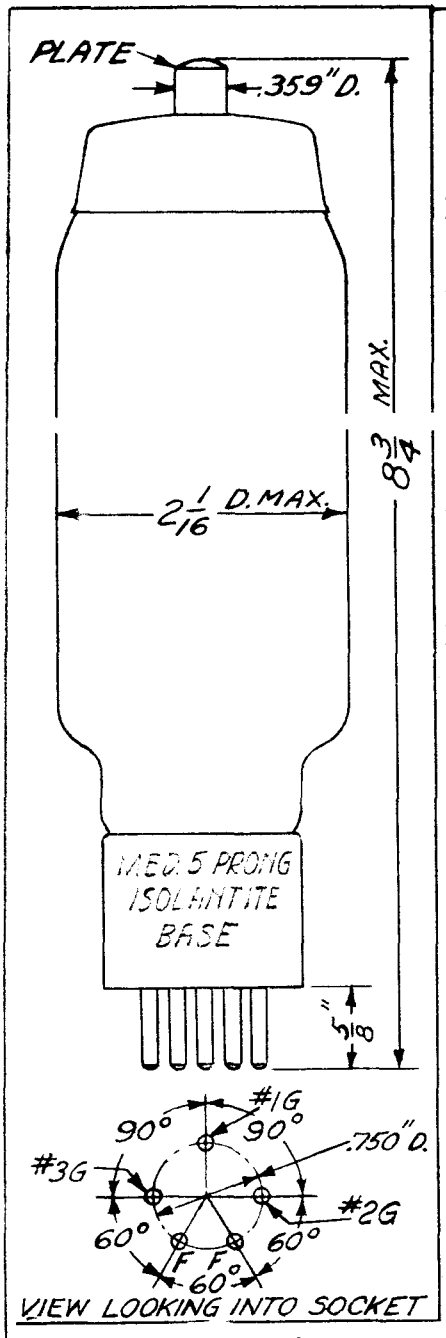
CHARACTERISTIC DATA SHEET
RAYTHEON 4-PILLAR TUBE

RK-20



The RK-20 is a thoriated filament type pentode with suppressor grid brought out to a separate base pin. This opens up the possibilities of modulating the plate current stream by means of the suppressor grid as well as by the conventional methods.

Crystal or Electron Coupled Oscillators. The low control grid-plate capacitance makes possible the use of a plate load circuit tuned to the fundamental in crystal or electron coupled oscillator circuits such as the Tri-Tet. Using crystal control, 50W r-f power can be taken from the plate load circuit without overloading the crystal.

FILAMENT

Voltage = 7.5 Volts Current = 3.0 Amperes

CAPACITIES

G-P = .012 mmf. Input = 11 mmf. Output = 10 mmf.

RATING

DC Plate Voltage	1250	(max)	Volts
DC Screen Voltage (Grid 2)	300	(max)	Volts
DC Suppressor Voltage (Grid 3)	45	(max)	Volts
Plate Dissipation	40	(max)	Watts
Screen Dissipation	15	(max)	Watts
DC Grid Current (Grid 1)	10	(max)	M.A.
RF Grid Current (Grid 1)	5	(max)	Amps.

TYPICAL OPERATION

RF Power Amplifier Class B Telephony Carrier Conditions for use with a Modulation Factor of 1.0.

DC plate Voltage	1250	Volts
DC Screen Voltage	300	Volts
DC Grid Voltage (Grid 1)	-30	Volts
DC Suppressor Voltage	0	Volts
Peak RF Input	70	Volts
DC Plate Current	43	M.A.
DC Screen Current	15	M.A.
Screen Resistor	60000	Ohms
Driving Power	.5	Watts
Peak Power Output	64	Watts
Carrier Power Output	16	Watts

Suppressor or Suppressor Screen Modulated RF Power Amplifier Class C Telephony. Carrier Conditions for use with a Modulation Factor of 1.0.

