

OPERATIONS MANUAL

VARIABLE AIR VOLUME TERMINALS CERTIFICATION PROGRAM



VAV OM – DECEMBER 2019

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PREFACE

The following manual outlines the procedures and policies of the Performance Certification Program for Variable Air Volume Terminals (VAV) operated by the Air-Conditioning, Heating, and Refrigeration Institute (AHRI). This manual is to be used in conjunction with the AHRI General Operations Manual for AHRI Certification Programs. Where the AHRI General Operations Manual and this product-specific manual differ, this product-specific operations manual shall prevail.

The revision of this manual supersedes all previous revisions. The current edition of this manual, as well as the AHRI General Operations Manual, can be accessed through the AHRI website, www.ahrinet.org.

The VAV Certification Program by AHRI provides for independent verification of the Variable Air Volume Terminals manufacturers' stated equipment performance. Safety criteria are not within the scope of this program.

Participation in the program is voluntary. Any manufacturer, regardless of AHRI membership, may obtain approval of Program Ratings and use of the AHRI VAV Certification Mark hereinafter referred to as the "Mark". The Mark is the Participant's public representation that the ratings of randomly selected samples have been verified by an independent laboratory in accordance with test procedures prescribed by this operations manual. A Certification Agreement is executed between the manufacturer and AHRI specifying the conditions under which such Ratings and the Mark may be used. No manufacturer has the right to use Program Ratings or to state that their products have been tested in conformance with the procedures outlined in this Rating Procedure unless and until they have received written authority from AHRI to use the Mark as applied to the specific approved Program Ratings.

This Operations Manual has been prepared to assure that administration of the program is carried out in a uniform manner. It is an amplification of the Certification Agreement signed by licensees and AHRI. General information, procedural details, and copies of forms are included in this Operations Manual. Provisions of the Operations Manual may be amended as provided in the Certification Agreement.

This certification program complies with requirements of the ISO/IEC Standard 17065:2012, *General Requirements for Bodies Operating Product Certification Systems*.

Note:

This manual supersedes the AHRI Variable Air Volume Terminals Certification Program Operations Manual, January 2018

CERTIFICATION OPERATIONS MANUAL FOR
VARIABLE AIR VOLUME TERMINALS

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1. Program Overview

1.1 Applicable Rating Standard. It is mandatory for program Participants to comply with the provisions of the latest edition of AHRI Standard 880, *Performance Rating of Air Terminals* (Standard). A copy of the Standard is available for download from the AHRI website, www.ahrinet.org.

1.2 Product Definitions. All terms in this document shall follow the AHRI General Operations Manual and the Standard definitions unless otherwise defined in this section.

1.2.1 Product Definition of Variable Air Volume (VAV) Terminal. A device that modulates the volume of air delivered to or removed from a defined space in response to an external demand. The various types of VAVs are defined in the Standard and include:

- Bypass Air Terminals;
- Dual Duct Air Terminals;
- Induction Air Terminals;
- Integral Diffuser Air Terminal;
- Fan-Powered Air Terminals (e.g. Booster Fan-Powered, Series Flow, and Parallel Flow);
- Single Duct Air Terminals (e.g. Reheat Air, Exhaust Air); and
- Single Duct Mechanically Pressure Independent (Compensated) Air Terminal.

1.3 Program Scope. This program applies to 50 Hz and 60 Hz Production Model Variable Air Volume Terminals, as defined in Section 1.2, and used in non-residential air distribution systems which provide control of air volume and/or air temperature by one (1) or more of the following means and may include a fan:

- Fixed or adjustable directional vanes;
- Pressure dependent volume air valves or shutoff valves (including air induction nozzles and air valves);
- Pressure independent (compensated) volume air valves or shutoff valves (including air induction nozzles and air valves);
- Integral heat exchanger(s) or electric heat;
- On/off fan control; and/or
- Variable speed fan control.

1.3.1 Program Scope Exclusions. This certification program does not apply to non-VAV diffusers, grilles, or registers or to products specifically covered by the AHRI Forced Circulation Air-Cooling and Air-Heating Coils Certification Program or the AHRI Room Fan-Coil Certification Program.

