

OPERATIONS MANUAL

FORCED-CIRCULATION AIR-COOLING AND AIR-HEATING COILS CERTIFICATION PROGRAM



AHRI ACHC OM – MAY 2022

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PREFACE

The following manual outlines the procedures and policies of the Performance Certification Program for Forced-Circulation Air-Cooling and Air-Heating Coils (ACHC) 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 ACHC Certification Program by AHRI provides for independent verification of the Forced-Circulation Air-Cooling and Air-Heating Coils 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 ACHC 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 Forced-Circulation Air-Cooling and Air-Heating Coils Operations Manual, January 2022.

CERTIFICATION OPERATIONS MANUAL FOR
FORCED-CIRCULATION AIR-COOLING AND AIR-HEATING COILS

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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 410, *Forced-Circulation Air-Heating and Air-Cooling Coils* (Standard) except as noted for Face and Bypass Coils. A copy of the Standard is available for download from the AHRI website, www.ahrinet.org.

1.2 Product Definitions.

1.2.1 Forced-Circulation Air Coil. A factory-made assembly which provides the functions of cooling, heating, or cooling and heating for use in an air stream whose circulation is caused by a difference in pressure produced by a fan or blower.

1.2.1.1 Forced-Circulation Air-Cooling Coil. A heat exchanger, with or without extended surfaces, through which either cold water, cold aqueous ethylene or propylene glycol solutions, or volatile refrigerant is circulated, for the purpose of total cooling (sensible cooling plus latent cooling) of a forced-circulation air stream.

1.2.1.2 Forced-Circulation Air-Heating Coil. A heat exchanger, with or without extended surfaces, through which either hot water, hot aqueous ethylene or propylene glycol solutions, or steam is circulated for the purpose of sensible heating of a forced-circulation air stream.

1.2.1.3 Integral Face and Bypass Coil. A type of coil which has damper(s) built into it, which controls the amount of airflow that bypasses the heat transfer surface. These units will be tested with the dampers fully open and with all external casing penetrations sealed.

1.2.2 Packaged Unit. An assembly of components including coil(s) with ratings based on a test of the complete assembly.

1.2.3 Special Coil. Coils of fin or tube material of special configuration not having cataloged performance data

1.3 Program Scope. This program applies to Forced-Circulation Air-Cooling Coils under non-frosting conditions and Forced-Circulation Air-Cooling and Air-Heating Coils, as defined in Section 1.2.1, only intended for:

- Field installation (built-up systems and duct-mounted coils); and
- Use in Central Station Air-Handling Units, as defined in the AHRI Central Station Air-Handling Units Casings (AHUC) OM.

1.3.1 Program Scope Exclusions. This certification program does not include:

- Coils installed in Packaged Units;
- Special Coil;
- Products certified under AHRI's Room Fan-Coil Units (AHRI Standard 440) Certification Program; or
- Products certified under AHRI's Unit Ventilators (AHRI Standard 840) Certification Program.

1.4 Intended Market. The Intended Market for this certification program, where the Standard applies, includes all products defined in Section 1.3 that are sold for use in the U.S. and Canada (U.S., U.S. Territories, and Canada).

1.5 Exception to Certify-All Rule. The Participant may exclude some coil lines from certification, provided it complies with provisions in Section 3.8.4. Unless certification is clearly claimed only for certified lines, non-certified coil lines shall not be included in the same published literature as those certified.

Participants shall ensure that certified Basic Model Groups (BMGs) have separate model number(s) and/or designation(s) than non-certified BMGs to avoid market place confusion. It is a violation of the program if any Participants markets certified product as non-certified that have the same model number(s) and/or designation(s). AHRI certified units shall be a different model number and that model number shall always be sold as certified. It is permissible for a Participant to have another set of model numbers for uncertified units as long as certification is not implied or claimed.

1.6 Basic Model. A Basic Model (model) is the market recognized nomenclature of a product possessing a discrete performance rating.

1.6.1 Model Number. When adding any model into the directory, the following fields must be identified in order for the directory to auto-generate the Model Number.

- Coil Line Designation;
- Function;
- Fluid Type;
- Tube Outside Diameter;
- Tube Spacing across Coil Face (S_f) X Tube Spacing between Coil Rows (S_r);
- Tube Internal Construction; and
- Fin Configuration with Edge Type.

1.7 Basic Model Groups (BMGs). A Participant's listing shall be grouped by BMG. A BMG is a set of models that share characteristics which allow the performance of one (1) model to be generally representative of the performance of other models within the group. This group of products does not necessarily have to share discrete performance. Minimum parameters to be used for defining BMGs are fin configuration, tube diameter and spacing, tube internal construction, and fluid type. For example, coils with the same tube diameter and spacing, same fin configuration, and same fluid type constitutes a BMG. Table 1 provides examples of how to define BMG(s).

