S.Q. TUBE

Special quality double triode designed for use as A.F. amplifier.

QUICK REFERENCE DATA			
Life test	10 000 hours		
Low interface resistance			
Mechanical quality	Shock and vibration resistant		
Base	Noval		
Heating	Indirect A.C. or D.C.; parallel supply		
Heater voltage	V_f	6.3	V
Heater current	I_f	330	mA
Anode current	I_a	1.25	mA
Mutual conductance	S	1.6	mA/V
Amplification factor	μ	100	
Hum voltage Section 1	V_g max.	5	μV_{RMS}
Section 2	V_g max.	15	μV_{RMS}

DIMENSIONS AND CONNECTIONS

Dimensions in mm

Base: Noval

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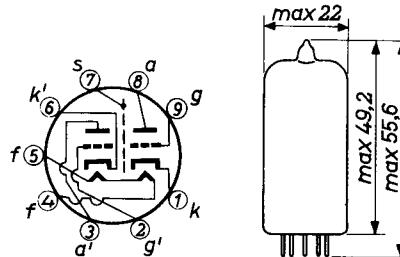
CHARACTERISTICS

Column I   Nominal value or setting of the tube
     II   Range values for equipment design: Initial spread
     III   Range values for equipment design: End of life

		I	II	III	
Heater voltage	V_f	6.3			V
Heater current	I_f	330	313 - 347		mA
Anode voltage	V_a	250			V
Cathode resistor	R_k	1.6			kΩ
Anode current	I_a	1.25	1.1 - 1.4	min. 0.8	mA
Mutual conductance	S	1.6	1.3 - 1.95	min. 1.05	mA/V
Amplification factor	μ	100			
Internal resistance	R_i	62.5			kΩ
Negative grid current	$-I_g$		max. 0.2	max. 0.5	μA
Anode voltage	V_a	100			V
Cathode resistor	R_k	2			kΩ
Anode current	I_a	0.5			mA
Mutual conductance	S	1.25			mA/V
Amplification factor	μ	100			
Internal resistance	R_i	80			kΩ
Cut-off voltage	$-V_g$		max. 4		V
Anode voltage	V_a	250			V
Anode current	I_a	20			μA
Grid current starting voltage Grid current +I_g = 0.3 μA	$-V_g$		max. 1		V
Leakage current between cathode and heater Voltage between cathode and heater V_{kf} = 100 V	I_{kf}		max. 5		μA

CHARACTERISTICS (continued)

Insulation resistance between electrodes		II	
Anode to all other electrodes	R	min. 300	MΩ
(Voltage between electrodes 300 V)			
Grid to all other electrodes	R	min. 300	MΩ
(Voltage between electrodes 100 V)			
Hum voltage Section 1	V_g	max. 5	μV_{RMS}
Section 2	$V_{g'}$	max. 15	μV_{RMS}
Anode supply voltage V_{ba} = 250 V			
Anode resistor R_a = 100 kΩ			
Grid resistor R_g = 1 MΩ			
Vibrational noise	V_g	max. 10	mV
Anode voltage V_a = 250 V			
Grid voltage $-V_g$ = 2 V			
Anode resistor R_a = 5 kΩ			
Frequency f = 25 Hz			
Acceleration = 2.5 g			

Microphony

The sensitivity of the amplifier circuit for 50 mW should not exceed 0.5 mV.

CAPACITANCES   Each system if applicable

Grid to cathode heater and screen	$C_{g/kfs}$	2.0	pF
Anode to cathode and screen	$C_{a/kfs}$	2.0	pF
Anode to grid	C_{ag}	1.2	pF
Grid to heater	C_{gf}	max. 0.01	pF
	$C_{g'f}$	max. 0.02	pF
Grid to grid other section	$C_{gg'}$	max. 0.01	pF
Anode to anode other section	$C_{aa'}$	max. 0.1	pF
Anode to grid other section	$C_{ag'}$	max. 0.06	pF
	$C_{a'g}$	max. 0.01	pF

SHOCK AND VIBRATION RESISTANCE

The following test conditions are applied to assess the mechanical quality of the tube. These conditions are not intended to be used as normal operating conditions.