1.4 Intended Market. The Intended Market for this Certification Program includes all products defined in Section 1.3 that are sold for use in the U.S. (including U.S. Territories) and Canada.

1.5 Basic Model Groups (BMGs). A Participant's listings shall be grouped by the following BMG categories. There are three (3) product types and eight (8) core BMGs with options for increasing the BMGs by subdividing the core BMGs, similar to the examples shown in Table 1.

TABLE 1. BMG DESCRIPTIONS		
PRODUCT TYPE	CORE BMG	EXAMPLES OF OPTIONAL BMGS TO THE CORE BMG
Non-fan powered VAV	Single duct terminal units (supply)	▪ Low profile units;
		▪ Hospital grade;
		▪ Standard height; and
		▪ With built-in silencers.
	Single duct terminal units (exhaust)	▪ Exhaust
	Bypass air terminal units	▪ Bypass
	Dual duct terminal units	▪ Non-mixing;
▪ With mixing baffles; and ▪ Triple duct units.		
Induction units	▪ Induction	
Mechanically pressure independent (compensated) units	▪ With built-in silencers	
	▪ Venturi supply; and	
	▪ Venturi exhaust.	
Fan powered VAV	Series fan powered units	▪ Standard units;
		▪ Low profile units;
		▪ Low noise units;
		▪ Dual inlet units; and ▪ Booster units.
	Parallel fan powered units	▪ Standard units; and ▪ Low profile units.
Integral diffuser units		▪ Heating only; and ▪ Cooling only.

1.6 Certify-All Policy. This program complies with the AHRI General Operations Manual Certify-All Policy for products within the program scope with the following allowances:

- Participants may optional certify all single duct terminal (exhaust) and mechanically pressure independent (compensated) type units before October 1, 2018. After October 1, 2018, all products within the program scope shall be certified.

2. Qualification Process

2.1 Original Equipment Manufacturer (OEM) Applicants. With the additions noted below, the OEM qualification process shall proceed according to the AHRI General Operations Manual, Section 4.

STEP 2.1.1 Certification Application Package. In addition to the Application for AHRI Certification and Annual Sales Volume Form noted in the AHRI General Operations Manual, Section 4, STEP 4.1, Applicants shall submit the following documentation to AHRI:

- Form VAV Mass Upload Form. This form shows how data shall be shown in the AHRI Directory of Certified Product Performance (Directory); and
- One test report for each BMG.

STEP 2.1.2 Processing Application Package.

STEP 2.1.2.1 Performance Certification Agreement for Original Equipment Manufacturer (OEM Agreement). No further action required beyond that listed in Section 4, STEP 4.2 of the AHRI General Operations Manual.

STEP 2.1.2.2 Participation and Licensing Fee Invoice. Payment of the Participation and Licensing Fee is due within 30 calendar days of the invoice issue date. Testing shall not be conducted until the invoice is paid in full. No further action required beyond that listed in Section 4, STEP 4.2 of the AHRI General Operations Manual.

STEP 2.1.3 Selection and Acquisition of Test Samples.

STEP 2.1.3.1 Number of Qualification Tests. One model per each BMG shall be tested. A minimum of four (4) models including at least one (1) test per country of manufacture, shall be selected for test.

STEP 2.1.3.2 Acquisition of Qualification Test Samples/Selection Criteria. Within 30 calendar days of a request from AHRI, the Applicant shall have samples available for selection. Samples shall be acquired in accordance with Section 3 of this manual.

STEP 2.1.4 Qualification Testing. AHRI shall supply the Independent Third-party Laboratory Contracted by AHRI (Laboratory) with the Published Ratings. The Laboratory shall conduct the testing of the samples in accordance with the Standard, against the Published Ratings.

STEP 2.1.4.1 Successful Completion of All Qualification Tests. If all qualification tests pass proceed to STEP 2.1.5.

STEP 2.1.4.2 First Sample Qualification Test Failure. Refer to Section 4, STEP 4.4.2 of the AHRI General Operations Manual for details regarding the first sample qualification failure options.

STEP 2.1.4.3 Second Sample Qualification Test Failure. Refer to Section 4, STEP 4.4.3 of the AHRI General Operations Manual for details regarding the second sample qualification failure options.

