

# Field Testing Ductwork

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# Learning Objectives

- Understand the difference between “System” leakage and “Duct” leakage
- Understand what information is required to properly specify duct leakage tests
- Understand what various codes and standards require for duct air leakage testing
- Understand misconceptions related to duct leakage testing

# Learning Objectives

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# What is “Duct Leakage”

- Duct leakage is the leakage of air from **DUCT**
- Equipment leakage is the leakage of air from **EQUIPMENT**
- Accessory leakage is the leakage of air from **ACCESSORIES**

# System Leakage

- HVAC Air System Leakage is the **combination** of duct, equipment and accessory leakage.
- **DUCT leakage is not SYSTEM leakage**

# Is Testing Justified?

- Many people agree that testing at least a portion of the ductwork is justified.
- How much should you test?
- What sections of duct should you test?

# How much to test?

- The majority of energy codes/standards require 25% of the “high-pressure” duct to be tested...
- **ASHRAE 90.1 2010:**
  - **6.4.4.2.2 Duct Leakage Tests.** Ductwork that is designed to operate at static pressures in excess of 3 in. w.c. and **all ductwork located outdoors** shall be leak-tested according to industry-accepted test procedures (see Informative Appendix E). Representative sections totaling **no less than 25%** of the total installed duct area for the designated pressure class shall be tested. All sections shall be selected by the building owner or the designated representative of the building owner. Positive pressure leakage testing is acceptable for negative pressure ductwork.

# How much to test?

- **IECC 2009:**
  - **503.2.7.1.3** High-pressure duct systems.  
...shall be leak tested in accordance with the *SMACNA HVAC Air Duct Leakage Test Manual*... Documentation shall be furnished by the designer demonstrating that representative sections totaling **at least 25 percent** of the duct area have been tested...

# How much to test?

- **IGCC V2**

**607.4.1 Duct Air Leakage Testing.** Ductwork that is designed to operate at static pressures exceeding 3 inches water column and all ductwork located outdoors shall be leak-tested in accordance with the *SMACNA HVAC Air Duct Leakage Test Manual*. Representative sections totaling **not less than 25%** of the total installed duct area for the designated pressure class shall be tested.

# How much to test?

- Some believe that 100% testing is required, and it is the only way “to be sure”...
- Perhaps a more practical approach is the 25-50-100 approach...

# Why not use a % to fan flow?

- Leakage is a function of pressure
- And the “size of the hole”

$$F = C_L P^N$$

# Why not use a % to fan flow?

- As mentioned earlier Leakage is a function of pressure, and it is a function of “the size of the hole”
- Leakage is not a function of the volume of air

