INCH-POUND

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SUPERSEDING
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PERFORMANCE SPECIFICATION SHEET

ELECTRON TUBE, MAGNETRON
TYPE 8855

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: Coaxial, tunable frequency 8,500 to 9,600 MHz, pulse type, integral magnet, 200-kw rated peak power output.

ABSOLUTE RATINGS:

Parameter:	Ef	if (surge)	tk	tpc	rrv	Du	epy	ib
Unit:	V	a	sec	µs	kv/µs	---	kv	a
Maximum:	15	12	---	2.8	160	0.0011	24	30
Minimum:	---	----	150	0.2 3/	90 4/	----	----	15

ABSOLUTE RATINGS:

Parameter:	Pi	pi	T(body)	Tuner stop torque	Alt	Pressurization	
						Input	Output
Unit:	W	kw	°C	inch-ounce	ft	psia	psia
Maximum:	680	680	160	60	----	45	45
Minimum:	----	----	-55 7/	----	6,000	12	12

PHYSICAL CHARACTERISTICS:

Dimensions:	See figure 1.	Marking:	25/
Mounting position:	Any.	Cooling:	Forced air 7/
Mounting support:	See figure 1.	Handling:	5/
Input coupling:	20/	Weight:	13 pounds (approximate)
Output coupling:	20/		

See footnotes at end of table I.

TEST CONDITION (1): 21/

Parameter:	Ef	tpc	rrv	Du	Ib	T(body)	F
Unit:	V	µs	kv/µs	---	mA dc	°C	MHz
Maximum	---	0.30	---	---	---	100	---
	0	---	---	0.001	27.5	---	F1, F2, F3
Minimum	--- 2/	0.20	160	---	---	80	---

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

TEST CONDITION (2): 21/

Parameter:	Ef	tpc	rrv	Du	Ib	T(body)	F
Unit:	V	µs	kv/µs	---	mA dc	°C	MHz
Maximum	---	2.60	---	---	---	100	---
	0	---	---	0.001	27.5	---	F1, F2, F3
Minimum	--- 2/	2.10	160	---	---	80	---

See footnotes at end of table I.

GENERAL:

Qualification - Required.
Holding period = 48 hours minimum.

TABLE I. Testing and inspection.

Inspection	Method	Notes	Test	Conditions	Symbol	Limits		Unit
						Min	Max	
Qualification inspection								
Temperature coefficient	4027	31/	2	T(body) = 70°C to 150°C; F = F2	ΔF/ΔT	---	0.25	MHz/°C
Shock	1042	30/	---	Condition K; No voltages applied	---	---	---	---
Direct-interelectrode capacitance	4266	---	---	Cathode terminal to mounting plate	C	9	14	pF
Low-temperature operation	1047	13/ 14/	2	F2	MP	---	0.5	%
Conformance inspection, part 1		1/	---					
Heater current, nonoperating	4289	---	---	Ef = 13.75 V	If	---	3.3	A
Mechanical tuning range	4223	---	1	Upper limit Lower limit	F F	9,600 ---	--- 8,500	MHz MHz
Pressurizing	4003	18/ 19/	---	40 to 45 psia input and output assemblies	---	---	---	---
Pulse voltage	4306	---	2		epy	20	23	kv
Power output	4250	22/ ---	1 2		Po Po	200 200	270 270	W W
RF bandwidth	4308	17/	1, 2		BW	---	2.0/tpc	MHz
Minor lobe ratio	4308	17/ 17/	1 2		Ratio Ratio	10 8	--- ---	dB dB
Stability	4315	14/	1, 2		MP	---	0.25	%
Starting stability	4315	23/	2	F2	MP	---	0.25	%
Frequency variations	---	24/	2		F	---	0.1	MHz
Conformance inspection, part 2								
Operating torque or force	4223	---	---	25°C ± 5°C	Torque	---	45	inch-ounce
Resettability	4223	---	2	F3 ± 50 MHz	ΔF	---	10	MHz
Forced cooling	1143	7/ 8/ 31/	2		ΔT	---	90	°C
Frequency pushing figure	4311	16/	2	ib = 15 to 27a	ΔF/Δa	---	0.1	MHz/a
Frequency pulling figure	4310	27/	2	ib = 27.5a	ΔF	---	5	MHz

See footnotes at end of table.

