

INCH-POUND

MIL-PRF-1/1461F
 27 March 2000
 SUPERSEDING
 MIL-PRF-1/1461E
 25 June 1999

PERFORMANCE SPECIFICATION SHEET

ELECTRON TUBE, MAGNETRON
 TYPE 7006

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: Pulsed, tunable frequency range 9,000 to 9,600 MHz, rated peak power output 210 kw, with integral magnet.

ABSOLUTE RATINGS:

Parameter:	Ef	If	if (surge)	tk	Du	tpc	rrv	epy	ib	Pi	pi
Unit:	V	A	a	sec	---	μs	kv/μs	kv	a	W	kw
Maximum:	15.3	3.75	12	---	.0013	3.30	230	23	30	690	690
Minimum:	---	---	---	120	.0001	0.10	---	---	15	---	---

ABSOLUTE RATINGS:

Parameter:	VSWR	T(anode)	T(tuner)	T (cathode terminal)	Torque (Tuner drive)	Pressurization		Alt
						Input	Output	
Unit:	---	°C	°C	°C	inch-ounce	psia	psia	ft
Maximum:	1.5:1	+150	+150	+165	200	45	45	10,000
Minimum:	---	-55	-55	-55	---	40	40	---

PHYSICAL CHARACTERISTICS:

Dimensions:	See figure 1	Tuner dial marking:	6/
Mounting position:	Any	Cathode:	Unipotential
Mounting support:	Base plate	Magnet isolation:	4/
Weight:	11 pounds (approximate)	Handling:	4/ 5/
Output coupling:	To UG-52B/U choke flange (modified)		

TEST CONDITIONS:

Parameter:	Ef	Du	tpc	rrv	lb	VSWR
Unit:	V	---	μs	kv/μs	mA dc	---
Tolerance:	---	---	---	min	---	max
Test condition 1:	9.5	.00018	0.12 ± 0.02	220	5.0	1.1:1
Test condition 2:	0	.001	1.00 ± 0.1	220	27.5	1.1:1

Frequency	
F	MHz
F1	9,000
F2	9,300
F3	9,600

See footnotes at end of table I.

GENERAL:

First article testing: 24/

Preheating: Test condition 1.

AMSC N/A

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TABLE I. Testing and inspection.

Inspection	Method	Notes	Test	Condition	Symbol	Limits		Unit
						Min	Max	
<u>Conformance inspection, part 1</u>								
Starting stability	4315	<u>1/</u> <u>7/</u>	1	ib = 30 a; F = F2	MP	---	0.5	%
Pressurizing	4003	---	---	Input and output assemblies; Method A; duration = 2 minutes; pressure = 42.5 ± 2.5 psia	---	---	---	---
Operating torque or force	4223	---	---	No voltages; T(anode and tuner) = 25°C	Torque	---	100	inch-ounce
Heater current	1301	---	---	Ef = 13.75 V; tk = 300 sec (min)	If	3.00	3.75	A
Output power measurement	4250	---	1 2	t = 300 sec (min) F = F1 to F3	Po Po	36 190	45 250	W W
RF bandwidth	4308	<u>14/</u> <u>14/ 15/</u>	1 2	F= F1, F2, F3 F = F1, F2, F3	BW BW	---	2.0/tpc 2.5/tpc	MHz MHz
Minor lobe ratio	4308	---	1 2		Ratio Ratio	7 8	--- ---	dB dB
Stability	4315	<u>16/</u>	1, 2	ib = 30 a; VSWR = 1.5:1	MP	---	0.25	%
Frequency pulling figure	4310	---	1	F = F1, F2, F3	ΔF	---	15	MHz
Pulse voltage	4306	---	2	F = F1, F2, F3	epy	19	23	kv
<u>Conformance inspection, part 2</u>								
Variable-frequency vibration	1031	<u>18/ 23/</u>	---	No voltages	---	---	---	---
Variable-frequency vibration test end points:	---							
RF bandwidth	4308	<u>14/</u>	1	F = F1, F2, F3	BW	---	2.0/tpc	MHz
Minor lobe ratio	4308	---	1		Ratio	7	---	dB
Stability	4315	<u>16/</u>	1	ib = 30 a; VSWR = 1.5:1	MP	---	0.25	%
Frequency drift	---	<u>19/</u>	2		ΔF	---	25	MHz
Operating torque or force	4223	Notes 13 and 14 of figure 1		T(anode) and T(tuner) = -55°C and +150°C	Torque	---	200	inch-ounce
Backlash	---	<u>20/</u>	2	F = F2; VSWR = 1.05:1	ΔF	---	10	MHz
Frequency pushing figure	4311	---	1	F = F1, F2, F3; Ib = 4.5 to 5.4 mA dc	ΔF	---	0.5	MHz/a

See footnotes at end of table.

