

INCH-POUND

MIL-PRF-1/986J
7 May 2004
SUPERSEDING
MIL-PRF-1/986H
16 December 2002

PERFORMANCE SPECIFICATION SHEET
ELECTRON TUBE, RADIATION COUNTER
TYPE 7616

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

Requirements for acquiring the electron tube described herein shall consist of this document and MIL-PRF-1.

DESCRIPTION: Low sensitivity, self-quenching for detection of beta and gamma radiation.

Dimensions: See figure 1.

Mounting position: Any.

Weight: 0.4 ounces (11.34 grams) nominal.

ABSOLUTE RATINGS:

Parameter:	Rp	TA	Barometric pressure, reduced
Unit:	Meg	°C	mm Hg
Maximum:	---	+55	87
Minimum:	---	-20	---
Test conditions:	1.0	---	---

See footnotes at end of table I.

GENERAL:

Qualification - Required.

Holding period - 3/

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. Tubes sold under service-life guarantee shall be marked with contract number and with the number of operating hours (250 hrs minimum) guaranteed. 16/

Comments, suggestions or questions on this document should be addressed to Defense Supply Center Columbus, ATTN: DSCC-VAT, P.O. Box 3990, Columbus, OH 43216-5000 or e-mailed to TubesFiberOptic@dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at www.dodssp.daps.mil.

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TABLE I. Testing and inspection.

Inspection	MIL-STD-1311 Method	Notes	Conditions	Acceptance level	Symbol	Limits		Unit
						Min	Max	
<u>Conformance inspection, part 1</u>				14/				
Background, contamination, and photosensitivity	6201	1/	t = 2 minutes (min)	0.65	N/t	---	10	Npm
Starting voltage	6211	2/	Nps = 20 nominal; R1 = C1 = C2 = 0; R2 = 1 Meg \pm 10%; C3 = 0.01 μ F \pm 10%	0.65	Es	710	---	V dc
Response count rate and current	6221	4/	50 r/hr	0.65	N/t	190	230	Nps
Response count rate (beta)	6221	5/ 6/		0.65	---	---	---	---
<u>Conformance inspection, part 2</u>								
Pulse amplitude	6226	8/	Nps = 20 nominal; R1 = 0.1 Meg \pm 10%; C1 = 0.01 μ F \pm 10%		Ebb	---	760	V dc
<u>Conformance inspection, part 3</u>								
Life test	---	9/, 16/	Group C; counting rate = 1,000 \pm 50 Nps; Ebb = 680 V dc; t = 250 hours		---	---	---	---
Life-test end point	---	10/, 16/			---	---	---	---
Variable-frequency vibration	1031	7/ 11/ 15/			---	---	---	---
Leakage current	6205	13/	Ebb = 500 V dc; relative humidity 90 \pm 5 percent		Lib	---	0.5	μ A dc
Temperature	---	12/ 13/	T = +50°C, -20°C		---	---	---	---
Shock	1041	7/ 15/	Hammer angle = 40°		---	---	---	---

See footnotes at top of next page.

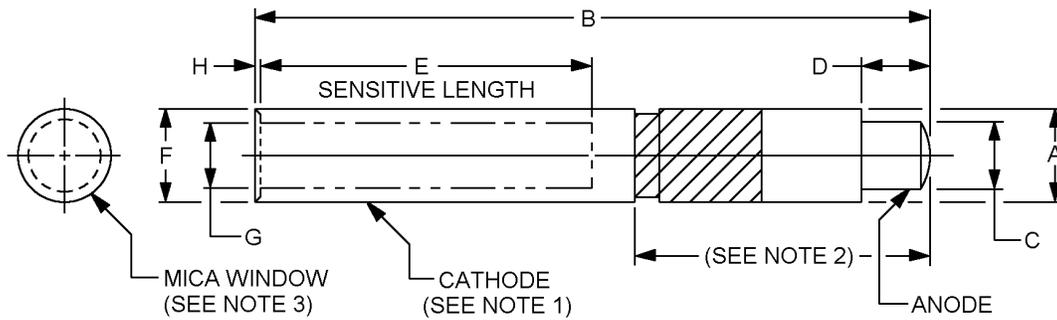
TABLE I. Testing and inspection - Continued.

- 1/ The tube response (count rate) due to the combined effects of background, contamination, and photosensitivity determined as specified herein, shall be not more than the limit specified herein. The tube may be shielded from extraneous radiation fields by lead and aluminum interposed between it and the tube. The lead shall have a maximum thickness of 2.00 inches (50.8 mm), the aluminum shall have a maximum thickness of .125 inch (3.18 mm). In determining tube response (count rate), Ebb = 750 volts and $R_p = 1$ Meg. The count rates shall be determined using a scaler having a resolving time of 5 microseconds and a discrimination level of 0.25 volt.
- 2/ Apply approximately 800 volts anode voltage. Decrease this voltage until the largest visible pulses are 2 volts \pm 20 percent. This voltage shall be considered the starting voltage.
- 3/ All tubes shall pass this test. Testing shall be performed 30 or more days after previous production tests on the same tubes. A tube that fails this test may be retested after an additional 30 or more days with the provision that the value of Ebb for anode voltage for pulse amplitude test does not change by more than \pm 5 volts from the value at the beginning of the last 30-day period, and that the tubes conform to the initial limits for starting voltage and background, contamination, and photosensitivity.
- 4/ Test shall be made using Government approved standard test unit. The source of radiation shall be Cesium 137. (Preliminary calibration of unit shall be as directed on operating instructions.) The external connections shall be as follows:
 - a. Counting circuit shall have a discrimination of +3 volts.
 - b. DC high voltage input shall be 680 ± 0.5 volts.
 - c. Trigger input shall be $1,000 \pm 10$ prr.
- 5/ Test shall be made with calibrated beta source. Ebb shall be anode voltage \pm 5 volts for 50-volt pulse as determined in the pulse amplitude test. The count rate shall be determined by using a scaler having a resolving time of 5 microseconds, and a discrimination level of 0.25 volt.
- 6/ The counting rate shall not vary by more than ± 0.3 N/t from the value of N/t of the calibrated beta source furnished.
- 7/ 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. Pulse amplitude.
 - c. Response count rate (beta).
- 8/ Test shall be conducted in the circuit as shown on figure 2 (in lieu of figure 6211-1). The procedure shall be as follows:

Apply 950 volts anode voltage. Observe the pulse pattern to determine if the tube goes into glow discharge. If the tube goes into a glow discharge, it shall be considered as a defective tube. If no glow discharge occurs, decrease this voltage until the largest visible pulses are 50 ± 2 volts. This voltage shall be considered anode voltage for a 50 volt pulse.

TABLE I. Testing and inspection - Continued.

- 9/ The tube shall be placed in a radiation field that will produce a counting rate of $1,000 \pm 50$ Nps when it is activated with a voltage pulse that has a maximum width of 50 μ s, a nominal height of 150 volts and a prr of $1,400 \pm 200$.
- 10/ The limits of acceptability shall be as follows:
- Background, contamination, and photosensitivity: Initial limits specified herein.
 - Starting voltage: 695 volts minimum.
 - Anode voltage for 50 volt pulse: Initial value -15, +5 volts.
- 11/ The tube shall be mounted with its longitudinal axis horizontal and perpendicular to the direction of motion by means of a rigid clamp at the center of the cathode. The time for gradually covering the frequency range shall be 15 minutes.
- 12/ The functional requirements of the tube over the stipulated range of temperature conditions shall be as follows:
- Background, contamination, and photosensitivity: Initial limits specified herein.
 - Starting voltage: Initial limits specified herein.
 - Pulse amplitude: Initial value ± 6 volts at $+50^{\circ}\text{C}$, ± 12 volts at -20°C .
- 13/ This test shall be performed during the initial production and once each succeeding 12-calendar months in which there is production. A sampling plan shall be used, with six tubes with an acceptance number of zero defects. In the event of failure, the test will be made as a part of conformance inspection, part 2 with an acceptance level of 6.5. The regular "12-calendar month" sampling plan shall be reinstated after three consecutive samples have been accepted.
- 14/ This specification sheet utilizes an accept on zero defects sampling plan in accordance with MIL-PRF-1, table III.
- 15/ 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.
- 16/ With qualifying activity approval the manufacturer may provide, in accordance with MIL-PRF-1, service-life guarantee, in lieu of performing life testing. Life test endpoints specified shall apply to service-life guarantee conformance as well as to life test conformance. The number of hours of system-deployed, accumulated tube-operating time shall be approved by the qualifying activity and shall be a minimum of 250 hours. Service-life guarantee shall define tube operating life and not time from purchase or delivery. Tubes sold under service-life guarantee shall be marked with contract number and with the number of tube operating hours guaranteed.



Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
Conformance inspection, part 1				
A	.328	.359	8.33	9.12
B	2.469	2.531	62.71	64.29
C	.245	.255	6.22	6.48
E	---	1.250	---	31.75
F	.339	.349	8.61	8.86
G	.248	.252	6.30	6.40
H	---	.020	---	0.51
Reference dimension				
D	.250		6.35	

NOTES:

1. Cathode material: Allegheny Ludlum Sealmet 1 steel for glass to metal seals, or equal.
2. Mechanical configuration and materials used may vary, provided all other specified dimensions are met.
3. Mica window: 3 to 4 mg/cm².

FIGURE 1. Outline drawing of electron tube types 7616.

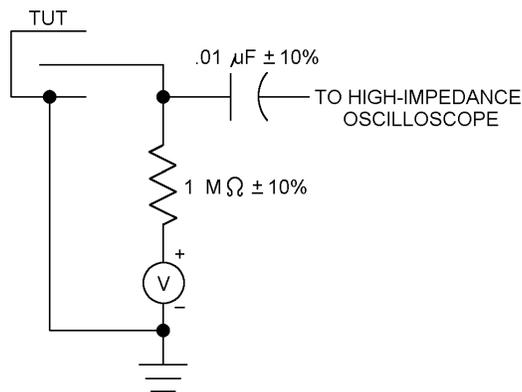


FIGURE 2. Circuit for measuring starting voltage and 50 volt pulse height.

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NOTES:

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

Changes from previous issue. The margins of this specification sheet are marked with vertical lines to indicate where changes from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

Custodians:

Army - CR
Navy - EC
Air Force - 11
DLA - CC

Preparing activity:

DLA - CC

(Project 5960-3707)

Review activities:

Army - AR, CR4
Navy - AS, MC, OS

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