VALVE ELECTRONIC

SERVICES VALVE TEST LABORATORY

CV 5212

SPECIFICATION	AD/CV.5212 incorporating MIL-E-1/3C
ISSUE NO. 1	Dated 5.7.62
To be read in conjunction with specification K.1006.	

SECURITY	
SPECIFICATION	VALVE
Unclassified	Unclassified

TYPE OF VALVE	High mu double triode
CATHODE	Indirectly heated
ENVELOPE	Glass
PROTOTYPE	12AT7WA

MARKING

See K.1001/4

Additional Marking 12AT7WA

BASE

See BS.448/B9A/1.1

RATINGS

Absolute unless otherwise stated

			Note
Heater Voltage nominal	(V)	12.6	A
Heater Current "	(A)	0.15	
Max. heater-cathode voltage	(V)	100	B
Max. D.C. anode voltage	(V)	330	B
Max. anode dissipation	(W)	2.5	B
Max. negative D.C. grid voltage	(V)	55	B
Max. grid resistance	(Meg)	0.25	C
Mean bulb temperature	(^{o}C)	165	
Max. altitude	(ft)	60,000	

CONNECTIONS

Pin	Electrode
1	Anode 2
2	Grid 2
3	Cathode 2
4	Heater
5	Heater
6	Anode 1
7	Grid 1
8	Cathode 1
9	Heater C.T.

DIMENSIONS

See BS.448/B9A/2.1
Size Ref. No. 2

	Min.	Max.
Seated ht.	-	1 5/16"
Diameter	3/4"	7/8"
Overall Length	-	2 3/16"

MOUNTING POSITION

Any

NOTES

A. Centre-tapped heater; for operation on 6.3 V connections should be made to pins 4 and 5 strapped and pin 9.

B. Each section.

C. For fixed bias operation; where cathode bias is used max. rated grid resistance is 0.5 Meg.

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15 June 1959
SUPERSEDING
MIL-E-1/003B(USAF)
29 January 1959 and
MIL-E-1/3A
23 August 1955

MILITARY SPECIFICATION SHEET

ELECTRON TUBE, RECEIVING, TWIN TRIODE, MINIATURE

JAN-12AT7WA

This specification sheet forms a part of the latest issue of Military Specification MIL-E-1.

DESCRIPTION: Twin triode, high mu

DESIGN-MAXIMUM RATINGS:

Parameter:	Ef	Eb	Ec	Ehk	Rk/k	Rg/g	Pp/p	T (envelope)	Alt
Units:	V	Vdc	Vdc	v	ohms	Meg	W	°C	ft
Maximum:	13.9 6.9	330	0	100	---	0.25 (see note 1)	2.5	165	60,000
Minimum:	11.4 5.7	---	-55	---	---	---	---	---	---
TEST CONDITIONS:	12.6	250	---	---	200	---	---	---	---

CATHODE: Coated unipotential

DIAMETER: 7/8 in. max

BASE: Miniature 9-pin button

HEIGHT: 2-3/16 in. max

PIN NUMBER: 1 2 3 4 5 6 7 8 9

ENVELOPE: T-6-1/2

ELEMENT: 2p 2g 2k h h 1p 1g 1k hct

PAR. NO.	TEST (SEE NOTE 2)	CONDITIONS	AQL (PERCENT DEFECTIVE)	INSPECTION LEVEL OR CODE	SYMBOL	LIMITS (SEE NOTE 3)						UNITS
						Min	LAL	Bogie	UAL	Max	ALD	
	General											
3.1	Qualification	Required for JAN marking	---	---	---	---	---	---	---	---	---	---
3.6	Performance		---	---	---	---	---	---	---	---	---	---
	Qualification tests (see note 4)											
---	Cathode	Coated unipotential	---	---	---	---	---	---	---	---	---	---
3.4.3	Base connections	Outline E9-1	---	---	---	---	---	---	---	---	---	---
4.9.20.3	Variable frequency vibration (1)	Ec = -3 Vdc; Rp = 2,000; Rk = 0 (see note 5)	---	---	Ep	---	---	---	---	100	---	mVac
	Measurement acceptance tests, part 1 (see note 6)											
4.10.8	Heater current		---	---	If	---	146	150	154	---	9	mA
4.10.8	Heater current		0.4	II	If	142	---	---	---	158	---	mA

