SPECIAL QUALITY TETRODE THYRATRON

M8204

100mA special quality tetrode xenon thyratron 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[3] (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.

	Relay service and grid-controlled rectifier	*Pulse modulator service*	
*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[a]

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

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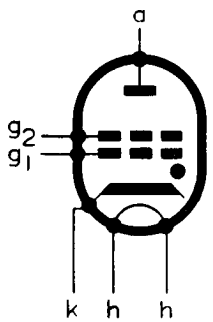
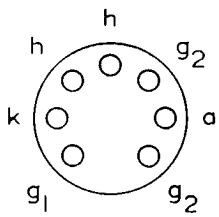
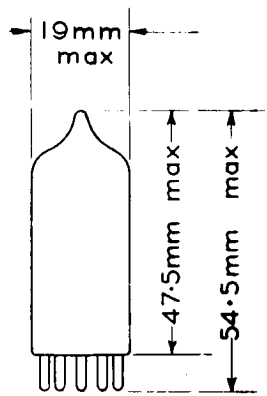




B7G Base



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

TEST CONDITIONS (unless otherwise specified)

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

TESTS GROUP A	A.Q.L.[4] (%)	*individuals*[5] Bogey[8]	Min.	Max.	*Lot average*[6] Min.	Max.	
Heater current	0.65	600	540	660	—	—	mA
	—	—	—	—	567	633	mA
Heater to cathode leakage current							
V_{h-k} = 25V cathode negative	0.65	—	—	15	—	—	μA
V_{h-k} = 100V cathode positive	0.65	—	—	15	—	—	μA
*Grid 1 voltage V_a = 460V r.m.s., R_{g1} = 100kΩ, R_a = 3.0kΩ	0.65	−3.7	−2.9	−4.5	—	—	V
	—	—	—	—	−3.4	−4.0	V
*Grid 1 voltage V_a = 460V r.m.s., R_{g1} = 10MΩ, R_a = 3.0kΩ	0.65	−4.2	—	−5.6	—	—	V
*Anode voltage V_{g1} = 0V, R_{g1} = 100kΩ, R_a = 1.0kΩ	0.65	22	—	38	—	—	V
	—	—	—	—	—	33	V
Anode voltage V_h = 0V, V_{g1} = −100V, R_a = 1.0kΩ							
No breakdown must occur	0.65	—	650	—	—	—	V
Operation. $I_{load\ (pulse)}$	0.65	—	16	—	—	—	A

Measured at $V_{a(b)}$ = 500V, $v_{a(pk)}$ = 1.0kV,
$v_{g1(pk)}$ = 100V, V_{g1} = −50V, R_{g1} = 10kΩ,
R_{g2} = 25kΩ.
p.r.f. = 500pps, $t_p = 2 \pm 0.2\mu s$.
Modulator line impedance Z_o = 25Ω.
Load resistance = 20Ω, Min. P.I.V. = 100V.
Pulse rise time = 0.2μs max.
Pulse fall time = 0.4μs max.

	A.Q.L[4] (%)	Individuals[5] Bogey[8]	Individuals[5] Min.	Individuals[5] Max.	Lot average[6] Min.	Lot average[6] Max.	
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 = 0.5μs max., pulse fall time = 1.0μs max., p.r.f. = 100 ± 5pps. Pulse applied across valve and 10Ω resistor in series.							
Voltage measured across valve	0.65	—	—	76	—	—	V
	—	—	—	—	—	65	V
Group quality level[9]	1.0	—	—	—	—	—	
*Adjust voltage to initiate conduction							
GROUP B							
Inoperatives[14]	0.4	—	—	—	—	—	
GROUP C							
Insulation g_2–a measured at $V_{a-g2} = \pm 380V$	2.5	—	760	—	—	—	MΩ
*Anode voltage. $V_h = 5.7V$, $V_{g1} = 0V$, $R_{g1} = 100k\Omega$, $R_a = 1.0k\Omega$	2.5	—	—	50	—	—	V
	—	—	—	—	—	45	V
*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)	6.5	−4.6	—	−6.4	—	—	V
*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	6.5	2.45	1.85	3.05	—	—	V
Vibration. No applied voltages. Vibrate for 60s at 25c/s 2.5g then repeat Group B test	6.5	—	—	—	—	—	
*Adjust voltage to initiate conduction							

GROUP D

Shock[13]

No applied voltages, 750g.

