

INCH-POUND

MIL-PRF-1/1677A(CR)
23 April 1998
SUPERSEDING
MIL-E-1/1677(EL)
6 October 1969

PERFORMANCE SPECIFICATION SHEET

ELECTRON TUBE, KLYSTRON

TYPE 8759

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: Integral cavity, reflex oscillator, 15.8 to 16.2 GHz.

Outline and dimensions: See figure 1.

ABSOLUTE RATINGS: 1/

Parameters:	Ef	Ek	Ik	Er	F	TE	Altitude	Applied tuner torque
Units:	V	V dc	mA dc	V dc	GHz	°C	Feet	Inch-ounce
Maximum:	6.9	350	45	-500	---	+150	55,000	100
Minimum:	5.7	---	---	-20	---	---	---	---
Test conditions:								
Test condition (1):	6.3	300	---	-85 to -120	16.0	---	---	---
Test condition (2):	6.3	300	---	-140 to -200	16.0	---	---	---
Test condition (3):	6.3	---	---	---	---	---	---	---

Mounting: Output flange, any position.

Voltage reference: Cathode.

Plug connections: 25/ 26/

Ground: Anode grounded internally to tube shell.

Cooling: Forced air, convection, or heat sink sufficient to maintain envelope temperature below maximum. Monitor temperature at point A, as shown on figure 1 and 21/.

Tuning: Single shaft, clockwise rotation decreases frequency. 35/

GENERAL:

Preproduction sample approval: Required. 23/

Performance: 33/

Cooling: See method 1155. 21/

Holding period: t = 168 hours.

Dimensions: See figure 1.

Marking: 34/

MIL-PRF-1/1677A(CR)

TABLE I. Testing and inspection.

Inspection	Method	Notes	Conditions	Acceptance level	Inspection level or code	Symbol	Limits		Unit
							Min	Max	
<u>Preproduction sample approval tests</u>		<u>23/</u>							
Low pressure	---	<u>6/ 7/ 9/</u>	Test condition (1)	---	---	F	---	17	MHz
Vibration (1)	---	<u>7/ 10/</u>	Test condition (1)	---	---	Ir	---	10	μA dc
Vibration (2)	---	<u>7/ 11/</u>	Test condition (1)	---	---	$\Delta F_{(p-p)}$ Po/Po	---	5 10	MHz %
Temperature coefficient	---	<u>2/ 6/ 7/</u>	Test condition (1)	---	---	$\Delta F/\Delta T$	---	0.5	MHz/°C
Mechanical tuning fatigue	4223	<u>3/</u>	Test condition (1)	---	---	---	1,000	---	Cycles
Shock	---	<u>7/ 8/</u>	Test condition (1)	---	---	F	---	±12	MHz
Humidity	1011	<u>32/</u>		---	---	---	---	---	---
<u>Conformance inspection, part 1</u>		<u>27/ 28/</u>							
Continuity	---	<u>12/</u>		---	---	---	---	---	---
Shorts	---	<u>13/</u>		---	---	---	---	---	---
Heater current	1301		Ef = 6.3 V	---	---	If	500	600	mA
Total reflector current	4229	<u>4/ 14/</u>	Test condition (2)	---	---	Irt	---	10	μA dc
Reflector leakage current	4229	<u>4/ 14/</u>	Test condition (2)	---	---	Irl	---	6	μA dc
Reflector gas current	4229	<u>4/ 14/</u>	Test condition (2)	---	---	Irg	---	4	μA dc
Cathode current	1256	<u>7/</u>	Test condition (1)	---	---	Ik	---	35	mA dc
Cathode emission	4214	<u>5/ 7/ 14/</u>	Test condition (1)	---	---	Ik	---	10	%
Power output (1)	4250	<u>6/ 7/</u>	Test condition (1) F = 15.8 GHz F = 16.2 GHz	---	---	Po Po	20 20	---	mW mW
Reflector voltage	4213	<u>6/ 7/</u>	Test condition (1) F = 15.8 GHz F = 16.2 GHz	---	---	Er Er	-100 ---	---	V dc V dc
Electronic tuning hysteresis	4231	<u>6/ 7/ 15/</u>	Test condition (1) F = 15.8 to 16.2 GHz (inclusive)	---	---	h	---	50	%
Mode centering	---	<u>6/ 22/</u>	Test condition (1) Er = -110 V dc F = 16.0 GHz	---	---	Po	---	0.2	dB

See footnotes at end of table.