Shock

The tube is subjected 5 times in each of 4 positions to an acceleration of 500 g supplied by an NRL shock machine with the hammer lifted over an angle of 30°.

Vibration

The tube is subjected during 32 hours in each of 3 positions to a vibration frequency of 50 Hz with an acceleration of 2.5 g.

LIFE

Production samples are tested to be within the end of life values (column III) during 10 000 hours.

LIMITING VALUES (Absolute max. rating system)

Anode voltage	V_{a_o}	max.	600	V
	V_a	max.	300	V
Anode dissipation	W_a	max.	1.2	W
Grid voltage	$-V_g$	max.	55	V
	$+V_g$	max.	0.5	V
Grid resistor with fixed bias	R_g	max.	1.2	MΩ
with autom. bias	R_g	max.	2.2	MΩ
Cathode current	I_k	max.	9	mA
Voltage between cathode and heater	V_{kf}	max.	200	V
Bulb temperature	t_{bulb}	max.	170	^{o}C
Resistance of cathode to heater circuit in case of phase inverter circuit	R_{kf}	max.	135	kΩ

Heater voltage: The average heater voltage should be 6.3 V.
Variations of the heater voltage exceeding the range of 6.0 V to 6.6 V will shorten the tube life.
The tolerance of heater current (column II) should be taken into account.

OPERATING CHARACTERISTICS

A.F. amplifier   Fig.1 see page 8

Anode supply voltage	V_{ba}	200	250	300	350	400	V
Anode resistor	R_a	47	47	47	47	47	kΩ
Cathode resistor	R_k	1500	1200	1000	820	680	Ω
Grid resistor next stage	R_o	150	150	150	150	150	kΩ
Anode current	I_a	0.86	1.18	1.55	1.98	2.45	mA
Output voltage at $+I_g = 0.3\ \mu A$	V_o	18	23	26	33	37	V_{RMS}
Voltage gain	V_o/V_i	34	37.5	40	42.5	44	
Total distortion [1]	d_{tot}	8.5	7.0	5.0	4.4	3.6	%
Anode voltage	V_{ba}	200	250	300	350	400	V
Anode resistor	R_a	100	100	100	100	100	kΩ
Cathode resistor	R_k	1800	1500	1200	1000	820	Ω
Grid resistor next stage	R_o	330	330	330	330	330	kΩ
Anode current	I_a	0.65	0.86	1.11	1.40	1.72	mA
Output voltage at $+I_g = 0.3\ \mu A$	V_o	20	26	30	36	38	V_{RMS}
Voltage gain	V_o/V_i	50	54.5	57	61	63	
Total distortion [1]	d_{tot}	4.8	3.9	2.7	2.2	1.7	%
Anode supply voltage	V_{ba}	200	250	300	350	400	V
Anode resistor	R_a	220	220	220	220	220	kΩ
Cathode resistor	R_k	3300	2700	2200	1500	1200	Ω
Grid resistor next stage	R_o	680	680	680	680	680	kΩ
Anode current	I_a	0.36	0.48	0.63	0.85	1.02	mA
Output voltage at $+I_g = 0.3\ \mu A$	V_o	24	28	36	37	38	V_{RMS}
Voltage gain	V_o/V_i	56	66.5	72	75.5	76.5	
Total distortion [1]	d_{tot}	4.6	3.4	2.6	1.6	1.1	%

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[1] The distortion is about proportional to the output voltage.

OPERATING CHARACTERISTICS (continued)

