

OPERATIONS MANUAL

INDIRECT WATER HEATERS CERTIFICATION PROGRAM



AHRI IWH OM - JANUARY 2018

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PREFACE

The following manual outlines the procedures and policies of the Performance Certification Program for Indirect Water Heaters (IWH) 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 IWH Certification Program by AHRI provides for independent verification of the performance of the Indirect Water Heaters manufacturer's 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 IWH Certification Mark hereinafter referred to as the "Mark". The Mark is the Participant's public representation that the ratings of randomly selected units 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 Indirect Water Heaters Operations Manual, January 2017.

CERTIFICATION OPERATIONS MANUAL FOR

INDIRECT WATER HEATERS

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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 IWH-TS-1, *Indirect-Fired Water Heater Testing Standard and supplement Method to Determine Performance of Indirect-Fired Water Heaters (March 2004) (Standard)* and the procedures outlined in this Operations Manual. 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 Indirect Water Heater. A water heating appliance which includes a heat exchanger used to transfer heat to potable water from hot water provided by an external source(s).

1.2.1.1 Indirect Storage Water Heater. An Indirect Water Heater consisting of a potable hot water storage tank equipped with an internal or external heat exchanger used to transfer heat to the stored potable water from an external source.

1.2.1.2 Indirect Instantaneous Water Heater. An Indirect Water Heater consisting of a tank which contains hot water from an external source and a heat exchanger used to transfer heat from this stored water to the potable water.

1.3 Program Scope. This program applies to Production Models of Indirect Water Heaters, as defined in Section 1.2, having a volume (potable plus heat source) of 120 gallons or less, and which are designed for installation with a hot water boiler(s) as the only heat source.

1.3.1 Program Scope Exclusions. The following are excluded from the IWH Certification Program:

- Direct-fired instantaneous or storage water heaters;
- Tankless water heaters;
- Heat pump water heaters, and;
- Combination space heating and water heating appliances.

1.3.2 Voluntary Program Scope Inclusion. Indirect Water Heaters for use with alternate heat sources meeting the scope of the Standard may be included in the Program at the Participant's option.

Participants shall ensure that certified Indirect Water Heaters and non-certified Indirect Water Heaters have a separate name and or designation to avoid market place confusion. It is a violation of the program if a buyer can look on the AHRI Directory of Certified Product Performance (Directory) and find the name of the "non-certified" unit listed. AHRI certified units must be a different model number and that model number must 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.

1.4 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 listing shall be grouped by BMG. A BMG is a regular range of sizes of a similar type, design and construction, and having a common designation as catalogued.

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:

- Test report(s) as required in Section 3.2.1, and;
- If the Applicant chooses to conduct witness testing at its AHRI Approved Test Stand within a Facility (Facility), all required forms per Section 3.5 of this manual for Witness Testing Facility Approval shall also be submitted.

Electronic forms can be obtained from AHRI (available on www.ahrinet.org under the Product-Specific Certification Program).

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 from each BMG shall be tested, with a minimum of one (1) model.

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 to deliver the selected sample(s) to the Laboratory or the AHRI-approved facility where witness testing will occur. It is acceptable for the Applicant/Participant to have a single sample available for selection.

STEP 2.1.3.3 *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, 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. Upon approval by AHRI, the Laboratory shall contact the Applicant to schedule initial qualification testing at either the Laboratory, or at another approved facility.

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 and the *IWH Testing Guidelines, Appendix A* (Testing Guidelines), against the Published Ratings.

For qualification testing, values for Continuous Draw and First Draw must meet or exceed 98% of the Participant's Published Rating. In addition, values for Standby Loss shall not exceed the Participant's Published Rating by more than 0.1 °F/h or 10%, whichever is greater. The results of the Heat Source Friction Loss Test shall not exceed the Participant's Published Rating by more than two (2) ft w.c. or 10%, whichever is greater.

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. No further action required beyond that listed in Section 5, STEP 5.1 of the AHRI General Operations Manual.

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 models shall be tested annually, with a minimum of one (1) model tested. Fractional test obligations shall be rounded up to the nearest integer.

3.2 Testing Requirement for Introduction of New BMG. Prior to being listed in the Directory, any new BMG introduced by the Participant shall undergo qualification testing as described in Section 2.1.

The Laboratory shall conduct the testing of the sample in accordance with the Standard and the Testing Guidelines, against the Published Ratings. The BMG shall pass qualification testing before it is listed in the Directory and before the Participant can claim AHRI Certified Ratings for models within the BMG.