TABLE I. Testing and inspection - Continued.

Inspection	Method	Notes	Test	Conditions	Symbol	Limits		Unit
						Min	Max	
Conformance inspection, part 3								
Life test	---	29/	---	Group D or S; VSWR = 1.5 (min), cycled through λg every 15 minutes (approximately)	---	1,500 1,250	--- ---	Cycles Hours
Life-test end points:	---							
Power output	4250	---	2		Po	160	---	W
Mechanical tuning range	4223	---	1	Upper limit Lower limit	F F	9,600 ---	--- 8,500	MHz MHz
RF bandwidth	4308	17/	1, 2		BW	---	2.5/tpc	MHz
Minor lobe ratio	4308	---	1, 2		---	6	---	dB
Stability	4315	14/	1, 2		MP	---	0.5	%
Tuning characteristics	---	6/ 28/	2		F	---	15	MHz
Operating torque or force	4223	6/	2	T(body) = -55°C and 150°C (max)	---	---	60	Inch-ounce
Mechanical tuning range	4223	6/	2	T(body) = -55°C and 150°C (max) Upper limit Lower limit	 F F	 9,600 ---	 --- 8,500	 MHz MHz
Variable-frequency vibration (1) (operating)	---	6/ 10/	2	ib = 27.5a; F3	---	---	---	---
Frequency variations	---	6/ 24/	2	F2	ΔF	---	1.0	MHz
Stability	4315	6/ 11/	2	F2	MP	----	0.5	%
Variable-frequency vibration (2) (operating)	---	6/ 9/ 26/	2	ib = 27.5a; F3	---	---	---	---

Fixed-frequency vibration (operating)	---	6/ 26/	2	ib = 27.5a; F3;
				F = 50; 10G;
				t = 60 seconds;
				3 planes
					---	---	---	---

Frequency change (warmup)	4302	6/ 15/	2	F3	ΔF	---	18	MHz
Tuning characteristics	---	6/ 28/	2		F	---	15	MHz
Mechanical tuning fatigue	4223	6/ 12/	---	No voltages applied	---	500	---	Cycles

See footnotes at top of next page.

TABLE I. Testing and inspection - Continued.

1/ The acceptance level for all tests listed under conformance inspection, part 1, shall be accept on zero failures.

2/ Prior to the application of high voltage, the cathode shall be heated to the required initial operating temperature. This shall be done by applying 13.75 volts ± 5 percent for 150 seconds maximum. Upon the application of anode voltage, the heater voltage shall be reduced according to the following schedule:

Du	Ib (mA dc)	Ef(V) ±5 percent
Standby - - - - - -	----	13.75
Operate 0.001	27.5	0

For Pi equal to or greater than 450 watts, Ef = 0

For Pi less than 450 watts, $Ef = 13.75 \left(\frac{1 - Pi}{450}\right) \pm 10$ percent

3/ The characteristics of the applied pulse shall be those which result in proper starting and oscillation. The rate of rise of the voltage pulse, the percentage of pulse voltage ripple, and the rate of pulse voltage fall are among the more important considerations. (See method 4304.)

4/ The rate of rise of voltage (rrv) shall be measured in accordance with method 4304, except that the steepest tangent to the leading edge of the voltage pulse shall be measured above the 70 percent amplitude point.

5/ In handling and mounting the magnetron, care shall be exercised to prevent demagnetization. (See figure 1.)

6/ This test shall be performed during the initial production and once each succeeding 12-calendar months in which there is production. Six (6) samples shall be used, with an acceptance on zero failures. In the event of failure, the test will be made as a part of conformance inspection, part 2, with an acceptance on zero failures. The regular “12-calendar month” sampling plan shall be reinstated after three consecutive samples have been accepted.

7/ With a total airflow of approximately 40 cfm at approximately 760 mmHg, divided equally and directed through the cooling fins toward the body of the tube from two .750 inch (19.05 mm) ducts placed .500 inch to .750 inch (12.7 mm to 19.05 mm) from the cooling fins, the rise above ambient temperature specified herein shall not be exceeded.

