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TU16- How “Green” Buildings Can Fail Due to the HVAC System

Presented by:
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Testing Adjusting and Balancing Bureau (TABB)

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- Please remember to mute all electronic devices.
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Learning Objectives:

Upon completing this program, the participant should know how to:

Learning Objective #1: Writing a spec for division 23 that meets "Green Building" standards

Learning Objective #2: Increase audience's awareness of what it takes for a successful and optimal performing HVAC system.

Learning Objective #3: How division 23 specifications for construction and performance testing of HVAC systems are required to assure that systems provide the proper airflow and outside air to the occupants.

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Who is TABB?

- Non-Profit
- SMACNA
- SMWIA
- Cell Phones

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Today's Topics

Why Balance a HVAC system in the first place

- What effects can *Green Design* have on a HVAC balancing job?
- What limitations are on a HVAC system?
- What restrictions or burdens are placed on a *Green Design* HVAC engineer?
- What to look for on TAB balancing reports and how it is affecting the buildings energy cost (Green).

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So the Need to Balance is???

- Design
- Old way
- New World way
- Space
- Rule of Thumb? Any one use them?
- Why

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What effects can design have on a HVAC balancing job?

- Perfect
- Installed vs. Drawn
- Life of the system
- Value engineered
- Payback

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What hinders a HVAC designer?

- Can you get what is really needed
  - HVAC equipment
  - Pumps
  - Fans
  - Duct work
  - Pipe sizes

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Types of Balancing Contractors

- Independent
- Mechanical contractors
- Commissioning contractors

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Proportional Balancing

- Why proportional?
- What is need to get proportional balancing done properly?
- System effects?
- Piping system vs. air systems?

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Two basic methods of Balancing HVAC systems:

- Proportional Balancing Method
  - Preferred method
  - Taught at 165 TABB training centers in US and Canada
  - Technician exam is build around this
- Sequential (or traverse) Method

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Proportional Balancing

- All systems being balanced shall have the least amount of restrictions being imposed on the system:
  - At least one outlet damper on every branch shall be fully open;
  - At least one branch duct damper shall be fully open for every trunk duct;
  - At least one trunk damper shall be fully open for every air system.
  - This should be a Green Requirement

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Proportional Balancing

- The basic principal of proportional balancing is, once set, the quantity of airflow from each outlet in a system will always remain in the same **ratio** to other outlets.
- Even if the total system flow changes, the outlets will stay in the same ratio to each other.

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Advantages of Proportional Balancing

- Based upon laws of physics;
- Each outlet is only balanced once to the key outlet;
- Minimum time is required to balance a system;
- A system that is proportionally balanced is delivering the air with the least amount of resistance.

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Advantages of Proportional Balancing

- No other method of balancing imposes less restriction on the HVAC system;
- Minimum noise is generated;
- Minimum horse power required;
- Minimum fan RPM is needed;
- If the CFM is below design, the system is still in balance. Each outlet will be delivering the maximum amount of air.

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Advantages of Proportional Balancing

- Lowest energy consumption;
- The HVAC system is under control;
- Adding more ventilation air will be delivered evenly through the system;
- The system can be brought up or down in air flow uniformly.

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Commissioning Agents

- Should they have complete understanding of proportional balancing?
- What are they to review any commissioning?
- Are they commissioning the balancing job on the report or Design, Installation, and Balancing?

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Tolerances ???? ☹

- If the fan is delivering 96% of flow…
  - What is the max tolerance between outlets?
  - 5 Diffuser @ 200 CFM = 1000 Total CFM
  - 96% of flow = 960 CFM
  - 1 outlet @ 220 CFM leaves 740 CFM for 4
  - 4 outlets @ 185 CFM (+ - 10%) = 740 CFM
  - When 1 of the 4 remain outlet gets 220 CFM
  - 3 remaining have 520 CFM or @ 173.3 CFM
  - They will never get the 180 CFM required
- What is the max tolerance between the outlets? Green decisions here?