A.F. amplifier   Fig. 2 see page 9   Input source resistance = 100 Ω

Anode supply voltage	V_{ba}	200	250	300	350	400	V
Anode resistor	R_a	47	47	47	47	47	kΩ
Grid resistor next stage	R_o	150	150	150	150	150	kΩ
Anode current	I_a	1.02	1.45	2.02	2.50	3.10	mA
Output voltage	V_o	18	23	26	33	37	V_{RMS}
Voltage gain	V_o/V_i	37	39	41	44	45	
Total distortion [1])	d_{tot}	5.6	4.2	2.9	2.7	2.5	%
Anode supply voltage	V_{ba}	200	250	300	350	400	V
Anode resistor	R_a	100	100	100	100	100	kΩ
Grid resistor next stage	R_o	330	330	330	330	330	kΩ
Anode current	I_a	0.7	1.00	1.29	1.62	1.95	mA
Output voltage	V_o	20	26	30	36	38	V_{RMS}
Voltage gain	V_o/V_i	50	51	54	56	58	
Total distortion [1])	d_{tot}	3.9	2.6	2.0	1.8	1.6	%
Anode supply voltage	V_{ba}	200	250	300	350	400	V
Anode resistor	R_a	220	220	220	220	220	kΩ
Grid resistor next stage	R_o	680	680	680	680	680	kΩ
Anode current	I_a	0.39	0.56	0.74	0.88	1.09	mA
Output voltage	V_o	24	28	36	37	38	V_{RMS}
Voltage gain	V_o/V_i	58	62	66	67	68	
Total distortion [1])	d_{tot}	4.6	2.7	2.2	1.7	1.4	%

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[1]) The distortion is about proportional to the output voltage.

OPERATING CHARACTERISTICS (continued)

<u>A.F. amplifier</u>   Fig. 3 see page 9   Input source resistance = 330 kΩ

Anode supply voltage	V_{ba}	100	150	200	250	300	350	400	V
Anode resistor	R_a	47	47	47	47	47	47	47	kΩ
Grid resistor next stage	R_0	150	150	150	150	150	150	150	kΩ
Anode current	I_a	0.35	0.84	1.40	1.95	2.52	3.19	3.80	mA
Voltage gain	V_0/V_i	25	33	34	36	38	40	41	
Total distortion at:									
V_0 = 2 V	d_{tot}	1.7	2.5	2.4	2.3	2.2	2.2	2.1	%
V_0 = 4 V	d_{tot}	2.1	4.6	4.7	4.6	4.5	4.2	4.2	%
V_0 = 6 V	d_{tot}	6.0	5.2	5.6	5.6	5.5	5.5	5.4	%

Anode supply voltage	V_{ba}	100	150	200	250	300	350	400	V
Anode resistor	R_a	100	100	100	100	100	100	100	kΩ
Grid resistor next stage	R_0	330	330	330	330	330	330	330	kΩ
Anode current	I_a	0.24	0.56	0.88	1.23	1.58	1.92	2.29	mA
Voltage gain	V_0/V_i	34	43	46	48	50	51	52	
Total distortion at:									
V_0 = 2 V	d_{tot}	1.6	1.9	1.9	1.8	1.8	1.8	1.7	%
V_0 = 4 V	d_{tot}	2.3	3.0	3.8	3.8	3.6	3.6	3.5	%
V_0 = 6 V	d_{tot}	2.5	4.7	5.1	5.1	5.0	4.9	4.8	%

Anode supply voltage	V_{ba}	100	150	200	250	300	350	400	V
Anode resistor	R_a	220	220	220	220	220	220	220	kΩ
Grid resistor next stage	R_0	680	680	680	680	680	680	680	kΩ
Anode current	I_a	0.14	0.32	0.49	0.67	0.85	1.05	1.23	mA
Voltage gain	V_0/V_i	42	51	54	57	58	59	60	
Total distortion at:									
V_0 = 2 V	d_{tot}	1.6	1.7	1.7	1.6	1.6	1.6	1.6	%
V_0 = 4 V	d_{tot}	2.5	3.0	3.0	2.9	2.9	2.8	2.7	%
V_0 = 6 V	d_{tot}	3.2	4.4	4.4	4.4	4.4	4.3	4.2	%

OPERATING CHARACTERISTICS (continued)

Phase inverter Fig. 4 see page 9

Anode supply voltage	V_{ba}	250		350	V
Anode voltage	V_a	65		90	V
Cathode resistor	R_k	68		82	$k\Omega$
Anode resistor	R_a, R_a'	100		150	$k\Omega$
Anode current	$I_a + I_a'$	1.0		1.2	mA
Voltage gain	V_o/V_i	25		27	
Output voltage ($+I_g = 0.3 \mu A$)	V_o	7	20	10 35	V_{RMS}
Total distortion [1])	d_{tot}	0.6	1.8	0.5 1.8	%