	Supp.	Supp.Scr.	
Eb Plate DC	1250	1250	Volts
Ec2 Screen DC	300	300	Volts
Ec1 Cont. Gr. DC	-100	-100	Volts
Ec3 Suppressor DC	-45	-40	Volts
Peak AF Eg3	75	75	Volts
Peak AF Eg2	0	150	Volts
Peak RF Input	175	175	Volts
Ib Plate DC	43	47	M.A.
Ic2 Screen DC	36	36	M.A.
Screen Res.	25000	25000	Ohms
Ic1 Cont.Gr. DC	5	5	M.A.
RF Input Power	0.9	0.9	Watts
AF Power	0.3	0.8	Watts
Peak Output	72	84	Watts
Carrier Output	18	21	Watts

Control Grid Modulated R-F Power Amplifier Class C Telephony. Carrier Conditions for use with a Modulation Factor of 1.0.

Eb Plate DC	1250	1250	Volts
Ec2 Screen DC	300	300	Volts
Ec1 Cont.Grid DC	-140	-140	Volts
Ec3 Suppressor DC	0	+45	Volts
Ib Plate DC	42	44	M.A.
Ic2 Screen DC	10	10	M.A.
Screen Res.	95000	95000	Ohms
Ic1 Cont.Gr. DC	1.8	1.8	M.A.
Pk.RF Input Eg1	160	160	Volts
Peak AF Eg1	60	60	Volts
AF Power	0.75	0.75	Watts
Pk.RF Input Power	2	2	Watts
Peak Output	72	84	Watts
Carrier Output	18	21	Watts

CONT. ON SH. 2

Combined Plate and Screen Modulation Class C Telephony. Carrier Conditions for use with a Modulation Factor of 1.0		
Eb Plate DC	900	Volts
Ec2 Screen DC	300	Volts
Ec1 Control Grid DC	-100	Volts
Ec3 Suppressor DC	0	Volts
Ib Plate DC	62	M.A.
Ic2 Screen DC	50	M.A.
Screen Resistor	12000	Ohms
Ic1 Cont.Gr. DC	6	M.A.
Peak AF Plate Ep	900	Volts
Peak AF Screen Eg2	150	Volts
Peak RF Input Eg1	180	Volts
RF Input Power	1.1	Watts
Peak Output	140	Watts
Carrier Output	35	Watts
AF Power	28	Watts

RF Power Amplifier and Oscillator Class C Telegraphy.			
Eb Plate DC	1250	1250	Volts
Ec2 Screen DC	300	300	Volts
Ec1 Control Gr. DC	-100	-100	Volts
Ec3 Suppressor DC	0	+45	Volts
Ib Plate DC	80	92	M.A.
Ic2 Screen DC	37	32	M.A.
Screen Resistance	26000	26000	Ohms
Ic1 Cont.Gr. DC	5	5	M.A.
Peak RF Input Eg1	175	175	Volts
RF Input Power	.9	.9	Watts
Carrier Output	64	80	Watts

OPERATING NOTES

CS-1064 shows the power output and plate and screen dissipation plotted vs. excitation as denoted by the grid current in milliamps. The power output flattens off arround 5 or 6 m.a. grid current with very little gained beyond these values of grid current. The screen dissipation increases with excitation and for this reason the excitation should be kept at reasonable values.

