

**PROCEDURAL GUIDE
FOR
RESIDENTIAL AND COMMERCIAL WATER HEATER
EFFICIENCY CERTIFICATION PROGRAMS**



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SPONSORED BY

GAMA
2107 Wilson Boulevard, Suite 600
Arlington, Virginia 22201
PH: (703) 525-7060
FAX: (703) 525-6790
Web site: www.gamanet.org
General Email: information@gamanet.org

PROGRAM ADMINISTRATOR

GAMA Certification Services
35 Russo Place
P.O. Box 218
Berkeley Heights, New Jersey 07922
PH: (908) 464-8200
FAX: (908) 464-7818
certification@gamanet.org

INDEPENDENT TESTING LABORATORY

Intertek
3933 US Route 11
P.O. Box 2040
Cortland, New York 13045-0950
PH: (607) 753-6711
FAX: (607) 753-1367
www.ETLsemko.com

FOREWORD

The Water Heater Efficiency Certification Program is sponsored by the Gas Appliance Manufacturers Association, Inc. (GAMA). It provides for independent verification of the water heater manufacturers' stated Energy Factor (EF) and First Hour Rating or Maximum GPM Rating for residential units and Thermal Efficiency (E_T) and Standby Loss (S) for commercial units. Safety criteria are not within the scope of this program.

Participation in the program is voluntary. The efficiency certification seal 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 the U.S. Department of Energy.

This procedural guide has been prepared to assure that administration of the program is carried out in a uniform manner. It is an amplification of the license agreement which licensees and GAMA sign. General information, procedural details, and copies of forms are included in the guide. Revisions may be issued from time to time.

This efficiency certification program complies with requirements of the "Guidelines for Federal Agency Use of Private Sector Third-Party Certification Programs" published in the February 15, 1984 Federal Register, Volume 49FR 5799 and ANSI Z34.1-1982, "Practice for Certification Procedures."

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SECTION 1. BASIC PROGRAM OUTLINE

1.1 EQUIPMENT COVERED

1.1.1 Residential Water Heaters

All electric, including heat pump, gas and oil water heaters having energy input ratings and capacities within the parameters outlined below are included in the program:

- Electric storage water heaters with energy input ratings of 12 kilowatts or less at a voltage no greater than 250 volts, and with a storage capacity of not less than 20 gallons nor more than 120 gallons, and electric heat pump water heaters with maximum current ratings of 24 amperes at a voltage no greater than 250 volts, which includes a storage tank with a rated capacity of not less than 20 gallons nor more than 120 gallons, and auxiliary water heating electric heat pumps with maximum current ratings of 24 amperes at a voltage no greater than 250 volts, intended for connection to an existing water heater or storage tank installation.
- Electric instantaneous water heaters with energy input ratings of 12 kilowatts or less with maximum voltage no greater than 250 volts.
- Gas storage water heaters with energy input ratings of 75,000 Btu/h or less and with a storage capacity of not less than 20 gallons nor more than 100 gallons.
- Gas instantaneous water heaters with energy input ratings greater than 50,000 Btu/h but less than 200,000 Btu/h, designed to deliver water at a controlled temperature of less than 180°F (82.2°C) and with a storage capacity of less than 2 gallons.
- Oil storage water heaters with energy input ratings of 105,000 Btu/h or less and with a storage capacity of 50 gallons or less.

Product classes (see Appendix A for Definitions) are as follows:

1. Electric storage water heater
2. Electric instantaneous water heater
3. Electric heat pump water heater with tank
4. Electric heat pump water heater without tank
5. Gas storage water heater
6. Gas instantaneous water heater
7. Oil storage water heater

1.1.2 Commercial Water Heaters

All commercial electric, gas, and oil water heaters which have input ratings of 500,000 Btu/h or less and which have energy input ratings and capacity within the parameters outlined below are included in the program.

- Electric storage water heaters with energy input ratings greater than 12 kilowatts or with storage capacity greater than 120 gallons
- Electric instantaneous water heaters with energy input ratings greater than 12 kilowatts
- Gas storage water heaters with energy input ratings greater than 75,000 Btu/h or storage capacities greater than 100 gallons
- Gas instantaneous water heaters with energy input of 200,000 Btu/h or greater, or designed to deliver water at a controlled temperature greater than 180°F (82.2°C) or with a storage capacity of 2 gallons or more
- Oil storage water heaters with energy input greater than 105,000 Btu/h or storage capacities greater than 50 gallons

1.1.3 Water heater models outside the parameters defined in 1.1.1 or 1.1.2 above may be included in the program at the participating manufacturer's option. Any such models included in the program must be rated in accordance with the test procedure specified in 1.2.1 and are subject to all the provisions in this procedural guide applicable to water heaters. Furthermore, the shipments of the model shall be included in the monthly report and payment specified in 2.1.2.3.

1.2 BASIS OF PARTICIPATION

Participation in this voluntary Program consists of the following:

1.2.1 Certification to Program Administrator. While water heater manufacturers will submit the data listed in 2.2.6 in order that a Directory may be issued, for purposes of this Program, they are to certify to the Program Administrator that the:

- a) For residential water heaters, the
- Energy Factor (EF)
 - First Hour Rating (gallons) for storage water heaters

- Maximum GPM Rating (gallons per minute) for instantaneous water heaters

of their model(s) have been determined in accordance with the requirements of the DOE Water Heater Test Procedures as published in the May 11, 1998 Federal Register Notice and any subsequent amendments thereto.

b) For commercial water heaters, the

- Thermal Efficiency (E_T)
- Standby Loss (S)

of their model(s), as appropriate, have been determined in accordance with the thermal efficiency and standby loss test specified in the American National Standard for Gas Water Heaters, Volume III, Storage, With Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous Water Heaters, Z21.10.3-1998. For electric and oil models these test procedures shall be appropriately modified to account for the use of the different energy source.

1.2.2 Certification Application. Examination and evaluation of a certification application submitted for every model via GAMA's web-based Certification Application Forms System (CAFS) (see 2.2).

1.2.3 Continuing Test Program. Participation by the manufacturer in the random test program at the Program's designated test facility (see 3.2).

1.2.4 Challenge Test. Participation by the manufacturer in challenge test procedure (see 3.3).

1.3 EVIDENCE OF PARTICIPATION

1.3.1 By GAMA. GAMA will periodically publish a Directory, at intervals established by the Procedural Guide Committee, listing all participants and their models eligible under this Program (see 2.2.6).

1.3.2 By Participants. The manufacturer may indicate participation in the Program by affixing the appropriate Certification Symbol (Seal) on all certified units included in the Program and by displaying the Seal on specification sheets, advertising, and in other literature carrying ratings, or claiming participation in the Program. The Seal may be affixed to units only at the time and place of manufacture, may not be sold, lent, or transferred in any manner other than affixing them to Licensee's certified units.

1.4 DATE OF EFFECT OF PROGRAM

For any participant entering the Program after its initiation, the “date of effect” or “date of entry” is the date of signing the License Agreement of GAMA. Following acceptance of a certification application by the procedure outlined herein, the participating manufacturer can immediately begin to use the Certification Symbol (see 2.3).

