

OPERATIONS MANUAL

LIQUID TO LIQUID BRAZED & FUSION BONDED PLATE HEAT EXCHANGERS



AHRI LLBF OM – MAY 2023

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PREFACE

The following manual outlines the procedures and policies of the Performance Certification Program for Liquid to Liquid Brazed & Fusion Bonded Plate Heat Exchangers (LLBF) 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 LLBF Certification Program by AHRI provides for independent verification of the Liquid to Liquid Brazed & Fusion Bonded Plate Heat Exchangers 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 LLBF 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 Liquid to Liquid Brazed & Fusion Bonded Plate Heat Exchangers Operations Manual, December 2019.

CERTIFICATION OPERATIONS MANUAL FOR
LIQUID TO LIQUID BRAZED & FUSION BONDED PLATE HEAT EXCHANGERS (LLBF)

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1. Program Overview

1.1 Applicable Rating Standard. It is mandatory for program Participants to comply with the provisions of AHRI Standard 400-2015, *Performance Rating of Liquid to Liquid Heat Exchangers* (Standard). A copy of the Standard is available for download from the AHRI website, www.ahrinet.org.

1.2 Product Definitions.

1.2.1 Liquid to Liquid Heat Exchanger. A heat transfer device used to exchange heat between two (2) liquid streams that are single phase fluids.

1.2.2 Brazed Plate Heat Exchanger. A Liquid to Liquid Heat Exchanger that typically utilizes corrugated metal plates brazed together to form channels where heat transfer occurs between the media in a countercurrent or co-current flow mode.

1.2.3 Fusion Bonded Plate Heat Exchanger. A Liquid to Liquid Heat Exchanger that typically utilizes corrugated metal plates diffusion bonded together to form channels where heat transfer occurs between the media in a countercurrent or co-current flow mode.

1.2.4 Large Volume Application Based Brazed Plate/Fusion Bonded Plate Heat Exchanger. A Brazed or Fusion Bonded Plate Heat Exchanger that is built to order, typically in large quantities to be integrated into a packaged unit.

1.3 Program Scope. This program applies to Production Models of Fusion Bonded & Brazed Plate Heat Exchangers (see Section 1.3.3), as defined in Section 1.2, that utilize water on one (1) or both circuits, for HVAC applications only.

1.3.1 Program Scope Exclusions. This certification program excludes all of the following:

- Heat exchangers used for phase-change heat transfer;
- Heat exchangers used for non-liquid heat transfer;
- Heat exchangers used for food-based processes;
- Heat exchangers with a capacity greater than 16,000,000 Btu/h; and
- Heat exchangers with a flow rate greater than 1,200 gpm.
- Large Volume Application Based Heat Exchangers, defined as per 1.2.4.

1.3.2 HVAC Applications. The purpose of a heat exchanger in a HVAC-system is to directly or indirectly serve either of the heating, cooling or tap water system in any kind of building. Examples of these applications are:

- Cooling
 - Pressure interceptor.
 - System isolator between cooling tower and chiller/dry cooler.
 - Heat exchanger serving in the ice/chilled water storage system.
 - Swimming pool cooler.
 - Tap water cooler.
- Heating
 - Pressure interceptor
 - System isolator between boiler or heat pump, etc. and secondary heating system for space heating
 - Tap water heater.
 - Swimming pool heater.
- District Energy (district cooling/district heating).
 - Heat exchanger in energy transfer station.

- Heat exchanger in free cooling application using a free cooling sink such as river water, lake water etc. to cool the district cooling water.
- Heat exchanger in free heating application using a hot stream from any source to heat district heating water.

1.3.3 Option to Certify Fusion Bonded Plate Heat Exchangers. Participants may choose to certify their Fusion Bonded Plate Heat Exchangers model line. If the Participant chooses to certify their Fusion Bonded Plate Heat Exchangers model line, then all Fusion Bonded Plate Heat Exchangers models within the program scope will be certified under this program (certify-all policy). This option is only available to Fusion Bonded Plate Heat Exchangers.

