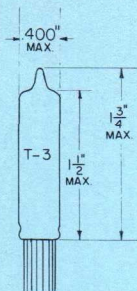


TUNG-SOL

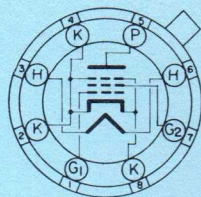
PENTODE
SUBMINIATURE TYPE

GLASS BULB

HEATER

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SUBMINIATURE BUTTON
0.017" TINNED FLEXIBLE LEADS
8 PIN BASE

8DL

THE 5902 IS A HEATER-CATHODE TYPE BEAM PENTODE OF SUBMINIATURE CONSTRUCTION SUITABLE FOR SERVICE WHERE SEVERE CONDITIONS OF MECHANICAL SHOCK OR VIBRATION ARE ENCOUNTERED. IT IS DESIGNED FOR AUDIO POWER AMPLIFIER SERVICE IN EQUIPMENTS WITH LOW PLATE SUPPLY VOLTAGES, AND IS CAPABLE OF APPROXIMATELY ONE WATT OUTPUT IN THE AUDIO RANGE. THE FLEXIBLE LEADS MAY BE SOLDERED OR WELDED DIRECTLY TO THE TERMINALS OF CIRCUIT COMPONENTS WITHOUT THE USE OF SOCKETS. STANDARD SUBMINIATURE SOCKETS MAY BE USED BY CUTTING THE LEADS TO A SUITABLE LENGTH.

RATINGS

MECHANICAL

MAXIMUM IMPACT ACCELERATION (SHOCK TEST-NOTE 3)	450	G
MAXIMUM UNIFORM ACCELERATION (CENTRIFUGE TEST-NOTE 4)	1000	G
MAXIMUM VIBRATIONAL ACCELERATION (96 HR. FATIGUE TEST-NOTE 5)	2.5	G
MAXIMUM BULB TEMPERATURE	220	°C

RATINGS

AND NORMAL OPERATION

MIL-E-1 SYMBOL	ABS. MIN.	NORM. TEST CONDIT - TIONS NOTE 7	NORMAL OPERATION NOTE 6	ABS. MAX.	MIL-E-1 UNITS
HEATER VOLTAGE (NOTE 8)	Ef: 6.0	6.3	6.3	6.6	VOLTS
PLATE VOLTAGE	Eb: ---	110	110	165	Vdc
GRID #1 VOLTAGE	Ec1: -55	0	0	0	Vdc
GRID #2 VOLTAGE	Ec2: ---	110	110	155	Vdc
PLATE DISSIPATION	Pp: ---	---	3.3	4.1	W
GRID #2 DISSIPATION	Pg2: ---	---	0.24	0.3	W
GRID #1 CIRCUIT RESISTANCE	Rg1: ---	---	---	0.55	MEG.
HEATER-CATHODE VOLTAGE	Ehk: -200	---	---	+200	VOLTS
CATHODE CURRENT	Ik: ---	---	---	50	mAde
CATHODE RESISTANCE	Rk: ---	270	270	---	OHMS
PLATE CURRENT (1):	Ib(1): ---	---	30	---	mAde
GRID #2 CURRENT	Ic2: ---	---	2.2	---	mAde
TRANSCONDUCTANCE (1)	Sm(1): ---	---	4200	---	μMHOS
PLATE RESISTANCE	rp: ---	---	0.015	---	MEG.

