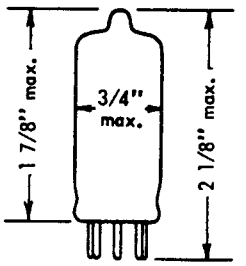
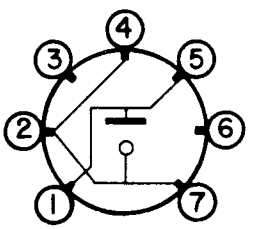
TYPE CK5651WA

The CK5651WA is a cold cathode, glow-discharge diode of miniature construction designed for use as a voltage reference tube in electronically regulated DC power supplies. It has an operating current range of 1.5 to 3.5 milliamperes over which it maintains a substantially constant voltage of 85 volts. Sudden voltage fluctuations of the CK5651WA are less than 0.005 volts within the rated operating current range and voltage drift is reduced by careful manufacturing processing, concluded by a stabilization of 46 hours operation. The CK5651WA has a negative temperature coefficient of -3.5 millivolts per degree centigrade over the temperature range of 25 to 150 degrees centigrade. Three cathode pins are provided which may be used to disconnect the load when the tube is removed from the socket. This type is characterized by long life and is designed for service where severe conditions of high temperature and mechanical shock or vibration are encountered.





BOTTOM VIEW

5BO

MECHANICAL DATA

ENVELOPE: T-5½ Glass

BASE: Miniature Button 7-Pin

TERMINAL CONNECTIONS:

Pin 1 Anode	Pin 5 Anode
Pin 2 Cathode	Pin 6 Internal Connection Do Not Use
Pin 3 Internal Connection Do Not Use	Pin 7 Cathode
Pin 4 Cathode	

MECHANICAL RATINGS:

Maximum Impact Acceleration (Shock Test-Note 2)	450 G
Maximum Vibrational Acceleration (96 Hours Fatigue Test-Note 3)	2.5 G
Maximum Bulb Temperature	155 °C

MOUNTING POSITION: Any

ELECTRICAL DATA

CAUTION - To Electronic Equipment Design Engineers: Special attention should be given to the temperature of the tubes. Reliability will be seriously impaired if maximum bulb temperature is exceeded. The life expectancy may be reduced if conditions more severe than those specified for life test are imposed on the tube and will be reduced appreciably if absolute ratings are exceeded. Attention should be given to the specified minimum supply voltage to insure operation in total darkness. Tube characteristics may deteriorate markedly if the tubes are stored at elevated ambient temperatures without drawing current.

RATINGS AND NORMAL OPERATION:	MIL-E-1B SYMBOL	ABSOLUTE MINIMUM	NORMAL OPERATION	ABSOLUTE MAXIMUM	MIL-E-1B UNITS
Starting Voltage	Ez:			115	Vdc
Operating Current Range (Note 4)	Ib:	1.5	2.5	3.5	mAdc
Operating Voltage Range	Etd:	82	85	88	Vdc
Ambient Temperature (Note 4)	TA:	-55		+150	°C

CHARACTERISTICS AND QUALITY CONTROL TESTS (Note 1)

Test	CONDITIONS	AQL %	MIL-E-1B SYMBOL	MIN.	LAL	BOGIE	UAL	MAX.	ALD.	MIL-E-1B UNITS
Continuity & Tap Shorts:		0.4								
ACCEPTANCE TESTS GROUP D			**COMBINED AQL = 1.0%**							
Ionization Voltage (1):	Rp/Ib=1.5-3.5 mAdc; ambient room light	0.65	(1) Ez:	95				110		Vdc

Tentative Data

Printed in U.S.A.

RAYTHEON MANUFACTURING COMPANY

RECEIVING AND CATHODE RAY TUBE OPERATIONS

June 15, 1955 NEWTON 58, MASS.

CHARACTERISTICS AND QUALITY CONTROL TESTS (Note 1) (cont'd)

ACCEPTANCE TESTS GROUP D (cont'd)

