INCH-POUND

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PERFORMANCE SPECIFICATION SHEET

ELECTRON TUBE, POWER
TYPE 8590

This specification is approved for use by the Department of the Air Force and is available for use by all Departments and Agencies of the Department of Defense.

The requirements for acquiring the electron tube described herein shall consist of this document and the latest issue of MIL-PRF-1.

DESCRIPTION: Tetrode, metal-ceramic
See figure 1.
Mounting position: Any.
Weight: 4 ounces nominal.

ABSOLUTE MAXIMUM RATINGS: F1 = 500 MHz.

Parameter:	Ef	Eb	eb	Ec1	Ec2	ec2	Ib	ib
Unit:	V 1/	V dc	v	V dc	V dc	v	mA dc	a 2/
Class C telegraphy:	6.0 ± 5%	2,500	---	-250	500	---	250	---
Grid pulsed,								
Class C rf amp:	6.0 ± 5%	5,500 10/	---	-250	---	1,000	---	6.0
Anode pulsed,								
Class C rf amp:	6.0 ± 5%	---	5,500	-250	---	1,000	---	6.0
Pulse mod or volt reg:	6.0 ± 5%	7,000	---	-400	750	---	---	6.0
Test conditions:	6.0	1,000	---	Adj	300	---	150	---

ABSOLUTE MAXIMUM RATINGS: F1 = 500 MHz.

Parameter:	tp	Du	Pg1	Pg2	Pp	T (anode core and seal)	tk	Cooling
Unit:	µs 2/	--- 2/	W	W	W	°C	sec (min)	--- 3/
Class C telegraphy:	---	---	2.0	12	250	250	30	---
Grid pulsed,								
Class C rf amp:	80	0.0016	2.0	12	250	250	30	---
Anode pulsed,								
Class C rf amp:	80	0.0016	2.0	12	250	250	30	---
Pulse mod or volt reg:	80	0.0016	2.0	12	250	250	30	---
Test conditions:	---	---	---	---	---	---	120	4/

See footnotes at end of table I.

GENERAL:

Qualification - Required.

TABLE I. Testing and inspection.

Inspection	Method	Conditions	Acceptance Level	Inspection level or code	Symbol	Limits		Unit
						Min	Max	
Conformance inspection, part 1								
Electrode voltage (grid)	1261		0.65	II	Ec1	-35.0	-48.0	V dc
Electrode current (screen)	1256		0.65	II	Ic2	-7.0	+3.0	mA dc
Total grid current	1266	Eb = 2,000 V dc; Ec1/Ib = 125 mA dc	0.65	II	Ic1	---	-15	µA dc
Primary grid emission (control)	1266	Ic1 = 70 mA dc; t = 15; anode and g2 floating	0.65	II	Isg1	---	-25	µA dc
Primary grid emission (screen)	1266	Ec1 = 0; t = 15; Ic2 = 100 mA dc; anode floating	0.65	II	Isg2	---	-250	µA dc
Current division (long pulse)	1372	Eb = Ec2 = 250 V dc; Ec1 = -100 V dc; prr = 11 ±1; tp = 4,500 µs (min); egk/ib = 1.0 a	0.65	II	egk ic1 ic2	5.0 --- ---	16.0 200 260	v mA mA
Conformance inspection, part 2								
Heater current	1301		---	---	If	2.3	3.0	A
Direct-interelectrode capacitance (grounded grid connection)	1331		--- --- ---	--- --- ---	Cpk Cin Cout	--- 12.0 3.9	0.01 16.0 4.35	pF pF pF

Power gain	---	F = 442 ± 5 MHz;
		ec2 = 1,000 v;
		Eb = 5,500 V dc;
		Ec1 = -100 to -200 V dc
		Du = 0.005;
		tp = 250 µs;
		prr = 20;
		pd = 1,000 w (max);
		ib = 3.5 a (max) 6/
			---	---	po	10.0	---	kw useful

See footnotes at end of table.

TABLE I. Testing and inspection - Continued.