1.3.4 Option to Certify Glycol Performance. Participants may optionally choose to certify their Heat Exchangers for use with Ethylene Glycol^{1, 2} and Propylene Glycol^{1, 2}.

¹1% - 60% concentration (m/m)

²Fluid properties shall be referenced from International Institute of Refrigeration Publications' "Properties of Secondary Working Fluids for Indirect Systems."

1.3.5 Option to Certify Large Volume Application Based Heat Exchangers. Participants may optionally choose to certify their Large Volume Application Based Heat Exchangers, defined as per 1.2.4.

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. and Canada (U.S., U.S. Territories, and Canada).

1.5 Basic Model Groups (BMGs). A Participant's listings shall be grouped by BMG. A BMG shall consist of a model or models and all iterations of pressing patterns, variations of geometry and quantities of plates.

1.5.1 Optional Subdivisions of BMG. The Participant may further sub-divide its BMGs. The following are examples of additional parameters that may be used to sub-divide BMGs.

- Port diameter;
- Heat Transfer surface capacity;
- Fluid Type;
- Construction variation; and
- Other prudent engineering reason.

1.5.2 Double Wall Heat Exchangers. Double wall heat exchangers shall be clearly identified as a separate model designation.

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, 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:

- One test report for each BMG;
- Copy of Applicant's Selection Rating Software (refer to Section 3.7); and

- If the Applicant chooses to conduct witness testing at its AHRI Approved Test Stand within a Facility (Facility), all required forms per Section 3.3.1 of this manual for Witness Testing Facility Approval shall also be submitted.

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 Selection Rating Software Approval. AHRI shall provide the Applicant with a login/password to a personalized Virtual Machine (VM) to install their Selection Rating Software, or to create a shortcut to the Software's webpage. Once the Applicant notifies AHRI that the Selection Rating Software has been successfully installed, AHRI shall grant approval of the Selection Rating Software.

STEP 2.1.3.2 Number of Qualification Tests. 25% of an Applicant's BMGs shall be tested, with a minimum of five (5) models, including at least one (1) model to be tested at the Laboratory. Fractional numbers shall be rounded to the nearest whole number using traditional rounding methods.

STEP 2.1.3.3 Acquisition of Qualification Test Samples/Selection Criteria. Within 90 calendar days of a request from AHRI, the Applicant shall have samples available for testing. Samples shall be acquired in accordance with Section 3 of this manual.

AHRI shall utilize the Applicant's Selection Rating Software to select a unit to operate within the limits of rating conditions per the Standard.

Upon notification of selections by AHRI, the Applicant shall work with AHRI to determine mutually agreed upon test date which may require Applicant to accelerate product production.

AHRI will choose a point of operation for the sample as applicable based upon the Standard and this manual. The point of operation selected will be suitable to the range of the unit. The point of operation, used in conjunction with the verified computerized heat exchanger rating methods as listed by the applicant, will be used to generate Published Ratings.

STEP 2.1.3.4 Facility Approval and Sample Selection. If the Applicant has applied to conduct witness testing at its facility, the Laboratory shall contact the Applicant to schedule a preliminary witness test facility inspection. Upon final approval of the Applicant's witness test facility and the approval of the Applicant's Selection Rating Software, the Laboratory shall contact the Applicant to schedule initial qualification testing. Section 3 further explains the requirements and procedures for applying and conducting witness testing.

Qualification testing may be scheduled simultaneously with facility inspection; however, should the facility fail inspection the testing must be delayed until the facility is brought into compliance.

If the Applicant has not applied to conduct witness testing at its facility, the qualification process shall continue with the approval of the Applicant's Selection Rating Software. Upon approval by AHRI, the Laboratory shall contact the Applicant to schedule initial qualification testing.

