Functional Testing of Underfloor Air Distribution Systems

Lessons Learned From Commissioning

Presented by:
Larry Luskay
Portland Energy Conservation Inc.

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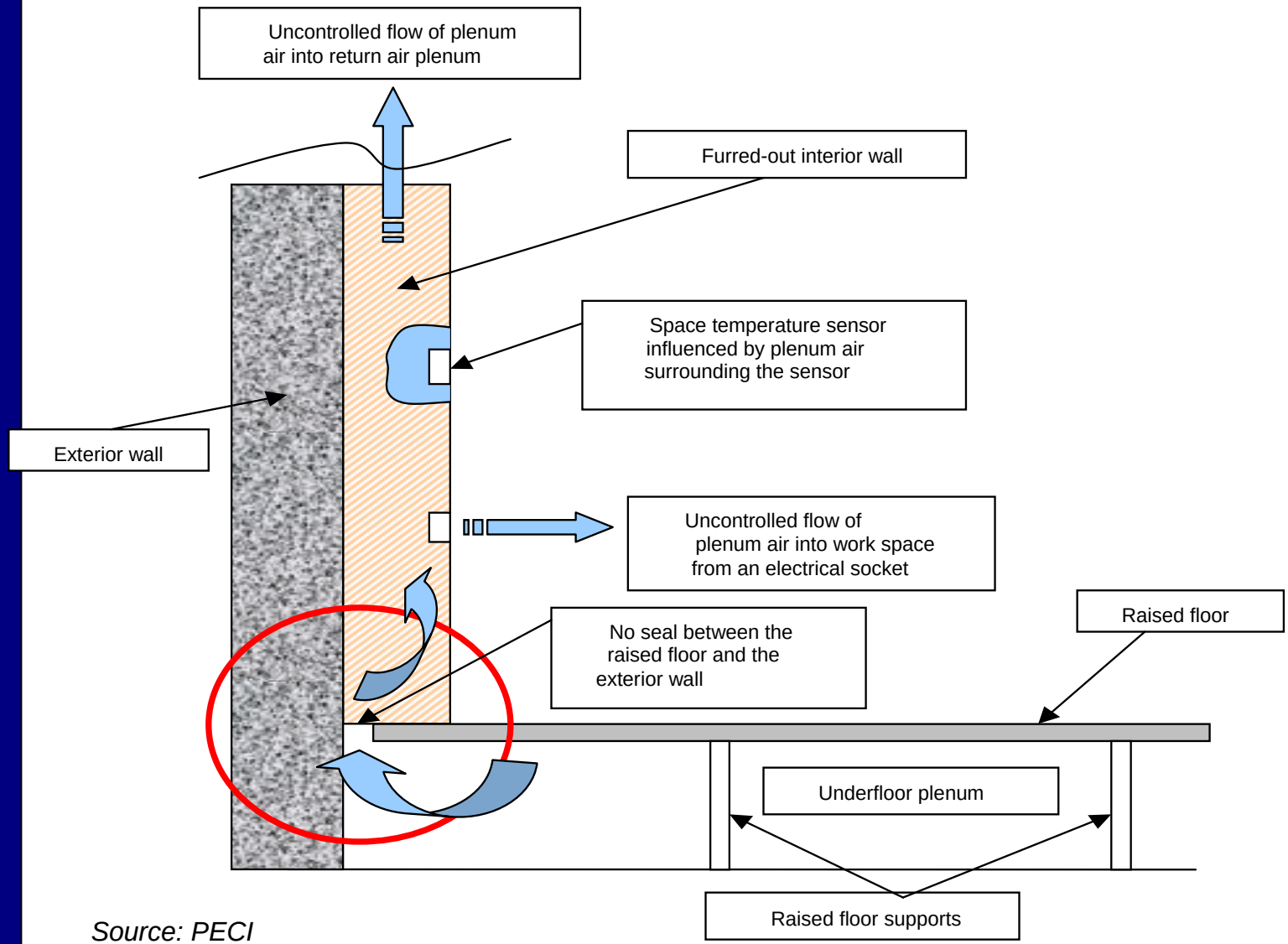
What We Will Cover

- What needs to be tested and why
- Issues that relate to plenum integrity
- Plenum pressure test
- Air handler issues
- Special Applications

What Needs to be Tested

- Underfloor plenum for leaks
  - Reduce energy usage
  - Reduce comfort complaints
- Air handling unit operation
  - Economizer
  - Discharge air temperature control
  - Humidity control
- Special Applications
  - Perimeter zones
  - Conference rooms

Why Test the Plenum for Leaks?

