5514

CLASS C R-F AMPLIFIER
CLASS B AUDIO AMPLIFIER

5514
65-WATT HIGH-MU TRIODE

The 5514 is a 65-watt, high-mu, all-purpose transmitting triode designed for highly efficient operation over a wide range of plate voltages in either audio or r-f applications. It has a low internal tube drop for maximum efficiency, dual base connections to the grid, zirconium-coated graphite plate, and lava-insulated plate cap. High amplification factor of the 5514 permits operation at plate voltages up to 1250 volts without exceeding maximum plate dissipation when no fixed bias is used and excitation is removed. At 1500 volts, a fixed bias of 4.5 volts is adequate for tube protection. The 5514 is interchangeable with many other triodes in its voltage range; substitution of the 5514 often permits higher input. Discontinued Hytron types HY30Z, HY40, HY40Z, HY51A, HY51B, and HY51Z are supplanted by the 5514.

OPERATION HINTS

So versatile is the 5514 that all its possible applications cannot be covered even in such comprehensive listings as are included in this data sheet. High amplification factor of the 5514 makes the bias problem simple. Maximum plate dissipation is high enough to permit zero-bias operation at up to 1250 plate volts, without fear of tube damage. For example, with grid excitation removed, zero bias, and 1250 plate volts, the static plate current ranges from 34 to 50 ma (dependent on normal variations in manufacture of the tubes), thus developing between 42.5 and 62.5 watts of plate dissipation.

Because of this feature, it is practical to construct a transmitter with no protective bias supply (operating bias obtained from a grid resistor in accordance with the data shown) and with 435 watts input for two tubes. Keying in low power stages for break-in operation is perfectly feasible under these conditions. To take advantage of this no-bias-supply feature, however, it is absolutely necessary that perfect neutralization and complete absence of parasitic oscillation be attained. If a cutoff bias (approximately plate potential divided by amplification factor) is used, the neutralization problem is much less critical.

The 5514 may also be used as a radio-frequency amplifier without any bias whatsoever. This class of operation is similar to the commonly used class B audio. It has the advantage of requiring extremely low driving power. The type of operation can be called class B r-f, but should not be confused with class B linear. Efficiency under class B r-f conditions is of the order of 60 to 70 per cent; as an example, the 5514 with 1000 plate volts delivers approximately 120 watts of class B r-f power output with about 3.5 watts drive. In class C, it would yield 132 watts with 8.7 watts drive. In either class of operation, it has been found that linearity of modulation is obtained without difficulty.

High output is delivered by the 5514 at low plate voltages, thus resulting in a low impedance output circuit. For this reason it is a simple matter to use the tube as a driver to match effectively the grid impedance of another 5514 in the following amplifier. Grid drive for triode power tubes is usually composed of a high current at a rather low voltage. This is particularly true of the 5514 with which the tendency to supply too much grid voltage must be avoided. A high current combined with a low voltage means a low impedance. Medium- and low-mu tubes generally require a high impedance plate load, therefore making it difficult to match their high-impedance outputs to a following low-impedance grid input. Using the 5514 in both driver and amplifier stages, however, simplifies the impedance matching problem. Since the 5514 can be operated with a low-impedance output, direct capacitive coupling to the following tube is effective and involves no special matching adjustments.

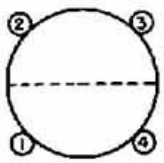
Close electrode spacings of the 5514 permit efficient operation at high frequencies, but the usual care must be exercised in transmitter design to avoid parasitic oscillations. High-frequency parasitics can be eliminated by tuned chokes in the plate leads. These chokes should be designed to have a high impedance at the parasitic frequency and a low impedance at the operating frequency.

It is advisable to have both grid leads of the 5514 tied together at the socket in all types of operation. This is particularly true at high frequencies, since the lead inductance in the grid circuit is thereby reduced.

GENERAL CHARACTERISTICS

Filament	thoriated tungsten	
Potential	7.5 ± 5%	volts
Current	3	amperes
Transconductance E_b = 1000V		
E_c = 0, E_f = 7.5V a-c	5100	μmhos
Amplification factor	145	
Direct interelectrode capacitances		
Grid-to-plate	7.9	μμfd
Input	7.8	μμfd
Ouput	1.0	μμfd
Maximum over-all length	6-9/16	inches
Maximum diameter	2-7/16	inches
Bulb		ST - 19
Base	4-pin medium, low-loss phenolic	
Cap	medium with ceramic insulation	
Mounting position	filament plane must be vertical	

Filament Plane



Terminal Layout

bottom view of socket

Terminal Connections

1—Filament
2—Grid
3—Grid
4—Filament
Cap—Plate

RATINGS vs. FREQUENCY

Maximum ratings for full input apply to 60 megacycles. The 5514 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). Special attention should be given to adequate ventilation of the bulb at these higher frequencies.

