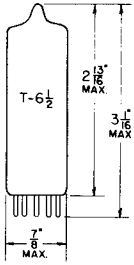
TUNG-SOL

PENTODE



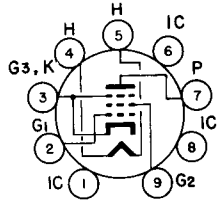
GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-4

COATED UNIPOTENTIAL CATHODE

HEATER

10.6[D] VOLTS 0.45[E] AMP.

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9CV

THE 10BQ5 IS AN OUTPUT PENTODE DESIGNED FOR APPLICATION IN MEDIUM POWER HI-FI AMPLIFIERS. A PAIR OF TUBES IN CLASS AB, PUSH-PULL CONVENTIONAL OPERATION YIELDS AN OUTPUT OF UP TO 17 WATTS AT 4% DISTORTION (WITHOUT FEEDBACK). IN SINGLE-ENDED OPERATION A POWER OUTPUT OF 5.7 WATTS CAN BE OBTAINED. EXCEPT FOR HEATER CHARACTERISTICS AND HEATER WARM-UP TIME, THE 10BQ5 IS IDENTICAL TO THE 6BQ5.

DIRECT INTERELECTRODE CAPACITANCES

GRID #1 TO ALL OTHER ELEMENTS	10.8	pf
PLATE TO ALL OTHER ELEMENTS	6.5	pf
PLATE TO GRID #1 (MAX.)	0.5	pf
GRID #1 TO HEATER (MAX.)	0.25	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER CURRENT[F]	450±30	MA.
MAXIMUM PLATE VOLTAGE[A]	300	VOLTS
MAXIMUM PLATE VOLTAGE WITHOUT PLATE CURRENT	550	VOLTS
MAXIMUM PLATE DISSIPATION[A]	12	WATTS
MAXIMUM GRID #2 VOLTAGE [A]	300	VOLTS
MAXIMUM GRID #2 VOLTAGE WITHOUT CURRENT	550	VOLTS
MAXIMUM GRID #2 DISSIPATION	2	WATTS
MAXIMUM GRID #2 PEAK DISSIPATION	4	WATTS
MAXIMUM NEGATIVE GRID #1 VOLTAGE	100	VOLTS
MAXIMUM GRID CURRENT STARTING POINT		
MAXIMUM GRID #1 VOLTAGE WHEN GRID #1 CURRENT IS 0.3 μAMP.	-1.3	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE WITH AUTOMATIC BIAS	1	MEGOHM
MAXIMUM GRID #1 CIRCUIT RESISTANCE WITH FIXED BIAS	0.3	MEGOHM
MAXIMUM CATHODE CURRENT	65	MA.
MAXIMUM VOLTAGE BETWEEN HEATER AND CATHODE	100	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER NEGATIVE WITH RESPECT TO CATHODE TOTAL DC AND PEAK	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE TOTAL DC AND PEAK	100	VOLTS
HEATER WARM-UP TIME*	11	SECONDS

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A, ONE TUBE

PLATE VOLTAGE			250			VOLTS
GRID #2 VOLTAGE			250			VOLTS
GRID #1 BIAS			−7.3			VOLTS
CATHODE RESISTOR			135			OHMS
PLATE LOAD RESISTANCE			5200			OHMS
INPUT A.F. VOLTAGE(RMS)	0	0.3	3.4	4.3	4.7	VOLTS
PLATE CURRENT	48	---	---	49.5	49.2	MA.
GRID #2 CURRENT	5.5	---	---	10.8	11.6	MA.
TRANSCONDUCTANCE	11300	---	---	---	---	μMHOS
PLATE RESISTANCE	38000	---	---	---	---	OHMS
AMPLIFICATION FACTOR OF GRID #2 WITH RESPECT TO GRID #1	19	---	---	---	---	
MAX. SIGNAL POWER OUTPUT[B]	0	0.05	4.5	5.7	6.0[C]	WATTS
TOTAL HARMONIC DISTORTION[B]	---	---	6.8	10	---	PERCENT
SECOND HARMONIC[B]	---	---	3.0	2.0	---	PERCENT
THIRD HARMONIC[B]	---	---	5.8	9.5	---	PERCENT

PLATE VOLTAGE			250			VOLTS
GRID #2 VOLTAGE			250			VOLTS
GRID #1 BIAS			−7.3			VOLTS
CATHODE RESISTOR			135			OHMS
PLATE LOAD RESISTANCE			4500			OHMS
INPUT A.F. VOLTAGE (RMS)	0	0.3	3.5	4.4	4.8	VOLTS
PLATE CURRENT	48	---	---	50.6	50.5	MA.
GRID #2 CURRENT	5.5	---	---	10	11	MA.
TRANSCONDUCTANCE	11300	---	---	---	---	μMHOS
PLATE RESISTANCE	38000	---	---	---	---	OHMS
AMPLIFICATION FACTOR OF GRID #2 WITH RESPECT TO GRID #1	19	---	---	---	---	
MAX. SIGNAL POWER OUTPUT[B]	0	0.05	4.5	5.7	6.0[C]	WATTS
TOTAL HARMONIC DISTORTION[B]	---	---	7.5	10	---	PERCENT
SECOND HARMONIC[B]	---	---	5.7	5.0	---	PERCENT
THIRD HARMONIC[B]	---	---	4.5	8	---	PERCENT

PLATE VOLTAGE			250			VOLTS
GRID #2 VOLTAGE			250			VOLTS
GRID #1 BIAS			−8.4			VOLTS
CATHODE RESISTOR			210			OHMS
PLATE LOAD RESISTANCE			7000			OHMS
INPUT A.F. VOLTAGE(RMS)	0	0.3		3.5	5.5	VOLTS
PLATE CURRENT	36	---		36.8	36	MA.
GRID #2 CURRENT	4.1	---		8.5	14.6	MA.
TRANSCONDUCTANCE	10000	---		---	---	μMHOS
PLATE RESISTANCE	40000	---		---	---	OHMS
AMPLIFICATION FACTOR OF GRID #2 WITH RESPECT TO GRID #1	19	---		---	---	
MAX. SIGNAL POWER OUTPUT[B]	0	0.05		4.2	5.6[C]	WATTS
TOTAL HARMONIC DISTORTION[B]	---	---		10	---	PERCENT
SECOND HARMONIC[B]	---	---		1.7	---	PERCENT
THIRD HARMONIC[B]	---	---		8.7	---	PERCENT

TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS - cont'd.