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PAR. NO.	TEST (SEE NOTE 2)	CONDITIONS	AQL (PERCENT DEFECTIVE)	INSPECTION LEVEL OR CODE	SYMBOL	LIMITS (SEE NOTE 3) Min LAL	Bogie LAL	Bogie UAL	Max UAL	Min ALD	Max ALD	UNITS
	Measurement acceptance tests, part 1 (see note 6) - Contd											
4.10.15	Heater-cathode leakage	Ehk = +100 Vdc Ehk = -100 Vdc (see note 7)	0.4	II	Ihk Ihk	--- ---	--- ---	--- ---	--- ---	7 7	--- ---	uAdc uAdc
4.10.6.1	Total grid current	Rg = 0.5 Meg (see note 7)	0.4	II	Ic	0	---	---	---	-0.7	---	uAdc
4.10.4.1	Plate current (1)	(See note 7)	---	---	Ib	---	8.5	10.0	11.5	---	3.4	mAdc
4.10.4.1	Plate current (1)	(See note 7)	0.4	II	Ib	7.0	---	---	---	14.0	---	mAdc
4.10.4.1	Plate current (2)	Ec = -20 Vdc; Rp = 0.1 Meg; Rk = 0; Ck = 0 (see note 7)	0.4	II	Ib	---	---	---	---	100	---	uAdc
4.10.9	Transconductance (1)	Ck = 1,000 uf (see note 7)	---	---	Sm	---	5,000	5,500	6,000	---	1,000	umhos
4.10.9	Transconductance (1)	Ck = 1,000 uf (see note 7)	0.4	II	Sm	4,500	---	---	---	6,500	---	umhos
---	Continuity and shorts	(See note 8)	0.4	II	---	---	---	---	---	---	---	---
4.9.1	Mechanical-production tests	Outline 6-7	---	---	---	---	---	---	---	---	---	---
	Measurement acceptance tests, part 2											
4.8	Insulation of electrodes	(See note 7) E (g-all) = -100 Vdc E (p-all) = -300 Vdc	2.5	L6	R R	500 500	---	---	---	---	---	Meg Meg
4.10.4.1	Plate current (1) (difference between sections)		2.5	I	Ib	---	---	---	---	3.2	---	mAdc
4.10.4.1	Plate current (3)	Ec = -7.0 Vdc; Rp = 0.1 Meg; Rk/k = 0 (see note 7)	2.5	I	Ib	5	---	---	---	---	---	uAdc
4.10.9	Transconductance (2)	Ef = 11.4 V; Ck = 1,000 uf (see note 7)	2.5	I	Δ Sm/Ef	---	---	---	---	15	---	%
4.10.6.2	Grid emission	Ef = 15.0 V; Ec = -20 Vdc; Rg/g = 0.5 Meg; Rk = 0; Ck = 0 (see notes 7 and 9)	2.5	I	Ic	0	---	---	---	-1.5	---	uAdc
4.10.3.1	Radio-frequency noise (other than shot-effect noise)	Ecal = 15 mVac; Rk = 100; Ck = 0.2 uf (see notes 5 and 10)	2.5	I	---	---	---	---	---	---	---	---
4.10.3.4	Noise and microphonics (for reliable receiving tubes)	Ef = 12.6 Vdc; Ebb = 300 Vdc; Ecal = 100 mVac; Rk = 200; Rp = 10,000; grid grounded; Ck = 1,000 uf (see notes 5 and 11)	2.5	I	---	---	---	---	---	---	---	---

