INCH-POUND

MIL-PRF-1/1388G
11 September 2013
SUPERSEDING
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15 August 2012

PERFORMANCE SPECIFICATION SHEET

ELECTRON TUBE, RADIATION COUNTER
TYPE 7840

This specification is approved 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: Thin end mica window, self-quenched counter tube for detection of low intensity beta radiation.

See figure 1.

Mounting position: Any.

Weight: 7 ounces (198.5 grams) nominal.

ABSOLUTE RATINGS:

Parameter:	Ebb	TA	Rp	Mica window thickness
Unit:	V dc	°C	MegΩ	mg/cm^2
Maximum:	1,600	40	---	2.2
Minimum:	1,300	0	1	1.8
Test conditions:	1,400	---	1	---

See footnotes at end of table I.

GENERAL:

Qualification - Required.

Holding period (MIL-STD-1311) - 60 days.

Window test - 13/

Shelf life - Required (see conformance inspection, part 1).

Acceptance test - Required. 15/

Service-life guarantee (MIL-PRF-1) - With qualifying activity approval manufacturer may provide service-life guarantee, in lieu of life test. Guaranteed tube operating time shall be 250 hours minimum.

Marking - Tubes sold under service-life guarantee shall be marked with contract number and with the number of tube operating hours (250 hrs min) guaranteed.

This specification sheet uses accept on zero defect sampling in accordance with MIL-PRF-1, table III.

TABLE I. Testing and inspection.

Inspection	Method MIL-STD-1311	Notes	Conditions	Symbol	Limits Min	Limits Max	Unit
Conformance inspection, part 1							
Background, contamination and photosensitivity	6201	2/ 6/ 12/ 17/	t = 4 minutes (min)	N/t	---	20	Npm
Starting voltage	6211	5/ 12/ 18/ 19/	Pulse amplitude = 0.50 V; Nps = 100 (min); R2 = 1 MegΩ ± 10%; R1 = C1 = C2 = 0; C3 = 0.01 μF ± 10%	Es	---	1,250	V dc
End-of-plateau voltage	6216	---	Ps = 3%/100 V dc	Ee	1,650	---	V dc
Relative plateau slope	6216	15/	Voltage range = 1,300 to 1,600 V dc	Ps	---	3	%/100 V dc
Background, contamination and photosensitivity	6201	2/ 6/ 12/ 17/	t = 4 minutes (min)	N/t	---	20	Npm
Response count rate and current (beta)	6221	3/ 6/ 12/	Ebb = 1,400 V dc; counting time = 2 minutes (min)	N/t	3/	---	Npm
Shelf life	---	14/		---	---	---	---
Conformance inspection, part 2							
Leakage current	6205	---	Ebb = 700	Lib	---	0.5	μA dc
Shock	1041	1/ 11/ 20/	450 G	---	---	---	---
Response count rate and current (hysteresis (1a))	6221	6/ 7/ 8/	Ebb = 1,400 V dc; t = 2 minutes (min); record count rate values	---	---	---	---
Response count rate and current (hysteresis (1b))	6221	6/ 8/	Ebb = 1,400 V dc; t = 15 minutes (min)	---	---	---	---
Response count rate and current (hysteresis (1c))	6221	6/ 8/	Ebb = 1,400 V dc; t = 2 minutes (min); from reading taken from count rate (1a)	N/t	---	±20	%
Response count rate and current (gamma)	6221	6/ 9/ 12/	Ebb = 1,400 V dc; counting time = 2 minutes (min)	N/t	---	110	Npm

See footnotes at end of table.

TABLE I. Testing and inspection - Continued.

Inspection	Method MIL-STD-1311	Notes	Conditions	Symbol	Limits		Unit
					Min	Max	
Conformance inspection, part 3							
Life test	---		Group D; Ebb = 1,400 V dc; N/t = 1,000 Npm; t = 250 hours	---	---	---	---
Life-test end points:	---						
Response count rate and current (beta)	6221	---		N/t	---	±10	%
Response count rate and current (gamma)	6221	---		N/t	---	±10	%
Variable-frequency vibration	1031	1/ 10/ 20/	Ebb = 0	---	---	---	---
Temperature range, operating	1026	4/		N/t	---	±20	%
Packaging	---	16/		---	---	---	---

1/ Criterion for passing this test shall be compliance after test of at least 80 percent of the tubes with the requirements for the following:

(a) Starting voltage.

