

INCH-POUND

MIL-PRF-1/665E
16 July 1999
SUPERSEDING
MIL-E-1/665D
2 September 1971

PERFORMANCE SPECIFICATION SHEET

ELECTRON TUBE, MAGNETRON
TYPE 6410A

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: Fixed nominal frequency of 2,805 MHz, 4.5 mW peak power output, with integral magnet.

ABSOLUTE RATINGS: Independent.

Parameter:	If	epy	tk	VSWR	T(anode)	T(bushing)	Output pressurization
Unit:	A	kv	sec	---	°C	°C	psia
Maximum:	80 <u>2/</u>	75	---	1.5 <u>3/</u>	100 <u>4/</u>	200 <u>4/</u>	50 <u>5/ 6/</u>
Minimum:	68	----	180	----	---	----	35

ABSOLUTE RATINGS: Dependent

Parameter:	ib	Pi	pi	Du	tpc
Unit:	a	kW	Mw	---	μs
Maximum:	135	10.0	10	0.001	2.2
Minimum:	90	---	---	---	1.8 <u>7/</u>

PHYSICAL CHARACTERISTICS:

Dimensions: Mounting position: Mounting support: Weight:	See figure 1 <u>11/</u> By means of hole in magnet 58 pounds, approximate	Cooling: Cathode: Magnet isolation:	<u>4/ 9/</u> Unipotential <u>8/</u> <u>10/</u>
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See footnotes at end of table I.

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TEST CONDITIONS: 6/

Parameter:	If(preheat)	If (radiate)	Ib	VSWR	T(anode)	tk	tpc	tfc	tfv	trv	trc	Du
Unit:	A	A	mA dc	---	°C	sec	μs	μs	μs	μs	μs	---
<u>Test condition 1:</u>												
Maximum:	80	76	---	---	90	180	2.2	0.6	2.5	0.5	0.35	---
Minimum :	75	70	130	1.1	50	---	---	---	---	---	---	0.001
	<u>2/ 14/ 15/</u>							← 18/ →				
<u>Test condition 2:</u>												
Maximum:	80	76	---	---	90	---	2.2	0.6	2.5	0.5	0.35	---
Minimum :	75	70	104	1.1	50	180	---	---	---	---	---	0.0008
	<u>2/ 14/ 15/</u>							← 18/ →				

See footnotes at end of table I.

GENERAL:

Qualifications: Required.

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TABLE I. Testing and inspection.

Inspection	Method	Notes	Test	Conditions	Symbol	Limits		Unit
						Min	Max	
<u>Qualification inspection</u>								
Temperature coefficient	4027	<u>4/</u>	1, 2	T = +40°C to +70°C	$\frac{\Delta F}{\Delta T}$	---	-0.15	MHz/°C
High-frequency vibration	1031	---	---	No voltages	---	---	---	---
Shock	1042	---	---	15 G; 11 ms; three planes one direction	---	---	---	---
Fixed frequency	---	<u>4/</u>	1		F	2,750	2,860	MHz
Pulse voltage	4306	---	---		epy	65	75	kv
Power output	4250	---	---		Po	4,500	---	W
RF bandwidth	4308	<u>19/</u>	---		BW	---	1.5	MHz
Pulse stability	4315	<u>16/</u>	1		MP	---	0.5	%
Frequency pushing figure	4311	<u>17/</u>	1, 2		$\frac{\Delta F}{\Delta b}$	---	0.025	MHz/A
<u>Conformance inspection, part 1</u>								
Pressurizing	4003	---	---	50 pound/square inch absolute (max), there shall be no leaks at the output	---	---	---	---
Filament voltage	1261	---	---	If = 76 A; tk = 600 sec (min)	Ef	6.5	8.8	V
Fixed frequency	---	<u>4/</u>	2		F	2,750	2,860	MHz
Pulse voltage	4306	---	---		epy	65	75	kv
Power output	4250	---	---		Po	3,600	---	W
RF bandwidth	4308	<u>19/</u>	---		BW	---	1.5	MHz
Pulse stability	4315	<u>16/</u>	2		MP	---	0.5	%
<u>Conformance inspection, part 2</u>								
Low-frequency vibration	1031	---	---	No voltages	---	---	---	---
Frequency pulling figure	4310	---	2		ΔF	---	15	MHz

See footnotes at end of table.

