Why is there a need for Standard 215?

ASHRAE TC 5.2 (Duct Design) years ago recognized that HVAC system air leakage significantly increases fan energy consumption

Fan energy waste is between a square and cubic function of percentage increase of system airflow (due to system curve and static pressure control)

ASHRAE Handbook currently references system air leakage as percentage of airflow and not of air Leakage Classes (airtightness) or Seal Classes (construction method)

Common air leakage test method uses duct pressurization to determine airtightness, but cannot determine operating leakage flow

PURPOSE

Standard 215 specifies a method of test to determine leakage airflow and fractional leakage of operating HVAC air distribution systems and determines the uncertainty of the test results.

8% ± 3.5% (range 4.5% - 11.5% of the design airflow)

What is Uncertainty Analysis?

Determine the uncertainty ("potential error") of test results (measured or calculated) based on calibration and statistical analysis principles

Terminology:

- Bias error: mean difference that persists between true and indicated values being measured – minimized through calibration
- Precision error: random error about mean that does not necessarily recur – reduced by increasing number of observations
- Accuracy: sum of bias and precision errors

2. SCOPE

2.1 This standard is for field application in both **new and existing buildings.**

2.2 This standard can be applied to determine whole-system or sectional leakage airflow.

2.3 This standard provides (1) test procedures and requirements for measuring inlet and outlet airflows during system operation, and methods for (2) calculating leakage airflows to/from system surroundings, (3) calculating leakage test uncertainties, (4) documenting the test plan, and (5) reporting test results.

2.4 The test procedures in this standard are limited to single-duct supply and independent exhaust air systems.

2.5 This standard is not for determining return air leakage.

2.6 This standard is not for determining leakage involving ceiling and floor plenums, systems serving pressure-controlled spaces, and air dispersion systems.

2.7 This standard does not replace ductwork pressurization leakage testing.

2.8 This standard does not specify leakage acceptance criteria.

2.9 This standard shall not be used to override any safety, health, or critical process requirements.

The test procedure (13 pages):

- Instrumentation (1 page)
- Test Setup (4 pages)
- Test Procedure (7 pages) – this also includes the calculation procedure
- Test Report (1 page)

Informative Annex's (total of 47 pages):

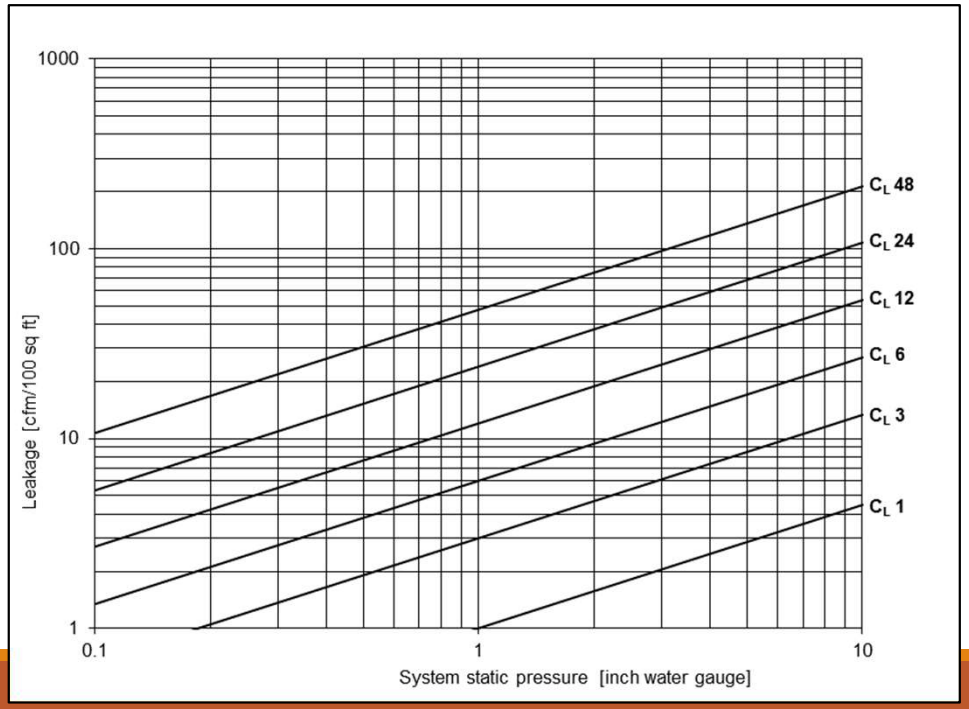
- Airflow Measuring Instrument Technologies
- Airflow Measuring Instrument Calibration and Verification Procedures
- **Example Calculations Including Uncertainty Analysis**
- Derivation of Moist Air Density Equation
- Effect of Bias Errors on Measured Airflow
- Example Test Plan and Test Report
- Diagnostic Procedure For Airtightness Testing of Low-Pressure System Sections During Operation
- Bibliography