STEP 2.1.5 Welcome to the Program. No further action required beyond that listed in Section 4, STEP 4.5 of the AHRI General Operations Manual.

2.2 Private Brand Marketer (PBM) Applicants. With the additions noted below, the PBM qualification process shall proceed according to the AHRI General Operations Manual, Section 5.

PBM Applicants are not required to undergo qualification testing. PBM product certification is contingent upon the certification of the associated OEM product.

STEP 2.2.1 Certification Application Package. In addition to the Application for AHRI Certification Form noted in the AHRI General Operations Manual, Section 5, STEP 5.1, Applicants shall submit the following documentation to AHRI:

- Certified product data sheets noting PBM/OEM equipment match-ups; and
- Form VAV Mass Upload Form. This form shows how data shall be shown in the AHRI Directory of Certified Product Performance (Directory).

STEP 2.2.2 Processing Application Package.

STEP 2.2.2.1 Performance Certification Agreement for Private Brand Marketer (PBM Agreement). No further action required beyond that listed in Section 5, STEP 5.2.1 of the AHRI General Operations Manual.

STEP 2.2.2.2 OEM Agreement on Behalf of the PBM Applicant. No further action required beyond that listed in Section 5, STEP 5.2.2 of the AHRI General Operations Manual.

STEP 2.2.2.3 Licensing Fee Invoice. Payment of the Licensing Fee is due within 30 calendar days of the invoice issue date.

STEP 2.2.3 Welcome to the Program. No further action required beyond that listed in Section 5, STEP 5.3 of the AHRI General Operations Manual.

3. Equipment Selection and Testing

3.1 Annual Testing Requirement. 20% of a Participant's BMGs shall be tested, with a minimum of four (4) models including at least one (1) test per country of manufacture. Fractional numbers shall be rounded to the nearest whole number using traditional rounding methods.

3.2 Location of Test. Testing shall be performed at the Laboratory and sample shall be installed in the test facility in accordance with the Participant's published installation instructions in printed or electronic format. Sound certification tests conducted at the Laboratory are to be conducted in a reverberation room that meets the full qualification and requirements as stated in the latest edition of AHRI Standard 220, *Reverberation Room Qualification and Testing Procedures for Determining Sound Power of HVAC Equipment*.

3.3 Selection of Test Samples. Selections shall be made based on data contained in the Directory. AHRI shall inform the Participant, in writing, of the sample(s) selected for test.

The models selected for test shall be a base terminal unit, with the applicable flow sensing element and with the standard offered means to adjust air flow from the fan.

3.4 Methods for Acquiring Test Samples. Laboratory personnel shall make a Random Sample Selection from the Participant's stock inventory within 60 calendar days of a selection by AHRI. Selected samples shall be shipped to the Laboratory accompanied by the Participant's published installation instructions in printed or electronic format. Sample selection shall follow the Two-Sample Supply method. Refer to Section 9 of the AHRI General Operations Manual.

3.5 Sample Acquisition Timeframe. The Participant shall deliver the selected sample(s) to the Laboratory within 60 calendar days of Random Sample Selection by Laboratory personnel.

3.6 Required Equipment and Test Provisions. The Participant shall provide the Laboratory a submittal drawing and installation instructions for each sample selected for test.

3.6.1 Insulation. The Participant shall submit a sample of the standard offered insulation and the name of the insulation manufacturer to the Laboratory. Such insulation sample needs to be supplied only once, so long as the same insulation is used. The Participant shall report to AHRI when new insulation is used and send a sample to the Laboratory.

3.6.2 Flow Sensor. If the model includes a Flow Sensor, then the test shall be conducted on the sample with the Flow Sensor.

3.6.3 Mechanically Pressure Independent (Compensated) Valve. The Participant is allowed to pre-set the flow position of the physically-selected unit(s) prior to taping by the Laboratory.

3.6.4 Verified Construction. The following model construction details shall be verified prior to test.

- Insulation Type, Thickness, and Average Density, lb/ft³; and
- Metal Gauge (casing or backpan), US Standard Gauge [mm].

3.7 Certified Data. In accordance with the Standard, the following certified ratings are verified by test:

- Primary Airflow, scfm [m^3/s];
- Minimum Supply Operating Pressure, in. H₂O [kPa];
- Radiated Sound Power Level, dB;
- Discharge Sound Power Level, dB;
- Electrical Power Input, W; and
- Induced or Fan Airflow Rate, scfm [m^3/s].

