

INCH-POUND

MIL-PRF-1/849G
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SUPERSEDING
MIL-E-1/849F
20 February 1976

PERFORMANCE SPECIFICATION SHEET

ELECTRON TUBE, MAGNETRON
TYPE 6543

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 8,500 to 9,600 MHz, rated peak power output 65 kw, integral magnet.

ABSOLUTE RATINGS:

Parameter:	Ef	if(surge)	tk	tpc	ib	pi	Pi	VSWR
Unit:	V	a	sec	μ s	a	kw	W	----
Maximum	13.7	10	----	3.3	16.0	250	250	1.5:1
Minimum	----	----	120	----	14.0	----	----	----

ABSOLUTE RATINGS:

Parameter:	Tuner drive torque	T (anode)	T (input bushing)	Altitude
Unit:	in.oz	$^{\circ}$ C	$^{\circ}$ C	ft
Maximum	50	150	175	10,000
Minimum	----	-65	-65	----

PHYSICAL CHARACTERISTICS:

Dimensions:	See figure 1	Cathode:	Unipotential
Mounting position:	Any	Magnet:	<u>4/</u>
Mounting support:	Mounting flange	Weight:	6 pounds 2 ounces (approx)
Marking:	<u>24/</u>	Handling:	<u>4/</u>

See footnotes at end of table I.

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Frequency
F1 = 8,500 MHz
F2 = 8,600 MHz
F3 = 9,000 MHz
F4 = 9,375 MHz
F5 = 9,600 MHz

TEST CONDITIONS 1:

Parameter:	Ef	tpc	rv	Du	lb	VSWR
Unit:	V	μs	kV/μs	----	mA dc	----
Maximum	----	0.40	----	----	----	1.10
	10.4	----	----	0.0003	4.5	----
Minimum	----	0.35	160	----	----	----

TEST CONDITIONS 2:

Parameter:	Ef	tpc	rv	Du	lb	VSWR
Unit:	V	μs	kV/μs	----	mA dc	----
Maximum	----	3.30	----	----	----	1.10
	7.8	----	----	0.001	15.0	----
Minimum	----	3.10	120 <u>22/</u>	----	----	----

See footnotes at end of table I.

GENERAL:

Qualification - Required.

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TABLE I. Testing and inspection.

