

INCH-POUND

MIL-PRF-1/1727B  
 6 January 2015  
 SUPERSEDING  
 MIL-PRF-1/1727A  
 w/AMENDMENT 2  
 11 March 2008

PERFORMANCE SPECIFICATION SHEET

ELECTRON TUBE, MICROWAVE, NEGATIVE GRID

TYPE DOD-018 \*

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 MIL-PRF-1.

DESCRIPTION: Triode, planar.  
 See figure 1.  
 Mounting position: Any.  
 Weight: 1 ounce nominal.

ABSOLUTE RATINGS:

Parameter:	Ef	F1	Eb	Ec	Ehk	ib	lb	lc	ik	ic	Pp	Pi	tp	Du	tk	T (seal)	Barometric pressure, reduced
Unit:	V	GHz	V dc	V dc	V dc	a	mA dc	mA dc	a	a	W	W	μs	---	sec	1/°C	2/mmHg
Osc or amp <sup>3/</sup>																	
Maximum:	<sup>4/</sup> 5.7	2.5	350	-50	±90	---	35	15	---	---	8.0	12	---	---	---	175	20
Minimum:	4.5	---	---	---	---	---	---	---	---	---	---	---	---	---	30	---	---
Pulse modulated, Osc or amp <sup>5/</sup>																	
Maximum:	<sup>4/</sup> 5.7	2.5	275	-50	±90	---	35	15	---	---	6.0	9.5	---	---	---	175	20
Minimum:	4.5	---	---	---	---	---	---	---	---	---	---	---	---	---	30	---	---
Anode pulsed, Osc or amp <sup>6/</sup>																	
Maximum:	<sup>4/</sup> 6.3	3.5	---	-100	±90	<sup>7/</sup> 2.5	2.5	1.25	3.75	1.25	7.5	7.5	2.0	0.001	---	175	250
Minimum:	5.7	---	---	---	---	---	---	---	---	---	---	---	---	---	60	---	---
Class A, RF amp																	
Maximum:	6.6	---	350	-25	±90	---	35	---	---	---	8.0	12	---	---	---	175	20
Minimum:	5.7	---	---	---	---	---	---	---	---	---	---	---	---	---	0	---	---
Test conditions:	6.3	---	350	Adj	---	---	35	---	---	---	---	---	---	---	120 min	<sup>10/</sup> ---	---

See footnotes at end of table I.

GENERAL:

Qualification: Required.

Holding period: t = 72 hours.

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

\* Replaces G. E. tube type Y-2052.



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TABLE I. Testing and inspection.

Inspection	MIL-STD-1311 method	Conditions	Symbol	Limits		Unit
				Min	Max	
<u>Conformance inspection, part 1</u>						
Pulsed oscillation	---	12/ F = 3.45 GHz (min); E <sub>py</sub> = 3,000 V; R <sub>g</sub> /I <sub>b</sub> = 2.5 mA dc; t <sub>pv</sub> = 1.0 μs ±10 percent; t <sub>rv</sub> = 0.1 μs (max); t <sub>fv</sub> = 0.2 μs (max); p <sub>rr</sub> /D <sub>u</sub> = 0.001 ±5 percent; E <sub>f</sub> = 6 V 14/ 15/	Po	1.90	---	W (useful)
Insulation of electrodes	1211	E <sub>f</sub> = 6.3 V 16/	R <sub>gp</sub> R <sub>gk</sub>	250 25	--- ---	MegΩ MegΩ
Emission	1231	E <sub>b</sub> = E <sub>c</sub> /I <sub>s</sub> = 40 ma dc	E <sub>b</sub> = E <sub>c</sub>	---	4.0	V dc
Pulsing emission	1231	P <sub>rr</sub> = 500 ±10 percent; t <sub>p</sub> = 1 ±0.1 μs; e <sub>b</sub> = e <sub>c</sub> /I <sub>s</sub> = 5 a	e <sub>b</sub> = e <sub>c</sub>	---	110	v
Electrode voltage (1) (grid)	1261		E <sub>c</sub>	-1.90	-4.40	V dc
Total grid current	1266		I <sub>c</sub>	---	0.5	μA dc
<u>Conformance inspection, part 2</u>						
Electrode voltage (2) (grid)	1261	E <sub>c</sub> /I <sub>b</sub> = 2 mA dc	E <sub>c</sub>	-3.60	-8.50	V dc
Heater current	1301		I <sub>f</sub>	840	960	mA
Transconductance	1306		S <sub>m</sub>	21,000 0	30,000	μmhos
Resonance test	---	No voltages applied 8/ 13/	---	---	---	---
Amplification factor	1316		μ <sub>u</sub>	60	110	---
Direct-interelectrode capacitance	1331	No voltages applied; use shielded socket in accordance with Drawing 260-JAN.	C <sub>gp</sub>	2.10	2.45	pF
			C <sub>gk</sub>	4.85	5.75	pF
			C <sub>pk</sub>	---	0.045	pF
Heater-cathode leakage	1336	E <sub>b</sub> = E <sub>c</sub> = 0	I <sub>hk</sub>	---	100	μA dc

