

FORCED AIR COOLED V.H.F. POWER TRIODE

Code: 5924

The 5924 is intended for use as a v.h.f. amplifier, in which application it is particularly suitable for handling television signals; or as an a.f. amplifier. It may be used at frequencies up to 220MHz.

CATHODE

Thoriated tungsten filament

Filament voltage (Note 1) 12,6 V

Filament current, nominal 33 A

The connection to the filament mid-point is intended for cathode connection but should not be used to carry filament current. At frequencies above 30MHz the filament pins should be decoupled to the centre tap with suitable capacitors.

Note 1. The filament has been designed to tolerate temporary fluctuations of supply voltage of +5% to -10%.

CHARACTERISTICS

Mutual conductance { Measured at $V_a = 4kV$ } 17 mA/V
Amplification factor { $I_a = 1A$ } 32

DIRECT INTERELECTRODE CAPACITANCES

Grid to anode 11 pF

Grid to filament 16 pF

Anode to filament 0,3 pF

MECHANICAL DATA

Dimensions As shown in outline drawing, Figure 5.

Mounting position Vertical, anode upwards or downwards.

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COMPONENTS

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MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

CLASS C. AMPLIFIER FOR TELEVISION SERVICE - GRID MODULATED

(Negative modulation, synch. positive)

Maximum Ratings

	Up to 75MHz	Up to 220MHz	
Direct anode voltage	5	4	kV
Direct anode current	1,9	1,6	A
Direct anode dissipation	5	4	kW
Direct grid dissipation	120	120	W
Negative grid bias	1	1	kV
Peak cathode current	10	8,1	A
Input power, average	9,5	6,5	kW

Typical Operating Conditions (2 tubes in push-pull)

	Up to 75MHz	Up to 220MHz	
Bandwidth			
-1,5dB	5,25	6,5	MHz
-3dB	8	10	MHz
Direct anode voltage	5	4	kV
Grid voltage			
synch.	-200	-150	V
black	-300	-225	V
white	-550	-500	V
Anode current			
synch.	2 x 1,9	2 x 1,6	A
black	2 x 1,3	2 x 1,3	A
R.F. input voltage (grid-to-grid peak)	1	1	kV
Grid current			
synch.	2 x 250	2 x 200	mA
black	2 x 175	2 x 110	mA
Power output, synch.	9	6	kW
Power in load, synch.	6,3	4,2	kW
Drive power	250	350 to 450	W

CLASS C. AMPLIFIER FOR TELEVISION SERVICE - GRID MODULATED
(Positive modulation, synch. negative)

Maximum Ratings

Direct anode voltage	5	kV
Direct anode current	1,9	A
Direct anode dissipation	5	kW
Direct grid dissipation	120	W
Negative grid bias	1	kV
Peak cathode current	10	A
Input power, average	9,5	kW
Frequency for above ratings	75	MHz

Typical Operating Conditions (2 tubes in push-pull)

Frequency	Up to 75	MHz
Bandwidth		
-1,5dB	5,25	MHz
-3dB	8	MHz
Direct anode voltage	5	kV
Grid voltage		
synch.	-580	V
black	-460	V
white	-200	V
Anode current		
white	2 x 1,9	A
black	2 x 400	mA
R.F. input voltage, grid-to-grid peak	1	kV
Grid current		
white	2 x 250	mA
black	0	mA
Power output, white	9	kW
Power in load, white	6,3	kW
Drive power	250	W

CLASS B. LINEAR POWER AMPLIFIER FOR TELEVISION SERVICE

Applied signal to be negatively modulated (synch. positive)

Maximum Ratings

	Up to 75MHz	Up to 220MHz	
Direct anode voltage	5	4	kV
Direct anode current	1,9	1,6	A
Direct anode dissipation	5	4	kW
Direct grid dissipation	120	120	W
Negative grid bias	1	1	kV
Peak cathode current	10	8,1	A
Input power, average d.c.	9,5	6,5	kW