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TUNG-SOL

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CHARACTERISTICS AND QUALITY CONTROL TESTS¹

TEST	AQL %	MIL-E-1 SYMBOL	MIN	LAL	BOG	UAL	MAX	ALD	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TESTS PART 1	COMBINED AQL=1.0% EXCLUDING MECH. AND INOPERATIVES								
HEATER CURRENT:	0.65	If:	420	432	450	468	480	36	mA
HEATER-CATHODE LEAKAGE: E _{hk} =-100 Vdc E _{hk} =+100 Vdc	0.65	I _{hk} :	---	---	---	---	15	---	μAdc
GRID CURRENT:	0.65	I _c (1):	---	---	---	---	-1.0	---	μAdc
PLATE CURRENT (1):	0.65	I _b (1):	23.0	27.0	30.0	33.0	37.0	8.0	mAdc
PLATE CURRENT (2): E _{c1} =-40 Vdc	0.65	I _b (2):	---	---	---	---	100	---	μAdc
POWER OUTPUT (1): E _{sig} =6.4 Vac; R _p =3000 OHMS	0.65	P _o (1):	0.75	---	---	---	---	---	W
CONTINUITY AND SHORTS: (INOPERATIVES):	0.4	---	---	---	---	---	---	---	---
MECHANICAL: ENVELOPE (8-4)	---	---	---	---	---	---	---	---	---
MEASUREMENTS ACCEPTANCE TESTS PART 2									
INSULATION OF ELECTRODES: E _f =6.3 V E _{g1} -all=-100 Vdc E _p -all=-300 Vdc	2.5	R _{g1} -all:	50	---	---	---	---	---	MEG.
	2.5	R _p -all:	50	---	---	---	---	---	MEG.
SCREEN CURRENT:	2.5	I _{c2} :	0	---	2.2	---	4.0	---	mA
TRANSCONDUCTANCE (1):	2.5	S _m (1):	3500	3850	4200	4550	4900	950	μMHOS
GRID EMISSION: R _g =0.47 meg; R _k =220 OHMS; E _f =7.5 V; PREHEAT 5 MINUTES AT E _{c1} =0; TEST AT E _{c1} =-40 Vdc	2.5	I _c (2):	---	---	---	---	-2.0	---	μAdc
POWER OUTPUT (2): E _f =5.7 V; E _{sig} =6.4 Vac; R _p =3000 OHMS. (NOTE 9)	2.5	ΔE _f P _o (2):	---	---	---	---	15	---	PERCENT
AF NOISE: E _{sig} =150 mVac; E _{c2} = 110 Vdc; E _{c1} =-8.7 Vdc; R _{g1} =0.5 meg.; R _{g2} = 0.01 meg.; R _p =2000 OHMS; R _k =0; C _{g2} =4 μf	2.5	EB:	---	---	---	---	17	---	VU
PLATE RESISTANCE:	6.5	r _p :	0.01	---	---	---	---	---	MEG.
CAPACITANCE:		C _{gp} :	---	---	---	---	0.20	---	μf
CAPACITANCE: (NOTE 2)	6.5	C _{in} :	5.5	---	6.5	---	7.5	---	μf
CAPACITANCE:		C _{out} :	6.5	---	7.5	---	8.5	---	μf
LOW PRESSURE VOLTAGE BREAK DOWN: PRESSURE =55±5 mm Hg; VOLTAGE = 300 Vac	6.5	---	---	---	---	---	---	---	---

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TUNG-SOL

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CHARACTERISTICS AND QUALITY CONTROL TESTS¹ - cont'd.

