Commissioning of Underfloor Air Distribution Systems

Lessons Learned From the Field

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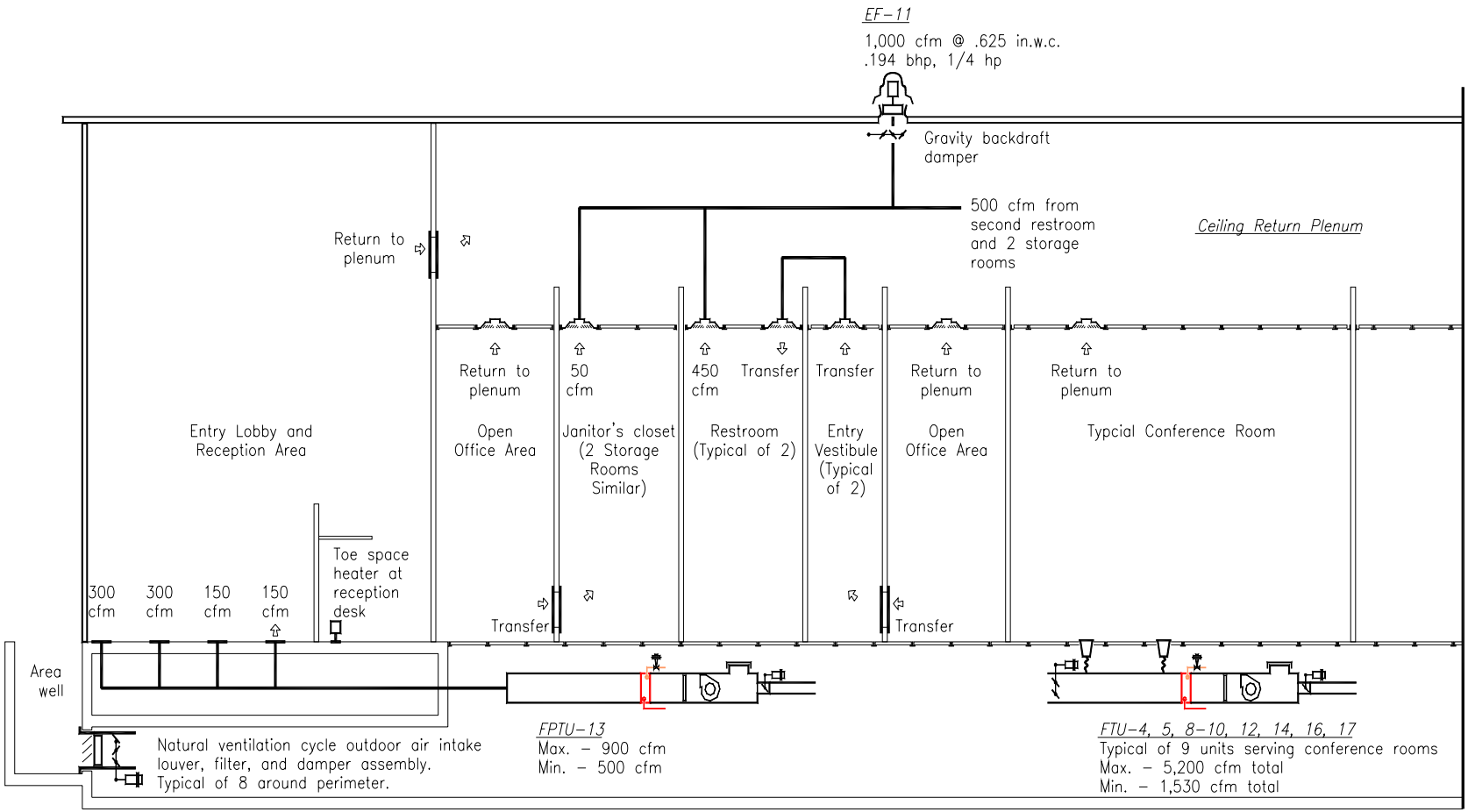
What We Will Cover

