 11: Grid No.1
Cap: Plate Terminal
Radiator: Plate Terminal
Ring: Grid-No.2 Terminal Contact Surface (For use at higher frequencies)

TYPICAL CONSTANT – CURRENT CHARACTERISTICS



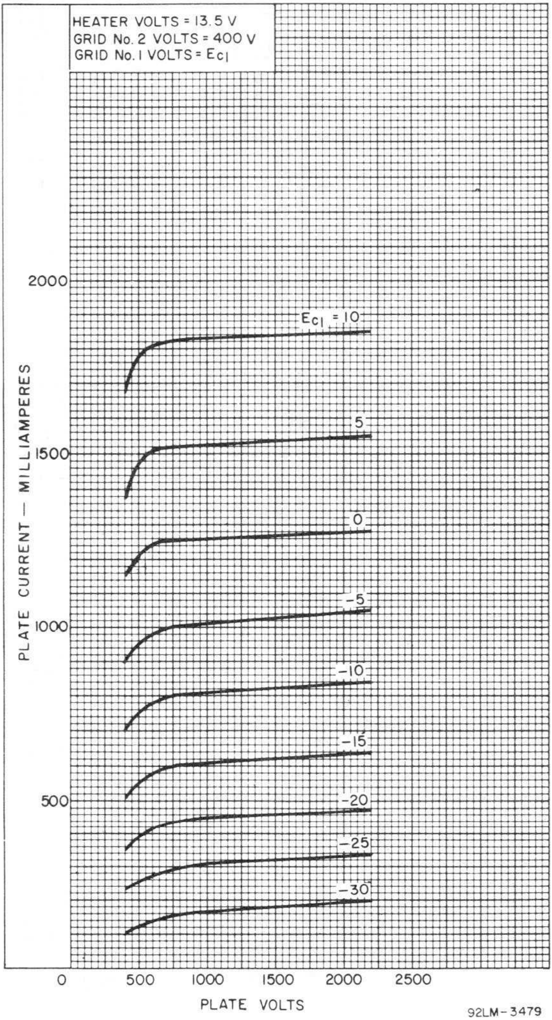
92LM-3477

TYPICAL CONSTANT – CURRENT CHARACTERISTICS

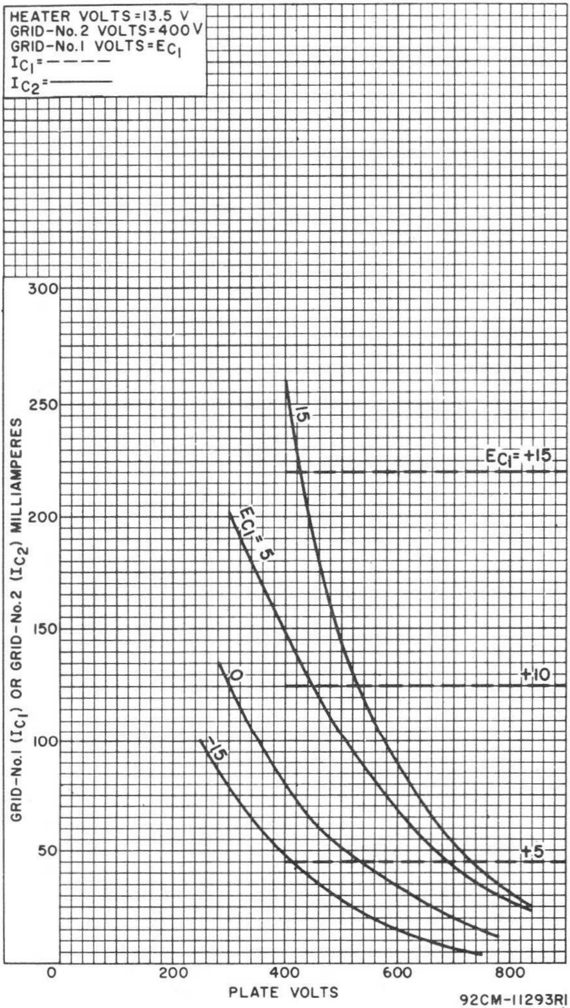


92LM-3478

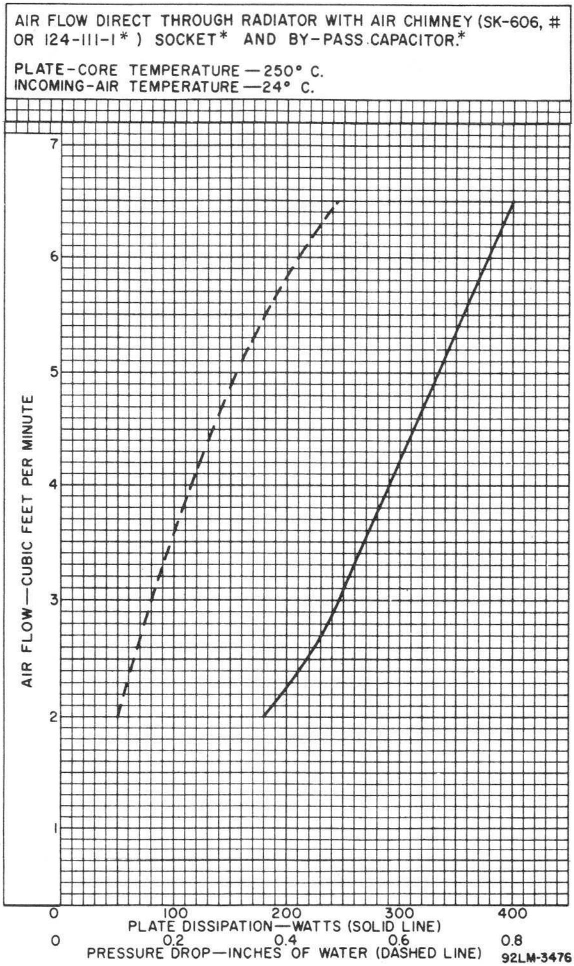
TYPICAL PLATE CHARACTERISTICS



TYPICAL GRID CHARACTERISTICS



TYPICAL COOLING REQUIREMENTS



#May be obtained through Eitel McCullough, Inc., San Carlos, CA 94070.

+May be obtained through EF Johnson, Co., 1921 10th Ave., SW, Waseca, MN 56093.

5558

5558

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

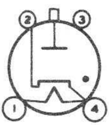
Mechanical:

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

APRIL 1, 1953 DATA

5558

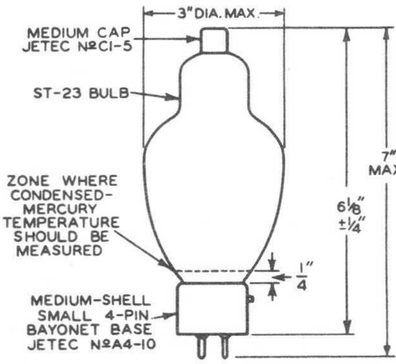
HALF-WAVE MERCURY-VAPOR RECTIFIER

HALF-WAVE RECTIFIER

Maximum Ratings, *Absolute Values: Up to 150 cps*

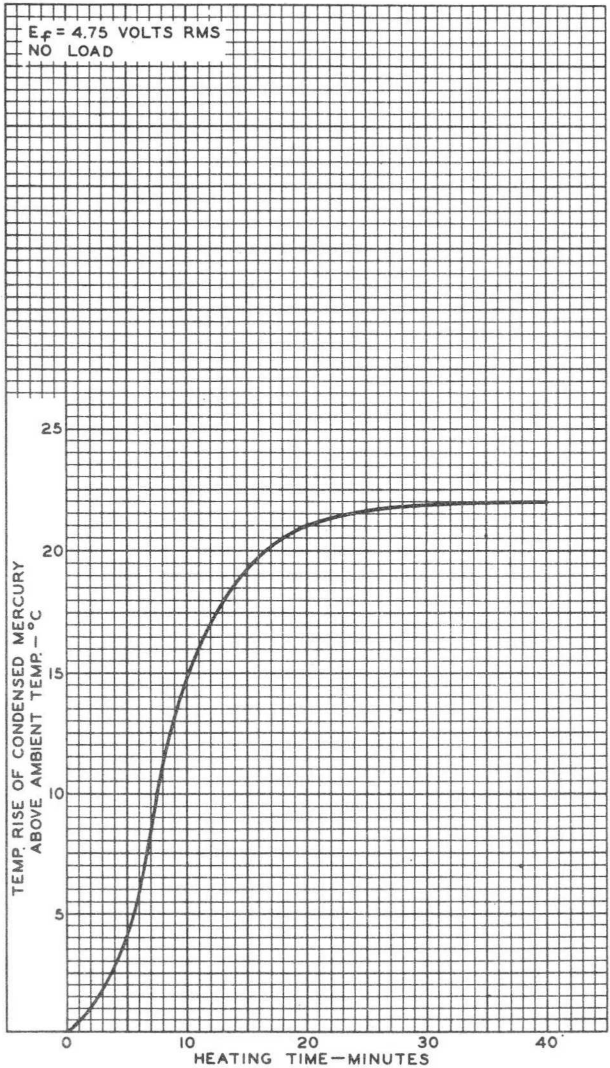
	Operating Condensed-Mercury Temperature Range		
	30° to 80°C	30° to 60°C	
PEAK INVERSE ANODE VOLTAGE	2000 max.	5000 max.	volts
CATHODE CURRENT:			
Peak	15 max.	15 max.	amp
Average■.	2.5 max.	2.5 max.	amp
Fault, for duration of 0.1 second max.	200 max.	200 max.	amp

■ Averaged over any interval of 15 seconds maximum.



92CS-6701R3

RATE OF RISE OF COND.-MERCURY TEMPERATURE



5561

5561

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.

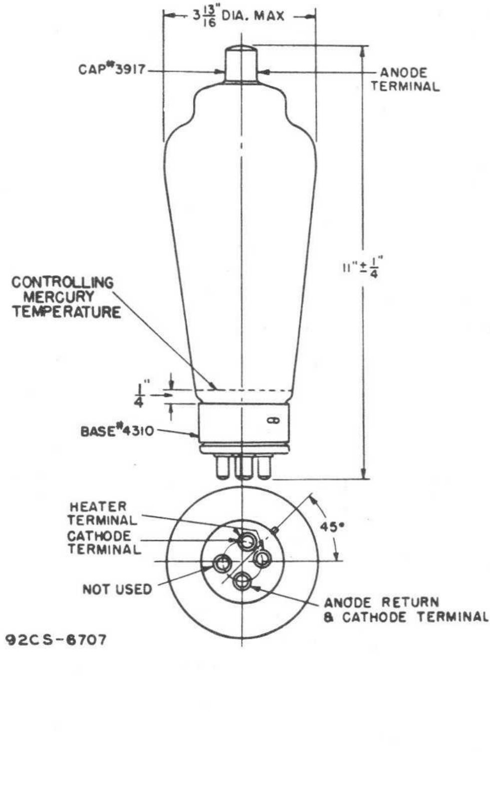
Averaged over any 15-second interval.

□ Recommended condensed-mercury temperature 40°C.

5561

5561

HALF-WAVE MERCURY-VAPOR RECTIFIER



5618

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

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

RCA

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.

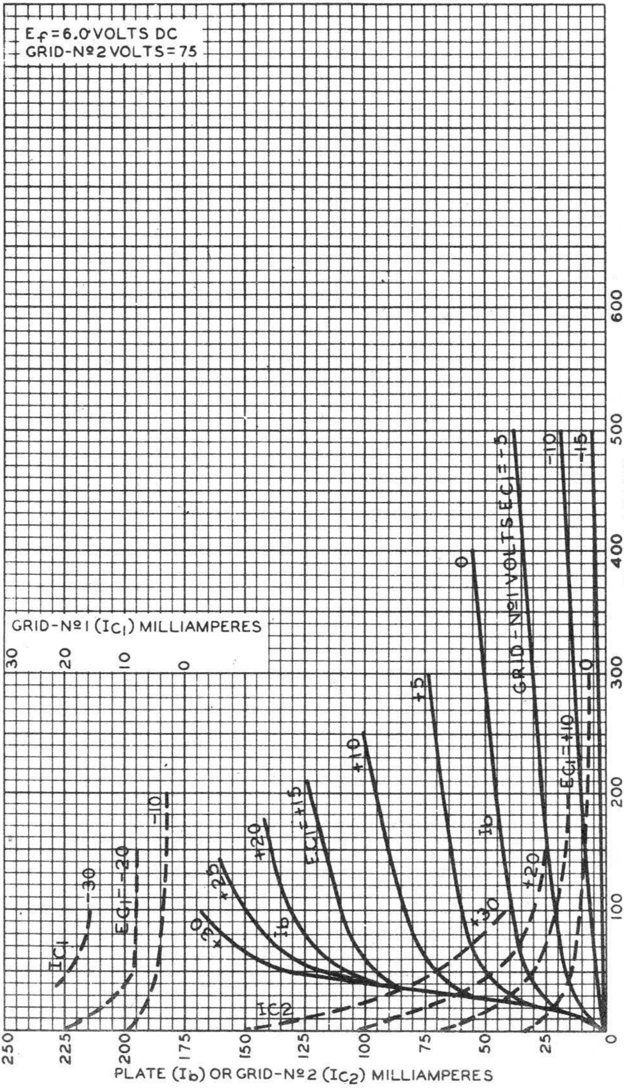
⊕ Filament may be connected in either parallel or series arrangement. With parallel connection, grid No.3 (pin No.4) is connected to pin No.5; for series operation, connect pin No.4 to pin No.1.

♠ Obtained from a fixed supply, or by a grid-No.1 resistor of value shown.

RCA

5618

AVERAGE CHARACTERISTICS



AUG. 1, 1947

TUBE DEPARTMENT

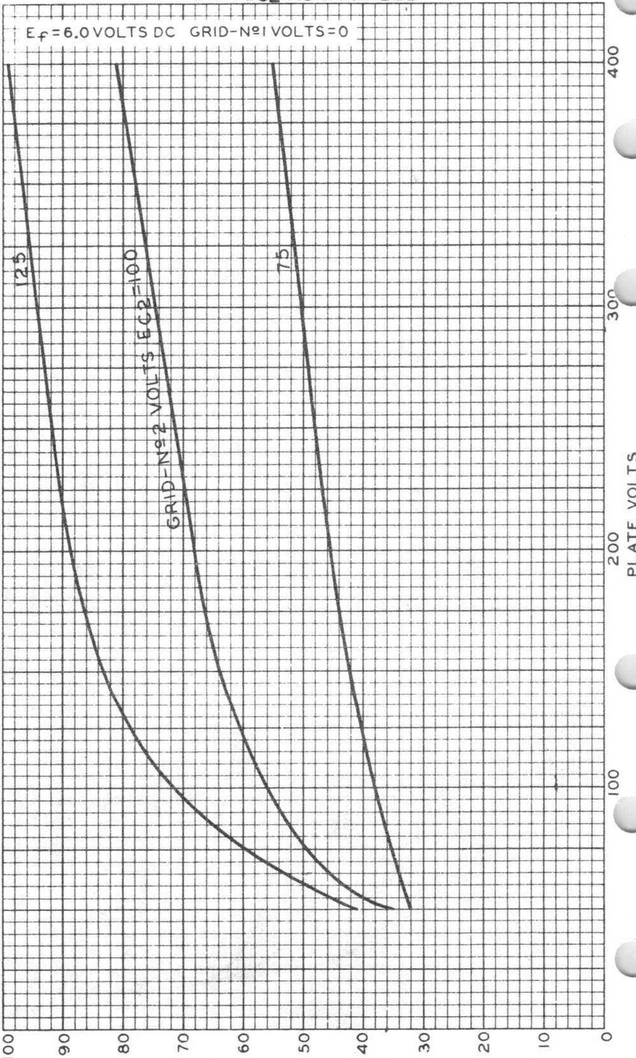
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6881

5618

5618

AVERAGE PLATE CHARACTERISTICS
WITH E_{C2} AS VARIABLE



AUG. 12, 1947 **TUBE DEPARTMENT** 92CM-6882

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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

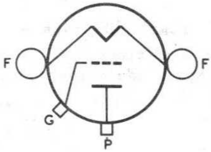
Direct Interelectrode Capacitances (Approx.):
- Grid to plate . . . . 50 μμf
- Grid to filament. . . . . 90 μμf
- Plate to filament . . . . 1.5 μμf

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.

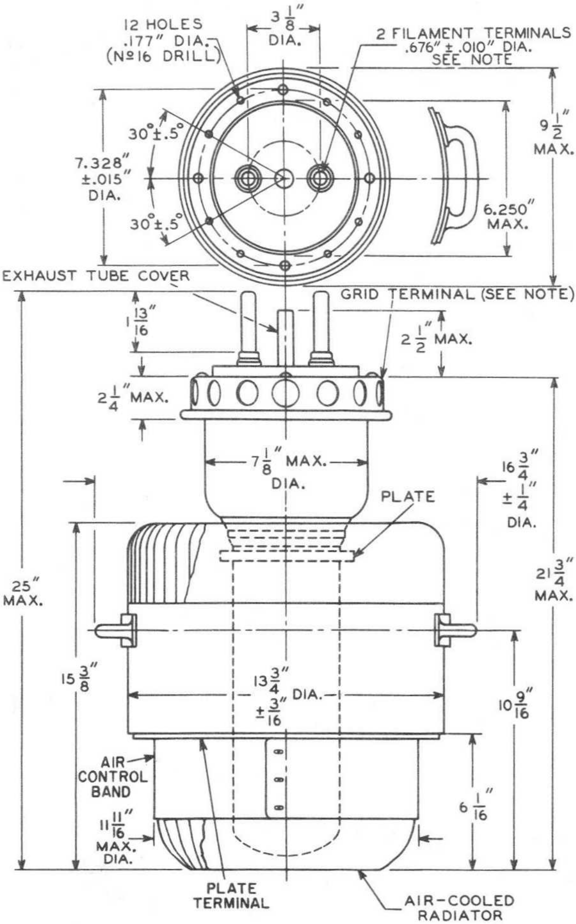
Note 6: With dc plate voltage of 2600 volts and instantaneous grid voltage adjusted to give instantaneous plate current of 35 amperes.

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

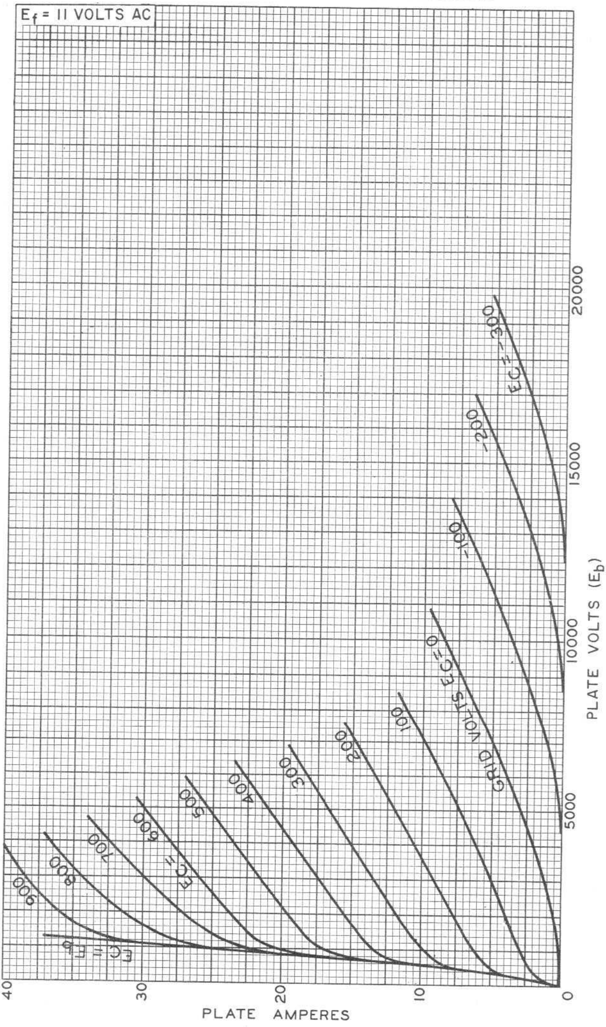
FREQUENCY	10	18	25	Mc
MAXIMUM PERMISSIBLE PERCENTAGE OF MAXIMUM RATED PLATE VOLTAGE AND INPUT:				
Class C Telephony (Plate-Modulated)	100	88	80	%
Class C Telegraphy	100	88	80	%



92CM-6897R3

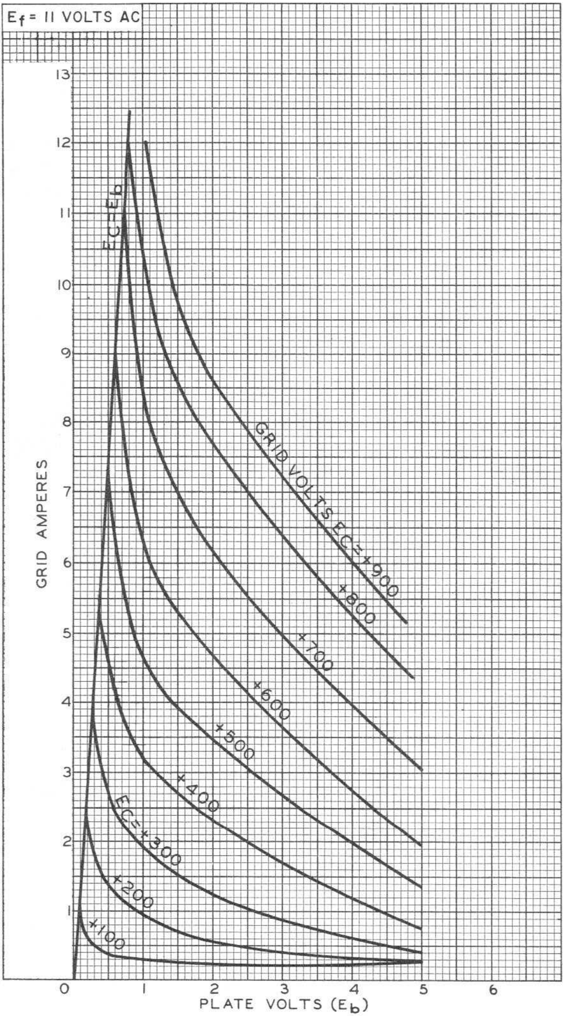
NOTE: FLEXIBLE CONNECTIONS ARE REQUIRED.

TYPICAL PLATE CHARACTERISTICS



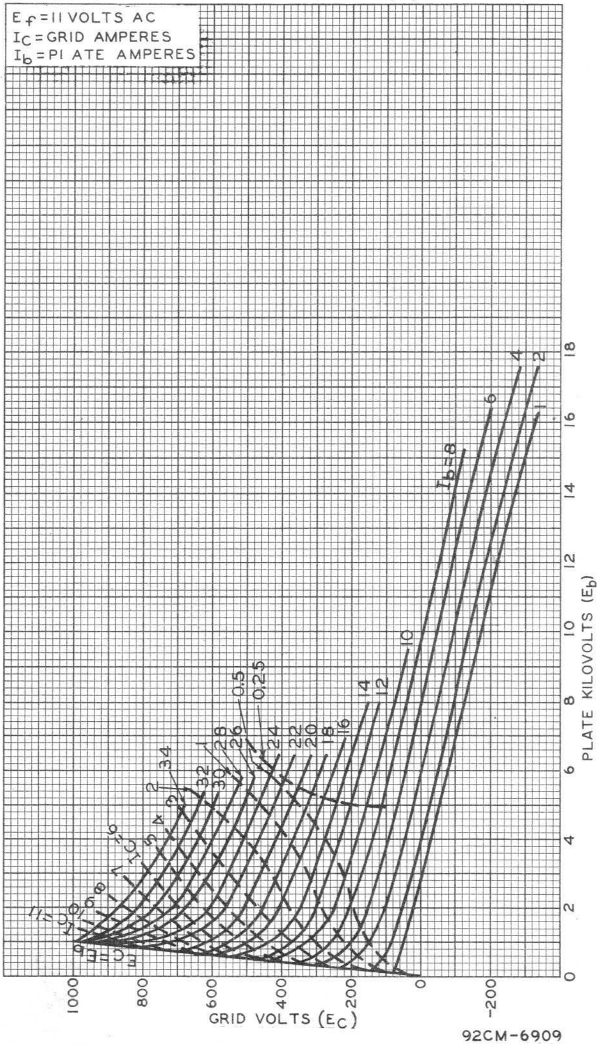
92CM-6899R1

TYPICAL CHARACTERISTICS



92CM-6900

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM-6909

Medium-Mu Triode

GLASS-METAL PENCIL TYPE

FAST WARM-UP TIME — STURDY COAXIAL-ELECTRODE STRUCTURE

For Cathode-Drive Applications with Full Input up to 1700 Mc and with Reduced Input up to 3000 Mc, and at Altitudes up to 100,000 Feet

GENERAL DATA

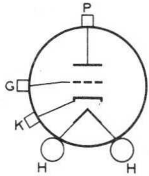
Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at heater volts = 6.3	0.135	amp
Amplification Factor	20	
Transconductance, for dc plate ma. = 24, dc plate volts = 135	6200	µmhos
Direct Interelectrode Capacitances:[a]		
Grid to plate	1.4	pf ←
Grid to cathode	2.4	pf ←
Plate to cathode	0.09 max.	pf

Mechanical:

Operating Position . . . . Any
Dimensions . . . . 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	175 max.	°C

RF POWER AMPLIFIER AND OSCILLATOR — Class C Telegraphy ←

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

Maximum CCS[e] 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	–90 max.	volts
DC CATHODE CURRENT	30 max.	ma

← Indicates a change.

DC GRID CURRENT	8 max.	ma
PLATE INPUT	5 max.	watts
PLATE DISSIPATION[f]	5 max.	watts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	90 max.	volts
Heater positive with respect to cathode	90 max.	volts

Typical CCS[e] Operation:

As oscillator in cathode-drive circuit

At frequency of	*1700*	*3000*	*Mc*
DC Plate-to-Grid Voltage	128	151.5	volts
DC Cathode-to-Grid Voltage	8	1.5	volts
From a grid resistor of	2000	5000	ohms
DC Plate Current	25	29	ma
DC Grid Current (Approx.)	4	0.3	ma
Useful Power Output (Approx.)	475	50	mw

Maximum Circuit Values:

Grid-Circuit Resistance	0.1 max.	megohm

[a] Without external shield.

[b] Grayhill, Inc., 561 Hillgrove Ave., LeGrange, 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 per cent of the carrier conditions.

[e] Continuous Commercial Service.

[f] 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.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Heater Current	1	0.125	0.145	amp
Direct Interelectrode Capacitances:				
Grid to plate	–	1.2	1.6	pf
Grid to cathode	–	2.0	2.6	pf
Plate to cathode	–	–	0.09	pf
Heater-Cathode Leakage Current:				
Heater negative with respect to cathode	1,2	–	100	μa
Heater positive with respect to cathode	1,2	–	100	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	–	14	volts
Amplification Factor	1,7	15	25	
Transconductance	1,7	5100	7700	μmhos

Plate Current (1)	1,7	17	31	ma
Plate Current (2)	1,8	–	100	μa
Power Output.	1,9	300	–	mw

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 150 volts, dc grid voltage of -2 volts, grid resistor of 0.1 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 135 volts, cathode resistor of 68 ohms, and cathode bypass capacitor of 1000 μf.

Note 8: With dc plate voltage of 120 volts and dc grid voltage of -25 volts.

Note 9: With dc plate voltage of 120 volts, grid resistor adjusted to give a dc plate current of 25 milliamperes in a cavity-type oscillator operating at 1700 ± 5 Mc.

SPECIAL TESTS AND PERFORMANCE DATA

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 150 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 every 90 days. 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 meet the following limits:

Heater-Cathode Leakage Current. . . . . . 100 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. . . . . 5100 min. μmhos
For conditions shown under *Characteristics Range Values Notes 1,7.*

Plate Current (2) . . . . 100 max. μa
For conditions shown under *Characteristics Range Values Notes 1,8.*

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 Tests:

Fracture tests are performed on a sample lot of tubes every 90 days.

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 30 pounds upon the grid flange without causing fracture of the glass insulation.

2. Tubes are held by clamping to the cathode cylinder. Tubes will 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, 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 30 ma and value is recorded. 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 limit:

Power Output. . . . . 0.2 min. watt
For conditions shown under *Characteristics Range Values Notes 1,9.*

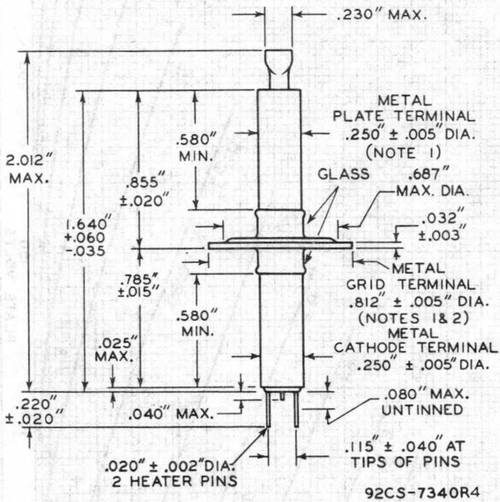
OPERATING CONSIDERATIONS

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-rated values.

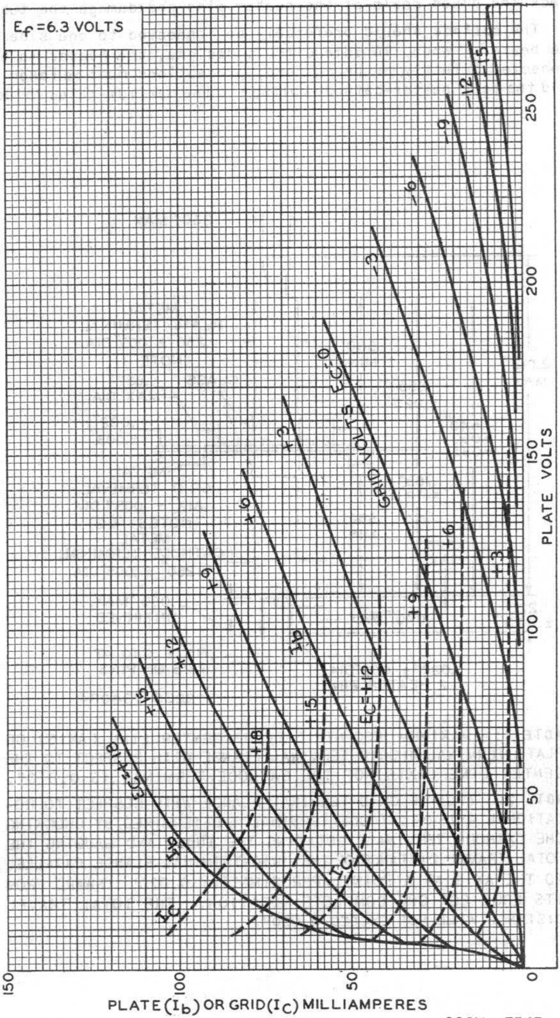


92CS-7340R4

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".

AVERAGE CHARACTERISTICS



92CM—7343

5763

5763

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:

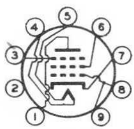
Mounting Position	Any
Maximum Overall Length	2-5/8"
Maximum Seated Length	2-3/8"
Length, Base Seat to Bulb Top (excluding tip) . . .	2" ± 3/32"
Maximum Diameter	7/8"
Bulb	T-6-1/2
Base . . . . Small-Button Noval 9-Pin (JETEC No.E9-1)	
Basing Designation for BOTTOM VIEW	9K

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.

5763

5763

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
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

5763

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

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

5763

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

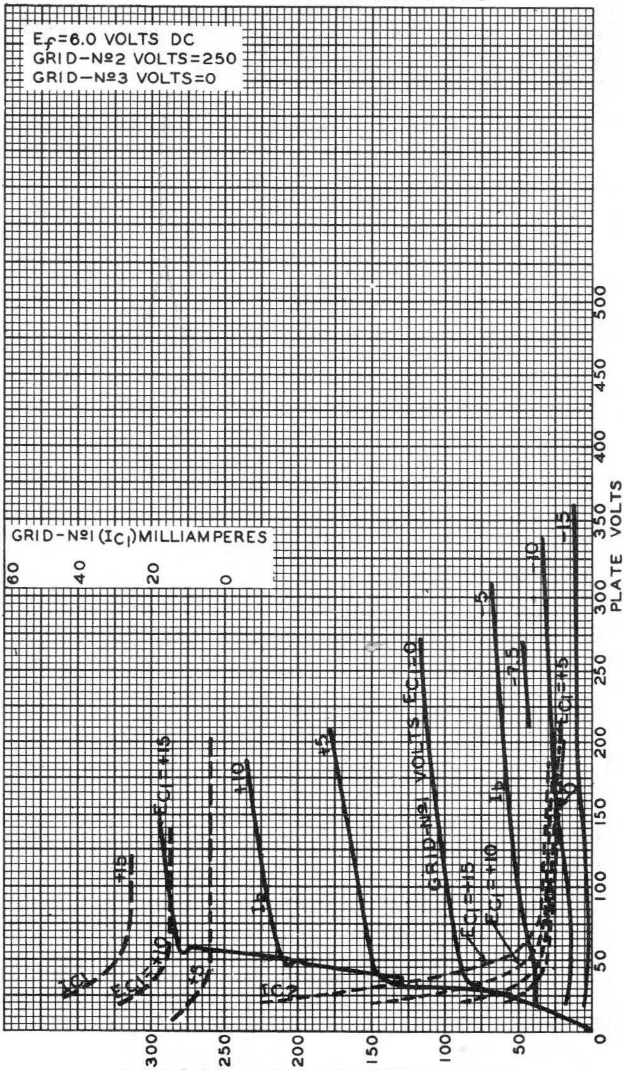
→ Indicates a change

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

5763

AVERAGE CHARACTERISTICS

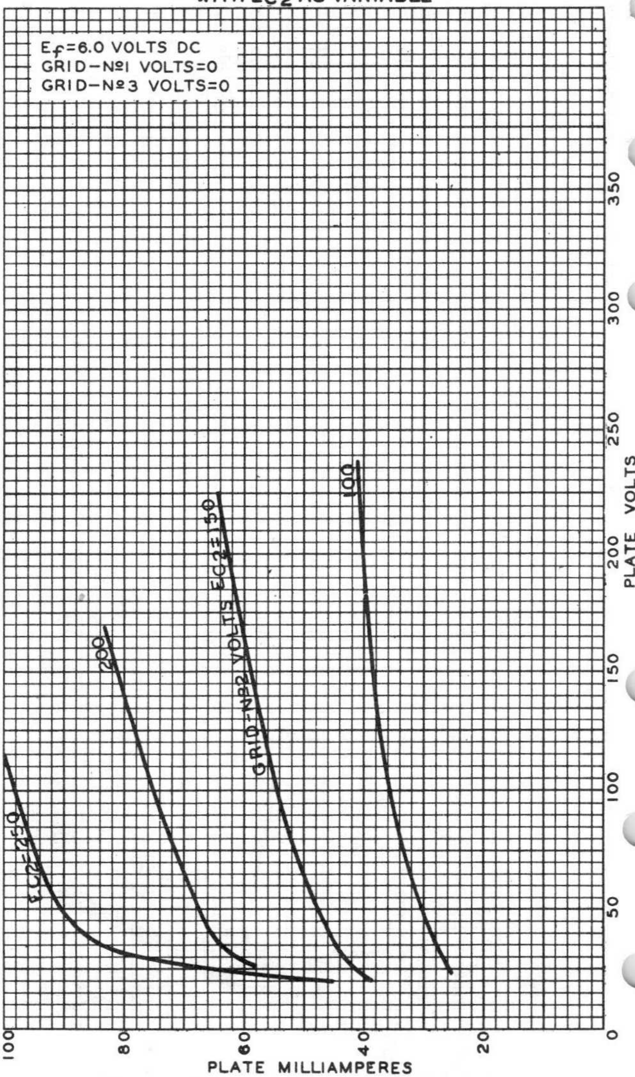


RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

5763

AVERAGE PLATE CHARACTERISTICS
WITH E_{C2} AS VARIABLE



JAN.10,1949

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7159

Power Triode

WATER AND FORCED-AIR COOLED — GROUNDED-GRID TYPE

GENERAL DATA

Electrical:

Filament, Multistrand Thoriated-Tungsten:

Voltage (AC or DC)	11 ± 0.6	volts
Current at filament volts = 11	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.

Minimum Heating Time	15	sec
Amplification Factor	40	←

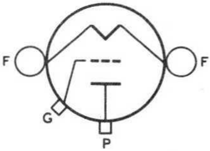
Direct Interelectrode Capacitances (Approx.):

Grid to plate	53	pf
Grid to filament	89	pf
Plate to filament	1.2	pf

Mechanical:

Operating Position. . . . . Vertical, filament end up
Maximum Overall Length. . . . . 24-1/2"
Maximum Diameter. 9-1/2"
Terminal Diagram (See *Dimensional Outline*):

F – Filament
G – Grid



P – Plate

Thermal:

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.

← Indicates a change.

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 heater 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, and plate) .	165 max.	°C

AF POWER AMPLIFIER & MODULATOR — Class B

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

DC PLATE VOLTAGE.	15000 max.	volts
MAX.-SIGNAL DC PLATE CURRENT[b]	6 max.	amp
Max.-SIGNAL PLATE INPUT[b].	90 max.	kw
PLATE DISSIPATION[b].	50 max.	kw

Typical Push-Pull 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.)[c]. .	120	688	watts
Max.-Sig. Power Output (Approx.). . .	37	117	kw

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:*

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:[d]			
From a fixed-supply	-1500	-1500	volts
From a grid resistor of 2100 ohms. .	-1500	-	volts
From a grid resistor of 1400 ohms. .	-	-1500	volts
Peak RF Grid Voltage.	2070	2180	volts
DC Plate Current.	3.3	4.5	amp
DC Grid Current (Approx.)[e].	0.72	1.1	amp
Driving Power (Approx.)[e].	1350	2160	watts
Power Output (Approx.).	28	45	kw

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

Maximum CCS Ratings, *Absolute-Maximum Values:*

DC PLATE VOLTAGE	17000 max.	volts
DC GRID VOLTAGE	-2000 max.	volts
DC PLATE CURRENT	9 max.	amp
DC GRID CURRENT	1.25 max.	amp
PLATE INPUT	150 max.	kw
PLATE DISSIPATION	50 max.	kw

Typical Operation in Grounded-Filament Circuit:

DC Plate Voltage	14000	17000	volts
DC Grid Voltage:[g]			
From a fixed supply	-900	-1450	volts
From a cathode resistor of 125 ohms	-900	–	volts
From a cathode resistor of 150 ohms	–	-1450	volts
From a grid resistor of 750 ohms	-900	–	volts
From a grid resistor of 1320 ohms	–	-1450	volts
Peak RF Grid Voltage	1600	2375	volts
DC Plate Current	6	8.5	amp
DC Grid Current (Approx.)[e]	1.2	1.1	amp
Driving Power (Approx.)[e]	1700	2300	watts
Power Output (Approx.)[e]	65	105	kw

Typical Operation in Grounded-Grid Circuit:

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

Driving Power (Approx.)[e]	6250	11200	watts
Power Output	70	114	kw

[a] Continuous Commercial Service.

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

[c] The driving stage should have good regulation and should be capable of supplying considerably more than the specified driving power.

[d] Obtained from a fixed supply, grid resistor, or a combination of both.

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

[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.

CHARACTERISTICS RANGE VALUES

	Note	*Min.*	*Max.*	
Filament Current	1	265	305	amp
Amplification Factor	1,2	35	45	←
Grid-Plate Capacitance	–	47	59	pf
Grid-Filament Capacitance	–	74	104	pf
Plate-Filament Capacitance	–	0.8	1.6	pf
Grid Voltage	1,3	-310	-490	volts
Plate Voltage	1,4	7100	9100	volts ←
Plate Voltage	1,5	3600	4600	volts
Peak Cathode Current	1,6	50	–	amp
Useful Power Output	1,7	80	–	kw ←

← Indicates a change.

Note 1: With 11 volts ac on filament.

Note 2: With dc grid voltage of -50 volts, and with plate voltage adjusted to give dc plate current of 2 amperes.

Note 3: With dc plate voltage of 15000 volts, and with grid voltage adjusted to give dc plate current of 0.05 ampere.

Note 4: With dc grid voltage of -100 volts, and with plate voltage adjusted to give a dc plate current of 2 amperes.

Note 5: With dc grid voltage of 0 volts, and with plate voltage adjusted to give dc plate current of 2 amperes.

Note 6: Represents the maximum usable cathode current (plate current and grid current) for the tube under any condition of operation.

→ Note 7: With dc plate voltage of 17000 volts, dc plate current of 8.8 amperes, dc grid current of 1.05 to 1.25 amperes, grid resistor of 1600 ± 10% ohms, and frequency of 1.6 Mc.

MAXIMUM RATINGS vs OPERATING FREQUENCY

OPERATING FREQUENCY Mc	MAXIMUM PERMISSIBLE PERCENTAGE OF MAXIMUM-RATED PLATE VOLTAGE & PLATE INPUT	
	TELEPHONY	TELEGRAPHY
	Class C Plate-Modulated	Class C Unmodulated
20	100	100
27	88	88
35	77	77

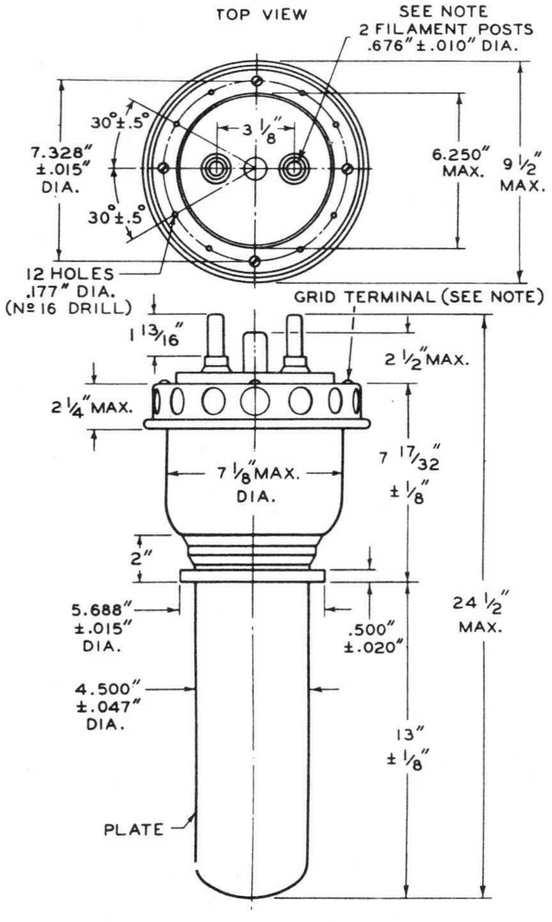
CURVES shown under Type 5671 also apply to the 5770

→ Indicates a change.

5770

5770

POWER TRIODE



NOTE: FLEXIBLE CONNECTIONS ARE REQUIRED

92CM-7070

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

5771

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 Interlectrode Capacitances (Approx.):		
Grid to Plate	24.5	$\mu\mu f$
Grid to Filament	47	$\mu\mu f$
Plate to Filament	3	$\mu\mu f$

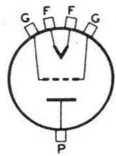
Mechanical:

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.

5771

5771

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.

5771

RCA
5771

POWER TRIODE

Typical Operation:

DC Plate Voltage	10000	volts
DC Grid Voltage⊕	−840	volts
	1075	ohms
Peak RF Grid Voltage	1440	volts
DC Plate Current	3.8	amp
DC Grid Current (Approx.)□	0.78	amp
Driving Power (Approx.)□	1010	watts
Power Output (Approx.)	29	kw

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

RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy

Key-down conditions per tube without modulation□□

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

	1.6 to 25 Mc	Below 1.6 Mc	
DC PLATE VOLTAGE	12500 max.	15000 max.	volts
DC GRID VOLTAGE	−1600 max.	−1600 max.	volts
DC PLATE CURRENT	6 max.	6 max.	amp
DC GRID CURRENT	0.8 max.	0.8 max.	amp
PLATE INPUT	60 max.	67.5 max.	kw ←
PLATE DISSIPATION	22.5 max.	22.5 max.	kw

Typical Operation:

DC Plate Voltage	10000	10000	12500	15000	volts
DC Grid Voltage▲▲	−720	−770	−630	−990	volts
	140	115	115	185	ohms
	1040	1000	840	1240	ohms
Peak RF Grid Voltage	1290	1440	1230	1620	volts
DC Plate Current	4.5	6	4.8	4.5	amp
DC Grid Current (Approx.)□	0.69	0.77	0.75	0.8	amp
Driving Power (Approx.)□	800	1000	1050	1160	watts
Power Output (Approx.)	33	40	44	53	kw

● Continuous Commercial Service.

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

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

▲▲ Obtained from cathode resistor (140, 115, 115, 185), or grid resistor (1040, 1000, 840, 1240) or by partial self-bias methods.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Filament Current	1	160	180	amp
Amplification Factor	1,2	17	23	

←Indicates a change.

5771

5771

POWER TRIODE

	Note	Min.	Max.	
Grid-Plate Capacitance	–	20	28	$\mu\mu f$
Grid-Filament Capacitance. . .	–	39	55	$\mu\mu f$
Plate-Filament Capacitance . .	–	2.3	3.7	$\mu\mu f$
Plate Voltage.	1,3	5300	7900	volts
Plate Voltage.	1,4	2100	3100	volts
Peak Cathode Current	1,5	35	–	amp
Useful Power Output.	1,6	33	–	kw

Note 1: With 7.5 volts ac on filament.

Note 2: With dc grid voltage of – 100 volts, and with plate voltage adjusted to give dc plate current of 2 amperes.

Note 3: With dc grid voltage of – 200 volts, and with plate voltage adjusted to give dc plate current of 2 amperes.

Note 4: With dc grid voltage of 0 volts, and with plate voltage adjusted to give dc plate current of 2 amperes.

Note 5: Represents the maximum usable cathode current (plate current and grid current) for the tube under any condition of operation.

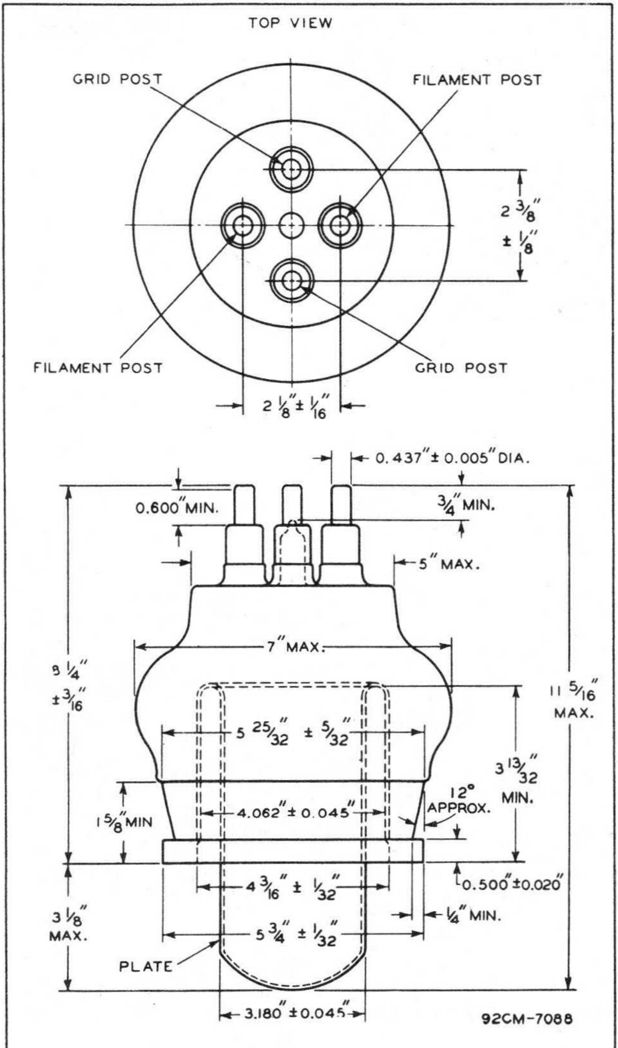
Note 6: With dc plate voltage of 12500 volts, dc plate current of 4.8 amperes, dc grid current of 0.6 to 0.9 ampere, grid resistor of 1600 ± 10% ohms, and frequency of 22 Mc.

Data on operating frequencies for the 5771 are given on the sheet TRANS. TUBE RATINGS vs FREQUENCY.

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA
5771

POWER TRIODE



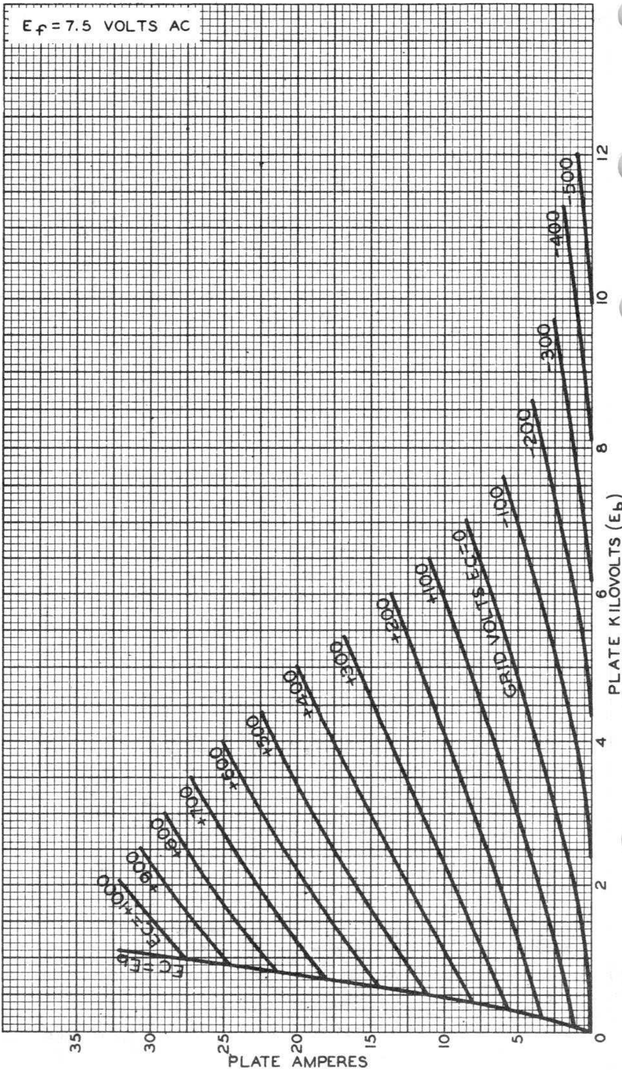
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

5771

RCA

5771

AVERAGE PLATE CHARACTERISTICS



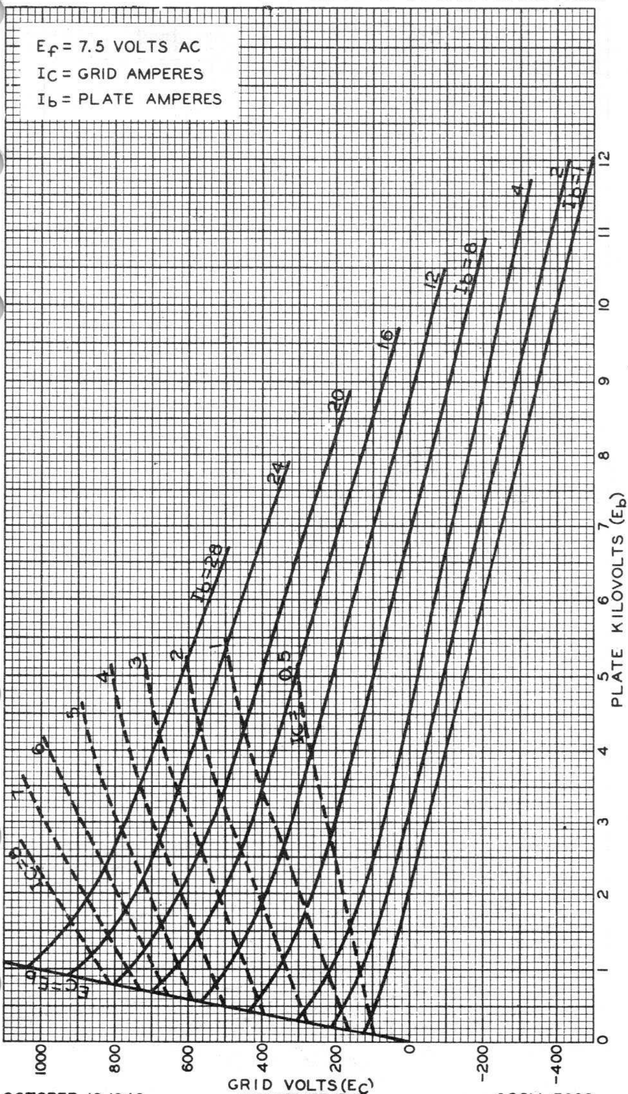
OCTOBER 28,1948 **TUBE DEPARTMENT** 92CM-7106

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

5771

5771

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



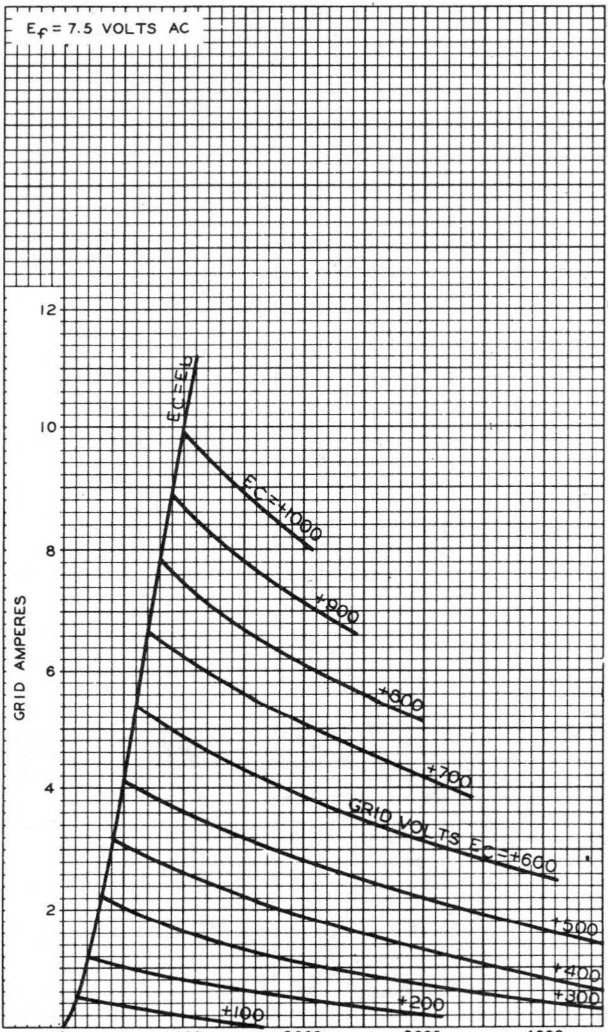
OCTOBER 18,1948 TUBE DEPARTMENT 92CM-7098

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

5771

5771

TYPICAL CHARACTERISTICS



OCTOBER 28,1948

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7107

5825

5825

HALF-WAVE VACUUM RECTIFIER

GENERAL DATA

Electrical:

Filament, Thoriated Tungsten:

Voltage	1.6	ac volts
Current	1.25	amp

Direct Interelectrode Capacitance:°

Plate to Filament	2.2	μμf
Tube Voltage Drop at maximum peak plate current	1750	volts

° With no external shield.

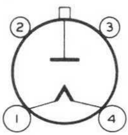
Mechanical:

Mounting Position	Any
Overall Length	5-11/16" ± 5/32"
Seated Length	5-1/6" ± 5/32"
Maximum Diameter	2-1/16"
Bulb	ST-16
Cap	Medium
Base	Medium-Shell Small 4-Pin
Basing Designation for BOTTOM VIEW	4P

Pin 1 – Filament

Pin 2 – No Connection

Pin 3 – No Connection



Pin 4 – Filament, Internal Shield

Cap – Plate

HALF-WAVE RECTIFIER

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

For supply frequencies up to 250 kc

PEAK INVERSE PLATE VOLTAGE	60000 max.	volts
PEAK PLATE CURRENT	40 max.	ma
AVERAGE PLATE CURRENT	2 max.	ma
HOT-SWITCHING TRANSIENT CURRENT for duration of 0.1 sec. max.	100 max.	ma
PLATE DISSIPATION	3.5 max.	watts
BULB TEMPERATURE	80 max.	°C

Typical Operation at 70 kc in Half-Wave Circuit with Capacitor-Input to Filter:

AC Plate-Supply Voltage (RMS)	21200	volts
Filter-Input Capacitor	350	μμf
Effective Plate-Supply Impedance	120000	ohms
DC Output Current	2	ma
DC Output Voltage at Input to Filter (Approx.):		
At half-load current (1 ma)	28000	volts
At full-load current (2 ma)	26700	volts
Voltage Regulation (Approx.):		
Half-load to full-load current	1300	volts

5825

5825

HALF-WAVE VACUUM RECTIFIER

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Filament Current	1	1.15	1.35	amp
Plate-Filament Capacitance	–	2.14	2.26	$\mu\mu$f

Note: With 1.6 volts dc on filament.

OPERATING NOTES

When the filament is supplied from an rf power source which is at a high dc potential above ground, adjustment of the filament voltage by direct measurement is usually impractical. However, a simple method utilizing visual comparison of filament temperatures can be used for adjustment of filament power. The color temperature of the filament operating from an rf power source may be checked visually by observing in a darkened room the reflection of the incandescent filament upon the surface of the internal shield. A visual comparison of this color temperature with that obtained when the filament of another 5825 is operated from a dc or low-frequency ac supply of 1.6 volts, provides a convenient means for adjusting the amount of rf excitation to produce 1.6 volts (rms) at the filament terminals.

The filament must never under any condition of operation be allowed to reach a temperature higher than that caused by operating the filament on dc or low-frequency ac at a voltage of 1.68 volts. Operation at higher temperatures will cause impaired performance of the tube. During circuit adjustment, however, it is permissible to allow the filament voltage to rise to 2 volts for the brief interval required to make the adjustment.

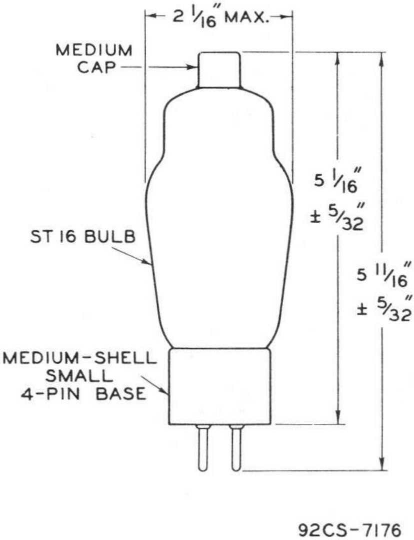
Soft x-rays are produced when the 5825 is operated at a plate voltage above approximately 20000 volts. These rays can constitute a health hazard unless the tube is adequately shielded. Relatively simple shielding should prove adequate, but the need for this precaution should be considered in equipment design.

5825

RCA

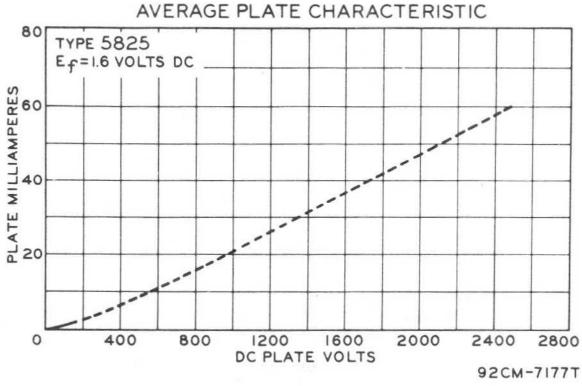
5825

HALF-WAVE VACUUM RECTIFIER



5825

5825
HALF-WAVE VACUUM RECTIFIER



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:

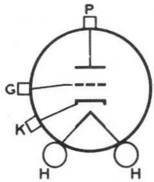
Operating Position . . . . Any

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-ID, 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-ID, 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-ID, 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. Lifetest 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.

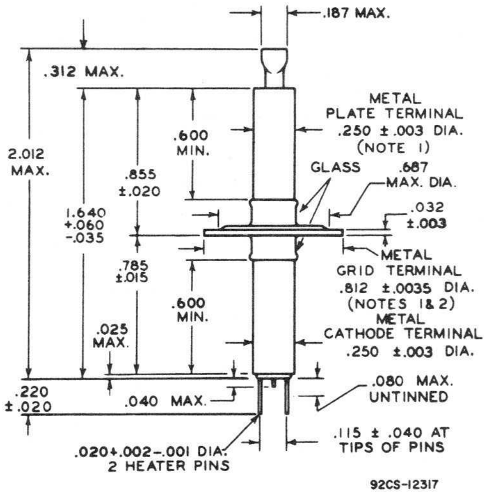
OPERATING CONSIDERATIONS

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.



→

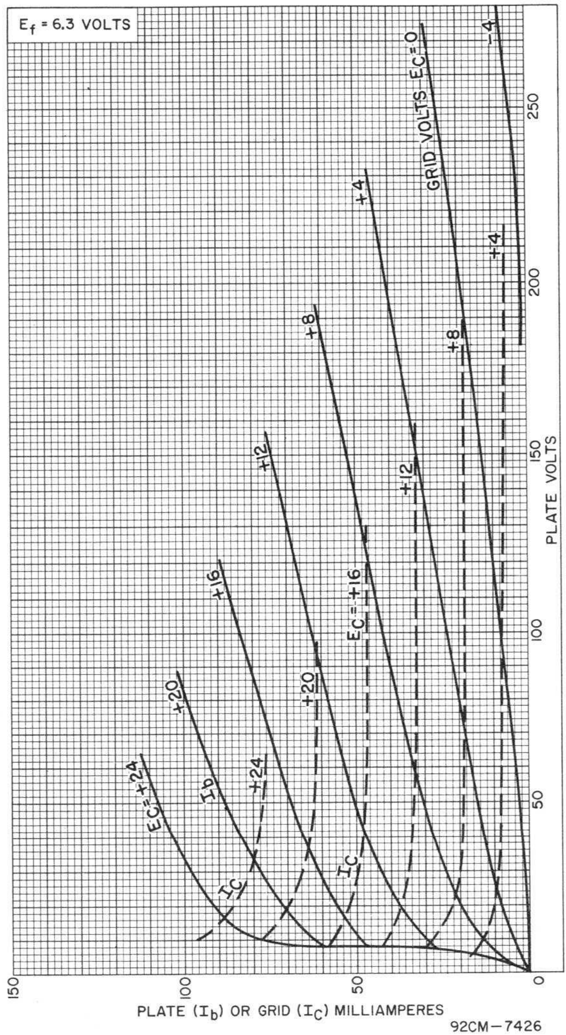
DIMENSIONS IN INCHES

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



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

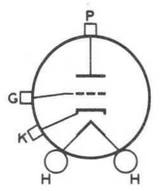
Electrical:

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-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 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-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 permanent shorts or open circuits.

Shorts and Continuity Test:

This test (similar to MIL-E-1D, 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.

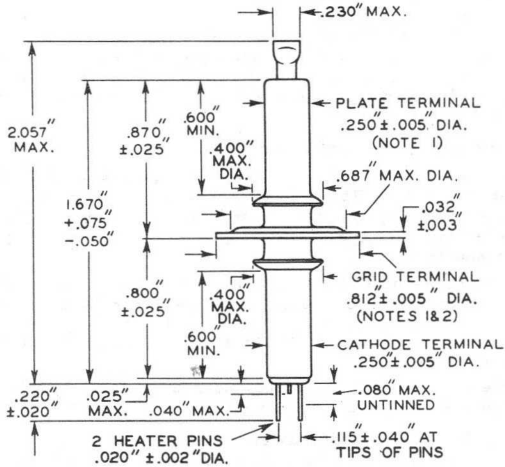
OPERATING CONSIDERATIONS

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

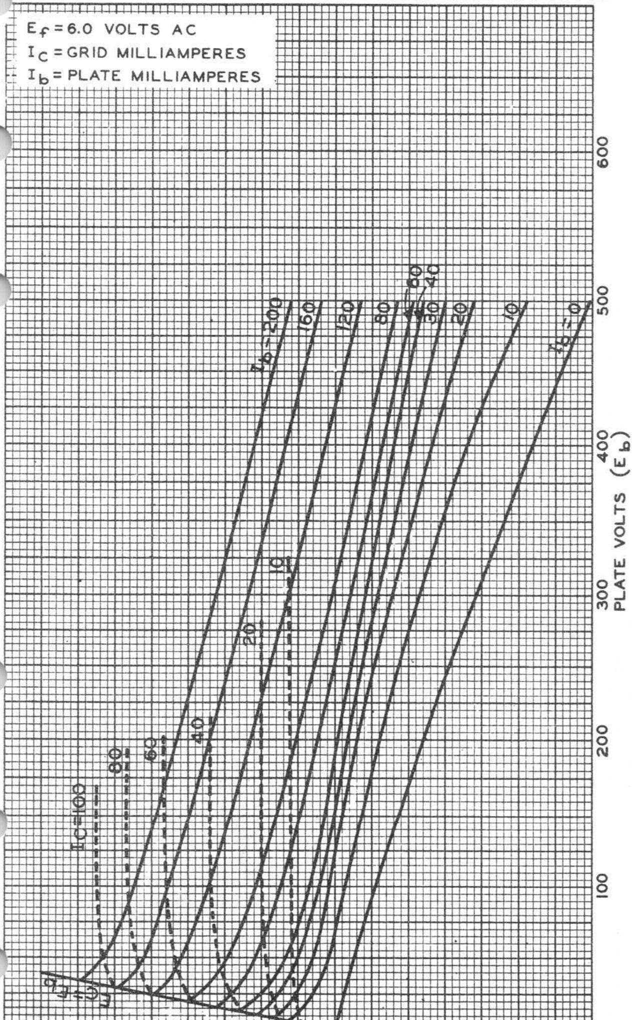
NOTE 1: MAXIMUM ECCENTRICITY OF CENTER LINE (AXIS) OF PLATE TERMINAL OR GRID-TERMINAL FLANGE WITH RESPECT TO THE CENTER LINE (AXIS) OF THE CATHODE TERMINAL IS 0.010".

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".

5893

5893

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



JAN. 23, 1952

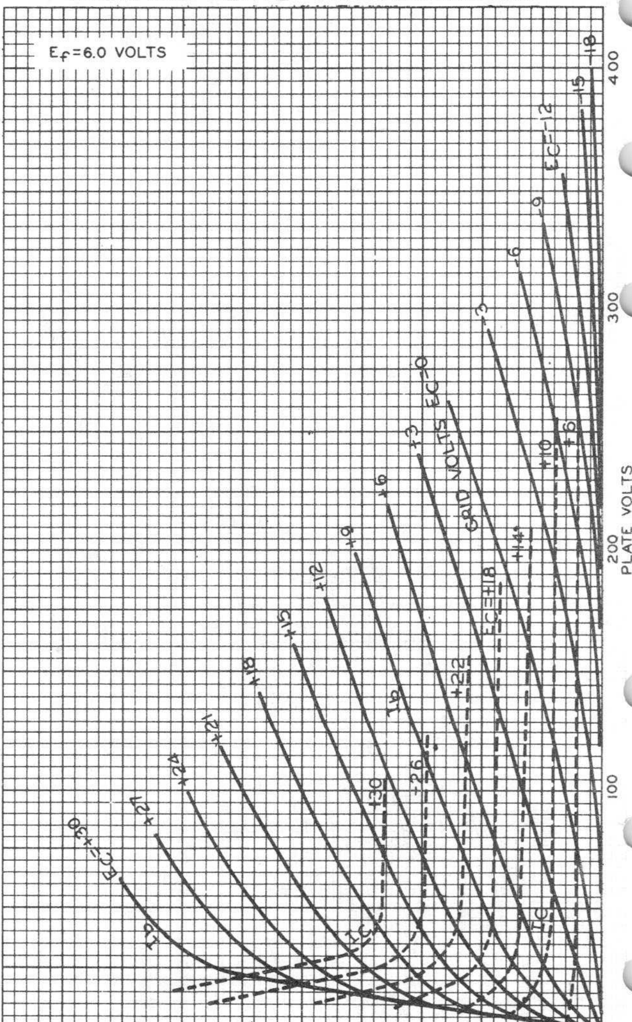
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7609R1

5893

5893

AVERAGE PLATE CHARACTERISTICS



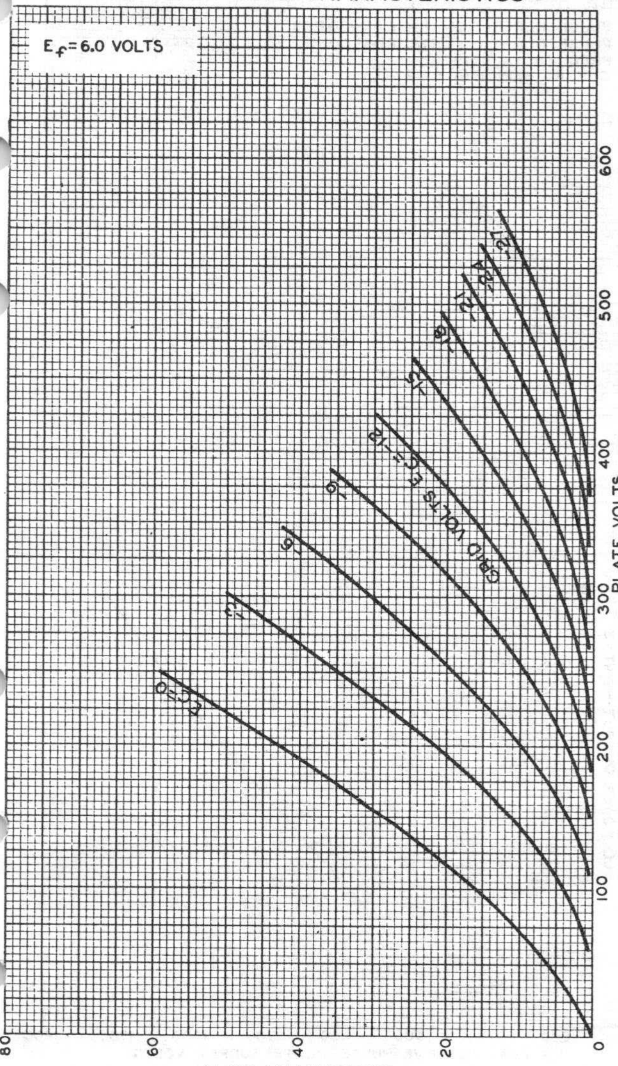
JUNE 13, 1951

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7610

AVERAGE PLATE CHARACTERISTICS



JUNE 13, 1951

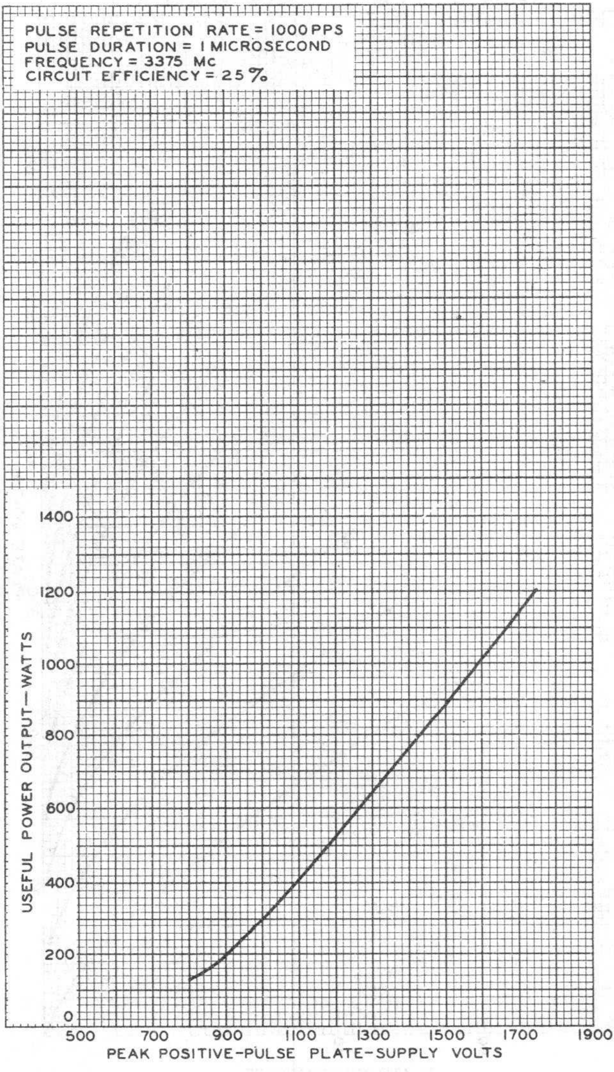
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7483

5893

5893

AVERAGE PERFORMANCE CHARACTERISTIC



Power Triode

FORCED-AIR COOLED — GROUNDED-GRID TYPE

For UHF Plate-Pulsed Oscillator and Amplifier Service

GENERAL DATA

Electrical: ←

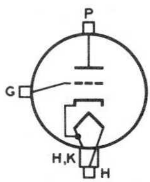
Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3	volts
Current	3.4	amp
Minimum heating time	1	minute
Amplification Factor	25	
Direct Interelectrode Capacitances:		
Grid to plate	6.0	pf
Grid to cathode	11.0	pf
Plate to cathode[a]	0.19 max.	pf

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

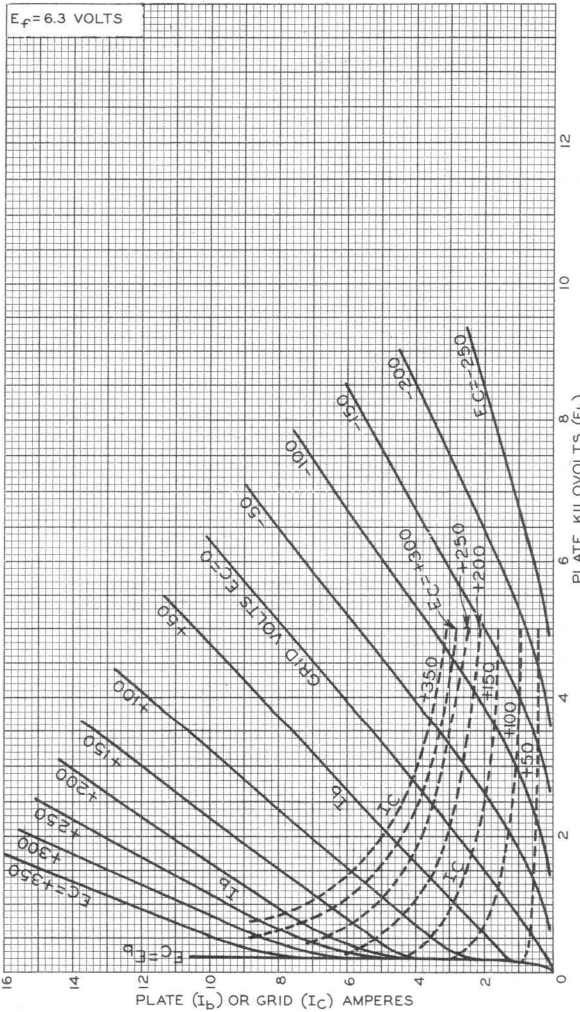
DIMENSIONAL OUTLINE and MOUNTING ARRANGEMENT shown under Type 6161 also apply to the 5946

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

6026

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	$\mu\mu f$
Grid to cathode and heater	2	$\mu\mu f$ ←
Plate to cathode and heater	0.42	$\mu\mu f$ ←

Characteristics, Class A_1 Amplifier:

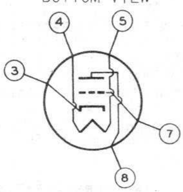
Plate-Supply Voltage	120	volts
Cathode Resistor	220	ohms
Amplification Factor	24	
Plate Resistance (Approx.)	4000	ohms
Transconductance	5900	μmhos
Plate Current	12	ma

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

6026

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	$\mu\mu$f
→ Grid to cathode and heater . . .	1	1.55	2.45	$\mu\mu$f
→ Plate to cathode and heater. . .	1	0.345	0.495	$\mu\mu$f
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.

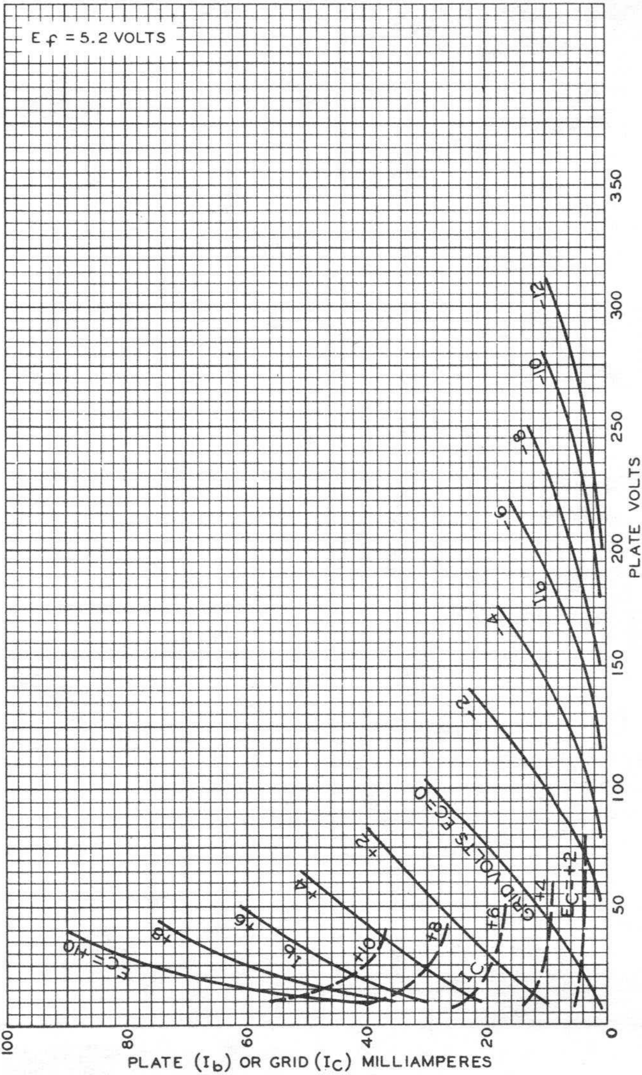
The *flexible leads* of the 6026 are usually soldered to the circuit elements. Soldering of the connections should be made as far as possible from the glass button. If this precaution is not followed, the heat of the soldering operation may crack the glass seals and damage the tube.

→ Indicates a change.

RCA

6026

AVERAGE PLATE CHARACTERISTICS



TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6146B/8298A

Beam Power Tube

HIGH POWER SENSITIVITY
RCA "DARK HEATER" WITH 5- TO 8-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 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

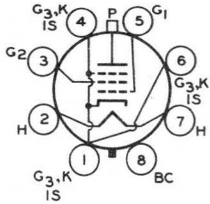
Mechanical:

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]

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].	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

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

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 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

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

	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:

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

6146B/8298A

Typical Operation:

As amplifier up to 60 Mc

	CCS	ICAS	
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 Current[w]. . .	–	–	15	ma
Useful Power Output[w].	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 90% 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.

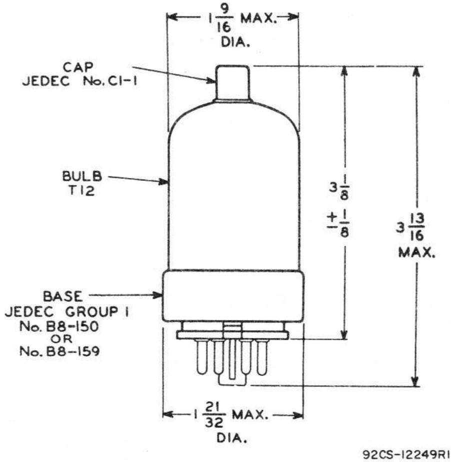
To insure adequate cooling it is essential that free circulation of air be provided around the tube. In most cases, no additional air is required.

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.

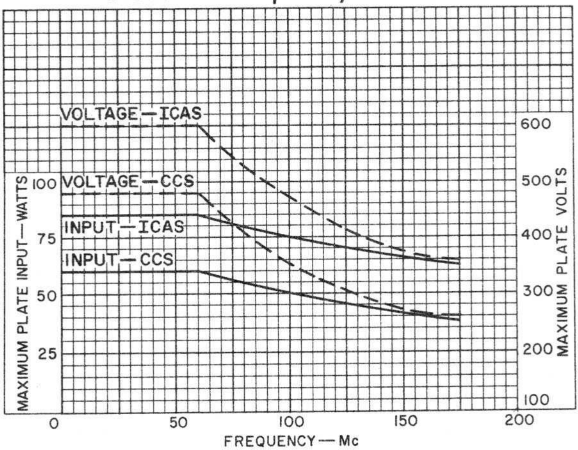
During standby periods in intermittent operation, it is recommended that the heater voltage be maintained at normal operating value when the period is less than 15 minutes, and that it be reduced to 80 per cent of normal when the period is between 15 minutes and 2 hours. For longer periods, the heater 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.



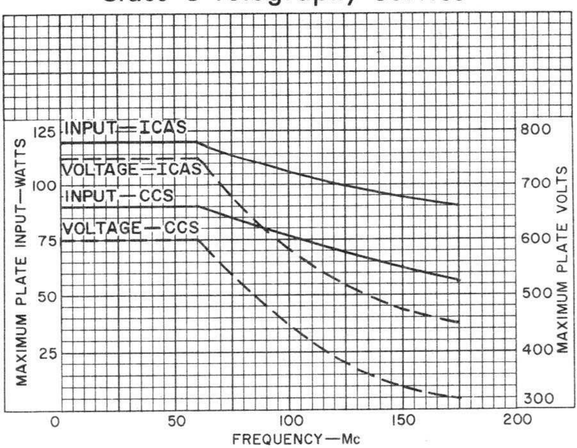
DIMENSIONS IN INCHES

RATING CHART I
Class C Telephony Service



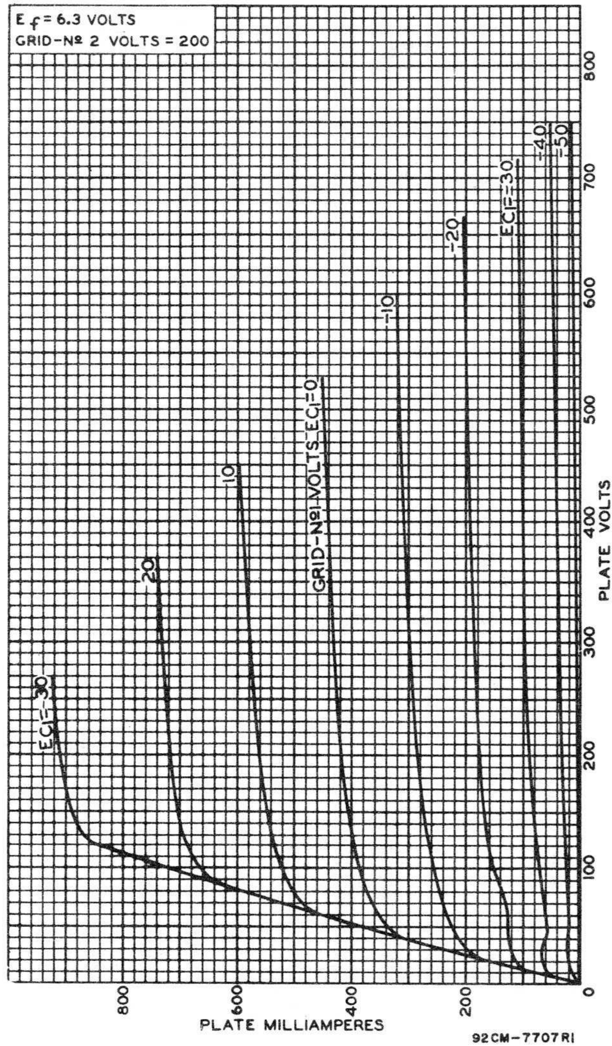
92CS-12244

RATING CHART II
Class C Telegraphy Service

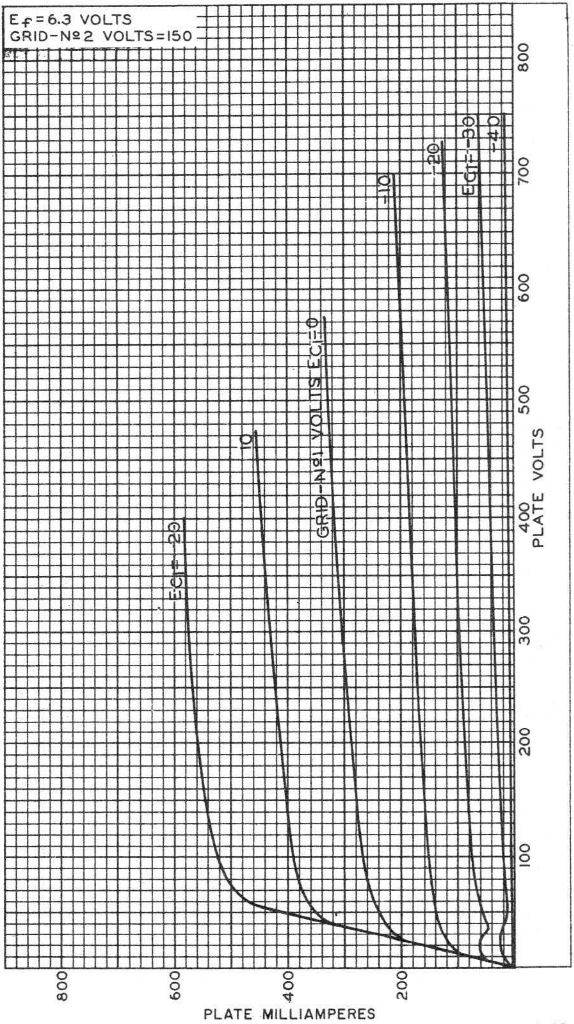


92CS-12243

TYPICAL PLATE CHARACTERISTICS

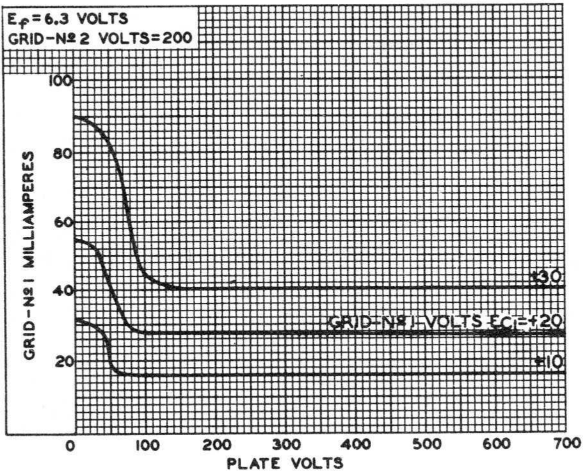


TYPICAL PLATE CHARACTERISTICS

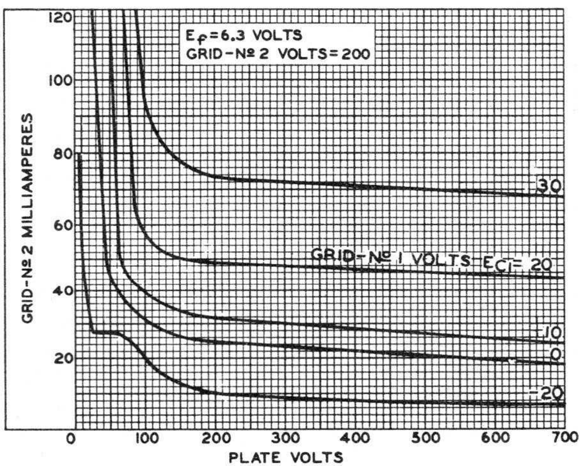


92CM-8145

TYPICAL CHARACTERISTICS

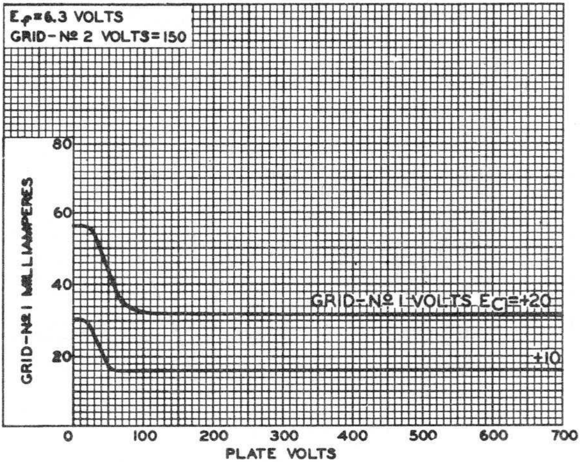


92CS-9617

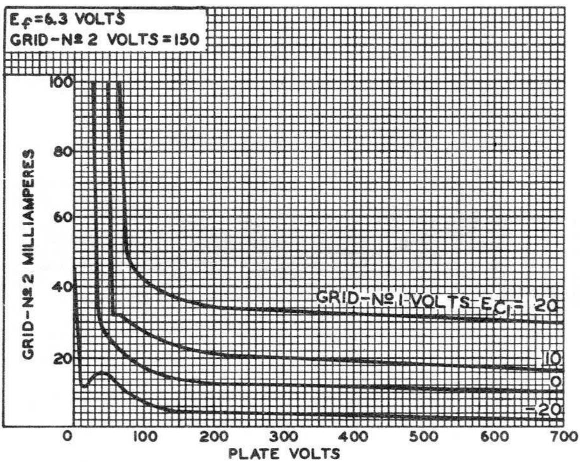


92CS-9618

TYPICAL CHARACTERISTICS



92CS-9619



92CS-9620

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

POWER TRIODE

FORCED-AIR COOLED

Useful with full input up to 900 Mc
and with reduced input up to 2000 Mc

The 6161 supersedes type 5588 for new equipment design.

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:

Voltage*	6.3 av.	ac or dc volts
	6.9 max.	ac or dc volts
Current at 6.3 volts	3.4	amp
Minimum heating time at 6.3 volts	1	minute
Amplification Factor for grid volts = −15, and plate ma. = 250	25	

Direct Interelectrode Capacitances:

Grid to plate§	6	μμf
Grid to cathode and heater§	11	μμf
Plate to cathode and heater°	0.19	μμf

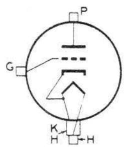
Mechanical:

Operating Position	Any
Overall Length	3-5/16" ± 3/32"
Greatest Diameter	1.750" ± 0.010"
Weight (Approx.)	8 oz
Radiator	Integral part of tube
Mounting	Special

Terminal Connections *(See Dimensional Outline)*:

G – Grid

H – Heater



K – Cathode

P – Plate

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.

Percentage of maximum-rated plate dissipation for each class of service	100	80	60	%
Minimum air flow	16	10	5.7	cfm
Static pressure	0.85	0.4	0.16	in. of water

*,§,°: See next page.

← Indicates a change.

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

RCA

6161

POWER TRIODE

The above flow and pressure values are for condition with radiator temperature held constant at 135° C rise above incoming-air 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 flange)	180 max.	°C
Grid-Terminal Temperature.	150 max.	°C
Cathode-Terminal Temperature	150 max.	°C
Seal Temperature (Plate, grid, and cathode). .	150 max.	°C

RF POWER AMPLIFIER — Class B Television Service

Synchronizing-level conditions per tube unless otherwise specified

Maximum CCS● Ratings, *Absolute Values:*

DC PLATE VOLTAGE	1600 max.	volts
DC PLATE CURRENT	0.350 max.	amp
→ DC GRID CURRENT:		
Negative value	0.010 max.	amp
Positive value	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	100	volts
Peak RF Cathode-to-Grid Voltage:		
Synchronizing level.	130	volts
Pedestal level	117	volts
DC Plate Current:		
Synchronizing level.	0.350	amp
Pedestal level	0.285	amp
DC Grid Current (Approx.):		
Synchronizing level.	0.040	amp
Pedestal level	0.013	amp
Driver Power Output (Approx.):♣		
Synchronizing level.	65#	watts
Pedestal level	40	watts
Output-Circuit Efficiency (Approx.). . . .	89	%
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
DC Cathode-to-Grid Voltage	100	volts

*, §, °, ●, ♠, ♣, #, ●●: See next page. → Indicates a change.

6161
POWER TRIODE

Peak RF Cathode-to-Grid Voltage:		
Synchronizing level	135	volts
Pedestal level	120	volts
DC Plate Current:		
Synchronizing level	0.350	amp
Pedestal level	0.280	amp
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	%
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:		
Negative value	0.010 max.	amp
Positive value	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	%
Useful Power Output (Approx.):		
Synchronizing level	325●●	watts
Pedestal level	195●●	watts

*,§,○,●,♠,♣,#,●●,⊕: See next page. ← Indicates a change.

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

RCA

6161

POWER TRIODE

Typical Operation in Cathode-Drive Circuit at 900 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	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	%
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	*See Rating Chart*	
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
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	%
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
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.)♣■	75⊕	watts

*,§,○,●,♦,♣,#,●●,⊕,■,**,⊕: See next page.

→ Indicates a change.

RCA

6161
POWER TRIODE

Output-Circuit Efficiency (Approx.) . . .	60	%
Useful Power Output (Approx.).	120●●	watts

RF POWER AMPLIFIER & OSCILLATOR — 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.	*See Rating Chart*	←
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 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	%
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 cathode resistor of	575	ohms
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	%
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.	*See Rating Chart*	←
PLATE INPUT.	400 max.	watts
PLATE DISSIPATION.	250 max.	watts

*,§,○,●,♣,#,●●,⊕,■,**,⊕,□,▲,†: See next page. ← Indicates a change.

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

6161

6161
POWER TRIODE

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 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 Efficiency (Approx.)	90	80	%
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	18	32	
Direct Interelectrode Capacitances:				
Grid to plate	–	5.6	6.6	μμf
Grid to cathode and heater. . .	–	10.5	12.5	μμf
Plate to cathode and heater . .	3	0.12	0.26	μμf
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	3.2	–	amp
Useful Power Output	1,8	225	–	watts

Note 1: With 6.3 volts ac on heater.

Note 2: With dc grid volts = –15, 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 volts = –10, and dc plate voltage adjusted to give dc plate current of 250 ma.

Note 5: With dc grid volts = –20, and dc plate voltage adjusted to give dc plate current of 250 ma.

Note 6: With dc plate volts = 1600, and dc grid voltage adjusted to give dc plate current of 1 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 with dc plate volts = 1600, dc plate ma. = 250, dc grid ma. = 50 to 75, grid resistor (ohms) = 2000 ± 10%, and frequency (Mc) = 15.

*,§,○,●,♠,♣,#,●●,⊕,■,**,⊕,□,▲,†: See next page. →Indicates a change.

RCA

6161

POWER TRIODE

* 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.

§ Without external shield.

○ With external flat shield 7-1/2" min. diameter located in plane of the grid terminal and perpendicular to axis of tube. Shield is connected to grid terminal.

● Continuous Commercial Service.

♁ Computed between half-power points and based on tube output capacitance only.

♣ 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 includes 24 watts of circuit loss and 36 watts added to plate input.

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

⊕ This value includes 28 watts of circuit loss and 40 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.

** This value includes 18 watts of circuit loss and 40 watts added to plate input.

⊕ 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.

† This value includes 23 watts of circuit loss and 45 watts added to plate input.

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, biased-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	%

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

RCA

6161

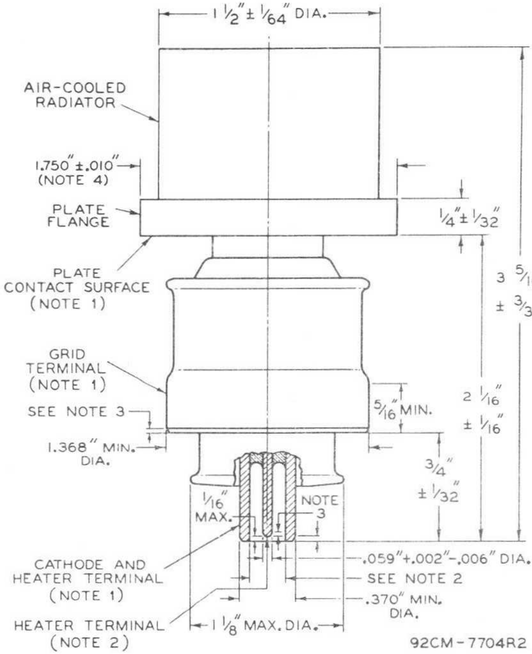
POWER TRIODE

→

OPERATING CONSIDERATIONS

In *tuning a cathode-drive rf amplifier*, it must be remembered that variations in the load on the output stage will produce corresponding variations in the load on the driving stage. This effect will be noticed by the simultaneous increase in plate currents of both the output and driving stages.

During *standby periods* of less than 15 minutes, it is recommended that the heater voltage be reduced to 80% of normal to conserve life; for longer standby periods, the heater power should be turned off.



→ Indicates a change.

6161

POWER TRIODE

NOTE 1: WITH THE CYLINDRICAL SURFACES OF ITS GRID AND CATHODE TERMINALS CLEAN, SMOOTH, AND FREE OF BURRS, THE TUBE WILL ENTER A GAUGE AS SHOWN IN SKETCH G_1. THE FOUR CYLINDRICAL HOLES H_1, H_2, H_3, and H_4 HAVE AXES COINCIDENT WITHIN 0.0005", LENGTHS DETERMINED FROM THE DIMENSIONAL OUTLINE, AND SUCCESSIVELY SMALLER DIAMETERS AS SHOWN IN THE SKETCH.

THE PLATE FLANGE WILL BE ENTIRELY ENGAGED BY HOLE H_1, AND THE CONTACT SURFACE OF THE PLATE FLANGE WILL SEAT ON THE SHOULDER BETWEEN HOLES H_1 AND H_2. THE PLANE SURFACE OF THIS SHOULDER IS $90^\circ \pm 2'$ TO THE AXES OF THE HOLES. SEATING IS DETERMINED BY FAILURE OF A 0.005"-THICKNESS GAUGE, 1/8" WIDE, TO ENTER MORE THAN 1/16" BETWEEN 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".

NOTE 2: CONCENTRICITY OF THE HEATER TERMINAL WITH RESPECT TO THE CATHODE TERMINAL IS DETERMINED BY A GAUGE AS SHOWN IN SKETCH G_2. THE CYLINDRICAL HOLE H_5 AND THE ANNULAR HOLE H_6 HAVE AXES COINCIDENT WITHIN 0.0005". THE CATHODE TERMINAL AND THE HEATER TERMINAL WILL ENTER THIS GAUGE TO A DEPTH OF 3/8".

NOTE 3: MAY BE ROUNDED OR BEVELED NOT TO EXCEED 1/16".

NOTE 4: THE AVERAGE OF THE MINIMUM DIAMETER AND THAT MEASURED 90° FROM THE MINIMUM WILL BE WITHIN THE SPECIFIED RANGE, AND THE DIFFERENCE BETWEEN THESE TWO MEASUREMENTS WILL NOT EXCEED .010".