TABLE I. Testing and inspection.

Inspection	Method	Notes	Test	Conditions	Symbol	Limits		Unit
						Min	Max	
<u>Conformance inspection, part 3</u>								
Life test	---	<u>12/ 13/</u>	2	Group D	t	400	---	hrs
Life-test end points:	---	---	---		---	---	---	---
Fixed frequency	---	<u>4/</u>	2		F	2,750	2,860	MHz
Power output	4250	---	1		P _o	3,600	---	W
			2		P _o	2,880	---	W
RF bandwidth	4308	<u>19/</u>	---		BW	---	2.0	MHz
Pulse stability	4315	<u>16/</u>	2		MP	---	1.0	%

- 1/ Unless otherwise specified, the acceptance level for conformance inspection, part 1, shall be 1.0 percent, inspection level II.
- 2/ The maximum value specified is for a nonoscillating condition. Heater surge current should not be allowed to exceed 100 amperes.
- 3/ Frequency skipping or unstable operation may be encountered at some phase positions when the mismatch occurs at the end of a "long" line.
- 4/ The anode and bushing temperature shall be measured at the points indicated on figure 1. The temperature shall be measured after thermal equilibrium has been reached.
- 5/ During operation, the gas used in pressurization shall provide insulating properties at least equal to that of clean dry air at the pressure indicated.
- 6/ Under test condition 1, or any other operating conditions in excess of 0.0008 duty cycle, it is essential to provide a stream of air (5 cfm minimum) to cool the magnetron output window in order to prevent damage due to thermal stresses.
- 7/ 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 among the more important considerations. Negative post-pulse voltage oscillations may cause leakage current and noise.
- 8/ The cathode terminal and high-voltage bushing shall be insulated by immersion in oil having the equivalent electrical characteristics of Federal Specification VV-I-530.
- 9/ At all times the anode temperature shall be maintained at least 5°C above the freezing point of the anode liquid coolant. Coolant pressure shall not exceed 55 pounds per square inch absolute, but sufficient pressure of coolant shall be maintained to provide cooling of the anode to the temperature limits specified.
- 10/ In handling and mounting the magnetron, care shall be exercised to prevent demagnetization. Ferromagnetic materials or energized magnets shall be kept more than 12 inches from the tube. Maintain 18 inches spacing (center-to-center) to any other 6410A tube. Do not place an unpacked 6410A tube on a case containing another 6410A tube.
- 11/ The tube shall be mounted with the cathode vertical within 15' and with the end of the cathode bushing pointing in the downward direction.
- 12/ Power input to the tube during life test shall be cycled according to the following schedule:
- Preheat (heater): 5 minutes.
Oscillate (RF): 4 hours
All voltages off: 1 hour

TABLE I. Testing and inspection - Continued.