STEP 2.1.4 Qualification Testing. AHRI shall supply the 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. PBM Selection Rating Software must directly correlate to OEM Selection Rating Software. If the software has variations, the PBM must register and test as an OEM.

STEP 2.2.1 Certification Application Package. In addition to the Application for AHRI Certification 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 3.7).

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 Selection Rating Software Approval. AHRI shall provide the Applicant with a login/password to a personalized Virtual Machine (VM) to install their Selection Rating Software, or to create a shortcut to the Software's webpage. Once the Applicant notifies AHRI that the Selection Rating Software has been successfully installed, AHRI shall grant approval of the Selection Rating Software.

STEP 2.2.4 *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 annually, with a minimum of three (3) models. Fractional numbers shall be rounded to the nearest whole number using traditional rounding methods. Annual testing of models shall be contributed from all Participant's manufacturing locations where plates get pressed and AHRI models are manufactured. At the beginning of each calendar year, Participant shall send a list to AHRI consisting of all manufacturing locations around the world where plates get pressed and AHRI models are manufactured. If the number of locations exceeds the Participant's annual number of tests, AHRI shall randomly select the manufacturing locations equivalent to the number of Participant's annual tests, which shall contribute towards testing requirements for each calendar year.

3.2 *Location of Test*. Testing shall be performed at the Laboratory or at the Facility and the sample shall be installed in accordance with the Participant's published installation instructions in printed or electronic format.

The Participant shall elect to conduct testing at the Laboratory or at the Facility. The Facility shall be approved by AHRI prior to any test being conducted. Testing shall continue to be conducted at the Participant's Facility, contingent upon it remaining AHRI-approved, or until the Participant notifies AHRI, in writing, of its desire to change facilities. All tests, regardless of location, must be conducted or witnessed by the Laboratory's Representative (Representative).

When testing with glycol as the fluid type, tests shall be conducted at the Laboratory to ensure that similar properties of glycol are used across tests.

3.3 *Witness Testing Procedures and Operations*. This Certification Program allows witness testing; where Participant personnel witnessed by the Representative, conducts testing at a Facility. Witness testing requirements are covered in the AHRI General Operations Manual, Section 9 and as specified below.

3.3.1 *Application for Witness Testing*. A Participant shall submit all of the following to AHRI:

- Form LLBF-WT1, Application for Witness Testing;
- Form LLBF-WT2, Facility and Equipment Questionnaire;
- Form LLBF-WT3, Personnel Experience Questionnaire;
- A complete list of all instruments and equipment being used to perform certification testing in accordance with the Standard and a copy of each calibration report showing date of last calibration;
- A schematic drawing of the area of the test facility in which AHRI certification testing will be performed; and
- Photographs of the test facility in which AHRI certification testing will take place, which shall include sufficient views to show the location and connection of each instrument.

Electronic copies of these forms are available from AHRI.

3.3.2 *Inspection of Witness Test Facility*. Following preliminary facility approval based on submitted data, the Representative shall inspect the Facility to verify compliance to the data submitted and to the certification program. Testing may be scheduled simultaneously with facility inspection; however, should the facility fail inspection, the testing must be delayed until the facility is brought into compliance.

3.3.2.1 Non-Compliant Inspection Results. If the results of the inspection indicate that a Facility is non-compliant with the certification program, all discrepancies must be resolved and resubmitted to AHRI, before approval can be granted to proceed with certified rating tests.

3.3.2.2 Final Approval of Witness Test Facility. Upon acceptable results of the inspection, AHRI shall notify the Facility of final acceptance and approval to proceed with certified ratings tests. AHRI shall provide the Participant with a certificate of approval that shall be displayed in the Facility.

3.3.3 Scheduled Witness Test Facility Re-approval. The Facility shall remain approved for no more than two (2) years. At this time, re-approval shall be required, including submittal of the documents outlined in Section 3.3.1 and inspection outlined in Section 3.3.2.