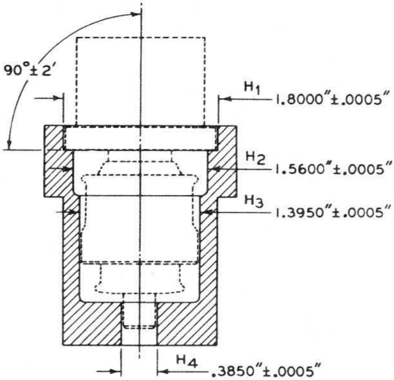
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

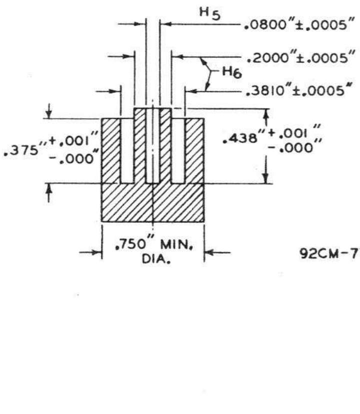
6161

POWER TRIODE

SKETCH G_1



SKETCH G_2



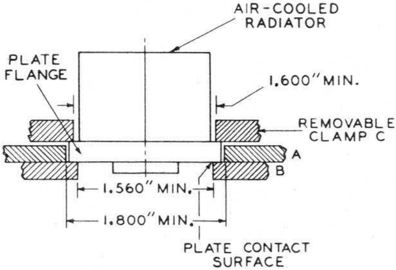
92CM-7705R1

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

6161

POWER TRIODE

MOUNTING ARRANGEMENT FOR USE WITH COAXIAL-LINE- OR CAVITY CIRCUITS

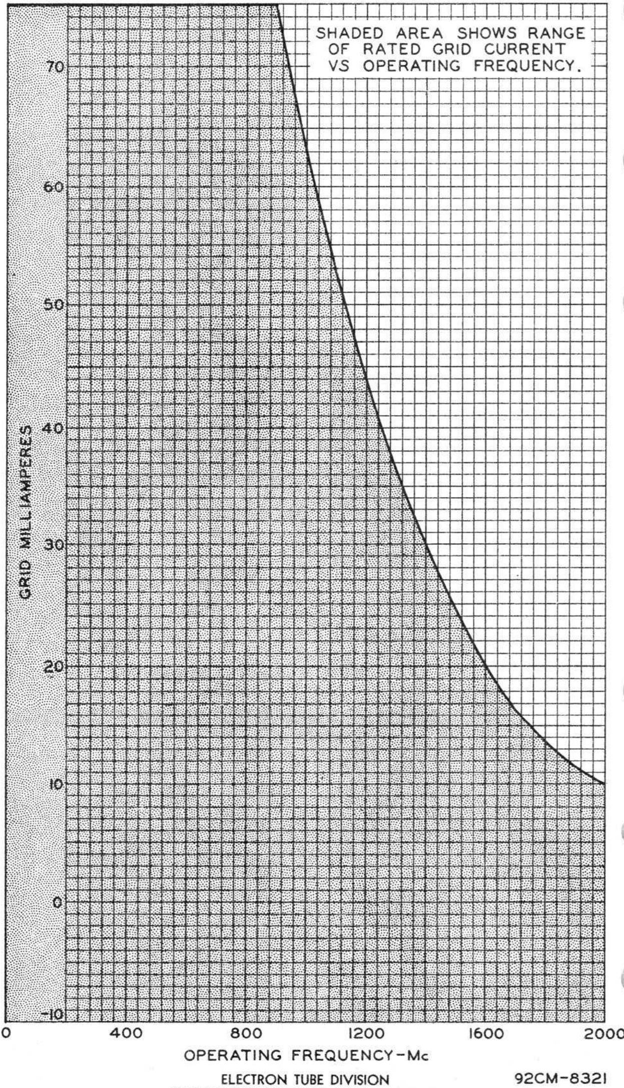


92CS-6833R2

6161

6161

RATING CHART



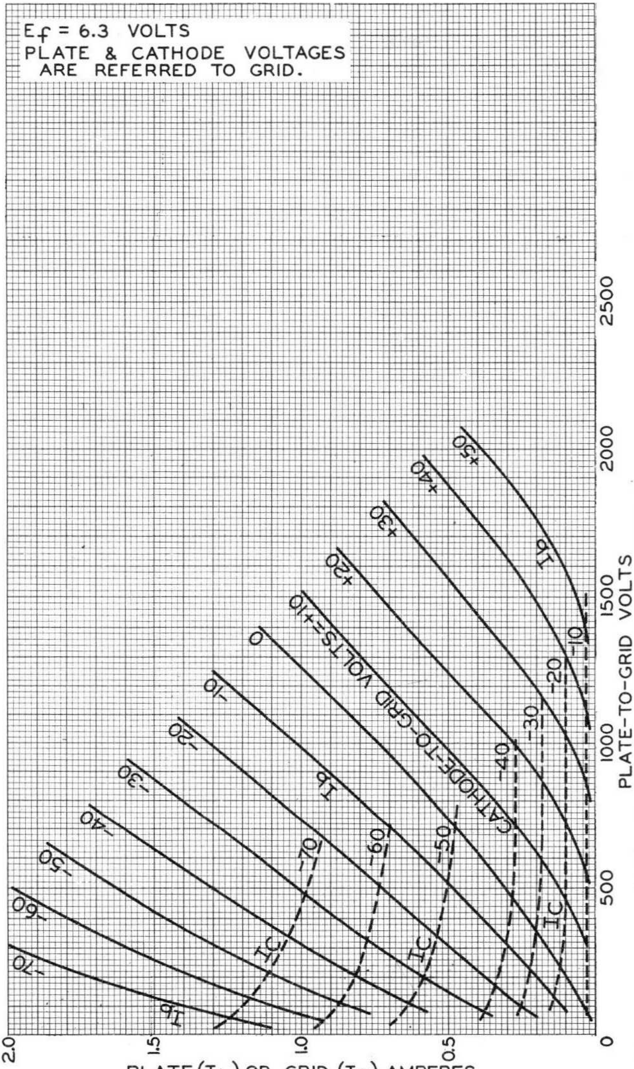
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8321

RCA

6161

AVERAGE CHARACTERISTICS



ELECTRON TUBE DIVISION 92CL-7771R1

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6161

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

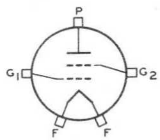
Electrical:

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.	$\mu\mu f$
Grid No.1 to filament	42	$\mu\mu f$
Plate to filament[b]	0.08 max.	$\mu\mu f$
Grid No.1 to grid No.2	60	$\mu\mu f$
Grid No.2 to plate	24	$\mu\mu f$

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*):

G_1 – Grid No.1
G_2 – Grid No.2



P – Plate
F – Filament

Air Flow:

Through radiator—The specified flow of incoming air at a temperature of 45° C for various plate dissipations, as indicated in the 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 net.

[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.

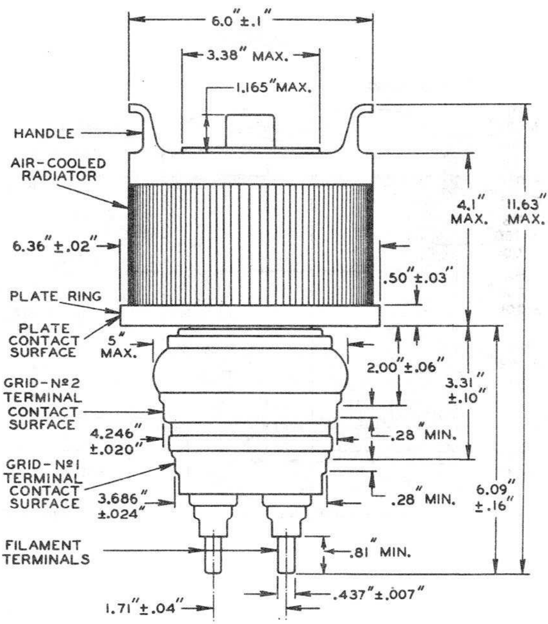
Note 4: With dc plate voltage of 6000 volts, dc grid-No.2 voltage of 1200 volts, and dc plate current of 20 ma.

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	%



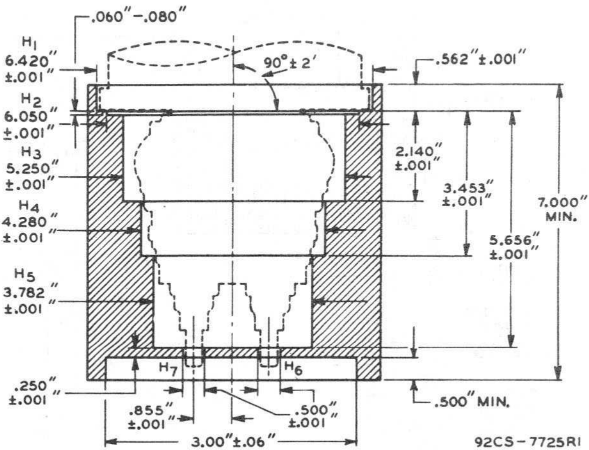
92CM-7716R2

← Indicates a change.

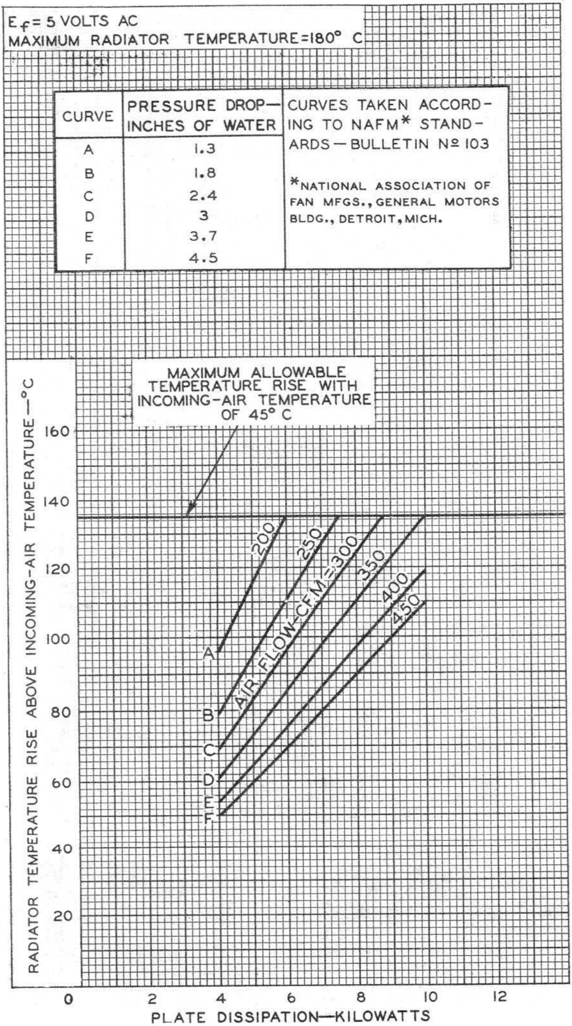
WITH THE CYLINDRICAL SURFACES OF THE GRID-No.2 TERMINAL, GRID-No.1 TERMINAL AND THE FILAMENT TERMINALS CLEAN, SMOOTH, AND FREE OF BURRS, THE TUBE WILL ENTER A GAUGE AS SHOWN IN SKETCH G_1. THE FIVE CYLINDRICAL HOLES H_1, H_2, H_3, H_4, AND H_5 HAVE AXES THAT ARE COINCIDENT WITHIN 0.001" AND HAVE SUCCESSIVELY 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



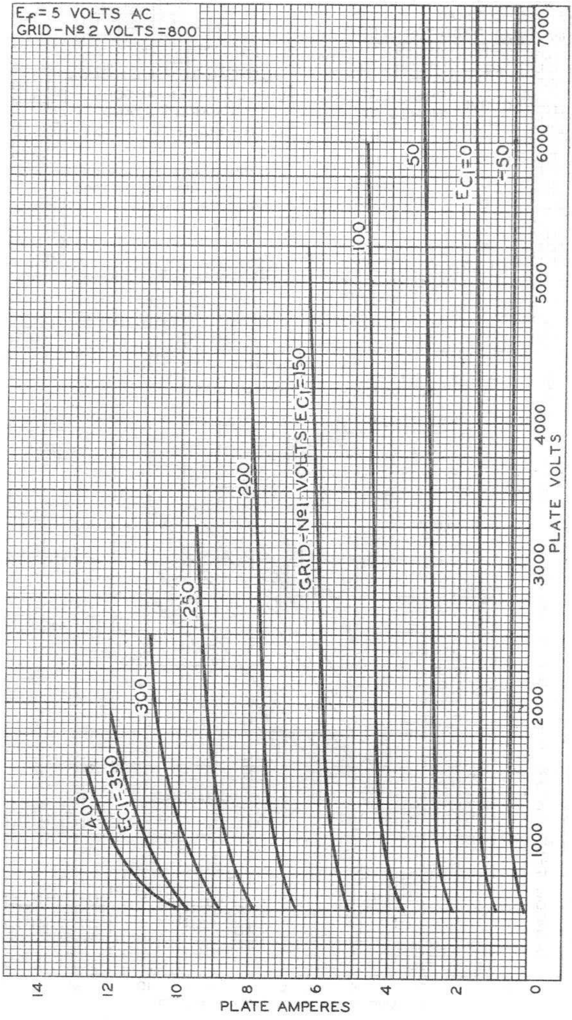
COOLING REQUIREMENTS



CURVE	PRESSURE DROP—INCHES OF WATER
A	1.3
B	1.8
C	2.4
D	3
E	3.7
F	4.5

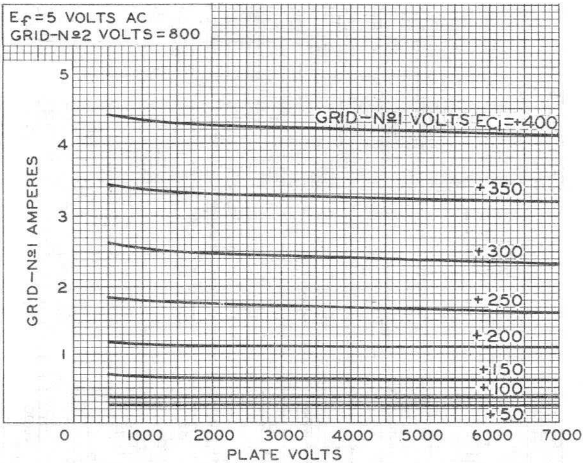
92CM-7728

AVERAGE PLATE CHARACTERISTICS

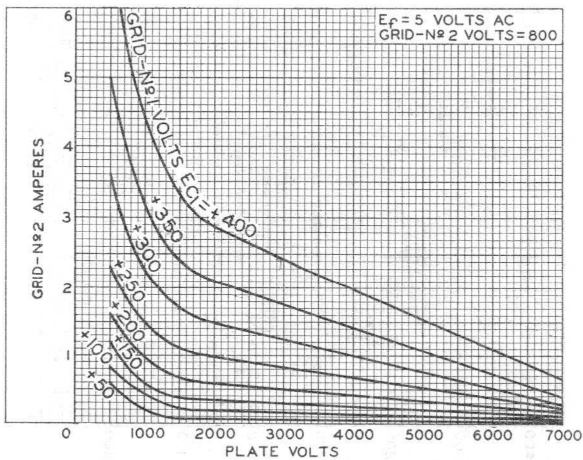


92CM-7736R1

AVERAGE CHARACTERISTICS

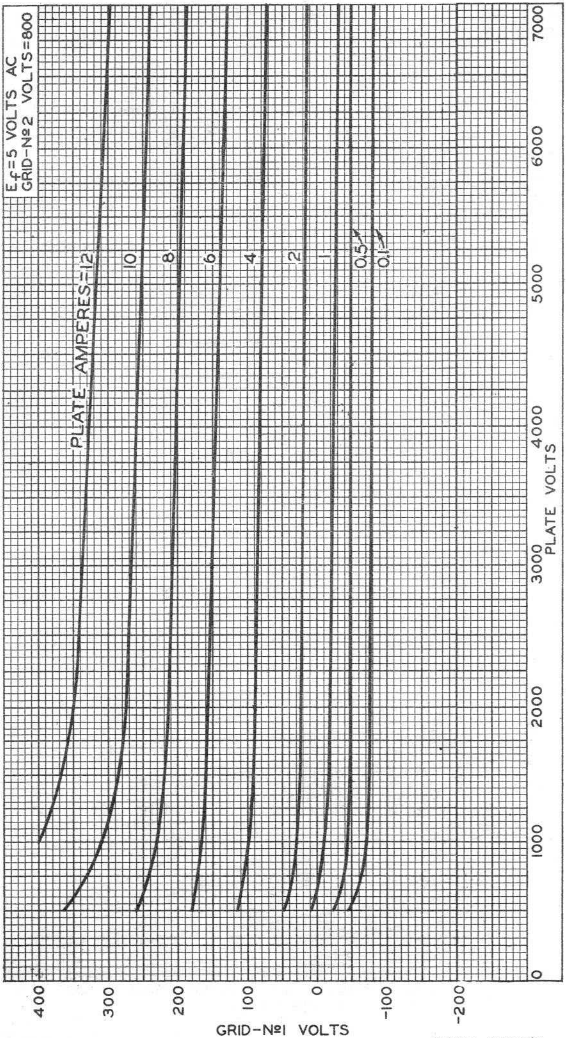


92CS-7744R1



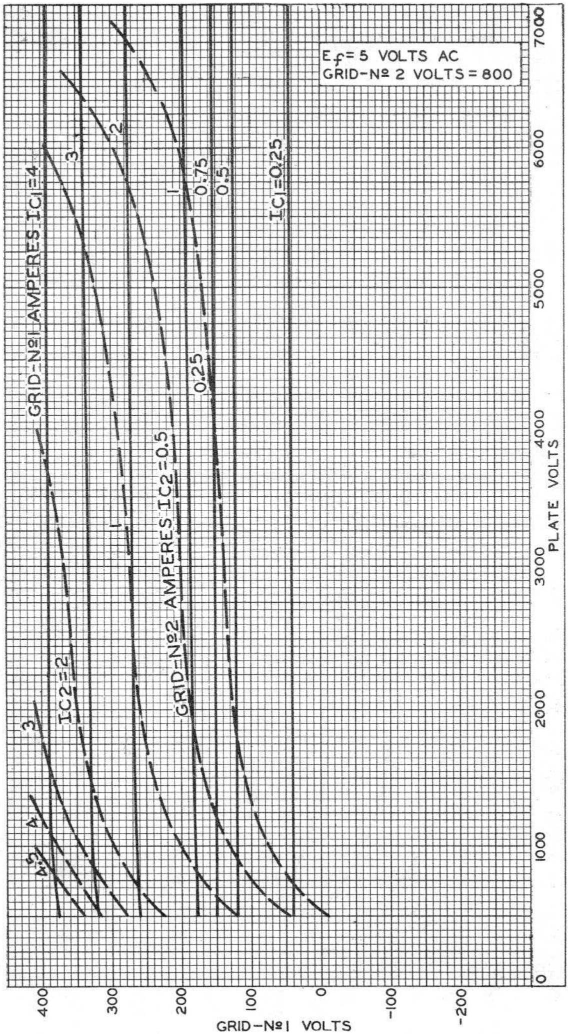
92CS-7743R1

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



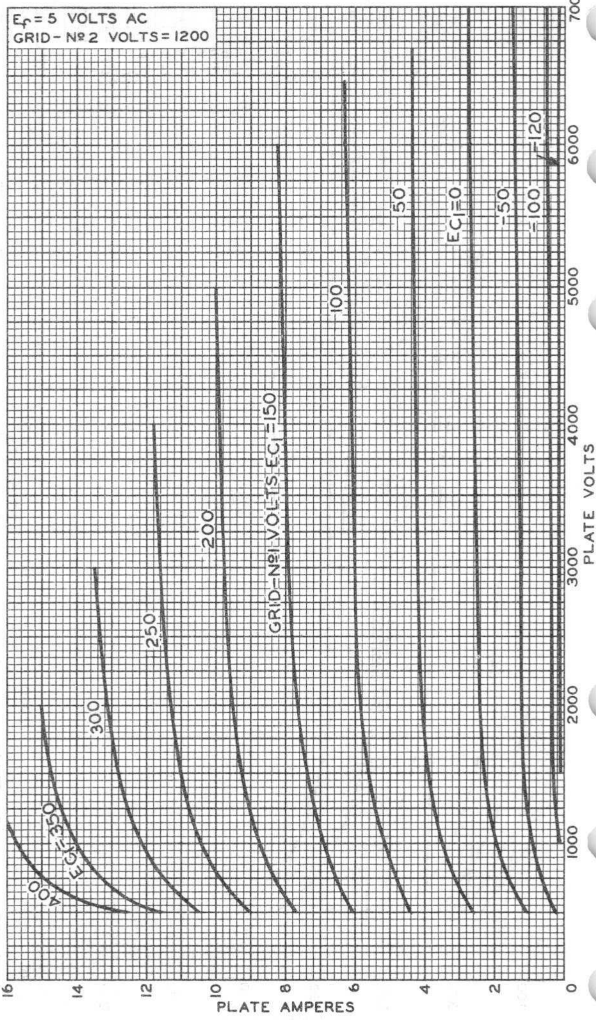
92CM-7737R1

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



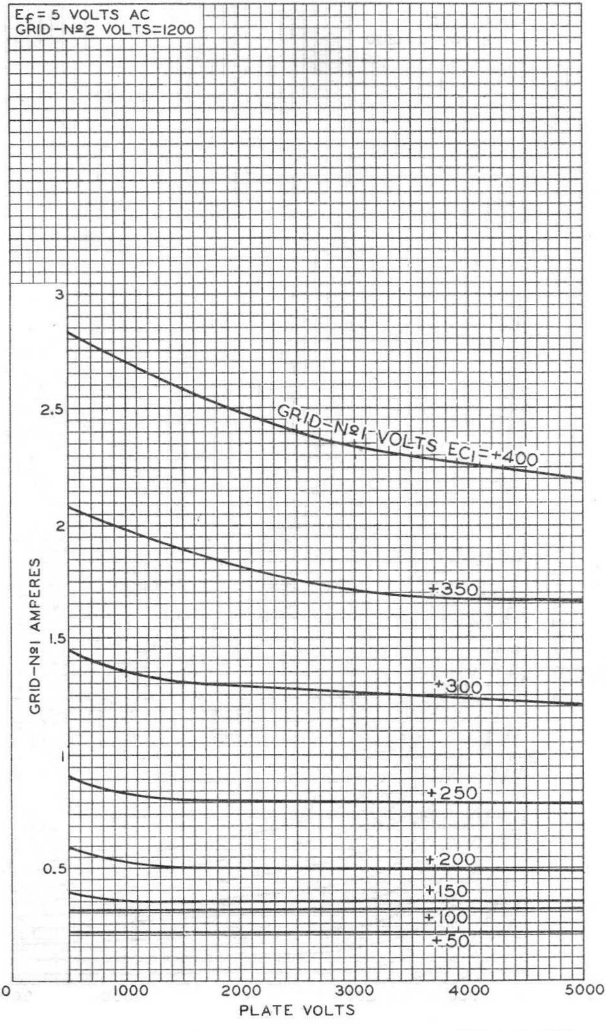
92CM-7738R2

AVERAGE PLATE CHARACTERISTICS



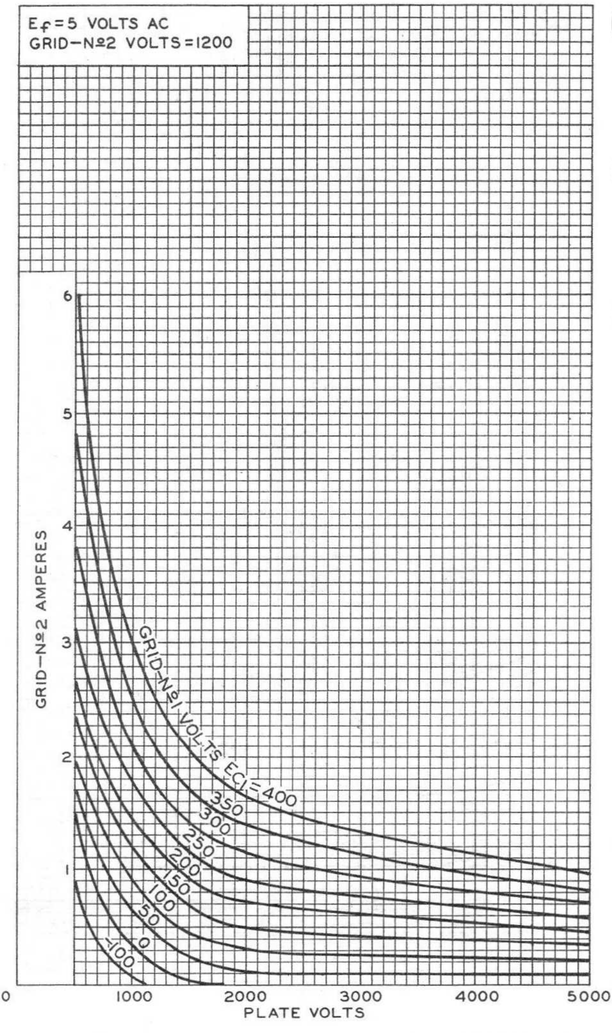
92CM-7735R1

AVERAGE CHARACTERISTICS



92CM-7740R2

AVERAGE CHARACTERISTICS

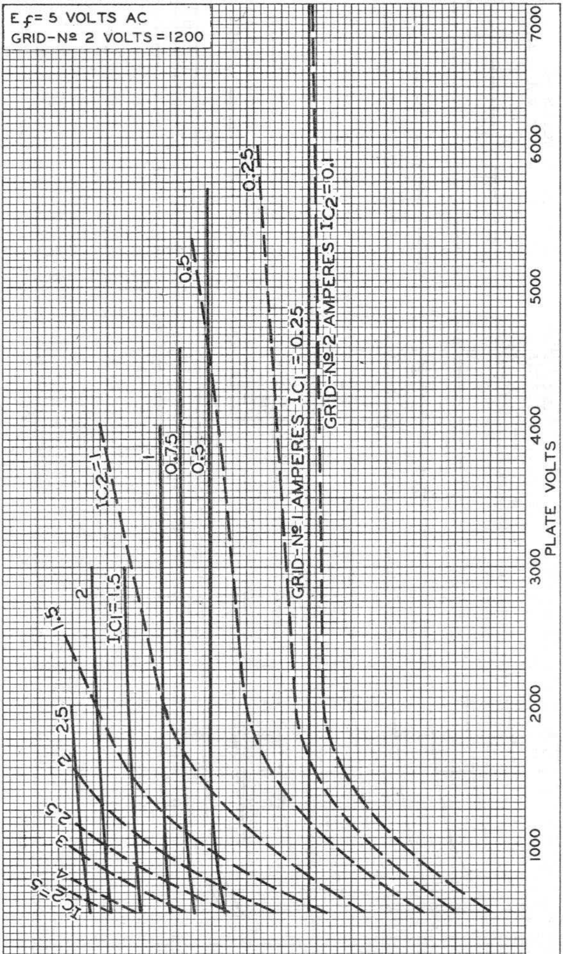


92CM-7739R1

AVERAGE CONSTANT-CURRENT CHARACTERISTICS

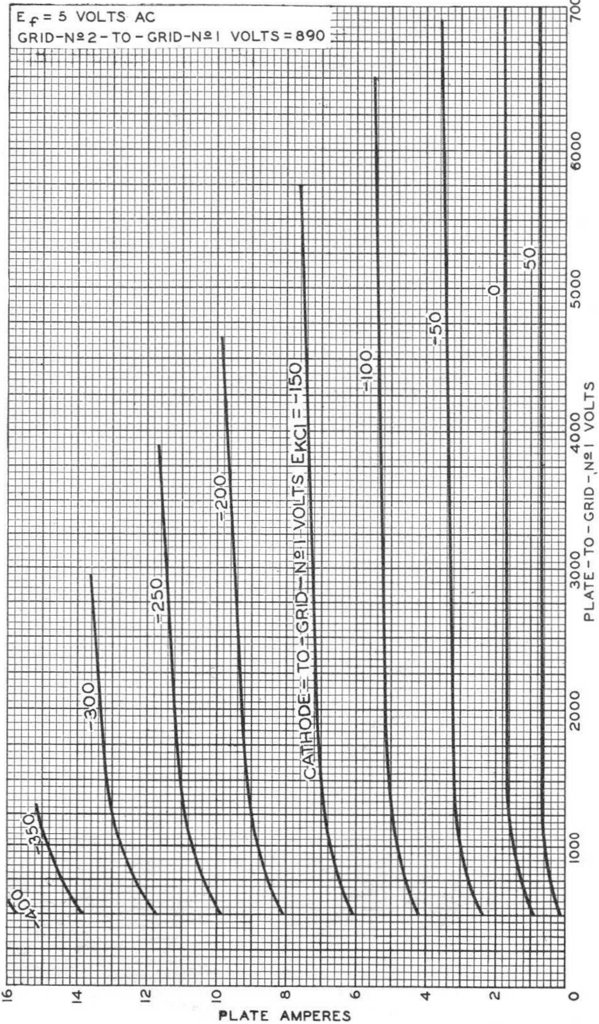
92CM-7733R1

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



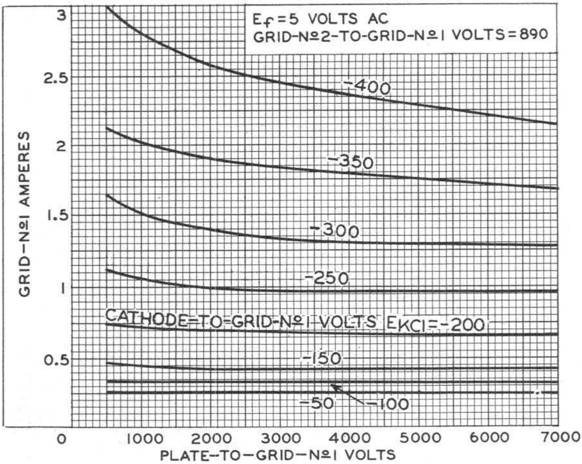
92CM-7730R2

AVERAGE PLATE CHARACTERISTICS
Cathode-Drive Service

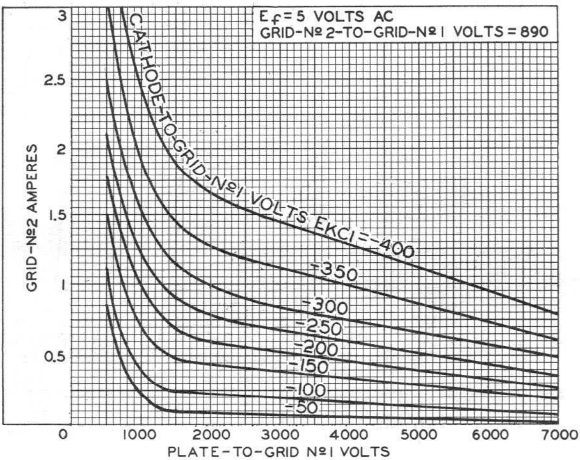


92CM-7750R1

AVERAGE CHARACTERISTICS
Cathode-Drive Service

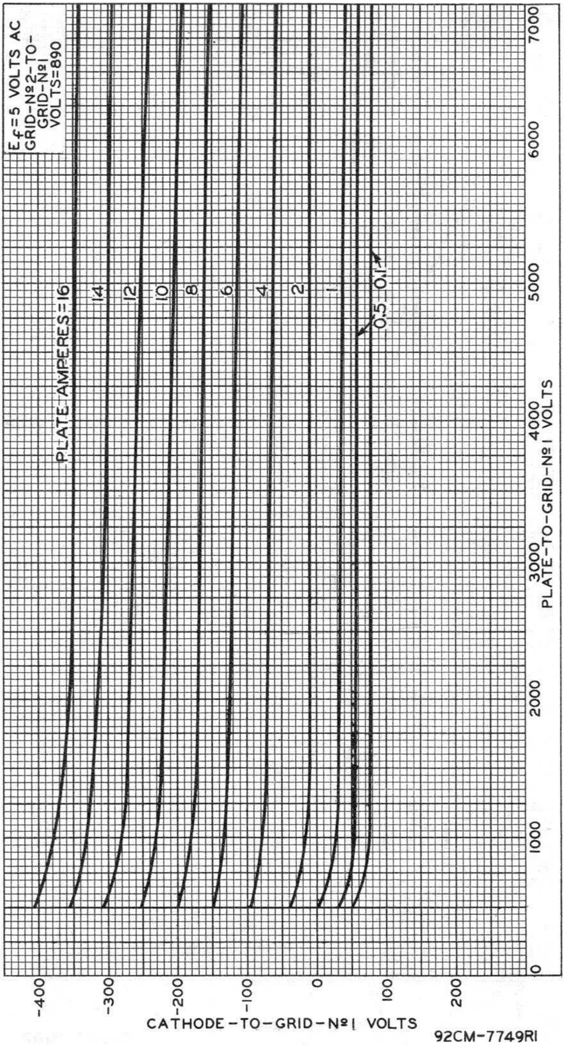


92CS-7746R1



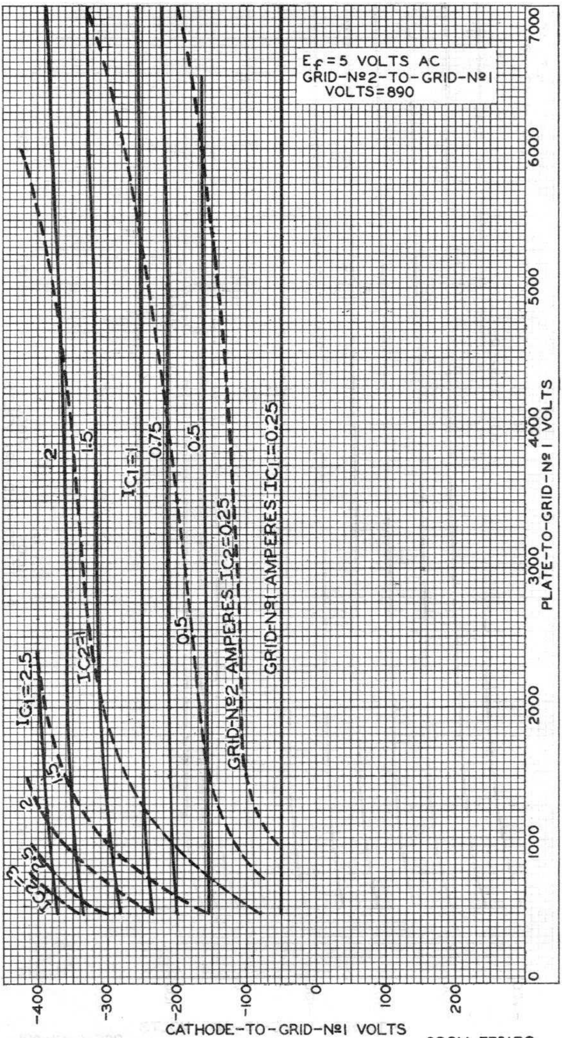
92CS-7752R3

AVERAGE CONSTANT-CURRENT CHARACTERISTICS
Cathode-Drive Service



92CM-7749R1

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:

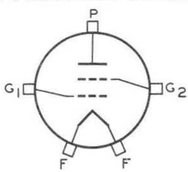
Filament, Multistrand Thoriated Tungsten:		
Voltage (AC or DC)▲	5 ± 5%	volts
Current at heater volts = 5	168	amp ←
Minimum heating time	15	sec
Cold resistance	0.0038	ohm
Mu Factor, Grid No.2 to Grid No.1 for plate volts = 2000, grid-No.2 volts = 1000, and plate amperes = 2	10	
Direct Interelectrode Capacitances:		
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*):

G_1 – Grid No.1
G_2 – 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

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%)ǂ	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.

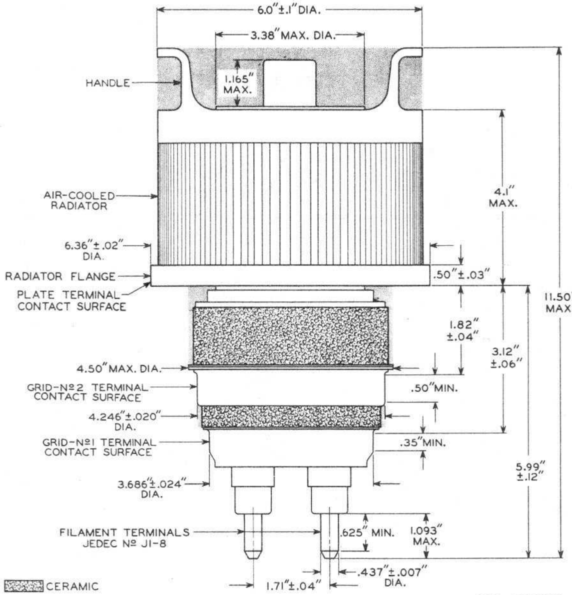
Note 2: With external, flat, metal shield 12" square having center hole 4-5/16" diameter. Shield is located in plane of the grid-No.2 terminal, perpendicular to the tube axis, and is connected to grid-No.2. All other electrodes are grounded.

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.

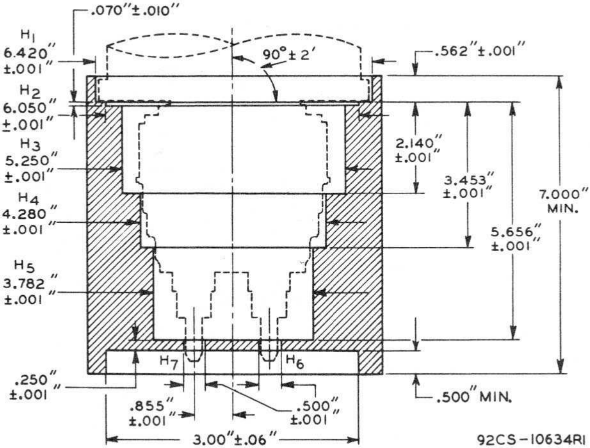
Note 5: With dc plate voltage of 1500 volts, dc grid-No.2 voltage of 1200 volts, and instantaneous grid-No.1 voltage adjusted to give peak plate current of 11 amp.

→ Indicates a change.



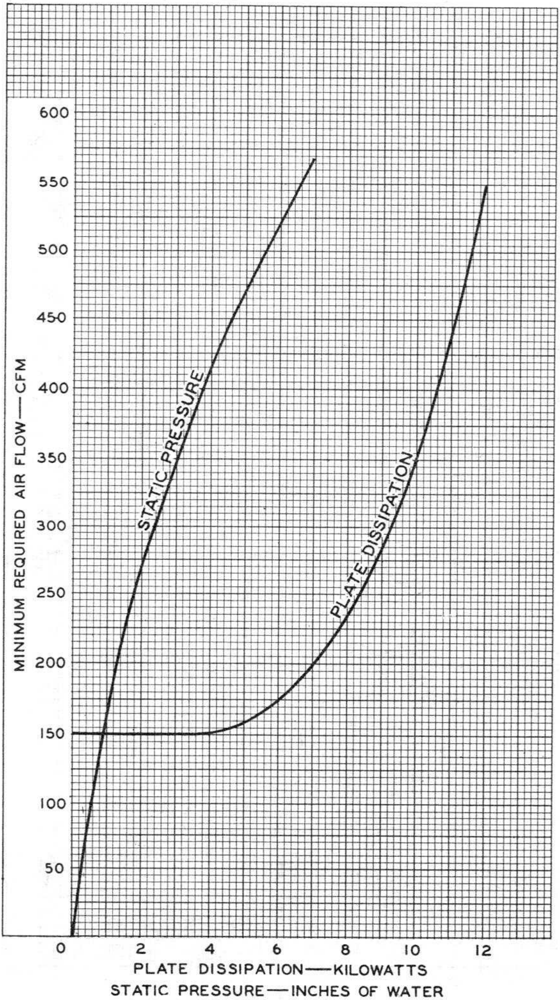
NOTE: WITH THE CYLINDRICAL SURFACES OF THE PLATE TERMINAL, GRID-No.2 TERMINAL, GRID-No.1 TERMINAL, AND FILAMENT TERMINALS CLEAN, SMOOTH, AND FREE OF BURRS, THE TUBE WILL ENTER A GAUGE AS SHOWN IN SKETCH G_1. PROPER ENTRY OF THE TUBE IN THE GAUGE IS OBTAINED WHEN THE PLATE TERMINAL IS ENTIRELY ENGAGED 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



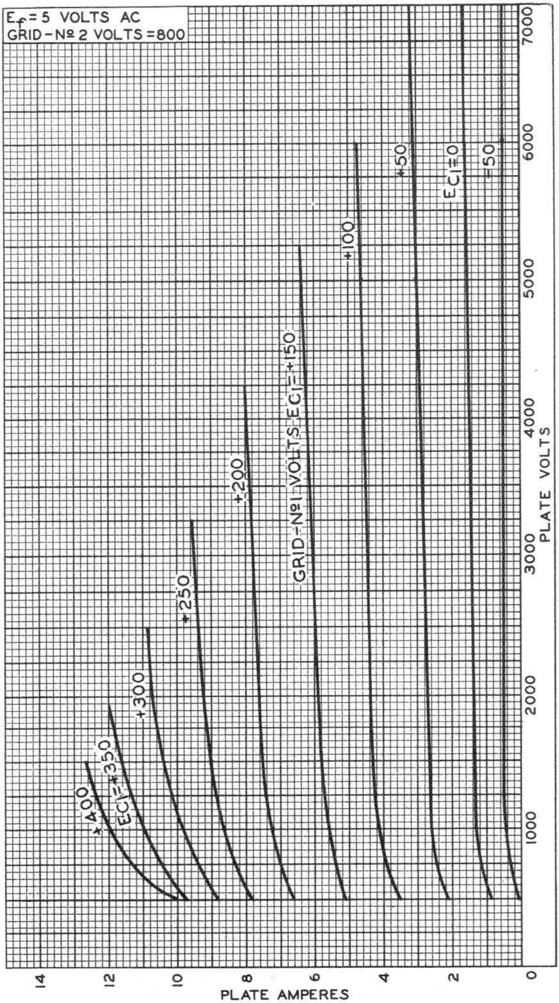
NOTE: THE FIVE CYLINDRICAL HOLES H_1, H_2, H_3, H_4 AND H_5 HAVE AXES COINCIDENT WITHIN 0.001". THE HOLES H_6 AND H_7 HAVE AXES PARALLEL TO THE AXES OF H_1, H_2, H_3, H_4 AND H_5 WITHIN $0^\circ \pm 2'$.

COOLING REQUIREMENTS



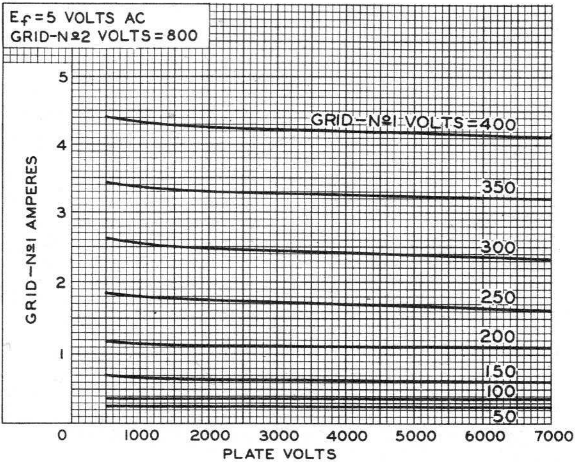
92CM—10785

AVERAGE PLATE CHARACTERISTICS

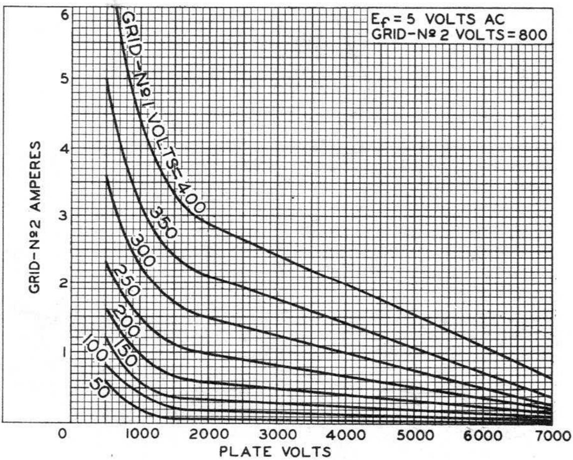


92CM-7736R1

AVERAGE CHARACTERISTICS



92CS-7744R1



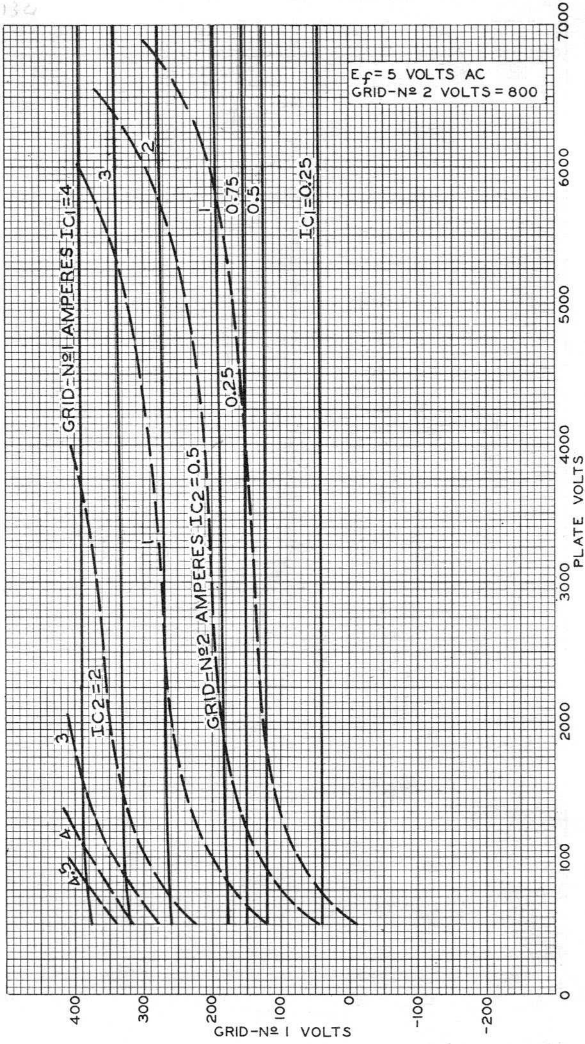
92CS-7743R1

6166-A/7007

AVERAGE CONSTANT-CURRENT CHARACTERISTICS

92CM-7737R1

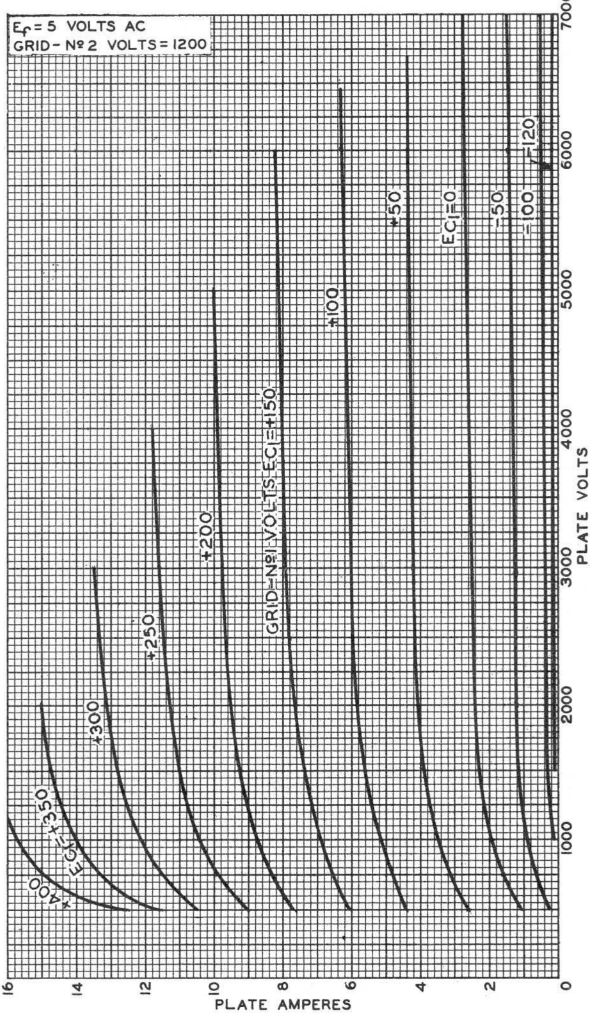
AVERAGE CONSTANT-CURRENT CHARACTERISTICS



92CM-7738R2

6166-A/7007

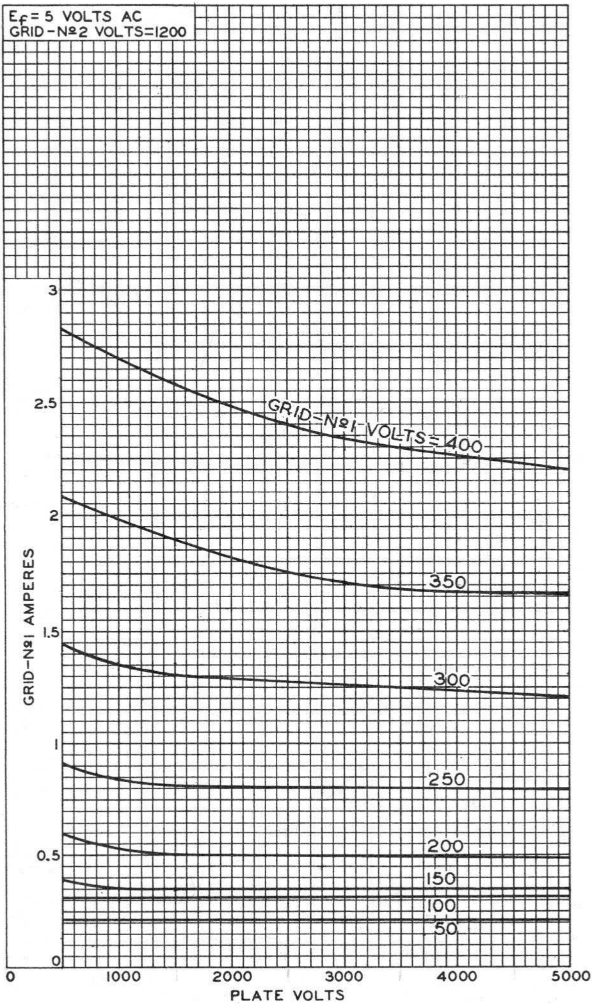
AVERAGE PLATE CHARACTERISTICS



92CM-7735RI

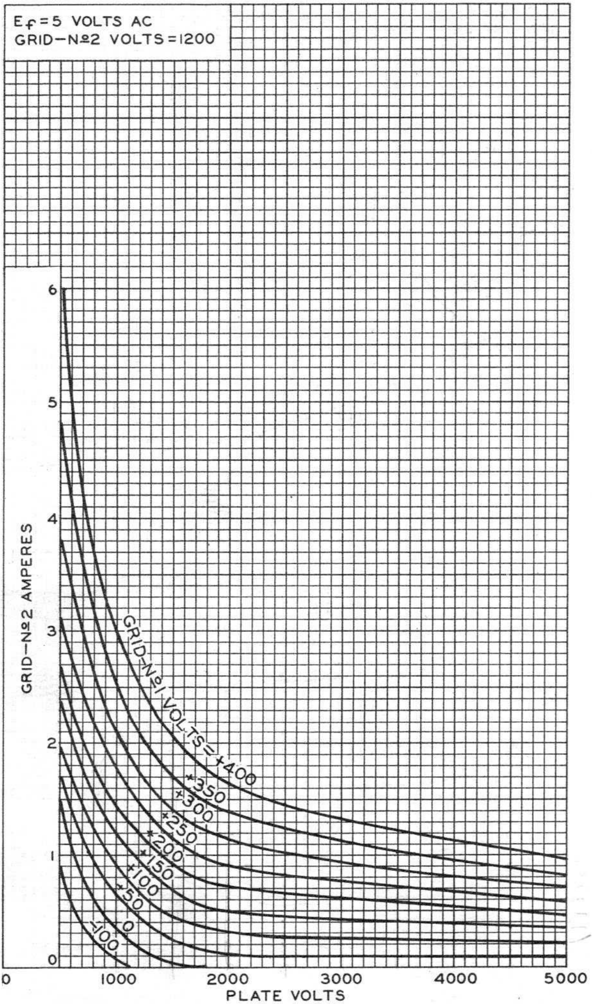
2136

AVERAGE CHARACTERISTICS



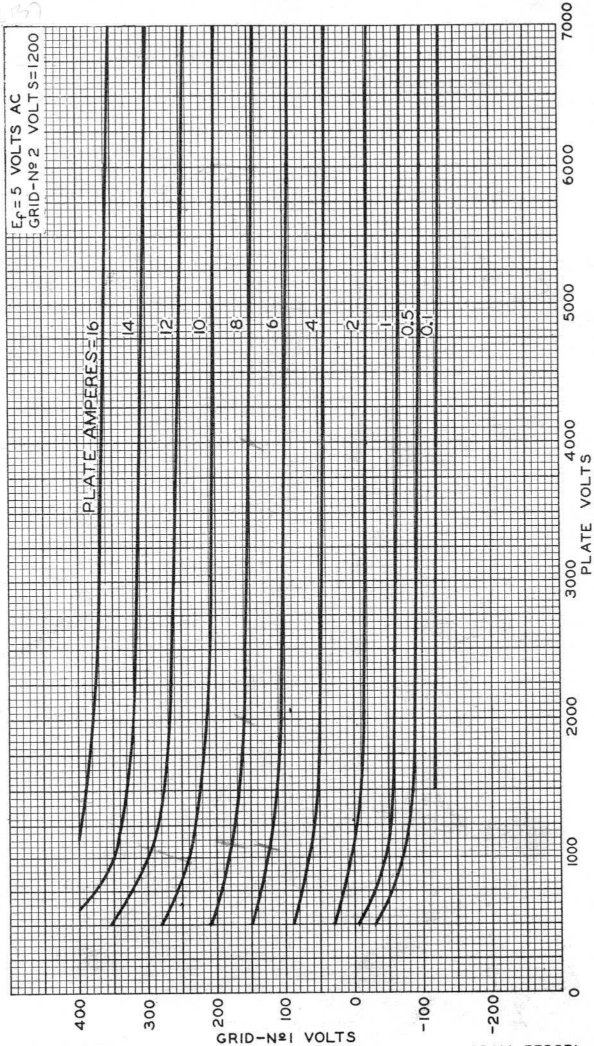
92CM-7740R2

AVERAGE CHARACTERISTICS



92CM-7739R1

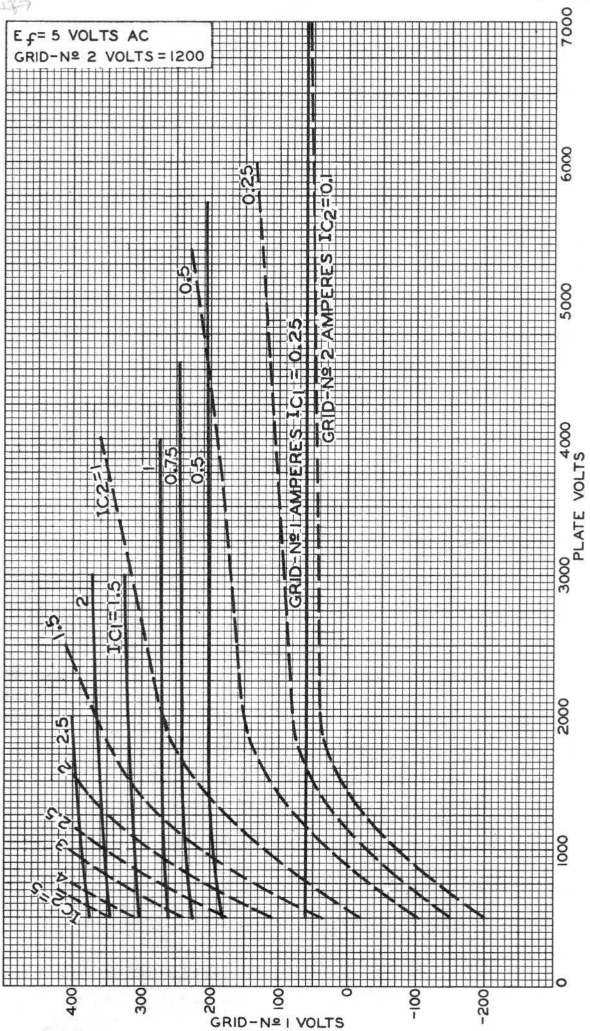
AVERAGE CONSTANT-CURRENT CHARACTERISTICS



92CM-7733RI

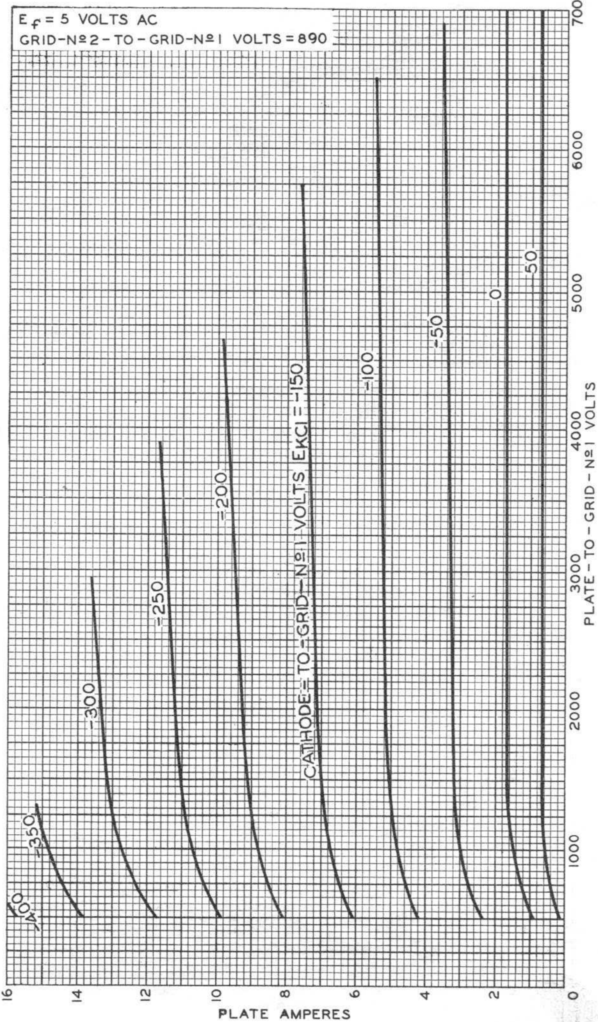
6166-A/7007

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



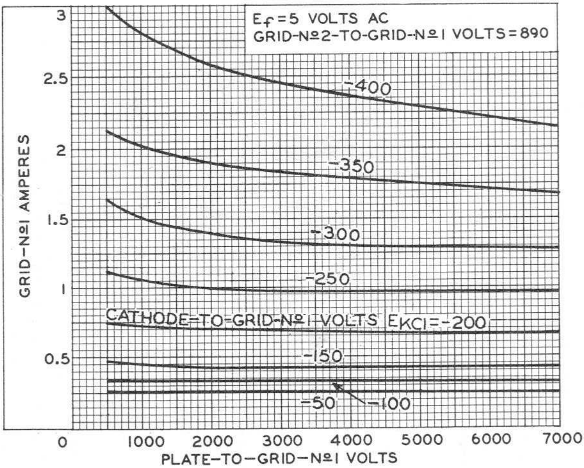
92CM-7730RI

AVERAGE PLATE CHARACTERISTICS
Cathode-Drive Service

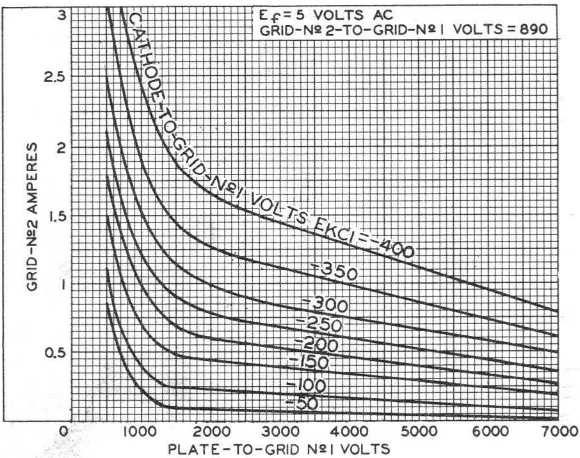


92CM-7750RI

AVERAGE CHARACTERISTICS
Cathode-Drive Service



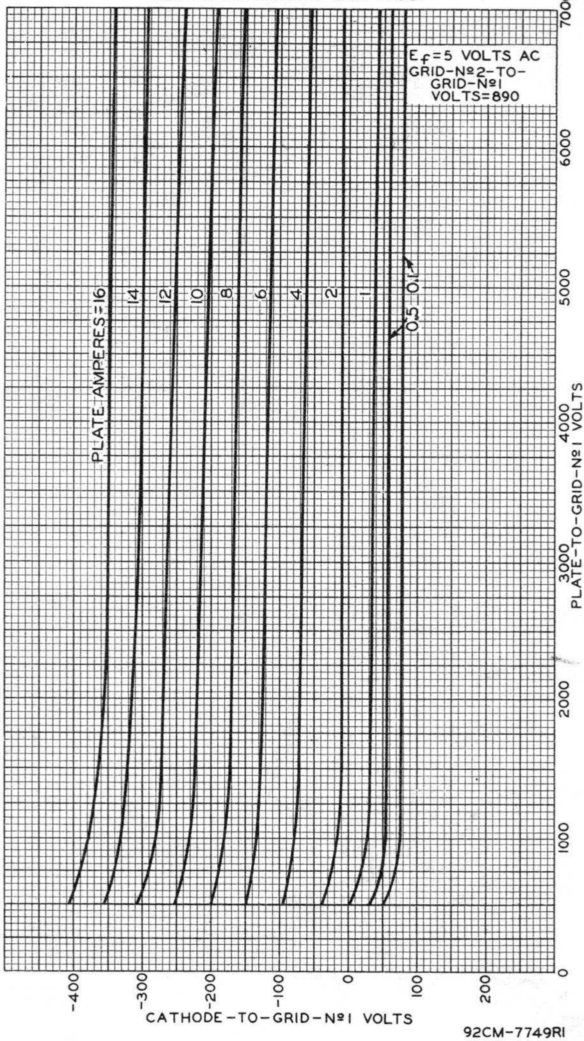
92CS-7746R1



92CS-7752R3

AVERAGE CONSTANT-CURRENT CHARACTERISTICS

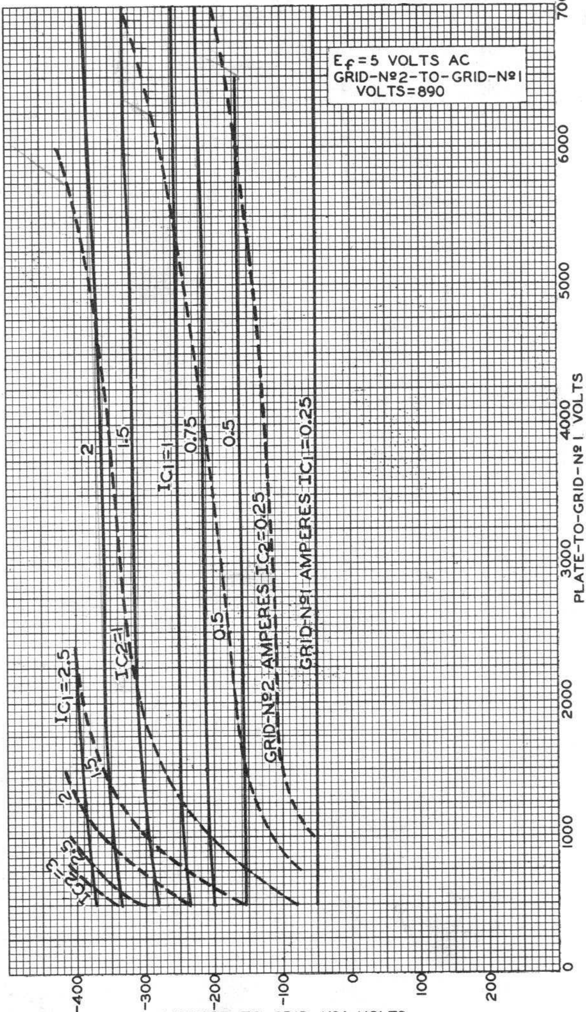
Cathode-Drive Service



92CM-7749RI

6166-A/7007

AVERAGE CONSTANT-CURRENT CHARACTERISTICS
Cathode-Drive Service



92CM-7751R2

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

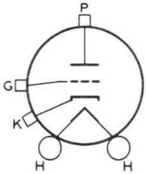
Dimensions and Terminal Connections . . . . See *Dimensional Outline*

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-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 -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-1D, 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-ID, 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-ID, 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-ID, 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-ID, 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.

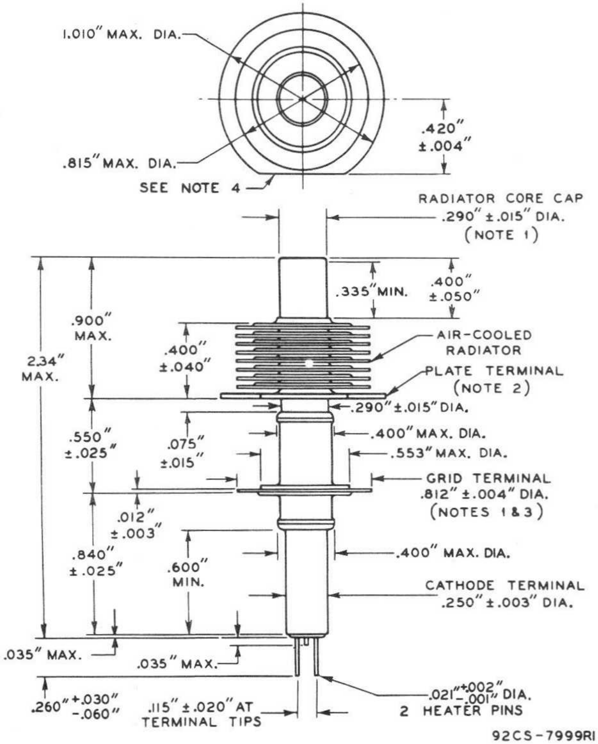
At the end of 500 hours, the tube will not show permanent shorts or open circuits and will be criticized for the total number of defects in the sample lot and for the number of tubes failing to meet the following limits:

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.
.550" ±.025"
.075" ±.015"
.400" MAX. DIA.
.553" MAX. DIA.
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

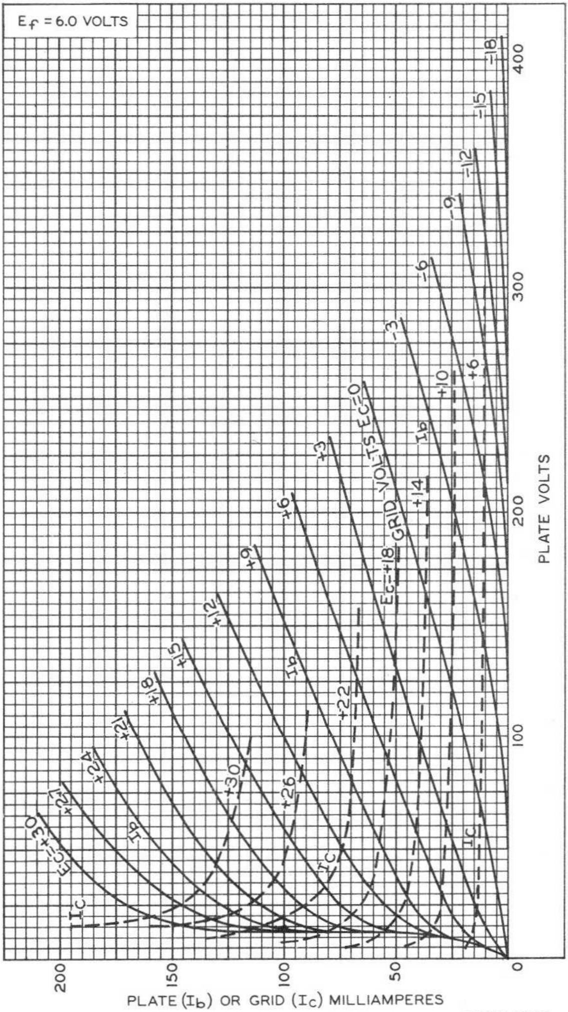
NOTE 1: ECCENTRICITY OF RADIATOR-CORE CAP WITH RESPECT TO THE CATHODE TERMINAL IS ONE-HALF THE TOTAL RUN-OUT DETERMINED BY CHUCKING THE CATHODE TERMINAL 0.050" TO 0.100" FROM CATHODE FLANGE, ROTATING THE TUBE, AND GAUGING THE TOTAL RUN-OUT AT A POINT 0.125" FROM THE END OF THE RADIATOR-CORE CAP. THE 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".

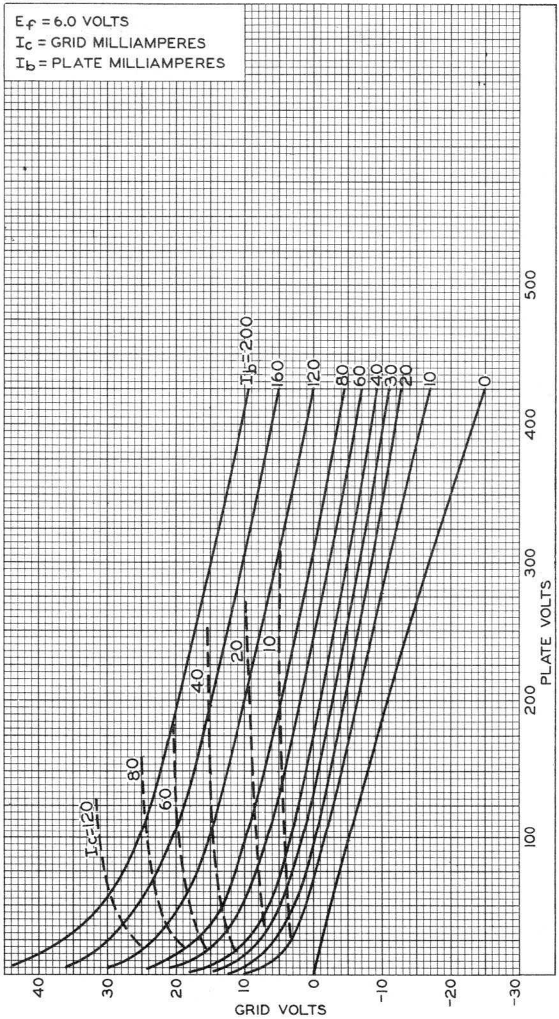
NOTE 4: THE STRAIGHT EDGE ON THE PERIMETER OF THE LARGE FIN (PLATE TERMINAL) IS PARALLEL TO A PLANE THROUGH THE CENTERS OF THE HEATER PINS AT THEIR SEALS WITHIN 15°.

AVERAGE CHARACTERISTICS



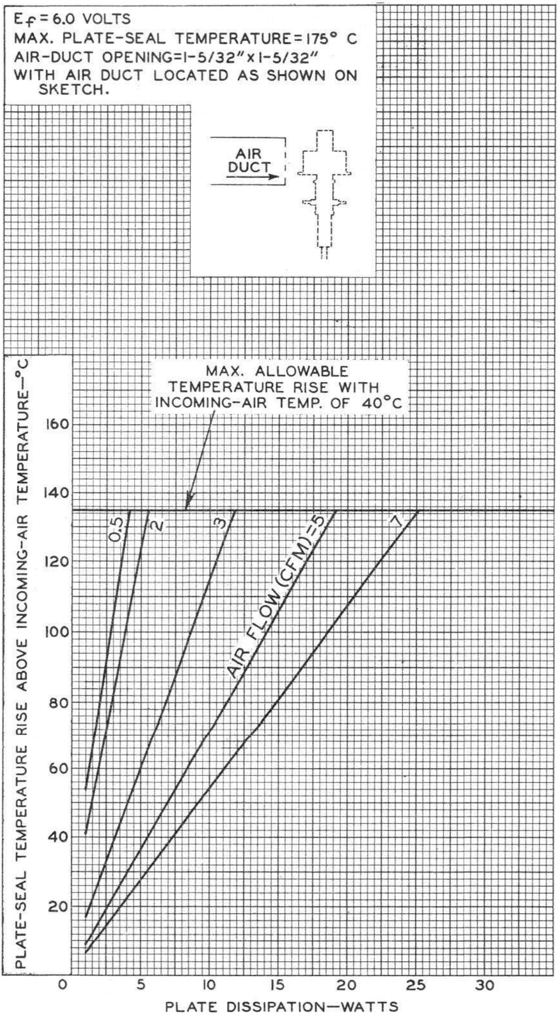
92CM-8103

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



92CM-8104

COOLING REQUIREMENTS



92CM-8120R1

6264-A

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:

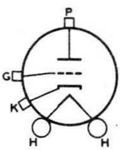
	Without External Shield	*With External Shield*▲	
Grid to plate.	1.75	1.5	$\mu\mu$f
Grid to cathode.	2.95	–	$\mu\mu$f
Plate to cathode	0.07 max.	–	$\mu\mu$f

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-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-1D, 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-1D, 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:

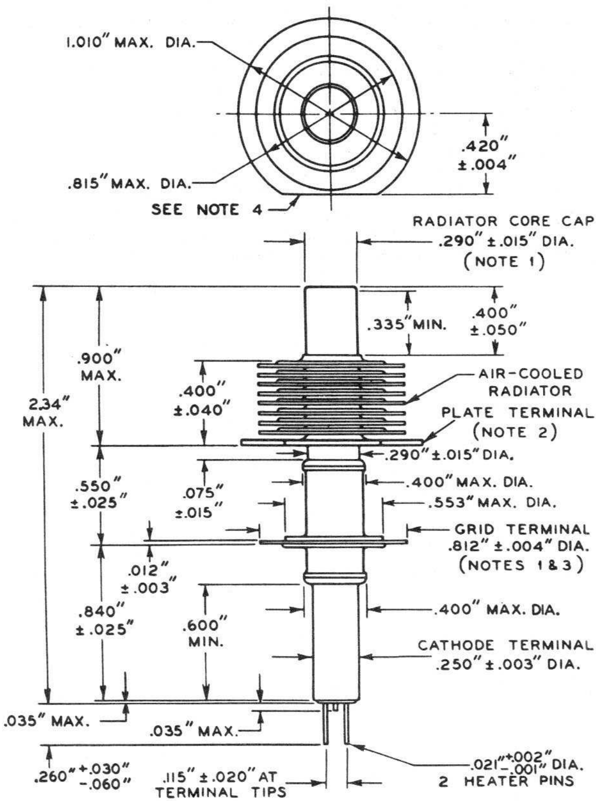
Reverse Grid Current . . . . 1 max. μa
For conditions shown under *Characteristics Range Values Notes 1,2*.

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.



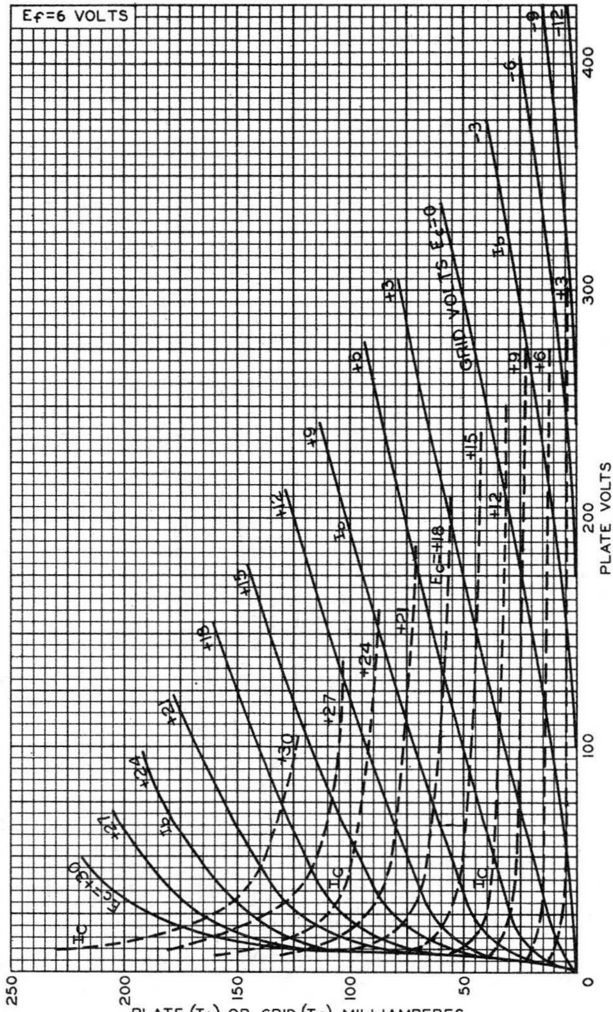
NOTE 1: MAXIMUM ECCENTRICITY OF CENTER LINE (AXIS) OF RADIATOR-CORE CAP OR GRID-TERMINAL FLANGE WITH RESPECT TO THE CENTER LINE (AXIS) OF THE CATHODE TERMINAL IS 0.015".

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".

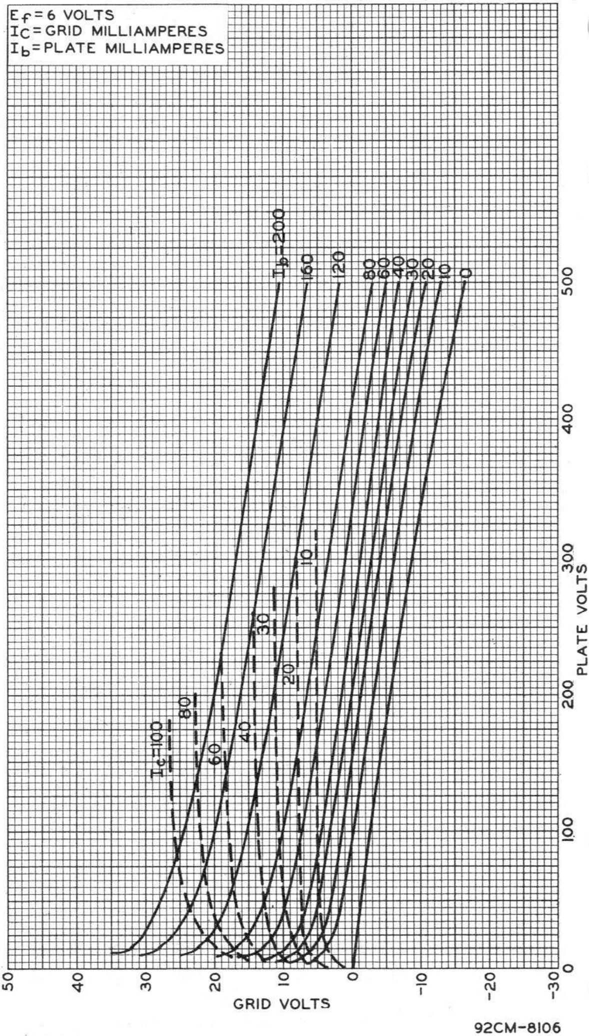
NOTE 4: THE STRAIGHT EDGE ON THE PERIMETER OF THE LARGE FIN (PLATE TERMINAL) IS PARALLEL TO A PLANE THROUGH THE CENTERS OF THE HEATER PINS AT THEIR SEALS WITHIN 15°.

AVERAGE CHARACTERISTICS

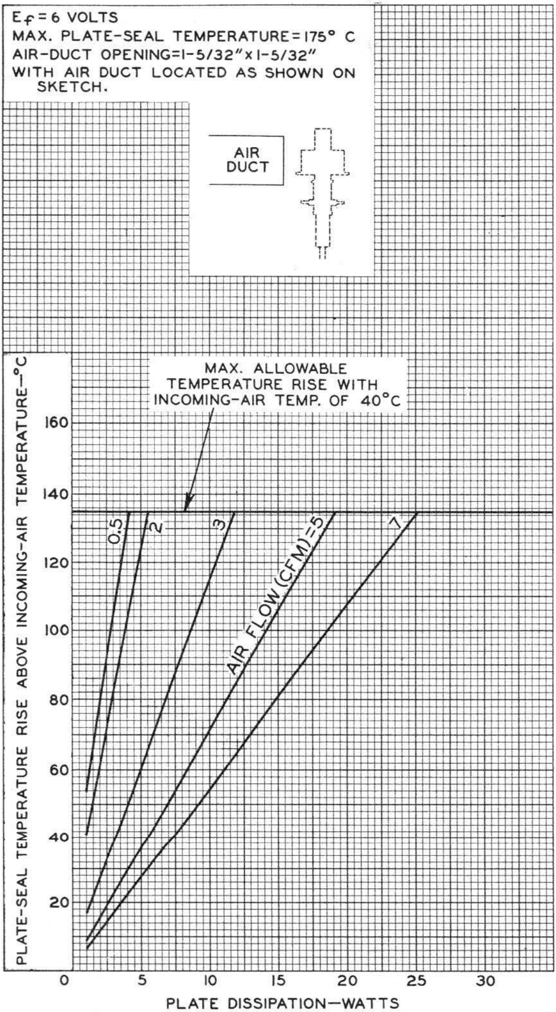


92CM-8105

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



COOLING REQUIREMENTS



92CM-8120R1

Beam Power Tube

For Pulse-Modulator Service

GENERAL DATA

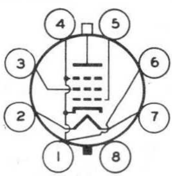
Electrical:

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. 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).	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.

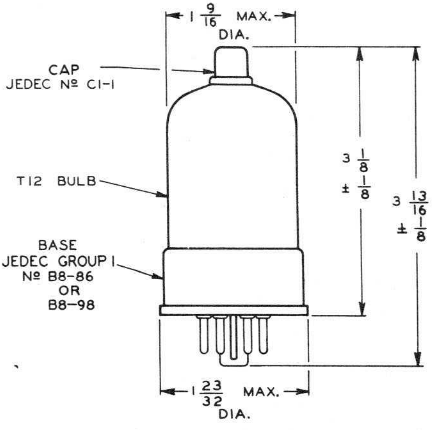
Note 2: With no external shield. Base sleeve (pin No.8) is grounded.

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

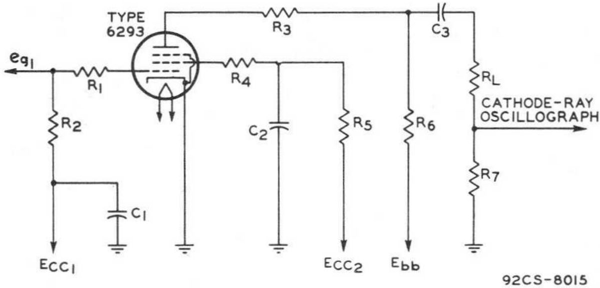
Plate shows no color when tube is operated at maximum CCS ratings.



92CS-7700R5

ALL DIMENSIONS IN INCHES.

TEST CIRCUIT



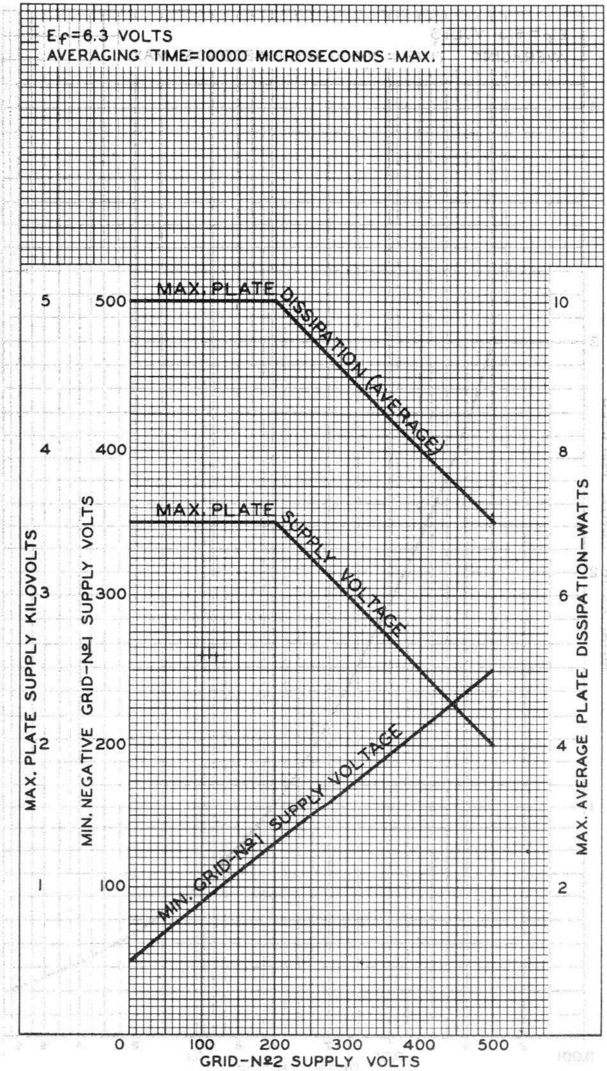
C_1: 0.1 μf, 600 v dc
C_2: 2 μf, 600 v dc
C_3: 0.25 μf, 5000 v dc
E_{cc1}: Grid-No.1 Supply Volt.
E_{cc2}: Grid-No.2 Supply Volt.
E_{bb}: Plate Supply Voltage
E_{g1}: Rectangular-Wave Signal Voltage
R_1: 20 ohms, 1 watt, non-inductive
R_2: 3000 ohms, 1 watt
R_3: 10 ohms, 5 watts, non-inductive
R_4: 25 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)

6293

RCA

6293

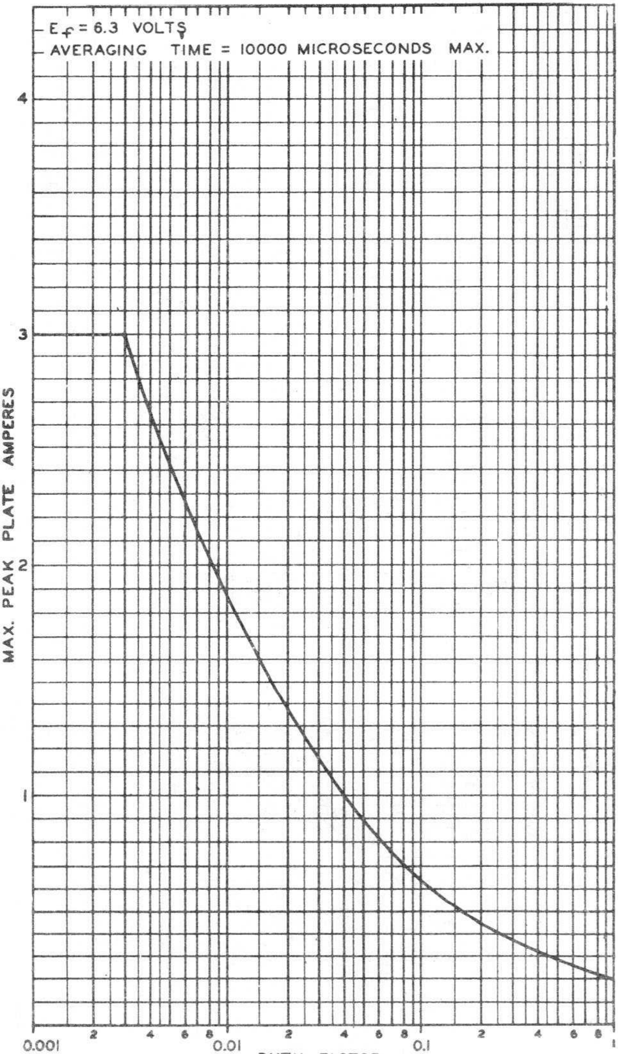
RATING CHART I



RCA

6293

RATING CHART II



JUN. 8, 1953

TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

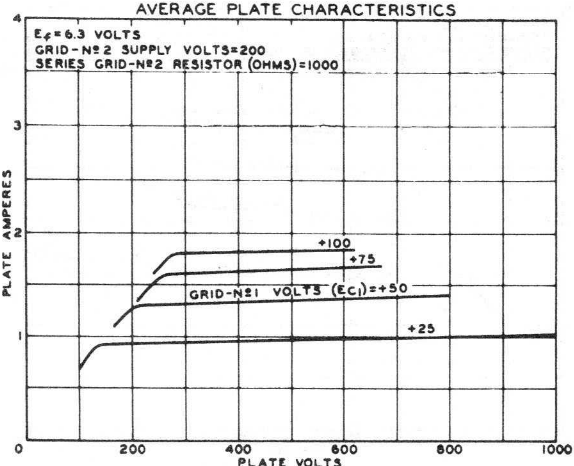
92CM-8014

6293

6293

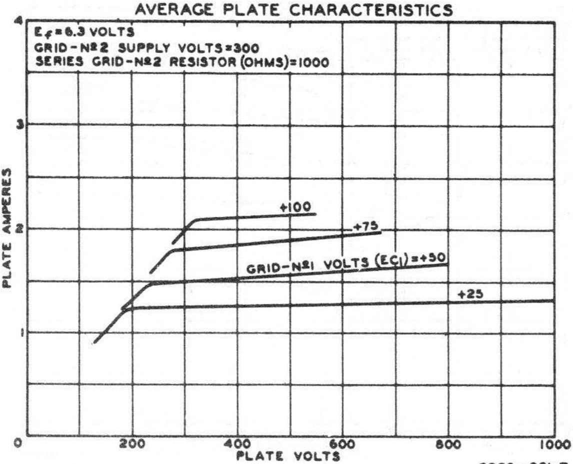
BEAM POWER AMPLIFIER

AVERAGE PLATE CHARACTERISTICS



92CS-8017T

AVERAGE PLATE CHARACTERISTICS

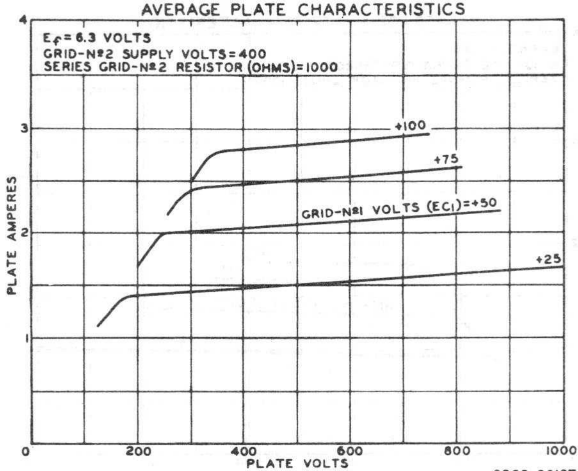


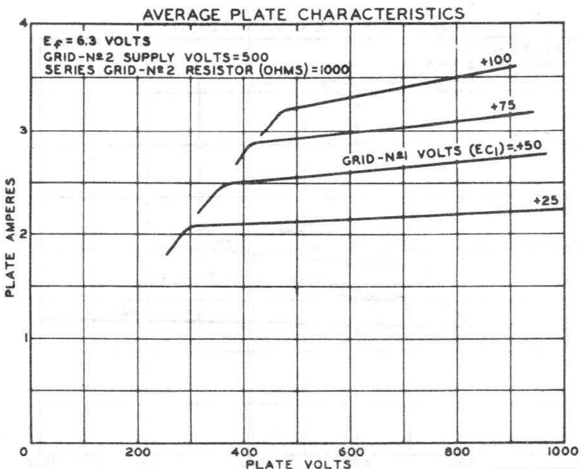
92CS-8016T

RCA

6293

BEAM POWER AMPLIFIER





6417

RCA

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.

6448

UHF BEAM POWER TUBE

WATER-COOLED ELECTRODES

GENERAL DATA

Electrical:

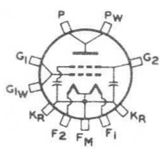
Filament*, 2-Section Multi-strand Thoriated Tungsten:

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.

6448

6448

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.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6448

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.

6448

6448

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.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

6448

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.

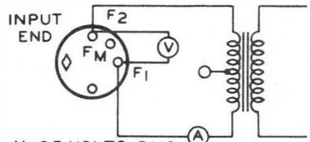
OPERATING NOTES

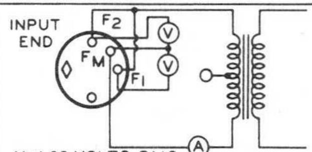
Instructions for conserving filament life of the 6448 and for the use of high-speed electronic protective devices with it are given in the technical bulletin. A copy of the technical bulletin for the 6448 will be supplied on request to Commercial Engineering, RCA, Harrison, N.J.

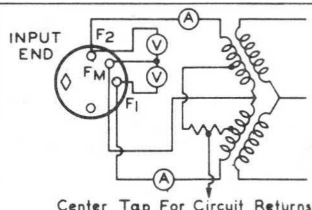
RCA

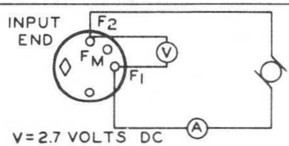
6448

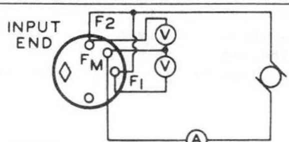
FILAMENT-SUPPLY CIRCUITS

<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>

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>
</table>

F_1 = FILAMENT SECTION No. 1
F_2 = FILAMENT SECTION No. 2
F_M = COMMON POINT OF FILAMENT SECTIONS

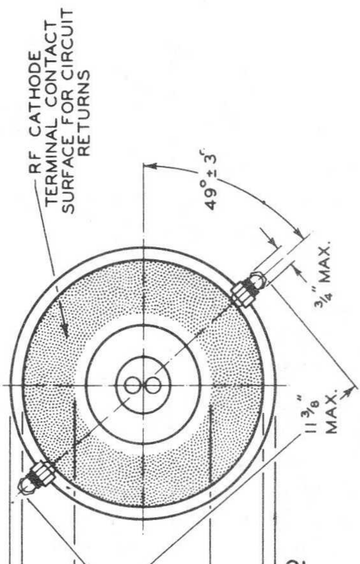
92CM-8249

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6448

6448

UHF BEAM POWER TUBE



MAY 3, 1954

TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

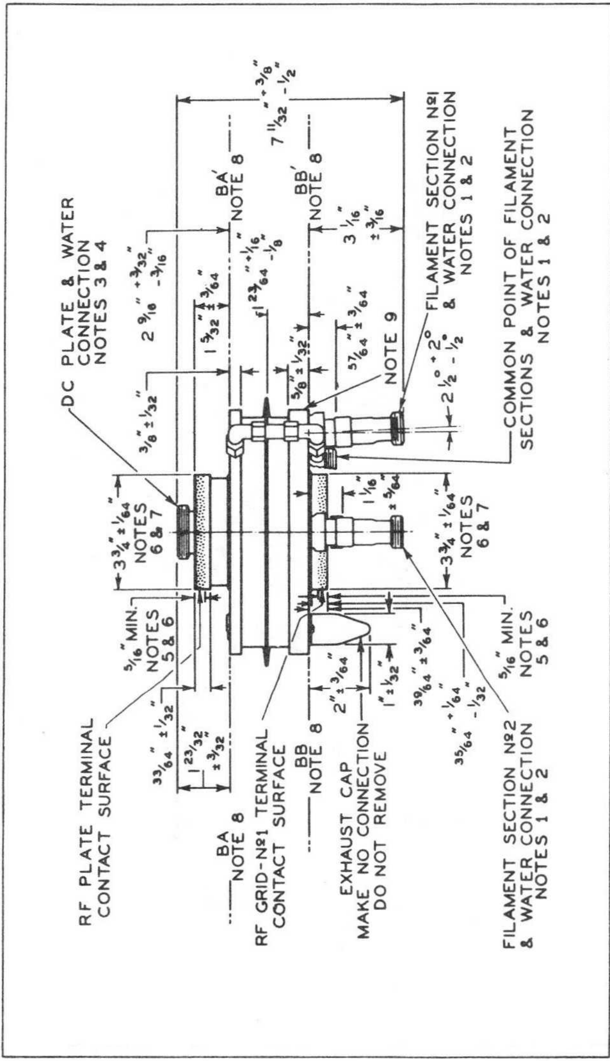
CE-8256A

6448

RCA

6448

UHF BEAM POWER TUBE

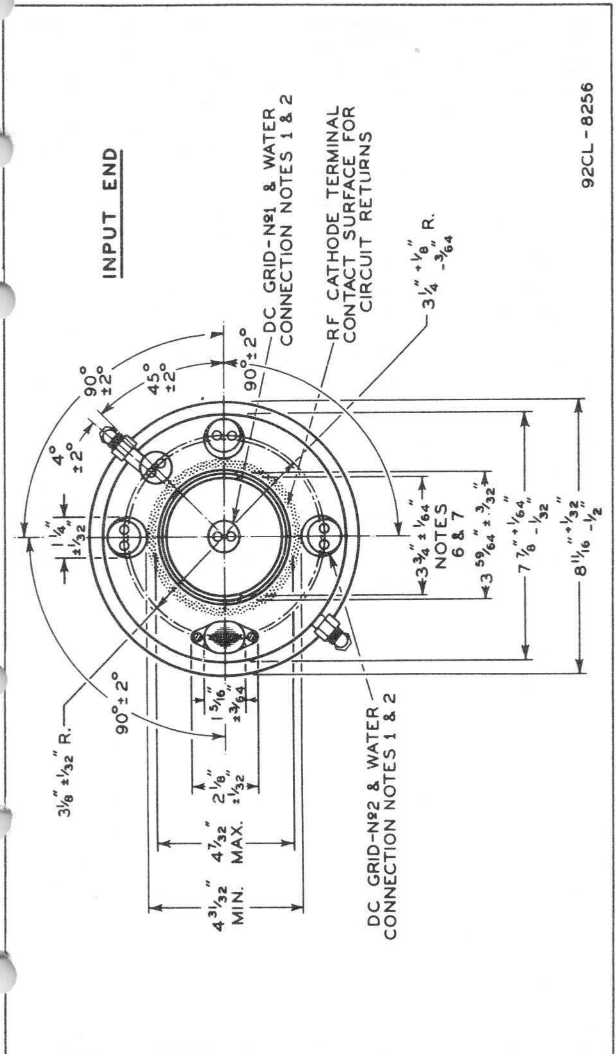


MAY 3, 1954

CE-8256B

6448

UHF BEAM POWER TUBE



6448

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".

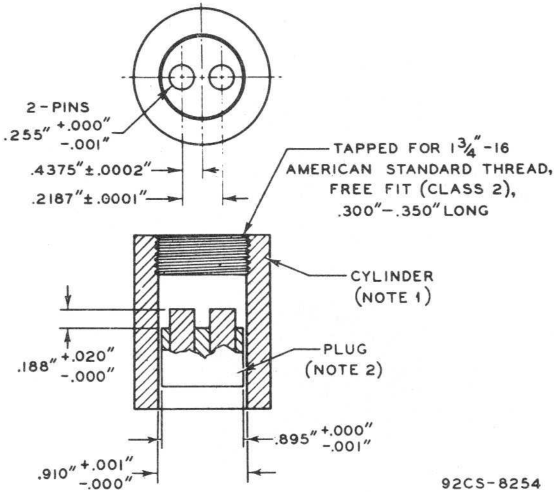
NOTE 9: SERIAL NUMBER IS LOCATED ON THIS SURFACE BETWEEN DC GRID-NO.2 AND FILAMENT SECTION No.1 CONNECTIONS.

RCA

6448

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".

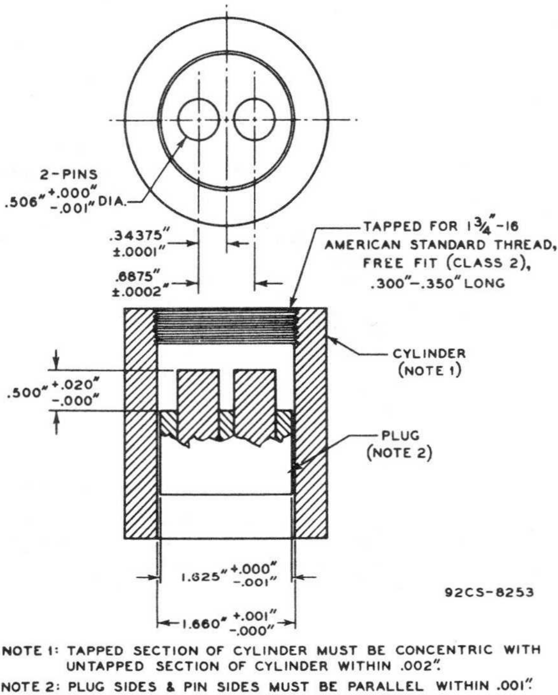
NOTE 2: PLUG SIDES & PIN SIDES MUST BE PARALLEL WITHIN .001".

RCA

6448

UHF BEAM POWER TUBE

GAUGE SKETCH G_2



92CS-8253

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".

