

# SPECIAL QUALITY TETRODE THYRATRON

# M8204

100mA special quality tetrode xenon thyatron with negative control characteristic for use in equipment where mechanical vibration and shocks are unavoidable and where statistically controlled major electrical characteristics are required.

## PRELIMINARY DATA

This data should be read in conjunction with the GENERAL NOTES – SPECIAL QUALITY THYRATRONS preceding this section of the handbook, and the index numbers are used to indicate where reference should be made to a specific note.

### LIMITING VALUES<sup>3</sup> (absolute ratings, not design centre)

It is important that these limits are never exceeded and such variations as mains fluctuations, component tolerances and switching surges must be taken into consideration in arriving at actual valve operating conditions.

	<i>Relay service and grid-controlled rectifier</i>	<i>Pulse modulator service</i>	
*Max. anode supply voltage	—	500	V
Max. peak anode voltage			
Inverse	1300	100	V
Forward	650	500	V
Max. cathode current			
Peak	0.5	10	A
Average (max. averaging time 30s)	100	10	mA
Surge (fault protection max. duration 0.1s)	10	10	A
Max. negative control-grid voltage			
Before conduction	100	100	V
During conduction	10	10	V
Max. average positive control-grid current for anode voltage more positive than -10V (averaging time 30s)	10	—	mA
Max. peak positive control-grid current during the time that the anode voltage is more positive than -10V	50	20	mA
Max. peak positive control-grid current during the time that the anode voltage is more negative than -10V	30	—	μA
Max. control-grid resistor	10	0.5	MΩ
Recommended min. control-grid resistor	100	—	kΩ
Max. negative shield-grid voltage			
Before conduction	100	50	V
During conduction	10	10	V

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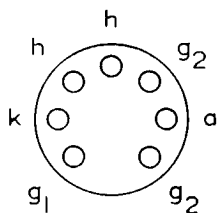
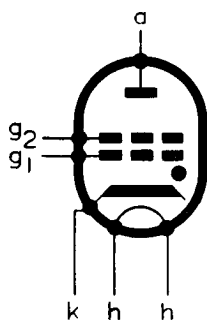
Max. average positive shield-grid current for anode voltage more positive than -10V (averaging time 30s)	10	—	mA
Max. shield-grid resistor	—	25	kΩ
Max. peak heater to cathode voltage			
Cathode negative	25	0	V
Cathode positive	100	0	V
Heater voltage	6.3V ± 10%	6.3V	+10% -5%
Min. valve heating time	20	20	s
Ambient temperature limits	-75 to +90	-75 to +90	°C
Max. pulse duration	—	5.0	μs
*Max. pulse repetition frequency	—	500	c/s
Max. duty cycle	—	0.001	
Max. rate of rise of current pulse	—	100	A/μs

\*After completion of a pulse a 20μs delay is required before a positive voltage of more than 10V is applied to the anode.

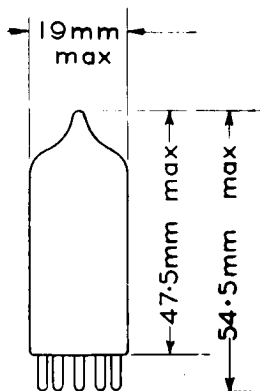
### CAPACITANCES<sup>2</sup>

Anode to control-grid	—	0.03	pF
Control-grid to cathode and shield-grid	—	2.5	pF

4087



B7G Base



The bulb and base dimensions of this valve are in accordance with BS 448, Section B7G

**TEST CONDITIONS** (unless otherwise specified)

$V_h$  (V) 6.3  
 $V_{g2}$  (V) 0

**TESTS  
GROUP A**

Heater current .. .. .