Frequency	60	80	100	mc
Percentage of maximum ratings:				
Plate potential	100	75	60	per cent
Plate input	100	75	60	per cent

A-F POWER AMPLIFIER AND MODULATOR — CLASS B

Maximum Ratings, Absolute Values

D-c plate potential	1500 max	volts	
Peak positive a-f grid potential	125 max	volts	
Max signal d-c plate current ψ	175 max	ma	
Max signal plate input power ψ	262.5 max	watts	
Plate dissipation ψ	65 max	watts	

Typical Operation — Average Characteristics

Unless otherwise specified, the values are for two tubes

D-c plate potential	400	500	600	600	750	750	850	850	1000	1000	1000	1250	1250	1250	1500	1500	1500	volts
D-c grid potential ‡ Iat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	−4.5	−4.5	−4.5	volts
Peak a-f grid to grid potential	98	96	96	136	93	135	90	126	89	123	135	84	118	134	96	130	146	volts
Zero signal d-c plate current	24	30	36	36	46	46	54	54	64	64	64	84	84	84	50	50	50	ma
Max signal d-c plate current	200	200	200	300	200	300	200	300	200	300	350	200	300	350	200	300	350	ma
Max signal d-c grid current	60	60	60	110	60	90	54	90	54	80	88	50	72	84	46	76	88	ma
Load resistance (plate to plate)	4000	5500	6500	4800	8400	6000	8500	7000	11600	8000	6500	15000	10000	8400	17000	12600	10500	ohms
Max sig grid driving power	3	3	3	7.5	3	6	2.5	5.5	2.5	5	6	2	4.5	5.5	2	5	6.5	watts
Max sig plate power output	50	65	85	135	105	175	115	200	145	230	260	170	270	320	215	350	400	watts
Total harmonic distortion	3	2.5	2	6.5	2	4.5	2	4.5	2.5	2.5	2	4	3	2.5	2.5	2	2.5	per cent

HYTRON 5514

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	1500 max volts	Peak positive r-f control grid potential	125 max volts
D-c control grid bias	−200 max volts	D-c plate input power	262.5 max watts
D-c plate current	175 max ma	Plate dissipation	65 max watts
D-c control grid current	60 max ma		

Typical Operation — Average Characteristics

D-c plate potential		400	400	500	500	600	600	750	750	850	850	1000	1000	1250	1250	1500	1500	volts
D-c grid potential ‡	(a)	−15	−24	−15	−36	−22.5	−36	−22.5	−36	−30	−60	−37	−60	−45	−84	−52	−106	volts
	(b)	400	400	600	600	600	600	600	600	800	1000	1000	1000	1200	1400	1400	1800	ohms
	(c)	110	110	110	170	165	170	165	100	220	250	270	250	330	360	380	450	ohms
Peak r-f grid potential		67	100	69	114	74.5	112	74.5	117	82	146	89	145	99	172	117	197	volts
D-c plate current		100	150	100	150	100	150	100	175	100	175	100	175	100	175	100	175	ma
D-c grid current		37	60	37	60	37	60	37	60	37	60	37	60	37	60	37	60	ma
Grid driving power (approx.)		2.5	6	2.5	6.8	2.8	6.7	2.8	7	3	8.8	3.3	8.7	3.7	9.9	4.4	12	watts
Plate power output (approx.)	Δ	30	43	37	54	43	65	55	92	64	110	75	132	93	165	112	200	watts

R-F POWER AMPLIFIER — CLASS C TELEPHONY

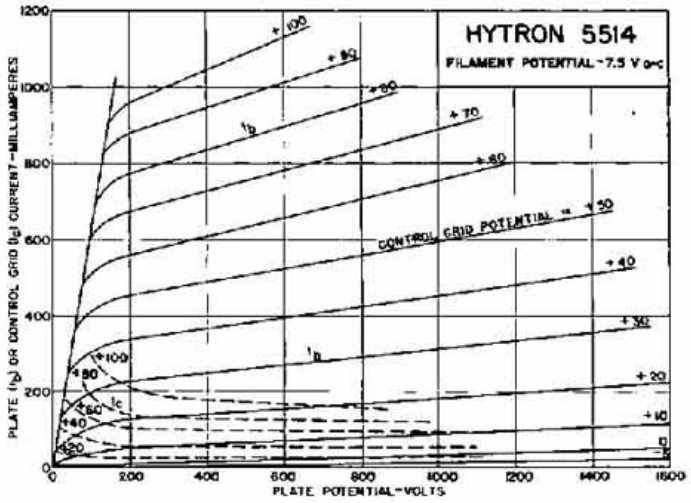
Carrier conditions for use with a maximum modulation percentage of 100

Maximum Ratings, Absolute Values

D-c plate potential	1250 max volts	Peak positive r-f grid potential	125 max volts
D-c control grid bias	−200 max volts	D-c plate input power +	175 max watts
D-c plate current	175 max ma	Plate dissipation +	43 max watts
D-c grid current	60 max ma		

Typical Operation — Average Characteristics

D-c plate potential		400	400	500	500	600	600	750	750	850	850	1000	1000	1250	1250	volts
D-c grid potential ‡	(a)	−15	−24	−15	−36	−22.5	−36	−22.5	−36	−30	−60	−37	−60	−45	−84	volts
	(b)	400	400	600	600	600	600	600	600	800	1000	1000	1000	1200	1400	ohms
	(c)	110	110	110	170	165	170	165	100	220	250	270	250	330	415	ohms
Peak r-f grid potential		67	100	69	114	74.5	112	74.5	117	82	146	89	145	99	168	volts
D-c plate current		100	150	100	150	100	150	100	175	100	175	100	175	100	142	ma
D-c grid current		37	60	37	60	37	60	37	60	37	60	37	60	37	60	ma
Grid driving power (approx.)		2.5	6	2.5	6.8	2.8	6.7	2.8	7	3	8.8	3.3	8.7	3.7	10	watts
Plate power output (approx.)	Δ	30	43	37	54	43	65	55	92	64	110	75	132	93	135	watts



‡ 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.

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