

INCH-POUND

MIL-PRF-1/943D  
23 July 1999  
SUPERSEDING  
MIL-E-1/943C  
12 November 1971

PERFORMANCE SPECIFICATION SHEET

ELECTRON TUBE, PHOTOMULTIPLIER  
TYPE 5819

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: 10-stage, head-on, S11 spectral response.

DIMENSIONS AND PIN CONNECTIONS: See figure 1.

ABSOLUTE RATINGS:

Parameter:	Ebb	Eb-Edy10	Light source	Light	Ib	TA	Rp	Cathode area	Alt
Unit:	V dc	V dc	---	μm	mA dc	°C	Ohms	Lighted sq. in.	ft
Maximum:	1,250 18/	250 1/ 18/	---	---	0.75 2/	75	3/	---	40,000
Test conditions:	1,000 4/	4/	LS1	10 <sup>-5</sup>	---	---	10,000	0.12	---

See footnotes at end of table I.

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GENERAL:

Qualification: Required.

Holding period (MIL-STD-1311): 336 hours.

## MIL-PRF-1/943D

TABLE I. Testing and inspection.

Inspection	Method	Notes	Conditions	Acceptance level	Inspection level or code	Symbol	Limits		Unit
							Min	Max	
<u>Qualification inspection</u>									
Low-pressure breakdown	---	<u>4/ 17/ 19/ 20/</u>	Ebb = 1,250 V dc; Eb to Edy10 = <u>18/</u> ; Rp = 1 Meg; t = 120	---	---	---	---	---	---
Direct-interelectrode capacitance (1)	1331	<u>13/</u>		---	---	C	2.7	5.7	pF
Direct interelectrode capacitance (2)	1331	<u>14/</u>		---	---	C	5.0	8.0	pF
Spectral response identification	5303	---	S11	---	---	---	---	---	---
Base material insulating quality	1216	---		---	---	---	---	---	---
<u>Conformance inspection, part 1</u>									
Cathode current	---	<u>6/ 7/</u>	Light = 0.01 $\ell$ m	---	---	Ik	0.40	---	$\mu$ A dc
Dark current (1)	5301	<u>8/</u>		---	---	Llb	---	0.04	$\mu$ A dc
Anode current	5301	<u>6/</u>	Rp = 10 K	---	---	lb	100	---	$\mu$ A dc
Dark current (2)	5301	<u>10/</u>	Light = 0	---	---	Llb	---	5.0	$\mu$ A dc
Blue sensitivity	---	<u>6/ 7/ 11/</u>		---	---	Ik	0.040	---	$\mu$ A dc
Signal-to-noise ratio	5306	<u>12/</u>	Light = $10^{-7}$ $\ell$ m Rp = 0.1 Meg	---	---	S/N	42	---	dB
<u>Conformance inspection, part 2</u>									
Secureness of base, cap, or insert	1101	<u>5/</u>		---	---	---	---	---	---
Base pin solder depth	1111	---		---	---	---	---	---	---
Permanence of marking	1105	---		---	---	---	---	---	---

See footnotes at end of table.

TABLE I. Testing and inspection - Continued.

Inspection	Method	Notes	Conditions	Acceptance level	Inspection level or code	Symbol	Limits		Unit
							Min	Max	
<u>Conformance inspection, part 3</u>									
Life-test	---	<u>15/</u>	Group D; t = 500 hours	---	---	---	---	---	---
Life-test end point:									
Anode current	---	<u>16/</u>		---	---	---	---	---	---

- 1/ DC supply voltage between anode and 10th dynode.
- 2/ Averaged over a period of 30 seconds maximum. Longer tube life may be expected when operating conditions require lower anode current.
- 3/ An anode load resistance of at least 10,000 ohms is recommended for a protective resistance.
- 4/ Overall supply voltage is across a voltage divider providing 16.67% of the voltage between cathode and dynode No. 1 and 8.33% of the voltage for each succeeding state including dynode No. 10 to anode.
- 5/ Omit immersion in water and test dry. Apply torque test with 40.0 pound-inches minimum.
- 6/ Light source shall be a projection lamp operated at 2,870°K. Use a light aperture 0.172 inch x 0.70 inch (4.37 mm x 17.78 mm) centered with respect to the cathode.
- 7/ Apply 167 volts dc between cathode and all other pins tied together.
- 8/ With  $10^{-5}$  lumens incident on the cathode vary the overall voltage to give  $I_b = 200 \mu\text{A}$ ; exclude the light and read the dark current.
- 9/ Anode current ratio. In addition to  $I_b$  test at center of photocathode, check  $I_b$  at four places spaced 90° apart. The spots shall be exposed one at a time in such a manner that no overlap of outer spots exist (if all were exposed at the same time). The ratio between maximum and minimum anode currents (including center reading) will be the anode current ratio. Place aperture between light source and tube such that the outer spots (on the photocathode) will lie on a .875 inch  $\pm$  .047 inch (22.23 mm  $\pm$  0.79 mm) diameter circle centered on the photocathode. The diameter of the outer spots on the photocathode shall be .50 inch (12.7 mm)  $\pm$  5 percent. All spots including center spot shall have equal area.
- 10/ Apply Ebb according to the range of  $I_b$  in the following table:

	<u><math>I_b</math></u>	<u>Overall supply voltage</u>
<u>Range</u>	100 to 160	1,350
	160 to 240	1,300
	240 and up	1,250

- 11/ With unfiltered light flux of 0.01 lumens, insert blue filter (Corning, Glass Code No. 5113 polished to one-half stock thickness, or equivalent) in place between the cathode and light source.

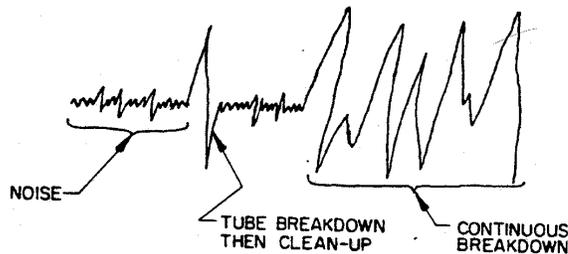
TABLE I. Testing and inspection - Continued.

- 12/ For this test, the light source shall be a square wave modulated at 90 Hz. Diameter of the light spot shall be 1.25 inch (31.75 mm). Output of the tube shall be fed into a low-pass amplifier, the bandwidth of which is 1,000 Hz. The amplifier output shall be read with a vu meter calibrated in dB. Amplifier attenuator is also calibrated in dB. Prior to testing, tubes shall be held at an ambient temperature of  $75^{\circ}\text{F} \pm 5^{\circ}\text{F}$  for not less than 1 hour in the dark.
- Signal: With light on, adjust attenuator so that vu meter is at zero. Read attenuator setting.
  - Noise: Read as above with light off.
  - S/N ratio = Signal (dB) - Noise (dB).
- 13/ Capacitance between anode and dynode No. 10, all other elements grounded.
- 14/ Capacitance between anode and all other elements.
- 15/ Ebb = 1,000 volts, adjust luminous flux at the cathode initially to obtain  $I_b = 0.75$  mA dc. Color temperature shall be greater than  $2,000^{\circ}\text{K}$ .
- 16/ Life-test end-point is either an  $I_b$  of  $20 \mu\text{A}$  or a decrease of 5% of the initial  $I_b$ , whichever is reached first.
- 17/ Test circuit and test equipment requirements.

A bleeder network to provide 16.67% of the overall voltage between cathode and dynode No. 1 and 8.33% of the overall voltage for each succeeding stage; 8-megohm series resistance for cathode, and all dynodes excluding the last dynode (10th); 1-megohm series resistance for last dynode (10th) and anode; a regulated (0.1 percent) power supply with low-ripple (0.05 volts peak-to-peak maximum) as a voltage source; a sensitive dc microammeter to determine anode current; an oscilloscope, with a low-capacity divider, is connected across the anode load resistance (1-megohm) to monitor noise and breakdown; base pins of photomultiplier under test connected so that the degradation of breakdown characteristic is minimized; a vacuum pump, low-pressure chamber and manometer; a light source with an adjustable iris and sandblasted glass.

Test method.

Mask tube with light proof material. The light-source should be located so that light from it is striking the cathode of the photomultiplier. (Light from the light source should be the only light striking the cathode.) The opening of the iris is varied to obtain approximately 10 microamperes of anode current. Observe the tube-noise signal as displayed by the oscilloscope. Reduce pressure of vacuum chamber to 130 millimeters of mercury. The tube should be subjected to this pressure for a period of 2 minutes. During pressure reduction, the tube noise signal, as displayed by the oscilloscope, should be observed to determine tube breakdown. When breakdown occurs, the signal being monitored by the oscilloscope will resemble the following:

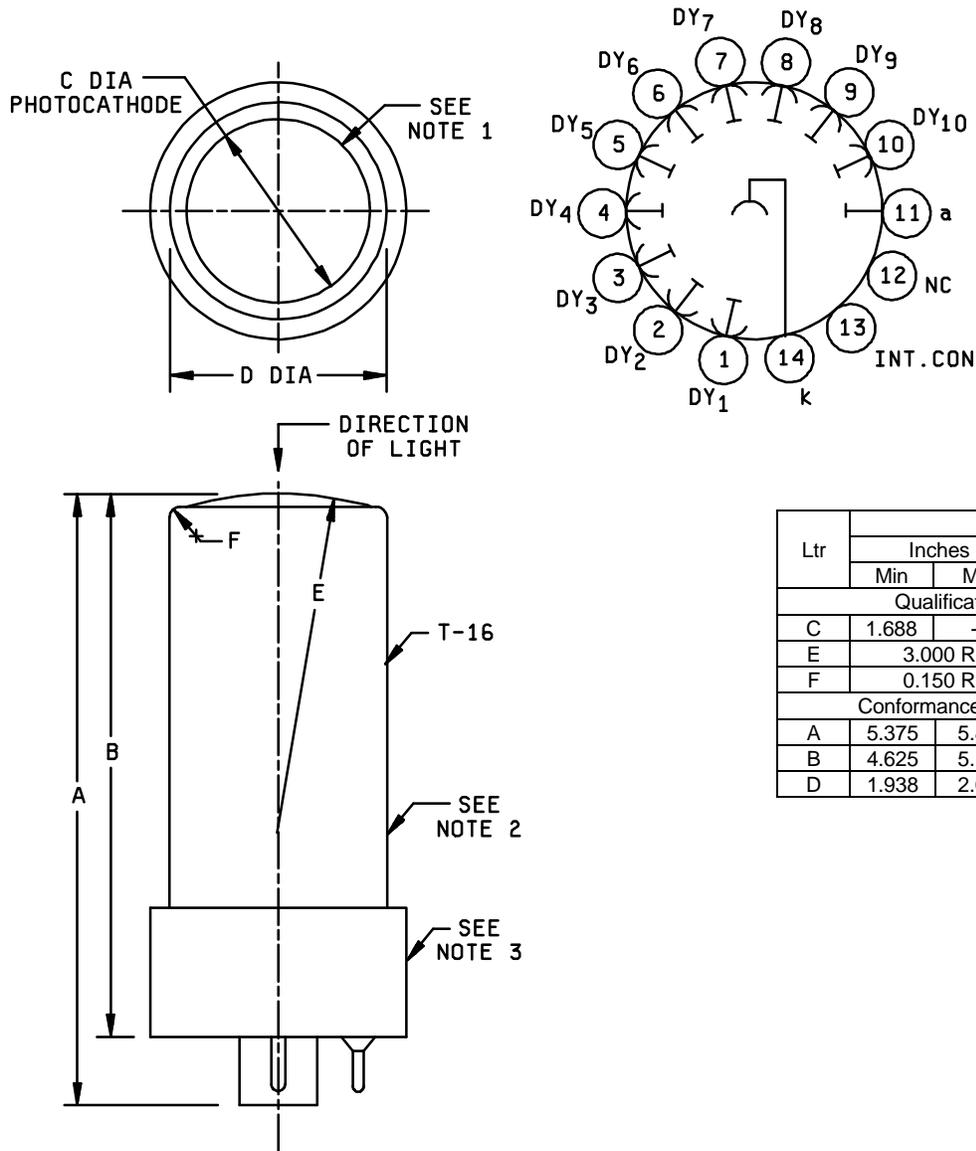


When continuous breakdown occurs, a change in anode current will result.

- 18/ An ac supply voltage may be used having a peak value equal to this maximum value.

TABLE I. Testing and inspection - Continued.

- 19/ Vary light to obtain approximately 10 microamperes of anode current.
- 20/ Tube shall operate without indication of breakdown in an evacuated chamber in which the pressure does not exceed 130 mmHg absolute.
- 21/ All conformance inspection, part 1, tests to be performed at the conclusion of the holding period.
- 22/ Marginal notations are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.



Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
Qualification inspection				
C	1.688	---	42.88	---
E	3.000 R		76.20 R	
F	0.150 R		3.81 R	
Conformance inspection, part 2				
A	5.375	5.875	136.53	149.23
B	4.625	5.125	117.48	130.18
D	1.938	2.063	49.23	52.40

NOTES:

1. Diameter C refers to the cathode diameter.
2. Centerline of bulb shall not deviate more than 2° in any direction from the perpendicular erected at center of bottom of base.
3. The base shall be a medium shell diheptal 14-pin base, B14-38.

FIGURE 1. Outline drawing of electron tube types 5819.

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Custodians:

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

Preparing activity:

DLA - CC

(Project 5960-3551-12)

Review activities:

Navy - AS, CG, MC, OS  
Air Force - 17, 99