Typical Operating Conditions (2 tubes in push-pull)

	Up to 75MHz	Up to 220MHz	
Bandwidth			
-1,5dB	5,25	6,5	MHz
-3dB	8	10	MHz
Direct anode voltage	5	4	kV
Direct grid voltage	-200	-150	V
Anode current			
synch.	2 x 1,9	2 x 1,6	A
black	2 x 1,5	2 x 1,3	A
white	2 x 100	2 x 100	mA
R.F. input voltage, grid-to-grid peak			
synch.	1	1	kV
black	800	750	V
white	250	200	V
Grid current			
synch.	2 x 250	2 x 200	mA
black	2 x 110	2 x 110	mA
white	0	0	mA
Power output, synch.	9	6	kW
Power in load, synch.	6,3	4,2	kW
Drive power, synch.	250	350 to 450	W

CLASS C. R.F. POWER AMPLIFIER. TELEGRAPHY OR F.M. TELEPHONY

Maximum Ratings

Direct anode voltage	6	kV
Direct anode current	1,5	A
Direct anode dissipation	5	kW
Direct grid dissipation	120	W
Direct grid current	350	mA
Negative grid bias	1	kV
Peak cathode current	9,5	A
Frequency for above ratings	75	MHz

Typical Operating Conditions (Frequency 75MHz)

Direct anode voltage	4	5	6	kV
Direct grid voltage	-200	-300	-400	V
Direct anode current	1,37	1,5	1,5	A
Peak r.f. grid voltage	500	640	740	V
Direct grid current	350	330	310	mA
Anode dissipation	1,5	1,9	2,1	kW
Efficiency	73	75	77	%
Power output	4	5,6	6,9	kW
Power into load	3,2	4,5	5,5	kW
Drive power	190	240	275	W

Typical Operating Conditions (2 tubes in grounded-grid push-pull)

Frequency	75	110	110	220	MHz
Direct anode voltage	6	4	5	4	kV
Direct cathode voltage	400	200	300	200	V
Direct anode current	2 x 1,5	2 x 1,37	2 x 1,5	2 x 1,25	A
Peak r.f. input voltage (f-f)	1,48	1	1,28	0,9	kV
Direct grid current	2 x 310	2 x 350	2 x 330	2 x 200	mA
Anode dissipation	2 x 2,1	2 x 1,7	2 x 2,2	2 x 2,5	kW
Efficiency	77	69	71	50	%
Power output (Note 2)	15,62(1,82)	8,6(1,0)	12,06(1,46)	5,6(0,6)	kW
Power into load	12,5	6,9	9,6	4,5	kW
Drive power	2,38	1,41	1,93	1,79	kW

Note 2. Figures in brackets denote power transferred through from the driver.

CLASS C. TELEPHONY (Carrier conditions for use with 100% anode modulation)

Maximum Ratings

Direct anode voltage	5	kV
Direct anode current	1,3	A
Direct anode dissipation	3,4	kW
Direct grid dissipation	120	W
Direct grid current	350	mA
Negative grid bias	1	kV
Peak cathode current	7,5	A
Frequency for above ratings	75	MHz

Typical Operating Conditions (Frequency 75MHz, carrier only)

Direct anode voltage	3	3,5	4	4,5	5	kV
Direct grid voltage	-250	-300	-300	-350	-400	V
Direct anode current	1	1,2	1,2	1,2	1,2	A
Peak r.f. grid voltage	510	600	600	650	690	V
Direct grid current	300	300	300	300	300	mA
Anode dissipation	0,8	1,2	1,3	1,3	1,3	kW
Efficiency	73	72	73	76	78	%
Power output	2,2	3	3,5	4,1	4,7	kW
Power into load at 80% transfer efficiency	1,76	2,4	2,8	3,3	3,75	kW
Drive power	170	205	205	230	205	W
Modulation power for 100% modulation depth	1,5	2,1	2,4	2,7	3	kW