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

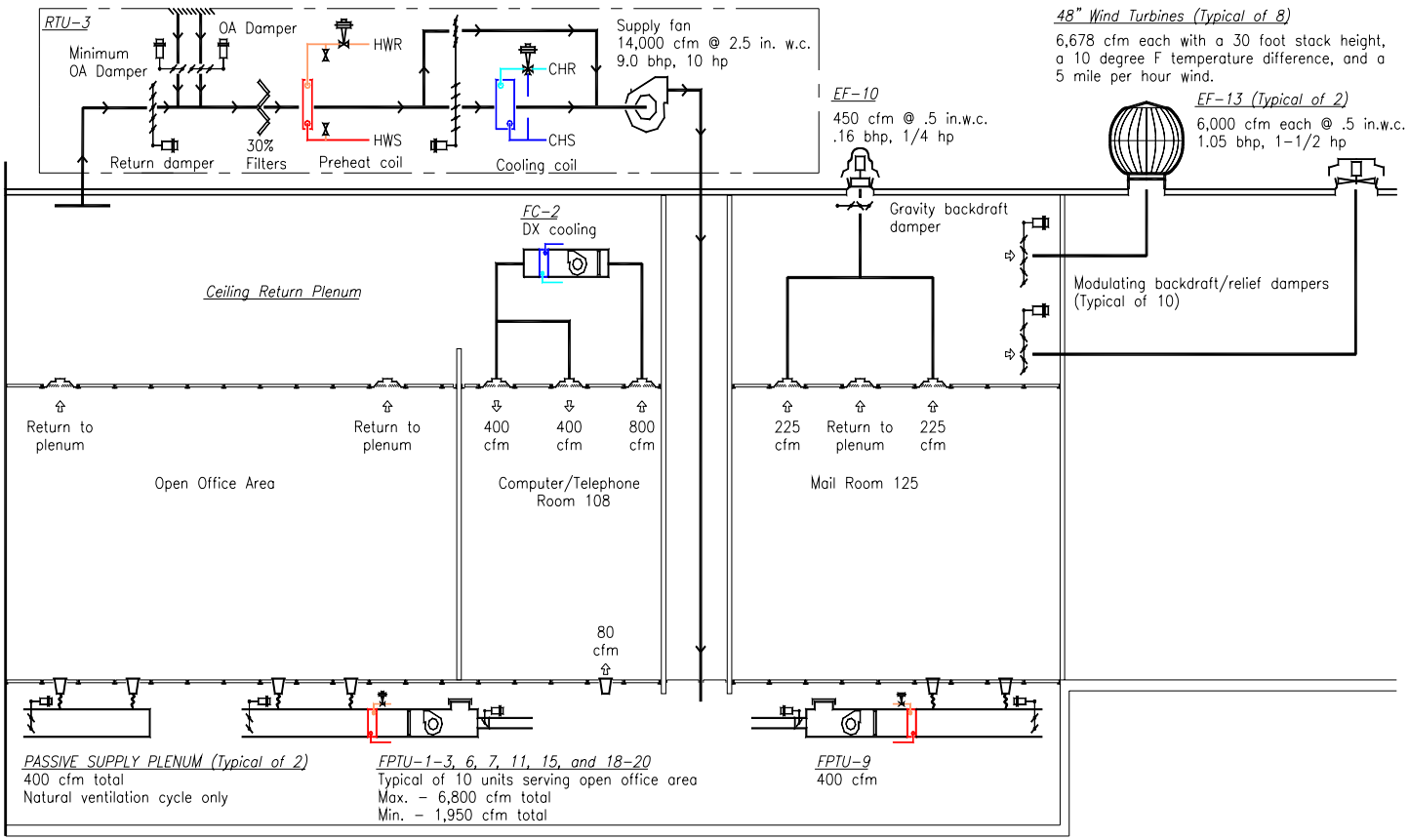
Coordination Issues

- Ensure adequate room for routine maintenance and equipment removal
- Locate equipment where access is unencumbered (i.e. hallways, open spaces)
- Coordination between trades (mechanical, electrical, plumbing, flooring)