CLASS A, ONE TUBE - CONT'D.

PLATE VOLTAGE			250		VOLTS
GRID #2 VOLTAGE			210		VOLTS
GRID #1 BIAS			-6.4		VOLTS
CATHODE RESISTOR			160		OHMS
PLATE LOAD RESISTANCE			7000		OHMS
INPUT A.F. VOLTAGE(RMS.)	0	0.3	3.4	3.8	VOLTS
PLATE CURRENT	36	---	36.6	36.5	MA.
GRID #2 CURRENT	3.9	---	7.3	8.0	MA.
TRANSCONDUCTANCE	10400	---	---	---	μMHOS
PLATE RESISTANCE	40000	---	---	---	OHMS
AMPLIFICATION FACTOR OF GRID #2 WITH RESPECT TO GRID #1	19	---	---	---	OHMS
MAX. SIGNAL POWER OUTPUT [B]	0	0.05	4.3	4.7[C]	WATTS
TOTAL HARMONIC DISTORTION[B]	---	---	10	---	PERCENT
SECOND HARMONIC[B]	---	---	1.8	---	PERCENT
THIRD HARMONIC[B]	---	---	9.3	---	PERCENT

CLASS B, TWO TUBES

PLATE VOLTAGE		250		300	VOLTS
GRID #2 VOLTAGE		250		300	VOLTS
GRID #1 BIAS		-11.6		-14.7	VOLTS
LOAD RESISTANCE, PLATE TO PLATE		8000		8000	
INPUT A.F. VOLTAGE (RMS)	0	8	0	10	VOLTS
PLATE CURRENT	2x10	2x37.5	2x7.5	2x46	MA.
GRID #2 CURRENT	2x1.1	2x7.5	2x0.8	2x11	MA.
MAX. SIGNAL POWER OUTPUT	0	11	0	17	WATTS
TOTAL HARMONIC DISTORTION	---	3	---	4	PERCENT

CLASS AB, TWO TUBES

PLATE VOLTAGE		250		300	VOLTS
GRID #2 VOLTAGE		250		300	VOLTS
COMMON CATHODE RESISTOR		130		130	OHMS
LOAD RESISTANCE, PLATE TO PLATE		8000		8000	OHMS
INPUT A.F. VOLTAGE (RMS)	0	8	0	10	VOLTS
PLATE CURRENT	2x31	2x37.5	2x36	2x46	MA.
GRID #2 CURRENT	2x3.5	2x7.5	2x4	2x11	MA.
MAX. SIGNAL POWER OUTPUT	0	11	0	17	WATTS
TOTAL HARMONIC DISTORTION	---	3	---	4	PERCENTS

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS - cont'd.

CLASS A IN TRIODE CONNECTION

(GRID #2 CONNECTED TO PLATE)

PLATE VOLTAGE	250	VOLTS
CATHODE RESISTOR	270	OHMS
PLATE LOAD RESISTANCE	3500	OHMS
ZERO-SIGNAL PLATE CURRENT	34	MA.
INPUT A.F. VOLTAGE (RMS)	6.7	VOLTS
MAX. SIGNAL PLATE CURRENT	36	MA.
MAX. SIGNAL POWER OUTPUT	1.95	WATTS
TOTAL HARMONIC DISTORTION	9	PERCENTS
INPUT A.F. VOLTAGE AT A POWER OUTPUT OF 50 MWATTS (RMS)	1.0	VOLT

CLASS AB, TWO TUBES IN TRIODE CONNECTION

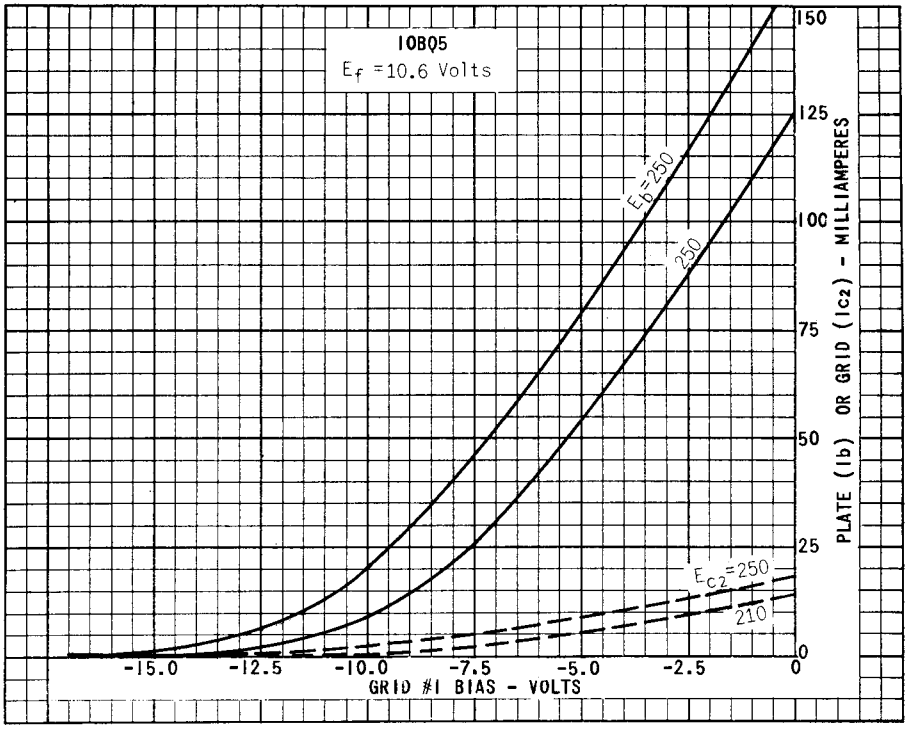
(GRID #2 CONNECTED TO PLATES)