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TABLE I. Testing and inspection - Continued.

Inspection	Method	Notes	Test	Condition	Symbol	Limits		Unit
						Min	Max	
<u>Conformance inspection, part 3</u>								
Intermittent life	4551	<u>3/ 11/</u> <u>12/ 13/</u> <u>21/ 22/</u>	1, 2	Group D	Cycles	1,000	---	---
Intermittent life-test end points:	---							
Pulse voltage	4306	---	2		epy	19	23	kv
Output power measurement	4250	---	2		Po	150	---	W
RF bandwidth	4308	---	2		BW	---	3.0/tpc	MHz
Minor lobe ratio	4308	---	2		Ratio	-6	---	dB
Mechanical tuning range	4223	<u>17/</u> Notes 14 and 15 of figure 1	2		F	9,000	9,600	MHz
Stability	4315	---	2	ib = 30 a	MP	---	0.5	%
<u>Periodic-check tests</u>								
Barometric pressure, reduced	1002	---	1	Pressure = 522 mmHg (absolute); VSWR = 1.5:1 (vary phase $\lambda/2$)	---	---	---	---
Forced cooling	1143	Notes 13, 14, and 15 of Figure 1	2	TA = 25°C \pm 3°C; Pi to Po = 380 W (adjust ib); airflow = 40 cfm (max)	T(rise)	---	50	°C
Phase of sink	4309	<u>8/</u>	---	No voltages	---	0.40	0.45	λ_g
Shock	1041	---	---	No voltages; 15 G	---	---	---	---
Shock-test end points:	---							
RF bandwidth	4308	<u>14/</u>	1	F = F1, F2, F3	BW	---	2.0/tpc	MHz
Minor lobe ratio	4308	---	1		Ratio	7	---	dB
Stability	4315	<u>16/</u>	1	ib = 30 a; VSWR = 1.5:1	MP	---	0.25	%
Temperature coefficient	4027	Notes 14 and 15 of figure 1	2	F = F2; T(anode) and T(tuner) = 55°C to 150°C	$\Delta F/\Delta T$	---	0.25	MHz/°C
Mechanical tuning fatigue	4223	<u>9/ 10/</u>	---	No voltages; T = 25°C \pm 3°C	---	5,000	---	Cycles

See footnotes at top of next page.

TABLE I. Testing and inspection - Continued.