3.3.4 Unscheduled Facility Re-approval. Any changes that may affect a Facility's ability to function per the certification program requirements shall be required to be re-approved by the Laboratory personnel prior to conducting any witness testing. At this time, re-approval shall be required, including submittal of the documents outlined in Section 3.3.1 and inspection outlined in Section 3.3.2.

3.3.5 Witness Test Operations at a Facility.

3.3.5.1 Advance Set-Up of Sample in the AHRI-Approved Test Facility. A Participant may set up the test sample in the Facility prior to the arrival of the Representative. Prior to test commencement, the Representative shall verify that the sample is the model selected by AHRI for testing and that the sample has been set up in the Facility in accordance with the Participant's installation instructions and referenced method of test.

3.3.5.2 Duty Assignments of Representative. Sample testing, data acquisition, and data reduction shall be performed by the Participant personnel and assisted and witnessed by the Representative. Participant or Facility personnel shall be on-hand to assist the Representative as requested and are permitted to be present but are not permitted to tamper or adjust samples during tests, unless specifically approved by the Representative responsible for the test.

Verification of instrument application (in accordance with the procedures defined in the Standard) and verification of calibrations shall be performed by the Representative.

3.3.5.3 Use of Instrumentation. The Representative shall use primary test instruments belonging to the Facility, in accordance with certification program requirements. The Laboratory shall provide secondary instrumentation to verify measured temperatures and pressure drop. The test results from the Facility data acquisition system shall be used, provided that:

- The facility's equipment is under current calibration;
- All data acquisition is in accordance with the Standard;
- Fluid temperature at each location does not differ from the Laboratory instrumentation measurements by more than 0.2°F (0.11°C); and
- Inlet and outlet fluid pressure does not differ from the Laboratory instrumentation measurements by more than 0.25 psi (1.7 kPa).

Should any of these criteria not be met, steps should be taken to ensure that the discrepancy is resolved. In cases where the discrepancy cannot be resolved and no damage is apparent, the Laboratory instrumentation data for that parameter shall be used.

3.3.5.4 Sample Start-Up and Operation. Start-up and operation of the sample shall be in accordance with the Participant's published installation instructions in printed or electronic format.

3.4 Selection of Test Samples. AHRI shall make a Build-To-Specification Test Sample Selection based on data contained in the Directory. AHRI shall utilize the Participant's AHRI approved Selection Rating Software(s) to select a sample to operate within the limits of rating conditions per the Standard. The selection specification sheet shall state the AHRI selected duty point. Refer to Section 9 of the AHRI General Operations Manual.

3.5 Method of Acquiring Test Samples. Selected samples shall be shipped to the Laboratory accompanied by the Participant's published installation instructions in printed or electronic format or be available at the Facility during Witness Testing.

3.6 Sample Acquisition Timeframe. Upon notification of selections by AHRI, the Participant shall have 90 calendar days to deliver the units to the Laboratory or conduct witness testing at the Facility. Extended transit times must be approved by AHRI staff prior to selection. Prior to test, AHRI shall supply the Laboratory with the Published Ratings.

Upon notification of selections by AHRI, the Participant shall work with AHRI to determine mutually agreed upon test date which may require the Participant to accelerate product production.

3.7 Selection Rating Software

3.7.1 Requesting Approval of Selection Rating Software. 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 Standard;
 - For web-based software, the Applicant/Participant shall provide AHRI with a link to the Selection Rating Software.
- Software specification sheets to provide outputs for:
 - Participant's Name or Private Brand Manufacturer Name;
 - Date of Specification Sheet Output (recommended but not required);
 - Model Number;
 - Volumetric Flow Rate;
 - Inlet Temperatures on Both Circuits;
 - Outlet Temperatures on Both Circuits;
 - Pressure Drops on Both Circuits;
 - Surface Margin (also known as Excess Surface Area);
 - Fouling Factor;
 - Heat Duty (also known as Heat Load);
 - Overall Heat Transfer Coefficient¹;
 - Heat Transfer Area;
 - Number of Plates;
 - Channel Arrangements on Both Circuits;
 - Number of Passes;
 - Plate Material and Thickness;
 - Connection Diameter;
 - Design Pressure;
 - Design Temperature;
 - Unit Dimensions (Length, Width, and Height);
 - Net Weight (Empty and Operating);
 - Fluid Type;
 - Fluid Properties (Density, Specific Heat Capacity, Viscosity, Thermal Conductivity); for units using glycol, concentration shall be included.