Table 1. Defining a BMG						
Number of Options (Offered by the Manufacturer)	Coil Line Designation					
	A	B	C	D	E	F
Fin Configuration ¹	1	1	1	1	2	2
Tube Diameter and Spacing ²	1	1	1	2	2	2
Tube Internal Design	1	2	2	3	3	1
Fluid Type ³	1	1	3	4	3	5
Basic Model Groups w/in Each Coil Line ⁴	1	2	6	24	36	20
Notes: <ol style="list-style-type: none"> 1. Lines "E" and "F" show two types of fins. (Ex. continuous flat plate fins and crimped spiral fins) 2. Tube O.D. and Tube spacing across coil face (S_f) by Tube spacing in the direction of air flow (S_{tr}) 3. Refer to Table 2 for allowable fluid type BMG combinations 4. Minimum number of mandatory Basic Model Groups = (# of Fins)*(# of Tubes Diameter and Spacing)*(# of Tube Internal Design)*(# of Fluid Types) 						

1.7.1 Fluid Types. The following fluid types may be certified within the ACHC Certification Program:

- Cold Water;
- Hot Water;
- Cold Ethylene Glycol;
- Hot Ethylene Glycol;
- Cold Propylene Glycol;
- Hot Propylene Glycol;
- Steam;
- R-22;
- R-134a;
- R-407C; and
- R-410A.

When calculating BMGs, a Participant may combine the functions and fluids as listed below in Table 2 at the Participant’s discretion. All such chosen grouping shall be clearly indicated on requisite forms (DS1).

Table 2. Allowable BMG Combinations	
Function	Fluid Type
Cooling	Water
Cooling	Ethylene Glycol
Cooling	Ethylene Glycol and Water
Cooling	Ethylene Glycol, Propylene Glycol and Water
Cooling	Propylene Glycol
Heating	Water
Heating	Ethylene Glycol
Heating	Ethylene Glycol and Water
Heating	Ethylene Glycol, Propylene Glycol and Water
Heating	Propylene glycol
Heating and Cooling	Water
Heating and Cooling	Propylene glycol
Heating and Cooling	Ethylene glycol
Heating and Cooling	Ethylene Glycol, Propylene Glycol and Water
Heating	Steam
Cooling	R-22
Cooling	R-134a
Cooling	R-407C
Cooling	R-410A

1.7.2 Optional BMG Subdivision. The Participant may further subdivide its BMGs provided that this is clearly indicated on requisite forms (DS1). AHRI may request supporting documentation at its discretion. The following are examples of additional parameters, which may be used to optionally subdivide BMGs:

- Number of rows;
- Construction variation; and/or
- Other prudent engineering reasons.

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, New Applicant License Fee Form – Sales Volume, and product specific ratings and data, noted in the AHRI General Operations Manual, Section 4, STEP 4.1, Applicants shall submit the following documentation to AHRI:

- Coil physical data per ASHRAE 33 (refer to Section 3.2);
- One test report for each BMG (refer to Section 3.2);
- Applicable Rating Calculation AHRI 410 Form (refer to Section 3.2); and
- Copy of Applicant's Selection Rating Software (refer to Section 3.8).

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. 100% of an Applicant's BMGs shall be tested, with a minimum of two (2) models.

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. Following a first sample qualification test failure, the Applicant shall choose to:

- Re-rate selection tools for all models within the failed sample's BMG proportionate to the failed test's results in accordance with Section 9 of the General Operations Manual and Appendix D of this Operations Manual. The re-rated data shall be reflected in all the Applicant's printed literature, specifications, and software;
- Test second sample of the same model, as described in Section 9.14.2.4.3 of the General Operations Manual;
- Terminate the application process.

The Applicant shall communicate its elected option to AHRI via Manufacturer's Decision Form.

STEP 2.1.4.3 Second Sample Qualification Test Failure. Following a second sample qualification test failure, the Applicant shall choose to:

- Re-rate selection tools for all models within the failed sample's BMG proportionate to the failed test's results in accordance with Section 9 of the General Operations Manual and Appendix D of this Operations Manual. The re-rated data shall be reflected in all the Applicant's printed literature, specifications, and software;
- Terminate the application process.

The Applicant shall communicate its elected option to AHRI via Manufacturer's Decision Form.

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 and product specific ratings and data noted in the AHRI General Operations Manual, Section 5, STEP 5.1, Applicants shall submit the following documentation to AHRI:

Copy of Applicant's Selection Rating Software (refer to Section 3.8).

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. 30% of a Participant's BMGs shall be tested annually, with a minimum of two (2) models. Fractional numbers shall be rounded up to the next whole number. (Example: 30% of 11 BMGs is 3.3 so the Participant shall have 4 tests.)

3.2 Requirement for Introduction of New BMG. Prior to being listed in the AHRI Directory of Certified Product Performance (Directory), any new BMG introduced by the Participant shall undergo qualification testing as described in Section 2. In addition, the Participant shall submit the same documentation as required for an Applicant (refer to Section 2.1 STEP 2.1.1). Such documentation shall be prepared in accordance with the following procedure:

3.2.1 Product Information. The Participant shall supply information for all models in the BMG in accordance with the applicable Standard and the following requirements.

3.2.1.1 Form ACHC-DS1, ACHC Certification Program Data Planning Worksheet. The Participant shall complete this worksheet to accurately reflect all products which are intended for certification in the ACHC Certification Program. The spreadsheet shall be completed correctly, in its entirety and returned to AHRI, before any sample selections for testing can be made. This form shows how the Participant's data shall be shown in the Directory.

3.2.1.1.1 Adding a New Single-Phase Fluid to an Existing Coil Line Exception. Existing Participants adding new single-phase fluid to an existing coil line are exempt from submitting Form ACHC-DS1. In lieu of this requirement, the Participant shall enter data directly into the Directory. Submissions are subject to approval by AHRI. Refer to Section 3.8 for software requirements.