MIL-PRF-1/1677A(CR)

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 2</u>									
Electrode insulation	---	<u>16/</u>		6.5	L6	lk-rs ih-rs	---	150 150	μ A dc μ A dc
Mode continuity	---	<u>7/ 17/</u>	Test condition	6.5	L6	---	---	---	---
Electronic tuning range	4200	<u>6/ 7/</u>	Test condition (1) 1/2 power	6.5	L6	F	50	---	MHz
Reflector voltage for electronic tuning	---	<u>6/ 7/ 18/</u>	Test condition (1) F = 15.8 GHz F = 16.2 GHz	6.5	L6	Er Er	---	35	V dc
							---	35	V dc
Modulation sensitivity	---	<u>6/ 7/ 19/</u>	Test condition (1)	6.5	L6	---	1.3	3.5	MHz/v
Tuner torque	---	<u>29/</u>		6.5	L6	---	---	32	Inch-ounces
Mechanical tuning range	---	<u>7/ 20/</u>	Test condition (1)	6.5	L6	---	---	---	---
Power output (2)	4211	<u>6/</u>	Test condition (1) ER = -110 V dc	6.5	L6	Po	20	---	mW
Tuner shaft sensitivity (1)	---	<u>7/</u>	Test condition (1)	6.5	L6	---	---	350	MHz/turn
Tuner shaft sensitivity (2)	---	<u>7/ 31/</u>	Test condition (1)	6.5	L6	Er	---	8	V/turn
Tuner stop torque test	---	<u>30/</u>	Torque = 100 inch-ounces max.	6.5	L6	---	---	---	Inch-ounces
<u>Conformance inspection, part 3, life</u>									
Life test (see 4.6)	---		Test condition (1) group S						
Intermittent life test operational	1501	<u>7/ 21/ 36/</u>	2,500 hours	---	---	---	---	---	---
Life test end point power output (1) (see 4.6.2)	---		---	---	---	Po	15	---	mW
Rough-handling test	---		In accordance with MIL-PRF-75 or contract						
Rough-handling test end points	1136			---	---	---	---	---	---
Preparation for delivery (see 5.1)			As specified in contract or purchase order	---	---	---	---	---	---

See footnotes at top of next page.

TABLE I. Testing and inspection - Continued.

- 1/ Refer to MIL-PRF-1, section 3.4.5, "Absolute ratings".
- 2/ Temperature coefficient test procedure:
 - a. Secure tube firmly with metal to metal contact to a section of standard waveguide at least 24 inches in length, ten (10) inches of which shall be included in the temperature chamber.
 - b. Close oven door and apply test voltages to the tube. Set the output frequency of the tube to approximately 16.0 GHz.
 - c. Allow the tube to stabilize for approximately 30 minutes in still air at room temperature. At the end of 30 minutes, adjust the reflector voltage to maximum power on Mode A and record frequency and temperature. Do not readjust the reflector voltage at any time during the remainder of the test.
 - d. Adjust the oven to obtain an ambient temperature of approximately 105°C. Allow the tube to stabilize for 30 minutes in still air and record the frequency and the temperature.
 - e. The temperature coefficient is the difference between the two frequency readings divided by the difference between the two temperature readings.
- 3/ After the specified number of cycles of Mechanical Fatigue Test starting at 15.8 GHz to 16.2 GHz and returning to 15.8 GHz, the tube shall pass the conformance inspection, part 1 requirement of the test specification.
- 4/ Apply heater voltage for one minute. Then apply other voltages plus the heater voltage for two minutes, and read the total reflector current at the end of this two minute period.
- 5/ Reduce heater voltage from 6.3 volts to 5.7 volts. The percentage change in resonator current after one minute shall not exceed the specified value.
- 6/ All oscillation tests are to be made with the tube rigidly connected to a UG-419/U cover flange on appropriate RG-91/U waveguide. The RF load shall have a maximum VSWR of 1.1 to 1.
- 7/ The reflector voltage is to be adjusted within the specified range for maximum power on mode A at the frequency specified. Mode A can be found between $E_r = -100$ V and -120 V.
- 8/ The tube is to be given 5 shocks at 70 g's and 6.5 milliseconds duration of sine pulse configuration in each of three mutually perpendicular axes. The tube must be mounted securely to the waveguide flange. The frequency shift shall be read following each shock, and the average shift resulting from five shocks shall not exceed the limit specified. The tube shall meet all other conformance inspection, part 1 test conditions after completion of shock testing.
- 9/ The frequency shall be stabilized at a pressure of 70 mmHg. The pressure shall be increased to 760 mmHg with uncontrolled temperature. The pressure change shall be complete and the frequency change measured within 10 seconds. The frequency change shall not exceed the limit specified. The tube is to be fastened to a waveguide which is maintained at atmospheric pressure during the test.
- 10/ The tube shall be vibrated at 10 g's at a frequency of 60 Hz for two minutes in three mutually perpendicular axes. The reflector current bursts shall be recorded with an instrument whose frequency response is from direct current to 100 Hz with no more than 3 dB fall-off at 100 Hz. There shall be no reflector current bursts greater than the limit specified.
- 11/ The tube shall be vibrated at 10 g's for five minutes in each of three mutually perpendicular axes over the frequency range of 40 Hz to 500 Hz at logarithmic sweep, and shall require the time specified to traverse the range. The frequency modulation and the change in power output, resulting from vibration shall not exceed the limits specified. The tube shall meet all conformance inspection, part 1 tests following vibration. The total power output change shall not exceed 20 percent.
- 12/ Continuity shall exist between pins C and E and between pins A and C.
- 13/ Continuity shall not exist between any of the following:
 - A and H
 - C and D
 - D and H