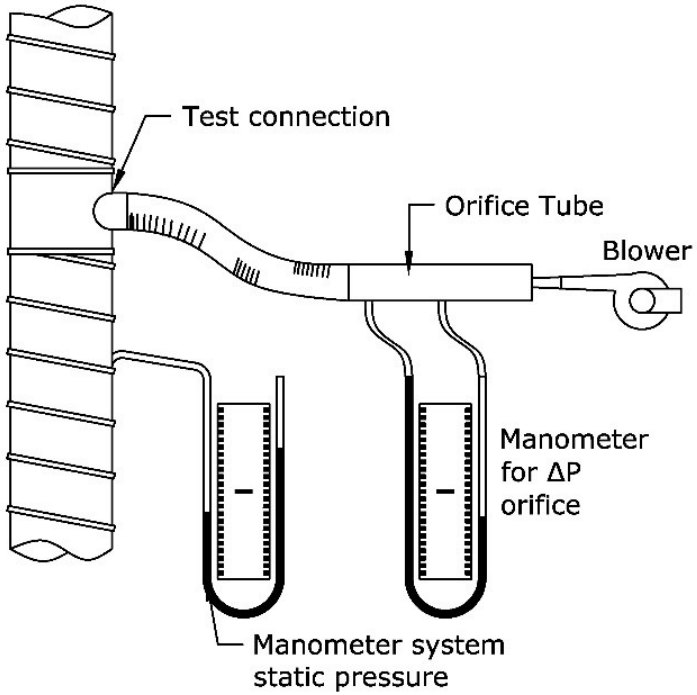
Excel spreadsheets available for use as templates