Heater to cathode leakage current

$V_{h-k}$  = 25V cathode negative  
 $V_{h-k}$  = 100V cathode positive

\*Grid 1 voltage  $V_a$  = 460V r.m.s.,  $R_{g1}$  = 100k $\Omega$ ,  
 $R_b$  = 3.0k $\Omega$

\*Grid 1 voltage  $V_s$  = 460V r.m.s.,  $R_{g1}$  = 10M $\Omega$ ,  
 $R_b$  = 3.0k $\Omega$

\*Anode voltage  $V_{g1}$  = 0V,  $R_{g1}$  = 100k $\Omega$ ,  $R_b$  = 1.0k $\Omega$

Anode voltage  $V_h$  = 0V,  $V_{g1}$  = -100V,  $R_b$  = 1.0k $\Omega$

No breakdown must occur

Operation.  $I_{load}$  (pulse)

Measured at  $V_{a(b)}$  = 500V,  $v_{a(pk)}$  = 1.0kV,

$V_{g1(pk)}$  = 100V,  $V_{g1}$  = -50V,  $R_{g1}$  = 10k $\Omega$ ,

$R_{g2}$  = 25k $\Omega$ .

P.r.f. = 500pps,  $t_p$  =  $2 \pm 0.2 \mu s$ .

Modulator line impedance  $Z_o$  = 25 $\Omega$ .

Load resistance = 20 $\Omega$ , Min. P.I.V. = 100V.

Pulse rise time = 0.2 $\mu s$  max.

Pulse fall time = 0.4 $\mu s$  max.

A.O.L. <sup>4</sup> (%)	Bogey <sup>8</sup>	Individuals <sup>5</sup>		Lot average <sup>6</sup>		mA
		Min.	Max.	Min.	Max.	
{ 0.65	600	540	660	567	633	mA
0.65	—	—	15	—	—	$\mu A$
0.65	—	—	15	—	—	$\mu A$
{ 0.65	-3.7	-2.9	-4.5	-3.4	-4.0	V
—	—	—	—	—	—	V
0.65	-4.2	—	-5.6	—	—	V
{ 0.65	22	—	38	—	33	V
—	—	—	—	—	—	V
0.65	—	650	—	—	—	V
0.65	—	16	—	—	—	A



A.Q.I. <sup>4</sup> (%)	Individuals <sup>5</sup>		Lot average <sup>6</sup>	
	Bogey <sup>8</sup> Min.	Max.	Min.	Max.
{ 0.65 —	—	76	—	65
1.0	—	—	—	—
0.4	—	—	—	—
2.5	—	760	—	—
{ 2.5 —	—	50	—	45
6.5	—4.6	-6.4	—	—
6.5	2.45	1.85	—	—
6.5	—	—	—	—

Pulse emission  $V_h = 6.3V$ ,  $V_a = V_{g2} = V_{g1} = 180 \pm 9V$ ,  
min. P.I.V. = 100V,  $t_p = 5 \pm 0.25 \mu s$ , pulse rise  
time = 0.5  $\mu s$  max., pulse fall time = 1.0  $\mu s$  max.,  
p.r.f. = 100  $\pm$  5pps. Pulse applied across valve and  
10 $\Omega$  resistor in series.  
Voltage measured across valve

Group quality level<sup>9</sup> . . . . .  
\*Adjust voltage to initiate conduction

### GROUP B

Inoperatives<sup>14</sup> . . . . .

### GROUP C

Insulation

$g_2$ - $a$  measured at  $V_a$ - $g_2 = \pm 380V$

\*Anode voltage.  $V_h = 5.7V$ ,  $V_{g1} = 0V$ ,  $R_{g1} = 100k\Omega$ ,  
 $R_a = 1.0k\Omega$

\*Grid 1 voltage.  $V_h = 7.0V$ ,  $V_a = 460V$  r.m.s.,

$R_{g1} = 10M\Omega$ ,  $R_a = 3.0k\Omega$

(Following special pre-heat condition)

\*Grid 2 voltage.  $V_a = 150V$  r.m.s.,  $R_a = 1.0k\Omega$ ,

$R_{g1} = 2.5k\Omega$   $V_{g1}$  supply in phase with  $V_a$  supply,

$V_{g2}$  in antiphase: r.m.s. voltage

Vibration. No applied voltages. Vibrate for 60s at

25c/s 2.5g then repeat Group B test

\*Adjust voltage to initiate conduction

**GROUP D**

**Shock<sup>13</sup>**

No applied voltages, 750g.