Inspection	Method	Notes	Test	Conditions	Symbol	Limits		Unit
						Min	Max	
<u>Qualification inspection</u>								
Variable-frequency vibration	1031	<u>6/ 7/ 8/ 30/ 32/</u>	---		---	---	---	---
Shock, specified pulse	1042	<u>6/</u>	---	No voltage applied; 15G; t = 11 ms	---	---	---	---
Tuner stop endurance	4223	<u>9/</u>	---	No voltages applied	Torque	50	---	in.-oz
Mechanical tuning fatigue	4223	<u>7/ 10/ 11/ 12/ 31/</u>	---	No voltages applied	---	10,000	---	Cycles
Operating torque or force	4223	<u>10/ 33/</u>	---	TA = 25°C	Torque	---	15	in. oz
Resettability	4223	<u>13/</u>	2	F = 9,550 ± 50 MHz	ΔF	---	15	MHz
Direct-interelectrode capacitance	4266	---	---		C	10	14	pF
Tuning rate	4223	<u>14/ 33/</u>	1	T (anode) = 70° ± 10°C	ΔF	---	±60	MHz
RF bandwidth	4308	<u>15/ 16/</u>	1	F = F1 to F5 Ib = 4.0 and 5.0 mA dc	BW	---	2.0/tpc	MHz
		<u>21/</u>	2	F = F1, F3, F5 Ib = 13.5 and 16.5 mA dc	BW	---	3.0/tpc	MHz
Minor lobe ratio	4308	<u>15/ 16/</u>	1	F = F1 to F5; Ib = 4.0 and 5.0 mA dc	Ratio	8	---	dB
Mechanical tuning rate	4223	<u>17/</u>	---		---	---	---	---
Barometric pressure, reduced	4028	<u>18/</u>	2	VSWR = 1.5:1; pressure = 500 mmHg (absolute)	---	---	---	---
Temperature coefficient	4027	<u>33/</u>	2	T(anode) = 70° to 100°C; F = F3	ΔF/ΔT	---	0.25	MHz/°C
Low-temperature operation	1047	<u>19/</u>	2	tk = 120 sec (max); F = F3	MP	---	2.0	%
Forced cooling	1143	<u>33/</u>	1		T	---	50	°C(rise)
<u>Conformance inspection, part 1</u>								
Pressurizing	4003	---	---	40 to 45 psia, input and output assemblies	---	---	---	---
Heater current	4289	---	---	Ef = 12.6 V; tk = 120 sec (max)	If	2.0	2.4	A
Operating torque or force	4223	<u>10/</u>	---	TA = 25° ± 5°C	Torque	---	15	in.-oz
Mechanical tuning range	4223	---	1	T(anode) = 70° ± 10°C Upper limit Lower limit	F	9,600	---	MHz
					F	---	8,500	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 1 - Continued</u>								
RF bandwidth	4308	<u>15/ 16/ 21/</u>	1 2	F = F1 to F5 F = F1 to F5	BW BW	---- ----	2.0/tpc 3.0/tpc	MHz MHz
Minor lobe ratio	4308	----	1		Ratio	8	----	dB
Stability	4315	<u>15/ 23/</u>	1, 2	F = F1 to F5	MP	----	1.0	%
Starting stability	4315	<u>5/ 21/ 23/</u>	2	F = F1	MP	----	1.0	%
Pulse voltage	4306	----	2	F = F5	epy	13.5	16.5	kv
Power output	4250	----	2	t = 300 (max); F = F1, F3, F5	Po	65	----	W
<u>Conformance inspection, part 2</u>								
Variable-frequency vibration	1031	<u>2/ 6/ 32/</u>	----	No voltages applied	----	----	----	----
Operating torque or force	4223	<u>10/</u>	----	TA = -50°C TA = +125°C; no voltages applied	Torque Torque	---- ----	25 15	in.-oz in.-oz
Resettability	4223	<u>13/</u>	1	F = 9,550 ± 50 MHz	ΔF	----	10	MHz
Frequency pulling figure	4310	----	1	F = F1 to F5, in 100 MHz increments	ΔF	----	15	MHz
Power output	4250	<u>16/</u>	2	F = F1 to F5	Po	65	----	W
Heater-voltage sensitivity	----	<u>25/</u>	1, 2		----	----	----	----
<u>Conformance inspection, part 3</u>								
Life test	----	<u>3/ 26/ 27/</u>	----	Group C; VSWR = 1.5:1 (min)	---- t	1,334 400	---- ----	Cycles hrs
Life-tests end points:	----							
Power output	4250	<u>28/</u>	2		Po	50	----	W
RF bandwidth	4308	<u>28/</u>	2		BW	----	3.0/tpc	MHz
Minor lobe ratio	4308	<u>28/</u>	1		Ratio	6	----	dB
Stability	4315	<u>28/</u>	1, 2		MP	----	2.0	%
Resettability	4223	<u>28/ 29/</u>	----		ΔF	----	50	MHz

See notes at end of table.

TABLE I. Testing and inspection - Continued.

