

# OPERATIONS MANUAL

## COMMERCIAL BOILERS CERTIFICATION PROGRAM

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**AHRI CBLR OM – DECEMBER 2021**

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Sponsored and administered by:



## **PREFACE**

The following manual outlines the procedures and policies of the Performance Certification Program for Commercial Boilers (CBLR) 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](http://www.ahrinet.org).

The CBLR Certification Program by AHRI provides for independent verification of the Commercial Boilers 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 CBLR 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 this Operations Manual may be amended as provided in the Certification Agreement.

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

### Note:

This manual supersedes the Commercial Boiler Operations Manual, December 2019.

**CERTIFICATION OPERATIONS MANUAL FOR**

**COMMERCIAL BOILERS**

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## 1. Program Overview

1.1 Applicable Rating Standard. It is mandatory for program Participants to comply with the applicable Standard:

- Department of Energy (DOE) commercial packaged boiler test procedures as published in the latest edition of the Code of Federal Regulations, 10 CFR Part 431, Subpart E, Appendix A.

A copy of the CFR is available for download from the U.S. Government Printing Office website, GPO Access, at <http://www.gpo.gov/fdsys/>.

1.2. Product Definition.

1.2.1 Heating Boiler. A heat exchanger designed with and for fuel-burning devices and other equipment to:

- Burn fossil fuels; and
- Transfer the released heat to water (in water Heating Boilers) or to water and steam (in steam Heating Boilers), shall conform to the safety and material requirements of the current ASME Boiler and Pressure Vessel Code, Section IV: Rules for Construction of Heating Boilers, or have an approved ASME code case.

1.2.2 Custom Boiler. A boiler that is built for a site-specific application and is neither listed in a catalog nor electronically.

1.2.3 Model Series. All boiler models that have a consistent geometry, design and construction. A basic model group, as defined in Section 1.5, may consist of part or all of a Model Series.

1.3 Program Scope. This program applies to gas and oil-fired steam and hot water Heating Boilers as defined in Section 1.2 with inputs ranging from 300 MBH to 2500 MBH.

1.3.1 Program Scope Exclusions. Custom Boilers as defined in Section 1.2.2 are excluded from the program scope.

1.3.2 Program Scope Inclusion. Boiler models within a Model Series, or individual boiler models, having inputs over 2500 MBH may be included in the program at the Participant's option. All general advertising and promotional literature containing certified and excluded models shall clearly claim certification only for certified models.

1.4 Intended Market. The Intended Market for this certification program, where the Standard applies, includes all products that are 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). Each 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.

1.6 Types of Tests and Associated Policies. Within the program, tests may be conducted under the following procedures:

1.6.1 Thermal Efficiency Test. Required as described in Section 3.10. The test shall yield a complete accounting of the energy input in terms of output and losses.

1.6.2 Combustion Efficiency Test. Required as described in Section 3.10. This test shall yield an account of energy input in terms of products of combustion only.

1.6.3 Additional Input Rates. Participants opting for certified ratings at alternate inputs may do so only after the completion of a test at 100% ± 2% of the minimum input provided for by the controls. Alternate input AHRI Ratings reported under the program shall be limited to input, Thermal Efficiency, Combustion Efficiency, Gross Output, and Net AHRI Ratings. All alternate input ratings shall be measured under the same tolerances and water temperatures as required under maximum input testing.

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

- New Participants shall certify all their BMGs encompassed by the program scope within three (3) years from the date they are accepted into the certification program.

## **2. Qualification Process**

2.1 Original Equipment Manufacturer (OEM). 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, the 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:

- Test reports, data, and calculations for each BMG (refer to Section 3.2);
- If the Applicant chooses to conduct witness testing at its AHRI Approved Test Stand within a Facility (Facility), all required forms per Section 3.5.1 of this manual for Witness Testing Facility Approval shall also be submitted; and
- An Applicant requesting AHRI to submit data to CEC and DOE shall submit third-party authorization, compliance forms and other necessary information.

All forms can be obtained through AHRI.

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 (1) model from each BMG shall be selected for qualification testing.