- 1/ Unless otherwise specified, all tests listed under conformance inspection, part 1, shall utilize accept on zero defect ($c = 0$) sampling plan, in accordance with MIL-PRF-1, Table III, for category XI.
- 2/ If these tests have previously been performed by the tube manufacturer, and if the materials, manufacturing processes, and test requirements are the same as when the tests were performed, the subject test (or tests) need not be performed.
- 3/ The tube heater shall be protected against arcing by the use of a connector that places a minimum capacitance of 4,000 pF across the heater directly at the input terminals.
- 4/ In handling and mounting the tube, care shall be exercised to prevent demagnetization. Ferromagnetic material shall not be brought within 12 inches of the tube; energized magnets shall not be brought within 18 inches of the tube.
- 5/ Reasonable care shall be used in transportation, storage, installation, and use of the tube to avoid imparting vibration or shock in excess of the values which the tube is designed to withstand.
- 6/ The tuner dial settings referable to corresponding frequency values shall be marked on each tube, in successive 100 MHz steps of frequency. Calibration of the tuner dial shall be effected under conditions of $T(\text{anode}) = +100^{\circ}\text{C}$ (approximate).
- 7/ The starting stability test shall be performed on 100 percent of the submitted lot.
- 8/ Measurement shall be made at the "hot test" frequency setting corresponding to 9,600 MHz (operational frequency), and shall be made using "cold test" techniques. The λ_g limits specified apply to the fraction of wavelength determinable as the test goal.
- 9/ One cycle shall consist of a complete traverse from one end of the tuning range to the other end, and back again.
- 10/ Separate samples shall be used for this test.
- 11/ A modulator of the discharging-network type shall be used for test(s).
- 12/ The standing-wave introducer shall be moved continuously, during the test, so that operation is obtained for all phases of VSWR. The standing-wave introducer shall be cycled continuously through a one-half wavelength of transmission line at a maximum rate of 4-cycles per hour.
- 13/ The characteristics of the applied pulse shall be those which result in proper starting and oscillation. The rate of pulse voltage rise, the percentage of pulse voltage ripple, and the rate of pulse voltage fall are important considerations. Fall time of the current pulse shall not exceed 0.12 μs . No spike or ripple shall exceed ± 7.0 percent of average peak of pulse current. Inverse voltage shall not exceed 30 percent of the forward voltage. There shall be no negative post-pulse voltage oscillations since they may result in leakage current and noise.
- 14/ The tube shall be operated into a transmission line having a minimum VSWR of 1.5:1 adjusted in phase to produce maximum spectrum degradation.
- 15/ The RF bandwidth shall be within the limits specified when a VSWR of 1.5:1 is introduced in the load at approximately 0.6 meters distance from the tube coupling flange, with the phase adjusted for widest spectrum.
- 16/ With the VSWR adjusted to that phase producing maximum instability, the missing pulses shall be counted during the last 3 minutes of a test period not exceeding 5 minutes.
- 17/ The tuner drive mechanism shall not be set against either mechanized stop.
- 18/ The tube shall be fastened rigidly to the vibration platform and vibrated with a simple harmonic motion at $F = 10$ to 55 to 10 Hz in 1 to 3 minutes at 10 G or 0.060-inch double amplitude. This cycle shall be repeated for a total of 90 minutes in each of three mutually perpendicular planes, and then the tube shall be vibrated for 30 minutes at each of the resonant frequencies noted.
- 19/ The frequency drift from start to stabilized frequency shall not be more than the specified amount, and at least one-half of the total frequency drift shall occur during the first 2 minutes of a 5-minute test period.

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TABLE I. Testing and inspection - Continued.

- 20/ After thermal equilibrium has been reached, the frequency obtained by turning the tuner from the beginning of the frequency range to the specified setting in one direction shall be reproducible within the specified limits when returning to that same setting from the extreme opposite direction.
- 21/ Life test shall be run with heater power frequency set at the major resonant frequency, if any, as determined by the heater-structure test, provided that the resonant frequency occurs between 55 to 65 Hz or in the range between 340 to 1,800 Hz. If there is no such resonant frequency, heater power may be at any convenient frequency up to 1,800 Hz, at the discretion of the manufacturer.
- 22/ A cycle for intermittent life-test operation shall consist of the following:

<u>Test condition</u>	<u>I_b</u> <u>mA dc</u>	<u>E_f</u> <u>V</u>	<u>Minutes</u> <u>duration</u>
Standby	0	13.75	2
1	5.0	9.5	5
2	27.5	0	40
Off	0	0	13

Operating frequencies shall be reset approximately every 24 hours as follows:

F = 9,000, 9,200, 9,400, 9,600 MHz; F = 9,000 MHz, etc.

- 23/ This is a destructive test.
- 24/ Unless otherwise stated in the contract or purchase order, requirements for first article inspection hereby replace those covering qualification approval specified herein. The testing program shall include all tests and requirements of this specification sheet and the applicable ones listed in table I, samples and acceptance criteria for qualification of MIL-PRF-1. There are no allowable defects during first article testing. Requirements covering the first article test plan and test reports shall also be as specified in the contract or purchase order.