3.2.1.1.2 Exception for providing a separate test for multiple single fluid BMGs. When an applicant or participant adds a new coil line and wishes to have separate BMGs for hot and cold single-phase fluids, they may submit a dry coil cooling test for the hot single-phase in lieu of a hot water test. Further, they may add other single phase fluid BMGs per section 3.2.1.1.1.

In lieu of a test report for each individual single phase fluid the applicant or participant shall provide a software output for the same coil with each fluid which they wish to submit as a separate BMG. This output shall be used to illustrate the difference in fluid performance with the same coil at the same input conditions.

3.2.1.2 Coil Physical Data. Refer to ASHRAE Standard 33, *Methods of Testing Forced Circulation Air Cooling and Air Heating Coils*, for the requirements for coil physical data by type.

3.2.1.3 Test Report. Refer to ASHRAE Standard 33, *Methods of Testing Forced Circulation Air Cooling and Air Heating Coils*, for the requirements for test reports by fluid type.

3.2.1.4 Applicable Rating Calculation AHRI 410 Form. The applicable rating calculation form, per Appendix A and found on AHRI's website, must be submitted.

3.2.2 Generation of Ratings. The Participant shall generate ratings for all models in the BMG in accordance with the Standard and the following requirements for application purposes. The pre-

qualification test report shall meet the following tolerances; the test capacity shall not be less than 97.5% and the test pressure drop shall not be greater than 105% of the Published Ratings.

3.2.2.1 Liquid Cooling Coils (Water, Glycol). The basic rating point shall be conducted at the following conditions:

- Entering Air Temperature, 80°F dry-bulb/67°F wet-bulb;
- Air Face Velocity, 500 feet per minute (fpm);
- Entering Fluid Temperature, 45°F;
- Leaving Fluid Temperature, 55 ± 2°F;
- Fluid Velocity, between 2 and 6 feet per second (fps); and
- Glycol Concentration, 50 percent by mass.

3.2.2.2 Liquid Heating Coils (Water, Glycol). The basic rating point shall be conducted at the following conditions:

- Entering Air Temperature, 60°F dry-bulb;
- Air Face Velocity, 500 fpm;
- Entering Fluid Temperature, 180°F;
- Leaving Fluid Temperature, 150 ± 10°F;
- Fluid Velocity, between 2 and 6 fps; and
- Glycol Concentration, 50 percent by mass.

3.2.2.3 Steam Coils. The basic rating point shall be conducted at the following conditions:

- Entering Air Temperature, 60°F dry-bulb;
- Air Face Velocity, 500 fpm; and
- Steam Pressure, 5 psig.

3.2.2.4 Volatile Refrigerant Coils (DX). The basic rating point shall be conducted at the following conditions:

- Entering Air Temperature, 80°F dry-bulb/67°F wet-bulb;
- Air Face Velocity, 500 fpm;
- Saturated refrigerant vapor temperature leaving coil suction header, 45°F;
- Refrigerant vapor superheat leaving coil suction header, 10°F; and
- Subcooled refrigerant liquid temperature entering liquid control device, 110 ± 10°F

3.2.3 Data to be Submitted with the Certification Application Package. The manufacturer shall submit sufficient data and calculations to show that the submitted ratings have been generated in accordance with Section 3.2.1. Test data and calculation for all tests are to be submitted on the appropriate forms from ASHRAE 33, *Methods of Testing Forced Circulation Air Cooling and Air Heating Coils*.

3.3 Testing

3.3.1 Location of Tests and Sample Installation. Testing shall be performed at the Laboratory and the sample shall be installed in the test facility in accordance with the Participant's published installation instructions in printed or electronic format.

3.3.2 Test Stand Verification. Test stands at the Laboratory must be in compliance with the requirements outlined in Appendix C.

3.4 Selection of Test Samples. AHRI shall make a Build-to-Specifications Test Sample Selection based on the data contained in the Directory and utilize the Participant's AHRI approved Selection Rating Software to select sample(s), which operates within the Range of Standard Rating Conditions listed in Table 1 of the Standard. Refer to Section 9 of the AHRI General Operations Manual.

3.5 Method of Acquiring Test Samples. Selected samples shall be supplied to the Laboratory in accordance with Appendix B.

3.6 Sample Acquisition Timeframe. Upon notification of selections by AHRI, the Participant shall have 30 calendar days to deliver selected sample(s) to the Laboratory.

3.7 Changes to Operating Conditions Profile Prior to Test. To ensure random selection of a sample, the profile entering a given sample may be changed after the original selection of the sample by AHRI, prior to testing. The new profile shall be applicable to the selected sample per the Selection Rating Software and shall be selected by AHRI.

3.8 Selection Rating Software

3.8.1 Requesting Approval of Rating Methods. A Participant shall request approval of its Selection Rating Software by submitting all of the following to AHRI:

- Selection Rating Software shall be either personal computer (PC) based, run on MS Windows® platform, or web-based software and allow for selection of any certified product at any application rating condition per the latest edition of the Standard;
- Provide outputs for:
 - Model Number;
 - Certified Data (Refer to Section 3.9);
 - Fin configuration;
 - Tube diameter and spacing;
 - Version number or other revision coding; and
 - Proper claims to AHRI Certification (Refer to Section 3.8.4);
- All necessary passwords to access software and updates; and
- Instructions for use of the Selection Rating Software.