TEST	AQL %	MIL-E-1 SYMBOL	MIN.	LAL	BOG	UAL	MAX	ALD	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TESTS									
PART 2 cont'd.									
COMBINED AQL = 1.0% EXCLUDING MECH. AND INOPERATIVES									
VIBRATION (1)									
NO VOLTAGES:									
f VARIABLE FROM 10-50									
cps; G max = 10; FIXED									
AMPLITUDE 0.040 INCH:									
POST SHOCK AND FATIGUE									
TEST END POINTS APPLY	---	---	---	---	---	---	---	---	---
VIBRATION (2):									
F = 40cps; G=15; Rp=									
2000 OHMS	2.5	Ep:	---	---	---	---	100	---	mVac
DEGRADATION RATE ACCEPTANCE TESTS									
SUBMINIATURE									
LEAK FATIGUE:	2.5	---	4.0	---	---	---	---	---	arcs
SHOCK:									
Ehk = ±100 Vdc; Rg=0.1									
MEG.; HAMMER ANGLE=									
30° (NOTE 3)									
	20	---	---	---	---	---	---	---	---
FATIGUE:									
96 HOURS; G=2.5;									
FIXED FREQUENCY;									
F = 25 min., 60 max.									
(NOTE 5)									
	6.5	---	---	---	---	---	---	---	---
POST SHOCK AND FATIGUE									
TEST END POINTS:									
VIBRATION (2):									
F = 40 cps; G = 15; Rp=									
2000 OHMS									
	---	Ep:	---	---	---	---	300	---	mVac
HEATER-CATHODE									
LEAKAGE: Ehk = ±100 Vdc									
Ehk = ± 100 Vdc									
	---	lhk:	---	---	---	---	20	---	PERCENT
CHANGE IN POWER OUT-									
PUT (1) OF INDIVIDUAL									
TUBES:									
	---	Δ _t Po(1):	---	---	---	---	40	---	μAdc
GLASS STRAIN (THERMAL SHOCK):									
	6.5	---	---	---	---	---	---	---	---
ACCEPTANCE LIFE TESTS									
HEATER CYCLING									
LIFE TEST:									
Ef = 7.0 V; Eb=Ec1=Ec2=									
0 V; 1 MIN ON, 4 MIN. OFF;									
Ehk = 140 Vac									
	2.5	---	2000	---	---	---	---	---	CYCLES
HEATER CYCLING LIFE									
TEST END POINTS:									
HEATER-CATHODE									
LEAKAGE: Ehk = ±100 Vdc									
Ehk = ±100 Vdc									
	---	lhk:	---	---	---	---	40	---	μAdc

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS AND QUALITY CONTROL TESTS¹ - cont'd.

TEST	ALLOWABLE DEFECTS PER CHARACTERISTIC		AQL %	MIL-E-1 SYMBOL	MIN.	MAX	MIL-E-1 UNITS
	1st SAMPLE	COMBINED SAMPLES					
ACCEPTANCE LIFE TESTS							
1 HOUR STABILITY LIFE							
TEST:							
TA = ROOM; Eb=Ec2=							
100 Vdc; Ehk=+200 Vdc;							
220 OHMS							

1 HOUR STABILITY LIFE							
TEST END POINTS:							
CHANGE IN POWER OUT-							
PUT (1) OF INDIVIDUAL							
TUBES:							
(TYPICAL SAMPLES							
SIZE = 50 TUBES)							
1.0							
$\Delta_t Po(1)$:							

10							
PERCENT							
100 HOUR SURVIVAL RATE							
LIFE TEST:							
TA= ROOM; Eb=Ec2=							
100 Vdc;Ehk=+200 Vdc;							
Rg= 0.47 MEG. Rk =220							
OHMS							

100 HOUR SURVIVAL RATE							
LIFE TEST END POINTS:							
(TYPICAL SAMPLE SIZE =							
200 TUBES)							

INOPERATIVES:							
0.65							

POWER OUTPUT (1):							
1.0							
Po(1):							
0.65							

W							
500 HOUR INTERMITTENT							
HIGH TEMPERATURE							
LIFE TEST:							
T BULB =220° C; Eb =Ec2 =							
100 Vdc; Ehk =+200 Vdc;							
Rg =0.47 MEG.; Rk =							
-220 OHMS							

500 HOUR INTERMITTENT							
HIGH TEMPERATURE							
LIFE TEST END POINTS:							
(TYPICAL SAMPLE SIZE=							
20 TUBES 1st SAMPLE;							
40 TUBES 2nd SAMPLE)							

INOPERATIVES:							
1							
3							

HEATER CURRENT:							
2							
5							

If:							
414							
492							
mA							
HEATER-CATHODE							
LEAKAGE: Ehk=100 Vdc;							
Ehk=±100 Vdc							
2							
5							

lhk:							