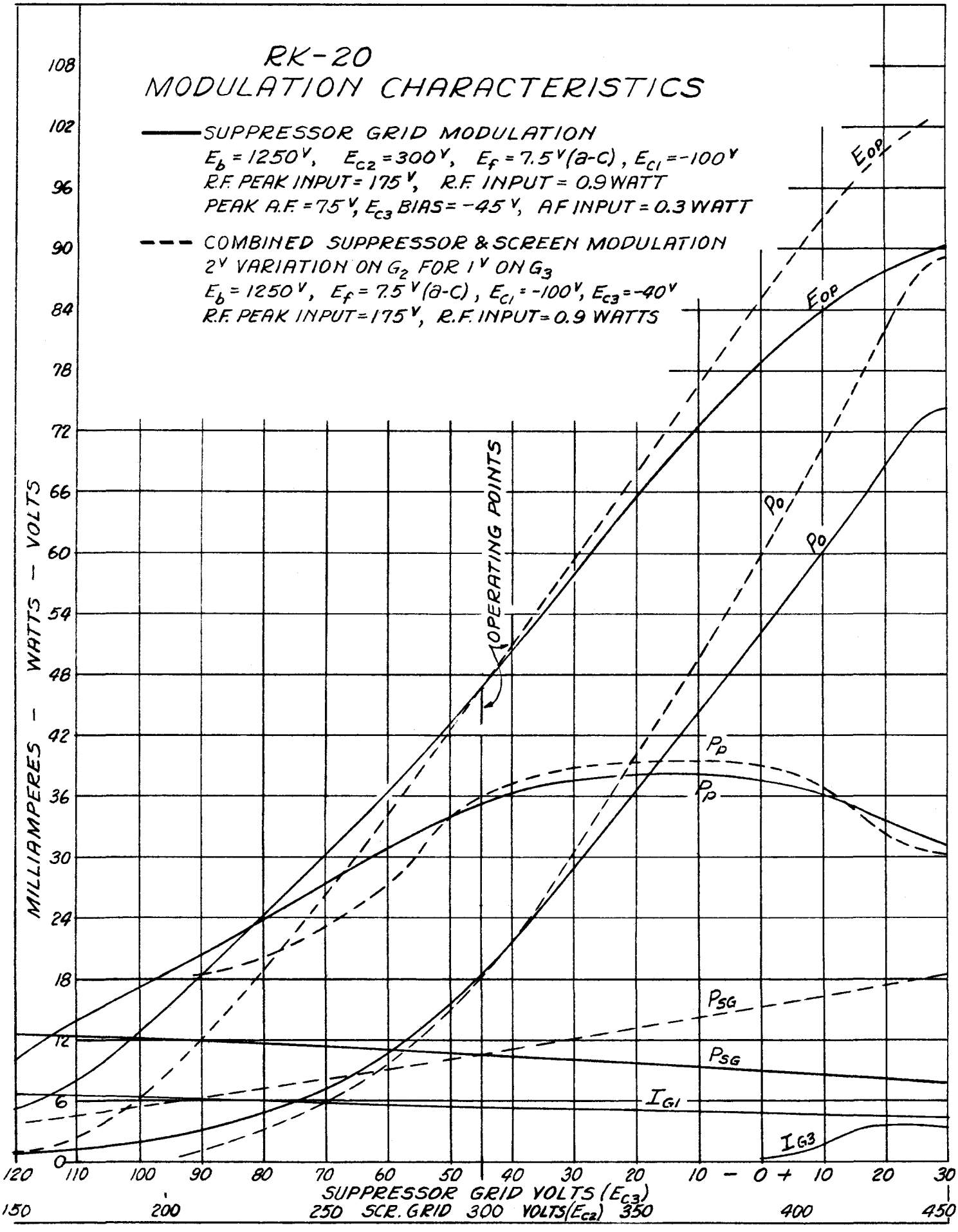
Load Resistance There are two methods of adjusting the plate load. One is to adjust for maximum efficiency which adjustment usually shows a decided dip in the plate current at resonance. The other is to obtain the maximum power for rated plate dissipation. There will usually be very little dip in the plate current when this is done. The load resistance should be adjusted by applying a d-c voltage to the modulating grid equal to peak a-f swing. Otherwise if the load is set at the no modulation condition, trouble will be experienced on the up modulation and the excitation will be set too high with resultant poor modulation and gross overloading on the screen. Care should be taken not to set the load resistance too low, however, because if this is done the plate will be overloaded. In case of combined plate and screen modulation the d-c plate voltage for adjustment should not exceed 1250 volts.