(b) End-of-plateau voltage.

(c) Relative plateau slope.

(d) Response count rate and current (beta).

(e) Response count rate and current (gamma).

2/ The tube shall be exposed to radiation from a General Electric 4-watt germicidal lamp, Type G-4T4/1, or equivalent, with relative positions as shown on figure 2.

3/ The counting rate shall not vary by more than ±0.10 N/t from the value (approximately 10,000 counts per minute (cpm)) marked on the Standard Beta Reference Source (SBRS). The SBRS shall be mounted in recess of the sample positioning shelf specified with the SBRS. The proper position of this shelf for this test is specified with the SBRS.

4/ With the tube in a field giving 10,000 ± 100 Npm at 1,400 V dc, tube response (count rate) shall be determined at 1,300, 1,400, and 1,600 V dc at each of the following temperatures and in the order shown.

(a) Room temperature.

(b) 5°C.

(c) Room temperature.

(d) 40°C.

(e) Room temperature.

TABLE I. Testing and inspection - Continued.

5/ After the holding period, starting voltage shall not vary by more than ± 7 volts.

6/ The tube shall be mounted vertically in the lead shield (see figure 3) of the excitation unit.

7/ The tube shall have been inoperative for a 24-hour period prior to test.

8/ Beta reference source shall be in position as specified in 3/.

9/ Test shall be performed with the assembly shown on figure 3 in a 1.4 mr/hr Cobalt-60 radiation field (calculated).

10/ The tube shall be tested only with its longitudinal axis vertical and parallel to the direction of motion. The tube shall be mounted by means of a rigid clamp at the base of the tube.

11/ The tube shall be tested only with its longitudinal axis horizontal and parallel to the direction of motion of the hammer. The tube shall be mounted by means of a rigid clamp at the base of the tube.

12/ This test shall be performed at the conclusion of the holding period.

13/ All tube windows shall be tested to assure that they can withstand an internal pressure of half of an atmosphere less than ambient pressure.

14/ The shelf life requirements shall be as follows:

(a) Tubes tested and acquired in accordance with this document shall be capable of a shelf life for a period of 18 months after the date of shipment from the manufacturer's plant. At any time during this shelf life period the tubes shall be capable of meeting all requirements of conformance inspection, part 1, as specified herein. Tubes found to be defective within the shelf life period shall be replaced by the manufacturer at no cost to the Government.

(b) A shelf life of 90 days with the conformance inspection, part 1, starting voltage test shall be instituted during continuous production, but shipments of that month's production shall not be held pending completion of the test. Tubes shall be considered to conform to this document when three of the four tubes for each of the first 3 month's production and 75 percent of the cumulative quantity pass the test. If either of the above conditions are not satisfied, shipments shall be halted until three or four tubes of current production conform to the starting voltage test.

15/ The relative plateau slope requirements shall be with the discrimination level of the scaler set at 0.25 V ± 10 percent for standard Geiger-Mueller counter tube operation, and accomplished in accordance with the following steps:

(a) With the equipment in operation and prepared for counting, set the high voltage adjust control to obtain 1,400 V dc.

(b) Mount standard reference source SBRS on the sample positioning shelf, place the shelf in position 1 of the tube, mount assembly and count for 5 minutes at 1,400 V dc. A new Geiger-Mueller counter tube (one that has not been used for a month or more) should be counted for 15 minutes rather than 5 minutes. It is not necessary to record the count rate obtained in this step.

(c) If the background is unknown, remove SBRS and obtain and record a 20 minute background count rate (cpm).

(d) Place SBRS on the sample positioning shelf; place shelf in position 1 of the tube mount assembly.

CAUTION

If at any time while performing steps 16e through 16g it becomes apparent that the tube under test is in continuous discharge (rapidly increasing count rate for a constant value of applied voltage), immediately set high voltage adjust control to 1,200 V dc. Determine if tube damage has occurred by raising the voltage in 50 V dc increments every 5 minutes. Do not exceed a high voltage setting of 1,500 V dc at any time. Otherwise continuous discharge will damage the tube. If continuous discharge occurs, again, replace tube.

TABLE I. Testing and inspection - Continued.

(e) Count SBRS for 100,000 counts minimum in the same position at 1,300 V dc and determine and record count rate in counts per minute (cpm). Count rate N1 equals total count divided by counting time in minutes minus background.