Inspection	Method	Conditions	Acceptance Level	Inspection level or code	Symbol	Limits		Unit
						Min	Max	
Conformance inspection, part 3								
Life test	---	Group C; power gain except pd = 1,000 w t = 500 hours 7/	---	---	---	---	---	---
Life-test end points:	---		---	---	po	9.0	---	kw useful
Power gain	---		---	---	ib	---	3.5	a
Primary grid emission (control)	1266		---	---	Isg1	---	-100	µA dc
Primary grid emission (screen)	1266		---	---	Isg2	---	-250	µA dc
Coolant-pressure drop versus coolant flow (forced air)	1155	Eb = 1,000 V dc; Ec1 = 0; Ec2/Ib = 250 mA dc; airflow = 4.8 cfm (max) 8/ 9/	---	---	P T(anode) core	--- ---	0.35 250	In.H_20 °C
Low-frequency vibration	1031	No voltages 12/	---	---	---	---	---	---
Shock, specified pulse	1042	No voltages; 12/ accel = 15 G peak (min); D = 11 ± 2 ms half-sine wave	---	---	---	---	---	---
Shock and low-frequency vibration low points:	---							
Electrode voltage (grid)	1261		---	---	Ec1	-35.0	-48.0	V dc
Total grid current	1266		---	---	Ic1	---	-15	µA dc
Resonance	---	No voltages applied 5/ 8/	---	---	F	465	489	MHz

See footnotes at top of next page.

TABLE I. Testing and inspection - Continued.

1/ At frequencies above approximately 300 MHz under Class C telegraphy conditions, it may be necessary to reduce heater voltage to compensate for rf transmit-time heating of the cathode. This type of back-heating is a function of frequency, grid bias, anode current, duty cycle, and circuit design and adjustment. Heater voltage should be maintained within ± 5 percent when long life and consistent performance are factors, but in no case shall the heater be operated at less than 5.4 volts. The following heater operation voltages are for straight-through CW amplifier operation:

Frequency	Ef (V)
300 or lower	6.00
301 to 400	5.75
401 to 500	5.50

2/ Peak anode current (ib) may be considered as average during the pulse and shall be limited to 6.0 amperes. With a pulse length (tp) longer than 80 µs or a duty ratio (Du) higher than 0.0016, peak anode current shall be reduced in accordance with the data shown on figure 2.

3/ Forced-air cooling shall be provided for the base and anode. The maximum seal and anode core temperature rating should not be exceeded. At an anode dissipation of 250 watts and an incoming air temperature of 50°C maximum at sea level, a minimum airflow of 4.8 cfm shall pass through the anode cooler. With voltages applied to the tube, the static pressure drop across the anode cooler with an airflow of 4.8 cfm at 50°C at seal is approximately 0.25 inch of water. The pressure drop varies with the amount of escaping air, air temperature, and with the shape and construction of the air detector. The pressure drop in most equipments can be expected to be considerably higher than 0.25 inch of water because of temperature and system losses caused by associated hardware such as collets, cavity, etc. The stem shall be cooled by a portion of the anode air or by a separate air supply. Airflow should be applied before or simultaneously with electrode voltages (including the heater) and may be removed simultaneously with them. In cases where long life and consist performance are factors, cooling in excess of minimum requirements is normally beneficial.

4/ In all electrical tests involving applications of heater voltage, forced-air cooling of the tube shall be allowable at the rate of 4.8 cfm maximum, for the base and anode, at sea level. Cooling air shall not have a temperature less than 20°C.

5/ Test cavity in accordance with Drawing No. 2019229-0501 (The Bendix Corporation, Communications Division), or equivalent. With the tube inserted in the cavity, a rf signal from a standard signal generator is coupled into the cavity by means of a small loop. Signal is extracted from the cavity by means of another small loop, detected, and displayed on an HP-415-B, or equivalent, standing-wave ratio indicator. The signal generator frequency is adjusted for maximum output after detection. The frequency is then measured by means of a good quality wavemeter, such as the PRD Electronics Inc., Model 1587A, or equivalent.

6/ Test cavity in accordance with Drawing No. 2059524-0501 or No. 2019230-0501 (The Bendix Corporation, Communications Division), or equivalent. Cooling air need not be restricted to 4.8 cfm during this test because of system losses. Cavity tuned so as to have a 3 dB bandwidth of 25 MHz centered at 442 MHz.

7/ When used in the AN/FPS-85, this tube shall have a 4,000-hour service-life guarantee. The life of the tube shall be considered terminated when one of the following conditions exist:

(a) There is an accumulation of 10-anode arcs.

(b) The power output has dropped to the 3 dB level.