- 1/ Unless otherwise specified, the acceptance level for all tests listed under conformance inspection, part 1, shall be 1.0, inspection level II.
- 2/ 10 to 55 to 10 Hz. Vibrate from 1 to 3 minutes at 10 G or 0.60-inch (1.53 mm) double amplitude; repeat for a total of 90 minutes in each of the three mutually perpendicular axes. Vibrate for 30 minutes at each of the resonant frequencies noted.
- 3/ VSWR cycled through $\lambda/4$ in about 30 minutes; starting at 8,500 MHz, the frequency shall be increased in 100 MHz increments every 10 hours.
- 4/ In handling and mounting the magnetron, care shall be exercised to prevent demagnetization.
5. Immediately after a nonoperating period of 168 hours minimum, the starting stability test shall be performed on 100 percent of the submitted lot.
- 6/ After subjection to the specified test, the tube shall meet the requirements for RF bandwidth, minor lobe ratio, and stability as specified under test condition 1.
7. Separate samples shall be required for this test.
- 8/ The tubes shall be fastened rigidly to the vibration platform and vibrated with simple harmonic motion. The direction of vibration shall be as indicated on figure 1.
- 9/ The tuning mechanism shall withstand the specified torque at the limits of mechanical motion.
- 10/ The torque required to operate the tuning shaft through the specified tuning range shall not exceed the maximum specified.
- 11/ The tuner shall operate for at least the specified number of cycles. The tube shall then meet all of the conditions of test condition 2 and the torque and backlash at room temperature shall not exceed the specified amount. One cycle is defined as a complete traverse from one end of the tuning range to the other and back again. During this test the tuner may be lubricated not more than once every 1,000 cycles with Texaco low-temperature grease No. 1,888, or equivalent.
- 12/ After the specified number of cycles, the tube shall pass all the tests under test condition 2 in conformance inspection, part 1.
- 13/ The frequency obtained by turning the tuner to a given setting in one direction shall be reproducible within specified limits when returning to that same setting from the opposite direction after thermal equilibrium.
- 14/ After thermal frequency stability has been reached at each of the frequencies of this test, F1, F2, F3, F4, F5 (see 24/), the curve of frequency versus tuner position shall not deviate more than the specified amount from the curve on figure 2.
- 15/ This test shall be performed by a continuous observation while the tube frequency and a stub having a VSWR of 1.5:1 minimum are continuously varying. The stub shall travel a minimum of 180 electrical degrees for every 20 MHz of magnetron tuning.
- 16/ The measurement shall be made throughout the specified tuning range at a rate sufficiently slow to permit steady-state indications. At no place in the specified tuning range shall the specified limits be exceeded.
- 17/ With the tuning dial adjusted for a frequency of 9,000 MHz, an operating frequency of 9,600 MHz shall be obtained by clockwise rotation of the designated end of the tuning shaft 68 ± 12 turns. A frequency of 8,500 MHz shall be attained by turning the shaft 49 ± 6 turns in the opposite direction from the 9,000 MHz setting.
- 18/ With the specified input pressurization, or output pressurization, or both, there shall be no evidence of breakdown in the input assembly, or output assembly.
- 19/ The missing pulses (MP), due to any causes, are considered to be missing if the RF energy is less than 70 percent of the normal energy level in the frequency range of 8,900 to 9,100 MHz. The VSWR shall be adjusted to that phase producing maximum instability and the MP counted during the last 3 minutes of a 5-minute test period.

TABLE I. Testing and inspection - Continued.

- 20/ An airflow of 10 cubic feet per minute (cfm) at approximately 760 mmHg shall be directed on the cooling fins from an orifice 2-1/2 inches by 1-3/16 inches (63.50 mm by 30.16 mm). Temperature of the anode shall be measured, and the rise shall not exceed the amount specified.
- 21/ The tube shall be operated into a transmission line with a VSWR of 1.5:1 minimum adjusted in phase to produce the maximum spectrum degradation.
- 22/ The rrv shall be expressed in kv per μ s defined by the steepest tangent to the leading edge of the voltage pulse above 80 percent amplitude. Any capacitance used in viewing system shall not exceed 6.0 pF. No spike or ripple shall exceed ± 7 percent of the average peak value of voltage or current. Inverse voltage shall not exceed 20 percent of the forward voltage. The negative amplitude of any post pulse voltage oscillation shall not exceed 10 percent of the average peak value.
- 23/ The VSWR shall be adjusted to the phase producing maximum instability and the MP counted for a period of 3 minutes starting 30 seconds after application of high voltage.
- 24/ In addition to regular markings, letters and dial settings shall be stamped on the tube at the point specified on figure 1, to indicate F1 through F5 ± 10 MHz at the start of life under test condition 2 conditions with the body temperature $70^\circ \pm 10^\circ\text{C}$.
- 25/ All of the requirements of test conditions 1 and 2 shall be met with the heater voltage at ± 8 percent from the voltage specified for test.
- 26/ Life test shall be run with heater power frequency set at the major resonant frequency, if any, as determined by the heater structure type test, provided the resonant frequency occurs at 55 to 65 Hz or in the interval 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. To measure the resonant frequency, one of the two following methods shall be used:
- (a) Supply the specified preheating voltage to the tube heater from a variable frequency power supply. Vary the supply frequency while listening (with a sensitive stethoscope) for any indication of resonance. At the resonant frequency distinct vibration of the structure will be heard.
 - (b) Supply heater voltage to the tube from a variable frequency supply. Operate the tube (test conditions 1) and observe the RF spectrum while varying the frequency of the heater voltage. At the resonant frequency of the heater cathode structure, large values of the frequency modulation will be observed.
- 27/ Life test shall be conducted in accordance with the following cycle:

Test condition	Ef (V)	Duration
Standby	12.6	2 minutes
1	10.4	3 minutes
2	7.8	15 minutes
Off	----	16 minutes

- 28/ If during life test the tube does not meet the specified limits, it shall be recycled for an additional 5 cycles. At such time the test shall be repeated. If the tube fails the second test, it shall be considered unsatisfactory.
- 29/ At each of the dial settings called for in 24/, the measured frequency shall not differ from the stated frequency by more than the amount specified.
- 30/ 5 G or DA = .01 inch, whichever is limiting value. Vibration frequency = 5 to 500 to 5 Hz varied uniformly over complete range in 15 minutes, repeat for a total of 2 hours in each of three axes.
- 31/ Duration of each cycle = 45 seconds (maximum).
- 32/ For vibration tests, axes of vibration shall be reference axes "A", "B", and "C".
- 33/ Reference point for anode T measurements locate where a central fin meets the anode block near the output section.

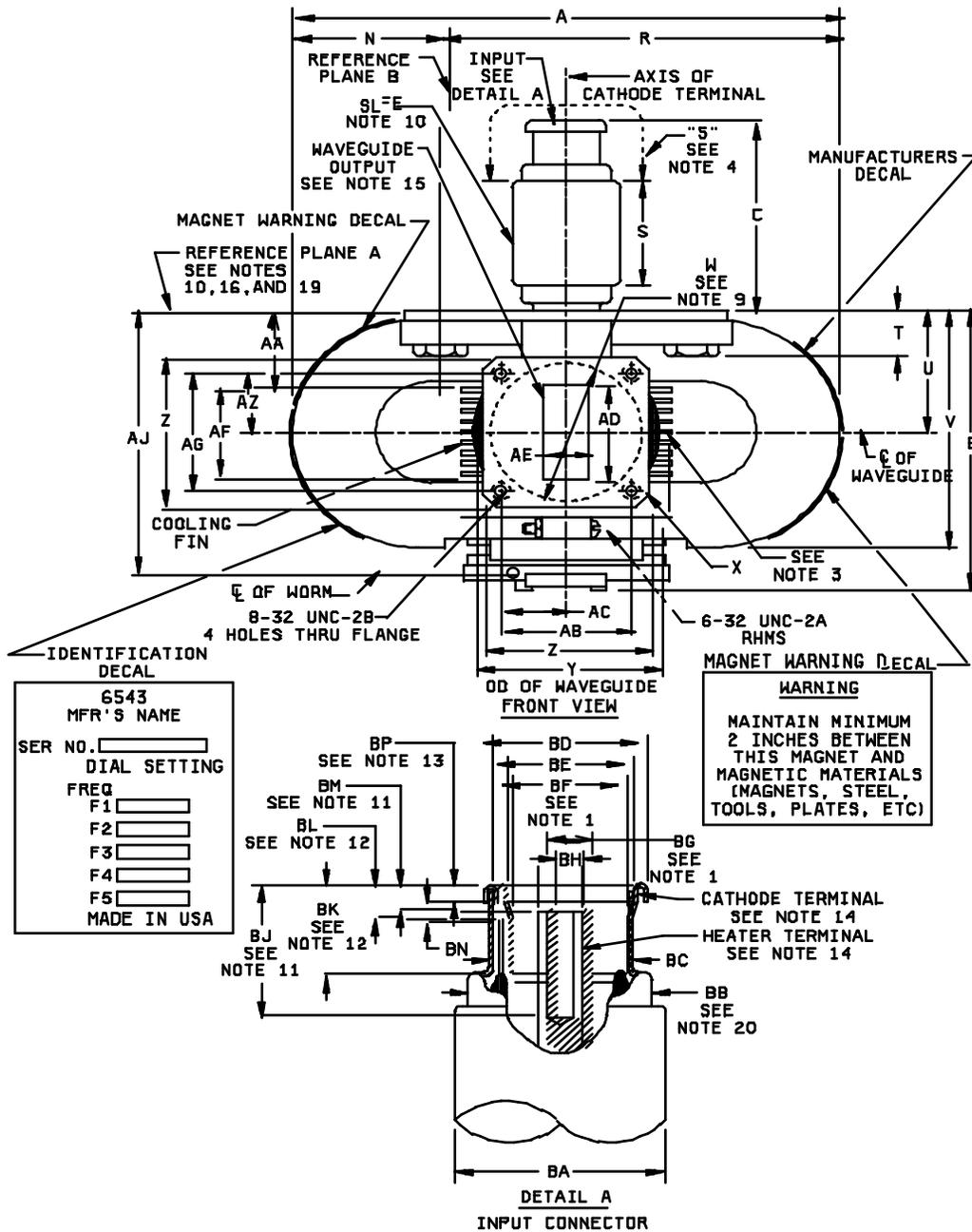


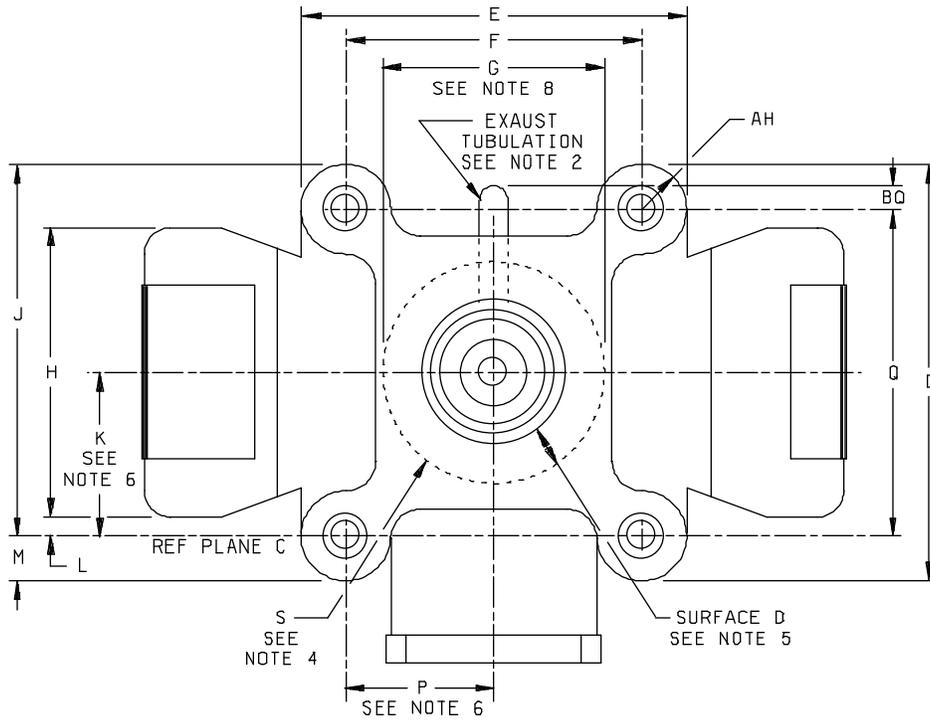
FIGURE 1. Outline drawing of electron tube type 6543.