STEP 2.1.3.2 Acquisition of Qualification Test Samples/Selection Criteria. Upon notification from AHRI, the Applicant will have 30 calendar days to deliver the selected model to the Laboratory or the AHRI-approved facility where qualification testing will occur. It is acceptable for the Applicant 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 Independent Third-Party Laboratory contracted by AHRI (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 shall 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.

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, the Applicant shall submit forms for each model being submitted into the program prior to being eligible to have the manufacturer name and models listed in the AHRI Directory of Certified Product Performance (Directory). The Applicant then proceeds to STEP 2.1.5.

STEP 2.1.4.2 Qualification Test Failure. In the event that the qualification test results show a combustion and/or thermal efficiency less than 98.0% of the claimed rating, the submitted ratings shall be rejected. The Applicant or Participant must restart the qualification process for that BMG.

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 witness test facility inspection or initial 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 is 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 all of the Participant's BMGs listed in the Directory shall be tested, with a minimum of one (1) test. Fractional test obligations shall be rounded down to the nearest whole number. All BMGs listed in the Directory shall be tested in a five (5) year period.

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. When a previously certified BMG manufactured by one Participant is to be manufactured and marketed by a second Participant, no qualification test is required unless the

second Participant is also making design changes that could affect ratings. In such cases, the qualification procedure shall be determined in accordance with Section 3.3.

The Participant shall submit pertinent documentation for the BMG covering all sizes, fuels, and burners for which approval is desired (refer to Section 2.1 STEP 1). Such documentation shall be prepared in accordance with the following procedure:

3.2.1 Generation of Ratings. The Participant shall generate ratings for all models in the BMG in accordance with the applicable Standard and the following requirements (refer to Section 3.10):

3.2.1.1 Thermal Efficiency Tests. Thermal Efficiency tests shall be conducted at  $100\% \pm 2\%$  of the rated input using one (1) of the following methods:

- a. Tests shall be conducted on at least the smallest and largest model in the BMG to be catalogued, where a consistent geometry exists throughout the BMG or Model Series. A larger model in the Model Series may be substituted for the largest model in the BMG. Tests on intermediate sizes may be required to determine the effect on performance when changes in design occur.
- b. Where individual models in a BMG consist of multiple combustion systems under one (1) jacket, at least the smallest and largest combustion system shall be tested. The efficiency may then be calculated using the weighted average of the efficiencies for each combustion system when used in multiples.
- c. Where it is desired to have more than one (1) input per assembly, Thermal Efficiency tests shall be conducted at the lowest and highest input for at least the smallest and largest assemblies.

3.2.1.2 Combustion Efficiency Tests. Combustion efficiency tests shall be conducted at  $100\% \pm 2\%$  of the rated input using one of the following methods:

- a. Tests shall be conducted on at least the smallest and largest model in the BMG to be catalogued, where a consistent geometry exists throughout the BMG or Model Series. A larger model in the Model Series may be substituted for the largest model in the BMG. Tests on intermediate sizes may be required to determine the effect on performance when changes in design occur.
- b. Where individual models in a BMG consist of multiple combustion systems under one (1) jacket, at least the smallest and largest combustion system shall be tested. The efficiency may then be calculated using the weighted average of the efficiencies for each combustion system when used in multiples.
- c. Combustion efficiency tests may be used to approve of the same Gross Output for the following:
  - o Modifications of the basic boiler design
  - o Alternate oil or gas power burners fired with the same fuel. The testing shall be conducted on the largest size boiler that the burner is to be applied.

3.2.1.3 Alternate Burners. Power gas burners and gas/oil combination burners may be approved as an alternate burner to the specified oil burner. The Participant has the option of taking a standard 3% re-rated gas performance or conducting a combustion efficiency test at  $100\% \pm 2\%$  of the rated input on the largest size assembly of the BMG. A larger model in the Model Series may be substituted for the largest model in the BMG. The gas ratings shall be based on either the 3%

re-rating or on the combustion efficiency test results, assuming the same radiation and unaccounted for losses that were recorded during the oil test. Ratings may be catalogued in one of the following ways:

- a. The gas input can be adjusted so the same Gross Output is shown for gas and oil.

$$\text{Gas input} = \frac{\text{Oil Input}}{0.97} = \frac{\text{Oil Input (Oil Combustion Eff.)}}{\text{Gas Combustion Eff.}}$$

- b. The gas Gross Output can be adjusted so the same input is shown.

$$\text{Gas Gross Output} = 0.97(\text{Oil Gross Output}) = \frac{\text{Gas Combustion Eff.}(\text{Oil Gross Output})}{\text{Oil Combustion Eff.}}$$

- c. The oil Gross Output can be re-rated to be the same as the gas Gross Output so the same inputs and outputs can be shown.