3.8 Sound Power Level Failures.

The Laboratory shall first adjust the Certified Rated Sound Power Level data by adding the first tolerance set forth in AHRI 880 (Table 6. Sound Power Level Rating Tolerances) to each denoted octave band. Then the Laboratory shall plot both, Adjusted Certified and Raw Test data on the same NC (Noise Criteria) chart using the standard deducts listed in Table E1, Appendix E of AHRI Standard 885. If the NC produced by the Raw Test data is greater than the NC produced by the Adjusted Certified data with the first tolerance added, then a second tolerance of 2 dB in one Octave Band and 1 dB in three alternate Octave Bands may be added to the most critical Octave Bands within the Adjusted Certified data with the first tolerance previously accounted for. If the NC produced by the Raw Test data is still greater than the Adjusted Certified data with the second tolerance added to the first tolerance, it is classified as a failure.

Discharge Sound deduction values (Small, Medium, or Large Box) shall be determined based on airflow (cfm or m^3/s) using the following criteria:

- Non-fan powered VAV airflow:
 - Single Duct (supply and exhaust), Dual Duct, Integral Diffuser Air Terminal Units, and Mechanically Pressure Independent (Compensated) Units shall use discharge airflow.
 - Bypass air terminal units shall use discharge airflow when operating with zero (0) bypass airflow.
- Fan powered VAV airflow:
 - Series Fan Powered Units shall use fan only airflow.
 - Parallel Fan Powered Units shall use primary airflow for Test Point 2 and fan only airflow for Test Point 4 (refer to the Standard, Table 5 for Test Point definitions).

3.9 Test Failures.

3.9.1 Options Following 1st Sample Failure. When the Participant is notified of a first sample certified rating failure, the Participant has seven (7) calendar days to select one (1) of the following options:

- Re-rate all failed Certified Data based on the following failure criteria:
 - Airflow failures, all models within the BMG shall be re-rated proportionate to the failed test's results;
 - Electrical power input and Minimum Supply Operating Pressure failures, all models within the BMG shall be re-rated proportionate to the failed test's results;
 - Sound power level failures, all models within the BMG shall be re-rated in accordance with the number of dB by which the first sample failed; and/or
 - If the test is a failure as a result of Minimum Supply Operating Pressure, testing shall be required if the Participant chooses to change the airflow.
- Re-rate the first tested model and test a different size of the same BMG. The Participant shall re-rate the model on the basis of the first sample test result and test a second model from the same BMG, selected by AHRI, as the failed model. If the second model passes, the first model shall be the only model in the BMG to be re-rated. Failure to deliver a sample to the Laboratory within 30 calendar

days shall forfeit the Participant's opportunity for a second sample test, thus automatically re-rating the entire BMG;

- Test second sample of the same model (sample shall be available within the timeframe and procedure allotted in Section 3.4 following notification of decision to AHRI via Manufacturer's Decision Form [MDF]); or
- Obsolete the model, which also obsoletes all models within the corresponding BMG.

3.9.2 Options Following 2nd Sample Failure. When the Participant is notified of a second-sample certified rating failure, the Participant has seven (7) calendar days to select one of the following options:

- Re-rate all failed Certified Data based on the following failure criteria:
 - Airflow failures, all models within the BMG shall be re-rated proportionally to the failed test's results;
 - Electrical power input and Minimum Supply Operating Pressure failures, all models within the BMG shall be re-rated proportionally to the failed test's results;
 - Sound power level failures, all models within the BMG shall be re-rated in accordance with the number of dB by which the second sample unit failed; and/or
 - If the test is a failure as a result of Minimum Supply Operating Pressure, testing shall be required if the Participant chooses to change the airflow.
- Obsolete the model, which also obsoletes all models within the corresponding BMG.

4. Challenge Tests

Refer to Section 10 of the AHRI General Operations Manual.

5. AHRI Directory of Certified Product Ratings

All certified products shall be listed in the Directory, www.ahridirectory.org. Certification shall not be implied nor claimed for any product not listed in the Directory. Except as noted below, the Participant shall follow the steps outlined in Section 11 of the AHRI General Operations Manual.

