S.Q. TUBE

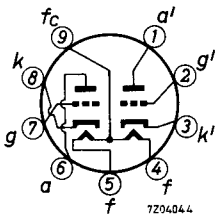
Special quality double triode designed for use as A.F. amplifier, phase inverter and amplifier in measuring equipment.

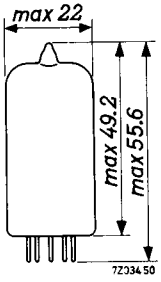
QUICK REFERENCE DATA			
Life test	10 000 hours		
Low interface resistance			
Low microphony level			
Mechanical quality	Shock and vibration resistant		
Base	Noval		
Heating	Indirect A.C. or D.C.; parallel supply		
Heater voltage	V_f	6.3 V or 12.6	V
Heater current	I_f	300 mA or 150	mA
Anode current	I_a	1.25	mA
Mutual conductance	S	1.6	mA/V
Amplification factor	μ	100	

DIMENSIONS AND CONNECTIONS

Dimensions in mm

Base: Noval





CHARACTERISTICS (Both systems if applicable)

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 pin 9 and 4 + 5	V_f	6.3			V
Heater current	I_f	300	285 - 315		mA
Heater voltage pin 4 and 5	V_f	12.6			V
Heater current	I_f	150			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
Cut-off voltage Anode current I_a = 20 μA	$-V_g$		max. 4		V
Anode voltage	V_a	100			V
Anode current	I_a	0.5			mA
Cathode resistor	R_k	2			kΩ
Mutual conductance	S	1.25			mA/V
Amplification factor	μ	100			
Internal resistance	R_i	80			kΩ
Leakage current between cathode and heater Voltage between cathode and heater V_{kf} = 100 V	I_{kf}		max. 5		μA

CHARACTERISTICS (continued)

		I	II	
Insulation resistance:				
Between grid and other electrodes	R_{ins}		max. 300	MΩ
Voltage between electrodes = 100 V				
Between anode and other electrodes	R_{ins}		max. 300	MΩ
Voltage between electrodes = 300 V				
Vibrational noise output (20 to 5000 Hz)	V_o		max. 10	mV_{RMS}
Anode supply voltage V_{ba} = 250 V				
Anode resistor R_a = 5 kΩ				
Grid voltage $-V_g$ = 2 V				
Vibration frequency = 25 Hz				
Acceleration = 2.5 g				
Units in parallel				

CAPACITANCES

Grid to cathode and heater	$C_{g/kf}$	1.6		pF
Anode to cathode and heater	$C_{a/kf}$	0.46		pF
	$C_{a'/k'f}$	0.34		pF
Anode to grid	C_{ag}	1.7		pF
Grid to heater	C_{gf}		max. 0.15	pF
Anode to anode other system	$C_{aa'}$		max. 0.6	pF
Grid to grid other system	$C_{gg'}$		max. 10	mpF
Anode to grid other system	$C_{ag'}$		max. 60	mpF
	$C_{ga'}$		max. 60	mpF

LIMITING VALUES (Absolute max. rating system) (Each unit)

Anode voltage	V_{a_o}	max. 600	V
	V_a	max. 330	V
Anode dissipation	W_a	max. 1.2	W
Grid voltage	$-V_g$	max. 55	V
	$+V_g$	max. 0.5	V
Cathode current	I_k	max. 9	mA

LIMITING VALUES (continued)

Grid resistor: fixed bias	R_g	max. 1.2	MΩ
automatic bias	R_g	max. 2.2	MΩ
grid current bias	R_g	max. 25	MΩ
Voltage between cathode and heater	V_{kf}	max. 200	V
Resistance in cathode heater circuit in case of phase inverter circuit	R_{kf}	max. 135	kΩ
Bulb temperature	t_{bulb}	max. 170	°C
Microphony: Input voltage required for 50 mW output	V_i	min. 0.5	mV

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 the heater current (column II) should be taken into account.

