Steam System Operation and Distribution System Optimization







Session Presenters

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Session Logistics

- Session Time 1:30pm 3:00pm
- Main Presentation 1:30pm 2:45pm
- **Questions and Answers** 2:45pm 3:00pm
- Phones Please put them on vibrate mode, also be considerate of others and take your calls outside





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AEA Multifamily Resource Guide





Stack Effect

The following equation used to calculate pressure differential the to stack greasley Eastrates the impact of the height of a building 6P.= C.-E.D.(T.-T.)/T.J.H

> P. - Stack pressure de w.c.) C_ = unit conversion factor = 20558[0.1 u.c.]

Stack effect is a major source of air leakage in

multifumily buildings. In the winter, heated at

rises to the top of the building, where it is at a

building, thus the air encopes, or exfiltrates, the

building. Because an equal amount of air must

then enter the building, air infiltrates at the

inothers of the building, where the measure is the lowest. During the coping several these flows are revensed. Near the middle of the building, there is a neutral pressure plane.

where air noither infiltrates nor exfiltrates. The strength of the stack effect is largely related to the height of the ballding, as seen in the equation above. Thus, the tailer the building

the greater potential there is for stack effect Ventilation Requirements and Health a adety Considerations

o entire section of this Guide has been felicated to ventilation in multifamily buildings, but for new it will be helpful to know that in the past buildings were often allowed to

have a degree of leakings to allow fresh air to of finate the building to dilute carbon monoxid

and other combustion products, to remove

excessive measture, to remove odors, and to

company addatile prestric compounds. In detoolit

higher pressure than the cool air outside the

xitXa //bm is - provitational constant 32.3 ft/s

is a independent of outdoord air dependent

T. a sixteloor sin terri construire

T_a = indoor air temperature

As air for any ideal gash is heated, the moles embody more energy, and become more spread out. Thus, warmer air is less dense than cooler air. In a building warm air will rise to the top of the building and cold air will settle to the errors, in the winter, warm air at the tap of the building is at a higher pressure than cooler of and time. Thus, a supraney difference it.



This pressure difference is called stack effect. and it has a much aveater potential in multifumily buildings because of their heigh

Pigure 4.22 Illustration of Mark offers

Chapter 4 - Building Enclosure

Chapter List:

•Chapter 1 – Managing Multifamily Weatherization •Chapter 2 – Understanding Multifamily Housing Stock •Chapter 3 – Multifamily Energy Auditing •Chapter 4 – Multifamily Building Enclosures •Chapter 5 – Heating and Domestic Hot Water Systems •Chapter 6 – Cooling and Heat Pump Systems •Chapter 7 – Mechanical Ventilation Systems •Chapter 8 – Lighting and Electrical Base Load •Chapter 9 – Energy Modeling and Savings Analysis •Chapter 10 – Project and Construction Management •Chapter 11 – Health and Safety Considerations

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Learning Objectives

- One Pipe Steam Distribution System Operation
 - Steam Movement and Heat Transfer
 - Air Vent Operation
 - Condensation Return
- One Pipe Steam Distribution System Issues
 - Distribution Imbalance (Over-heating and Under-heating)

- CNT Energy Case Study
 - One Pipe Steam Distribution System Optimization
 - Energy Savings Associated with Distribution Measures





- Off Cycle
 - Notice the water level at both ends of the building is equal.

Steam Boilers





Pressuretrols







- A Few Minutes After Start Up
 - Notice the air in the distribution system venting out.



• A Few More Minutes After Start Up



- Radiators Getting Filled With Steam
 - Notice:
 - Condensate
 - Steam
 - Water Level, Etc...



 All Radiators Filled With Steam





- Air vent working principle:
 - Lets air out, but not steam
 - The alcohol/water mixture expands and contracts depending what is surrounding it (steam or hot condensate)

One Pipe Steam System Why Doesn't This Radiator Get Hot?



 The air vent needs to be pointing upward, otherwise no air can get out and no steam can get into the radiator.

Where Do I Change The Air Vent?

- Wrong air vent:
 - A straight vent rather than an angle vent.

• Steam Leaks

and a solution

Temperature Imbalance

- Stack Effect
 - Upper Floors are Overheated

Temperature Imbalance

- Energy Improvements
 - Insulation
 - Air Sealing
 - Window Replacement
 - Oversized Heating System

How Do We Balance A One Pipe Steam System?

Balancing a One Pipe Steam System

 Let's see what's going on here:

- Steam and condensate pass through the same valve
 - So What?

Balancing a One Pipe Steam System

Incorrect

If you throttle this valve, you restrict the flow area and now steam and condensate compete to pass through limited space and we have water hammer problem

Use Different Capacity Vents

Balancing a One Pipe Steam System

- Use larger capacity vents for radiators farther from the boiler and smaller capacity vents for radiators closer to the boiler. Why??
 - Remember flow seeks path of least resistance

Distribution Piping Layouts

- Which riser is "furthest" from the boiler?
- What do you need to do to be able to tell?

Master Venting

Maid-O'-Mist D

2" Rise

t all a fills solution

Master Venting – Improper Installation

Distribution Controls

Non-electric thermostatic radiator valves ("TRV")

One Pipe Steam TRV

Thank You!