SECTION 2. OPERATION OF PROGRAM

2.1 COST OF PROGRAM

- 2.1.1 General. In order to cover the costs of administration and conduct of the random test program, an initiation fee and a recurring monthly charge is assessed on the basis of the previous month’s shipments, as reported to GAMA. These fees are published in the Program’s Fee Schedule, available from GAMA on request, and are subject to review by the membership of GAMA’s Water Heater Division.
- 2.1.2 Changes in Fees. Any proposed increase in fees will be made known to all participants at least 30 days in advance of being finalized. Any final increase in fees will become effective no sooner than 60 days after official notification of such final change.
- 2.1.2.1 Initial Fee. Upon submission of certification applications on the complete line of models in production via CAFS, GAMA shall invoice the manufacturer in the amount of the initiation fee published in the Fee Schedule. Private labelers are assessed fees as provided in 2.1.3.4.1.
- 2.1.2.2 Charge Per Unit Shipped. The charge per unit shipped is established in the Fee Schedule. Program participants shall compute their monthly program dues based on this fee.
- 2.1.2.3 Monthly Shipment Report and Payment. Each participant shall file a statement of the number of units coming within the scope of this Program that the participant has shipped each calendar month, using the form supplied by GAMA for reporting monthly shipments. The report should be received at GAMA by the 30th day of the next calendar month.
- The reports of all manufacturers are held in strictest confidence and destroyed after verification in accordance with 2.1.2.5 below.
- 2.1.2.4 Reporting Form. Copies of reporting forms to be used for this purpose are provided as separate attachments. The forms are maintained by

GAMA's Statistical Department. The total charge will be based on the shipments reported on these forms.

- 2.1.2.5 Shipment Verification. Each participant shall designate an official of the organization to verify to GAMA annually, the shipments reported to the Program. Additionally, at the discretion of GAMA, participants shall agree to submit to an independent audit (auditing firm to be selected by GAMA) to verify the accuracy of the reported shipments for the previous calendar year if requested to do so by GAMA. The cost of a GAMA initiated audit will be borne by the Program. If the audit reveals an understatement of shipments, the participant will be billed for the amount of the understating plus a penalty charge of 10% of the amount understated.
- 2.1.2.6 Test Units and Shipping Costs. Participants shall provide units selected for test at no charge. All costs of selecting, shipping to and from the test facility and testing of the first two units of a residential or first unit of a commercial model selected for testing will be borne by the Program (see 3.2.2.4 and 3.2.2.5 for details). If a participant is unable to furnish a requested sample from inventory, the Program Administrator may purchase the sample on the open market and recover the purchasing cost from the participant. Costs of testing additional units (other than the first sample) and challenge testing under Sections 2.1.3.3.2, 3.2.3.2, and 3.3, respectively, must be paid by the party (other than GAMA) requesting the testing against invoice from the Program's designated testing agency before testing may commence. Final allocation of costs in these situations is governed by Sections 2.1.3.3.2.1, 3.2.4, and 3.3.2, respectively.
- 2.1.2.7 Directory Costs. Electronic copies of the Directory will be provided free of charge on the Program Administrator's website.
- 2.1.2.8 Reporting to Facilitate Testing Priorities. Participants shall provide at such times as shall be specified by the Program Administrator information on models that will provide the proper identification of:
- models that account for the majority of Licensee's production regardless of their date of manufacture
 - the best manner and means of obtaining models selected by the Program's designated testing agency for testing
 - models which are participant's new basic models (which upon entry into the Program, are defined as models not certified during the preceding calendar year; thereafter new models will be defined as those certified too late for inclusion in the previous Directory.

- models which are participant's carryover basic models.

2.1.3 Specific Cases.

- 2.1.3.1 Model in Stock and Continuing in Production. All models in stock and currently in production that fall within the scope of the Program shall be certified by the manufacturer, and charges shall be assessed based on reported monthly shipment of all such units.
- 2.1.3.2 New Models Being Put Into Production. All new models shall be certified, and shall be assessed based on reported monthly shipments.
- 2.1.3.3 Manufacturers Entering the Program for the First Time. A manufacturer entering the Program for the first time shall submit a certification application via CAFS on each model coming within the scope of the Program prior to being eligible to have the manufacturer name and models listed in the Directory.
- 2.1.3.3.1 Initial Random Test. As part of the procedure for this certification, the manufacturer shall submit two residential units for test as per section 3.2.3.2.1 or one commercial unit for test as per 3.2.3.2.2, selected by the Program Administrator. Cost of testing is borne by the Program if the model meets the Program criteria for EF and First Hour or Maximum GPM Ratings, or for Thermal Efficiency and Standby Loss Ratings, as applicable.
- 2.1.3.3.2 Additional Random Tests. If the initial random sample tested (see 2.1.3.3.1) does not confirm compliance, additional units shall be tested in accordance with section 3.2.3.2.1.1, and if in the judgment of the Program Administrator that such action is warranted, may require random testing of additional models.
- 2.1.3.3.2.1 Payment of Cost of Additional Tests. If the unit fails to confirm compliance, the manufacturer shall pay for all costs; if the confirms compliance, the cost of the first two tests shall be absorbed by the program. Any remaining testing costs shall be paid by the manufacturer.
- 2.1.3.3.3 Failure Followed by Withdrawal from the Program. In the event that the Initial Random Test has failed and that, subsequently, the manufacturer withdraws from the Program, the Initial Test Fee (2.1.2.1) is forfeited and shall be retained by GAMA.
- 2.1.3.4 Private Brand Manufacturers Entering the Program for the First Time. A private brand labeler entering the Program for the first time, who

purchases models certified under the Program by the original equipment manufacturers in the Program, shall have the manufacturer file on behalf of the private brand, certification applications and a certification affidavit via CAFS in order to cover the complete line of models that are within the scope of the Program.

- 2.1.3.4.1 Fees. Upon submission of certification applications on the complete line of models sold by the private brand manufacturer via CAFS, GAMA shall invoice the manufacturer a Private Brand Rating Extension Fee according to the Fee Schedule (see 2.1.1).
- 2.1.3.5 Private Brand Manufacturers Purchasing Previously Uncertified Models. A private brand manufacturer who wishes to include models in the Program, but who purchases uncertified units from an original equipment manufacturer, shall certify such models under the procedure established under 2.1.3.3, and meet all other requirements of Program participation including payment of the fee per unit shipped and filing certification applications and affidavits via CAFS.
- 2.1.4 Payment Exemptions from Fee Per Unit Shipped. No fees per unit shipped payments shall be made for the following cases.
- 2.1.4.1 Exports. Exported units are not required to carry the Seal or bear payment of the fee per unit shipped.
- 2.1.4.2 Field Tests. Field test units are not required to carry the Seal or to bear payment of the fee per unit shipped.

2.2 PROCEDURE FOR CERTIFICATION

- 2.2.1 Certification Forms. The Program Administrator will provide each original equipment manufacturer with electronic application forms for certification of models through CAFS. Only these forms shall be used in submitting models for certification.
- 2.2.1.1 Originator of Submittal. Original Equipment Manufacturers submit all data forms via CAFS.
- 2.2.1.2 Use of Data. All data submitted to the Program Administrator and developed by the Program Administrator, shall be held confidential, except such information that is published in the Directory (see 2.2.6) or otherwise authorized for release by GAMA. Such data includes:
- communication with Licensee with regard to the test results on Licensee's own units

- communication with challenging Licensee with regard to the Program Administrator's test results and findings of the challenged unit
- communication with Licensor with regard to test results and findings which Licensor deems necessary for the proper operation of the Program

2.2.2 Reporting of Models. In reporting models for certification, and for publication in the Directory, certified ratings shall be given for all models of a manufacturer's or private label manufacturer's equipment covered by the Program (see 1.1).

2.2.3 Submittal and Examination of Data. For all new residential models submitted for listing in the Program and for any existing listing where the manufacturer wishes to increase the rated energy factor, first hour rating, or maximum GPM rating, the manufacturer shall provide a summary of the tests that were conducted to determine the energy factor, and first hour or maximum GPM ratings, as applicable, of the model. This summary shall include the number of tests, the resulting ratings from each test, the average ratings and the adjusted mean of the ratings determined in accordance with the U.S. Department of Energy regulations.