Screen Supply The screen voltage may be obtained either from a separate source or through a dropping resistor. The dropping resistor aids modulation but not very much. For example, the combined suppressor and screen modulation curve shows an upper limit of the effect of the screen on modulation. Actually, however, the results obtained will be closer to the curve for suppressor alone than to the combined modulation curves. The screen should in all cases be by-passed for r.f.

Frequency Doubler The power ratings given should be decreased when used in this service. The adjustments are much more critical than for a straight amplifier or modulator. If care is taken in the adjustment about 50 watts should be obtained with reasonable plate dissipation with at least 100 volts bias on the control grid.

Shielding Shielding of the grid input tuning system from the plate tuning apparatus is desirable and will provide improved stability. If a shield is applied to the RK-20, it should enclose the base end and extend up only to the lower internal shield and should clear the glass bulb by at least 1/16 of an inch.

Bias Supply Battery bias or at least partial battery bias in the control grid is recommended. Additional bias may be obtained by placing a resistor in series with the battery.


RK-20
MODULATION CHARACTERISTICS
SUPPRESSOR GRID MODULATION
$E_b = 1250^V$, $E_{c2} = 300^V$, $E_f = 7.5^V$ (a-c), $E_{c1} = -100^V$
R.F. PEAK INPUT = 175 V, R.F. INPUT = 0.9 WATT
PEAK A.F. = 7.5 V, E_{c3} BIAS = -45 V, AF INPUT = 0.3 WATT
COMBINED SUPPRESSOR & SCREEN MODULATION
2 V VARIATION ON G_2 FOR 1 V ON G_3
$E_b = 1250^V$, $E_f = 7.5^V$ (a-c), $E_{c1} = -100^V$, $E_{c3} = -40^V$
R.F. PEAK INPUT = 175 V, R.F. INPUT = 0.9 WATTS
OPERATING POINTS
E_{OP}
E_{OP}
P_o
P_o
P_p
P_p
P_{SG}
P_{SG}
I_{G1}
I_{G3}
MILLIAMPERES - WATTS - VOLTS
108
102
96
90
84
78
72
66
60
54
48
42
36
30
24
18
12
6
0
120 110 100 90 80 70 60 50 40 30 20 10 - 0 + 10 20 30
SUPPRESSOR GRID VOLTS (E_{c3})
150 200 250 SCR. GRID 300 VOLTS (E_{c2}) 350 400 450