PAR. NO.	TEST (SEE NOTE 2)	CONDITIONS	AQL (PERCENT DEFECTIVE)	INSPECTION LEVEL OR CODE	SYMBOL	LIMITS (SEE NOTE 3) Min	LAL	Bogie	UAL	Max	ALD	UNITS
	Measurement acceptance tests, part 2 - Contd											
---	Pulse cathode current	Ef = 12.6 V; Eb = 250 Vdc; Ec = -30 Vdc; Rk = 1.0 (see notes 7 and 12)	2.5	Code H	ik	280	---	---	---	---	---	ma
4.10.11.1	Amplification factor	(See note 7)	6.5	L6	Mu	50	---	---	---	70	---	---
4.10.14	Direct interelectrode capacitance	No shield	6.5	Code E	Cgp	1.30	---	---	---	1.90	---	uuf
		No shield			Cin	2.00	---	---	---	3.00	---	uuf
		No shield; section 1			Cout	0.20	---	---	---	0.70	---	uuf
		No shield; section 2			Cout	0.16	---	---	---	0.60	---	uuf
		No shield			Cpp	0.15	---	---	---	0.33	---	uuf
		No shield			Chk	2.10	---	---	---	3.50	---	uuf
4.9.12.1	Low-pressure voltage breakdown	Pressure = 55±5 mm Hg; voltage = 500 Vac	6.5	(See note 13)	---	---	---	---	---	---	---	---
4.9.19.1	Low-frequency vibration (2)	Ec = -3 Vdc; Rp = 2,000; Rk = 0; Ck = 0; G = 10; F = 40 cps (see note 5)	6.5	Code I	Ep	---	---	---	---	100	---	mVac
	Degradation rate acceptance tests (see note 14)											
4.9.20.5	Shock test	Hammer angle = 42°; Ehk = ±100 Vdc (see note 15)	---	---	---	---	---	---	---	---	---	---
4.9.20.6	Fatigue test	G = 2.5; fixed frequency; F = 25 min, 60 max	6.5	(See note 13)	---	---	---	---	---	---	---	---
---	Post shock and fatigue test end points	Vibration (2)	---	---	Ep	---	---	---	---	150	---	mVac
		Heater-cathode leakage										
		Ehk = ±100 Vdc	---	---	Ihk	---	---	---	---	20	---	uAdc
		Ehk = -100 Vdc	---	---	Ihk	---	---	---	---	20	---	uAdc
		Transconductance (1)	---	---	Sm	3,800	---	---	---	---	---	umhos
		Grid current	---	---	Ic	0	---	---	---	-1.5	---	uAdc
4.9.6.1	Miniature-tube base-strain		---	---	---	---	---	---	---	---	---	---
4.9.6.3	Glass strain (for receiving tubes)	(See note 16)	2.5	I	---	---	---	---	---	---	---	---

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PAR. NO.	TEST	CONDITIONS	AQL (PERCENT DEFECTIVE)	INSPECTION LEVEL OR CODE	ALLOWABLE DEFECTIVES PER CHARACTERISTIC		LIMITS SYMBOL	Min	Max	UNITS
					First sample	Combined samples				
	Acceptance life tests (see note 14)									
4.11.7	Heater-cycling life test	Ef = 7.5 V; heaters in parallel; Ehk = ∱135 Vdc (see note 17)	---	---	---	---	---	---	---	---
4.11.4	Life-test end points	Heater cathode leakage								
		Ehk = ∱100 Vdc	---	---	---	---	Ihk	---	15	uAdc
		Ehk = -100 Vdc	---	---	---	---	Ihk	---	15	uAdc
---	Stability life test	Ehk = ∱135 Vdc; Rg/g = 0.5 Meg; TA = room (see note 18)	1.0	Code I	---	---	---	---	---	---
4.11.4	Life-test end points (stability) (2 and 20 hours)	Change in transconductance (1) of individual tubes	---	---	---	---	Δ_t Sm	---	10	%
4.11.3.1(b)	Survival-rate life test	Stability life test conditions or equivalent (see notes 19 and 20)	---	II	---	---	---	---	---	---
4.11.4	Life-test end points (survival rate) (100 hours)	Continuity and shorts	0.65	---	---	---	---	---	---	---
		Transconductance (1)	1.0	---	---	---	Sm	3,800	---	umhos
4.11.5	Intermittent life-test operation	Stability life test conditions; T (envelope) = 165° C min (see notes 21 and 22)	---	---	---	---	---	---	---	---
4.11.4	Life-test end points (intermittent) (500 hours)	(See note 23)								
		Inoperatives (see note 24)	---	---	1	3	---	---	---	---
		Total grid current	---	---	1	3	Ic	0	-0.7	uAdc
		Heater current	---	---	1	3	If	142	162	mA
		Change in transconductance (1) of individual tubes	---	---	1	3	Δ_t Sm	---	20	%
		Transconductance (2)	---	---	1	3	Δ_{Ef} Sm	---	15	%
		Heater-cathode leakage								
		Ehk = ∱100 Vdc	---	---	1	3	Ihk	---	7	uAdc
		Ehk = -100 Vdc					Ihk	---	7	uAdc
		Insulation of electrodes								
		E (g-all) = -100 V	---	---	1	3	R	250	---	Meg
		E (p-all) = -300 V					R	250	---	Meg
		Transconductance (1) average change	---	---	---	---	Avg Δ_t Sm	---	15	%
		Total defectives	---	---	3	6	---	---	---	---