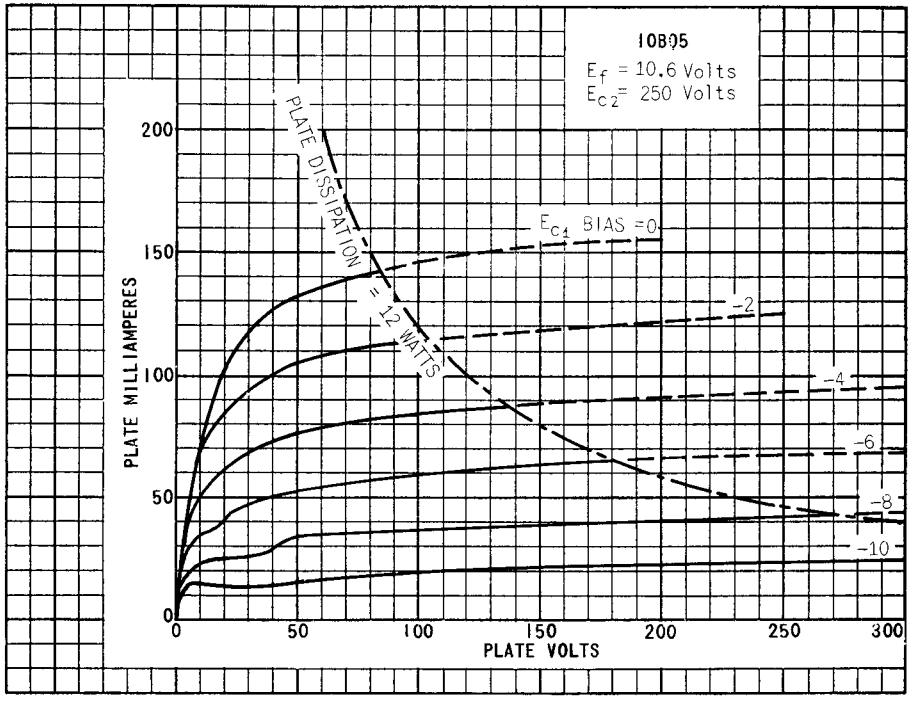
PLATE VOLTAGE	250	300	VOLTS
COMMON CATHODE RESISTOR	270	270	OHMS
LOAD RESISTANCE (PLATE TO PLATE)	10 000	10 000	OHMS
ZERO-SIGNAL PLATE CURRENT	2x20	2x24	MA.
INPUT A.F. VOLTAGE (RMS)	8.3	10	VOLTS
MAX. SIGNAL PLATE CURRENT	2x21.7	2x26	MA.
MAX. SIGNAL POWER OUTPUT	3.4	5.2	WATTS
TOTAL HARMONIC DISTORTION	2.5	2.5	PERCENTS
INPUT A.F. VOLTAGE AT A POWER OUTPUT OF 50 MWATTS (RMS.)	0.95	0.9	VOLTS

[A] WHEN THE HEATER AND POSITIVE VOLTAGES ARE OBTAINED FROM A STORAGE BATTERY BY MEANS OF A VIBRATOR, THE MAX. VALUES OF THE PLATE AND GRID #2 VOLTAGES ARE 250 VOLTS AND THAT OF THE PLATE DISSIPATION 9 WATTS.

[B] MEASURED WITH FIXED BIAS.

[C] POWER OUTPUT AT START OF POSITIVE GRID CURRENT.