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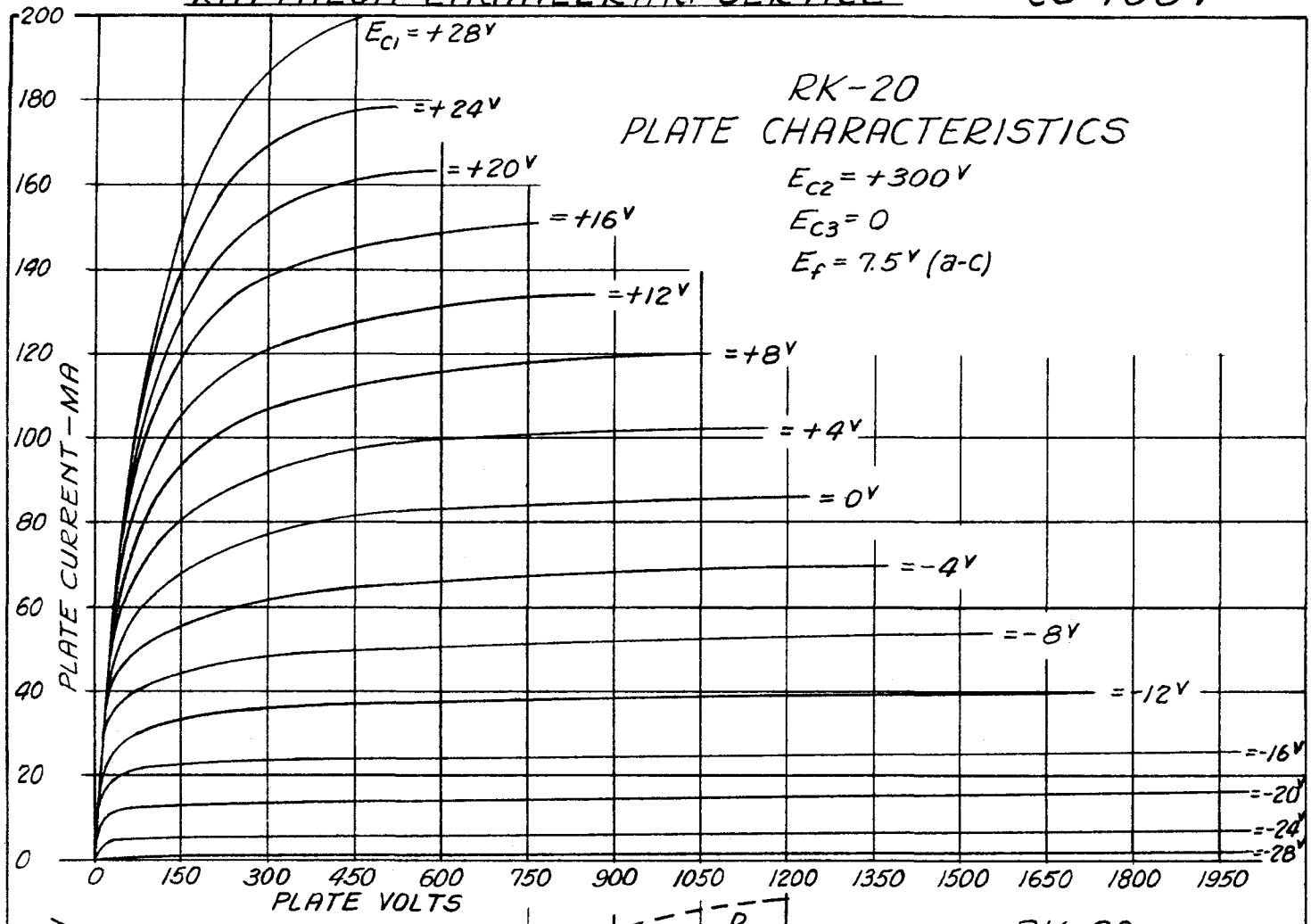
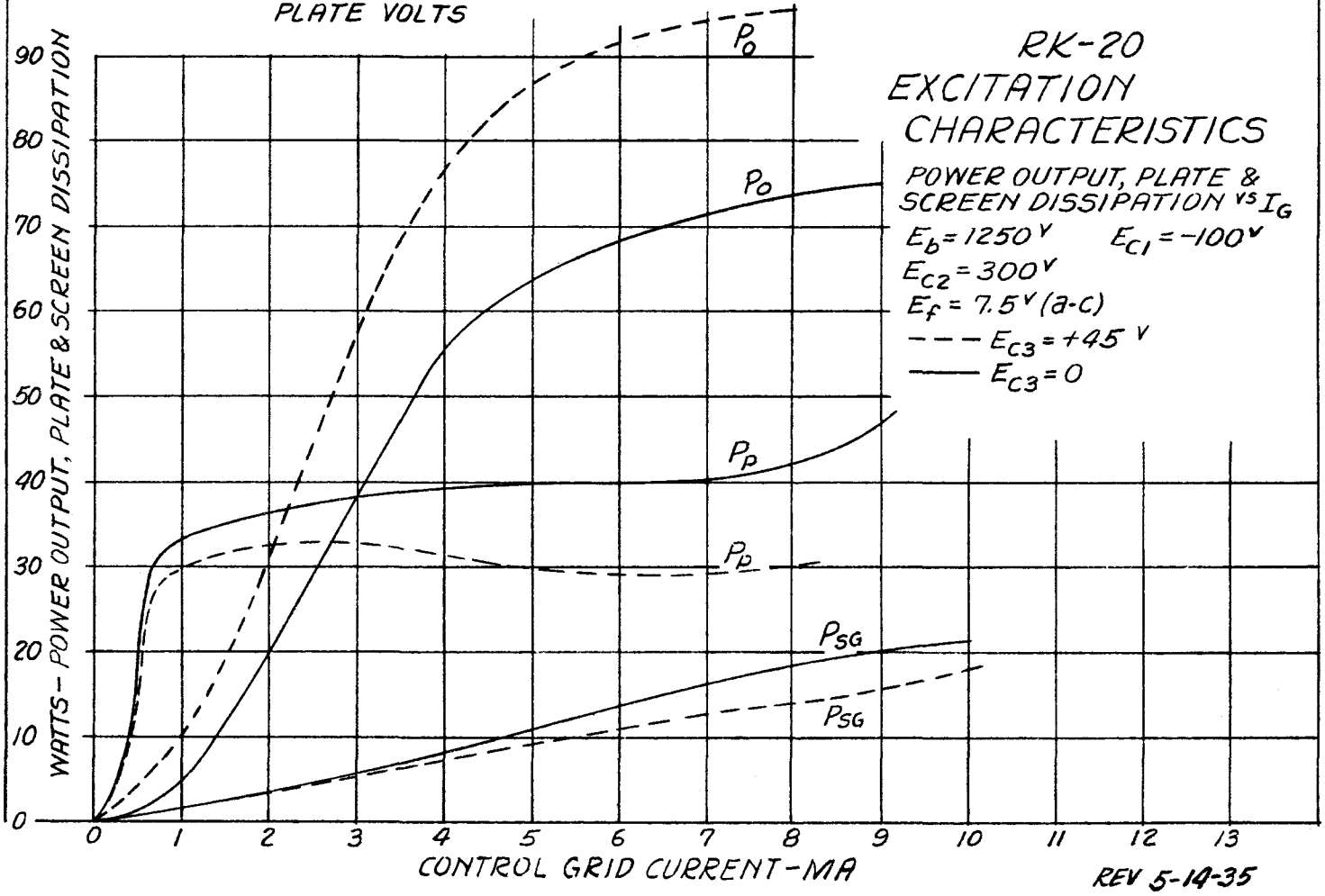