CLASS B. LINEAR R.F. AMPLIFIER (Applied signal to be 100% modulated.
Carrier conditions listed)

Maximum Ratings

Direct anode voltage	6	kV
Direct anode current	1,1	A
Direct anode dissipation	5	kW
Direct grid dissipation	120	W
Direct grid current	350	mA
Negative grid bias	1	kV
Peak cathode current	4,6	A
Frequency for above ratings	75	MHz

CLASS B. LINEAR R.F. AMPLIFIER (continued)

Typical Operating Conditions (Frequency 75MHz)

Direct anode voltage	5	6	kV
Direct grid voltage	-145	-180	V
Direct anode current	900	990	mA
Peak r.f. grid voltage	225	250	V
Anode dissipation	3	4	kW
Efficiency	32	32	%
Power output	1,45	1,9	kW
Power into load for 100% modulation	1,16	1,52	kW
Drive power	160	170	W
Direct grid current	320	300	mA

CLASS B. A.F. AMPLIFIER (for balanced 2-tube operation)

Maximum Ratings (per tube)

Direct anode voltage	6	kV
Direct anode current	1,5	A
Direct anode dissipation	5	kW
Direct grid dissipation	120	W
Direct grid current	350	mA
Peak cathode current	5,7	A
Grid-to-filament resistance	15	k Ω

Typical Operating Conditions (2 tubes in push-pull)

Direct anode voltage	3	3,5	4	4,5	5	6	kV
Direct grid voltage	-90	-100	-112	-125	-138	-165	V
Direct grid current	2x200	2x180	2x190	2x90	2x140	2x280	mA
Direct anode current							
zero signal	2x65	2x75	2x100	2x100	2x110	2x125	mA
max. signal	2x800	2x950	2x940	2x920	2x910	2x1 500	mA
Peak grid-to-grid voltage	400	440	450	465	470	645	V
Anode dissipation	2x0,75	2x1,0	2x1,1	2x1,15	2x1,25	2x2,35	kW
Efficiency	69	70	71	72	73	74	%
Power output	3,3	4,6	5,3	6	6,6	13,3	kW
Drive power	104	100	108	54	84	230	W
Anode-to-anode resistance	4,4	4,2	4,9	6,1	6,4	4,9	k Ω
Total distortion	3,3	2,9	2,6	3,7	3,3	4,3	%

COOLING REQUIREMENTS

The tube must not be operated without a heat dissipating connector or the filament mid-point pin.

Maximum filament seal temperature 210°C

Maximum anode and grid seal temperature 180°C

In order to keep within the temperature limits, it may be necessary to direct a flow of air on to the filament and grid seals.

The amount of forced-air-cooling required by the 5924 tube depends upon its height above sea level, the ambient air temperature and the anode dissipation. Typical data are given in the following table:

Anode dissipation (kw)	Height above sea level		Max. inlet temperature (°C)	Min. rate of air flow		Pressure drop between inlet and outlet	
	(m)	(ft)		m ³ /min.	ft ³ /min.	mm. water	in. water
1	0	0	35	3	105	8	0,32
1	0	0	45	3,1	110	8	0,32
1	1 500	4 920	35	3,7	130	9	0,35
1	3 000	9 840	25	4,1	145	10	0,39
3	0	0	35	5,2	185	23	0,9
3	0	0	45	6,1	215	29	1,14
3	1 500	4 920	35	6,2	220	26	1,02
3	3 000	9 840	25	6,6	235	26	1,02
5	0	0	35	9,2	325	68	2,7
5	0	0	45	10,7	380	90	3,5
5	1 500	4 920	35	11,2	395	81	3,2
5	3 000	9 840	25	11,6	410	71	2,8