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Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
Conformance inspection, part 1 (see note 1)				
A		5.938		150.83
B		3.232		82.09
C	2.094	2.219	53.19	56.36
N		1.688		42.88
R		4.250		107.95
S	1.250		31.75	
T	.594	.656	15.09	16.66
U	1.386	1.426	35.20	36.22
Y		1.906		48.41
AB	1.470	1.478	37.34	37.54
AC	.732	.742	18.59	18.85
AG	1.348	1.356	34.24	34.44
AJ	2.984	3.016	75.79	76.61
AZ	.671	.681	17.04	17.30
BA		1.188		30.18
BB	.995	1.005	25.27	25.53
BC	.745	.755	18.92	19.18
BD	.825	.838	20.96	21.29
BE	.645	.655	16.38	16.64
BF	.532	.545	13.51	13.84
BG	.234	.266	5.94	6.76
BH	.164	.174	4.17	4.42
BJ	.750		19.05	
BK	.516		13.11	
BL		.200		5.08
BM	.125	.187	3.18	4.75
BN	.109	.141	2.77	3.58
BP	.115	.135	2.92	3.43
Reference dimensions				
V	2.781		70.64	
W	1.625 DIA		41.28 DIA	
X	1.156 RAD		29.36 RAD	
Z	1.830		46.48	
AA	.922		23.42	
AD	1.122		28.50	
AE	.497		12.62	
AF	.984		24.99	

FIGURE 1. Outline drawing of electron tube type 6543 - Continued.

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BOTTOM VIEW

Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
Conformance inspection, part 1 (see note 1)				
D		3.625		92.08
E		3.438		87.33
F	2.521	2.541	64.03	64.54
G	1.875 DIA		47.63 DIA	
H		2.425		61.60
J		3.203		81.36
L	.178	.258	4.52	6.55
M		.422		10.72
Q	2.771	2.791	70.38	70.89
Conformance inspection, part 2				
BQ		.125		3.18
Reference dimensions				
K	1.391		35.33	
P	1.265		32.13	
AH	.375 RAD		9.53 RAD	

FIGURE 1. Outline drawing of electron tube type 6543 - Continued.