The oil portion of combination gas/oil burners shall also be tested and shall meet the requirements of Section 3.2.1.2.c.

3.2.1.4 Forced versus Natural Draft Burners. The thermal efficiency test of a BMG catalogued for forced draft burners shall not be used in applying for approval of ratings for the BMG catalogued for natural draft burners. A thermal efficiency test shall be conducted on the natural draft assembly.

3.2.1.5 Basis of Ratings. Boiler Ratings shall meet the following conditions:

- a. For boilers where the air/fuel ratio is field-adjustable independently of input, the CO<sub>2</sub> content of the flue gas shall be specified by the manufacturer and shall be the same as the value (to be) shown in the Directory, with a tolerance of ± 0.10%.
- b. For oil or power gas burner units with natural or induced draft, the draft in the firebox shall be specified by the manufacturer and shall be the same as the value (to be) shown in the Directory. On forced draft or pressure-fired boilers, the pressure at the vent connection shall be specified by the manufacturer and shall be the same as the value (to be) shown in the Directory. Since outdoor boilers have integral venting means, no draft need be specified.

3.2.1.6 Outdoor Boilers. Ratings for outdoor boilers may be based on test data from indoor boilers when the required test conditions in the applicable Standard are met and differences between the indoor and outdoor boilers do not affect combustion. Outdoor boiler thermal efficiency and outdoor boiler gross output must be calculated according to the applicable Standard.

The outdoor boiler efficiency rating and gross output shall not be higher than the indoor boiler efficiency rating and gross output.

3.2.2 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.

3.2.2.1 Ratings Generated by Manufacturer. Where ratings are based on testing performed by the manufacturer, the manufacturer shall submit all raw test data and calculations used to generate the ratings. This shall include:

- Completed Sample Test Report Forms in AHRI 1500, Appendix F (i.e. Log Sheet and Report Sheet) for each model tested. The manufacturer may submit the data required on these forms in a different format acceptable to AHRI.
- Any additional data or calculations (such as interpolations) needed to support the submitted ratings.

3.2.2.2 Ratings Generated by Accredited Certification Agency. Where ratings are based on testing performed, or witnessed, by an ISO 17025-2017 accredited certification agency, a report from the agency shall be acceptable in lieu of the data and calculations required by Section 3.2.2.1. This report shall include ratings for all models for which testing is required under Section 3.2.1 and shall include a statement that these ratings have been generated in accordance with the Applicable Rating Standard specified by Section 1.1 or Section 3.2.2.3. If the manufacturer performs interpolations, or other calculations, to generate ratings for models not included in this report, such calculations shall also be submitted.

3.2.3 Qualification Testing. AHRI shall supply the Laboratory with the Program Ratings as submitted by the manufacturer, as well as other data to verify the model as the one selected by AHRI. One (1) qualification test shall be performed on each new BMG. The Laboratory shall conduct the testing, or witness the testing, of the unit(s) at a Facility, in accordance with the applicable Standard.

3.2.3.1 Threshold for Acceptance of Submitted Ratings. In the event that the qualification test results show combustion and/or thermal efficiencies greater than or equal to 98.0% of the claimed ratings, the submitted ratings shall be accepted as is.

3.2.3.2 Failure Options. In the event that the qualification test results show a combustion and/or thermal efficiency less than 98.0% of the claimed rating, the submitted ratings shall be rejected. The Applicant/Participant shall then have the options outlined in Section 2 STEP 2.1.4.

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, the changed BMG shall undergo qualification testing.

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 shall 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.

AHRI reserves the right to make unannounced physical inspections at the Participant's facility to determine if products have been changed and to verify Participant compliance with procedures for notifying AHRI of changed BMGs.

3.3.3.1 Increased Product Ratings. If the Participant notifies AHRI that the product ratings will increase, 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.