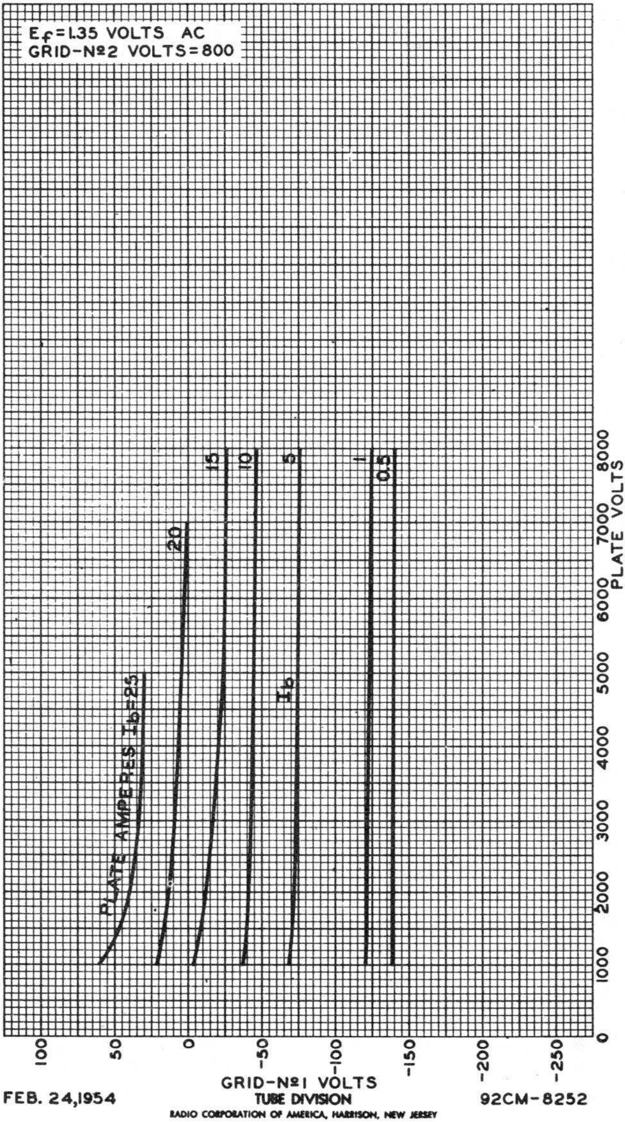
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

6448

6448

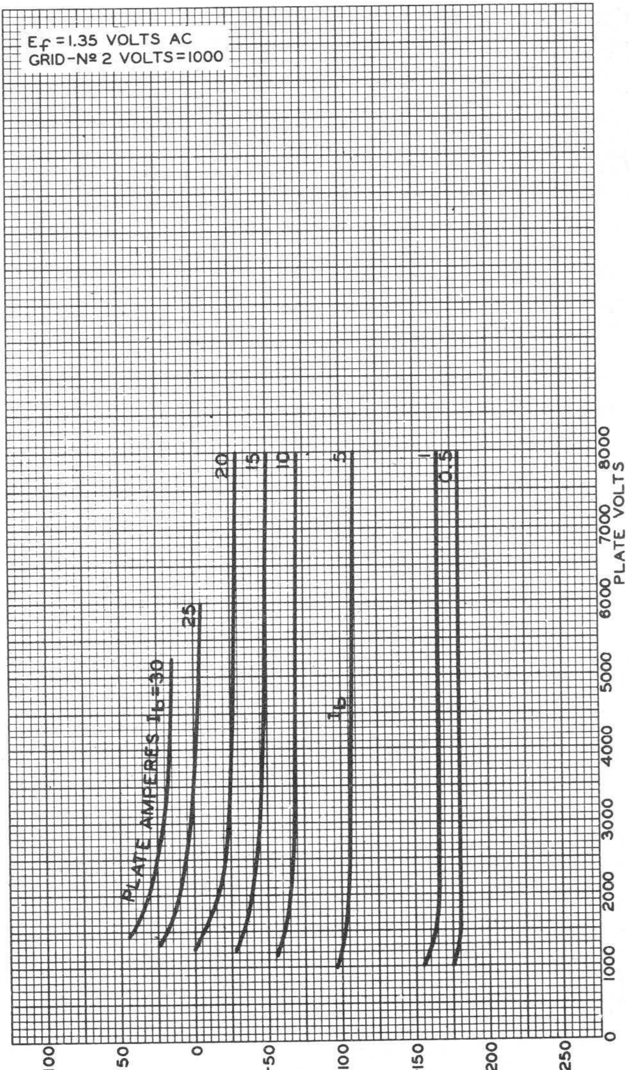
AVERAGE CONSTANT-CURRENT CHARACTERISTICS



6448

6448

AVERAGE CONSTANT-CURRENT CHARACTERISTICS



FEB. 24, 1954

TUBE DIVISION

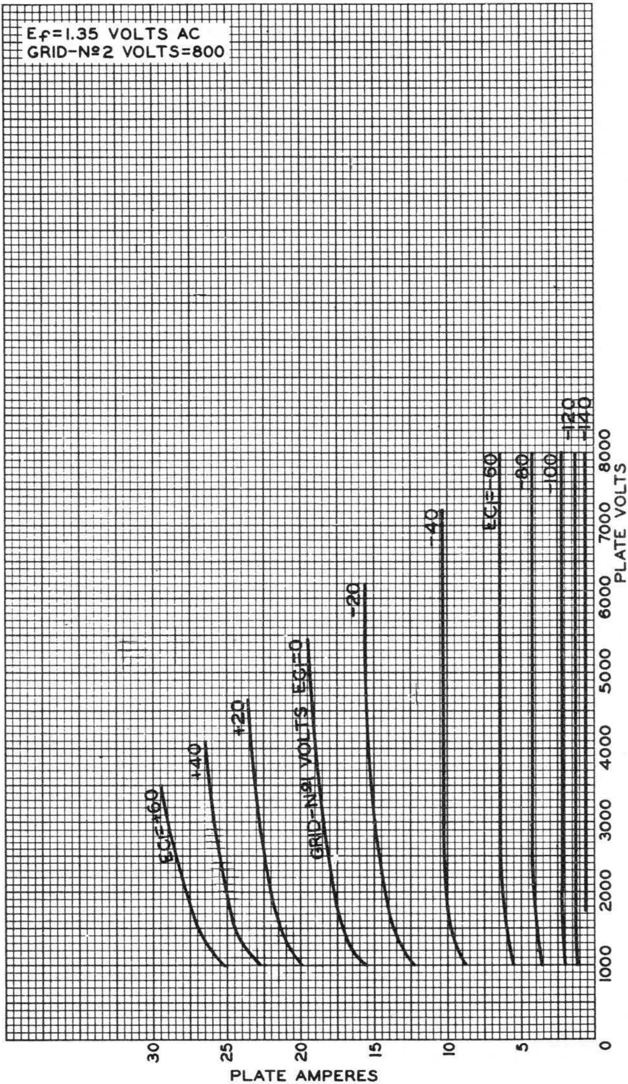
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8255

RCA

6448

AVERAGE PLATE CHARACTERISTICS



FEB. 18, 1954

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

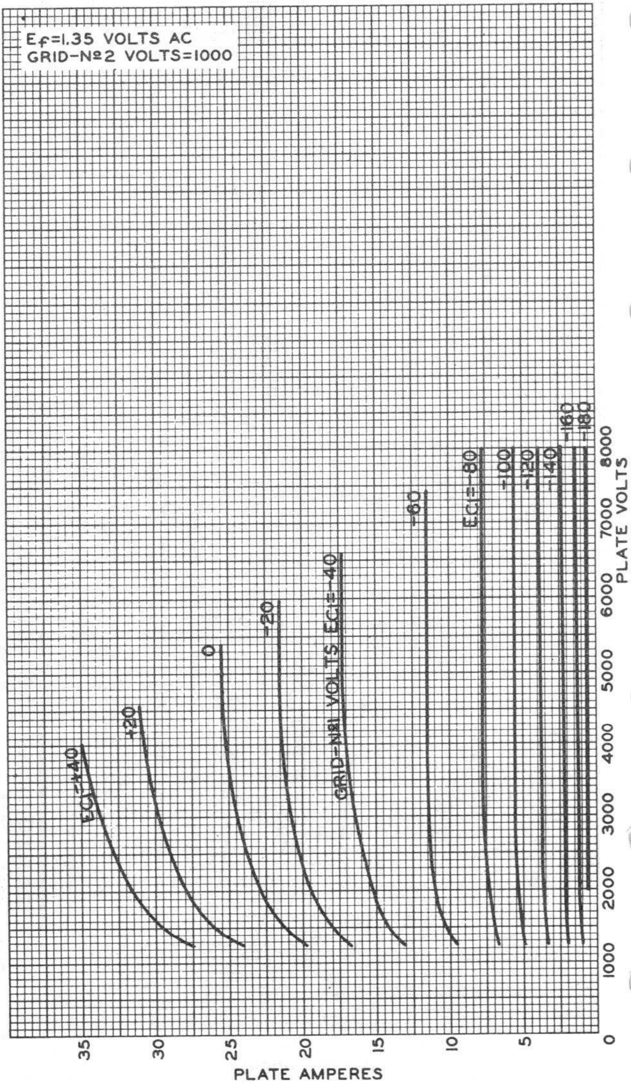
92CM-8247

6448

RCA

6448

AVERAGE PLATE CHARACTERISTICS



FEB.19,1954

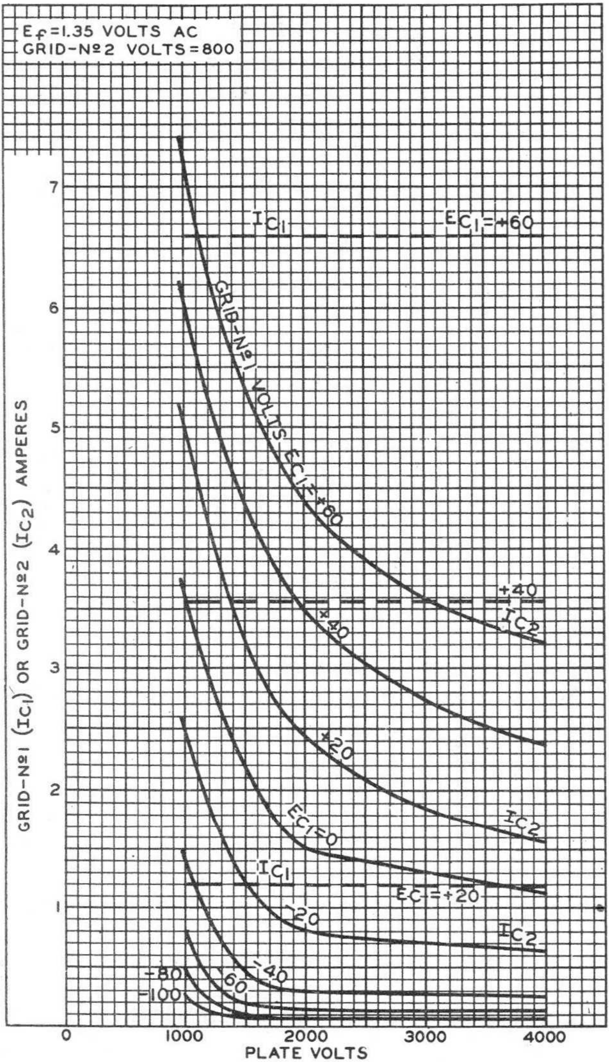
92CM-8248

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

6448

AVERAGE CHARACTERISTICS



FEB. 17, 1954

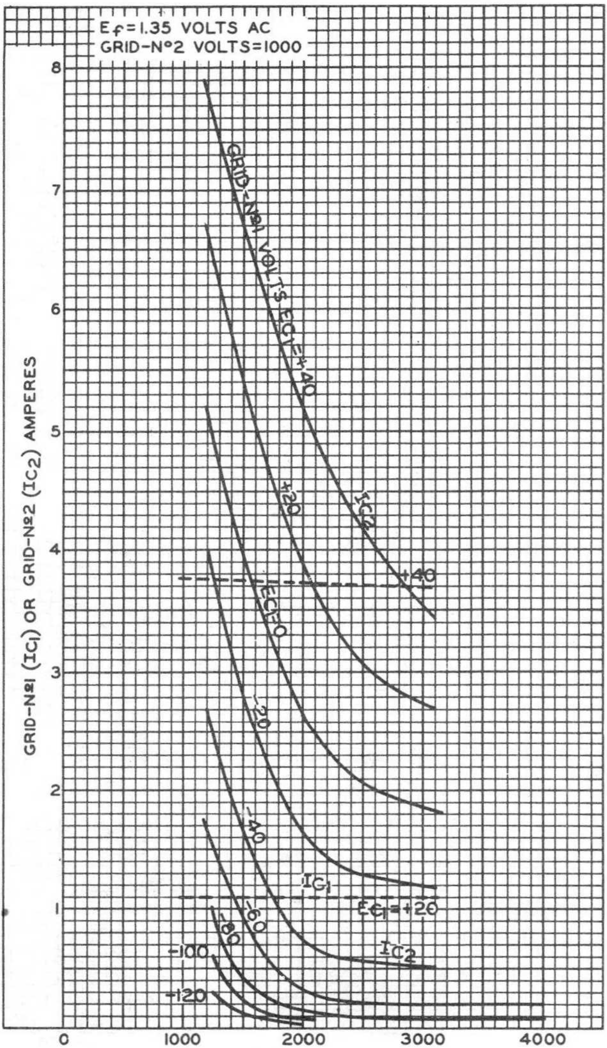
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8245

RCA

6448

AVERAGE CHARACTERISTICS



RCA

6521

MAGNETRON

FORCED-AIR COOLED

Fixed Frequency: 5400 ± 20 Mc

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:

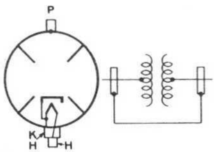
Voltage	10 ± 10%	ac or dc volts
Current	3.2	amp

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/^{o}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^{o}C.

To Heater-Cathode Terminal--Adequate flow should be provided to maintain the temperature of the heater-cathode terminal below 165^{o}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^{o}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.

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. / 80 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

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

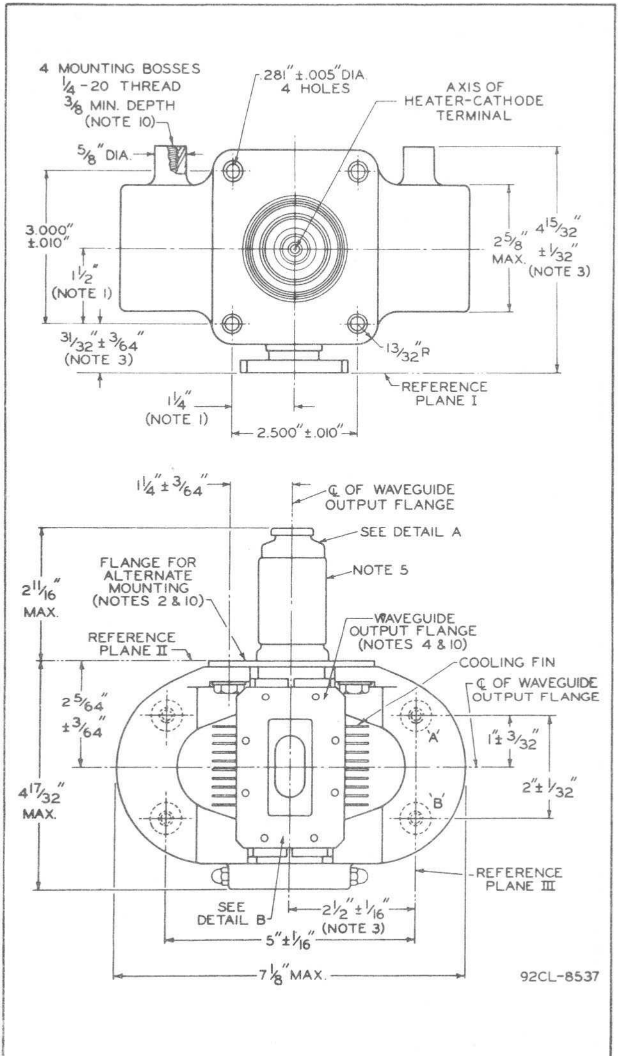
As soon as the 6521 begins to oscillate, the *heater voltage* should be reduced to 9.1 volts when it is operated under the typical operating conditions shown in the tabulated data. For other operating conditions, the heater voltage (E_f) should be reduced depending on the average power input (P_i) to 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

6521

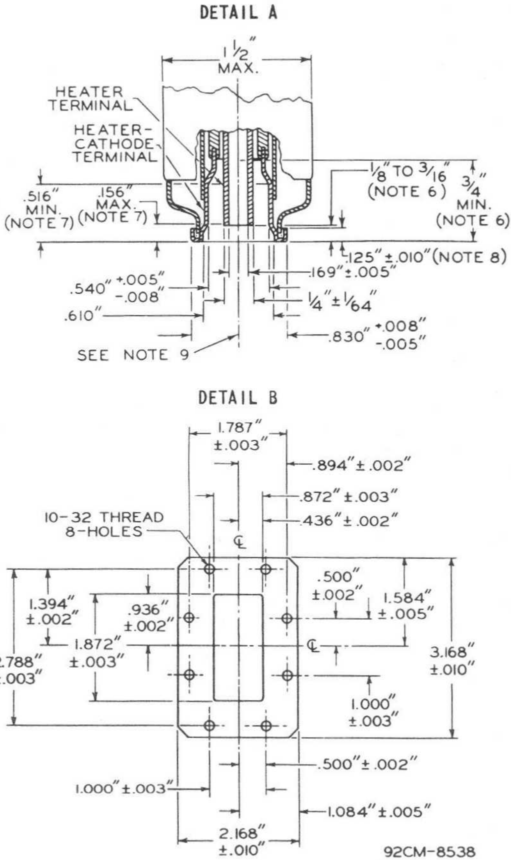
6521
MAGNETRON



RCA

6521

MAGNETRON



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'.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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 $\pm 2^{o}$.

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.

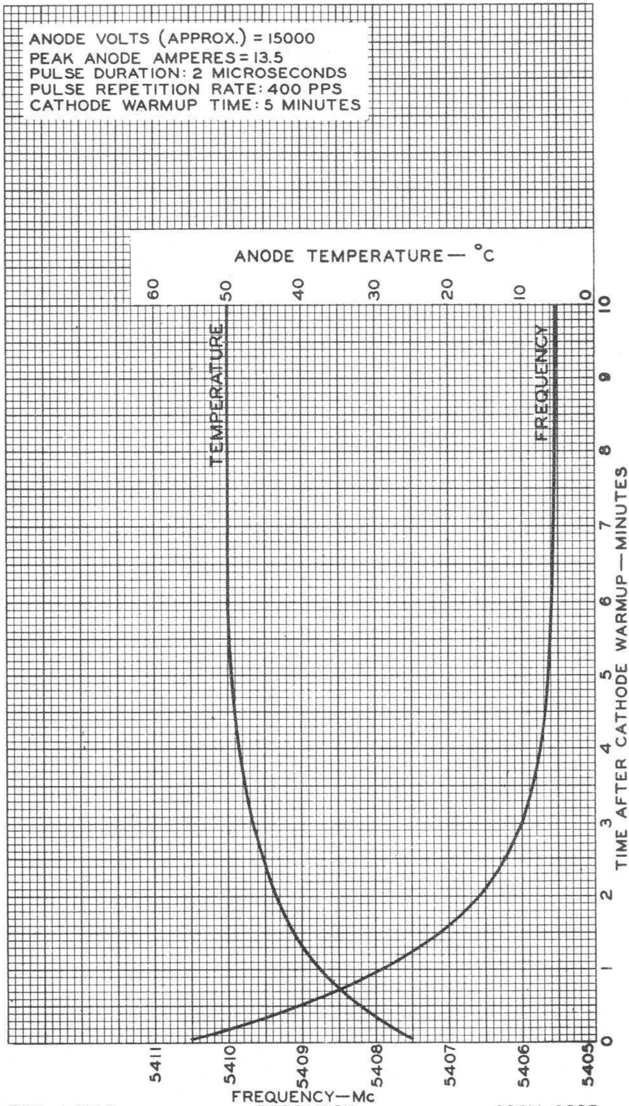
NOTE 8: No part of the connector device for the heater and heater-cathode terminals should bear against the underside of this lip.

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.

6521

TYPICAL STABILIZATION CHARACTERISTICS



FEB. 4, 1955

TUBE DIVISION

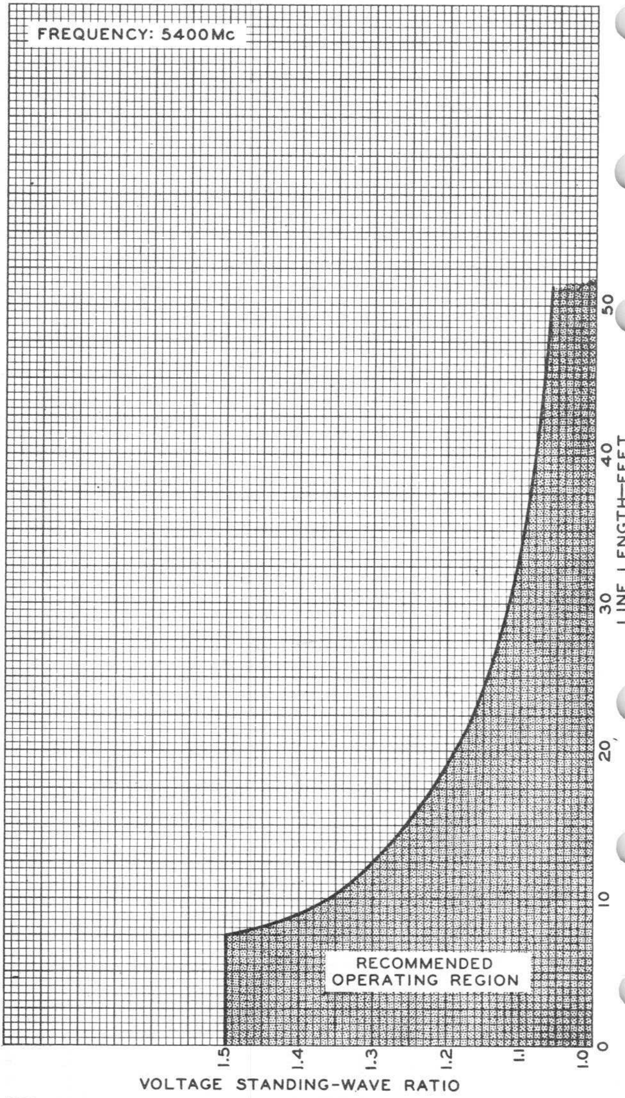
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8527

6521

6521

OPERATING REGION



FEB. 4, 1955

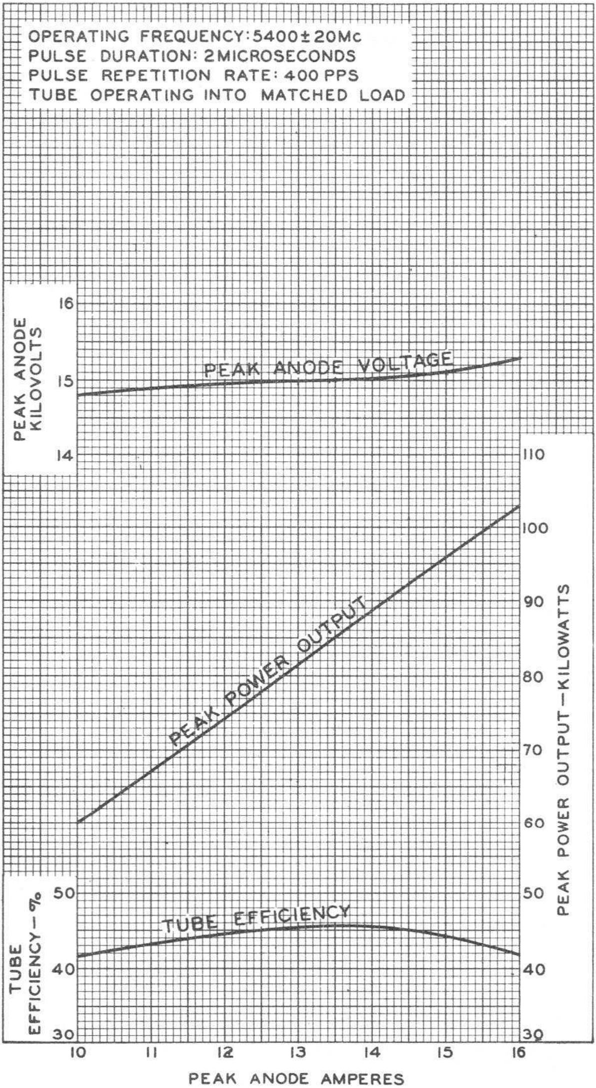
92CM-8528

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

6521

PERFORMANCE CHART



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:

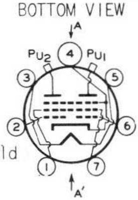
Heater, for Unipotential Cathode:		
Voltage	6.3 ± 10% . . .	ac or dc volts
Current	1.25	amp
Transconductance▲ for dc plate volts = 200, dc grid-No.2 volts = 200, and dc plate ma. = 50 . .	4500	μmhos
Mu-Factor, Grid No.2 to Grid No.1▲ for dc plate volts = 200, dc grid-No.2 volts = 200, and dc plate ma. = 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
P_{U1} - Plate of Unit No.1
P_{U2} - 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.

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.

RCA

6524

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.

6524

RCA

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 resistor 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 resistor 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 resist r 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.

°, °°, ‡, ●●, ⊕, ■: See next page.

6524

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:

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.

6524

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

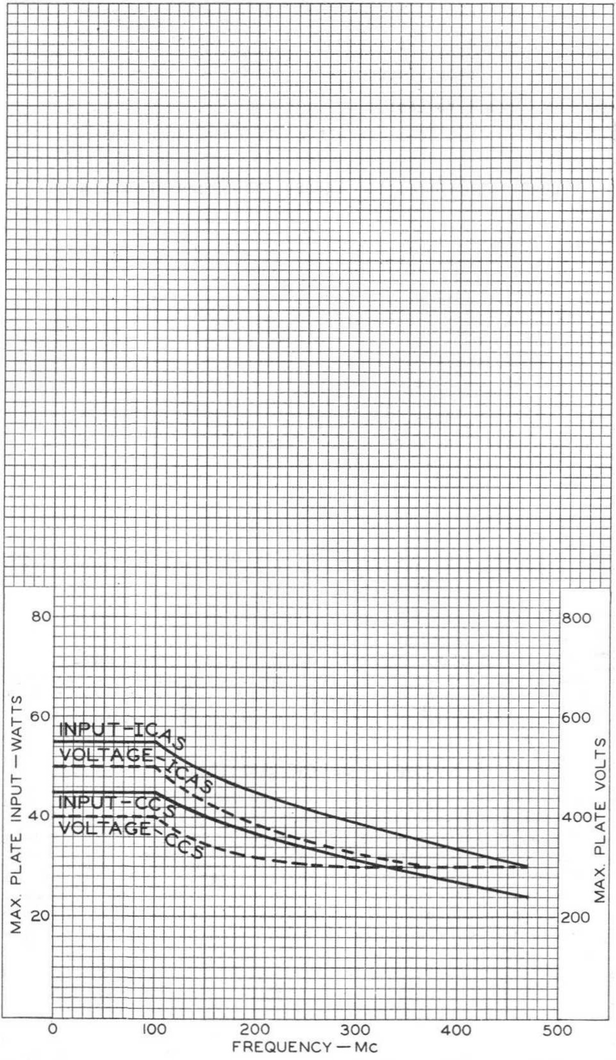
Shielding of the 6524 in rf service is required for stable operation. A convenient method of shielding is to mount the socket approximately 5/8" beneath a hole in the chassis plate so that when the 6524 is inserted in the socket, the internal shield (see *Dimensional Outline*) of the tube will be close 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.

RCA

6524

RATING CHART I
CLASS C TELEPHONY



TUBE DIVISION

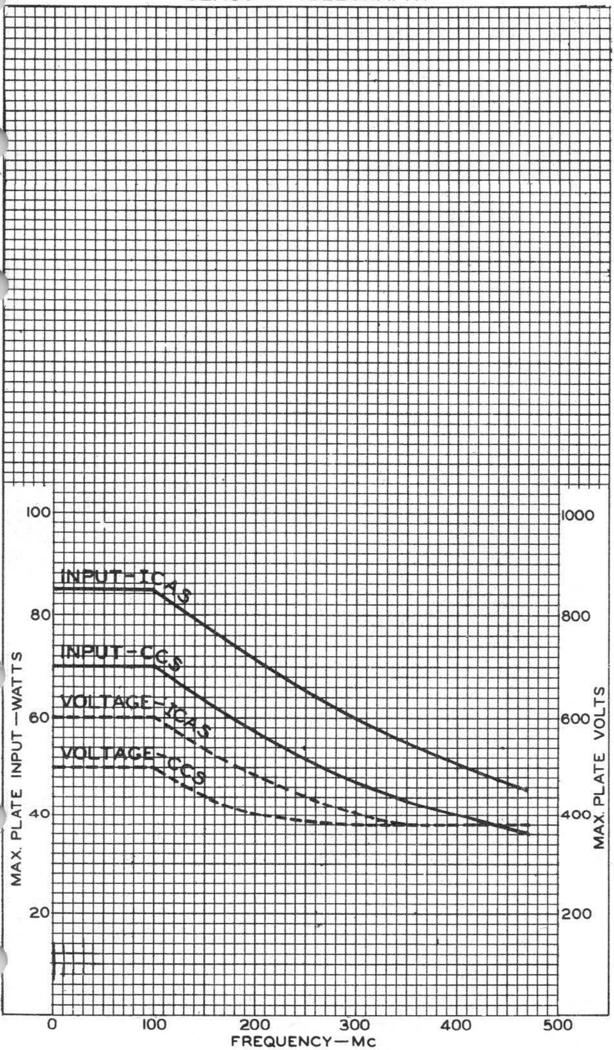
92CM-8347

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

6524

RATING CHART II
CLASS C TELEGRAPHY

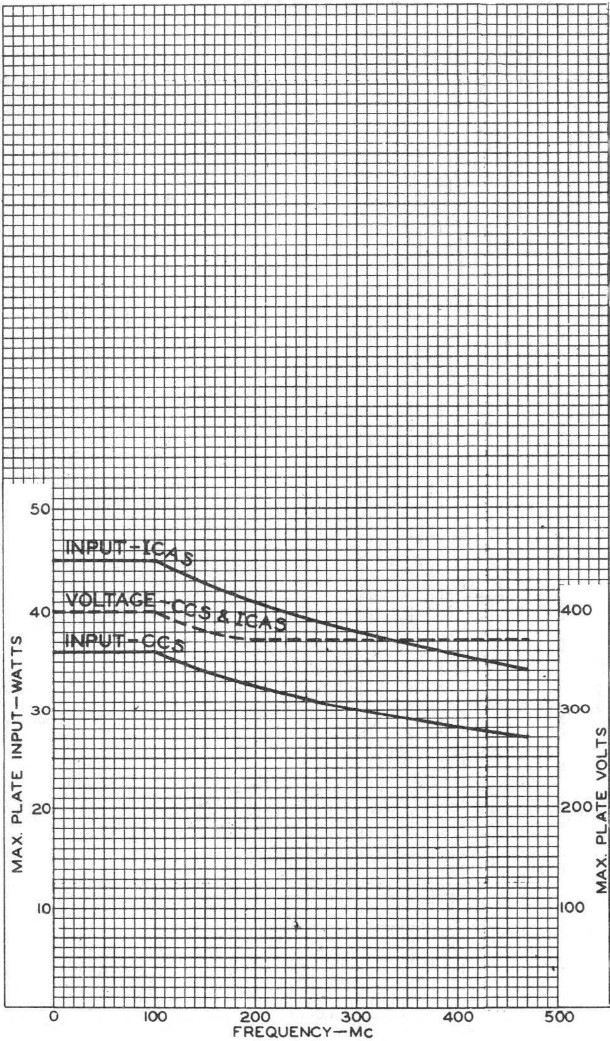


RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6524

RATING CHART III

CLASS C TRIPLER



JULY 13, 1954

TUBE DIVISION

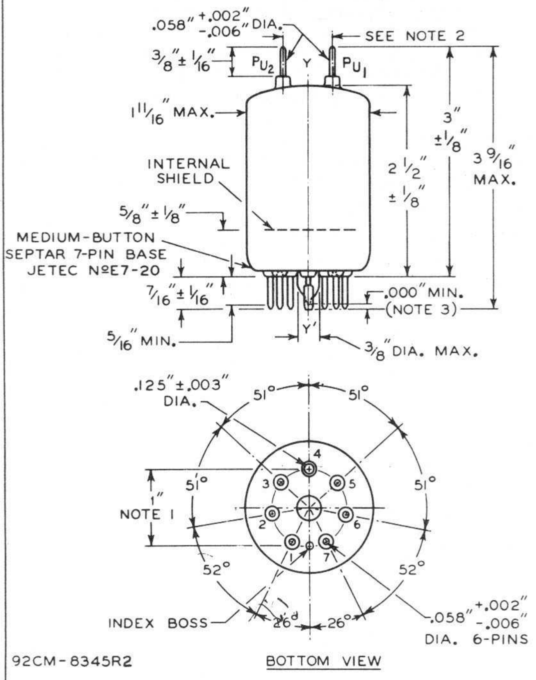
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8349

RCA

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.

RCA

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'.

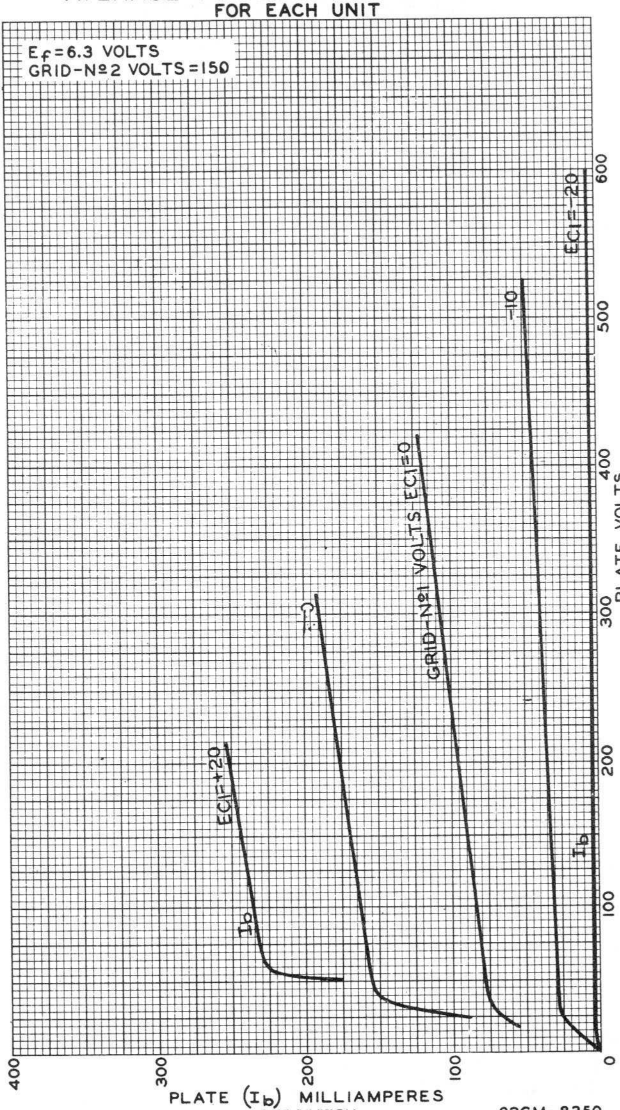
NOTE 2: THE PLATE LEADS WILL ENTER A FLAT-PLATE PLATE-LEAD GAUGE HAVING MINIMUM THICKNESS OF 0.375" AND HAVING TWO HOLES 0.1200" ± 0.0005" WHOSE CENTERS ARE LOCATED AT A DISTANCE OF 0.343" ± 0.001" FROM THE AXIS YY' AND WHOSE AXES ARE PARALLEL TO YY'. THE PLANE THROUGH THESE AXES WILL BE 90° ± 5' FROM 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



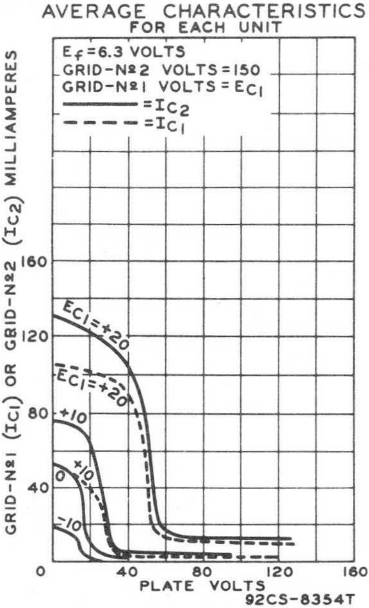
JULY 15, 1954 | TUBE DIVISION | 92CM-8350

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

6524

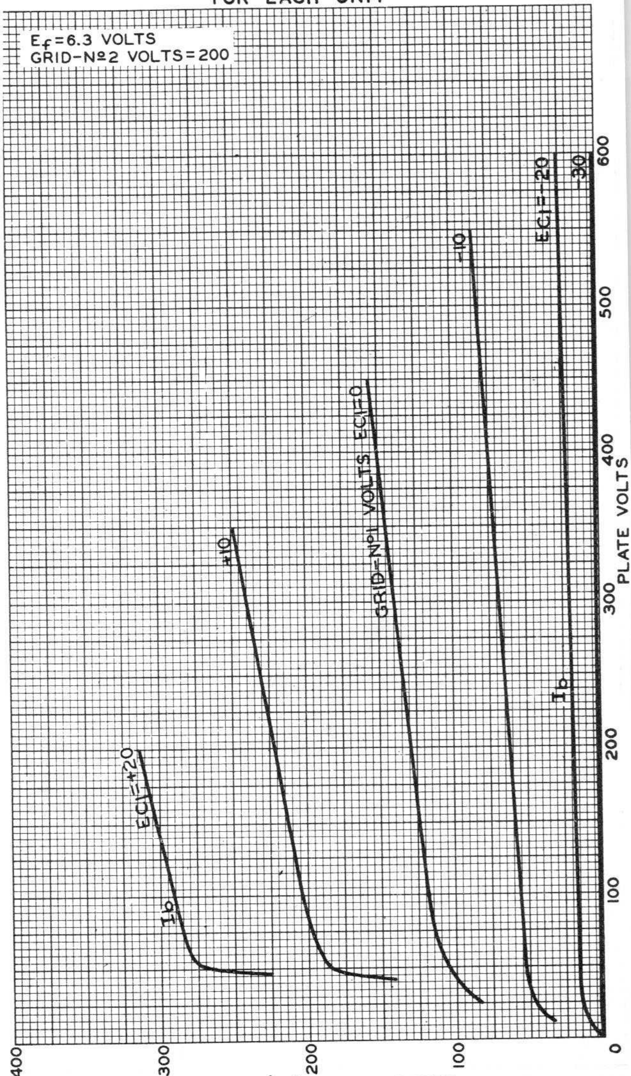
CHARACTERISTICS CURVES



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA
6524

AVERAGE PLATE CHARACTERISTICS
FOR EACH UNIT



JULY 12, 1954

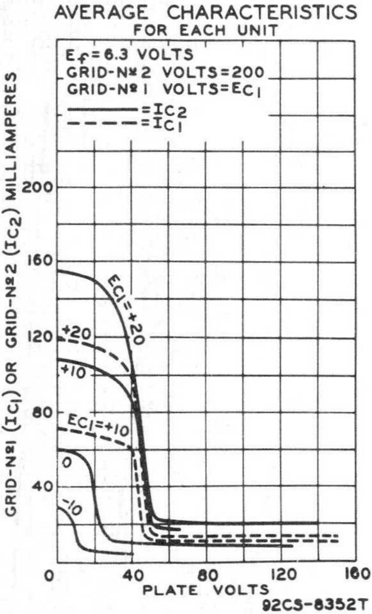
TUBE DIVISION
RADIO CORPORATION OF AMERICA. HARRISON. NEW JERSEY

92CM-8346

RCA

6524

CHARACTERISTICS CURVES

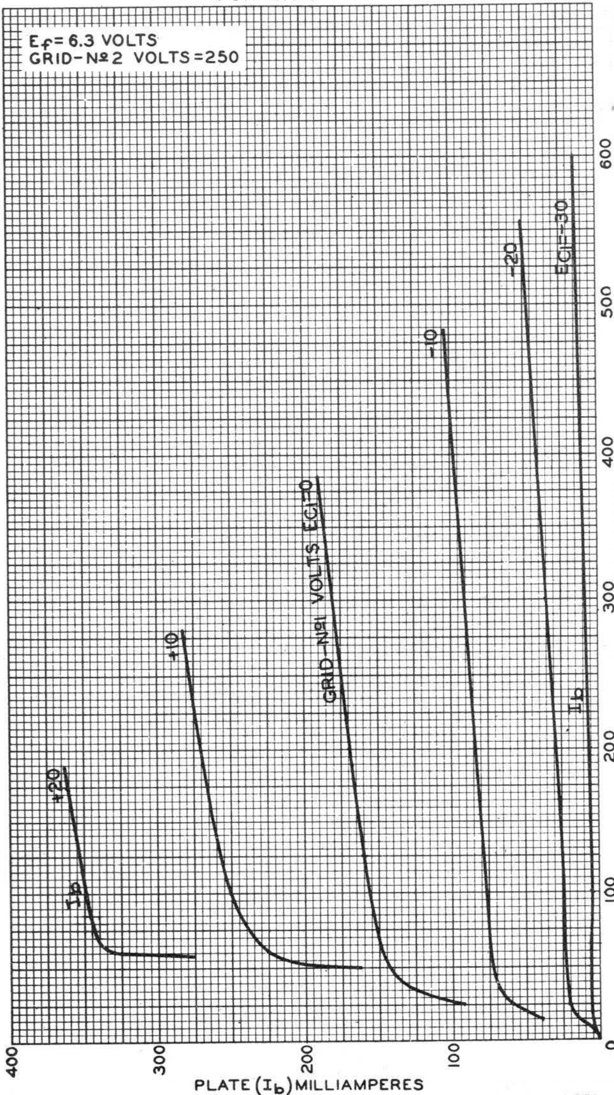


6524

RCA

6524

AVERAGE PLATE CHARACTERISTICS
FOR EACH UNIT



JULY 15, 1954

TUBE DIVISION

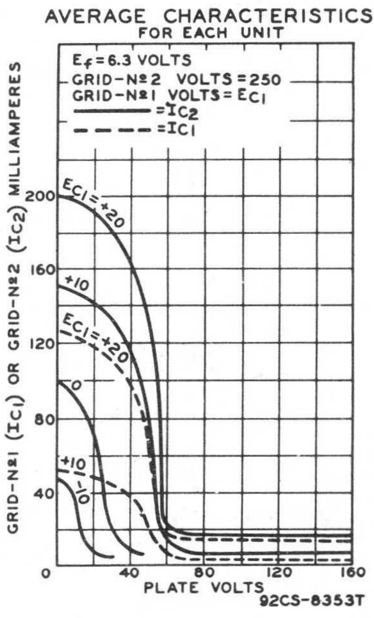
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8351

6524

6524

CHARACTERISTICS CURVES



Fixed-Tuned Oscillator Triode

PENCIL TYPE WITH INTEGRAL RESONATORS

For Radiosonde Service at 1680 Mc

GENERAL DATA

Electrical:

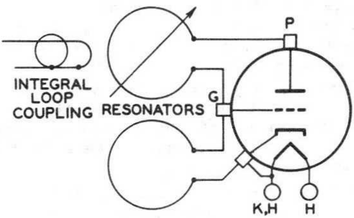
Heater, for Unipotential Cathode:		
Voltage range (AC or DC)	5.2 to 6.6[a]	volts
Current at heater volts = 6.0	0.160	amp
Frequency (Approx.)	1680	Mc
Frequency Adjustment Range	±12[b]	Mc
RF Coaxial Output Terminal:		
Characteristic impedance (Approx.)	50	ohms

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.

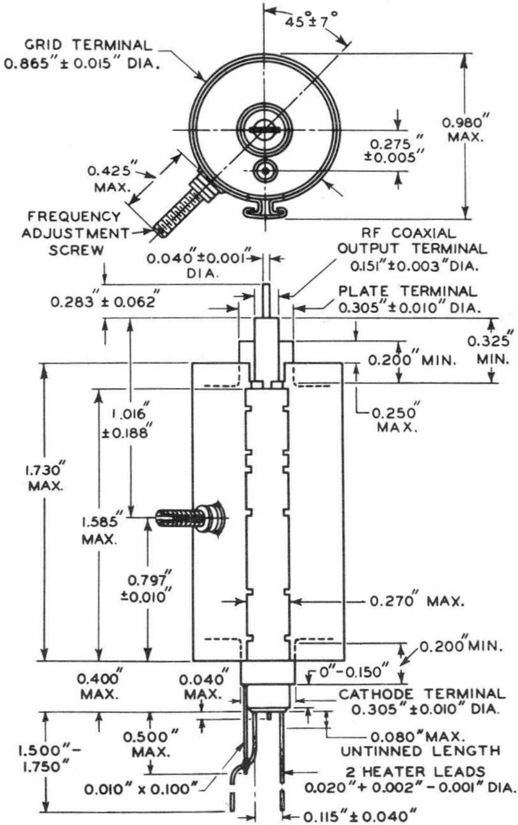
OPERATING CONSIDERATIONS

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.
PLATE TERMINAL
0.305"±0.010" DIA.
0.283"± 0.062"
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.
0.080" MAX.
UNTINNED LENGTH
0.500"
MAX.
1.500"-
1.750"
2 HEATER LEADS
0.020"+ 0.002" - 0.001" DIA.
0.010" x 0.100"
0.115"± 0.040"

92CM-8747RI

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:

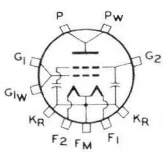
Voltage★ per section (AC or DC) . . .	1.25 min.°	volts
	1.35 typical	volts
	1.50 max.	volts
Current per section at 1.35 volts . .	1000	amp
Starting current per section	Must never exceed 1200 amperes, even momentarily	
Cold resistance per section	0.00025	ohm
Minimum heating time	30	sec
Mu-Factor, Grid 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	*Typical Flow*	*Pressure⊕ Differential for Typical Flow*
	gpm	*gpm*	*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.

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

○, ★, ⊕, ●, §, ⊕, ♠, ♣, ●●: See next page.

← Indicates a change.

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

RCA

6806

BEAM POWER TUBE

	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 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.

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

RCA

6806

6806

BEAM POWER TUBE

	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.

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

6806

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.

○ 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.

6806

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.

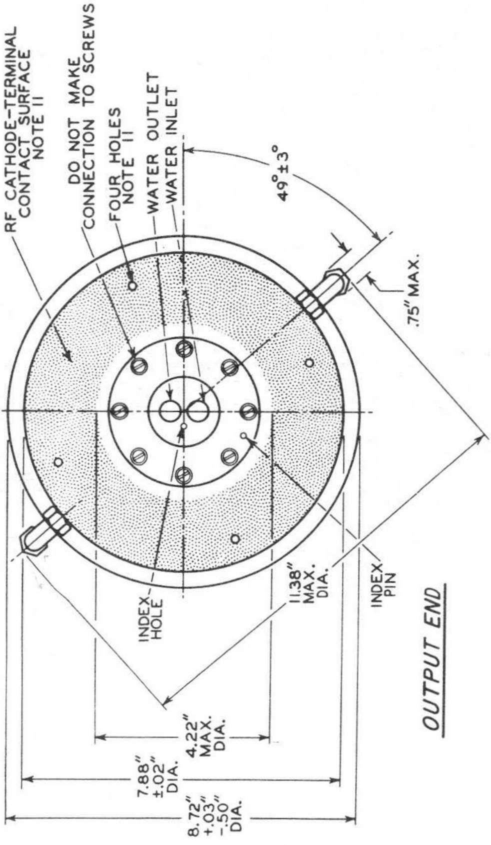
Note 7: With driving power measured at input to input-cavity circuit fed by transmission line having voltage-standing-wave ratio not greater than 1.5. Power gain is ratio of useful power output to driving power.

← Indicates a change.

RCA

6806

BEAM POWER TUBE

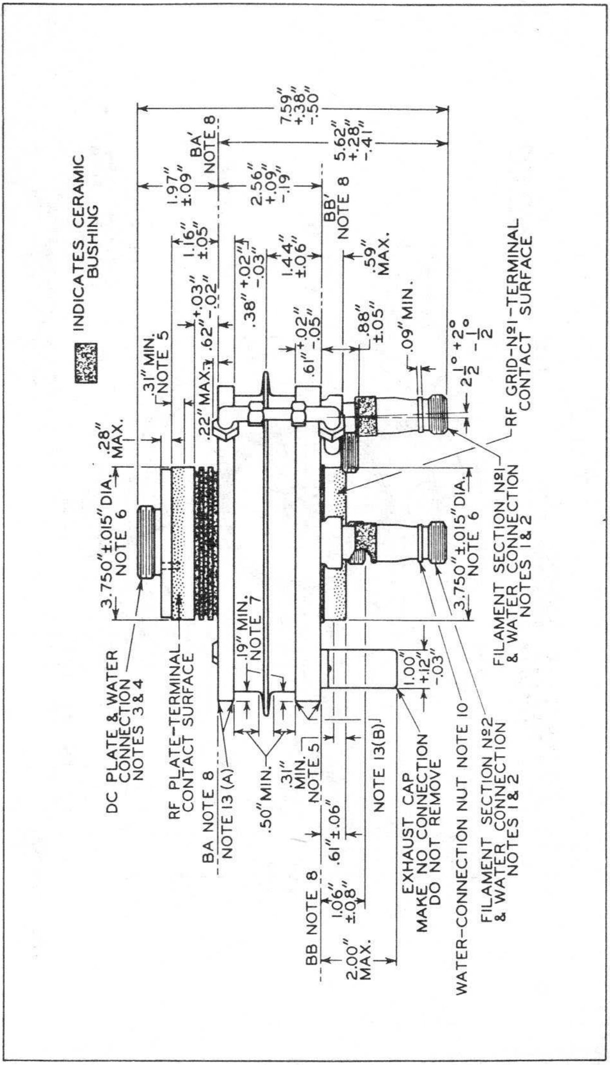


ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

6806

BEAM POWER TUBE

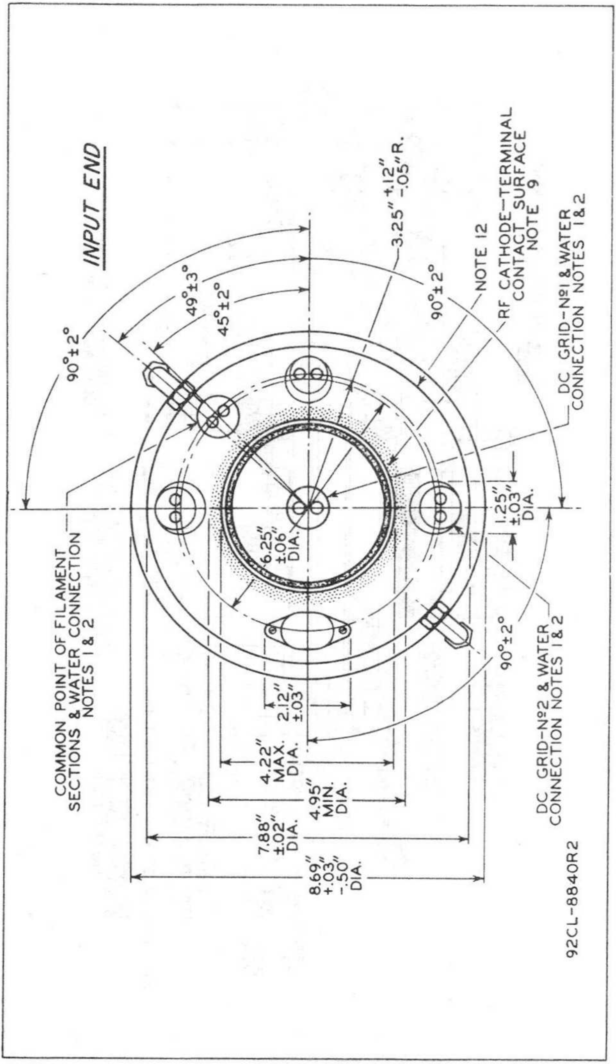


ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6806

6806

BEAM POWER TUBE



6806

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.

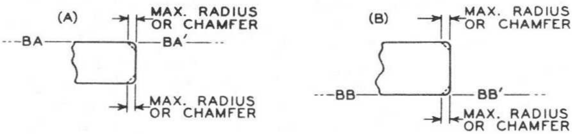
NOTE 11: CONTACT OF THE OUTPUT-END RF CATHODE TERMINAL SHOULD NOT BE MADE AT A DIAMETER SMALLER THAN 4.22". THE PRESSURE EXERTED FOR THIS RF CONTACT SHOULD BE LIMITED TO THAT NECESSARY FOR GOOD ELECTRICAL CONTACT. THE MECHANICAL FORCE FOR THE CAVITY SUPPORT SHOULD BE MADE AT A DIAMETER NOT LESS THAN 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.

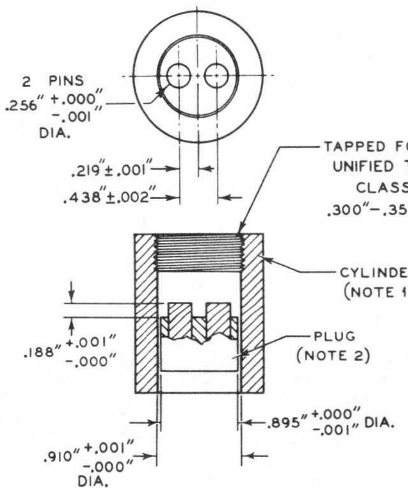
6806

BEAM POWER TUBE

NOTE 13: CORNERS MAY BE ROUNDED OR CHAMFERED, AS INDICATED IN (A) AND (B), NOT TO EXCEED 0.05".



GAUGE G_1



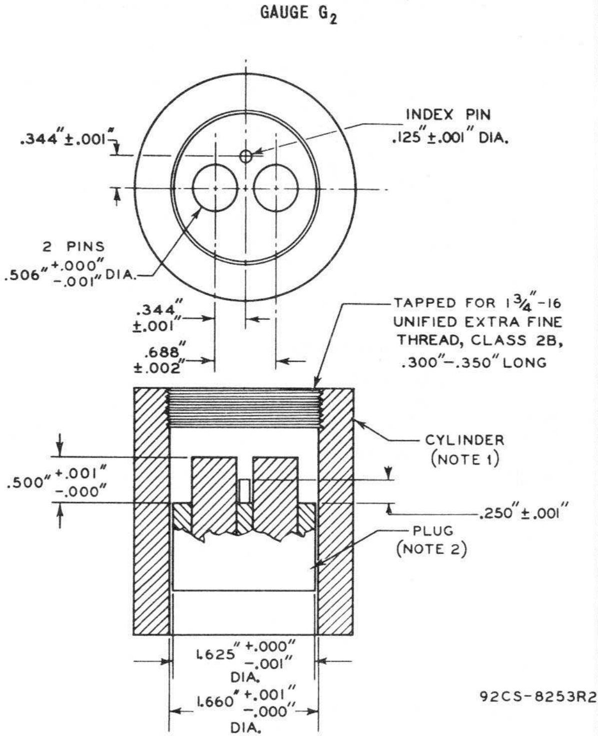
92CS-8254R2

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 6806

BEAM POWER TUBE



92CS-8253R2

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".

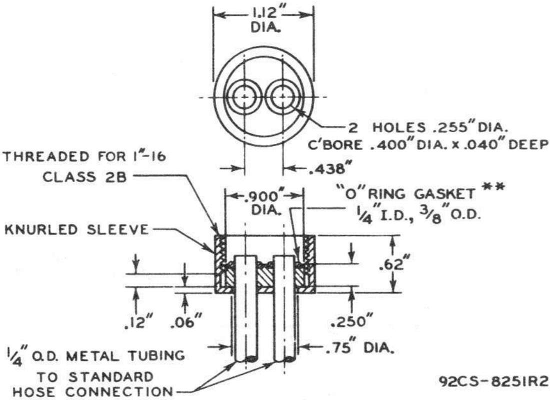
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

6806

BEAM POWER TUBE

TYPICAL FITTING LAYOUT FOR ALL WATER CONNECTIONS OTHER THAN THAT FOR PLATE



** DWG. № 24849-5, GARLOCK PACKING CO., PALMYRA, N.Y.

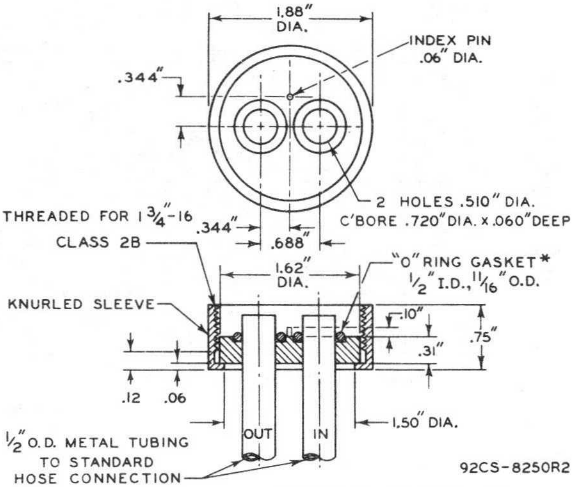
For essential design tolerances, see Gauge G_1

RCA

6806

BEAM POWER TUBE

TYPICAL FITTING LAYOUT FOR PLATE WATER CONNECTION



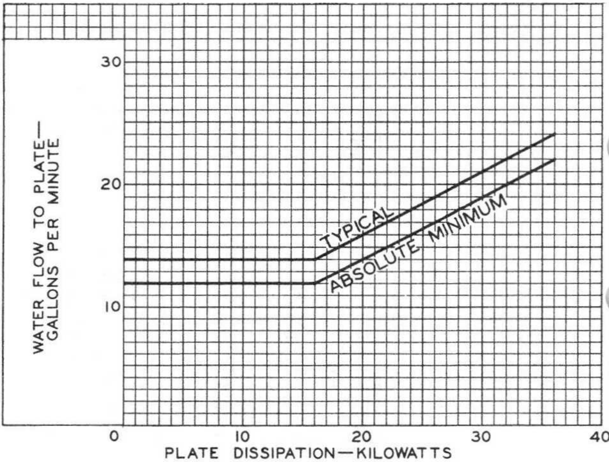
*DWG. № 24849-10, GARLOCK PACKING CO., PALMYRA, N.Y.

For essential design tolerances, see Gauge G_2

6806

6806

PLATE COOLING REQUIREMENTS

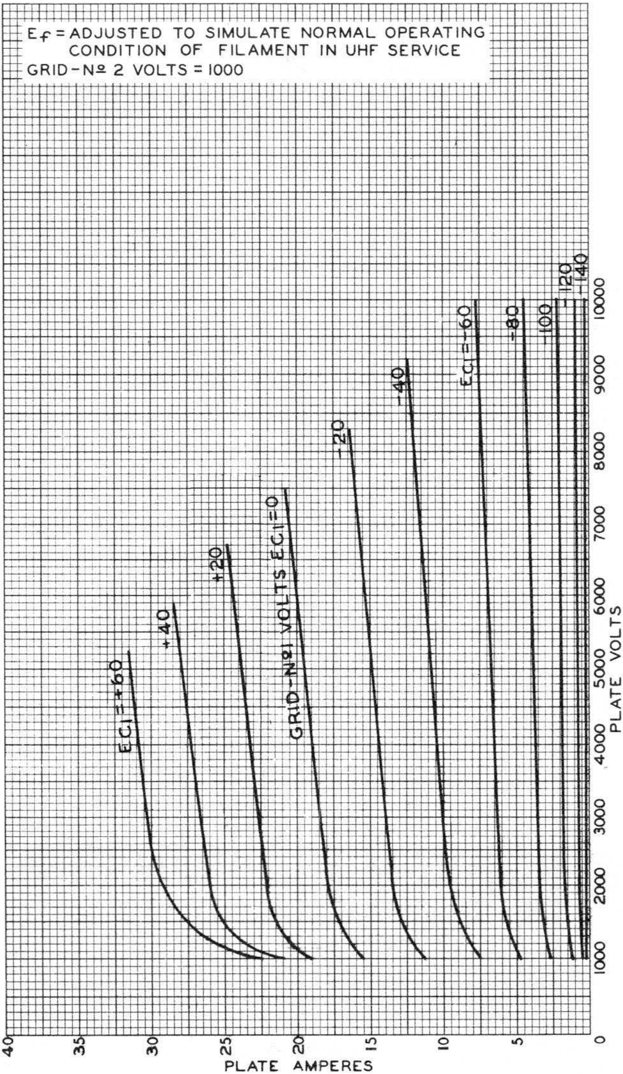


92CS-8929

6806

6806

TYPICAL PLATE CHARACTERISTICS



ELECTRON TUBE DIVISION

92CM-8899

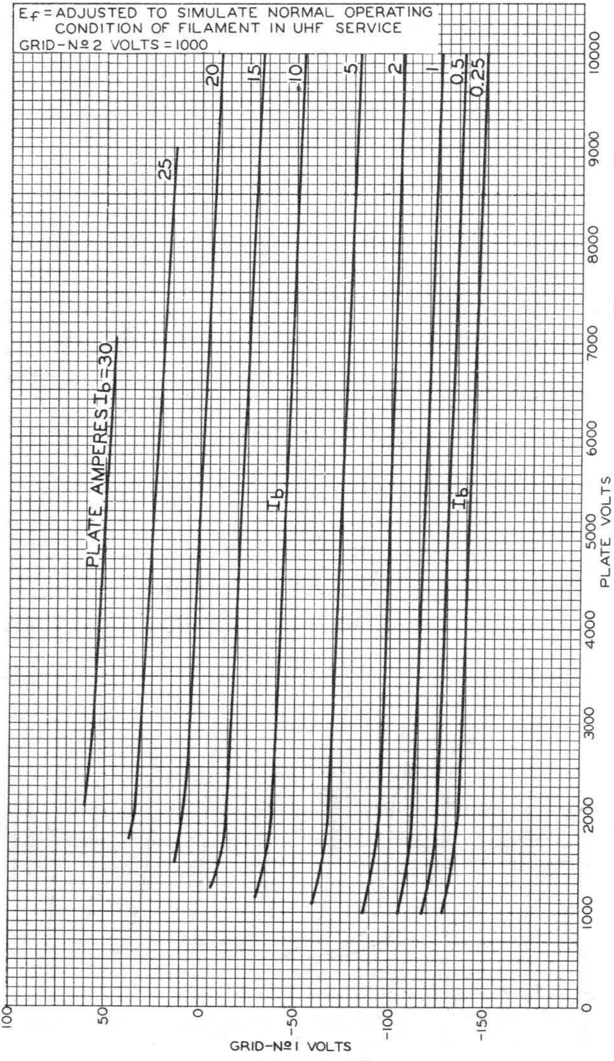
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6806

RCA

6806

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



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

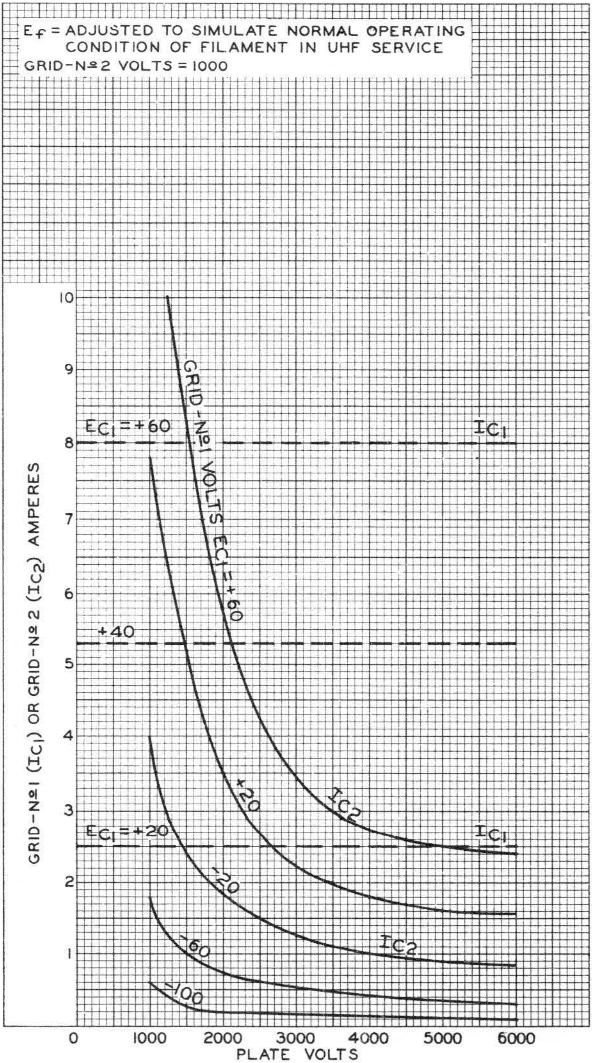
92CL-8901

RCA

6806

6806

TYPICAL CHARACTERISTICS



ELECTRON TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8909

Beam Power Tube

CERMOLOX TYPE

OXIDE-COATED CATHODE	FORCED-AIR COOLED
80 WATTS CW POWER OUTPUT AT 400 MHz	40 WATTS CW POWER OUTPUT AT 1215 MHz

For Use in Compact Aircraft, Mobile, and Stationary Equipment

ELECTRICAL

Heater, for Unipotential Cathode[g]		
Voltage (AC or DC)	6.3 typ / 6.9 max	V / V
Current at heater volts = 6.3	2.1	A
Minimum heating time	60	s
Mu-Factor, Grid No.2 to Grid No.1	18	
Direct Interelectrode Capacitances[a]		
Grid No.1 to plate	0.065 max	pF
Grid No.1 to cathode & heater	13.0	pF
Plate to cathode & heater	0.013 max	pF
Grid No.1 to grid No.2	18.0	pF
Grid No.2 to plate	4.8	pF
Grid No.2 to cathode & heater	0.45 max	pF

MECHANICAL

Operating Position	Any
Overall Length	1.93 max in
Greatest Diameter	1.265 max in
Weight (Approx.)	2 oz
Radiator	Integral part of tube

For operation up to 400 MHz ←

Socket including Grid-No.2 Bypass Capacitor . . . . . Erie[b] 2948-000, E.F. Johnson[c] DN124-152-1 Jettron[d] 89-001, or equivalent

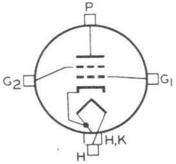
Grid-No.2 Bypass Capacitor . . . . Erie[b] 2926-000, 2929-001, or equivalent

For operation at high frequencies

See *Preferred 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

Terminal Temperature (Plate, Grid No.2, Grid No.1, cathode, and heater)	250 max	°C
Plate-Core Temperature	250 max	°C
See Dimensional Outline for temperature-measurement points		
Air Flow[h] (See Typical Cooling Requirements)		

AF POWER AMPLIFIER & MODULATOR—Class AB_1 [j]

Maximum CCS Ratings, Absolute-Maximum Values

DC plate voltage	1000	V
DC grid-No.2 (screen-grid) voltage	300	V
Max.-signal dc plate current	180	mA
Max.-signal plate input	180	W
Max.-signal grid-No.2 input	4.5	W
Plate dissipation	115	W

Typical CCS Operation

Values are for 2 tubes

DC Plate Voltage	650	850	V
DC Grid-No.2 Voltage	300	300	V
DC Grid-No.1 (Control-Grid) Voltage	-15	-15	V
From fixed-bias source			
Peak AF Grid-No.1-to-Grid-No.1 Voltage	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	4330	7000	Ω
Plate to plate			
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		
With fixed-bias	30000	Ω
With cathode-bias	Not recommended	

AF POWER AMPLIFIER & MODULATOR — Class AB_2 [j]

Maximum CCS Ratings, Absolute-Maximum Values

DC plate voltage	1000	V
DC grid-No.2 (screen-grid) voltage	300	V
Max.-signal dc plate current	180	mA
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 Operation

Values are for 2 tubes

DC Plate Voltage	650	850	V
DC Grid-No.2 Voltage	300	300	V
DC Grid-No.1 Voltage	-15	-15	V
From fixed-bias source			

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

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	2450	3960	Ω
Plate to plate			
Max.-Signal Driving Power (Approx.)	0.3	0.3	W
Max.-Signal Power Output (Approx.)	85	140	W

LINEAR RF POWER AMPLIFIER, Class AB_1[j]

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 1215 MHz	
DC plate voltage	1000	V
DC grid-No.2 voltage	300	V
DC grid-No.1 voltage	100	V
DC plate current at peak of envelope	350[e]	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 with "Two-Tone" Modulation

	At 30 MHz		
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		
With fixed bias	25000	Ω
With fixed bias (In Class AB_1 operation)	100000	Ω
With cathode bias	Not recommended	
Grid-No.2 Circuit Impedance	See Footnote[k]	
Plate Circuit Impedance	See Footnote[m]	

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

	Up to 1215 MHz	
DC plate voltage	800	V
DC grid-No.2 (screen-grid) voltage	300	V
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	3	W
Plate dissipation	75	W

Typical CCS Operation

	At 400 MHz		
DC Plate Voltage	400	700	V
DC Grid-No.2 Voltage	200	250	V
DC Grid-No.1 Voltage	-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.)	2	3	W
Useful Power Output (Approx.)	16	45	W

Maximum Circuit Values

Grid-No.1-Circuit Resistance Under Any Condition	30000	Ω

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

Maximum CCS Ratings, Absolute-Maximum Values

	Up to 1215 MHz	
DC plate voltage	1000	V
DC grid-No.2 voltage	300	V
DC grid-No.1 voltage	-100	V
DC plate current	180	mA
DC grid-No.1 current	30[f]	mA
Plate input	180	W
Grid-No.2 input	4.5	W
Plate dissipation	115	W

Typical CCS Operation

	At 400 MHz		*At 1215 MHz*	
DC Plate Voltage	400	900	900	V
DC Grid-No.2 Voltage	200	300	300	V
DC Grid-No.1 Voltage	-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.)	3	3	5	W
Useful Power Output (Approx.)	23	80	40	W

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

Maximum Circuit Value

Grid-No.1-Circuit Resistance		
Under Any Condition	30000	Ω

[a] Measured with special shield adapter.

[b] Erie Technological Products, Inc., 2206 West 15th Street, Erie, Pennsylvania.

[c] E. F. Johnson Co., 299 10th Ave., S.W., Waseca, Minn.

[d] Jettron Products, Inc., 56 Rt. 10, Hanover, N.J.

[e] The maximum rating for a signal having a minimum peak-to-average power ratio less than 2, such as is obtained in "Single-Tone" operation, is 180 mA. During short periods of circuit adjustment under "Single-Tone" conditions, the average plate current may be as high as 250 mA.

[f] In applications where the frequency is less than 80 MHz and the bias is less than −50 volts, the maximum value is 40 mA.

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*.

[k] See *Electrical Considerations* — Grid-No.2 Voltage Supply.

[m] See *Electrical Considerations* — Plate Voltage Supply.

CHARACTERISTICS RANGE VALUES

	Note	*Min*	*Max*	
1. Heater Current.	1	1.84	2.26	A
2. Direct Interelectrode Capacitances				
Grid No.1 to plate.	2	-	0.065	pF
Grid No.1 to cathode & heater .	2	11.0	15.0	pF
Plate to cathode & heater . . .	2	-	0.013	pF
Grid No.1 to grid No.2	2	15.0	20.0	pF
Grid No.2 to plate.	2	4.2	5.2	pF
Grid No.2 to cathode & heater .	2	0.20	0.45	pF
3. Grid-No.1 Voltage	1,3	-6	-15	V
4. Grid-No.1 Cutoff Voltage. . . .	1,4	-	-48	V
5. Grid-No.1 Current	1,5	6	-	mA
6. Reverse Grid-No.1 Current . . .	1,3	-	8	μA
7. Grid-No.2 Current	1,3	-8	+2.0	mA
8. Peak Emission	1,6	-	300	~~peak~~
9. Interelectrode Leakage Resistance	7	1.0	-	MΩ
10. Useful Power Output	8	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 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 300 volts, and dc grid-No.1 voltage adjusted to give a dc plate current of 1 mA.

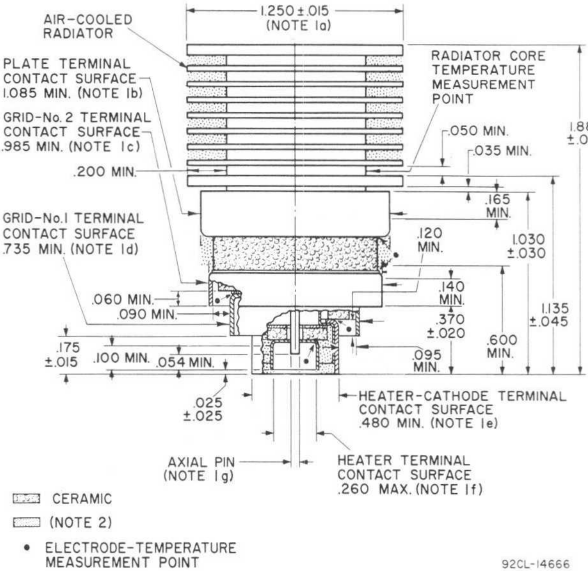
Note 5: With plate and grid-No.2 floating and dc grid-No.1 voltage of +2 volts.

Note 6: 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 300 volts (peak).

Note 7: 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 1.0 megohm, will be 1.0 megohm.

Note 8: In a single-tube, grid-drive coaxial-cavity class C amplifier circuit at 400 MHz 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 zero 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.

DIMENSIONAL OUTLINE

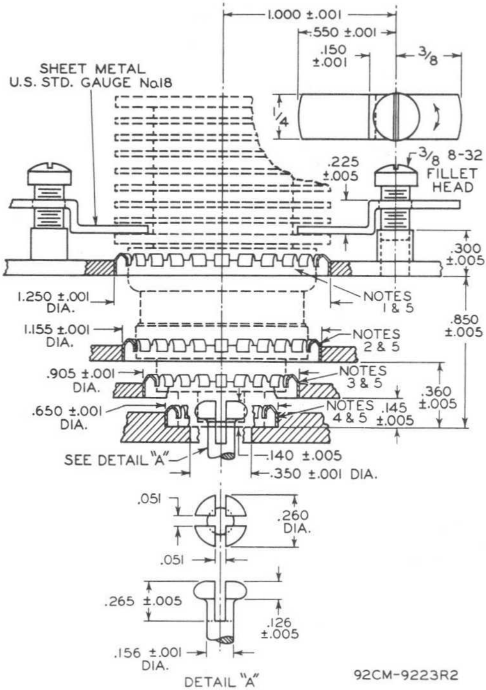


Note 1: The following diametrical space requirements accommodate the concentricity of the cylindrical surfaces of the radiator fins, axial pin, and each electrode terminal:

a. Radiator Band - 1.316"
b. Plate Terminal - 1.119"
c. Grid-No.2 Terminal - 1.019"
d. Grid-No.1 Terminal - 0.764"
e. Heater-Cathode Terminal - 0.519"
f. Heater Terminal - 0.240"
g. Axial Pin - 0.071"

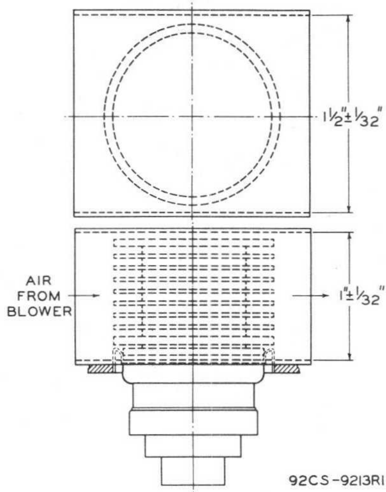
Note 2: Keep all stippled regions clear. Do not allow contacts or circuit components to protrude into these annular volumes.

PREFERRED MOUNTING ARRANGEMENT



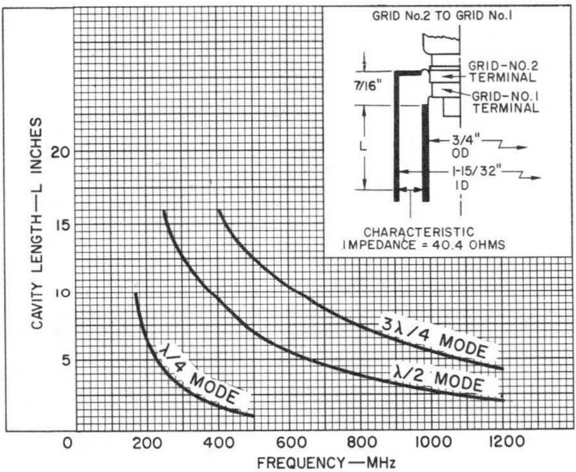
Note 1: Contact ring No. 97-252 or finger stock No. 97-380.
Note 2: Contact ring No. 97-253 or finger stock No. 97-380.
Note 3: Contact ring No. 97-254 or finger stock No. 97-380.
Note 4: Contact ring No. 97-255 or finger stock No. 97-380.
Note 5: The specified contact ring of preformed finger stock 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.

RECOMMENDED COWLING
FOR DIRECTING AIR FLOW THROUGH RADIATOR



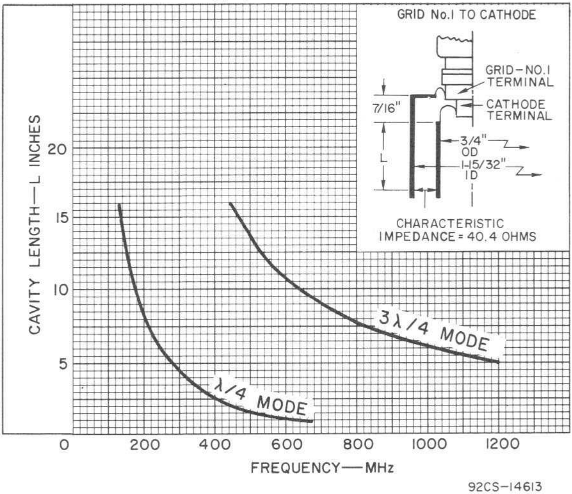
92CS-9213R1

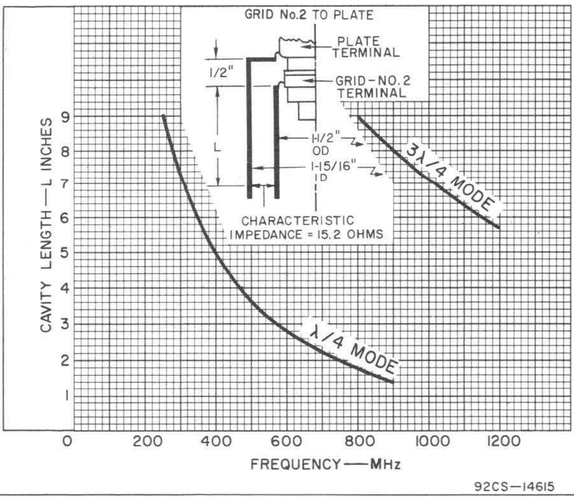
Tuning Characteristics



92CS-14614

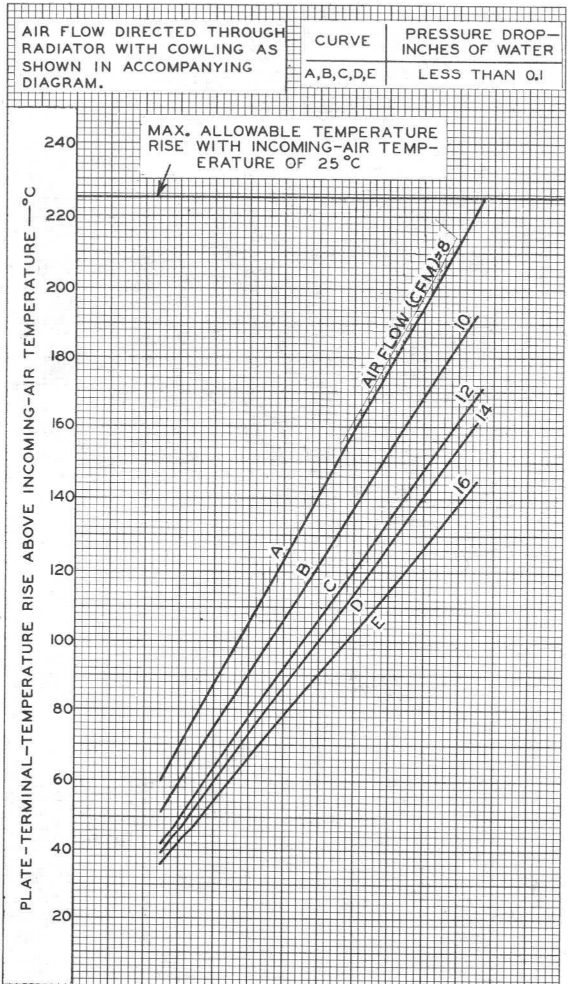
Tuning Characteristics





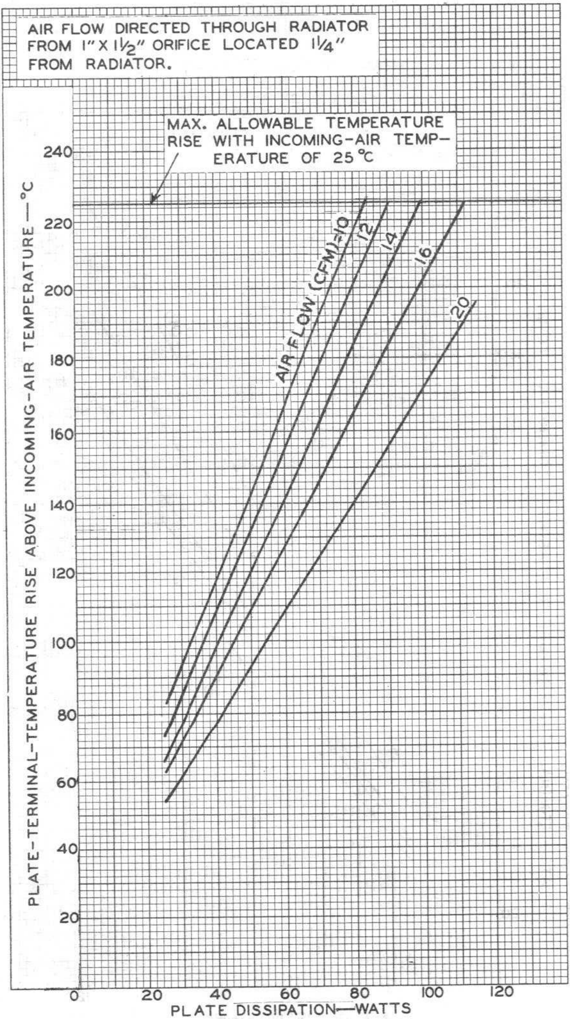
RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

TYPICAL COOLING REQUIREMENTS
With Cowling



92CM-9219R1

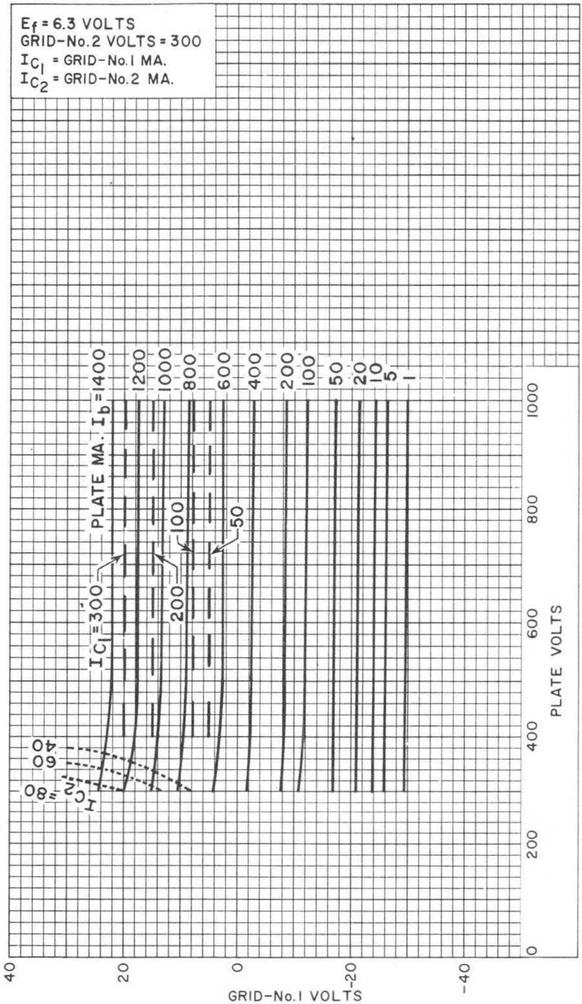
TYPICAL COOLING REQUIREMENTS
Without Cowling



92CM-9220R1

Typical Constant-Current Characteristics

With Grid-No. Volts = 300



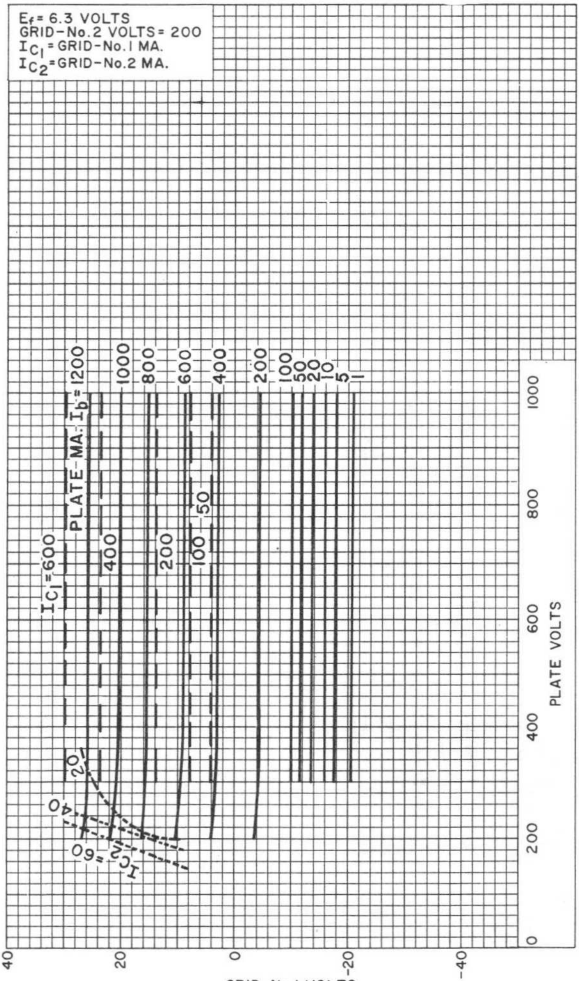
92CM-11749

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

DATA 7
7-67

Typical Constant-Current Characteristics

With Grid-No.2 Volts = 200



92CM-11745

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

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.

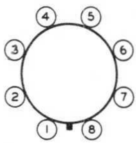
Minimum Cathode Heating Time	1	minute
Frequency Range	2700 to 3500	Mc
Cold Insertion Loss	80	db

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.

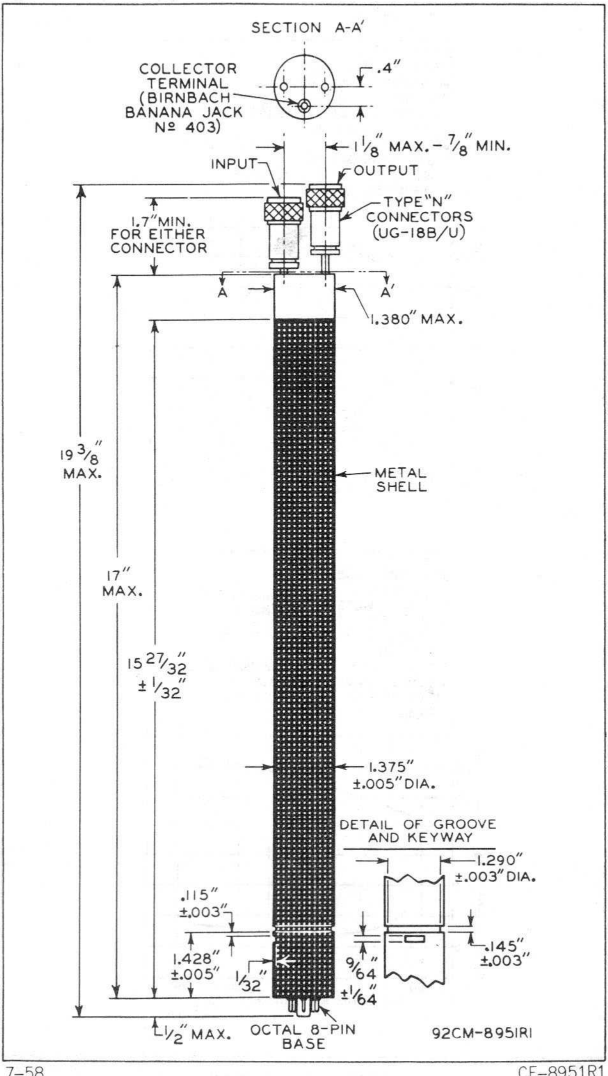
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6861

RCA

6861

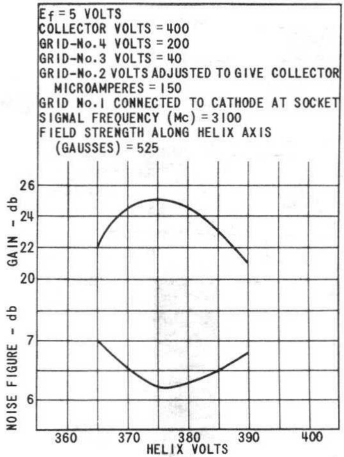
TRAVELING-WAVE TUBE



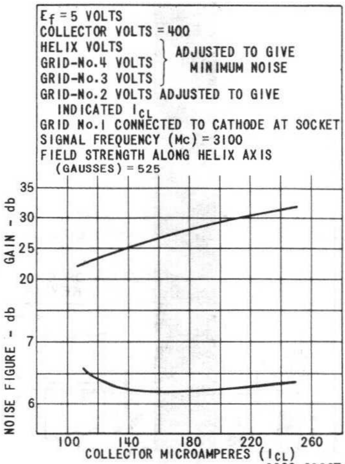
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6861

NOISE-FIGURE CHARACTERISTICS



92CS-8965T

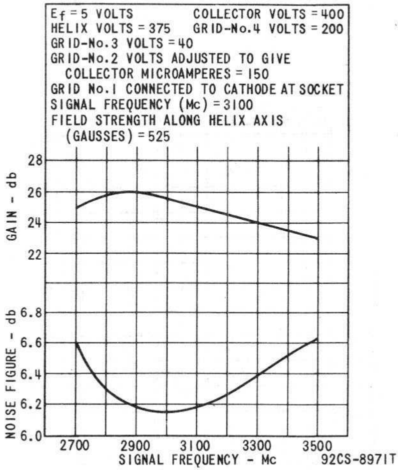


92CS-8968T

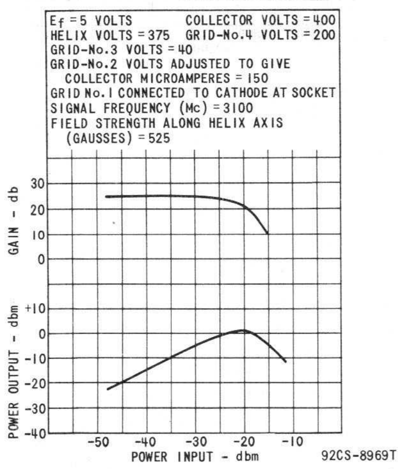
6861

TRAVELING-WAVE TUBE

NOISE-FIGURE CHARACTERISTICS



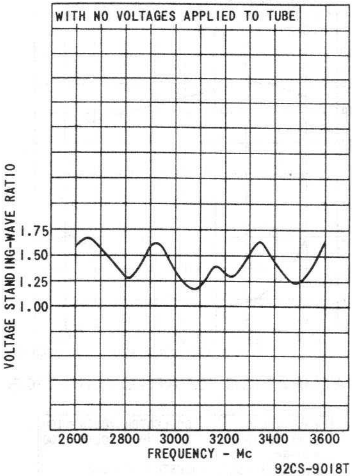
SATURATION CHARACTERISTICS



RCA

6861

INPUT-MATCHING CHARACTERISTIC



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

Beam Power Tube

HIGH POWER SENSITIVITY
RCA "DARK HEATER" WITH 12- TO 15-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 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

CERMOLOX TYPE

OXIDE-COATED CATHODE
80 WATTS CW POWER OUTPUT
AT 400 MHz

FORCED-AIR COOLED
40 WATTS CW POWER OUTPUT
AT 1215 MHz

For Use in Compact Aircraft, Mobile, and Stationary Equipment

The 6884 is the same as the 6816 except for the following items:

Heater, for Unipotential Cathode

Voltage (AC or DC)	26.5 typ 29.2 max	V V
Current at heater volts = 26.5	0.54	A ←

CHARACTERISTICS RANGE VALUES

	Note	*Min.*	*Max.*	
Heater Current	1	0.48	0.60	A ←
Useful Power Output	8	80	-	W

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 MHz 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 zero and 10,000 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.

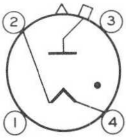
Half-Wave Mercury-Vapor Rectifier

The 6894 is the same as the 6895 except for the following items:

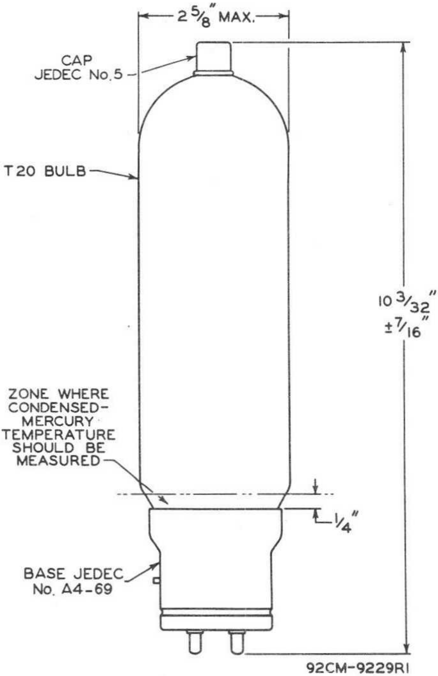
Mechanical:

Overall Length. . . . . 10-3/32" ± 7/16"
Socket. . . . . Johnson No.123-211, or equivalent
Base. . . . . .Skirted Medium-Metal-Shell Jumbo 4-Pin with Bayonet (JEDEC No.A4-69)
Basing Designation on BOTTOM VIEW. 4AT

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



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



92CM-9229R1

← Indicates a change.

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
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

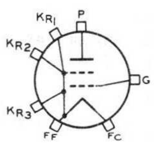
Direct Interelectrode Capacitances:

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
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

6949
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.

6949

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

6949

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	μμf
Grid to filament.	–	1150	1550	μμf
Plate to filament	–	140	170	μμf

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 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.

** 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.

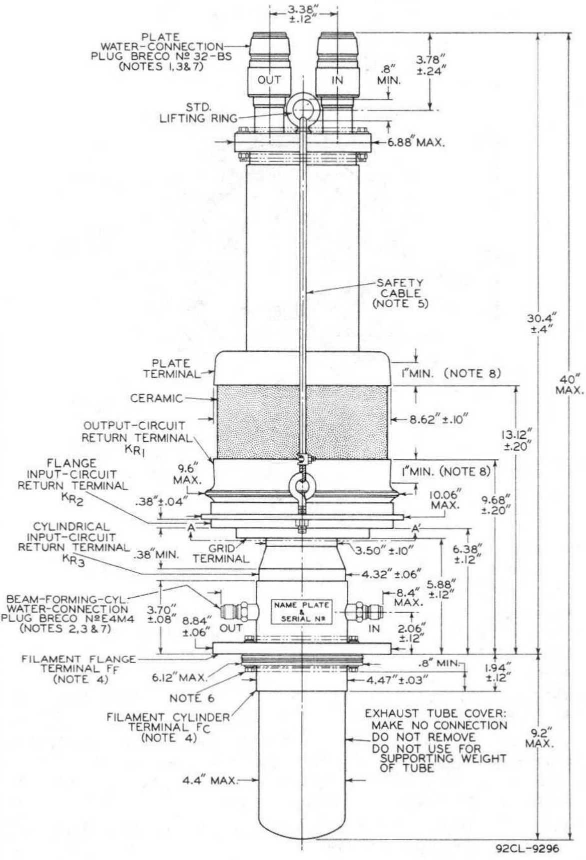
OPERATING CONSIDERATIONS

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.

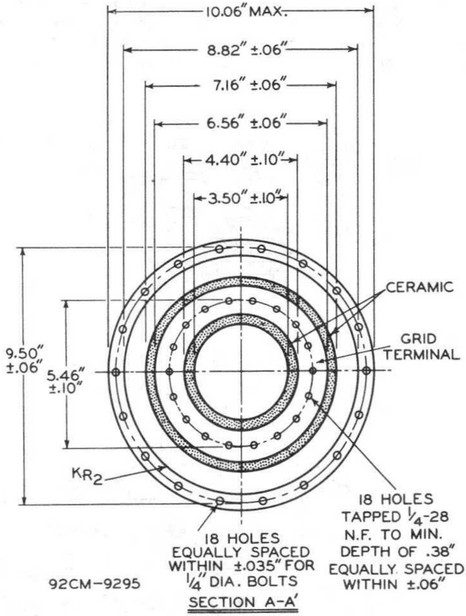


Notes 1 to 8: See next page.

Notes 1 to 8: See next page.

6949

6949
SUPER-POWER SHIELDED-GRID BEAM TRIODE



92CM-9295

SECTION A-A'

NOTE 1: SOCKET No.412-BS 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.

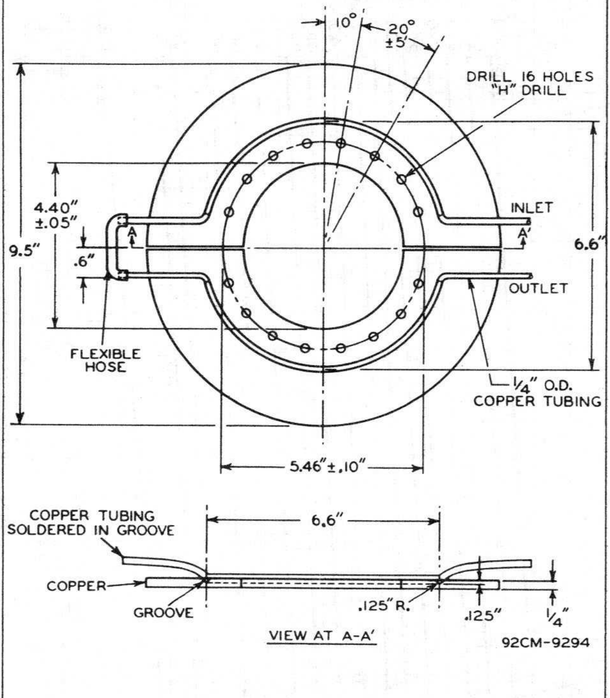
RCA

6949
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

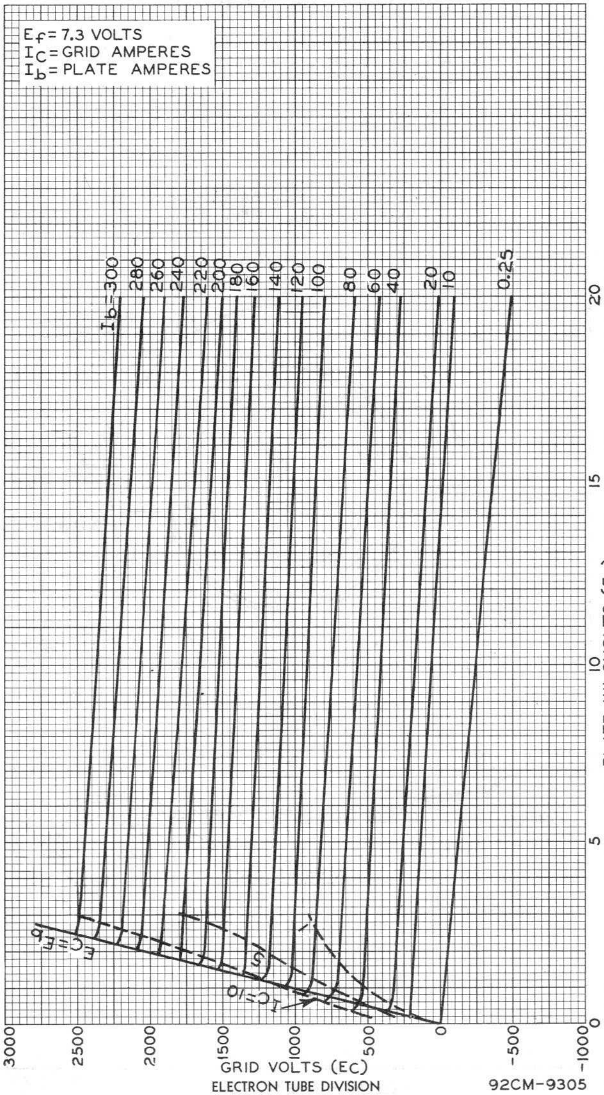


6949

RCA

6949

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM-9305

ELECTRON TUBE DIVISION

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

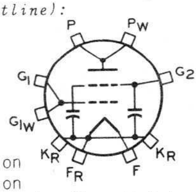
Electrical:

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	*Typical Flow*	*Max. Pressure Differential for Typical Flow*[c]
	gpm	*gpm*	*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[e]	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.

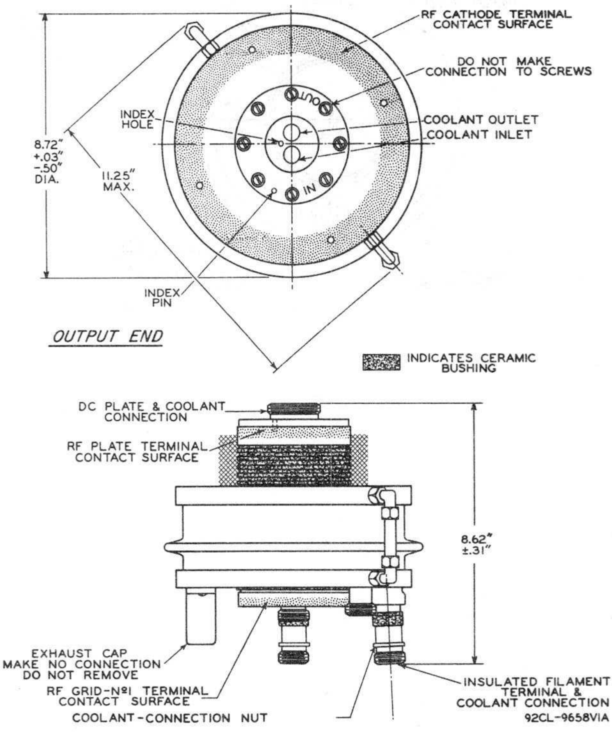
In spite of the usual precautions taken to eliminate contamination of the coolant by oil, dust, etc., some impurities are likely to enter the fluid. The use of a strainer with at least 60-mesh screen is recommended in the coolant supply line as near to the tube as possible to trap any foreign particles 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.