OPERATING CHARACTERISTICS

A.F. amplifier - circuit fig.1

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	$R_{g'}$	150	150	150	150	150	kΩ
Anode current	I_a	0.86	1.18	1.55	1.98	2.45	mA
Output voltage (Grid current = 0.3 μA)	V_o	18	23	26	33	37	V_{RMS}
Voltage gain	V_o/V_i	34.0	37.5	40.0	42.5	44.0	
Total distortion	d_{tot}	8.5	7.0	5.0	4.4	3.6	%

OPERATING CHARACTERISTICS (continued)

A.F. amplifier - circuit fig.1 (continued)

Anode supply 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_g'	330	330	330	330	330	kΩ
Anode current	I_a	0.65	0.86	1.11	1.40	1.72	mA
Output voltage (Grid current = 0.3 μA)	V_o	20	26	30	36	38	V_{RMS}
Voltage gain	V_o/V_i	50	54.5	57.0	61.0	63.0	
Total distortion	d_{tot}	4.8	3.9	3.7	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_g'	680	680	680	680	680	kΩ
Anode current	I_a	0.36	0.48	0.63	0.85	1.02	mA
Output voltage (Grid current = 0.3 μA)	V_o	24	28	36	37	38	V_{RMS}
Voltage gain	V_o/V_i	56	66.5	72.0	75.5	76.5	
Total distortion	d_{tot}	4.6	3.4	2.6	1.6	1.1	%

A.F. amplifier - circuit fig.2.

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_g'	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	d_{tot}	5.6	4.2	2.9	2.7	2.5	%

OPERATING CHARACTERISTICS (continued)

A.F. amplifier - circuit fig.2. (continued)

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	$R_{g'}$	330	330	330	330	330	kΩ
Anode current	I_a	0.70	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	d_{tot}	3.9	2.6	2.0	1.8	1.6	%

Anode voltage	V_{ba}	200	250	300	350	400	V
Anode resistor	R_a	220	220	220	220	220	kΩ
Grid resistor next stage	$R_{g'}$	680	680	680	680	680	kΩ
Anode current	I_a	0.39	0.56	0.75	0.88	1.09	mA
Output voltage	V_o	24	28	36	37	38	V
Voltage gain	V_o/V_i	58	62	66	67	68	
Total distortion	d_{tot}	4.6	2.7	2.2	1.7	1.4	%

A.F. amplifier - circuit fig.3.

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	$R_{g'}$	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_o/V_i	25	33	34	36	38	40	41	
Total distortion:									
at V_o = 2 V_{RMS}	d_{tot}	1.7	2.5	2.4	2.3	2.2	2.2	2.1	%
at V_o = 4 V_{RMS}	d_{tot}	2.1	4.6	4.7	4.6	4.5	4.2	4.2	%
at V_o = 6 V_{RMS}	d_{tot}	6.0	5.2	5.6	5.6	5.5	5.5	5.4	%

OPERATING CHARACTERISTICS (continued)

A.F. amplifier - circuit fig.3. (continued)

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_g'	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_o/V_i	34	43	46	48	50	51	52	
Total distortion:									
at V_o = 2 V_{RMS}	d_{tot}	1.6	1.9	1.9	1.8	1.8	1.8	1.7	%
at V_o = 4 V_{RMS}	d_{tot}	2.3	3.0	3.8	3.8	3.6	3.6	3.5	%
at V_o = 6 V_{RMS}	d_{tot}	2.6	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_g'	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_o/V_i	42	51	54	57	58	59	60	
Total distortion:									
at V_o = 2 V_{RMS}	d_{tot}	1.6	1.7	1.7	1.6	1.6	1.6	1.6	%
at V_o = 4 V_{RMS}	d_{tot}	2.5	3.0	3.0	2.9	2.9	2.8	2.7	%
at V_o = 6 V_{RMS}	d_{tot}	3.2	4.4	4.4	4.4	4.4	4.3	4.2	%

Phase inverter - circuit fig.4

Supply voltage	V_b	250		350		V
Anode voltage	V_a	65		90		V
Anode resistor	R_a, R_a'	100		150		kΩ
Cathode resistor	R_k	68		82		kΩ
Anode current	I_a+I_a'	1.0		1.2		mA
Voltage gain	V_o/V_i	25		27		
Output voltage (Grid current = 0.3 μA)	V_o	7	20	10	35	V_{RMS}
Total distortion	d_{tot}	0.6	1.8	0.5	1.8	%

V_a should be adjusted to the specified value for I_a+I_a'

OPERATING CHARACTERISTICS (continued)

Phase inverter - circuit fig.5.