3.2.1 Required Data. A Participant wishing to certify a new BMG shall submit Form IWH-DS1, along with all supporting test data, covering all sizes for which approval is desired.

Form IWH-DS1 shall include a test report for each model and size of the new BMG with the following exceptions:

- Where a single tank size and configuration is equipped with different heat exchangers, only one (1) Standby Loss Test is required; and
- Where a series of storage type water heaters are identical except for the heat exchanger size, a First Draw Test is only required on one (1) model in the series. The results of this test may then be applied to the entire series.

All forms can be obtained through AHRI's website: www.ahrinet.org.

The Applicant/Participant shall submit to AHRI forms covering each model being submitted into the Program prior to being eligible to have the models listed in the Directory.

3.3 Testing Requirement for Voluntarily Changed BMG. A BMG shall be considered voluntarily changed if the Participant makes a physical change(s) to any model within the BMG and continues to market the product under the same designation as the product since its last submittal to AHRI. If the product has changed in such a way that may affect the BMG's Certified Ratings, one (1) model from the changed BMG shall undergo qualification testing again to become qualified for the certification program.

3.3.1 Notification of Voluntarily Changed BMG. Prior to introducing the changed product to the market, introducing program ratings for the changed product, or updating the Directory, the Participant must notify AHRI, in writing, of the exact changes proposed, the date the changed product is expected to be introduced on the market, and the requested ratings for the changed product. AHRI shall review the submitted materials and notify the Participant, in writing, if qualification testing is required. The Participant shall not implement the changes, publish ratings for the changed product, or update Directory ratings, until necessary AHRI testing is completed or AHRI notifies the Participant that the BMG is exempt from qualification testing.

3.3.1.1 Improved Product Ratings. If the Participant notifies AHRI that the product ratings will improve, or AHRI determines the product's certified ratings may be affected by the proposed change, the Participant shall complete the qualification procedure as prescribed in Section 3.2.

3.3.1.2 Conservative Product Ratings. If the Participant notifies AHRI that the product ratings will be made more conservative, the Participant may be required, at the discretion of AHRI, to complete the qualification procedure as prescribed in Section

3.3.1.3 Unchanged Product Ratings. If the Participant notifies AHRI that the product ratings will remain the same and AHRI determines a BMG's certified ratings are unaffected by the physical changes made to the product, the BMG shall not be subject to qualification testing.

3.4 Location of Test and Selection of Laboratory. Testing shall be performed at the Laboratory or a Facility and the sample shall be installed in the Facility 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 a Facility. The Participant's 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).

3.5 *Witness Testing Procedures and Operations*. The AHRI IWH 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.

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

- Witness Testing Application Package including:
 - Form IWH-WT1, Application for Witness Testing;
 - Form IWH-WT2, Personnel Experience Questionnaire; and
 - Form IWH-WT3, Facility and Equipment 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.
- 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 the forms are available on AHRI's website.

3.5.1.1 *Acknowledgement of Request*. AHRI shall acknowledge receipt of the Participant's application to conduct witness testing. AHRI shall review the material and shall inform the Participant if additional information and/or changes are required for the Facility to meet the Standard.

3.5.2 *Inspection of Witness Test Facility*. Following preliminary test 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 shall be delayed until the facility is brought into compliance. An Indirect Water Heater shall be running in the facility for the inspection to be completed. The Representative shall confirm the submitted data on Form IWH-WT3.

3.5.2.1 *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.

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

3.5.3 *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 3.5.1 and inspection outlined in Section 3.5.2. Upon re-approval by AHRI, the Facility shall receive a new certificate of approval to be displayed in the Facility.

3.5.4 *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 Laboratory personnel prior to conducting any witness testing. At this time, re-approval shall be

required, including submittal of documents outlined in Section 3.5.1 and inspection outlined in Section 3.5.2.

3.5.5 Witness Test Operations at Participant's Facility.

3.5.5.1 Advance Set-Up of Sample in the 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.

3.5.5.2 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 permitted to be present but are not permitted to tamper or adjust samples during test, unless specifically approved by the Representative responsible for the test. Verification of instrument application (in accordance with the procedures defined in the Standard and the Testing Guidelines) and verification of calibrations shall be performed by the Representative.

3.5.5.3 Use of Instrumentation. The Representative shall use primary test instruments belonging to the Facility, in accordance with certification program requirements.