The Selection Rating Software shall meet the requirements set forth in Section 9. If the Participant has more than one (1) Selection Rating Software available to users, each program shall be verified by AHRI.

3.8.1.1 Installation of Selection Rating Software. AHRI shall provide the Participant with a login/password to a personalized Virtual Machine (VM) to install their Selection Rating Software. The Participant shall generate two (2) random selections to ensure successful software installation and operation. Once the Participant notifies AHRI that the Selection Rating Software has been successfully installed, AHRI shall grant approval of the Selection Rating Software within seven (7) calendar days.

3.8.2 Initial Approval of Selection Rating Software through Published Rating Comparison. AHRI upon receiving the necessary materials shall, if applicable, utilize the Participant's Selection Rating Software to determine computer ratings for a certain set of conditions. The Selection Rating Software output (printout and on-screen display) shall meet requirements outlined in Section 9. AHRI may also request selection sheets from customers who have received bids. These selection sheets shall match the Selection Rating Software output.

The Participant shall be notified when the Selection Rating Software has been approved for certification. Upon approval from AHRI, the Participant may release the software to other users. Selection Rating Software released to other users prior to obtaining AHRI approval shall result in a program violation. Also, the Selection Rating Software shall be approved by AHRI prior to field release.

3.8.3 Updates to Previously Approved Software. Per the AHRI General Operations Manual, Section 9, AHRI shall have an updated copy of any software being used in the field. Major changes to software shall go through an Initial Approval as per Section 3.8.2 and adhere to the requirements in Section 9.2.3.

After the participant installs the new version of the software onto the Virtual machine, the new Selection Rating Software can be approved and ACHC Directory listings can be updated. After the software has been installed, the Participant shall notify AHRI via email.

Note: Any edit to the Directory may temporarily hide the revised listing. Contact AHRI prior to any changes to minimize any unnecessary down time for the listings.

3.8.4 Statements Regarding Certification. For units within the scope of the program, the AHRI Certified Mark shall be included on the Selection Rating Software outputs for certified units in accordance with the AHRI Brand Usage Guide.

All Selection Rating Software outputs from an approved Selection Rating Software shall include one of the following statements:

3.8.4.1 For Units within the Scope of the Program. “Certified in accordance with the AHRI Forced-Circulation Air-Cooling and Air-Heating Coils Certification Program, which is based on AHRI Standard 410 within the Range of Standard Rating Conditions listed in Table 1 of the Standard. Certified units may be found in the AHRI Directory at www.ahridirectory.org.”

3.8.4.2 For Units Outside the Scope of the Program. “Coil is NOT certified by AHRI. Coil is outside the scope of the AHRI Forced-Circulation Air-Cooling and Air-Heating Coils Certification Program.”

3.8.4.3 For Non-Certified Units within the Scope of the Program. “Coil is NOT certified by AHRI.” Coil is within the scope of the AHRI Forced-Circulation Air-Cooling and Air-Heating Coils Certification Program.”

3.9 Certified Data. In accordance with the Standard, at operating conditions designated by AHRI, the following certified ratings are verified, by test:

- Average cooling or heating capacity, Btu/h [W];
- Air pressure drop through coil at standard air density, in H₂O [kPa]; and
- Water or aqueous glycol solution pressure drop through coil (including headers) at average fluid density, ft of fluid [m of fluid].

Note: Tolerances used to determine whether a sample has passed or failed a certification test will be computed in accordance with Section 6.4 of the Standard.

3.10 Test Failures.

3.10.1 *Options Following First 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 models within the failed sample's BMG proportionate to the failed test's results. Refer to Section 3.11 and Appendix D for the software re-rate procedure and specified equations;
- Test a second sample of the same model;
- Test a second sample of the same model and receive the 1st sample for failure analysis. Upon submitting a Participant's Decision Form (MDF) the Participant shall also submit documentation of the cause of the unit's failure. Once AHRI has received the documentation, the failed unit will be returned to the Participant, who will have 30 calendar days from the date of the unit's arrival at the Participant's facility to diagnose the cause of the unit's failure and submit a second sample for testing. In order to remain in compliance the participant must submit the following to AHRI when the sending the 2nd sample:
 - Documentation establishing the date of the returned unit's arrival at the Participant's facility;
 - A detailed explanation of the cause of the unit's failure; and
 - The tracking number for the 2nd sample.

If these are not received within the required timeframe the failed sample's BMG will be automatically re-rated; or

- Obsolete the model, which also obsoletes all models within the corresponding BMG.

The Participant shall also complete the "Reasons for Failures" section of the Manufacturer's Decision Form by selecting one (1) of the following options and providing a detailed explanation for the reason for failure.

- Manufacturing Error;
- Software Error; and
- Other Error.

3.10.2 *Options Following Second 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 models within the failed sample's BMG proportionate to the failed test's results. Refer to Section 3.11 and Appendix D for the software re-rate procedure and specified equations; or
- Obsolete the model, which also obsoletes all models within the corresponding BMG.

The Participant shall also complete the "Reasons for Failures" section of the Manufacturer's Decision Form by selecting one (1) of the following options and providing a detailed explanation for the reason for failure.

- Manufacturing Error;
- Software Error; and
- Other Error.

3.11 *Re-rate Procedure.* To successfully complete a re-rate, AHRI and the Participant(s) shall collaborate to prove compliance. Re-rates will be reflected on the Directory for one (1) year as a footnote on all models within the re-rated BMG. Software or literature updates need to be made within 60 calendar days from the submission of the Manufacturer's Decision Form (MDF).