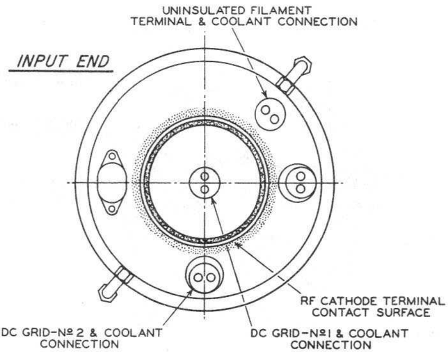
FOR ADDITIONAL INFORMATION ON THIS TYPE INCLUDING INPUT AND OUTPUT CAVITY DRAWINGS, WRITE FOR TECHNICAL BULLETIN AVAILABLE FROM:

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

SIMPLIFIED DIMENSIONAL OUTLINE[r]

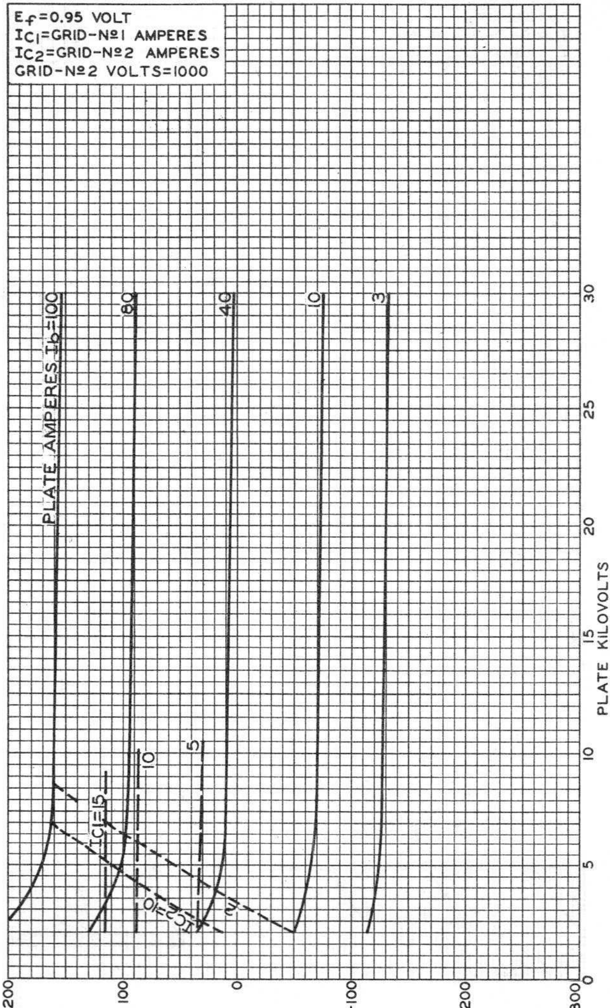


[r] A detailed Dimensional Outline and associated Gauge Drawings are given in the Technical Bulletin available upon request.



92CL-9658VIB

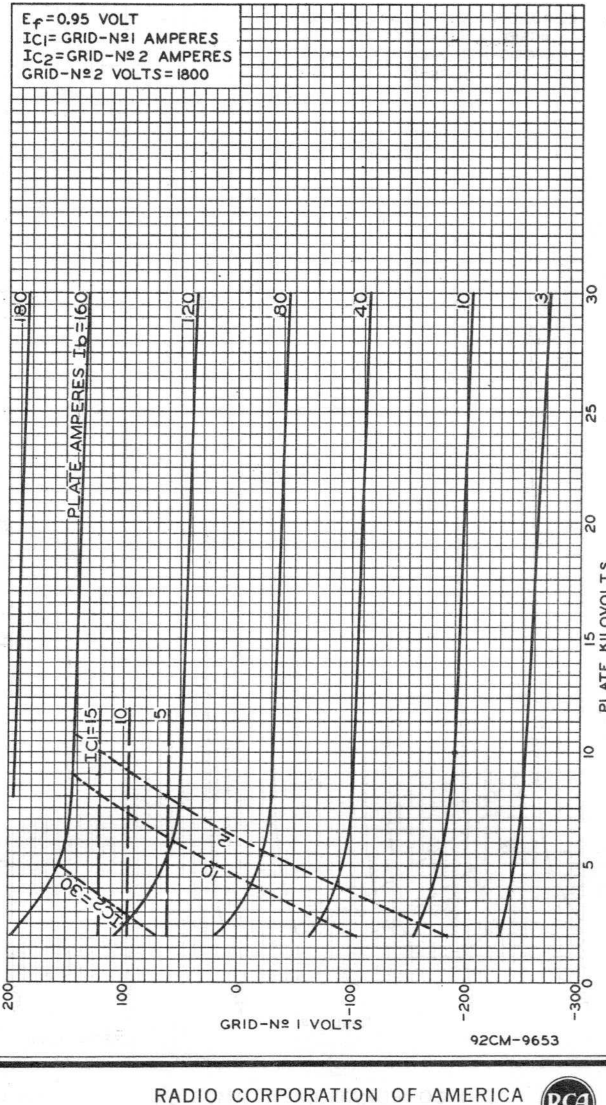
TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM-9649

6952

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM-9653

7008

RCA

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 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:

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

7008

7008

MAGNETRON

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.

7008

MAGNETRON

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 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. 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

RCA
7008
MAGNETRON

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, 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 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.

MAGNETRON

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.

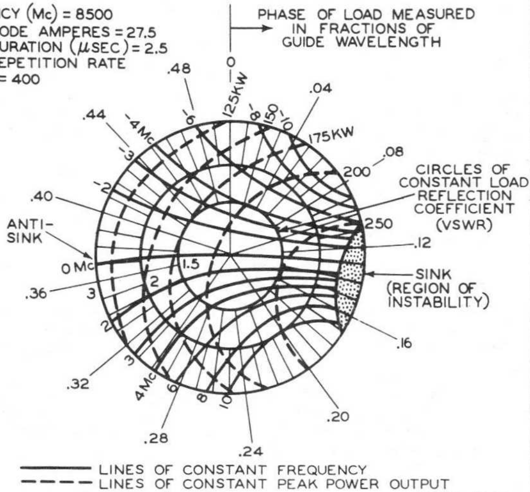
Our engineers are ready to assist you in circuit applications of the RCA-7008. For further information, write to Commercial Engineering, RCA, Harrison, New Jersey, giving complete details as to the proposed service.

RCA

7008
MAGNETRON

RIEKE DIAGRAM

FREQUENCY (Mc) = 8500
PEAK ANODE AMPERES = 27.5
PULSE DURATION (μSEC) = 2.5
PULSE-REPETITION RATE (PPS) = 400



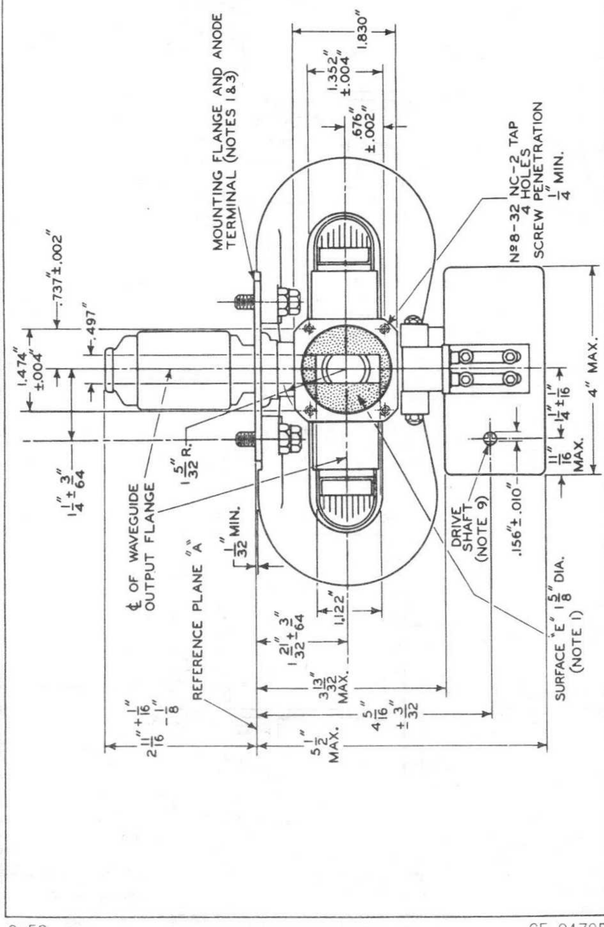
92CM-9629

RCA

7008

MAGNETRON

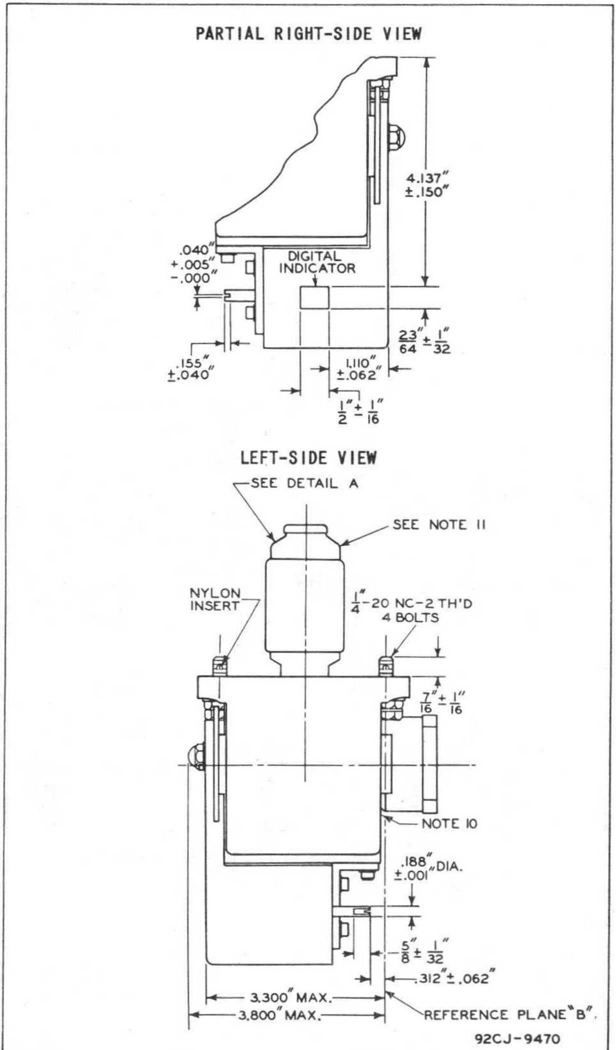
FRONT VIEW



RCA

7008

MAGNETRON

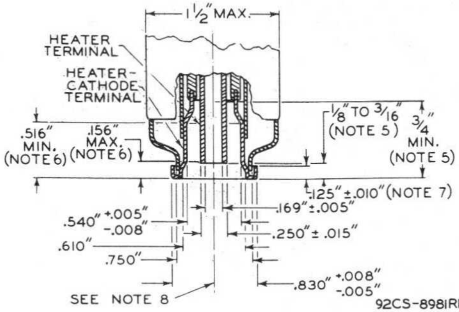


RCA

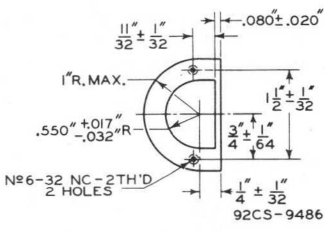
7008

MAGNETRON

DETAIL A



DETAIL B



RCA

7008
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 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.

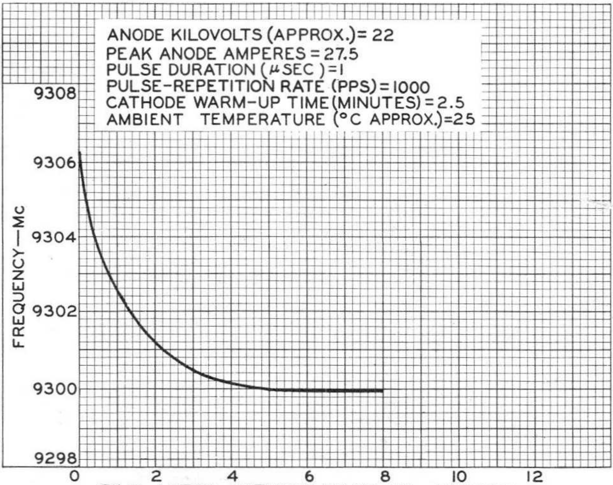
NOTE 8: THE HEATER TERMINAL AND THE HEATER-CATHODE TERMINAL ARE CONCENTRIC WITH 0.010".

NOTE 9: CLOCKWISE ROTATION OF DRIVE SHAFT DECREASES FREQUENCY.

NOTE 10: ANODE TEMPERATURE MEASURED AT JUNCTION OF WAVEGUIDE AND ANODE BLOCK.

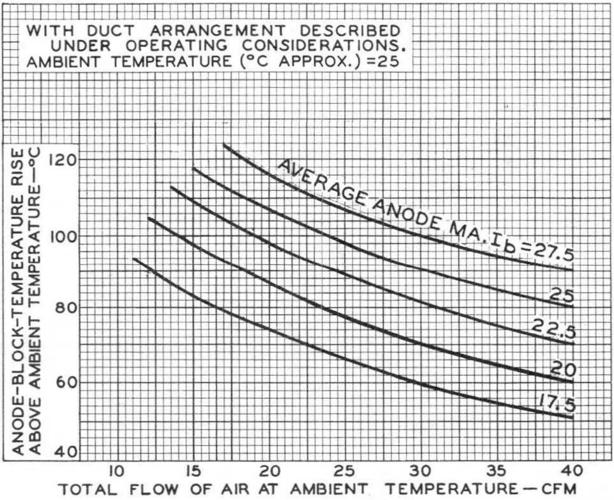
NOTE 11: TEMPERATURE OF HEATER-CATHODE TERMINAL MEASURED HERE.

TYPICAL STABILIZATION CHARACTERISTIC



92CS-8941R1

TYPICAL COOLING REQUIREMENTS

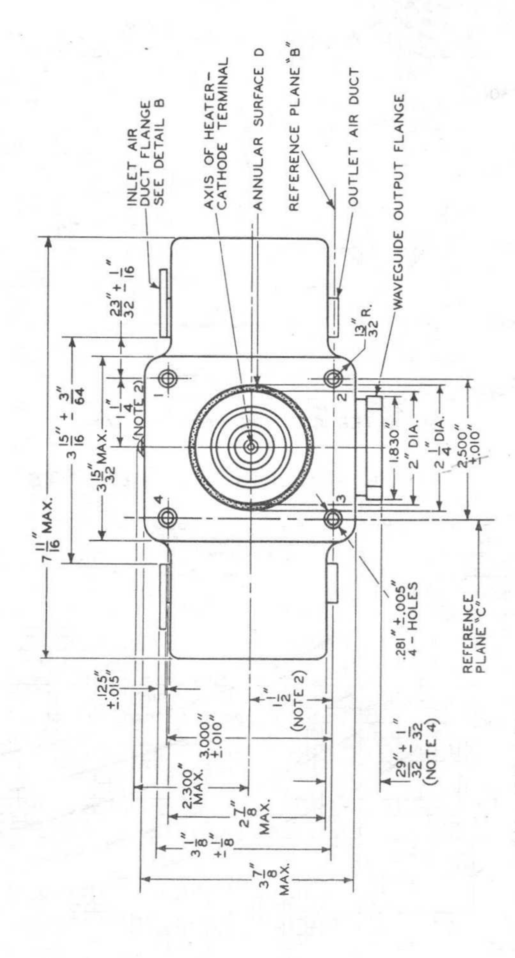


92CS-9472R1

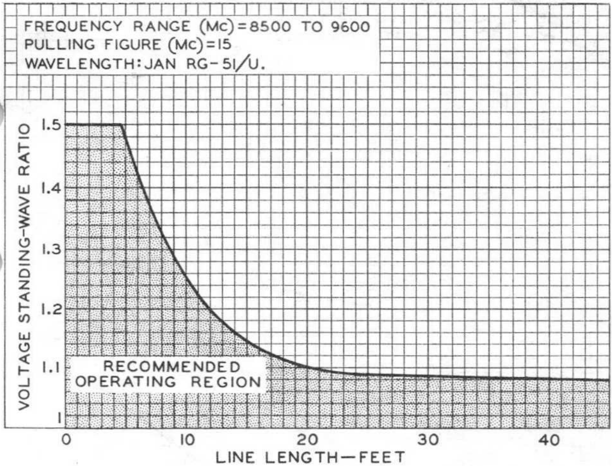
RCA

7008
MAGNETRON

TOP VIEW

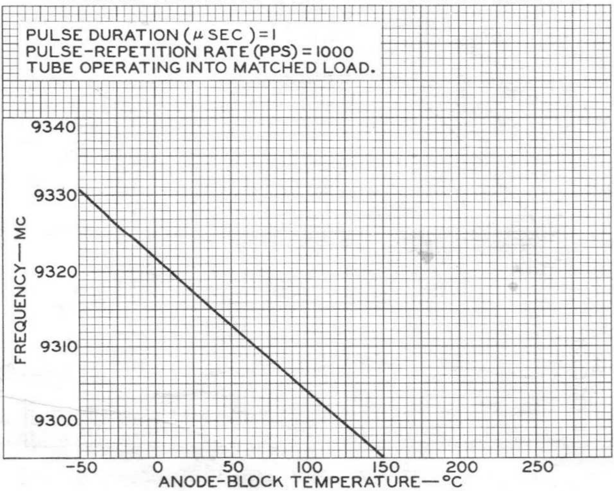


EFFECT OF LENGTH OF TRANSMISSION LINE BETWEEN OUTPUT FLANGE AND LOAD ON ALLOWABLE VOLTAGE STANDING-WAVE RATIO



92CS-9469R1

TYPICAL THERMAL-FACTOR CHARACTERISTIC

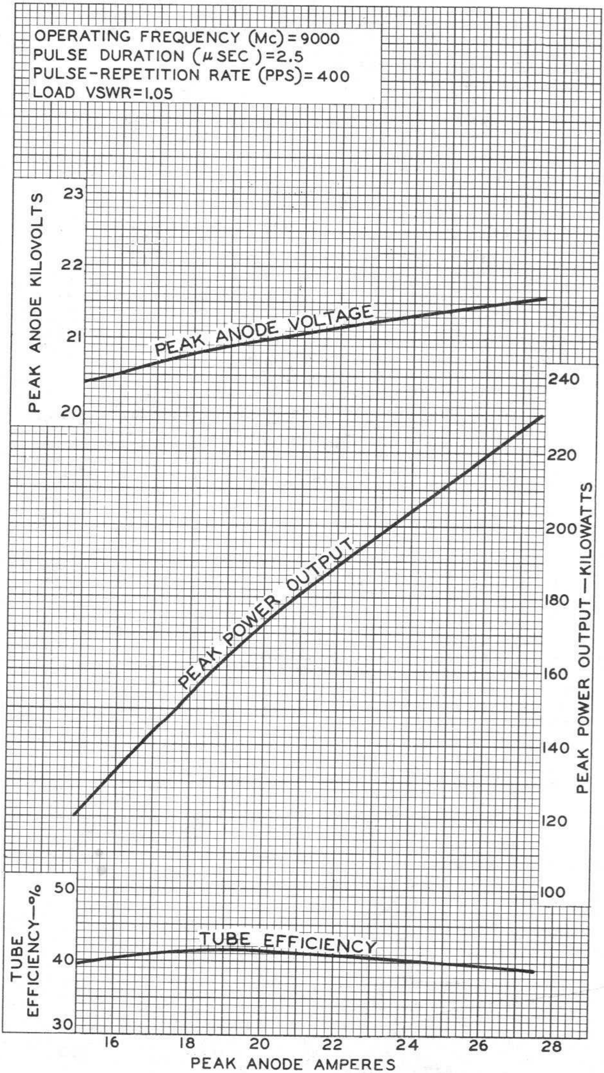


92CS-9285R1

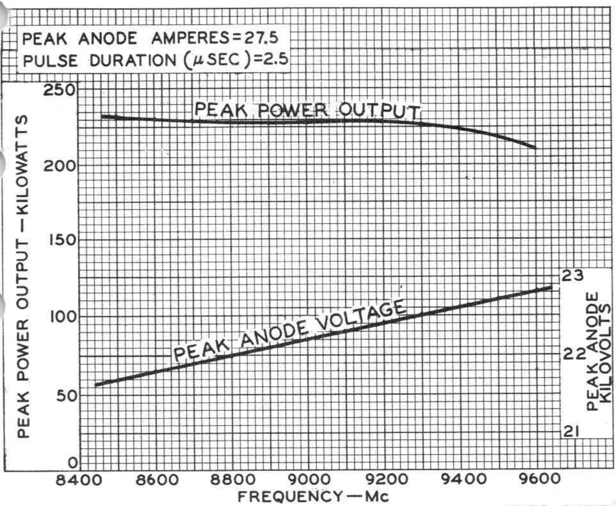
RCA

7008

TYPICAL PERFORMANCE CURVES

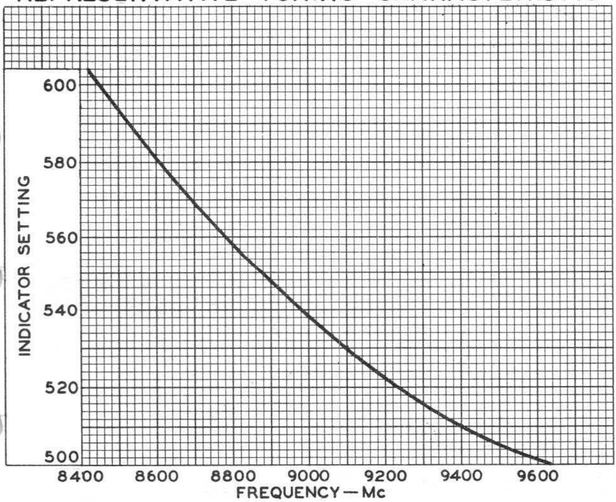


TYPICAL PERFORMANCE CURVES



92CS-9471R1

REPRESENTATIVE TUNING CHARACTERISTIC



92CS-9466

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:

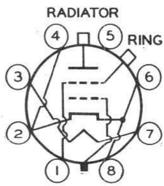
Heater, for Unipotential Cathode:		
Voltage (AC or DC)[a]	6.0 ± 10%	volts
Current at heater volts = 6.0	2.6	amp
Minimum heating time	30	sec
Mu-Factor, Grid No.2 to Grid No.1, for grid-No.2 volts = 300 and grid-No.2 ma. = 50	5	
Direct Interelectrode Capacitances:[b]		
Grid No.1 to plate	0.03	$\mu\mu$f
Grid No.1 to cathode, grid No.2, and heater	16	$\mu\mu$f
Plate to cathode, grid No.2, and heater	4.4	$\mu\mu$f

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.):[1]				
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*[m]	*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[m]	
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[g] 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	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 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.

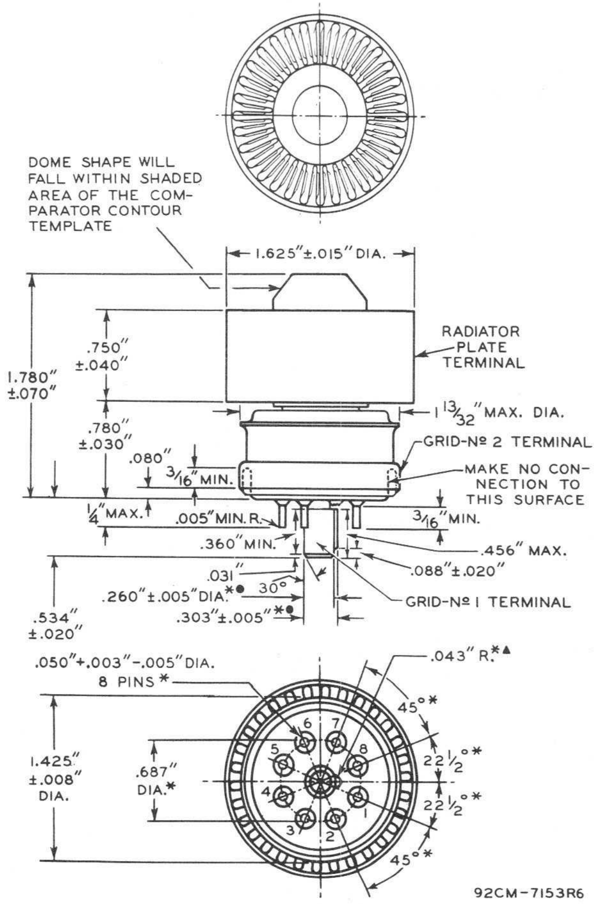
SPECIAL PERFORMANCE DATA

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:

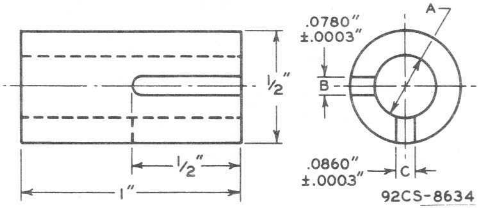
USING ONLY SLOT C, TRY THESE GAUGES IN NUMERICAL ORDER UNTIL ONE IS FOUND THAT WILL ACCEPT THE ENTIRE GRID-No. 1 PLUG. USING THE FIRST GAUGE THUS FOUND, IT WILL NOT BE POSSIBLE TO INSERT THE GRID-No. 1 PLUG IN SLOT B.

● 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.

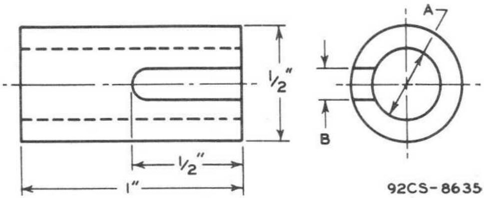
* BASE-PIN POSITIONS ARE HELD TO TOLERANCES SUCH THAT THE ENTIRE LENGTH OF THE PINS WILL, WITHOUT UNDUE FORCE, PASS INTO AND DISENGAGE FROM THE FLAT-PLATE GAUGE SHOWN IN SKETCH G_3.

GAUGE SKETCH G_1



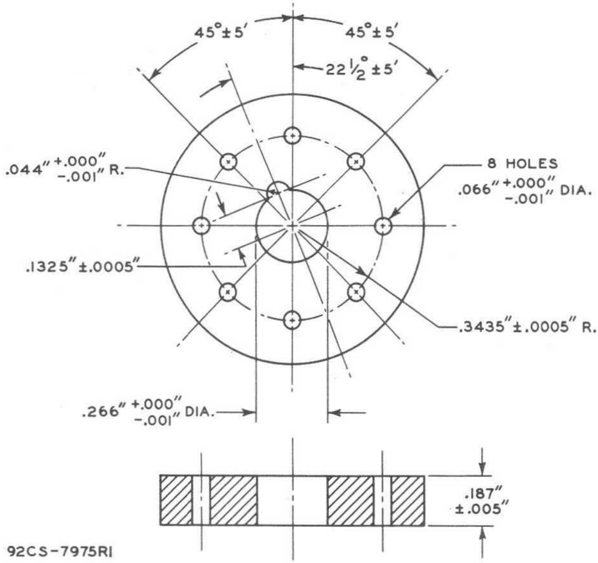
Gauge	Dimension A
G_1-1	.2575" + .0000" − .0005"
G_1-2	.2600" + .0000" − .0005"
G_1-3	.2625" + .0000" − .0005"
G_1-4	.2650" + .0000" − .0005"

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

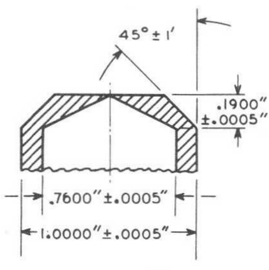
GAUGE SKETCH G_3



92CS-7975R1

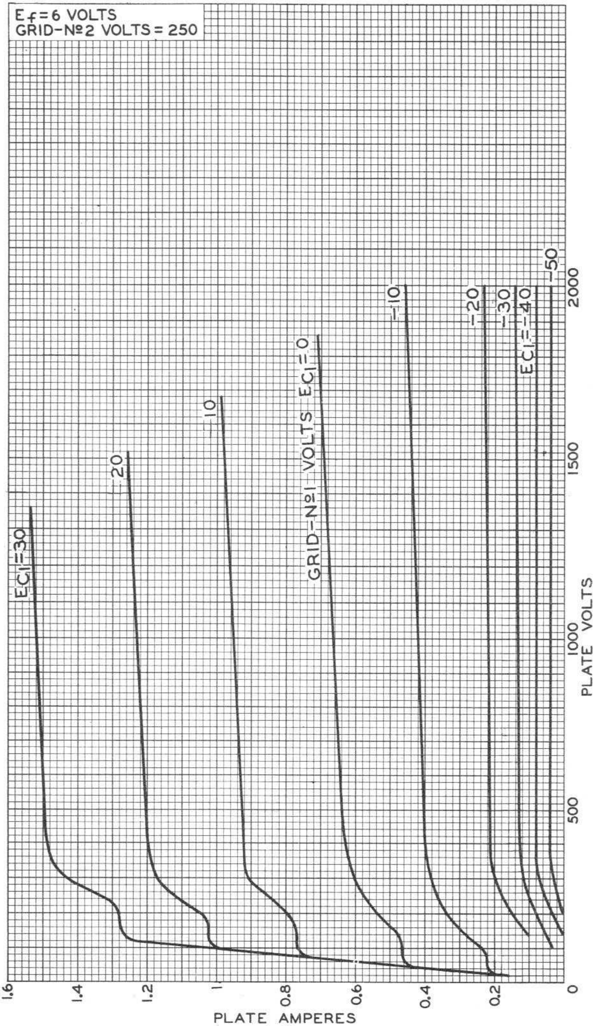
TOLERANCES ARE NOT CUMULATIVE

COMPARATOR CONTOUR TEMPLATE



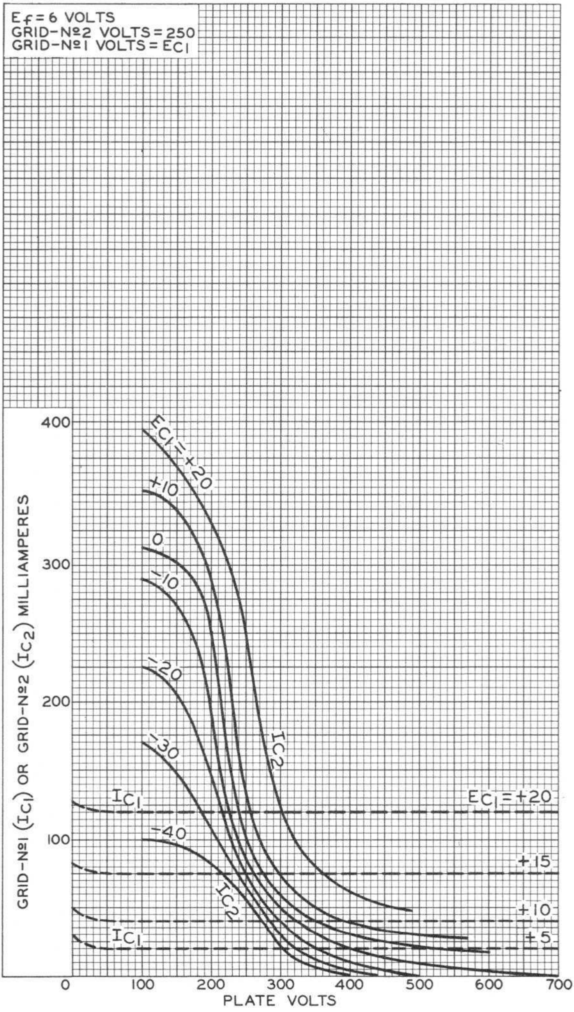
92CS-10554R1

TYPICAL PLATE CHARACTERISTICS



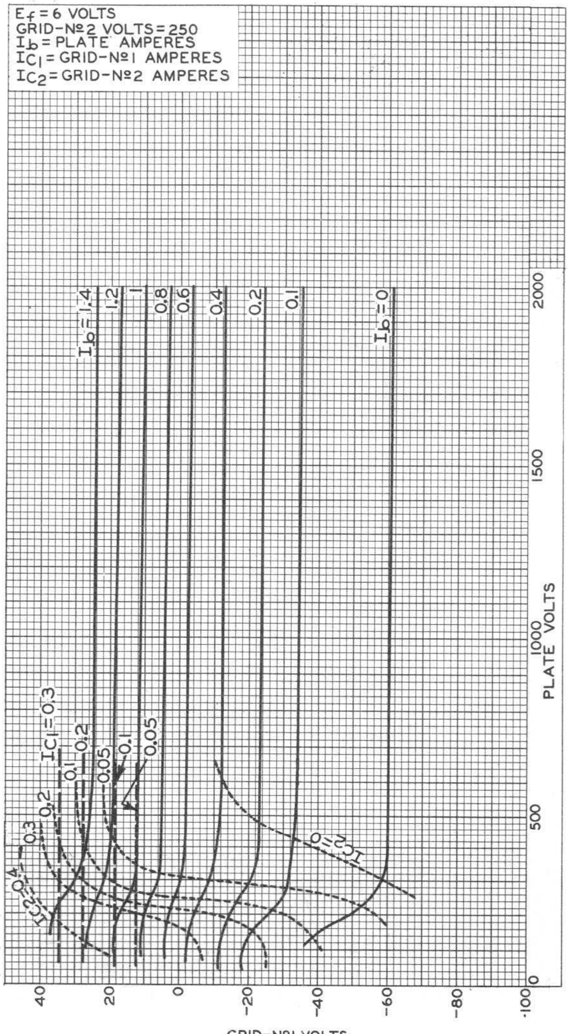
92CM-9755

TYPICAL CHARACTERISTICS



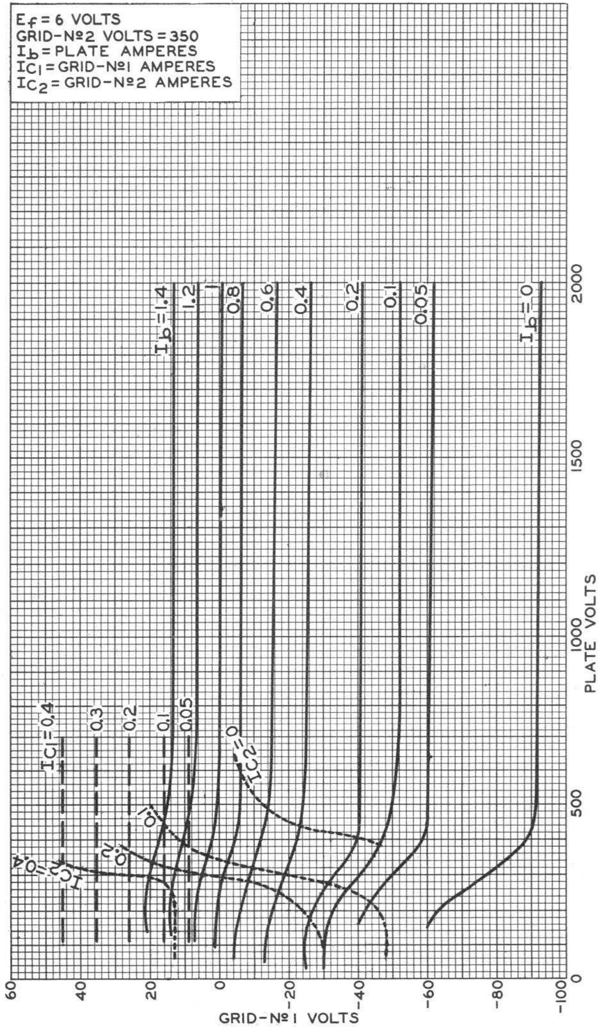
92CM-9756

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM-9760

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM—9761

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: ←

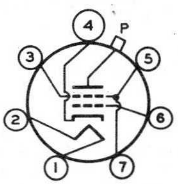
Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	2.85	amp
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 300, grid-No.2 volts = 300, and plate ma = 150.	7	
Direct Interelectrode Capacitances (Approx.):[a]		
Grid No.1 to plate	0.6	μμf
Grid No.1 to grid No.2 & 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

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]

Maximum Ratings, *Absolute-Maximum Values:*

	CCS[d]	*ICAS*[e]	
	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.

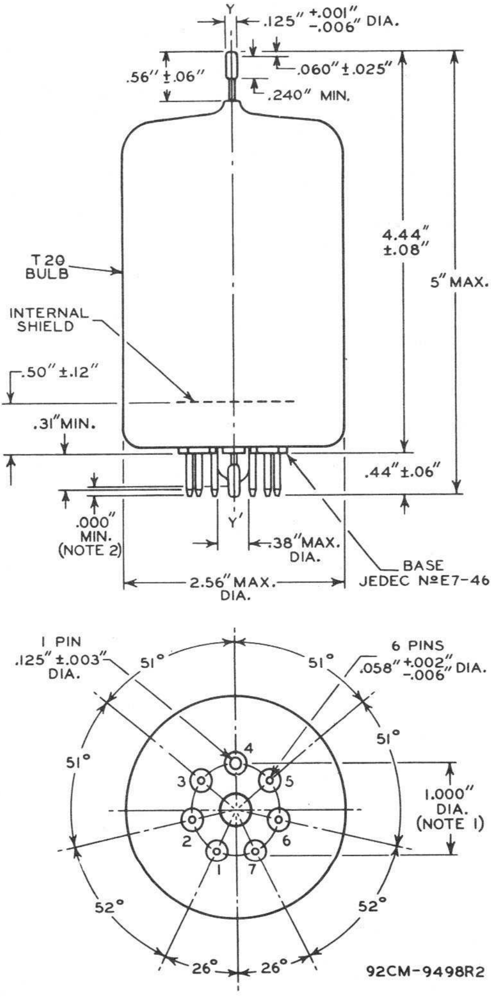
[r] Indicated values are for operation at 60 Mc. Less driver power output is required at frequencies below 60 Mc.

[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.

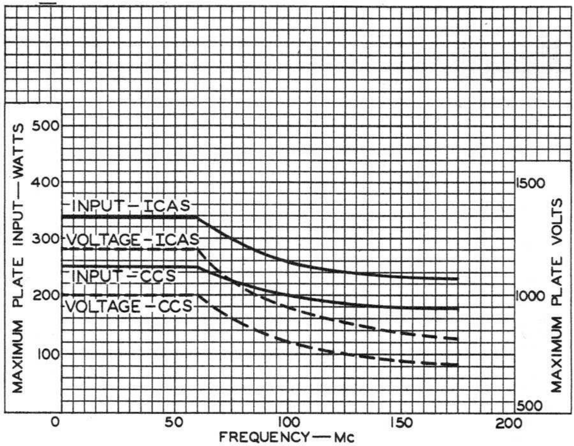

Y
.125" +.001" -.006" DIA.
.56" ±.06"
.060" ±.025"
.240" MIN.
4.44" ±.08"
5" MAX.
T20 BULB
INTERNAL SHIELD
.50" ±.12"
.31" MIN.
.44" ±.06"
.000" MIN. (NOTE 2)
Y'
.38" MAX. DIA.
BASE JEDEC № E7-46
2.56" MAX. DIA.
1 PIN .125" ±.003" DIA.
6 PINS .058" +.002" -.006" DIA.
51°
51°
51°
51°
52°
52°
26°
26°
1.000" 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'.

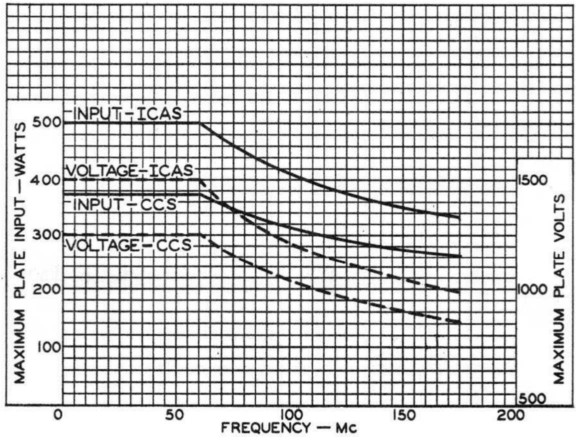
NOTE 2: EXHAUST TIP WILL NOT EXTEND BEYOND THE PLANE WHICH PASSES THROUGH THE ENDS OF THE THREE LONGEST PINS.

RATING CHART I
Class C Telephony Service



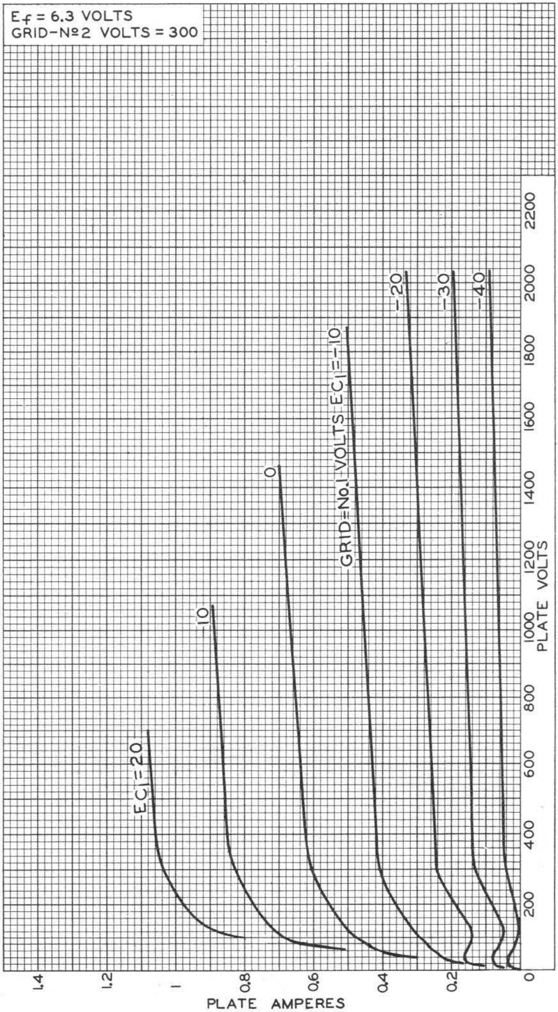
92CS-9492

RATING CHART II
Class C Telegraphy Service



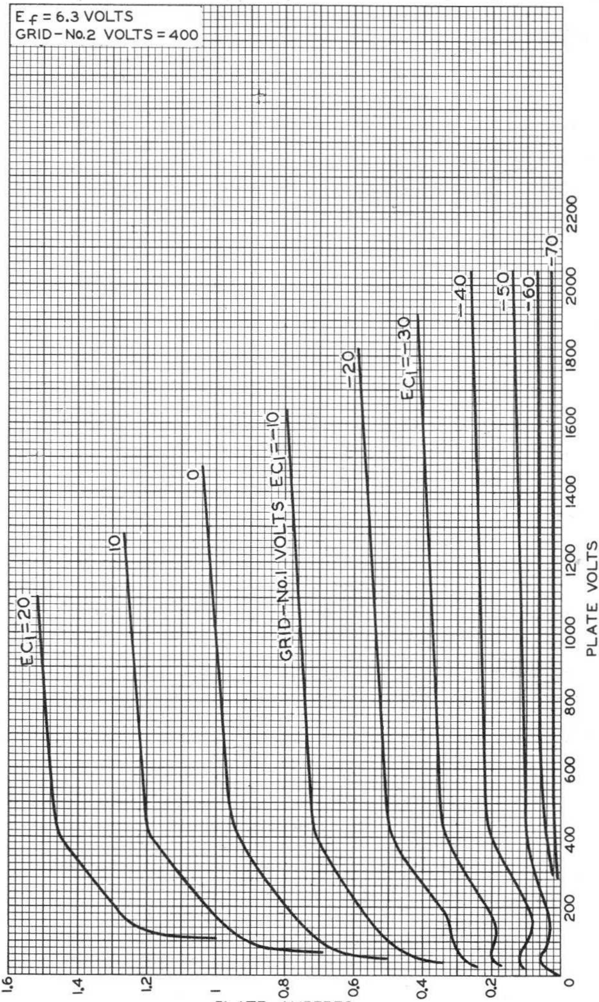
92CS-9491

TYPICAL PLATE CHARACTERISTICS



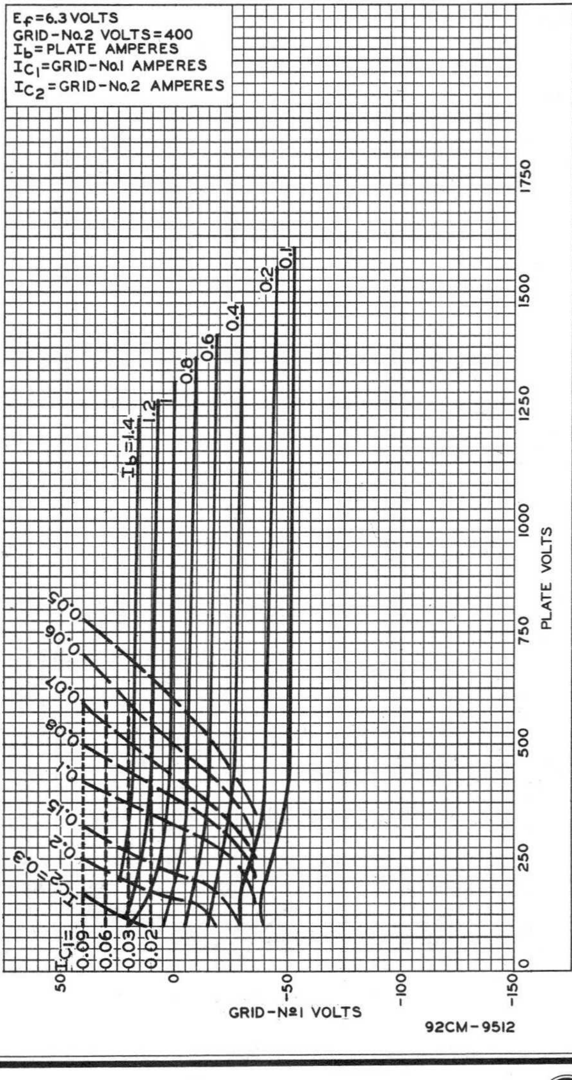
92CM-9511

TYPICAL PLATE CHARACTERISTICS

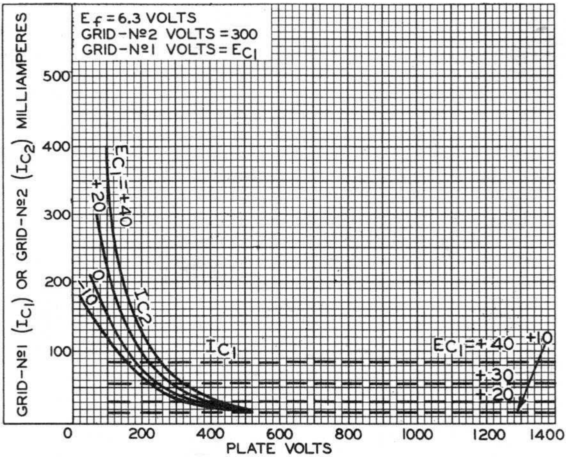


92CM-9502R1

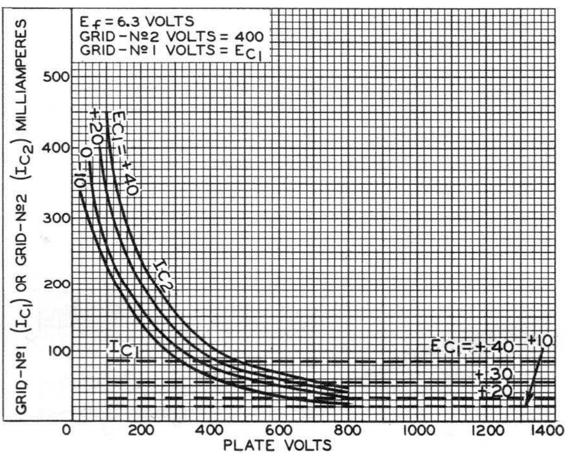
AVERAGE CONSTANT-CURRENT CHARACTERISTICS



TYPICAL CHARACTERISTICS

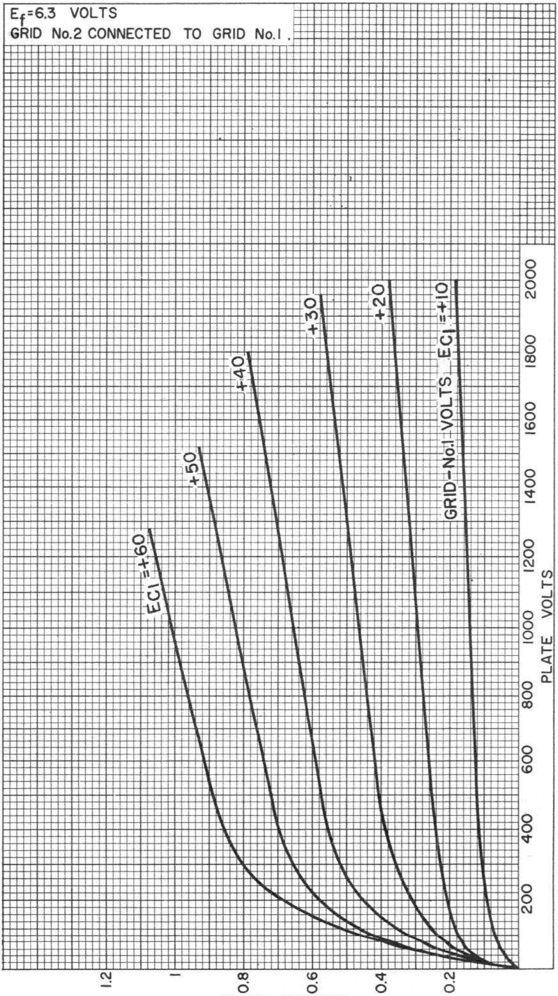


92CS-9501R1



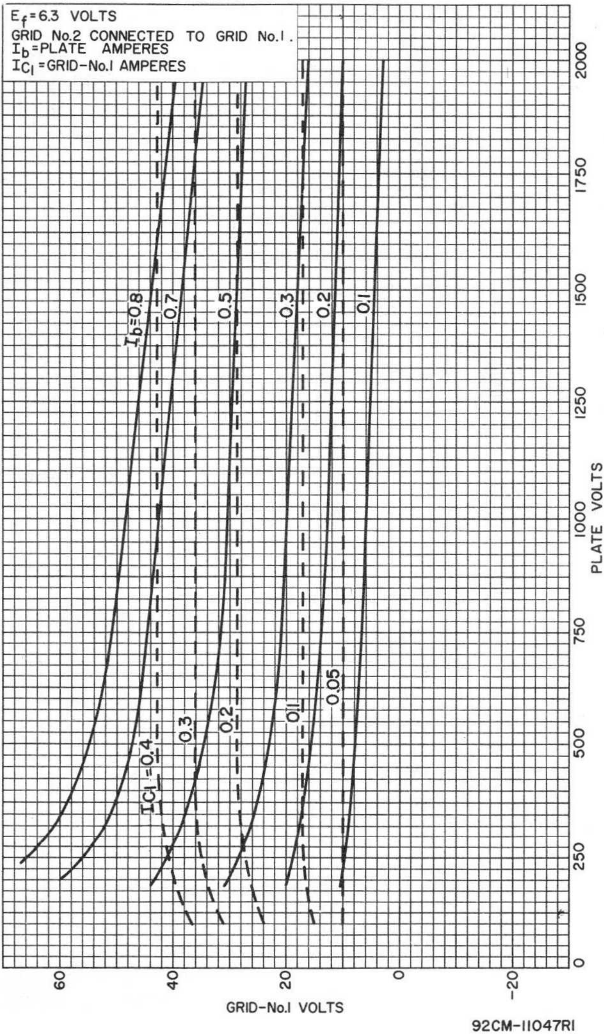
92CS-9500R1

TYPICAL PLATE CHARACTERISTICS
Triode Connection



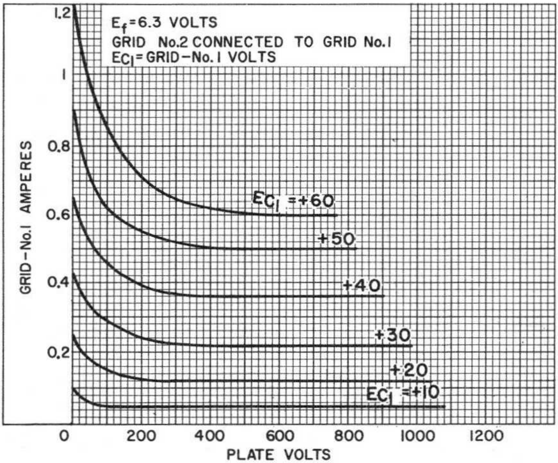
92CM-11045RI

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.

$$P_i \text{ up to 100 watts: } E_f = 13.75 \text{ volts}$$

$$P_i \text{ greater than 100 watts: } E_f = 14\left(1 - \frac{P_i}{1120}\right) \text{ volts}$$

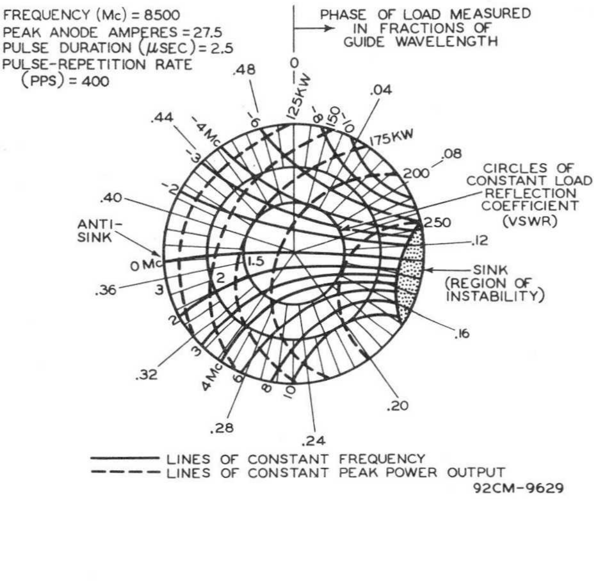
For *standby operation,* during which the high-voltage pulses are not applied to the tube, the heater voltage should be restored to 13.75 volts.

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.

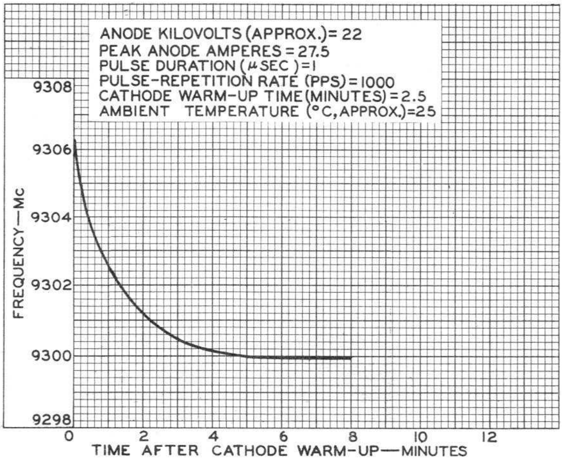
For precise tuning adjustment, the final indicator setting should be approached using the same direction of rotation of the tuning shaft. There is little frequency drift after changing tuner setting.

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

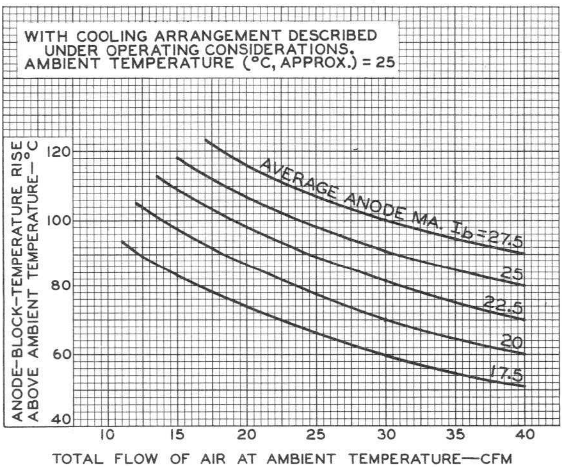


TYPICAL STABILIZATION CHARACTERISTIC

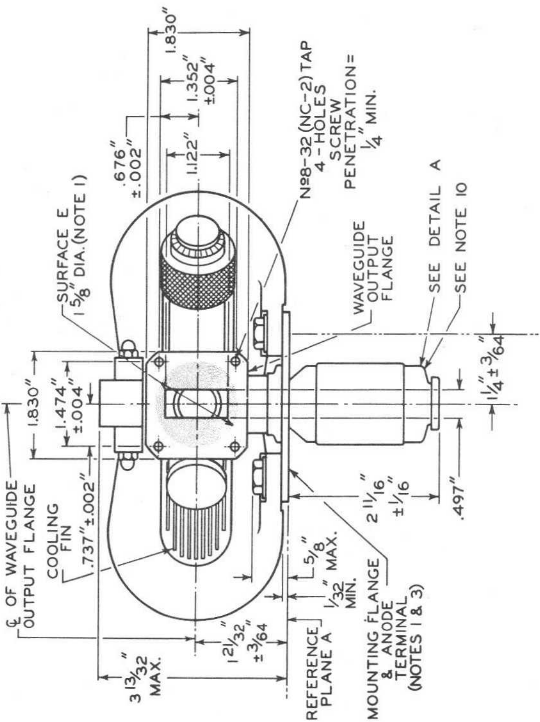


92CS-8941R1

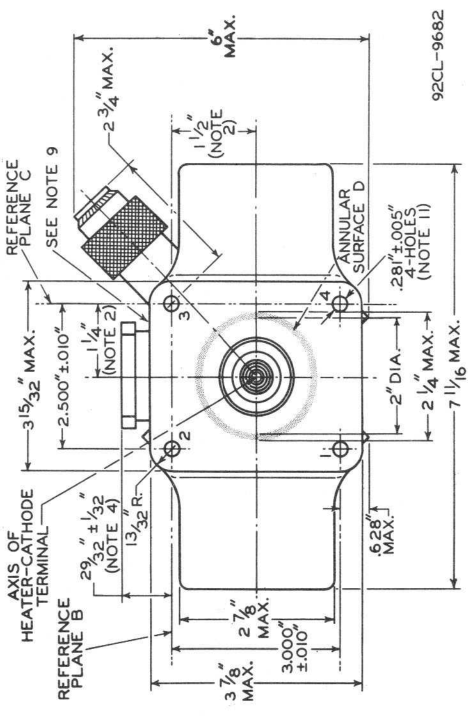
TYPICAL COOLING REQUIREMENTS



92CS-9688R1

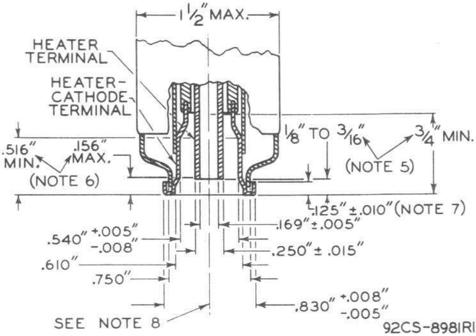


℄ OF WAVEGUIDE OUTPUT FLANGE
COOLING FIN
.737"±.002"
1.830"
1.474" ±.004"
SURFACE E 1 5/8" DIA. (NOTE 1)
.676" ±.002"
1.122"
1.352" ±.004"
1.830"
No8-32 (NC-2) TAP 4-HOLES SCREW PENETRATION = 1/4" MIN.
SEE DETAIL A
SEE NOTE 10
WAVEGUIDE OUTPUT FLANGE
1 1/4" ± 3/64"
.497"
2 11/16" ± 1/16"
5/8" MAX.
1/32" MIN.
MOUNTING FLANGE & ANODE TERMINAL (NOTES 1 & 3)
REFERENCE PLANE A
1 21/32" ± 3/64"
3 13/32" MAX.



REFERENCE PLANE C
SEE NOTE 9
2 3/4" MAX.
6" MAX.
1 1/2" (NOTE 2)
92CL-9682
ANNULAR SURFACE D
.281"±.005" 4-HOLES (NOTE 11)
3 15/32" MAX.
2.500"±.010"
1 1/4" (NOTE 2)
2" DIA.
2 1/4" MAX.
7 11/16 MAX.
AXIS OF HEATER-CATHODE TERMINAL
29/32" ± 1/32" (NOTE 4)
13/32" R.
.628" MAX.
REFERENCE PLANE B
2 7/8" MAX.
3.000" ±.010"
3 7/8" MAX.
1
2
3
4

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.

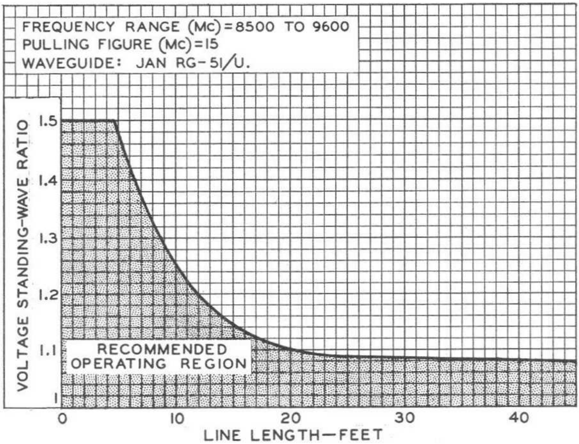
NOTE 8: THE HEATER TERMINAL AND THE HEATER-CATHODE TERMINAL ARE CONCENTRIC WITHIN 0.010".

NOTE 9: ANODE TEMPERATURE MEASURED AT JUNCTION OF WAVEGUIDE AND ANODE BLOCK.

NOTE 10: CATHODE TEMPERATURE MEASURED HERE.

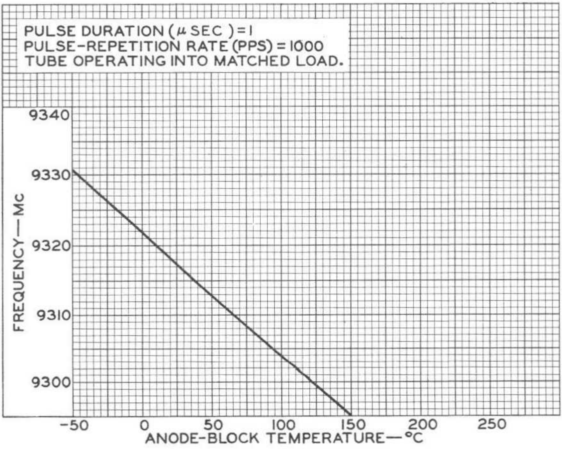
NOTE 11: THE ENDS OF THE MOUNTING STUDS MUST NOT PENETRATE THROUGH THE MOUNTING HOLES MORE THAN 1-3/32" FROM THE MOUNTING-FLANGE SURFACE.

EFFECT OF LENGTH OF TRANSMISSION LINE BETWEEN OUTPUT FLANGE AND LOAD ON ALLOWABLE VOLTAGE STANDING-WAVE RATIO



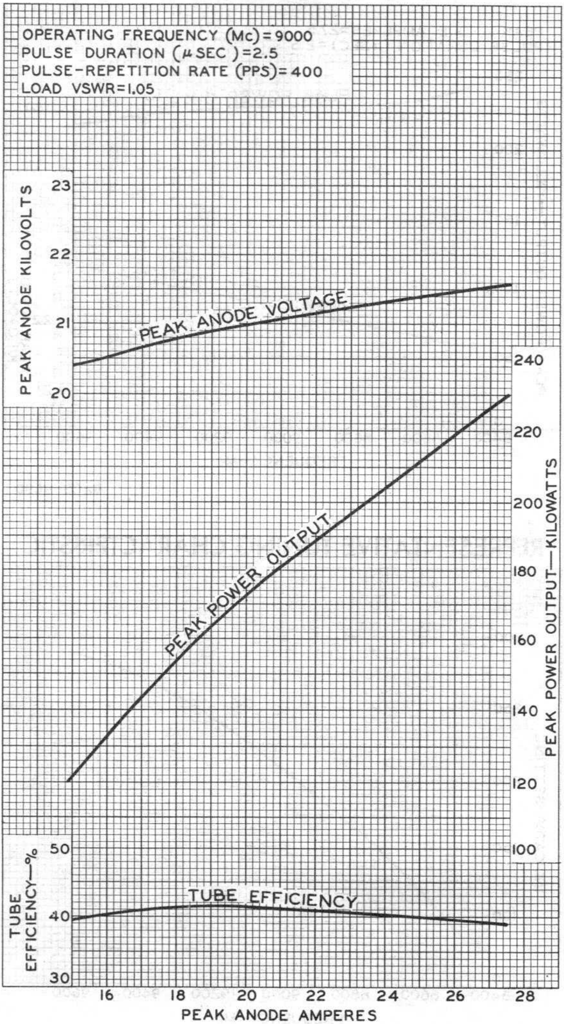
92CS-9469R1

TYPICAL THERMAL-FACTOR CHARACTERISTIC



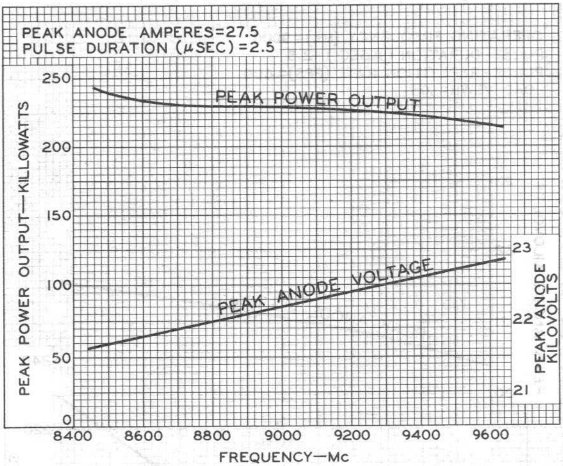
92CS-9285R1

TYPICAL PERFORMANCE CHARACTERISTICS



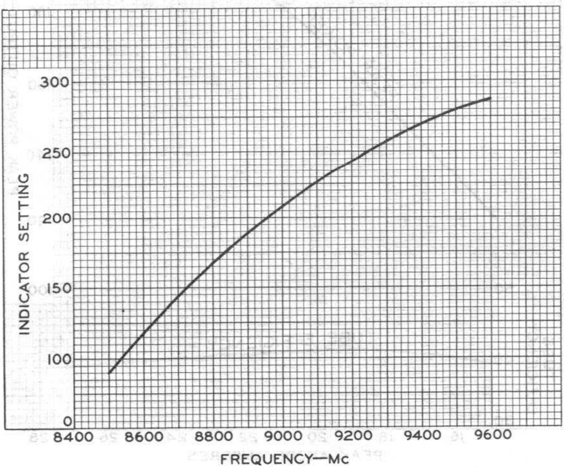
92CM-9468R1

TYPICAL PERFORMANCE CHARACTERISTICS



92CS-9690

REPRESENTATIVE TUNING CHARACTERISTIC



92CS-9691

7203/4CX250B

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

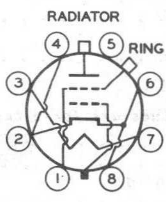
Electrical:

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.)[l]	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 cylidrical 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	$\mu\mu$f ←
Grid No.1 to cathode, grid No.2, and heater	2	14.2	17.2	$\mu\mu$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	-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:

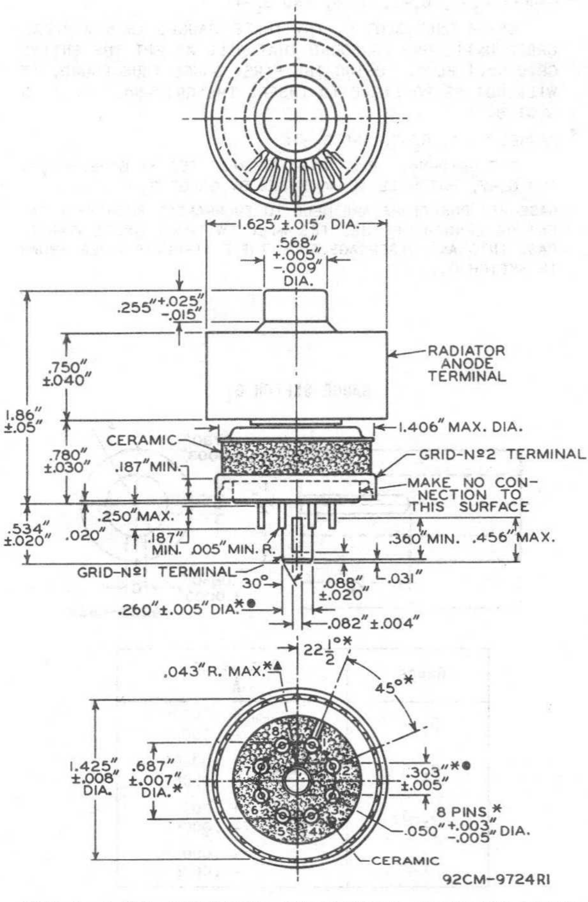
This test is destructive and is performed on a sample lot of tubes from each production run under the following conditions: ac heater volts = 6.6, no voltage on other elements, and specified forced-air cooling for *Air-System Socket*. At the end of 500 hours, with tube at 25° C, and with no voltage applied 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:

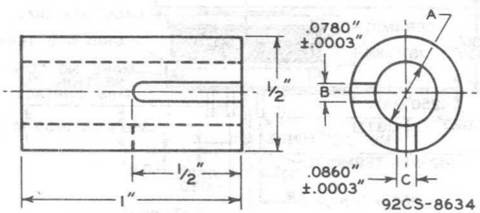
USING ONLY SLOT C, TRY THESE GAUGES IN NUMERICAL ORDER UNTIL ONE IS FOUND THAT WILL ACCEPT THE ENTIRE GRID-No.1 PLUG. USING THE FIRST GAUGE THUS FOUND, IT WILL NOT BE POSSIBLE TO INSERT THE GRID-No.1 PLUG IN SLOT B.

● 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.

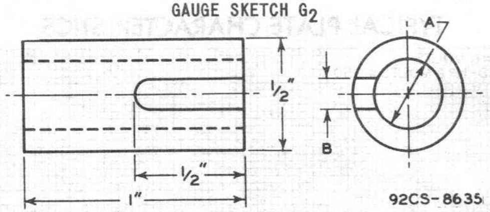
* BASE-PIN POSITIONS ARE HELD TO TOLERANCES SUCH THAT THE ENTIRE LENGTH OF THE PINS WILL, WITHOUT UNDUE FORCE, PASS INTO AND DISENGAGE FROM THE FLAT-PLATE GAUGE SHOWN IN SKETCH G_3.

GAUGE SKETCH G_1



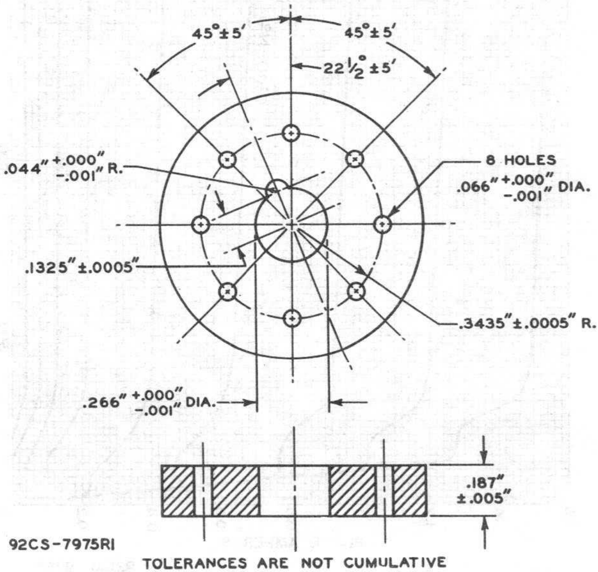
Gauge	Dimension A
G_1-1	.2575″ + .0000″ − .0005″
G_1-2	.2600″ + .0000″ − .0005″
G_1-3	.2625″ + .0000″ − .0005″
G_1-4	.2650″ + .0000″ − .0005″

GAUGE SKETCH G_2



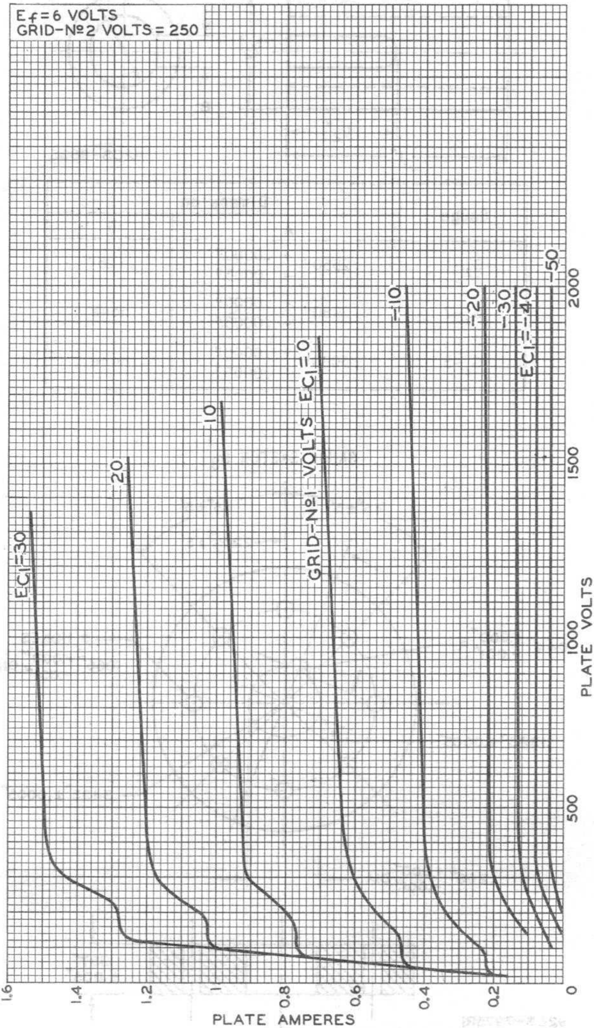
Gauge	Dimension	
	A	B
G_2-1	.2550" $^{+.0000"}_{-.0005"}$	.125"
G_2-2	.2980" $^{+.0000"}_{-.0005"}$	none
G_2-3	.3080" $^{+.0000"}_{-.0005"}$	none

GAUGE SKETCH G_3



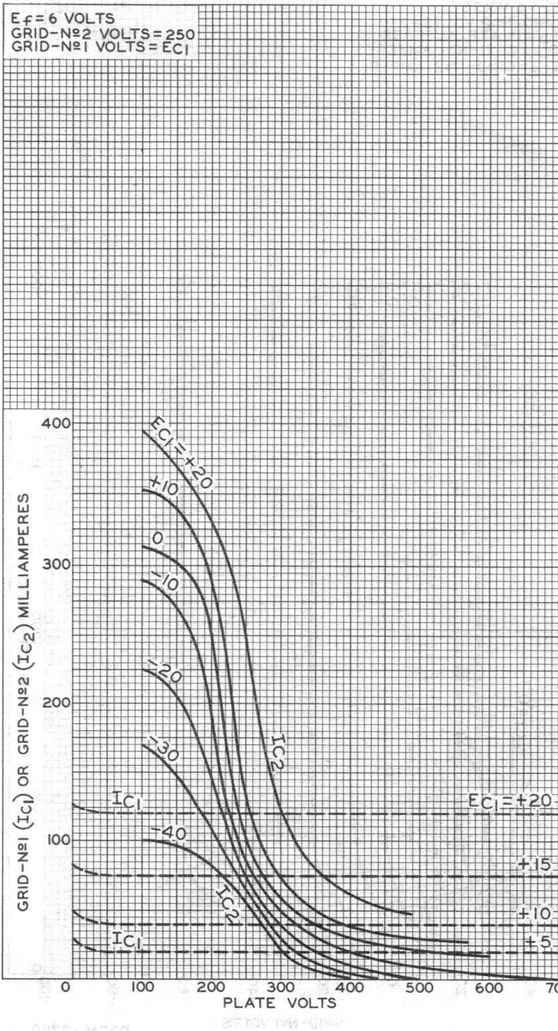
TOLERANCES ARE NOT CUMULATIVE

TYPICAL PLATE CHARACTERISTICS



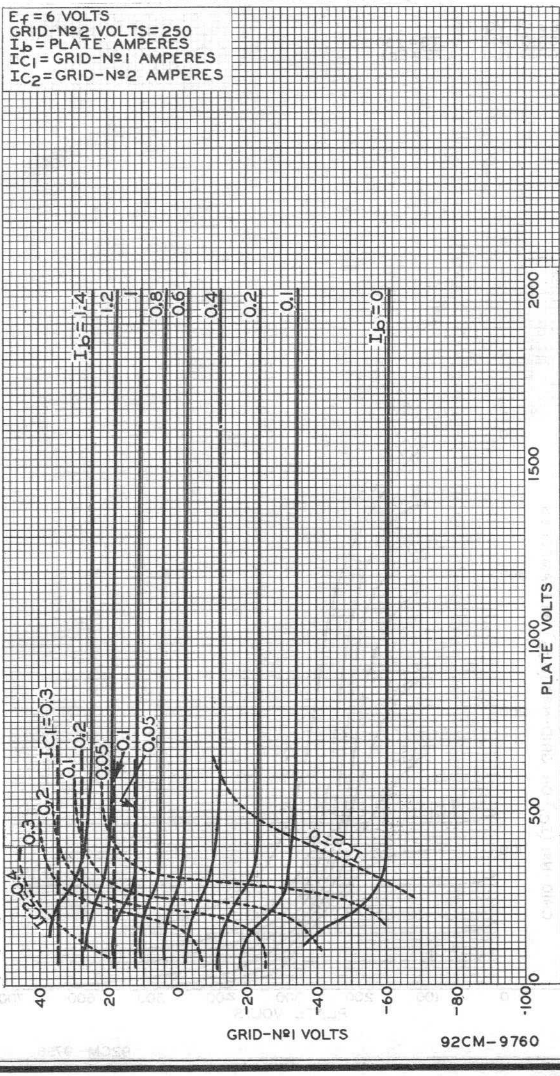
92CM-9755

TYPICAL CHARACTERISTICS



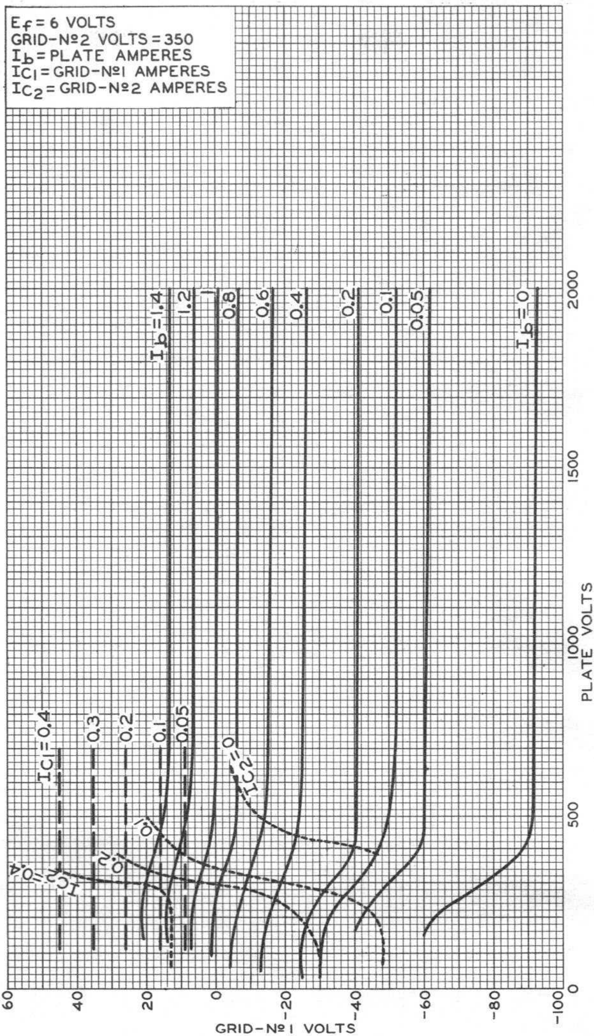
92CM-9756

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



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

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM-9761

7204/4CX250F

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

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

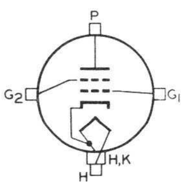
Electrical:

Heater, for Matrix-Type, Oxide-Coated, Unipotential Cathode:		
Voltage (AC or DC)[a]	5.5 typical / 6 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	
Direct Interelectrode Capacitances:		
Grid No.1 to plate[b].	0.17 max.	μμf
Grid No.1 to cathode & heater. . . .	42	μμf
Plate to cathode & heater[bc].	0.017 max.	μμf ←
Grid No.1 to grid No.2	55	μμf
Grid No.2 to plate	16	μμf
Grid No.2 to cathode & heater[c] . . .	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

Thermal:

Air Flow:

Through radiator—Adequate air flow to limit the plate-seal temperature to 250° C should be delivered by a blower

← Indicates a change.

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 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[d] Ratings, *Absolute-Maximum 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:[e]

	Up to 60 Mc		
DC Plate Voltage.	2250	2500	volts
DC Grid-No.2 Voltage[f]	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.	0.045	0.045	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[d] Ratings, *Absolute-Maximum Values:*

	Up to 1215 Mc	
DC PLATE VOLTAGE.	2000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE. . . .	1000 max.	volts

→ Indicates a change.

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[g].	500	500	volts
DC Grid-No.1 Voltage[h].	-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.)[j]	50	55	watts
Useful Power Output (Approx.).	650[k]	800[k]	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under any condition.	5000[l] max.	ohms

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

Maximum CCS[d] Ratings, *Absolute-Maximum 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[n].	500	500	volts
DC Grid-No.1 Voltage[p].	-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.)[j]	70	75	watts
Useful Power Output (Approx.).	1050[k]	1350[k]	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under any condition.	5000[k] 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 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] Continuous Commercial Service.

[e] "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.

[f] Preferably obtained from a fixed supply.

[g] Obtained preferably from a separate source modulated along with the plate supply.

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

[j] 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.

[k] This value of useful power is measured in load of output circuit.

[l] If this value is insufficient to provide adequate bias, the additional required bias must be supplied by a cathode resistor or fixed supply.

[m] 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.

[n] Obtained preferably from a fixed supply, or from the plate-supply voltage with a voltage divider.

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

SPECIAL TESTS & PERFORMANCE DATA

Design samples of the 7213 have been subjected to the following tests without adverse effects.

Variable-Frequency Vibration Performance:

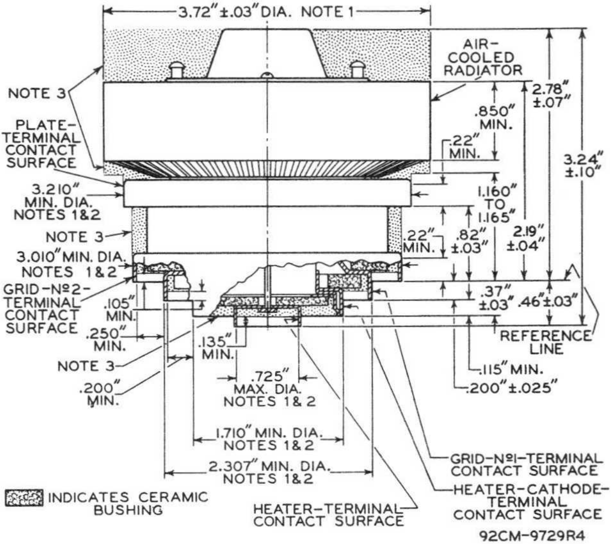
This test was performed (per MIL-E-1C[q], paragraph 4.9.20.3) under the following conditions: heater volts = 5.5, plate-supply volts = 450, grid-No.2 volts = 300, grid-No.1 voltage varied to give a plate current of 10 milliamperes, and plate load resistor (ohms) = 2000. The tubes were vibrated in each 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). During the test, the tubes did not show an rms output voltage across the plate load resistor in excess of 500 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.

[q] Military Specification, Electron Tubes and Crystal Rectifiers, 3 October 1955.

← Indicates a change.

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.

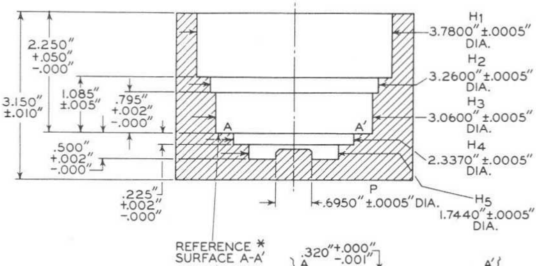


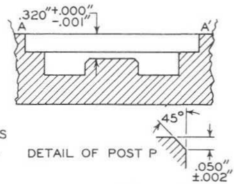
NOTE 1: WITH THE CYLINDRICAL SURFACES OF THE RADIATOR BAND, PLATE TERMINAL, GRID-No.2 TERMINAL, GRID-No.1 TERMINAL, HEATER-CATHODE TERMINAL, AND HEATER TERMINAL CLEAN, SMOOTH, AND FREE OF BURRS, THE TUBE WILL ENTER A GAUGE AS SHOWN IN SKETCH G_1. PROPER ENTRY OF THE TUBE IS OBTAINED WHEN THE GRID-No.2 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 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





DETAIL OF POST P

*THIS SURFACE IS FLAT WITHIN .0005" PEAK TO VALLEY AND IS PERPENDICULAR TO THE AXIS OF THE CYLINDRICAL HOLES WITHIN .00025".

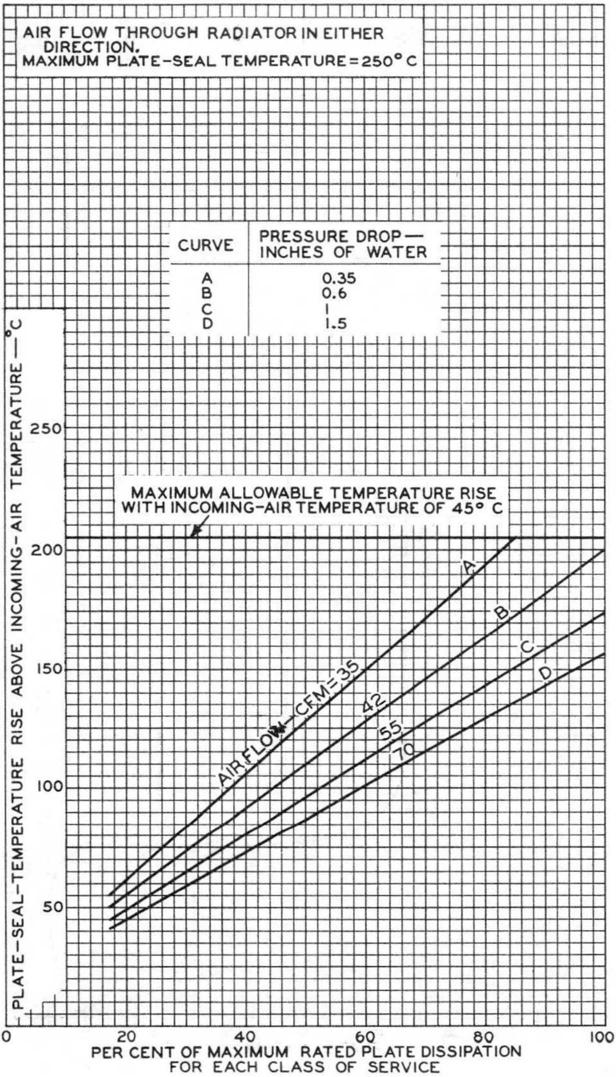
THE AXES OF THE CYLINDRICAL HOLES H_1 THROUGH H_5 AND THE AXIS OF POST P ARE COINCIDENT WITHIN .001".

92CM-9735R2

RCA

7213

TYPICAL COOLING REQUIREMENTS

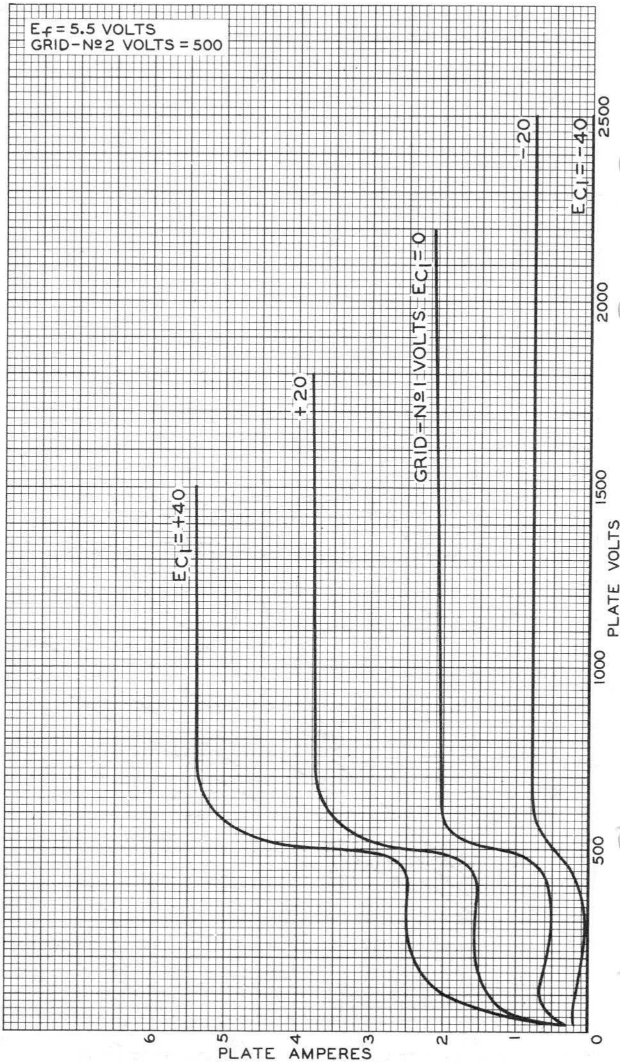


ELECTRON TUBE DIVISION 92CM-9737
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

7213

7213

TYPICAL PLATE CHARACTERISTICS



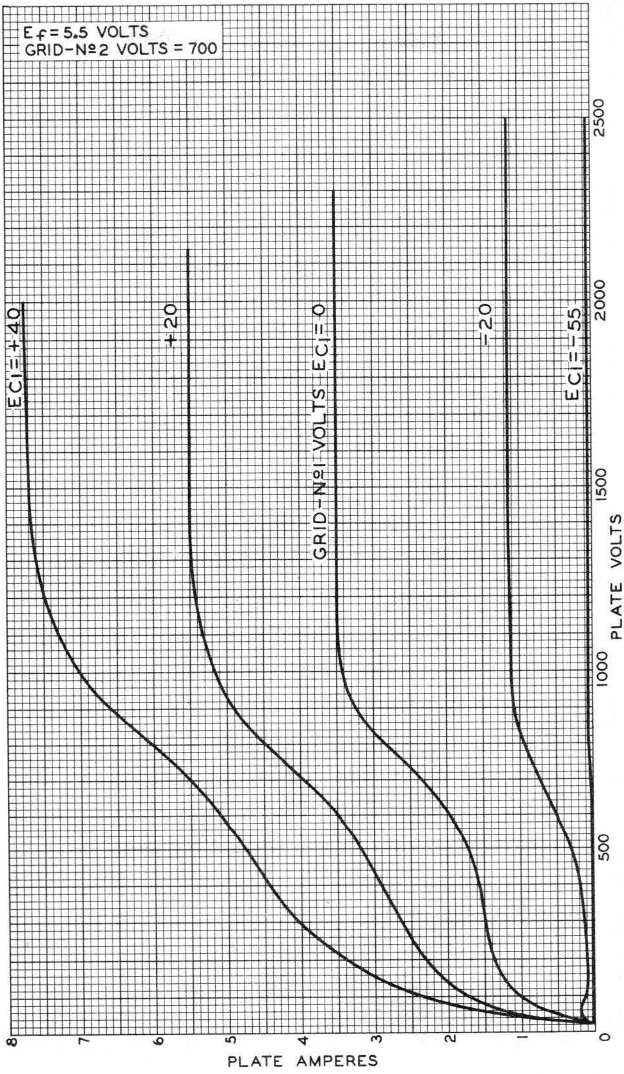
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9738

7213

7213

TYPICAL PLATE CHARACTERISTICS



ELECTRON TUBE DIVISION

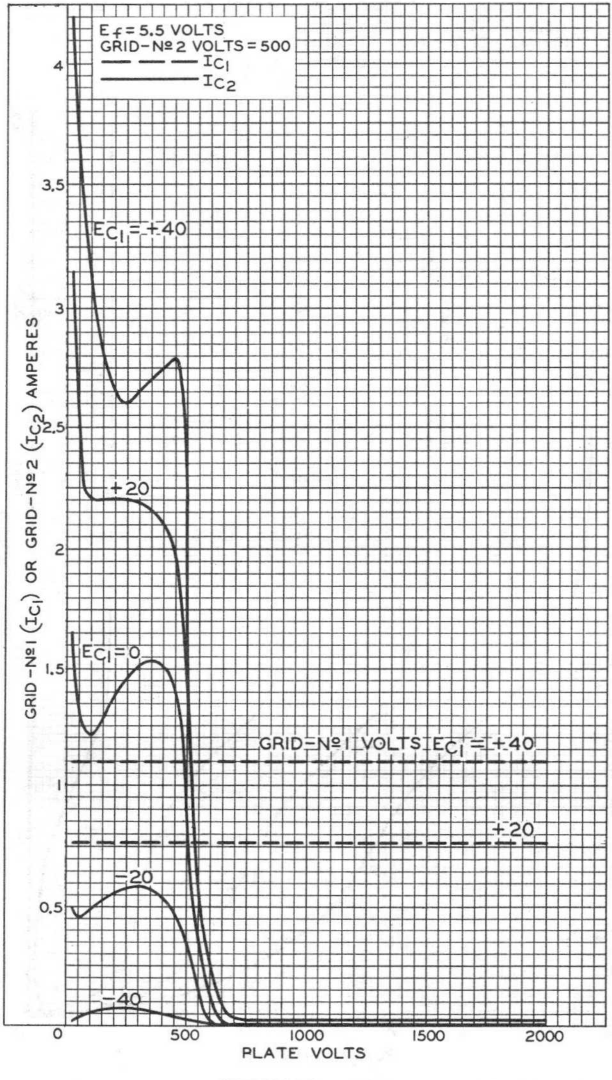
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9753

7213

7213

TYPICAL CHARACTERISTICS



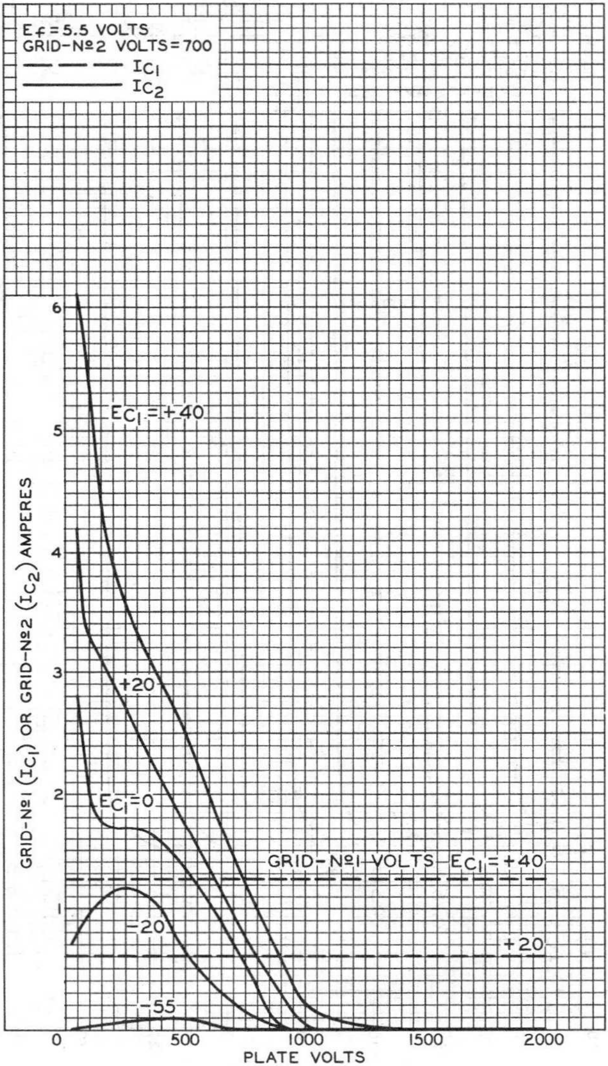
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9740

RCA

7213

TYPICAL CHARACTERISTICS



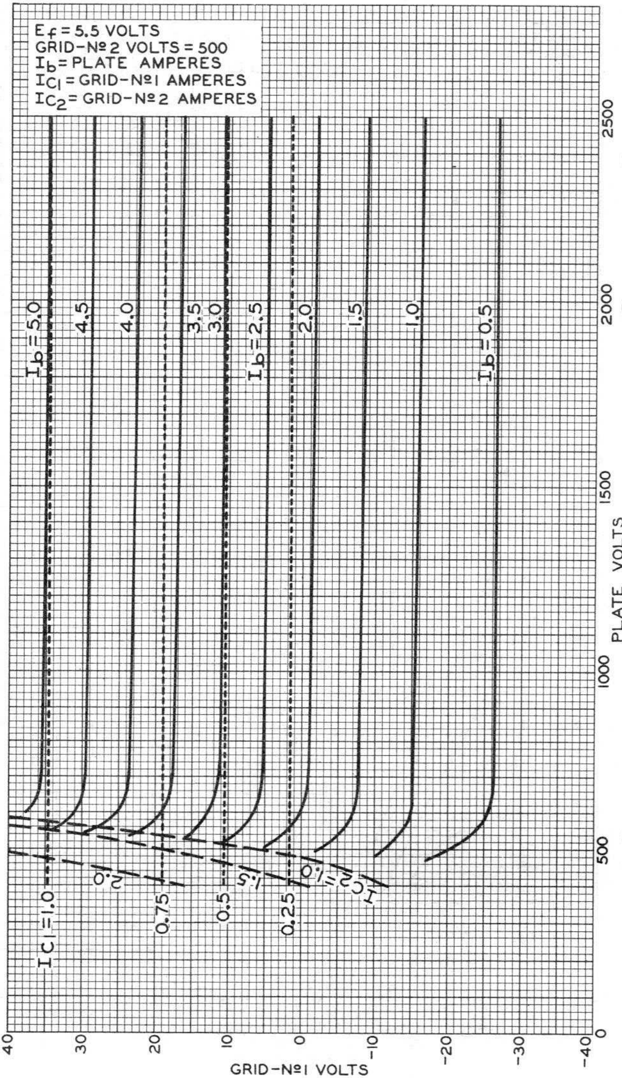
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9754

RCA

7213

TYPICAL CONSTANT–CURRENT CHARACTERISTICS

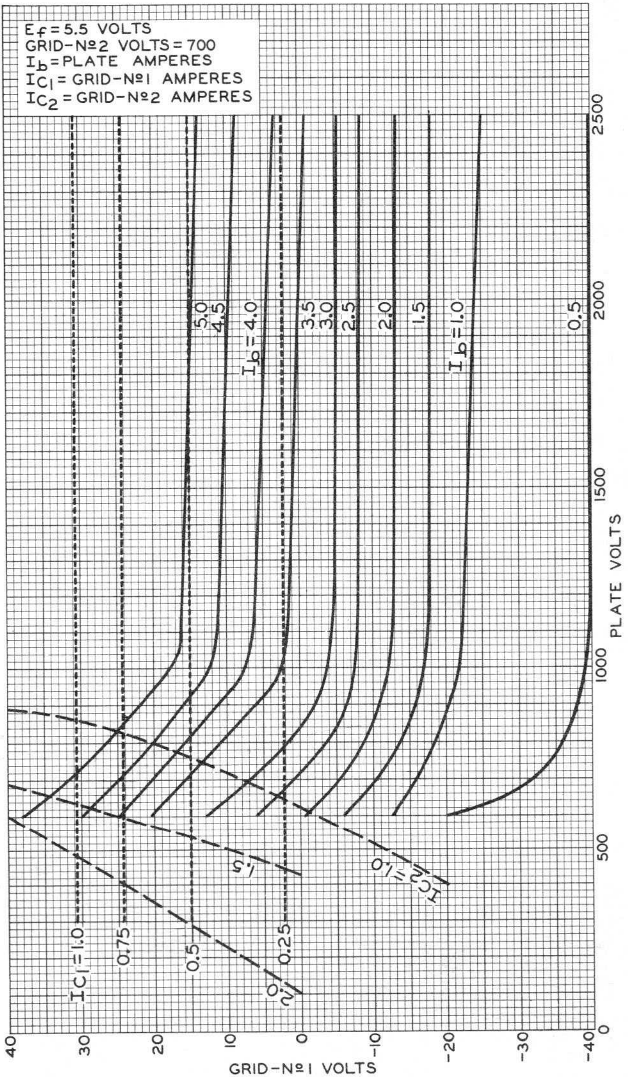


92CM–9744

RCA

7213

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



ELECTRON TUBE DIVISION

92CM-9752

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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

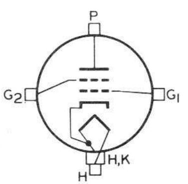
Electrical:

Heater, for Matrix-Type, Oxide-Coated, Unipotential Cathode:		
Voltage (AC or DC)[a]	5.5 typical	volts
	6 max.	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	19	
Direct Interelectrode Capacitances:		
Grid No.1 to plate[b]	0.17 max.	μμf
Grid No.1 to cathode & heater	42	μμf
Plate to cathode & heater[b,c]	0.017 max.	μμf
Grid No.1 to grid No.2	55	μμf
Grid No.2 to plate	16	μμf
Grid No.2 to cathode & heater[c]	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

← Indicates a change.

Thermal:

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

For maximum "on" time[e] 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[f] 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.)[g]	4.5	kw
Useful Power Output at peak of pulse (Approx.)	20	kw

PLATE- AND SCREEN-PULSED RF AMPLIFIER

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

For maximum "on" time[e] 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
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[f] 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.)[g]	10	11	kw
Useful Power Output at peak of pulse (Approx.)	50	65	kw

[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 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 termmnal perpendicular to the tube axis.

[d] Continuous Commercial Service.

[e] *"On" time* is defined as the sum of the durations of 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.