PAR. NO.	TEST	CONDITIONS	AQL (PERCENT DEFECTIVE)	INSPECTION LEVEL OR CODE	ALLOWABLE DEFECTIVES PER CHARACTERISTIC		SYMBOL	LIMITS		UNITS
					First sample	Combined samples		Min	Max	
	Acceptance life tests (see note 14) - Contd									
4.11.4	Life-test end points (intermittent) (1,000 hours)	(See note 23)								
		Inoperatives (see note 24)	---	---	1	3	---	---	---	---
		Total grid current	---	---	1	3	Ic	0	-0.7	uAdc
		Heater current	---	---	1	3	If	142	164	mA
		Change in transconductance (1) of individual tubes	---	---	1	3	ΔSm t	---	25	%
		Transconductance (2)	---	---	1	3	ΔSm Ef	---	20	%
		Heater-cathode leakage								
		Ehk = +100 Vdc	---	---	1	3	Ihk	---	7	uAdc
		Ehk = -100 Vdc					Ihk	---	7	uAdc
		Insulation of electrodes								
		E (g-all) = -100 Vdc	---	---	1	3	R	100	---	Meg
		E (p-all) = -300 Vdc					R	100	---	Meg
		Total defectives	---	---	4	8	---	---	---	---
4.11.8	Cathode interface life test	Ef = 6.9 V; heaters in parallel; other electrodes disconnected (see note 25)	---	---	---	---	t	500	---	hr
4.11.4	Life-test end points	Ef = 5.7±0.05 Vdc; heaters in parallel; Eb = 135 Vdc; Ec/Ib = 2.0 mAdc (see notes 26 and 27)	---	---	1	3	Ri	---	50	ohm
4.9.18	Container drop (see note 28)	(d) Package group 1; container size B								

Note 1: This value is for operation under fixed bias conditions. With cathode bias, Rg may be 0.5 Meg maximum.

Note 2: The sequence of tests listed hereon is the suggested order in which the tests should be conducted.

Note 3: Variables sampling procedure (see 4.1.1.7).

Note 4: All tests listed hereon shall be performed during qualification; however, these three tests are normally performed qualification inspection only.

Note 5: Tie 1k to 2k; 1g to 2g; and 1p to 2p.

Note 6: The AQL for the combined defectives for attributes in measurements acceptance tests, part 1, excluding inoperatives and mechanical, shall be 1 percent.

Note 7: Test each unit separately.

Note 8: Tubes shall be tested for continuity of all possible circuits, for shorts between the tube elements and for air leaks.

During both continuity and short testing, the tube under test shall be tapped at least three times, in each of two planes 90° to 120° apart, with a tapper, which shall be adjusted to give an impulse of approximately one-half sine wave of 300±50 microseconds duration, as measured 10 percent from the base, and having a minimum average amplitude equivalent to 80 G's peak acceleration for T-5-1/2 and larger tubes.

During tapping, the tube shall be supported only by the socket and light finger or soft cushioned mechanical pressure on the dome of the bulb. The finger or mechanical pressure on the dome of the bulb shall be used only when necessary to prevent the tube from coming out of the socket and shall be so applied that it offers negligible restraint to lateral motion at the top of the bulb.

The tap blows shall be delivered to the tube approximately two-thirds up on the seated height.

The tapper impulse shall be measured with a Gulton Manufacturing Company type A-305 accelerometer, or equivalent, mounted in a standard production type (replaceable cap and clips) T-5-1/2 socket and having no other support. The tap blows shall be delivered to the accelerometer at the approximate midpoint of its seated height and in a direction parallel to the plane of maximum sensitivity of the accelerometer. The output of the accelerometer shall be coupled through a cathode follower and low-pass filter-amplifier combination to a suitable calibrated oscilloscope. The low-pass filter shall have a minimum high frequency cutoff at 5,000 cycles per second. The Gulton KA-1 test, set on 5-kc filter position, possesses appropriate characteristics.