Within 10 calendar days of submitting the MDF, AHRI will select two (or more) software selection outputs from the existing software (that has not been re-rated) that is within the failed BMG. These additional software selection outputs are only providing an additional assessment to ensure that the re-rates will be processed across the entire BMG and will not be subjected to Laboratory testing.

Within 60 calendar days of submitting the MDF, participants shall provide the following to prove compliance:

- Software selection output for the failed sample in the re-rated software;
- Software outputs for two (2) additional samples within the failed BMG, at conditions within the range of Standard Rating Conditions listed in Table 1 of the Standard, in both the old and re-rated versions of software;
- Form ACHC-DS3, Re-rate Check Worksheet, designated sections of the worksheet for Participant (Refer to Appendix A and Appendix D).

The tested model shall be re-rated to the failed test result utilizing the nearest "round-off" multiple specified in the test standard, but no better than the actual test results. Appendix D shall be used when re-rating selection software. AHRI shall review the re-rate submission package and shall grant access to the Participant to install the revised software on the VM or update their online software. The Participant shall notify AHRI as soon as the Selection Rating Software is fully operational. A re-rate is a major change and Selection Rating Software shall go through an Initial Approval as per Section 3.8.2. Once the Selection Rating Software has been reviewed and approved, AHRI will select the previously made additional software selection outputs on the revised version of the Selection Rating Software. If the re-rate percentage is within the acceptance criteria, then the re-rate shall be complete. If the re-rate percentage is not within the acceptance criteria, then the Participant shall revise their software until the re-rate percentage is acceptable.

3.12 *Consequences for Improper Ratings.* If a model is re-rated following sample test failure, AHRI shall immediately assign two (2) Penalty Tests. Penalty Test Re-rates will follow the same consequences as first and second sample failures.

4. Challenge Tests

Except as noted below, the Challenge Test process shall proceed according to the AHRI General Operations Manual, Section 10.

4.1 *Procedure for Initiating a Challenge.* Specification sheet verifications should be requested prior to the initiation of a challenge. In addition to the requirements noted in the AHRI General Operations Manual, Section 10, the challenger shall provide AHRI with:

- Form ACHC-DS2, Coil Inputs Form (refer to Appendix A); and
- A copy of the selection sheet showing the disputed ratings of a unit listed in the Directory or a copy of the disputed ratings published by the manufacturer (for products that are not AHRI-certified).

4.2 *Selection Software Verification of Challenged Product.* Within seven (7) calendar days of the date the challenge is presented to AHRI, the challenged party's selection software shall be locked and official challenge verification shall be run. If the software has already been corrected by the challenged party, the verification shall be performed in the new software. If the verification shows a re-rate of the challenged product, the challenger has the option to challenge the re-rated data or drop the challenge.

4.3 Obtaining Equipment for a Challenge Test. AHRI shall approach the challenged party to obtain a sample. It shall be necessary to reveal that a product rating has been challenged; however, AHRI shall not divulge the name of the challenger.

5. AHRI Directory of Certified Product Performance

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 Certified Reference Number;
- Name of Manufacturer;
- Brand Name of Model;
- Basic Model Group ID
- Series/AHU Name;
- Model Number¹;
- Coil Line Designation;
- Model Status;
- Publication:
 - Selection Rating Software Name
 - Selection Rating Software Version Number.
- Function;
- Fluid Type;
- Tube Outside Diameter;
- Re-Rated;
- Header;
- Tube Arrangement;
- Certified/Production Fin Spacing; and
 - Range Minimum
 - Range Maximum
- Certified/Production Rows
 - Range Minimum
 - Range Maximum

¹As defined in Section 1.6.1 of this document

5.2 Data Forms. Each Participant shall list its products by BMG on the Directory. Each unique model listing shall be assigned a unique AHRI reference number. Specific BMG numbers and groupings shall not be published on the Directory. Participants shall supply certified model listings to AHRI via the Directory. OEM and PBM Participants shall submit/edit product data via the Directory.

6. Assessment and Payment of Certification Fees

Refer to Sections 9 and 12 of the AHRI General Operations Manual.

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

Refer to Section 8 of the AHRI General Operations Manual.

9.1 *Publication of Non-Certified Ratings.* Some products certified through the AHRI ACHC Certification Program may be capable of operation at conditions outside the scope of the certification program. Participant's printed materials and Selection Rating Software may contain non-certified ratings; however it shall be clearly indicated that such ratings are outside the scope of the AHRI ACHC Certification Program and shall comply with all requirements in Section 3.8.4.

9.2 *AHRI Verification and Monitoring of Selection Rating Software and Selection Methods.*

9.2.1 *Random Comparisons.* AHRI shall make random comparisons of the catalog ratings, if applicable, and the Selection Rating Software as a further check procedure to guard against a Participant using software not approved by AHRI.

9.2.2 *Additional Monitoring.* AHRI may request Participants, users, consulting engineers, etc. to submit copies of specific job conditions and ratings that they have utilized. Additionally, parties may request that AHRI verify certification of product ratings. AHRI shall compare the ratings with the results obtained through use of the Participant's Selection Rating Software. Comparison shall only be made on jobs in which the Selection Rating Software implemented by the user matches that of the verified rating method, including issue date or code, of the current software held by AHRI. AHRI provides verification services to all legitimate parties. All requesters shall provide the following information before verifications are completed:

- Name of the Requester;
- Affiliation of the Requester;
- Contact information of the Requester (email, phone number);
- Original job submittal with the job name;
- Manufacturer representative that provided the selection; and
- Form ACHC-DS2 (refer to Appendix A).