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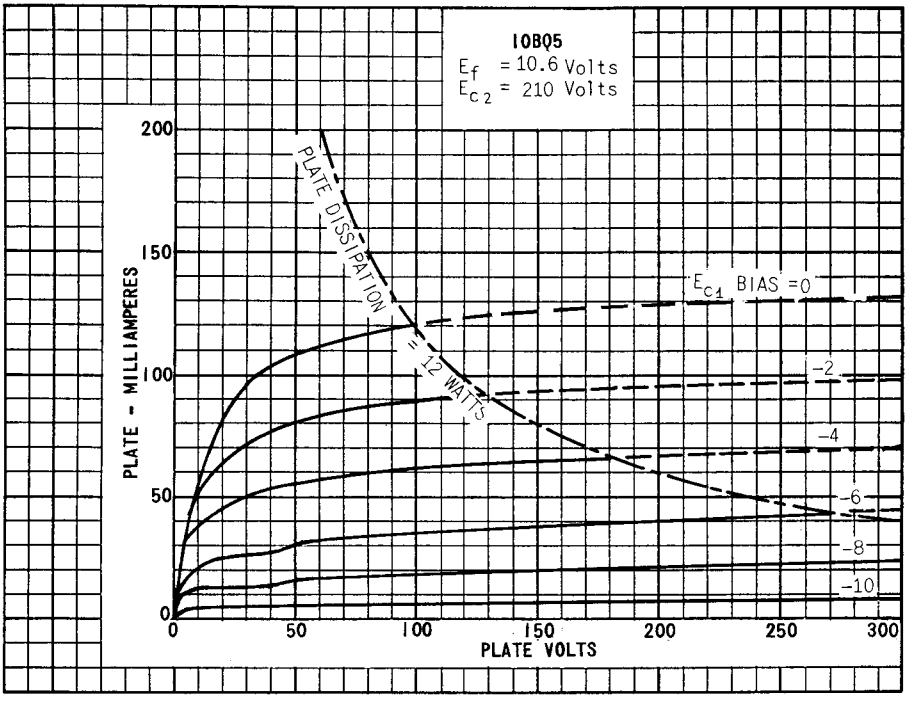
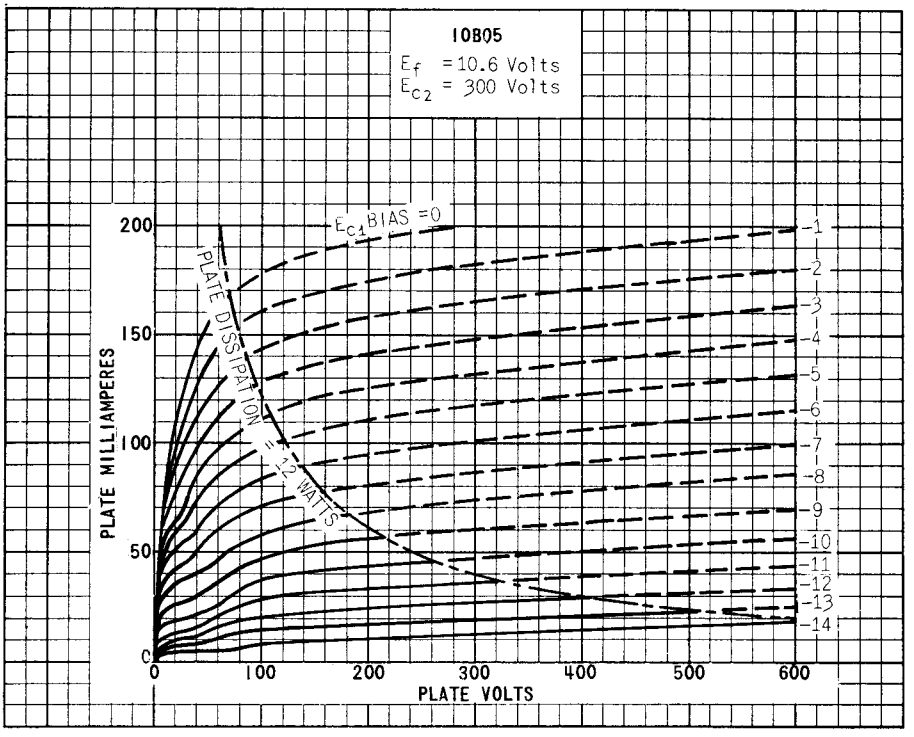
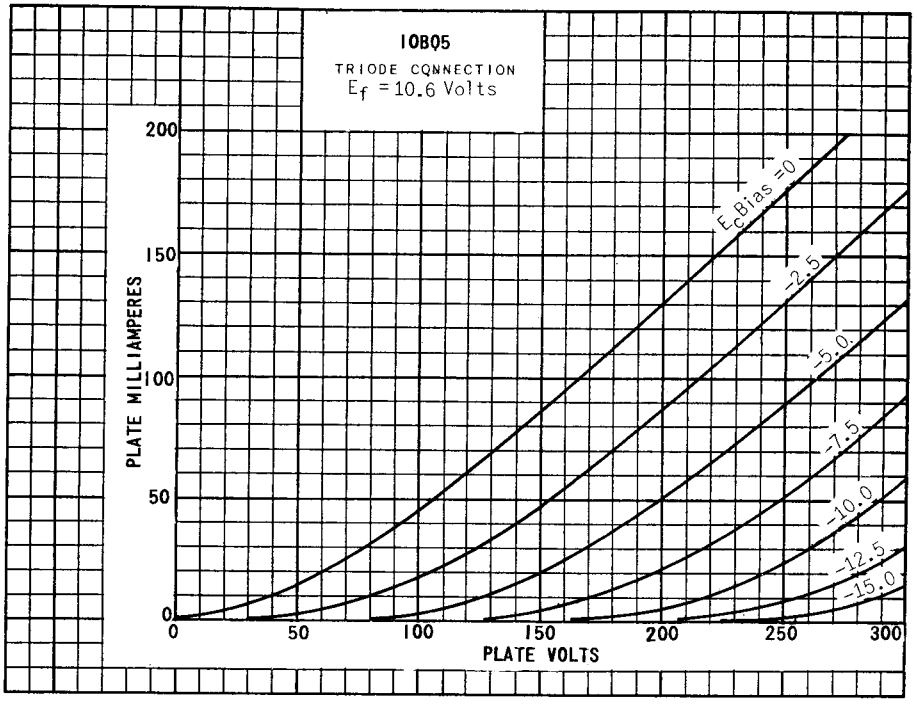
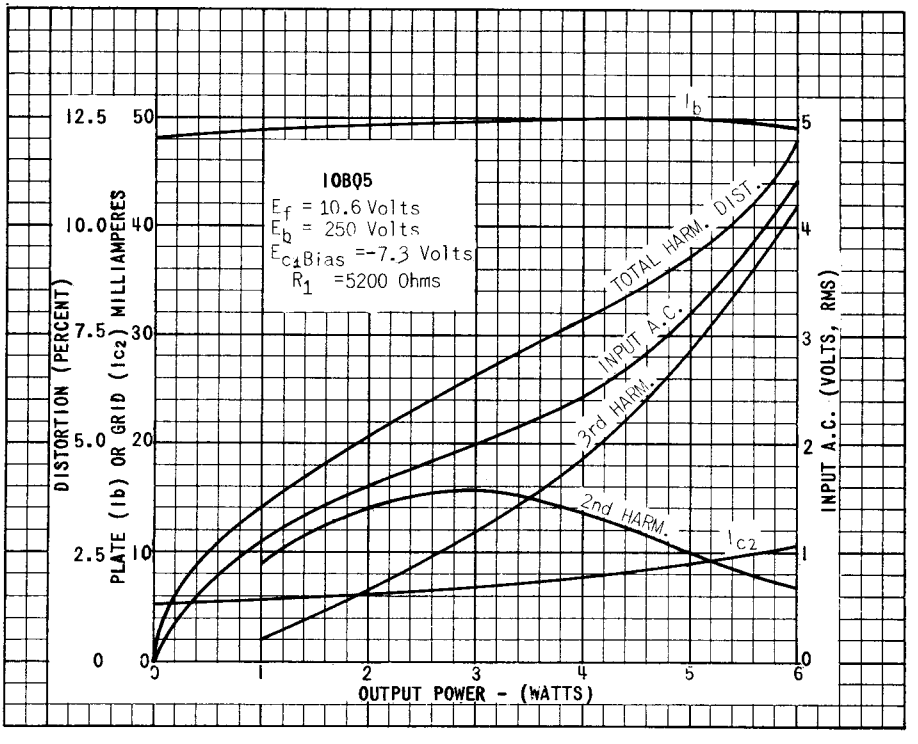
10BQ5