See footnotes at end of table.

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TABLE I. Testing and inspection - Continued.

Inspection	MIL-STD-1311 method	Conditions	Symbol	Limits		Unit
				Min	Max	
<u>Conformance inspection, part 3</u>						
Life test	---	Group S; t = 1,000 hours; Ef = 6.3 V (no other voltages) <u>20/</u>	---	---	---	---
Life-test end point:						
Pulsed oscillation	---		$\Delta P_o$	---	25	%
Interelectrode capacitance (gk)	---		$\Delta C_{gk}$	---	0.35	pF
<u>Periodic-check tests</u>						
Barometric pressure, reduced (1)	1002	Pressure = 250 mmHg (max); voltage = 2,000 V ac; TA = +30°C ±10°C <u>11/ 18/</u>	---	---	---	---
Barometric pressure, reduced (2)	1002	Pressure = 20 mmHg (max); voltage = 500 V ac; TA = +30°C ±10°C <u>11/ 18/</u>	---	---	---	---
High-frequency vibration	1031	Ebb = 300 V dc; Ec/lb = 10 mA dc; Rp = 10,000 ohms; use socket in accordance with Drawing 261-JAN <u>17/</u>	Ep	---	100	mV ac
Shock	---	No voltages applied; accel = 400 G peak (min); 0.5 ms duration (min); use socket in accordance with Drawing 261-JAN <u>11/ 21/</u>	---	---	---	---
Shock-test end point:	---					
Total grid current	1266		Ic	---	-0.6	μA dc
Torque	---	No voltages applied <u>9/ 17/</u>	---	---	---	---
Torque-test end points:	---					
Total grid current	1266		Ic	---	-0.6	μA dc
Heater current	1301		If	840	960	mA
Storage	---	<u>19/</u>	---	---	---	---
Storage-test end points:						
Total grid current	1266		Ic	---	-1.0	μA dc
Heater current	1301		If	840	960	mA

See footnotes on the next page.

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TABLE I. Testing and inspection - Continued.