The short indicator sensitivity, between adjacent elements, shall be defined as an equivalent resistance which persists for a period of time in excess of that determined by a limiting curve of resistance versus time duration passing through the following points:

Duration	Sensitivity
Permanent short	600,000 ohms
500 microseconds	500,000 ohms
100 microseconds	100,000 ohms
60 microseconds	1,000 ohms

The voltage applied between adjacent elements of the tube under test shall have a value between 20 and 70 volts dc or peak ac.

The tube under test shall be connected to the shorts test equipment with elements in sequence for single section tubes but like elements in the sections of a multisection tube may be paralleled, providing the mechanical assembly of the tube structure is such that the possibility of a short due to section-to-section crossover jumpers is remote.

Tubes which give an indication of one or more of the following shall be rejected as inoperable:

a. Either a permanent or tap short at any time during the tapping procedure.
b. Any open circuit.
c. Air leaks. (See 4.7.6.)

Note 9: Prior to this test, tubes shall be preheated a minimum of 5 minutes with all sections operating at the conditions indicated below. The 3-minute test is not permitted. Test at specified conditions within 3 seconds after preheating. Grid emission shall be the last test performed on the sample selected for the grid emission test. ←

Ef	Ec1	Eb	Rk/k	Rg/g
V	Vdc	Vdc	ohms	Meg
15.0	0	250	200	0.5

Note 10: In addition to the rejection criteria of 4.10.3.1, the output shall be read on a VU meter using a rejection limit of 5 VU. Five VU is the meter deflection obtained with a steady state output of 3 mW from the amplifier. ←

Note 11: The rejection level shall be set at the VU meter reading obtained during calibration. ←

Note 12: The grid is driven with a pulse voltage as follows: egk = ƒ30 v; prr = 1,000; tp = 10 us; tr ∠1 us; tf ∠1 us (egk shall be defined as the instantaneous peak voltage between the grid and the negative end of the cathode resistor). Peak cathode current shall be measured by means of a high impedance oscilloscope, or equivalent, device connected across a cathode resistor of 1.0 ohm. Preheat at Ef = 12.6 V for 5 minutes; no other voltages applied. ←

Note 13: This test shall be conducted on the initial lot and thereafter on a lot approximately every 30 days. When one lot has passed, the 30-day rule shall apply. In the event of lot failure, the lot shall be rejected and the succeeding lots shall be subjected to this test until one lot passes. Standard MIL-STD-105, sample size code letter F, shall apply. ←

Note 14: Destructive tests. Tubes subjected to the following destructive tests shall not be delivered on the contract or order: ←

4.9.20.5	Shock test
4.9.20.6	Fatigue test
4.11.7	Heater-cycling life test
4.11.5	Intermittent life-test operation
4.11.8	Cathode interface life test

Note 15: A grid resistor of 0.1 Meg shall be added to each section; however, this resistor shall not be used when a thyratron-type short indicator is employed. ←

Note 16: The following modifications apply to 4.9.6.3:

a. Replace fifth sentence with the following:
The holder shall be in accordance with Drawing 245-JAN, and the tubes shall be immersed quickly.

b. Replace seventh sentence with the following:
After the 5-second submersion period, the tubes shall be removed and allowed to return to room temperature on a wooden surface.

Note 17: The no-load to steady state full load regulation of the heater voltage supply shall be not more than 3.0 percent. This test shall be made on a lot-by-lot basis. A failure or defect shall consist of an open heater, open cathode circuit, heater-cathode short, or heater-cathode leakage current in excess of the specified heater-cycling life-test end-point limit.

Note 18: Stability life test.

a. Life-test sample shall be selected from a lot at random in such a manner as to be representative of the lot. If such a selection results in a sample containing tubes which are outside the initial specification sheet limits for the relevant life-test end-point characteristics, such tubes shall be replaced by randomly selected acceptable tubes.

b. Serially mark all tubes of the sample.

Record referenced characteristic measurements on the entire sample after a maximum operation of 15 minutes under specified voltage and current conditions.

d. The regular stability life-test sample shall be operated at specified stability life test conditions, or equivalent, for 20 hours (±4 hours) with an intermediate down-period reading point at 2 hours (±30 minutes). (Intermittent or continuous operation may be used.) The regular stability life test shall be in effect initially and shall continue in effect until eligibility criteria for the reduced hours stability life test have been met.

e. Reduced hours stability life test.