[f] *Duty factor* for the 7214 is defined as the "on" time in microseconds divided by 1000 microseconds.

[g] 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.

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[h], 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 500 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.

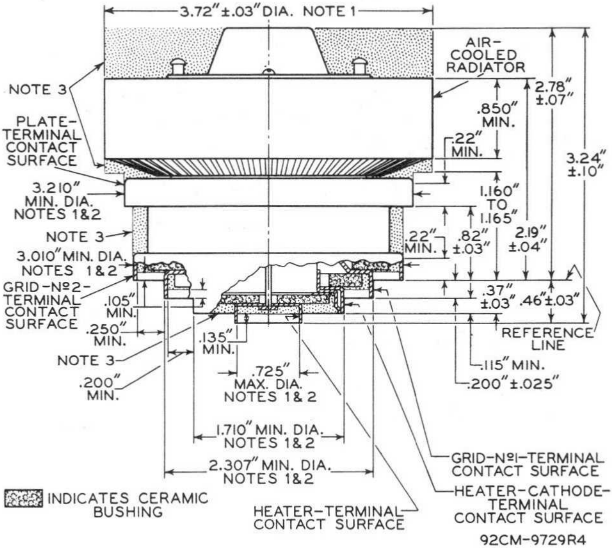
OPERATING CONSIDERATIONS

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.

[h] 31 March 1958, Military Specification, Electron Tubes and Crystal Rectifiers.

→ Indicates a change.

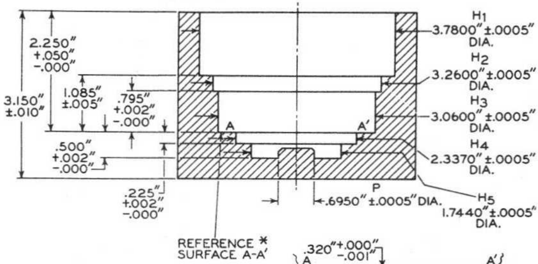


NOTE 1: WITH THE CYLINDRICAL SURFACES OF THE RADIATOR BAND, PLATE TERMINAL, GRID-No.2 TERMINAL, GRID-No.1 TERMINAL, HEATER-CATHODE TERMINAL, AND HEATER TERMINAL CLEAN, SMOOTH, AND FREE OF BURRS, THE TUBE WILL ENTER A GAUGE AS SHOWN IN SKETCH G_1. PROPER ENTRY OF THE TUBE IS OBTAINED WHEN THE GRID-No.2 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.

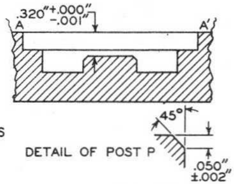
NOTE 3: KEEP ALL STIPPLED REGIONS CLEAR. DO NOT ALLOW CONTACTS OR CIRCUIT COMPONENTS TO PROTRUDE INTO THESE ANNULAR VOLUMES.

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_5 AND THE AXIS OF POST P ARE COINCIDENT WITHIN .001".



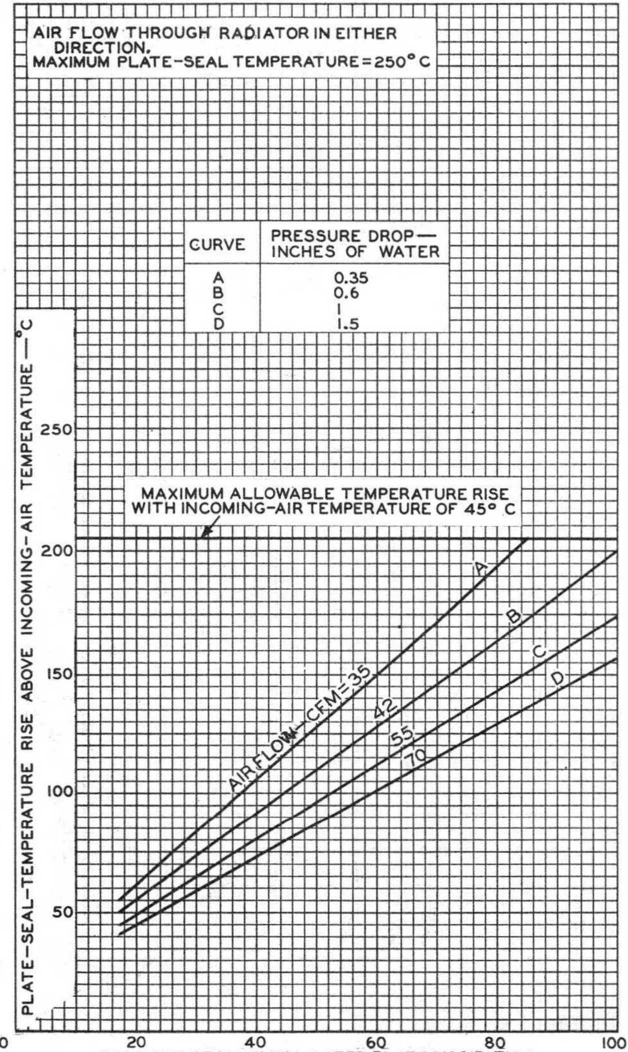
DETAIL OF POST P

92CM-9735R2

RCA

7214

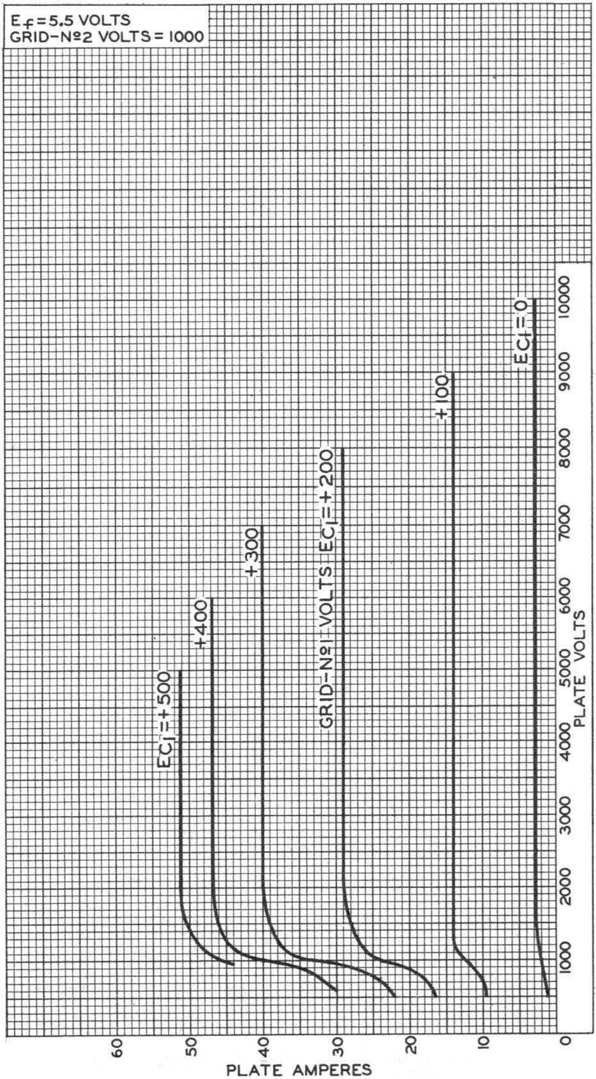
TYPICAL COOLING REQUIREMENTS



RCA

7214

TYPICAL PLATE CHARACTERISTICS



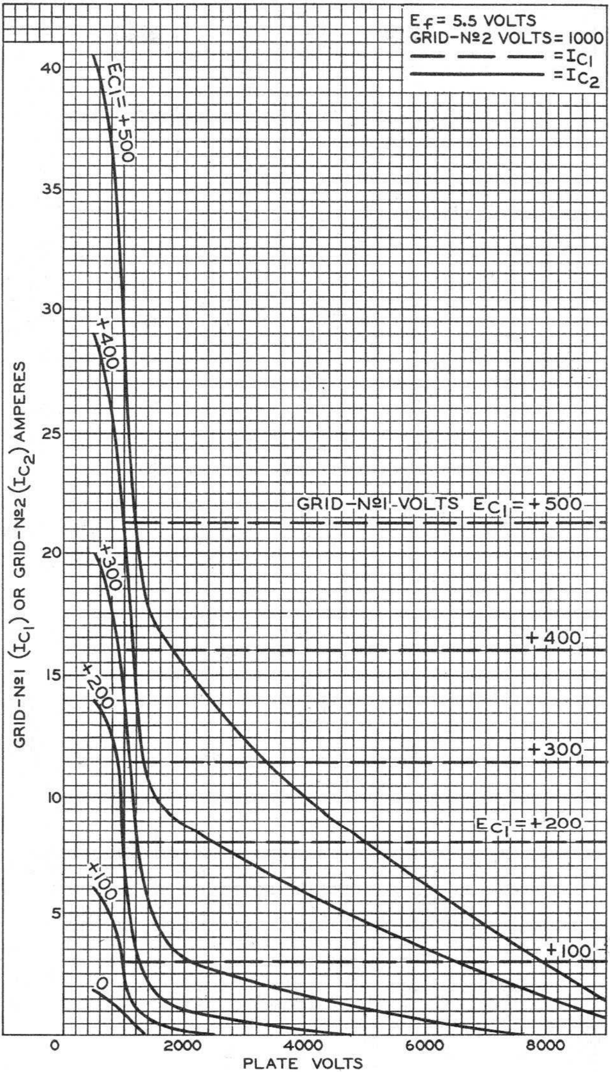
ELECTRON TUBE DIVISION 92CM-10186

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

7214

7214

TYPICAL CHARACTERISTICS



ELECTRON TUBE DIVISION

92CM-10185

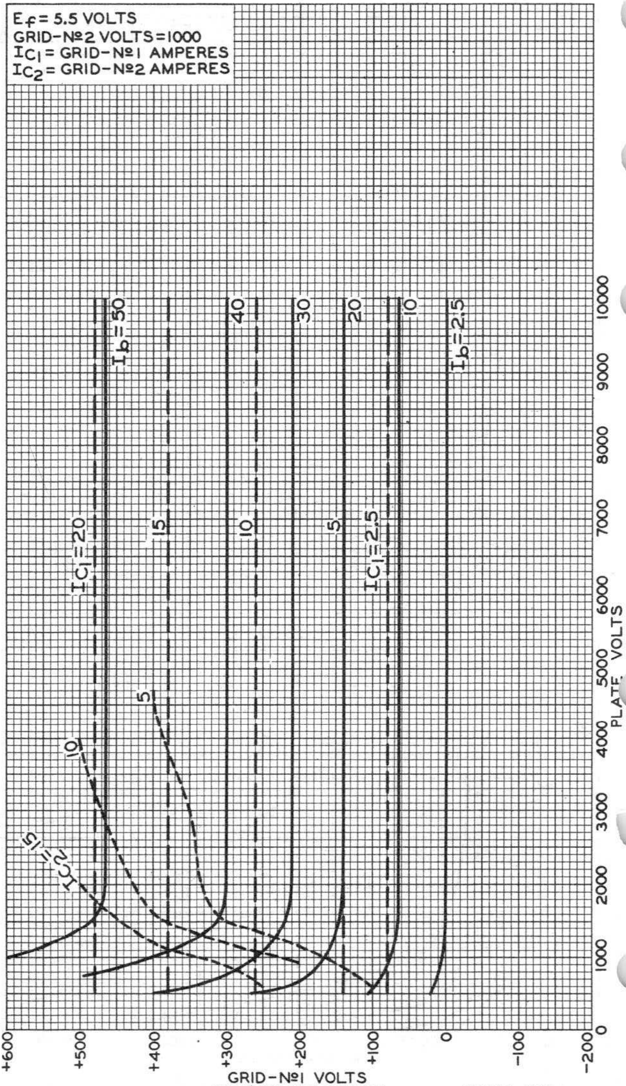
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

7214

RCA

7214

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



ELECTRON TUBE DIVISION

92CM-10184

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

Beam Power Tube

Cermolox
Forced-Air Cooled

Ruggedized
Integral Radiator

80 Watts CW Power Output at 400 MHz
40 Watts CW Power Output at 1215 MHz

For Applications in Which Dependable Performance Under Severe Shock and Vibration is Essential

ELECTRICAL

Heater for Matrix-Type Oxide-Coated Unipotential Cathode:[g]

Voltage (ac or dc)	6.3 ± 10%	V
Current at 6.3 volts	3.2	A
Minimum heating time	1	minute
Mu-Factor, Grid No.2 to Grid No.1	18	

Direct Interelectrode Capacitances[a]:

Grid No.1 to plate	0.065 max.	pF
Grid No.1 to cathode & heater	14	pF
Plate to cathode & heater	0.019	pF
Grid No.1 to grid No.2	19	pF
Grid No.2 to plate	4.5	pF
Grid No.2 to cathode & heater	1.30	pF

MECHANICAL

Operating Position	Any
Overall Length	1.880" ± .050"
Greatest Diameter	1.265" max.
Terminal Connections	See *Dimensional Outline*

For operation up to 400 MHz

Socket, including Grid-No.2 Bypass Capacitor	Erie[b] 2948-000, E.F. Johnson[c] DN124-152-1, Jettron[d] 89-001, or equivalent
Grid-No.2 Bypass Capacitor	Erie[b] 2926-000, 2929-001, or equivalent

For operation at high frequencies

See Accompanying Preferred Mounting Arrangement

Radiator	Integral part of tube
Weight (Approx.)	2 oz.

THERMAL

Terminal Temperature (Plate, grid No.2, grid No.1, cathode, and heater)	250 max. °C
Plate-Core Temperature	250 max. °C

Air Flow:[h]

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 two graphs under *Typical Cooling Requirements.*

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 as indicated may be met by use of blowers and associated motors manufactured by Rotron Mfg. Co., Inc., Woodstock, N.Y., or equivalent.

AF POWER AMPLIFIER & MODULATOR – Class AB_1[i]

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	115 max.	watts

Typical CCS 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	watt
Max.-Signal Power Output (Approx.)	50	80	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under Any Condition:

With fixed bias	30,000 max.	ohms
With cathode bias	Not recommended	

AF POWER AMPLIFIER & MODULATOR – Class AB_2 [i]

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	115 max.	watts

Typical CCS 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

PLATE-MODULATED RF POWER AMPLIFIER – Class C Telephony[i]

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

Maximum CCS Ratings, *Absolute-Maximum Values*

	Up to 1215 MHz:	
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	75 max.	watts

Typical CCS Operation:

	At 400 MHz:		
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	30,000 max.	ohms

RF POWER AMPLIFIER & OSCILLATOR – Class C Telegraphy[i]

and

RF POWER AMPLIFIER – Class C FM Telephony

Maximum CCS Ratings, *Absolute-Maximum Values:*

	Up to 1215 MHz:	
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[c] 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 MHz	At 1215 MHz		
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 . . . . 30,000 max. ohms

LINEAR RF POWER AMPLIFIER,[i]
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 1215 MHz		
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 at Peak of Envelope	250[c]	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 with "Two-Tone" Modulation:

	At 30 MHz		
DC Plate Voltage	650	850	volts
DC Grid-No.2 Voltage	300	300	volts
DC Grid-No.1 Voltage	–18.5	–18.5	volts
Zero-Signal DC Plate Current	40	40	mA
Effective RF Load Resistance	2200	3500	ohms
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	watt

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	watts
Peak envelope	25	40	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[k]	10000 max.	ohms

[a] Measured with special shield adapter.

[b] Erie Technological Products, Inc., 2206 West 15th Street, Erie, Pennsylvania

[c] E.F. Johnson Co., 299 10th Ave., S.W., Waseca, Minn.

[d] Jettron Products, Inc., 56 Rt. 10, Hanover, N.J.

[e] The maximum dc plate current at peak of envelope is 250 mA dc for a signal having a minimum peak-to-average power ratio of 2. During short periods of circuit adjustment under "Single-Tone" conditions, the average plate current may be as high as 250 mA. 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.

[f] In applications where the frequency is less than 80 MHz and the bias is less than −50 volts, the maximum value is 40 mA.

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.

[i] See *Classes of Service*.

[k] See *Electrical Considerations*—Grid No.2 Voltage Supply.

CHARACTERISTICS RANGE VALUES

	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
Grid No.2 to plate	2	4	5.1	pF
Grid No.2 to cathode & heater	2	–	1.30	pF
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	+2.0	mA
6. Peak Emission	1,4	–	300	peak volts
7. Interelectrode Leakage Resistance	5	1.0	–	megohm
8. Useful Power Output	6	85	–	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 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 the value specified.

Note 5: 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 1.0 megohm, will exceed the value specified.

Note 6: In a single-tube, grid-driven coaxial-tuned amplifier circuit at 400 MHz 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 voltage adjustable for dc plate current of 180 mA maximum, dc grid-No.1 current of 30 mA maximum and driver power output of 3 watts maximum.

SPECIAL TESTS AND PERFORMANCE DATA

The environmental conditions shown for the tests below are those applied directly to the tube. Extreme care must be used in the design of the mountings to minimize mounting resonances.

50g, 11-Millisecond Shock Test:

This test is performed on samples 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 3 and 4 under *Characteristics Range Values*.

500g, Nominal 3/4-Millisecond Shock Test:

This test is performed on samples 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 positions.

At the end of this test, tubes are required to meet the limits for items 3 and 4 under *Characteristics Range Values*.

5-2000 Hz Variable Frequency Vibration Test:

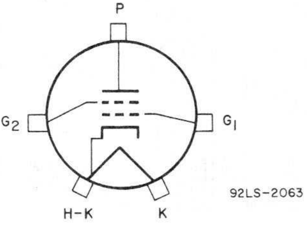
This test is performed on samples of tubes to determine the ability of the tube to withstand variable frequency vibration. With heater voltage of 6.3 volts ac or dc, dc plate supply voltage of 300 volts, dc grid-No.2 voltage of 250 volts, grid-No.1 voltage adjusted to give dc plate current of 10 mA, and plate load resistor of 2000 ohms. This tube is vibrated along each of three mutually perpendicular axes over an 8-minute sweep consisting of:

a. 5-10 Hz with fixed double amplitude of 0.080 inch ±10%.
b. 10-15 Hz at fixed acceleration of 0.41 g ± 10%.
c. 15-75 Hz with fixed double amplitude of 0.036 inch ±10%.
d. 75-2000 Hz at fixed acceleration of 0 g ± 10%.

During the above vibration tests, tubes will show an rms output voltage in excess of 15 volts across the plate load resistor in the 5-2000 hertz range.

At the end of this test, tubes are required to meet the limits for items 3 and 4 under *Characteristics Range Values*.

TERMINAL DIAGRAM



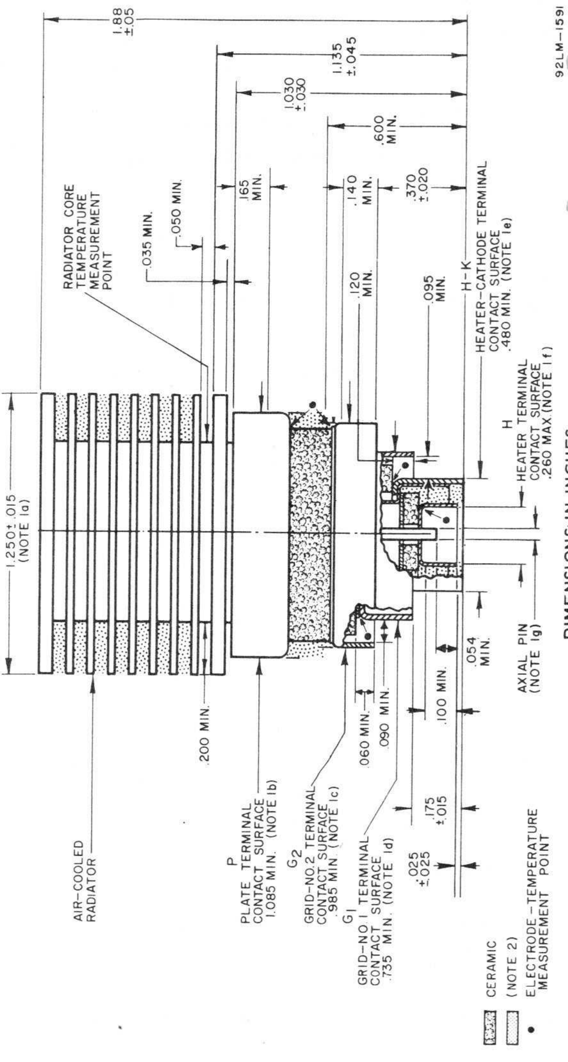
NOTES FOR DIMENSIONAL OUTLINE

Note 1: The following diametrical space requirements accommodate the concentricity of the cylindrical surfaces of the radiator fins, axial pin, and each electrode terminal:

a. Radiator Band – 1.316"
b. Plate Terminal – 1.120"
c. Grid-No.2 Terminal – 1.020"
d. Grid-No.1 Terminal – 0.765"
e. Heater-Cathode Terminal – 0.520"
f. Heater Terminal – 0.240"
g. Axial Pin – 0.072"

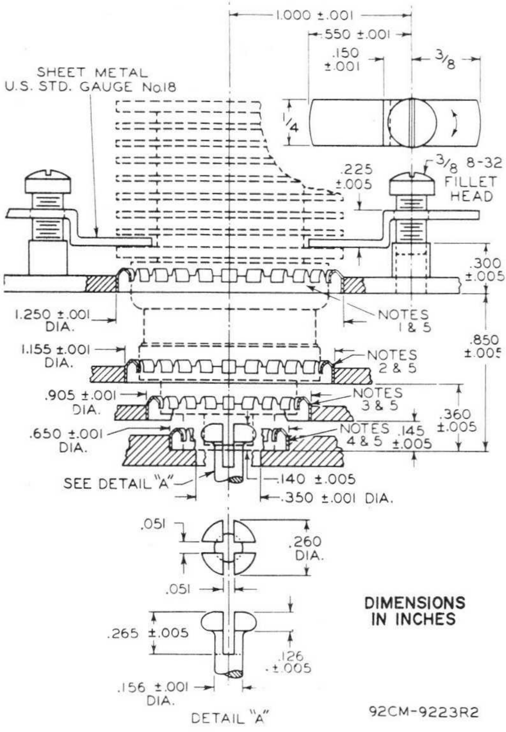
Note 2: Keep all stippled regions clear. Do not allow contacts or circuit components to protrude into these annular volumes.

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

PREFERRED MOUNTING ARRANGEMENT



Note 1: Contact ring No.97-252 or finger stock No.97-380.

Note 2: Contact ring No.97-253 or finger stock No.97-380.

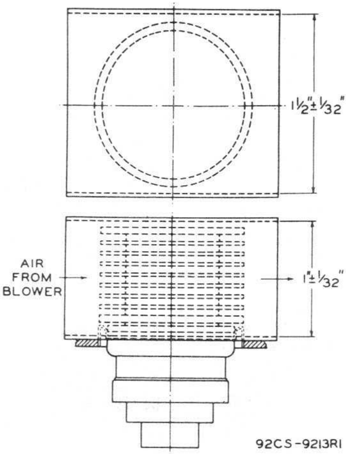
Note 3: Contact ring No.97-254 or finger stock No.97-380.

Note 4: Contact ring No.97-255 or finger stock No.97-380.

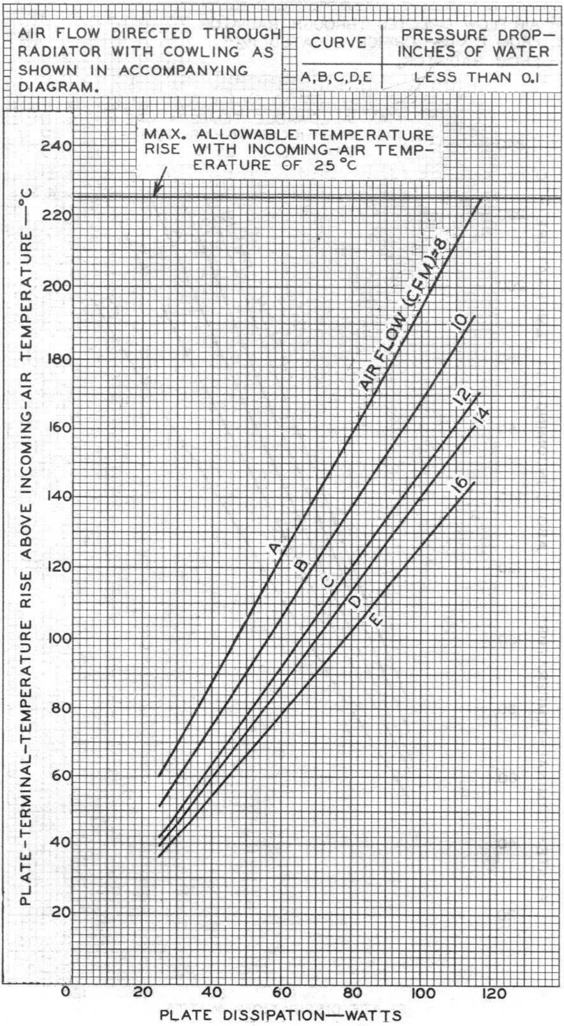
Note 5: The specified contact ring of preformed finger stock and finger stock No.97-380 provide adequate electrical contact, but the finger stock No.97-380 is less susceptible to breakage than the specified contact ring. Both types are made by Instruments Specialties Co., Little Falls, N.J.

RECOMMENDED COWLING

For Directing Air Flow Through Radiator

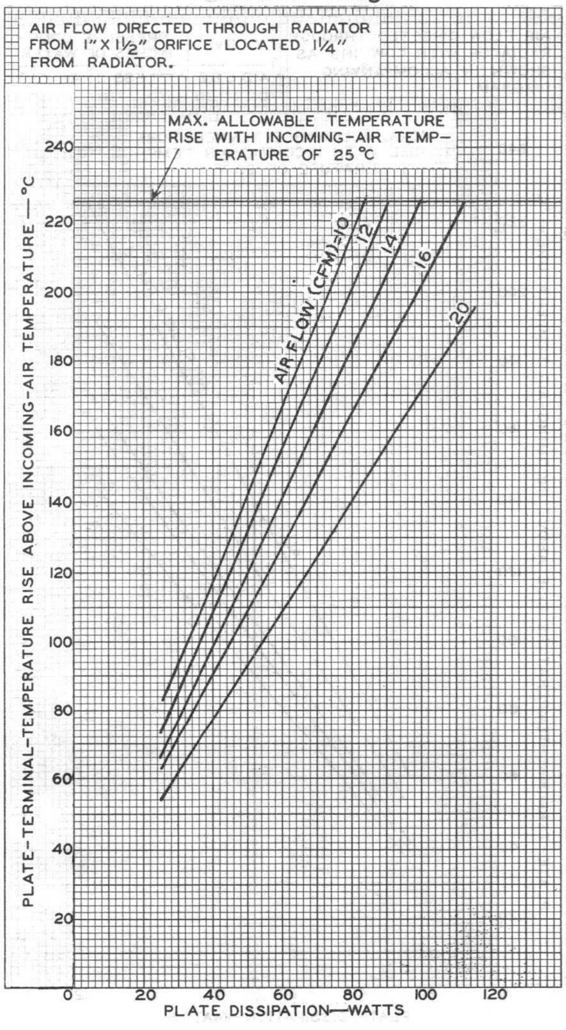


TYPICAL COOLING REQUIREMENTS
With Cowling



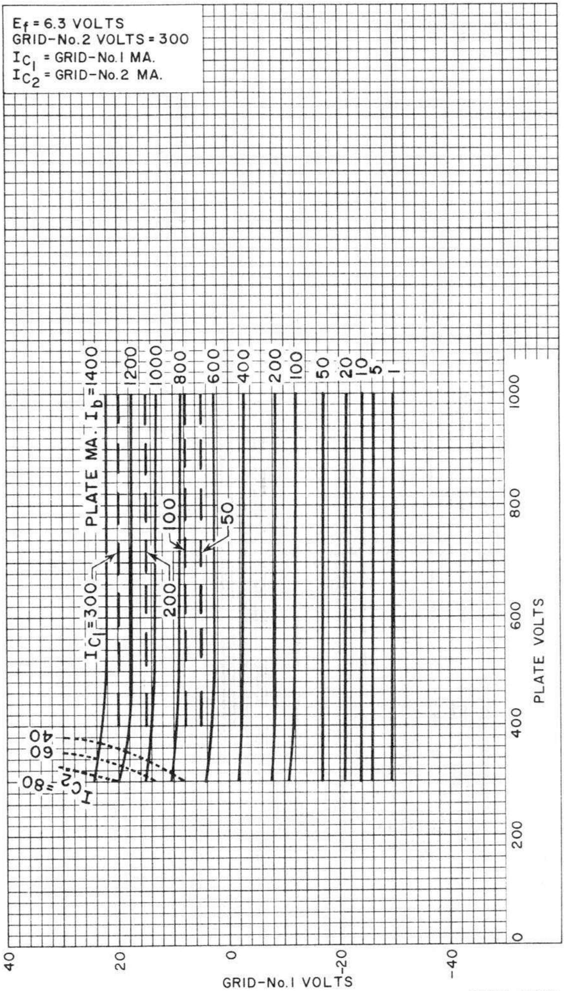
92CM-9219R1

TYPICAL COOLING REQUIREMENTS
Without Cowling



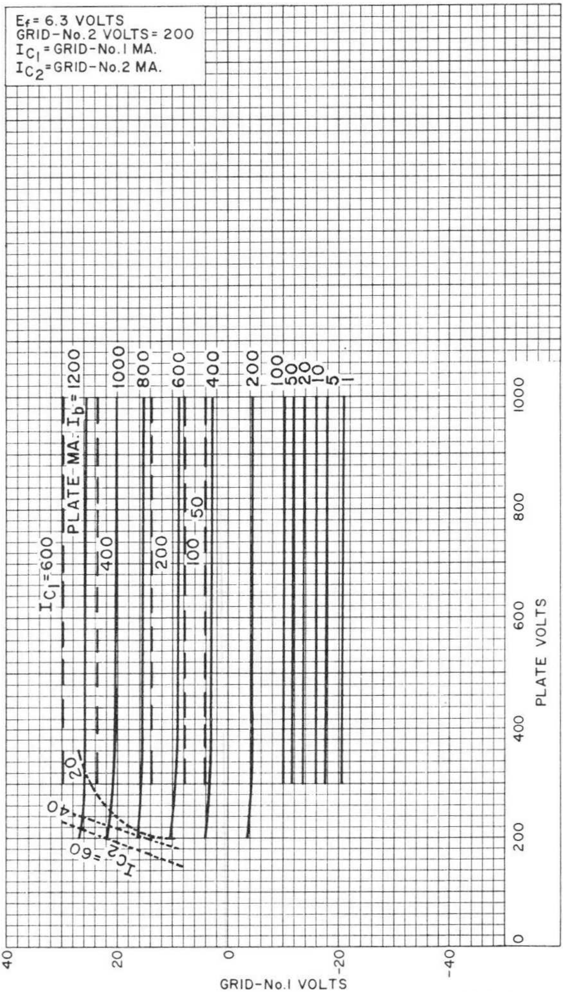
92CM-9220R1

TYPICAL COOLING REQUIREMENTS



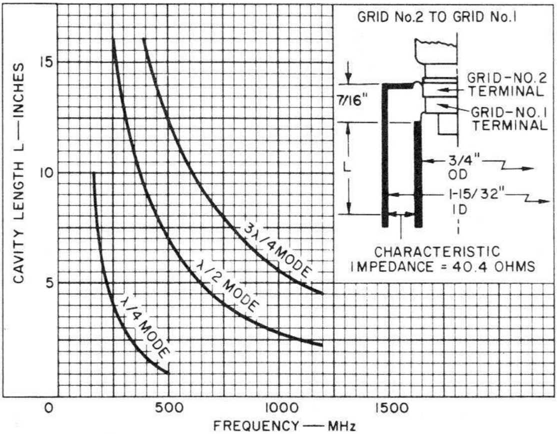
92CM-11749

TYPICAL COOLING REQUIREMENTS

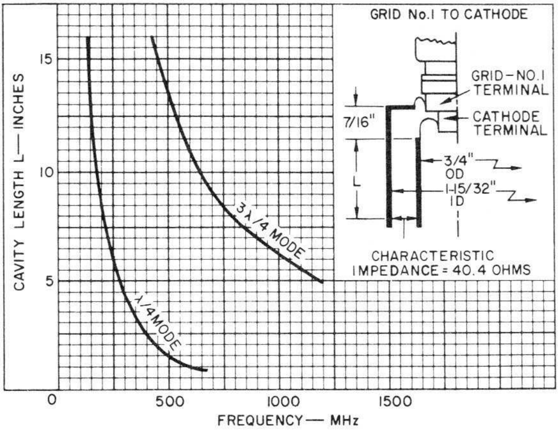


92CM-11745

TUNING CHARACTERISTICS

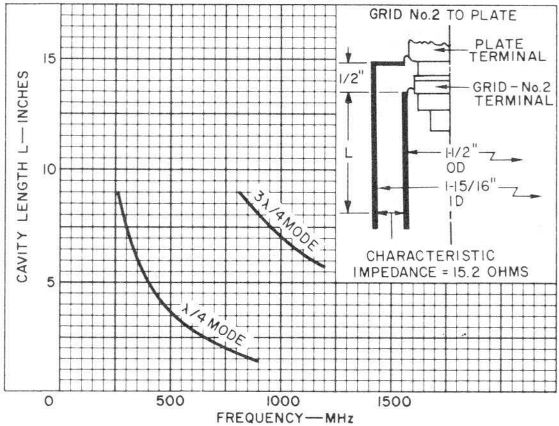


92CS-14833



92CS-14834

TUNING CHARACTERISTICS



92CS-14835

Tunable Oscillator Triode

PENCIL TYPE WITH INTEGRAL RESONATORS

For Radiosonde Service at Frequencies between 1660 and 1700 Mc

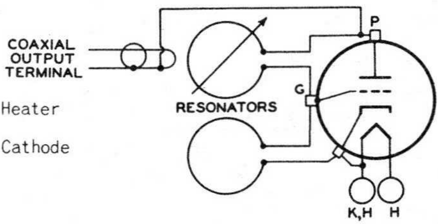
GENERAL DATA

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*):



H – Heater
K – Cathode
G – Grid
P – Plate

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 if 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 6.6 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.*

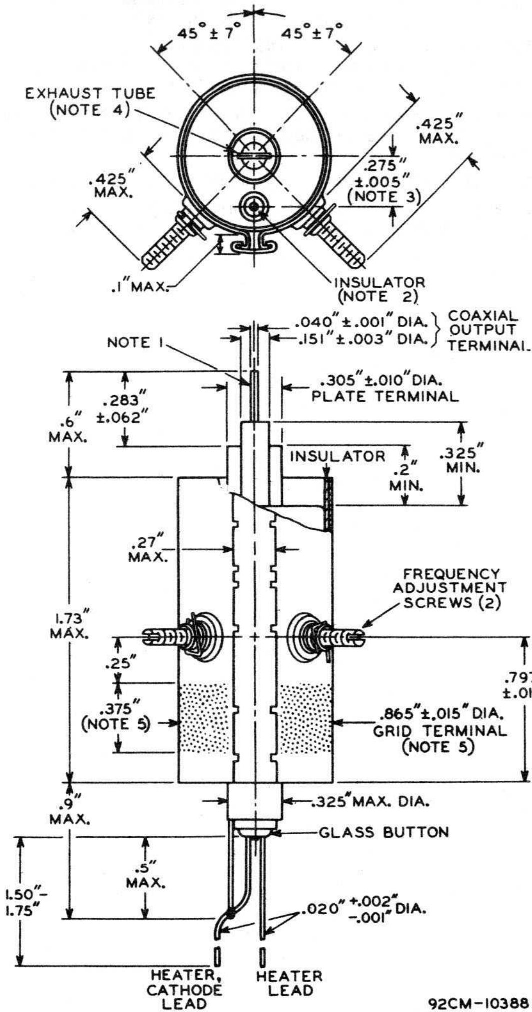
OPERATING CONSIDERATIONS

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.
INSULATOR
.2" MIN.
.325" 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 as a Low-Noise-Amplifier Tube in Receiver Applications up to 1500 Mc 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, dc grid volts = 0, cathode resistor (ohms) = 0, load resistor (ohms) = 10, and heater volts = 6.3	10	sec
Amplification Factor	80	
Transconductance for dc plate ma. = 13, dc plate volts = 125, and cathode resistor (ohms) = 50	13500	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	2.0	μμf

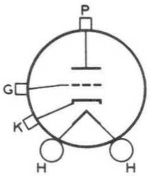
Mechanical:

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)	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

→ RADIO-FREQUENCY AMPLIFIER — Class A_1

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

For altitudes up to 100,000 feet and frequencies up to 1500 Mc

DC PLATE VOLTAGE	250 max.	volts
DC GRID VOLTAGE	-50 max.	volts
DC PLATE CURRENT	25 max.	ma
PLATE DISSIPATION	2.5 max.	watts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	50 max.	volts
Heater positive with respect to cathode	50 max.	volts
PLATE-SEAL TEMPERATURE	225 max.	°C

Typical CCS[h] Operation in Cathode-Drive Circuit:

	At 550 Mc	*At 800 Mc*	*At 1100 Mc*	
DC Plate-to-Grid Voltage	125	125	150	volts
Cathode Resistor	50	50	50	ohms
Input-Signal-Level Range	-70 to -20	-70 to -20	-70 to -20	dbm
DC Plate Current	13	13	13.5	ma
Power Gain	16.5	18	16	db
Bandwidth	5	5	10	Mc
Noise Figure	6.5	8.5	12.5	db

Maximum Circuit Values:

Grid-Circuit Resistance:		
For fixed-bias operation	Not recommended	
For cathode-bias operation	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 up to 1000 Mc and above.
[g] Resdel Engineering Corp., 330 South Fair Oaks Avenue, Pasadena, California. This series of cavities covers the range from 215 to 2325 Mc.
[h] Continuous Commercial Service.

→ Indicates a change.

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

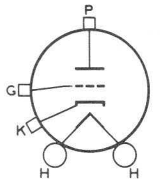
Mechanical:

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	1,6	–	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-ID, 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-ID, 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-ID, 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-ID, 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. . . . . For conditions shown under *Characteristics Range Values, Note 1.*	300 max.	ma
Heater-to-Cathode Leakage Current . . For conditions shown under *Characteristics Range Values, Notes 1,3.*	60 max.	μa
Grid-to-Cathode Leakage Resistance. . For conditions shown under *Characteristics Range Values, Notes 1,4.*	50 min.	megohms

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:

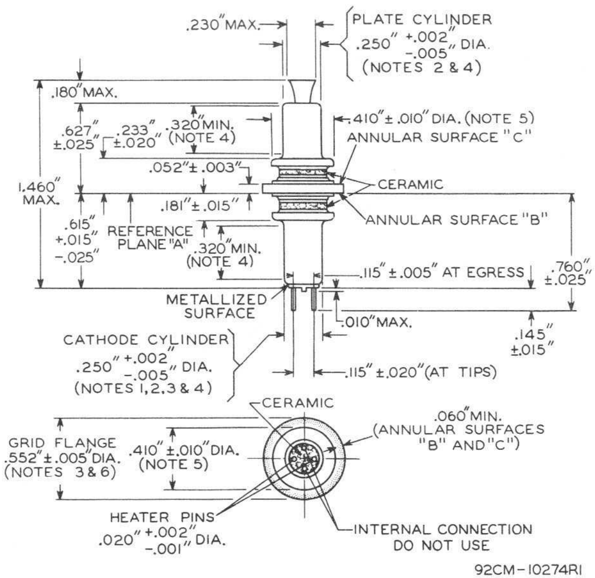
Heater Current.	300 max.	ma
For conditions shown under *Characteristics Range Values, Note 1.*		

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.



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".

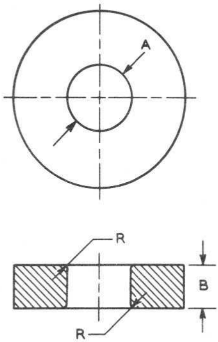
NOTE 3: THE AXES OF THE CATHODE CYLINDER AND GRID FLANGE WILL COINCIDE WITHIN 0.005".

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.

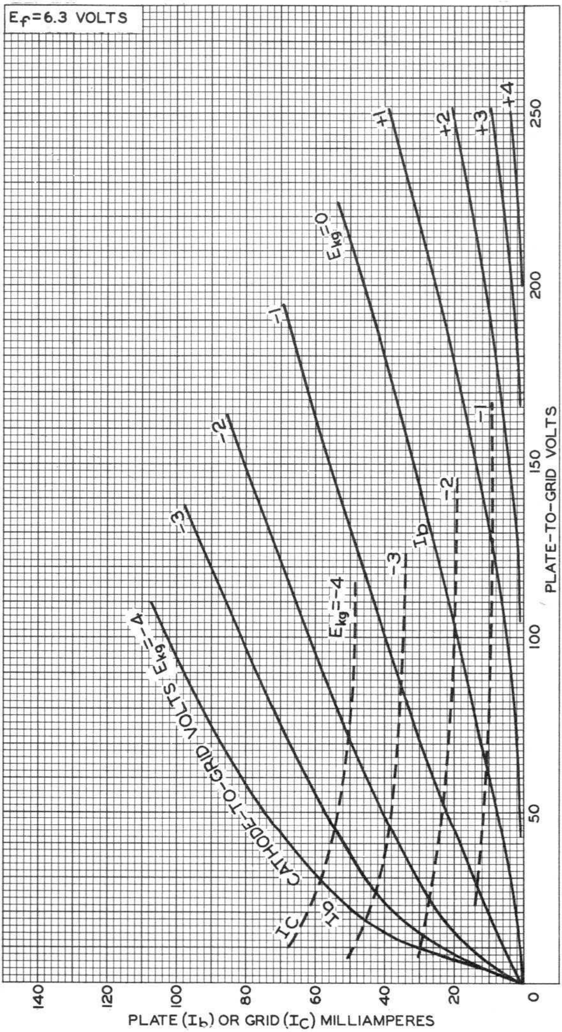
GAUGES



92CS-10370

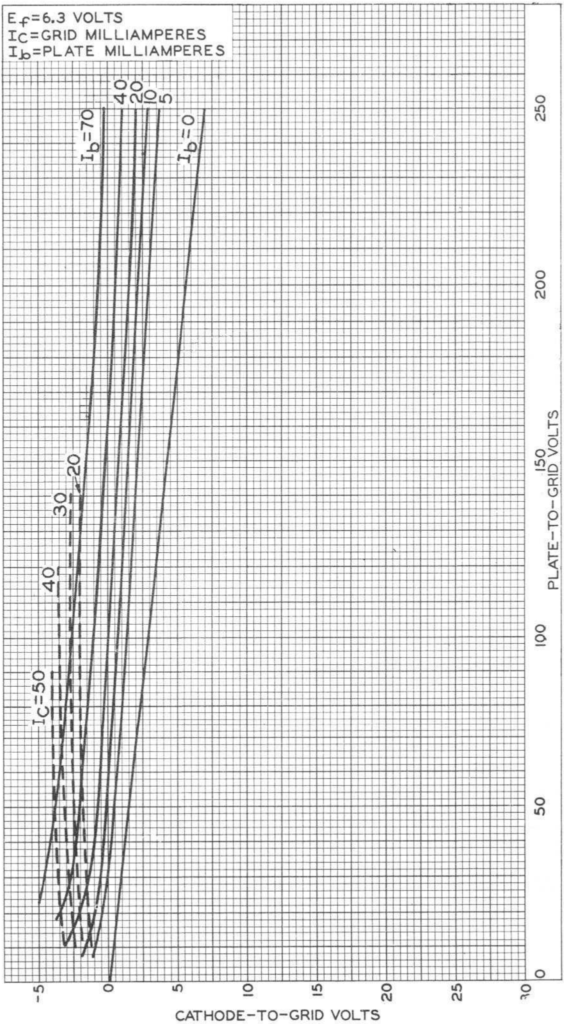
Gauge	Type	Dimension		
		Diameter A	Thickness B	Radius R
G_1-1	GO	0.25200" +0.00000" −0.00007"	0.320" +0.001" −0.000"	0.003" MAX.
G_1-2	NO-GO	0.24500" +0.00007" −0.00000"	–	–
G_2-1	GO	0.42000" +0.00000" −0.00007"	–	–
G_2-2	NO-GO	0.40000" +0.00007" −0.00000"	–	–
G_3-1	GO	0.55700" +0.00000" −0.00007"	–	–
G_3-2	NO-GO	0.54700" +0.00007" −0.00000"	–	–

AVERAGE CHARACTERISTICS
Cathode-Drive Service



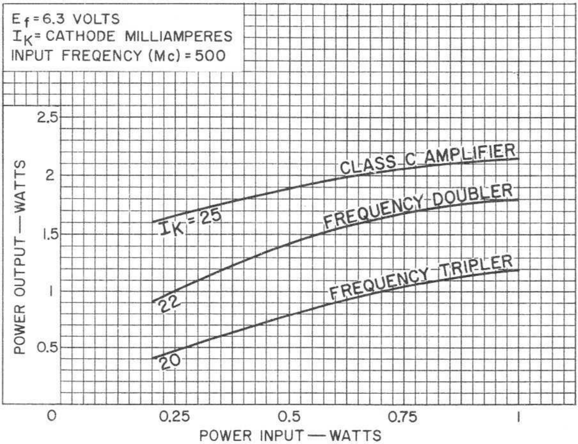
92CM-10262

AVERAGE CONSTANT-CURRENT CHARACTERISTICS
Cathode-Drive Service

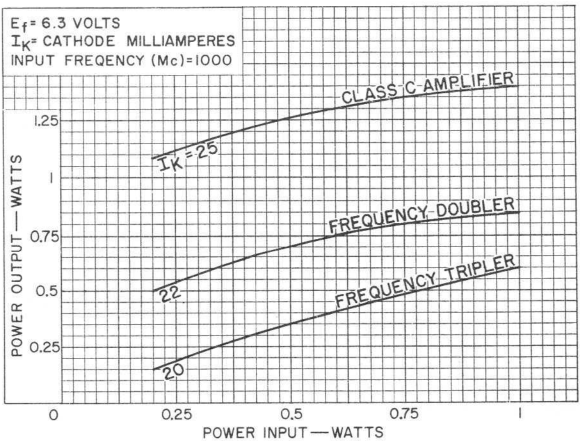


92CM-10263R1

TYPICAL POWER-OUTPUT CHARACTERISTICS
Cathode-Drive Service

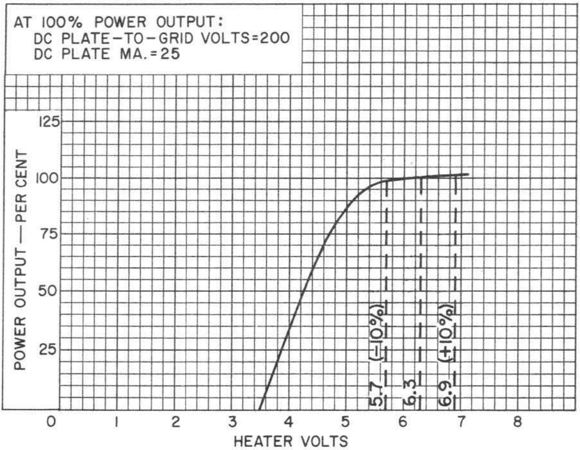


92CS-11625R1



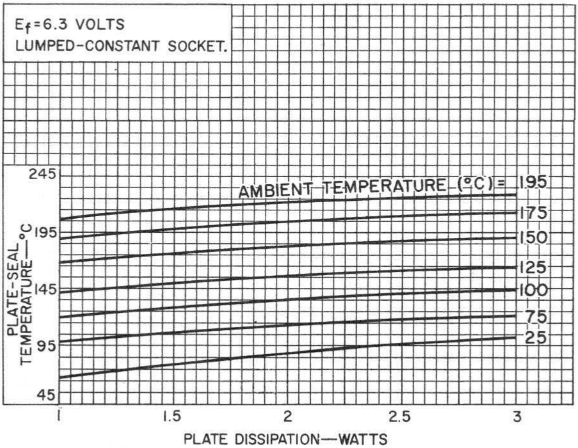
92CS-11626R1

TYPICAL POWER-OUTPUT CHARACTERISTICS
With Variation in Heater Voltage
Cathode-Drive Service



92CS-11624R1

PLATE-SEAL-TEMPERATURE CHARACTERISTICS



92CS-11488

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.

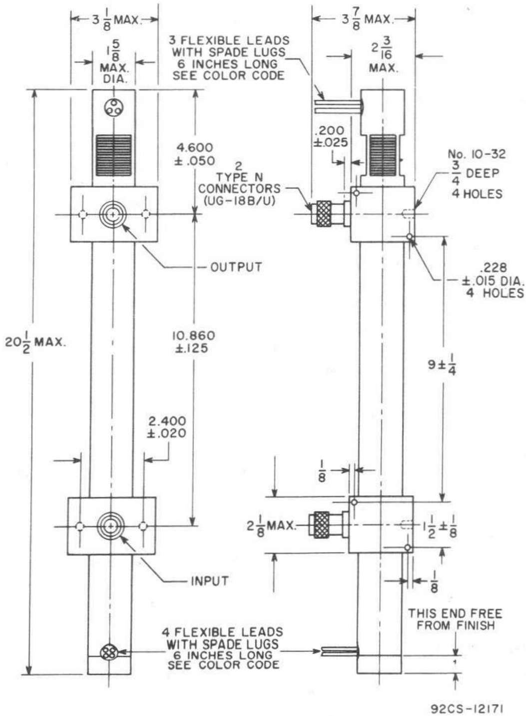
The rated values for collector voltage, helix voltage, and grid-No.2 voltage are high enough to be dangerous to the user. Care should be taken during adjustment of circuits, especially when exposed circuit parts are at a high dc potential.

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
"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

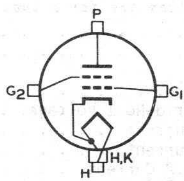
Electrical:

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.	$\mu\mu$f
Grid No.1 to cathode & heater	29	$\mu\mu$f
Plate to cathode & heater	0.011 max.	$\mu\mu$f
Grid No.1 to grid No.2.	37	$\mu\mu$f
Grid No.2 to plate.	5.3	$\mu\mu$f
Grid No.2 to cathode & heater	1.1 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 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	0.05	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	$\mu\mu$f
Grid No.1 to cathode & heater	2	26	32	$\mu\mu$f
Plate to cathode & heater	2	–	0.011	$\mu\mu$f
Grid No.1 to grid No.2	2	34	41	$\mu\mu$f
Grid No.2 to plate	2	4.3	6.3	$\mu\mu$f
Grid No.2 to cathode & heater	2	–	1.1	$\mu\mu$f
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%.

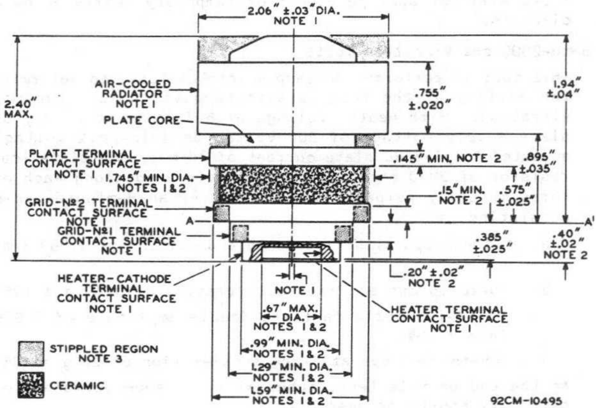
d. 105-to-2000 cps at fixed acceleration of 20 g ± 10%.

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.

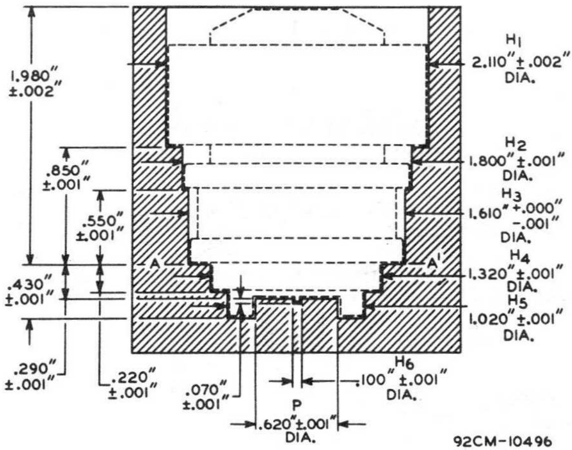


NOTE 1: WITH THE CYLINDRICAL SURFACES OF THE RADIATOR BAND, PLATE TERMINAL, GRID-No.2 TERMINAL, GRID-No.1 TERMINAL, HEATER-CATHODE TERMINAL, AND HEATER TERMINAL CLEAN, SMOOTH, AND FREE OF BURRS, THE TUBE WILL ENTER A GAUGE AS SHOWN IN SKETCH G_1. PROPER ENTRY OF THE TUBE IS OBTAINED WHEN THE GRID-No.2 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.

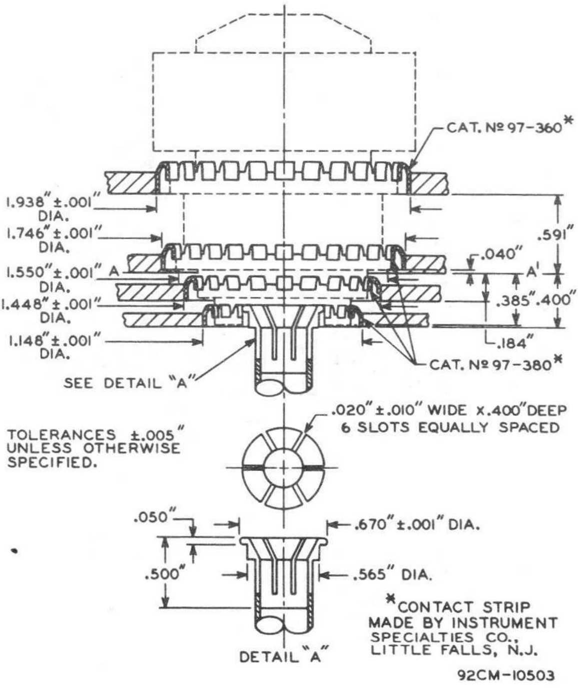
SKETCH G_1



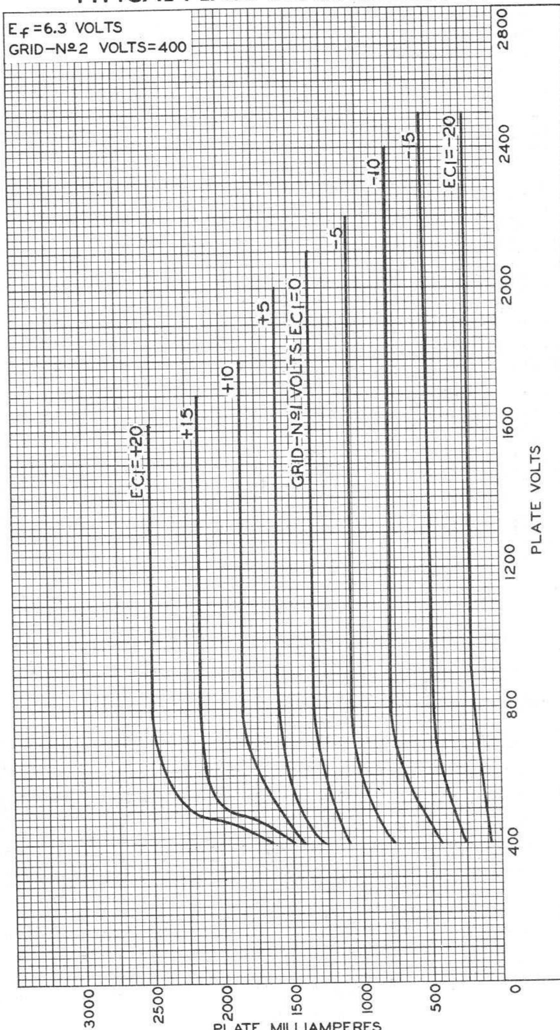
SURFACE A-A' IS FLAT WITHIN 0.0005" PEAK TO VALLEY AND IS PERPENDICULAR TO THE AXIS OF THE CYLINDRICAL HOLES WITHIN 0.00025".

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

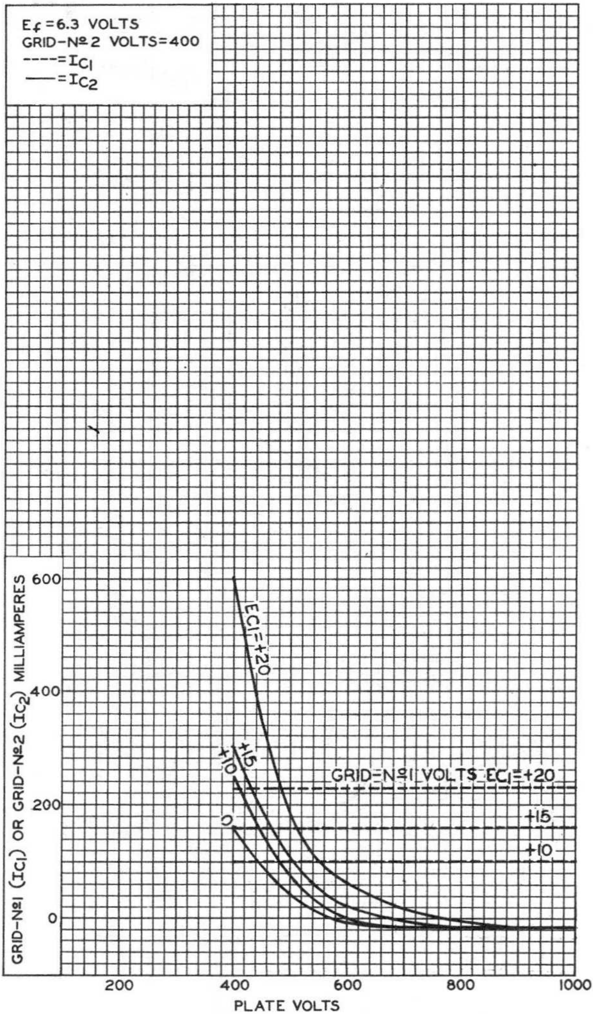


TYPICAL PLATE CHARACTERISTICS



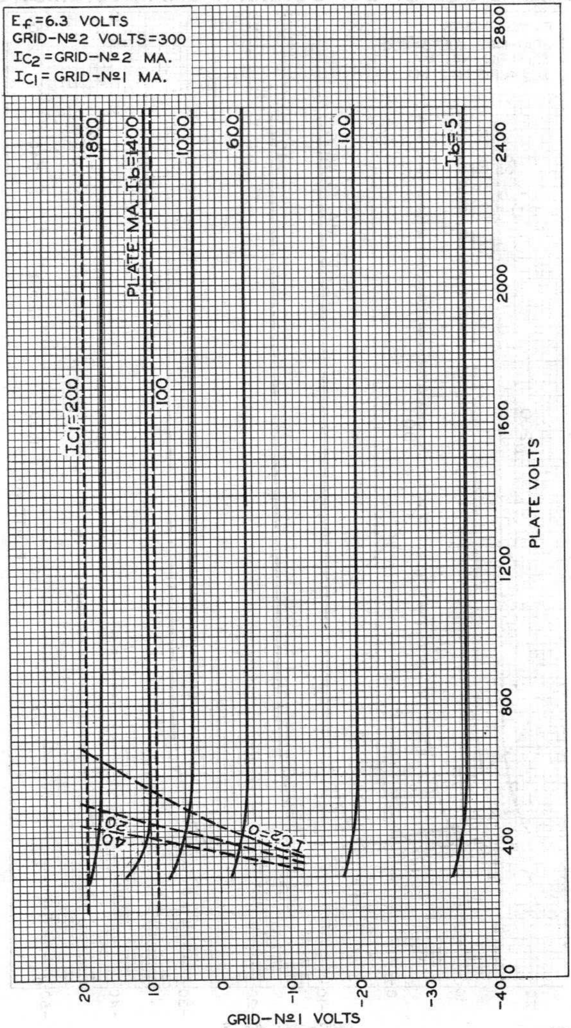
92CM–10487

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]

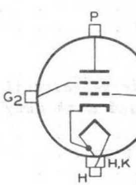
Grid No.1 to plate	0.13 max.	μμf
Grid No.1 to cathode & heater	29	μμf
Plate to cathode & heater	0.01 max.	μμf
Grid No.1 to grid No.2	38	μμf
Grid No.2 to plate	6.5	μμf
Grid No.2 to cathode & heater	0.8 max.	μμf

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*):

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

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

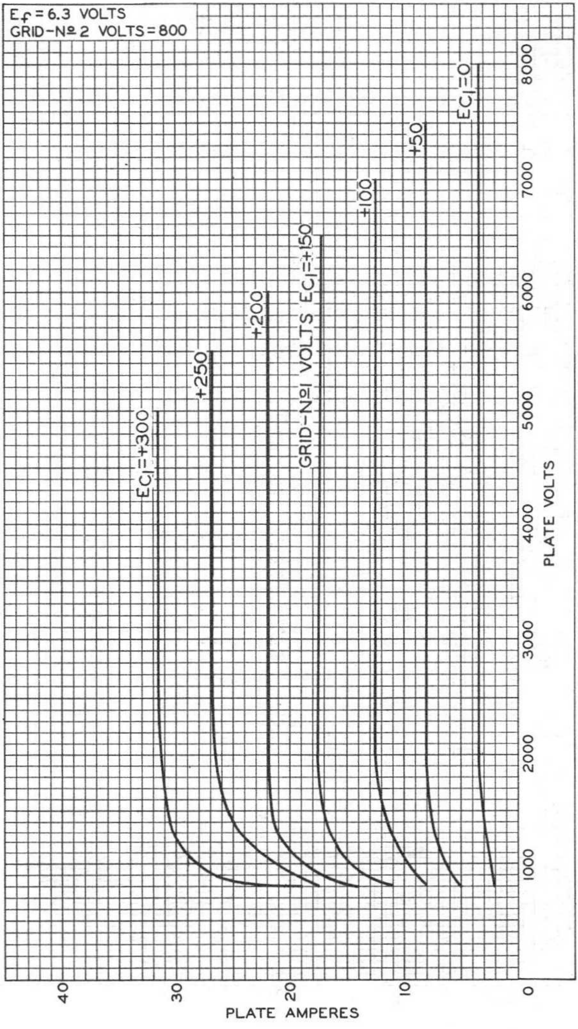
A suggested *mounting arrangement* for the 7651 is shown in the accompanying drawing along with a layout of the associated contacts. Flexible connectors are required for the plate, grid-No.2, grid-No.1, cathode, and heater contact surfaces.

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.

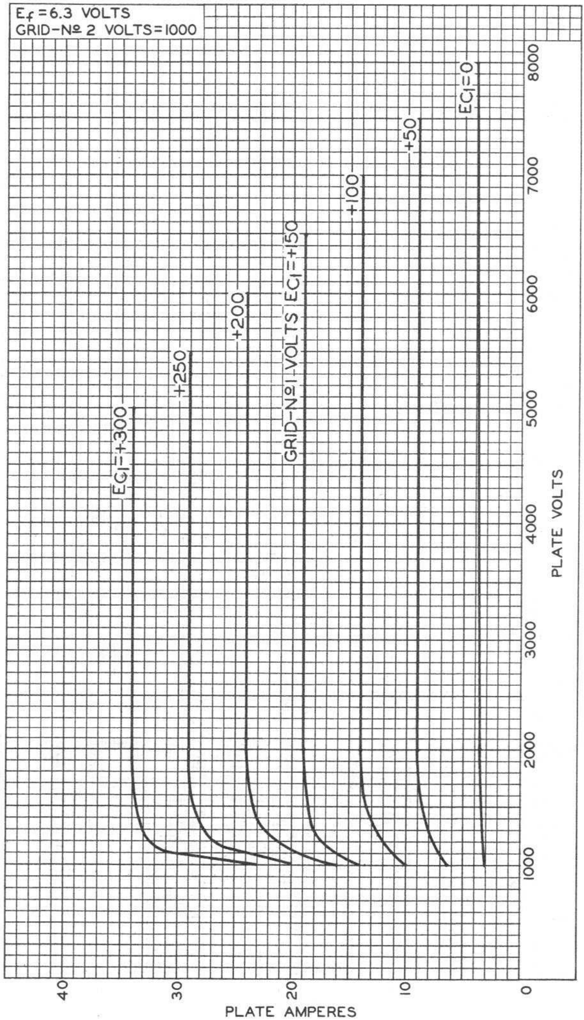
DIMENSIONAL OUTLINE,
GAUGE DRAWING, and
SUGGESTED MOUNTING ARRANGEMENT
& LAYOUT OF ASSOCIATED CONTACTS
shown under Type 7650 also apply to the 7651

TYPICAL PLATE CHARACTERISTICS



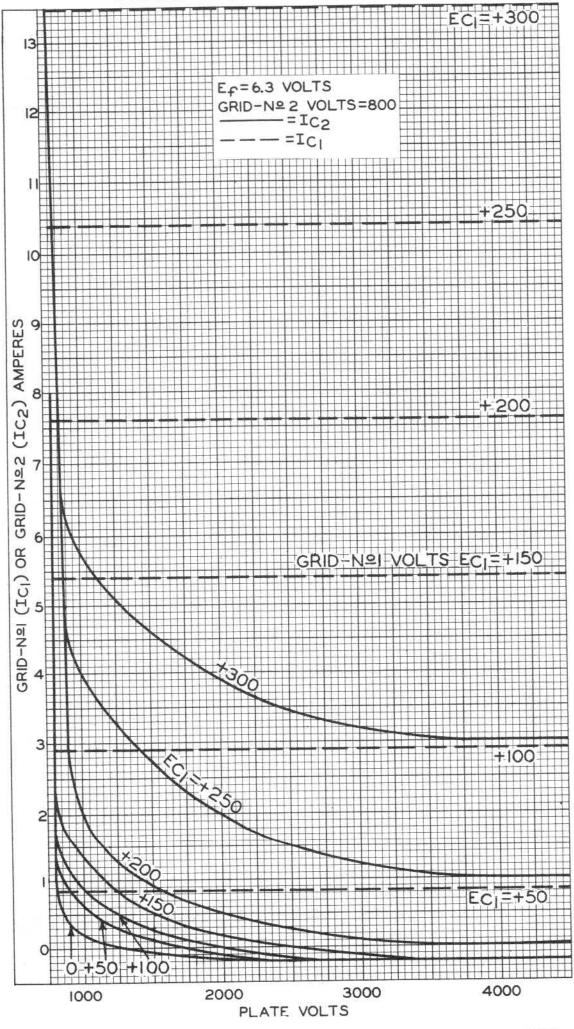
92CM-10492

TYPICAL PLATE CHARACTERISTICS



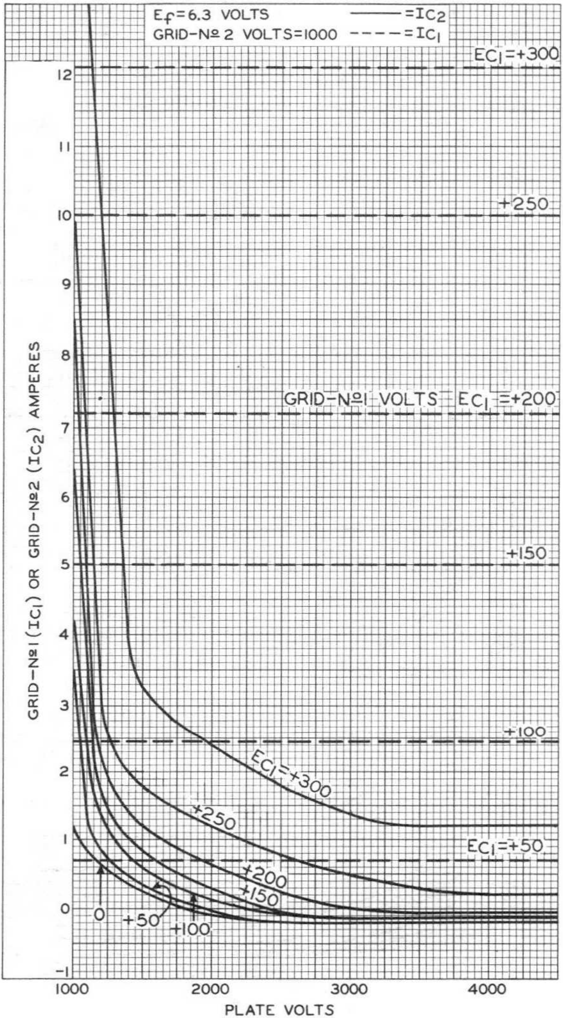
92CM-10491

TYPICAL CHARACTERISTICS



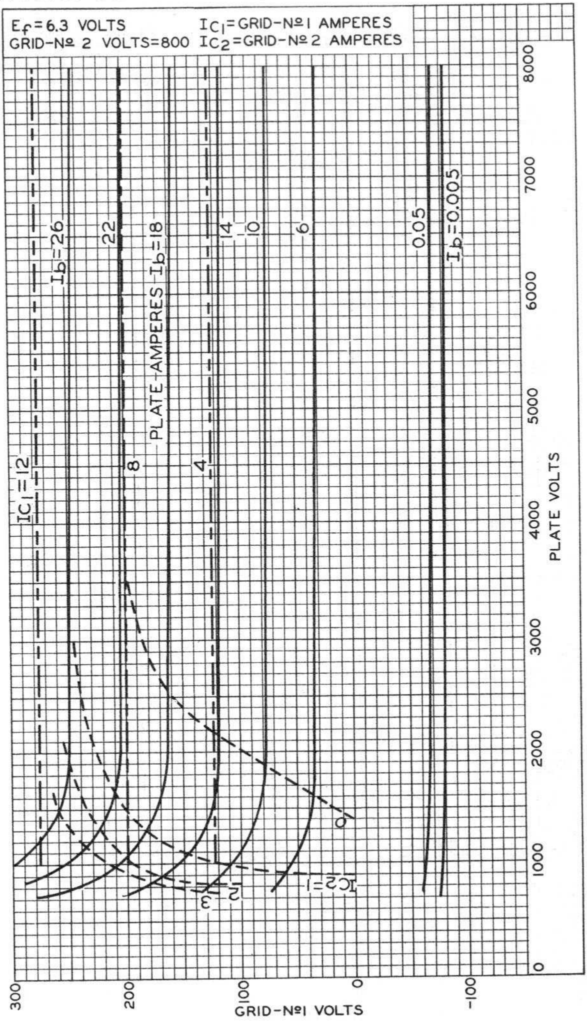
92CM-10502

TYPICAL CHARACTERISTICS



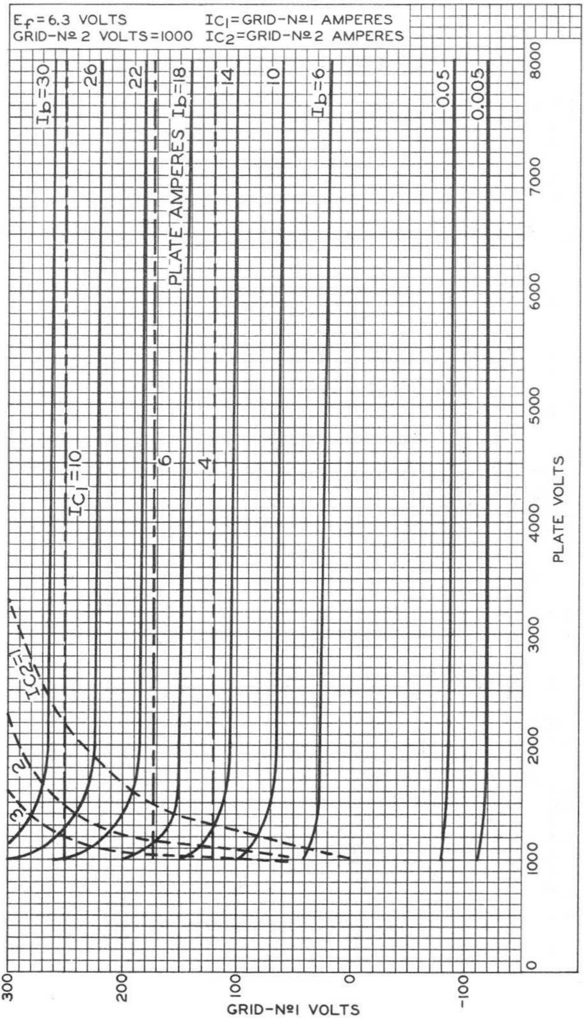
92CM-10501R1

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:

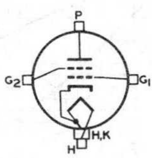
Heater, for Unipotential Cathode:		
Voltage (AC or DC)[a]	12.6 ± 10%	volts
Current at 12.6 volts	0.5	amp
Minimum heating time	40	sec
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 250, grid-No.2 volts = 250, and plate ma. = 35	30	
Direct Interelectrode Capacitances:[b]		
Grid No.1 to plate	0.025 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.

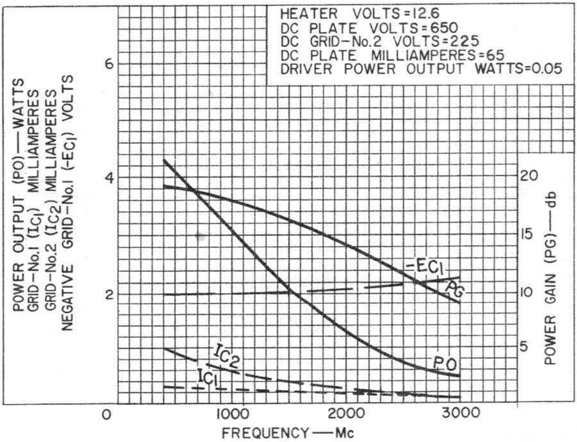
RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy
and
RF POWER AMPLIFIER — Class C FM Telephony

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

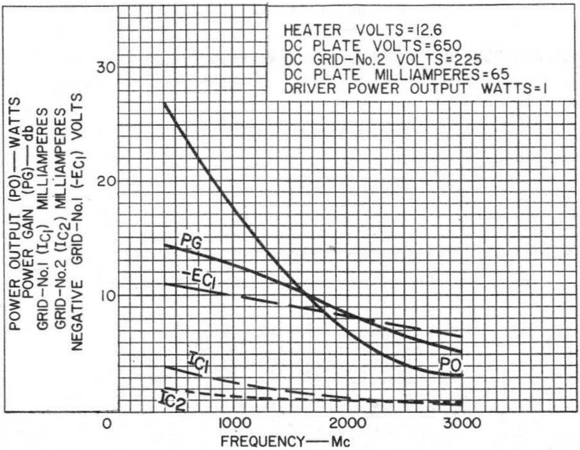
DC PLATE VOLTAGE	750	max.	volts
DC GRID-No.2 VOLTAGE	250	max.	volts
DC GRID-No.1 VOLTAGE	-100	max.	volts
DC PLATE CURRENT	70	max.	ma
DC GRID-No.1 CURRENT	15	max.	ma
PLATE INPUT	52.5	max.	watts
GRID-No.2 INPUT	2	max.	watts
PLATE DISSIPATION	d		

Typical CCS Operation in Cathode-Drive Circuit:

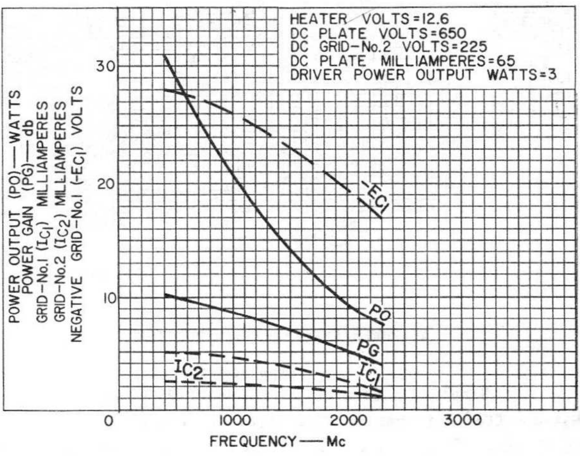
Shown Graphically in the following three Charts 92CS-10945, -10944, and -10942



92CS-10945



92CS-10944



92CS-10942

PLATE-MODULATED RF POWER AMPLIFIER — Class C Telephony

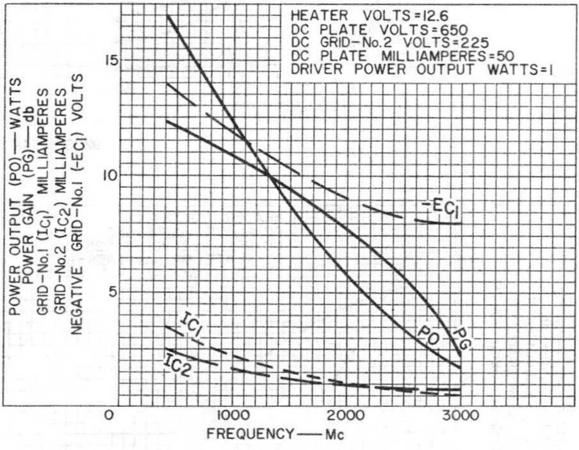
Carrier conditions per tube for use with a maximum modulation factor of 1

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[g] may be calculated from the equation:

$$K = \frac{W}{A\,\frac{(T_2 - T_1)}{L}} \qquad (1)$$

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

[g] 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:

$$K_S = \frac{W_P}{T_2 - T_1} \qquad (2)$$

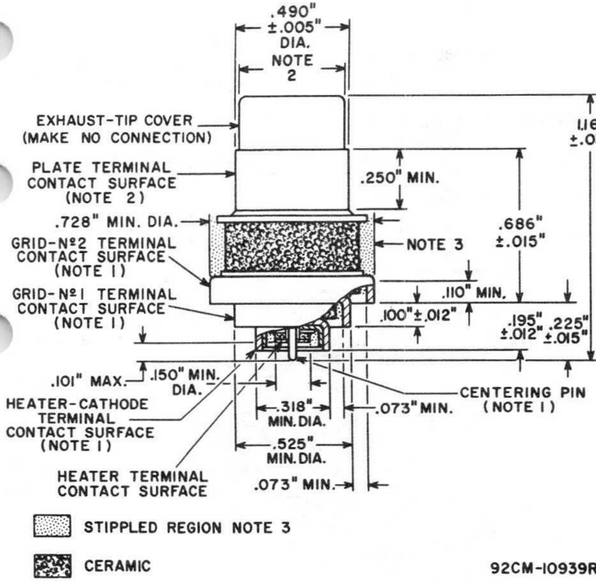
where:

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



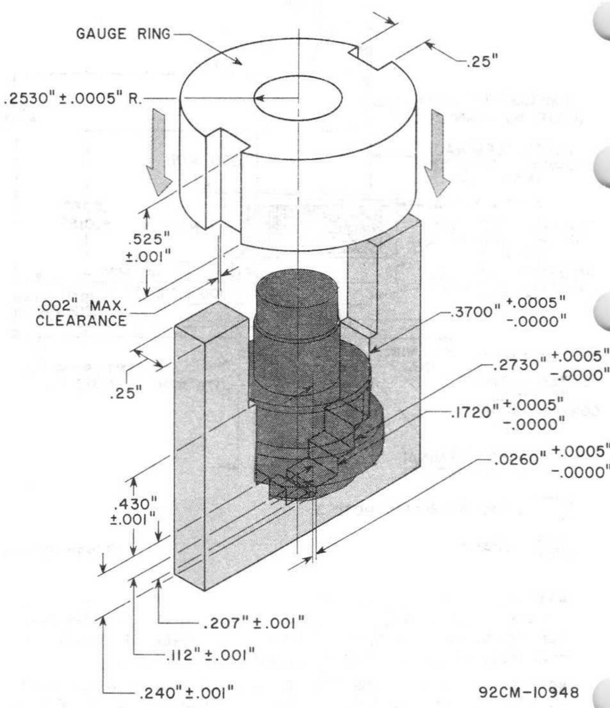
92CM-10939R1

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.

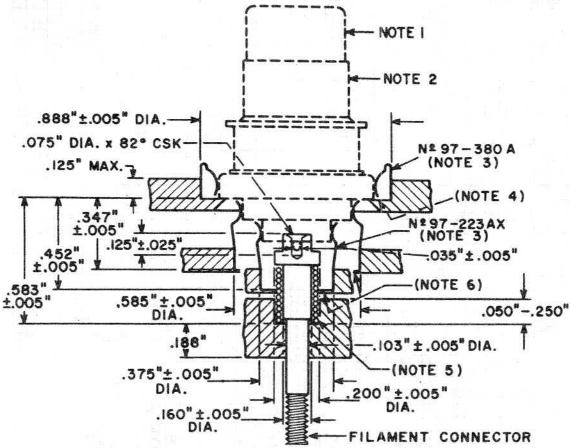
NOTE 3: KEEP ALL STIPPLED REGIONS CLEAR. DO NOT ALLOW CONTACTS OR CIRCUIT COMPONENTS TO PROTRUDE INTO THESE ANNULAR VOLUMES.

SKETCH G_1



92CM-10948

SUGGESTED MOUNTING ARRANGEMENT & LAYOUT OF ASSOCIATED CONTACTS



92CM-10938

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.

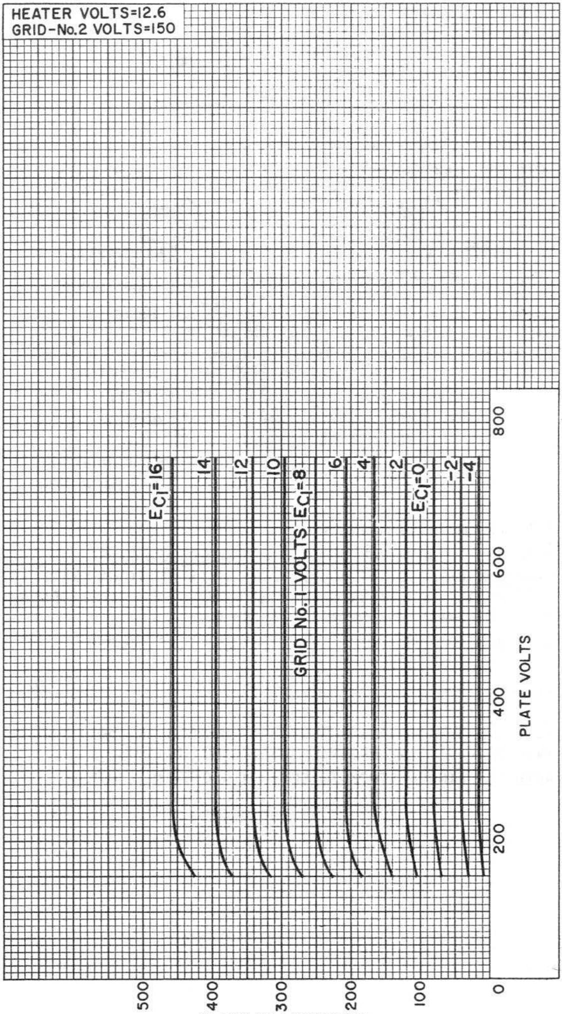
NOTE 3: MADE BY INSTRUMENTS SPECIALTIES COMPANY, LITTLE FALLS, NEW JERSEY.

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.

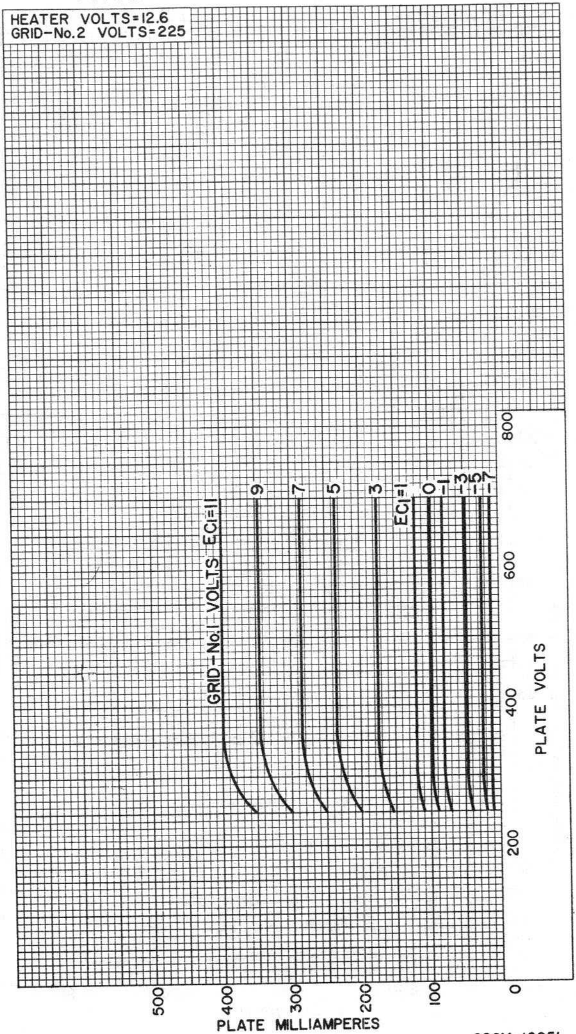
NOTE 6: FINGER STOCK TO SEAT ON 0.013-INCH LIP.

TYPICAL PLATE CHARACTERISTICS



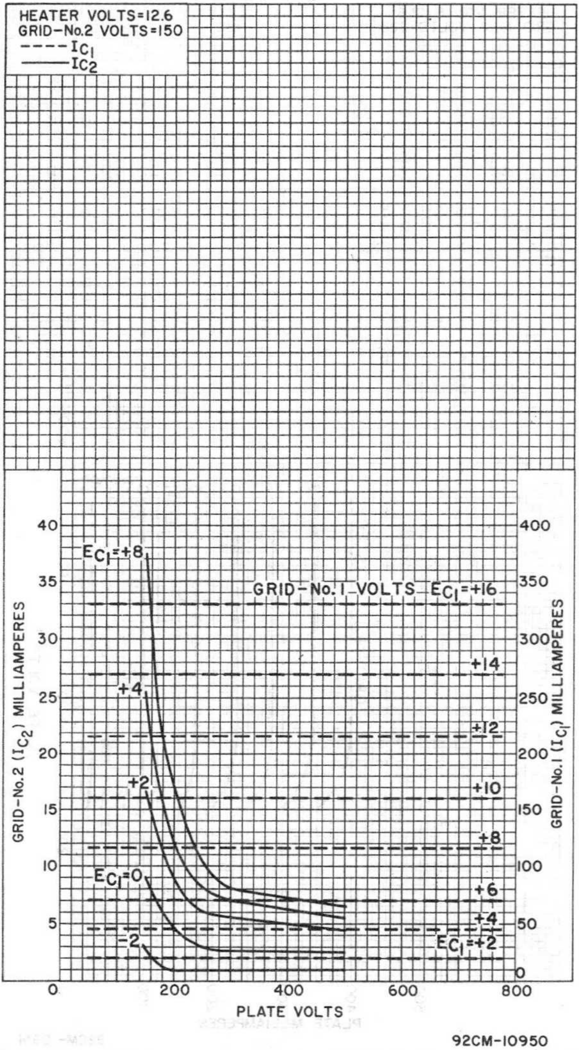
92CM-10949

TYPICAL PLATE CHARACTERISTICS



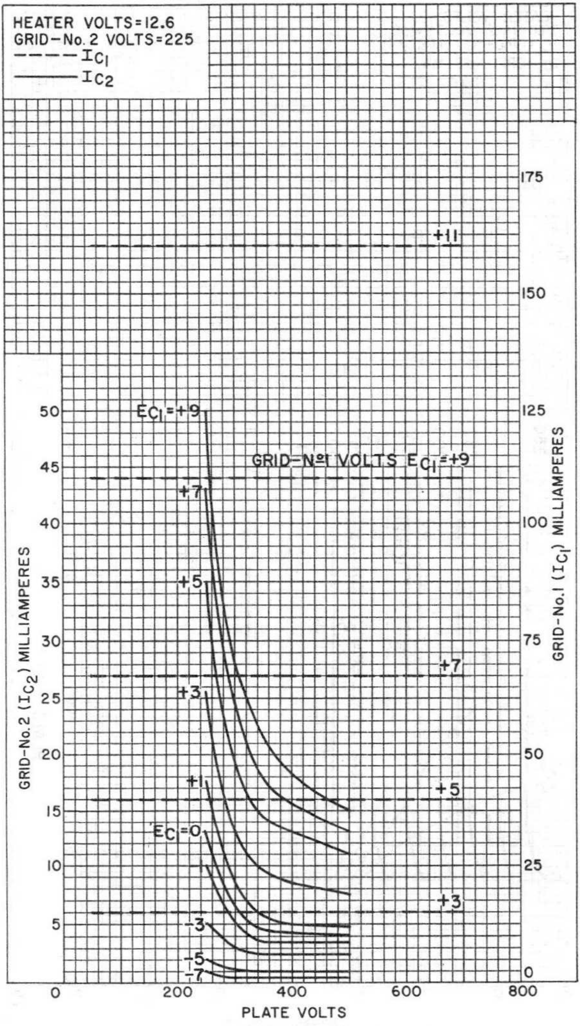
92CM-10951

TYPICAL CHARACTERISTICS



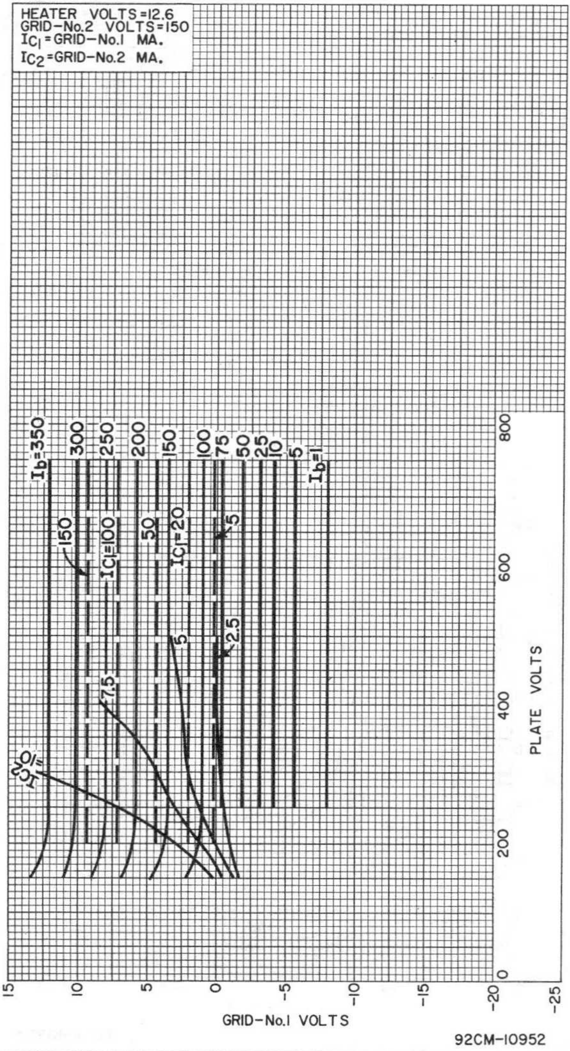
92CM-10950

TYPICAL CHARACTERISTICS



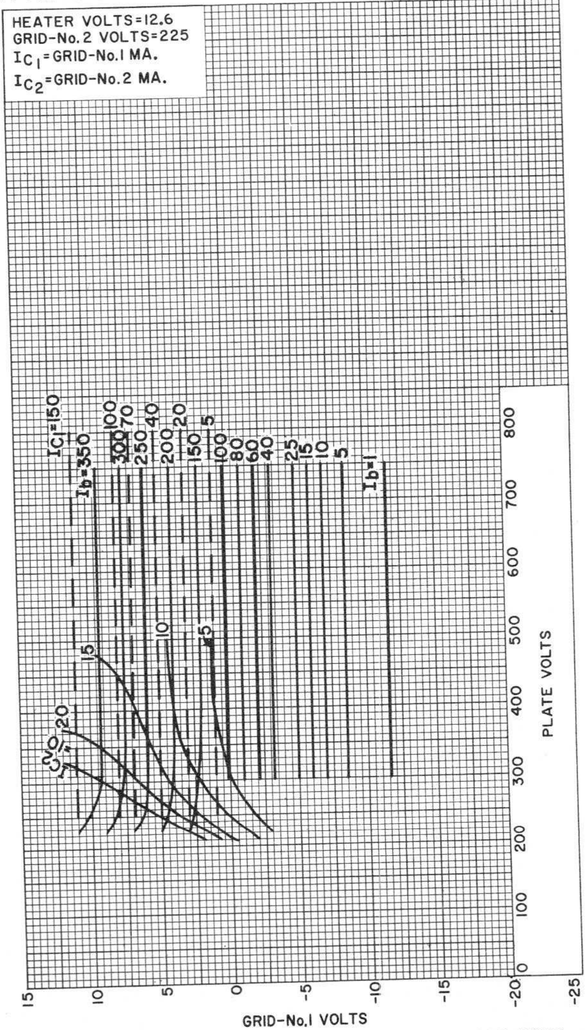
92CM-10954

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 — INTEGRAL WATER DUCTS
DOUBLE-ENDED CONSTRUCTION — 17.00 INCHES MAX. LENGTH
COAXIAL-ELECTRODE STRUCTURE — 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

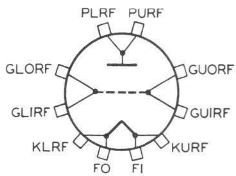


PLATE-PULSED AMPLIFIER—Class B[q]

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

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 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 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.

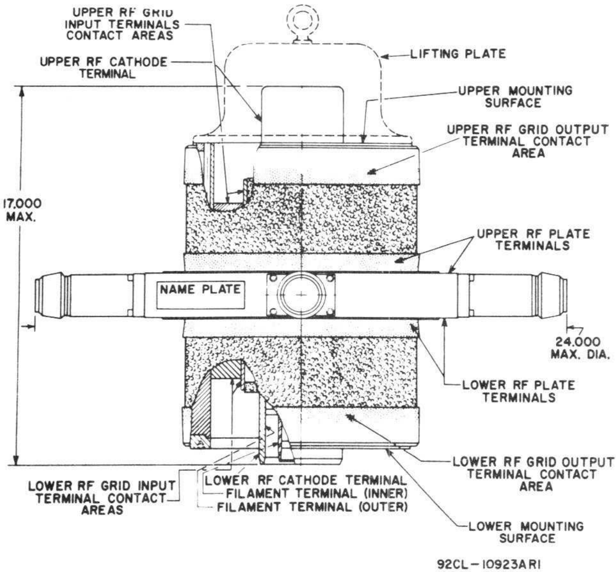
[p] See *Cooling Considerations* - Liquid Cooling.

[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



DIMENSIONS IN INCHES

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

Beam Power Tube

CERMOLOX
Matrix-Type Cathode
Conduction Cooled
Linear RF Power Amplifier

Ruggedized
80 Watts CW Power Output at 400 MHz
40 Watts CW Power Output at 1215 MHz

ELECTRICAL

Heater for Matrix-Type, Oxide-Coated, Unipotential Cathode:

Voltage (ac or dc)	6.3 ± 10%	V
Current at 26.5 volts	3.2	A
Minimum heating time	60	s
Mu-Factor, Grid No.2 to Grid No.1	18	

MAXIMUM CCS RATINGS, Absolute-Maximum Values

	Up to 1215 MHz	
DC Plate Voltage	1000	V
DC Grid-No.2 Voltage	300	V
DC Grid-No.1 Voltage	−100	V
DC Plate Current	180	mA
Plate Dissipation	115	W

MECHANICAL

Operating Position	Any
Weight (Approx.)	2 oz (0.06 kg)

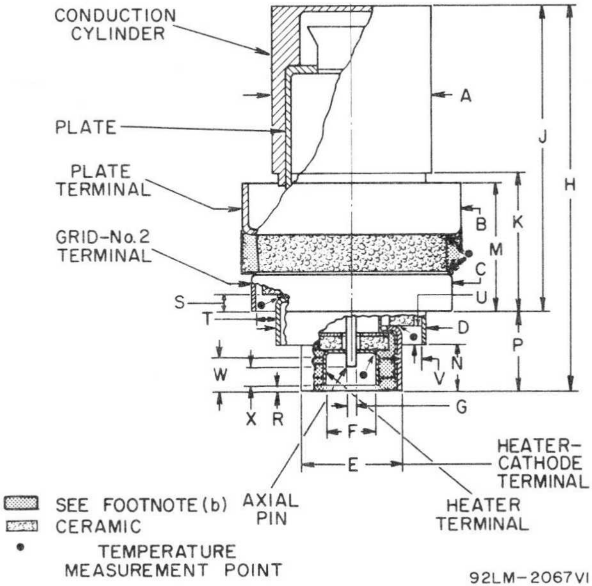
THERMAL[a]

Terminal Temperature (Plate, grid No.2, grid No.1, cathode, and heater)	250 max.	°C
Plate-Core Temperature	250 max.	°C

[a] See *Dimensional Outline* for temperature-measurement points.
b Keep all stippled regions clear. Do not allow contacts or circuit components to protrude into these annular volumes.

Detailed performance and application information is available through your RCA Sales Office, Distributor, or write to RCA Commercial Engineering, Harrison, NJ 07029.

DIMENSIONAL OUTLINE



DIMENSION	INCHES	MILLIMETERS	DIMENSION	INCHES	MILLIMETERS
A	0.900 ±.005	22.86 ± .1	M	0.66 ±.02	16.76 ± .51
B	1.085 Min.	27.56 Min.	N	0.175 ±.015	4.45 ± .38
C	0.985 Min.	25.02 Min.	P	0.37 ±.02	9.40 ± .51
D	0.735 Min.	18.67 Min.	R	0.025 ±.025	0.64 ± .64
E	0.480 Min.	12.32 Min.	S	0.06 Min.	1.52 Min.
F	0.260 Max.	6.60 Max.	T	0.09 Min.	2.29 Min.
G	0.062 Max.	1.57 Max.	U	0.12 Min.	3.05 Min.
H	1.88 ±.05	47.75 ± 1.27	V	0.095 Min.	2.41 Min.
J	1.51 ±.03	38.35 ± .76	W	0.10 Min.	2.54 Min.
K	0.730 ±.02	18.54 ± .51	X	0.054 Min.	1.37 Min.

Beam Power Tube

CERMOLOX

Oxide-Coated Cathode
Conduction Cooled

Linear RF Power Amplifier

80 Watts CW Power Output at 400 MHz

40 Watts CW Power Output at 1215 MHz

ELECTRICAL

Heater for Oxide-Coated Unipotential Cathode:

Voltage (ac or dc)	26.5 ± 10%
Current at 26.5 volts	0.5 A
Minimum heating time	60 s
Mu-Factor, Grid No.2 to Grid No.1	18

MAXIMUM CCS RATINGS, Absolute-Maximum Values

	Up to 1215 MHz:	
DC Plate Voltage	1000	V
DC Grid-No.2 Voltage	300	V
DC Grid-No.1 Voltage	-100	V
DC Plate Current	180	mA
Plate Dissipation	115	W

MECHANICAL

Operating Position	Any
Weight (Approx.)	2 oz (0.06 kg)

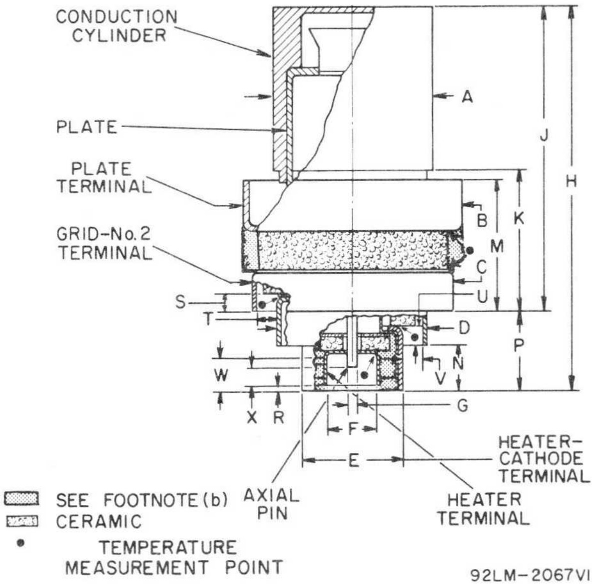
THERMAL[a]

Terminal Temperature (Plate, grid No.2, grid No.1, cathode, and heater)	250 max. °C
Plate-Core Temperature	250 max. °C

[a] See *Dimensional Outline* for temperature measurement points.
[b] Keep all stippled regions clear. Do not allow contacts or circuit components to protrude into these annular volumes.

Detailed performance and application information is available through your RCA Sales Office, Distributor, or write to RCA Commercial Engineering, Harrison, NJ 07029.

DIMENSIONAL OUTLINE



DIMENSION	INCHES	MILLIMETERS	DIMENSION	INCHES	MILLIMETERS
A	0.900 ± .005	22.86 ± .1	M	0.66 ± .02	16.76 ± .51
B	1.085 Min.	27.56 Min.	N	0.175 ± .015	4.45 ± .38
C	0.985 Min.	25.02 Min.	P	0.37 ± .02	9.40 ± .51
D	0.735 Min.	18.67 Min.	R	0.025 ± .025	0.64 ± .64
E	0.480 Min.	12.32 Min.	S	0.06 Min.	1.52 Min.
F	0.260 Max.	6.60 Max.	T	0.09 Min.	2.29 Min.
G	0.062 Max.	1.57 Max.	U	0.12 Min.	3.05 Min.
H	1.88 ± .05	47.75 ± 1.27	V	0.095 Min.	2.41 Min.
J	1.51 ± .03	38.35 ± .76	W	0.10 Min.	2.54 Min.
K	0.730 ± .02	18.54 ± .51	X	0.054 Min.	1.37 Min.