System Diagram



System Diagram



Coordination Issues

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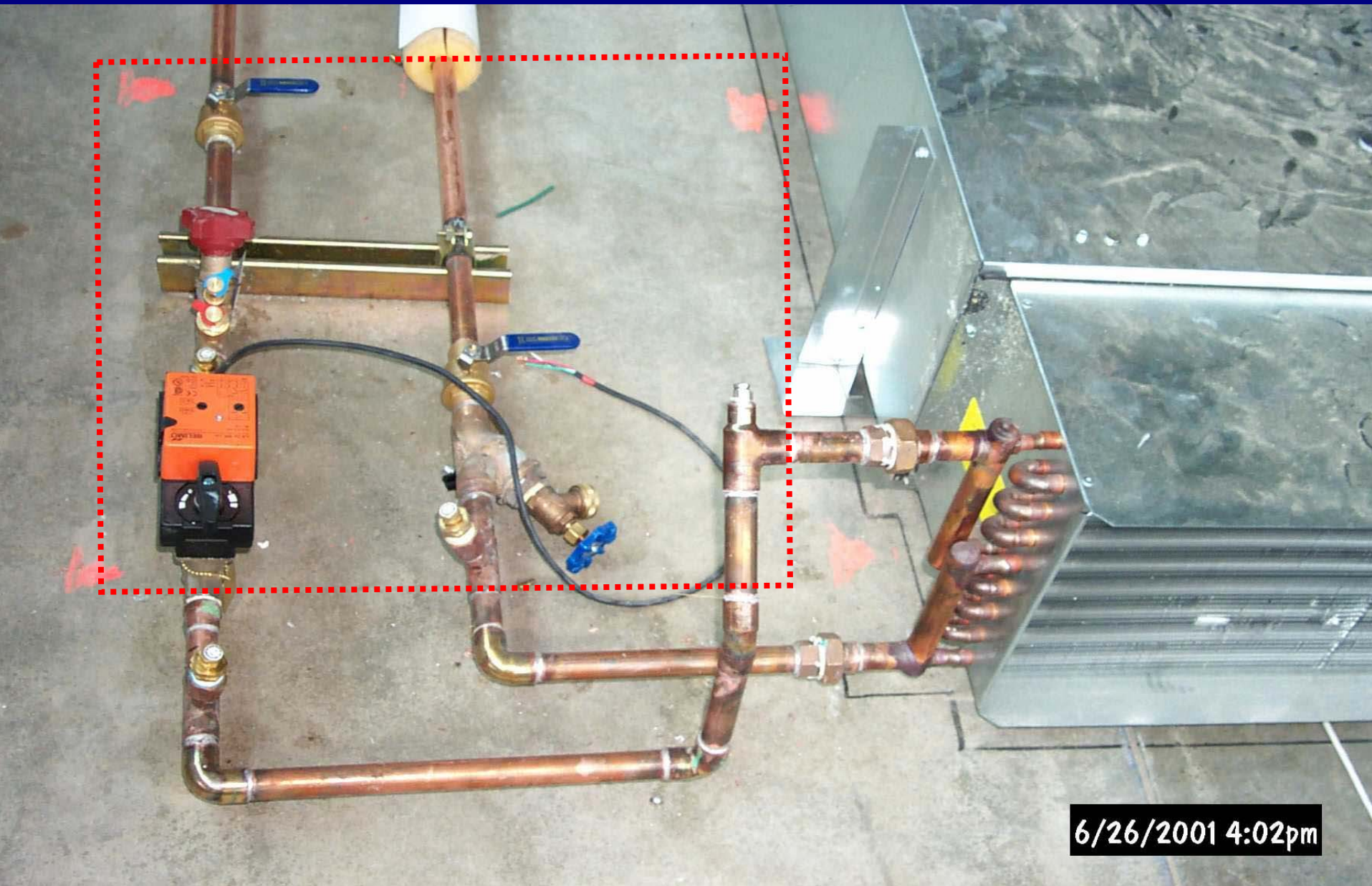
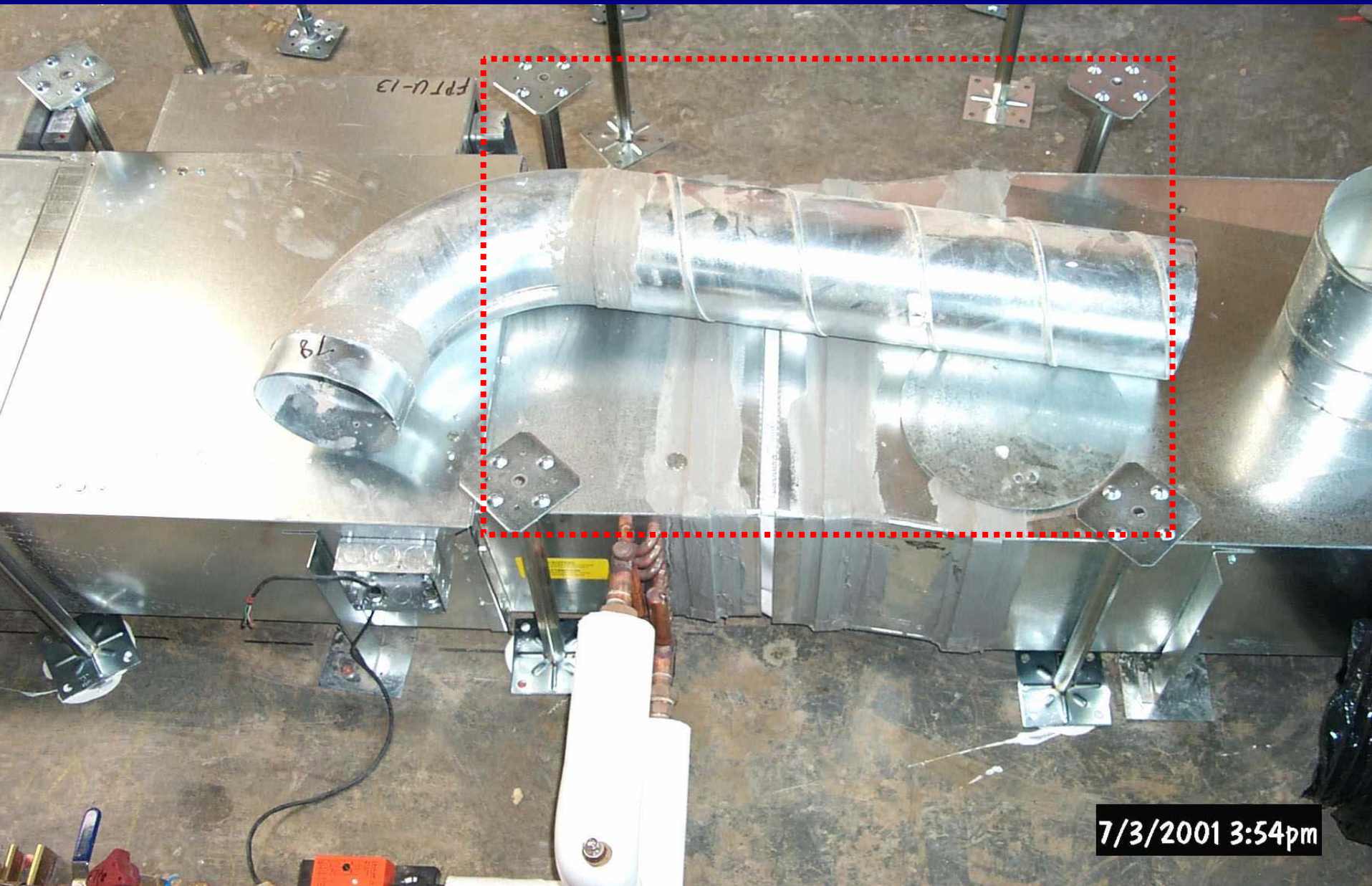
Note how the sheet metal in the red circle was bent out of shape when the floor support leg was installed. This racked the damper frame to the point where it would not close properly

