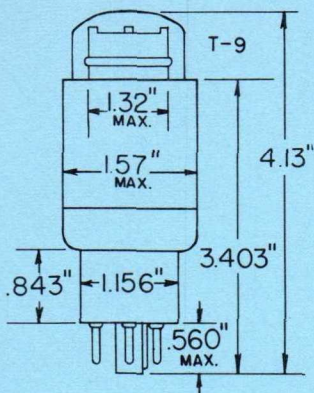


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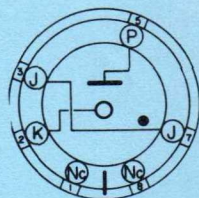
VOLTAGE REGULATOR



GLASS BULB

COLD CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

SPECIAL SKIRTED
SMALL SHELL OCTAL
6 PINLOW LOSS
PHENOLIC MATERIAL

THE OD3W IS A TWO ELECTRODE, INERT GAS FILLED COLD CATHODE TUBE INTENDED FOR USE AS A VOLTAGE REGULATOR. THE TUBE HAS A MAINTAINING VOLTAGE OF APPROXIMATELY 150 VOLTS OVER A CURRENT RANGE OF 5 TO 40 MILLIAMPERES.

THE OD3W IS EXCELLENT FOR APPLICATIONS WHICH REQUIRE GOOD VOLTAGE REGULATION AND LONG LIFE. TUBE ENVELOPE IS FLOATED WITHIN THE BASE SHELL BY A SPONGE RUBBER FILLER. THIS CUSHION DAMPENS VIBRATION AND DECREASES THE TRANSMISSION OF SHOCK TO THE ACTIVE TUBE ELEMENTS. BOTH THE BASING ARRANGEMENT AND HEAVY DUTY PARTS CONSTRUCTION MAKE THE OD3W ESPECIALLY SUITED FOR USE IN APPLICATIONS WHERE SEVERE MECHANICAL PUNISHMENT WILL BE ENCOUNTERED.

ELECTRICAL DATA

CATHODE

COLD

MECHANICAL DATA

MOUNTING POSITION
MAXIMUM OVERALL HEIGHT
MAXIMUM SEATED HEIGHT
MAXIMUM DIAMETER
WEIGHT (APPROX.)
BULB (SEE OUTLINE)
BASE

ANY
4 1/8 INCHES
3 9/16 INCHES
1 9/16 INCHES
2 OUNCES
T-9

SPECIAL SKIRTED, SMALL SHELL OCTAL
6-PIN, LOW LOSS PHENOLIC MATERIAL

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TUNG-SOL

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RATINGS
ABSOLUTE VALUES

MAXIMUM AVERAGE STARTING CURRENT ^A	100	MA.DC
MAXIMUM D.C. CATHODE CURRENT	40	MA.DC
MINIMUM D.C. CATHODE CURRENT	5	MA.DC
AMBIENT TEMPERATURE	-55 TO 70	°C
MAXIMUM ALTITUDE	10 000	FEET
MAXIMUM INVERSE VOLTAGE	-50	VDC
SHOCK IMPACT	900	G/M SEC.
MAXIMUM VIBRATION RATING ($D=0.08''$ @ 50 CPS)	10	G

^AAVERAGE OVER A STARTING PERIOD NOT EXCEEDING 10 SECONDS. NORMAL OPERATION SHOULD BE CONTINUED FOR AT LEAST TWENTY MINUTES AFTER PASSING THIS CURRENT TO STABILIZE THE TUBE.

ADDITIONAL TESTS TO INSURE RELIABILITY

RANDOMLY SELECTED SAMPLES ARE SUBJECTED TO THE FOLLOWING TESTS

SHOCK: 60° HAMMER ANGLE IN NAVY, FLYWEIGHT,
HIGH IMPACT MACHINE (900 G/MSEC.)