TABLE I. Testing and inspection - Continued.

- 14/ This test is to be performed after the holding period.
- 15/ The mode discontinuity percentage shall be defined as the ratio of the power level at which a discontinuity in the mode shape is exhibited to the maximum power level.
- 16/ Apply 300 V dc between the elements specified. The resulting current shall not exceed the limits specified. No other voltages are to be applied.
- 17/ With a 1.5 to 1 voltage standing wave inserted in the guide, there shall be no discontinuity at the maximum power points for any phase of standing wave.
- 18/ The change in reflector voltage required to tune across the specified minimum electrode tuning range (not to 1/2 power points) shall not exceed the limit specified. The center of the electronic tuning range is to be the maximum power point of the mode.
- 19/ Modulation sensitivity is defined as the specified electronic tuning range (50 MHz) divided by the reflector voltage between the ± 25 MHz points.
- 20/ Mechanical tuning range: The total number of turns of the tuner shaft between mechanical stops shall be 6 to 9 turns. The midpoint of the total tuner shaft travel shall be the reference point for measurement of the tuning range. The specified tuning range of 15.8 to 16.2 GHz shall be covered in any portion of the travel of the tuning shaft within ± 2 turns of the reference point as limited by the tuner shaft sensitivity (1) requirement.
- 21/ Tubes shall operate at an ambient temperature of 25°C to 40°C with no cooling except convection and conduction to the waveguide (UG-419).
- 22/ With reflector voltage set at the specified value, the power output shall be within the amount specified of the power output obtainable by optimizing the reflector voltage at the frequency specified.
- 23/ Preproduction sample approval requirements hereby replace any qualification requirements referable to the product covered herein. The term "First Article Testing" shall be considered synonymous with the term "Preproduction Sample Approval Testing." All tests applicable herein (including all preproduction sample approval and conformance inspection, parts 1, 2, and 3) shall be performed during preproduction sample inspection. A failure of any one tube in any of the tests shall be cause for preproduction sample disapproval.
- 24/ Wire shall be MIL-PRF-16878/7, type F-22.
- 25/ Connector plug shall be Continental type No. C7-20P-V SC4HC or Amphenol type 126-195.
- 26/ Plug connections shall be as follows:

Element	Pin connection
Cathode	A
Heater	C
Reflector	D
Heater	E
Shell	H

NOTE: Wire size described in 24/

All testing of the tube to be done only after assembly of plug to the tube.

- 27/ The acceptance level for the combined defectives for attributes in acceptance inspection, part 1, production, excluding mechanical and inoperatives, shall be 1.0 percent.
- 28/ All tests on this specification shall be performed at the conclusion of the specified non-operating holding period commencing with the total reflector current test.