Fig. 1. Typical Anode and Grid Characteristics

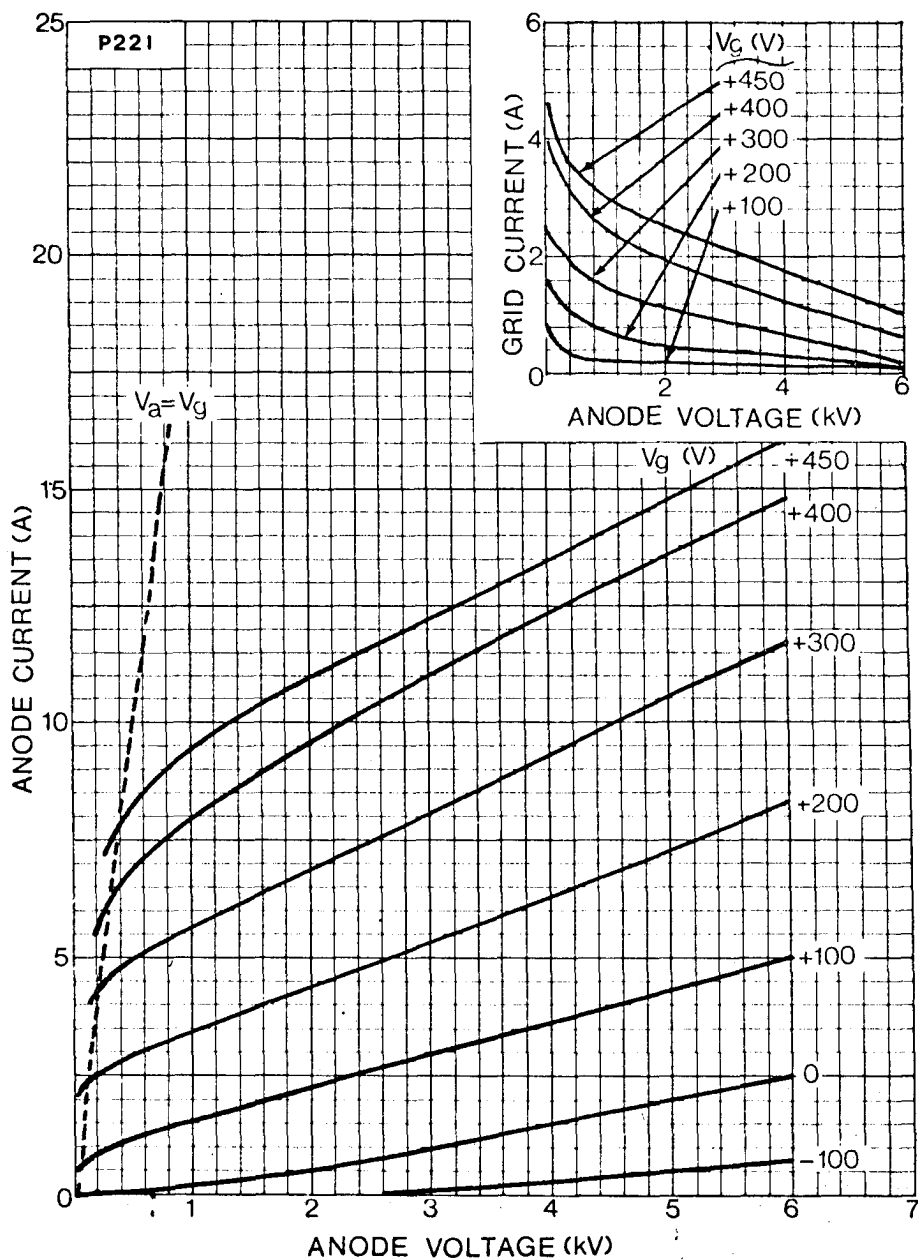


Fig. 2. Typical Constant Current Characteristics