- Software Version number;
- Proper claim to AHRI Certification (Refer to Section 3.7.4 and 3.7.5);
- All necessary passwords to access software and updates;
- Instructions for use of the Selection Rating Software; and
- A copy of the Participant(s) published catalog, if applicable.

¹If both clean and fouled Overall Heat Transfer Coefficients are provided, the calculations must be in alignment with Appendix D of AHRI Standard 400.

If the Participant has more than one (1) Selection Rating Software available to users, each software shall be verified by AHRI.

3.7.1.1 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.

3.7.1.2 Reinstallation of Selection Rating Software. At times, the Selection Rating Software or VM can crash due to unforeseen circumstances (or other circumstances such as expired software). In such cases, AHRI will contact the Participant to reinstall their Selection Rating Software. The Participant has 21 calendar days from the date of request to work with AHRI to reinstall their software on the VM.

3.7.2 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 and compare them for the same conditions as those in the published catalog, if a published catalog exists. The Selection Rating Software output (printout and on-screen display) shall match the published certified ratings from the catalog, if applicable. 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 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.

3.7.3 Updates to Previously Approved Software. Per the AHRI General Operational Manual, Section 17, AHRI shall have an updated copy of any software being used in the field. Any updates shall promptly be provided to AHRI via installation to the Participant's VM. Major changes to software shall go through an Initial Approval as per Section 3.7.2 and adhere to the requirements in Section 3.7.1. The Directory shall be locked and Participants shall not be allowed to make changes to Selection Rating Software version updates until the Participant has obtained approval from AHRI.

3.7.4 Statements Regarding Certification – Certified Selections. For units within the scope of the program, the Mark should be included on the unit and on the Selection Rating Software outputs for certified units in accordance with the AHRI Brand Usage Guide and should have the following statement:

“This Heat Exchanger is certified by the AHRI Liquid to Liquid Braze & Fusion Bonded Plate Heat Exchangers (LLBF) Certification Program, based on AHRI Standard 400. AHRI certified units are subject to rigorous and continuous testing, have performance ratings independently measured and are third-party verified. Certified units may be found in the AHRI Directory at www.ahridirectory.org”

3.7.5 Statements Regarding Certification – Non-Certified Selections. For units outside the scope of the program but rated to AHRI Standard 400, the Mark shall not be included on the unit or on the Selection Rating Software Outputs and should have the following statement.

“This Heat Exchanger is outside the scope of the AHRI Liquid to Liquid Braze and Fusion Bonded Plate Heat Exchanger (LLBF) Certification Program but is rated in accordance with AHRI Standard 400.”

A Participant’s software output specification sheet containing improper or missing claims to AHRI certification shall be subject to program violation (refer to Section 14 of the AHRI General OM).

3.8 Changes to Operating Conditions Profile Prior to Test. To ensure random selection of sample(s), the entering test conditions for a given sample may be changed by AHRI, after the sample has been installed in the Laboratory, or the Participant’s Facility, prior to test. Flow rates may be changed by a percentage not to exceed 10%. Profiles may also be adjusted to accommodate the conditions available in the Laboratory or Participant’s Facility on the day of the test. The new profile shall be applicable to the selected sample per the Selection Rating Software provided by the Participant.

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

- Total heat transfer rate (calculated based on tested and verified data), Btu/h [W];
- Cold stream pressure drop, psig [kPa]; and
- Hot stream pressure drop, psig [kPa].