- 13/ The interpretation of the VSWR shall be as specified in method 4310. The standing wave introducer shall be cycled continuously through a one-half wavelength line at a minimum rate of one cycle/hour.
- 14/ The heater current should be reduced at 75 percent of the maximum power input. This reduced heater current shall be maintained at ± 3.5 percent of the specified value.
- 15/ Each tube shall be labeled to indicate If for both preheat and radiate conditions.
- 16/ The interpretation of the VSWR shall be as specified in method 4310. The missing pulse rate shall be counted during the last 5 minutes of a test interval not to exceed 15 minutes.
- 17/ The peak anode current shall be varied at more than 50 Hz through a range exceeding 20 percent, but not exceeding 45 percent of the peak value obtained under test condition 1 or test condition 2 conditions; the average current being held at test condition 1 or test condition 2 value. This test may be performed under either test condition 1 or test condition 2 conditions. The frequency shift per ampere shall be within the limit specified.
- 18/ This test shall be conducted for only one set of conditions within the limits specified for the test condition specified. The pulse characteristics shall be measured as follows:
- tfc and tfv: 0 to 85 percent point
trc and trv: 20 to 85 percent point
- No spike ripple shall exceed ± 7 percent of the average peak value of the voltage pulse. Inverse voltage shall not exceed 35 percent of the forward voltage. There shall be no negative post-pulse voltage.
- 19/ The rf bandwidth shall be within the limits specified where a VSWR of 1.5:1 is introduced into the load, the phase being adjusted for maximum spectrum width.