Air Pressurization Test

$$C_L = \frac{Q}{A\,p^{0.65}}$$

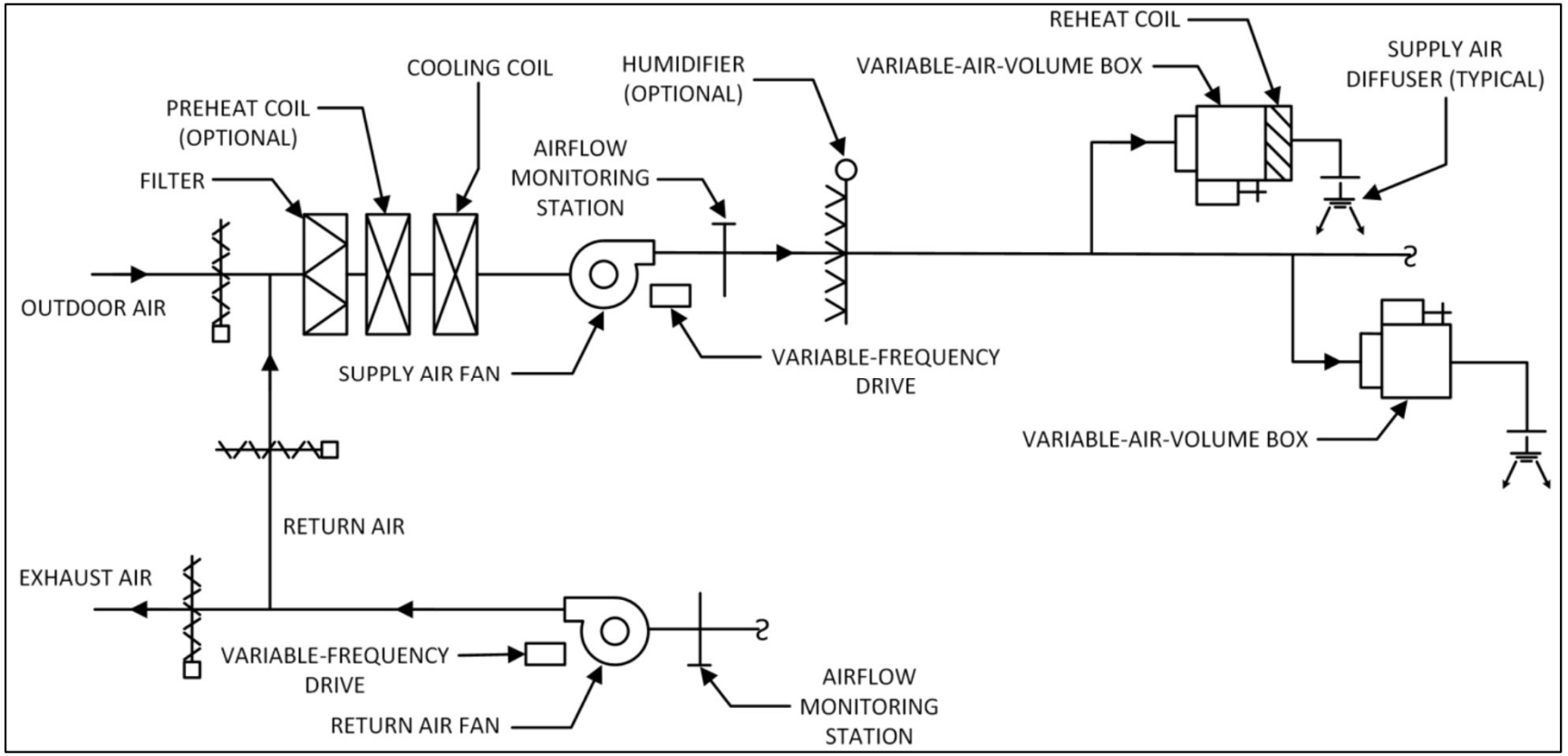
$C_{L=}$ Leakage Class, cfm per (inch water gauge)$^{0.65}$ per 100 ft^2 of duct surface area
Q = air leakage, cfm
P = system static pressure, inch water gauge
A = 100 square feet of surface area of duct tested, 100 x ft^2