Beam Power Tube

CERAMIC-METAL SEALS
"ONE-PIECE" ELECTRODE DESIGN
CONDUCTION COOLED
COAXIAL-ELECTRODE STRUCTURE

52.5-WATTS CW INPUT
27-WATTS CW OUTPUT AT 400 Mc
15-WATTS CW OUTPUT AT 1200 Mc
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.

RCA

8008

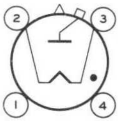
HALF-WAVE MERCURY-VAPOR RECTIFIER

The 8008 is the same as the 872-A except for the following items:

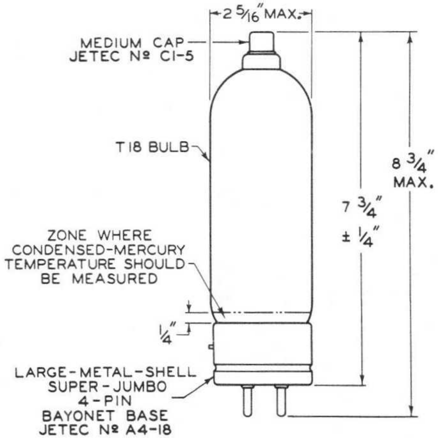
Mechanical:

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.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

8013-A

HALF-WAVE VACUUM RECTIFIER

GENERAL DATA

Electrical:

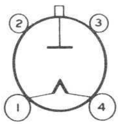
Filament, Thoriated Tungsten:

	Min.	*Av.*	*Max.*	
Voltage	2.37	2.50	2.63	ac volts
Current at 2.50 volts . . .	4.7	5.0	5.3	amp

Mechanical:

Mounting Position . . Any, preferably vertical with base down
Maximum Overall Length. . . . . 6-1/16"
Seated Length . . . . 5-9/32" ± 5/32"
Maximum Diameter. 2-1/16"
Weight (Approx.). 2.9 oz
Bulb. ST-16
Cap . . . . Skirted Medium with Rolled Edge (JETEC No. C1-19)
Base. . . . . Medium-Shell Small 4-Pin (JETEC No. A4-9)
Basing Designation for BOTTOM VIEW. 4P

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



Pin 4 - Filament
Cap - Plate

HALF-WAVE RECTIFIER

Maximum Ratings, *Absolute Values:*

PEAK PLATE VOLTAGE:			
Forward	40000▲	max.	volts
Inverse	40000▲	max.	volts
PLATE CURRENT:			
Peak.	150	max.	ma
Average	20	max.	ma
Fault	500	max.	ma
PLATE DISSIPATION	12	max.	watts

OPERATING CONSIDERATIONS

Filament and *plate voltage* may be applied simultaneously to the 8013-A.

The *bulb* of the 8013-A should be cleaned regularly. Accumulation of dust or other foreign matter on the bulb will cause leakage and, as a result, probably tube failure.

X-rays are produced during normal operation of the 8013-A. 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 it provides the required protection to the operator.

▲This value may be increased to 55000 volts when the 8013-A is immersed in oil.

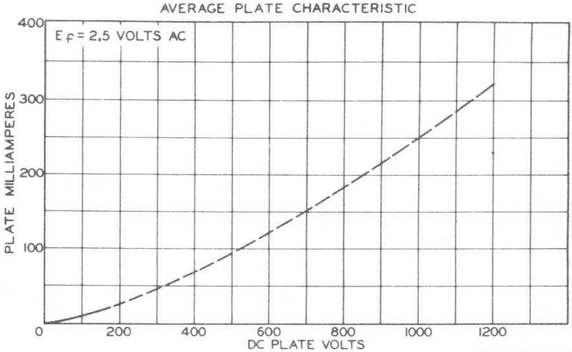
← Indicates a change.

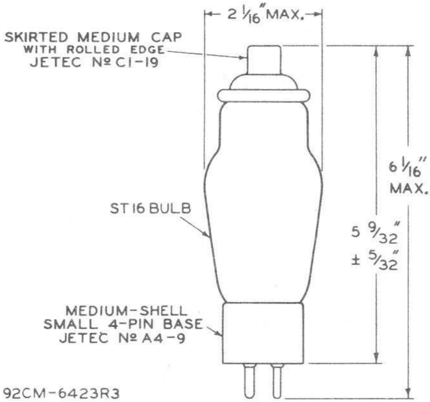
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

8013-A

HALF-WAVE VACUUM RECTIFIER





8020

RCA

8020

HALF-WAVE HIGH-VACUUM RECTIFIER

DATA

Electrical:

Filament, Thoriated Tungsten:		
Voltage	5	volts
Current	5.5 – 6.5	amp
Direct Interelectrode Capacitance:		
Anode to Filament	1.4	μμf
Tube Voltage Drop at 100 ma.	200	volts

Mechanical:

Mounting Position	Vertical, Base Down
Overall Length	7-1/2" ± 1/2"
Maximum Diameter	2-5/16"
Bulb	T-18
Cap	Medium
Base	Medium 4-Pin, Bayonet

RECTIFIER SERVICE

Maximum Ratings, Absolute Values:

PEAK INVERSE ANODE VOLTAGE	40000 max.	volts
PEAK ANODE CURRENT	750 max.	ma.
AVERAGE ANODE CURRENT	100 max.	ma.

SURGE - LIMITING DIODE SERVICE

Maximum Ratings, Absolute Values:

FILAMENT VOLTAGE	5.8 max.	volts
PEAK FORWARD ANODE VOLTAGE	12500 max.	volts
AVERAGE ANODE DISSIPATION	75 max.	watts

Typical Operation:

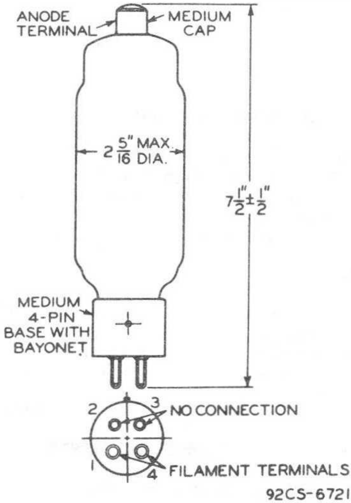
Filament Voltage	5.5	volts
Peak Forward Anode Voltage	10000	volts
Minimum Peak Anode Current	2	amp

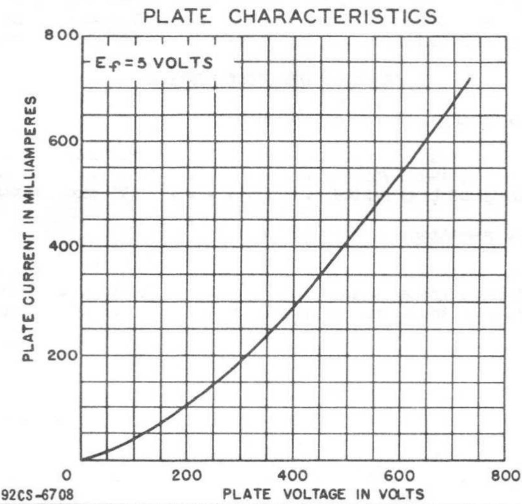
8020

RCA

8020

HALF-WAVE HIGH-VACUUM RECTIFIER





Beam Power Tube

CERAMIC-METAL SEALS
CONDUCTION COOLED

COAXIAL-ELECTRODE STRUCTURE
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

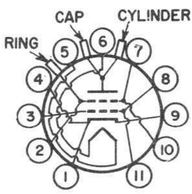
Mechanical:

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 Grid-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[m]	110[m]	70[m]	105[m]	85[m]	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 rati.g 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:

$$K_S = \frac{W_P}{T_2 - T_1} \tag{2}$$

where;

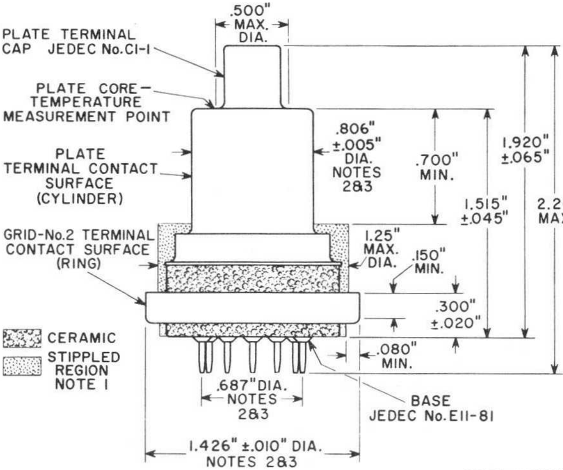
K_S = thermal conductance of the system

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

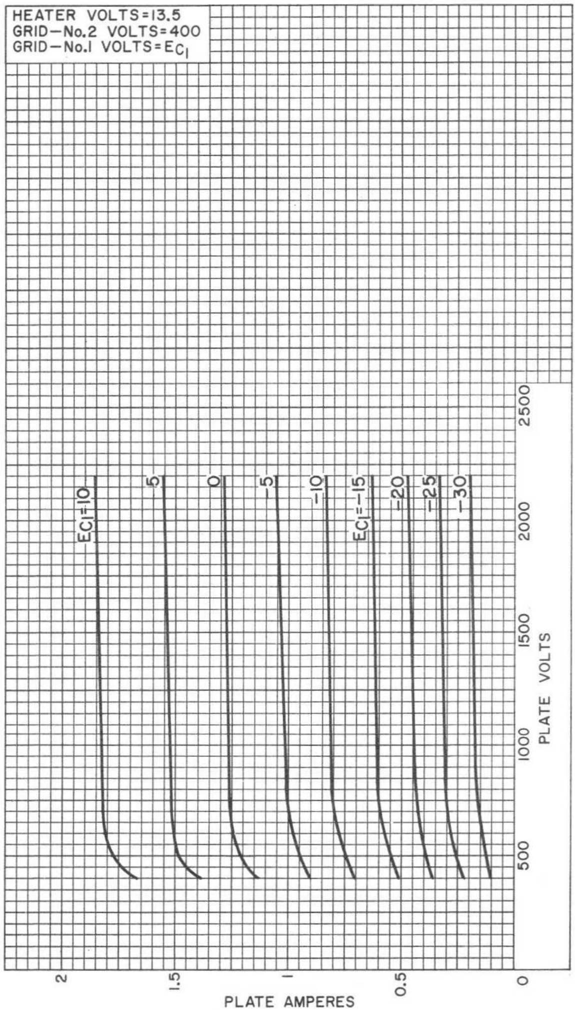
NOTE 1: KEEP ALL STIPPLED REGIONS CLEAR. DO NOT ALLOW CONTACTS OR CIRCUIT COMPONENTS TO PROTRUDE INTO THESE ANNULAR VOLUMES.

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"

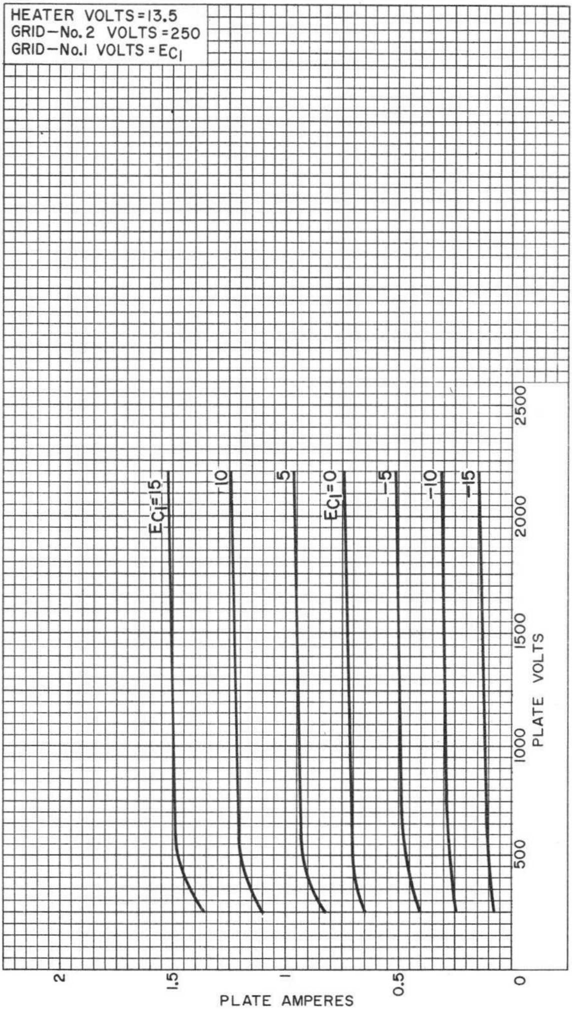
NOTE 3: THE FULL INDICATOR READING IS THE MAXIMUM DEVIATION IN RADIAL POSITION OF A SURFACE WHEN THE TUBE IS COMPLETELY ROTATED ABOUT THE CENTER OF THE REFERENCE SURFACE. IT IS A MEASURE OF THE TOTAL EFFECT OF RUN-OUT AND ELLIPTICITY.

TYPICAL PLATE CHARACTERISTICS



92CM—11290

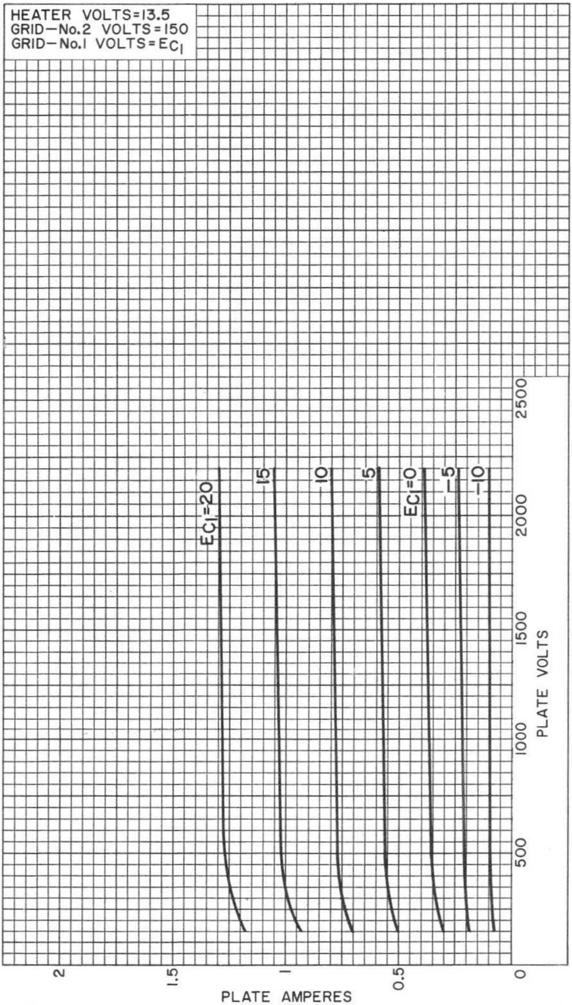
TYPICAL PLATE CHARACTERISTICS



92CM—11288

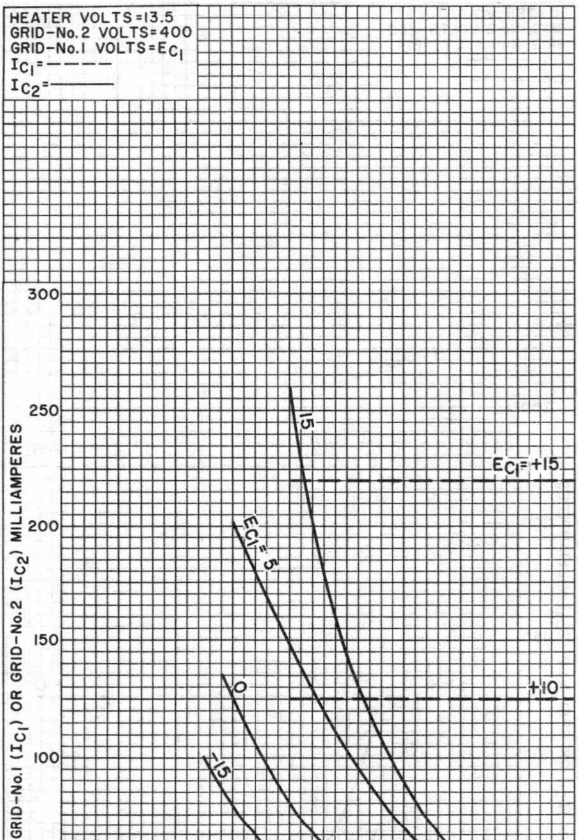
8072

TYPICAL PLATE CHARACTERISTICS



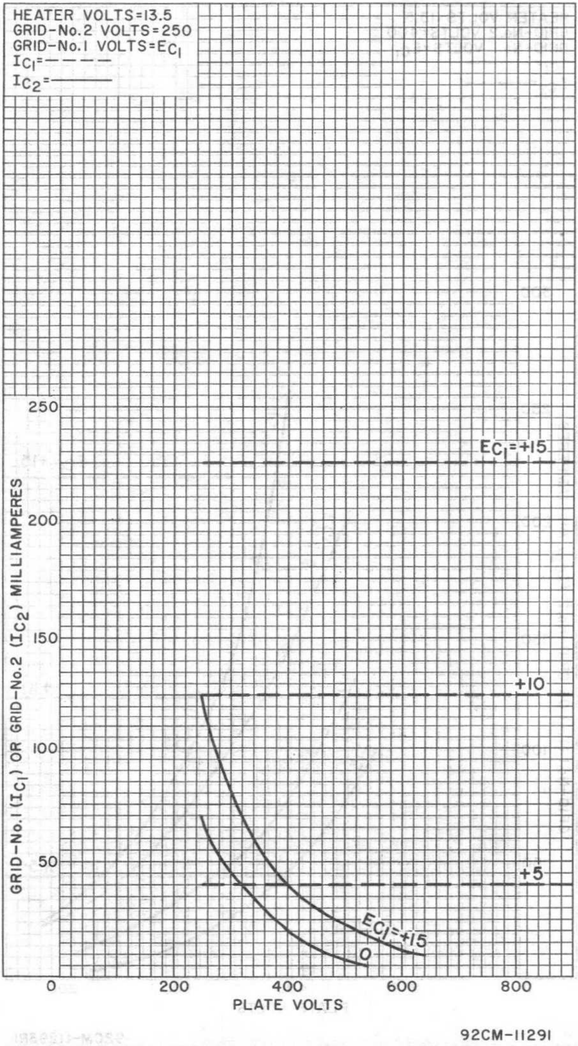
92CM—11289

TYPICAL CHARACTERISTICS



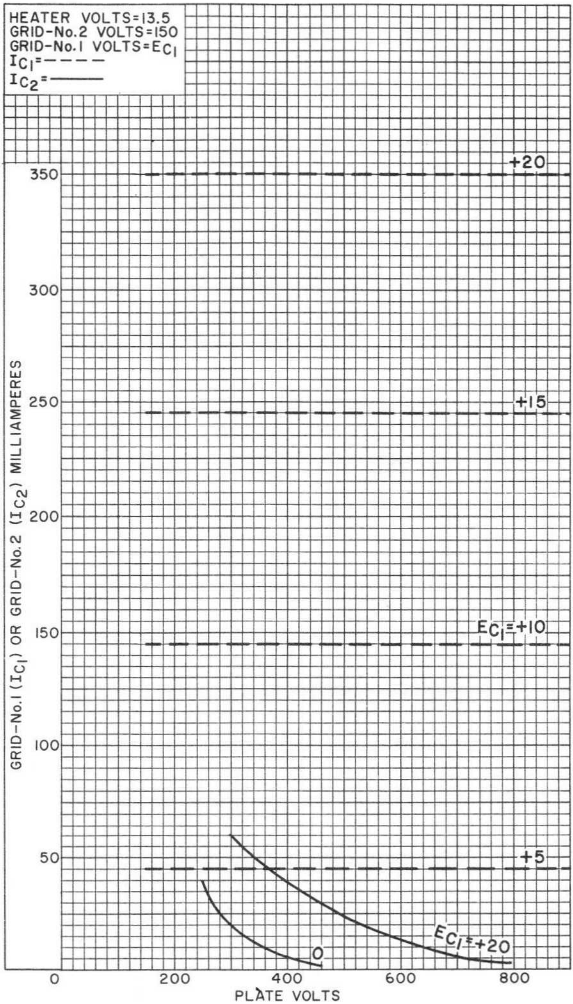
92CM-11293R1

TYPICAL CHARACTERISTICS



92CM-11291

TYPICAL CHARACTERISTICS



92CM-11292

Beam Power Tube

FORCED-AIR COOLED

CERAMIC-METAL SEALS	170 WATTS PEP OUTPUT AT 30 MHz
COAXIAL-ELECTRODE STRUCTURE	235 WATTS CW OUTPUT AT 470 MHz
UNIPOTENTIAL CATHODE	INTEGRAL RADIATOR

Full Ratings up to 500 MHz

ELECTRICAL

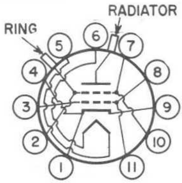
Heater, for Unipotential Cathode		
Voltage (AC or DC)[a]	13.5 ± 10%	V
Current at 13.5 volts.	1.3	A
Minimum heating time	60	s
Mu-Factor, Grid No.2 to Grid No.1.	12	
Plate volts = 450, grid No.2 volts = 325, plate A = 1.2		
Direct Interelectrode Capacitances[b]		
Grid No.1 to plate	0.13 max	pF
Grid No.1 to cathode	16	pF
Plate to cathode	0.011	pF
Grid No.1 to grid No.2	24	pF ←
Grid No.2 to plate	6.5	pF
Grid No.2 to cathode	2.6	pF ←
Cathode to heater.	3.4	pF

MECHANICAL

Operating Position	Any
Maximum Overall Length	2.196 in
Seated Length.	1.850 ± 0.065 in
Greatest Diameter.	1.460 ± 0.015 in ←
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 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[d] – Grid-No.2 Terminal Contact Surface

THERMAL

Terminal Temperature (All Terminals)	250	°C
Radiator Core Temperature		
See *Dimensional Outline*.	250	°C
Air Flow		
See accompanying *Typical Cooling Requirements* curve.		

← Indicates a change.

LINEAR RF POWER AMPLIFIER

Single-Sideband Suppressed-Carrier Service

Peak envelope conditions for a singlehaving a minimum peak-to-average power ratio of 2

Maximum CCS Ratings, Absolute-Maximum Values

	Up to 500 MHz	
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

Typical CCS Operation with "Two-Tone Modulation"

	At 30 MHz		
DC Plate Voltage	1000	1500	V
DC Grid-No.2 Voltage[f]	250	250	V
DC Grid-No.1 Voltage[f]	-20	-20	V
Zero-Signal DC Plate Current	100	100	mA
Effective RF Load Resistance	2270	3800	Ω
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	W
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]	W
Average	55[k]	85[k]	W

Maximum Circuit Values

Grid-No.1-Circuit Resistance Under Any Condition		
With fixed bias	25000	Ω
With fixed bias (In Class AB_1 operation)	100000	Ω
With cathode bias	Not recommended	
Grid-No.2-Circuit Impedance	10000	Ω
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 MHz	
→ DC Plate Voltage	1800	V
DC Grid-No.2 Voltage	400	V
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
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode	150	V
Heater positive with respect to cathode	150	V

Typical CCS Operation

In grid-drive circuit at frequency of	*50*			*470*			*MHz*
DC Plate Voltage	700	1000	1500	700	1000	1500	V
DC Grid-No.2 Voltage	175	200	200	200	200	200	V
DC Grid-No.1 Voltage	-10	-30	-30	-30	-30	-30	V
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.)[h]	1.2	2	2	5	5	5	W
Useful Power Output	120[k]	175[k]	275[k]	100[p]	165[p]	235[p]	W

Maximum Circuit Values

Grid-No.1-Ciruit Resistance Under Any Condition		
With fixed bias	25000 max	Ω
Grid-No.2-Circuit Impedance	10000 max	Ω
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 MHz, 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.

→ Indicates a change.

[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 as the input to the grid circuit. It will vary depending upon the frequency of operation and the circuit used.

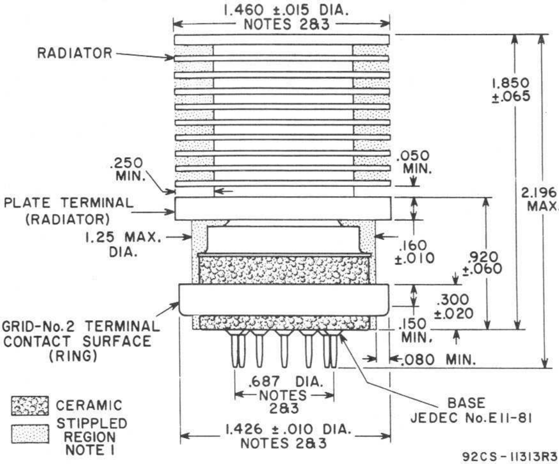
[p] Measured in a typical coaxial-cavity circuit.

CHARACTERISTICS RANGE VALUES

Test No.	*Note*	*Min*	*Max*	
1. Heater Current	1	1.15	1.45	A
2. Direct Interelectrode Capacitances	2			
Grid No.1 to plate	-	-	0.13	pF
Grid No.1 to cathode	-	14.3	17.7	pF
Plate to cathode	-	0.0065	0.0155	pF
Grid No.1 to grid No.2	-	20.8	25.2	pF
Grid No.2 to plate	-	5.7	7.1	pF
Grid No.2 to cathode	-	2.0	3.0	pF
Cathode to heater	-	2.5	4.1	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	-	MΩ

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 p/s. 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.

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

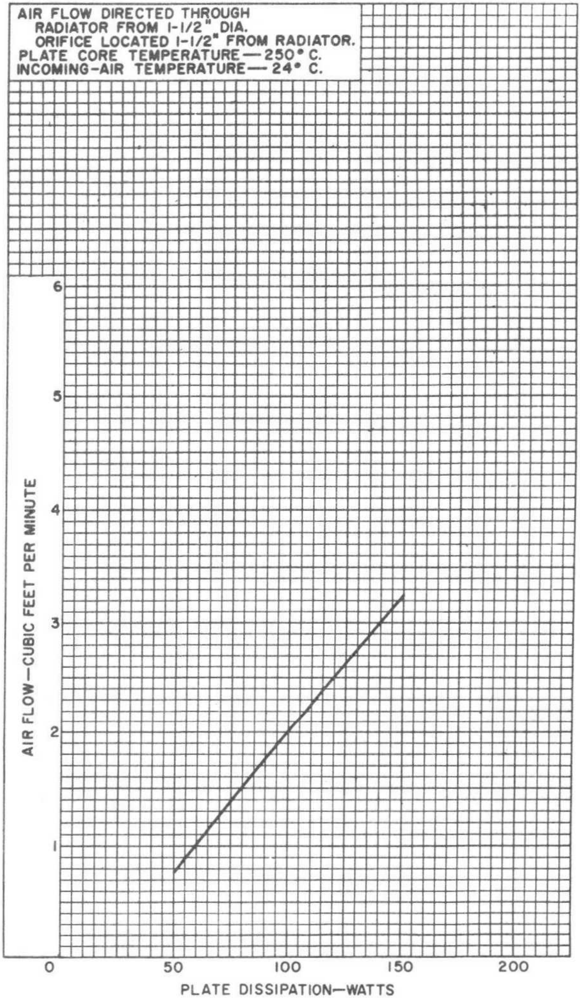
Note 1: Keep all stippled regions clear. Do not allow contacts or circuit components to protrude into these annular volumes.

Note 2: The diameters of the 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 inch max
Radiator to Pin Circle	0.040 inch max
Grid-No.2 Terminal Contact Surface to Pin Circle	0.030 inch 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.

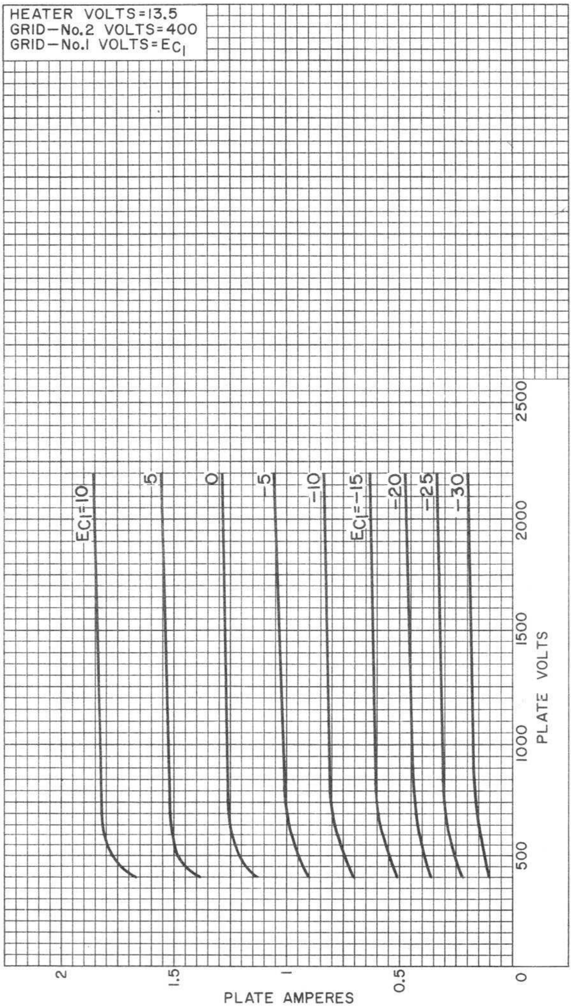
TYPICAL COOLING REQUIREMENTS



92CM-11298

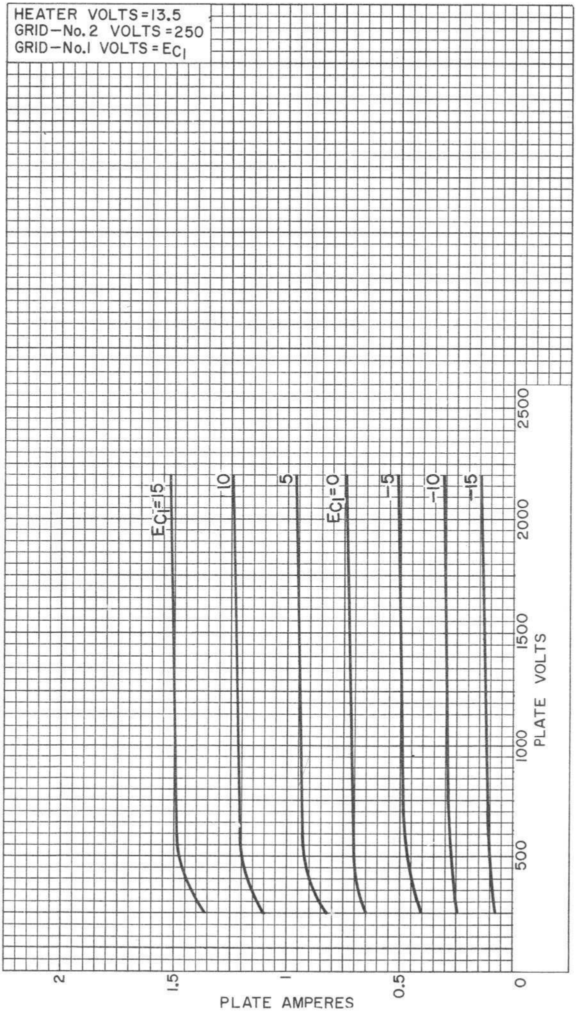
RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

TYPICAL PLATE CHARACTERISTICS



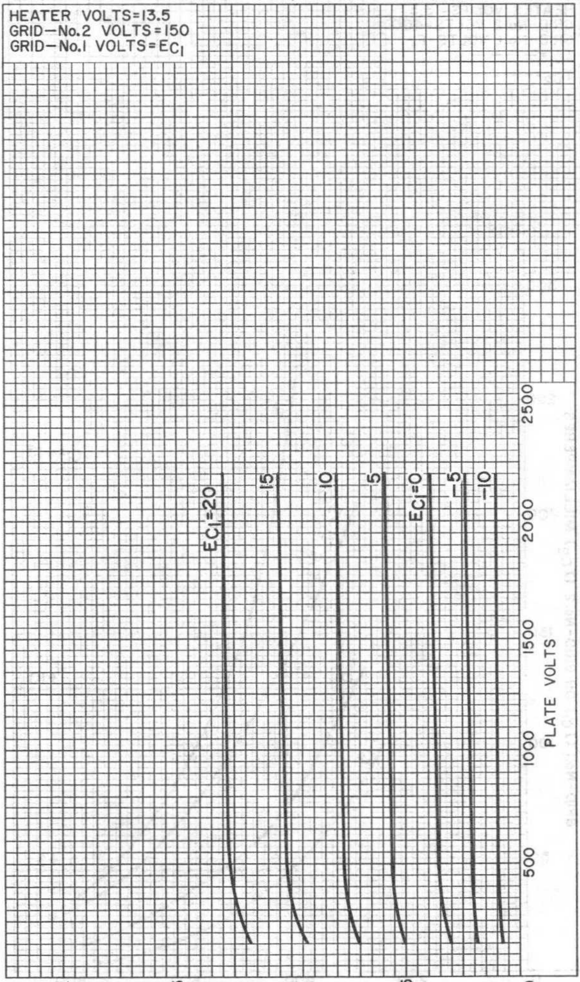
92CM—11290

TYPICAL PLATE CHARACTERISTICS



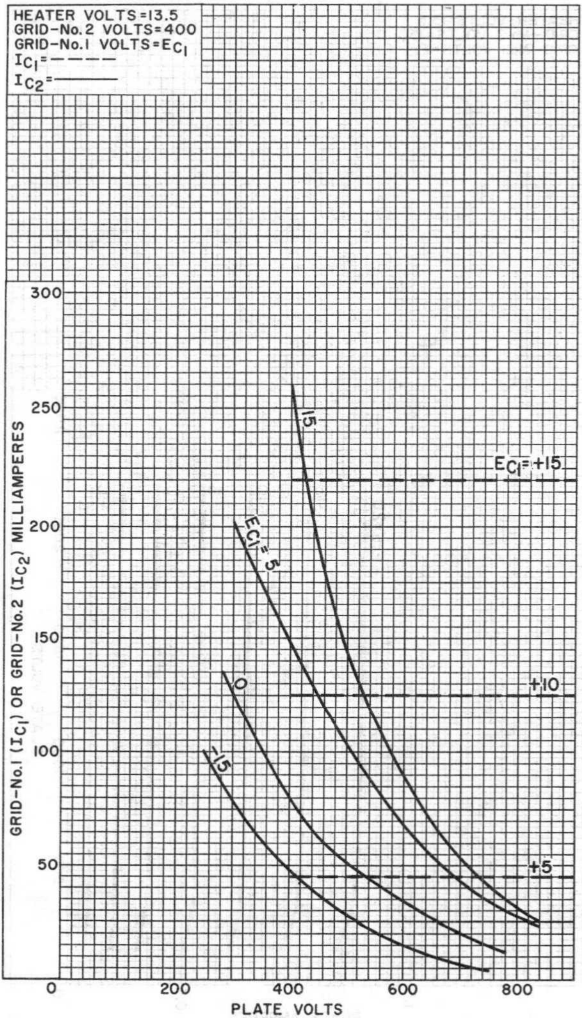
92CM—11288

TYPICAL PLATE CHARACTERISTICS



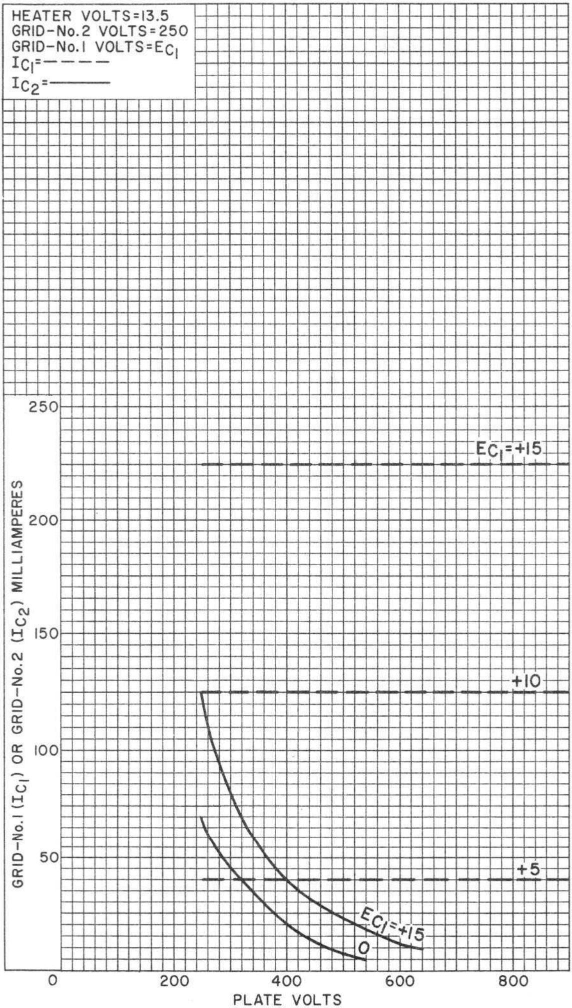
92CM–11289

TYPICAL CHARACTERISTICS



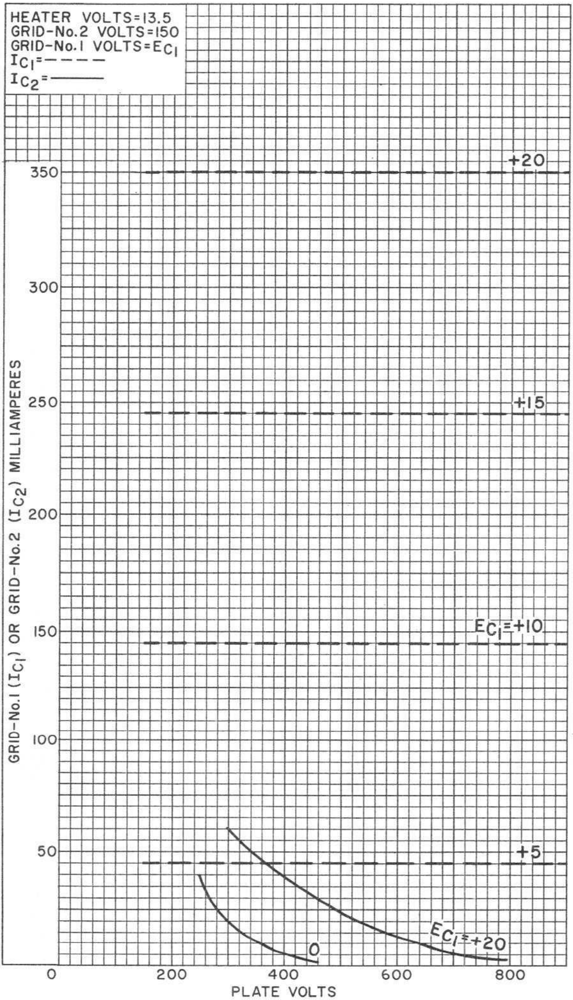
92CM-11293R1

TYPICAL CHARACTERISTICS



92CM-11291

TYPICAL CHARACTERISTICS



92CM-11292

Beam Power Tube

FORCED-AIR COOLED
CERAMIC-METAL SEALS
COAXIAL ELECTRODE STRUCTURE
UNIPOTENTIAL CATHODE

INTEGRAL RADIATOR
380 WATTS PEP OUTPUT AT 30 MHz AB_1
570 WATTS PEP OUTPUT AT 30 MHz AB_2
300 WATTS CW OUTPUT AT 470 MHz

For Use as an RF Power Amplifier, Oscillator, Regulator, Distributed Amplifier or Linear RF Power Amplifier in Mobile or Fixed Equipment

ELECTRICAL

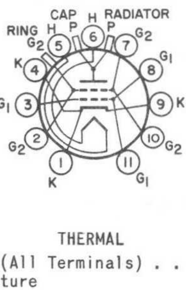
Heater, for Unipotential Cathode[p]		
Voltage (AC or DC)[a]	13.5 ± 10%	V
Current at 13.5 volts	1.3	A
Minimum heating time	60	s
Mu-Factor, Grid No.2 to Grid No.1	12	
Plate volts = 450, grid-No.2 volts = 325, plate amperes = 1.2		
Direct Interelectrode Capacitances[b]		
Grid No.1 to plate	0.13 max	pF
Grid No.1 to cathode	16	pF
Plate to cathode	0.011	pF
Grid No.1 to grid No.2	24	pF
Grid No.2 to plate	7	pF
Grid No.2 to cathode	2.6	pF
Cathode to heater	3.4	pF

MECHANICAL

Operating Position . . . . . Any
Maximum Overall Length . . . . . 2.26 in
Seated Length . . . . . 1.920 ± 0.065 in
Diameter . . . . . 1.625 ± 0.015 in
Weight (Approx.) . . . . . 3.5 oz
Socket . . . . . Erie[c] No.9802-000 and 9804-000, Johnson[d] No.124-311-110, Mycalex[e] No.CP464-2, or equivalent
Grid No.2 Bypass Capacitor . . . . Erie[c] No.2943-002, Johnson[d] No.124-121, or equivalent
Base . . Large-Wafer Elevenar 11-Pin with Ring (JEDEC No.E11-81)

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
CAP – Plate Terminal
RADIATOR – Plate Terminal
RING – Grid-No.2 Terminal Contact Surface (For use at higher frequencies)

THERMAL

Terminal Temperature (All Terminals) . . . . . 250 max °C
Radiator Core Temperature
See *Dimensional Outline* . . . . . 250 max °C
Air Flow[q] (See accompaying *Typical Cooling Requirements* curve).

LINEAR RF POWER AMPLIFIER[r]

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		
Up to 30 MHz	3000[f]	V
Up to 500 MHz	2200	V
	Up to 500 MHz	
DC Grid-No.2 Voltage	400	V
DC Grid-No.1 Voltage	-100	V
DC Plate Current at Peak of Envelope	450[g]	mA
DC Grid-No.1 Current	100	mA
Plate Dissipation	400	W
Grid-No.2 Dissipation	8	W
Peak Heater-Cathode Voltage	±150	V

Typical CCS Operation at 30 MHz with "Two-Tone Modulation"

	AB_1	AB_2	
DC Plate Voltage	2000	2500	V
DC Grid-No.2 Voltage	400	400	V
DC Grid-No.1 Voltage	-35	-35	V
Zero-Signal DC Plate Current	100	115	mA
Effective RF Load Resistance	3050	3500	Ω
DC Plate Current			
Peak of envelope	335	400	mA
Average	250	275	mA
DC Grid-No.2 Current			
Peak of envelope	10	6	mA
Average	7	4	mA
Average DC Grid-No.1 Current	0.05[h]	3	mA
Peak-of-Envelope Driver Power Output (Approx.)	0.3	0.5	W
Output-Circuit Efficiency (Approx.)	90	90	%
Distortion Products Level			
Third order	29[j]	28	dB
Fifth order	32	32	dB
Useful Power Output (Approx.)			
Peak of envelope	380	570	W
Average	190	285	W

Maximum Circuit Values

Grid-No.1 Circuit Resistance Under Any Condition[k]		
With fixed bias	25000	Ω
With fixed bias (In Class-AB_1 operation)	100000	Ω
With cathode bias	Not recommended	
Grid-No.2-Circuit Impedance[m]	10000	Ω
Plate-Circuit Impedance[f]	n	

PLATE-MODULATED RF POWER AMPLIFIER - Class C Telephony[r]

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

Maximum CCS Ratings, Absolute-Maximum Values

	Up to 500 MHz	
DC Plate Voltage	1800	V
DC Grid-No.2 Voltage	400	V
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.	280	W

RF POWER AMPLIFIER & OSCILLATOR - Class C Telegraphy[r]
and
RF POWER AMPLIFIER - Class C FM Telephony[r]

Maximum CCS Ratings, Absolute-Maximum Values

	Up to 500 MHz	
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.	400	W
Peak Heater-Cathode Voltage.	±150	V

Typical CCS Operation

In grid-drive circuit at 50 MHz

DC Plate Voltage	700	1000	1500	2000	V
DC Grid-No.2 Voltage	175	200	200	200	V
DC Grid-No.1 Voltage	-10	-30	-30	-30	V
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.). . . .	1.2	2	2	2	W
Useful Power Output.	120	175	275	375	W

In grid-drive circuit at 470 MHz

DC Plate Voltage	700	1000	1500	2000	V
DC Grid-No.2 Voltage	200	200	200	200	V
DC Grid-No.1 Voltage	-30	-30	-30	-30	V
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.). . . .	5	5	5	5	W
Useful Power Output.	100	165	235	300	W

Maximum Circuit Values

Grid-No.1 Circuit Resistance Under Any Condition		
With fixed bias.	25000	Ω
Grid-No.2-Circuit Impedance.	10000	Ω
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 MHz, heater volts = 12.5 (approx.).

[b] Measured with special shield adapter.

[c] Erie Technological Products, Inc., 645 West 12th Street, Erie, Pa.

[d] E. F. Johnson Co., 1921 10th Ave. S.W. Waseca, Minn.

[e] Mycalex Corporation of America, 775 Clifton Boulevard, Clifton.

[f] For operation above 2200 plate volts, the tube shall see an effective plate-supply impedance of no less than 750 ohms. A fault current

limiting resistor of no less than 15 ohms is to be used between the output filter capacitance and the tube plate. The plate-supply-output-filter capacitance is to be no greater than 10 μF.

g 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.

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 The value of third order distortion product level shown may be improved by approximately 5 dB by utilizing an unbypassed, non-inductive 20-ohm resistor between the cathode and ground; a slight increase in drive power will be required.

k A fault current limiting resistor of no less than 20 ohms is to be used between the bias supply output filter capacitance and the tube grid-No.1. The bias supply output filter capacitance is to be no greater than 150 μF.

m A fault current limiting resistor of no less than 320 ohms is to be used between the screen output filter capacitance and the tube screen. The screen supply output filter capacitance is to be no greater than 80 μF.

n The tube should see an effective plate supply impedance which limits the peak current through the tube under surge conditions to 15 amperes.

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

p See *Electrical Considerations* - Filament or Heater.

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

r See *Classes of Service.*

CHARACTERISTICS RANGE VALUES

Test No.	*Note*	*Min*	*Max*	
1. Heater Current.	1	1.15	1.45	A
2. Direct Interelectrode Capacitances	2			
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	20.8	25.2	pF
Grid No.2 to plate.	2	5.7	7.1	pF
Grid No.2 to cathode.	2	2.0	3.0	pF
Cathode to heater	2	2.5	4.1	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	50	-	MΩ
→ 8. Zero Bias Plate Current	1,6	1	1.8	A

Note 1: With 13.5 volts ac or dc on heater.

Note 2: Measured with special shield adapter.

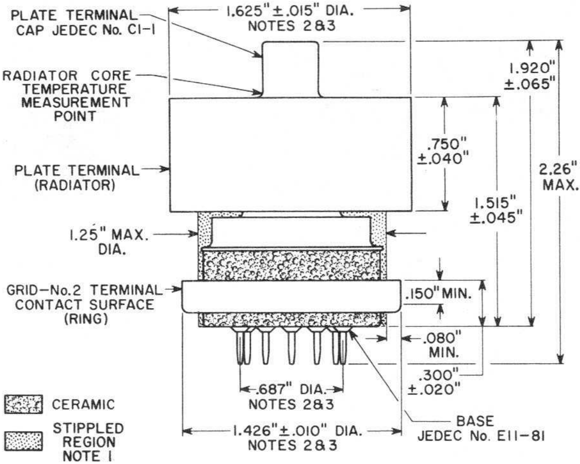
Note 3: With dc plate voltage at 700 volts, dc grid-No.2 voltage of 250 volts, and dc grid-No.1 voltage adjusted to give a dc plate current of 185 mA.

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 p/s. 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 not be less than the value specified.

Note 6: With dc plate voltage of 450 volts, dc grid No.2 voltage of 400 volts, dc grid No.1 voltage of - 100 volts, grid drive voltage to zero. With pulse duration of 4500 to 5000 μs and pulse repetition frequency is 10 to 12 p/s.

→ Indicates a change.



92CS-11304R1

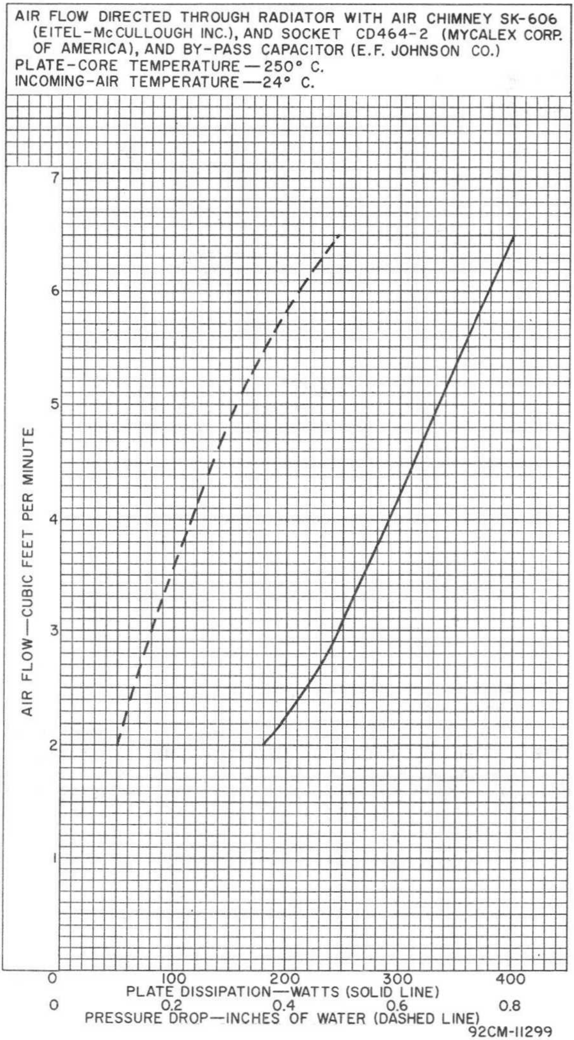
NOTE 1: KEEP ALL STIPPLED REGIONS CLEAR. DO NOT ALLOW CONTACTS OR CIRCUIT COMPONENTS TO PROTRUDE INTO THESE ANNULAR VOLUMES.

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.

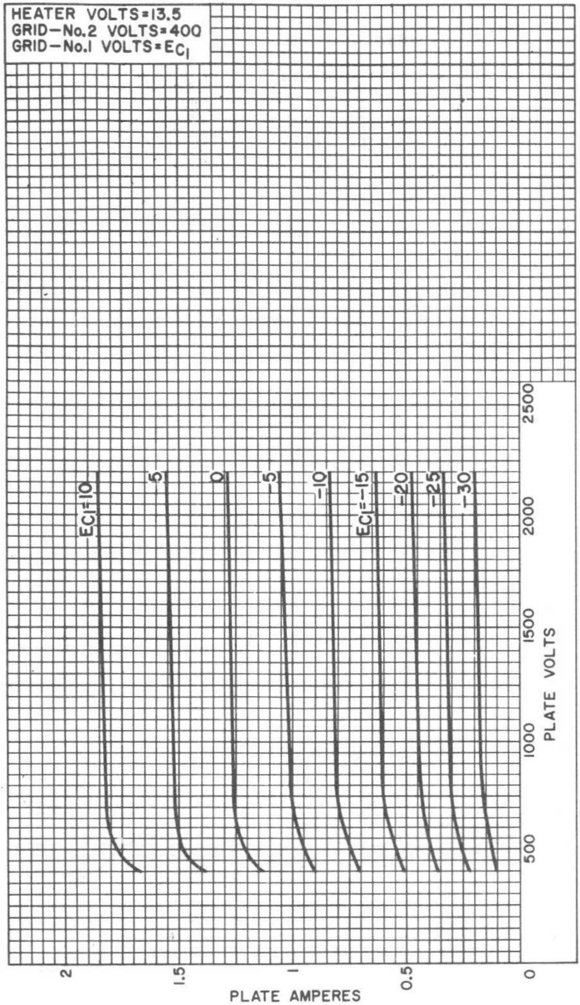
NOTE 3: THE FULL INDICATOR READING IS THE MAXIMUM DEVIATION IN RADIAL POSITION OF A SURFACE WHEN THE TUBE IS COMPLETELY ROTATED ABOUT THE CENTER OF THE REFERENCE SURFACE. IT IS A MEASURE OF THE TOTAL EFFECT OF RUN-OUT AND ELLIPTICITY.

TYPICAL COOLING REQUIREMENTS



TYPICAL PLATE CHARACTERISTICS

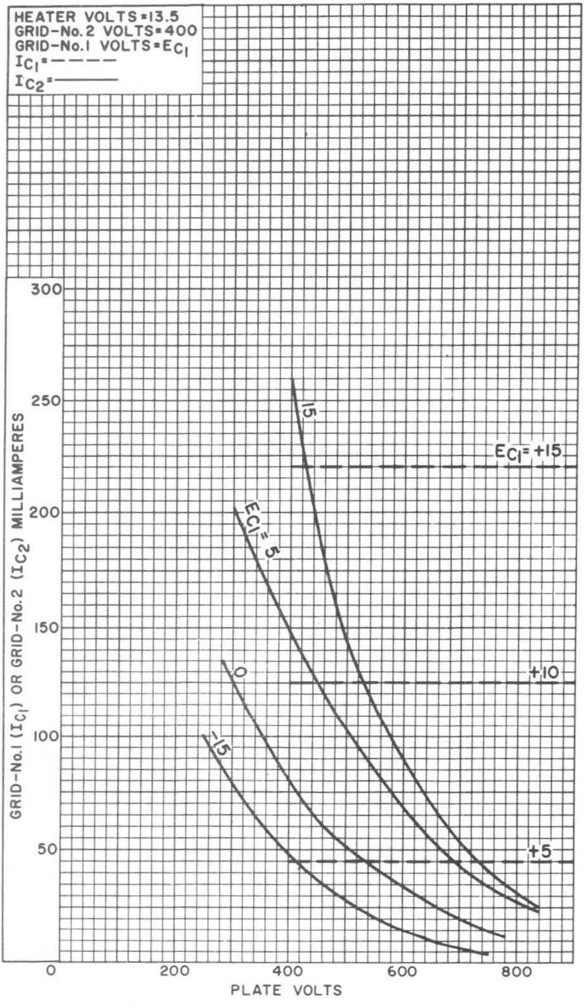
For Grid-No.2 Voltage = 400 Volts



92CM—11290

TYPICAL CHARACTERISTICS

For Grid-No.2 Voltage = 400 Volts

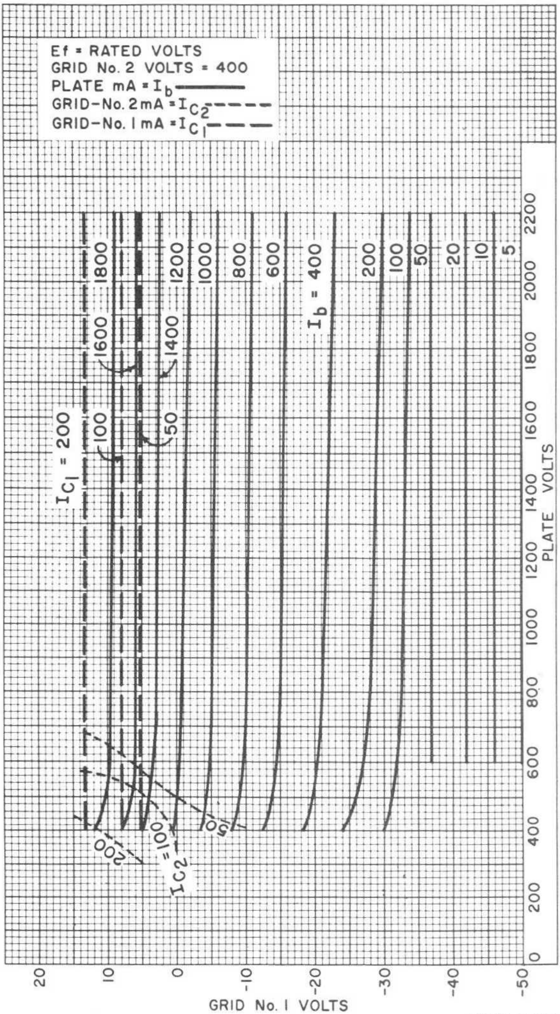


92CM-11293R1

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

TYPICAL CONSTANT-CURRENT CHARACTERISTICS

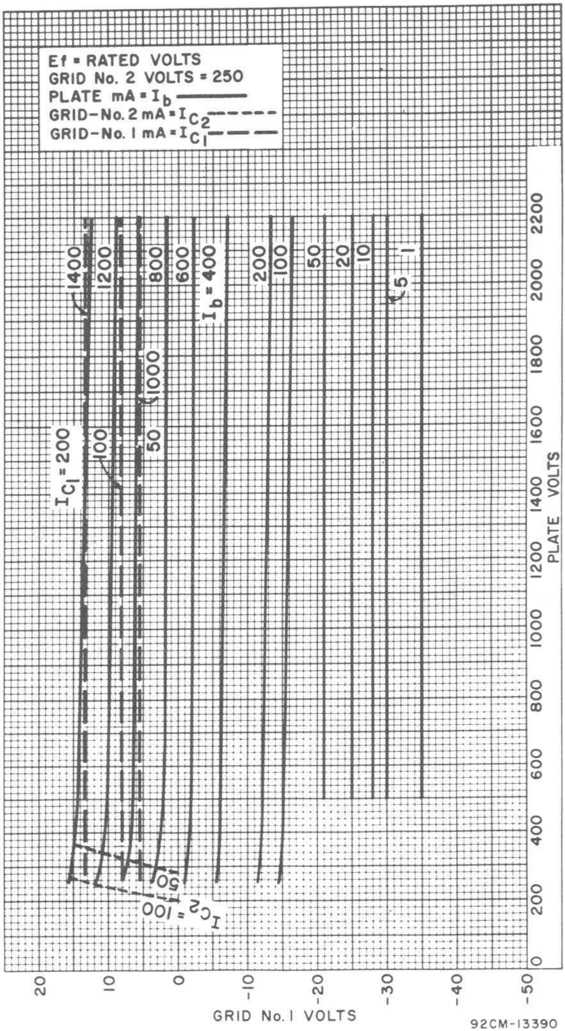
For Grid-No.2 Voltage = 400 Volts



92CM-13389

TYPICAL CONSTANT-CURRENT CHARACTERISTICS

For Grid-No.2 Voltage = 250 Volts



92CM-13390

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

Beam Power Tube

CERAMIC-METAL SEALS
"ONE-PIECE" ELECTRODE DESIGN
COAXIAL-ELECTRODE STRUCTURE
INTEGRAL RADIATOR

2 MEGAWATT MAXIMUM PEAK POWER INPUT UP TO 500 Mc
MATRIX-TYPE, OXIDE-COATED, UNIPOTENTIAL CATHODE

For use at Frequencies up to 500 Mc

GENERAL DATA

Electrical:

Heater, for Matrix-Type, Oxide-Coated, Unipotential Cathode[a]

	Typical	*Maximum*	
Voltage (AC or DC)	22	23	volts
Current at heater volts = 22	12.6		amp
Minimum heating time	5		minutes

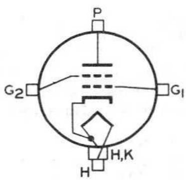
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 5000, grid-No.2 volts = 1400, and plate ma. = 500	25	
Direct Interelectrode Capacitances:		
Grid No.1 to plate[b]	0.3 max.	pf
Grid No.1 to cathode & heater	100	pf
Plate to cathode & heater[b,c]	0.03 max.	pf
Grid No.1 to grid No.2	110	pf
Grid No.2 to plate	24	pf
Grid No.2 to cathode & heater[c]	1.5 max.	pf

Mechanical:

Operating Position	Any
Maximum Overall Length	7.24"
Maximum Diameter	5.56"
Weight (Approx.)	8.5 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

Thermal:

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 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.

To Plate, Grid-No.2, Grid-No.1, Cathode, and Heater Terminals— A sufficient quantity of air should be allowed to flow past each of these terminals to prevent their temperature from exceeding the specified maximum value of 250° C.

Plate power, grid-No.2 power, heater power, and the forced-air flow may be removed simultaneously.

Terminal Temperature[d] (Plate, grid No.2, grid No.1, cathode, and heater)	250 max.	°C
Plate Core Temperature[d]	250 max.	°C

PULSED RF AMPLIFIER

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

For maximum "on" time[f] of 10 microseconds in any 2000-microsecond interval and frequencies up to 500 Mc

PEAK POSITIVE PULSE PLATE VOLTAGE[g]	25000 max.	volts
DC PLATE VOLTAGE[g]	15000 max.	volts
POSITIVE-PULSE GRID-No.2 VOLTAGE:		
Peak	2500 max.	volts
DC	2500 max.	volts
NEGATIVE-PULSE GRID-No.1 VOLTAGE:		
Peak	500 max.	volts
DC	500 max.	volts
DC-PULSE PLATE CURRENT	80 max.	amps
DC PLATE CURRENT	0.5 max.	amp
GRID-No.2 INPUT (Average)	150 max.	watts
GRID-No.1 INPUT (Average)	100 max.	watts
PLATE DISSIPATION (Average)	10000 max.	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under any condition	2000 max.	ohms

[a] See *Operating Considerations.*

[b] With external flat metal shield 8" diameter having center hole 4" diameter. Shield is located in plane of the grid-No.2 terminal, perpendicular to the tube axis, and is connected to grid No.2 and ground.

[c] With external flat metal shield 8" diameter having center hole 3-3/8" diameter. Shield is located in plane of the grid-No.1 terminal, perpendicular to the tube axis, and is connected to grid No.1 and ground.

[d] See *Operating Considerations* and also *Dimensional Outline* for temperature-measurement points.

[e] Continuous Commercial Service.

[f] *"On" time* is defined as the sum of the durations of all the individual pulses which occur during the 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. *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 is defined as the ratio of "on" time to total elapsed time in any interval.

[g] Pressurization may be required when the tube is used at high altitudes and plate voltages near the maximum rating to prevent flash-over at the tube seals.

CHARACTERISTICS RANGE VALUES

	Note	*Min.*	*Max.*	
Heater Current	1	11.7	13.5	amp
Direct Interelectrode Capacitances:				
Grid No.1 to plate	2	-	0.3	pf
Grid No.1 to cathode & heater		91	113	pf
Plate to cathode & heater	2,3	-	0.03	pf
Grid No.1 to grid No.2		99	121	pf
Grid No.2 to plate		21	26	pf
Grid No.2 to cathode & heater	3	-	1.5	pf
Grid-No.1 Voltage	1,4	-27	-61	volts
Grid-No.1 Cutoff Voltage	1,5	-	-95	volts

Note 1: With 22 volts ac or dc on heater.

Note 2: With external flat metal shield 8" diameter having center hole 4" diameter. Shield is located in plane of the grid-No.2 terminal, perpendicular to the tube axis, and is connected to grid No.2 and ground.

Note 3: With external flat metal shield 8" diameter having center hole 3-3/8" diameter. Shield is located in plane of the grid-No.1 terminal, perpendicular to the tube axis, and is connected to grid No.1 and ground.

Note 4: With dc plate voltage of 5000 volts, dc grid-No.2 voltage of 1500 volts, and dc grid-No.1 voltage adjusted to give a plate current of 500 ma.

Note 5: With dc plate voltage of 5000 volts, dc grid-No.2 voltage of 1500 volts, and dc grid-No.1 voltage adjusted to give a plate current of 20 ma.

OPERATING CONSIDERATIONS

Heater

The heater of the 8184 should be operated at constant voltage rather than constant current. The rated heater voltage of 22 volts should be applied for 5 minutes to allow the cathode to reach normal operating temperature before voltages are applied to the other electrodes. 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%.

Temperature

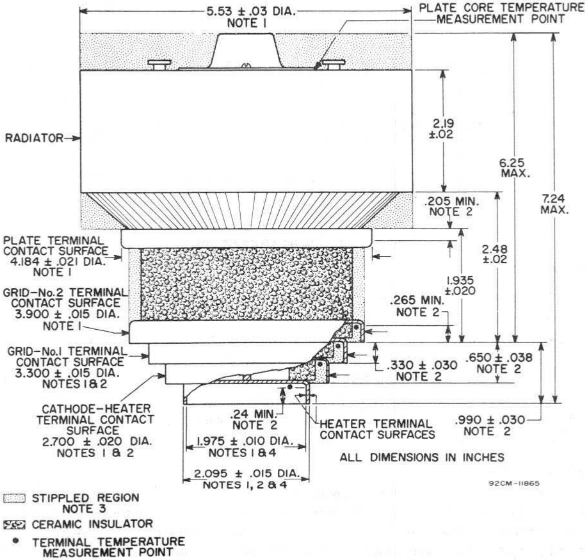
The maximum terminal temperature of 250° C is a tube rating and is to be observed in the same manner as other ratings. The temperature may be measured with temperature-sensitive paint, such as Tempilaq. The latter is made in the form of liquid and stick by the Tempil Corporation, 132 West 22nd Street, New York 11, N.Y.

Standby Operation

During long or frequent standby periods, the 8184 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

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.



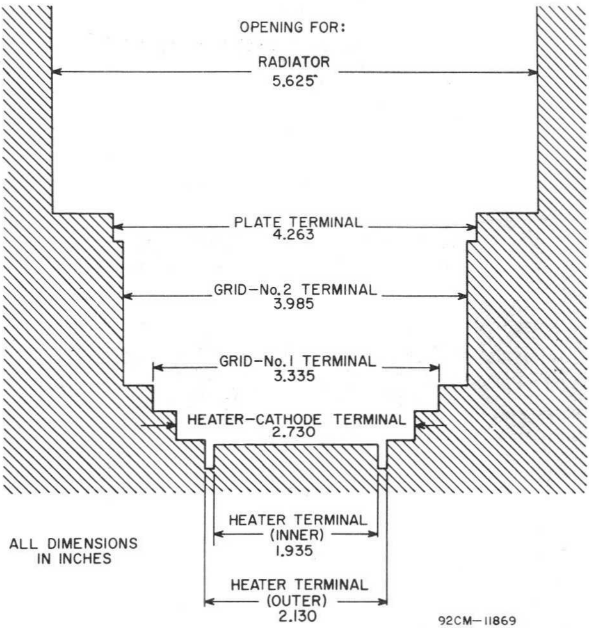
NOTE 1: SEE SKETCH G1 FOR THE MAXIMUM DIAMETRICAL SPACE REQUIRED BY THE 8184 BASED UPON THE DIAMETER AND ECCENTRICITY OF RADIATOR BAND AND OF EACH RING TERMINAL.

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, 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.

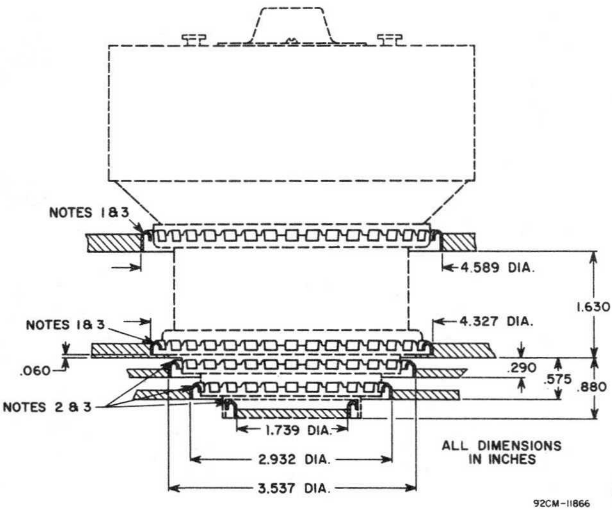
NOTE 3: KEEP ALL STIPPLED REGIONS CLEAR. DO NOT ALLOW CONTACTS OR CIRCUIT COMPONENTS TO PROTRUDE INTO THESE ANNULAR REGIONS.

NOTE 4: THE HEATER TERMINAL IS DIMENSIONED FOR INSIDE DIAMETER AND OUTSIDE DIAMETER TO PROVIDE A CHOICE OF CONTACT MOUNTING; THE DIMENSIONS SHALL NOT BE CONSIDERED CONCURRENTLY.

SKETCH G1



SUGGESTED MOUNTING ARRANGEMENT
& LAYOUT OF ASSOCIATED CONTACTS

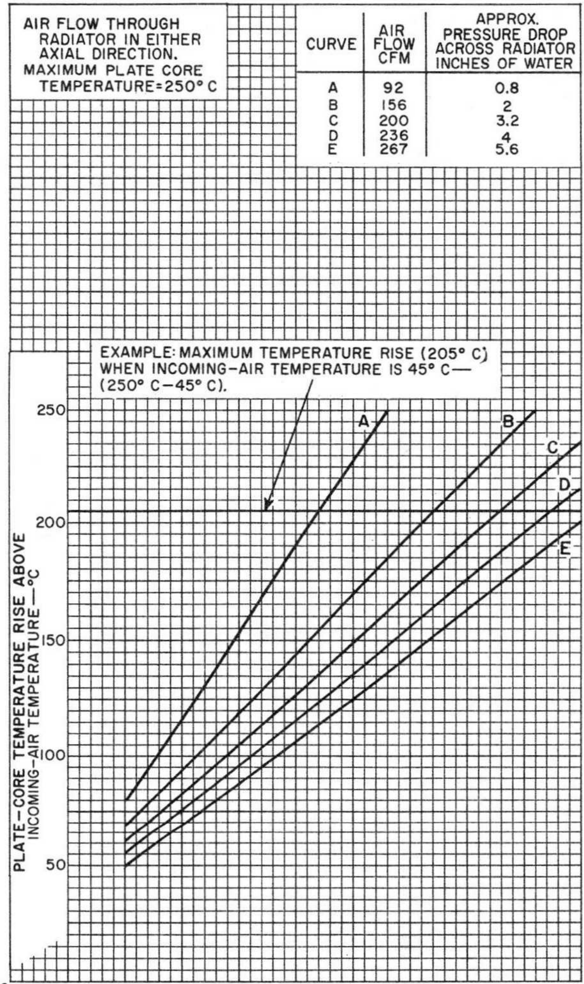


NOTE 1: FINGER STOCK NO.97-310.

NOTE 2: FINGER STOCK NO.97-139.

NOTE 3: SPECIFIED FINGER STOCK IS MADE BY INSTRUMENT SPECIALITIES COMPANY, LITTLE FALLS, NEW JERSEY.

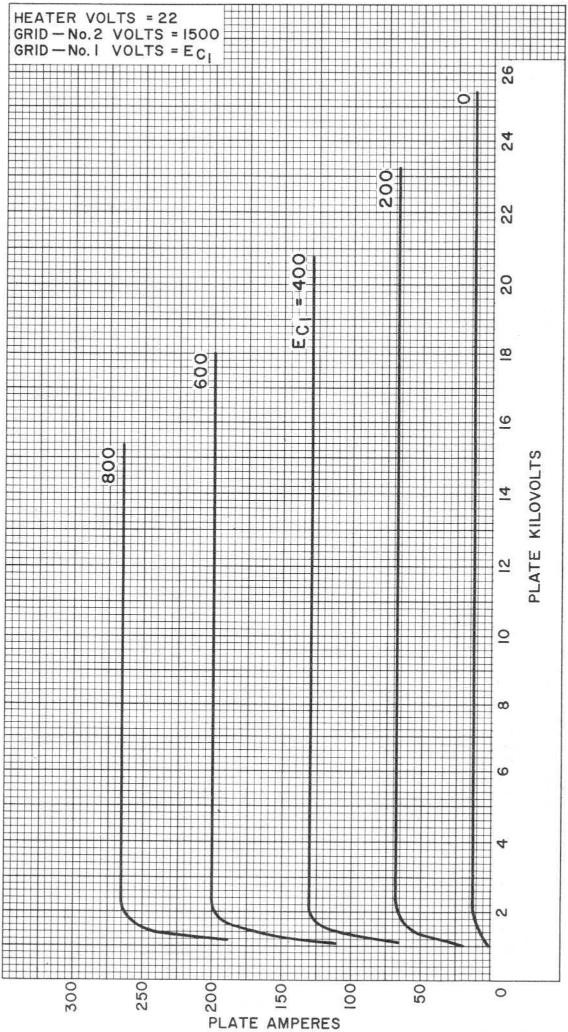
TYPICAL COOLING REQUIREMENTS



CURVE	AIR FLOW CFM	APPROX. PRESSURE DROP ACROSS RADIATOR INCHES OF WATER
A	92	0.8
B	156	2
C	200	3.2
D	236	4
E	267	5.6

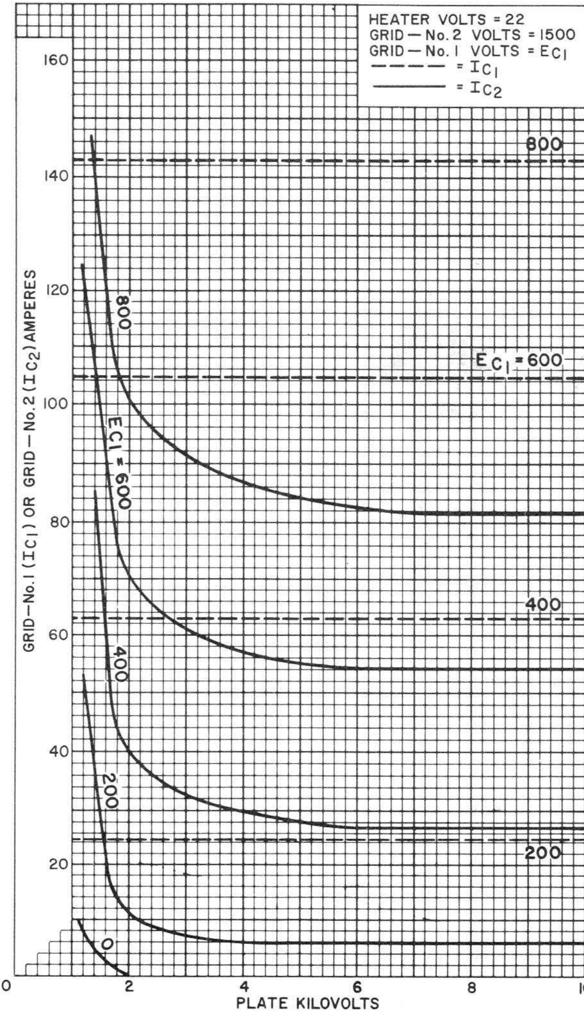
92CM−11861

TYPICAL PLATE CHARACTERISTICS



92CM—11862

TYPICAL CHARACTERISTICS



92CM-11864

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.

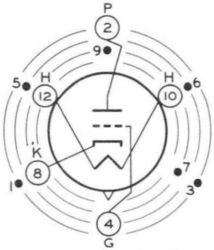
Electrical:

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 A$_1$ 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 $\leq$ 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 $\leq$ 1 μs, and time of fall $\leq$ 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.

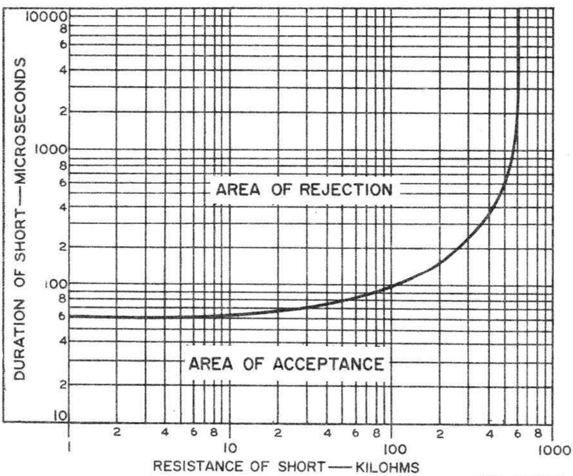
Grid Pulse Life (1000 hours):

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.

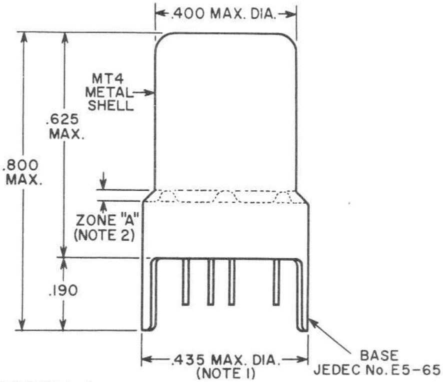
Tubes are tested at 500 hours and 1000 hours for Inoperatives[h] and Peak Cathode Emission Current (Pulsed).

[h] An inoperative is defined as a tube having a discontinuity, permanent short, or air leak.

SHORTS-TEST ACCEPTANCE LIMITS



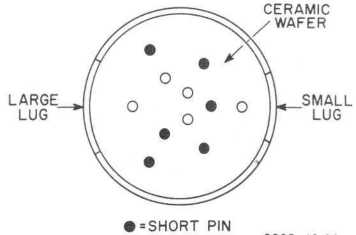
92CS-10465R1



DIMENSIONS IN INCHES

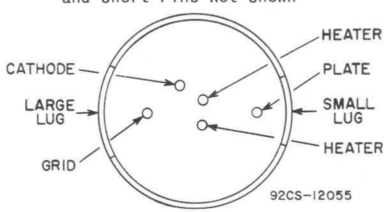
92CS-12024

BOTTOM VIEW
Showing Arrangement of All 11 Base Pins



92CS-12162

MODIFIED BOTTOM VIEW
With Element Connections Indicated
and Short Pins Not Shown

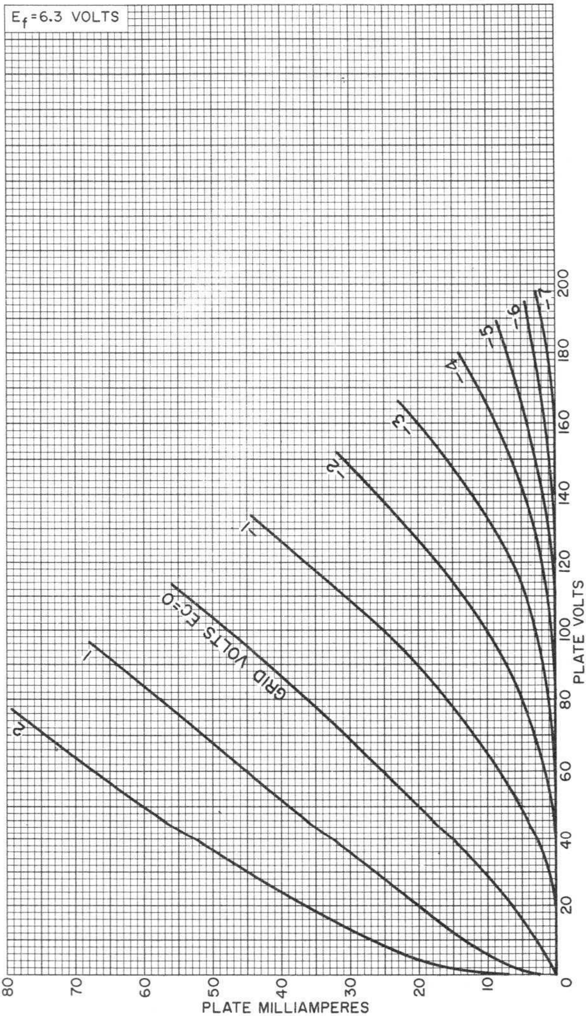


92CS-12055

Note 1: Maximum outside diameter of 0.440" is permitted along 0.190" lug length.

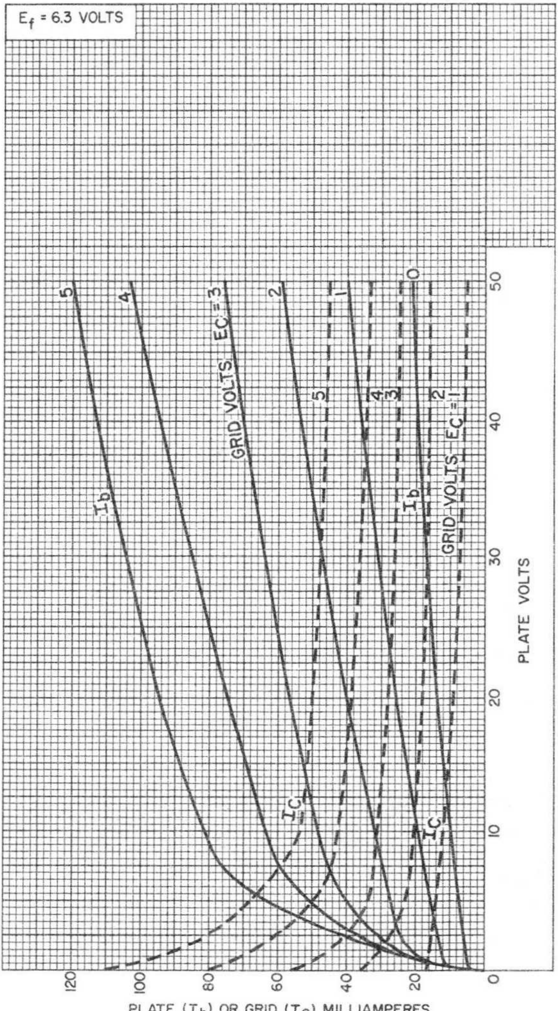
Note 2: Metal-shell temperature should be measured in zone "A".

AVERAGE PLATE CHARACTERISTICS



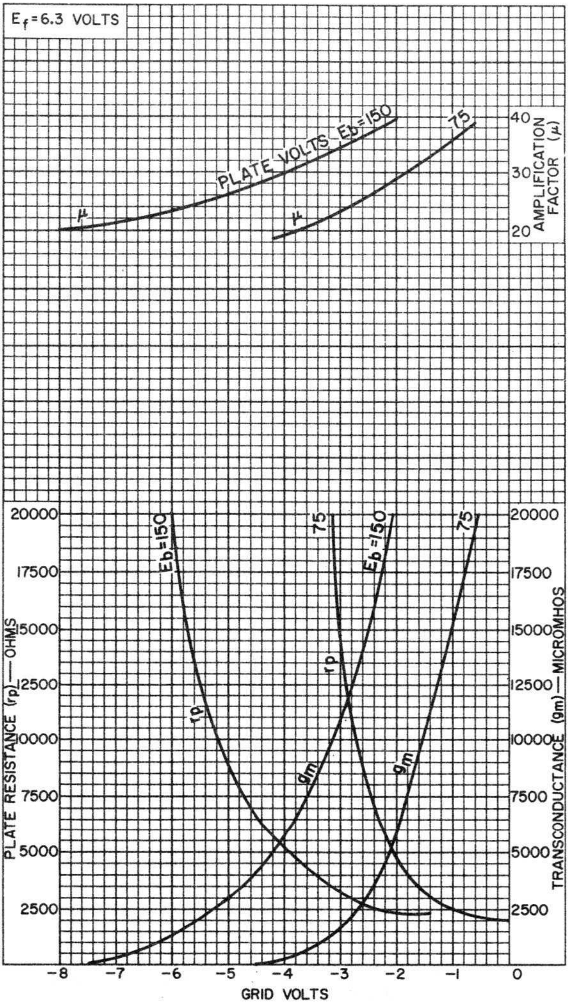
92CM–12508

AVERAGE CHARACTERISTICS



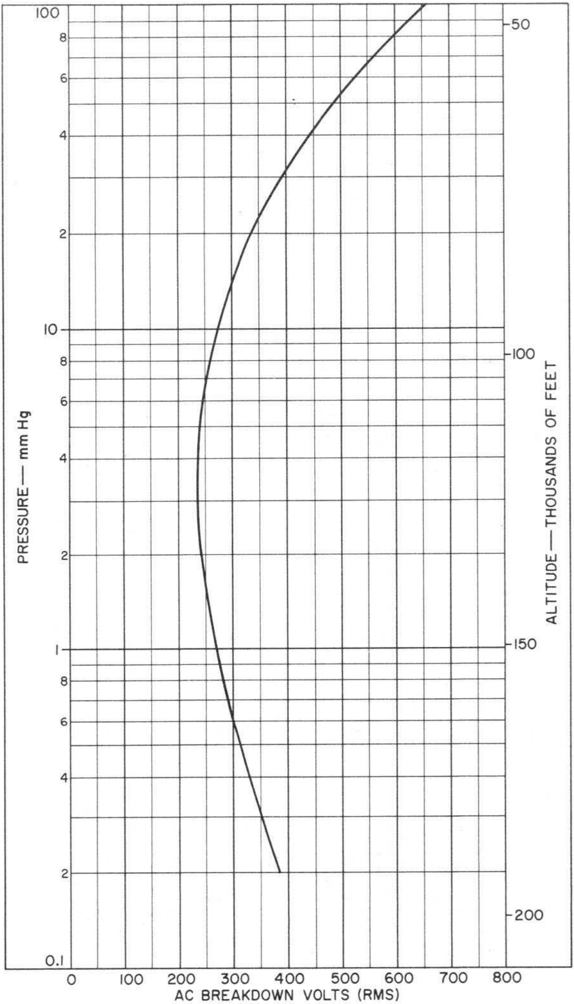
92CM-12506

AVERAGE CHARACTERISTICS



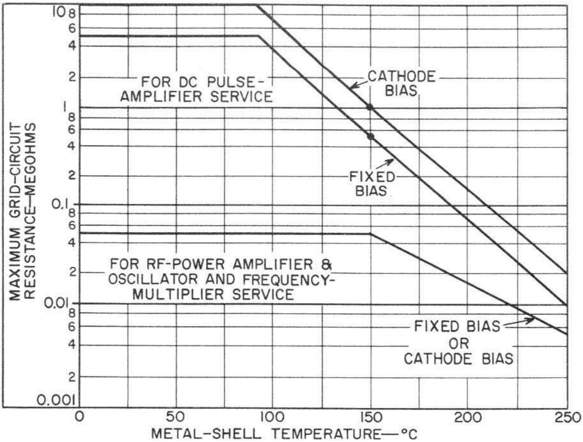
92CM-12507

LOW-PRESSURE VOLTAGE-BREAKDOWN CHARACTERISTICS OF NUVISTOR TRIODE BASE



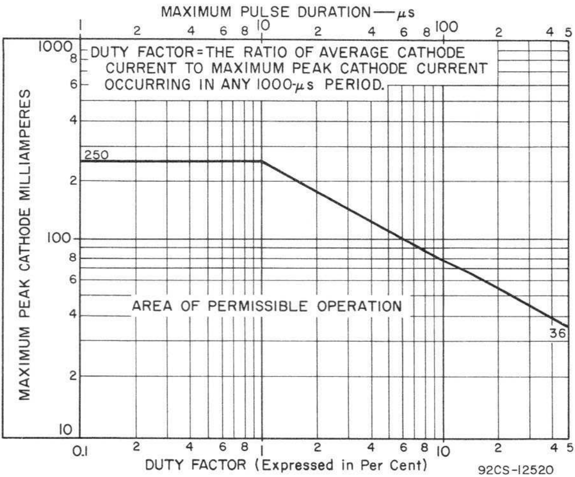
92CM—12509

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

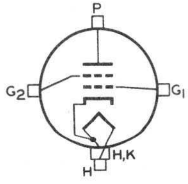
Electrical:

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*):

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 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

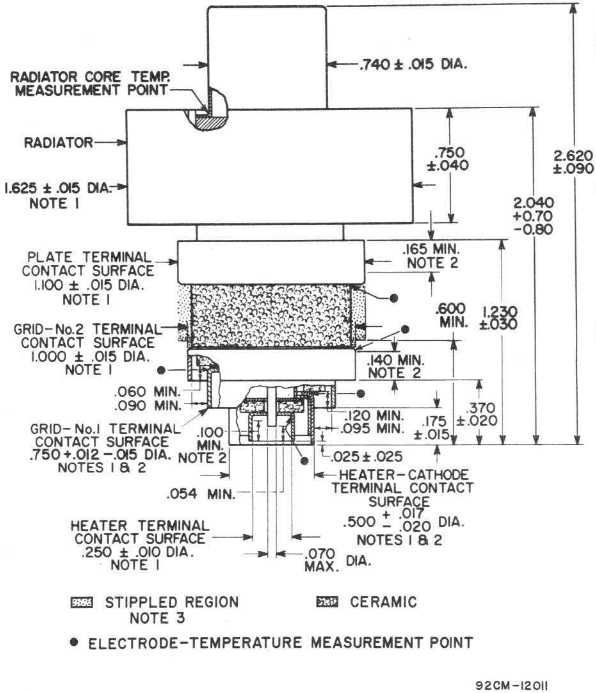
During long or frequent standby periods, the 8226 may be operated at decreased heater voltage to conserve life. It is recommended that the heater voltage be reduced to 80% of normal during standby periods up to 2 hours. For longer periods, the heater voltage should be turned off.

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.



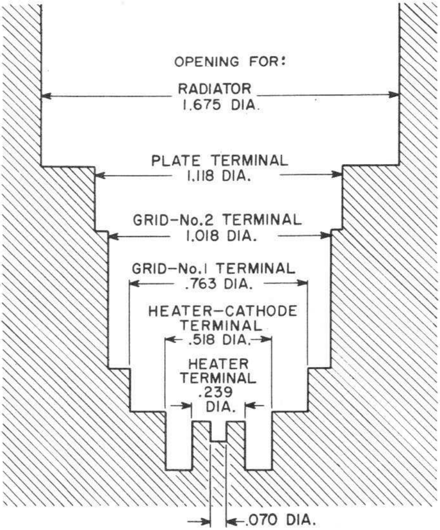
ALL DIMENSIONS IN INCHES

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.

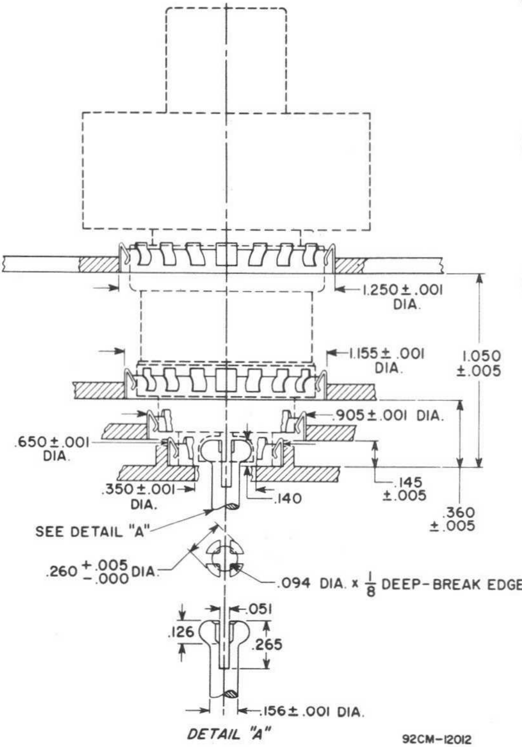
NOTE 3: KEEP ALL STIPPLED REGIONS CLEAR. DO NOT ALLOW CONTACTS OR CIRCUIT COMPONENTS TO PROTRUDE INTO THESE ANNULAR REGIONS.

SKETCH G1



ALL DIMENSIONS IN INCHES

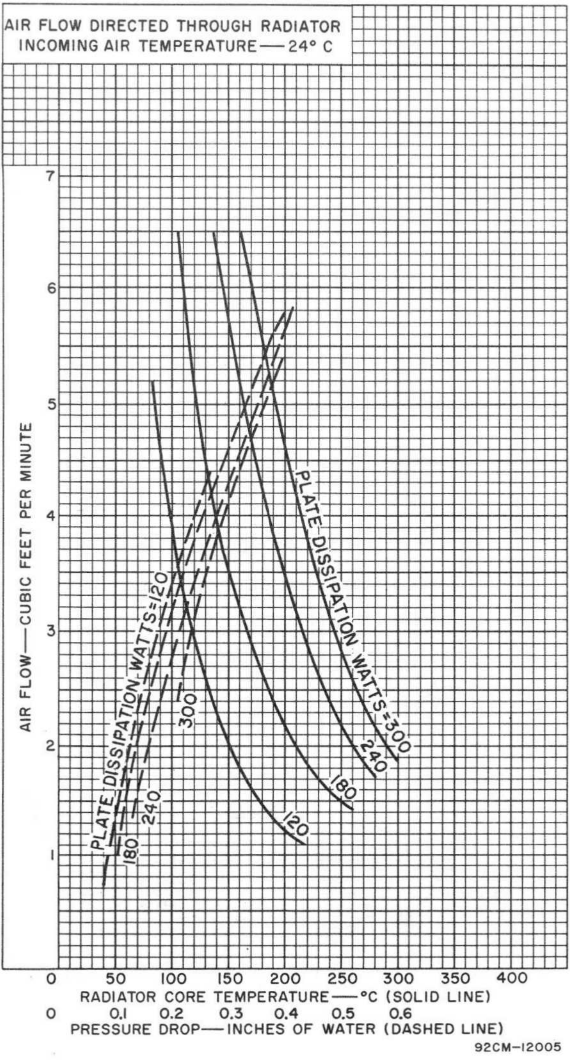
PREFERRED MOUNTING ARRANGEMENT
& LAYOUT OF ASSOCIATED CONTACTS



ALL DIMENSIONS IN INCHES

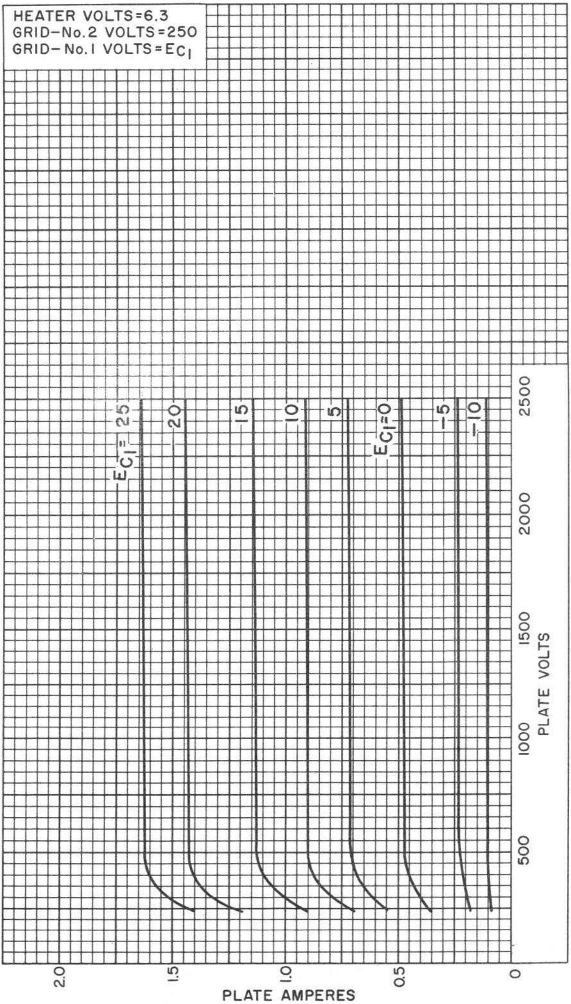
NOTE: ALL FINGER STOCK (No. 97-380) MADE BY INSTRUMENT SPECIALTIES COMPANY, LITTLE FALLS, NEW JERSEY.

TYPICAL COOLING REQUIREMENTS



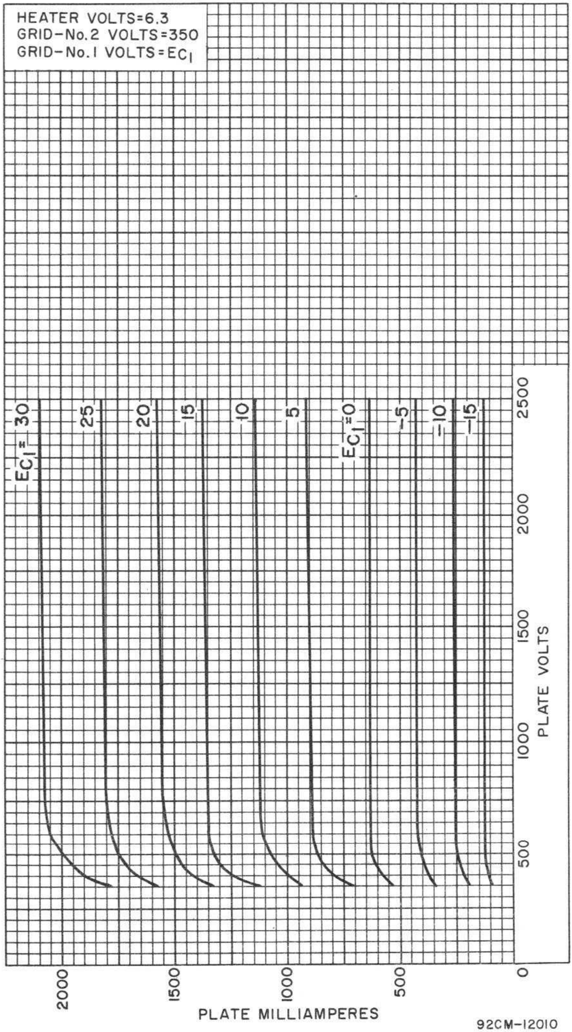
92CM-12005

TYPICAL PLATE CHARACTERISTICS



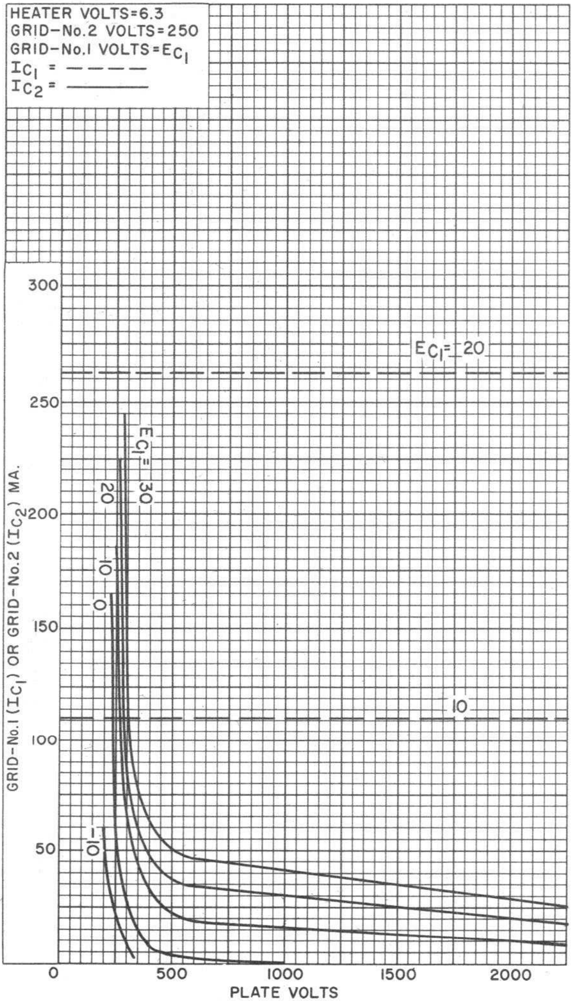
92CM-12006

TYPICAL PLATE CHARACTERISTICS



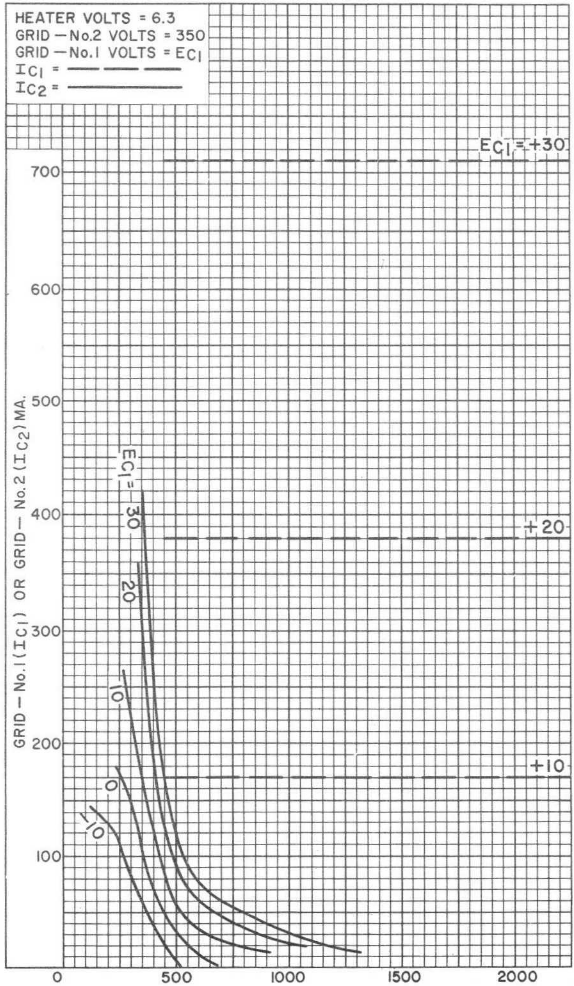
92CM-12010

TYPICAL CHARACTERISTICS



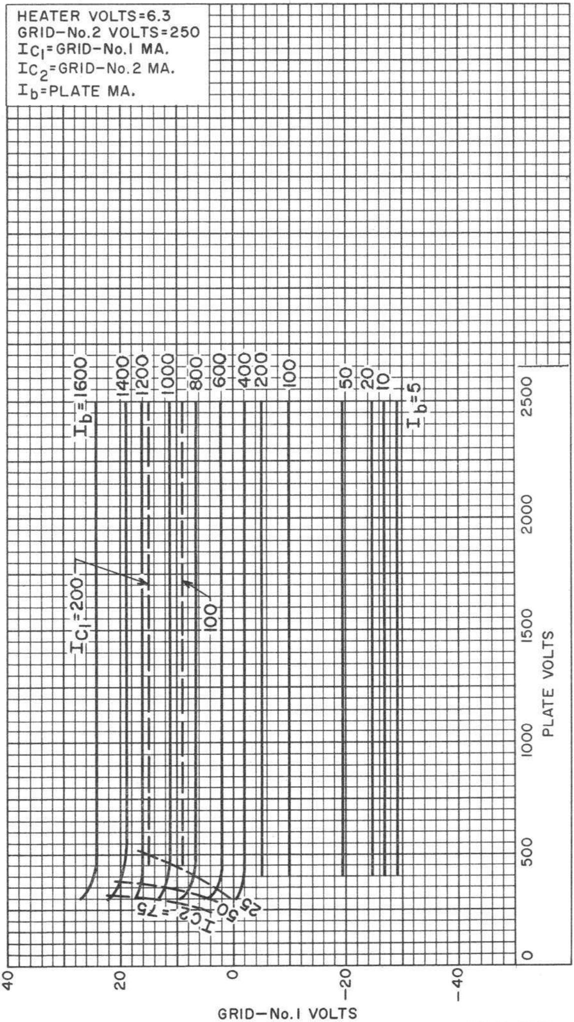
92CM-12016

TYPICAL CHARACTERISTICS



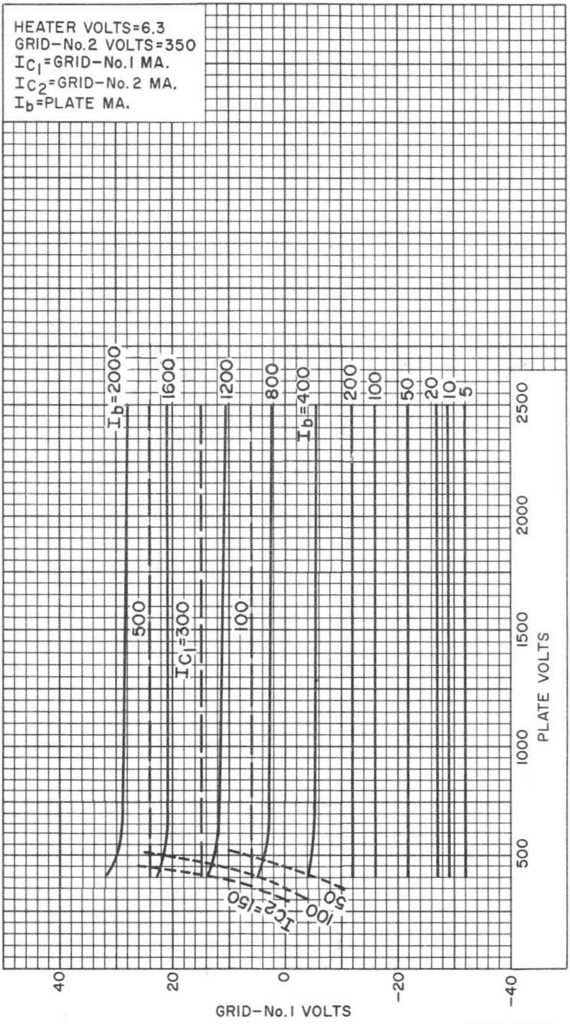
92CM—12013

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM–12015

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM-12007

Traveling-Wave Tube

HELIX-TRANSMISSION-LINE TYPE **NF = 4.5 db**
FREQUENCY RANGE, 2320-2680 Mc **31-db GAIN**
LOW-NOISE AMPLIFIER TYPE **SOLENOID FOCUSING**

For Use in Input Stage of Radar, Scatter Propagation, and Other Microwave Receivers, and in IF Amplifiers

Electrical:

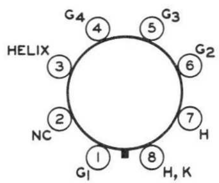
Heater, for Unipotential Cathode:		
Voltage (AC or DC)	5.0 ± 5%	volts
Current at heater volts = 5.0	0.65	amp
Starting current	Must never exceed 4 amperes, even momentarily	
Minimum cathode heating time	1	minute
Frequency range	2320 to 2680	Mc
Minimum cold insertion loss	60	db

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 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.