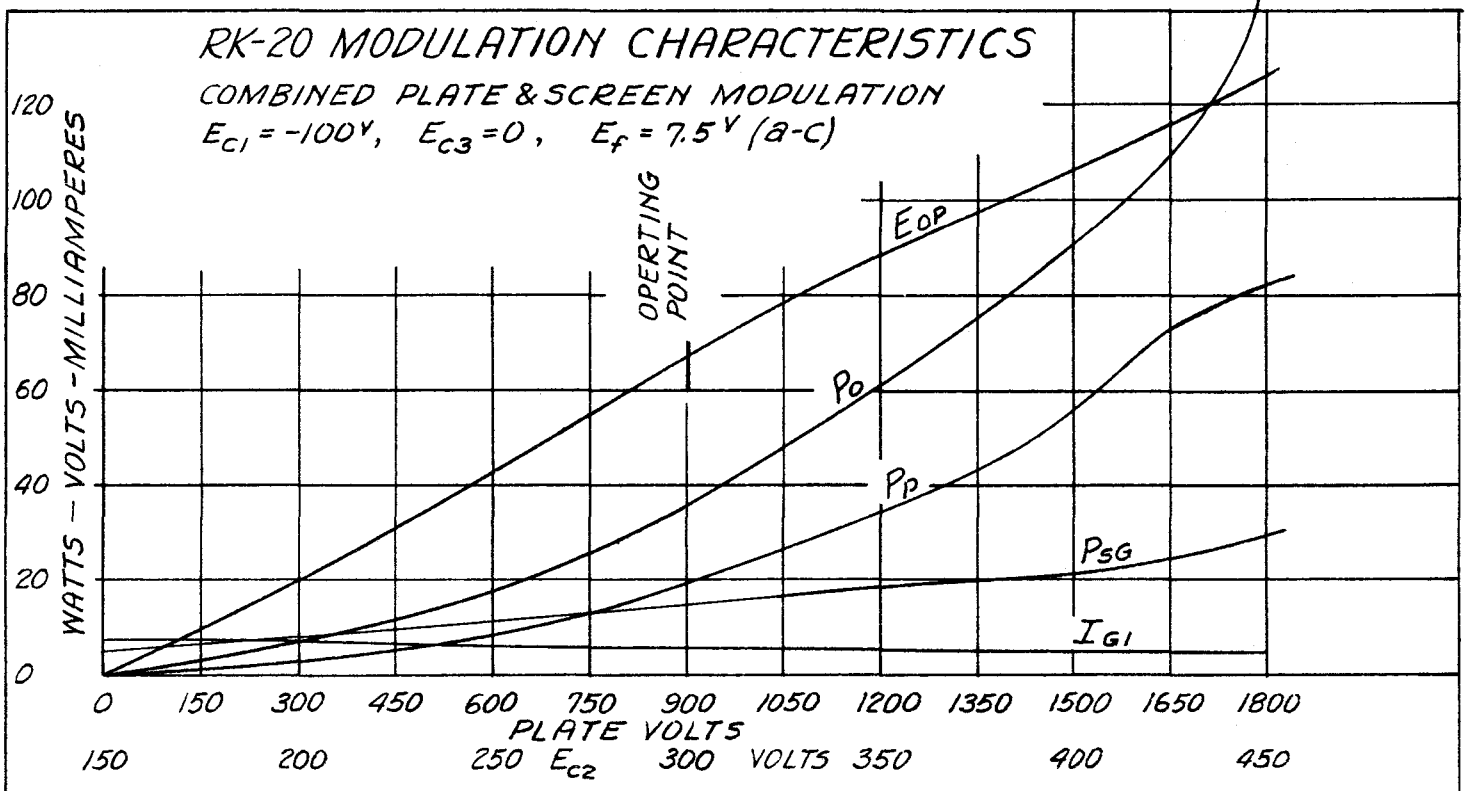
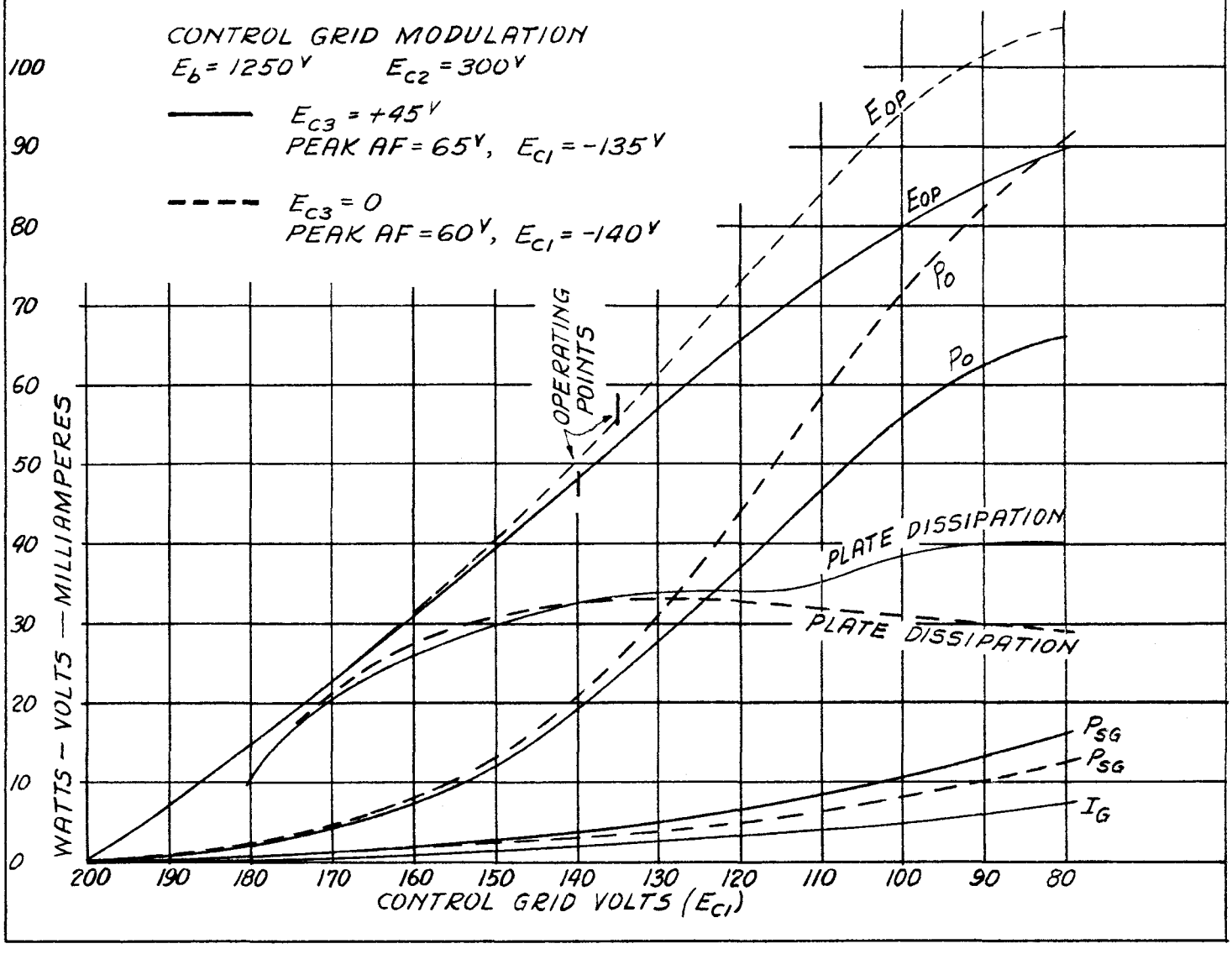