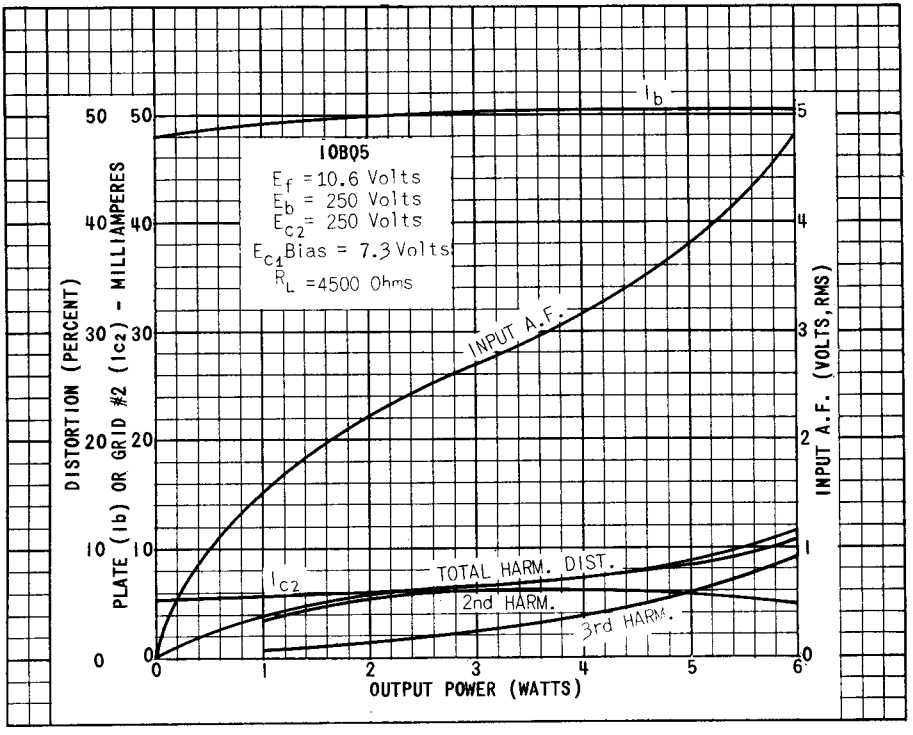

10BQ5
E_f = 10.6 Volts
E_{c2} = 210 Volts
PLATE - MILLIAMPERES
PLATE VOLTS
PLATE DISSIPATION = 12 WATTS
E_{c1} BIAS = 0
-2
-4
-6
-8
-10
0
50
100
150
200
250
300

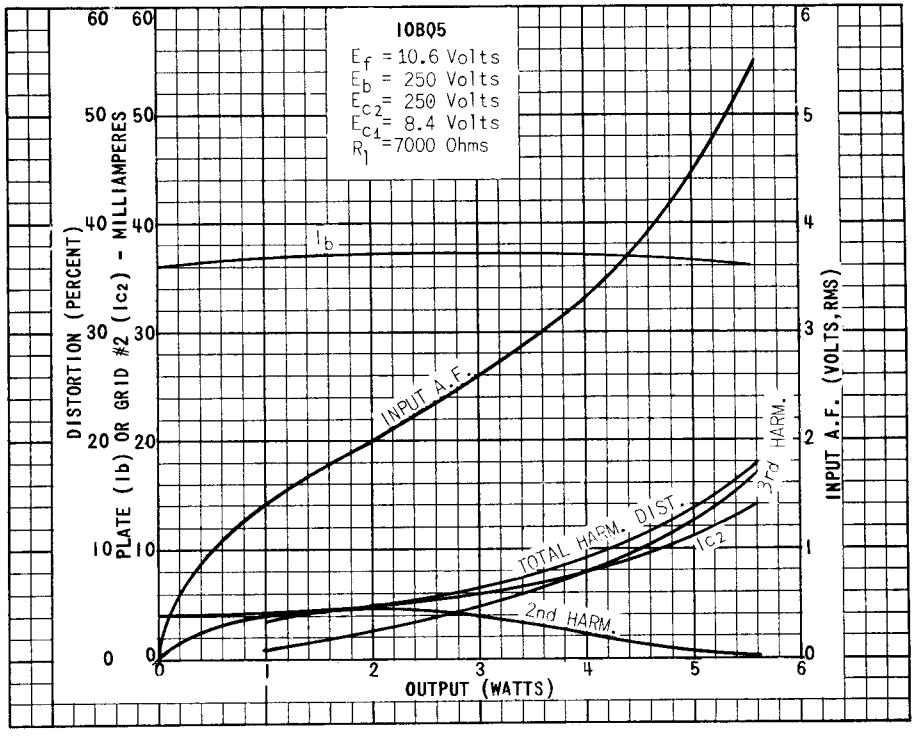

10B05
E_f = 10.6 Volts
E_{c2} = 300 Volts
PLATE MILLIAMPERES
PLATE VOLTS
PLATE DISSIPATION = 12 WATTS
E_{c1} BIAS = 0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
-13
-14
0
50
100
150
200
300
400
500
600

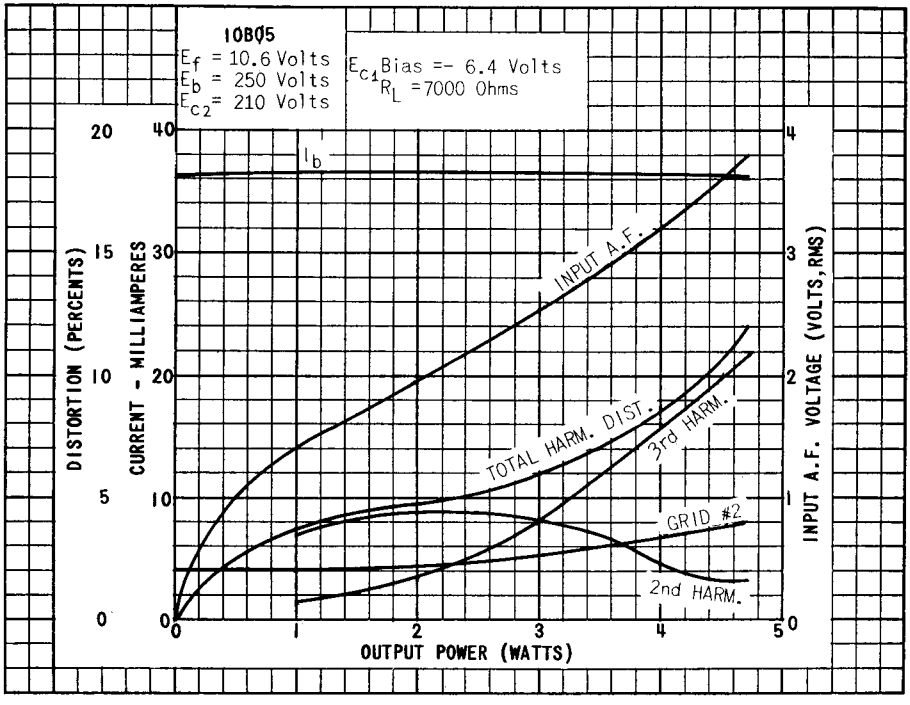

10BQ5
TRIODE CONNECTION
E_f = 10.6 Volts
PLATE MILLIAMPERES
PLATE VOLTS
E_c Bias = 0
-2.5
-5.0
-7.5
-10.0
-12.5
-15.0
0
50
100
150
200
250
300

