Heating Season Tips: System Balance

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In the following slides we will talk about tips on how to address system balance inefficiencies with equipment from the CUNY Field Equipment Lending Library (FELL).

Tips on:

- Checking your air flow at discharge diffuser to understand the temperature being supplied into the space.
- Identifying if your thermostat is calibrated and that you are getting the right readings.
- How to identify if you are under- or over-ventilating your space.
- Understand flow rate and delta T on hot water systems.

*Remember: click on the equipment images to be taken to their listing in the online FELL directory.*
<table>
<thead>
<tr>
<th>Applications</th>
<th>Instruments to use</th>
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<td>• Air flow temperature at discharge diffuser</td>
<td><strong>Infrared thermometer</strong></td>
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<td>• Thermostat calibration (at room levels)</td>
<td><strong>Balometer</strong></td>
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<td>• Room heat up (space heating)</td>
<td><strong>Temperature logger</strong></td>
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<td>• Adequate ventilation or excess ventilation</td>
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<td>• Hot water system (flow rate and delta T)</td>
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# System Balance

## Applications

- Air flow and temperature at discharge diffuser

## Instruments to use

- **Infrared thermometer**
- **Balometer**

## Tips

Confirm temperatures and air flow with an infrared thermometer and a Balometer in order to address the following concerns:

- Check your air flow temperature at discharge diffusers.
- Make sure you are not losing heat somewhere along your system and that you are supplying the right temperature.
- Is your system balanced?

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*Use an infrared thermometer to measure temperature at diffusers.*

*Use a balometer to measure air flow at diffusers.*
# System Balance

## Applications

- Thermostat calibration (at room levels)
- Room heat up (space heating)

## Instruments to use

![Temperature logger](image)

## Tips

Monitor your temperature readings with a temperature data logger:

- Is your thermostat calibrated? Use a calibrated logger to confirm.
- Is your space taking very long to heat up? Place a logger and see how long it takes to get to occupant comfort level.
- Are you getting cold or hot complaints in your office spaces? Place a temperature logger and record ambient temperature over time, providing you a log throughout the day. See when these complaints are coming in and compare with your data.
System Balance

Applications

- Adequate ventilation or excess ventilation

Table 2. Ventilation and Resultant CO₂ Concentrations

<table>
<thead>
<tr>
<th>Carbon Dioxide Level</th>
<th>Outdoor Air (CFM per person)</th>
<th>CO₂ Differential Between Indoor and Outdoor Air</th>
</tr>
</thead>
<tbody>
<tr>
<td>800 ppm suggests about . . .</td>
<td>20 CFM or less</td>
<td>500 ppm</td>
</tr>
<tr>
<td>1,000 ppm suggests about . . .</td>
<td>15 CFM or less</td>
<td>650 ppm</td>
</tr>
<tr>
<td>1,400 ppm suggests about . . .</td>
<td>10 CFM or less</td>
<td>1,050 ppm</td>
</tr>
<tr>
<td>2,400 ppm suggests about . . .</td>
<td>5 CFM or less</td>
<td>2,050 ppm</td>
</tr>
</tbody>
</table>

Tips

- Monitor your CO₂ level with a CO₂ data logger.
- Identify if you are getting enough fresh air within your occupant spaces.
- Identify if you are over- or under-ventilating your spaces.
- Understand how many occupants are in your work space, and how much air is needed in the space.
- Prevent high CO₂ levels from causing your occupants to feel drowsy and sleepy.

Note: The CO₂ values in this table are approximate and based on a constant number of sedentary adult occupants, a constant ventilation rate, and outdoor-air CO₂ concentration of about 380 ppm, and good mixing of the indoor air. Source: Rich Prill. “Why Measure Carbon Dioxide Inside Buildings”. Washington State University Extension Energy Program. 2000.
### System Balance

#### Applications
- Hot water system (flow rate and delta T)

#### Instruments to use
- Ultrasonic flow meter

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**Tips**

**Q:** What is “delta T” and why is it important?

**A:** Delta T is the difference between the water return and supply temperature through a heating or cooling coil. All HVAC hydronics systems have a design delta T; however, this objective is rarely achieved at part load. Delta T is the single most effective indicator of system performance. The higher delta T, the less flow required to serve the load.

**Q:** In operation, where does the excess flow go if coil delta T is less than design?

**A:** Excess flow must be processed at the central plant or through a decoupled bypass when delta T is below design. This wastes a large amount of pump and chiller energy.

**Q:** If delta T performance is poor, why can’t a facility simply reduce the pump speed to raise it?

**A:** The system is asking for the flow it requires. Reducing the flow rate will simply starve the coil of the flow that it needs at a given load condition.