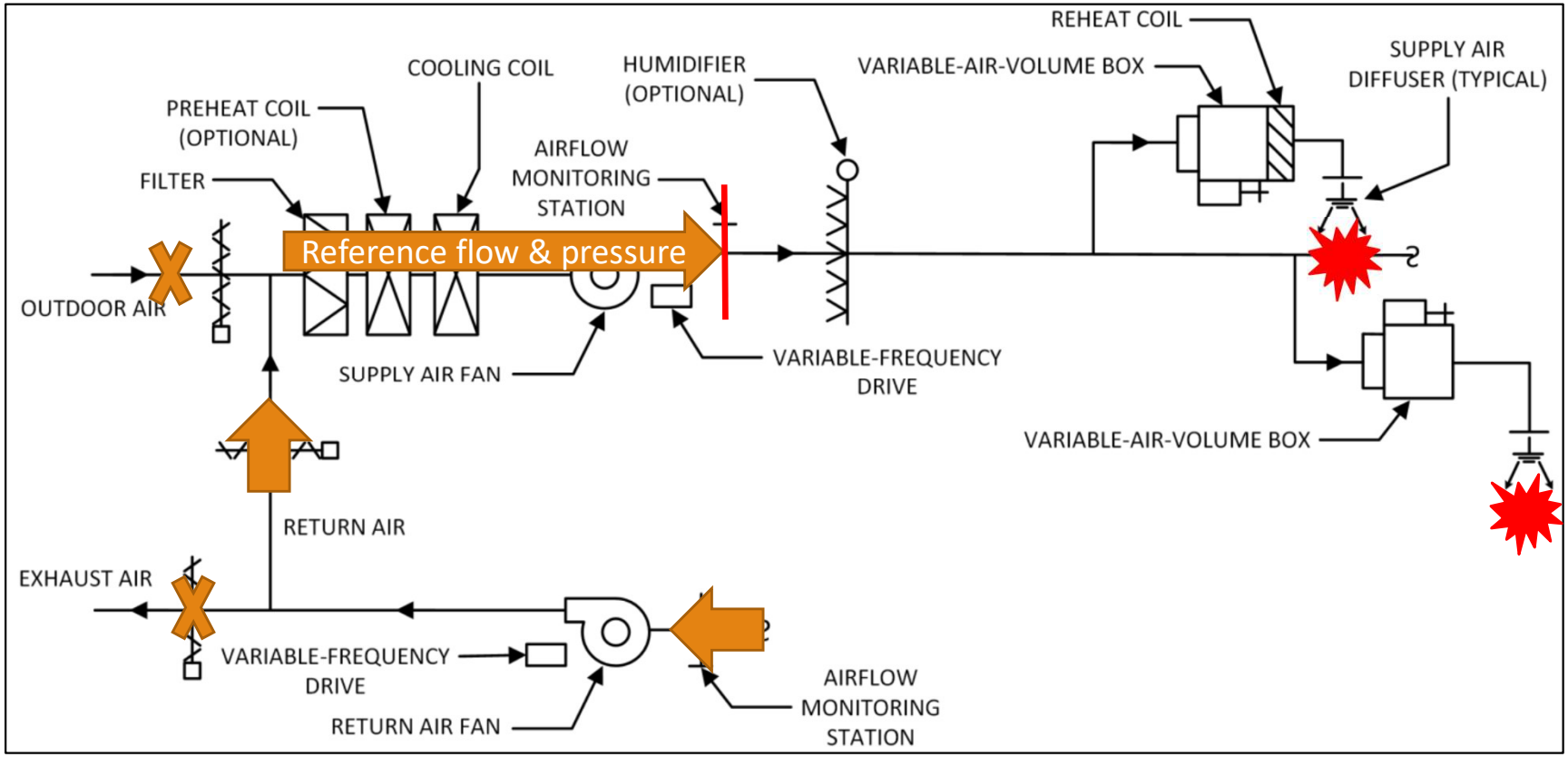


Leakage Testing by Orifice Tube

Standard 215 Test



Standard 215 Test



What is the reference operating condition?

Configuration, as applicable, of system fans and all other system components and commands necessary to achieve desired reference operating condition.

Corresponds to greatest system inlet flow (outlet flow for exhaust systems) possible without being detrimental to occupants of building, building structure, or HVAC mechanical components, while maintaining duct static pressure set point (where applicable) specified in design documents.

What is the practical use/value of this new MOT?

Establishes a standardized (and repeatable) test of a complete and operational system to calculate the system air leakage as a percentage of the reference operating airflow **and its statistical uncertainty.**

What is the acceptable system air leakage as a percentage of the reference operating airflow?

This Standard MOT is a "testing procedure". It is up to the engineer or code authority to specify both the maximum allowable air leakage and its acceptable associated uncertainty. The current ASHRAE Handbook gives some guidance.

What affects the upper and lower bounds of the "uncertainty"?

The statistical analysis that is a part of this MOT is influenced primarily by the precision of the testing instruments, but also by the number of readings tabulated for the calculations (e.g., number of supply grille airflows).

Does this replace pressurization leak testing?

No. TC 5.2 recommends that pressurization tests be performed throughout the construction process to ensure that the final system air leakage at operating conditions (as determined by Standard 215) will meet the requirements specified by the Engineer.