3.3.3.2 Decreased Product Ratings. In the Participant notifies AHRI that the product ratings will decrease, the Participant may be required, at the discretion of AHRI, to complete the qualification procedure as prescribed in Section 3.2.

3.3.3.3 Unchanged Product Ratings. If 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.

3.3.3.4 Optional BMG Inclusions. For BMGs included in the program at the Participant's option (refer to Section 1.3.2), if qualification testing is required and the Participant is unable to test the unit, the BMG shall be removed from the Directory and all claims to AHRI certification shall cease for that BMG.

3.4 Location of Test. Testing shall be performed at the Laboratory or a Facility and the sample shall be installed in the test 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 Facility shall be approved by AHRI prior to any testing 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, shall be conducted or witnessed by the Laboratory's Representative (Representative).

3.5 Witness Testing Procedures and Operations. This Certification Program allows for witness testing, where Participant personnel witnessed by a Representative conducts testing at a Facility selected by the Participant. Witness testing requirements are covered in the AHRI General Operations Manual, Section 9.9 and as specified below.

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

- Form CBLR-WT1, Application for Witness Testing;
- Form CBLR-WT2, Calibration Report;
- 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 can be obtained on the AHRI website ([www.ahrinet.org](http://www.ahrinet.org)).

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 Facility to meet the applicable Standard.

3.5.2 Inspection of Witness Test Facility. Following preliminary test facility approval based on submitted data, the Representative shall inspect the test 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. A boiler shall be running in the facility for the inspection to be completed. The Representative shall confirm the submitted data on form CBLR-WT1 and CBLR-WT2.

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 shall be resolved and the corrective actions submitted to AHRI before approval may be granted to proceed with testing.

3.5.2.2 Final Approval of Witness Test Facility. Upon acceptable results of the inspection, AHRI shall notify the Participant, in writing, of final acceptance and approval to proceed with testing. AHRI shall provide the Participant with a certificate of approval.

Scheduled Witness Test Facility Re-approval. The facility shall remain approved for no more than two (2) years, after which time re-approval shall be required. The Participant shall provide all the items listed in Section 3.5.1. The Representative shall inspect the test facility to verify compliance (Section 3.5.2). Upon re-approval by AHRI, the Participant shall receive a new certificate of approval to be displayed in the AHRI approved test facility.

3.5.3 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 3.5.1 and inspection outlined in Section 3.5.2.

3.5.4 Witness Testing Operations at the AHRI Approved Facility.

3.5.4.1 Advance Setup of Sample in the AHRI Approved Test Facility. Participant may setup 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 setup in the Facility in accordance with the Participant's installation instructions and referenced method of test.

3.5.4.2 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 testing, unless specifically requested by the Representative responsible for testing.

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

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

3.5.4.4 Sample Start-Up and Operation. Start-up and operation of the unit shall be in accordance with the Participant's installation and operations instructions accompanied by the unit in printed or electronic format.

3.5.4.5 Verification of Test Sample. Upon completion of testing, the Representative may photograph any and all components of the tested sample and associated test equipment. The Representative shall notify AHRI immediately if the tested sample is suspected to not match construction of the model selected.

3.6 Selection of Test Samples. Selections will be made based on data contained in the Directory.

3.6.1 Selection Provisions.

- All BMGs listed in the Directory shall be tested within a five (5) year period; if at the end of the fourth year a BMG has not been tested, the Participant shall be notified that a sample from the untested BMG shall be produced and tested in the following year's production schedule. If the sample is not made available within the five (5) year period, the BMG shall be made Discontinued in the Directory, and all claims to AHRI certification shall cease for that BMG.
  - *Exception:* For BMGs included in the program at the Participant's option (as referenced in 1.3.1) that are not available within the five (5) year period, the BMG shall be removed from the Directory, and all claims to AHRI certification shall cease for that BMG.

3.7 Methods for Acquiring Test Samples. Upon notification of selection by AHRI, the selected samples shall be made available accompanied by the Participant's published installation instructions in printed or electronic format. If a sample is not available, the Participant shall work with AHRI to provide access for testing on next production. Refer to Section 9 of the AHRI General Operations Manual.