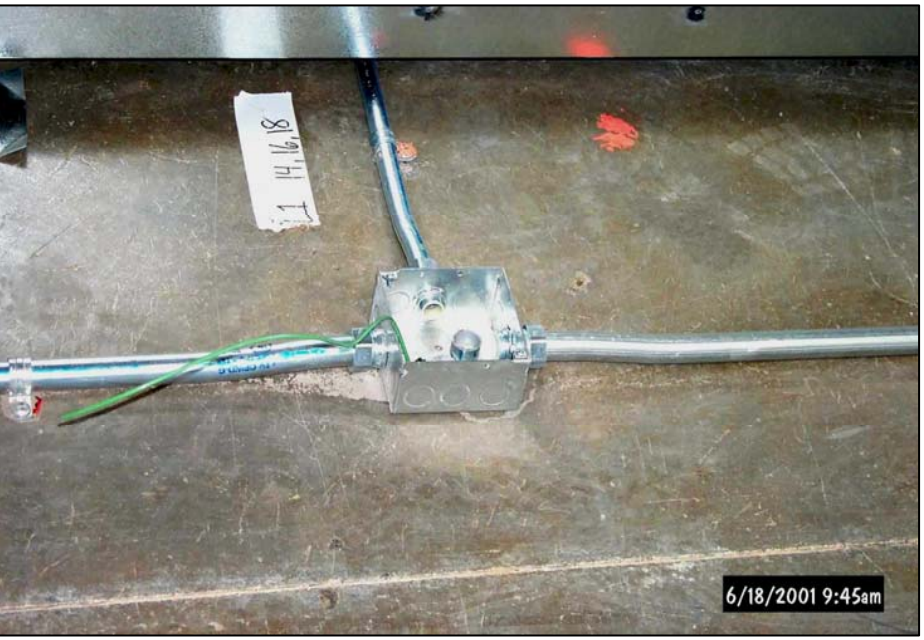
Coordination Issues



Coordination Issues



Coordination / Design Issue



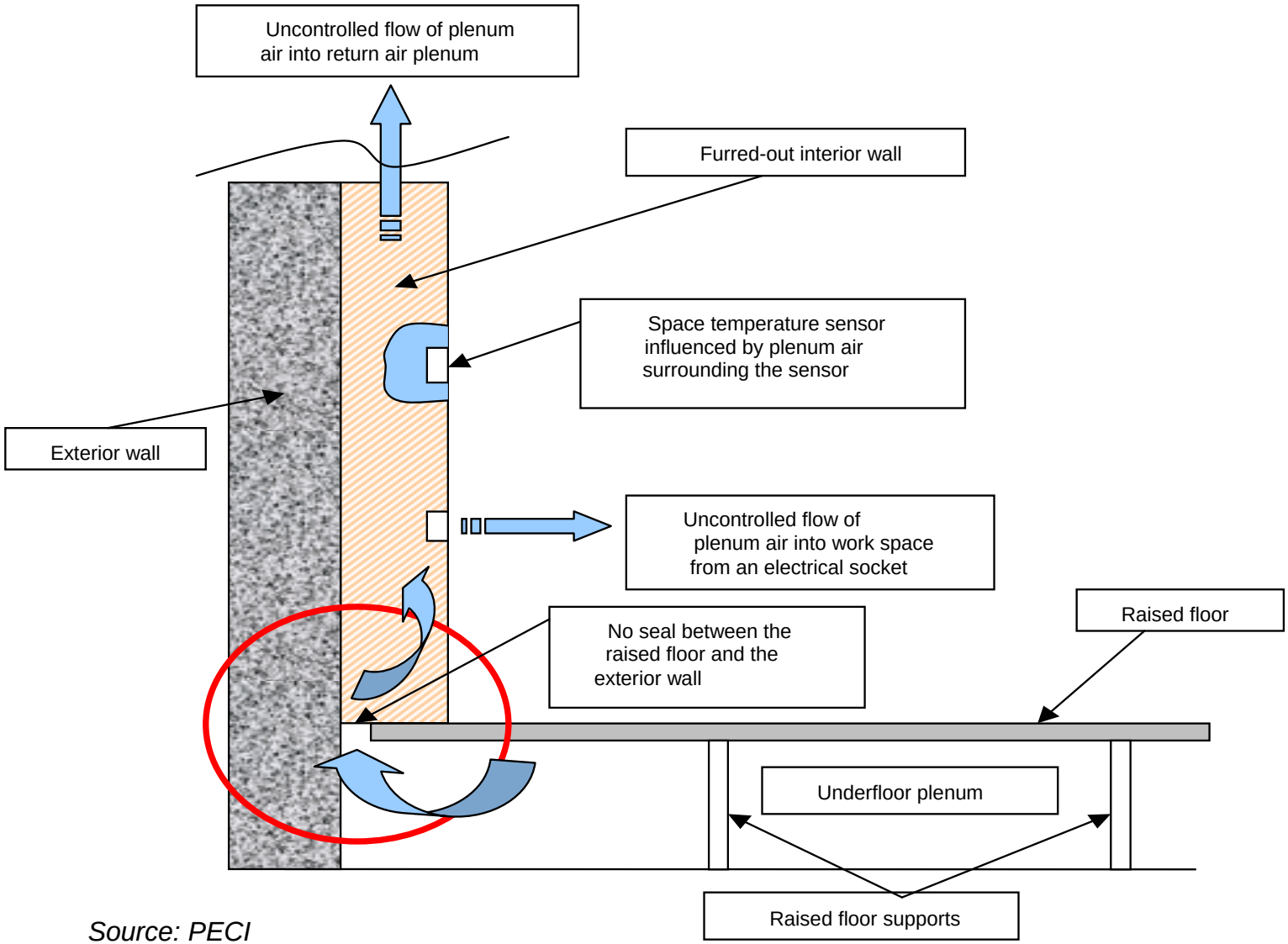
Note the junction box is mounted directly flush with the underfloor slab. The concern is that water on the slab could penetrate the junction box and cause an electrical short if the box contains any wire connections