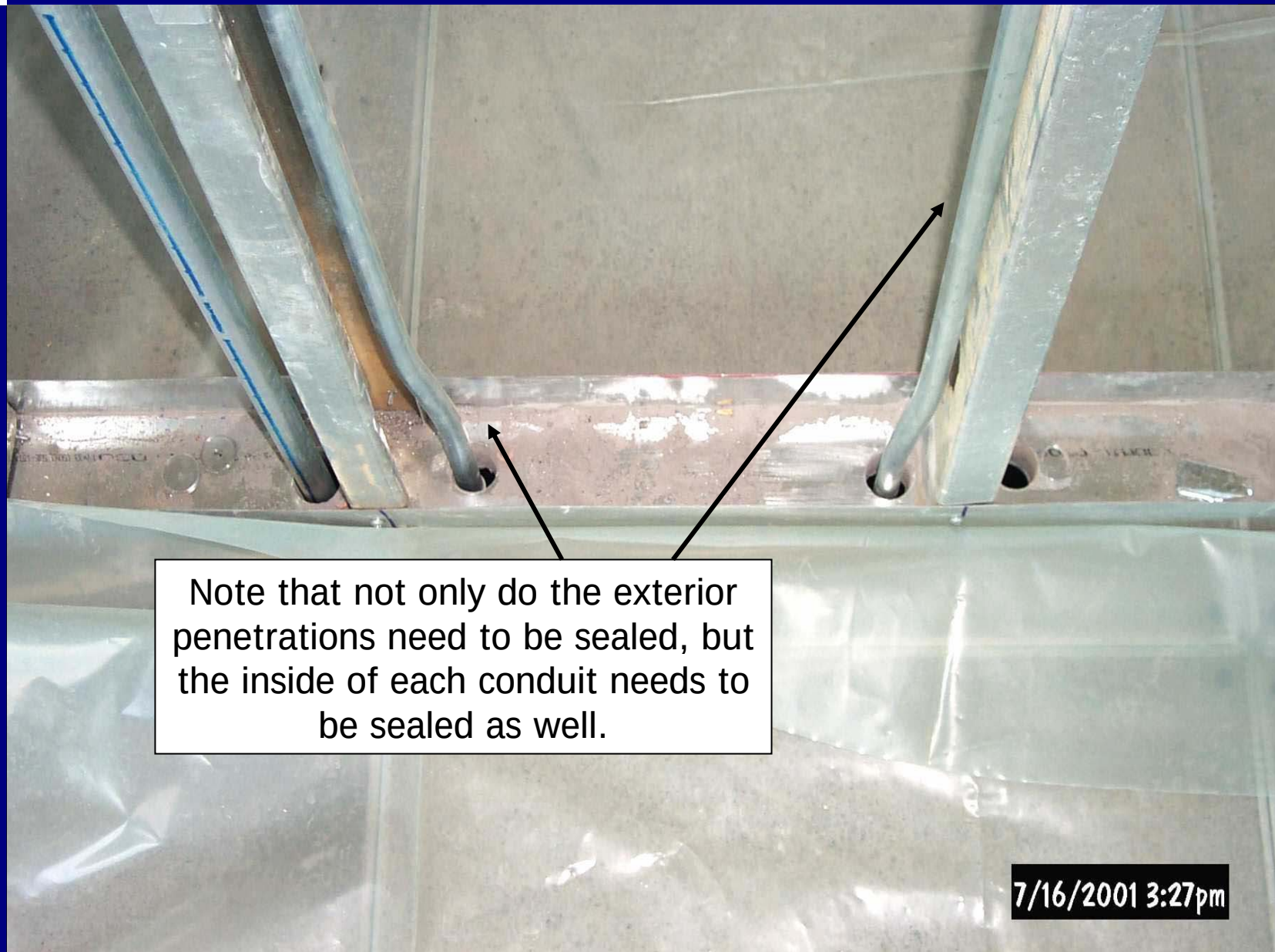


Source: PECI

Quick Example

- Open floor space
  - 120 feet by 120 feet
  - 1/16” to gap around perimeter
  - About 2.5 square foot hole
- Put another way .....
  - 60% of one tile completely missing