**Post shock tests**

Heater to cathode leakage current							
$V_{h-k} = 25V$	cathode negative	..	..	—	—	—	$\mu A$
$V_{h-k} = 100V$	cathode positive	..	..	—	—	—	$\mu A$
Anode voltage as in Group A ( $V_{g1} = 0V$ )							
Pulse emission as in Group A							
Grid 1 voltage as in Group A ( $R_{g1} = 100k\Omega$ )							
Sub-group quality level <sup>9</sup>	..	..	..	-2.9	—	—	V
Sub-group quality level <sup>9</sup>	..	..	..	-4.5	—	—	V
Sub-group quality level <sup>9</sup>	..	..	..	20	—	—	V

**Fatigue<sup>14</sup>**

$V_h = 6.3V$ , no other applied voltages, 2.5g acceleration,  $f = 25 \pm 2c/s$  for 32 hours in each of three mutually perpendicular planes

**Post fatigue tests**

Heater to cathode leakage current							
$V_{h-k} = 25V$	cathode negative	..	..	—	—	—	$\mu A$
$V_{h-k} = 100V$	cathode positive	..	..	—	—	—	$\mu A$
Anode voltage as in Group A ( $V_{g1} = 0V$ )							
Pulse emission as in Group A							
Grid 1 voltage as in Group A ( $R_{g1} = 100k\Omega$ )							
Sub-group quality level <sup>9</sup>	..	..	..	-2.9	—	—	V
Sub-group quality level <sup>9</sup>	..	..	..	20	—	—	V
Base strain test <sup>11</sup>	..	..	..	6.5	—	—	V



### GROUP E

**Heater cycling life test**  $V_h = 7.5V$ , 1 minute on, 1 minute off, 2000 cycles.  $V_{h-k} = 100V$  cathode positive. No other applied voltages

### Heater cycling life test end points

Heater to cathode leakage current  
 $V_{h-k} = 25V$  cathode negative  
 $V_{h-k} = 100V$  cathode positive

### Intermittent life<sup>12</sup>

Running conditions as grid controlled rectifier 500 hours

$V_a = 460V$  r.m.s.,  $I_k = 80mA$  (d.c.)  $R_{g1} = 50k\Omega$ ,

$I_{k(pk)} = 0.5A$ , Cathode heating time =  $20^{+0}_{-1}$  s

Room temperature

### Intermittent life test end points

Inoperatives<sup>11</sup>

Heater to cathode leakage current

$V_{h-k} = 25V$  cathode negative

$V_{h-k} = 100V$  cathode positive

Anode voltage as in Group A ( $V_{g1} = 0V$ )

Pulse emission as in Group A

Insulation  $g_{2-a}$  as in Group C

### Continuous life, 200 hours' duration<sup>12</sup>

Adjust  $V_{a(pk)}$  for load pulse = 20A initially

Running conditions, pulse modulator service

$V_{a(b)} = 250V$ ,  $V_{a(pk)} = 500V$ ,  $V_{g1(pk)} = 100V$ ,

$V_{g1} = -50V$ ,  $V_{g2} = 0V$ ,  $R_{g1} = 10k\Omega$ ,  $R_{g2} = 25k\Omega$ ,

