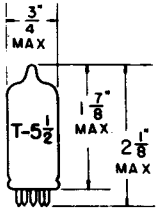
TUNG-SOL

DIODE

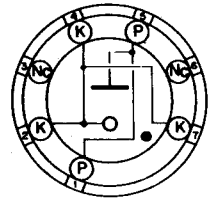
MINIATURE TYPE



GLASS BULB

COLD CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL-BUTTON MINIATURE
7 PIN BASE
5B0

THE 5651WA IS A MINIATURE TWO ELECTRODE INERT-GAS-FILLED, COLD CATHODE, GLOW DISCHARGE DIODE FOR USE AS A VOLTAGE REFERENCE TUBE IN ELECTRONIC REGULATED SUPPLIES. IT HAS AN OPERATING VOLTAGE OF 86 VOLTS OVER A CURRENT RANGE OF 1.5 TO 3.5 MILLIAMPERES. THIS TUBE IS IDEALLY SUITED FOR APPLICATIONS IN WHICH SUDDEN FLUCTUATIONS MUST BE KEPT BELOW 5 MVOLTS OVER THE ENTIRE RANGE AND WHICH REQUIRE VERY LOW OPERATING VOLTAGE DRIFT AND LONG LIFE. THE 5651WA FEATURES HIGH SHOCK AND VIBRATION RATINGS AND WILL "STRIKE" AT LOW VOLTAGES IN THE ABSENCE OF LIGHT.

ELECTRICAL DATA

CATHODE	COLD	

MECHANICAL DATA

MOUNTING POSITION	ANY	
MAXIMUM OVERALL LENGTH	2 1/8	INCHES
MAXIMUM SEATED LENGTH	1 7/8	INCHES
MAXIMUM DIAMETER	3/4	INCH
BULB	T-5 1/2	
BASE	7 PIN E7-1 SMALL-BUTTON MINIATURE	
NET WEIGHT (APPROX.)	0.3	OUNCES
MAXIMUM SHOCK RATING	450	G/1 MS
MAXIMUM VIBRATION RATING (D=.08" @ 50 CPS)	10	G

RATINGS
ABSOLUTE VALUES

MAXIMUM DC OPERATING CURRENT	3.5	MA.
MINIMUM DC OPERATING CURRENT	1.5	MA.
AMBIENT TEMPERATURE RANGE	-55 TO +150	°C
ALTITUDE	60 000	FEET

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TUNG-SOL

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ADDITIONAL TESTS TO INSURE RELIABILITY

RANDOMLY SELECTED SAMPLES ARE SUBJECTED TO THE FOLLOWING TESTS

SHOCK: 30° HAMMER ANGLE IN NAVY, FLYWEIGHT, HIGH IMPACT MACHINE (450G/MSEC)

FATIGUE: 25 CPS, 0.08" TOTAL DISPLACEMENT FOR 32 HOURS IN EACH OF 3 MUTUALLY PERPENDICULAR PLANES (2.5 G)

POST SHOCK AND FATIGUE LIMITS:		
IONIZATION VOLTAGE (MAX.)	115	VDC
REGULATION (1.5 TO 3.5 MA)	82 TO 90	VDC
TUBE VOLTAGE DROP (1.5 AND 3.5 MA.) (MAX.)	3.0	VDC
STABILITY LIFE TEST (1 HOUR):		
END POINT: CHANGE IN TUBE VOLTAGE DROP FROM INITIAL VALUE @ I_b=2.5 mAdc (MAX.)	200	mVDC
SURVIVAL RATE LIFE TEST (100 HOURS):		
END POINT: CHANGE IN TUBE VOLTAGE DROP FROM INITIAL VALUE @ I_b=2.5 mAdc (MAX.)	500	mVDC
INTERMITTENT LIFE TEST: END POINTS (500 HOURS)		
CHANGE IN TUBE VOLTAGE DROP FROM INITIAL VALUE @ I_b = 2.5 mVdc (MAX.)	1.5	VDC
TUBE VOLTAGE DROP	82 - 90	VDC
REGULATION (MAX.)	3.0	VDC
IONIZATION VOLTAGE (MAX.)	115	VDC
END POINTS: (1000 HOURS):		
TUBE VOLTAGE DROP	82 - 90	VDC
REGULATION (MAX.)	3.2	VDC
IONIZATION VOLTAGE (MAX.)	115	VDC