(f) Count SBRS for 33,333 counts minimum in the same position at 1,400 V dc and determine and record count rate in counts per minute. Count rate N2 equals total count divided by counting time in minutes minus background.

(g) Count SBRS for 100,000 counts minimum in the same position at 1,500 V dc and determine and record count rate in counts per minute. Count rate N3 equals total count divided by counting time in minutes minus background.

(h) Determine plateau slope in percent as follows: Percent per 100 V dc slope equals 100 times (N3 minus N1) divided by the quantity (N3 plus N1). This result shall be less than or equal to ± 3 percent per 100 V dc.

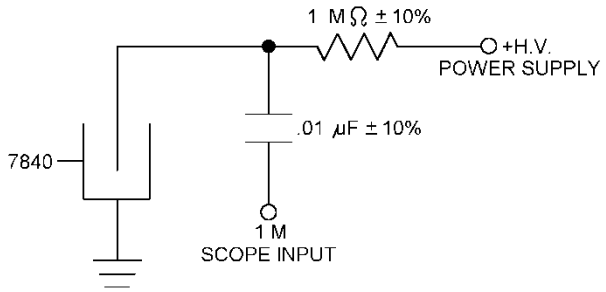
(i) The measured count rate N2 shall be within ± 10 percent of the quantity, (N1 plus N3) divided by 2.

16/ Each tube shall be packaged in a container capable of withstanding pressures in the range of 87.3 to .760 mmHg.

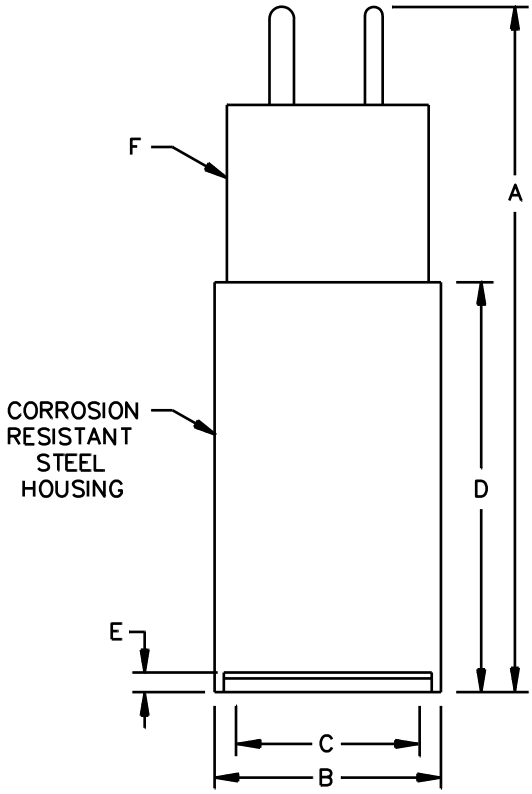
17/ Spurious pulses of amplitude greater than four volts shall not occur after four minutes of operation.

18/ A new Geiger-Mueller tube (one that has not been used for a month or more) should be counted at 1,400 V with standard reference source SBRS on shelf in position 1 of the tube-mount assembly for 15 minutes before starting voltage is measured.

19/ Starting voltage test circuit:



20/ The manufacturer, with the approval of the qualifying activity, may perform this test on a periodic basis, versus performing the test on every lot. Approval will be based on demonstrating to the qualifying activity the capability of the design to meet this requirement. If the design, material construction or processing of the tube is changed or if there are any quality problems, the qualifying activity may require resumption of the original testing frequency. This allowance does not relieve the manufacturer from meeting the test requirements in case of dispute.



PIN CONNECTIONS	
PIN NO.	ELEMENT
1	nc
2	a
3	nc
4	k

Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
Conformance inspection, part 2				
A	---	4.50	---	114.3
B	1.367	1.385	34.72	35.18
D	2.610	2.640	66.29	67.06
Conformance inspection, part 3 (see note)				
F	Base: A4-9 (EIA)			
Reference dimensions				
C	1.125		28.58	
E	.031		0.79	

NOTE: Reference dimension C is the effective mica window diameter.

FIGURE 1. Outline drawing of electron tube types 7840.