Note the electrical conduit is mounted directly flush with the underfloor slab. This can impede water flow to the drains should a leak occur

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?

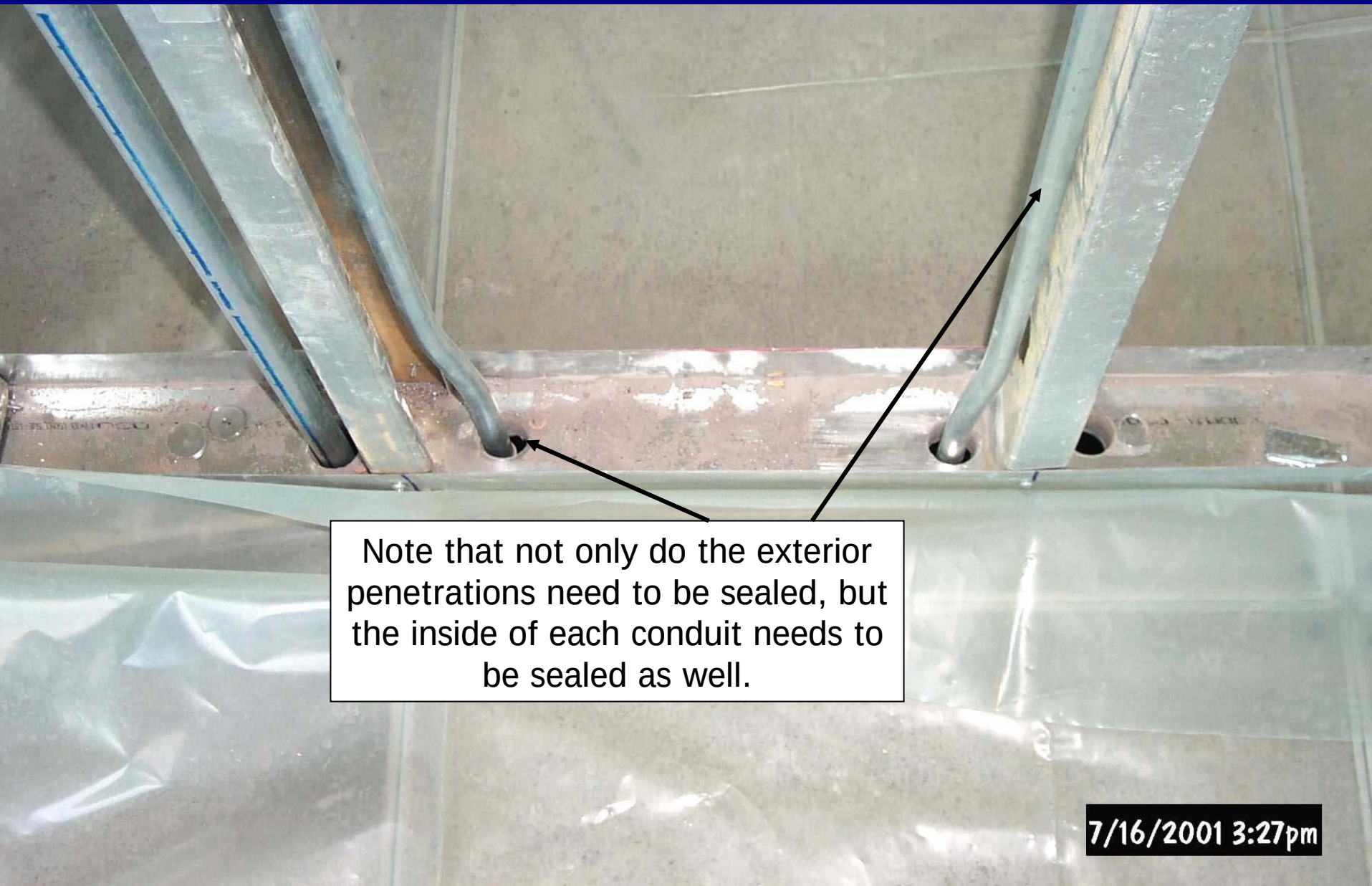


Source: PECI

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



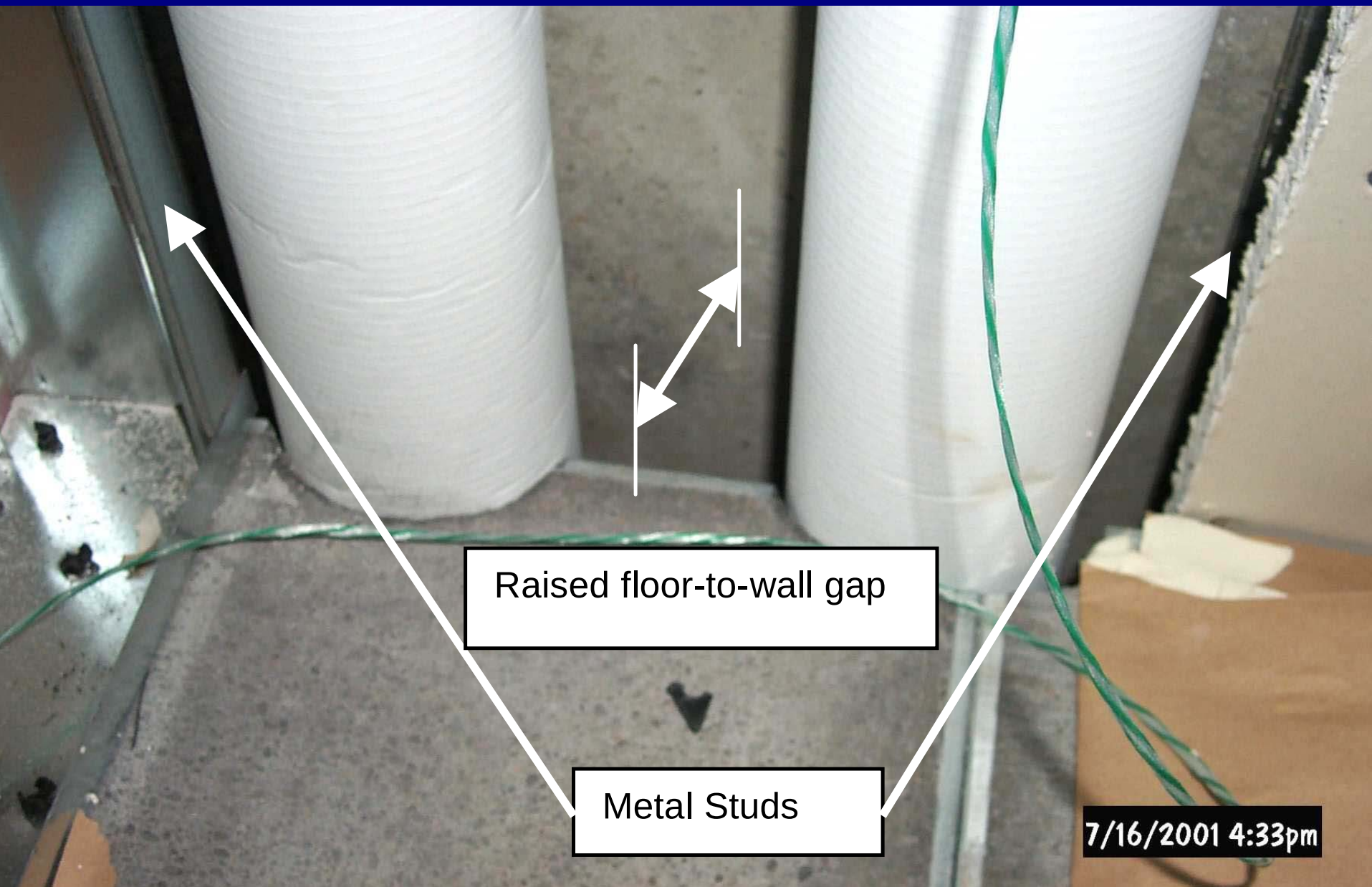
Air Leak from Wall Socket

Something just isn't right!