Test	CONDITIONS	AQL %	MIL-E-1B SYMBOL	MIN.	LAL.	BOGIE	UAL	MAX.	ALD	MIL-E-1B UNITS
Tube Voltage Drop (2):	Rp / Ib = 3.5 mAdc	0.65	(2)Etd:		84.0	85.5	87.5	88.0	2.0	Vdc
Tube Voltage Drop (1):	Rp / Ib = 1.5 mAdc	0.65	(1)Etd:	82.0	82.5	84.5	86.0		2.0	Vdc
Regulation:	(2) Etd - (1) Etd	0.65	Reg:					2.0		Vdc
Voltage Jump:	(Note 6)	0.65	Jump:					5.0		mVdc
Tube Voltage Drop (3):	Rp / Ib = 2.5 mAdc	0.65	(3)Etd:	83.5		85.0		86.5		Vdc
ACCEPTANCE TEST GROUP E										
Noise:	Rp / Ib = 3.5 mAdc RL = 500 ohms	1.0	Eb:					5.0		mVac
Oscillation:	Esig = 100 mVac; Rp / Ib = 1.5 - 3.5 mAdc; RL = 500 ohms	1.0								
ACCEPTANCE TEST GROUP F										
Ionization Voltage (2):	Rp / Ib = 1.5 - 3.5 mAdc Total Darkness (Note 5)	6.5	(2)Ez:	95				115		Vdc
Leakage Current:	Eb = 50 Vdc; Rp = 3000 ohms	6.5	Lib:					5		μAdc
Vibration (2):	f = 40 cps; G = 15; Rp = 10,000 ohms; Ebb / Ib = 2.5 mAdc	6.5	Ep:					5		mVac
ACCEPTANCE TEST GROUP G										
Repeatability:	Rp / Ib = 2.5 mAdc Note 8, 9	6.5	Δ(3)Etd:					100		mVdc
ACCEPTANCE TEST GROUP A										
Fatigue:	96 hours (Note 3)	6.5								
Shock:	Hammer Angle = 30° (Note 2)									
Post Shock and Fatigue Limits:										
Ionization Voltage (1):	Rp / Ib = 1.5 - 3.5 mAdc		(1)Ez:	95				115		Vdc
Tube Voltage Drop (2):	Rp / Ib = 3.5 mAdc		(2)Etd:	82				90		Vdc
Tube Voltage Drop (1):	Rp / Ib = 1.5 mAdc		(1)Etd:	82				90		Vdc
Regulation:	(2) Etd - (1) Etd		Reg:					3		Vdc
ACCEPTANCE TEST GROUP B										
Glass Strain:		2.5								

ACCEPTANCE TESTS - LIFE

TEST	CONDITIONS	AQL %	MIL-E-1B SYMBOL	MIN.	MAX.	MIL-E-1B UNITS	MAX. DEFECTS PER CHARACTERISTICS	
							1st Sample	Combined Sample
1 Hour Stability Life Test:	TA = Room; Rp / Ib = 2.5 mAdc							
1 Hour Stability Life Test End Points:	ΔTube Voltage Drop (3) (Note 7) Typical sample size = 35 tubes	2.5	Δ(3)Etd:		200	mVdc		
100 Hour Survival Rate Life Test:	TA = Room; Rp / Ib = 2.5 mAdc							

CHARACTERISTICS AND QUALITY CONTROL TESTS (Note 1) (cont'd)

ACCEPTANCE TESTS - LIFE

TEST	CONDITIONS	AQL %	MIL-E-1B SYMBOL	MIN.	MAX.	MIL-E-1B UNITS	MAX. DEFECTS PER CHARACTERISTICS	
							1st Sample	Combined Sample
100 Hour Survival Rate Life Test End Points:								
Inoperatives:	(Typical sample size=150 tubes)	0.4						
△Tube Voltage Drop (3):	Note 7 (Typical sample size=35 tubes)	2.5	△(3)Etd:		500	mVdc		
Intermittent Life Test (1):	T Bulb=155°C; Rp/Ib=2.5 mAdc							
500 Hour Intermittent Test End Points:	(Typical sample size=20 tubes 1st sample, 40 tubes 2nd sample. Total allowable number of defects; 3 1st sample; 6 combined samples)							
Inoperatives:							1	3
Regulation:			Reg:		3	Vdc	1	3
Tube Voltage Drop (2):			(2)Etd:	82	90	Vdc	1	3
Tube Voltage Drop (1):			(1)Etd:	82	87.5	Vdc	1	3
Tube Voltage Drop (3):			(3)Etd:	82	88.5	Vdc	1	3
Ionization Voltage (1):			(1)Ez:	95	115	Vdc	1	3
△Tube Voltage Drop (3):	(Note 7)		△(3)Etd:		1.5	Vdc	1	3
1000 Hour Intermittent Life Test End Points:	(Typical sample size=20 tubes 1st sample; 40 tubes 2nd sample)							
Inoperatives:							2	5
Regulation:			Reg.		3.2	Vdc	2	5
Tube Voltage Drop (2):			(2)Etd:	82	91	Vdc	2	5
Tube Voltage Drop (1):			(1)Etd:	82	88	Vdc	2	5
Tube Voltage Drop (3):			(3)Etd:	80	90	Vdc	2	5
Ionization Voltage (1):			(1)Ez:	95	115	Vdc	2	5

NOTES:

Note 1: Characteristics, Quality Control Test Procedures, and Inspection Levels are made according to the appropriate paragraphs of MIL-E-1B, "Inspection Instructions for Electron Tubes" and MIL-STD-105A.

