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5516

CLASS C R-F BEAM PENTODE FREQUENCY MULTIPLIER A-F AMPLIFIER & MODULATOR

5516

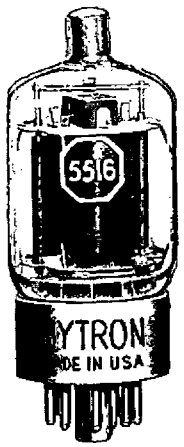
15-WATT BEAM PENTODE INSTANT-HEATING FILAMENT

The 5516 is an instant-heating filamentary-type 15-watt transmitting beam pentode. Designed for vhf mobile equipment, it is ideal as a class C frequency multiplier or as a class C amplifier requiring no neutralization in properly designed circuits operating up to 165 mc. Extremely low internal tube drop makes the 5516 highly efficient at the low plate potentials so desirable for portable and mobile applications. A tremendous saving in battery power (over that with cathode-type tubes) is made possible in such applications by the 5516's instant-heating filament. When used in conjunction with other instant-heating types (such as the 2E25 and 2E30), all electrode potentials may be applied simultaneously, thus permitting the instant-heating filament to be turned off during transmitting standby periods. Filament of the 5516 is rated at 6.0 volts—the potential preferred by RMA for mobile service. While the 5516 is primarily adapted to mobile equipment, all ratings are for continuous commercial service (CCS) and are equally suitable for fixed station use.

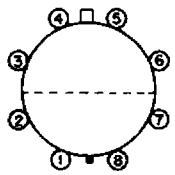
The 5516 has several constructional advantages. Zirconium-coated plate, gold-plated control grid, and carbonized screen grid enable maximum possible vhf ratings, despite compact size. A special, rugged filament suspension avoids short circuits and burn-outs in rigorous mobile applications. Three separate base-pin connections to the filament center tap provide for the lowest possible cathode lead inductance. The dishpan stem and compact structure give short, heavy leads with low inductance and capacitance.

General Characteristics

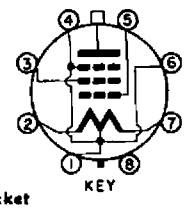
Filament*	center-tapped oxide-coated	
Potential a-c or d-c	6.0 ± 10%	volts
Current	0.7	amperes
Heating time (approx.)*	2	seconds
Transconductance (for Eb = 450V, Ec2 = 250V, Ec1 = −19V, Ef = 6.0V a-c)	4000	μmhos
Average amplification factor (G_1 to G_2)	9	
Direct interelectrode capacitances (no external shield)		
Grid to plate (max)	0.12	μμfd
Input	8.5	μμfd
Output	6.5	μμfd
Bulb		T-11
Maximum overall length	3-21/32	inches
Maximum seated height	3-3/32	inches
Maximum diameter	1-7/16	inches
Base	short octal low-loss phenolic	
Cap	small metal	
Mounting position	filament plane must be vertical	



Filament Plane



Terminal Layout



bottom view of socket

Terminal Connections

Pin	Connection	Pin	Connection
1	Fil. center tap and beam plates	5	Control grid
		6	Same as pin 1
2	Filament	7	Filament
3	Screen grid	8	No connection
4	Same as pin 1	Cap	Plate

A-F Power Amplifier and Modulator — Class A_1

Maximum Ratings, Absolute Values

D-c plate potential	600 max	volts
D-c screen grid potential	250 max	volts
Control grid resistor	50000 max	ohms
D-c plate input power	15 max	watts
D-c screen grid input power	5 max	watts
Plate dissipation	15 max	watts

Typical Operation — Average Characteristics

Push-Pull Amplifier

Unless otherwise specified, the values are for two tubes:

A-c filament potential ø		6.0	6.0	6.0	6.0	volts
D-c plate potential		250	300	400	500	volts
D-c screen grid potential		250	250	250	250	volts
D-c control grid bias ø ‡	(a	−15	−17.5	−18.5	−21	volts
	(b	...	...	...	...	
	(c	135	170	240	330	ohms
Peak a-f control grid to control grid potential		30	35	37	42	volts
Zero signal d-c plate current		104	96	75	60	ma
Max signal d-c plate current		116	114	100	92	ma
Zero signal d-c screen grid current		10	8	4	3	ma
Max signal d-c screen grid current		20	17	14	10	ma
Effective load resistance (plate to plate)		5000	5000	8000	11000	ohms
Max signal plate power output		9.5	11	15	21	watts
Total harmonic distortion		4.5	4	4	3.5	percent

A-F Power Amplifier and Modulator — Class AB_1

Maximum Ratings, Absolute Values

D-c plate potential	600 max	volts
D-c screen grid potential	250 max	volts
Control grid resistor	50000 max	ohms
D-c screen grid input power	5 max	watts
Plate dissipation	15 max	watts

Typical Operation — Average Characteristics

Unless otherwise specified, the values are for two tubes:

A-c filament potential ø		6.0	6.0	6.0	6.0	volts
D-c plate potential		300	400	500	600	volts
D-c screen grid potential		250	250	250	250	volts
D-c control grid bias ø ‡	(a	−25	−25	−25	−25	volts
Peak a-f control grid to control grid potential		50	50	50	50	volts
Zero signal d-c plate current		32	32	34	36	ma
Max signal d-c plate current		90	90	90	90	ma
Zero signal d-c screen grid current		1	1	1	1	ma
Max signal d-c screen grid current		16	14	14	14	ma
Effective load resistance (plate to plate)		6500	9000	12000	16000	ohms
Max signal plate power output		15	20	28	38	watts
Total harmonic distortion		2.5	2.5	2.5	2.5	percent

A-F Power Amplifier and Modulator — Class AB_2

Maximum Ratings, Absolute Values

D-c plate potential	600 max	volts
D-c screen grid potential	250 max	volts
Peak positive a-f control grid potential	20 max	volts
Max signal d-c plate current ψ	70 max	ma
Max signal plate input power ψ	42 max	watts
Max signal screen grid input power ψ	5 max	watts
Plate dissipation ψ	15 max	watts

Typical Operation — Average Characteristics

Unless otherwise specified, the values are for two tubes:

A-c filament potential ø		6.0.	6.0	6.0	6.0	volts
D-c plate potential		300	400	500	600	volts
D-c screen grid potential		250	250	250	250	volts
D-c control grid bias ø ‡	(a	−25	−25	−25	−25	volts
Peak a-f control grid to control grid potential		80	80	80	80	volts
Zero signal d-c plate current		30	32	34	36	ma
Max signal d-c plate current		140	140	140	140	ma
Zero signal d-c screen grid current		1	1	1	1	ma
Max signal d-c screen grid current		24	24	24	24	ma
Max signal d-c control grid current		4	4	4	4	ma
Effective load resistance (plate to plate)		4000	6000	8000	10500	ohms
Max signal control grid driving power		0.16	0.16	0.16	0.16	watts
Max signal plate power output		25	38	53	67	watts
Total harmonic distortion		4	3.5	3.5	3.5	percent

PREPARED BY COMMERCIAL ENGINEERING DEPT.

HYTRON RADIO & ELECTRONICS CORP.

MAIN OFFICE: SALEM, MASSACHUSETTS

HYTRON 5516

R-F Power Amplifier and Oscillator
Class C Telegraphy and Frequency Modulation

Key-down conditions per tube without amplitude modulation.

Maximum Ratings, Absolute Values

D-c plate potential	600 max	volts
D-c screen grid potential	250 max	volts
D-c control grid bias	−150 max	volts
Control grid resistor	50000 max	ohms
D-c plate current	90 max	ma
D-c control grid current	6 max	ma
Peak positive r-f control grid potential	35 max	volts
D-c plate input power	45 max	watts
D-c screen grid input power	5 max	watts
Plate dissipation	15 max	watts

Typical Operation — Average Characteristics

Filament potential		6.0	6.0	6.0	volts
D-c plate potential		400	500	600	volts
D-c screen grid potential		250	250	250	volts
D-c control grid bias ‡	(a	−60	−60	−60	volts
	(b	12000	12000	12000	ohms
	(c	650	550	650	ohms
Peak r-f control grid potential		85	85	85	volts
D-c plate current		75	90	75	ma
D-c screen grid current		15	15	15	ma
D-c control grid current		5	5	5	ma
Control grid driving power (approx)		0.5	0.5	0.5	watts
Plate power output (approx) Δ		21	32	32	watts

Measured performance at 156 mc

				mc	
Filament potential			6.0	6.0	volts
D-c plate potential			400	450	volts
D-c screen grid potential			250	250	volts
D-c control grid bias ‡	(a		−40	−40	volts
	(b		20000	20000	ohms
	(c		410	435	ohms
Peak r-f control grid potential			60	60	volts
D-c plate current			80	75	ma
D-c screen grid current			15	15	ma
D-c control grid current (approx)			2	2	ma
Control grid driving power (approx)			2	2	watts
Plate power output (approx) Δ			19	21	watts
Useful power output (approx) Δ			16	18	watts

Plate & Screen Grid Amplitude Modulated
R. F. Power Amplifier — Class C Telephony

Carrier conditions for use with a max modulation percentage of 100

Maximum Ratings, Absolute Values

D-c plate potential	475 max	volts
D-c screen grid potential	250 max	volts
D-c control grid bias	−150 max	volts
D-c plate current	75 max	ma
D-c control grid current	6 max	ma
Peak positive r-f control grid potential	35 max	volts
D-c plate input power †	30 max	watts
D-c screen grid input power †	3.3 max	watts
Plate dissipation †	10 max	watts

Typical Operation — Average Characteristics

Filament potential		6.0	6.0	6.0	volts
D-c plate potential		300	400	475	volts
D-c screen grid potential		250	250	250	volts
D-c control grid bias ‡	(a	−90	−90	−90	volts
	(b	18000	18000	22500	ohms
	(c	1050	1000	1200	ohms
Peak r-f control grid potential		115	115	115	volts
D-c plate current		60	75	63	ma
D-c screen grid current		15	12.5	10	ma
Screen grid dropping resistor		3500	12000	22500	ohms
D-c control grid current		5	5	4	ma
Control grid driving power (approx)		0.6	0.6	0.5	watts
Plate power output (approx) Δ		12	20	22	watts