9.2.3 *Responsibility of Participant for Software Revisions.* Whenever a Participant's Selection Rating Software is revised, the Participant shall promptly supply the revised version(s) to AHRI. The Participant's software shall comply with the following:

- Version number shall be in increasing numerical order so that the revision level can be determined by AHRI;
- Software outputs shall prominently display a revision code, software name, date, and/or version identification;
- Version number shall match the number listed on the performance output data sheet generated from the Selection Rating Software and the Directory; and
- Version number shall be tied to ratings; if any ratings are changed, a new version of the software shall be issued.

Once the Participant notifies AHRI that the Selection Rating Software has been successfully installed, AHRI shall grant approval of the Selection Rating Software within seven (7) calendar days.

Upon approval from AHRI, the Participant may release the software to other users. Selection Rating Software released to other users prior to obtaining approval from AHRI shall result in a program violation. After the new Selection Rating Software has been approved, the Participant shall install update the ACHC Directory listings and notify AHRI via email.

Note: Any edit to the Directory may temporarily hide the revised listing. Contact AHRI prior to any changes to minimize any unnecessary down time for the listings.

9.2.4 Data in Rating Software and Catalogs. If, at any time, the Selection Rating Software does not correspond to the version listed in the Directory, the Participant shall be issued a program violation notifying them of the discrepancy and shall have 60 calendar days to resolve the discrepancy.

APPENDIX A- Forms

Data Sheets

Electronic forms available for download from AHRI's website.

A.1 ACHC-DS1, ACHC Certification Program Data Panning Worksheet. Complete this worksheet to provide information and data for each certified BMG to be reviewed and approved by AHRI prior to publication in the Directory.

A.2 ACHC-DS2, Coil Inputs Submittal.

A2.1 Challenge Test

A2.2 Request for Verification. Enter the same job conditions and inputs used to obtain the outputs you would like AHRI to verify. A copy of the output from the manufacturer's computerized rating method must be submitted in conjunction with this form. All fields must be completed prior to submission.

A.3 ACHC-DS3, Re-rate Check Worksheet. Complete and return this worksheet when submitted software revised after a re-rate.

AHRI Standard 410 Forms

A.4 All AHRI Standard 410 electronic forms are available for download from AHRI's website. These include:

- 410-1, Calculation Procedure To Determine Fin Efficiencies and Metal Thermal Resistances.
- 410-2, Calculation of Air-Side Resistances from Steam and Single-phase Fluids Coil Tests.
- 410-3, Calculation of Tube-Side Pressure Drops from Steam and Single-phase Fluids Coil Tests.
- 410-4, Calculation of Refrigerant-Side Thermal Resistances from Volatile Refrigerant Coils Tests.
- 410-5, Suggested Form for Rating Calculation Procedure for Sensible Heat Air Coils.
- 410-6, Suggested Form for Rating Calculation Procedure for Cooling and Dehumidifying Coils.
- 410-7, Calculation of Heat Transfer Coefficient and Friction Factor for Ethylene Glycol Coils.

APPENDIX B : MANUFACTURER REQUIREMENTS TO ENSURE PROPER SETUP AND COMPLETE TESTING

	<p style="text-align: center;">MANUFACTURER REQUIREMENTS TO ENSURE PROPER SETUP AND COMPLETE TESTING</p> <p style="text-align: center;">AHRI CERTIFICATION PROGRAM FOR FORCED-CIRCULATION AIR-COOLING AND AIR-HEATING COILS</p>
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Dear Certification Program Participant/Applicant:

This document outlines Participant/Applicant requirements and recommendations for delivering test sample(s) to the Laboratory. Required information must be supplied on or before receipt of the test sample(s) at the Laboratory or the samples **shall not be tested**. Further, this documents contains information on default test sample installation. Any deviations from default test installations must be received by AHRI and the Laboratory, in writing, before test sample(s) arrive at the Laboratory or the test sample will be tested in the default configuration.

Test Sample Information – Required

Supply the following information with/on test sample(s):

1. Test sample(s) shall be permanently affixed with the AHRI test number (permanent marker or label shall suffice)
2. Test sample(s) shall be labeled with arrows indicating the following:
 - a. Direction of airflow
 - b. Fluid Inlet
 - c. Fluid Outlet
 - d. Which side is “Up”
3. Diagram of test sample including physical dimensions
4. For Volatile Refrigerant (DX) coils: Provide all rating information which is not explicitly included in Published Ratings.
 - a. tr_{2g} , Saturated refrigerant vapor temperature leaving coil suction header, °F [°C]
 - b. Δtr_2 , Refrigerant vapor superheat leaving coil suction header (as rated), °F [°C]
 - c. tr_0 , Subcooled refrigerant liquid temperature entering liquid control device, °F [°C]
 - d. Δtr_0 , Refrigerant liquid subcooling entering liquid control device shall not be less than 5°F [2.8°C]

Coil Connection Fittings – Required

Supply test sample(s) with one of the following connection fittings:

1. For Water/glycol/steam coils:
 - a. External or internal threaded connections with right hand National (American) Standard Pipe Taper (NPT) threads per ASME B1.20.3 (Dryseal Pipe Threads), or if this is not possible;
 - b. Six (6) in. [152 mm], minimum length, copper pipe attached to header inlet/outlet. The pipe shall be the same size (diameter and wall thickness) as the header inlet/outlet connection.
2. For DX coils provide:
 - a. Six (6) in. [152 mm], minimum length, copper pipe attached to the refrigerant distributor inlet. The copper pipe shall be the same diameter as the refrigerant distributor inlet with Type L or Type K wall thickness as specified in Table 1 of ASTM B88, *Standard Specification for Seamless Copper Water Tube*. It is standard procedure for the Laboratory to braze/solder the thermostatic expansion valve (TXV) onto the pipe inlet. Participants shall provide written instructions for any other TXV mounting location and/or orientation. For example, “Remove process tube and cap assembly from the refrigerant distributor inlet. Directly mount TXV to refrigerant distributor inlet;” or
 - b. Six (6) inch [152 mm], minimum length, copper pipe attached to the suction header. The pipe shall be the same size (diameter and wall thickness) as the suction header connection.

Standard Laboratory Test Sample Setup

Any deviations from default test installations must be received by AHRI and the Laboratory, in writing, before test sample(s) arrive at the Laboratory or the test sample will be tested in the default configuration.

1. Casing holes and casing air leakage: It is standard procedure for the Laboratory to seal casing holes before testing. Sheet metal casing joints and coil tube-to-sheet metal casing joints shall not be sealed.
2. Standard Coil Orientation and Top Casing Channel Orientation: Test sample(s) shall be tested in the Standard Coil Orientation (horizontal tubes, vertical coil face, horizontal air flow, level top casing channel). Configurations other than Standard Coil Orientation shall have specific instructions provided by the Participant (either in an instruction manual delivered with the test sample or via email to AHRI prior to delivery) specifying:
 - a. Coil orientation:
 - i. horizontal tubes, angle of inclined coil face, horizontal air flow;
 - ii. vertical tubes, vertical coil face, horizontal air flow;
 - iii. vertical tubes, angle of inclined coil face, horizontal air flow;
 - iv. horizontal tubes, horizontal coil face, vertical (up or down) air flow Air Heating Coil. The Laboratory will test in the Standard Coil Orientation; or
 - v. horizontal tubes, horizontal coil face, vertical (up or down) air flow Air Cooling Coil. The Laboratory cannot test this orientation.
 - b. Casing Position:
 - i. Top casing channel pitch (inches of difference in elevation/ft coil face length); and
 - ii. Casing pitch direction (measuring the vertical distance each end of the coil is above a level surface, subtracting the two measurements, and dividing by the coil face length). For example, the casing is sloped down towards the return connection.

Crating – Recommended

AHRI recommends Participants/Applicants deliver test sample(s) to be crated or packaged:

1. Individually, or if this is not possible;
2. By batching similar tube-side fluid types together (each crate may have one or multiple test samples):
 - a. Water and Steam;
 - b. DX;
 - c. Propylene glycol; or
 - d. Ethylene glycol.

Test Reports

Only test reports for failed samples shall be sent directly to Participants by AHRI. Laboratory provides secure, online access all reports.

Please contact AHRI (AHRIcertACHC@ahrinet.org) if you have any questions regarding this information. Thank you for your participation in the AHRI Certification Program.

APPENDIX C: METHOD OF VERIFICATION FOR TEST STAND AIR VELOCITY AND TEMPERATURE UNIFORMITY

The purpose of this appendix is to provide a method for verifying a test stand’s velocity and temperature uniformity for 3rd party laboratories which perform ACHC certification program testing. The velocity and temperature uniformity verifications shall be performed prior to initial use and at least annually thereafter, with corrective action taken, if necessary. If any modifications are made to the test stand which may affect velocity or temperature uniformity, the verifications shall be re-performed. Note: the uniform face velocity and the uniform temperature tests below do not have to be performed on the same coil. Specific coil parameters must be met for the Uniform face velocity but the uniform temperature may be conducted with any coil.

C1 Uniform face velocity – the highest face velocity shall not exceed the lowest face velocity by more than 20%.

C1.1 Laboratories shall run their periodic verifications using two (2) coils. One (1) coil shall have the smallest coil face height (H) and/or coil face length (L) that may be tested and one (1) coil shall have the largest coil face height (H) and/or coil face length (L) that may be tested.

Exception: If the variation between the smallest coil face height (H) and/or coil face length (L) that may be tested and the largest coil face height (H) and/or coil face length (L) that may be tested is less than 15%, the laboratory may choose to test only one (1) coil for the verification.

C2 Procedure for measuring face velocity.

C2.1 Any of the following instruments may be used:

C2.1.1 Pitot tube

C2.1.2 Vane anemometer with a diameter of no more than 25 mm [1"]

C2.1.3 Hot wire anemometer

C2.1.3.1 A permanent grid of hot wire anemometers that meet the requirements of Section C1.2.3.

C2.2 The coil fins shall be dry when the air velocity is measured.

C2.3 The velocities shall be measured in a grid with the distance between measurements to be no less than L/6, H/6, or at least every 150 mm [6"], whichever is the greater distance.