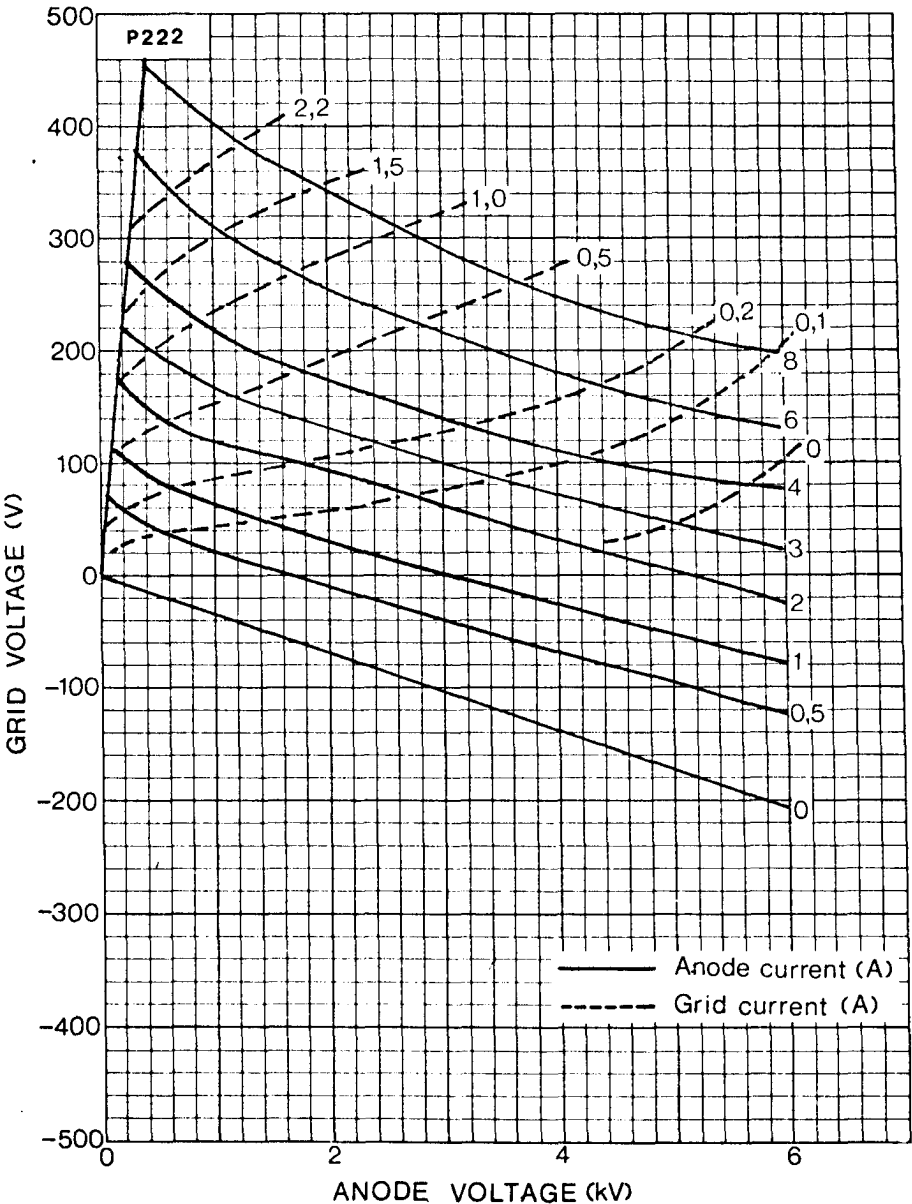


Fig. 3. Typical Anode Current versus Grid Voltage