VIBRATION: 10-50-10 CPS, 0.08" TOTAL DISPLACEMENT,
IN EACH OF THREE MUTUALLY PERPENDICULAR
PLANES. (10 G)

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

LIFE TEST 500 HOURS: $R_p/I_b = 30$ MA. DC

POST SHOCK AND FATIGUE, AND LIFE TEST LIMITS:

IONIZATION VOLTAGE (MAX.)	185	VDC
TUBE VOLTAGE DROP (5 TO 30 MA.)	142 TO 163	VDC
REGULATION (5 TO 40 MA) (MAX.)	5.5	VDC
REGULATION (5 TO 30 MA) (MAX.)	4.5	VDC

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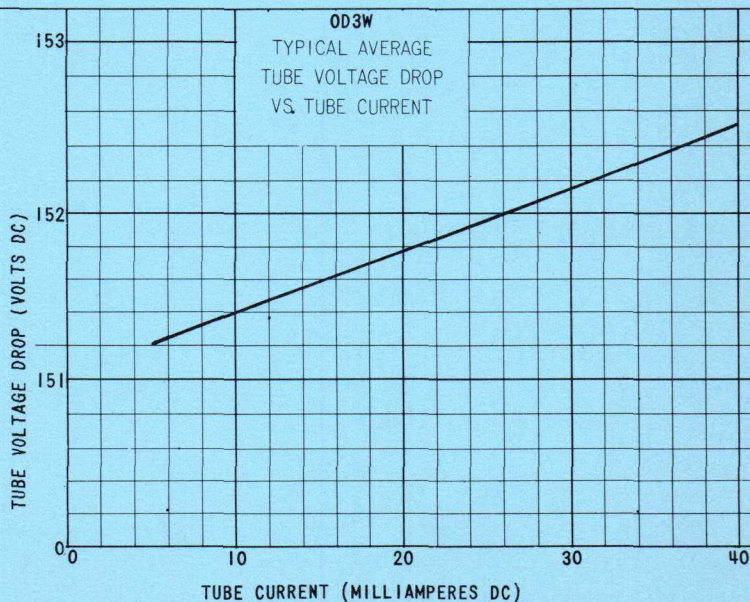
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EQUIPMENT DESIGN AND RANGE VALUES

	MIN.	AVG.	MAX.	
D.C. ANODE SUPPLY VOLTAGE IN DARKNESS	225 ^B	---	---	VOLTS
D.C. ANODE SUPPLY VOLTAGE IN LIGHT	185 ^B	---	---	VOLTS
ANODE BREAKDOWN VOLTAGE	---	158	185	VOLTS
TUBE VOLTAGE DROP (1) AT 40 MA.	---	153	165	VOLTS
TUBE VOLTAGE DROP (2) AT 30 MA.	---	---	163	VOLTS
TUBE VOLTAGE DROP (3) AT 5 MA.	142	151	---	VOLTS
REGULATION	---	2.0	5.5	VOLTS
OSCILLATION (AURAL CHECK)	---	---	---	
NOISE	---	0	15	MVAC
LEAKAGE CURRENT ($E_b = 50V.DC$; $R_p = 400 K\Omega$)	---	0	10	μA
SERIES RESISTOR	C	---	---	
SHUNT CAPACITOR	---	---	0.1	μfd
CURRENT THROUGH INTERCONNECTED LEADS	---	---	2.0	AMP.

^B IN ORDER TO ASSURE STARTING THROUGH TUBE LIFE NOT LESS THAN THE SPECIFIED SUPPLY VOLTAGE SHOULD BE PROVIDED.

^C SUFFICIENT SERIES RESISTANCE MUST BE USED TO LIMIT THE CURRENT TO A MAXIMUM OF 40 MA.DC AT THE HIGHEST ANODE SUPPLY VOLTAGE AND TO LIMIT THE CURRENT TO A MINIMUM OF 5 MA.D.C. AT THE LOWEST ANODE SUPPLY VOLTAGE.



TUNG-SOL

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OPERATING NOTES

IN THE OPERATION OF A GLOW TUBE THERE ARE SEVERAL REQUIREMENTS WHICH MUST ALWAYS BE MET. THE FIRST IS THAT THE SUPPLY VOLTAGE MUST ALWAYS BE GREATER THAN THE ANODE BREAKDOWN VOLTAGE AND THE SECOND IS THAT SUFFICIENT RESISTANCE MUST ALWAYS BE PUT IN SERIES WITH THE TUBE IN ORDER TO LIMIT THE CURRENT TO THE MINIMUM AND MAXIMUM VALUES GIVEN IN THE RATINGS.