p.r.f. = 1000pps., modulator line impedance

$Z_0 = 12.5\Omega$ , load resistance = 7.5 $\Omega$ ,  $t_p = 2 - 0.2\mu s$

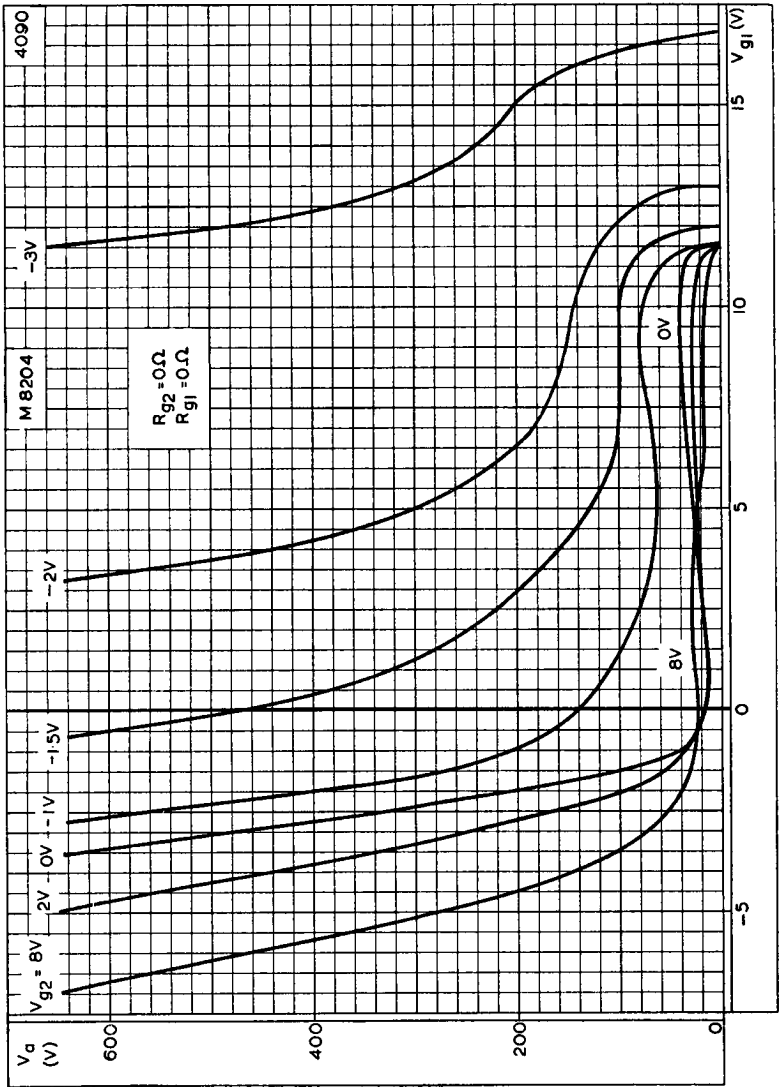
### Life test end points

load pulse

Average life

Pulse emission as in Group A

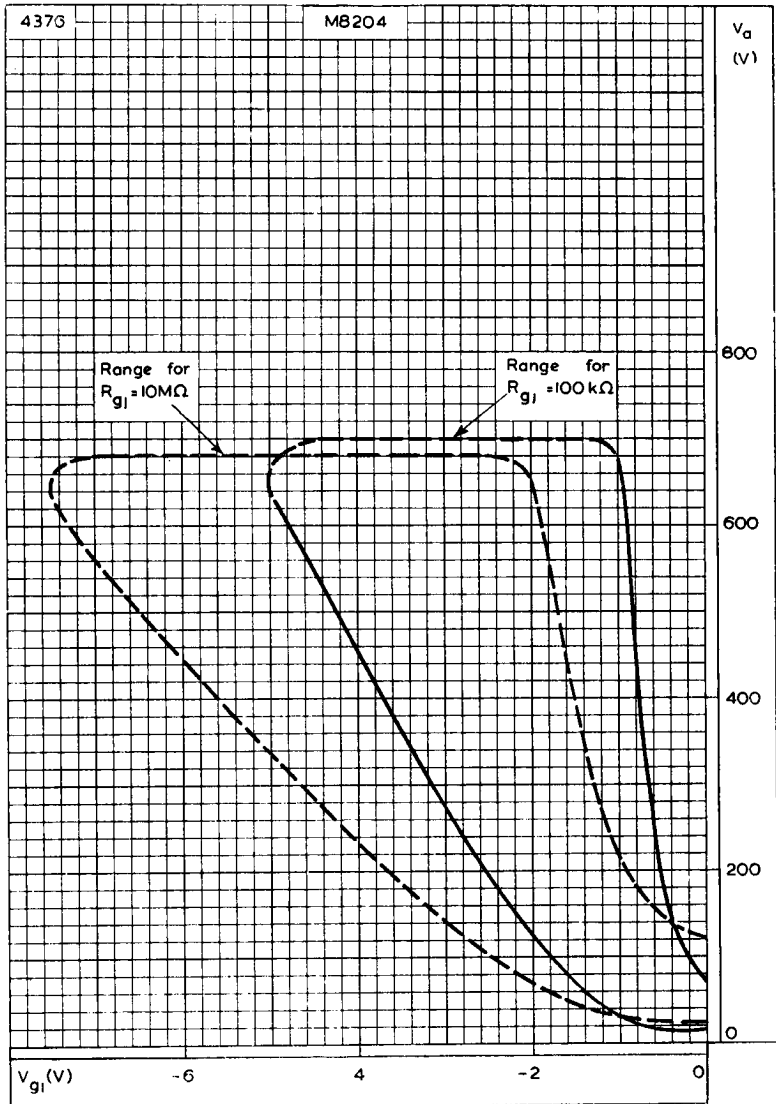
	A.Q.L. <sup>4</sup> (%)	Individuals <sup>5</sup>		
		Min.	Max.	