3.5.5.4 Sample Start-Up and Operation. Start-up and operation of the sample shall be in accordance with the installation and operation instructions provided by the Participant.

3.6 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.

3.7 Methods for Acquiring Test Samples for Annual Testing. AHRI or its representative shall make a Random Sample Selection from the Participant's production lines or distribution within 30 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. Refer to Section 9 of the AHRI General Operations Manual. For Witness Testing, AHRI shall request at least three (3) serial numbers of stock units from which a sample can be chosen at random. Selected samples shall be accompanied by the Participant's published installation instructions in printed or electronic format. Upon notification of selections by AHRI, the Participant will work with AHRI to determine mutually agreed upon test date which may require the Participant to accelerate product production.

3.8 Sample Acquisition Timeframe. For testing at the Laboratory or the Facility, the Participant shall deliver the selected sample(s) to the Laboratory within 14 calendar days of the Random Sample Selection by the Laboratory personnel. The Participant is responsible for supplying all proprietary components and components normally shipped with the sample at the same time the sample is made available at the designated test facility.

3.9 Certified Data. At conditions specified in the Standard, the following Certified Ratings are verified by test:

- Standby Loss, °F/hr (to the nearest 0.1°F/hr);
- First Draw Rating, gal/hr (to the nearest 1 gal/hr);
- Continuous Draw Rating, gal/hr (to the nearest 1 gal/hr); and
- Heat Source Friction Loss, ft w.c. (to the nearest 0.1 ft w.c.).

3.10 *Test Data.* The Laboratory personnel shall collect and submit the following data, for each Indirect Water Heater tested, to AHRI at the conclusion of testing:

- An Indirect Water Heater test report including:
 - Report Sheet Form IWH-R1;
 - Standby Test Log Form IWH-ST1;
 - First Draw Test Log Form IWH-FD1;
 - Continuous Draw Test Log Form IWH-CD1;
 - Volume Log Form IWH-V1; and
 - Heat Source Friction Loss Form IWH-FL1.

All forms are available in the Applicable Rating Standard or upon request to AHRI.

3.11 *Testing Threshold.* For annual verification testing, values for Continuous Draw and First Draw must meet or exceed 95% of the Participant's Published Rating. In addition, values for Standby Loss shall not exceed the Participant's Published Rating by more than 0.1 °F/h or 10%, whichever is greater. The results of the Heat Source Friction Loss test shall not exceed the Participant's Published Rating by more than two (2) ft w.c. or 10%, whichever is greater.

3.12 *Test Failures.*

3.12.1 *Options Following First Sample Failure.* When the Participant is notified of a first sample Certified Rating failure, they have seven (7) calendar days to select one of the following options:

- Re-rate all models in the BMG proportionate to the first sample's failed test results. The failed model shall be re-rated to the nearest round-off (threshold should be the same as the one used for data entered in the Directory and no better than the test results). Other models in the BMG shall be re-rated in accordance with the percentage by which the tested sample failed;
- Test second sample of the same model (sample shall be available within the timeframe and procedure allotted in Sections 3.7 and 3.8 following notification of decision to AHRI via Manufacturer's Decision Form [MDF]); or
- Obsolete all models in the BMG.

3.12.2 *Options Following Second Sample Failure.* When the Participant is notified of a second sample Certified Rating failure, they have seven (7) calendar days to select one of the following options:

- Re-rate all models in the BMG proportionate to the second sample's failed test results. The failed model shall be re-rated to the nearest round-off (threshold should be the same as the one used for data entered in the Directory and no better than the test results). Other models in the BMG shall be re-rated in accordance with the percentage by which the tested sample failed; or
- Obsolete all models in the BMG.

4. Challenge Tests

Refer to Section 10 of the AHRI General Operations Manual.

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 lists:

- AHRI Certified Reference Number;
- Model Status;
- Trade or Brand Name of Model;
- Name of Manufacturer;
- Model Number(s) or Designation(s);
- Heater Type;
- Potable Volume, gal;
- Heat Source Volume, gal;
- Standby Loss, °F/hr;
- First Hour Rating, gal/hr;
- First Draw Rating, gal/hr;
- Continuous Draw Rating, gal/hr;
- Minimum Heat Source Output, MBH;
- Minimum Heat Source Flow, gpm; and
- Heat Source Friction Loss, feet w.c.