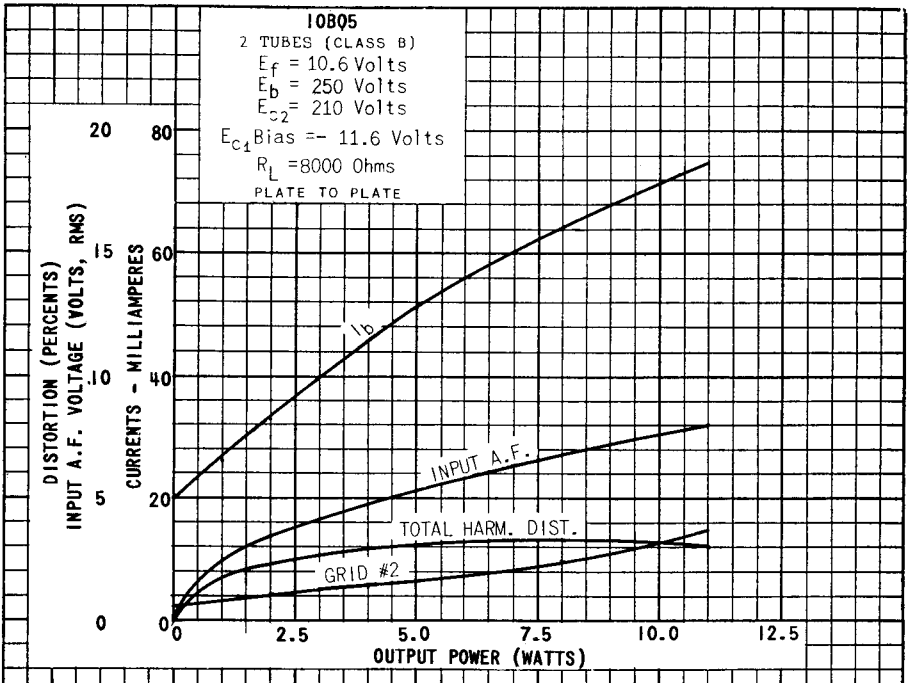

10BQ5
E_f = 10.6 Volts
E_b = 250 Volts
E_{c_1} Bias = -7.3 Volts
R_1 = 5200 Ohms
DISTORTION (PERCENT)
PLATE (Ib) OR GRID (I_{c_2}) MILLIAMPERES
INPUT A.C. (VOLTS, RMS)
OUTPUT POWER - (WATTS)
I_b
TOTAL HARM. DIST.
INPUT A.C.
3rd HARM.
2nd HARM.
I_{c_2}

10BQ5


10BQ5
E_f = 10.6 Volts
E_b = 250 Volts
E_{c2} = 250 Volts
E_{c1} Bias = 7.3 Volts
R_L = 4500 Ohms
I_b
INPUT A.F.
I_{c2}
TOTAL HARM. DIST.
2nd HARM.
3rd HARM.
DISTORTION (PERCENT)
PLATE (I_b) OR GRID #2 (I_{c2}) - MILLIAMPERES
INPUT A.F. (VOLTS, RMS)
OUTPUT POWER (WATTS)


10BQ5
E_f = 10.6 Volts
E_b = 250 Volts
E_{c2} = 250 Volts
E_{c1} = 8.4 Volts
R_l = 7000 Ohms
I_b
INPUT A.F.
3rd HARM.
TOTAL HARM. DIST.
I_{c2}
2nd HARM.
DISTORTION (PERCENT)
PLATE (I_b) OR GRID #2 (I_{c2}) - MILLIAMPERES
INPUT A.F. (VOLTS, RMS)
OUTPUT (WATTS)