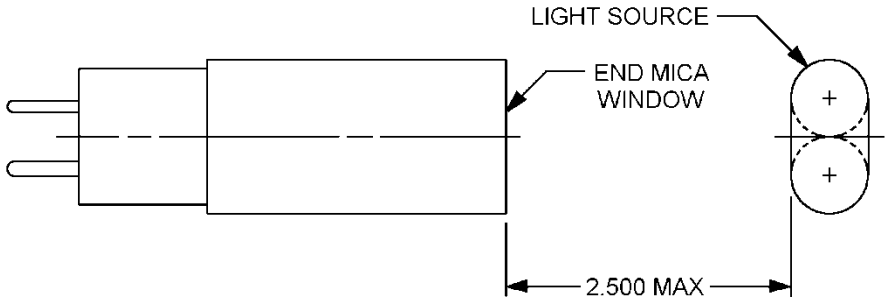


FIGURE 2. Position of tube for photosensitivity test

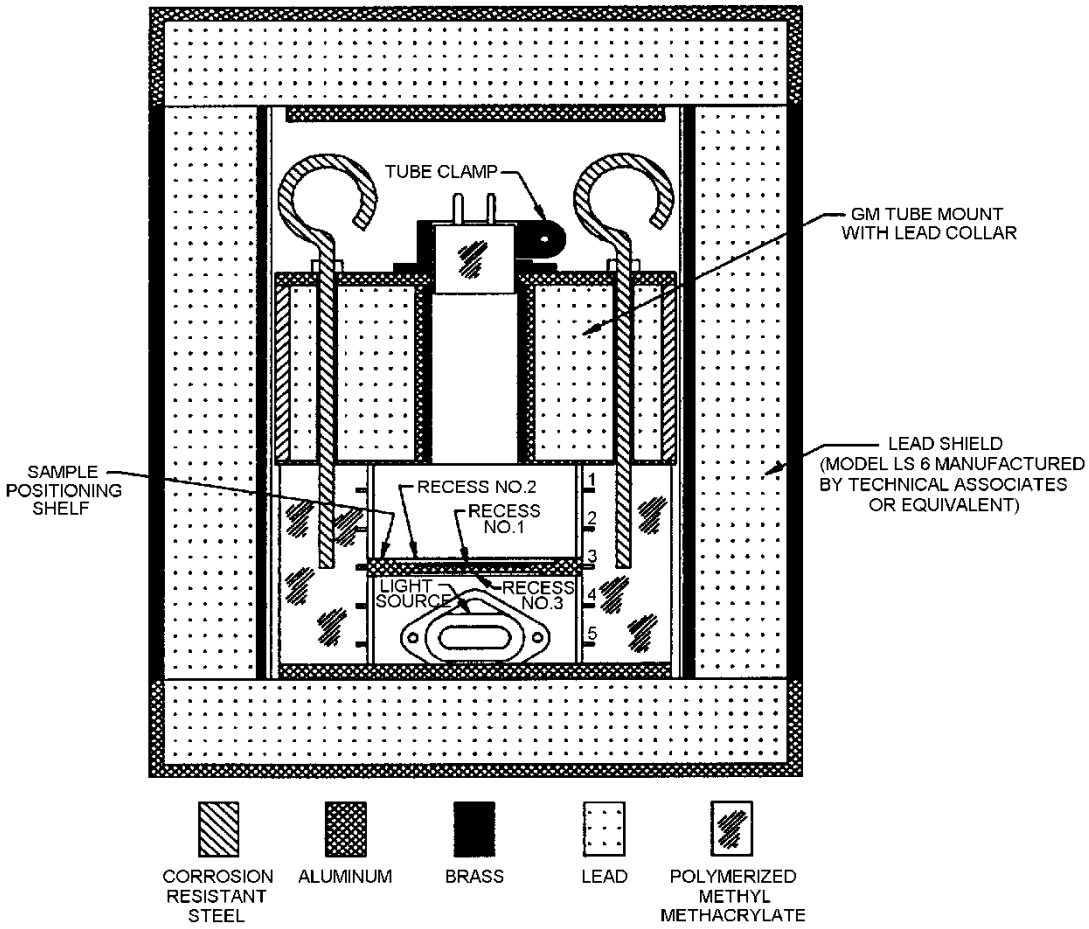


FIGURE 3. Tube position and shielding for response tests.

Referenced documents. In addition to MIL-PRF-1, this specification sheet references MIL-STD-1311.

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