Note that only Standby Loss, First Draw Rating, Continuous Draw Rating, Heat Source Friction Loss are Certified Ratings. All other ratings are considered non-certified program ratings. The published First Hour Rating shall be the sum of the rounded values of the First Draw and Continuous Draw Ratings.

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 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 81. Of the AHRI General OM and the AHRI Brand Usage Guide.

9.1 Publication of Non-Certified Ratings. Certification shall only be implied for products that fall within the Program Scope and the Intended Market of the IWH Certification Program. However, an AHRI certified model shall have a separate model name or designation from a non-certified model to avoid marketplace confusion. Where ratings are included that are outside the scope of the certification program, they shall be

accompanied by the following statement: “Ratings outside of the scope of the AHRI IWH Certification Program.”

9.2 Minimum Data Requirements for Publication in Literature. The following minimum data requirements listed below shall be published in all literature in which Certified Data are shown:

- Model Number;
- First Hour Rating, gal/hr;
- Continuous Draw Rating, gal/hr;
- Standby Loss, °F/hr;
- Heat Source Friction Loss, ft w.c.;
- Minimum Heat Output Rate, Btu/h;
- Minimum Heat Source Flow Rate, gpm;
- The wording including the ratings “These ratings were obtained with a heat source output rate of _____ Btu/h at a heat source flow rate of _____ gpm. Other results shall be obtained under different conditions.”; and
- AHRI Certified Mark with the notation “®”

9.3 Minimum Data to be Shown on Indirect Water Heater.

- Model Number;
- First Hour Rating, gal/h;
- Heat Source Output Required, labeled “AHRI Heat Source Output”, Btu/h; and
- AHRI Certified Mark with the notation “®”.

APPENDIX A
AHRI Indirect Water Heater Testing Guidelines

Pre-test

1. Select the Indirect Water Heater (IWH) from storage. If the sample was selected for a verification test, verify that the tamper-proof tape shows no signs of tampering. If there is evidence of tampering, report the evidence to AHRI prior to proceeding.
2. Uncrate the unit, saving the original packaging material so the sample can be crated for return shipment after testing is completed, if requested by the Participant or Applicant.
3. Label the unit, all panels, and extra parts, with the assigned Test Sample Number. If the unit's model and serial do not match what was selected, stop and contact AHRI to verify that testing can continue.
4. Inspect the indirect water heater for damage that may have occurred during shipment. Record a description and include photos of any damage for the test file. If the damage could possibly impact testing, report the damage to AHRI and the manufacturer before proceeding further.
5. Create an electronic folder.
6. Record the following nameplate information into the excel file for record keeping:
 - a. Model number
 - b. Serial number
 - c. First Hour Rating (gal/h)
 - d. Heat Source Output Required or AHRI Heat Source Output (Btu/h)

If any required information is missing from the nameplate, contact AHRI.

7. Scan or save the manual provided with the unit into the electronic folder so that the installation manual is always available for reference.
8. If it is an annual or penalty test, go to the AHRI Directory and locate and record the heat source flow rate. If it is a qualification or challenge test, the heat source flow rate shall be taken from form IWH-DS1 that the manufacturer and AHRI submitted. If there is an inconsistency between the submitted or listed heat source flow rate and the installation instructions, or no heat source flow rate is found, stop and contact AHRI and the manufacturer for clarification and approval to continue testing. Save all communication in the electronic folder.

Testing

Once the unit's information has been recorded, and all ratings are found, testing may begin. The test procedures to be used are:

AHRI Testing Standard for Indirect-Fired Water Heaters (IWH-TS1) and Supplement Method to Determine Performance of Indirect-Fired Water Heaters (March 2004)

Perform the testing described in the above standard in accordance with the following guideline:

1. Perform the volume determinations described in Section 7.1 of the Applicable Rating Standard first. Valves and fittings used to fill and purge the potable and heat source sides of the indirect water heater shall contain as little volume as possible, so as to maximize the accuracy of the indirect water heater volume measurements. Make sure that the portion of the IWH being filled is completely purged of air. Refer to the installation manual supplied with the IWH for any special filling and purging requirements. Record the following data as required by the Standard:
 - a. Dry weight of IWH and fittings.
 - b. Weight with potable portion of IWH filled
 - c. Weight with potable and heat source portion filled
 - d. Temperature of water used to fill IWH.