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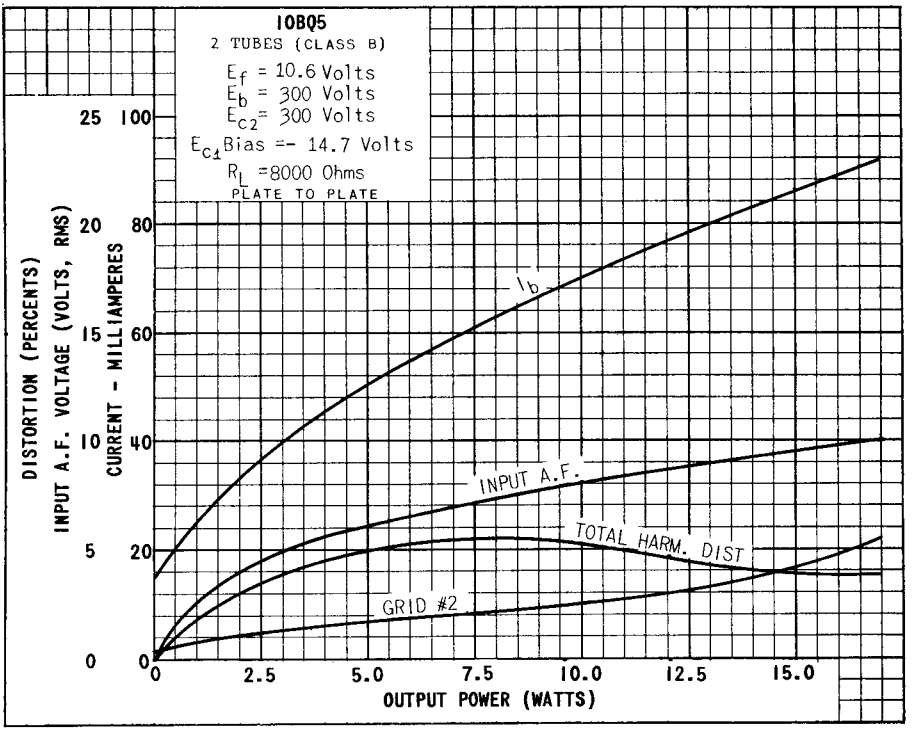
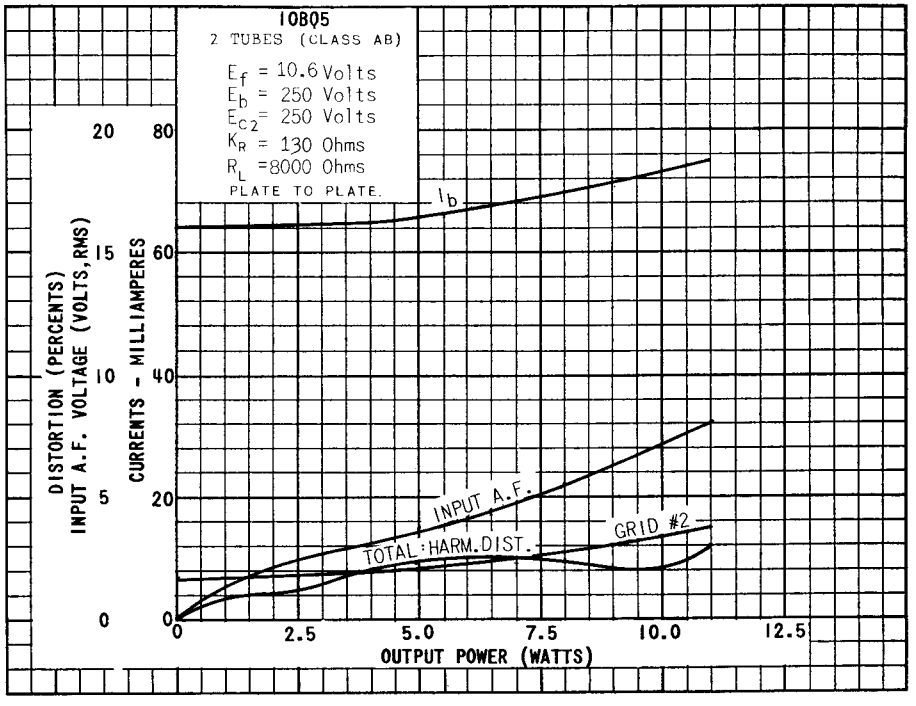
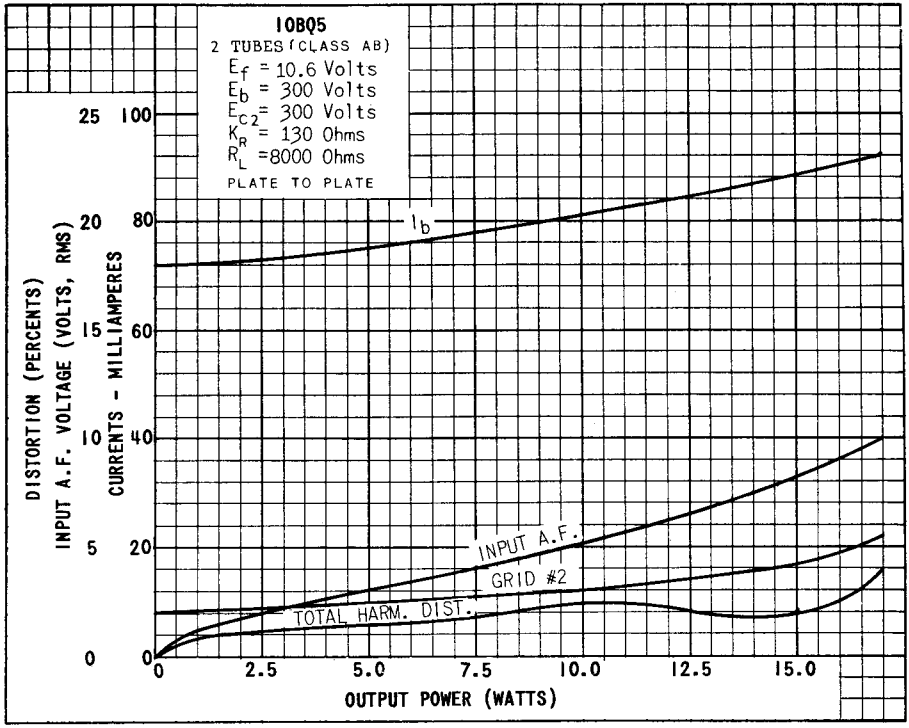
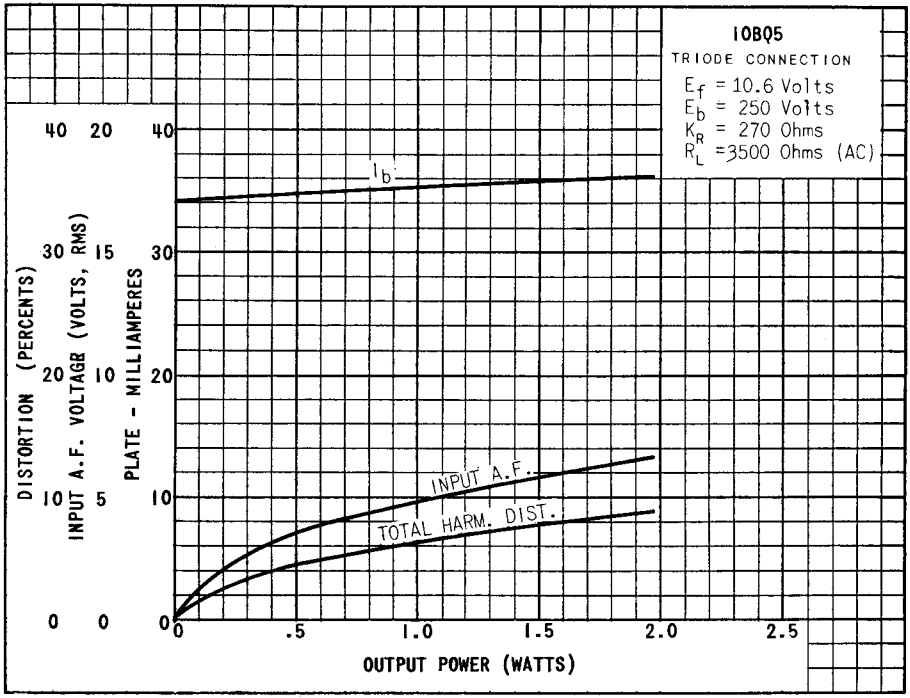

10BQ5
2 TUBES (CLASS B)
E_f = 10.6 Volts
E_b = 300 Volts
E_{c2} = 300 Volts
E_{c1} Bias = - 14.7 Volts
R_L = 8000 Ohms
PLATE TO PLATE
DISTORTION (PERCENTS)
INPUT A.F. VOLTAGE (VOLTS, RMS)
CURRENT - MILLIAMPERES
25
20
15
10
5
0
100
80
60
40
20
0
I_b
INPUT A.F.
TOTAL HARM. DIST
GRID #2
0
2.5
5.0
7.5
10.0
12.5
15.0
OUTPUT POWER (WATTS)