- 1/ Sufficient conduction and convection cooling shall be provided to limit the envelope temperature to the specified maximum to +175°C under all operating conditions.
- 2/ Operation at this altitude is possible in a suitably designed circuit.
- 3/ Modulation essentially negative may be used if the positive peak of the audio frequency envelope does not exceed 115 percent of the carrier conditions.
- 4/ This tube operates at frequencies where transit-time effects of the electron current shall be considered. The principal effects influencing the tube operation are the decrease in power output and operating efficiency with increase in frequency, and the bombardment and heating of the cathode by electrons from the region of the grid, which can be sufficiently severe to result in short tube life and erratic operation. Operating frequency, circuit design and adjustment, grid bias, grid current, average power input and the operating voltage contribute to some degree to the magnitude of the resulting cathode bombardment. There is a heater voltage which will maintain the cathode at the correct operating temperature for a set of operating conditions. If the conditions of operation result in appreciable cathode back-heating, it may be necessary to initiate dynamic operation of the tube at normal heater voltage, followed by a reduction of heater voltage to the proper value. A maximum variation of  $\pm 5$  percent in heater voltage is recommended where consistent operation and extended tube life is a factor.
- 5/ Carrier conditions for use with a maximum modulation factor of 1.0.
- 6/ Tube shall not be operated for more than 4 microseconds in any 2,000 microsecond interval. Tube shall not be grid-pulsed beyond the CW ratings.
- 7/ The regulation of series-anode-supply impedance, or both, shall limit the instantaneous peak current, with the tube considered as a short circuit, to a maximum of 10 times the specified maximum current rating.
- 8/ Other tube contact configurations may be used provided the tube contact area remains unchanged and the socket, jig, or cavity gives equal performance. Mounting of the socket, jig, or cavity may be at the option of the manufacturer.
- 9/ Torque test shall be performed as follows:
  - a. A torque of 15 inch-pounds shall be applied between the anode and the heater terminal No. 1 without shock.
  - b. A torque of 5 inch-pounds shall be applied between heater terminal No. 1 and heater terminal No. 2 without shock.
- 10/ During any test the maximum temperature of any part of the envelope shall be limited to +175°C maximum by conduction or forced convection cooling.
- 11/ Perform test on 10 tubes selected at random from the first production lot of each calendar year. No failures allowed. If one tube fails, the test shall become part of conformance inspection, part 2, with acceptance on zero defects. After three consecutive successful submissions, the test shall revert to an annual 10-tube test.
- 12/ All tests listed under conformance inspection, part 1, are to be performed at the conclusion of the holding period.

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TABLE I. Testing and inspection - Continued.

13/ Grid-anode resonance: Test in cavity in accordance with DSCC drawing D64102. Cavity shall resonate at 1.74 GHz  $\pm$ 2.5 MHz with tuning slug in accordance with DSCC drawing B64103 at TA = +25°  $\pm$ 5°C.

Grid-cathode resonance: Test in cavity in accordance with DSCC drawing D64102. Cavity shall resonate at 1.793 GHz  $\pm$ 2.5 MHz with tuning slug in accordance with DSCC drawing B64103 at TA = +25°  $\pm$ 5°C.

When plotted on graphs of resonant frequency versus grid-anode capacitance and resonant frequency versus grid-cathode capacitance, the tube under test (TUT) shall be represented by a point within a parallelogram whose four corners are located by the following points:

Points	Capacitance (pF)		Frequency (GHz)	
	Cgp	Cgk	Fgp	Fgk
1	2.10	4.85	1.928	1.879
2	2.10	4.85	1.947	1.903
3	2.45	5.75	1.895	1.845
4	2.45	5.75	1.914	1.869

14/ Test in cavity in accordance with Drawing 253-JAN (see 23/). Measure useful power output with the coupling and tuning adjusted for maximum power output. The tube shall operate under the given conditions and after the required circuit adjustments for a minimum of 10 seconds without arcing or instability as evidenced by pronounced variations in the average anode current meter or the power output meter. If temporary arcing does occur during the 10-second period, the tube shall subsequently operate for 60 seconds without arcing. The test may be discontinued at the end of the 10-second period if the power output has not completely stabilized but is rising. If the power output is falling, the test will be continued until a stable reading is obtained. For qualification purposes, a stabilized reading shall be obtained. All readings shall be "nonsquegging" power.

15/ The pulse characteristics are defined as follows:

- a. epy is the smooth peak voltage excluding spike (see MIL-STD-1311, method 1296).
- b. The interval of trv and tfv is between 20 and 85 percent of the smooth peak value of the voltage pulse.
- c. The definition of tp is applicable to tpv.
- d. The parameter tpv, tfv, and trv may be measured with the tube replaced by a 1,000-ohm non-inductive resistor.

The load VSWR shall be 1.5 maximum.

16/ The insulation between the grid and the cathode shall be measured with a voltage of 100 V dc. The other insulation test shall be made in accordance with MIL-STD-1311, method 1211.

17/ Test 10 tubes selected at random from the first production lot of each calendar year and approximately every 90 days during the year. No failures allowed. If a tube fails to pass the specified end points, the failed test shall become a part of conformance inspection, part 2, with acceptance on zero defects, on all lots in process. After three consecutive successful submissions, the test shall revert to a 10-tube quarterly test.