2. Construct and install the 6 point thermocouple probe for mean tank temperature (Ts) measurement described in Section 5.4.1 of the Applicable Rating Standard and in the Thermocouple Placement Procedure described below. It is required to use sheathed thermocouple probes, and to read the thermocouples individually and average them instantaneously through a data acquisition system to provide live readings of Ts. If the design of the IWH is such that the mean temperature probe cannot be installed through an existing tapping, contact AHRI and the manufacturer for guidance on how to install the probe.

Thermocouple Placement Procedure for Indirect Water Heaters

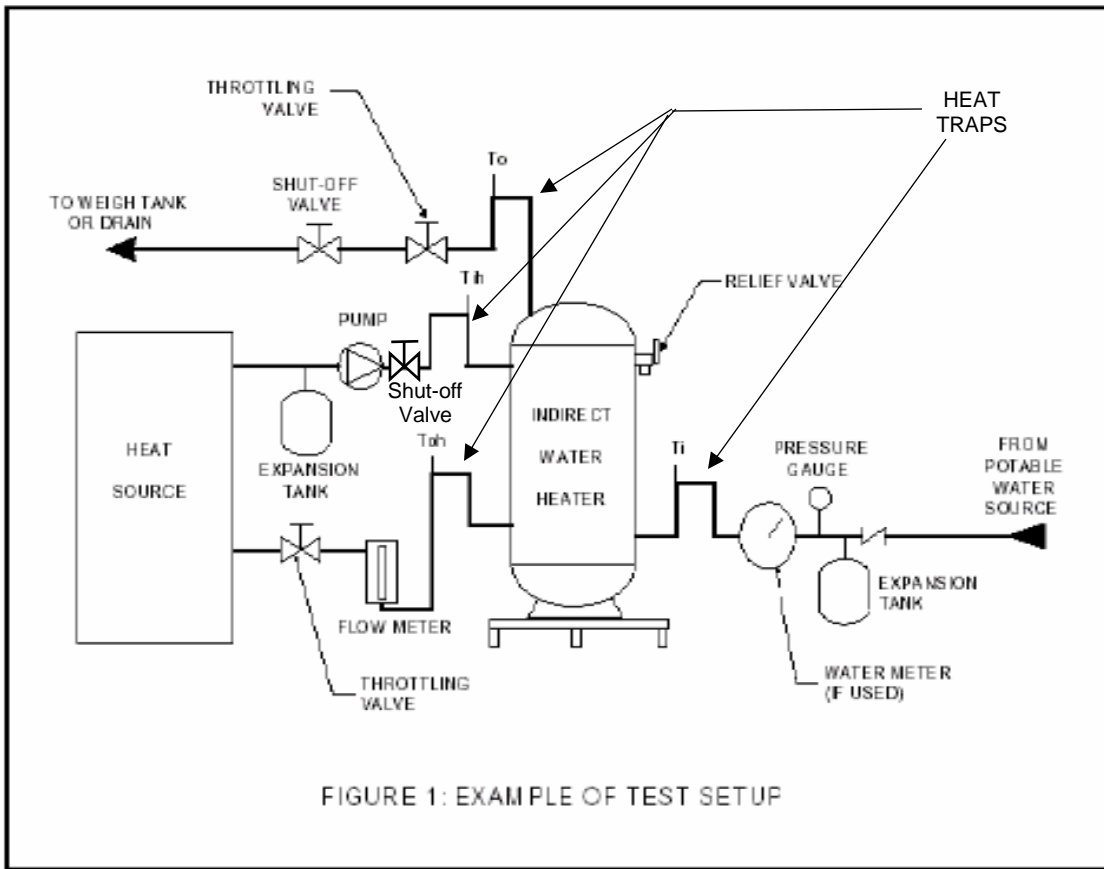
1. Install a clear 0.25 in. inner diameter (ID) tube on tank drain cock with provision to control the flow of water drained from the water heater. Draw the tube up the side of the water heater jacket and secure the end of the tube.
2. Fill water heater with water as directed in manufacturer's instructions.
3. Open drain cock and allow water level to stabilize in tube. Ensure the water heater is filled to its normal operating condition. CAUTION: Do not allow the insulation to become wet, if the insulation becomes wet, the unit must be replaced with a new unit.
4. Place tank top mark "T" on the water heater jacket at level of full water heater.
5. Using the weight of the potable water in the tank ($W_P - W_t$), drain $(W_P - W_t)/12 \pm 0.5$ lbm of water.
6. Allow the water level in the tube to stabilize. Mark water level in tube on water heater jacket.
7. Remove $(W_P - W_t)/6 \pm 0.5$ lbm of water for each successive thermocouple. After each draw, allow the water level in the tube to stabilize.
8. Mark water level in tube on water heater jacket.
9. Measure and record all 6 thermocouple locations.