V_a should be adjusted to the specified value of $I_a + I_a'$

Phase inverter Fig. 5 see page 9

Anode supply voltage	V_{ba}	250		350	V
Cathode resistor	R_k	1200		820	Ω
Anode current	$I_a + I_a'$	1.08		1.7	mA
Voltage gain	V_o/V_i	58		62	
Output voltage ($+I_g = 0.3 \mu A$)	V_o	7.0	35	9 45	V_{RMS}
Total distortion [1])	d_{tot}	1.1	5.5	0.7 3.5	%
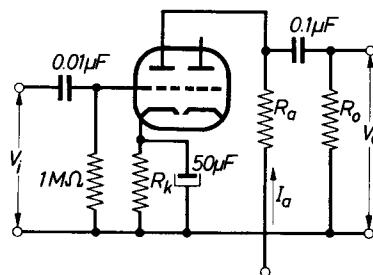
Fig. 1

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[1]) The distortion is about proportional to the output voltage.
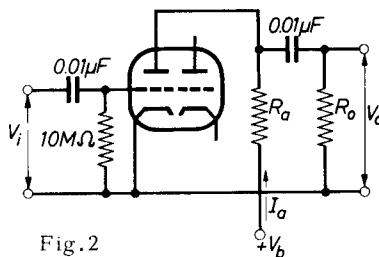
Fig.2
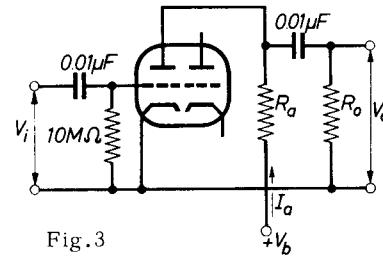
Fig.3