Post shock tests

Heater to cathode leakage current								
V_{h-k} = 25V cathode negative	—	—	—	40	—	—	μA
V_{h-k} = 100V cathode positive	—	—	—	40	—	—	μA
Anode voltage as in Group A (V_{g1}=0V)	—	—	—	50	—	—	V
Pulse emission as in Group A	—	—	—	76	—	—	V
Grid 1 voltage as in Group A (R_{g1}=100kΩ)	—	—	-2.9	-4.5	—	—	V
Sub-group quality level [9]	20						

Fatigue[14]

V_h = 6.3V, no other applied voltages, 2.5g acceleration, f = 25±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	—	—	—	40	—	—	μA
V_{h-k} = 100V cathode positive	—	—	—	40	—	—	μA
Anode voltage as in Group A (V_{g1}=0V)	—	—	—	50	—	—	V
Pulse emission as in Group A	—	—	—	76	—	—	V
Grid 1 voltage as in Group A (R_{g1}=100kΩ)	—	—	-2.9	-4.5	—	—	V
Sub-group quality level [9]	20	—	—	—	—	—	
Base strain test[11]	6.5	—	—	—	—	—	

GROUP E	A.Q.L.[4] (%)	Individuals[5] Min.	Individuals[5] Max.	
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	1.0	—	—	
Heater cycling life test end points				
Heater to cathode leakage current				
V_{h-k} = 25V cathode negative	—	—	20	μA
V_{h-k} = 100V cathode positive	—	—	20	μA
Intermittent life[12]				
Running conditions as grid controlled rectifier 500 hours				
V_a = 460Vr.m.s., I_k = 80mA (d.c.) R_{g1} = 50kΩ,				
$i_{k(pk)}$ = 0.5A, Cathode heating time = 20^{+0}_{-1}s				
Room temperature				
Intermittent life test end points				
Inoperatives[14]				
Heater to cathode leakage current				
V_{h-k} = 25V cathode negative	—	—	20	μA
V_{h-k} = 100V cathode positive	—	—	20	μA
Anode voltage as in Group A (V_{g1} = 0V)	—	—	50	V
Pulse emission as in Group A	—	—	100	V
Insulation g_2-a as in Group C	—	380	—	MΩ
Continuous life, 200 hours' duration[12]				
Adjust $v_{a(pk)}$ for $I_{load\ pulse}$ = 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} = 10kΩ, R_{g2} = 25kΩ,				
p.r.f. = 1000pps., modulator line impedance				
Z_o = 12.5Ω, load resistance = 7.5Ω. t_p = 2±0.2μs				
Life test end points				
$I_{load\ pulse}$	—	16	—	A
Average life	—	180	—	hrs
Pulse emission as in Group A	—	—	100	V