Conduit Penetrations



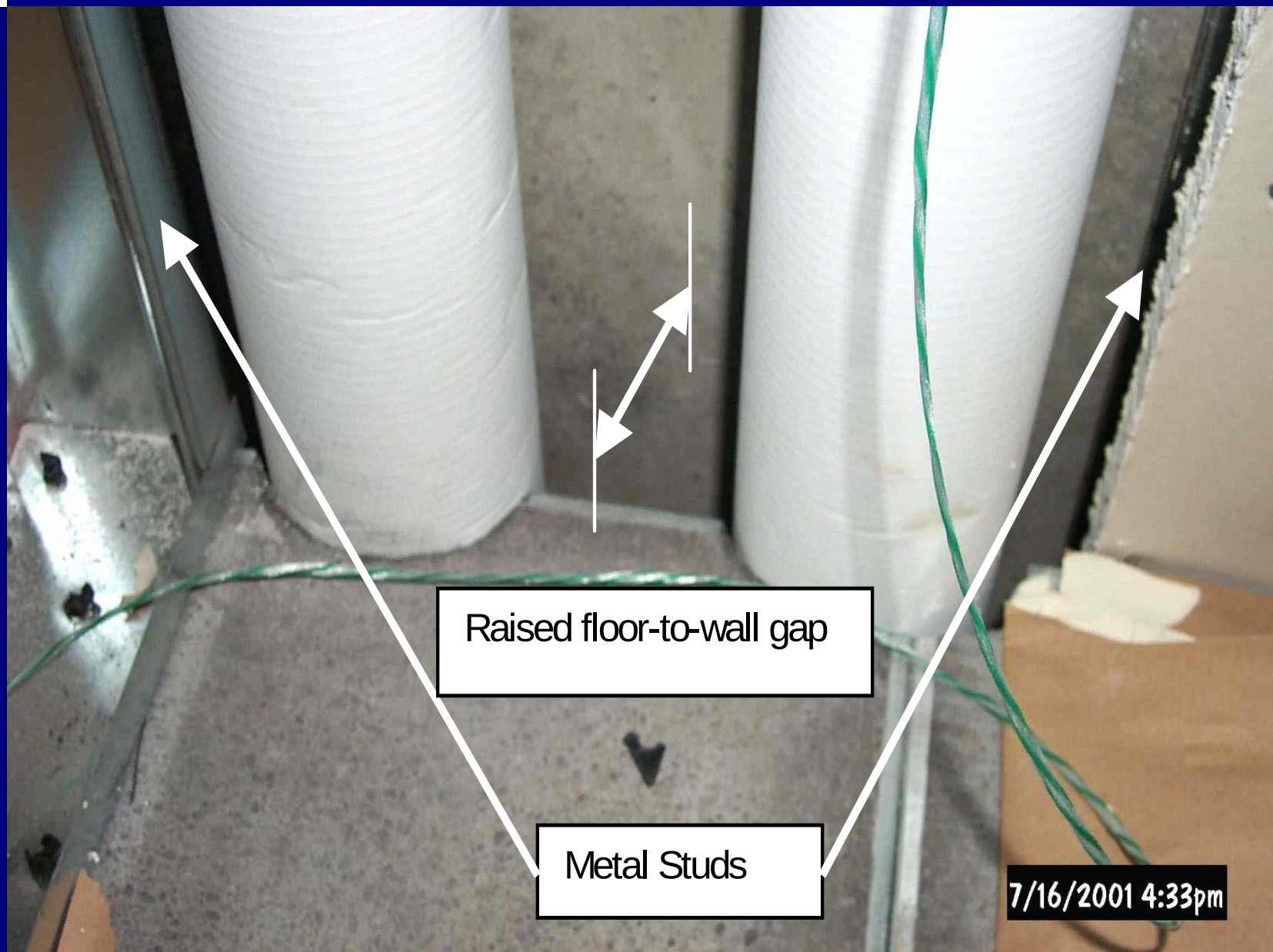
Air Leak from Wall Socket

Something just isn't right!