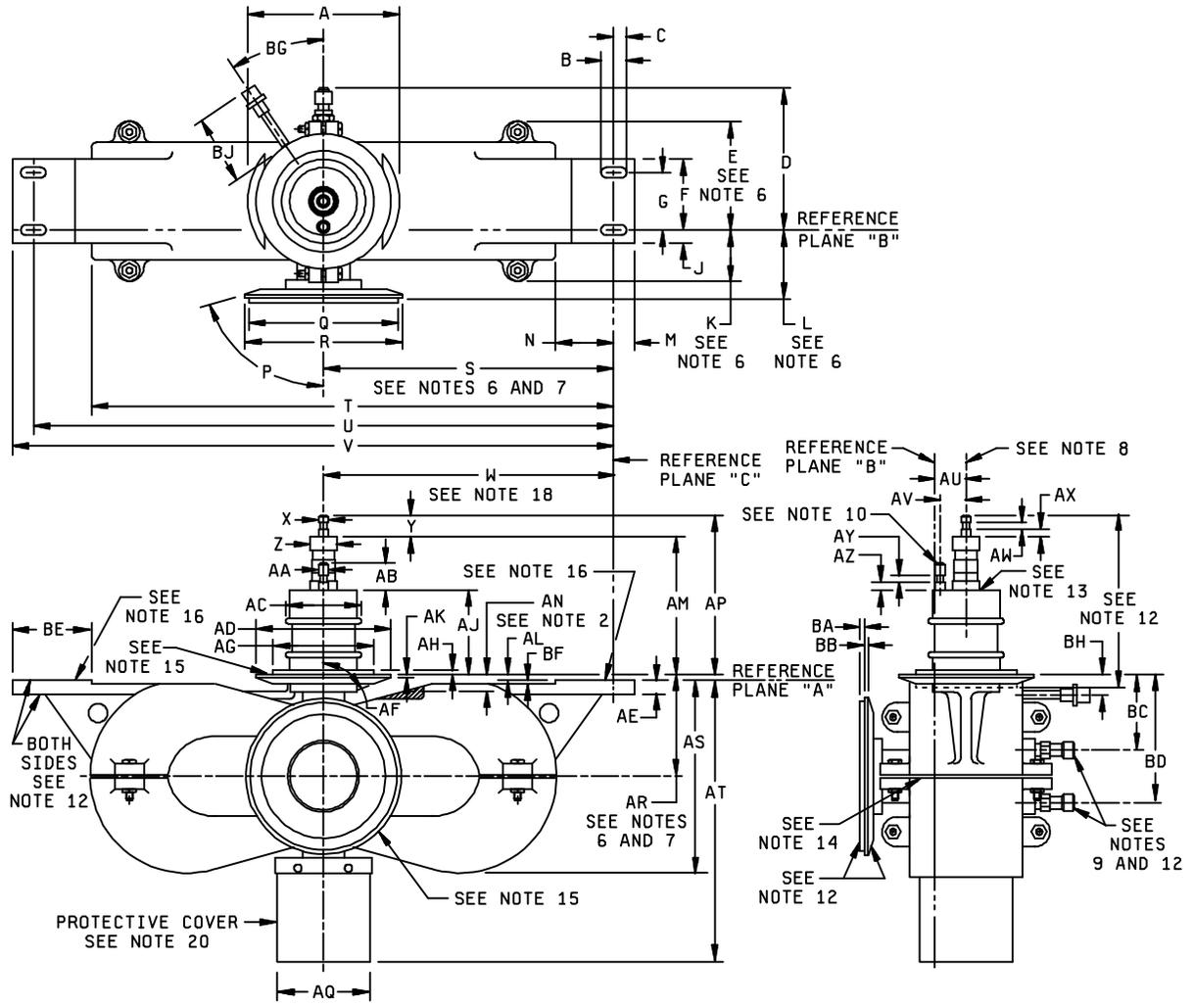


FIGURE 1. Outline drawing of electron tube type 6410A.

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Ltr	Dimensions				Ltr	Dimensions			
	Inches		Millimeter			Inches		Millimeters	
	Min	Max	Min	Max		Min	Max	Min	Max
Conformance inspection, part 1 (see note 1)					Conformance inspection, part 2 - Continued				
B	.860	.890	21.84	22.61	N	1.250	---	31.75	---
C	.425	.450	10.80	11.43	T	---	18.500	---	469.90
F	---	2.437	---	61.90	BE	2.000	---	50.80	---
H	.190 RAD	.210 RAD	4.83 RAD	5.33 RAD	BF	---	.062	---	1.57
J	---	.437	---	11.10	Reference dimensions				
L	2.195	2.445	55.75	62.10	D	4.917	---	124.89	---
M	---	.750	---	19.05	P	70°	---	70°	---
Q	5.025 DIA	5.051 DIA	127.64 DIA	128.30 DIA	W	9.812	---	249.22	---
R	5.285 DIA	5.315 DIA	134.24 DIA	135.00 DIA	Y	.674	---	17.12	---
S	9.662	9.962	245.41	253.03	Z	.740 DIA	---	18.80 DIA	---
U	19.437	19.813	493.70	503.25	AB	.875	---	22.23	---
V	---	20.625	---	523.88	AE	.375	---	9.53	---
X	---	.344 DIA	---	8.74 DIA	AF	70°	---	70°	---
AA	---	.312 DIA	---	7.92 DIA	AG	3.485 DIA	---	88.52 DIA	---
AC	---	2.875 DIA	---	73.03 DIA	AH	.125	---	3.18	---
AD	4.485 DIA	4.515 DIA	113.92 DIA	114.68 DIA	AK	.063	---	1.60	---
AJ	---	3.500	---	88.90	AU	1.000	---	25.40	---
AL	---	.300	---	7.62	AV	.850	---	21.59	---
AM	---	5.000	---	127.00	AW	.187	---	4.75	---
AN	.385	---	9.78	---	AX	.250	---	6.35	---
AP	---	6.000	---	152.40	AY	.187	---	4.75	---
AQ	---	3.250 DIA	---	82.55 DIA	AZ	.250	---	6.35	---
AR	3.250	3.500	82.55	88.90	BA	.094	---	2.39	---
AS	---	6.500	---	165.10	BB	.063	---	1.60	---
AT	---	9.750	---	247.65	BC	2.620	---	66.55	---
Conformance inspection, part 2					BD	4.120	---	104.65	---
A	4.812 DIA	---	122.22 DIA	---	BG	35°	---	35°	---
E	---	3.875	---	98.43	BH	.685	---	17.40	---
G	1.985	2.015	50.42	51.18	BJ	2.250	---	57.15	---
K	---	1.812	---	46.02					

FIGURE 1. Outline drawing of electron tube type 6410A - Continued.