10. Using thermocouple placements determined in 6 through 9, and taking into account placement of the thermocouple tree fitting, set thermocouples in tree within $\pm 1/16$ " of the measured thermocouple positions.

For witness testing, either before or after the test, inspect the thermocouple probe to confirm that the thermocouple probe is constructed and installed correctly.

Note: RTDs may be used in lieu of thermocouples so as long as accuracy requirements are met.

3. Connect the IWH to the set-up required for the continuous draw test described in Section 7.3 of the Applicable Rating Standard. An example of the test set-up is located in Figure 1. All inlet and outlet water connections shall be piped with heat traps as shown in Figure 1. The heat traps shall have a minimum 6" lateral run at the top and run a minimum 6" down away from the indirect water heater. The heat traps shall be as close as practical to the indirect water heater and oriented vertically. All water piping shall be insulated for the first 4' starting from the connection to the indirect water heater. Install the relief valve in the location specified by the manufacturer's instructions. Any piping between the indirect water heater and a relief valve shall be insulated; however, the relief valve shall not be insulated. Any discharge piping and fittings attached to the relief valve during testing shall be non-metallic. Install inlet and outlet potable and heat source thermocouples in accordance with Section 5.4 or 5.5 of the Applicable Rating Standard, as appropriate. Install a shut-off valve on the heat source outlet (see Figure 1).
4. Ambient room temperature shall be $75^{\circ}\text{F} \pm 10^{\circ}\text{F}$ during the conduct of the Continuous and First Draw tests.



5. Fill both the heat source and potable water sides of the system. Make sure that both side of the system are completely purged of air (if you hear “flow noises”, they are not). Refer to the installation manual supplied with the IWH for any special filling and purging requirements.
6. Set conditions for the Continuous Draw test. Set potable inlet water temperature to $58^{\circ}\text{F} \pm 2^{\circ}\text{F}$ with a potable outlet water temperature that is $77^{\circ}\text{F} \pm 2.5^{\circ}\text{F}$ above the potable inlet water temperature. Set the heat source inlet water temperature to $180^{\circ}\text{F} \pm 2.5^{\circ}\text{F}$ at the rated flow ± 0.25 gpm.
7. Once all conditions have been met, perform an equilibrium test to ensure that the IWH is at steady state conditions (Note: this equilibrium test is not described in the standard, but is an AHRI requirement). Record the following data at 5 minute intervals:
 - a. Time
 - b. Potable Water Inlet Temperature, T_i
 - c. Potable Water Outlet Temperature, T_o
 - d. Entering Heat Source Water Temperature, T_{ih}
 - e. Exiting Heat Source Water Temperature, T_{oh}
 - f. Heat Source Water Flow Rate, w_h
 - g. Room Temperature, T_a
8. The equilibrium test must be at least 30 minutes long and the conditions described in 4 above must be maintained over the entire course of the test. Use the last set of readings of the equilibrium

test as the first set of readings for the Continuous draw test. Record the potable water temperature rise ($T_{oh} - T_{ih}$) for this last set of readings.