8/ This test shall be performed during the initial production and once each succeeding 12-calendar months in which there is production. A regular double sampling plan shall be used, with the first sample of three tubes with an acceptance number of zero, and a second sample of three tubes with a combined acceptance number of one. In the event of failure, the test shall be made as a part of Conformance Inspection, part 2, Code level D, with a acceptance level of of 6.5. The regular “12-calendar months” double sampling plan shall be reinstated after three consecutive samples have been accepted.

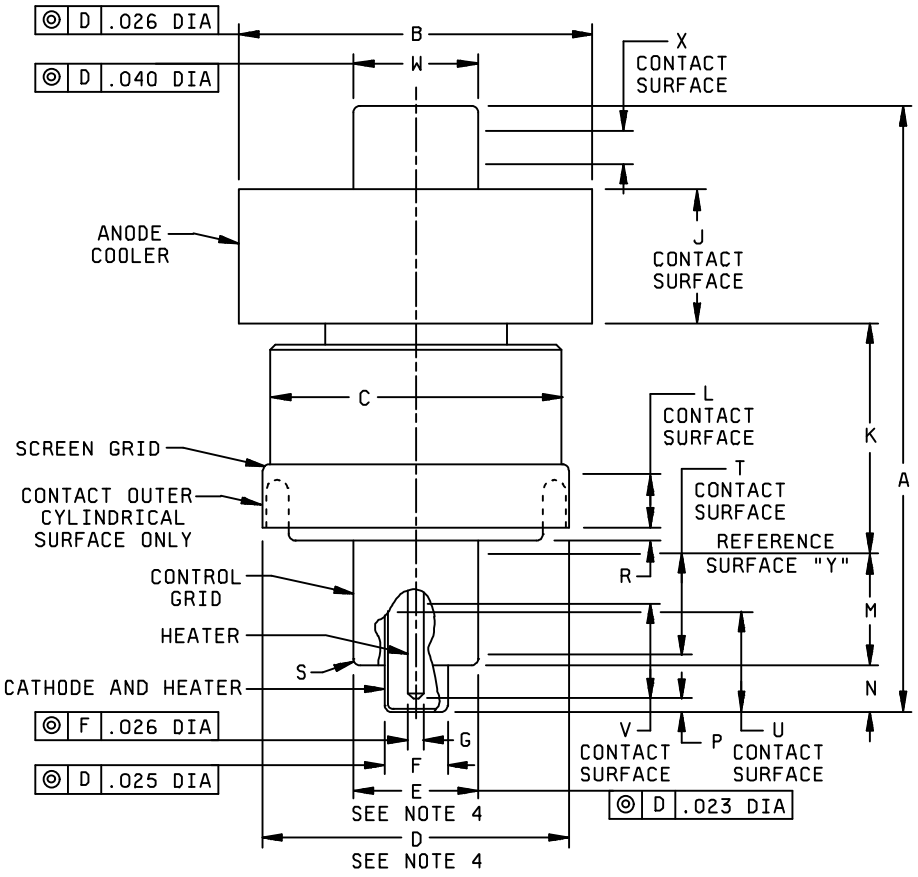
TABLE I. Testing and inspection - Continued.

9/ Pressure drop shall be measured across the anode cooler only, with the tube operating. Anode core temperature shall be measured with the tube operating, with an ambient air temperature of 25°C, with both base and anode cooled by applying an airflow of 4.8 cfm maximum at sea level. Temperature shall be measured by means of a thermocouple attached to the top of the anode core, adjacent to the cooler, by any suitable means. Good electrical continuity between the thermocouple and the metal area in proximity shall be demonstrated before the cooling test is performed.

10/ Eb of 6,300 V dc (maximum) is permissible under zero drive conditions.

11/ Reclaimed materials shall be utilized to the maximum extent possible.

12/ Test to be performed every three months, utilizing an accept on zero sampling plan.



Inches	mm
.023	0.58
.025	0.64
.026	0.66
.040	1.02

NOTES:

1. The eccentricity values shown shall be considered as maximum values, and shall be checked on a Conformance Inspection, part 3 (basis), with the provisions of note 5 applicable.

2. The tube shall be rotated on diameter D when eccentricity is being measured.

3. Surface Y shall be perpendicular to the measuring platform when eccentricity is being measured.

4. Average diameter of E shall be as noted, and may be out of round a total of .006 inch (0.15 mm). Average diameter of F shall be as noted, and may be out of round .006 inch (0.15 mm).