Supply voltage	V_b	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 (Grid current = 0.3 μA)	V_o	7	35	9	45	V_{RMS}
Total distortion	d_{tot}	1.1	5.5	0.7	3.5	%

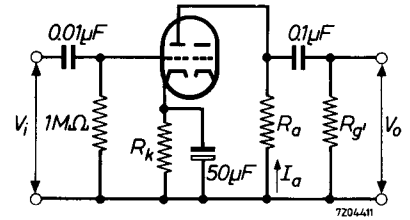


Fig. 1

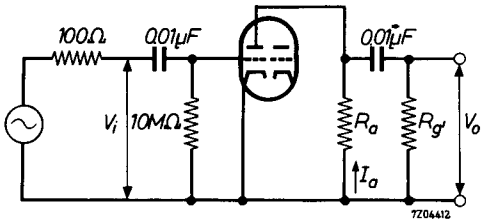


Fig. 2

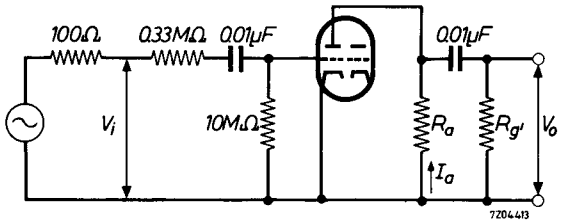