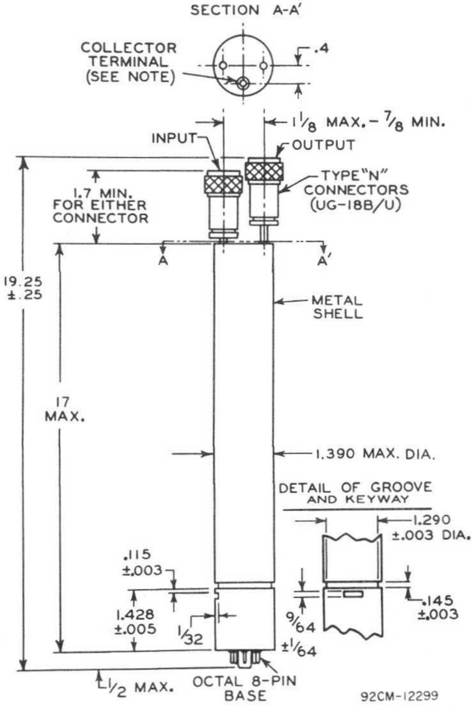
A low-noise traveling-wave tube used in a superheterodyne circuit will cause a 3 db degradation in noise figure unless a filter is used at the output of the traveling-wave tube to remove noise generated at the image frequency.

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.

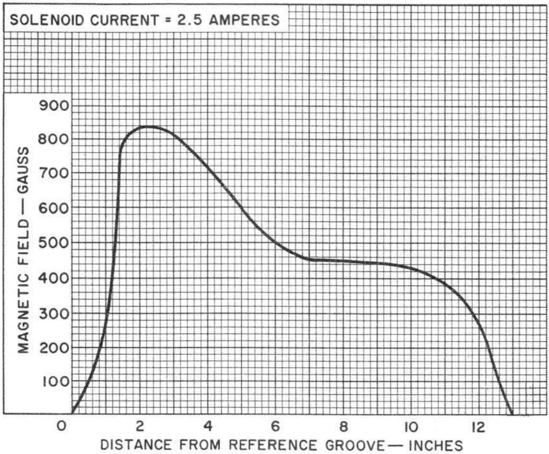
DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

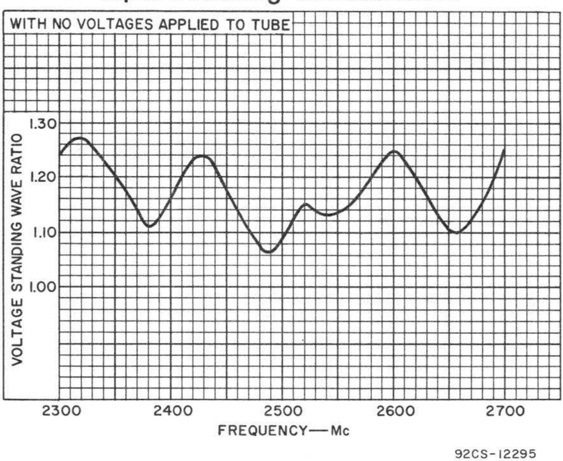
Note: Special Banana Jack--Mates with Raytheon Test Jack 27-1594G21 fitted with an insulator from an HH Smith Type 211 Banana Plug.

Characteristics of RCA-MW4901 Solenoid



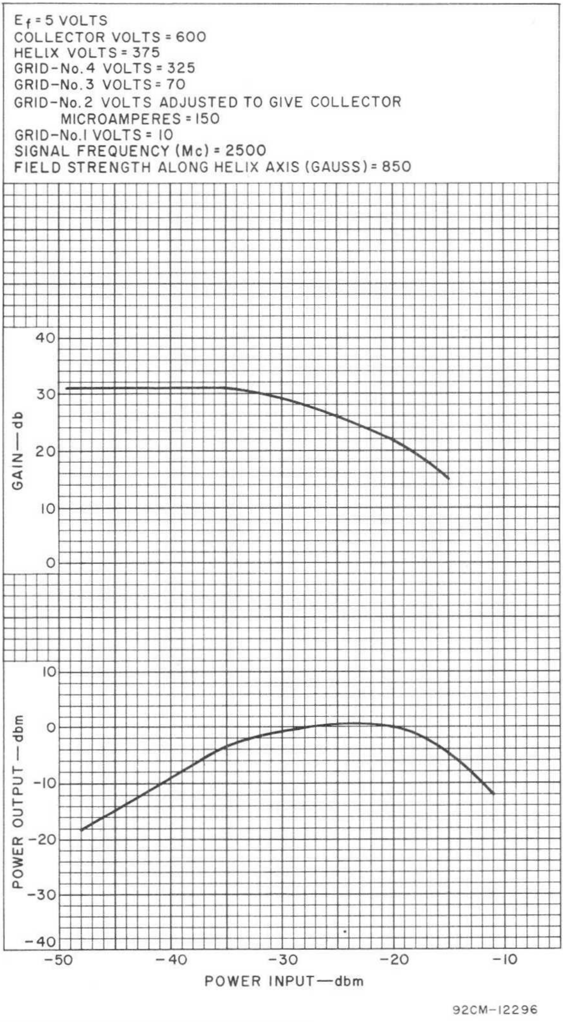
92CS-12298

Input-Matching Characteristic



92CS-12295

Saturation Characteristics



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

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:

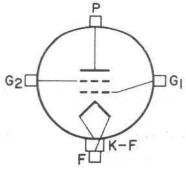
Filamentary Cathode, Thoriated-Tungsten Cylindrical-Mesh Type:		
Voltage (AC or DC)	8.5 typ.	volts
	9.0 max.	volts
Current:		
Typical value at 8.5 volts	88	amp
Maximum value for starting, even momentarily	300	amp
Minimum heating time.	15	sec
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 7000, grid-No.2 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 airflow 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.

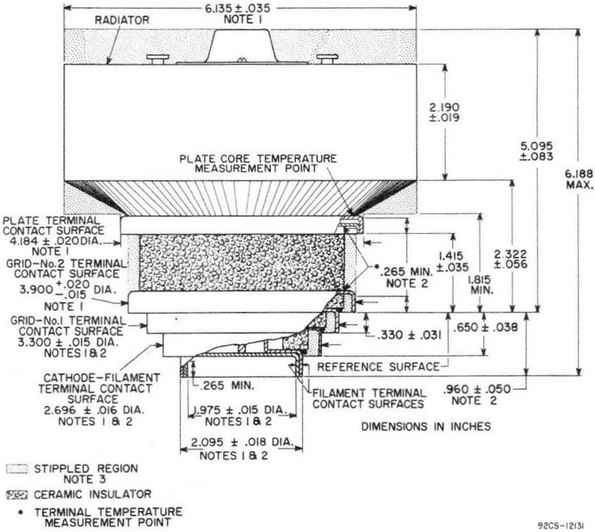
Standby Operation

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.

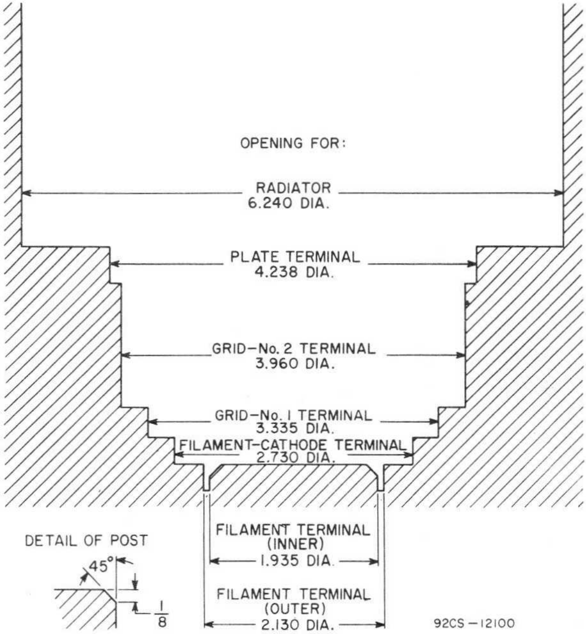


NOTE 1: SEE *SKETCH G1* FOR THE MAXIMUM DIAMETRICAL SPACE REQUIRED BY THE 8437 BASED UPON THE DIAMETER AND ECCENTRICITY OF RADIATOR BAND AND OF EACH RING TERMINAL.

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.

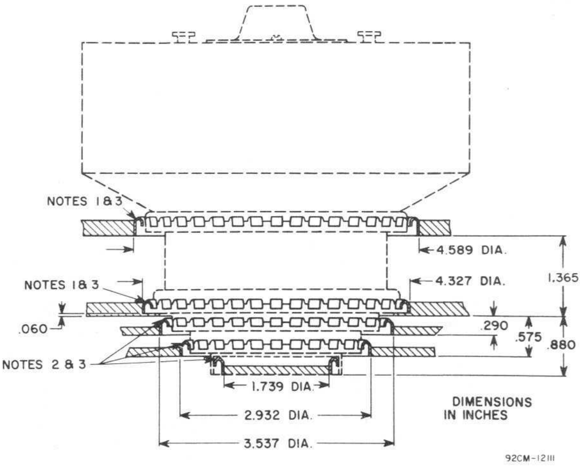
NOTE 3: KEEP ALL STIPPLED REGIONS CLEAR. DO NOT ALLOW CONTACTS OR CIRCUIT COMPONENTS TO PROTRUDE INTO THESE ANNULAR REGIONS.

SKETCH G1



DIMENSIONS IN INCHES

PREFERRED MOUNTING ARRANGEMENT
& LAYOUT OF ASSOCIATED CONTACTS

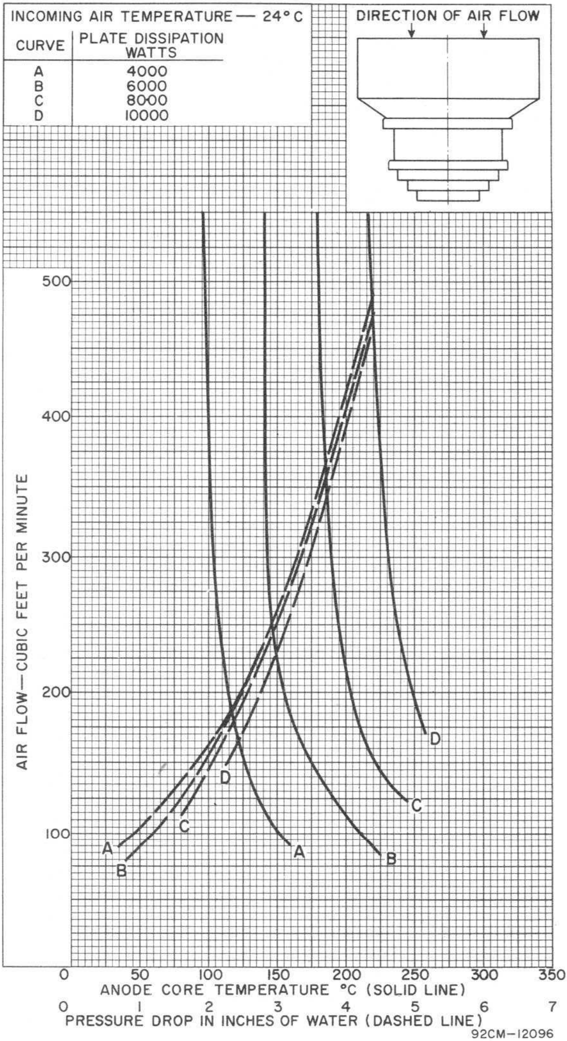


NOTE 1: FINGER STOCK No. 97-310.

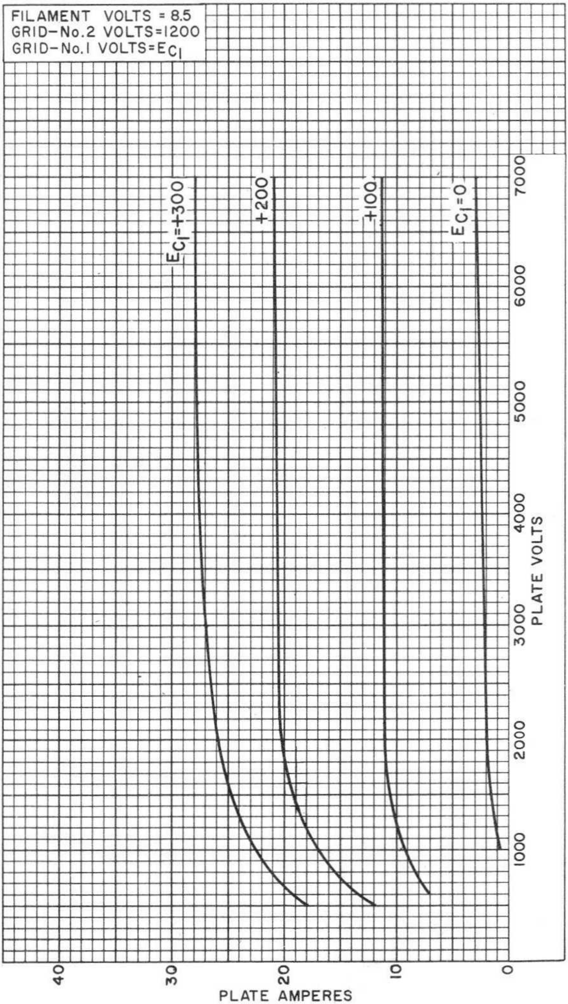
NOTE 2: FINGER STOCK No. 97-139.

NOTE 3: SPECIFIED FINGER STOCK IS MADE BY INSTRUMENT SPECIALTIES CO., LITTLE FALLS, N.J.

TYPICAL COOLING REQUIREMENTS

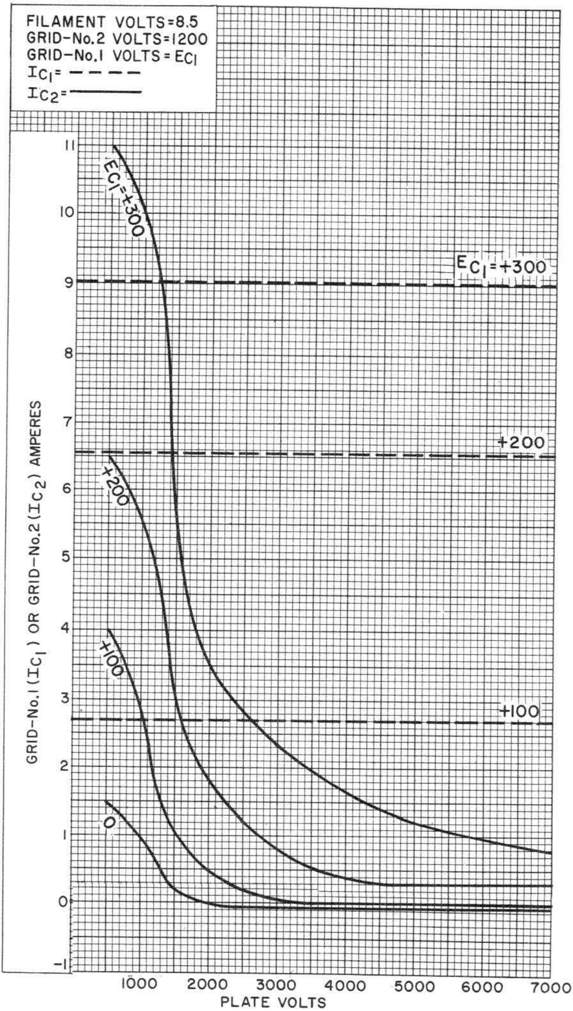


TYPICAL PLATE CHARACTERISTICS



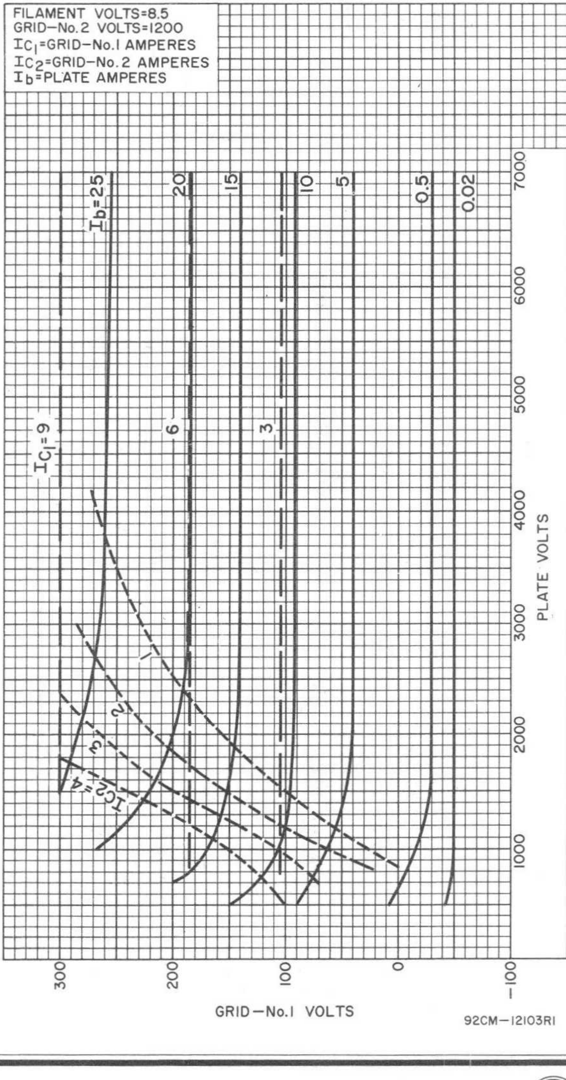
92CM-12098

TYPICAL CHARACTERISTICS



92CM-12101R1

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM—12103R1

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

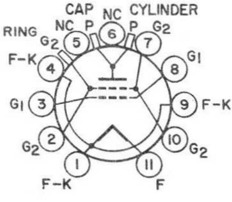
Mechanical:

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.

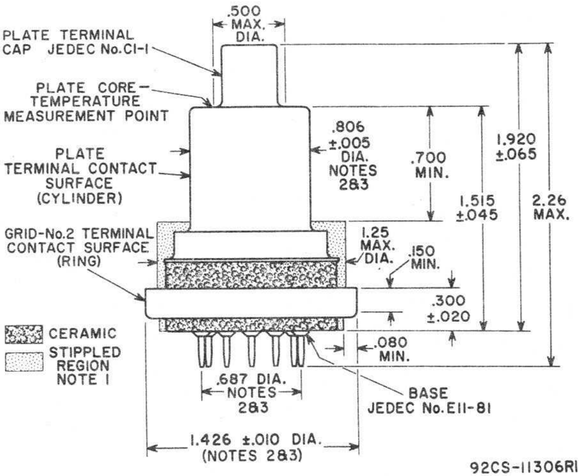
CHARACTERISTICS RANGE VALUES

	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.

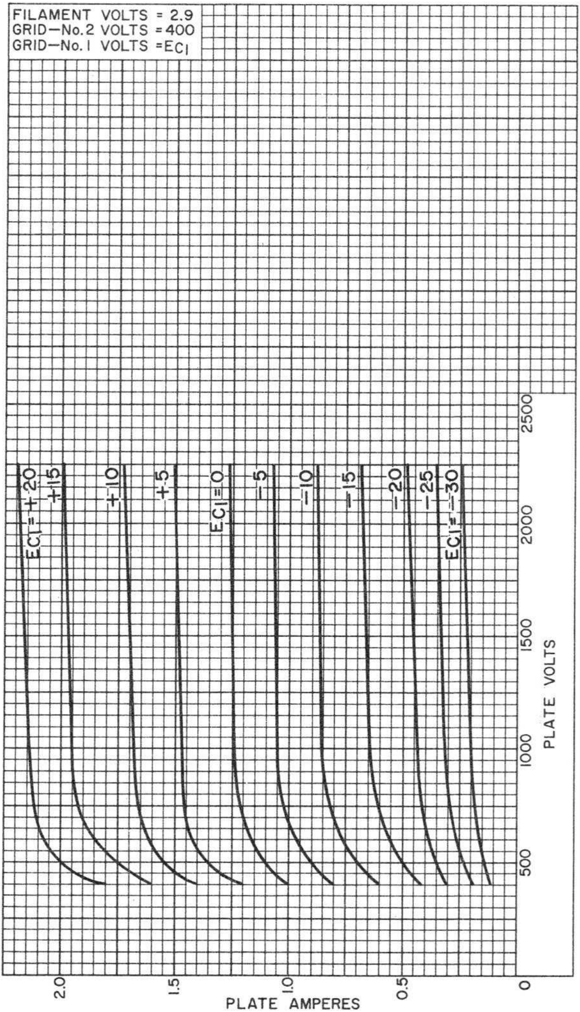
Note 2: The diameters of the plate terminal contact surface, grid-No.2 terminal contact surface, and pin circle to be concentric within the following values of maximum full indicator reading:

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.

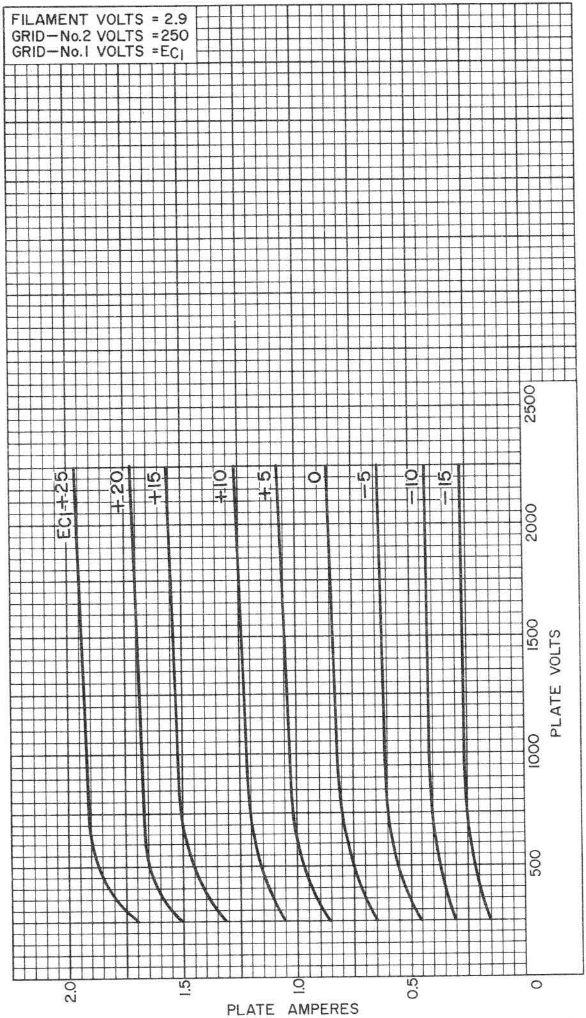
8462

TYPICAL PLATE CHARACTERISTICS
At a Constant Grid-No.2 Voltage of 400 Volts

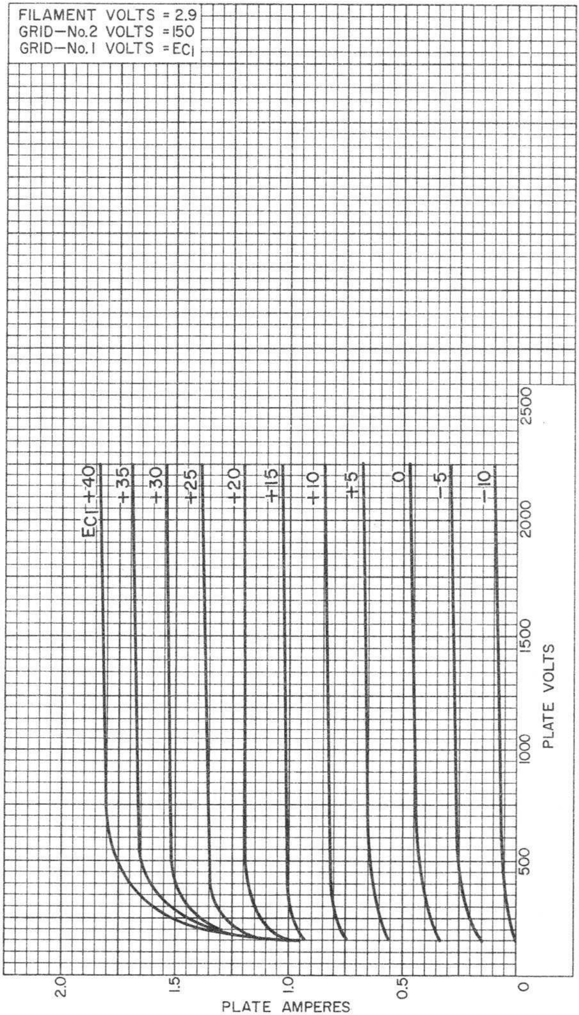


92CM—12225

TYPICAL PLATE CHARACTERISTICS
At a Constant Grid-No.2 Voltage of 250 Volts

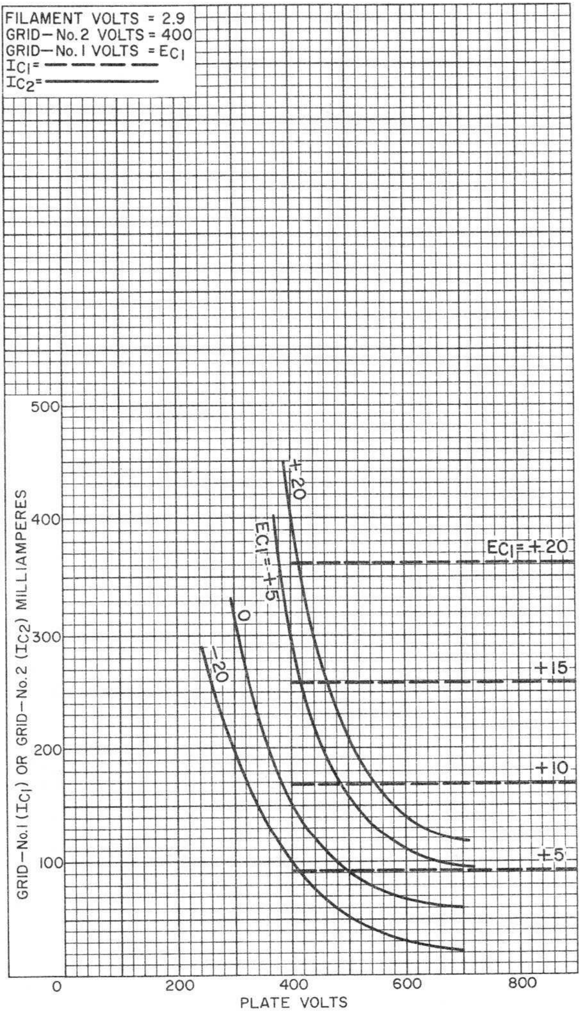


TYPICAL PLATE CHARACTERISTICS
At a Constant Grid-No.2 Voltage of 150 Volts



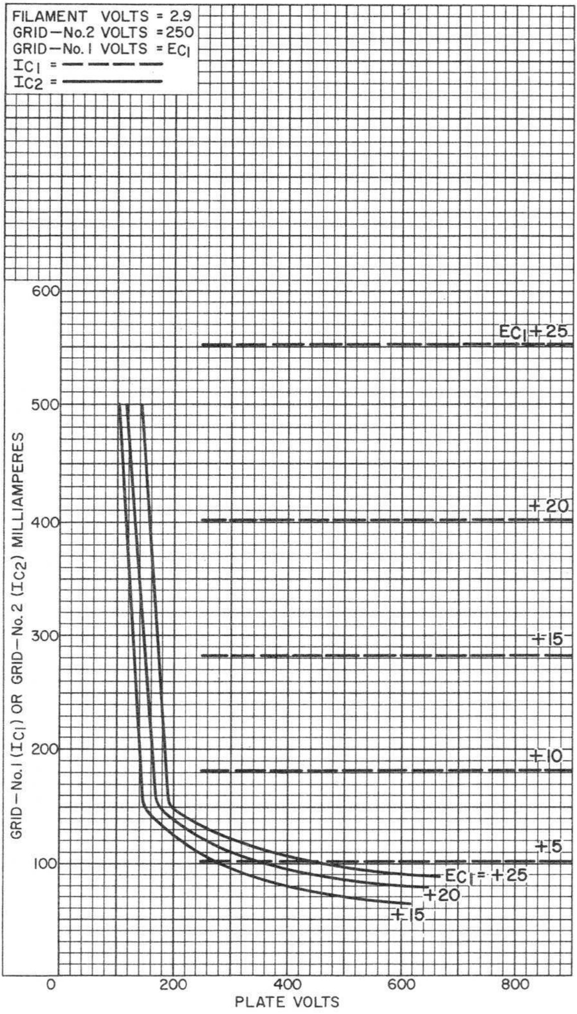
92CM—12234

TYPICAL CHARACTERISTICS
At a Constant Grid-No.2 Voltage of 400 Volts



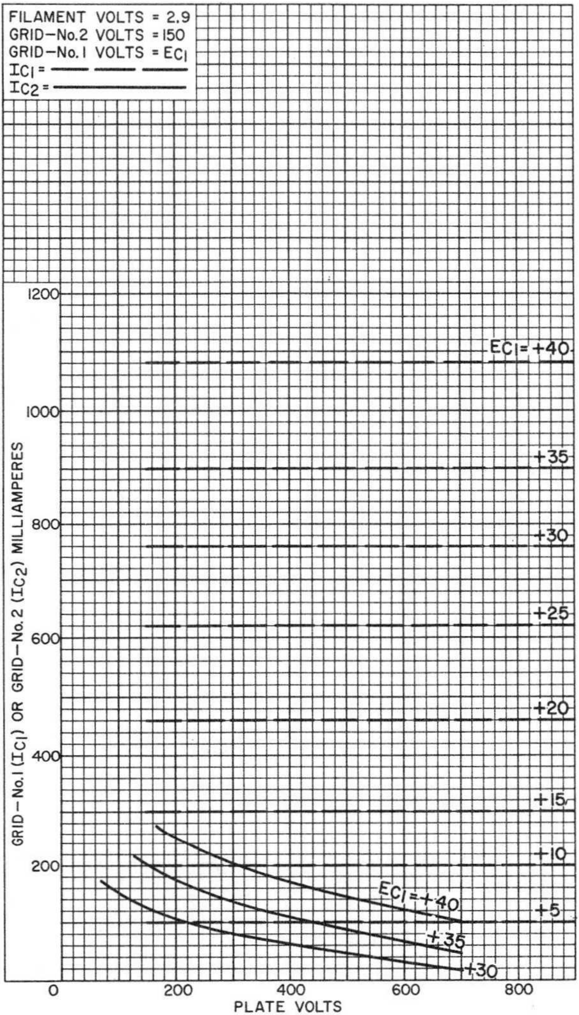
92CM—12226

TYPICAL CHARACTERISTICS
At a Constant Grid-No.2 Voltage of 250 Volts



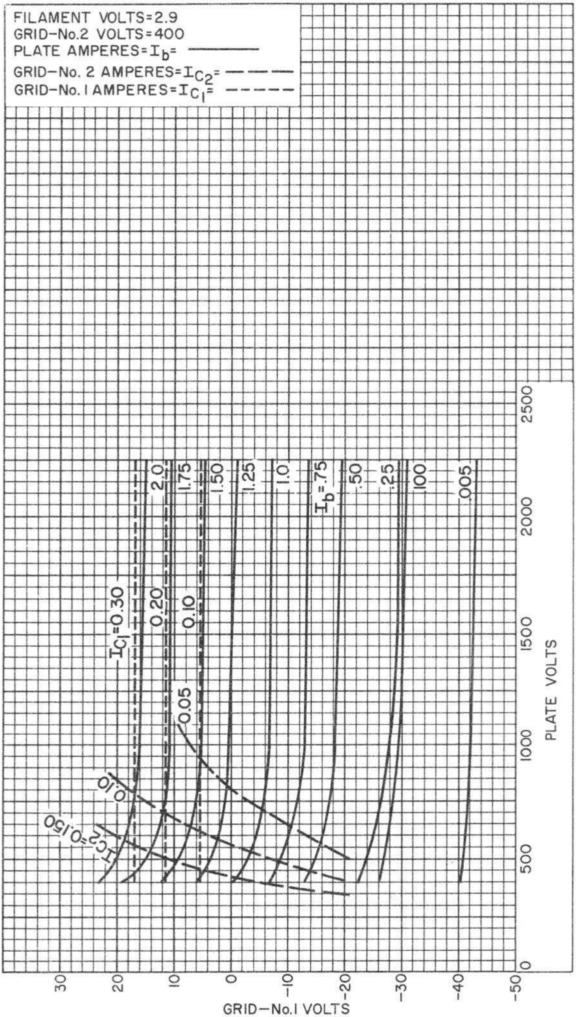
92CM—12229

TYPICAL CHARACTERISTICS
At a Constant Grid-No.2 Voltage of 150 Volts

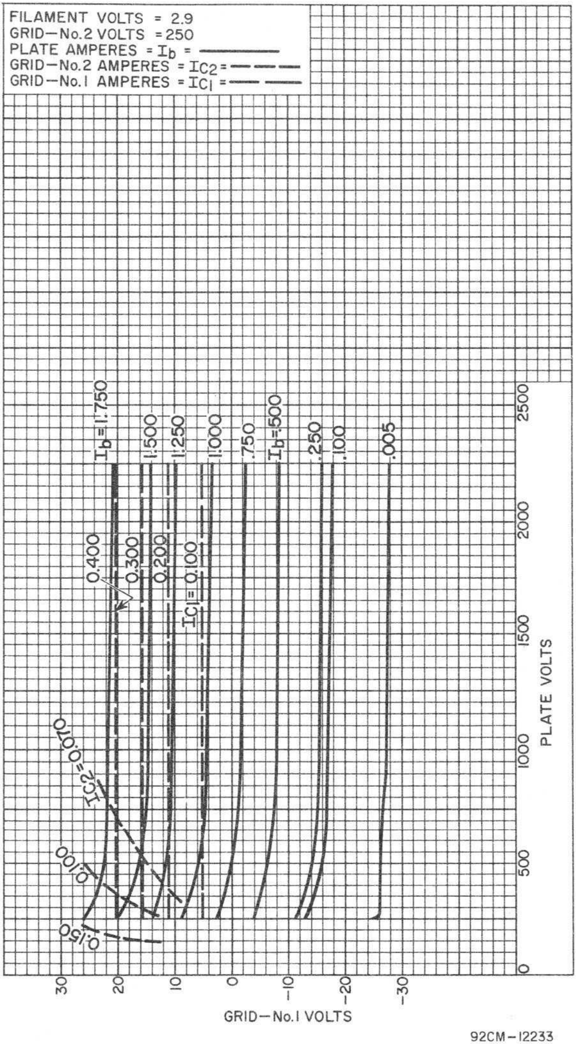


92CM-12241

TYPICAL CONSTANT-CURRENT CHARACTERISTICS
At a Constant Grid-No.2 Voltage of 400 Volts

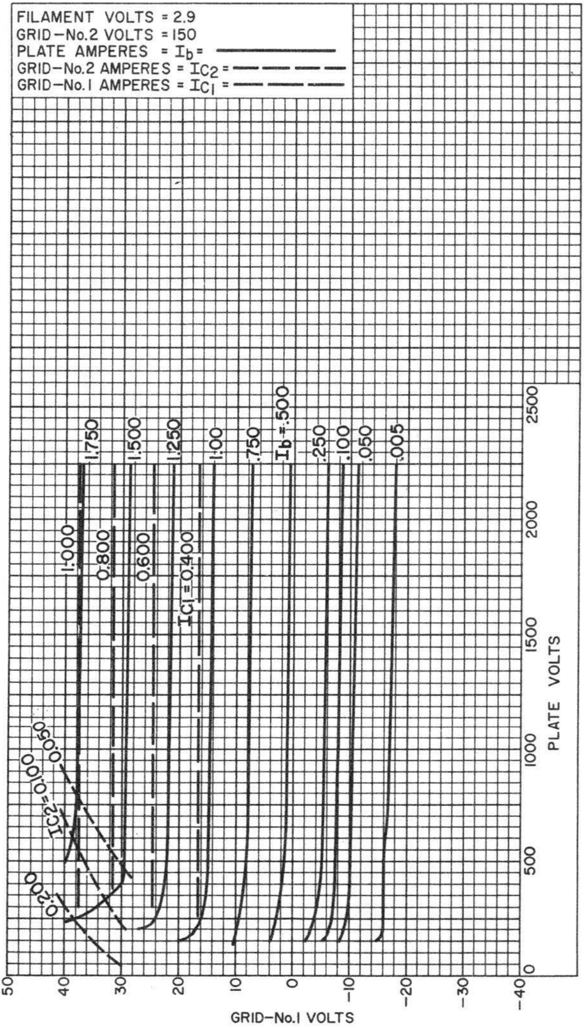


TYPICAL CONSTANT-CURRENT CHARACTERISTICS
At a Constant Grid-No.2 Voltage of 250 Volts



92CM-12233

TYPICAL CONSTANT-CURRENT CHARACTERISTICS
At a Constant Grid-No.2 Voltage of 150 Volts



92CM—12240

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:

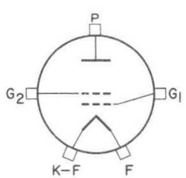
Filamentary Cathode, Thoriated Tungsten Mesh Type:[c]			
Voltage (AC or DC)	4.5	typ.	volts
	5.0	max.	volts
Current:			
At 4.5 volts	125	typ.	amp
For starting, even momentarily	300	max.	amp
Cold resistance	0.005		ohm
Minimum heating time	15		sec
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 1200, 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	0.65	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

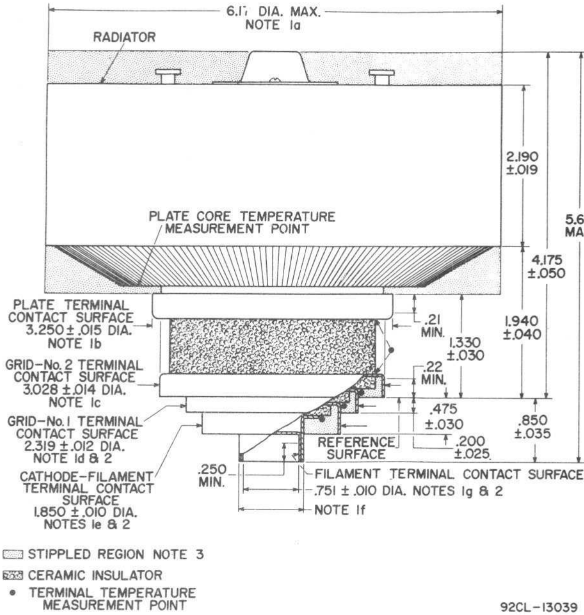
a With external flat metal shield 8" in diameter having a center hole 3" in diameter. Shield is located in plane of the grid-No.2 terminal, perpendicular to the tube axis, and is connected to grid No.2.

b With external flat metal shield 8" in diameter having a center hole 2-3/8" in diameter. Shield is located in plate 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

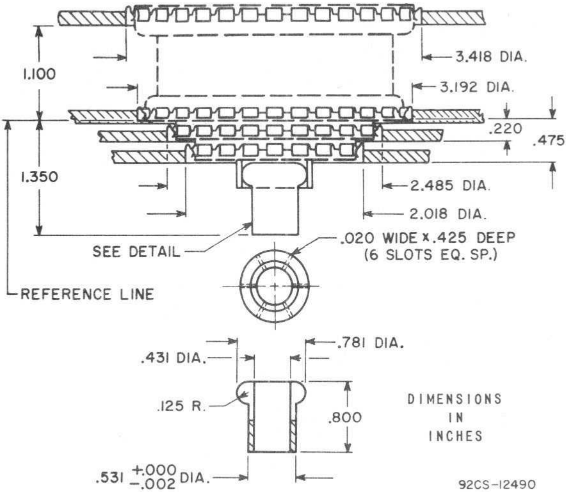
Note 1: Concentricity between the various diameters is such that the tube will enter a gauge having suitably spaced concentric apertures and posts of the following diameters:

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.

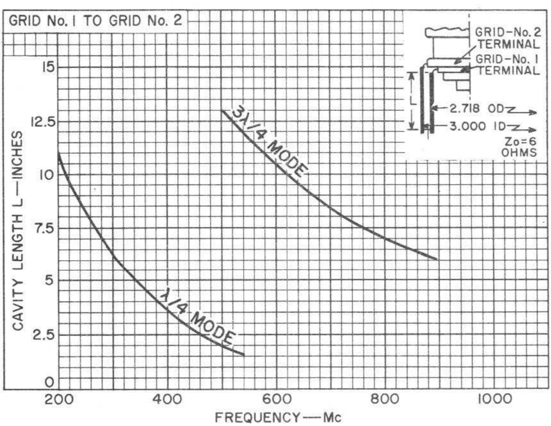
PREFERRED MOUNTING ARRANGEMENT



92CS-12490

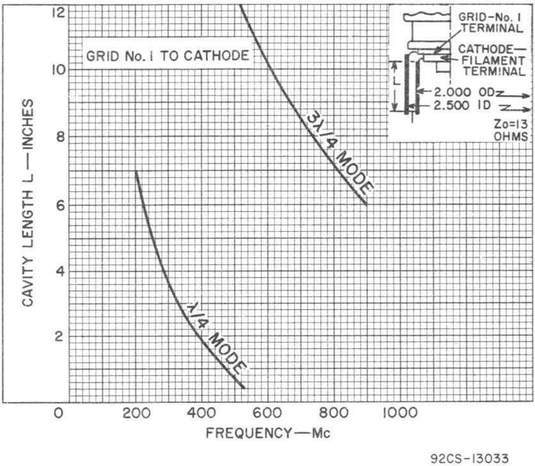
Note: All finger stock No.97-380, made by Instrument Specialties Co., Little Falls, N.J.

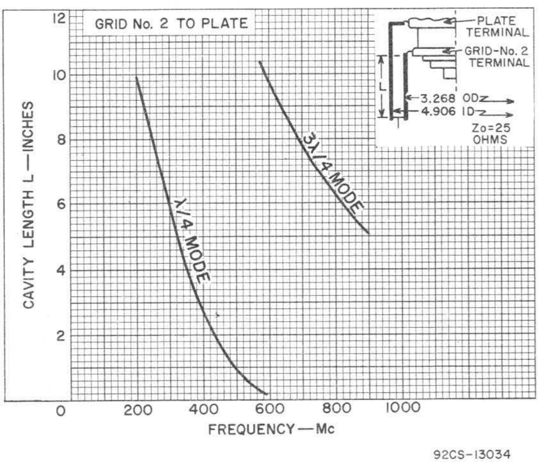
CAVITY TUNING CHARACTERISTICS



92CS-13035

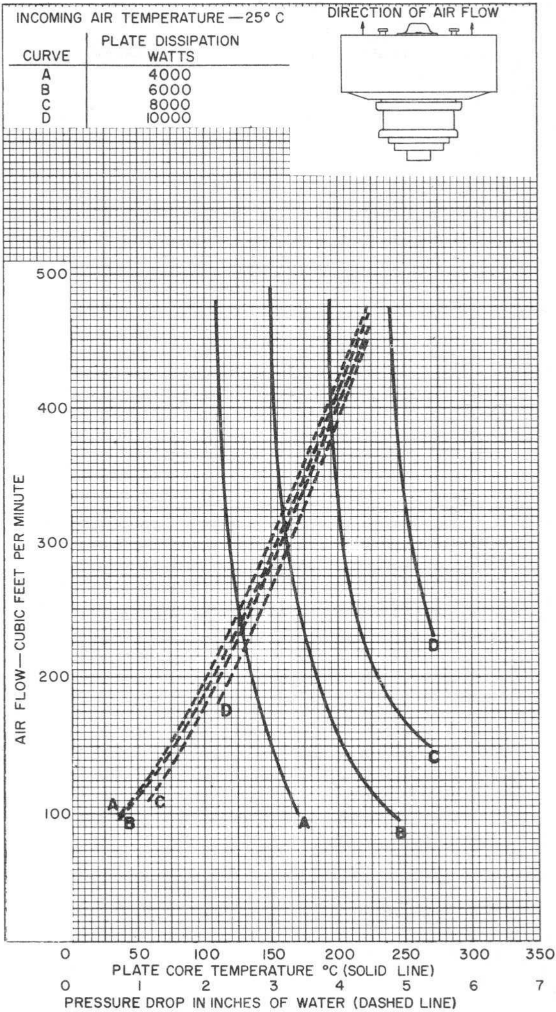
CAVITY TUNING CHARACTERISTICS





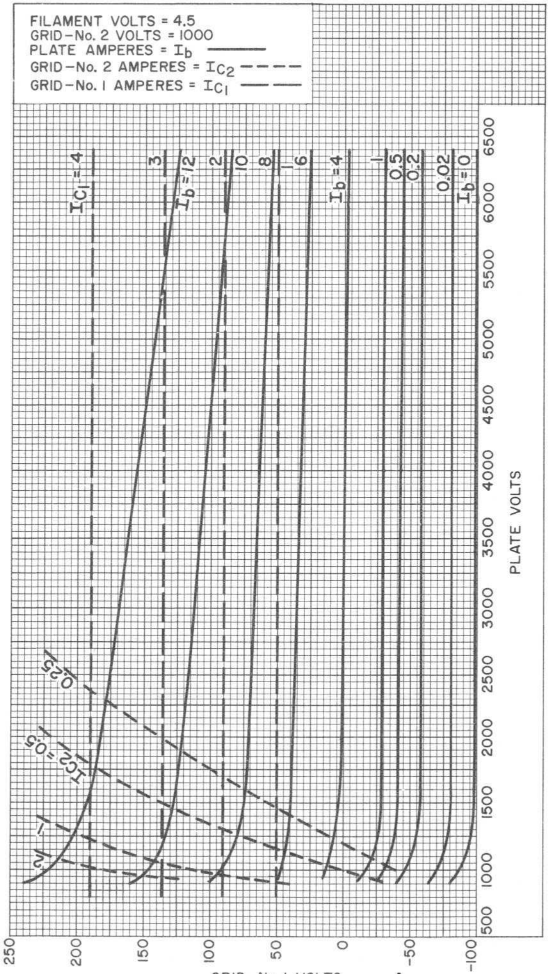
RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

TYPICAL COOLING CHARACTERISTICS



92CM-12488

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM-13036

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	100 max °C
Electron-gun-assembly bath	
Window Band Temperature	90 max °C
Through 10-32 NF tapped hole in window cover to accommodate thermocouple	
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*, 1CE-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 8568 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.

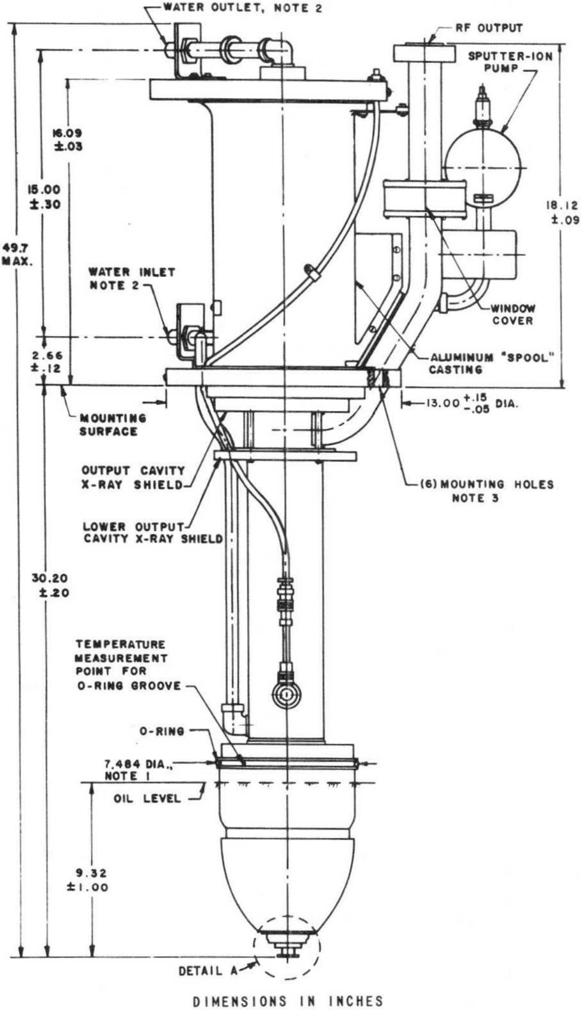
The window must be kept clean of any foreign material. When the load waveguide is not connected to the tube, the plastic cover supplied for shipping should be used to cover the tube waveguide flange.

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 must 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

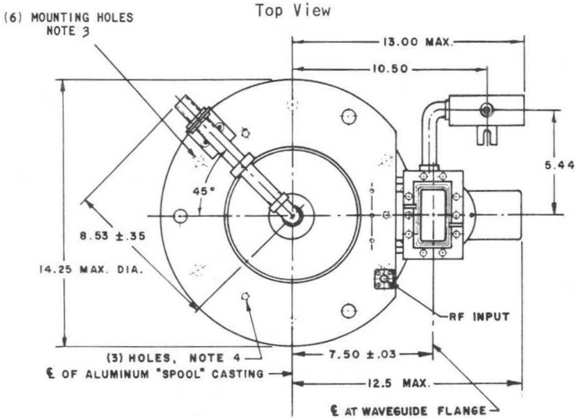
DIMENSIONAL OUTLINE
Side View



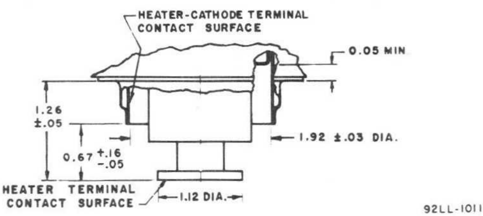
DIMENSIONS IN INCHES

DIMENSIONAL OUTLINE

Top View



Detail A



DIMENSIONS IN INCHES

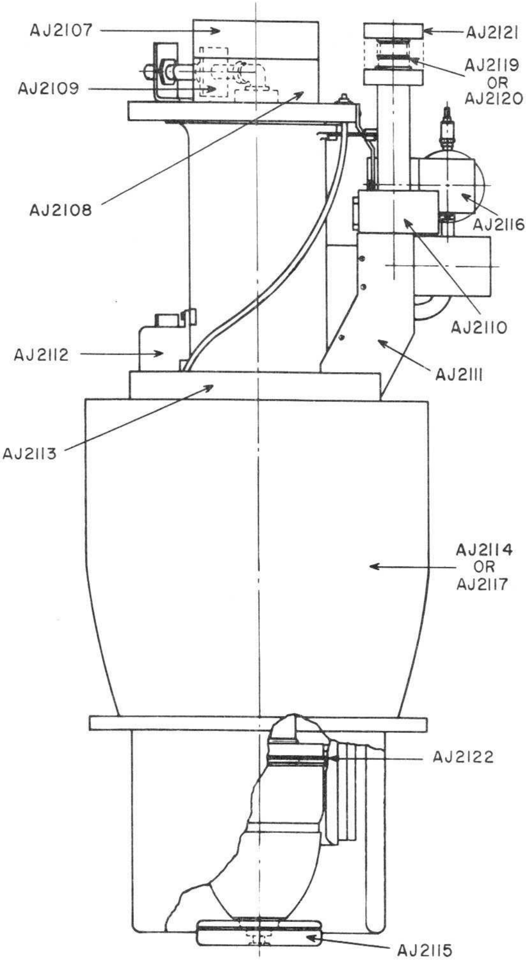
Note 1: Recommended diameter of O-ring sealing surface.

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.

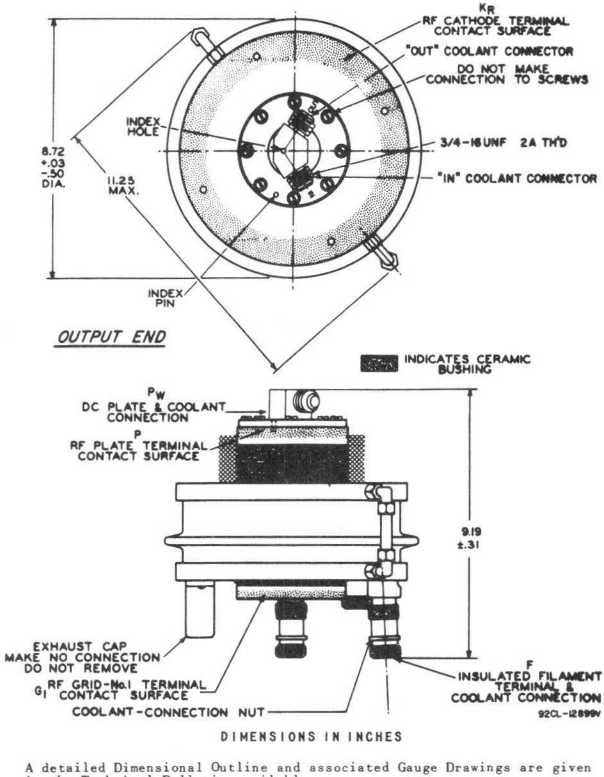
(a) When water or ethylene-glycol-water solution is used, the plate-terminal assembly may stick in (1) above due to excessive deposit build-up. If so, clean the plate coolant course before further attempting to remove the assembly. In (3) above determine if there is a flaky or adherent deposit on the 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

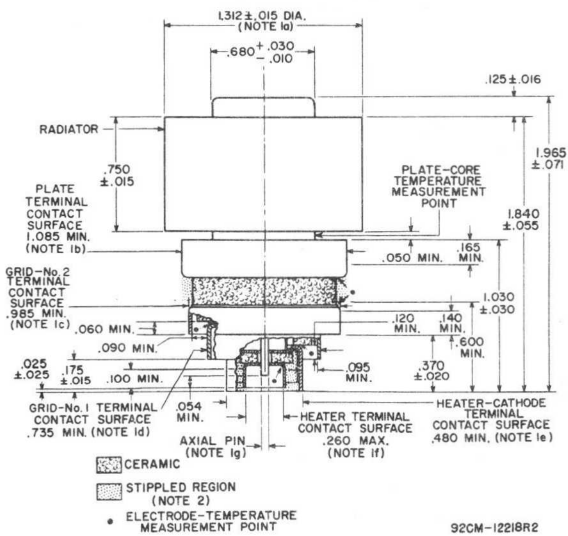
Plate, Grid No.2, Grid No.1, Cathode, and
Heater Temperature . . . . 250 max °C
Plate-Core Temperature . . . . 250 max °C

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.

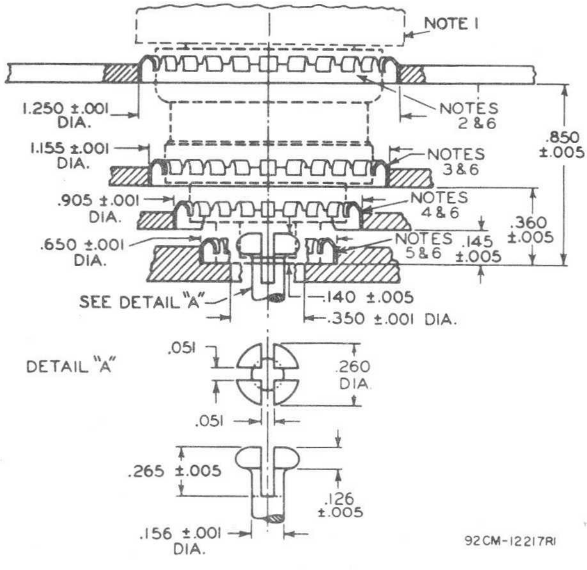
NOTE 1: The following diametrical space requirements accommodate the concentricity of the cylindrical surfaces of the radiator band, axial pin, and each electrode terminal:

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 A_I 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

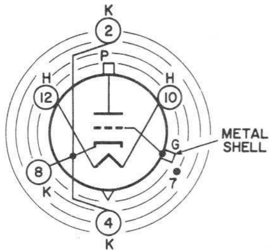
Heater Voltage	E_f	6.3	6.3	V
Plate Supply Voltage	E_{bb}	150	110	V
Grid Supply Voltage	E_{cc}	0	0	V
Cathode Resistor	R_k	150	47	Ω

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 $T_E \leq 150^\circ$ C		50	50	kΩ
For $T_E > 150^\circ$ C		See *Grid-Circuit-Resistance Rating Chart*		

RADIO CORPORATION OF AMERICA
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 5NS-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	
$\Delta 1g_m$	-	±15	%
I_c	-	-0.1	μA
I_{hk}	-	±10	μA
ER_{pm} (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	✓		

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)

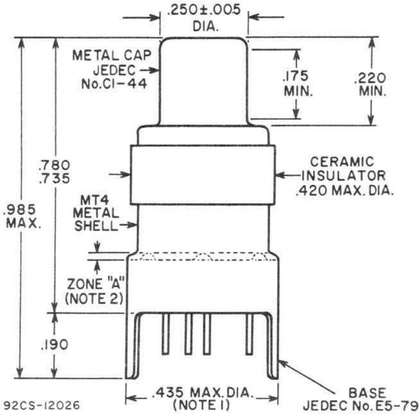
Operating Conditions

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
I_c.	-	-	-	-0.2	-	-	-	-	μA

DIMENSIONAL OUTLINE

JEDEC No.4-6



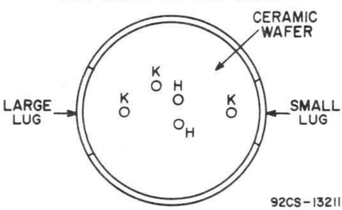
DIMENSIONS IN INCHES

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".

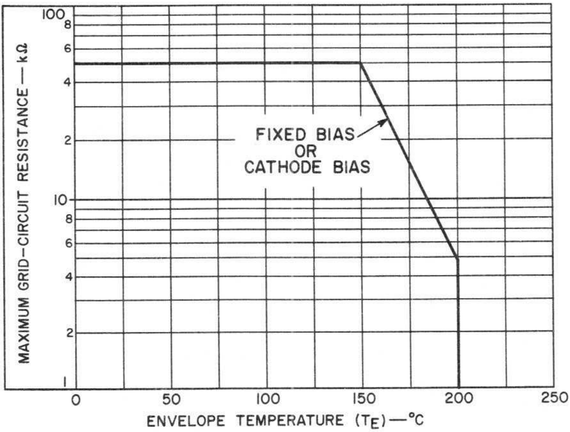
MODIFIED BOTTOM VIEW

With Element Connections Indicated and Short Pin Not Shown



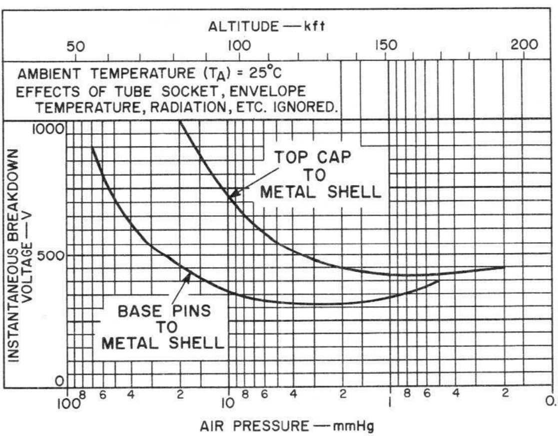
RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

Grid-Circuit-Resistance Rating Chart



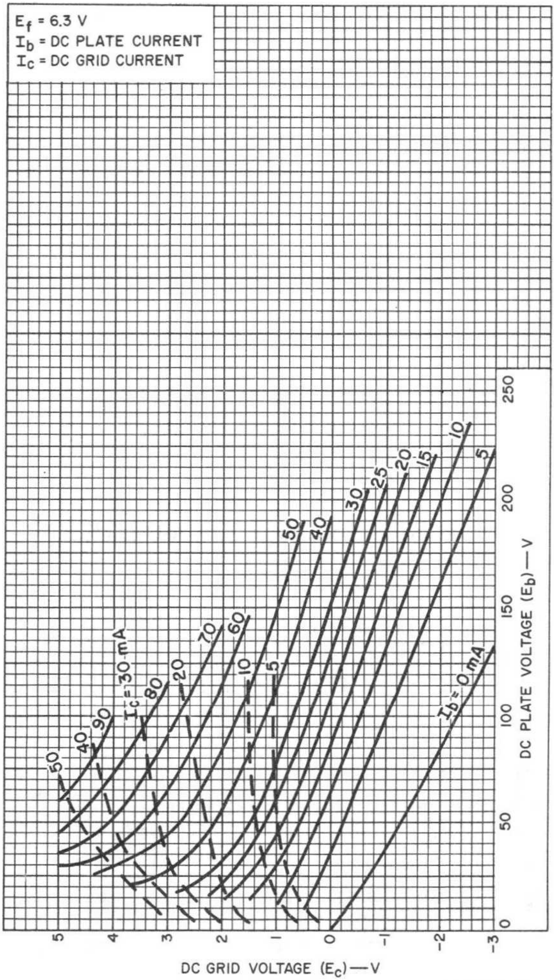
92CS-13119R1

Breakdown-Voltage Characteristics



92CS-13117R1

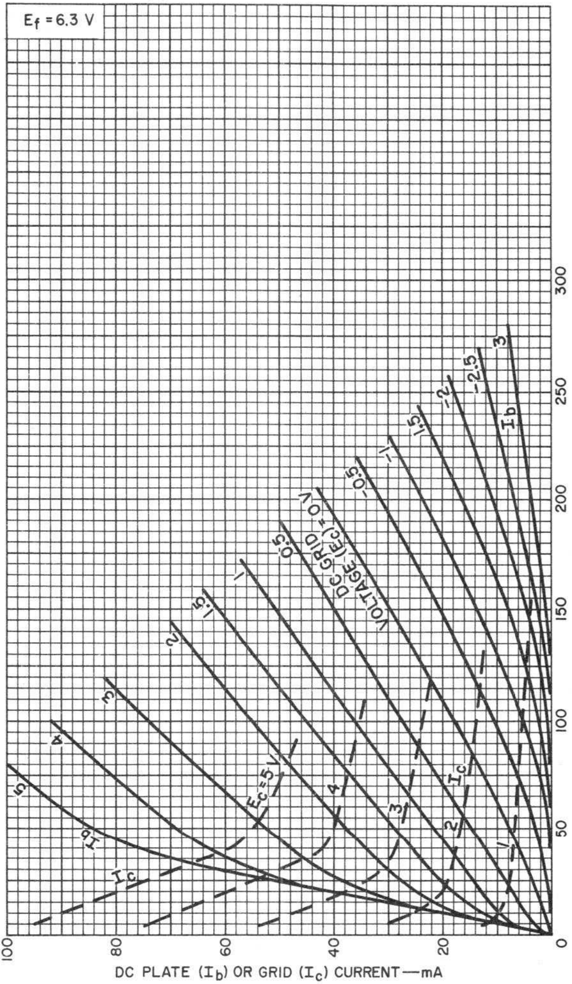
Typical Constant-Current Characteristics



92CM-13220

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

Typical Characteristics



92CM-13219

High Power Magnetron

Ceramic-Metal Construction

CW Oscillator — **80% Efficiency**
30 Kilowatts at 915 MHz — **Liquid Cooled**

MAGNETRON

ELECTRICAL

Filament, Tungsten Coil
- AC Supply Voltage . . . . 12.5 V
- Current[a] at 12.5 volts . . . . 115 A
- Starting Current . . . . Must never exceed 250 amperes, even momentarily
- Cold resistance . . . . 0.010 Ω
- Minimum heating time at normal filament voltage before anode voltage is applied . . . . 10 s

Center Frequency . . . . 915 ± 15 MHz
Focusing[b] . . . . Electromagnet, using AJ2134, AJ2134V1, or equivalent

MECHANICAL

Operating Position . . . . Vertical, either end up
Maximum Overall Length. . . . . 18.25"
Maximum Diameter . . . . 4.94"
Terminal Connections . . . . See *Dimensional Outline*
Weight (Approx.) . . . . 16 lbs

THERMAL

Ceramic-Insulator Temperature . . . . 150 max. °C
Metal-Surface Temperature . . . . 100 max. °C

Air Cooling

It is important that the temperature of any external part of the tube should not exceed the specified values. Uniform forced-air cooling of the output ceramic dome is required; with an RCA-AJ2134 or -AJ2134V1 Waveguide Adapter, approximately 20 cfm at 2.5 inches of water is adequate. Forced-air cooling of filament-terminal stem is also required. Approximately 5 cfm at 2 inches of water is required when using the RCA-AJ2137 Filament Connector. The air flow must start before application of the filament voltage and preferably should continue for several minutes after removal of the voltage. Interlocking of the air flow with the filament power supply is recommended to prevent tube damage in case of failure of adequate air flow.

Liquid Cooling

Liquid cooling of the anode is required. The liquid flow must start before application of the filament voltage and preferably should continue for several minutes after removal of the voltage. Interlocking of the liquid flow with the filament power supply is recommended to prevent tube damage in case of failure of adequate liquid flow. When the liquid is water, the use of distilled or filtered deionized water is essential.

For information on the cooling system and quality of water, see *Cooling Considerations* under *RCA Transmitting Tube Operating Considerations* at front of this section.

Typical Water Flow to tube for 6 kW Anode Dissipation	3 gpm
Pressure Drop, at 3 gpm	25 psi
Maximum Outlet Water Temperature	70 °C
Maximum Inlet Water Pressure	100 psig

CW OSCILLATOR

Absolute-Maximum Ratings

DC ANODE VOLTAGE[c]	14 kV
ANODE CURRENT	3 A
ANODE DISSIPATION	15 kW
LOAD VSWR[d]	
At a Power Output of 30 kW	1.1:1
At a Power Output of 25 kW	2.5:1
At a Power Output of 20 kW	3.0:1

Typical Operation at 915 MHz

AC Filament Voltage	11.7	11.4	11.4	V
Filament Current[a]	105	100	100	A
DC Anode Voltage	7.0	12.5	12.6	kV
Anode Current	2.0	2.4	2.8	A
DC Electromagnet Current	1.8	3.1	3.1	A
Useful Power Output[e]	10	25	30	kW
Efficiency	78	84	86	%

[a] The filament is subjected to back bombardment during operation. This will increase the filament temperature and shorten tube life if left uncorrected. Therefore, the filament current should be reduced under operating conditions to a value that will give the same "hot filament resistance" as when no rf power is being generated. The operating filament current must be established in the following manner:

(1) With no anode voltage applied, set the filament current to 115 amperes without exceeding the starting current of 250 amperes. Calculate the "hot filament resistance" after the filament has stabilized (approximately 5 minutes) by dividing the applied filament voltage by the filament current.

(2) Apply power to the electromagnet (See *Magnetron Operating Considerations*, **Electromagnet Operation**), and then apply the desired anode voltage.

(3) Reduce the filament current in approximate 5-ampere steps until the "hot filament resistance" is the same as that calculated in Step 1. See *Typical Operation* data for approximate operating current.

(4) To restart the magnetron after the anode voltage has been removed, reset the filament current to 115 amperes, apply anode voltage and after the tube is generating power, reduce the filament current to the operating value determined in Step 3.

[b]The magnetic field must be turned "on" before application of the anode voltage and turned "off" only after removal of the anode voltage. For further details, see *Waveguide Adapter*.

[c]The anode is normally grounded.

[d]Refer to *Typical Rieke Diagram* for the effects of load VSWR on power output and frequency.

[e]At a load VSWR not exceeding 1.1:1.

MAGNETRON OPERATING CONSIDERATIONS

For considerations common to all RCA super-power tubes, see *Application Guide for RCA Super Power Tubes, 1CE-279A.* **Additional considerations specifically for the 8684 are given below.**

Use of RF-Gasket

The rf connection between the magnetron and waveguide adapter is made by an rf gasket, RCA-AJ2138 or equivalent.

Harmonic Radiation Shielding

Harmonic energy may be radiated through the high-voltage and filament insulators. An rf shielded enclosure or suitable absorbing material may be required to reduce the harmonic radiation to acceptable levels.

Electromagnet Operation

To establish the electromagnet coil current when a tube is first installed, it is recommended that the electromagnet coil current be set at a value that will keep the magnetron anode current cut off when the anode voltage is applied. The typical electromagnet coil current necessary to achieve anode current cutoff with various anode potentials is shown in Fig.2. In no case should the coil current exceed 4.0 amperes. After the anode voltage has been applied, the electromagnet coil current should be gradually reduced to give the required magnetron rf power output. The magnetron anode current and rf power output will increase slowly as the magnet coil current is gradually reduced.

When the tube is restarted after it has been shut down, the electromagnet coil current may be reset at the value determined above provided the coil is not connected in series with the magnetron anode supply. See *Wave-Guide Adapter,* **Operating Considerations** for electromagnet and tube operation with the coil connected in series with the magnetron anode supply.

RF-RADIATION WARNING

Because the 8684 is designed to generate high rf power levels at high frequencies, care must be taken to protect personnel from possible injury due to rf-radiation leakage.

Care must be exercised by the equipment designer and tube operator to insure that the rf seals obtained between the tube RF Output Terminal Contact Surface (See *Dimensional Outline*) and *Waveguide Adapter*, between waveguide flanges, and between the waveguide and rf probes are adequate to limit the rf leakage radiation to safe values.

CONNECTORS

RCA-AJ2137 is a connector for contacting the **filament** terminal of the magnetron. It contains a duct to permit forced-air cooling of the filament terminal, filament insulator, and the filament-cathode connector. This connector includes a 10-inch long braided lead with connector lug for 3/8-inch bolt.

RCA-AJ2136 is a connector for contacting the **filament-cathode** terminal of the magnetron. This connector includes a 10-inch long braided lead with connector lug for 3/8-inch bolt.

RCA-AJ2136V1 is a variant of the AJ2136 described above. It features a molded material which suppresses spurious radiation from the high-voltage insulator area of the magnetron.

AJ2137	
AC or DC Current (typical)	115 A
Pressure Drop, at air flow of 5 ft^3/min	2 inches of water
AJ2136	
AC or DC Current (typical)	115 A
AJ2136V1	
AC or DC Current (typical)	115 A
Spurious Radiation Attenuation:	
Minimum	10 dB
Typical	12 dB

WAVEGUIDE ADAPTER

RCA–AJ2134 and AJ2134V1 Waveguide Adapters include the necessary electromagnet and rf circuitry for coupling rf energy from the 8684 to WR975 waveguide. The AJ2134 and the AJ2134V1 are identical except for the waveguide connector flange.

ELECTRICAL

DC Coil Voltage	39 V
Coil Current at 39 volts	3.0 A
Voltage Transients Across Electromagnet	Must never exceed 500 volts, even momentarily

MECHANICAL

Maximum Overall Length	23.4"
Maximum Height	16.62"
Maximum Width	13.50"
Mounting Bracket	See *Assembly Outline*
Electromagnet Electrical Terminal Connection	See *Assembly Outline*
Electromagnet Coolant Connections	See *Assembly Outline*
Weight (Approx.)	145 lbs.

THERMAL

Liquid Cooling

Liquid Cooling of the electromagnet coil is required. The liquid flow must start before application of the electromagnet voltage and preferably should continue for several minutes after removal of the voltage. Interlocking of the liquid flow with the electromagnet and the magnetron high voltage supply is recommended to prevent damage to the electromagnet and/or tube in case of failure of adequate liquid flow.

Typical Water Flow for coil dissipation of 140 watts	0.25 gpm
Maximum Pressure Drop, at 0.25 gpm	10 psi
Maximum Outlet Water Temperature	70 °C
Maximum Inlet Water Pressure	100 psig

Absolute-Maximum Ratings

DC Electromagnet Voltage [f]	50 V
DC Electromagnet Power	190 watts

[f] A shunt protection circuit such as provided by a thyrite is recommended for protecting the electromagnet from high voltage transients.

WAVEGUIDE ADAPTER OPERATING CONSIDERATIONS

See RCA-8684 Ratings for Typical Operation and Magnetron Operating Considerations. The electromagnet may be operated with a separate current-regulated power supply or it may be connected in series with the anode of the RCA-8684 magnetron, as shown in Fig.1, to minimize the sensitivity of the rf power output to anode voltage variations. In the series connected mode a separate power supply must also be connected to the electromagnet to (1) allow setting the coil current to the level required for proper tube operation (2) allow slight compensation for changes in the electromagnet coil resistance due to heat, and (3) permit the application and interruption of the magnetron anode voltage without creating excessive transient voltages across unprotected electromagnet coils.

To prevent damage to a non-protected electromagnet in the series connected mode, the magnetron anode voltage must neither be applied nor removed without first increasing the electromagnet coil current to a level that will keep the magnetron anode current cut off. The typical electromagnet coil current necessary to achieve anode current cutoff with various anode potentials is shown in Fig.2. Once the anode voltage is applied, the electromagnet coil current may be reduced to the required level by adjusting the output of the electromagnet supply. The magnetron anode current and rf power output will increase slowly as the coil current is gradually reduced.

SERIES CONNECTED POWER SUPPLY FOR ELECTROMAGNET OPERATION

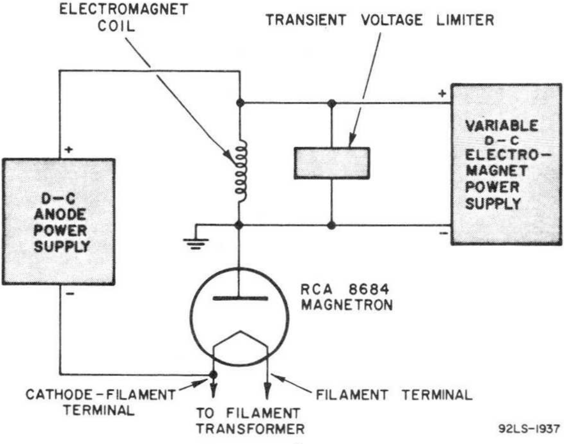
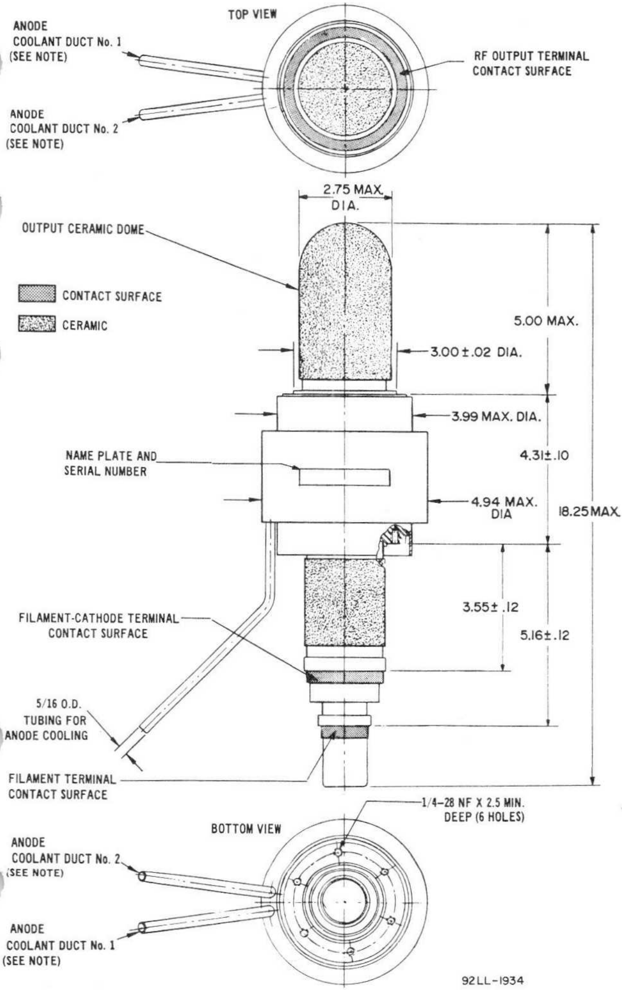


Fig.1

DIMENSIONAL OUTLINE



NOTE: Recommended direction of anode coolant flow: Duct #1 is "IN" and Duct #2 is "OUT" when tube is operated with Output Ceramic Dome UP. With Output Ceramic Dome DOWN, the flow should be reversed.

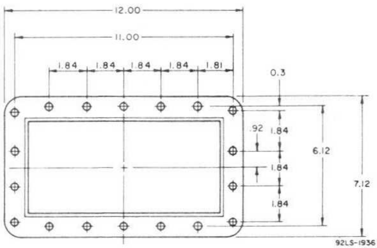
ACCESSORIES

RCA Type No.	Description
AJ2134	Waveguide Adapter; mates with EIA Standard CRP975F(WR975) Waveguide Flange.
AJ2134V1	Waveguide Adapter; mates with Alternate Waveguide Flange (See Flange on Assembly Outline.)
AJ2135	Magnetic Pole Piece
AJ2136	Filament-Cathode Connector
AJ2136V1	Filament-Cathode Connector with Molding
AJ2137	Filament Connector
AJ2138	RF Gasket
AJ2140	Accessory Kit including -AJ2135, -AJ2136, -AJ2137
AJ2141	Accessory Kit including -AJ2135, -AJ2136V1, -AJ2137.

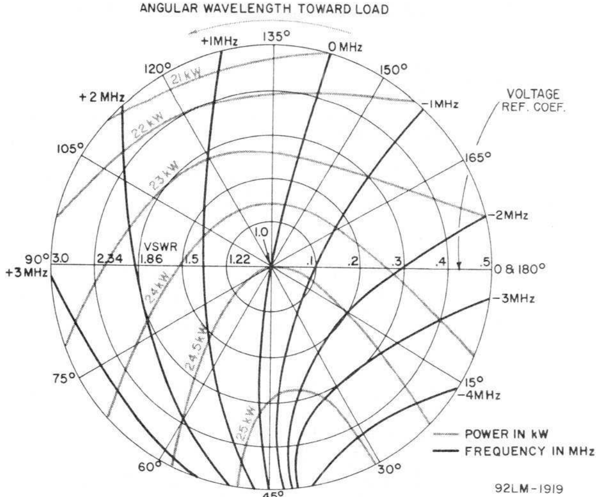
AJ2134 Waveguide Adapter flange mates with EIA standard CRP975F (WR975) waveguide flange

or

AJ2134V1 Waveguide Adapter flange mates with alternate flange shown below



TYPICAL RIEKE DIAGRAM



Note: The zero degree reference point is located at the plane of the waveguide connector flange on RCA-AJ2134 or -AJ2134V1 Waveguide Adapter.

COIL CURRENT vs. ANODE VOLTAGE

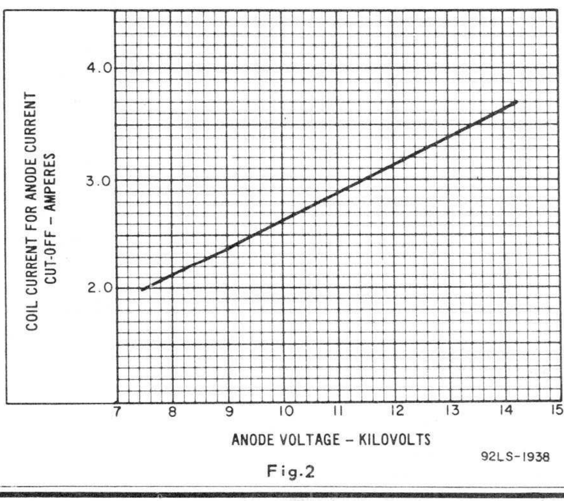
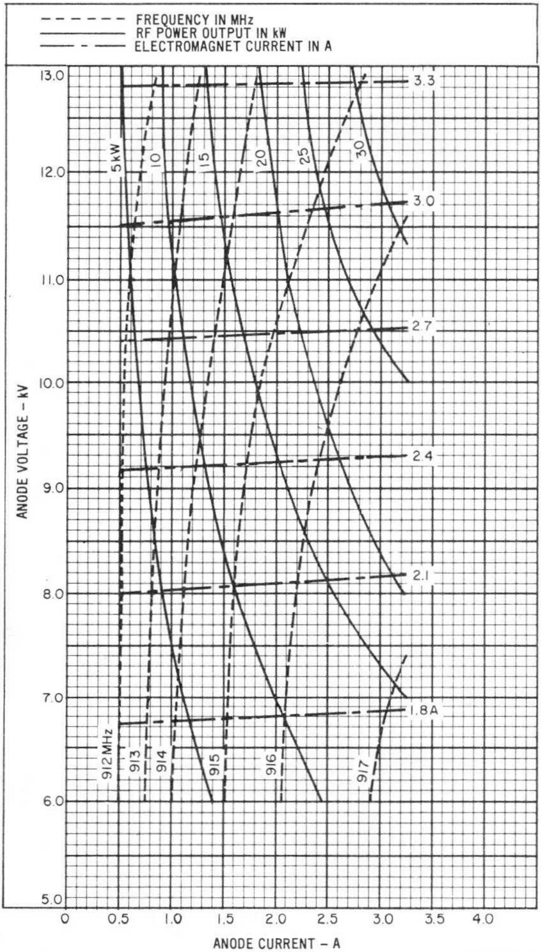


Fig.2

TYPICAL PERFORMANCE CHARACTERISTICS



92LM-2192

Pencil Tube

Fast Warmup Time **Pre-Tinned Heater Pins**

Ceramic Metal, High-Mu Triode
Sturdy Coaxial-Electrode Structure

GENERAL

Heater, for Unipotential Cathode:

Voltage (AC or DC)	6.3 ± 10%	V
Current at 6.3 volts	0.225	A
Cathode Warmup Time (Average) to reach 80% of operating power output as RF oscillator or amplifier	5	s
Amplification Factor	70	
Transconductance, for dc plate current of 14 milliamperes, dc plate voltage of 125 volts, and cathode resistor of 50 ohms	16,000	µS
Direct Interelectrode Capacitances:		
Grid to plate	2.1	pF
Grid to cathode and heater	4.4	pF
Plate to cathode and heater	0.04 max.	pF
Operating Position		Any
Dimensions and Terminal Connections	See *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 MHz (Including heater-terminals connector)	Jettron[b] No.CD7010, or equivalent
Cavities (Including heater-terminals connector)	J-V-M[c] No.D-7980 Series,[d] Resdel[d] No.10 Series, AML, Inc,[e] MCL, Inc,[f] or equivalent

RF POWER AMPLIFIER & OSC. – Class C Telegraphy[g] and RF POWER AMPLIFIER – Class C FM Telephony

Maximum CCS[h] Ratings, *Absolute-Maximum Values up to 5 GHz:*

For Altitudes up to 100,000 feet

DC Plate Voltage	250 max.	V
DC Grid Voltage	-50 max.	V
DC Cathode Current	25 max.	mA
DC Grid Current	6 max.	mA
Grid Resistor	0.25 max.	MΩ

Plate Dissipation	2.5 max.	W
Plate-Seal Temperature	225 max.	°C
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode	50 max.	V
Heater positive with respect to cathode	50 max.	V

Typical CCS Operation as Oscillator in Cathode-Drive Service:

	At 500 MHz	*At 1,000 MHz*	*At 2,000 MHz*	*At 3,000 MHz*	*At 4,150 MHz*	*At 5,000 MHz*	
DC Plate-to-Grid Voltage	205	203	151	125	200	200	V
DC Cathode-to-Grid Voltage	5	3	1	0.1	0.26	–	V
From a grid resistor of. .	1,000	600	250	500	130	100	Ω
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	W

Typical CCS Operation as Amplifier in Cathode-Drive Service:

	At 500 MHz	*At 1,000 MHz*	
DC Plate-to-Grid Voltage	204	185	V
DC Cathode-to-Grid Voltage	4	10	V
From a grid resistor of	800	2,000	Ω
DC Cathode Current	21	24	mA
DC Grid Current	5	5	mA
Drive Power Input (Approx.)	0.2	0.2	W
Useful Power Output (Approx.)	2.2	1.4	W

FREQUENCY DOUBLER – Class C

Maximum CCS[h] Ratings, *Absolute-Maximum Values up to 2 GHz· For Altitudes up to 100,000 feet*

DC Plate Voltage	250 max.	V
DC Grid Voltage	-50 max.	V
DC Cathode Current	22 max.	mA
DC Grid Current	6 max.	mA
Grid Resistor	0.25 max.	MΩ

Plate Dissipation	2.5 max.	W
Plate-Seal Temperature	225 max.	°C
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode	50 max.	V
Heater positive with respect to cathode	50 max.	V

Typical CCS Operation as Doubler in Cathode-Drive Service:

	At 550 MHz		*At 1,000 MHz*		
DC Plate-to-Grid Voltage	193	207	218	181	V
DC Cathode-to-Grid Voltage	18	7	18	6	V
From a grid resistor of	3,600	2,300	3,600	2,000	Ω
DC Cathode Current	20	18	21	19	mA
DC Grid Current	5	3	5	3	mA
Drive Power Input (Approx.)	0.8	0.2	0.8	0.2	W
Drive Power Output (Approx.)	1.3	0.75	0.9	0.4	W

FREQUENCY TRIPLER – Class C

Maximum CCS[h] Ratings, *Absolute-Maximum Values[i] up to 2 GHz:*
For Altitudes up to 100,000 feet

DC Plate Voltage	250 max.	V
DC Grid Voltage	-50 max.	V
DC Cathode Current	20 max.	mA
DC Grid Current	6 max.	mA
Grid Resistor	0.25 max.	MΩ
Plate Dissipation	2.5 max.	W
Plate-Seal Temperature	225 max.	°C
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode	50 max.	V
Heater positive with respect to cathode	50 max.	V

Typical CCS Operation as Tripler in Cathode-Drive Service:

	At 645 MHz		*At 1,000 MHz*		
DC Plate-to-Grid Voltage	202	240	205	185	V
DC Cathode-to-Grid Voltage	27	15	30	10	V
From a Grid Resistor of	9,000	25,000	10,000	14,000	Ω
DC Cathode Current	19	13	19	12	mA
DC Grid Current	3	0.6	3	0.7	mA
Drive Power Input (Approx.)	0.6	0.2	0.6	0.2	W
Useful Power Output (Approx.)	0.7	0.4	0.4	0.15	W

CHARACTERISTICS RANGE VALUES

	Note	Min.	Max.	
Heater Current	1	0.205	0.245	A
Direct Interelectrode Capacitances:				
Grid to plate	–	1.5	2.7	pF
Grid to cathode	–	3.6	5.0	pF
Plate to cathode	–	–	0.04	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
Leakage Resistance:				
From grid to plate and cathode connected together . .	1,4	100	–	MΩ
From plate to grid and cathode connected together . .	1,5	100	–	MΩ
Reverse Grid Current . . .	1,6	–	0.3	µA
Emission Voltage	7	–	4	V
Amplification Factor . . .	1,8	55	85	
Transconductance	1,8	12,500	19,500	µS
Plate Current (1)	1,8	9	19	mA
Plate Current (2)	1,9	–	50	µA
Power Output	1,10	1.7	–	W
Change in Power Output .	1,10,11	–	0.2	W

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 and adjusted to produce a cathode current of 30 milliamperes, 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 1,000 microfarads.

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 approximately 550 ± 10 MHz, 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 milliamperes.

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.

[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 number applies to a series of cavities covering the range from 220 to 3500 MHz.

[d] Resdel Engineering Corp., 990 South Fair Oaks Ave., Pasadena, Calif. This series of cavities covers the range from 215 to 2325 MHz.

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

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

[g] 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.

[h] Continuous Commercial Service.

SPECIAL TESTS AND PERFORMANCE DATA

Low-Pressure Voltage Breakdown Test

This test (similar to MIL-E-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-Hz rms voltage of 300 volts is applied between the plate cylinder and grid flange.

Low-Frequency Vibration Performance

This test (similar to MIL-E-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 Hz 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:

Negative Grid Current ($-I_C$) . . . . 1 max. µA

For conditions shown under *Characteristics Range Values, Note 1.*

Variable-Frequency Vibration Performance

This test (similar to MIL-E-1) is performed on a sample lot of tubes from each production run. Tube operating conditions are the same as for *Low-Frequency Vibration.* The tubes are vibrated perpendicular to the major axis through a frequency range from 5 to 500 Hz and back. From 5 to 50 Hz, the tubes are vibrated at a constant displacement of 0.0400 $\pm$ 0.0025 inch. From 50 to 500 Hz, the tubes are vibrated at a constant acceleration of 10 $\pm$ 2 g. Total time to complete a sweep cycle is 10 $\pm$ 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:

Negative Grid Current ($-I_C$) . . . . 1 max. μA

For conditions shown under *Characteristics Range Values, Note 1.*

Shock Test

This test (similar to MIL-E-1) 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:

Negative Grid Current ($-I_C$) . . . . 1 max. μA

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-1) 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 Continunity Test

This test (similar to MIL-E-1) 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 MIL-E-1.

At the end of this test, the tubes will not show permanent shorts or open circuits and will meet the following limit:

Negative Grid Current ($-I_C$) . . . . 1 max. μA

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 inch (23.812 ± 3.96 mm), and with the grid flange centered between these supports, the tubes will withstand the gradual application of a force of 30 pounds (13.6 kilograms), 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-1) 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^{o} C for at least 15 seconds and then immersing immediately in water at not more than 5^{o} C for 5 seconds.

After drying for 48 hours at room temperature, the tubes will meet the following test limits:

Negative Grid Current ($-I_C$) . . . . 1 max. μA

For conditions shown under *Characteristics Range Values, Note 1.*

Heater-Cycling Life Performance

This test (similar to MIL-E-1) 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 2,000 cycles.

At the end of this test, tubes will not show permanent shorts or open circuits, and are required to meet the following limits:

Negative Grid Current ($-I_C$) . . . . 1 max. μA

For conditions shown under *Characteristics Range Values, Note 1.*

Heater-to-Cathode Leakage Current . . . . 30 max. μA

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

Grid-to-Cathode Leakage Resistance . . . 50 min. MΩ

For conditions shown under *Characteristics Range Values, Notes 1, 4.*

1-Hour Stability Life Performance

This test (similar to MIL-E-1) 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 percent 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:

Negative Grid Current ($-I_C$) . . . . 1 max. μA

For conditions shown under *Characteristics Range Values, Note 1.*

100-Hour Survival Life Performance

This test (similar to MIL-E-1) 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:

Negative Grid Current ($-I_C$) . . . . 1 max. μA

For conditions shown under *Characteristics Range Values, Note 1.*

Transconductance. . . . . 9,000 min. μS

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-1) 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 MHz 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 milliamperes; and grid-circuit resistance adjusted to give grid current of 6 milliamperes, 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:

Negative Grid Current ($-I_C$) . . . . 1 max. μA

For conditions shown under *Characteristics Range Values, Note 1.*

Leakage Resistance:

From grid to plate and cathode connected together . . . . 60 min. MΩ

From plate to grid and cathode connected together . . . . 60 min. MΩ

For conditions shown under *Characteristics Range Values, Notes 1, 4, and 1, 5.*

Power Output . . . . 1.5 min. W

For conditions shown under *Characteristics Range Values, Notes 1, 10.*

At the end of 1,000 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:

Negative Grid Current ($-I_C$) . . . . 1 max. μA

For conditions shown under *Characteristics Range Values, Note 1.*

Power Output . . . . 1.3 min. W

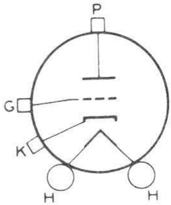
For conditions shown under *Characteristics Range Values, Notes 1, 10.*

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 be connected to one side of the heater. In some circuit designs, when 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.

TERMINAL CONNECTIONS



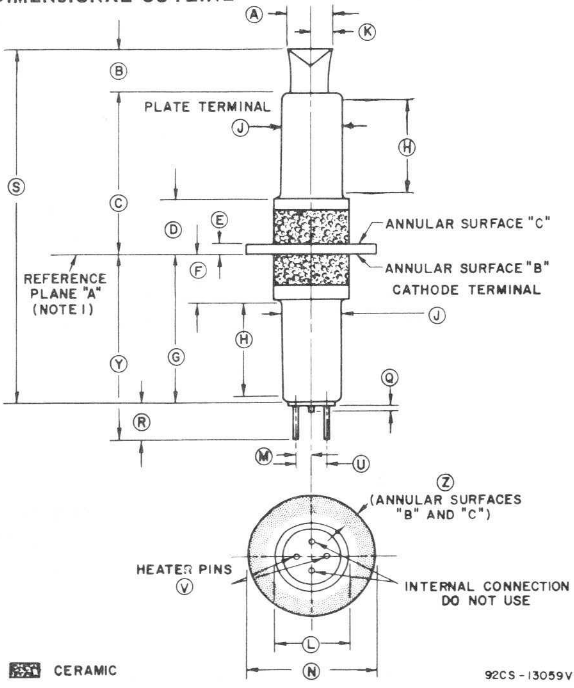
H: Heater Pin

K: Cathode Cylinder
(Adjacent to Heater Pins)

G: Grid Flange

P: Plate Cylinder
(Adjacent to pinch-off)

DIMENSIONAL OUTLINE



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.

OUTLINE DIMENSIONS AND NOTES

Symbol	Inches Min.	Inches Max.	Millimeters Min.	Millimeters Max.	Notes
A	–	0.230	–	5.84	
B	–	0.180	–	4.57	
C	0.555	0.605	14.10	15.36	
D	0.165	0.205	4.19	5.20	
E	0.049	0.055	1.245	1.397	
F	0.120	0.150	3.05	3.81	
G	0.535	0.575	13.59	14.60	
H	0.320	–	8.13	–	4
J	0.245	0.252	6.223	6.401	1-4
K	–	0.115	–	2.92	
L	0.335	0.355	8.51	9.01	
M	0.048	0.068	1.22	1.72	
N	0.547	0.557	13.894	14.148	3,5
Q	–	0.010	–	0.254	
R	0.095	0.125	2.41	3.17	
S	–	1.360	–	34.54	
U	0.095	0.135	2.41	3.42	
V	0.020	0.030	0.508	0.762	
Y	0.650	0.700	16.51	17.78	
Z	0.060	–	1.52	–	

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".

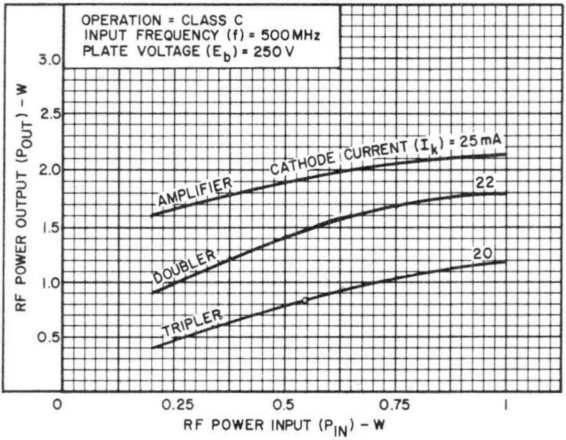
NOTE 2: The axes of the plate cylinder and cathode cylinder will coincide within 0.010".

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 G1-1 and G1-2, respectively.

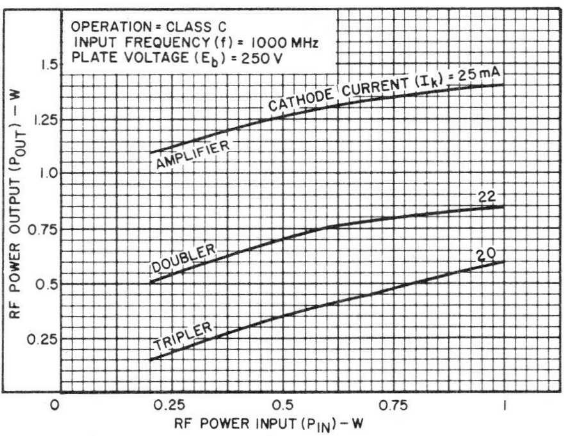
NOTE 5: This diameter is measured with "go" and "no-go" gauges G3-1 and G3-2, respectively.