8/ The frequency shall be the frequency of minimum power output between F1 and F3.

9/ The tube under test (TUT) shall be mounted in a resonance free jig and vibrated with sinusoidal excitation in each of three mutually perpendicular axes through the following amplitudes for both resonance and cycling tests: 50 to 500 Hz at 5G.

Cycling test: The frequency shall increase from 50 to 500 Hz with approximately logarithmic progression, and shall require approximately 10 minutes to traverse the range. Frequency shall then decrease from 500 to 50 Hz in the same manner. This constitutes one cycle. The TUT shall be vibrated for three such cycles in each of the three axes.

Resonant test: Mechanical resonant frequencies of the magnetron shall be determined during the cycling test. The TUT shall then be vibrated at the indicated resonant conditions for a period of 30 minutes. If more than one resonant frequency is encountered, the test period may be accomplished at the most severe resonance, or the period may be divided among the resonant frequencies, whichever is most likely to produce failure.

10/ The TUT shall be mounted in a resonance free jig and vibrated with sinusoidal excitation in each of three mutually perpendicular axes through the following amplitudes:

15 to 30 Hz at 0.1 - inch angular displacement

30 to 500 Hz at 2G

The frequency shall increase from 15 to 500 Hz then decrease to 15 Hz with approximately logarithmic progression, and shall require approximately 15 minutes to traverse the range. Inter-pulse frequency stability and rf stability shall not exceed the limits specified herein.

TABLE I. Testing and inspection - Continued.

11/ A missing pulse is defined as one whose energy within ± 1 percent frequency range of the normal operating frequency is 70 percent or less than that of a normal pulse. The tube shall be considered stable if the missing pulse limit specified is not exceeded during the vibration time at acceleration levels and durations specified in the operating vibration test.

12/ The tuner shaft shall be continuously driven at a speed of 85 ± 10 rpm. At the completion of the test, the TUT shall meet test condition 1 requirements. The backlash shall not exceed 15 MHz. During the test, the tuning shaft shall not be lubricated. A cycle consists of two complete excursions each in opposite directions through the tuning range of the TUT. This is a destructive test. Life-test samples may be used.

13/ The ambient temperature of the chamber shall be -55°C. The cooling air supplied to the TUT shall be -55°C at 40 cfm maximum. The temperature of the TUT shall be allowed to stabilize at this ambient temperature for a minimum of 4 hours. At the conclusion of this exposure period and while at this temperature, heater voltage of 13.75 V shall be applied for a maximum of 150 seconds before application of anode voltage. The stability test shall be of 3-minute duration and shall begin after 30 seconds of anode operation. The provisions of 14/ shall apply.

14/ Stability shall be measured in terms of the average number of output pulses missing, expressed as a percentage of the number of input pulses applied during the period of observation. 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. The stability shall be measured when a VSWR of 1.5 minimum is introduced in the load and the phase is adjusted to produce maximum instability. The missing pulse test shall be counted during any three consecutive minute intervals of a 6-minute period.

15/ Cooling air shall be applied so that under the conditions of test condition 2, T(body) measured at the point indicated on figure 1, shall fall between 80°C and 100°C after the thermal equilibrium has been reached. The TUT may be operated and the airflow preset a minimum of 12 hours before the test. The TUT shall not have been operated for 12 hours prior to the performance of the frequency change (warm up) test. The test shall be performed in the following manner: Anode voltage, as specified for test condition 2, shall be applied after a maximum of 150-seconds heater warm up time. The frequency shall then be measured at approximately 3-minute intervals until frequency stabilization occurs. A graph of frequency versus time shall be constructed using the data. The frequency deviation from the stabilization frequency shall not exceed the limit specified herein.

16/ The pushing factor shall be measured in three steps, 4 amperes each (15a to 19a, 19a to 23a, 23a to 27a) and no value shall exceed the limits specified herein. The peak current through the TUT shall alternately be the limits as specified under this test condition. These tests shall be run to exclude the effects of thermal drift and frequency instability not due to pushing.