EQUIPMENT DESIGN AND RANGE VALUES

	MIN.	AVG.	MAX.	
DC ANODE SUPPLY VOLTAGE IN DARKNESS	115[A]	---	---	VOLTS
DC ANODE SUPPLY VOLTAGE IN LIGHT	115[A]	---	---	VOLTS
ANODE BREAKDOWN VOLTAGE	---	106	115	VOLTS
TUBE VOLTAGE DROP (1) AT 1.5 MA.	82	84.5	---	VOLTS
TUBE VOLTAGE DROP (2) AT 3.5 MA.	---	86.0.	88	VOLTS
REGULATION	---	0.8	1.0	VOLTS/MA.
VOLTAGE JUMP[B]	---	0	5.0	MVOLTS
VOLTAGE REPEATABILITY[C]	---	0.01	0.1	VOLTS
OSCILLATION (AURAL CHECK)	---	---	---	
NOISE	---	0	5.0	MVOLTS
LEAKAGE CURRENT (E_b =50V, R_p=3000Ω)	---	0	5.0	μAMPS.
GENERATED PLATE VOLTAGE (WHEN VIBRATED AT 40 CPS, 15G, R_p=10000Ω, I_b=2.5mAdc)	---	---	5.0	MVOLTS
MAXIMUM SHUNT CAPACITOR	---	---	0.02	μf
SERIES RESISTOR	D	---	---	
MAXIMUM CURRENT THROUGH INTERCONNECTED LEADS	---	---	1.0	AMP.

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NOTES

A TO ASSURE STARTING THROUGHOUT TUBE LIFE, THE SUPPLY VOLTAGE SHOULD NOT BE LESS THAN THIS VALUE.

B THE MAXIMUM VOLTAGE FLUCTUATION AT ANY CURRENT LEVEL WITHIN THE OPERATING CURRENT RANGE.

C TUBE IS CYCLED ONE MINUTE ON AND ONE MINUTE OFF FOR FIVE CYCLES. @ I_b = 2.5 mADC. READINGS ARE TAKEN INITIALLY AND AT THE END OF EACH "ON" PERIOD.

D SUFFICIENT SERIES RESISTANCE MUST BE USED TO LIMIT THE CURRENT TO A MAXIMUM OF 3.5 MA. AT THE HIGHEST ANODE SUPPLY VOLTAGE AND TO LIMIT THE CURRENT TO A MINIMUM OF 1.5 MA AT THE LOWEST ANODE SUPPLY VOLTAGE.

APPLICATION NOTES

VOLTAGE REFERENCE TUBES ARE OFTEN CONFUSED WITH VOLTAGE REGULATOR TUBES WHILE A REFERENCE TUBE IS A REGULATOR TUBE, IT IS A SPECIAL FORM OF REGULATOR TUBE, IN WHICH CURRENT RANGE AND REGULATION IS SACRIFICED TO PROVIDE VOLTAGE REPEATABILITY AND TEMPERATURE STABILITY AND TO MINIMIZE VOLTAGE JUMP AND LONG TERM DRIFT.

THE VOLTAGE REGULATION CHARACTERISTIC OF A REFERENCE TUBE IS NOT INDEPENDENT OF THE TUBE CURRENT. THEREFORE THE 5651WA **SHOULD BE RUN FROM A** CONSTANT SOURCE SUCH AS A VR TUBE, A PENTODE, OR A SIMPLE SERIES REGULATOR. PRACTICAL CIRCUITS ARE GIVEN IN FIGURES 1, 2, AND 3.

IF SO DESIRED, "INPUT AND OUTPUT" CONNECTIONS TO EITHER THE ANODE OR CATHODE CAN BE MADE TO DIFFERENT INTERNALLY CONNECTED PINS, SO THAT THE CIRCUIT WILL BE BROKEN UPON THE REMOVAL OF THE TUBE FROM ITS SOCKET. UNUSED PINS SHOULD NOT BE USED FOR CIRCUIT TIE POINTS AS VOLTAGE ON THESE PINS MAY CAUSE ERRATIC BEHAVIOR OF THE 5651WA OR EVEN FORM UNWANTED CIRCUIT CONNECTIONS THROUGH GAS BREAKDOWN. THE TUBE SHOULD BE SHIELDED IF IT IS TO BE USED IN STRONG RF OR MAGNETIC FIELDS.

MANY CIRCUITS UTILIZING THE 5651WA OR ITS PROTOTYPE, THE 5651, ARE TO BE FOUND IN THE HANDBOOK, PREFERRED CIRCUITS, Navy Aeronautical Electronic Equipment (NAVAER 16-1-519). THIS IS AVAILABLE FROM THE SUPERINTENDENT OF DOCUMENTS, US GOVT. PRINTING OFFICE, WASHINGTON 25, D.C. AT $1.75.