18/ The specified voltage shall be applied between anode and grid. No other voltages shall be applied. The TUT shall be excited under specified conditions at atmospheric pressure for 10 seconds minimum. There shall be no evidence of arc-over or instability as evidenced by significant variations observed in the waveform of the applied voltage. Should arcing occur during the 10-second period, the TUT shall subsequently operate for 60 seconds minimum without arcing. The pressure shall then be reduced to specified conditions and the TUT must operate for another 60 seconds minimum without visible arc-over.

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TABLE I. Testing and inspection - Continued.

- 19/ The tube under test shall be placed in storage under room ambient conditions. The total grid current of the tube shall be measured every 30 days until a total storage period of 90 days has elapsed. Heater warm up shall be not less than 2 minutes and total test time shall not exceed 5 minutes including warm up. This test shall be performed on 4 tubes per month when tube is in production, but shipments of that month's production shall not be held pending completion of the 90 day test. So long as there are no failures such that all 4 tubes for each of the first 3 months of a production run pass the tests, and 80 percent of the cumulative quantity of tubes tested pass the tests, tubes shall be considered to conform to this specification. If any of the above conditions are not met, shipments shall be halted until there are no failures such that all 4 tubes of current production pass the 90 day test.
- 20/ The test shall be conducted under room ambient conditions. No cooling of the tube and no heat sink shall be permitted. The filament voltage shall be cycled "on" 1 hour 45 minutes and "off" 15 minutes. The specified life test duration applies to accumulated "on" time.
- 21/ Each tube shall be subjected to a total of 20 shocks; that is, 5 shocks in each position X, Y, Z plus, and Z minus in any sequence. This is a destructive test.