17/ The rf bandwidth and minor lobe ratio shall be within the limits specified herein when a VSWR of 1.5 minimum is introduced in the load and the phase is adjusted at the start of each measurement to produce maximum degradation. A satisfactory spectrum is one whose slope does not change sign more than once for power levels greater than the specified dB below its peak.

18/ The seal formed by clamping the magnetron mounting plate against a suitable magnetron test fixture shall be hermetically tight for 1 minute minimum with the air pressure specified herein applied to surround the entire input bushing below the mounting plate.

19/ The seal formed by clamping the magnetron output flange against a suitable magnetron test fixture shall be hermetically tight for 1 minute minimum with the air pressure specified herein applied internally to test fixture.

20/ The minimum air pressure to assure prevention of electrical breakdown in the output coupling shall be 15 psia for VSWR up to 1.5 with phase shift variable over 360 electrical degrees. The TUT shall be coupled directly to M3922/53-002 (UG-51/U) choke flange in accordance with MIL-DTL-3922/53 modified so that mounting holes provide clearance for No. 8 bolts.

21/ The modulator shall be such that the energy per pulse delivered to the tube, if arcing occurs, shall not greatly exceed the normal energy per pulse. The tube heater shall be protected against arcing by use of a connector that places a minimum of 4,000 pF across the heater directly at the input terminals.

22/ The power output shall be continuous over the range from F1 to F3. At no frequency in this range shall the power output be less than then minimum value specified herein.

TABLE I. Testing and inspection - Continued.

23/ After the holding period, the anode voltage shall be applied 150 seconds minimum after the application of the standby heater voltage. The missing pulse count test interval of 3 minutes shall start immediately after the application of anode voltage. The provisions of 14/ shall apply.

24/ For frequency variation measurements, the maximum peak-to-peak frequency deviation shall not exceed the amount specified herein. The test shall be run excluding thermal drift and pushing effects. The test equipment shall have a band pass of 10 MHz minimum at the 3 dB points. Frequency variations are defined as inter-pulse frequency changes, commonly called clatter.

25/ In addition to regular markings, the tuner dial settings for the following frequencies shall be marked on the tube during final testing by the manufacturer. The accuracy of these settings shall be ± 10 MHz at the start of life under conditions of test condition 2 with the body temperature approximately 80°C measured at the point specified on figure 1 when tuning is performed in the order of decreasing the frequency.

Frequency (MHz)	Dial setting	Frequency (MHz)	Dial setting
8,500	---	9,150	---
8,650	---	9,300	---
8,800	---	9,450	---
9,000	---	9,600	---

26/ At the completion of this test, the TUT shall meet the power output and voltage requirements of test 2 of the conformance inspection, part 1, and the operating torque or force and resettability requirements of conformance inspection, part 2.

27/ The frequency deviation (maximum frequency minus minimum frequency) shall not exceed the limits specified herein when a VSWR of 1.5 minimum is introduced into the load and is varied throughout all phases.

28/ At each of the dial settings and under the operating conditions specified in 25/, the measured frequency shall not differ from the stated frequency by more than the amount specified herein.

29/ Starting at F1 and increasing to F3, then decreasing to F1, the frequency of the TUT will be changed in 150 MHz increments after each 50 hours (approximately) of high-voltage operation. The duration of the switching interval between test 1 and test 2 shall not exceed 5 seconds. The following cycle shall be used for the life test:

Condition	ib (A)	Ef(V)	Duration
Standby	0	13.75	2.5 minutes
Test 1	27.5	0	25.0
Test 2	27.5	0	25.0
Off	0	0	7.5

30/ Following impact tests, the TUT shall show no mechanical failure and shall meet all power output and voltage requirements of test condition 2 and operating torque or force of conformance inspection, part 2.

31/ Body temperature shall be measured at the point indicated in note 5 of the mechanical drawing. The TUT serviceability shall not be impaired with a screw inserted or removed from this threaded hole.