Measured performance at 156 mc

				mc	
Filament potential			6.0	6.0	volts
D-c plate potential			300	350	volts
D-c screen grid potential			250	250	volts
D-c control grid bias ‡	(a		−45	−45	volts
	(b		15000	15000	ohms
	(c		650	550	ohms
Peak r-f control grid potential			65	65	volts
D-c plate current			55	70	ma
D-c screen grid current			12.5	12.5	ma
Screen grid dropping resistor			4000	8000	ohms
D-c control grid current (approx)			3	3	ma
Control grid driving power (approx)			3	3	watts
Plate power output (approx) Δ			14	14	watts
Useful power output (approx) Δ			8	12	watts

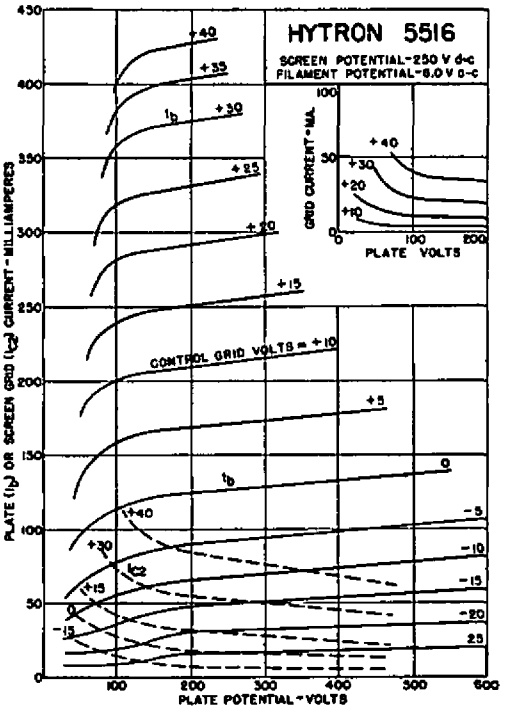
* The plate supply must be switched off before or simultaneously with the filament in all applications. When the 5516 is used as an r-f driver for a tube having a thoriated-tungsten filament, provision must be made so that the driven tube(s) is not operated with plate and screen potential applied but without a bias voltage during the time interval required for the 5516 to come up to operating temperature. When the filament is heated from a transformer with a nominal 6.3-volt output, the filament connections may be made with small wire to introduce the necessary drop of 0.3 volts.

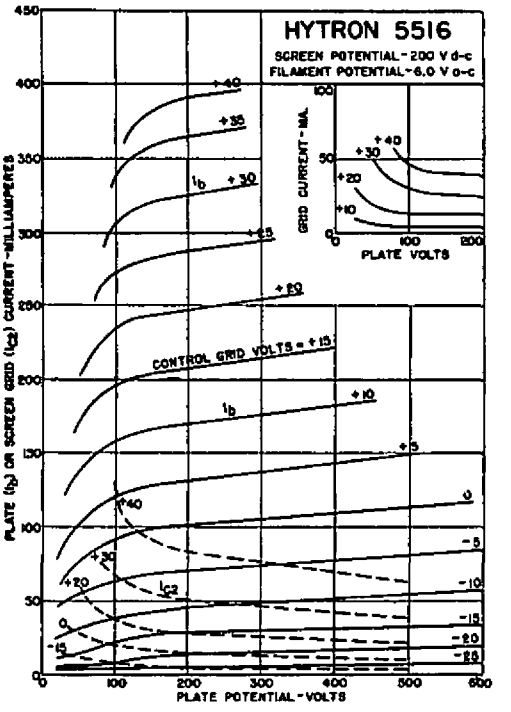
Tube conservation: When the standby period is generally less than 15 minutes, additional tube life can be obtained by reducing the filament potential to 80% of the nominal operating voltage. For longer standby periods, the filament should be turned off.

Ratings vs. Frequency

Maximum ratings for full input apply to 80 megacycles. The 5516 may be operated at higher frequencies provided the maximum values of plate voltage and power input are reduced according to the tabulation below (other maximum ratings are the same as shown above). Special attention should be given to adequate ventilation of the bulb at these higher frequencies.

Frequency	80	135	165	mc
Percentage of maximum ratings:				
Plate potential	100	83	75	percent
Plate input	100	89	78	percent





ø When d-c is used on the filament, the bias should be reduced approximately 3-1/2 volts and the grid return made to the negative leg of the filament.

‡ Obtained from (a) fixed supply, (b) control grid resistor, (c) cathode resistor, or by combination of methods.

ψ Averaged over any a-f cycle of sine wave form.

† When modulated 100% with a sine wave, the average power increases by 50%. With a complex wave form, such as is produced by speech or music, the average power increases approximately 15% to 25%.

Δ "Plate power output" includes circuit losses and r-f radiation losses as well as useful power delivered to the load.

* In vhf circuits all three filament center taps should be well bypassed to or grounded to a common point to provide lowest effective cathode inductance.

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