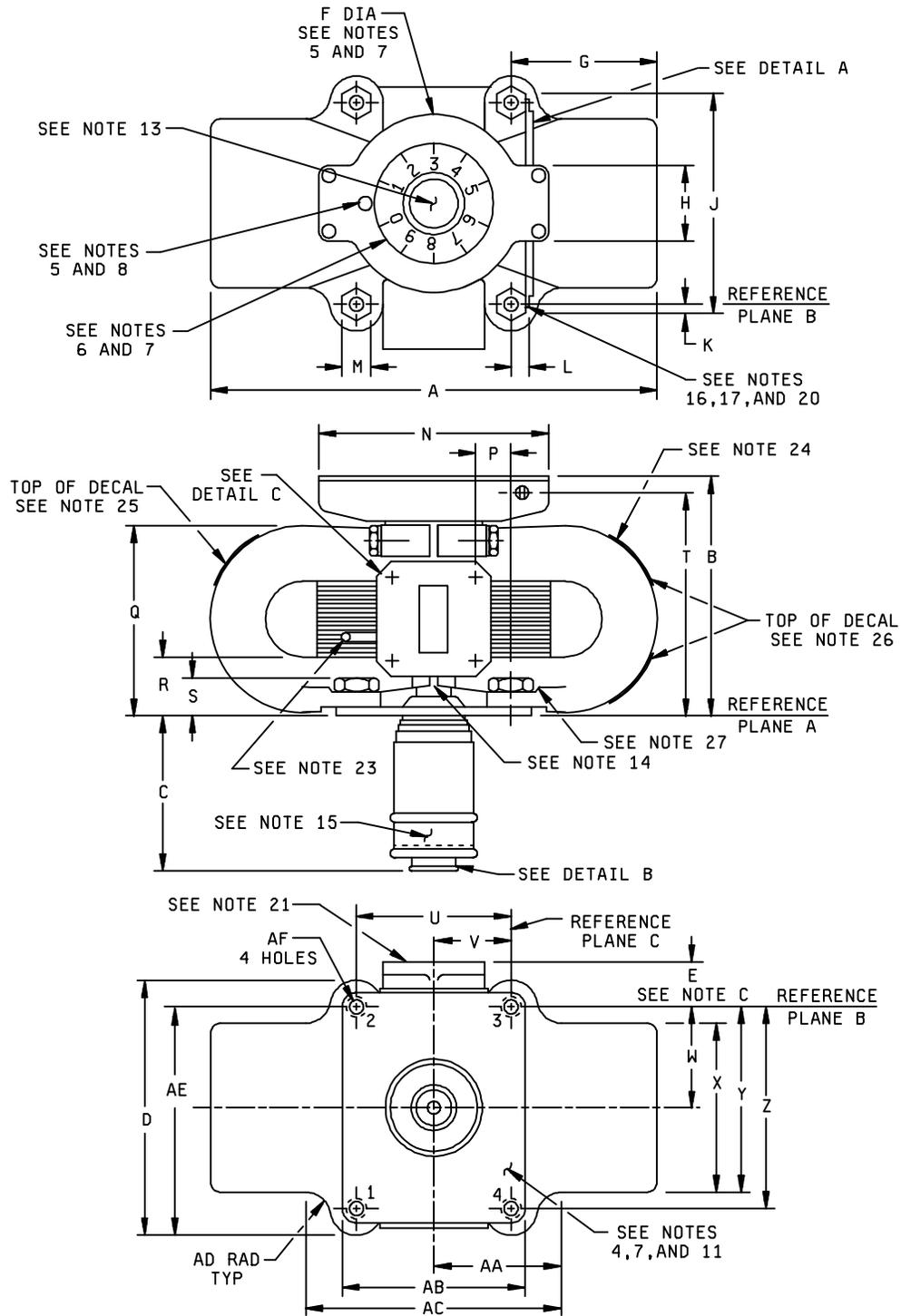


FIGURE 1. Outline drawing of electron tube type 7006.