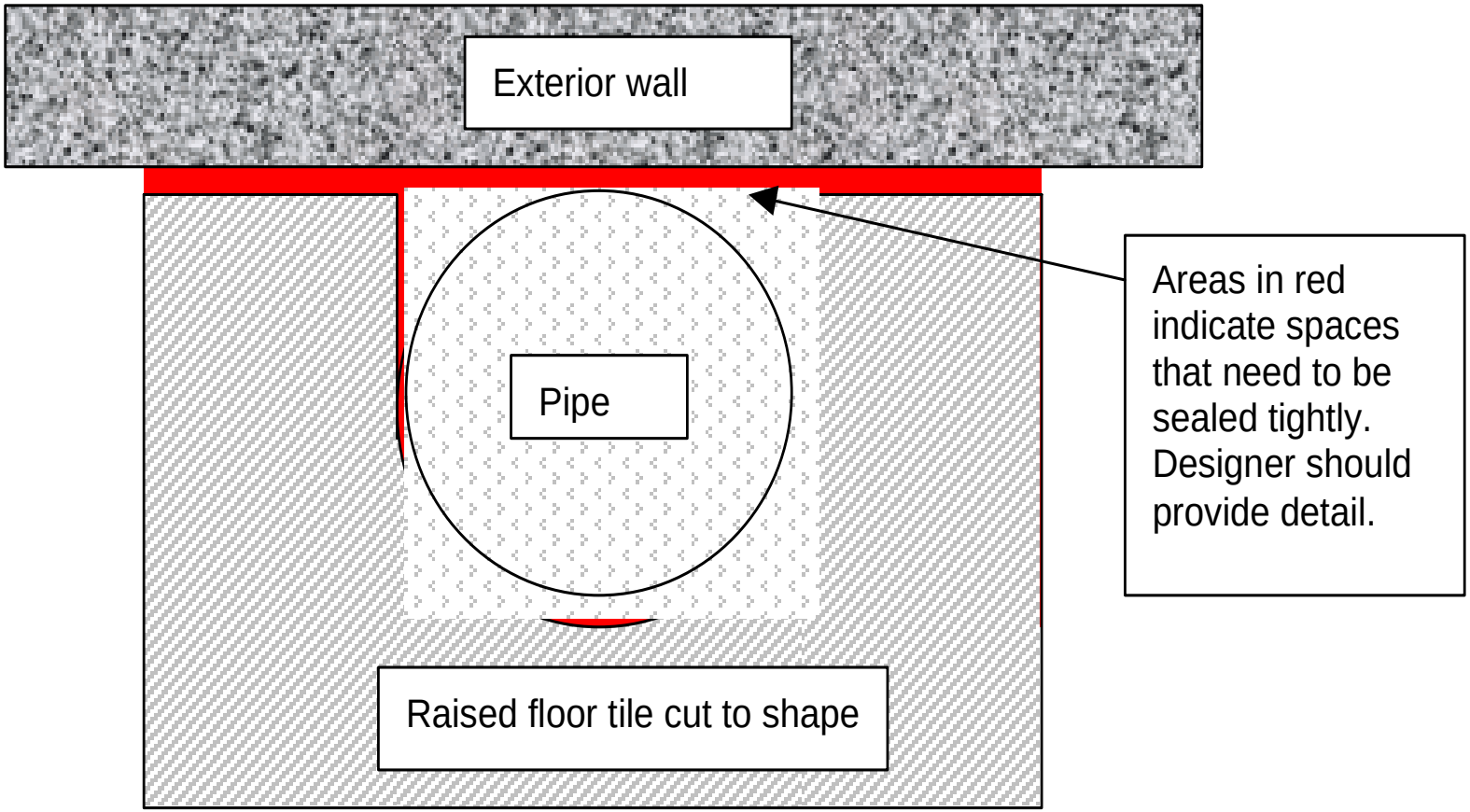
Design Issues

- Designing an air tight assembly
  - Specifications clearly outline each contractor's responsibility and scope of work
  - Provide drawing details for critical or unconventional situations

Piping Penetration



Design Detail



Source: PECI

Plenum Pressure Test Procedures

- Floor must be complete
- Seal all diffusers
- Command return dampers closed
- Command outdoor air damper open
- Return fan is off
- Manually adjust supply fan VFD until plenum reaches design pressure
- Measure outdoor air flow

Plenum Leakage Test Results

Plenum Test Procedure	Low CFM Value	%Total Supply Flow	High CFM Value	%Total Supply Flow
First plenum test	4,000 CFM	29%	4,400 CFM	31%
Second plenum test	3,500 CFM	25%	4,000 CFM	29%
Measured Leaks				
Leaks into work space	920 CFM	6.6%	1,120 CFM	8.0%
Leaks from dampers	380 CFM	2.7%	460 CFM	3.3%
Unknown leakage	2,200 CFM	16%	2,420 CFM	17%
Estimated damper leakage[1]	50 CFM	0.4%	60 CFM	0.4%
Total plenum leakage	**2,250 CFM**	**16%**	**2,480 CFM**	**18%**

Note: 1 – Estimated damper leakage rate is based on properly operating natural ventilation dampers

Air Handler Issues

- Economizer operation
  - Typical plenum air temperature about 65F
- Discharge air temperature
  - Humidity Control
  - Face and by-pass
  - Transfer air

Special Zone Requirements

- Perimeter Zones
  - Plenum Divider
    - Leakage from perimeter zone to core zone
    - Look for temperature change in core zone plenum
  - VAV Box with Reheat
    - Zone temperature sensor
    - Reheat coil
    - Box fan (if applicable)
- Conference Rooms
  - VAV box
  - Occupancy sensor

Questions