Note 2: Test conditions and acceptance criteria per Shock Test Procedures of MIL-E-1B basic specifications.

Note 3: Test Conditions and acceptance criteria per Fatigue Test Procedures of MIL-E-1B basic specifications.

Note 4: Limits beyond which normal tube performance and tube life may be impaired.

Note 5: This test conducted in total darkness after tubes have been held in darkness for 24 hours.

Note 6: Vary current slowly from 1.5 to 3.5 mA and back to 1.5 mA by adjusting Ebb. Sudden voltage jumps registered on an oscilloscope connected across the tube should not be greater than 0.005 volts.

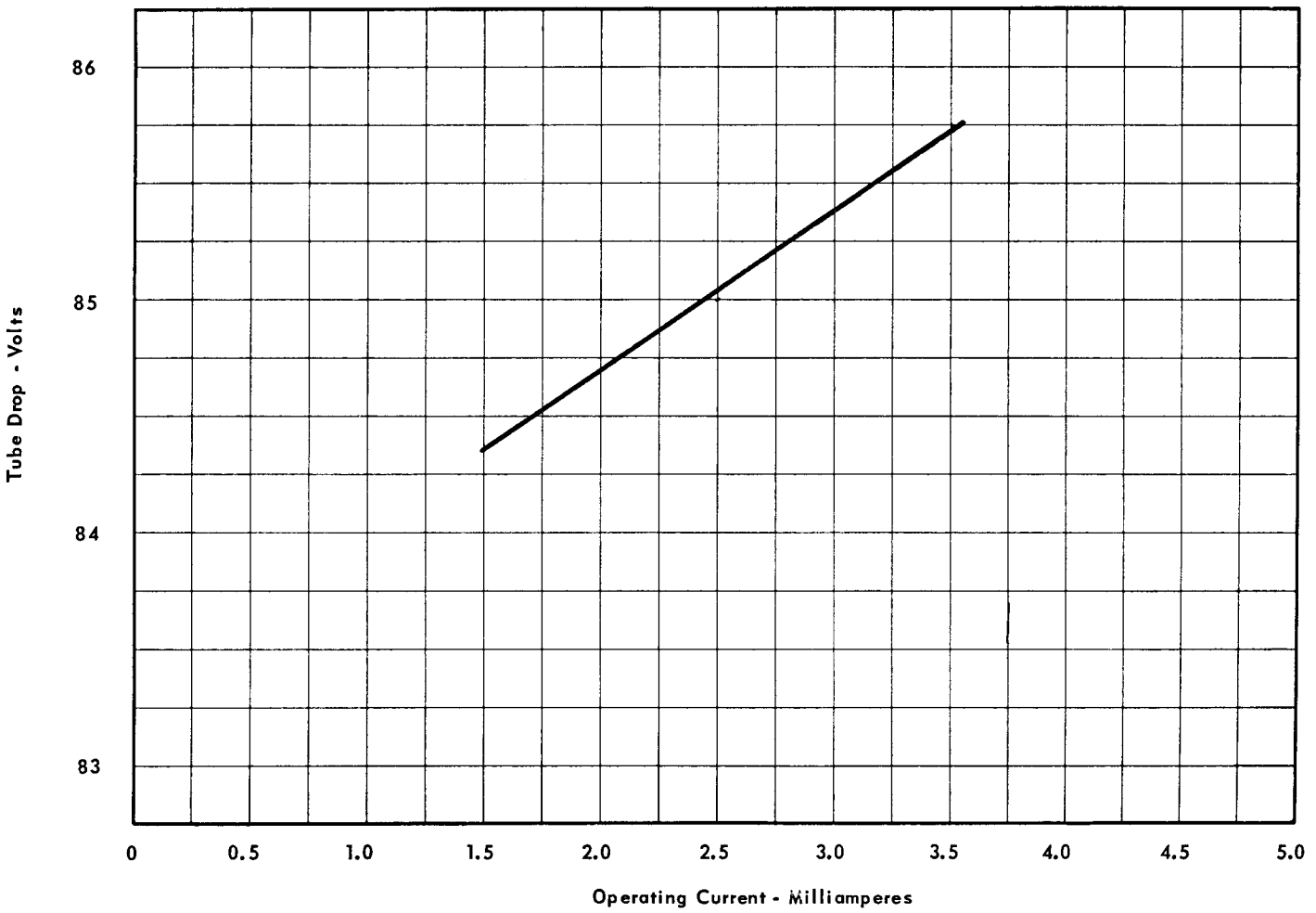
Note 7: △Tube Voltage Drop (3) is the change of tube voltage drop (3) from its initial value at the beginning of life to that at the specified life hour. The voltage drop △(3) Etd is the change in individual tubes.

