



Air Systems Design

Introduction



Next Steps in your Training

- We spent the last three weeks teaching hard core fundamentals
- Now is the time to learn how to apply those fundamentals to design
- This module is on air system design
- The next module is on chiller plant design
- Then comes decentralized air conditioning design

What you will Learn in this Lesson

- A description of the practice of air conditioning design
 - Design philosophy
 - Design intent
 - Owners project requirements
 - Codes and standards
 - Local construction practices
- The design engineer's interface with manufacturers reps

ASD Philosophy

- In week 2 we discussed the design process
- Now we dive into some detail of what goes on in the design phase
- Several issues affect the process of design
 - The purpose of the building
 - The project budget
 - The location, jurisdiction, & construction environment
 - The expertise of the designer(s)
 - The philosophy of the design firm
 - The relationship between the designer and you

Air Side Design

- An air system designer will respond to many inputs
 - Layout of the building
 - Space types
 - Owners requests (demands!)
 - Budget
- An air conditioning system has a universal function of maintaining a desired environmental condition within an occupied space.
- The definition of the desired environmental condition is a shared responsibility between the designer and the owner

Air Side Design

- Designers have many options to choose for an air conditioning system
- That choice is debated in early design phases but once design development starts, the choice is locked down
- Once chosen, a designer goes through a relatively routine process of design which customizes a system concept into a unique adaptation for each project
 - A product REP is an integral part of this process

Air Side Design

- Not all design engineers are alike
- They may have much experience and skills
- They may have a narrow specialty
- Get to know the registered engineer of record for a project
- Understand the hierarchy of professionals in the design firm
- Some individuals will have authority for design decisions but most do not

Air Side Design

- Risk
- Most firms are risk adverse
- Any engineer who has had to defend themselves on a witness stand is risk adverse
- Be aware of when you are asking a designer to make the leap to a new technology

Air Side Design

- Design intent
- Owners project requirements
- Basis of design
- Design criterion
- These define the design
- There is no single solution to the design
- Opportunities exist to influence the design if:
 - You are in the right place at the right time
 - You know what you are talking about
 - You have a good relationship with the designer

Design Intent

- What does the owner want to do with this building?
- We will use this large office building to use as an example
- The building is quite large:
 - Six floors, each 100,000 square feet
 - Each floor is very different from the others
 - Floors five and six are shelled in for future development
 - Floor three is completely finished as open office
 - There are a variety of space loads

Design Intent

- Floor 1: Mixed Use Retail
 - Three large dry goods retail
 - One restaurant with full kitchen
 - An open mall
 - A loading dock
 - A staff break room
 - MEP space
 - The main entry
 - Toilets

Design Intent

- Floor 2: Classic Office Layout
 - Four large open office area
 - Four groups of private offices
 - Three groups of various sized conference rooms
 - An elevator lobby
 - MEP space
 - Toilets

Design Intent

- Floor 3: All Open Office Layout
 - Elevator Lobby
 - Toilets
 - MEP space
 - All the rest is open office

Design Intent

- Floor 4: Conference and Learning Center
 - Elevator Lobby
 - Toilets
 - MEP space
 - Reception area
 - Registration area
 - Lounge
 - A Ballroom
 - Some open office
 - Some private office
 - All the rest is Classroom of various sizes

Owners Project Requirements

- Each of these floors has a different owner
- Each has a different schedule, plug load, light level, and occupancy
- All of the stakeholders need to provide input to the design intent and the owners project requirements
- Suppose you were the owner of the conference center, what would your requirements be?
- How about the retail floor?

Most Jobs have Little Information

- Often owners won't have specific requirements
- Office development will care about lease space
- Condo development will care about least cost
- Long term care is much like condo development
- Fast food has a fixed design
- Big box retail has specific rules which designers must follow
- Manufacturers think mostly about the process

Design: SD and DD

- Schematic design begins to select systems
- First loads are calculated
- MEP spaces are identified
- Initial system layout begins
- Equipment choices are investigated
- Budgets are started (in some cases, budgets are fixed)

Rules of Thumb

- Everybody uses them: usually at schematic design (never in design development or construction documents!)
- For general offices
 - 450 100 ft²/ton for cooling loads
 - 1.5 0.5 cfm/ft² for air supply in office buildings
 - 400 cfm/ton air supply for all-air systems
- For Hospitals: 333 ft²/ton for cooling loads
- For Hotels: 350 ft²/ton for cooling loads
- For Restaurants: 150 ft²/ton for cooling loads

Rules of Thumb

- Space for MEP
 - General: 4% to 9% of total floor area
 - Apartments, schools: 5%
 - Office Buildings: 7.5% (mostly in basements or penthouses)
 - Research Labs: 10%
 - Health Care: 10%

Issues for System Selection

- Access for maintenance and repair
- Noise and vibration control
- Central vs. distributed equipment
- Utilities: gas? electric? geothermal?
- Space availability
- Budget
- Capabilities of maintenance staff
- Service contracts
- Owners preference
- Codes and standards

End of Lesson

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