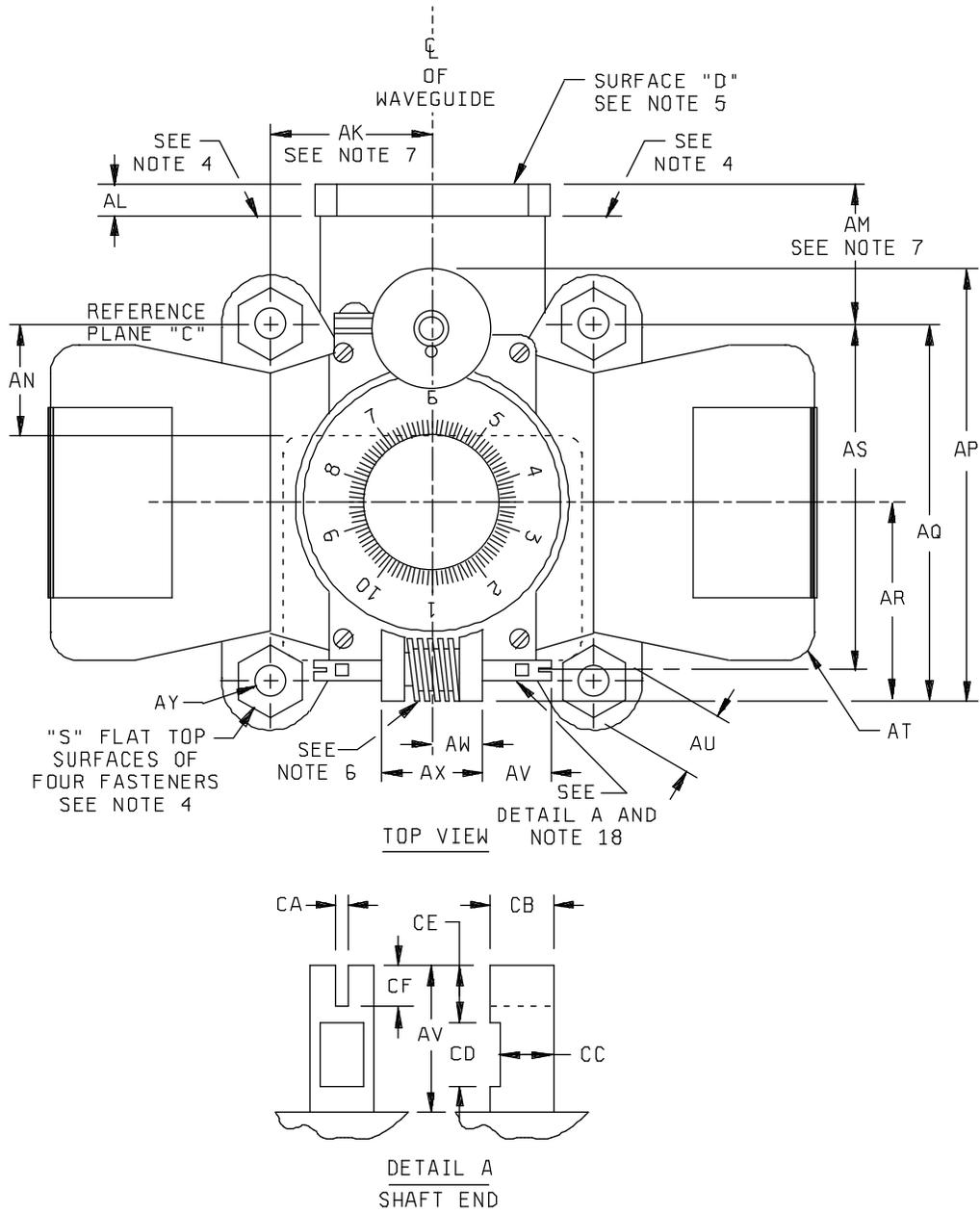


FIGURE 1. Outline drawing of electron tube type 6543 - Continued.

TOP VIEW

Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
Conformance inspection, part 1 (see note 1)				
AK	1.250	1.280	31.75	32.51
AM	.990	1.040	25.15	26.42
AP	3.243	3.293	82.37	83.64
AQ	2.844	2.938	72.24	74.63
AR	1.490	1.510	37.85	38.35
AS	2.594	2.688	65.89	68.28
AT	.094 RAD		2.39 RAD	
AV	.428	.448	10.87	11.38
AX	1.000	1.016	25.40	25.81
AY	.276 DIA	.286 DIA	7.01 DIA	7.26 DIA
CA	.040	.045	1.02	1.14
CB	.187 DIA	.190 DIA	4.75 DIA	4.83 DIA
CC	.151	.161	3.84	4.09
CD	.188	.203	4.78	5.16
CE	.141	.156	3.58	3.96
CF	.115	.135	2.92	3.43
Reference dimensions				
AL	.250 FLANGE		6.35 FLANGE	
AN	.797		20.24	
AU	.500		12.70	
AW	.437		11.10	

FIGURE 1. Outline drawing of electron tube type 6543 - Continued.

NOTES:

1. Gold, silver, or nickel plate over full extent of maximum plug penetration.
2. Maximum projection of the tubulation shall not extend more than 0.125 inch (3.18 mm) beyond the centerline of the two mounting holes on the side opposite the waveguide flange.
3. Reference point for anode T measurements locate where a central fin meets the anode block near the output section.
4. All metal surfaces shall be painted except those designated "S" and "D". Surfaces designated "S" shall be gold, silver, nickel, or bright alloy plated, or brass surfaces except as specified.
5. Hermetic connections may be made to surface "D".
6. Axis of cathode terminal shall occupy specified location within 0.047 inch (1.19 mm) RAD. \bar{Z} shall apply.
7. Limits include angular and lateral deviations.
8. With diameter "G" resting on a plane surface coincident with reference plane "A", a gage 0.010 inch (0.25 mm) thick and 0.125 inch (3.18 mm) wide shall not enter, and areas of the base plate outside diameter "G" shall be within 0.010 inch (0.25 mm) of the plane surface.
9. With diameter "W" resting on a plane surface, a gage 0.005 inch (0.13 mm) thick and 0.125 inch (3.18 mm) wide shall not enter.
10. Any portion of the assembly which extends below reference plane "A" shall be within 0.625 inch (15.88 mm) RAD of specified axis of input.
11. Defines extremity of cylindrical section designated by 0.169 inch (4.29 mm) diameter.
12. Defines extremity of cylindrical section designated by 0.540 inch (13.72 mm) diameter.
13. Clamping shall be confined to this area.
14. Heater terminal and cathode terminal shall be concentric within 0.010 inch (0.25 mm).
15. Protective covers shall be provided with tube.
16. Reference planes "A", "B", and "C" are mutually perpendicular.
17. Gear and worm threads shall be free from corrosion, paint, and other imperfections. All tuner parts except worm, shaft, and striking pin shall be nickel plated.
18. A sleeve .195 inch (4.95 mm) inside diameter by .406 inch (10.31 mm) outside diameter by 1.00 inch (25.40 mm) long must pass over ends of shaft to face of worm bracket.
19. For vibration tests, axes of vibration shall be normal to reference planes "A", "B", and "C".
20. Reference point for cathode bushing temperature measurements. Locate on 1.000 inch (25.40 mm) diameter cathode terminal.

FIGURE 1. Outline drawing of electron tube type 6543 - Continued.

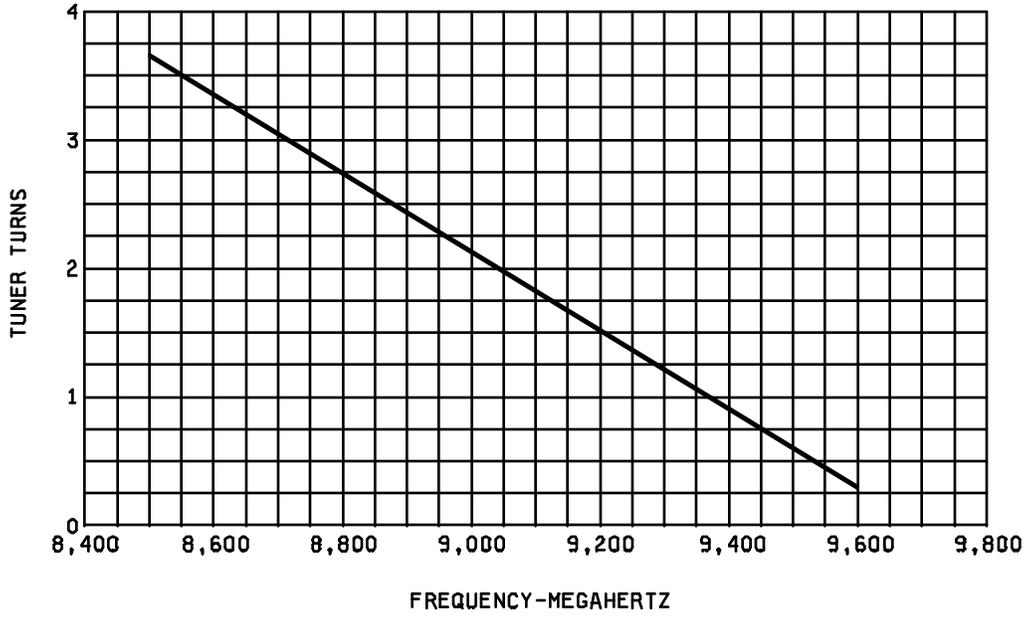


FIGURE 2. Tuning linearity.

Custodians:

Army - CR
Navy - EC
Air Force - 85

Review activities:

Navy - AS, CG, MC, OS
Air Force - 11, 99

Preparing activity:
DLA - CC

(Project 5960-3466-29)