C2.3.1 The velocities shall be measured in a plane at least 225 mm [9"] upstream of the coil and no more than 450 mm [18"] upstream of the coil.

C2.3.2 The velocities shall be measured at least 50 mm [2"] away from duct walls.

C2.4 Laboratories shall run their periodic verifications using the minimum and maximum velocities that may be tested. (For example, if a laboratory only tests from 2 m/s [400 fpm] to 4 m/s [800 fpm], the verifications would be performed at 2 m/s and 4 m/s.)

C2.5 The air pressure drop of the coil(s) used for the verification shall not exceed 50 Pa [0.2 in. w.c.] at 2.5 m/s [500 fpm].

C3 Uniform temperature – The maximum measured dry bulb temperature shall not exceed the minimum measured dry bulb by more than 0.6°C [1°F] across the face of the coil.

C3.1 Measurement during the verification. The dry bulb entering air temperatures shall be measured in a grid with horizontal and vertical spacing no less than L/6, H/6, or at least every 150 mm [6"], whichever is the greater distance.

C3.1.1 The temperatures shall be measured at least 225 mm [9"] upstream of the coil and no more than 450 mm [18"] upstream of the coil.

C3.1.2 The temperatures shall be measured at least 50 mm [2"] from the duct walls.

C3.1.3 Each point shall be individually measured and recorded.

C3.1.4 Two verification tests shall be performed as detailed in sections 2.1.4.1 and 2.1.4.2

C3.1.4.1 Dehumidifying test

C3.1.4.1.1 Coil entering air temperature 26.67°C DB/19.44°C WB [80°F DB/67°F WB]

C3.1.4.1.2 Coil sensible heat ratio less than 0.75 and greater than 0.6

C3.1.4.1.3 Coil total capacity less than or equal to 25 percent of the rated capacity for the test chamber.

C3.1.4.2 Heating Test

C3.1.4.2.1 Coil entering air temperature 15.55°C DB [60°F DB]

C3.1.4.2.2 Entering fluid temperature greater than 37.78°C DB [100°F DB]

C3.1.4.2.3 Coil total capacity greater than or equal to 75 percent of the rated capacity for the test chamber.

APPENDIX D: RE-RATE EQUATIONS

The purpose of this appendix is to assist the Participant in completing a successful re-rate. When a Participant is conducting a re-rate, the equation set used by the Selection Rating Software shall be modified to include a re-rate multiplier that satisfies re-rate requirements.

D1 Average Total Cooling or Heating Capacity, (Btu/h)

D1.1 Air-Heating Coils and Sensible Only Air-Cooling Coils (Dry Surface Sensible Heat Transfer Equations)

$$q_s = RRM_{q_s} \frac{A_o \Delta t_m}{R}$$

D1.2 Air-Cooling and Dehumidifying Coils (Wet Surface Total Heat Transfer Equations)

$$q_t = RRM_{q_t} (q_{tD} + q_{tW})$$

D2 Air Pressure Drop Through Coil at Standard Air Density, (in. H₂O)

D2.1 Air-Heating Coils and Sensible Only Air-Cooling Coils (Dry Surface Sensible Heat Transfer Equations)

$$\Delta p_{st} = RRM_{\Delta p_{st}} (\Delta p_{st} / N_r)$$

D2.2 Air-Cooling and Dehumidifying Coils (Wet Surface Total Heat Transfer Equations)

$$\Delta p_{sw} = RRM_{\Delta p_{sw}} (\Delta p_{sw} / N_r)$$

D3 Water, or Aqueous Ethylene Glycol, or Aqueous Propylene Glycol Solution Pressure Drop Through Coil (including headers) at Average Fluid Density, (ft. of fluid)

$$h_L = RRM_{h_L} \frac{144 \Delta p_L}{\rho_{Lm}}$$

D4 Symbol Key

D4.1 A_o – Total External Surface Area, ft²

D4.2 h_L – Water, or Aqueous Ethylene Glycol, or Aqueous Propylene Glycol Solution Pressure Drop (Head Loss) Through Coil (including headers) at Average Fluid Density, ft. of fluid

D4.3 N_r – Number of Rows of Fin Holes, in Direction of Airflow

D4.4 Δp_L – Water, or Aqueous Ethylene Glycol, or Aqueous Propylene Glycol Solution Pressure Drop Through Coil (including headers), psi

D4.5 Δp_{st} – Dry Surface Air Pressure Drop Through Coil at Standard Air Density, in. H₂O

D4.6 Δp_{sw} – Wet Surface Air Pressure Drop Through Coil at Standard Air Density, in. H₂O

D4.7 q_s – Average or Rated Sensible Capacity, Btu/h

D4.8 q_t – Average or Rated Total Capacity, Btu/h

D4.9 q_{tD} – Dry Surface Cooling Capacity, Btu/h

D4.10 q_{tW} – Wet Surface Cooling Capacity, Btu/h

D4.11 R – Overall Thermal Resistance, Referred to Total External Surface Area, h•ft²•F/Btu

D4.12 RRM – Re-rate Multiplier. The re-rate multiplier can be calculated from the following: $RRM = \frac{\text{Failed Test Value}}{\text{Rated Value}}$ for the specific Certified Rating.

D4.13 Δt_m – Logarithmic Mean Temperature Difference

D4.14 ρ_{Lm} – Average Water, or Aqueous Ethylene Glycol, or Aqueous Propylene Glycol Solution Density, lbm/ft³