

# Title: The Significance of Bypass Air on HVAC System Efficiency and Indoor Air Quality

**Introduction:** HVAC systems are vital in maintaining comfortable and healthy indoor environments in commercial and residential buildings. Air filters serve as the first line of defense against pollutants and allergens, ensuring that indoor air quality remains healthy. However, bypass air, where air bypasses the air filter and continues downstream without being filtered, is a common problem in HVAC technology. This can lead to indoor air quality issues and unnecessary costs for building owners and facility managers. In this white paper, we will discuss the effects of bypass air on HVAC system efficiency and indoor air quality. We present the results of an ASHRAE test that quantifies the impact of bypass air on air filter efficiency. **Carolina IAQ** hired an independent ASHRAE lab to conduct this test, and Arthur Dwight, the co-owner of **Carolina IAQ**, observed the test.

**The Issue of Bypass Air:** Bypass air occurs when there is a gap between the air filter and the frame or if the seal around the air filter is not properly installed. This allows unfiltered air to bypass the air filter and enter downstream fans, coils, ducts, and registers. This unfiltered air can contain pollutants and allergens, leading to health problems, particularly for those with respiratory conditions. Additionally, bypass air can increase energy costs as equipment efficiency is reduced due to additional workload.

**ASHRAE Test Results:** To quantify the impact of bypass air on air filter efficiency, an ASHRAE test was performed by an independent testing company hired by **Carolina IAQ**. A 24" x 24" 95% ASHRAE (MERV 14) air filter was installed in a test duct and tested for efficiency following the ASHRAE Standard 52.2. The efficiency of the properly sealed air filter was measured, and then a 5/32-inch space was created on one side of the air filter to allow for bypass air. The test was repeated with all conditions remaining identical, except for the presence of bypass air.

**The results of the test** showed that the improperly sealed filter at 95% efficiency (MERV 14) had a net efficiency comparable to a 20-25% efficient (MERV 8) filter. This demonstrates that even a small gap or improperly sealed air filter can significantly reduce the efficiency of the air filter and compromise indoor air quality. Unfiltered air that bypasses the air filter can contaminate downstream components, leading to additional costs for building owners and facility managers.

**Conclusion:** Bypass air in HVAC systems is a common issue that can have a significant impact on air filter efficiency and indoor air quality. The ASHRAE test conducted by an independent lab hired by **Carolina IAQ** shows that even a small gap or improperly sealed air filter can significantly reduce air filter efficiency and allow unfiltered air to enter downstream components. Building owners and facility managers must ensure that air filters are correctly sealed and installed to prevent bypass air. This can help maintain healthy indoor air quality, reduce energy costs, and prolong the lifespan of HVAC components.