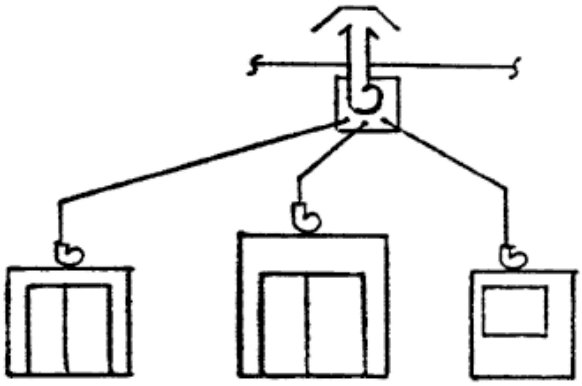
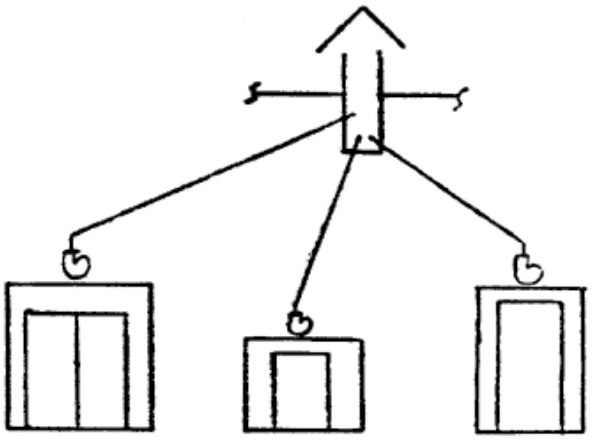
Wall Losses and Energy Consumption



Calculating Wall Losses or Energy Consumption is extremely difficult to estimate for a number reasons. The actual energy usage can vary from model to model. This is also true for identical equipment depending on the following conditions:

- Volume and weight of products being processed.
- Process temperature/s.
- Ramp time/s.
- Fresh-air and exhaust damper position (work chamber pressure and exhaust volume).
- Recirculation blower fan efficiency.
- General condition of equipment:
  - Doors.
  - Door seals.
  - Louvers.
  - Recirculation blower fan.
  - Etc.
- Wall losses.
- Non-linearity of gas valves and some SCR firing electric systems.

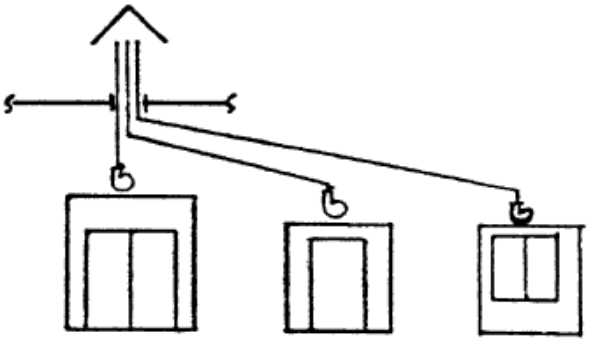


CALCULATING FUEL CONSUMPTION AND WALL LOSSES

The best way to determine the wall losses or energy consumption is to operate the equipment and obtain the actual values.

ON/OFF Control System

With the equipment at setpoint for a minimum of sixty (60) minutes:



- Monitor the temperature controller output or the HEAT/BURNER ON pilot light over a twenty (20) minute period, then calculate the percentage of time the heat is on.
- Divide the percentage of time the heat is on by the rated heater kilowatt hours or burner BTU's per hour *(listed on the equipment nameplate)*.

Example: 68 Kw electric oven operating at 350°F, the HEAT ON pilot light was on for eight (8) minutes and off for twelve (12) minute.

- 8 divide by 20 = 0.4 or 40% output
- 68 Kw times 0.4 = 27.2Kw/H (27.2 Kw/H times 3412 BTU/Kw = 92,806 BTU/H)

- 27.2 Kw/H or 92,800 BTU/H would be the fuel consumption for this example.

Modulating Control System (Gas Fired)

See Note #2: Modulating Control System (SCR Fired - Silicon Controlled Rectifier)

See Note #3: Modulating Control System (SSR Drive - Solid State Relay)

With the equipment at setpoint for a minimum of sixty (60) minutes:

- Place the temperature controller on a MANUAL mode.
- Adjust the temperature controller output to the SSR package to maintain the process setpoint with a fixed manual output value. Monitor over a twenty (20) minute time period to determine the average manual output value required to maintain the process setpoint.
- Divide the percentage of output by the rated heater kilowatt hours *(listed on the equipment nameplate)*.

Example: 136 Kw electric oven operating at 550°F, the controller output averaging 60% at setpoint.

- 136 Kw times 60% or 0.6 = 81.6 Kw/H (81.6 Kw/H times 3412 BTU/Kw = 278,419 BTU/H)
- 81.6 Kw /H or 278,419 BTU/H would be the fuel consumption for this example.

Wall Losses Calculations:

To calculation wall losses, use the same procedures/example listed above, while operating the equipment empty at the desired setpoint temperature with the fresh-air and exhaust dampers closed fully.

Note #1: When calculating the usage during the ramp from ambient to the process temperature you should generally figured it at 100% of the rated heater kilowatt hours or burner BTU's per hour.

Example: 1,000,000 BTU's gas fired oven takes 30 minutes to ramp from 70°F to 500°F.

- 30 divided by 60 = 0.5 or 50%
- 1,000,000 times 50% or 0.5 = 500,000 BTU's

Note #2: Because of the non-linearity of gas valves, you can not accurately calculate fuel consumption of a modulating gas fired system without configuring them to operate ON/OFF. The simplest and most accurate method in this case is to connect a gas flow meter in-line to monitor fuel flow rates.

Note #3: Because of the non-linearity of some SCR firing systems, you can not accurately calculate fuel consumption of a modulating SCR fired electric system without configuring them to operate ON/OFF.

We hope you will find this information useful. THANK YOU for contacting us and allowing us to be a service to you. Please contact us at 1-800-473-7373 if you have any questions.