32/ Revision letters are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

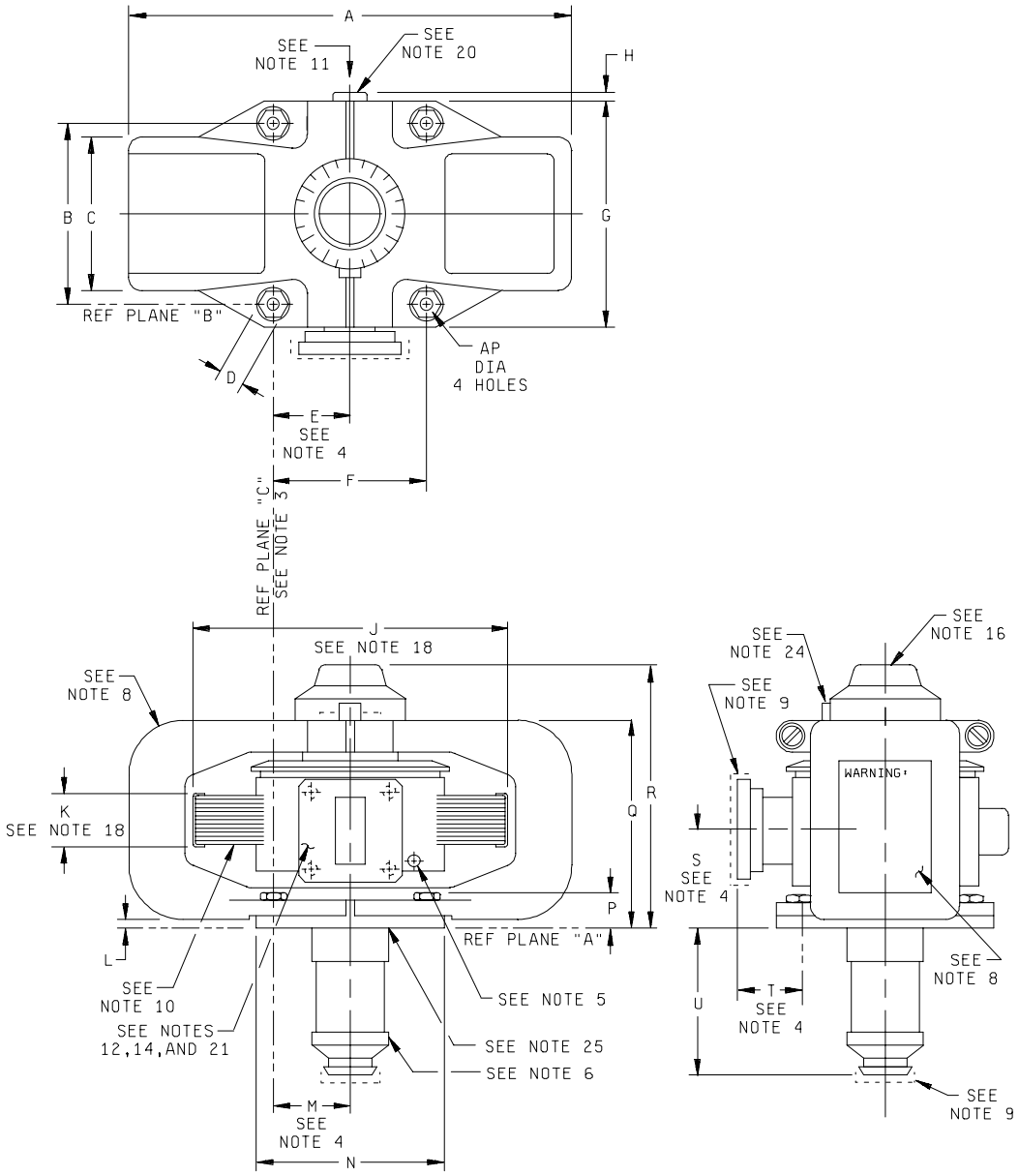
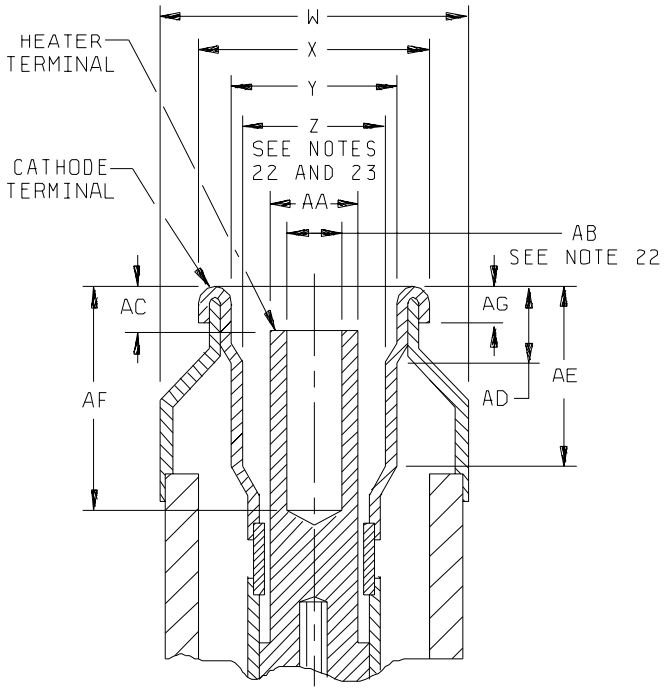
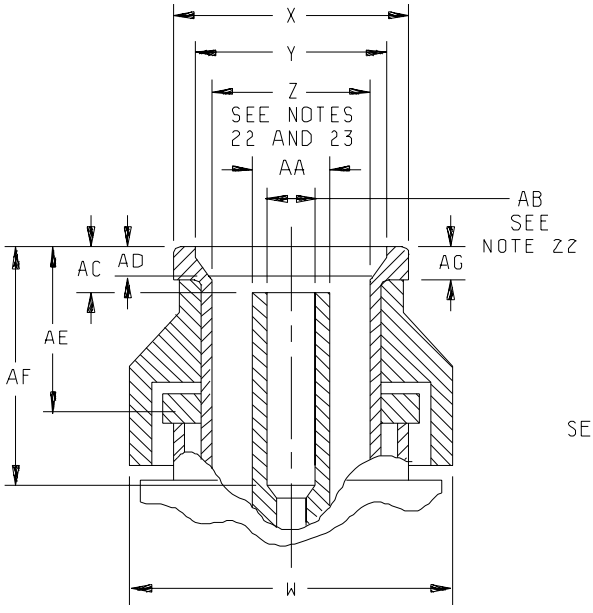