Heater cycling life test	1.0	—	—	—
Heater to cathode leakage current	—	—	20	$\mu A$
Insulation $g_{2-a}$ as in Group C	—	380	—	M $\Omega$
Average life	—	16	—	A
Pulse emission as in Group A	—	180	—	hrs
	—	—	100	V



CONTROL CHARACTERISTIC

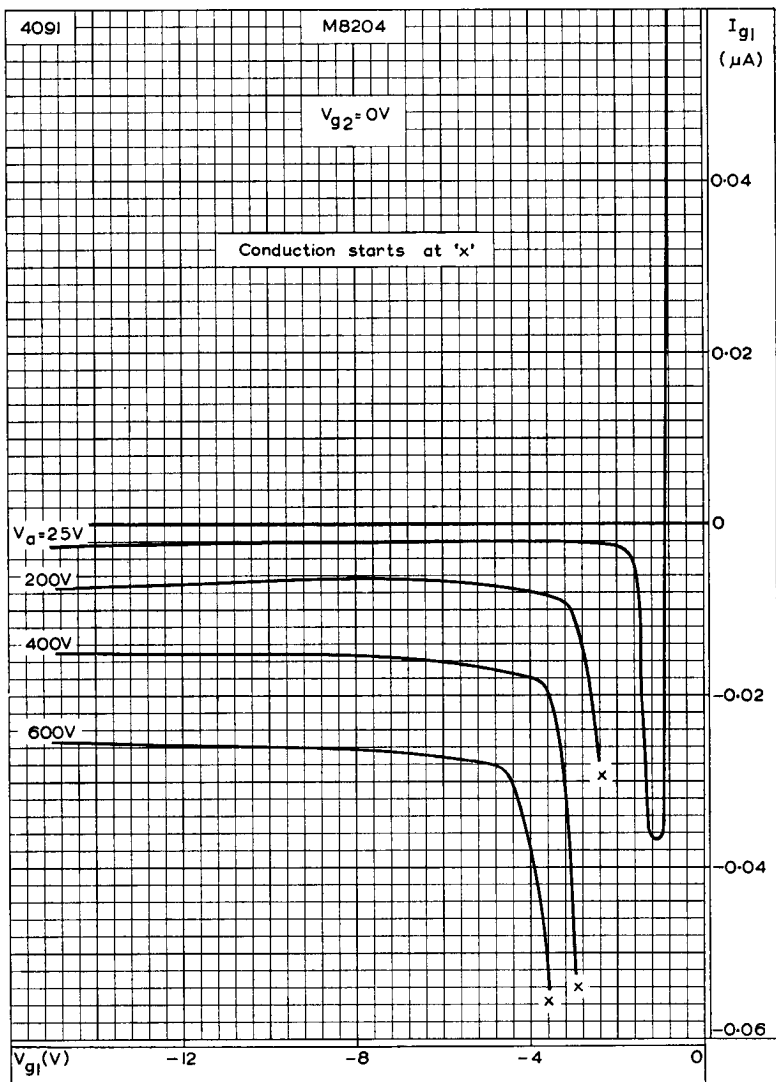
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## SPECIAL QUALITY TETRODE THYRATRON



