



## Back-to-Back vs. Distributed Arrangement of Air-Conditioning Units

In raised-floor data centers, one of the factors affecting the distribution of cooling air through the perforated tiles is the location of the computer room air-conditioning (CRAC) units relative to the perforated tiles. In this document, we compare two possible arrangements shown in Figure 1. The flow rates are calculated using the software package **TileFlow** from Innovative Research, Inc.

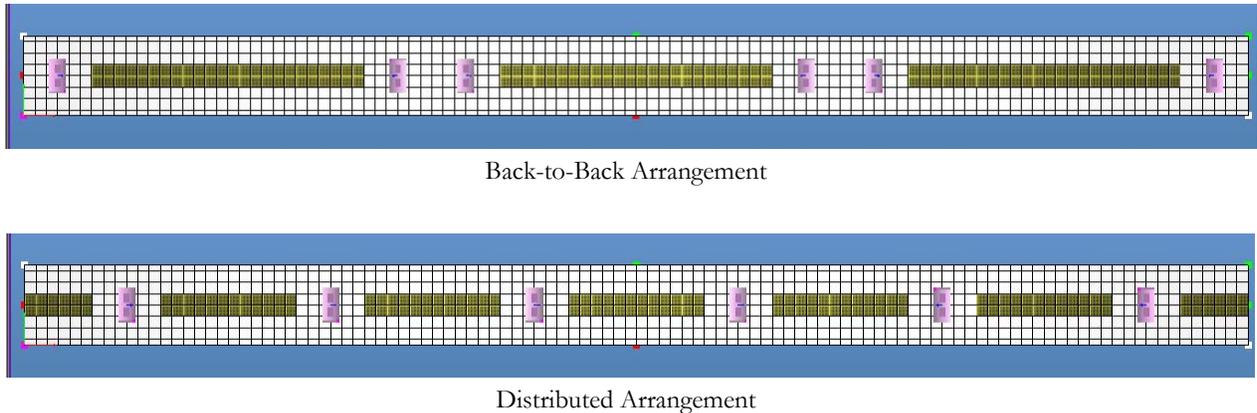


Figure 1. Possible Arrangements for CRAC Units

In the back-to-back arrangement, two CRAC units are placed next to each other, with no perforated tiles between them. That is, perforated tiles are placed on only one side of a CRAC unit. In the distributed arrangement, perforated tiles are placed on both sides of a CRAC unit.

To illustrate the behavior of the two arrangements, calculations are performed for a 12-inch plenum height with no under-floor obstructions. For simplicity, the CRAC units are defined to be symmetrical with no back-to-front bias for the airflow. The two arrangements have the same number of CRAC units and perforated tiles. Each CRAC unit supplies 10,000 CFM.

This idealized situation allows a clean comparison of the two layouts without the complicating effect of many other factors. To establish the quantitative behavior in a real situation, airflow simulations must be performed with the actual geometry and layout details.

**Airflow Distributions.** In the back-to-back arrangement, the entire 10,000 CFM airflow from each CRAC unit goes on one side of the unit, creating a large horizontal velocity. In the distributed

arrangement, the flow from each CRAC unit splits into two equal streams. Now 5,000 CFM airflow goes to each side of the unit, producing a smaller horizontal velocity compared to that in the back-to-back arrangement. The smaller velocity reduces the non-uniformity in the plenum pressure. Thus, the airflow distribution through the perforated tiles is more uniform for the distributed arrangement.

Figures 2 and 3 show the calculated airflow rates for the two configurations. As expected, the airflow distribution is more non-uniform in the back-to-back arrangement. In this arrangement, the flow rates vary from 300 CFM to 500 CFM. In the distributed arrangement, on the other hand, the flow rates vary between 370 CFM and 445 CFM.

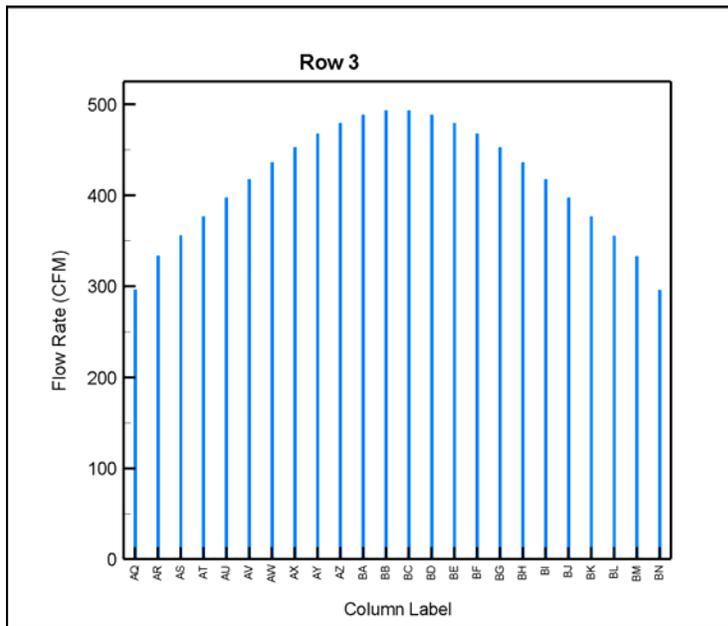


Figure 2. Flow Rates for the Back-to-Back Arrangement.

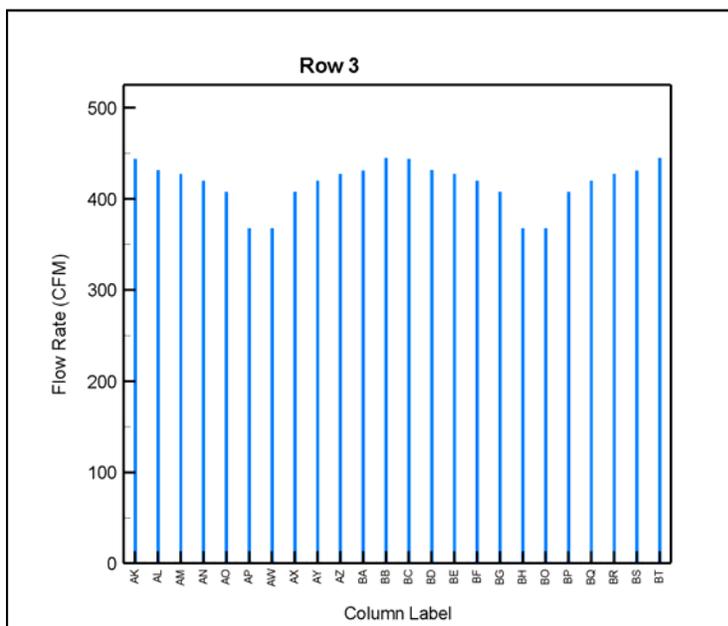


Figure 3. Flow Rates for the Distributed Arrangement.