1. Eligibility for reduced hours stability life test shall be as follows: No lot failure due to the regular stability life test has occurred in the preceding five consecutive lots.

2. Reduced hours stability life test shall be conducted for 2 hours (±30 minutes). Acceptance shall be based on the stability life-test end-point limit. One lot failing the reduced hours stability life test shall result in loss of eligibility for the reduced hours stability life test.

3. The stability life-test sample from the first lot accepted each month shall continue on stability life test to the 20 hours (±4 hours) duration. Failure of this sample to meet the regular stability life-test end-point limit shall result in loss of eligibility for the reduced hours stability life test.

f. Life test shall be conducted as specified in 4.11, 4.11.1, and 4.11.5, except that the following shall be substituted for 4.11.1(b): The mean electrode potentials, except heater or filament, may be established at values differing by not more than 5 percent from the specified values, provided the same average electrode dissipations are obtained that occur with the specified voltages. Fluctuations of all voltages, including heater or filament voltage, shall be as small as practicable.

g. Record referenced characteristic measurements at the specified reading periods. Referenced characteristic measurements shall be taken immediately following the specified reading periods or tubes shall be preheated a maximum of 15 minutes, under specified voltage and current conditions, and immediately measured following the specified reading periods. The preheat shall be considered as part of the test time.

h. A defective shall be defined as a tube having a change in referenced characteristic greater than that specified on the specification sheet.

i. A resubmitted lot shall be subjected to all measurement acceptance tests except mechanical inspection, capacitance, vibration, and low-pressure voltage breakdown tests.

Note 19: Survival-rate life test: The sampling and testing procedures for this test shall be as specified in 20.2.5.2 to 20.2.5.2.4, inclusive, of Appendix C, with the following exceptions:

20.2.5.2.3 Replace the last sentence with the following: If such selection results in a sample containing one or more tubes which are defective as defined under note 8 of this specification sheet, such tubes shall be replaced by randomly selected good tubes.

20.2.5.2.4(b) Replace with the following: Tubes shall be subjected at 100 hours to the continuity and short test under the same conditions as for the initial test. When any tap-short indication is obtained, the test shall be repeated. When any short indication is again obtained, the tube shall be rejected as inoperable.

Note 20: For survival-rate life test, the equivalent stability life-test conditions shall be as specified in 20.2.5.2.5 of Appendix C.

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Note 21: Intermittent life test. Sampling and acceptance procedures for these tests shall be as specified in 20.2.5.3 of Appendix C.

Note 22: Envelope temperature is defined as the highest temperature indicated when using a thermocouple of No. 40 B & S or smaller diameter elements welded to a ring of 0.025-inch diameter phosphor bronze in contact with the envelope. The envelope temperature requirement will be satisfied if a tube having bogie plate current (±5 percent) under normal test conditions, is determined to operate at or above the minimum specified temperature in any position of the life-test rack.

Note 23: Order for evaluation of life-test defects. See 4.11.3.1.2.

Note 24: An inoperative as referenced in life test is defined as a tube having one or more of the following defects: Discontinuity (see note 8, except tube shall not be tapped), permanent short (see note 8, except tube shall not be tapped), air leaks. (See 4.7.6.)

Note 25: The cathode interface life-test sample shall consist of 20 tubes, and not more than one tube failure shall be permitted. In the event of rejection of the first sample due to failure of more than one tube, a second sample of 40 tubes shall be selected from the lot. Acceptance shall then be based on the combined first and second samples. The total tube failures from the combined first and second samples shall not exceed three. A life-test defect is defined as a failure to meet the life-test end-point limits as specified on the tube specification sheet. The cathode interface life-test sample shall be read at zero hours and 500 hours (plus 48 hours, minus 24 hours).

Note 26: Preheat approximately 5 minutes prior to testing, using either Ef = 11.4 V (heaters in series) or Ef = 5.7 V (heaters in parallel), other electrodes disconnected. No other test shall be made from the start of the cathode interface life test until after the measurement of the end point characteristic, following completion of the indicated minimum number of life-test hours.

Note 27: The value of interface resistance shall be measured in the standard test circuit, Drawing 248-JAN. As an alternative, a test method known to correlate with the method and conditions specified in this specification sheet may be utilized.

Note 28: Not required for qualification.

Note 29: Referenced documents shall be of the issue in effect on the date of invitations for bid.