For all new commercial models submitted for listing in the Program and for any existing listing where the manufacturer wishes to increase the rated thermal efficiency or lower the rated standby loss, the manufacturer shall provide a test report that substantiates the thermal efficiency and standby loss, as applicable.

The Program Administrator is authorized to examine ratings as they are received and if they are deemed questionable for any reason, the manufacturer shall be asked to reaffirm or revise said rating. The model shall not be included in the Program until such request for reaffirmation or revision is answered to the satisfaction of the Program Administrator.

2.2.4 Responsibility. All ratings, submitted for publication by participating Licensees on models manufactured for them, or models they manufacture under their own brand name or for the private labelers, shall in each case be submitted with a properly executed Certification Affidavit by the designated representative who has been authorized to undertake this responsibility by the filing with GAMA of Form DR. CAFS requires participants to agree to the Certification Affidavit at the time any new application or change is submitted for approval. The form for designating the representative to the Program (Form DR) must be filed with GAMA, will be maintained by GAMA and will be used by GAMA and the Program's designated testing agency for notices, official communications, and a

listing of who is authorized to access CAFS and submit new applications on behalf of the participant.

2.2.5 Acceptance of Certification Data. When the information submitted with the application for certification of a model or models is satisfactory to the Program Administrator and has been reviewed by the submitter as it will appear prior to publication, the listing will appear in the next issued directory per the publication date specified by the participant in their application.

2.2.6 Publication of Certified Ratings and Other Information. The following information pertaining to each model certified, shall be published in the Directory:

- Name of Manufacturer
- Address of the Manufacturer
- Trade or Brand Name of Model
- Model Number(s) or Designation(s)
- DOE Ratings

For Residential Water Heaters:

- | <u>Storage</u> | <u>Instantaneous</u> |
|-------------------------------|---|
| • First Hour Rating (gallons) | • Maximum GPM Rating (gallons per minute) |
| • Energy Factor | • Energy Factor |
| • Volume (gallons) | • Maximum Input (Btu/h or kW) |
| • Input (Btu/h or kW) | • Recovery Efficiency* (%) |
| • Recovery Efficiency* (%) | |

* For gas and oil-fired models. Electric water heater recovery efficiencies are not reported because they have a recovery efficiency of 98%.

For Commercial Water Heaters, as applicable:

- Thermal Efficiency (%)
- Standby Loss (% per hour or Btu/h, as per federal requirements)
- Storage Volume (gallons)
- Input (Btu/h or kW)

2.3 DISPLAY OF CERTIFICATION SYMBOL ON PRODUCTION UNITS

Each participating manufacturer is entitled to display the Certification Symbol on units of models that have been certified. The Certification Symbol must conform

to the design approved for the Symbol (specification for which will be supplied by GAMA) and in all respects, including design, dimensions, letter size, and color.

2.4 APPEALS AND DISPUTE RESOLUTION

2.4.1 Appeals. A participating manufacturer may ask for a retest of any sample unit or set of samples tested as part of the random test procedure described in section 3.2.3.2 if the manufacturer believes that the test has been conducted incorrectly. In making this request, the manufacturer shall describe the specific step or part of the test that is being questioned and provide data or other evidence that indicates an error may have occurred. The manufacturer must submit a request for retest within 10 days of receiving the test report from the Program Administrator. The Program Administrator shall decide to grant or deny the request within 5 days of receiving the request. If the request is granted the retest shall be conducted within 5 days of that decision.

If a retest is conducted and the result does not indicate that the first test of the sample(s) was conducted incorrectly, the manufacturer shall pay the cost of the test. The Program procedures shall be applied using the first test result of the sample(s).

If the retest indicates that the first test of the sample(s) was conducted incorrectly, the first test result(s) will be voided. The results of the retest(s) will be used to determine whether the model's rating is verified and whether any additional action is required in accordance with the Program's procedures.

2.4.2 Review Committee. The review committee shall consist of the designated representatives from each of the manufacturers participating in the Program. Any general question regarding the testing conducted by the test facility or the proper implementation of the Program's procedures, as described herein, shall be referred to the Program's Review Committee. The Review Committee shall consider any such questions within fifteen (15) days of receipt. As a result of that consideration the Review Committee shall either render a decision or schedule a meeting or teleconference with the party that submitted the question.

Any issue that cannot be resolved by the Review Committee shall be referred to a three-member impartial panel appointed by the President of GAMA within 15 days after receiving notice of the dispute. The panel shall give adequate notice and promptly hold a hearing affording all parties an opportunity to be heard. The panel shall render a decision within 30 days of the hearing.

SECTION 3. TESTING REQUIREMENTS

3.1 GENERAL

The Program requires that all certification applications be based on tests, or calculations based on tests.

3.1.1 Types of Tests. Within the Program, tests may be conducted under the following procedures:

- Initial Random Test
- Random Test
- Challenge Test

3.1.2 Laboratory Test Requirements. As a control and to provide equal treatment to all, not less than one model of each manufacturer will be tested at the independent testing facility each year; this model will be obtained by the independent testing facility, on a random basis, from models specified by the Program Administrator. In addition, for commercial water heaters, a model of each fuel type manufactured by the participant shall be tested in a three-year period.

3.1.3 Number of Units to be Tested.

3.1.3.1 Residential. The total number of residential water heaters to be tested per year under the random test program shall be at least 200, representing 100 basic models. The total number of tests per year for any one participant who manufactures at least ten basic models shall not exceed one third (1/3) of that participant's basic models.

3.1.3.2 Commercial. The total number of commercial water heaters to be tested per year under the random test program shall not exceed 45 basic models.

3.1.4 Determining the Number of Models Tested from Each Participant.

3.1.4.1 The procedure for determining the testing obligation of each participant will be as follows:

- The Program Administrator will count the number of basic models reported by each participant.
- These will be added together by the Program Administrator to obtain the total number of all basic models included in the program.

- Based on the ratio of basic models of each participant to the total number of basic models included in the Program, the Program Administrator will determine the percentage of models that a participant will have subjected to annual verification testing. (For example, if there are 500 total basic models reported in the Program, and a participant has reported 150 basic models, they must supply 30 percent of the 200 units subject to annual verification testing, meaning 60 units. However, since this would exceed the 1/3 selection limit (see 3.1.3.1), the 60-unit obligation would be reduced to 50 units. Fractional shares shall be rounded down.

3.1.5 Selecting Models for Verification Testing. Selection of each participant's models to be tested will be made by the Program Administrator using the following criteria as a guide:

- Voluntarily re-rated models
- At random
- Anticipated models that will be among those providing the majority of participant's production volume
- Ratings exceedingly high
- New Models

3.1.6 Report on Results of Tests. For tests that find models in compliance, the Testing Agency will render the complete report to the manufacturer within reasonable time. For tests that find models in noncompliance, the Program Administrator will render the complete report to the manufacturer within five (5) business days and provide the acceptable corrective actions under this Procedural Guide.

3.2 RANDOM TEST PROCEDURE

3.2.1 Random Test Defined. The Program Administrator may select a model on the basis of evaluation of a manufacturer's certification application or to establish a suitable pattern of types and sizes tested, or on the basis of availability in stock; the particular unit to be tested is selected at random from the available stock (see 3.1.5).

3.2.2 Random Tests at the Laboratory. Random tests shall be performed at the Program's designated testing agency. Units shall be set up and adjusted at the testing agency in accordance with test procedures specified by the Program (see 1.2.1) and the manufacturer's written installation instructions.

