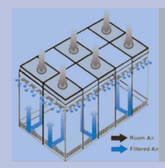
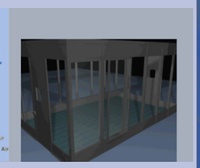
Developing a Standard Test Method for Evaluating Fan-Filter Unit (FFU) Performance

Applications in Utility Incentive Programs

Overview

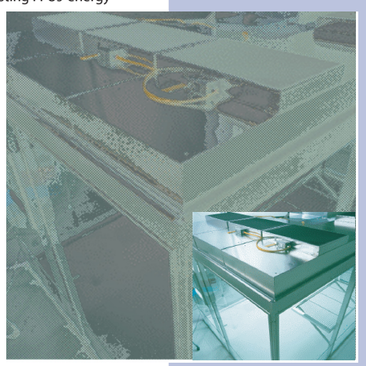
Lawrence Berkeley National Laboratory (LBNL) is performing research aimed at improving energy efficiency in contamination control facilities such as cleanrooms. This project is to develop a standard method of evaluating fan-filter unit (FFU) performance. Using this test standard can provide comparable performance information that can be applied to utility incentive programs.





Objectives

- Develop a standard method of testing FFUs' energy performance
- Assist utilities in developing baseline information for their energy efficiency programs
- Assist the ongoing IEST Recommended Practice development (www.iest.org)



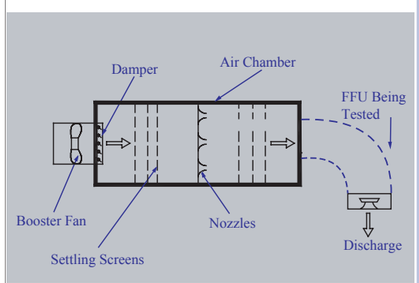
Scopes

This standard applies specifically to evaluate fan-filter units' energy and air movement performance in a laboratory setting.

It may be used as the basis for gathering baseline information and for comparison of fan-filter units' energy performance equipped with typical high efficiency filters such as ULPA or HEPA.

What is an FFU?

- Maintains specific airflow in critical facilities such as cleanrooms and minienvironment
- Consists of a small fan, controller, and a HEPA/ULPA filter enclosed in a box
- Commonly fits into ceiling grids, typically 4x2 ft or 4x4 ft
- Gains more and more uses in contamination controls such as cleanrooms



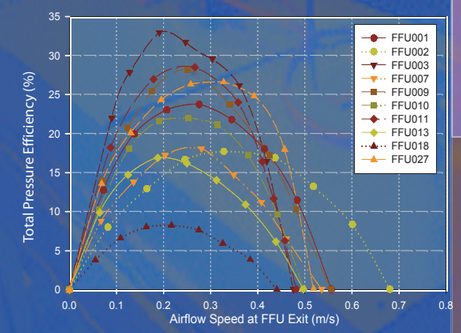
Testing Setup

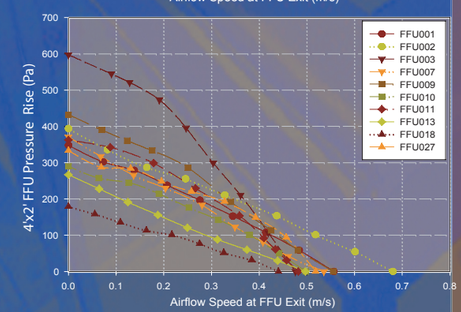
Principles
Laboratory testing to obtain multiple accurate measurements under various operating conditions

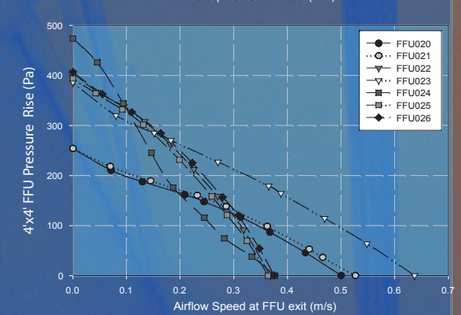
Control and Methods
Use an ancillary fan and a damper to control the airflow rate across the FFU tested

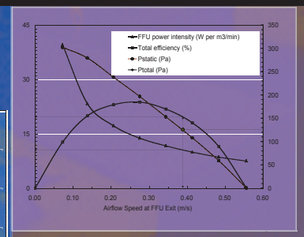
Device Layout
The FFU to be tested will be mounted horizontally or vertically on the exit of the air chamber

Instrumentation
- Unit airflow rate
- Total power usage
- Static (and total) pressure across the FFU









Performance Reporting

- Total efficiency changes with airflow speeds
- Electrical power intensity changes with airflow speeds
- Static and total pressure rise across the FFU changes with airflow speeds

Metrics

Unit Airflow Rate (Speed):
- Airflow rate through the FFU tested with a specific static pressure, in cfm or m^3/min (fpm, or m/s for airflow speed)

Total Power Usage:
- Total electrical power input to operate the FFU at certain airflow conditions, including the fan motor, controller, etc., in W

Airflow Velocity Power:
- Portion of the total power that is moving air through the FFU at certain airflow conditions, in W

Total Pressure (Power) Efficiency:
- Ratio of airflow velocity power to total power input to an FFU, %
- A higher value indicates higher operating efficiency

Energy Performance Index (EPI):
- Unit's total power usage normalized by the airflow rate through the FFU under certain conditions, in W/cfm
- A lower value corresponds to higher operating efficiency

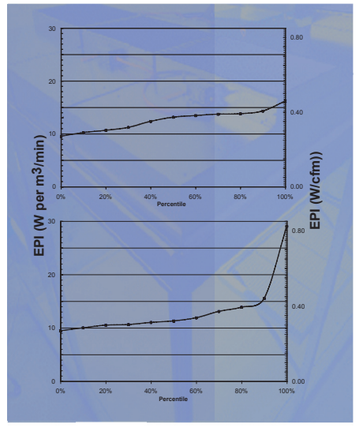
Partnerships

This procedure is intended for industry use, including fan-filter unit manufacturers, end users, utility companies, and designers. We have built strong partnerships with these industry stakeholders and other industry associations during the development of the standard procedure for testing FFUs' energy performance.

Key partners include:
- The Institute of Environmental Sciences and Technology (IEST)
- Industrial Technology Research Institute (ITRI)
- Air Movement and Control Association International (AMCA)
- International SEMATECH
- Suppliers and users

Applications

- Applying this standard in laboratory testing, industry users can obtain comparable data of FFUs' energy performance
- Promoting FFU energy efficiency and to integrate into the industry practices
- The Energy Performance Index (EPI, W/cfm) can be used to develop an energy performance baseline for FFUs in the market. Utilities can create a baseline to establish incentive programs, which encourage use of energy efficient units where they are selected
- Implementing such energy incentive programs will lead to large energy savings in buildings that required FFUs, such as cleanrooms, hospitals, and post offices



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http://www.energy.ca.gov/

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