Fig.4

Fig.5

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$V_a = 250V$
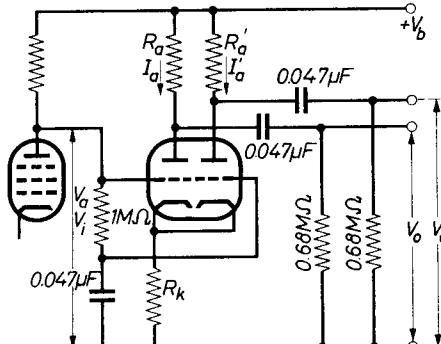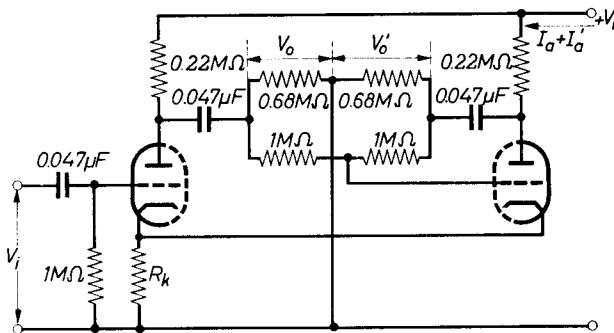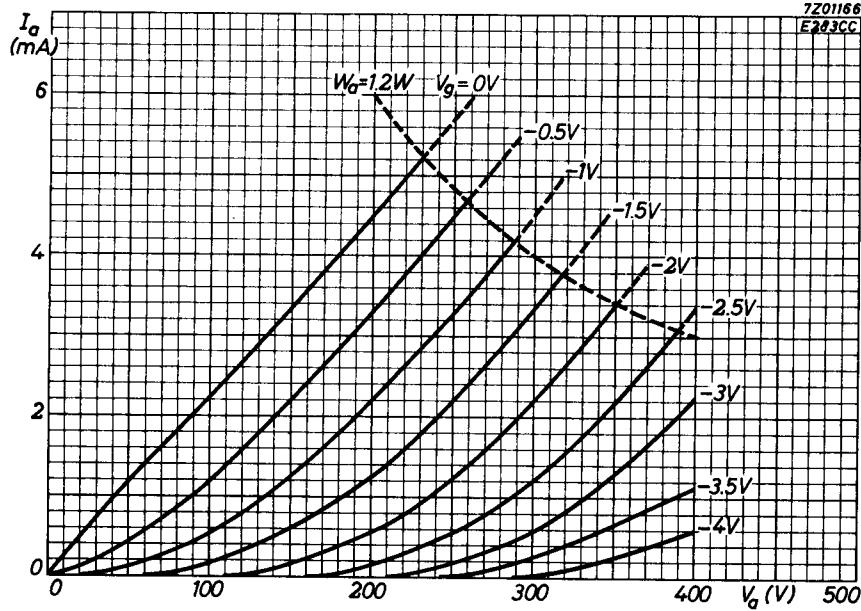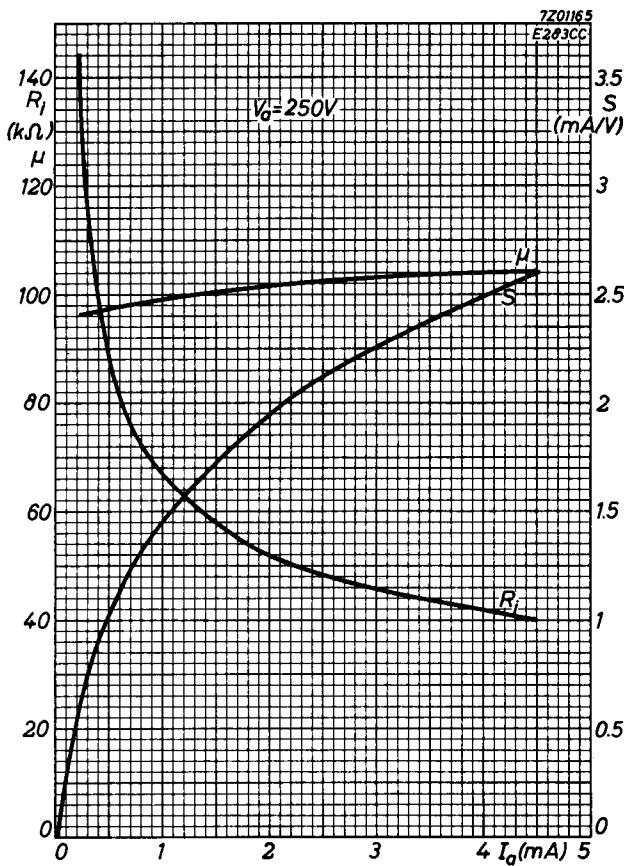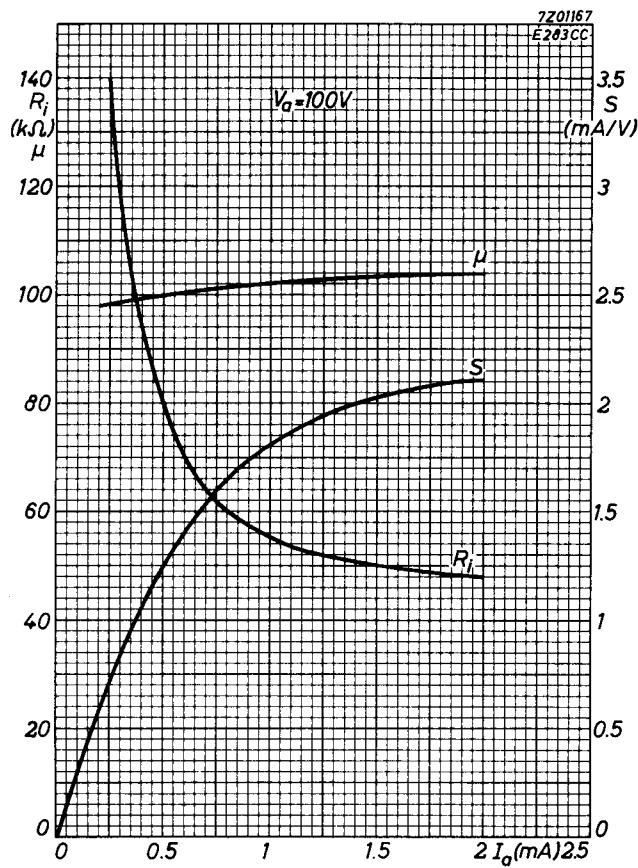
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Data handbook

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Electronic components and materials

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