3.2.2.1 Selection, Shipment, and Return. Representatives of the Program Administrator or Testing Agency will randomly select samples from a

group of at least three (3) units per model unit obtained from the manufacturer's production. The manufacturer shall retain and be responsible for arranging for the samples to be delivered to the receiving platform of the Program's designated Testing Agency. Following completion of the test, the Testing Agency will arrange for the return shipment of the samples to the destination designated by the manufacturer as provided for in 3.2.2.6.

- 3.2.2.2 Time Limitation on Acquisition of Unit. If the testing agency is unable to obtain a unit of a model chosen (per 3.2.2.1) for test within 30 days after the Program Administrator has requested such unit, the manufacturer shall be notified that their name and listing will be removed from the Program if the request is not satisfied within thirty (30) days of such notification.
- 3.2.2.3 Participant's Representatives. Only the testing agency's personnel shall be permitted to install and check out test units. The procedure used shall be in accordance with the manufacturer's published installation start-up and service instructions. No manufacturer's personnel shall have access to the Program's designated testing agency, test sample, or test stand (if test sample is set up) prior to or during testing of the first sample. Participants may review test results after testing of the first sample and the test set-up prior to testing of the second sample, and may be present during any testing that occurs subsequent to the first sample random test.
- 3.2.2.4 Handling of Test Unit. The Program's designated testing agency will have the responsibility of uncrating, setting up, testing, and re-crating (in the original crate or carton) the unit for shipment (including any overpacking of the test unit). Licensee shall be charged for downtime resulting from any malfunction of the sample during testing.
- 3.2.2.5 Shipping Costs. The Program shall pay the cost involved in shipping the unit from the stock point to the testing agency and after completion of the test, the cost of shipping the unit to the destination specified by the manufacturer.
- 3.2.2.6 Disposition of Tested Units. Upon completion of all compliance procedures and confirmation of the model's ratings, re-rating, or obsolescing per 3.2.3, one of the following methods of disposition, or any combination thereof, is to be employed with respect to those units that have been tested by the testing agency. Such units shall be:
- returned to the Licensee
 - turned over to the Licensee's carrier
 - donated to learning institutions as designated by the licensee

- otherwise disposed of in such manner as the Licensor and Licensee may agree to. If misrated units are returned to, or turned over to Licensee's carrier, the Licensee shall inform the Program Administrator of their disposition.

3.2.2.7 Disposition of Defective Units. Samples received at the Testing Agency which are damaged, produce more than 400 ppm air free CO* at normal input, or otherwise cannot be tested, will be returned to the manufacturer. Tested samples that have insulation voids totaling more than one third of 1% of the tank top and side surface area shall be deemed defective and the test result voided. The sample will be returned to the manufacturer. All costs incident to selection, shipping, test labor, and handling will be charged to the manufacturer. Time limitation on the acquisition of defective parts or units shall be the same as that for the initial sample (see 3.2.2.2).

3.2.3 Compliance Criteria and Procedures.

3.2.3.1 Acceptance Criteria.

- For Residential Water Heaters:

Mean Energy Factor test results must satisfy one of the compliance criteria specified in 3.2.3.2.1.2.

Mean First Hour Rating or mean Maximum GPM test results must be greater than or equal to 90% of the certified rating.

- For Commercial Water Heaters:

Thermal efficiency test results must be greater than or equal to 98% of the certified rating. Standby loss test results must be less than or equal to 110% of the certified rating.

3.2.3.2 Compliance Procedures.

3.2.3.2.1 Residential Water Heaters.

3.2.3.2.1.1 First, two units, x_1 and x_2 , are tested.

* Since a flue gas sample is not taken as part of the Department of Energy's water heater efficiency test procedures, a CO measurement shall be made only on gas water heaters, which are being tested as the results of a challenge (see 3.3). For these tests, the flue gas sample shall be drawn at a point in time in which the water heater is operating at a steady-state condition using the procedure for obtaining the sample as described in ANSI Z21.10.1 or Z21.10.3, as applicable.

The mean energy efficiency, \bar{x}_1 , the standard deviation, s_1 , and the standard error, $s_{\bar{x}_1}$, of the measured ratings are determined as follows:

$$\text{Sample Mean} = \bar{x}_1 = \frac{(x_1 + x_2)}{2}$$

$$\text{Standard Deviation} = s_1 = \frac{|x_1 - x_2|}{\sqrt{2}}$$

$$\text{Standard Error} = s_{\bar{x}_1} = \frac{s_1}{\sqrt{2}} = \frac{|x_1 - x_2|}{2}$$

The Lower Control Limit, LCL_1 , and the Upper Control Limit, UCL_1 , for the sample are determined as follows:

$$LCL_1 = EPS - t_1 s_{\bar{x}_1} \quad UCL_1 = EPS + t_1 s_{\bar{x}_1}$$

where t_1 equals 3.078 and represents the t critical value of the test at a confidence level of 80% and a sample size of two.

Rounding shall be done at the end of each calculation in accordance with standard significant digit methods. Rounded values shall not be employed to determine subsequent values. The mean energy efficiency, \bar{x}_1 , the Lower Control Limit, LCL_1 , and the Upper Control Limit, UCL_1 , shall all be rounded to the nearest hundredth before determining compliance under section 3.2.3.2.1.2.

3.2.3.2.1.2 Determination of Compliance

- If $x_1 \geq EPS$ and $x_2 \geq EPS$, the model is considered in compliance and no further testing on that model is required.
- If $\bar{x}_1 > EPS - 0.01$ and $s_1 \leq 0.01(EPS)$, the model is considered in compliance and no further testing on that model is required.
- If $\bar{x}_1 \geq UCL_1$, the model is considered in compliance and no further testing on that model is required.

- If $\bar{x}_1 < LCL_1$, the model is considered in noncompliance and no further testing on that model is required unless the manufacturer requests further testing as per section 3.2.3.2.1.4.
- If $LCL_1 \leq \bar{x}_1 < UCL_1$, then m shall be determined as follows:

$$m = \left(\frac{t_1 s_1}{0.03(EPS)} \right)^2 - 2$$

If $m \leq 0$ and $\bar{x}_1 \geq 0.97(EPS)$, the model is considered in compliance and no further testing on that model is required.

If $m \leq 0$ and $\bar{x}_1 < 0.97(EPS)$, the model is considered in noncompliance and no further testing on that model is required unless the manufacturer requests further testing as per section 3.2.3.2.1.4.

If $m > 0$, then a supplemental sample is necessary and the supplemental sample procedure of section 3.2.3.2.1.3 shall apply.

- 3.2.3.2.1.3 Supplemental Sample Procedure. If the initial determination of compliance under 3.2.3.2.1.2 requires additional samples, the Program Administrator shall first examine each unit from the initial sample for potential erroneous tests. This examination shall be determined by using the following formula:

$$\left(\frac{EPS_c - EPS_m}{s_p} \right) \geq 2$$

where:

EPS_c = claimed efficiency rating of the model

EPS_m = measured efficiency rating of the unit

s_p = program standard deviation, as determined from complete prior year program data

If the formula is true, the unit's measured EPS may be an erroneous test and the Program Administrator will retest the unit. However, if the unit is a power gas or oil model, the Program Administrator must forward the relevant test data to

the participant for review prior to retest to ensure there are no safety concerns.

- If the retest confirms the initial measured *EPS*, then the Program Administrator will notify the manufacturer that an additional two samples will be selected and tested as per 3.2.3.2.1.3.1.
- If the retest does not confirm the initial measured *EPS*, then that first test shall be considered an erroneous test. The Program Administrator will use the newly determined *EPS* in lieu of the erroneous test value to reexamine the model's compliance per the criteria of 3.2.3.2.1.2.