3.10 Verified Data. At operating conditions designated by AHRI, the following non-certified data is verified during the test:

- Hot stream inlet and outlet temperatures, °F [°C];
- Cold stream inlet and outlet temperatures, °F [°C];
- Identification of Hot Stream and Cold Stream Liquids;
- Hot stream flow rate, gpm [L/s];
- Cold stream flow rate, gpm [L/s]; and
- Number of plates in the sample.

3.11 Test Failures.

3.11.1 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 of the following options:

- Re-rate all models within the failed sample’s BMG proportionate to the failed test’s results;
- Test second sample of the same model (sample must be available within the timeframe and procedure allotted in Section 3.6, 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.

3.11.2 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; or

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

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 Test. Specification sheet verifications should be requested prior to the initiation of a challenge. The challenger shall provide AHRI with:

- The model number of the unit being challenged;
- A copy of the selection sheet showing the disputed ratings of a unit listed in the Directory or a copy of the published disputed ratings (for products that are non AHRI certified);
- The profile for which the unit being challenged was specified; and
- Data for a comparable unit from the challenger (5-10% surface area discrepancy is expected but not a cut-off for challenge viability).

4.2 Selection Software Verification of Challenged Product. Within seven (7) calendar days of the date the challenge is presented to AHRI, an official challenge verification will be run on the challenged party's selection software. 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 per section 10 of the AHRI General OM or drop the challenge.

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. For each certified model, the Directory shows:

- AHRI Certified Reference Number;
- Model Status;
- Brand Name;
- Model Number;
- Fluids Used;
- Software Name; and
- Software Version

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

5.3 Publication of Notice of Verification. Upon approval of a Participant's Selection Rating Software, AHRI will publish a notice of verification on the Directory.

6. Assessment and Payment of Certification Fees

Refer to Section 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

Except as noted below, the proper use of the AHRI Certification Mark and claims to Certification shall proceed according to Section 8 of the AHRI General Operations Manual.

9.1. AHRI Verification and Monitoring of Selection Rating Software and Selection Methods.

9.1.1 Data Comparison between Selection Rating Software and Catalog. AHRI shall make random comparisons of the catalog ratings, if applicable, and the ratings acquired through the Participant's Selection Rating Software(s) to verify that the Participant is not using separate software program(s) not approved for AHRI Certification.

Any published catalog shall make reference to the version number of the Selection Rating Software to which it corresponds. AHRI considers the Selection Rating Software output to be the primary source of information. If, at any time, the referenced computerized rating output is not in agreement with the catalog, or if the catalog or Selection Rating Software output 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.

9.1.2 Additional Monitoring. AHRI may request that Participants, users, consulting engineers, etc. to submit to AHRI 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 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 be required to provide the following information before verifications are completed:

- Name of the Requester;
- Affiliation of the Requester;
- Contact information of the Requester;
- Original job submittal with the job name; and
- Manufacturer representative that provided the request.

APPENDIX A
Minimum Test Report Requirements for Liquid to Liquid Brazed & Fusion Bonded Plate Heat Exchangers (LLBF)

Parameter	Parameter Units
Manufacturer's Name	None
AHRI Test No.	None
Model No.	None
Date of Test	None
Location of Test	None
Connection Size / diameter	Inches
Number of Plates	None
Heat Transfer Rate, Hot Stream	Btu/h
Heat Transfer Rate, Cold Stream	Btu/h
Water Flow Rate, Hot Stream	GPM
Water Flow Rate, Cold Stream	GPM
Hot Stream Inlet / temperature	°F
Hot Stream Outlet / temperature	°F
Cold Stream Inlet / temperature	°F
Cold Stream Outlet / temperature	°F
Water Pressure Drop / Hot Stream	PSI
Water Pressure Drop / Cold Stream	PSI
Actual Pressures (Hot Stream)	PSI
Actual Pressures (Cold Stream)	PSI