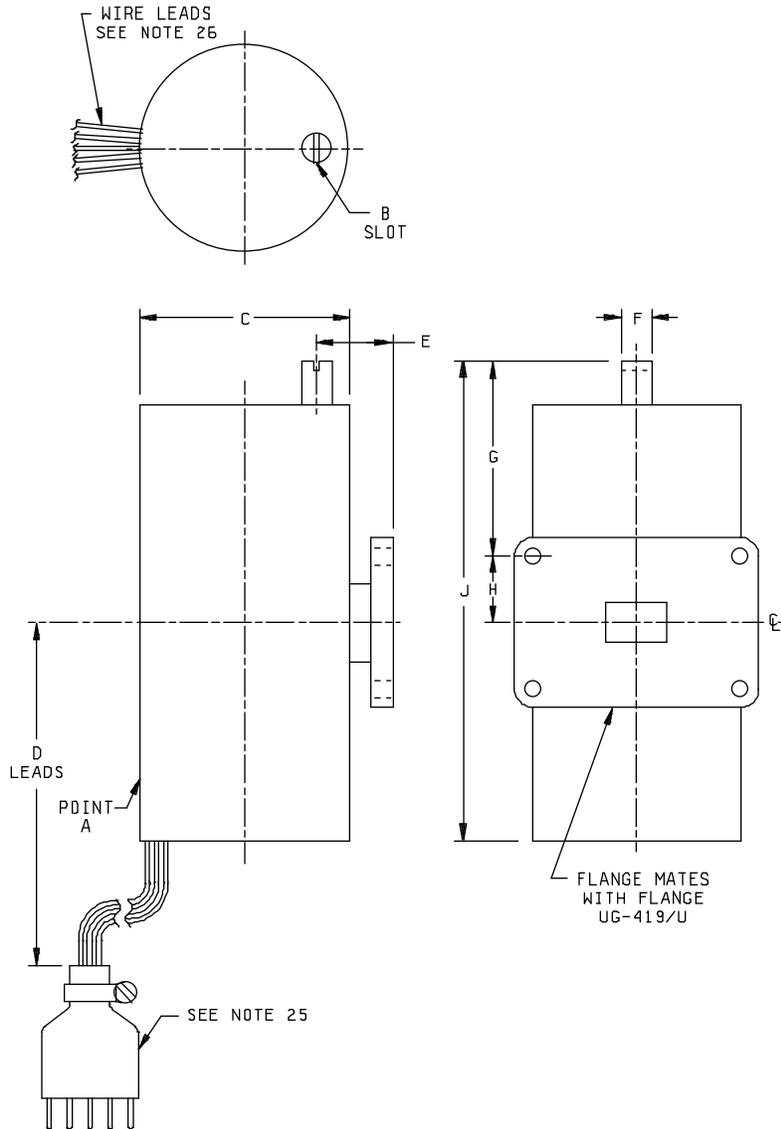
MIL-PRF-1/1677A(CR)

TABLE I. Testing and inspection - Continued.

- 29/ Under the conditions specified, the tuning mechanism shall be smoothly operable throughout the entire mechanical tuning range without the specified torque being exceeded.
- 30/ The tuning mechanism shall withstand the maximum specified stop torque at the extreme ends of the tuning range without damage.
- 31/ Tune tube to 15.8 GHz and measure the reflector voltage at mode center. Turn tuner one turn counter-clockwise and measure reflector voltage at mode center for this tuner position. The difference in reflector voltage divided by the one turn change in tuner position shall not exceed the limit specified.
- 32/ After completion of this test, tube shall meet the requirements of power output (1) and tuner torque.
- 33/ Associated with and in addition to the performance requirements covered herein, all tests listed in MIL-PRF-1, 3.1, are applicable except those referred to in MIL-STD-1311, methods E-1011, E-1111, and E-1201.
- 34/ Marking shall be in accordance with MIL-PRF-1. If any specification requirements waiver has been granted, the product-identification marking shall consist of the tube type-number only.
- 35/ There shall be no lateral movement of the tuning shaft as it is rotated through the mechanical tuning range.
- 36/ Life-test data and curves of failure are also to be submitted to the following in addition to the requirements of MIL-PRF-1.

Commanding General
US Army Communications - Electronics Command
ATTN: AMSEL-LC-LEO-E-EP
Fort Monmouth, NJ 07703-5023

MIL-PRF-1/1677A(CR)



Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
B	---	.040 wide	---	1.02 wide
	---	.070 deep	---	1.78 deep
C	---	1.5	---	38.10
D	8.0	8.5	203.2	215.9
E	.250	.312	6.35	7.92
F	.185	.187	4.70	4.75
G	1.125	1.250	28.58	31.75
H	.478 Nom		12.14 Nom	
J	---	3.25	---	83.55

(NOT TO SCALE)

FIGURE 1. Outline and dimensions.

MIL-PRF-1/1677A(CR)

Custodian:
Army - CR

Preparing activity:
DLA - CC

(Project 5960-3485)