If the erroneous test formula is false, the unit's measured *EPS* is not considered an erroneous test and the Program Administrator will notify the manufacturer that an additional two samples will be selected and tested as per 3.2.3.2.1.3.1.

3.2.3.2.1.3.1. Two additional units will be selected and tested. The measured results from the combined sample of four units, n_1 , will be evaluated according to the DOE Sampling Plan for Enforcement Testing (see Appendix B). If the model is found in compliance, no further testing on that model is required. If the model is found in noncompliance, then the failure procedure of section 3.2.3.2.3 shall apply.

3.2.3.2.1.4 Noncompliance of Initial Sample. If the mean test results of the first sample fail to verify the ratings, then the manufacturer shall be notified and granted the option to submit an additional two units for testing via selection by the Program Administrator (see 3.2.2.1), unless the manufacturer voluntarily discontinues or re-rates as provided for in Section 4. However, this re-rate cannot exceed the measured test result of the first sample random test.

The manufacturer shall inform the Program Administrator of their decision within 15 days of this notification.

If additional units are tested, the measured results from the combined sample of four units, n_1 , are combined and evaluated according to the DOE Sampling Plan for Enforcement Testing (see Appendix B). If the model is found in compliance, no further testing on that model is required. If

the model is found in noncompliance, then the failure procedure of section 3.2.3.2.3 shall apply.

3.2.3.2.2 Commercial Water Heaters with Inputs of 500,000 Btu/h or Less.

First, one unit is tested.

If the test results comply with the applicable acceptance criteria, the unit passes and no further testing on that model is required.

3.2.3.2.2.1 Failure of First Sample Test. If the first unit does not comply, then the manufacturer shall be notified by phone that an additional single-unit sample will be selected by the Program Administrator for testing (see 3.2.2.1), unless the manufacturer voluntarily re-rates as provided for in section 4.0. If the test results for the second test comply with the applicable compliance criteria, the ratings shall be considered verified.

3.2.3.2.3 Failures. If the combined sample test results of all units of residential models tested do not comply, or if the test results of the second unit of a commercial model also do not comply with the applicable acceptance criteria, then the manufacturer shall be notified by email with confirmation via facsimile that they are to either:

- discontinue the distribution in commerce of units of the model to which such ratings apply
- re-rate the model as provided for in Section 4.0, or
- at the option of the manufacturer, request additional testing in accordance with the requirements of 3.2.3.2.4.

The manufacturer shall inform the Program Administrator of their decision within 15 days of this notification.

3.2.3.2.4 Optional Retesting. At their own expense, the manufacturer has the option of requesting the Program's designated testing agency to conduct additional series of tests on randomly selected units of the model in question. The additional units to be tested shall be selected by a program representative(s) (see 3.2.2.1). Where possible such additional units should be from different production runs.

The participant, at their option, may request that up to sixteen (16) additional residential units or eighteen (18) additional commercial units be tested to determine if the ratings for the model comply with the applicable DOE acceptance criteria (see Appendix B). The measured ratings used for making this determination shall be the mean of all the test results, e.g. measured results from the combined sample of four residential units, n_1 , and any additional units tested under this paragraph.

The testing of the additional samples requested by the manufacturer shall be completed within six (6) months of the decision to pursue optional retesting.

- 3.2.4 Responsibility for Testing Charges. For tests conducted on the first sample under 3.2.3.2.1 or 3.2.3.2.2, all charges shall be borne by the Program.

For tests conducted on the second sample of residential models under 3.2.3.2.1 and the second units of commercial models under 3.2.3.2.2 and all additional units under 3.2.3.2.4, the costs of testing all units including additional costs for selection, shipping, and handling shall be borne by the manufacturer. These costs will be at the same rate as similar costs borne by the Program in accordance with the fee schedule listed in the current Certification Service Contract between the Program Administrator and the Licensor. Licensee shall make payment against the Testing Agency's invoice in advance of testing.

- 3.2.5 Failure. In the event that the manufacturer is unable to substantiate the ratings, the model shall be considered in noncompliance. Further action regarding such a finding shall be in accordance with Section 4.3.

3.3 CHALLENGE TEST PROCEDURE

Any participant that wishes to file a challenge against a model manufactured by another participant in the Program must first submit supporting test data to the Program Administrator (see 3.3.1). This data must include results from no fewer than two sample units before the challenge can be considered. If in the judgment of the Program Administrator there appears to be reasonable grounds for action, the challenge test shall proceed as follows:

- GAMA will review selection and testing records to determine the status of the model in question with respect to the Program. If it has been tested recently, GAMA will review the results then contact the challenger to inquire whether or not they wish to proceed based on the outcome. 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, GAMA will 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 if the randomly selected sample complies with the acceptance criteria.

- If the model is a residential water heater, the Program Administrator shall notify the manufacturer of the challenge. The manufacturer must then provide and sequester twenty (20) units of the model in question by close of business on the fifth business day from notification. At that time, Program representatives will arrive to randomly select (see Section 3.2.2.1) four (4) units from the sequestered lot. If after the fifth business day the units remain unselected, they shall be obtained from commerce at the expense of the manufacturer. Note that in each case, the samples must have been manufactured within the previous ninety (90) days from the date of notification to the manufacturer (see Figure 1).

The model shall be tested for compliance according to the DOE Sampling Plan for Enforcement Testing (see Appendix B). If the test results comply with the applicable DOE acceptance criteria, the challenge shall be considered unjustified. If the acceptance criteria are not met, the challenge shall be considered justified.

- If the model is a commercial water heater, the Program Administrator shall obtain two random samples (3.2.1) of the model in question and shall test both samples.
- Any tests on the remaining samples from the original sequestered lot of twenty (20) shall be completed within six (6) months of the decision to ask for such testing.

3.3.1. Requirements of Challenger. No one is to ask for such a test until the challenger has tested no fewer than two sample units of the model and filed the test data and results with the Program Administrator.

3.3.2 Cost of Test. The cost of testing at the Program's designated testing agency including selection, shipping, and final disposition of the units shall be borne completely by one of the two parties concerned. In the event that the testing agency's test results show the challenge to be justified, the manufacturer of the model in question shall pay the costs and take appropriate action as specified in Section 4.3. In the event the testing agency's test results do not bear out the challenge, challenger shall pay these costs, and, for commercial models, the fair value of the units tested.

3.3.3 Test Requirement. For residential models, the DOE compliance criteria shall be used for challenge testing. For commercial models, the same compliance criteria specified in Section 3.2.3 will be adhered to for

challenge testing except that the average of the units will be used to determine compliance.