60							
μ Adc							
GRID CURRENT (1):							
1							
3							

lc(1):							

-2.0							
μ Adc							
POWER OUTPUT (1)							
CHANGE OF IN-							
DIVIDUAL TUBES							
FROM INITIAL:							
1							
3							

$\Delta_t Po(1)$:							

20							
PERCENT							
POWER OUT PUT (1)							

Ave. $\Delta_t Po(1)$:							

15							
PERCENT							
AVERAGE CHANGE:							
INSULATION OF ELECTRODES:							
g-all							
2							
5							
{							

Rg1-all:							
25							

MEG.							
p-all							

Rp-all:							
25							

MEG.							
POWER OUTPUT (2)							
(NOTE 9)							
2							
5							

$\Delta_{Ef} Po(2)$:							

15							
PERCENT							
TOTAL DEFECTIVES:							
4							
8							

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TUNG-SOL

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CHARACTERISTICS AND QUALITY CONTROL TESTS¹ cont'd.

TEST	ALLOWABLE DEF.		AQL %	MIL-E-1 SYMBOL	MIN.	MAX.	MIL-E-1 UNITS
	PER CHARACTERISTIC	1st SAMPLE					
ACCEPTANCE LIFE TESTS - cont'd.	COMBINED SAMPLES						
1000 HOUR HIGH TEMPERATURE INFORMATION							
LIFE TEST:							
T BULB=220°C; Eb=							
Ec2=100 Vdc; Ehk=+							
200 Vdc; Rg=0.47 MEG ;							
Rk =220 OHMS							
1000 HOUR HIGH TEMPERATURE INFORMATION							
LIFE TEST END POINTS:							
READ FOR SAME CHARACTERISTICS AS FOR 500							
HOUR INTERMITTENT							
HIGH TEMPERATURE LIFE							
TEST. LIMITS NOT							
ESTABLISHED.							

NOTE 1: CHARACTERISTICS, QUALITY CONTROL TEST PROCEDURES, AND INSPECTION LEVELS ARE MADE ACCORDING TO THE APPROPRIATE PARAGRAPHS OF MIL-E-1 "INSPECTION INSTRUCTIONS FOR ELECTRON TUBES," AND MIL-STD-105A.

NOTE 2: WITH A CYLINDRICAL SHIELD (0.405" I.D.-1 7/8" LONG) CONNECTED TO CATHODE LEADS.

NOTE 3: TEST CONDITIONS AND ACCEPTANCE CRITERIA PER SHOCK TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.

NOTE 4: CENTRIFUGE TEST WITH FORCES APPLIED IN ANY DIRECTION.

NOTE 5: TEST CONDITIONS AND ACCEPTANCE CRITERIA PER FATIGUE TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.

NOTE 6: THESE NORMAL VALUES REPRESENT CONDITIONS AT WHICH CONTROL OF RELIABILITY MAY BE EXPECTED.

NOTE 7: THESE NORMAL TEST CONDITIONS ARE USED FOR ALL CHARACTERISTIC TESTS UNLESS OTHERWISE STATED UNDER THE INDIVIDUAL TEST ITEM.

NOTE 8: FOR MOST APPLICATIONS THE PERFORMANCE WILL NOT BE ADVERSELY AFFECTED BY $\pm 5\%$ HEATER VOLTAGE VARIATION, BUT WHEN THE APPLICATION CAN PROVIDE A CLOSER CONTROL OF HEATER VOLTAGE, AN IMPROVEMENT IN RELIABILITY WILL BE REALIZED.

NOTE 9: CHANGE OF POWER OUTPUT FOR INDIVIDUAL TUBES FROM THAT VALUE MEASURED AT $E_f = 6.3$ V TO THAT VALUE MEASURED AT $E_f = 5.7$ V.