10BQ5
2 TUBES (CLASS AB)
E_f = 10.6 Volts
E_b = 250 Volts
E_{c2} = 250 Volts
K_R = 130 Ohms
R_L = 8000 Ohms
PLATE TO PLATE.
DISTORTION (PERCENTS)
INPUT A.F. VOLTAGE (VOLTS, RMS)
CURRENTS - MILLIAMPERES
20
15
10
5
0
80
60
40
20
0
I_b
INPUT A.F.
TOTAL HARM. DIST.
GRID #2
0
2.5
5.0
7.5
10.0
12.5
OUTPUT POWER (WATTS)





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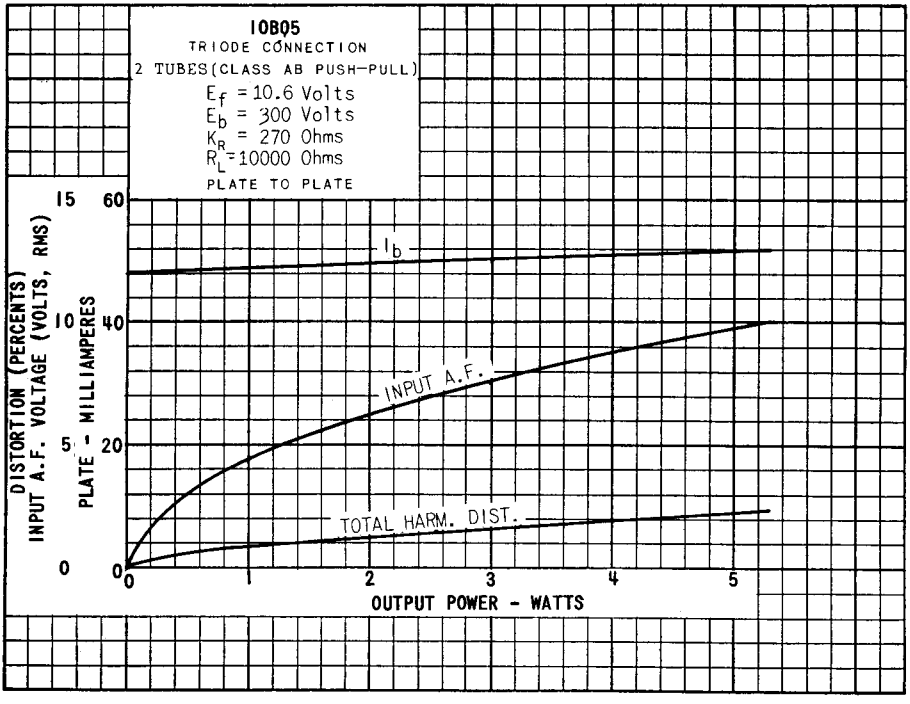
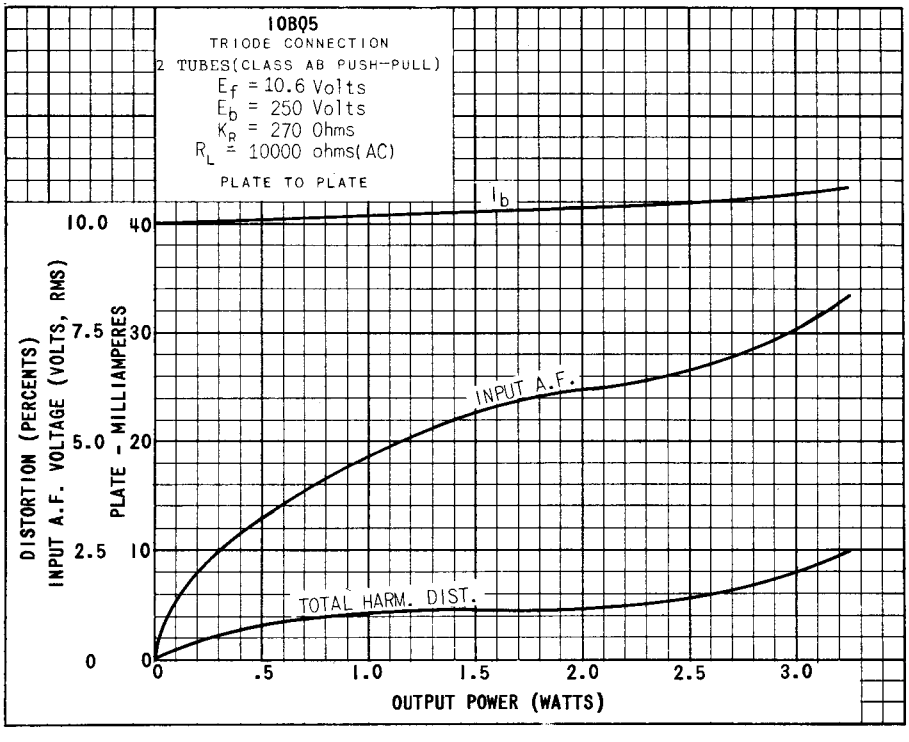

10BQ5
TRIODE CONNECTION
2 TUBES(CLASS AB PUSH-PULL)
E_f = 10.6 Volts
E_b = 300 Volts
K_R = 270 Ohms
R_L = 10000 Ohms
PLATE TO PLATE
I_b
INPUT A.F.
TOTAL HARM. DIST.
DISTORTION (PERCENTS)
INPUT A.F. VOLTAGE (VOLTS, RMS)
PLATE - MILLIAMPERES
OUTPUT POWER - WATTS
0
5
10
15
20
40
60
1
2
3
4


10BQ5
TRIODE CONNECTION
2 TUBES(CLASS AB PUSH-PULL)
E_f = 10.6 Volts
E_b = 250 Volts
K_R = 270 Ohms
R_L = 10000 ohms(AC)
PLATE TO PLATE
I_b
INPUT A.F.
TOTAL HARM. DIST.
DISTORTION (PERCENTS)
INPUT A.F. VOLTAGE (VOLTS, RMS)
PLATE - MILLIAMPERES
OUTPUT POWER (WATTS)
0
2.5
5.0
7.5
10.0
10
20
30
40
.5
1.0
1.5
2.0
2.5
3.0