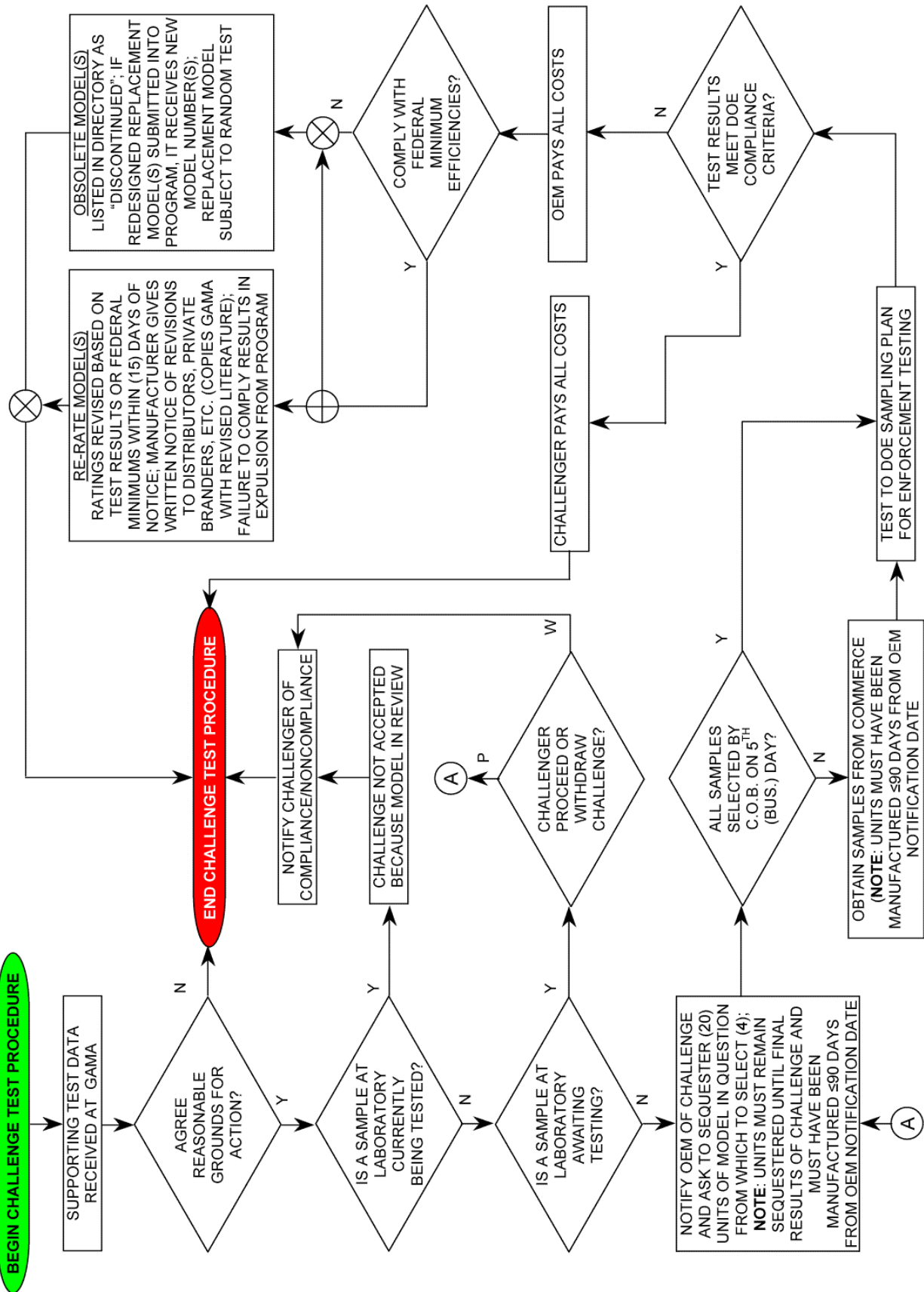


Figure 1: Residential Water Heater Challenge Test Procedure

3.4 TEST PROCEDURE REVISIONS AND MODIFICATIONS

3.4.1 General. The DOE Test Procedure upon which the Challenge Procedure is based cannot be changed without proposed amendments being published in the Federal Register by DOE and giving interested parties at least 45 days to present oral and written views. (Section 323(a)(7) of the Energy Policy and Conservation Act, 42 USC 6293) As a possible step prior to such petition to DOE, the GAMA Certification Program offers an opportunity to first have a proposed amendment developed by industry experts that perhaps can achieve industry consensus on needed changes and can be submitted to DOE as a Program-recommended amendment, in the hope that the DOE decision-making process could thereby be assisted and accelerated.

3.4.2 Program Steps. Requests from Program participants for either revisions of basic test procedures being used or modifications that would affect only certain models may be sent to GAMA to be processed as follows:

- GAMA will distribute request to GAMA's Water Heater Division Technical Committee for a recommendation of whether the request is of obvious merit and without controversy and can be sent out for review and comment. If it can be so recommended, GAMA will forward a petition to DOE immediately as provided for below.
- Alternatively, the Water Heater Division Technical Committee can recommend that GAMA distribute the request for comment to all participants in the GAMA Certification Program.
- Comments will then be reviewed by the Water Heater Division Technical Committee, which, together with the party requesting the modification, will attempt to agree whether the request has
 - adequate consensus support,
 - inadequate consensus support, or
 - could have consensus support if modified.
- The Water Heater Division Technical Committee shall make a recommendation on the requests as presented (or modified with the approval of the requesting party) which, together with a tabulation of responses and pertinent comments resulting from distribution of the request as noted above, will be included in a Letter Ballot to be sent to all Program participants for approval by 80% of the participants.
- If a Federal test procedure is involved, GAMA will petition the Federal government to revise or modify the Federal test procedure in order to

reflect any revision or modification recommended by the GAMA Certification Program.

3.5 CLARIFICATION IN RUNNING OF THE TEST PROCEDURE

The Program Administrator and Testing Agency shall develop a Test Procedure Guideline that will facilitate correlation of all Program participants to a standardized running of the DOE test procedures. Such guidelines shall not revise or modify the basic DOE test procedure, which is provided for in 3.4 above, but will seek to provide uniformity in interpretation of terms, measurements, and application of procedures.

SECTION 4. ENFORCEMENT

4.1 VOLUNTARY RATING

If by testing in the Licensee's own facilities or otherwise, a Licensee has reason to believe that a model has been certified at a rating better than is supportable under this Program, the Licensee may voluntarily re-rate that model and other models similarly affected by such re-rating without testing, or further testing, under the Program, provided that the Licensee complies with the notice requirements set out in Section 4.3.2 and the requirement to modify advertising literature set out in Section 4.4. The Program Administrator will schedule testing of such models on a high priority basis consistent with the orderly administration of the Program.

4.2 CONTINUED VIOLATION

In the case of continued violation of provisions of the License Agreement or Procedural Guide as applicable, the Certification Symbol shall be withdrawn and the participant's entire listing shall be removed from the next and subsequent issues of the Directory. When this action is taken, the next issue of the Directory shall list the name of the participant and the words "Listing Withdrawn" and Section 4.3.2 will be applied if appropriate. Appeal of this action may be made to the GAMA Procedural Guide Committee as specified in Section 2.4.

- 4.2.1 Notice of Violation. Before such withdrawal of privileges shall be made, the manufacturer shall have been notified of the violation or violations and have had fifteen (15) days during which to correct, or to have made substantial progress toward correction of, the causes of the violation.

4.3 FAILURE UNDER RANDOM OR CHALLENGE TESTS

Except as noted below, if any model is found by random or challenge test to be in noncompliance, it shall be treated as an obsolete model (see 4.3.1), re-rated (see 4.3.2) or actions described in Section 4.3.4 shall be taken. Models found in

noncompliance with the applicable federal minimum efficiency requirement may not be re-rated.