5. Dimensions listed under Conformance Inspection, part 3, shall be checked twice yearly, using a sample of 10 tubes with 1 failure allowed. In case of a sample failure, the failing dimension(s) shall become Conformance Inspection, part 2, acceptance level of 6.5, Inspection Level S3, for three consecutive successful submissions, at which time the test may revert to the periodic-check test basis.

FIGURE 1. Outline drawing of electron tube type 8590.

Ltr	Dimensions			
	Millimeters		Inches	
	Min	Max	Min	Max
Conformance inspection, part 2				
A	---	2.813	---	71.45
D	1.415	1.435	35.94	36.45
Conformance inspection, part 3 (periodic check) (see note 5)				
B	1.615	1.640	41.02	41.66
C	---	1.406	---	35.71
E	.588	.597	14.94	15.16
F	.318	.325	8.08	8.26
G	.091	.095	2.31	2.41
J	.585	.665	14.86	16.89
K	.900	.950	22.86	24.13
L	.187	---	4.75	---
M	.520	.560	13.21	14.22
N	.235	.265	5.97	6.73
P	.032	.082	0.81	2.08
R	---	.040	---	1.01
S	---	.171 RAD	---	4.35 RAD
T	.388	---	9.86	---
U	.406	---	10.31	---
V	.468	---	11.89	---
W	.559	.573	14.20	14.55
X	.240	---	6.10	---

FIGURE 1. Outline drawing of electron tube type 8590 - Continued.

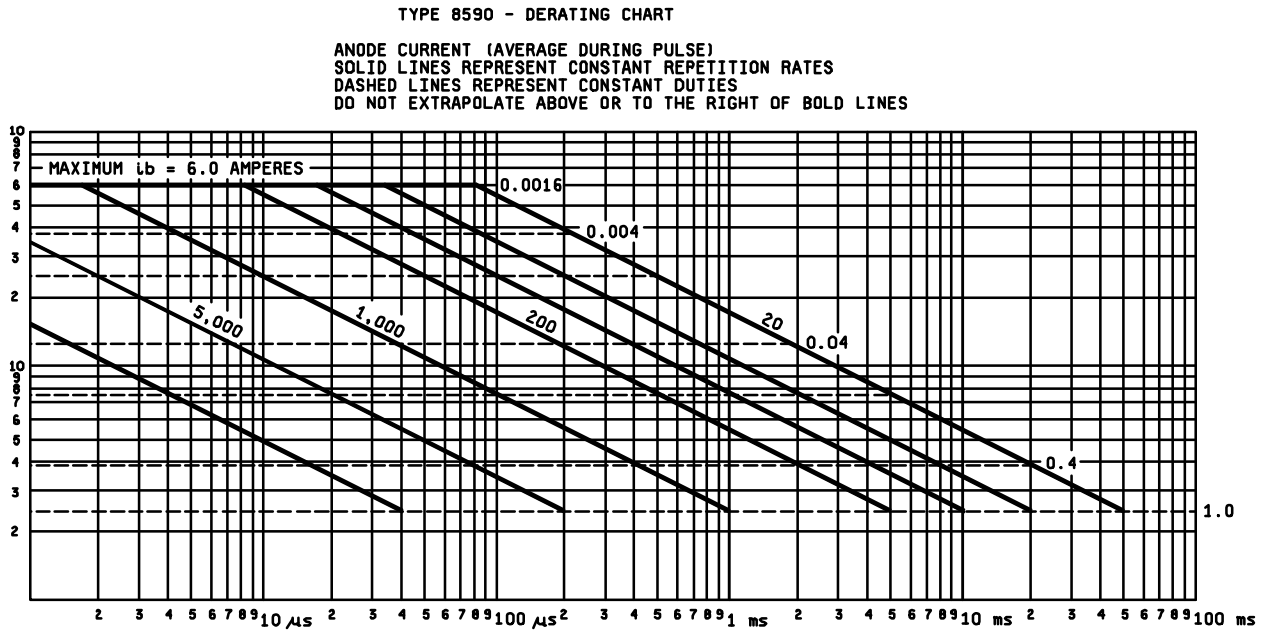


FIGURE 4. Derating chart.

Custodians:
Air Force - 85

Preparing activity:
DLA - CC

(Project 5960- F238)

Review activities:
Air Force - 11, 99