NOTES:

1. Dimensions without tolerances are for information only and are not required for inspection purposes.
2. Applies to dimension A.
3. Reference plane A is defined as that plane which passes along face of mounting brackets.
4. Reference plane B is defined as that plane which passes through centers of mounting slots as shown, and which is perpendicular to plane A.
5. Reference plane C is defined as that plane which passes through centers of mounting slots as shown, and which is mutually perpendicular to planes A and B.
6. Includes angular and lateral deviations.
7. Refers to center line of waveguide.
8. Parts located on this line may vary from true location by .125 inch (3.175 mm).
9. Coupling plug, Hanson B3-T20, or equivalent.
10. Common cathode connection.
11. All soldered joints on output sections shall provide hermetic seal.
12. The following surfaces shall be free from paint: Front and rear faces of oil sealing sleeve, parts above flange, front and rear faces of output flange, exhaust cap, and mounting surfaces of magnets and coolant plug connectors.
13. Cathode stem temperature measured at this point.
14. Anode temperature shall be measured at right side (facing output) of output transformer by inserting thermocouple plug as shown on figure 2.
15. Equipment flanges shall mate with oil sealing flange and output flange by means of flexible union. Oil sealing flange and output flange shall not be used to support tube. Entire weight of tube shall be supported by magnet mounting brackets.
16. These surfaces shall be coplanar within .032 inch (0.81 mm). This feature shall be inspected on a qualification basis.
17. Paint with heat resistant, noncorrosive paint.
18. Parts located on this line may vary from true location by .188 inch (4.78 mm).
19. Magnet may be of two-piece or four-piece construction.
20. Protective shipping covers shall be provided.

FIGURE 1. Outline drawing of electron tube type 6410A - Continued.