# Why not use a % to fan flow

- ASHRAE RP 1292

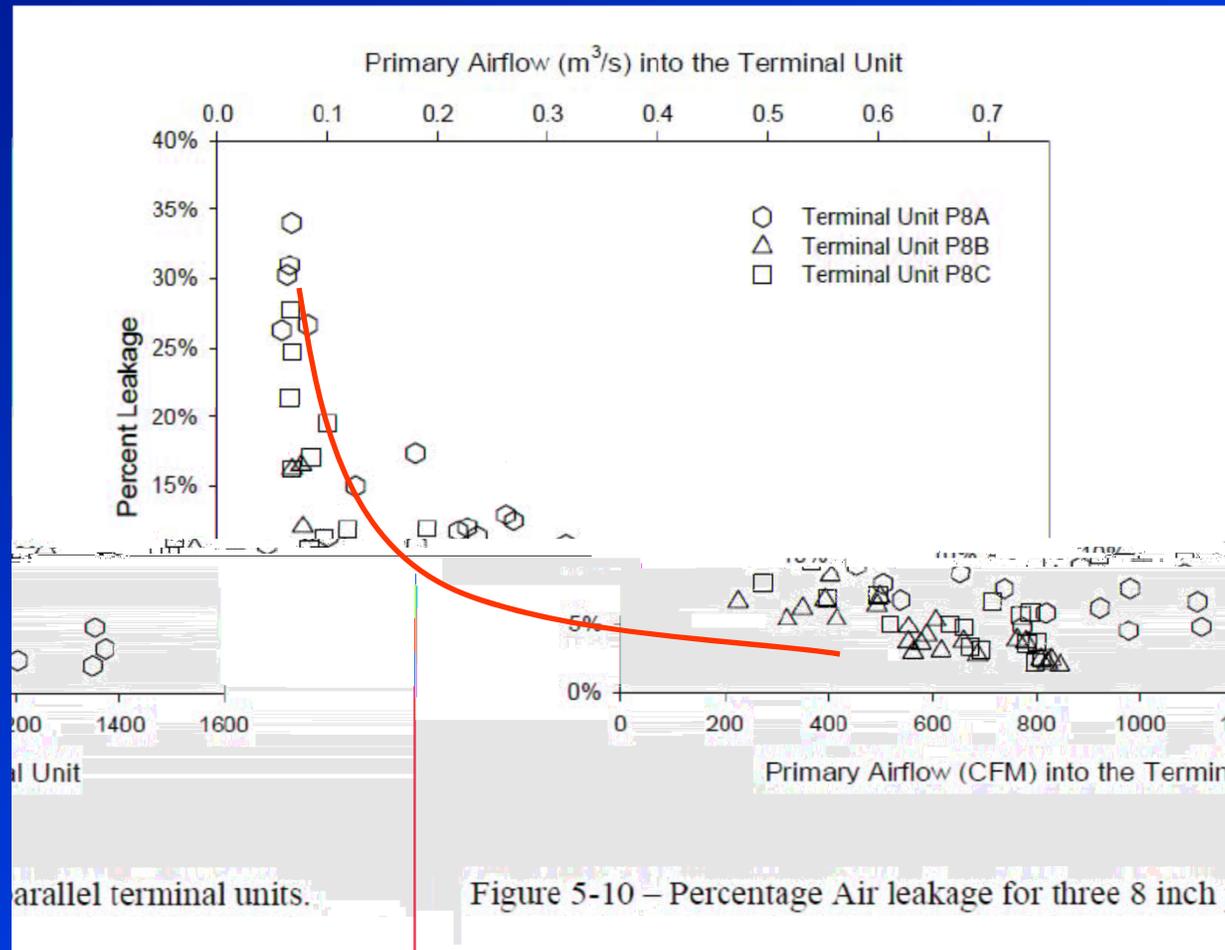


Figure 5-10 – Percentage Air leakage for three 8 inch parallel terminal units.

# Why not use a % to fan flow?

Figure 5-10 shows a plot of the **percentage leakage as a function of the supply airflow** from the eight inch terminal units. **In general, the percent of leakage ( $Q_{\text{leakage}}$  divided by  $Q_{\text{primary}}$ ) increased as the primary airflow decreased.**

# Why not use a % to fan flow?

- Put simply as the “fan flow” decreased the percentage of leakage increased...
- This is likely because the leakage itself stayed nearly constant because the test pressure was the same.

# Where should a % be used?

- The percent to fan flow should be used during the design process.
- The summation of duct, equipment, and accessory leakage can be limited to X% of fan flow.

# What about “low-pressure” duct?

- This is where discretion must be used.
- “...low pressure duct leaks more than high pressure duct...”
  - This statement is true if the duct is tested at the same pressure, especially in older buildings where the seal class varied by pressure.

# What about “low-pressure” duct?

- As seal class “A” becomes the norm the difference in leakage (at the same pressure) will likely decrease or perhaps disappear altogether. So under operating conditions the potential leakage for the low pressure side would be lower because the operating pressure would be lower...if...