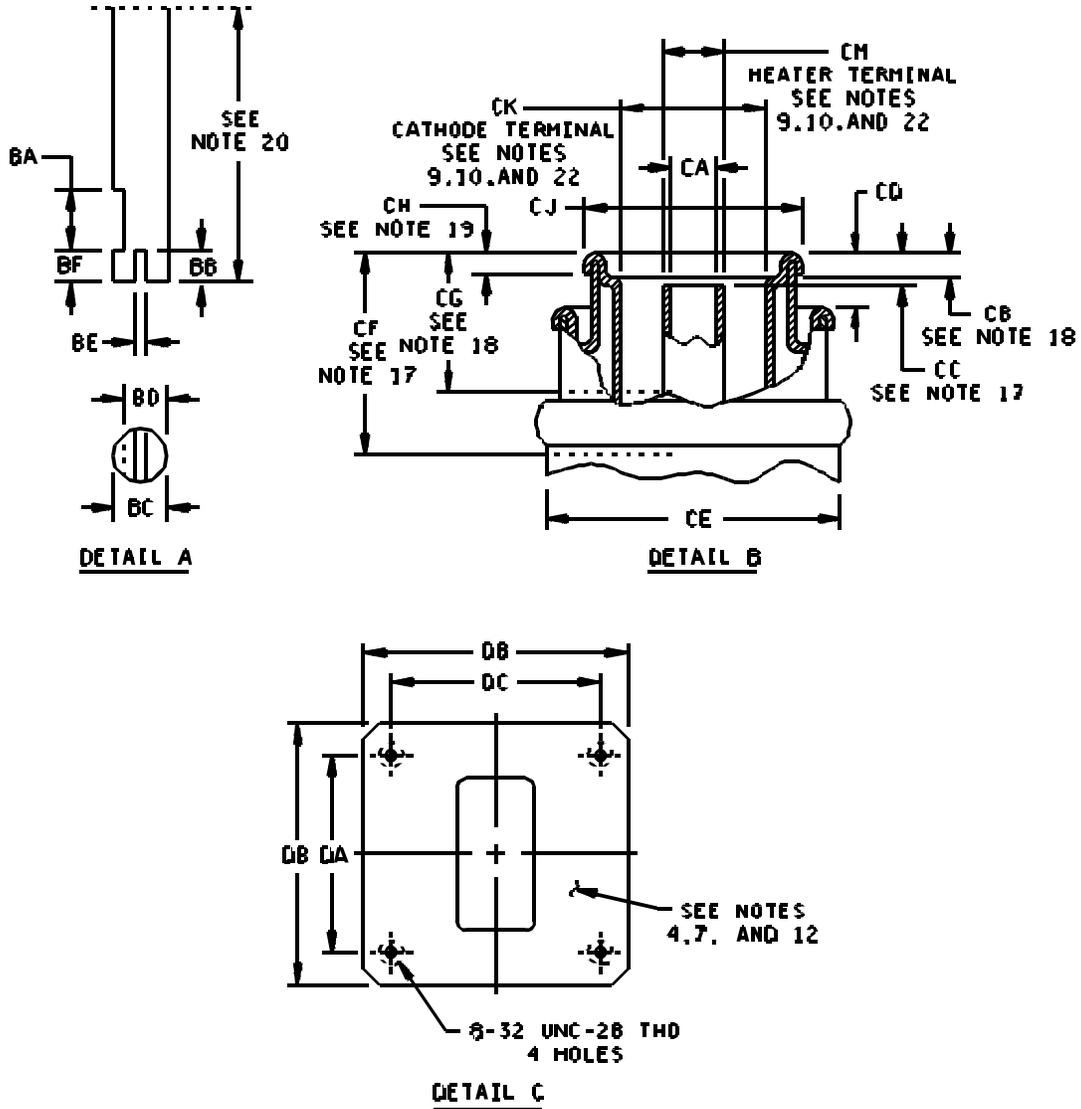


FIGURE 1. Outline drawing of electron tube type 7006 - Continued.

Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
Conformance inspection, part 1				
A	---	7.718	---	196.04
E	.882	.932	22.40	23.67
K	.062	.187	1.57	4.75
L	.186	.256	4.72	6.50
P	.468	.558	11.89	14.17
R	.945	1.009	24.00	25.63
T	3.438	3.530	87.33	89.66
AF	.276	.286	7.01	7.26
BE	.047	.057	1.19	1.45
CC	.125	.187	3.18	4.75
CJ	.825	.838	20.96	21.29
CK	.540	.545	13.72	13.84
DA	1.348	1.356	34.24	34.44
DC	1.470	1.478	37.34	37.54
Conformance inspection, part 2				
C	2.625	2.750	66.68	69.85
G	---	2.607	---	66.22
J	---	3.250	---	82.55
Q	---	3.270	---	83.06
S	.585	.656	14.86	16.66
U	---	2.500	---	63.50
Z	---	3.000	---	76.20
AA	---	2.350	---	59.69
AC	---	4.700	---	119.38
AD	---	.960	---	24.38
CA	.164	.174	4.17	4.42
CD	.219	.281	5.56	7.14

Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
Conformance inspection, part 3				
B	---	3.937	---	100.00
D	---	3.875	---	98.43
F	---	2.937 DIA	---	74.60 DIA
H	---	2.000	---	50.80
N	---	4.125	---	104.78
X	---	2.875	---	73.03
Y	---	3.000	---	76.20
AB	---	3.468	---	88.09
AE	---	3.421	---	86.89
CB	---	.156	---	3.96
CE	---	1.500	---	38.10
CF	.750	---	19.05	---
CG	.316	---	8.03	---
Reference dimensions				
M	.500		12.70	
V	1.250		31.75	
W	1.500		38.10	
BA	.1875		4.76	
BB	.125		3.18	
BC	.187		4.75	
BD	.1562 DIA		3.97 DIA	
BF	.125		3.18	
CH	.125		3.18	
CM	.250		6.35	
DB	1.830		46.48	

FIGURE 1. Outline drawing of electron tube type 7006 - Continued.

NOTES:

1. Reference plane "A" is a plane coincident with the indicated surface of the mounting flange.
2. Reference plane "B" is a plane perpendicular to Plane "A" and is coincident with the centers of mounting-flange holes No. 2 and No. 3.
3. Reference plane "C" is a plane perpendicular to Planes "A" and "B", and is coincident with the centers of mounting-flange holes No. 3 and No. 4.
4. These surfaces suitable for hermetic-seal connections. Output coupling to mate with UG-52B/U choke flange modified by clearing threads.
5. The tuner housing shall have a scribed, black line from index hole to tuner dial.
6. The tuner dial face shall be black finish, and shall have 100 graduations scribed as follows: Numbers 0 to 9 as indicated, and 1/10-division marks between the respective numbers. All numerals and division marks shall be white or silver color.
7. If used, all metal surfaces shall be black (or equivalent) finish satisfying environmental requirements, except mounting and connecting surfaces and tuner operators and indicators. Unpainted surfaces shall be nickel or silver plated, brass, or cadmium plated. If nickel or cadmium plating is required, it is recommended it be used only when other plating cannot meet performance requirements.
8. Number visible here shall be within the sequence of 0 to 6, and shall be indicative of the number of complete revolutions of the worm gear.
9. The heater and cathode terminals shall be concentric within .010 inch (0.25 mm). The axis of the heater-cathode terminal shall be within .046 inch (1.17 mm) of specified location.
10. The limits include angular as well as lateral deviation.
11. All points on mounting surface (base plate) shall be within .015 inch (0.38 mm) of Plane "A".
12. With the flange on a plane surface, a .005 inch (0.13 mm) thickness gauge, .125 inch (3.18 mm) wide, shall not enter.
13. Tuner temperature measurement point.
14. Anode temperature measurement point.
15. Heater-cathode temperature measurement point.
16. Clockwise rotation of this end of tuner operator shall result in decreased frequency. Approximately 136 revolutions of tuner operator shall suffice to traverse the frequency range.
17. These dimensions define the limits of dimension CA.
18. These dimensions define the limits of dimension CK. The step with the dimension CB is optional.
19. No connector clamping means shall bear beyond this depth.
20. A sleeve .195 inch (4.95 mm) I. D. by .406 inch (10.31 mm) O. D. shall be able to pass over end of tuner operator to within .250 inch (6.35 mm) of tuner housing.
21. A suitable dust cover to protect the opening of the waveguide output flange shall be provided with the tube.
22. Entire extent of connection areas of heater and cathode terminals shall be silver or nickel plated. If nickel plated is required, it is recommended it be used only when other plating cannot meet performance requirements.
23. Seal-off shall not extend beyond outline of magnets.
24. Frequency-dial setting information shall be located here.
25. The following warning shall be located here: "WARNING; MAINTAIN MINIMUM CLEARANCE OF 2 INCHES BETWEEN MAGNET AND MAGNETIC MATERIAL."
26. Identification markings such as Serial No. and date shall be located here.
27. Clearance above mounting-surface bulges shall be provided to enable installation of four 1.750 inch (44.45 mm) mounting bolts.

FIGURE 1. Outline drawing of electron tube type 7006 - Continued.

Custodians:

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

Preparing activity:

DLA - CC
(Project 5960-3568)

Review activities:

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