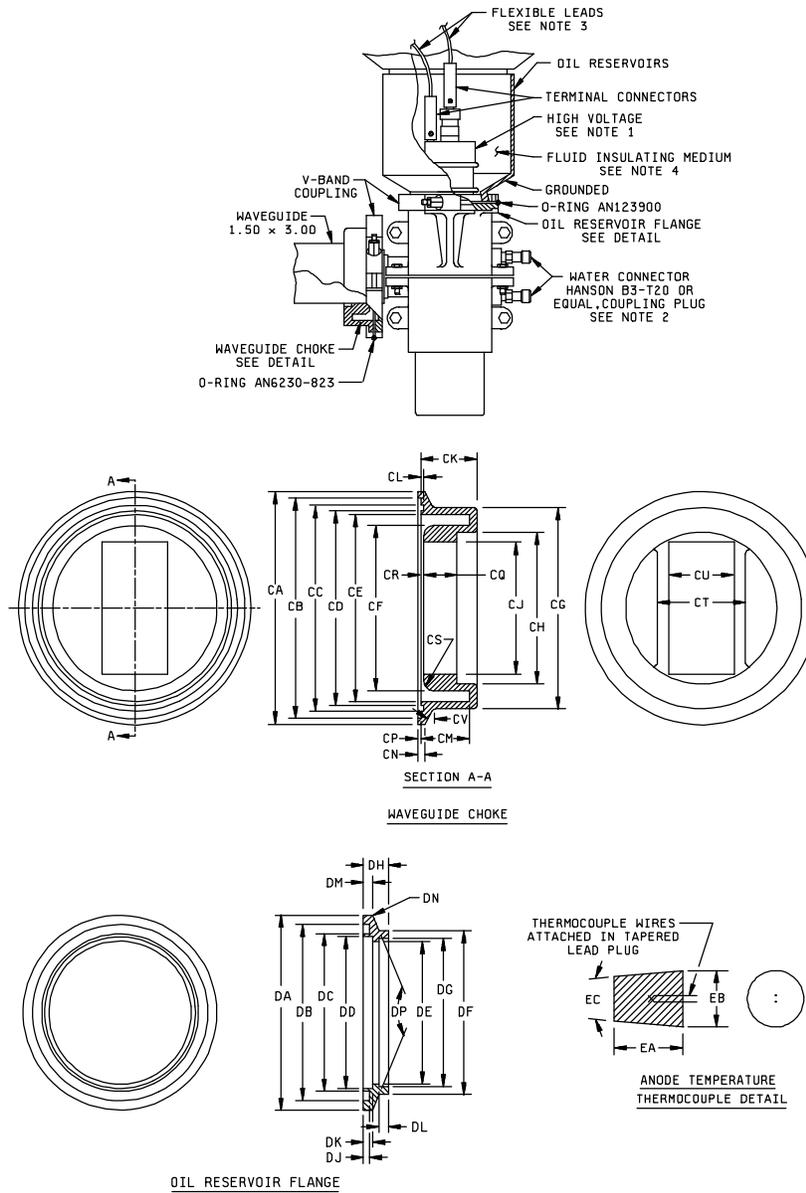


FIGURE 2. Installation details.

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Ltr	Dimensions				Ltr	Dimensions			
	Inches		Millimeter			Inches		Millimeters	
	Min	Max	Min	Max		Min	Max	Min	Max
CB	5.052 DIA	5.062 DIA	128.32 DIA	128.57 DIA	DG	3.395 DIA	3.405 DIA	86.23 DIA	86.49 DIA
CC	4.684 DIA	4.688 DIA	118.97 DIA	119.08 DIA	DH	.528	.532	13.41	13.51
CD	4.382 DIA	4.386 DIA	111.30 DIA	111.40 DIA	DJ	.119	.123	3.02	3.12
CE	4.260 DIA	4.270 DIA	118.20 DIA	118.46 DIA	DK	.156	.160	3.96	4.06
CF	3.760 DIA	3.770 DIA	95.50 DIA	95.76 DIA	DL	.183	.189	4.65	4.80
CJ	3.000	3.010	76.20	76.45	DM	.195	.199	4.95	5.05
CL	.113	.118	2.87	3.00	DP	139°30'	140°30'	139°30'	140°30'
CM	1.115	1.125	28.32	28.58	EA	.160	.170	4.06	4.32
CN	.169	.173	4.29	4.39	EB	.130 DIA	.145 DIA	3.30 DIA	3.68 DIA
CP	.065	.070	1.65	1.78	EC	10°20'	11°0'	10°20'	11°0'
CR	.045	.055	1.14	1.40	Reference dimensions				
CU	1.495	1.505	37.97	38.23	CA	5.312 DIA		134.92 DIA	
CV	19°30'	20°30'	19°30'	20°30'	CG	4.562 DIA		115.87 DIA	
DA	4.490 DIA	4.510 DIA	114.05	114.55	CH	3.438 DIA		87.33 DIA	
DB	4.000 DIA	4.010 DIA	101.60 DIA	101.85 DIA	CK	1.281		32.54	
DC	3.625 DIA	3.635 DIA	92.08 DIA	92.33 DIA	CQ	.750		19.05	
DD	3.500 DIA	3.510 DIA	88.90 DIA	89.15 DIA	CS	.250 RAD		6.35 RAD	
DE	3.195 DIA	3.205 DIA	81.15 DIA	81.41 DIA	CT	2.000		50.80	
DF	3.675 DIA	3.685 DIA	93.35 DIA	93.60 DIA	DN	.031 RAD		0.79 RAD	

NOTES:

1. Minimum distance from high voltage to ground shall be 1.500 through oil and 10.000 through air, at atmospheric pressure.
2. Mates with socket, Hanson 3-S20, or equivalent.
3. Leads shall conduct 100 RMS amperes minimum.
4. Fluid insulating medium shall be Univolt 35 transformer oil, or equivalent.
5. All corners .125 RAD (3.17 mm RAD), except as shown.

FIGURE 2. Installation details - Continued.

Custodians:

Army - CR
Navy - EC
Air Force - 80
DLA - CC

Preparing activity:

DLA - CC

Project 5960-3551-01)

Review activities:

Army - AR
Navy - AS, CG, MC, OS, SH
Air Force - 11, 17, 99