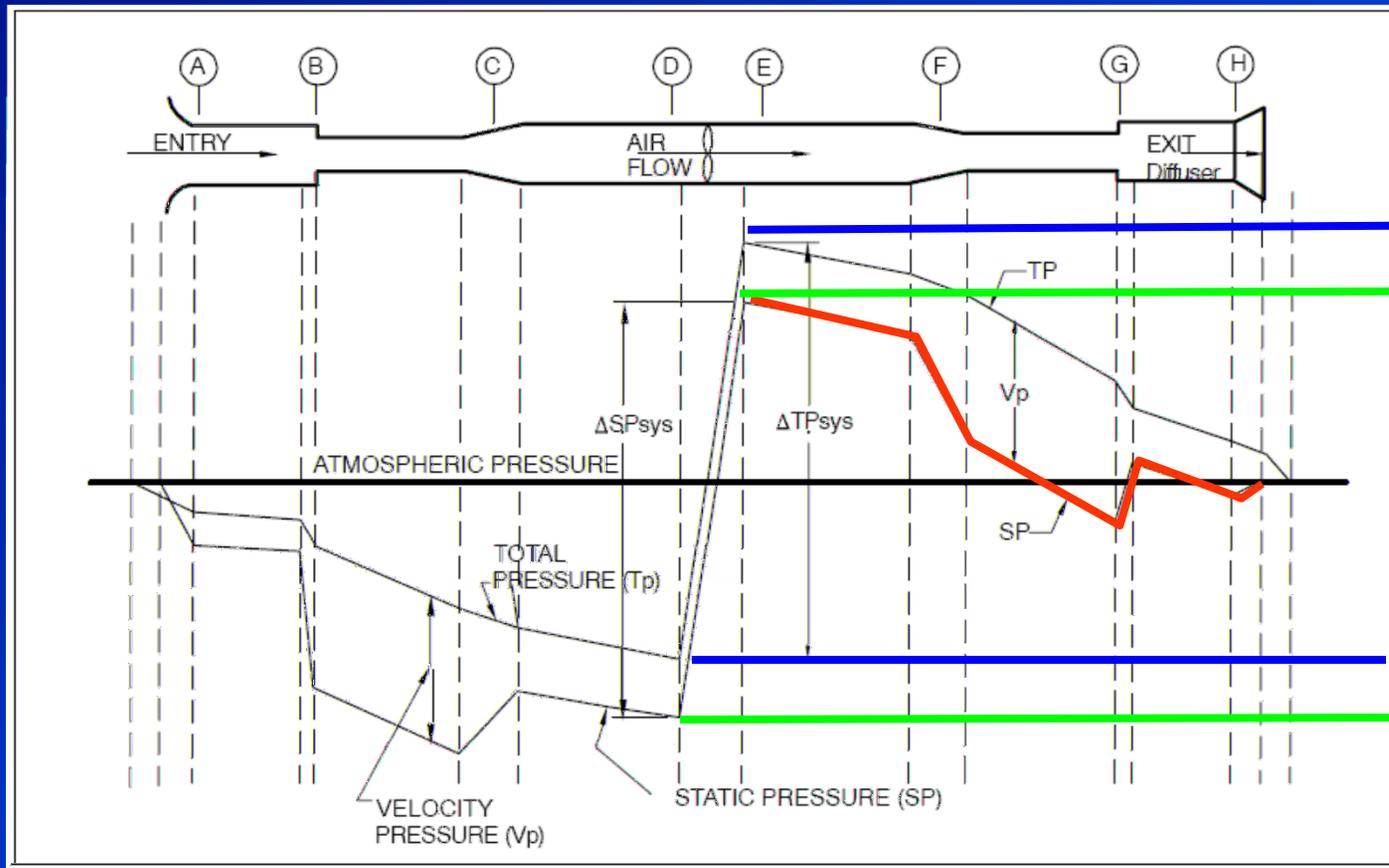
# What about “low-pressure” duct?

- Leakage is also a function of the “size of the hole” which means it is a function of the amount of duct used.
- If the majority of duct is low pressure it may be justified to test some of it.
- USE 25-50-100

# Misconceptions

- The leakage rate determined through testing (SMACNA, ASHRAE) is the actual leakage under operating conditions
  - Test pressures do not typically match operating pressures
  - Also, this test is intended for duct not for the system

# Misconceptions



# Misconceptions

- The cost associated with testing the duct system is basically the time and material to perform the test.
- Not true...Often the largest expense associated with testing is the disruption to workflow or job schedule in addition to the time and materials to perform the test.

# Good Practices

- Test some of the ductwork early on in the construction process
  - It will make sure that all parties involved understand what is expected
  - It will identify any potential issues early which makes them easier and less expensive to fix

# Good Practices

- Write a good specification
  - Detail how much duct is to be tested
    - 25-50-100
  - Provide a “correct” pass/fail criterion
    - AVOID arbitrary values such as X%
    - Use available data from research
  - Specify seal class “A” for duct

# Summary

- Testing 100% of the ductwork is rarely justified
- Testing ductwork does not reduce leakage
  - Sealing ductwork reduces leakage
- There is no consensus based method of test for an entire system
- There is no consensus based method to determine a correct pass/fail criteria for the system

Thank You

Questions?