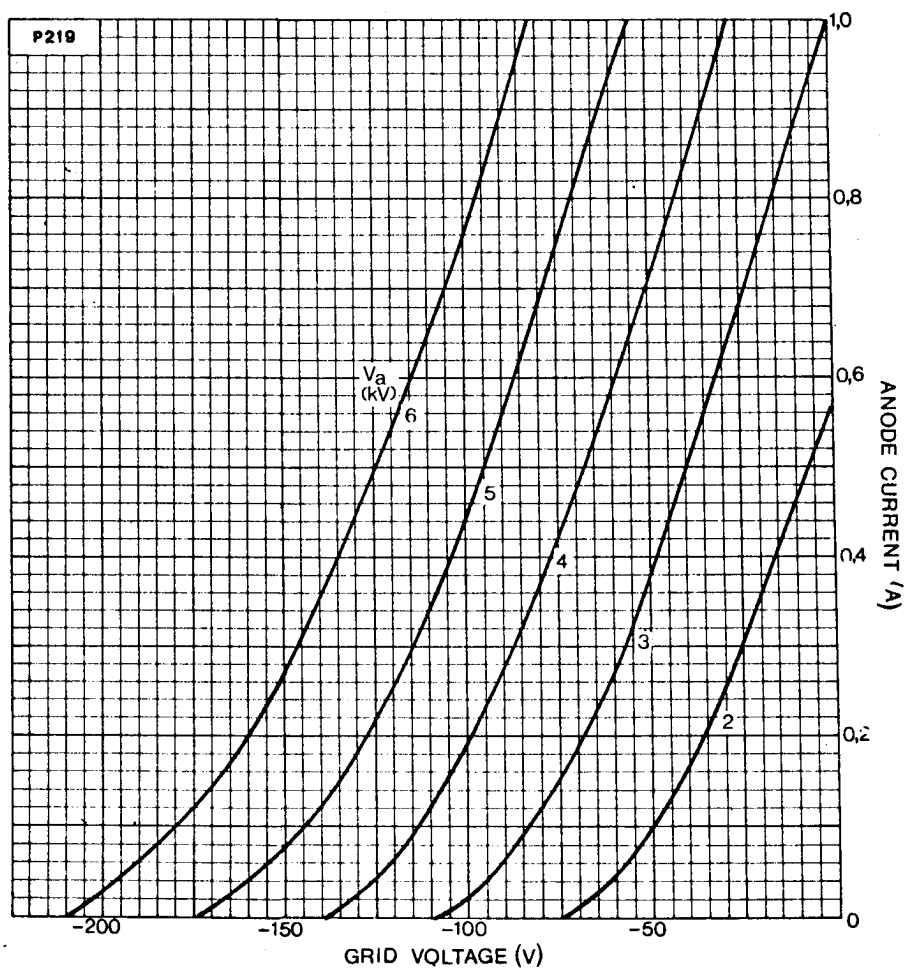


Fig. 4. Typical Power Output, Anode Current, Anode Voltage and Efficiency versus Frequency.

