

MET 466 – Thermal Processes Lab

Lab #4 Lighting Energy Balance Lab

Assigned: 3/5/09

Due: 3/26/09

Purpose: The purpose of this laboratory exercise is to investigate the heating effects of lighting.

Equipment:

Agilent/HP data acquisition unit

500W work lights

Type J thermocouples

Fluke IR thermometer

Background: This lab will take place in EPS 008E. The first chamber will be heated using six 500 watt halogen work lights. Thermocouples (type J) are embedded in the wall and ceiling in several places in order to record temperatures at various locations. The thermocouple wires are routed to the panel outside of the chamber located behind the computer. The thermocouples measure the temperatures between the different materials used to construct the chamber. The figures in Attachment 1 show the construction of the ceiling and walls and the location of the thermocouples.

TA Set Up:

1. Six 500 watt work lights were set up in the outside chamber in room EPS 008E.
2. Temperature measurements were taken of the floor, all four walls, windows, door and the ceiling with the use of the Fluke IR thermometer.
3. The six work lights and the data acquisition unit were then turned on. The data acquisition was set up to record all of the thermocouple data at 5 minute intervals.
4. The lights were turned off when steady state conditions were achieved. The temperature measurements were again taken of the floor, all four walls, windows, door and the ceiling.
5. The data acquisition unit was left on to record the thermocouple temperatures as the room cooled until steady state conditions were achieved. The temperature measurements were again taken of the floor, all four walls, windows, door and the ceiling.

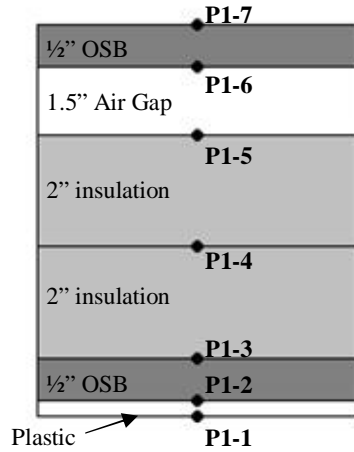
Lab:

1. Observe the experimental set-up. Including the work lights and the program written for the data acquisition.
2. Record measurements of the lengths and heights of the walls, and also record the area of the door and windows.
3. Record the data generated from this experiment (excel file).

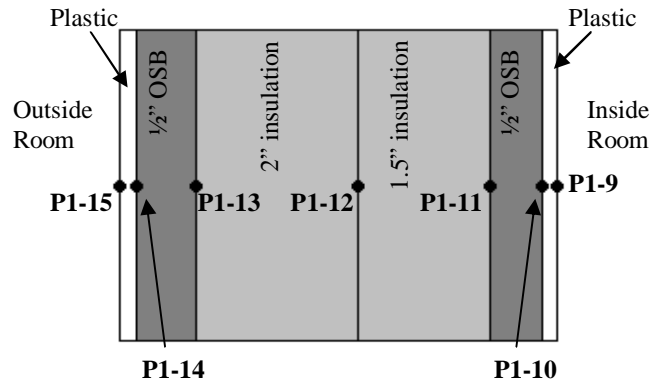
Results:

1. Graph the temperature vs. time for the ceiling, wall, stud cross-sections and wall window.
2. Explain graphs.
3. Using the heat flux and the measured areas, find the heat that leaves the room through the walls/stud/ceiling.
4. Assuming that 100% of the power used by the lights is converted to heat, compare q_{in} to q_{out} . Explain the discrepancies and where heat is lost.

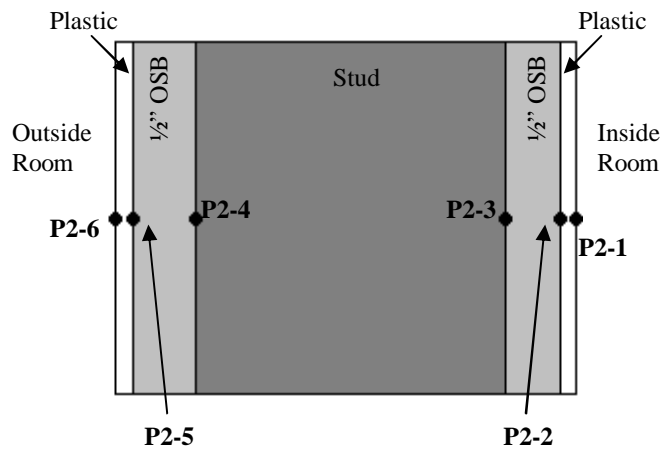
Attachment 1: Cross-section Views and Thermocouple Locations



Ceiling Cross-section and TC Locations



Wall Cross-section and TC Locations



Stud Cross-section and TC Locations