Fig. 3

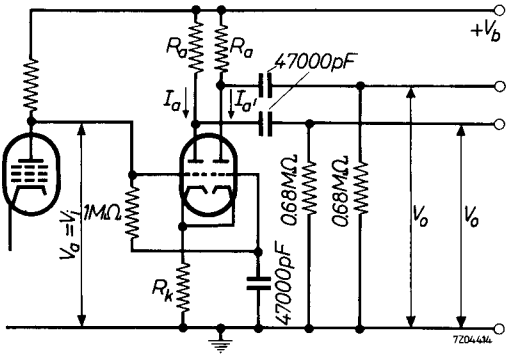

+Vb
Ra
Ra
47000pF
Ia
Ia'
0.68MΩ
0.68MΩ
Vo
Vo
Va = Vi
1MΩ
Rk
47000pF
7204434

Fig. 4

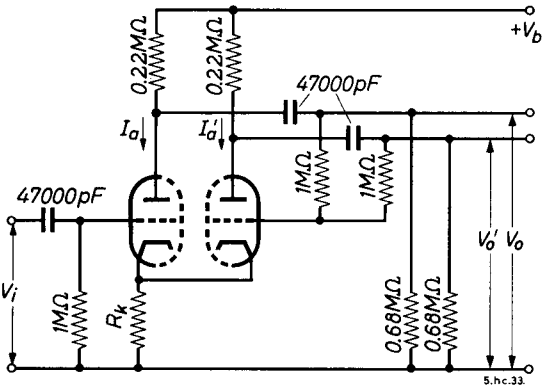
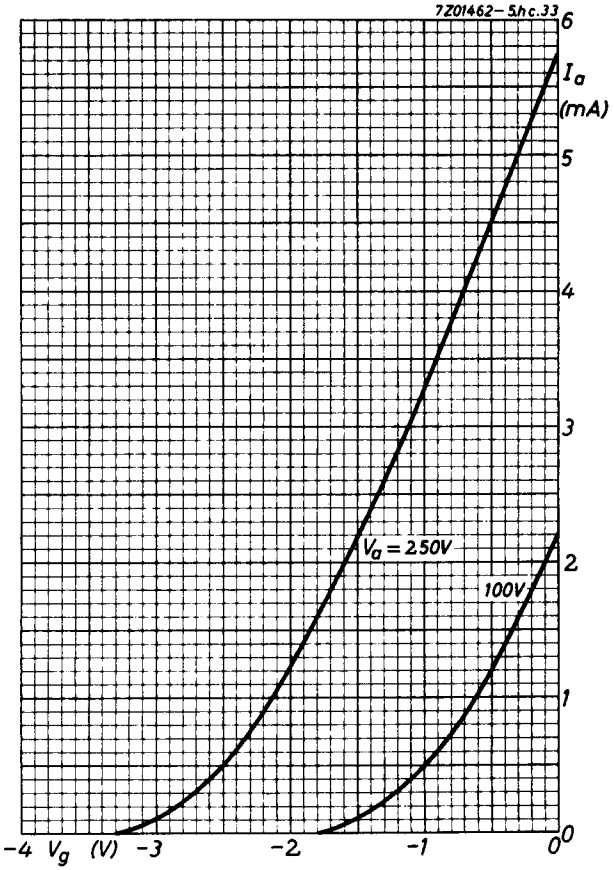
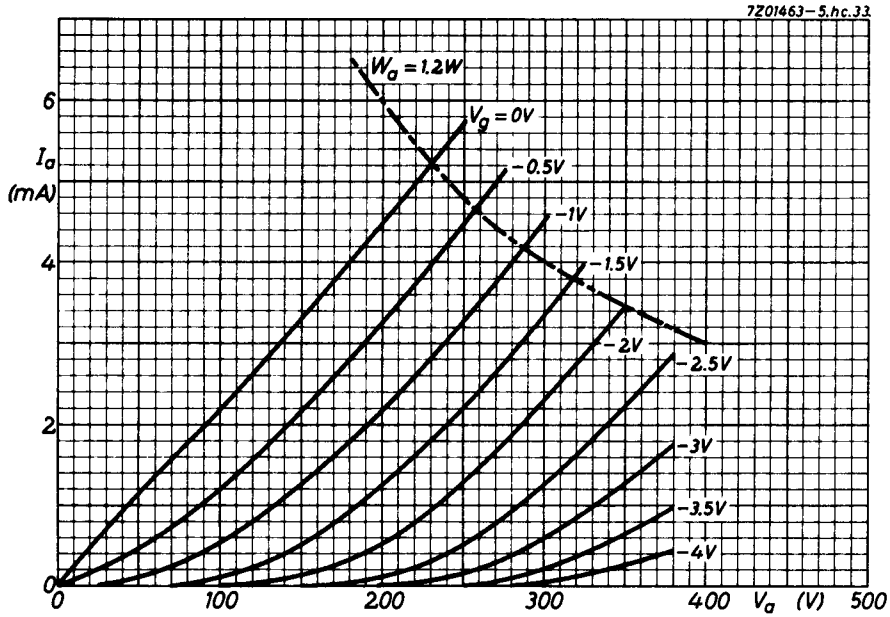
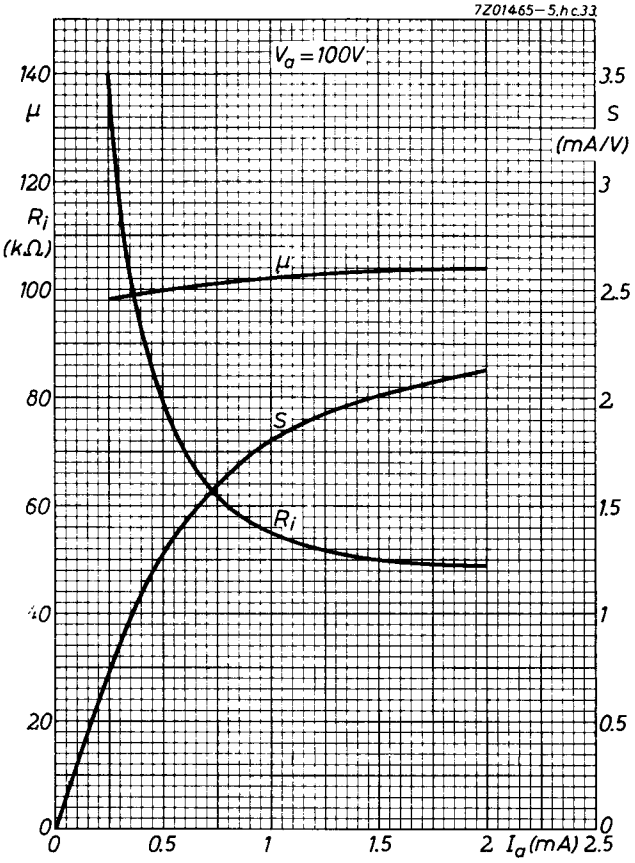