TYPICAL POWER OUTPUT vs. POWER INPUT (500-MHz INPUT)



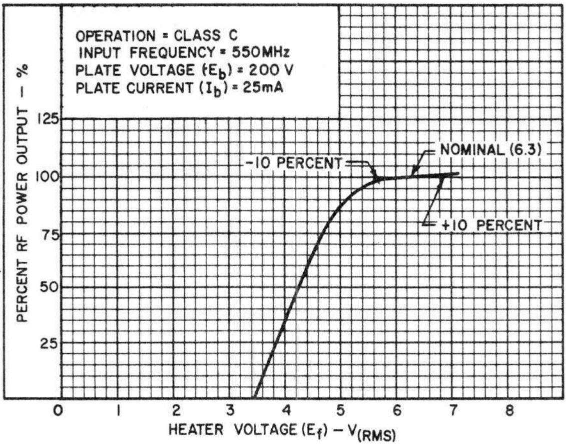
92CS-11625R2

TYPICAL POWER OUTPUT vs. POWER INPUT (1,000-MHz INPUT)



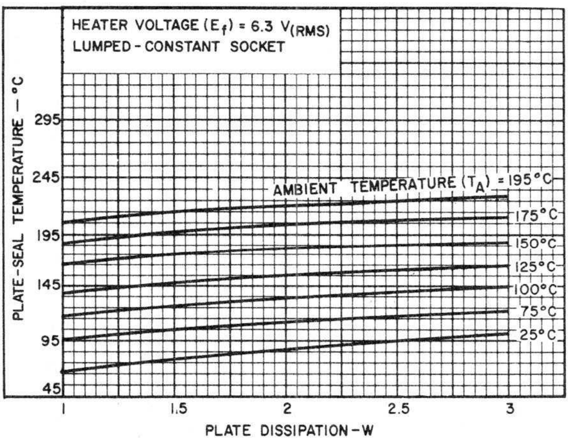
92CS-11626R2

TYPICAL POWER OUTPUT vs. HEATER VOLTAGE (550-MHz OPERATION)



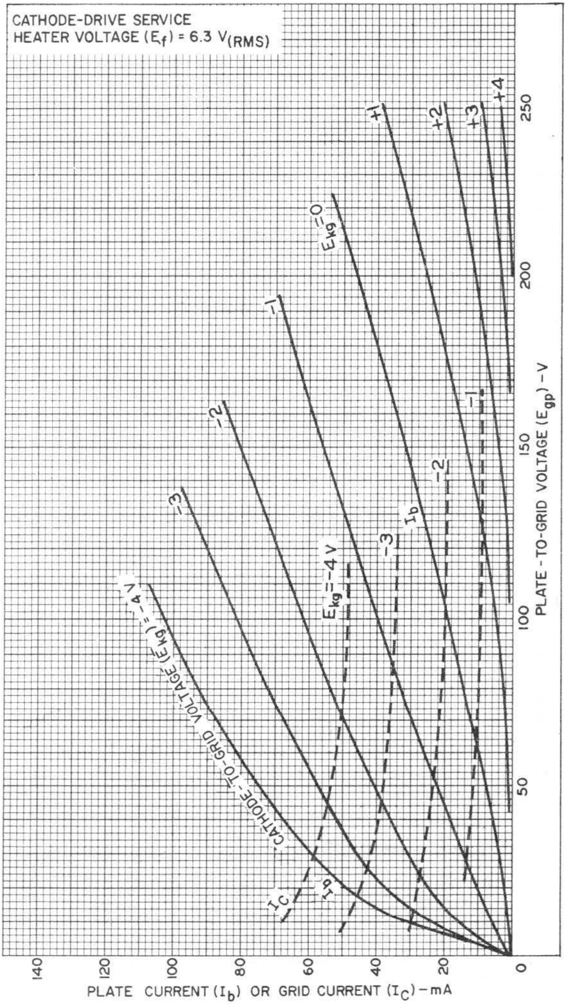
92CS-11624R2

TYPICAL PLATE-SEAL TEMPERATURE vs. PLATE DISSIPATION



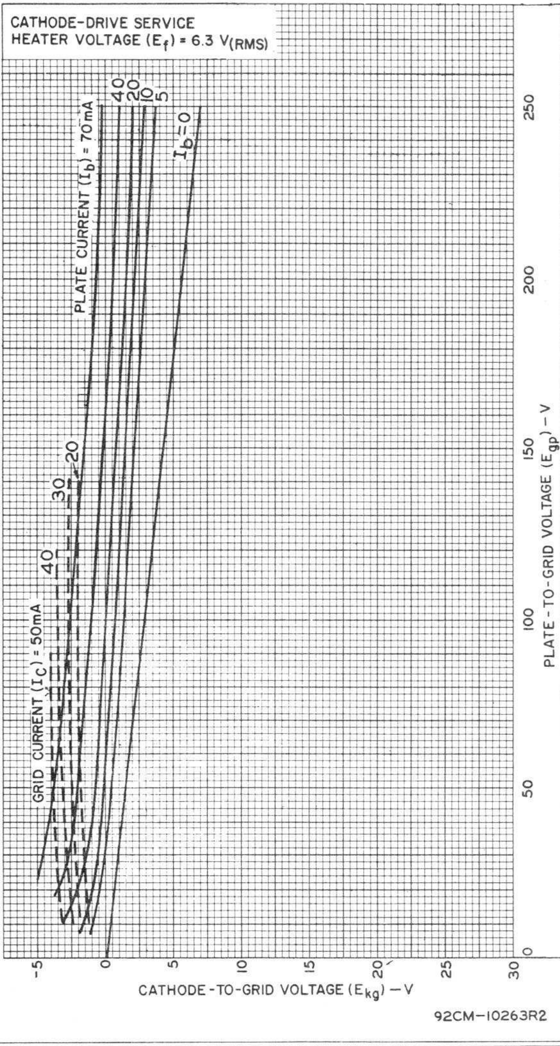
92CS-11488R1

AVERAGE PLATE OR GRID CURRENT CHARACTERISTICS vs. PLATE-TO-GRID VOLTAGE FOR CATHODE DRIVE SERVICE



92CM−10262R1

AVERAGE CONSTANT-CURRENT CHARACTERISTICS FOR CATHODE DRIVE SERVICE



92CM-10263R2

VHF-TV Amplifier Tube

1000W Peak Sync. Output in VHF-TV Service

CERMOLOX®

Ruggedized, Reliable | **Full Input to 400 MHz**

Forced-Air Cooled | **Matrix Oxide Cathode**

ELECTRICAL

Heater-Cathode:

Type	Unipotential, Oxide Coated, Matrix Type	
Voltage (ac or dc)	6.3 typ. / 6.6 max.	V
Current at 6.3 volts	7.5	A
Minimum Heating Time	120	s
Mu-Factor, (Grid No.2 to Grid No.1)	13	

GRID-MODULATED RF POWER AMPLIFIER–CLASS C TELEVISION SERVICE

Maximum CCS Ratings, Absolute-Maximum Values	**Up to 216 MHz**	
DC Plate Voltage	3000	V
DC Grid No. 2 Voltage	750	V
DC Grid No. 1 Voltage (white level)	−250	V
DC Plate Current	750	mA
Grid No. 2 Input	25	W
Plate Dissipation	1000	W
Grid No. 1 Current	100	mA

MECHANICAL

Operating Position	Any
Weight (Approx.)	3/4 lb (0.3 kg)

THERMAL[a]

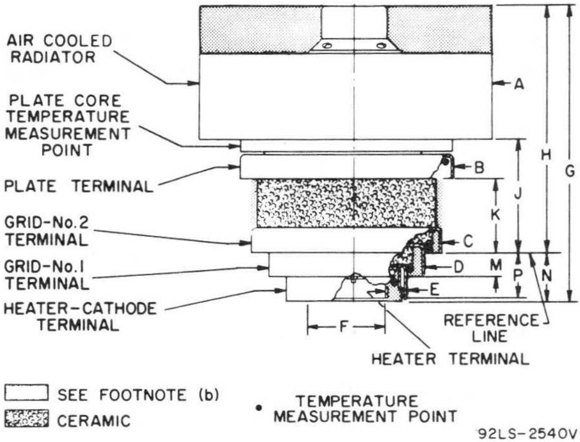
Seal Temperature[c] (Plate, Grid No.2, Grid No.1, Cathode-Heater and Heater)	250 max. °C
Plate-Core Temperature	250 max. °C

[a] See *Dimensional Outline* for temperature measurement points.

[b] Keep all stippled regions clear. Do not allow contacts or circuit components to protrude into these annular volumes.

Detailed performance and application information is available through your RCA Sales Office, Distributor, or write to RCA Commercial Engineering, Harrison, N.J. 07029.

DIMENSIONAL OUTLINE



DIMENSION	INCHES	MILLIMETERS
A Max.	2.52	(64.0) Dia.
B Min.	1.745	(44.32) Dia.
C Min.	1.590	(40.38) Dia.
D Min.	1.290	(32.76) Dia.
E Min.	0.99	(25.14) Dia.
F Max.	0.67	(17.02) Dia.
G Max.	2.44	(62.0)
H	1.98 ± .04	(50.29 ± 1.01)
J	0.830 ± .035	(21.08 ± .88)
K	0.575 ± .025	(14.61 ± .63)
M	0.20 ± .02	(5.08 ± .51)
N	0.40 ± .02	(10.16 ± .51)
P	0.385 ± .025	(9.78 ± .63)

VHF-TV Amplifier Tube

1350W Peak Sync. Output in VHF-TV Service

CERMOLOX® — Full Input to 400 MHz

Sturdy, Reliable — Matrix Oxide Cathode

ELECTRICAL

Heater-Cathode:

Type	Unipotential, Oxide Coated, Matrix Type		
Voltage[a] (ac or dc)	5.5	typ.	V
	5.8	max.	V
Current (@ 5.5 V)	17.3		A
Minimum heating time	180		s
Mu Factor[b] (Grid No.1 to Grid No.2)	6.5		

GRID-MODULATED RF POWER AMPLIFIER— CLASS C TELEVISION SERVICE

MAXIMUM CCS RATINGS, Absolute-Maximum Values:

	Up to 400 MHz	
DC Plate Voltages	3500	V
DC Grid-No. 2 Voltages	1000	V
DC Plate Current	1.25	A
Grid-No. 2 Input	50	W
Plate Dissipation	1500	W
Grid-No. 1 Current	200	mA

MECHANICAL

Operating Position	Any
Weight (Approx.)	2 lbs (0.9 kg)

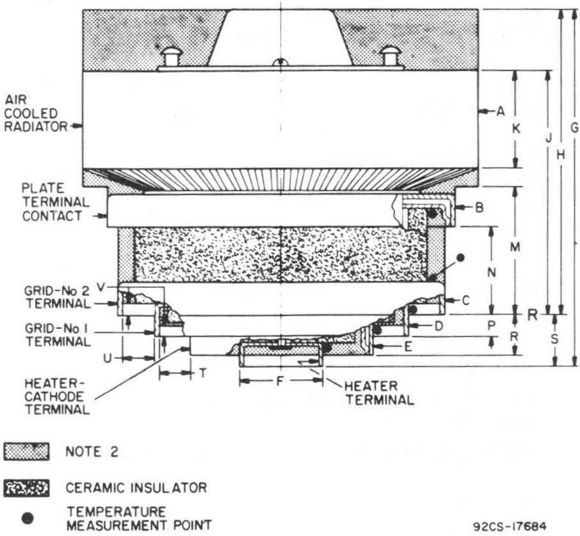
THERMAL[a]

Seal Temperature	250	max.	°C
Plate Core Temperature	250	max.	°C

[a] See *Dimensional Outline* for temperature measurement points.

[b] Keep all stippled regions clear. In general do not allow contacts to protrude into these annular regions. If special connectors are required which may intrude on these regions, contact RCA Power Tube Application Engineering, Lancaster, Pa., for guidance.

Detailed performance and application information is available through your RCA Sales Office, Distributor, or write to RCA Commercial Engineering, Harrison, N.J. 07029.



DIMENSION	INCHES	MILLIMETERS
A	3.72 ± .03	(94.49 ± .76) Dia.
B Min.	3.210	(81.54) Dia.
C Min.	3.010	(76.45) Dia.
D Min.	2.307	(58.60) Dia.
E Min.	1.710	(43.41) Dia.
F Max.	0.725	(18.41) Dia.
G	3.24 ± .10	(82.3 ± 2.5)
H	2.78 ± .07	(70.61 ± 1.78)
J	2.19 ± .04	(55.63 ± 1.02)
K Min.	0.85	(21.59)
M	$1.160 \begin{smallmatrix}+.005\\.000\end{smallmatrix}$	$(29.464 \begin{smallmatrix}+.127\\-.000\end{smallmatrix})$
N	0.82 ± .03	(20.83 ± .76)
P	0.200 ± .025	(5.08 ± .63)
R	0.37 ± .03	(9.40 ± .76)
S	0.46 ± .03	(11.68 ± .76)
T Min.	0.200	(5.08)
U Min.	0.250	(6.35)
V Min.	0.105	(2.66)

Beam Power Tube

CERMOLOX

5,000 Watts PEP Output **10,000 Watts Output**
Full Input to 400 MHz **Telegraphy or FM Telephony**
Sturdy, Reliable, Thoriated Tungsten, Mesh Filaments

ELECTRICAL

Filamentary Cathode:		
Type	Thoriated-Tungsten Mesh	
Voltage (ac or dc)	5.7 typ-6.0 max.	V
Current:		
Typical value at 5.7 volts	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)	10	

MAXIMUM CCS RATINGS, Absolute-Maximum Values:

	Up to 400 MHz	
DC Plate Voltage	7000	V
DC Grid-No.2 Voltage	1500	V
DC Plate Current at Peak of Envelope	40	A
Plate Dissipation	5.0	kW

MECHANICAL

Operating Position	Vertical, either end up
Weight (Approx.)	6 lb (2.7 kg)

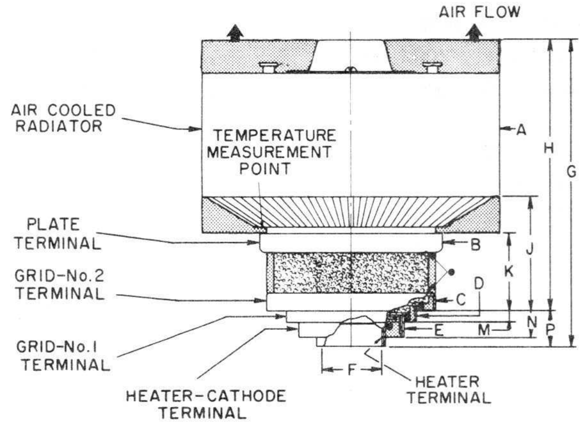
THERMAL[a]

Seal Temperature	250 max. °C
Plate-Core Temperature	250 max. °C

[a] See *Dimensional Outline* for temperature measurement points.
[b] Keep all stippled regions clear. Do not allow contact or circuit components to intrude into these annular volumes.

Detailed performance and application information is available through your RCA Sales Office, Distributor, or write to RCA Commercial Engineering, Harrison, NJ 07029.

DIMENSIONAL OUTLINE



SEE FOOTNOTE(b)
CERAMIC

• TEMPERATURE MEASUREMENT POINT

92LM-2542V

DIMENSION	INCHES	MILLIMETERS
A Dia.	4.570 Max.	116.07 Max.
B Dia.	3.235 Min.	82.17 Min.
C Dia.	3.014 Min.	76.52 Min.
D Dia.	2.307 Min.	58.60 Min.
E Dia.	1.840 Min.	46.74 Min.
F Dia.	1.210 Max.	30.73 Max.
G	4.795 ± .080	121.79 ± 2.03
H	4.140 ± .050	105.16 ± 1.27
J	1.940 ± .040	49.28 ± .101
K	1.330 ± .030	33.78 ± .76
M	0.200 ± .025	5.08 ± .63
N	0.475 ± .035	12.06 ± .88
P	0.650 ± .030	16.51 ± .76

Beam Power Tube

CERMOLOX

10,000 Watts PEP Output — **15,000 Watts Output**
Full Input to 400 MHz — **Telegraphy or FM Telephony**
Sturdy, Reliable, Thoriated Tungsten, Mesh Filaments

ELECTRICAL

Filamentary Cathode:

Type	Thoriated-Tungsten Mesh	
Voltage (AC or DC)	5.7 typ.–6.0 max.	V
Current:		
Typical value at 5.7 volts	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)	10	

MAXIMUM CCS RATINGS, Absolute-Maximum Values:

	Up to 400 MHz	
DC Plate Voltage	8000	V
DC Grid-No.2 Voltage	1650	V
DC Plate Current at Peak of Envelope	4.0	A
Plate Dissipation	12.5	kW

MECHANICAL

Operating Position	Vertical, either end up
Weight (Approx.)	10 lb (4.54 kg)

THERMAL[a]

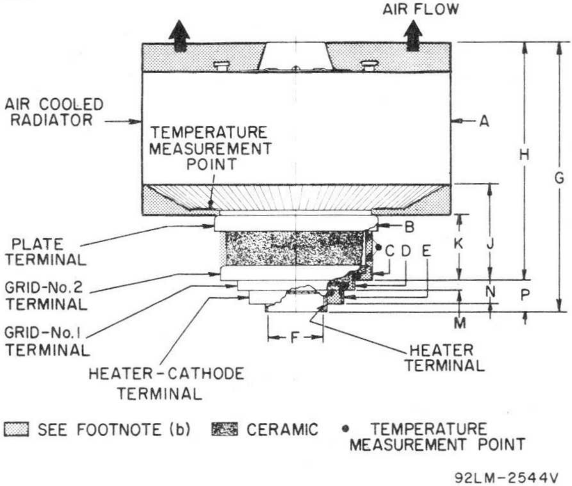
Seal Temperature (Plate, grid No.2, grid No.1, cathode heater, 2nd heater)	250 max. °C
Plate-Core Temperature	250 max. °C

[a] See *Dimensional Outline* for temperature measurement points.

[b] 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.

Detailed performance and application information is available through your RCA Sales Office, Distributor, or write to RCA Commercial Engineering, Harrison, NJ 07029.

DIMENSIONAL OUTLINE



DIMENSION	INCHES	MILLIMETERS
A Dia.	6.135 ±.035	155.83 ±.88
B Dia.	3.235 Min.	82.17 Min.
C Dia.	3.014 Min.	76.56 Min.
D Dia.	2.307 Min.	58.60 Min.
E Dia.	1.840 Min.	46.74 Min.
F Dia.	1.210 Max.	30.73 Max.
G	5.370 ±.080	136.4 ±2.0
H	4.715 ±.050	119.7 ±1.2
J	1.940 ±.040	49.28 ±1.01
K	1.330 ±.030	33.78 ±.76
M	0.200 ±.025	5.08 ±.63
N	0.475 ±.030	12.06 ±.76
P	0.650 ±.030	16.51 ±.76

Beam Power Tube

CERMOLOX — **12.5 kW Peak Sync Output**

Full Input to 400 MHz — **thru VHF-TV High Band**

2.5 kW Carrier for Linear Operation

ELECTRICAL

Filamentary Cathode:		
Type	Thoriated-Tungsten Mesh	
Voltage (ac or dc)	5.7 typ.-6.0 max.	V
Current:		
Typical value at 5.7 volts	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)	20	

MAXIMUM CCS RATINGS, Absolute-Maximum Values

	Up to 400 MHz	
DC Plate Voltage	8000 max.	V
DC Grid-No.2 Voltage	1650 max.	V
DC Grid-No.1 Voltage	−450 max.	V
DC Plate Current	4.0 max.	A
Grid-No.1 Input	150 max.	W
Grid-No.2 Input	250 max.	W
Plate Dissipation	12500 max.	W

MECHANICAL

Operating Position	Vertical, either end up
Weight (Approx.)	10 lb (4.54 kg)

THERMAL[a]

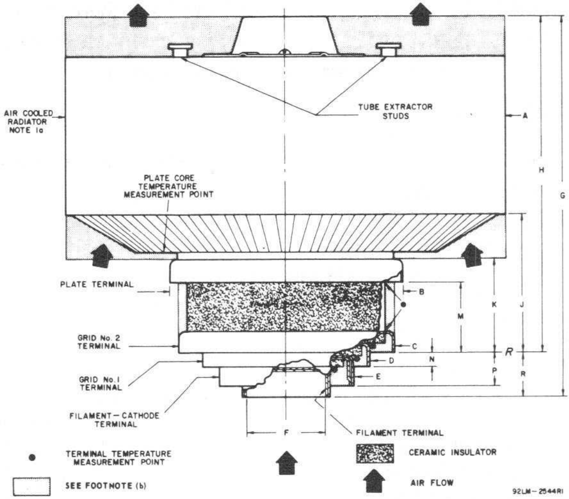
Seal Temperature (Plate, grid No.2, grid No.1, filament-cathode and filament)	250 max. °C
Plate-Core Temperature	250 max. °C

[a] See *Dimensional Outline* for temperature measurement points.

[b] Keep all strippled regions clear. Do not allow contacts or circuit components to protrude into these annular regions.

Detailed performance and application information is available through your RCA Sales Office, Distributor, or write to RCA Commercial Engineering, Harrison, N.J. 07029.

DIMENSIONAL OUTLINE



DIMENSION	INCHES	MILLIMETERS
A Dia.	6.135 ±.035	155.83 ±.88
B Dia.	3.235 Min.	82.17 Min.
C Dia.	3.014 Min.	76.56 Min.
D Dia.	2.307 Min.	58.60 Min.
E Dia.	1.840 Min.	46.74 Min.
F Dia.	1.210 Max.	30.73 Max.
G	5.370 ±.080	136.4 ±2.0
H	4.715 ±.050	119.7 ±1.2
J	1.940 ±.040	49.28 ±1.01
K	1.330 ±.030	33.78 ±.76
M	1.005 ±.020	25.53 ±.51
N	0.200 ±.025	5.08 ±.63
P	0.475 ±.030	12.06 ±.76
R	0.650 ±.030	16.51 ±.76

Beam Power Tube

CERMOLOX — **20 kW Peak Sync Output**
Full Input to 400 MHz — **Forced-Air-Cooled**
3.75 kW Carrier for Linear Operation

ELECTRICAL

Filamentary Cathode, Thoriated-Tungsten Mesh Type:		
Voltage (ac or dc)	9.5 typ. / 10.0 max.	V / V
Current:		
Typical value at 9.5 volts	145	A
Maximum value for starting, even momentarily	300	A
Cold Resistance	0.01	Ω
Minimum heating time	15	s
Mu-Factor (Grid No.2 to Grid No.1)	10	

MAXIMUM CCS RATINGS, Absolute-Maximum Values

	Up to 400 MHz	
DC Plate Voltage	10,000 max.	V
DC Grid-No.2 Voltage	2000 max.	V
DC Plate Current at Peak of Envelope	6.0 max.	A
DC Grid-No.1 Current	500 max.	mA
Grid-No.2 Input	450 max.	W
Plate Dissipation	15 max.	kW

MECHANICAL

Operating Position	Vertical, either end up
Weight (Approx.)	12 lb (5.5 kg)

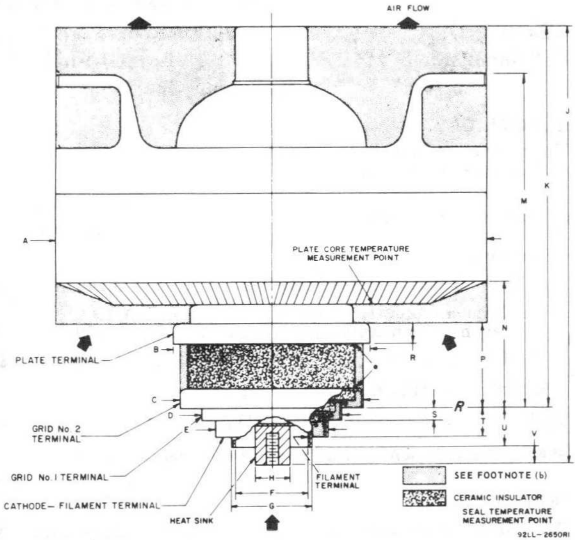
THERMAL[a]

Seal Temperature (Plate, Grid No.2, Grid No.1. Cathode-Filament, and Filament)	250 max. °C
Plate-Core Temperature	250 max. °C

[a] See *Dimensional Outline* for temperature measurement points.
[b] Keep all strippled regions clear. Do not allow contacts or circuit components to protrude into these annular regions.

Detailed performance and application information is available through your RCA Sales Office, Distributor, or write to RCA Commercial Engineering, Harrison, N.J. 07029.

DIMENSIONAL OUTLINE



DIMENSION	INCHES	MILLIMETERS
A Dia.	7.075 ±.035	179.71 ±.89
B Dia.	3.235 Min.	82.17 Min.
C Dia.	3.014 Min.	76.56 Min.
D Dia.	2.307 Min.	58.60 Min.
E Dia.	1.840 Min.	46.74 Min.
F Dia.	1.210 Max.	30.73 Max.
G Dia.	1.314 Min.	33.38 Min.
H Dia.	0.620 Max.	15.75 Max.
J	7.345 Max.	186.56 Max.
K	6.30 Max.	160.0 Max.
M	5.50 Ref.	139.7 Ref.
N	2.04 ±.04	51.8 ±1.0
P	1.33 ±.03	33.8 ±.8
R	0.325 Ref.	8.26 Ref.
S	0.200 ±.025	5.08 ±.63
T	0.50 ±.03	12.7 ±.8
U	0.76 ±.04	19.3 ±1.0
V	0.25 Ref.	6.4 Ref.

C Band Klystron

- Gang Tuned Cavities
- Air Cooled
- High Efficiency
- High Power Gain
- Compact
- Sturdy

Frequency . . . . 4.4 to 5.0 GHz

Electrical:

Cathode . . . . Indirectly-heated Tungsten Dispenser Cathode

Filament:

Voltage	6.5 ± 0.5	V
Current at 6.5 V	7.6	A
Maximum current	8.2	A
Warmup time (min.)	180	s

Mechanical:

Mounting Position		Any	
Length (max.)	(393 mm)	15.5	in
Width (max.)	(267 mm)	10.5	in
Weight (approx.)	(17.2 kg)	38	lb
In commercial pack	(18.1 kg)	40	lb
In military pack	(22.5 kg)	50	lb

Thermal:

Collector Temperature (max.)	260	°C
Body Temperature (max.)	150	°C
Tuner Fin Temperature (max.)	150	°C
Electron Gun Potting		
Insulation temperature (max.)	250	°C
Storage temperature (min.)	-65	°C

Cooling

Forced air flow across the collector, body, and tuner, is required.

Typical air requirements for operation with 20° C ambient air temperature at sea level are:

	Min Req Air Flow lb/min	Min Req Air Flow kg/min	Max Press-Drop in H_2O	Max Press-Drop cm H_2O
Collector	7.5	3.4	2.0	5.1
Body & Tuners	0.85	0.38	0.75	1.9

Performance

Maximum CW Ratings, Absolute-Maximum Values:

DC Beam Voltage	8.5	kV
DC Beam Current	600	mA
DC Body Current	60	mA
Surge Current	25	A
Load VSWR	2.0:1	
Input VSWR	2.0:1	

Typical CW Operation:

High Efficiency Tuned

Frequency	4.4 GHz	5.0 GHz	
DC Beam Voltage	8.0	8.0	kV
DC Beam Current	520.0	520.0	mA

Typical CW Operation (cont'd.)

High Efficiency Tuned

Frequency	4.4 GHz	5.0 GHz	
DC Body Current	10.0	10.0	mA
RF Power Output	1.60	1.45	kW
Bandwidth (3 dB)	8.0	10.0	MHz
Efficiency	39.0	35.0	%
Gain	45.0	45.0	dB
Drive	50.0	50.0	mW
Load VSWR	1.05:1	1.05:1	–
Input VSWR	1.3:1	1.3:1	–

High Gain Tuned

Frequency	4.4 GHz	5.0 GHz	
DC Beam Voltage	8.0	8.0	kV
DC Beam Current	520.0	'520.0	mA
DC Body Current	10.0	10.0	mA
RF Power Output	1.45	1.30	kW
Bandwidth (3 dB)	6.0	8.0	MHz
Efficiency	35.0	31.0	%
Gain	52.0	52.0	dB
Drive	10.0	10.0	mW
Load VSWR	1.05:1	1.05:1	–
Input VSWR	1.3:1	1.3:1	–

Broadband Tuned Frequency	4.4 GHz	5.0 GHz	
DC Beam Voltage	8.0	8.0	kV
DC Beam Current	520.0	520.0	mA
DC Body Current	10.0	10.0	mA
RF Power Output	1.5	1.4	kW
Bandwidth (3 dB)	13.0	19.0	MHz
Efficiency	36.0	33.0	%
Gain	42.0	42.0	dB
Drive	100.0	100.0	mW
Load VSWR	1.05:1	1.05:1	–
Input VSWR	1.3:1	1.3:1	–

General Information

Installation and Operation

No installation or operation should be attempted without first consulting the Installation and Operating Instructions shipped with each tube or available on request from Super Power Marketing, RCA, Lancaster, PA.

RCA reference publications required for the installation and operation of this device include the following:

Data Sheet – RCA-8811
Application Note AN 4213
Application Guide 1CE-279A

These publications are available as a complete packet – request PWR 542 "Applications Information for the RCA-8811 klystron."

Personnel Safety

The high voltages and microwave radiations from this device can be dangerous to life. High voltage shielding and interlock precautions must be taken and all rf connections must be tightly closed and rf terminals shielded.

Packaging

Two types of packaging are available with these tubes; Commercial Pack and Military Pack. The customer specifies the desired type.

The Commercial Pack is made of nesting carboard cartons with the inner carton shock-mounted. The Military Pack complies with MIL-S-4473C for air shipment. It uses a hermetically-sealed metal container which protects the tube and serves to shield the area surrounding the pack from stray magnetic fields set up by the klystron focusing magnet.

In shipment, the tube is enclosed in a polyethylene bag to prevent dust and other particles from collecting in the waveguide or tuning system. It is recommended that the tube be stored in the bag and in the shipping container when not in use. Dust or other unwanted particles in the waveguide can cause arcing during operation and subsequent tube destruction.

Cooling

Air ducts must be provided to connect to the top of the collector and the tuner cooling duct. See Outline Drawing.

Mounting

Four holes are provided in the gun-end of the focusing magnet for mounting purposes. Only non-magnetic studs should be used.

Thermocouple

A thermocouple mounted on the collector provides a signal output for excessive collector temperature. This output is used to operate protective circuitry.

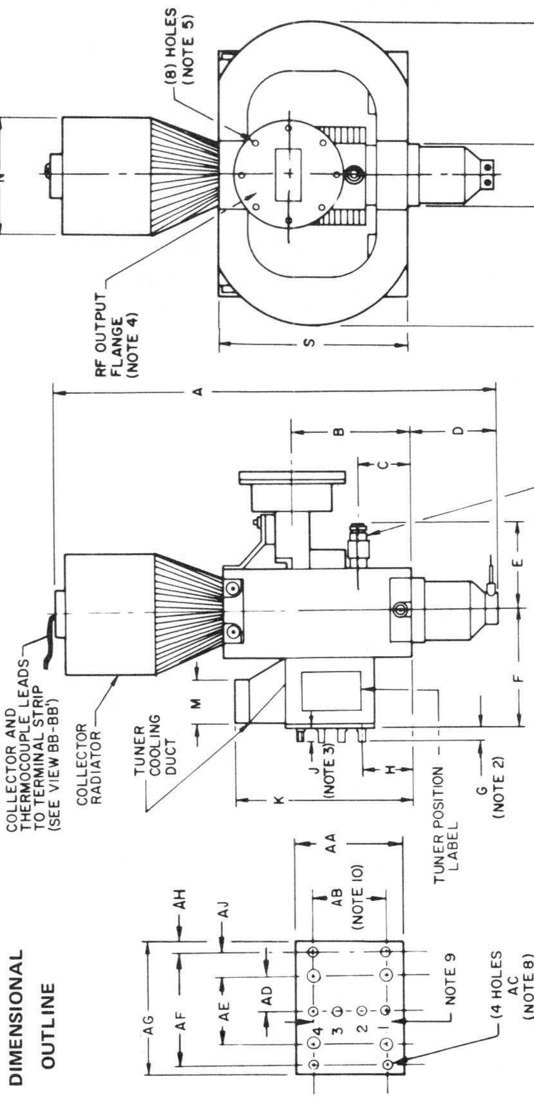
Tuning

Tuning is accomplished by a single knob which "gang-tunes" all four cavities simultaneously. The second, third and output cavities may be individually trimmed for optimizing the tube performance at any frequency within the tube operating band. See Outline Drawing.

Protection Circuits

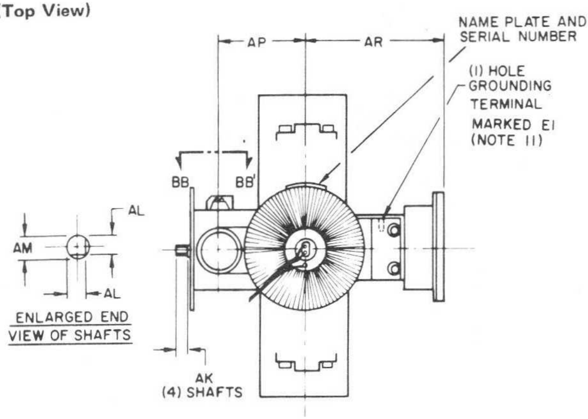
Protection circuits serve a threefold purpose: safety of personnel, protection of the tube and protection of tube circuits. Consult Application Guide 1CE-279A for complete information on protection circuits.

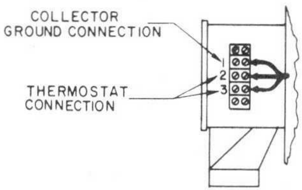
DIMENSIONAL OUTLINE



DIMENSIONAL OUTLINE

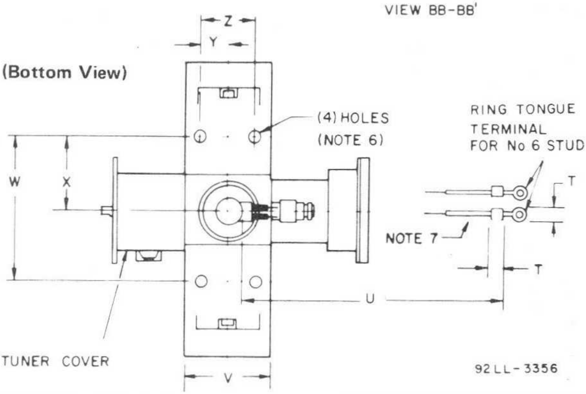
(Top View)





VIEW BB-BB'

(Bottom View)



92LL-3356

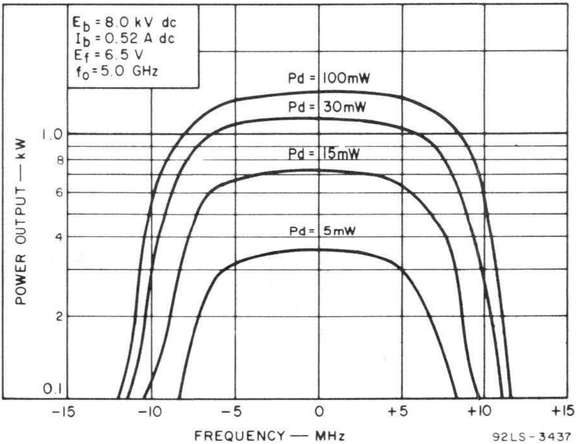
Tabulated Dimensions for the Dimensional Outline

Dimension Reference	Specified Values Inches		Millimeters	
A	15.5	max.	393.7	max.
B	4.06	±.12	103.1	±3.0
C	1.80	±.12	45.7	±3.0
D	3.5	max.	88.9	max.
E	3.00	±.06	76.2	±1.5
F	3.80	±.12	96.5	±3.0
G	0.68	±.05	17.3	±1.3
H	1.80	± .09	45.7	±2.3
J	0.68	+.15 -.10	17.3	+3.8 -2.5
K	6.25	max.	158.8	max.
M	1.50	±.03	38.1	± .8
N Dia.	4.12	±.03	101.6	± .8
P Dia.	2.130	±.015	54.10	± .38
R	10.5	max.	266.7	max.
S	6.5	±.5	165.0	±13.0
T Dia.	0.250	±.015	6.35	± .38
U	13.50	±.25	343.0	± 6.0
V	3.25	max.	82.55	max.
W	5.00	±.06	127.0	±1.5
X	2.50	±.06	63.5	±1.5
Y	1.00	±.06	25.4	±1.5
Z	2.00	±.06	50.8	±1.5
AA	3.00	±.06	76.2	±1.5
AB	2.10	±.02	53.34	± .51
AC	0.201	±.010	5.11	± .25
AD	1.00	±.03	25.4	± .8
AE	2.00	±.03	50.8	± .8
AF	3.25	±.02	82.55	± .51
AG	3.75	±.03	95.3	± .8
AH	0.25	±.03	6.4	± .8
AJ	0.62	±.03	15.8	± .8
AK	0.440	±.010	11.18	±.25
AL	0.230	±.005	5.84	±.13
AM Dia.	0.249	±.002	6.325	±.051
AN	0.125	±.030	3.2	±.8
AP	3.00	±.06	76.2	±1.5
AR	4.75	±.12	120.6	±3.0

Notes for Dimensional Outline

1. Mates with Type "N" Connector UG-21 B/U or equivalent.
2. Dimension applies to Shaft No.1 only.
3. Dimension applies to Shafts No,'s 2, 3, and 4 only.
4. Mates with UG-149 A/U or equivalent.
5. Holes 10-32 UNF-2B equally spaced on 3.250 ±.032 (82.6 ± .8 mm) dia. circle.
6. Holes 0.437 ± .062 (11.1 ± 1.6 mm) thru (One side only).
7. High-Voltage Lead Designation : Heater Lead – Yellow
Heater-Cathode Lead – White
8. Thru-holes checked with gauge.
9. Three spaces between shafts are 0.70 ± .03 (17.8 ± .8 mm) and add to 2.100 (53.34 mm). Shafts are numbered as shown. (1) Gang tuner, (2) Cavity two, (3) Cavity three, (4) Output cavity.
10. Tolerance for this dimension applies to location of four 0.201 (5.11 mm) holes.
11. Hole No.6-32 UNC-2B, 0.25 (6.35 mm) minimum depth.

BANDWIDTH CHARACTERISTIC CURVE



The *Beam Current Characteristic, Gain Characteristic, and Output Characteristic* curves shown under Type 4658 also apply to Type 8811.

UHF TV Klystron Amplifier

- Water/Vapor Cooled
- Electromagnet Focusing
- Easy to Install and Operate
- Modulating Anode — permits both visual and aural application with a single beam supply
- High Power Output
- Very High Gain
- Long Life, High Reliability
- Integral Cavity Construction

General Data

Electrical:

Frequency Range . . . . 698-890 MHz

Cathode Type. . . . . . Indirectly heated, tungsten-dispenser cathode

Heater (dc or 50-60 Hz):

Voltage[a]	6.0 ± 0.5	V
Current @ 6.0 V, typical	16.4	A
Surge current, maximum	30.0	A
Warm-up time, minimum	180	sec

Focusing . . . . RCA-AJ2168 Electromagnet

Mechanical:

Mounting Position . . . . Vertical, cathode down

Dimensions, Maximum:

Height. . . . . (1165 mm) 45.9 in

Width (excluding output connector). . . . . . . (330 mm) 13.0 in

Weight, Approximate:

Uncrated. . . . . (81.6 kg) 180 lbs

Crated . . . . (204 kg) 450 lbs

Inlet Coolant Connector . . . . Mates with Hansen LL3-H21

Outlet Coolant Connector . . . . Mates with Hansen LL6-H31

Steam Outlet . . . . See Dimensional Outline

Electrical Connections:

RF Input . . . . UG-22B/U jack mates with UG-21D/U plug

RF Output . . . . See Dimensional Outline

Collector[b] . . . . Pins F and G, Cannon Rec.[c]

Thermocouple:

Chromel . . . . Pin H Cannon Rec.[c]

Alumel . . . . Pin J Cannon Rec.[c]

Body	Pin E Cannon Rec.[c]
Modulating Anode	See Dimensional Outline
Heater-Cathode	See Dimensional Outline
Heater	See Dimensional Outline
Interlock No.1	Pins A and B, Cannon Rec.[c]
Interlock No.2	Pins C and D, Cannon Rec.[c]

Thermal:

Collector Temp. (max.)	145	°C
Body Temperature (max.)	100	°C
Electron Gun Insulator Temp. (max.)	250	°C
Storage Temp.[d] (min.)	–65	°C

Coolant Requirements:

Collector and Body

Water flow (min.)	(0.125 l/s) 2.0	gpm
Inlet water temperature (max.)	70	°C

Electron Gun

Forced air flow[e] (min.)	(24 l/s) 50	cfm
Water Pressure Differential for Typical Flow of 2.1 gpm (max.)	3.5 kg/cm² / 50	psi
Water Pressure at any Inlet (max.)	4.2 kg/cm² / 60	psi

Maximum Ratings, Absolute-Maximum Values

Beam Voltage, DC	20	max.	kV
Beam Current, DC	5.5	max.	A
Body Current, DC	250	max.	mA
Modulating Anode Voltage, DC	20	max.	kV
Load VSWR	1.5:1.0		

Typical Operation, UHF Television Service (Visual 699.25 MHz, Aural 703.75 MHz)

	Visual	Aural	
Collector Voltage, DC[f]	0	0	V
Body Voltage, DC	0	0	V
Beam Current, DC	4.7	2.4	A
Body Current, DC[g]	70	15	mA
Modulating Anode Voltage, DC	0	–6	kV
Modulating Anode Current, DC	1.5	1.0	mA
Cathode Voltage, DC	–18	–18	kV

Focusing Current, DC (Typical With RCA-AJ2168 Electromagnet)	28	28	A
Load VSWR	1.1:1	1.1:1	–
Drive Power for Visual Peak-of-Sync or Aural CW	10	1.1	W
Output, for Visual Peak-of-Sync or Aural CW	31	12	kW
Gain	35	40	dB
Efficiency	37	28	%

[a] Careful attention to maintaining the minimum value of filament voltage consistent with adequate emission will result in conserving the life of the tube.

[b] Pins F and G must always be used in parallel.

[c] Type CA22365-2729 Cannon Receptacle.

[d] All water must be removed from the coolant course during storage and shipping.

[e] Cooling-air blower must be directed toward the electron gun and located within a distance of 24 inches.

[f] A dc ammeter makes the connection between the collector and ground.

[g] The body is connected directly to ground. Body current is measured in the ground leg of the beam power supply.

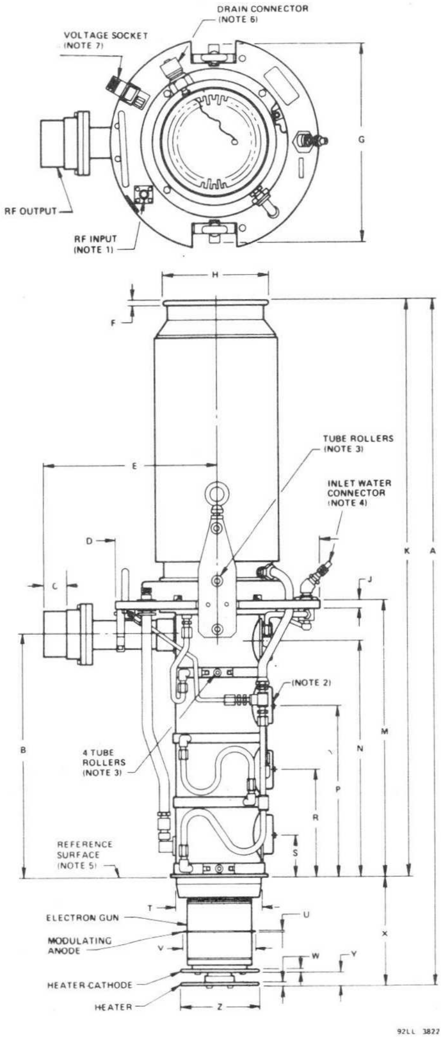
Operating Considerations

Typical operating coil currents are noted under "Typical Operation" data section in this data sheet.

It is recommended that the coil coolant flow start before the application of any coil voltage and preferably continue for five minutes after the removal of voltages. Interlocking of the coolant flow with the klystron beam and modulating-anode voltages and coil voltages is highly recommended to prevent tube and coil damage in the event of inadequate coolant flow.

The use of a solid-state diode connected in parallel with the electromagnet is recommended to prevent excessive transient voltage build-up in the event of coil current interruptions. Connections should be made so the coil current will flow through the diode when the polarity of the normal coil voltage becomes reversed.

Dimensional Outline — Klystron



Pin Connections — Voltage Socket

A } Jumpered B }	F Collector*
	G Collector*
C } Jumpered D }	H Thermocouple (Chromel)
	J Thermocouple (Alumel)
E Body (Ground)	*Always use pins F and G in parallel.

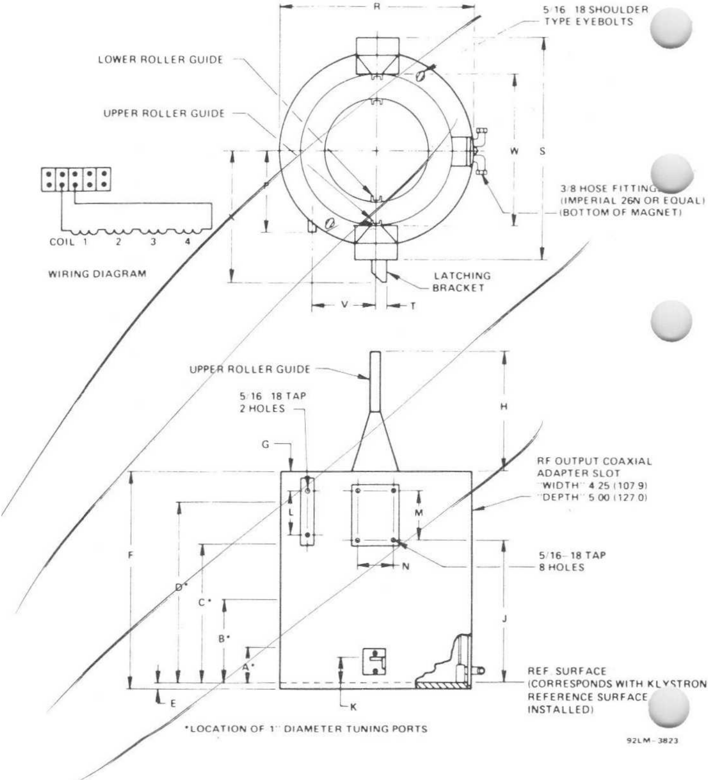
Tabulated Dimensions for Klystron

Dim.	Value — Inches	Value — Millimeters
A	45.56 ± .32	1157 ± 8
B	16.33 ± .06	414.8 ± 1.5
C	1.50 ± .01	38.10 ± .25
D	13.00 Max.	330.2 Max.
E	11.00 ± .12	279.4 ± 3.0
F	0.23 ± .04	5.8 ± 1.0
G	12.40 Max.	315.0 Max.
H	6.40 ± .04	162.6 ± 1.0
J	0.50 ± .02	12.70 ± .51
K	38.67 ± .25	982.2 ± 6.4
M	18.66 ± .08	474.0 ± 2.0
N	15.74 ± .06	399.8 ± 1.5
P	11.50 ± .05	292.1 ± 1.3
R	7.15 ± .04	181.6 ± 1.0
S	2.82 ± .03	72.4 ± .8
T	5.76 Max.	14.63 Max.
U	0.04 Ref.	1.0 Ref.
V	5.00 ± .01	127.00 ± .25
W	0.19 ± .01	4.83 ± .25
X	6.89 ± .07	175.0 ± 1.8
Y	0.69 ± .05	17.5 ± 1.3
Z	5.00 ± .03	127.0 ± .8

Notes:

1. RF Input Jack, UG-22 B/U mates with UG-21 D/U.
2. Channel tuning screws. These screws have a 5/16 inch hex socket head.
3. Tube rollers mate with roller guides in the RCA AJ2168 Electromagnet.
4. Inlet Water Connector mates with Hansen LL3-H21 Connector.
5. Reference Surface corresponds with electromagnet reference surface when installed.
6. Drain Connector mates with Hansen LL6-H32 Connector.
7. Cannon Receptacle CA22365-2729. Mates with Cannon Plug 24-20.

Dimensional Outline — Electromagnet



Personnel Safety

The high voltages and microwave radiations from this device can be dangerous to life. High voltage shielding and interlock precautions must be taken and all rf connections must be tightly closed and rf terminals adequately shielded. This device, in operation, may produce X-radiation which can constitute a health hazard. Shielding or other precautions may be required.

Tabulated Dimensions for Electromagnet

Dim.	Value – Inches	Value – Millimeters
A	2.87 ± .03	72.9 ± .8
B	7.25 ± .03	184.2 ± .8
C	11.60 ± .03	294.6 ± .8
D	15.79 ± .03	401.1 ± .8
E	0.50 ± .02	12.7 ± .5
F	19.28 ± .05	489.7 ± 1.3
G	1.76 ± .06	44.7 ± 1.5
H	10.00 ± .03	254.0 ± .8
J	12.79 ± .03	324.9 ± .8
K	3.16 ± .06	80.3 ± 1.5
L	4.00 ± .03	101.6 ± .8
M	4.50 ± .03	114.3 ± .8
N	3.00 ± .03	76.2 ± .8
P	7.00 ± .03	177.8 ± .8
R	16.00 ± .03	406.4 ± .8
S	17.00 Max.	431.8 Max.
T	1.00 ± .03	25.4 ± .8
V	5.60 ± .03	142.2 ± .8
W	12.80 ± .05	325.1 ± 1.3
X	10.68 ± .05	271.3 ± 1.3

General Information

Cooling

The electron gun is cooled by forced air directed at the cathode-seal area. Air flow must be at least 50 cfm. (24.0 l/sec). The remainder of the tube is cooled by water/vapor system with water cooling the resonators and drift-tube sections and vapor cooling the collector.

The use of distilled water is essential. The liquid flow must start before application of any voltages and preferably should continue for five minutes after removal of voltages. It is recommended that the liquid flow through each of the cooled elements be interlocked with the beam supply to prevent damage to the tube in case of cooling failure.

A steam exhaust sleeve must be provided for the top of the klystron boiler. A flexible, neoprene type is recommended.

The sleeve is placed over the lip provided at the top of the boiler (see Dimensional Outline) and clamped securely in place for a water-tight connection.

Electrical Connections to Tube Terminals

Connections to the Heater, Heater-Cathode and Modulating Anode Terminals (see Dimensional Outline) are made with preformed finger stock or knife blade type fuse clips. Care should be taken when making these connections not to place excessive stress on the ceramic-to-metal seals.

Protection Circuits

Protection circuits serve a threefold purpose: safety of personnel, protection of the tube and protection of tube circuits. Consult Application Note AN4206 for complete information on protection circuits required.

A means of protecting the klystron against damage which would result from failure of the collector vapor cooling system is provided by an integral chromel-alumel thermocouple with terminals at the Cannon Receptacle.

RCA AJ2168 Electromagnet

The RCA 8826 klystron is designed to be mounted in and its beam focused by the water-cooled, single-coil electromagnet, RCA-AJ2168. The exposed surfaces of the electromagnet are treated by painting or plating to resist corrosion.

General Data

Voltage, DC (max.)		35	V
Current, DC (max.)		30	A
Dimensions		See Dimensional Outline	
Weight (Approx.)	Uncrated (104 kg)	230	lbs
	Crated (145 kg)	320	lbs
Cooling:			
Water flow, minimum	(0.063 l/s)	1	gpm
Inlet temperature, maximum		70^{o}	C
Maximum water pressure differential for typical flow (gauge)	(3.5 kg/cm^2)	50	psi
Maximum water pressure at any inlet (gauge)	(4.2 kg/cm^2)	60	psi

Beam Power Tube

Full Ratings to 500 MHz
80 Watts PEP Output at 30 MHz

ELECTRICAL

Heater, for Unipotential Cathode:		
Voltage (AC or DC)[a]	26.5	V
Current at 26.5 volts	0.68	A
Minimum heating time	120	s
Mu-Factor, (Grid No.2 to Grid No.1)[b]	12	
Direct Interelectrode Capacitances:[c]		
Grid No.1 to plate	0.15 max.	pF
Grid No.1 to cathode	16	pF
Plate to cathode	0.010	pF
Grid No.1 to grid No.2	23	pF
Grid No.2 to plate	7.2	pF
Grid No.2 to cathode	2.7	pF
Cathode to heater	3.3	pF
Mounting flange to plate	3.0	pF

MECHANICAL

Operating Position	Any
Maximum Overall Length	(56.9 mm) 2.24 in
Seated Length	(49.8 mm) 1.96 in
Greatest Radius	(35.1 mm) 1.38 in
Base-Large Wafer Elevenar 11-Pin with Ring	(JEDEC No.E11-81)
Socket[d]	Erie 9802-000, Erie 9804-000 Johnson 124-311-100 or equivalent
Grid No.2 By-pass Capacitor	Erie 2943-002, Johnson 124-121 or equivalent
Weight (Approx.)	(170.1 gr) 6 oz

THERMAL

Terminal Temperature[e]	250 max.	°C
Radiator Core Temperature[e]	250 max.	°C
Mounting Flange Temperature[e]	125 max.	°C

LINEAR RF POWER AMPLIFIER[f]
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 MHz	
DC Plate Voltage	2200 max.	V
DC Grid-No.2 Voltage	400 max.	V
DC Grid-No.1 Voltage	-100 max.	V
DC Plate Current at Peak of Envelope[g]	450 max.	mA
DC Grid-No.1 Current	100 max.	mA
Plate Dissipation[h]	200 max.	W
Grid No.2 Dissipation	8 max.	W
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode	150 max.	V
Heater positive with respect to cathode	150 max.	V

TYPICAL CCS OPERATION WITH "TWO-TONE MODULATION":

	At 30 MHz	
DC Plate Voltage[j]	700	V
DC Grid-No.2 Voltage[k]	250	V
DC Grid-No.1 Voltage[m]	-20	V
Zero-Signal DC Plate Current	100	mA
Effective RF Load Resistance	1420	Ω
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[n]	1.0	mA
Peak-Envelope Driver Power Output (Approx.)[p]	0.3	W
Output-Circuit Efficiency (Approx.)	95	%
Distortion Products Level:[r]		
Third order	30	dB
Fifth order	35	dB
Useful Power Output (Approx.):		
Average[s]	40	W
Peak envelope	80	W

MAXIMUM CIRCUIT VALUES

Grid-No.1-Circuit Resistance

Under Any Condition:

With fixed bias	25000 max. Ω
With fixed bias (in Class AB_1 operation)	100000 max. Ω
With cathode bias	Not recommended
Grid-No.2 Circuit Impedance	10000 Ω
Plate Circuit Impedance	See Note j

PLATE-MODULATED RF POWER AMPLIFIER[f] CLASS C TELEPHONY

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

MAXIMUM CCS RATINGS, *Absolute-Maximum Values:*

	Up to 500 MHz	
DC Plate Voltage	1800 max.	V
DC Grid-No.2 Voltage	400 max.	V
DC Grid-No.1 Voltage	-100 max.	V
DC Plate Current	250 max.	mA
DC Grid-No.1 Current	100 max.	mA
Grid-No.2 Input	5 max.	W
Plate Dissipation	150 max.	W

TYPICAL CCS OPERATION

In grid-drive circuit at 50 MHz

DC Plate Voltage	500	700	V
DC Grid-No.2 Voltage[t]	150	150	V
DC Grid-No.1 Voltage[u]	-20	-25	V
DC Plate Current	200	250	mA
DC Grid-No.2 Current	35	40	mA
DC Grid-No.1 Current	20	35	mA
Driver Power Output (Approx.)[v]	1.2	2	W
Output Circuit Efficiency (Approx.)	90	90	%
Useful Power Output (Approx.)	50	100	W

MAXIMUM CIRCUIT VALUES

Grid-No.1-Circuit Resistance

Under Any Condition:

With fixed bias	25000 max. Ω
Grid-No.2 Circuit Impedance	10000 max. Ω
Plate Circuit Impedance	See Note j

RF POWER AMP. AND OSCILLATOR[f], CLASS C TELEGRAPHY
RF POWER AMPLIFIER[f] AND CLASS C FM TELEPHONY

MAXIMUM CCS RATINGS, *Absolute-Maximum Values:*

	Up to 500 MHz	
DC Plate Voltage[j]	2200 max.	V
DC Grid-No.2 Voltage[k]	400 max.	V
DC Grid-No.1 Voltage[m]	-100 max.	V
DC Plate Current	300 max.	mA
DC Grid-No.1 Current	100 max.	mA
Grid-No.2 Dissipation	8 max.	W
Plate Dissipation[h]	200 max.	W
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode	150 max.	V
Heater positive with respect to cathode	150 max.	V

TYPICAL CCS OPERATION

In Grid-Drive Circuit at 50 MHz

DC Plate Voltage	500	700	V
DC Grid-No.2 Voltage	160	175	V
DC Grid-No.1 Voltage	-10	-10	V
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.)[v]	1.2	1.2	W
Useful Power Output[s]	75	100	W

MAXIMUM CIRCUIT VALUES

Grid-No.1-Circuit Resistance Under Any Condition:	
With Fixed bias	25,000 max. Ω
Grid-No.2 Circuit Impedance	10,000 max. Ω
Plate Circuit Impedance	See Note j

CHARACTERISTICS RANGE VALUES

	Note	Min.	Max.	
Heater Current	1	0.62	0.74	A
Direct Interelectrode Capacitances:				
Grid-No.1 to plate	2		0.15	pF
Grid-No.1 to cathode	2	14.6	18.0	pF
Plate to cathode	2	0.004	0.016	pF
Grid-No.1 to grid No.2	2	20.0	26.5	pF
Grid-No.2 to plate	2	6.5	7.9	pF
Grid-No.2 to cathode	2	2.1	3.3	pF
Cathode to heater	2	2.5	4.1	pF
Grid-No.1 Voltage	1,3	-8	-19	V
Grid-No.2 Current	1,3	-5	+6	mA
Interelectrode Leakage Resistance	4	50		MΩ
Cutoff Grid-No.1 Voltage	1,5		-47	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 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: 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 is measured with a 200-volt Megger-type ohmmeter, or equivalent, having an internal impedance of 1.0 megohm.

Note 5: With dc plate voltage of 2000 volts, dc grid-No.2 voltage of 250 volts, and dc grid-No.1 voltage varied to obtain a plate current of 5 ma.

b For plate volts = 450 V, Grid No.2 volts = 325 V,
Plate Current = 1.2 A

c Measured with special shield adapter.

d These items may be obtained from:

Erie Technological Products Inc.,
644 West Twelfth Street
Erie, PA 16512

E. F. Johnson Company
299 Tenth Avenue S. W.
Waseca, MN 56093

e See Dimensional Outline for Temperature Measurement Points.

g 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.

h Maximum plate dissipation is limited by the maximum mounting flange temperature and the cooling system to maintain tube operation below the specified maximum mounting flange temperature.

n 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.

p 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.

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

s This value of useful power is measured at the load of the output circuit.

t Obtained preferably from a separate source modulated along with the plate supply.

u Obtained from the Grid-No.1 resistor or from a combination of Grid-No.1 resistor with either a fixed supply or cathode resistor.

v Driver power output included 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.

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

a–See *ELECTRICAL CONSIDERATIONS* - Filament or Heater.

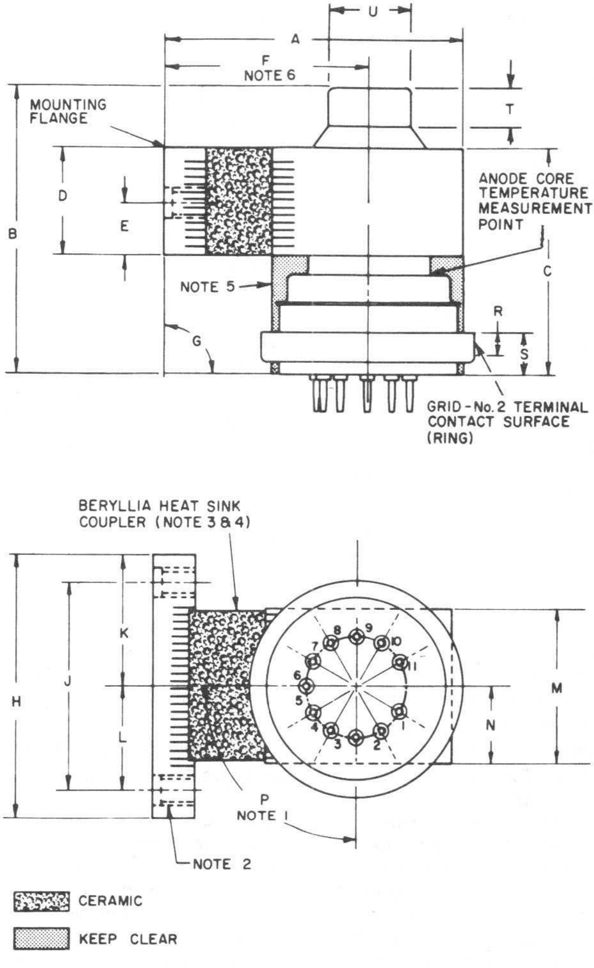
f–See *CLASSES OF SERVICE* - RF Power Amplifiers or Oscillators.

j–See *ELECTRICAL CONSIDERATIONS* - Plate Voltage Supply.

k–See *ELECTRICAL CONSIDERATIONS* - Grid-No. 2 Voltage Supply.

m–See *ELECTRICAL CONSIDERATIONS* - Grid-No. 1 Voltage Supply.

DIMENSIONAL OUTLINE



OUTLINE DIMENSIONS

Dimension	Inches	Millimeters	Degrees
		Value	
A	2.000 max.	50.80 max.	
B	1.960 max.	49.78 max.	
C	1.515 ± .030	38.48 ± .76	
D	0.700 ± .020	17.78 ± .51	
E	0.350 ± .010	8.89 ± .25	
F	1.375 ref.	34.93 ref.	
G			$90^{\circ} \pm 1^{\circ}$
H	1.750 ± .020	44.45 ± .51	
J	1.375	34.93	
K	0.875	22.23	
L	0.688	17.48	
M	1.187 ± .015	30.15 ± .38	
N	0.593 ± .005	15.06 ± .13	
P			90°
R	0.150 min.	3.81 min.	
S	0.300 ± .020	7.62 ± .51	
T	$0.255^{+.025}_{-.015}$	$6.48^{+.64}_{-.38}$	
U	$0.568^{+.005}_{-.009}$	$14.43^{+.13}_{-.23}$	

DIMENSIONAL OUTLINE NOTES

Note 1: Flat location in relation to pin 6 of JEDEC Base E11-81.

Note 2: Tapped holes (2) 6-32 for conduction cooling system.

Note 3: CAUTION! Heat sink ceramic consists of beryllium oxide. Inhalation of beryllium oxide dust can be hazardous. Disposal precaution required.

Note 4: Reference. J.F. Gaylord. "The Conduction Cooling of Power Tubes in Vehicular Communication Equipment", RCA Publication ST 2250 9/63.

Note 5: Keep all stippled regions clear. Do not allow contact or circuit components to intrude into this annular volume.

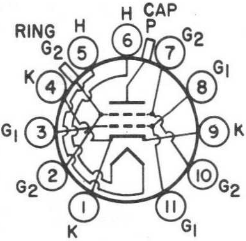
Note 6: In order to accomodate the eccentricities of the tube base with respect to the anode, and the variations in manufacturing tolerances of the conduction cooling assembly it is recommended that the holes for socket mounting be made larger than that required for screw clearance. Thus the tube may be mounted to the heat sink without placing undue strain on the tube base pins. An increase in socket mounting hole size of .030 inch should be adequate in most instances.

TERMINAL DIAGRAM

(Bottom View)

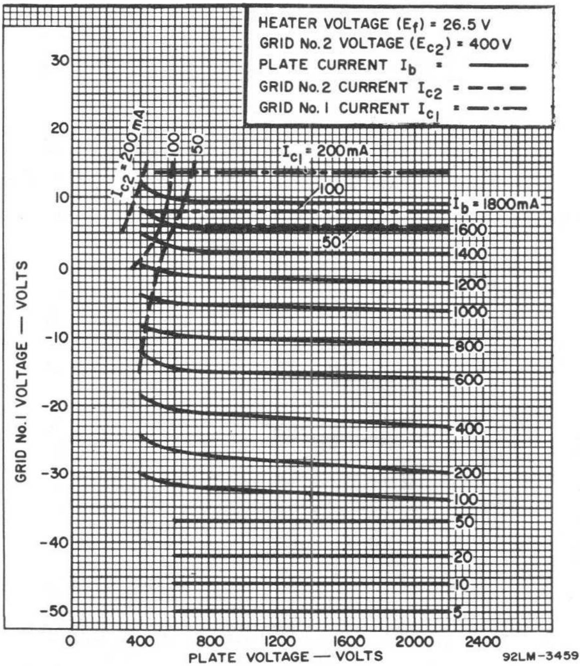
Pin 1: Cathode
Pin 2: Grid No.2
Pin 3: Grid No.1
Pin 4: Cathode
Pin 5: Heater
Pin 6: Heater
Pin 7: Grid No.2
Pin 8: Grid No.1
Pin 9: Cathode
Pin 10: Grid No.2
Pin 11: Grid No.1

Cap: Plate Terminal
Ring: Grid-No.2 Terminal Contact Surface (For use at higher frequencies)

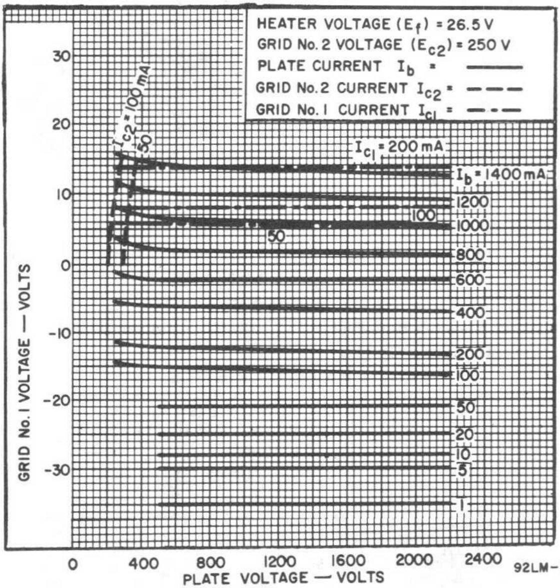


Base conforms to specification of JEDEC No.E11-81
Large Wafer Elevenar Base Eleven Pin with Ring and can be checked with gauge JEDEC No.GE11-1

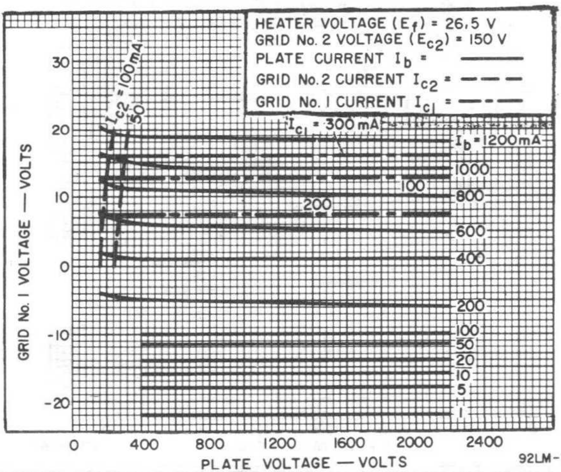
CONSTANT-CURRENT CHARACTERISTICS



CONSTANT-CURRENT CHARACTERISTICS



92LM-3460



92LM-3461

Linear Beam Power Tube

CERMOLOX®

Full Input to 400 MHz

7000 W Peak Sync. Output through
VHF-TV Band with 16 dB Gain

ELECTRICAL

Filamentary Cathode:

Type	Thoriated-Tungsten Mesh	
Voltage[a] (ac or dc)	5.7 typ.	V
	6.0 max.	V
Current:		
Typical value at 5.7 volts	125	A
Maximum value for starting even momentarily	300	A
Cold Resistance	0.005	Ω
Minimum heating time	15	s

Mu-Factor[b]

(Grid No.2 to Grid No.1)	20	

Direct Interelectrode Capacitances:

Grid No.1 to plate[c]	0.40 max.	pF
Grid No.1 to filament	70	pF
Plate to filament[c,d]	0.05 max.	pF
Grid No.1 to grid No.2	95	pF
Grid No.2 to plate	12	pF
Grid No.2 to filament[d]	2.5 max.	pF

MECHANICAL

Operating Position	Vertical, either end up
Overall Length	(127.3 mm) 5.01 max. in
Greatest Diameter	(116.1 mm) 4.57 max. in
Terminal Connections	See Dimensional Outline
Sockets	See footnote **p**
Radiator	Integral part of tube
Weight (Approx.)	(2.7 kg) 6.0 lb

THERMAL

Seal Temperature[e] (Plate, grid No.2, grid No.1, filament-cathode and filament)	250 max. °C
Plate-Core Temperature[e]	250 max. °C

RF Power Amplifier or Oscillator — Class C Telegraphy or Class C FM Telephony[f]

MAXIMUM CCS RATINGS, Absolute-Maximum Values

	Up to 400 MHz	
DC Plate Voltage	8000 max.	V
DC Grid-No.2 Voltage[g]	1650 max.	V
DC Grid-No.1 Voltage[h]	-450 max.	V
DC Plate Current	4.0 max.	A
DC Grid-No.1 Current	500 max.	mA
Grid-No.1 Input[h]	150 max.	W
Grid-No.2 Input[g]	250 max.	W
Plate Dissipation	5000 max.	W

MAXIMUM CIRCUIT VALUES

Grid-No.1-Circuit Resistance Under Any Conditions:		
With fixed bias	5000 max.	Ω
With cathode bias	Not recommended	
Grid-No.2 Circuit Impedance	See note g	
Plate Circuit Impedance	See note j	

CALCULATED CCS OPERATION

In a grid-drive circuit at 108 MHz

DC Plate Voltage	6500	V
DC Grid-No.2 Voltage	1000	V
DC Grid-No.1 Voltage	-50	V
DC Plate Current	2.35	A
DC Grid-No.2 Current	85	mA
DC Grid-No.1 Current	143	mA
Driver Power Output	60	W
Output Circuit Efficiency	95	%
Useful Power Output	10,000	W

In a cathode-drive circuit at 216 MHz

DC Plate Voltage	6300	V
DC Grid-No.2 Voltage	1000	V
DC Grid-No.1 Voltage	-34	V
DC Plate Current	1.31	A
DC Grid-No.2 Current	40	mA

DC Grid-No.1 Current	40	mA
Driver Power Output (Approx.)	50	W
Output Circuit Efficiency	95	%
Useful Power Output	4500	W

RF Power Amplifier — Class B Television Service[f]

Synchronizing-level conditions per tube unless otherwise specified

MAXIMUM CCS RATINGS, Absolute-Maximum Values

DC Plate Voltage[j]	8000 max.	V
DC Grid-No.2 Voltage[g]	1650 max.	V
DC Grid-No.1 Voltage[h]	-450 max.	V
DC Plate Current	5 max.	A
Plate Dissipation	5000 max.	W
Grid-No.2 Input	250 max.	W
Grid-No.1 Input	150 max.	W

CALCULATED CCS OPERATION

In a cathode-drive circuit at 216 MHz and a bandwidth of 6.3 MHz[m]

DC Plate Voltage	5030	V
DC Grid-No.2 Voltage	1000	V
DC Grid-No.1 Voltage[n]	-30	V
DC Plate Current		
Synchronizing level	2.35	A
Blanking level	1.80	A
DC Grid-No.2 Current		
Synchronizing level	47	mA
Blanking level	27	mA
DC Grid-No.1 Current		
Synchronizing level	135	mA
Blanking level	81	mA
Input Circuit Efficiency	95	%
Driver Power Output		
Synchronizing level	145	W
Blanking level	80	W
Plate Dissipation		
Blanking level	5000	W

Output Circuit Efficiency	95	%
Useful Power Output		
Synchronizing level	7000	W
Blanking level	3940	W

a Measured at tube terminals. The filament may be subjected to rf heating as the frequency of operation is increased. It is recommended that the filament voltage be operated at the lowest voltage that will give stable performance.

b For plate voltage = 2000 V, Grid No.2 voltage = 1375 V, Peak plate current = 6.0 A.

c With external flat metal shield 8" (200 mm) in diameter having a center hole 3" (76 mm) 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.

d With external flat metal shield 8" (200 mm) in diameter having a center hole 2-3/8" (60 mm) 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.

e See Dimensional Outline for temperature measurement points.

m Calculated at the -1.0 dB power point of a double-tuned output circuit using two times tube output capacity.

n Adjusted for I_{bo} = 650 mA.

p Fully engineered sockets for the 8890 tube type are available in limited quantities from RCA (Type J15283), are in production quantities from Jettron Products Inc., 56 Route 10, Hanover, NJ 07936 (Type CD89 085). For effective cooling, it is recommended that the RCA "Heat Pipe" Dev. No.J15304 be used in conjunction with these sockets.

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

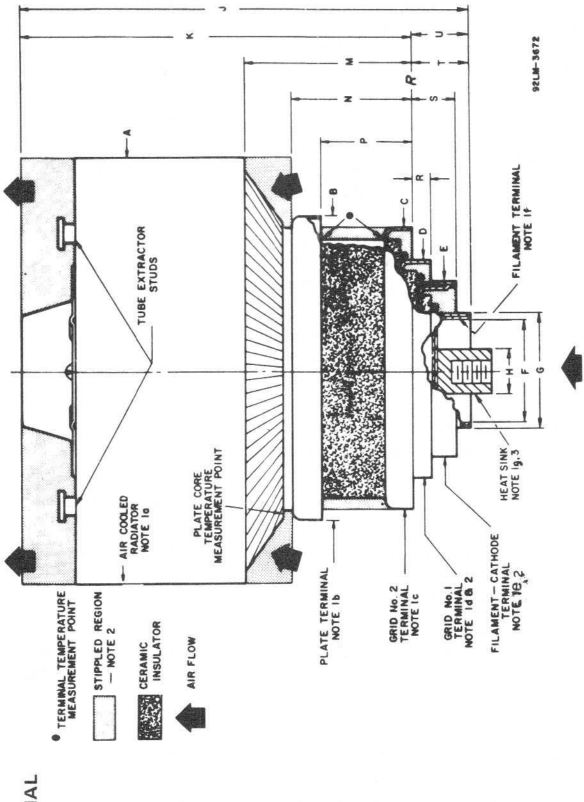
f See Classes of Service.

g See Electrical Considerations - Grid-No.2 Voltage Supply.

h See Electrical Considerations - Grid-No.1 Voltage Supply.

j See Electrical Considerations - Power Supplies and Plate Voltage Supply.

DIMENSIONAL OUTLINE



DIMENSIONAL OUTLINE

Tabulated Dimensions*

Dimension	Value	
A Dia.	4.570 max.	(116.1 max.)
B Dia.	3.235 min.	(82.17 min.)
C Dia.	3.014 min.	(76.56 min.)
D Dia.	2.307 min.	(58.60 min.)
E Dia.	1.840 min.	(46.74 min.)
F Dia.	1.210 max.	(30.73 max.)
G Dia.	1.314 min.	(33.38 min.)
H Dia.	0.620 max.	(15.75 max.)
J	4.930 ± .080	(125.2 ± 2.0)
K	4.300 ± .050	(109.2 ± 1.2)
M	1.790 ± .040	(45.47 ± 1.01)
N	1.330 ± .030	(33.78 ± .76)
P	1.005 ± .020	(25.53 ± .51)
R	0.200 ± .025	(5.08 ± .63)
S	0.475 ± .030	(12.06 ± .76)
T	0.650 ± .030	(16.51 ± .76)
U	0.800 ref.	(20.3 ref)

Note 1 – The contact distance* listed is the uniform indicated length as measured from the edge of the terminal.

		Contact Distance*
1.a	Radiator	1.930 (49.02) min.
1.b	Plate Terminal	0.210 (5.33) min.
1.c	Grid No.2 Terminal	0.200 (5.08) min.
1.d	Grid No.1 Terminal	0.175 (4.45) min.
1.e	Cathode-Filament Terminal	0.220 (5.59) min.
1.f	Filament Terminal ID	0.250 (6.35) max.
1.g	Heat Sink Terminal	0.375 (9.52) max.

Note 2 – Keep all stippled regions clear. In general, do not allow contacts to protrude into these annular regions. If special connectors are required which may intrude on these regions contact RCA Power Tube Application Engineering, Lancaster, PA.

Note 3 – Tapped 1/4-20 NC x 0.5 inch (12.7 mm) deep.

FORCED-AIR COOLING

AIR FLOW

Through radiator — Adequate air flow to limit the plate-core temperature to 250° C should be delivered by a blower through the radiator before and during the application of filament, plate, grid-No.2, and grid No.1 voltages.

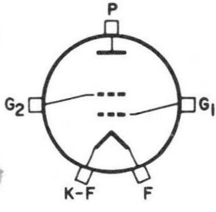
For a plate dissipation of 5000 watts and an incoming air temperature of 50° C, and air flow of 105 cfm is required in accordance with the Typical Cooling Characteristics.

To Plate, Grid-No.2, Grid-No.1, Filament-Cathode, 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. In normal operation this value is approximately 40 cfm (18.8 x 10^3 cc/s).

During Standby Operation — Cooling air is required when filament voltage is applied to the tube.

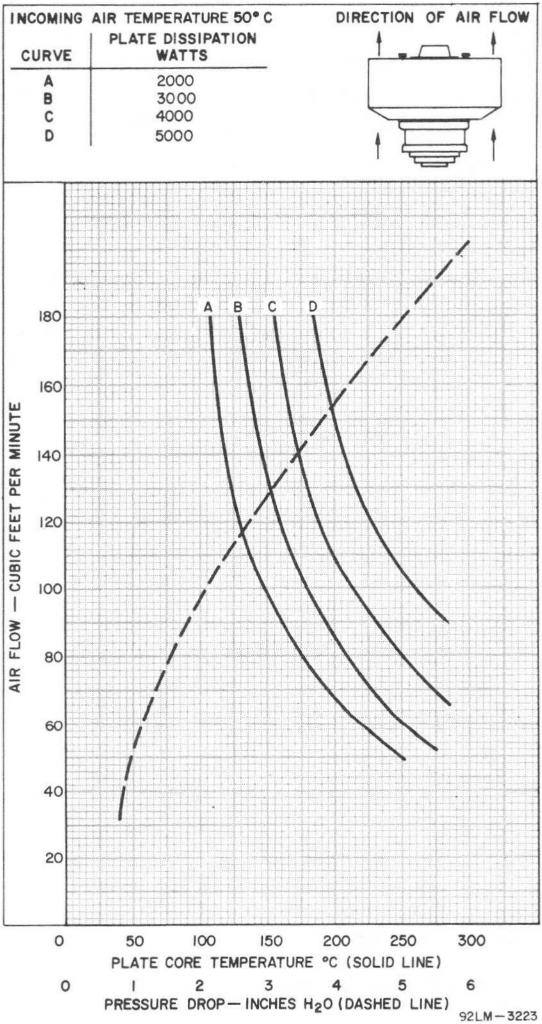
During Shutdown Operation — Air flow should continue for a few minutes after all electrode power is removed.

TERMINAL DIAGRAM

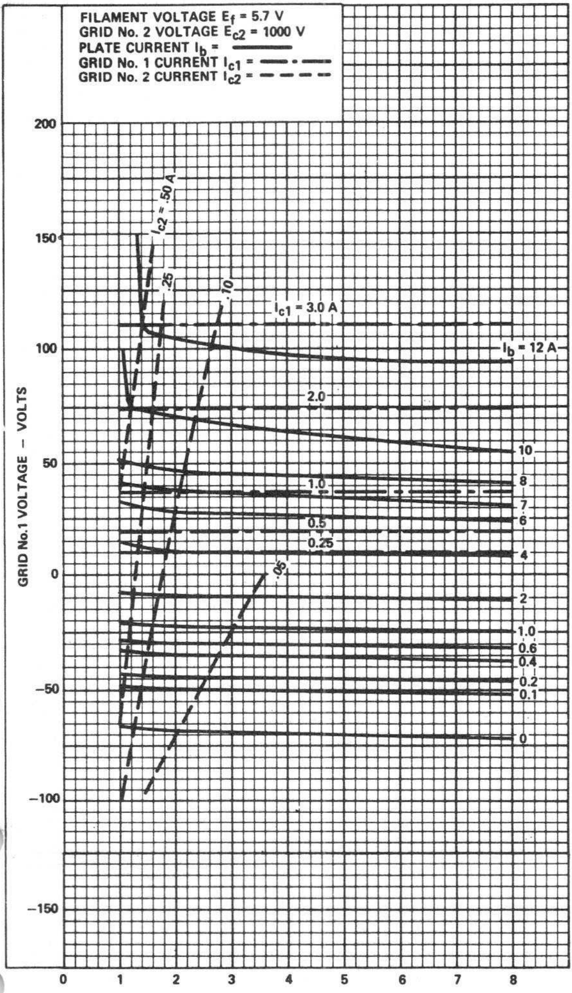


P — Plate Terminal
G_1 — Grid No.1 Terminal
G_2 — Grid No.2 Terminal
K-F — Cathode-Filament Terminal
F — Filament Terminal

TYPICAL COOLING CHARACTERISTICS

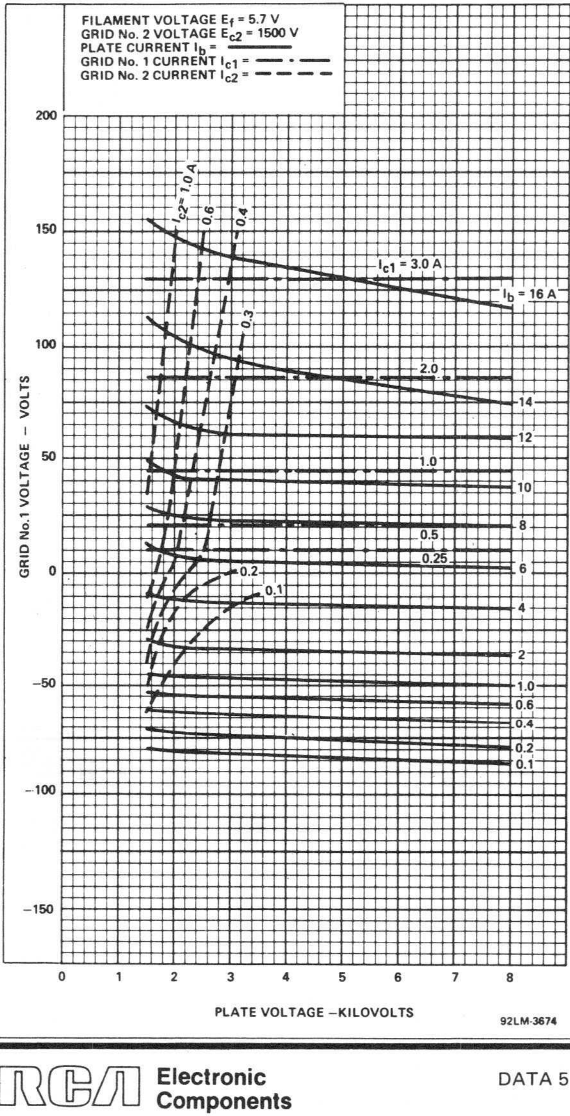


TYPICAL CONSTANT CURRENT CHARACTERISTICS



92LM-3673

TYPICAL CONSTANT CURRENT CHARACTERISTICS



92LM-3674

Beam Power Tube

CERMOLOX® **Full Input to 400 MHz**

20.0 Kilowatt Peak Sync. Output Through VHF-TV Band at 13 dB Gain

ELECTRICAL

Filamentary Cathode, Thoriated-Tungsten Mesh Type			
Voltage[a] (AC or DC)	9.5	typ.	V
	10.0	max.	V
Current			
Typical value at 9.5 V	153		A
Maximum value for starting even momentarily	300		A
Cold resistance	0.01		Ω
Minimum heating time	15		s
Mu Factor[b] (Grid No.2 to Grid No.1)	12.5		
Direct Interelectrode Capacitances:			
Grid No.1 to plate[c]	0.4	max.	pF
Grid No.1 to filament	100		pF
Plate to filament[c,d]	0.15	max.	pF
Grid No.1 to grid No.2	85		pF
Grid No.2 to plate	20		pF
Grid No.2 to filament[d]	4.0	max.	pF

MECHANICAL

Operating Position		Vertical, either end up		
Overall Length	(180.3 mm)	7.100	max.	in
Greatest Diameter	(210.4 mm)	8.285	max.	in
Radiator		Integral part of tube		
Weight (Approx.)	(10.0 kg)	22		lb

THERMAL

Seal Temperature[e] (Plate, grid No.2, grid No.1, cathode-filament, and filament)	250	max.	°C
Plate Core Temperature[e]	250	max.	°C

RF Power Amplifier
Class B Television Service[f,p]

Synchronizing level conditions per tube unless otherwise specified.

MAXIMUM CCS RATINGS, Absolute-Maximum Values:

DC Plate Voltage[g]	9,000	max.	V
DC Grid No.2 Voltage[h]	2,000	max.	V
DC Grid No.1 Voltage[j]	−600	max.	V
DC Plate Current	6.0	max.	A
Grid No.2 Input	450	max.	W
Grid No.1 Input	250	max.	W
Plate Dissipation	See Note m		

Calculated CCS Operation:

In a cathode-drive circuit at 216 MHz and a bandwidth of 6.0 MHz[k].

DC Plate Voltage	6,580	V
DC Grid No.2 Voltage	1,000	V
DC Grid No.1 Voltage	−115	V
Zero Signal DC Plate Current	1.0	A
Effective RF Load Resistance	660	Ω
DC Plate Current:		
Synchronizing level	4.82	A
Blanking level	3.68	A
DC Grid No.2 Current:		
Synchronizing level	137	mA
Blanking level	33	mA
DC Grid No.1 Current:		
Synchronizing level	437	mA
Blanking level	131	mA
Input Circuit Efficiency (Approx.)	92.5	%
Driver Power Output:		
Synchronizing level	865	W
Blanking level	504	W
Output Circuit Efficiency (Approx.)	92.5	%
Useful Power Output:		
Synchronizing level	18.8	kW
Blanking level	10.6	kW

Linear RF Power Amplifier[f,p]

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 400 MHz		
DC Plate Voltage[g]	10,000	max.	V
DC Grid-No.2 Voltage[h]	2,000	max.	V
DC Plate Current at Peak of Envelope	6.0	max.	A
DC Grid-No.1 Current	500	max.	mA
Grid-No.2 Input	450	max.	W
Plate Dissipation	15	max.	kW

MAXIMUM CIRCUIT VALUES

Grid-No.1-Circuit Resistance Under Any Conditions:			
With fixed bias	5,000	max.	Ω
With fixed bias (In Class AB_1 operation).	25,000	max.	Ω
With cathode bias	Not recommended		
Grid-No.2 Circuit Impedance	See Note h		
Plate Circuit Impedance	See Note g		

Calculated Class AB_1 CCS Operation with "Two-Tone" Modulation

In a grid-drive circuit at 7 MHz

DC Plate Voltage	8,000	V
DC Grid-No.2 Voltage	1,500	V
DC Grid-No.1 Voltage	−191	V
Zero-Signal DC Plate Current	1.0	A
Effective RF Load Resistance	978.5	Ω
DC Plate Current (At peak of envelope)	3.91	A
Average DC Plate Current	2.49	A
DC Grid-No.2 Current (At peak of envelope)	137	mA
Average DC Grid-No.2 Current	53	mA
Peak Envelope Drive Power	See Note n	
Output Circuit Efficiency (Approx.)	95	%
Useful Power Output (Approx.)		
Average	8,750	W
Peak envelope	17,500	W

Linear RF Power Amplifier[f,p]
Class AB or Class B Telephony

Carrier conditions for use with a maximum modulation factor of 1.0.

MAXIMUM CCS RATINGS, Absolute-Maximum Values

DC Plate Voltage[g]	10,000	max.	V
DC Grid-No.2 Voltage[h]	2,000	max.	V
DC Plate Current	3.0	max.	A
Grid-No.2 Input	300	max.	W
Plate Dissipation	See Note m		

Calculated CCS Operation

In a cathode drive circuit at 400 MHz.

DC Plate Voltage	8,000	V
DC Grid-No.2 Voltage	1,500	V
DC Grid-No.1 Voltage[r]	−235	V
DC Plate Current	2.47	A
DC Grid-No.1 Current	0	mA
DC Grid-No.2 Current	24	mA
Driver Power Output	500	W
Output Circuit Efficiency (Approx.)	80	%
Useful Power Output	5,000	W

a Measured at the tube terminals. The filament may be subjected to rf heating as the frequency of operation is increased. It is recommended that the filament power be regulated at the lowest value that will give stable performance. For those applications where hum is a critical consideration, dc filament operation or hum bucking circuits are recommended.

b For plate voltage = 2000 V, grid No.2 voltage = 1250 V, and plate current = 15 A.

c With external flat metal shield 8" (200 mm) in diameter having a center hole 3" (76 mm) 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.

d With external flat metal shield 8" (200 mm) in diameter having a center hole 2-3/8" (60 mm) in diameter. Shield is located in plane on the grid No.1 terminal, perpendicular to the tube axis, and is connected to grid No.1.

e See Dimensional Outline for Temperature Measurement Points.

k The bandwidth of 6.0 MHz is calculated at the −1.0 dB power points of a double tuned output circuit using two times the tube capacity and a damping factor of $\sqrt{1.5}$.

m Permitted plate dissipation is a function of cooling. For specific ratings see Forced Air Cooling information.

n Driver power output represents circuit losses and is the actual power measured at the input to the 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.

p The maximum voltage and air flow rates must be modified to obtain adequate holdoff voltage and cooling at temperatures in excess of 35° C and altitudes above 7000 feet.

r Obtained from a fixed supply with an internal impedance of 695 ohms to provide necessary increase in bias at crest of modulating signal.

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

f See Section Class of Service.

g See Section Electrical Considerations - Power Supplies and Plate Voltage Supply.

h See Section Electrical Considerations - Grid-No.2 Voltage Supply.

j See Section Electrical Considerations - Grid-No.1 Voltage Supply.

DIMENSIONAL OUTLINE NOTES

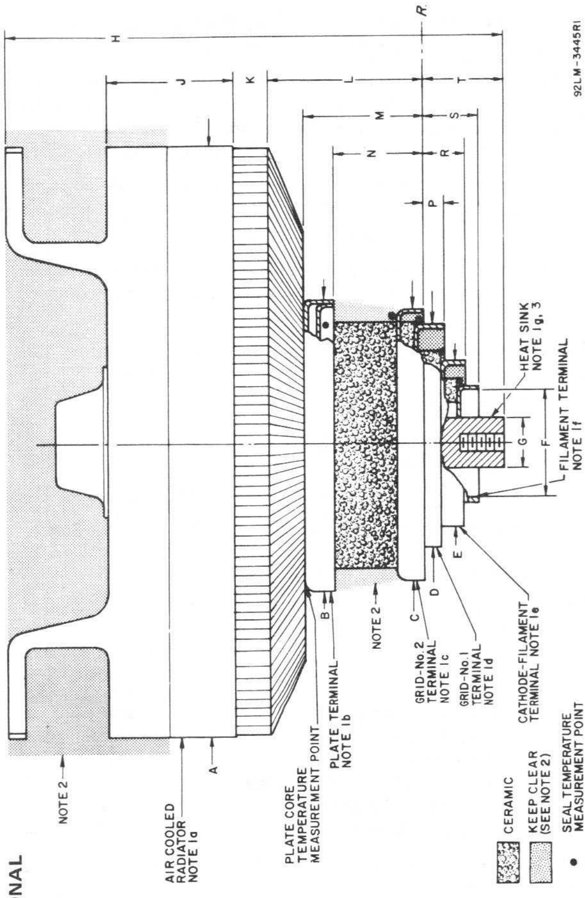
Note 1: The contact distance listed is the minimum, uniform, indicated length as measured from the edge of the terminal.

	Contact Distance inch (mm)
1a. Radiator	0.800 (20.32)
1b. Plate Terminal	0.265 (6.73)
1c. Grid No.2 Terminal	0.265 (6.73)
1d. Grid No.1 Terminal	0.265 (6.73)
1e. Cathode-Filament Terminal	0.250 (6.35)
1f. Filament Terminal	0.265 (6.73)
1g. Heat Sink (post)	0.450 (11.43)

Note 2: Keep all stippled regions clear. In general do not allow contacts to protrude into these annular regions. If special connectors are required which may intrude on these regions, contact RCA Power Tube Application Engineering, Lancaster, PA 17604.

Note 3: Tapped 1/4-20 NC x 0.5 in (12.7 mm) deep.

DIMENSIONAL OUTLINE



DIMENSIONAL OUTLINE

TABULATED DIMENSIONS

Dimensions	Value Inches	Value Millimeters
A Dia.	8.250 ± .035	(209.5 ± .9)
B Dia.	4.188 ± .020	(106.58 ± .51)
C Dia.	3.915 ± .015	(99.44 ± .38)
D Dia.	3.315 ± .015	(84.20 ± .38)
E Dia.	2.696 ± .015	(68.48 ± .38)
F Dia.	1.960 ± .015	(49.78 ± .38)
G Dia.	0.810 max.	(20.57 max.)
H	7.10 max.	(180.3 max.)
J	1.750 ± .030	(44.5 ± .8)
K	0.500 ref.	(12.7 ref.)
L	2.150 ± .050	(54.6 ± 1.3)
M	1.775 min.	(45.1 min.)
N	1.420 ± .030	(36.1 ± .8)
P	0.330 ± .030	(8.4 ± .8)
R	0.650 ± .038	(16.5 ± 1.0)
S	0.960 ± .050	(24.4 ± 1.3)
T	1.200 ref.	(30.5 ref.)

FORCED-AIR COOLING

AIR-FLOW

Through radiator – Adequate air flow to limit the plate-core temperature to 250° C should be delivered by a blower through the radiator before and during the application of filament, plate, grid-No.2, and grid-No.1 voltages.

For typical operation, the required air flow is as follows:

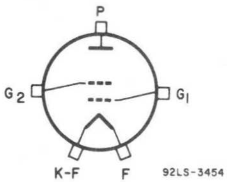
Plate Dissipation	Air Flow	Pressure Drop
Kilowatts	CFM	Inches H_2O
12.5	350	1.75
15.0	425	2.50
17.5	550	3.50

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 its 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.

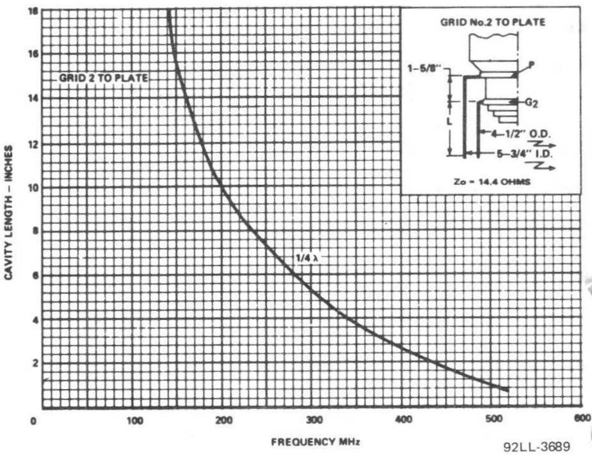
During Shutdown Operation – Air flow should continue for a few minutes after all electrode power is removed.

TERMINAL DIAGRAM

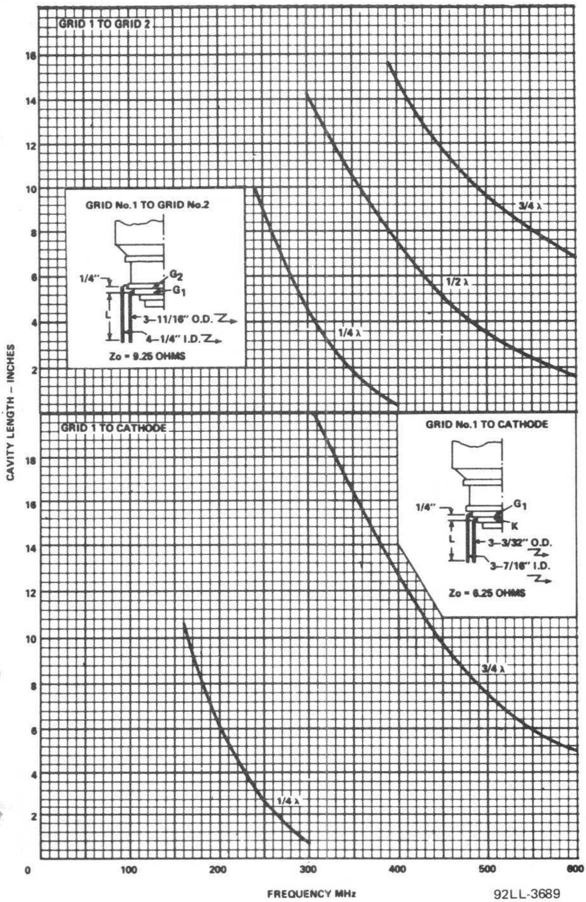


P – Plate Terminal
G_2 – Grid-No.2 Terminal
G_1 – Grid-No.1 Terminal
K-F – Cathode Filament Terminal
F – Filament Terminal

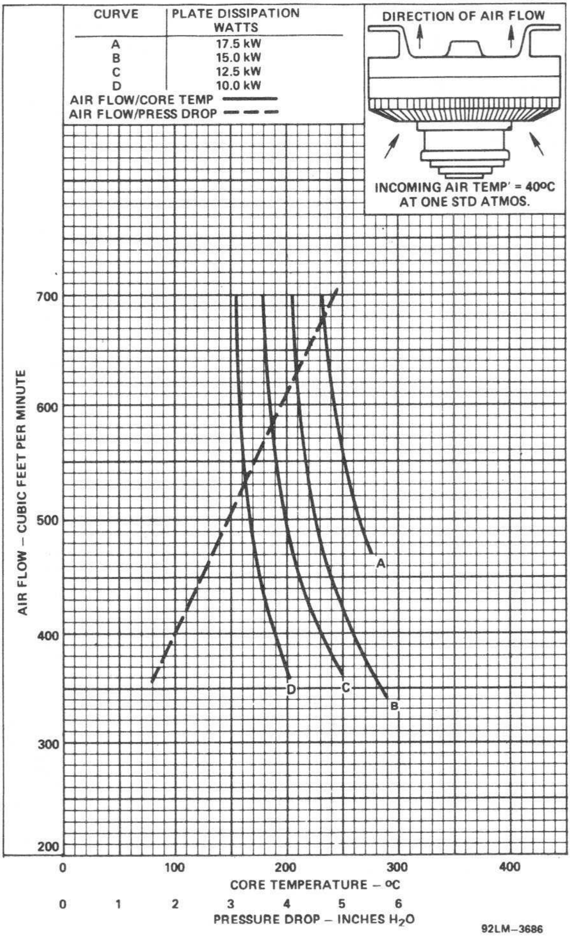
ELECTRODE CAVITY TUNING CHARACTERISTICS



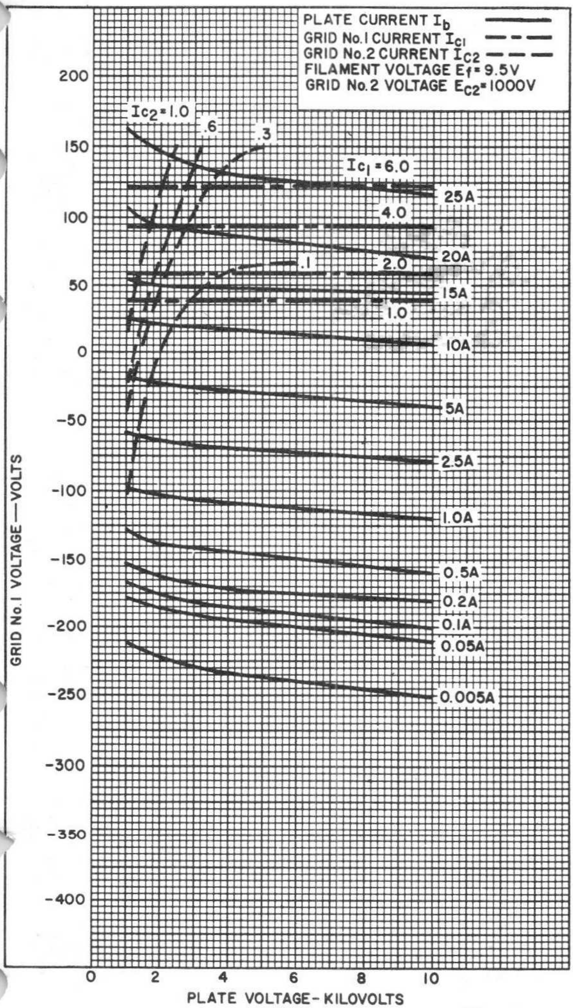
ELECTRODE CAVITY TUNING CHARACTERISTICS (Cont'd.)



TYPICAL COOLING CHARACTERISTICS

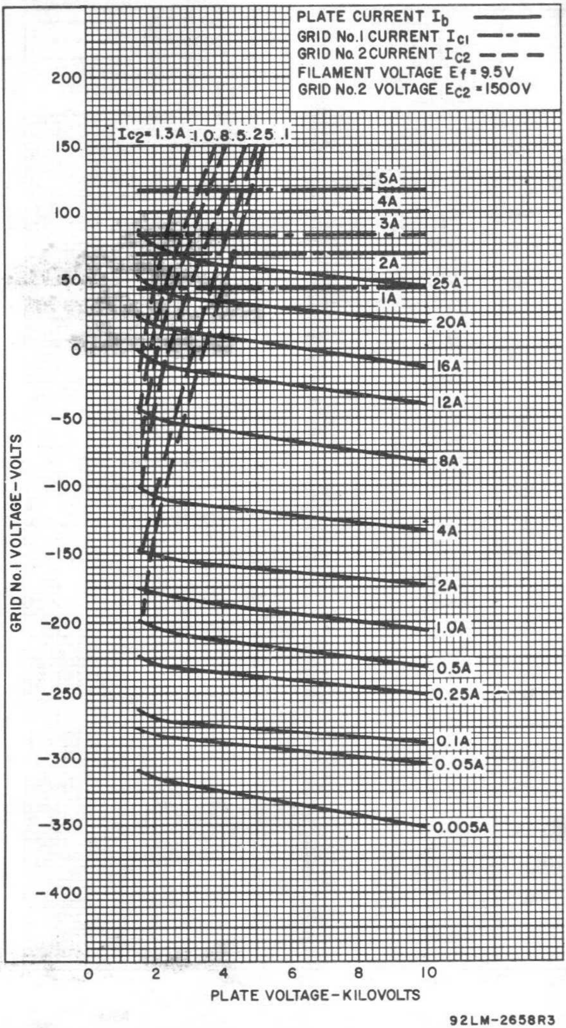


TYPICAL CONSTANT CURRENT CHARACTERISTICS



92LM-2864R2

TYPICAL CONSTANT CURRENT CHARACTERISTICS



92LM-2658R3