5.1 Publication of Ratings in Certified Directory. The following information pertaining to each model certified shall be published in the Directory:

- AHRI Reference Number;
- Name of Manufacturer;
- Model Status;
- Brand Name of Model;
- Model Size Designation;
- Primary Air Flow Rate, cfm [m³/s];
- Induced/Fan Air Flow Rate (for fan and diffusers only), cfm [m³/s];
- Electric Power Input, W;
- Minimum Supply Operating Pressure, in. H₂O;
- Radiated Sound Power Levels (As required per table 5 of the Standard and listed in VAV Mass Upload Form), dB; and/or
- Discharge Sound Power Levels (As required per table 5 of the Standard and listed in VAV Mass Upload Form), dB.
- Exhaust Sound Power Levels (As required per table 5 of the Standard and listed in VAV Mass Upload Form), dB.

5.2 Data Forms. Each Participant shall list its products, by BMG. OEM and PBM Participants shall submit/edit product data via the Directory.

6. Assessment and Payment of Certification Fees

Refer to Section 12 of the AHRI GOM.

7. Issuance of Violations and/or Termination

Refer to Section 14 of the AHRI General Operations Manual.

8. Program Hierarchy, Complaints, and the Appeals Process

Refer to Section 15 of the AHRI General Operations Manual.

9. Proper Use of the AHRI Certification Mark and Claims to Certification

Except as noted below, refer to Section 8 of the AHRI General Operations Manual.

9.1 Publication of Non-Certified Ratings (Application Ratings). Products certified through the AHRI Variable Air Volume Terminals Certification Program may operate at conditions outside the scope of the certification program. Product ratings acquired in accordance with the latest edition of AHRI Standard 880 but not achieved at standard rating conditions, are referred to as application ratings. Application ratings are not certified by the AHRI Variable Air Volume Terminals Certification Program. Participant's printed materials and Selection Rating Software may contain application ratings; however, it shall be clearly indicated that such ratings are outside the scope of the AHRI Variable Air Volume Terminals Certification Program. This note shall state: "Application ratings are outside the scope of the Certification Program."

The Certified Data from the Standard shall be included in the appropriate application table in a position of logical progression from one point of operation to another and shall be clearly marked and identified differentiating it from the non-certified data. Motor related data may be displayed in a separate table.

In addition to the application table, the Certified Data shall be presented per the Standard. The Mark shall be displayed in a manner to only associate it with the Certified Data table in accordance with the AHRI Brand Usage Guide. The Certified Data table with the Mark shall be published on a separate page than application data. In addition, prior to publication, all Participants shall provide AHRI a sample of the proposed printed publication to ensure compliance. AHRI shall respond back to the Participant within 14 calendar days.

9.2 Selection Rating Software and Cataloged Data. The Participant shall provide AHRI with current copies of all paper and/or electronic catalogs containing product data. AHRI shall periodically check data contained in the Directory against the catalogs to provide assurances that the data matches. All electronic support tools shall include a link to the AHRI certification data, www.ahridirectory.org and shall accurately reflect all data presented in printed and electronic publications.

If there are default values for NC determination with all Selection Rating Software, they shall be per Appendix E in the latest edition of AHRI Standard 885.

Selection Rating Software programs shall adjust Octave Band Level ratings for insulation liners and sensors and the adjustments shall be publicly available. These options are not part of the VAV Certification Program verification testing. It is understood that this requires each Participant to provide data for all liners and sensors in Selection Rating Software that offer these options.

9.3 Publication of NC Ratings. NC values shall be based on Appendix E in the latest edition of AHRI Standard 885. NC values for applications covered in AHRI Standard 885 shall not be published with attenuation values other than those in Appendix E.

For specific applications not covered by AHRI Standard 885, disclaimers shall be published with the data clearly stating that the data is not covered by AHRI Standard 885. Also, the method of calculation including the attenuation values and/or test methods shall be included with the published data.

Any NC values output from the Selection Rating Software shall clearly identify assumptions used for calculations. The statement shall also include “NC values are not part of the AHRI VAV Certification Program.”

For air terminal discharge sound, use the box size appropriate for the airflow at that NC calculation point.