IN ORDER TO ILLUSTRATE HOW TO CALCULATE THE VALUE OF THE SERIES RESISTANCE A TYPICAL REGULATOR CIRCUIT IS SHOWN IN FIGURE 1.

FROM FIGURE 1 WE SEE THAT V_1 IS THE UNREGULATED SUPPLY VOLTAGE, V_2 IS THE TUBE VOLTAGE DROP OR THE REGULATED VOLTAGE SUPPLIED TO THE LOAD, R_1 IS THE SERIES LIMITING RESISTOR, R_2 IS THE VARIABLE LOAD, I_T IS THE TUBE CURRENT AND I_L IS THE LOAD CURRENT.

WE SEE THAT THE TUBE CURRENT WILL BE A MAXIMUM WHEN THE SUPPLY VOLTAGE IS A MAXIMUM (V_1 MAX.); WHEN THE LOAD CURRENT IS A MINIMUM (I_L MIN.); AND WHEN THE TUBE VOLTAGE DROP IS A MINIMUM (V_2 MIN.). THEREFORE THE CONDITIONS WHICH DETERMINE THE LOWER LIMIT FOR THE SERIES RESISTANCE R_1 ARE THAT

$$R_1 > \frac{V_1 \text{ MAX.} - V_2 \text{ MIN.}}{I_T \text{ MAX.} + I_L \text{ MIN.}}$$

IN A LIKE MANNER IT CAN BE SHOWN THAT THE VALUE OF R_1 IN ORDER TO LIMIT THE CURRENT TO THE MINIMUM VALUE REQUIRES THAT

$$R_1 < \frac{V_1 \text{ MIN.} - V_2 \text{ MAX.}}{I_T \text{ MIN.} + I_L \text{ MAX.}}$$

WHEN THESE VALUES HAVE BEEN COMPUTED, ONE SHOULD CHECK TO SEE IF THERE IS SUFFICIENT STARTING VOLTAGE BY THE FOLLOWING RELATION

$$V_1 \text{ MIN.} \cdot \frac{R_2}{R_1 + R_2} > V \text{ STARTING}$$

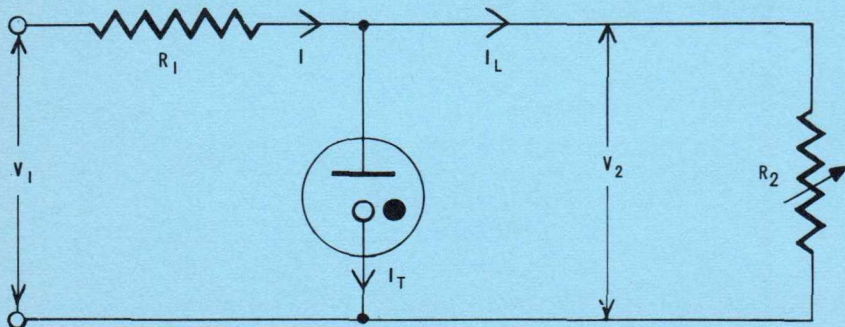


FIGURE 1

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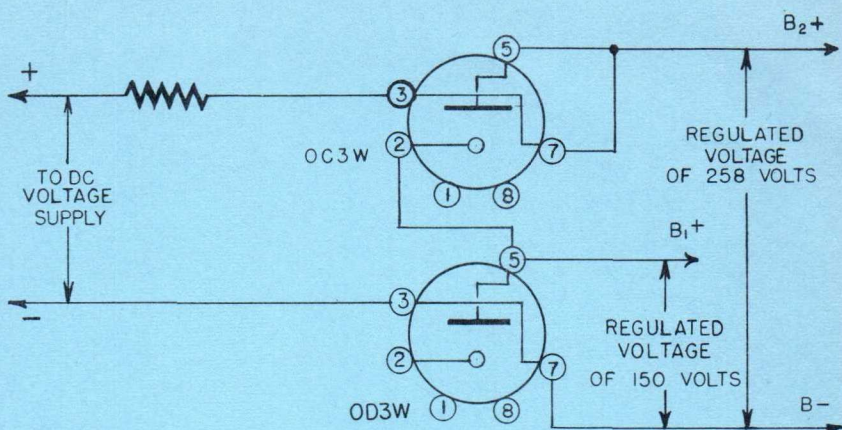