- 4.3.1 Obsolete Model. Where a unit acquired under the random or challenge test procedure has failed and the manufacturer claims it to be obsolete (current production incorporating one or more changed components), its replacement counterpart shall be identified by a new or clearly revised model number designation.
- 4.3.1.1 Test of Revised Model. Where a unit has failed under random or challenge test procedure, and has been declared obsolete by the manufacturer, its replacement counterpart shall be subjected to a random test at the Program's designated testing agency, to validate its rating. If the model is re-rated and a manufacturer submits a new model that replaces the re-rated model at its previous efficiency rating, the new model shall be subjected to a random test at the testing agency to validate its rating. The cost of the testing required above shall be borne by the Program if the result satisfies the acceptance criteria specified in 3.2.3.1. If the test result does not meet the criteria specified in 3.2.3.1, the cost of testing will be charged to the manufacturer.
- 4.3.1.2 List of Obsolete Models. When a model has been declared obsolete as described in 4.3.1, it shall be listed in the Directory under the heading "Discontinued Models" for a period of at least one year. This listing shall not be removed from succeeding issues so long as there are units in stock that are under the manufacturer's control and for sale. This listing shall show the efficiency rating corresponding to the test(s) (see 3.2.3) by which failure to validate the former rating occurred or the applicable federal minimum efficiency requirement, whichever is greater.
- 4.3.1.3 Fees for Discontinued Models. All shipments of discontinued units shall be assessed, based on reported monthly shipments.
- 4.3.2 Manufacturers Notice Procedure Under a Re-rating Determination. Upon a determination that a re-rating is necessary, the manufacturer is to revise the rating for that model(s) and all derivative models based on the test results of the model(s) within fifteen (15) days of manufacturer's voluntary decision to re-rate or receipt of written decision to re-rate or receipt of written notification from the Program Administrator that a re-rating is required. Within those fifteen (15) days, whether or not the model is in production, the manufacturer shall at their own expense give notice of the revised claims in writing to all distributors or others under their control in the line of distribution, including private brand owners, who are responsible for sales to dealers or other retail outlets. The revised claim

may not be better than that determined by the Testing Agency or the applicable federal minimum efficiency requirement, whichever is greater. For commercial water heaters, the revised rating will be the higher thermal efficiency and lower standby loss, as applicable, of the results of the two units tested. In addition, Licensee shall make reasonable effort that dealers of the brand are notified. Copies of all such notices, reasonable action to notify brand dealers, and revised literature shall be supplied to the Program Administrator as soon as available. Failure to comply with the requirements of this subsection will result in the termination of the manufacturer from the Program.

4.3.3 Licensors Notification of Re-rating.

4.3.3.1 The Licensor shall advise other Licensees of the determination of noncompliance and the subsequent re-rate action 30 days after the manufacturer of the model has been notified of the determination of noncompliance.

4.3.3.2 If the Program Administrator notifies the Licensor that the time period allowed the Licensee for notice under Section 4.3.2 has expired, Licensor will notify Licensee that the Licensee is in default under this License Agreement and request that the notices be sent immediately. Concurrently with this, all other Licensees will be advised of the re-rate action by letter.

4.3.3.3 If immediately after receiving the notice from Licensor under Section 4.3.3.2, Licensee does not notify distributors and take reasonable action to notify dealers of the re-rating, Licensor shall promptly take appropriate steps to exclude Licensee from the Program and notify other Licensees of this action.

4.3.4 Directory Notice of Withdrawal of Certification. If testing under the Program fails to verify an energy efficiency rating published in the Directory, and the manufacturer ceases to participate in the Program, consumers and others who have relied on the Directory rating will be notified that the previous ratings may be in question by inclusion of the following statement in the Directory: "Most recent testing of units of a model (or models) under the Program did not verify ratings in previous edition of the Directory." The Program Administrator will also notify all Program participants of this pending Directory entry.

4.3.5 Directory Listing of Re-rated Models. Revised ratings will be identified in a suitable manner in the Certification Directory, and shall be so identified for at least 1 year. However, a model for which re-rating is required too late to appear in the latest edition of the Directory for that model year will appear

with its revised rating in the next edition of the Directory and will be identified as a model of the previous year.

- 4.3.6 Revision of Literature. Any changes in model or Program participation status resulting from Section 4 activity shall require Licensee to revise all literature (e.g. specification sheets, full line folder, ad mats, plus any sales promotion and/or advertising materials which could be used with potential consumers) at its next printing.

4.4 VIOLATIONS OF RULES CONCERNING ADVERTISING LITERATURE

If a participant violates the provisions of this Procedural Guide in the publication of specification sheets, literature and all other advertising, such publication shall promptly be discontinued or corrected, or the action described in Section 4.2 shall be taken. Indication of such discontinuance or correction must be furnished promptly to the Program Administrator and GAMA.

4.5 NONPAYMENT OF FEES

- 4.5.1 Shipment Fees. The following procedure is to be followed in regard to shipment fees:
- If the monthly shipment report and accompanying check (see 2.1.2.3) is not received by GAMA by the 30th day of the calendar month following the reporting period, an estimated bill will be prepared and sent by GAMA.
 - That invoice must be paid within thirty (30) days from the date of invoice. If payment is not made within thirty (30) days, then a second notice will be sent with a 10 percent penalty added. If the invoice is still unpaid after forty-five (45) days from date of invoice, then a letter will be sent to the participant with the delinquent account reminding the participant that the contract between their company and GAMA calls for payment of such fees.
 - If the invoice is not paid within sixty (60) days from the date of invoice, the participant with the delinquent account shall be informed that the participant's Licensing Agreement under the Program is cancelled.
- 4.5.2 Directory Notice of Dismissal From Program. If Program participation is cancelled pursuant to Sections 3.2.2.2 and 4.5.1, all entries regarding the former participant will be deleted from the next edition, or update, of the Directory.

4.6 NOTICE TO OTHER PROGRAM PARTICIPANTS OF PARTICIPANT WITHDRAWAL OR TERMINATION

If Program participation is cancelled under the Program, GAMA Notification to all other Program participants shall include these terms: “As of (date), the (company) is no longer a participant in the GAMA Certification Program. Only units of the former participant covered by the Program that were manufactured before that date may continue to display the GAMA Certification Symbol (Seal), and the participant is not authorized to make further reference in literature and advertising materials to its participation in, or ratings pursuant to, the GAMA Certification Program.”

APPENDIX A

DEFINITIONS

Basic Model

All units of a given type of covered water heater product (or class thereof) manufactured by one manufacturer and which have the same primary energy source and which, with the exception of immersed heating elements, do not have any differing electrical, physical, or functional characteristics that affect energy consumption.

Water Heaters

A closed vessel, in which water is heated by the combustion of fuels, electricity or any other source and is withdrawn for use external to the vessel at pressures not exceeding 160 psig, including the apparatus by which heat is generated and all controls and devices necessary to prevent water temperatures from exceeding 210 °F.

Residential Storage Water Heater means an automatically controlled thermally insulated vessel designed for heating produce hot water at a temperature of less than 180 degrees F. These water heaters are further categorized as follows:

Electric Storage Water Heater – means a water heater which utilizes electricity as the energy source for heating the water, which has a manufacturer’s specified energy input rating of 12 kilowatts or less at a voltage not greater than 250 volts, and which has a manufacturer’s specified storage capacity of not less than 20 gallons nor more than 120 gallons.

Electric Heat Pump Water Heater With Tank – means a water heating system which utilizes electricity as the energy source to supply the heat pump and auxiliary heating element, if any, for heating water. The heat pump transfers thermal energy from one temperature level to a higher temperature level to heat water and includes all auxiliary equipment such as fans, pumps, or controls necessary for the device to perform its function. It has a maximum current rating of 24 amperes at a voltage no greater than 250 volts, and includes a storage tank with a rated capacity of not less than 20 gallons nor more than 120 gallons.

Electric Heat Pump Water Heater Without Tank – means a heat pump which utilizes electricity as the energy source and which is intended for connection to an existing water heater or storage tank installation. The heat pump transfers thermal energy from one temperature level to a higher temperature level to heat water, and includes all auxiliary equipment such as fans, pumps, or controls necessary for the device to perform its function. It has a maximum current rating of 24 amperes at a voltage no greater than 250 volts.

Gas Storage Water Heater - means a water heater which utilizes gas as the energy source for heating the water, which has a manufacturer's specified energy input rating of 75,000 Btu/h or less, and which has a manufacturer's specified storage capacity of not less than 20 gallons nor more than 100 gallons.