TUNG-SOL

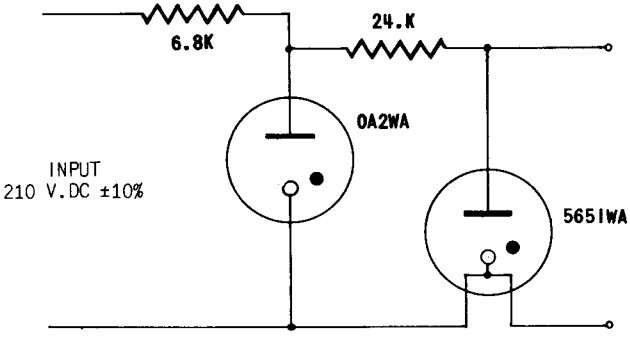

FIGURE 1

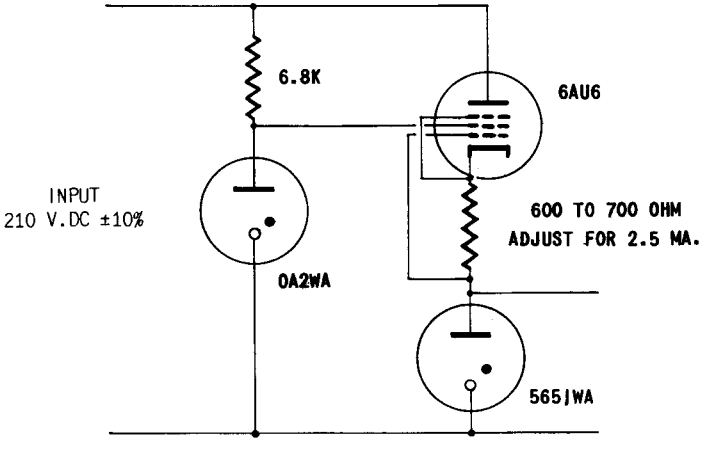

FIGURE 2

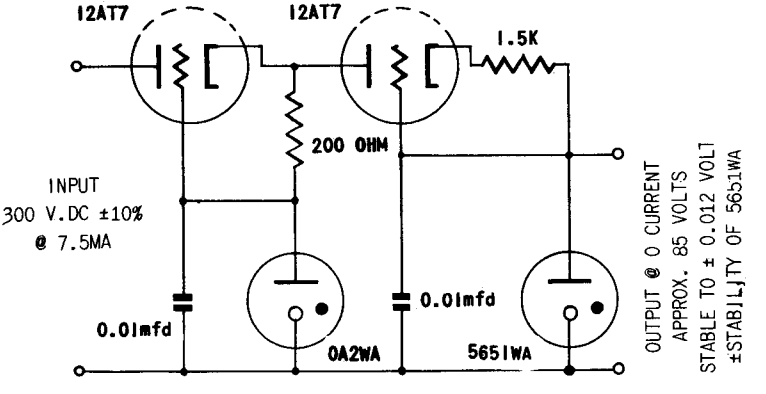

FIGURE 3

TUNG-SOL

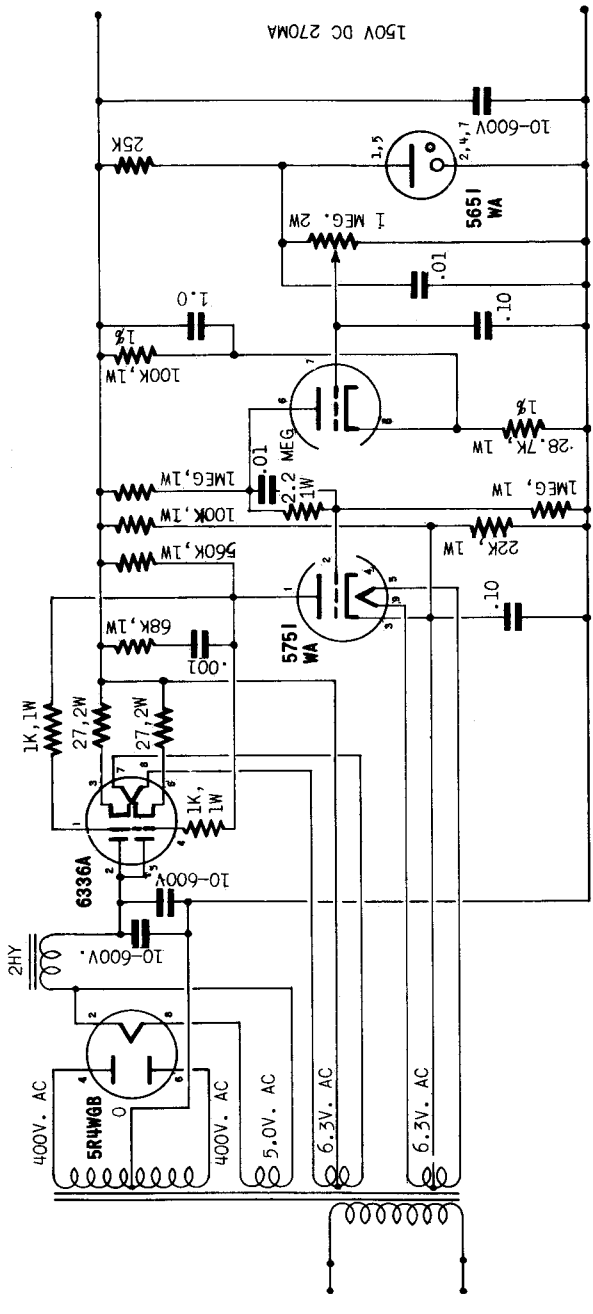

FIGURE 4

TENTATIVE DATA