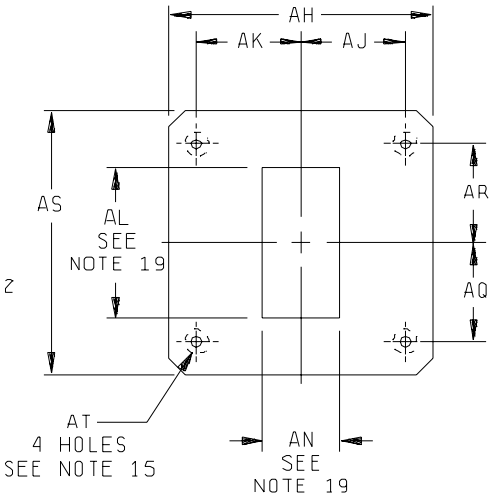
FIGURE 1. Outline drawing of electron tube type 8855.



DETAIL OF INPUT CONNECTION



DETAIL OF ALTERNATE INPUT CONNECTION



DETAIL OF OUTPUT FLANGE

FIGURE 1. Outline drawing of electron tube type 8855 - Continued.

Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
Conformance inspection, part 1				
B	2.990	3.010	75.946	76.454
E	1.204	1.296	30.582	32.918
F	2.490	2.510	63.246	63.754
M	1.204	1.296	30.582	32.918
S	1.610	1.702	40.894	43.231
T	.874	.938	22.200	23.815
U	2.562	2.749	65.075	69.825
X	.825	.838	20.955	21.285
Z	.532	.545	13.513	13.843
AA	.234	.266	5.944	6.756
AB	.164	.174	4.166	4.420
AC	.125	.187	3.175	4.750
AE	.562	---	14.275	---
AF	.750	---	19.050	---
AG	.115	.135	2.921	3.429
AJ	.732	.742	18.592	18.850
AK	.732	.742	18.592	18.850
Conformance inspection, part 2				
D	.470	.655	11.938	16.637
L	.031	---	0.787	---
W	1.062	1.125	26.975	28.575
AD	---	.156	---	3.962
AH	1.860	1.890	47.244	48.006
AS	1.860	1.890	47.244	48.006

Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
Conformance inspection, part 3 (see 6/)				
A	---	7.687	---	195.250
C	---	2.750	---	69.850
Q	---	3.535	---	89.789
Y	.603	.617	15.316	15.672
AQ	.671	.681	17.043	17.297
AR	.671	.681	17.043	17.297
AP	.276	.286	7.010	7.264
Nominal dimensions (see note 17)				
G	3.750		95.250	
H	.297		7.544	
J	5.400		137.160	
K	1.200		30.480	
N	3.406		86.512	
P	.581		14.757	
R	4.500		114.300	
AT	8 (.164)-32		8 (4.166)-32	
AL	1.122		28.498	
AN	.497		12.624	

NOTES:

1. Reference plane ‘A’ is defined as a plane passing along the face of the mounting.
2. Reference plane ‘B’ is defined as a plane perpendicular to plane ‘A’ passing through the axis of the holes, as shown at reference plane ‘A’.
3. Reference plane ‘C’ is defined as a plane mutually perpendicular to planes ‘A’ and ‘B’ passing through the axis of the holes, as shown at reference plane ‘A’.
4. Includes angular as well as lateral deviations.
5. Body temperature shall be measured at this point. The TUT serviceability shall not be impaired with a screw inserted or removed from this threaded hole.
6. Input bushing temperature shall be measured at this point.
7. For vibration and shock testing, the planes of testing shall be reference planes ‘A’ - ‘B’ - ‘C’.
8. WARNING: Maintain a minimum clearance of 4 inches between magnet and magnetic materials (magnets, steel tools, plates etc.).
9. Protective closure. Shall be removed before the TUT is used, and attached when the tube is not in use.
10. The inner laminations of the cooling fins shall not be painted. However, there may be an overspray of the protective paint.
11. Indicates direction of body cooling airflow.

FIGURE 1. Outline drawing of electron tube type 8855 - Continued.

NOTES - Continued.

12. Mates with modified waveguide RG-52/U in accordance with MIL-DTL-85/1. (Clearance instead of threaded holes.)

13. With the TUT mounted on the test fixture and with the specified air pressure applied so as to surround the entire input terminal beyond the TUT mounting plate, the entire TUT and fixture are to be submerged in water. No bubbles are allowed in a 1-minute interval.

14. With the TUT output flange clamped against a modified choke flange, UG-52B/U, in accordance with MIL-DTL-3922/59, and using a gasket, A-A-55549, and with the air pressure specified herein applied to the interior of the waveguide, submerge entire assembly in water. No bubbles will be permitted in a 1-minute interval.

15. A plane passing through the axis of two threaded holes perpendicular to the face of the output flange shall be parallel to planes 'A' and 'B' within .030 inch.

16. The frequency increases as the tuner knob is driven in a counterclockwise direction.

17. Dimensions without tolerances are for information only and are not required for inspection purposes.

18. This dimension refers to radiator fin size only.

19. Rectangular opening to be centered within .005 inch with respect to the axis of the four threaded holes.

20. Permanently attached protective closure for the exhaust tubulation of the TUT shall not restrict airflow nor impair serviceability of the TUT.

21. The face of the waveguide shall be flat within .010 inch total indicator reading. The surface of this flange shall be of such a quality that a hermetic type seal can be effected. See note 14.

22. Heater terminal and cathode terminal shall be concentric within .010 inch.

23. This diameter applies for length AE.

24. Tuner dial lock.

25. This identifies a North seeking pole. This may be tested by observing which compass needle points to the geographic South. The same compass needle will point toward the TUT North seeking pole when it is brought near the input stem of the TUT. Care should be taken to insure that the TUT field does not reverse the polarity of the compass.

FIGURE 1. Outline drawing of electron tube type 8855 - Continued.

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

Review activities:
Navy - AS, CG, MC, OS

Preparing activity:
DLA - CC

(Project 5960-3595)