

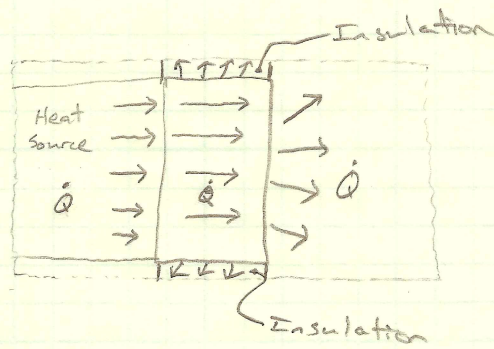
Energy Balance (Specimen)

$$\dot{E}_{in} + \dot{E}_{out} + \dot{E}_g = \dot{E}_{st}$$

$\dot{E}_{in} \approx$  to energy generated from heater

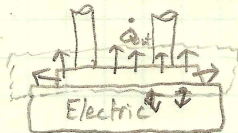
$\dot{E}_g \Rightarrow$  within the specimen there is no generation

$\dot{E}_{st} \Rightarrow$  In steady-state conditions  $\therefore \dot{E}_{in} \approx -\dot{E}_{out}$  of the system  
no energy is stored



Note: ① Minor losses in heat due to contact surface  $\leftarrow$  absorption of insulation. Both neglected as explained in concept.

Energy Balance (Heaters)



Hot Plate

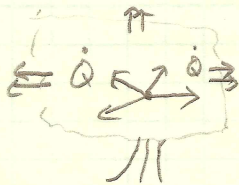
$$\dot{E}_{in} \approx 0$$

$$\therefore \dot{E}_g \approx \dot{E}_{out}$$

$\dot{E}_{st} \approx 0$ , steady-state

Note: ① Distribution of heat generation across hot plate is not uniform  
② Losses due to absorption in insulation or convection in air.

(Skin heaters / Cartridge heaters)



$\dot{E}_g \approx$  electrically generated

$\dot{E}_{st} = 0$ , steady-state

Losses: ① Compared to manufacturers capabilities losses in wires and contact (if any)

$$\dot{E}_g \approx -\dot{E}_{out} ; \dot{E}_{out} \text{ is in all directions}$$