9. Record an additional 6 sets of readings at 5 minute intervals. During the Continuous draw test, the potable water temperature rise must not deviate by more than ± 1.5 °F from the initial potable water rise recorded in (7). If it does, abort the test and go back to (5). The Continuous draw test data consists of the last seven sets of recorded readings.
10. The First Draw Test (per Section 7.4 of the *Applicable Rating Standard*) is performed following the completion of the Continuous Draw Test. Once the Continuous Draw test is completed, stop the flow of heat source water (close the heat source shut-off valve shown in Figure 1) and let the potable water flow continue until an average tank temperature (T_s) of 70°F or lower is reached. Stop the potable water flow using a shutoff valve downstream of the tank (DO NOT TOUCH THE THROTTLING VALVE THAT WAS USED TO ESTABLISH THE POTABLE WATER FLOW DURING THE CONDUCT OF THE CONTINUOUS DRAW TEST) and restart the heat source water flow at the same flow rate used during the conduct of the Continuous Draw test. Stop the flow of heat source water when the value of the mean tank temperature, T_s , approaches the temperature shown in 7.4.1 or 7.4.2 of the *Applicable Rating Standard* as appropriate (135°F for Storage type, 175°F for Instantaneous type). Continually monitor the mean tank temperature (T_s) and record the maximum value of T_s after the flow of heat source water is interrupted. If the maximum value of T_s is within the limits shown in the appropriate section of 7.4 of the *Applicable Rating Standard* (135°F to 140°F for Storage type, 175°F to 180°F for Instantaneous), proceed with the draw portion of this test. If the maximum value of T_s is outside of this range, reduce the mean tank temperature to less than 70°F in accordance with Section 7.4 of the *Applicable Rating Standard*. When the peak mean temperature requirement is obtained, record the start weight of the weigh tank or the initial reading of the volumetric water meter. Record the mean tank temperature, T_s , every 5 minutes until three consecutive readings of T_s are recorded between within the limits shown in Section 7.4. (The temperature trend for, T_s , is to be even or decreasing.) Initiate the potable water flow, at the same flow rate obtained during the Continuous Draw Test (Section 7.3 of the *Applicable Rating Standard*). Indirect Water Heaters that are tested with a mixing valve shall use the same mixing setting that was used to determine the potable water flow rate under Section 7.3.2 of the *Applicable Rating Standard*. Record the maximum heated potable water outlet temperature, $T_o(\max)$. Monitor T_o and T_i on a continuous basis and continue the draw until T_o reaches $T_o(\max)$ minus 25°F ± 0.5 °F, at which time the draw is terminated. Measure the total weight of water drawn, W_d , pounds, or record the total potable water volume, V_d , gallons, drawn during the test. Record all First Draw Test data required by the *Applicable Rating Standard*. During the draw, maintain T_i so that it is 58° \pm 10°F 5 seconds after the draw has commenced and 58° \pm 2°F 15 seconds after the draw has commenced.
11. The Standby test shall be conducted in an area that is free of drafts and is maintained at a uniform ambient temperature of 70°F \pm 5°F. If not already present, install an isolation valve immediately downstream of the potable water outlet thermocouple. Unless the manufacturer specifies a soak

period as specified by Section 7.0 of the Applicable Rating Standard, start with a tank of cold supply water (mean tank temperature ≤ 70 F). Initiate the flow of heat source water through the heat exchanger. Stop the flow of heat source water when the value of the mean tank temperature, T_s , exceeds that prescribed by Section 7.2.1 or 7.2.2 of the Applicable Rating Standard as appropriate. Stop the heating process and close the two isolation valves described above. Monitor the mean tank temperature, T_s , and start recording Mean Tank (T_s) and Ambient (T_a) Temperatures at 15 minute intervals when the mean tank temperature is in the range called for in Section 7.2.1 or 7.2.2.1 of the Applicable Rating Standard (138°-137 F Storage Type, 183°-182°F for Instantaneous Type). Continue recording T_s and T_a at 15 minute intervals until the last value for T_s recorded is below that called for in Section 7.2.1 or 7.2.2 of the Applicable Rating Standard ((133°F Storage Type, 178°F for Instantaneous Type). During the conduct of the Standby Loss Test, Do NOT disturb the tank (moving the tank will mix the water and cause the decay rate to change). Record all data required by the Standard.

12. Perform the Heat Source Friction Loss Test as described in the Supplement Method to Determine Performance of Indirect-Fired Water Heaters (March 2004). Verify that the straight piping described in Section 6.1.2.2 of the Applicable Rating Standard (in which the gauge is connected) is free of burrs, corrosion, or excess pipe joint compound. Fill the system with cold water (58-80°F) and purge it of all air (do not proceed with the test if you hear any flow noises). Apply enough pressure to the system that a positive pressure reading will be obtained at both the heat source inlet and outlet connections. Adjust the flow rate to obtain the heat source flow rate (V_h) \pm 0.25 GPM. Record the following data as required by the Standard:
 - a. Heat source flow rate (W_{hf})
 - b. Heat Source Inlet Pressure with flow (P_{iht})
 - c. Heat Source Outlet Pressure with flow (P_{oht})
 - d. Heat Source Inlet Pressure without flow (P_{ihs}) (if using 2-gauge method)
 - e. Heat Source Outlet Pressure without flow (P_{ohs}) (if using 2-gauge method)
 - f. Length of straight pipe between gauge connection and heat source inlet connection (L_{in})
 - g. Length of straight pipe between gauge connection and heat source outlet connection (L_{out})