3.8 Testing Punch List. The Participant shall complete and provide a Punch List (refer to the AHRI website) in electronic format to the Laboratory prior to sample arrival at the Laboratory. Punch lists shall not be required for witness testing. The Participant may choose to furnish a single Punch List for multiple tests.

The Punch List shall not contradict the installation and operations manual provided by the Participant. If there is a discrepancy between notes written on the Punch List, Installation and Operations Manual, product specific operations manual, Standard, and/or the Directory, AHRI shall determine which document takes precedence.

3.9 Sample Acquisition Timeframe. AHRI shall work with the Participant to make the selected unit(s) available for testing at the Laboratory or designated Facility on a date acceptable to AHRI. Upon notification of selection by AHRI, the Participant shall have 90 calendar days to deliver the units to the Laboratory or conduct witness testing at the

Facility. Prior to test, AHRI shall supply the Laboratory with the Published Ratings. The Participant is responsible for supplying all proprietary components and components normally shipped with the boiler at the same time the sample is made available at the Laboratory or designated Facility.

3.10 Certified Data. At conditions specified in the applicable Standard, the following certified ratings are verified by test:

<b>Table 1: Certified Ratings</b>		
	Thermal Efficiency (E <sub>T</sub> ), %	Combustion Efficiency (E <sub>c</sub> ), %
Water boilers up to 2500 MBH	Required	Optional
Water boilers above 2500 MBH	Optional	Required
Steam Boilers	Required	Optional

3.11 Determination of Input, Gross Output, and Net AHRI Ratings for Commercial Boilers.

3.11.1 Input and Gross Output, Tested Sizes.

3.11.1.1 Input and Gross Output Relationship. The relationship between Input and Gross Output shall be determined by the required efficiency test conducted as specified in Section 3.10. Input and Gross Output may be lower but shall be based on the relationship described in this Section except as provided for in Section 3.2.1.3.

3.11.1.2 Rounding. Input for oil boilers shall be based on 140,000 Btu per gallon for Number 2 fuel oil and 150,000 Btu per gallon for Number 4 or 6 fuel oil and shall be rounded out according to the following schedule:

<b>Table 2: Oil Boiler Rounding Schedule</b>	
Range	Rounding Precision
< 5.00 gph	0.05 gph
≥ 5.0 and < 10.0 gph	0.1 gph
≥ 10.0 and < 20.0 gph	0.2 gph
≥ 20.0 and < 50.0 gph	0.5 gph
≥ 50 gph	1 gph

Input for gas boilers shall be rounded to the nearest MBH.

Gross Output shall be rounded out to the nearest MBH.

3.11.2 Input and Gross Output, Untested Sizes and Heating Mediums.

3.11.2.1 Oil and Gas. Where a consistent geometry exists, as specified in Section 3.2.1, the calculated Inputs and Gross Outputs for untested sizes shall be not greater than those determined by linear interpolation between maximum permissible exact Input and Gross Output values for tested sizes (before rounding out). Where multiple combustion systems are utilized as specified in Section 3.2.1.3, the calculated Inputs and Gross Outputs for untested sizes shall be not greater than the weighted average of the individual combustion systems. Inputs shall then be rounded out according to the schedule shown in Table 2. Interpolation between combustion and thermal efficiency is not permissible.

3.11.2.2 Extending Steam Ratings to Water. Obtaining AHRI Ratings using water as the heating medium may not always be practical on larger boilers. Participants may extend equivalent ratings measured via tests using steam as the heating medium to water in lieu of performing this testing.

3.11.3 Determination of Net AHRI Rating. Net AHRI Ratings are determined by dividing the Gross Output by the piping and pickup factor listed in Table 3 and rounding out to the nearest MBH. Net AHRI Rating, Steam (sq.ft) shall be determined by dividing the rounded Net AHRI Rating, Steam (MBH) by 0.240 square feet of steam per MBH. It may be catalogued to the nearest square foot (sq ft) or the nearest five (5) sq ft.