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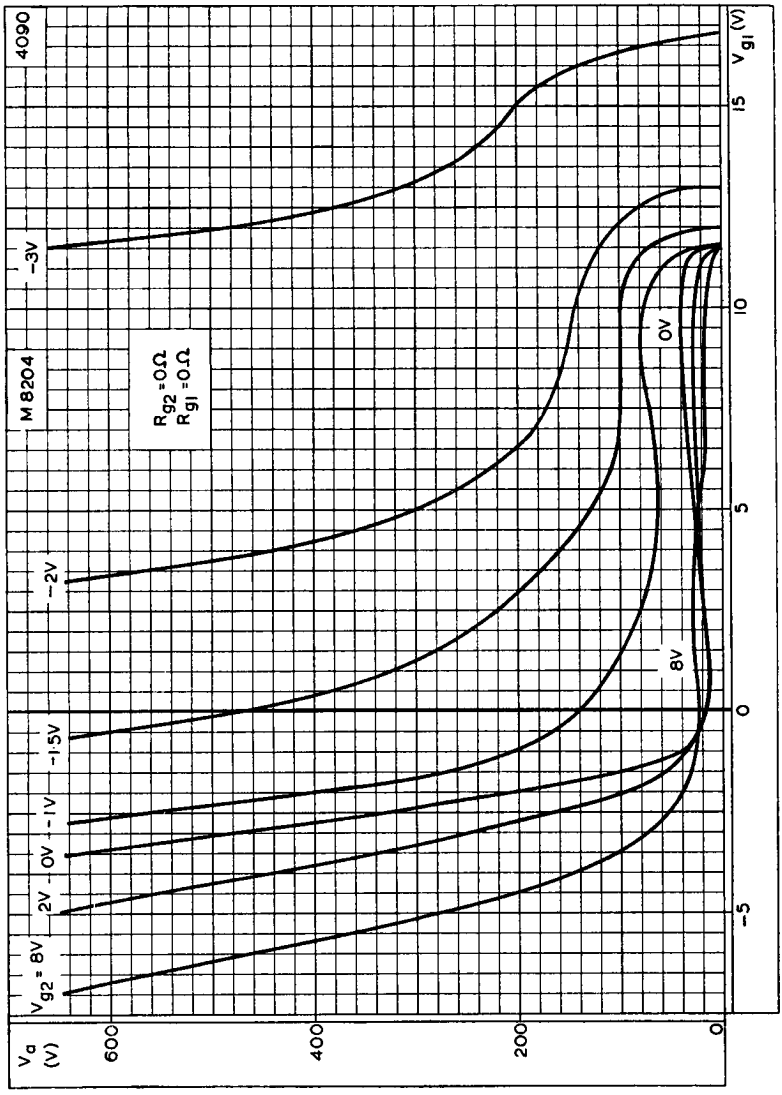
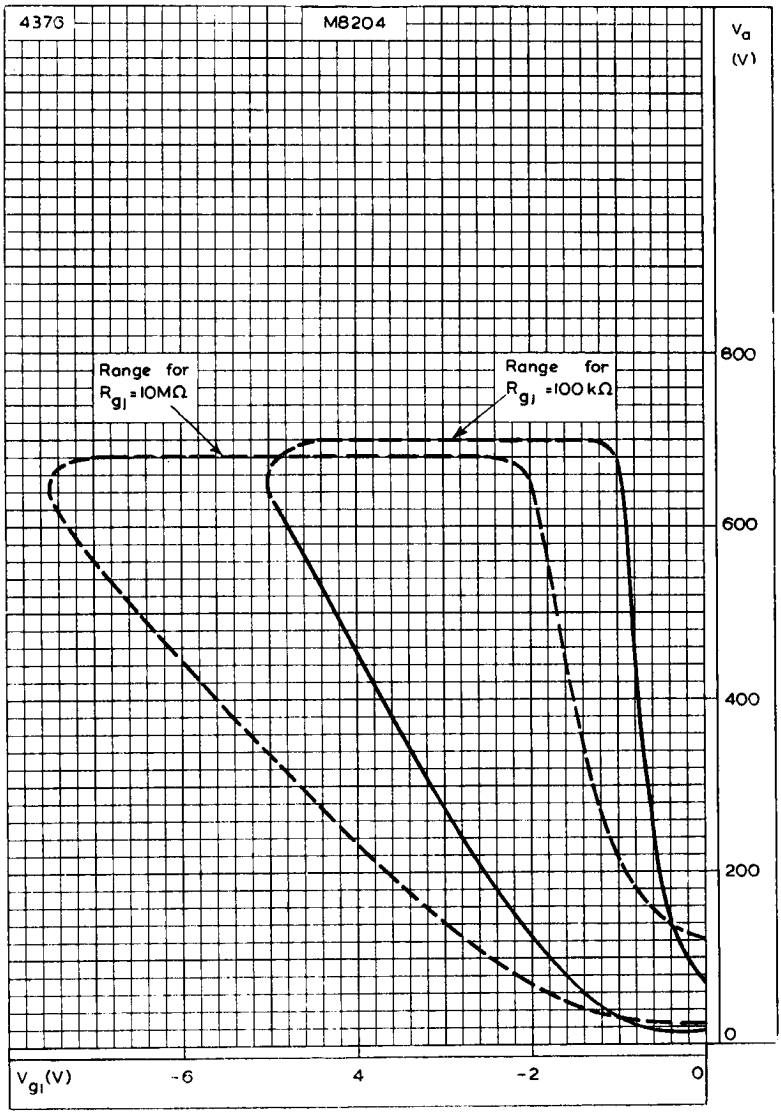
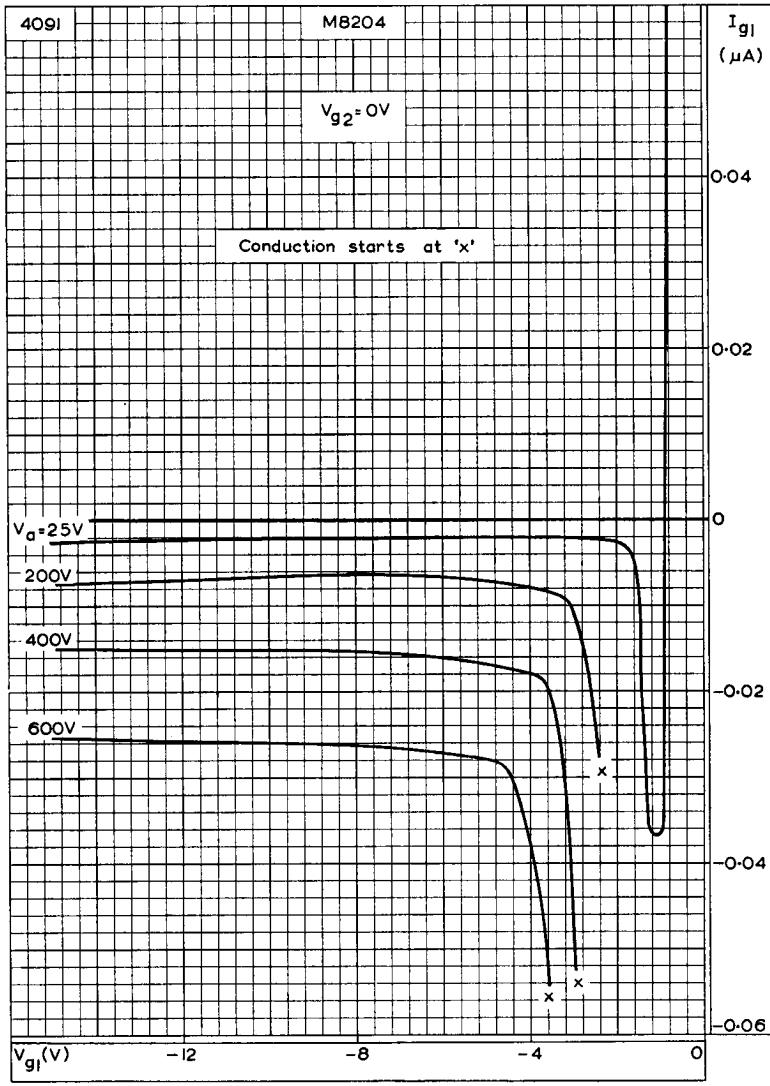