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Sequential Balancing

- Requires frequent settings, measuring, and resetting of zones.
- Generally is more time consuming than proportional balancing.
- All dampers will be adjusted, increasing system resistance.
- I use to fix my car sequentially!!!

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Scope of Work

- Building balancing:
  - Are all of the HVAC systems working together?
- System balancing:
  - Individual systems within specified tolerances.
  - One may be 9% low and the other 9% high and still be balanced meeting the specified requirements.
- How can the GREEN TEAM HELP here? Your spec

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Balancing Reports

- Re-balance?
- Why?
- Why not?
- Who is your eyes and ears?
- How can a good balancer help the designer?

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Cost of not balancing properly

- How much more horse power is required to move twice the air through the same duct?
- Do you want to sacrifice a system for one outlet?
- Suggestions from the balancing contractor.

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Class Example on Energy use

- A duct is delivering 50 CFM of air with all dampers leading to it wide open.
- Design calls for 100 CFM.
- Old Brake Horse power is 2.3 Bhp
- New Brake Horse power is:
  - BHP new = BHP old X (CFM new/CFM old) to the third
  - 100/50 = 2 cubed (2x2x2) = 8 X 2.3 = 17.4 Bhp

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Re-Balance

- What is left to re-balance if it is balanced?
- Value engineering ring a bell?
- Does the commissioning guy know this?
- Can anyone answer this question?
  - If a HVAC system is proportionally balanced how can more air be delivered in the key outlet without adding energy cost (SP) to the system?

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One More Class Problem

- 6” round delivering 55 CFM.
- Design says 100 CFM is needed.
- Static pressure is .18 at the take off of main duct.
- What new static is needed to provide the design CFM using the second affinity law?
  - CFM new over CFM old squared multiplied by old static pressure

100/55=1.81 1.81 squared = 3.28 X .18” = .59”

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Cost of not designing a duct system properly

- 24/7 8,000 hours per year.
- Would duct replacement be cost worthy over the long run?
- Use your balancing professional as a partner to make your design the best possible running HVAC system.

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Are you Wasting Energy Efficiently?

- Defeats the purpose of "Green"
- Checklist commissioning agents
- Demand for sustainability drives many buildings to use more energy
  - UFAD example
- Expert energy use review is required

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ANSI/ISO 17024

- Eliminates conflicts of interest
  - Future competitors are not judged by existing contractors.
- Follows international standards.
- Makes TABB adhere to policies via audit process.

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ANSI

- TABB is the only HVAC Certification body who is approved to even apply for recognition.
- ANSI + TABB = Green

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Integrity Agreement

- All technicians must sign.
- Certification can be revoked for:
  - Falsification of reports;
  - Misuse of the TABB logo.

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Logical Choice

- Hire a TABB certified contractor.
- Decide if you are going to want the contractor to solve problems or report them, to determine if you need a mechanical contractor.
- ANSI
- ISO 17024

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Specifications

- TABB Model Specifications
- SMACNA Standards
- Who writes your specs, and how?

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DEFINITIONS

- Adjusting: **Varying** of system flow by modifying settings of dampers and valves, in combination with varying fan speeds to obtain optimum operating conditions for the entire system.
- Balancing: **Proportioning** of air and hydronic flows through system mains, branches, and terminal devices using standardized procedures to obtain specified air or hydronic flow while imposing the least amount of restriction on the HVAC system.
- Testing: Use of specialized and **calibrated instruments** to measure temperatures, pressures, rotational speeds, electrical characteristic, air and hydronic flow in velocities or quantities used in evaluating the performance of a HVAC system.

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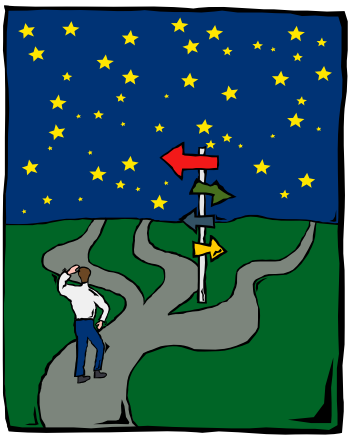

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Thank You for Attending!

Any Questions?

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