<b>Table 3. Piping and Pickup Factors</b>		
<b>Gross Output, MBH</b>	<b>Steam Factor</b>	<b>Water Factor</b>
≤ 1255	1.333	1.15
> 1255 and ≤ 1839	$1.5462 - [(2.353 \cdot 10^{-4}) \cdot \text{Gross Output}] + [(5.2086 \cdot 10^{-8}) \cdot (\text{Gross Output})^2]$	1.15
≥ 1840 and ≤ 1939	$1.3268 - [(2 \cdot 10^{-5}) \cdot \text{Gross Output}]$	1.15
≥ 1940	1.288	1.15
NOTE: Round calculated steam factors to three decimal places. Gross output used in Table 3 to be in MBH.		

3.12 Test Data. The Representative shall collect and submit the following data, for each boiler tested, to AHRI at the conclusion of testing:

- Data for Each Boiler Tested - Thermal Efficiency Test
  - Report Sheet, in AHRI 1500, Appendix F, showing test results for all tests required.
  - Log Sheets, in AHRI 1500, Appendix F, for all tests shown in the Report Sheet.
- Data for Each Boiler Tested - Combustion Efficiency Test
  - Report Sheet, in AHRI 1500, Appendix F, showing test results
  - Log Sheet, in AHRI 1500, Appendix F, for all tests.
- Additional Data Required
  - In the case of all boiler-burner units for which approval with an alternate oil burner, gas/oil combination burner, or power gas burner is desired, the following is required.
    - Oil burner, gas/oil combination burner, or power gas burner data including the following: name, model, manufacturer, type, certified capacity range, certified file number, and a schedule of burners used with each boiler size in the BMG to validate Form 710.
    - Report Sheet, in AHRI 1500, Appendix F, showing the results of a combustion test on the largest unit of the BMG on which the burner is to be used. This is optional for gas burners (refer to Section 3.2.1.3).
    - Burner data as required in the first bullet under "Additional Data Required" above.

A copy of the log sheet(s) should be left with the Participant.

3.13 Testing Threshold. Annual testing for Thermal Efficiency and/or Combustion Efficiency shall meet or exceed 95.0% of the published rating.

3.14 Test Failures.

3.14.1 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 in the BMG proportionate to the failed test's results. The failed model shall be re-rated to the nearest 0.1% for combustion and/or Thermal Efficiency 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 unit failed. Where applicable, outputs shall be recalculated using the re-rated efficiency;
- Test second sample of the same model (sample shall be available within 90 calendar days following notification of failure); or
- Obsolete all models in the BMG.



3.14.2 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 (1) of the following options:

- Re-rate all models in the BMG proportionate to the failed test's results. The failed model shall be re-rated to the nearest 0.1% for combustion and/or thermal efficiency 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 unit failed. Where applicable, outputs shall be recalculated using the re-rated efficiency; or
- Obsolete all models in the BMG

#### 4. Challenge Tests

All inquiries except Challenge Test Procedure as described in Section 4.1 shall refer to Section 10 of the AHRI General Operations Manual.

4.1 Challenge Test Procedure. AHRI shall review selection and testing records to determine the status of the challenged model in question with respect to the Program. If the model has been tested recently, AHRI shall review the results, and then contact the challenger to inquire whether or not it wishes to proceed. If the model is in the process of being tested, the challenger shall be informed that the challenge cannot be accepted because the rating of the model is under review. If the model is scheduled for testing, AHRI shall contact the challenger and inquire whether or not they wish to proceed or withdraw in deference to the random testing of the model. In either case, the challenger shall be subsequently notified of the outcome.

4.2 Cost of Test. AHRI reserves the right to require an advanced deposit of test funds from either or both parties. If an advanced deposit of the test funds is requested from the challenger and the challenger fails to make such deposit, AHRI shall have no obligation to conduct testing in accordance with Section 4.1 or otherwise respond to the challenger.

The cost of all fees (e.g. selection, sample, sample shipment and disposition, witness testing facility approval (if applicable), testing materials and testing) associated with the challenge test shall be borne by one of the two parties concerned. If the final outcome of the challenge test is a "pass," the challenging party is responsible for all costs. If the final outcome of the challenge test is a "fail," the challenged party is responsible for all costs.

4.3 Refusal to Allow Challenge Testing. If the challenged party refuses to provide the sample or otherwise precludes confirmation testing in accordance with Section 4.1 or fails to provide an advanced deposit of test funds, which may be required under Section 4.2, AHRI shall notify the manufacturer that the Ratings of the BMG are withdrawn and shall be Discontinued by the challenged party.