FIGURE 2 - OPERATION OF REGULATOR TUBES IN SERIES

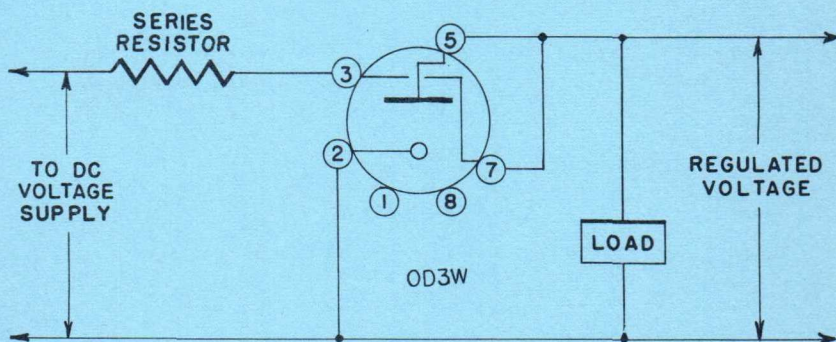


FIGURE 3 - TYPICAL CIRCUIT FOR VOLTAGE REGULATOR

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WHEN THESE CALCULATIONS HAVE BEEN MADE AND THERE IS INSUFFICIENT STARTING VOLTAGE, A NEW LOAD CURRENT OF LOWER VALUE MUST BE USED AND THE CALCULATIONS REPEATED.

CIRCUITS WHICH HAVE A CAPACITOR IN SHUNT WITH THE OD3W SHOULD BE LIMITED IN VALUE TO $0.1 \mu f$, LARGER VALUES MIGHT CAUSE OSCILLATIONS.

OPERATION OF THE OD3W IN PARALLEL IS NOT RECOMMENDED UNLESS A RESISTANCE OF APPROXIMATELY 100 OHMS IS USED IN SERIES WITH EACH OD3W TO EQUALIZE DIVISION OF CURRENT. HOWEVER, IT SHOULD BE NOTED THAT WHILE THIS ENABLES ONE TO HANDLE MORE LOAD CURRENT IT REDUCES THE REGULATION THAT CAN BE OBTAINED.

IF IT IS DESIRED TO OBTAIN HIGHER REGULATING VOLTAGES, TUBES MAY BE OPERATED IN SERIES AS INDICATED IN FIGURE 2. HOWEVER, CARE SHOULD BE TAKEN TO SEE THAT SUFFICIENT SUPPLY VOLTAGE IS AVAILABLE TO START BOTH TUBES.

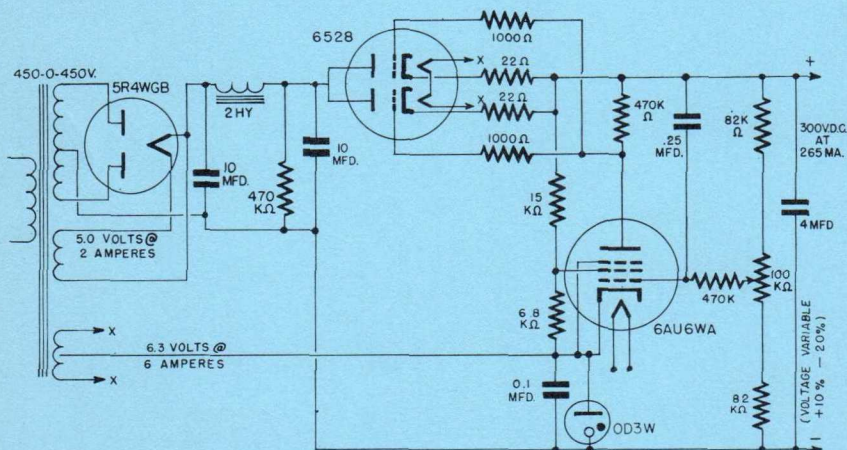


FIGURE 4

TYPICAL APPLICATION OF OD3W USED IN
VOLTAGE REGULATED POWER SUPPLY