+Vb
0.22MΩ
0.22MΩ
47000pF
Ia
Ia'
1MΩ
1MΩ
47000pF
Vi
1MΩ
Rk
0.68MΩ
0.68MΩ
Vo' Vo
5.hc.33.

Fig. 5


7Z01462-Sh.c.33
6
I_a
(mA)
5
4
3
2
1
0
V_a = 250V
100V
-4 V_g (V) -3
-2
-1
0


7Z01463-5.hc.33
$W_a = 1.2W$
$V_g = 0V$
-0.5V
-1V
-1.5V
-2V
-2.5V
-3V
-3.5V
-4V
I_a (mA)
6
4
2
0
0
100
200
300
400
V_a (V)
500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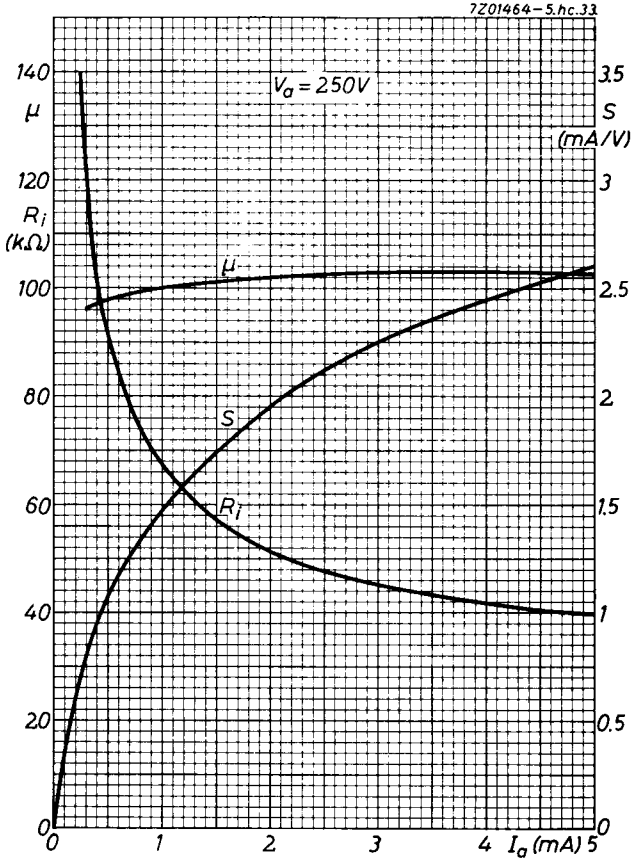
$V_a = 100V$
140
μ
120
R_i
(kΩ)
100
80
60
40
20
0
3.5
S
(mA/V)
3
2.5
2
1.5
1
0.5
0
μ
S
R_i
0
0.5
1
1.5
2
I_a(mA)
2.5


7Z01464-5.hc.33
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140
μ
120
R_i
(kΩ)
100
80
60
40
20
0
3.5
S
(mA/V)
3
2.5
2
1.5
1
0.5
0
μ
S
R_i
0
1
2
3
4
I_a(mA)
5

PHILIPS

Data handbook

PHILIPS Electronic components and materials

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