#### 5. AHRI Directory of Certified Product Performance

5.1 Publication of Ratings in Certified Directory. For each certified model, the AHRI Directory of Commercial Boiler Equipment lists:

- AHRI Reference Number;
- Model Status;
- Trade or Brand Name of Model;
- Model Number(s) or Designation(s);
- Primary Heat Exchanger Material;
- Location (Indoor or Outdoor);
- Fuel Type;
- Heating Medium;
- Ignition Type;
- Control Tlye;
- Condensing (Yes or No);
- Input Rating, MBH and/or gph;
- Gross Output, MBH;
- Combustion Efficiency ( $E_c$ ), % (where applicable);
- Thermal Efficiency ( $E_T$ ), % (where applicable);

- Net AHRI Rating, Steam (sq ft) and Net AHRI Rating, Steam (MBH) or Net AHRI Rating, Water (MBH);
- CO<sub>2</sub> that is the basis for rating (where air/fuel ratio is field-adjustable independent of input); and
- Draft or vent pressure that is the basis for rating (Oil and Power-Gas burner only);
- Draft Type;
- Where the Models are Sold;
- Rerate Status.

Note that only Thermal Efficiency and Combustion Efficiency are certified ratings. All other ratings are considered non-certified program ratings.

5.2 Publication of Directory. AHRI shall maintain a Directory of certified models on its website. As new BMGs are added, deleted, or revised, the Directory shall be updated.

The Directory can be viewed from the AHRI website, [www.ahridirectory.org](http://www.ahridirectory.org).

## **6. Assessment and Payment of Certification Fees**

Refer to Section 12 of the AHRI GOM.

## **7. Issuance of Violations and/or Termination**

Refer to Section 14 of the AHRI GOM.

## **8. Program Hierarchy, Complaints, and the Appeals Process**

Refer to Section 15 of the AHRI GOM

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

Refer to Section 8 of the AHRI General Operations Manual.

## **10. Minimum Data Requirements for Certified and Non-Certified Program Ratings**

10.1. Definition of Program Ratings. All efficiency and performance measures that are certified (Thermal Efficiency and Combustion Efficiency) and non-certified (e.g. Net AHRI Ratings) in accordance with the Applicable Rating Standard and this operations manual.

10.2 Publication of Non-Certified Ratings. A Participant's printed or online material may contain non-certified ratings (e.g. Net AHRI Ratings). The literature shall clearly distinguish between certified and non-certified ratings.

10.3 Minimum Data Requirements for Publication in Literature. The minimum data requirements listed in this section shall be published in all literature in which Program Ratings are shown or which contain statements or representations, expressed or implied, to the effect that ratings have been determined as prescribed in this operations manual (including, without limitation, any catalogs, installation instructions, bulletins, circulars, advertisements, price sheets, or other items that contain Program Ratings, or such statements or representations). However, literature may contain statements or representations that ratings have been determined as prescribed in this operations manual or indicate that boilers have Program Ratings without including the minimum data listed below if such literature does not contain the actual ratings and makes a specific reference to, and positive identification of, other literature that is customarily distributed with, and usually accompanies, the literature in question and contains all the required minimum data, including the actual approved ratings.

10.3.1 Oil-Fired Boiler.

- Model Number;
- Gross Output;
- Net AHRI Rating;
  - Steam boiler - in square feet and MBH steam;
  - Steam and water boilers - in square feet and MBH steam, and MBH water;
  - Water boiler - in MBH water;
- Input in gallons per hour and heat value of fuel on which it is based;
- AHRI Certification Mark

10.3.2 Gas-Fired Boiler.


- Model Number;
- Gross Output;
- Input in MBH;
- Net AHRI Rating;
  - Steam boiler - in square feet and MBH steam;
  - Steam and water boilers - in square feet and MBH steam, and MBH water;
  - Water boiler - MBH water;
- AHRI Certification Mark

10.3.3. Net AHRI Ratings. All product literature in which Net AHRI Ratings are shown shall include statements covering the following points:

- a) The Net AHRI Steam Ratings shown are based on a piping and pickup allowance of 1.333. If the applicable factor in Table 3 for the boilers being catalogued differs from 1.333, substitute such applicable factor.
- b) The Net AHRI Water Ratings shown are based on an allowance of 1.15.
- c) The manufacturer should be consulted before selecting a boiler for installations having unusual piping and pickup requirements, such as intermittent system operation, extensive piping systems, etc.
- d) If the ratings have been determined under the provisions governing forced draft boiler-burner units, a statement shall be included to this effect.
- e) Literature shall be identified by a form number or some other means, including the date of printing or issuance.
- f) If literature contains some ratings that are not Net AHRI Ratings, the AHRI Mark shall be positioned in such a way as to make clear which are Net AHRI Ratings.
- g) Literature in which Net AHRI Water Ratings are shown may include the following statement:  
*“For forced hot water heating systems where the boiler and all the piping are within the area to be heated, the boiler may be selected on the basis of its Gross Output.”*
- h) Literature in which Net AHRI Ratings are shown shall not contain any references to a specific adjustment of the Net AHRI Rating due to changes in piping and pickup loads except that listed in part g above, nor shall such literature contain a listing of any other Net AHRI Ratings.


10.3.4 Display of Minimum Data. Minimum data shall appear on an individual page of manufacturer literature and may include product pictures, dimensional drawings or shipment information. AHRI Ratings and other minimum data shall be placed into a table meeting the specified format found in the examples below.

**Example 1: Commercial Gas Boilers Tested at Alternate Inputs with Steam and Water Ratings\***

Brand X Commercial Gas Series 							
Model Number	Input, MBH	Gross Output, MBH	Net AHRI Ratings			Thermal Efficiency, %	Combustion Efficiency, %
			Steam sq ft	Steam, MBH	Water, MBH		
BX-G1	350	284	885	212	247	81.2	83.2
BX-G2	650	523	1634	392	454	80.4	83.0
	325	263	820	197	229	80.9	82.0
BX-G3	162.5	132	413	99	115	81.4	83.4
	850	692	2164	519	602	81.4	83.4
	212.5	174	543	130	151	81.9	84.5

\* Shown with optional Thermal and Combustion Efficiencies.

**Example 2: Residential and Commercial Gas Modulating Boilers of a Single Series Tested at Alternate Inputs Sharing a Common Table\***

Brand X Gas Series 							
Model Number	Input, MBH		Output, MBH	Net AHRI Rating Water, MBH	AFUE, %	Thermal Efficiency, %	Combustion Efficiency, %
	Min	Max					
BX-G1	30	120	111	97	92.4	–	–
BX-G2	52.5	210	193	168	91.9	–	–
BX-G3	73	290	264	230	91.2	–	–
BX-GC4	92.5	370	342	297	–	92.4	95.1
	185		172	150	–	93.1	95.2
	92.5		87	76	–	94.3	95.0
BX-GC5	112.5	450	410	357	–	91.1	92.5
	112.5		106	92	–	94.1	94.6

\* Shown with optional Thermal and Combustion Efficiencies.  
 \* When both residential and commercial boilers of a single product series share a common table, an accompanying footnote shall state "Output" is "Heating Capacity" for units with inputs <300 MBH and "Gross Output" for units ≥300 MBH.

10.3.5 Minimum Data to be Shown on Boiler.

10.3.5.1 Oil-Fired Boilers.

- Model Number;
- Gross output;
- Net AHRI Rating;
  - Steam boiler - in square feet and MBH steam;
  - Steam and water boilers - in square feet and MBH steam, and MBH water;
  - Water boiler - in MBH water;
- Input in gallons per hour indicating whether based on light (lt) or heavy (hvy) oil\*;
- AHRI Certification Mark with the notation "®";

\* For modular boilers, the individual burner capacity shall be shown on each module

10.3.5.2 Gas-Fired Boilers.

- Model Number;
- Gross Output;

- Net AHRI Rating;
  - Steam boiler - in square feet and MBH steam;
  - Steam and water boilers - in square feet and MBH steam, and MBH water;
  - Water boiler - in MBH water;
- Input in MBH;
- AHRI Certification Mark with the notation "®";