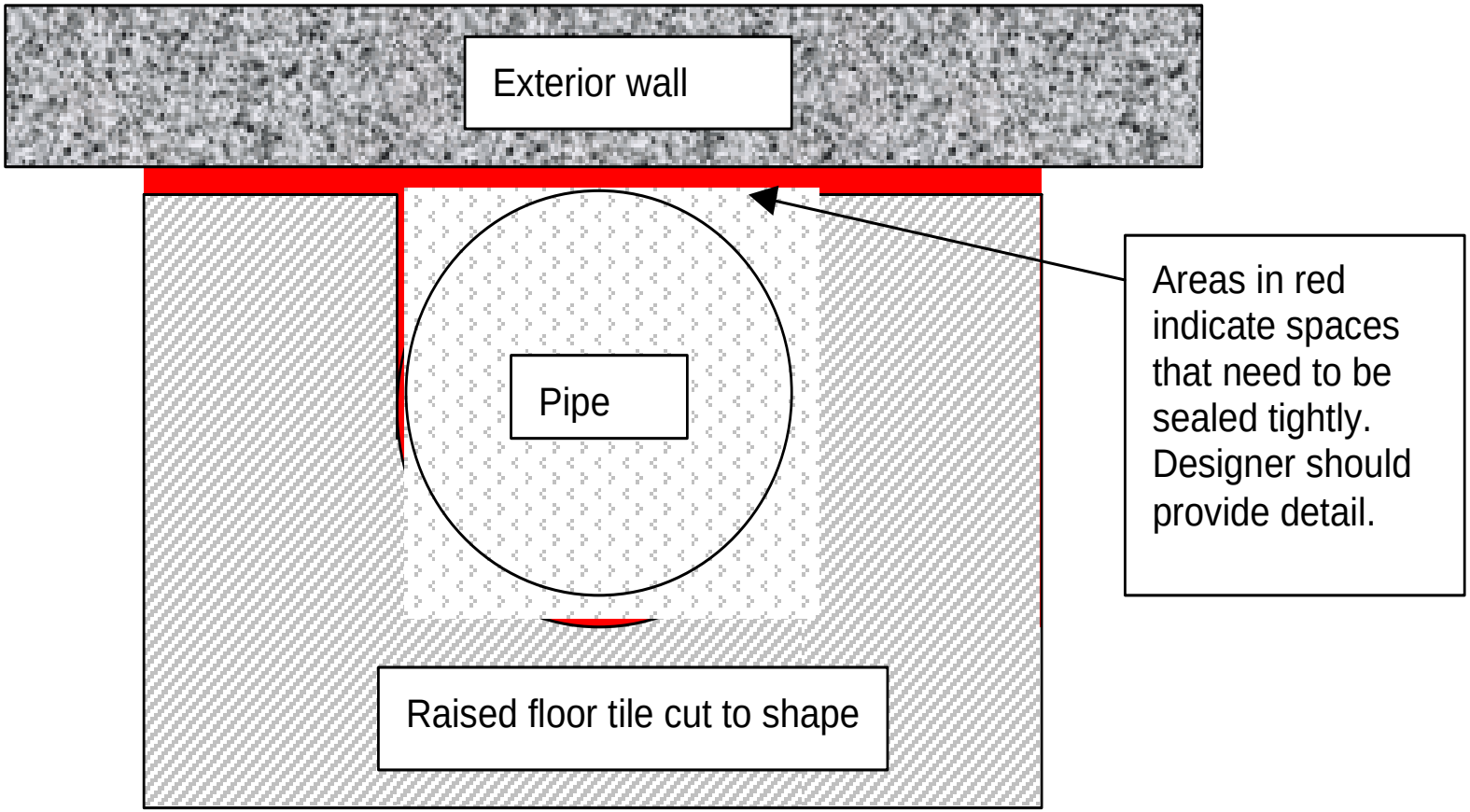
Design Issues

- 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

Known Leakages

Measuring the amount of air discharged from the diffusers with the fan-power terminal box primary damper and duct end damper shut and the natural ventilation dampers took some creativity

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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


I knew I should have at least asked how to find the freeway.
REPSOL
SPEED
CHANNEL