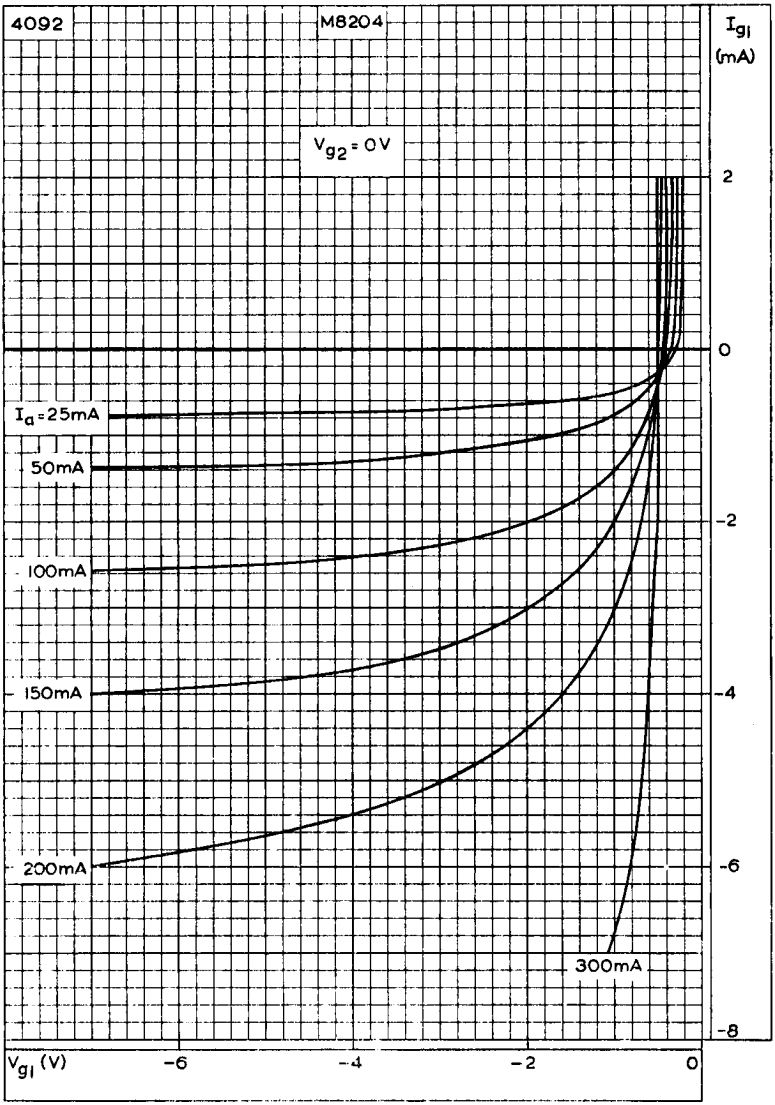
CONTROL CHARACTERISTIC



OPERATING RANGE OF CRITICAL CONTROL-GRID VOLTAGE



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



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