Homework: design voltage regulator [R_S w/ and zener, power ratings]

to take voltage from center-tapped 350-0-350 power supply and produce $V_L = 300V$

(a) $I_L = 0 - 30\,mA$

solution: first, go back to raw power supply specs;

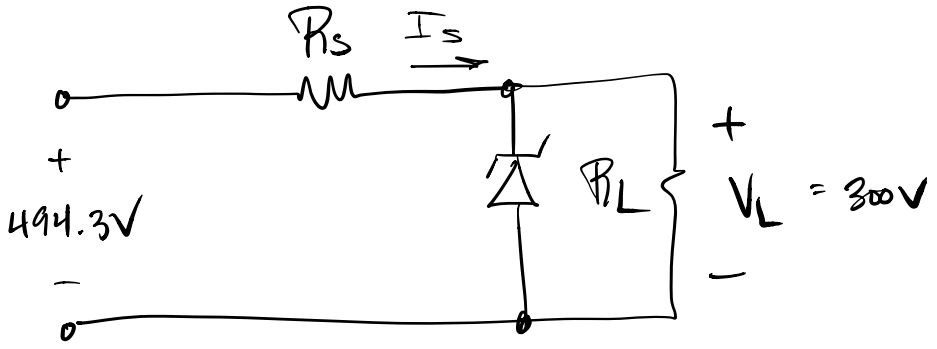
$$V_{peak} = 494.3\,V$$

$$V_{ripple} = 16.67\,V_{P\text{-}P}$$

$$\rightarrow V_L = 486\,V \quad \left.\right\} \text{(e) } I_L = 200mA$$

∴ since max. load current is only 30mA here, ripple will be much lower and we can simply use $V_{RAW} \simeq 494.3V$

* this ripple is at 200mA, at 30mA it becomes negligible



∴ assume $I_{Z_{min.}} = 2mA$ will ensure regulation

∴ then $I_S = I_{Z\,min} + I_{L\,max} = 2 + 30$

$= 32\ mA$

∴ "constant" input voltage simplifies computation!

$$R_S = \frac{V_{IN} - V_L}{I_S} = \frac{494.3 - 300}{32}$$

$$R_S = 6.072\ k\Omega$$

use **5.6 kΩ** [round down to nearest E24]

$$P_{R_S} = \frac{V^2}{R} = \frac{(494.3 - 300)^2}{5.6k} = 6.741\ W$$

use **10W resistor, preferably 15 or 20W!**

494.3

∴ max power in zener occurs when V_{IN} is high

and I_L is low

↘ $I_L = 0$

$$I_Z = I_S - I_L = 32 - 0 = 32\ mA$$

then $P_Z = V_Z \cdot I_Z$

$$= 300 \cdot 0.032$$

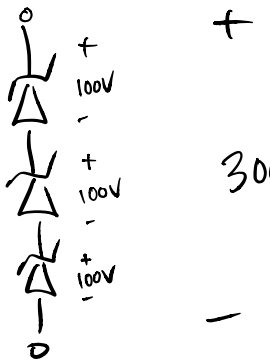
$$P_Z = 9.6\ W$$

∴ hard to find a 300V zener over 5W;

instead, use three 100V 5W

zener diodes in series

Total power dissipation: 15W



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45¢ ea. on Mouser.com

Midwest Surplus Electronics may have 'em!