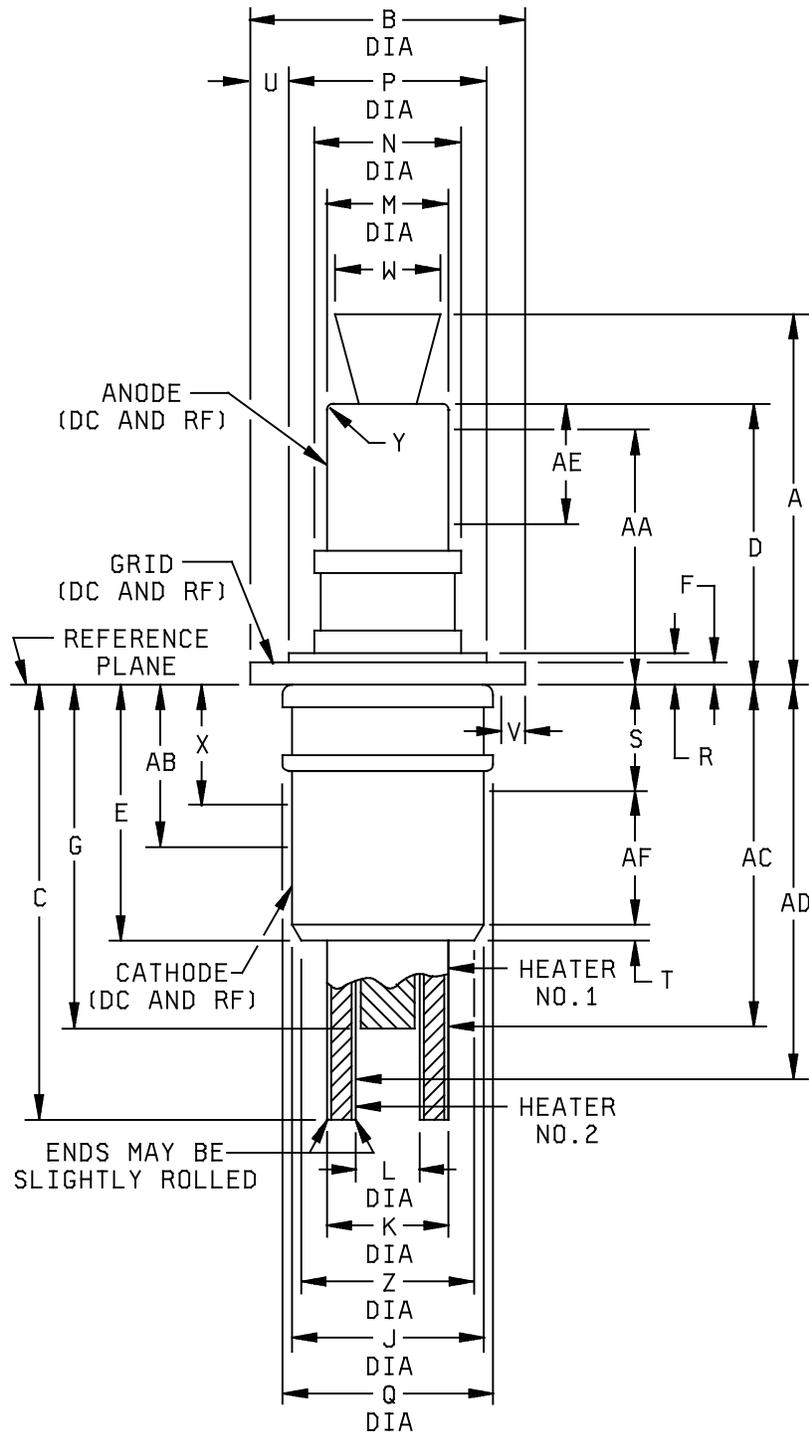


FIGURE 1. Outline drawing of electron tube type DOD-018.

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Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
Conformance inspection, part 2					
A	---	.250	---	6.35	
B	.810	.818	20.57	20.77	
C	1.219	1.281	30.96	32.53	
D	.953	.984	24.21	24.99	
E	.750	.813	19.05	20.65	
F	.070	.078	1.78	1.98	4, 5
G	---	1.016	---	25.80	
J	.539	.549	13.69	13.94	6
K	.318	.328	8.08	8.33	
L	.180	.190	4.57	4.82	
M	.365	.371	9.27	9.42	
AE	.429	---	10.90	---	4
Conformance inspection, part 3 (periodic check)					3
N	---	.453	---	11.50	
P	.560	.570	14.22	14.47	
Q	---	.609	---	15.46	
R	.077	.097	1.96	2.46	
S	---	.266	---	6.75	
T	.015	.090	0.38	2.28	
W	---	.285	---	7.24	1
X	---	.375	---	9.52	7
Z	.490	.520	12.45	13.20	
Reference dimensions					
U	0.094		2.39		4, 5
V	0.094		2.39		4, 5
Y	0.016 R		0.41 R		
AA	0.750		19.05		2
AB	0.547		13.89		2
AC	1.000		25.40		2
AD	1.109		28.17		2
AF	0.453		11.51		4

FIGURE 1. Outline drawing of electron tube type DOD-018 - Continued.

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NOTES:

1. Exhaust tubulation shall not be subjected to any mechanical stress.
2. Eccentricity shall be gauged at points designated and shall be as follows (note 3 shall apply):

Contact	Eccentricity		Reference
	Inches	Millimeters	
Anode	.010 max	.25	Grid contact
Cathode	.010 max	.25	Grid contact
Anode-cathode	.020 TIR	.51	Grid contact
Heater No. 1	.015 max	.38	Grid contact
Heater No. 2	.015 max	.38	Grid contact
Heater No. 1 and 2	.030 TIR	.76	Grid contact

3. These dimensions shall be tested on 10 tubes per month when in continuous production. No failures allowed. Failure of one tube to meet tolerances for any dimension shall cause that dimension to become, for all lots in process, part of conformance inspection, part 2.
4. Contact surface shall be confined to this area.
5. Only these surfaces shall be used for tube stops or clamping.
6. Maximum diameter shall not be increased by solder.
7. Tube marking shall be confined to this area.

FIGURE 1. Outline drawing of electron tube type DOD-018 - Continued.

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Referenced Documents. In addition to MIL-PRF-1, this specification sheet references:

MIL-STD-1311	261-JAN
253-JAN	D64102
260-JAN	B64103

NOTE: To obtain copies of JAN drawings, please send a request via email to [TubesAmps@dla.mil](mailto:TubesAmps@dla.mil).

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