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An American National Standard

Standard Practice for Determining the Field Performance of Commercial Kitchen Demand Control Ventilation Systems[1]

This standard is issued under the fixed designation F2976; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice determines the energy savings potential of Commercial Kitchen Demand Control Ventilation (CKDCV) systems by outlining a procedure to measure system performance.

1.1.1 Fan energy savings potential of a Commercial Kitchen Demand Control Ventilation system will be determined.

1.1.2 Thermal energy savings potential of a Commercial Kitchen Demand Control Ventilation system will be determined.

1.2 This Standard Practice applies to commercial kitchen exhaust and supply demand control ventilation system in the following foodservice establishments: Casino hotel foodservice facilities, commercial cafeterias, full service restaurant, hotel foodservice facility, quick service restaurant, school cafeteria, supermarket, health care foodservice facility. See Appendix X1 for descriptions of facilities.

1.3 This CKDCV field test protocol does not apply to other demand control ventilation applications such as building heating, ventilation, and air-conditioning (HVAC) applications or laboratory applications.

1.4 *Units*—The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

F2975 Test Method for Measuring the Field Performance of Commercial Kitchen Ventilation Systems

2.2 *Other Standards:*

Standard 154 Ventilation of Cooking Processes[3]

3. Terminology

3.1 *Definitions:*

3.1.1 *capture and containment (C&C)*—the ability of the hood to capture and contain grease laden cooking vapors, convective heat and other products of cooking processes. Hood capture refers to the products getting into the hood reservoir from the area under the hood, while containment refers to these products staying in the hood reservoir and not spilling out into the space adjacent to the hood.

3.1.2 *commercial kitchen ventilation system (CKV system)*—hoods, fans, make up air units, and other specialized equipment that comprise the system for ventilating a commercial kitchen.

3.1.3 *commercial kitchen exhaust demand control ventilation system (CKDCV system)*—a control system that varies the amount of airflow a kitchen ventilation system exhausts and makes up based on the cooking load.

3.1.4 *duty rating*—categories of cooking equipment based on the strength of the thermal plume and the quantity of grease, smoke, heat, water vapor, and combustion products produced. Categories include light duty, medium duty, heavy duty, and extra heavy duty.

3.1.5 *engineered hood*—a hood that has been engineered to facilitate the flow of exhaust air such that it may be exempt

[1] This practice is under the jurisdiction of ASTM Committee F26 on Food Service Equipment and is the direct responsibility of Subcommittee F26.07 on Commercial Kitchen Ventilation.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE), 1791 Tullie Circle, NE, Atlanta, GA 30329, http://www.ashrae.org.vailable from

from International and Uniform Mechanical code-specified exhaust rates if listed to UL 710.

3.1.6 *make up air (MUA)*—outside air brought into a building to replace exhausted air.

3.1.7 *make up air unit (MAU)*—the equipment that brings make up air into a building.

3.1.8 *non-engineered hood*—a hood that has not been listed to UL 710 and therefore must meet Model Code-specified exhaust rates per local jurisdictions.

3.1.9 *Type I exhaust hood*—a kitchen exhaust hood designed for removing grease and smoke, including gaseous, liquid, and solid contaminants produced by the cooking process and products of combustion. Typically used to cover equipment such as ranges, fryers, griddles, broilers or other equipment producing smoke or grease laden air.

3.1.10 *Type II exhaust hood*—a kitchen exhaust hood designed for removing heat and condensate. Typically used to cover equipment such as dishwashers, steam tables, ovens, steamers, and kettles if they do not produce smoke or grease laden vapor.

3.1.11 *variable frequency drive (VFD)*—a system for controlling the rotational speed of an alternating current (AC) electric motor by controlling the frequency of the electrical power supplied to the motor.

3.1.12 *hood styles:*

3.1.12.1 *backshelf, proximity or low profile*—a hood that is usually closed on three sides and low to the appliances. The front edge of the hood does not overhang the appliances, but is set back.

3.1.12.2 *eyebrow*—a hood mounted directly to a piece of cooking equipment.

3.1.12.3 *double island canopy*—a hood that covers cooking equipment that is in a back to back configuration.

3.1.12.4 *recirculating hood*—a hood that does not require venting or ducting to outside of the building.

3.1.12.5 *single island canopy*—a hood that covers cooking equipment in a single island configuration.

3.1.12.6 *wall mounted canopy*—a hood that covers cooking equipment located against a wall.

3.1.13 *make up air configurations:*

3.1.13.1 *air curtain supply*—make up air is introduced into the kitchen vertically through an integrated hood plenum along the front edge of the hood creating a vertical air curtain between the cooking area and the rest of the kitchen.

3.1.13.2 *backwall supply*—make up air is introduced into the kitchen vertically through an integrated hood plenum along the back edge of the hood that discharges down behind the cooking equipment.

3.1.13.3 *front face supply*—make up air is introduced into the kitchen horizontally through an integrated hood plenum along the front end of the hood such that air is blown perpendicularly from the hood into the kitchen.

3.1.13.4 *transfer air no dedicated makeup air supply*—no makeup air is provided. Exhaust air is replaced by building supply air to maintain balance.

3.1.13.5 *perforated perimeter supply*—make up air is introduced into the kitchen through a plenum in front and along the sides of the hood and dispersed vertically through a perforated air diffuser.

3.1.13.6 *short circuit supply*—make up air is introduced directly into the hood through an integrated hood plenum along the front of the hood.

4. Summary of Practice

4.1 The field evaluation includes three basic steps: 1) Baseline evaluation, 2) System retrofit or adjustment, 3) New system evaluation. The Standard Practice first addresses fan energy determination pre and post system retrofit or new system (section 6.2), then as they relate to heating and cooling energy determination (section 6.3).

5. Significance and Use

5.1 *Fan Energy*—This standard practice determines the fan energy requirements for a constant speed and demand controlled kitchen ventilation system and estimates the savings. It can be used to compare systems' fan savings potential.

5.2 *Heating and Cooling Energy*—This standard practice determines the heating and cooling energy requirements for a constant speed and demand controlled kitchen ventilation system and estimates the savings. It can be used to compare systems' heating and cooling savings potential.

6. Procedure

6.1 *Test Equipment:*

6.1.1 *Fan Energy Test Equipment:*

6.1.1.1 *Current Transformer*—Current transformers should be selected with an input range corresponding to the maximum amperage of each fan motor and must have an accuracy of ±1 % or better at 10 to 130 % of rated current.

6.1.1.2 *Power Meter*—Power meters (or energy loggers) must have an accuracy within ±1 % of reading, recording either average power or cumulative energy per logged interval. Secondary power meters to verify data quality must measure true root mean square (RMS).

6.1.2 *Heating and Cooling Energy Test Equipment:*

6.1.2.1 *Analog Input Signal Logger*—Analog input loggers must be capable of measuring the VFD output frequency reference signal, for example, 0–10V or 4–20ma.

6.1.2.2 Additional airflow measurement equipment may be required. Specific requirements will depend on the methodology used. Accuracy requirements are specified in ASTM F2975.

6.2 *Test Method for Fan Energy Consumption and Savings:*

6.2.1 *Baseline Evaluation:*

6.2.1.1 Gather site information: facility name, address, and contact information, facility market segment, operating hours per day, operating hours per year, shutdown schedules and major maintenance.

6.2.1.2 Gather information on CKV system configuration: existing CKV system control strategy, hood style(s), hood filter