RK-20
PLATE CHARACTERISTICS
$E_{C2} = +300^V$
$E_{C3} = 0$
$E_f = 7.5^V$ (a-c)
$E_{C1} = +28^V$
$= +24^V$
$= +20^V$
$= +16^V$
$= +12^V$
$= +8^V$
$= +4^V$
$= 0^V$
$= -4^V$
$= -8^V$
$= -12^V$
$= -16^V$
$= -20^V$
$= -24^V$
$= -28^V$
PLATE CURRENT—MA
PLATE VOLTS
0 150 300 450 600 750 900 1050 1200 1350 1500 1650 1800 1950
0 20 40 60 80 100 120 140 160 180 200


RK-20
EXCITATION
CHARACTERISTICS
POWER OUTPUT, PLATE & SCREEN DISSIPATION VS I_G
$E_b = 1250^V$ $E_{C1} = -100^V$
$E_{C2} = 300^V$
$E_f = 7.5^V$ (a-c)
--- $E_{C3} = +45^V$
—— $E_{C3} = 0$
P_o
P_o
P_p
P_p
P_{SG}
P_{SG}
WATTS—POWER OUTPUT, PLATE & SCREEN DISSIPATION
CONTROL GRID CURRENT—MA
0 1 2 3 4 5 6 7 8 9 10 11 12 13
0 10 20 30 40 50 60 70 80 90

RAYTHEON ENGINEERING SERVICE

RK-20 MODULATION CHARACTERISTICS