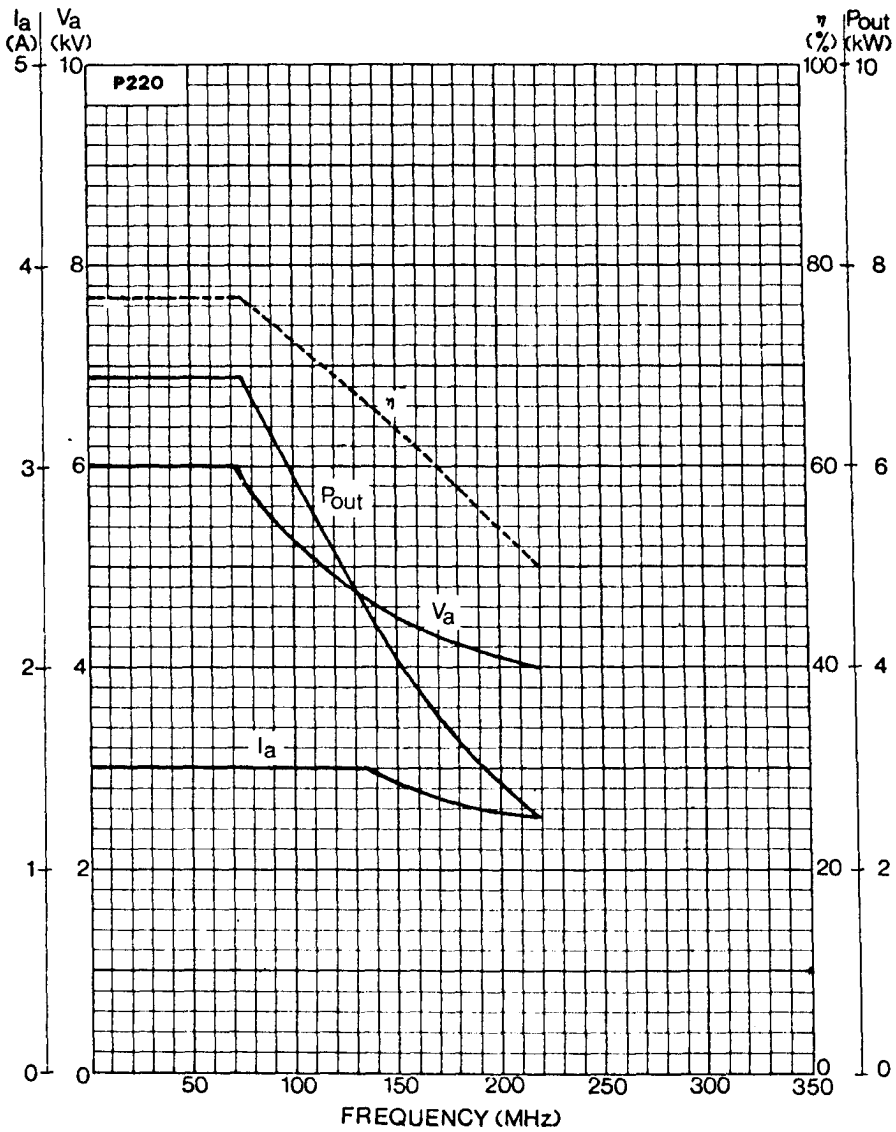
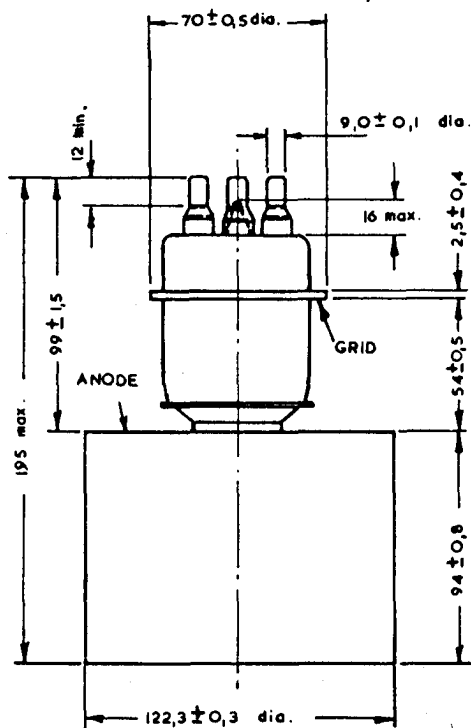
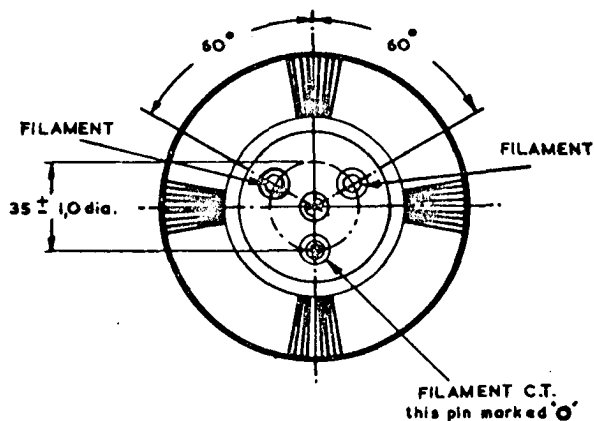


Fig. 5. Outline of 5924 Tube



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