Note 8: The Tube Voltage Drop will stabilize within 1 minute after starting.

Note 9: Repeatability shall be defined as the maximum shift in tube voltage drop between successive firings of the tube. The test shall be made in the following manner. The tube voltage drop is read at 2.5 mA drain, then the tube is turned off 1 minute. The tube is restarted and operated at the same current. The voltage drop is read after 1 minute of operation. The on-off cycle must be repeated a minimum of 5 times. The maximum difference in tube voltage is taken as the measure of repeatability.

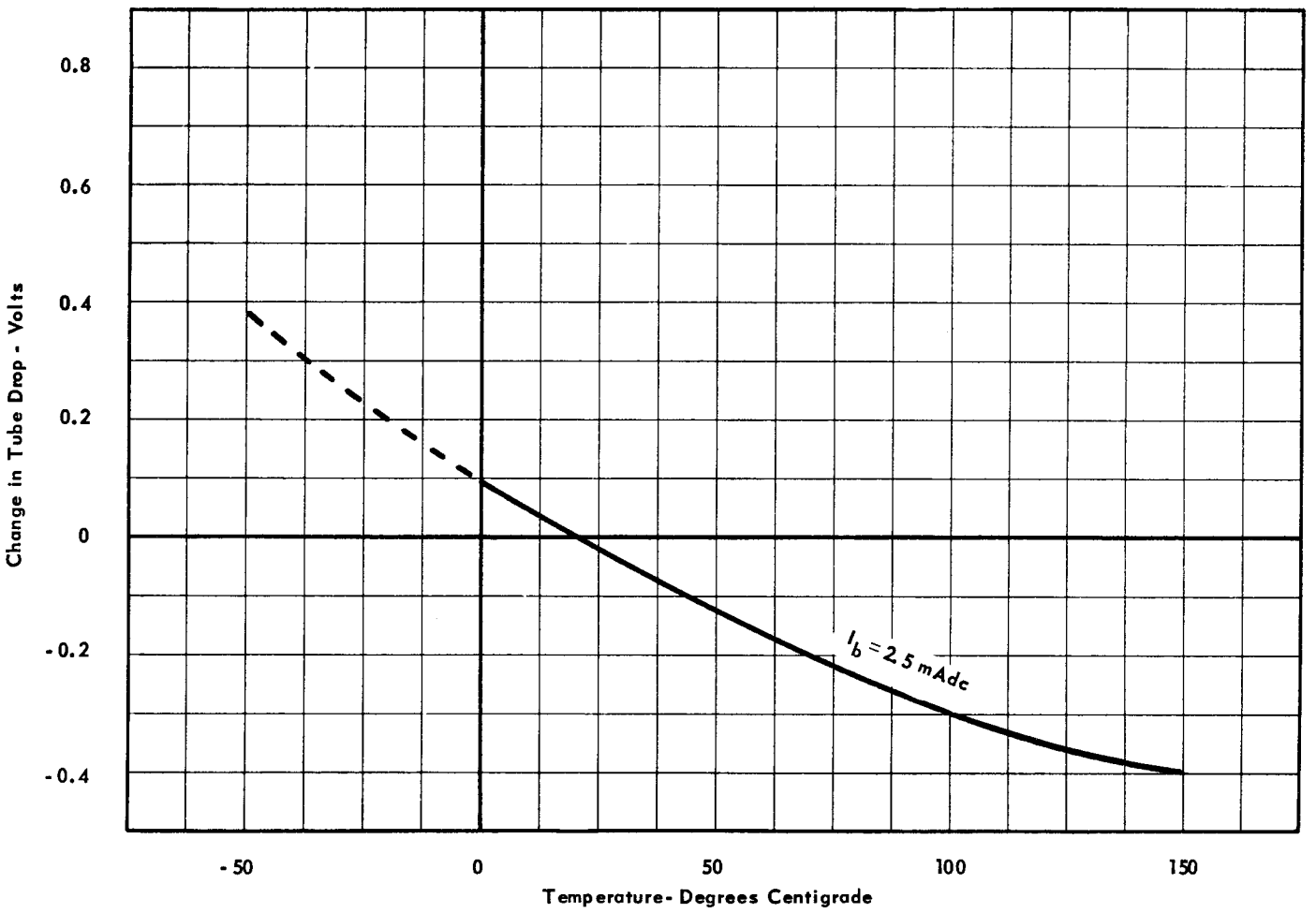
COLD CATHODE GAS DIODE

TYPICAL VOLTAGE - CURRENT CHARACTERISTICS



COLD CATHODE GAS DIODE

TYPICAL VOLTAGE - AMBIENT TEMPERATURE CHARACTERISTICS



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