OPERATING RANGE OF CRITICAL CONTROL-GRID VOLTAGE

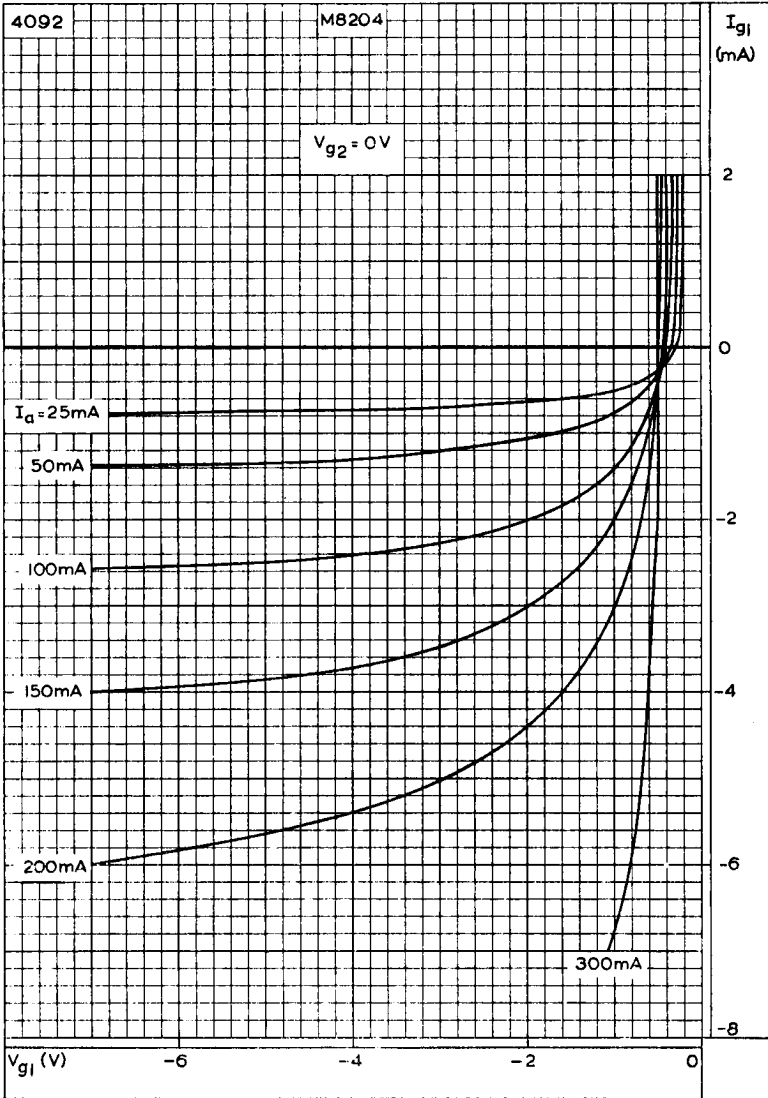




CONTROL-GRID CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE BEFORE CONDUCTION

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## SPECIAL QUALITY TETRODE THYRATRON



CONTROL-GRID CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE  
DURING CONDUCTION