Oil Storage Water Heater - means a water heater which utilizes oil as the energy source for heating the water, which has a manufacturer's specified energy input rating of 105,000 Btu/h or less, and which has a manufacturer's specified storage capacity of 50 gallons or less.

Residential Gas Instantaneous Water Heater - means a water heater which utilizes gas as the energy source controlled manually or automatically by a water flow activated control or a combination of water flow and thermostatic control, which is designed to deliver water at a controlled temperature of less than 180 °F, and which has an input greater than 50,000 Btu/h and less than 200,000 Btu per hour, and a manufacturer's specified storage capacity of less than 2 gallons.

Residential Electric Instantaneous Water Heater - means a water heater which utilizes electricity as the energy source controlled manually or automatically by a water flow activated control or a combination of water flow and thermostatic control, which is designed to deliver water at a controlled temperature of less than 180 °F, and which has an input of 12 kilowatts or less, and a manufacturer's specified storage capacity of less than 2 gallons.

Commercial Electric Storage Water Heater - means a water heater which utilizes electricity as the energy source for heating water and has a manufacturer's specified energy input rating greater than 12 kilowatts or rated storage capacity greater than 120 gallons.

Commercial Gas Storage Water Heater - means a water heater which utilizes gas as the energy source for heating water and has a manufacturer's specified energy input rating greater than 75,000 Btu/h or rated storage capacity greater than 100 gallons.

Commercial Gas Instantaneous Water Heater - means a water heater which utilizes gas as the energy source for heating water and has an input rating of a least 4,000 Btu/h per gallon of stored water and a manufacturer's specified input rating greater than 200,000 Btu/h or is designed to deliver water at a controlled temperature greater than 180 °F.

Commercial Oil Storage Water Heater - means a water heater which utilizes oil as the energy source for heating water and has a manufacturer's specified energy input greater than 105,000 Btu/h or storage capacity greater than 50 gallons.

APPENDIX BSAMPLING PLAN FOR ENFORCEMENT TESTING

Department of Energy Sampling Plan for Enforcement Testing
(Issued in February 7, 1989 Federal Register)

Double Sampling

- Step 1. The first sample size (n_1) must be four or more units.
- Step 2. Compute the mean (\bar{x}_1) of the measured energy performance of the n_1 units in the first sample as follows:

$$\bar{x}_1 = \frac{1}{n_1} \left(\sum_{i=1}^{n_1} x_i \right) \quad (1)$$

where x_i is the measured energy efficiency or energy consumption of unit i .

- Step 3. Compute the standard deviation (s_1) of the measured energy performance of the n_1 units in the first sample as follows:

$$s_1 = \sqrt{\frac{\sum_{i=1}^{n_1} (x_i - \bar{x}_1)^2}{n_1 - 1}} \quad (2)$$

- Step 4. Compute the standard error of the measured energy performance of the n_1 units in the first sample as follows:

$$s_{\bar{x}_1} = \frac{s_1}{\sqrt{n_1}} \quad (3)$$

- Step 5. Compute the upper control limit (UCL_1) and lower control limit (LCL_1) for the mean of the first sample using the applicable DOE energy performance standard (EPS) as the desired mean and a probability level of 95 percent (two-tailed test) as follows:

$$LCL_1 = EPS - ts_{\bar{x}_1} \quad (4)$$

$$UCL_1 = EPS + ts_{\bar{x}_1} \quad (5)$$

where t is a statistic based on a 95 percent two-tailed probability level and a sample size of n_1 , as provided below in Table B1.

Table B1: *t* Critical Values at 95% Confidence Level

Initial Sample Size, n	t
2	12.706
3	4.303
4	3.182
5	2.776
6	2.571
7	2.447
8	2.365
9	2.306
10	2.262
11	2.228
12	2.201
13	2.179
14	2.160
15	2.145
16	2.131
17	2.120
18	2.110
19	2.101
20	2.093

Step 6A. For an Energy Efficiency Standard, compare the mean of the first sample (\bar{x}_1) with the upper and lower control limits (UCL_1 and LCL_1) to determine one of the following:

- (i) If the mean of the first sample is below the lower control limit, then the basic model is in noncompliance and testing is at an end. (Do not go on to any of the steps below.)
- (ii) If the mean of the first sample is equal to or greater than the upper control limit, then the basic model is in compliance and testing is an end. (Do not go on to any of the steps below.)
- (iii) If the sample mean is equal to or greater than the lower control limit but less than the upper control limit, then no determination of compliance or noncompliance can be made and a second sample size is determined by Step 7a.

Step 6B. For an Energy Consumption Standard, compare the mean of the first sample (\bar{x}_1) with the upper and lower control limits (UCL_1) and (LCL_1) to determine one of the following:

- (i) If the mean of the first sample is above the upper control limit, then the basic model is in noncompliance and testing is at an end. (Do not go on to any of the steps below.)
- (ii) If the mean of the first sample is equal to or less than the lower control limit,

then the basic model is in compliance and testing is at an end. (Do not go on to any of the steps below.

- (iii) If the sample mean is equal to or less than the upper control limit but greater than the lower control limit, then no determination of compliance or noncompliance can be made and a second sample size is determined by Step 7b.

Step 7A. For an Energy Efficiency Standard, determine the second sample size (n_2) as follows:

$$n_2 = \left(\frac{ts_1}{0.05 \text{ EPS}} \right)^2 - n_1 \quad (6a)$$

where s_1 and t have the values used in Steps 4 and 5, respectively. The term “0.05 EPS” is the difference between the applicable energy efficiency standard and 95 percent of the standard, where 95 percent of the standard is taken as the lower control limit. This procedure yields a sufficient combined sample size ($n_1 + n_2$) to give an estimated 97.5 percent probability of obtaining a determination of compliance when the true mean efficiency is equal to the applicable standard.

Given the solution value of n_2 , determine one of the following:

- (1) If the value of n_2 is less than or equal to zero and if the mean energy efficiency of the first sample (\bar{x}_1) is either equal to or greater than the lower control limit (LCL_1) or equal to or greater than 95 percent of the applicable energy efficiency standard (EES), whichever is greater, i.e., if

$$n_2 \leq 0 \text{ and } \bar{x}_1 \geq \max(LCL_1, 0.95 \text{ EES}),$$

the basic model is in compliance and testing is at an end.

- (2) If the value of n_2 is less than or equal to zero and the mean energy efficiency of the first sample (\bar{x}_1) is less than the lower control limit (LCL_1) or less than 95 percent of the applicable energy efficiency standard (EES), whichever is greater, i.e., if

$$n_2 \leq 0 \text{ and } \bar{x}_1 \leq \max(LCL_1, 0.95 \text{ EES}),$$

the basic model is in noncompliance and testing is at an end.

- (3) If the value of n_2 is greater than zero, then the value of the second sample size is determined to be the smallest integer equal to or greater than the solution value of n_2 for equation (6a). If the value of n_2 so calculated is greater than $20 - n_1$, set n_2 equal to $20 - n_1$.

Step 7B. For an Energy Consumption Standard, determine the second sample size (n_2) as follows:

$$n_2 = \left(\frac{ts_1}{0.05 \text{ EPS}} \right)^2 - n_1 \quad (6b)$$

where s_1 and t have the values used in Steps 4 and 5, respectively. The term “0.05 EPS” is the difference between applicable energy consumption standard and 105 percent of the standard, where 105 percent of the standard is taken as the upper control limit. This procedure yields a sufficient combined sample size ($n_1 + n_2$) to give an estimated 97.5 percent probability of obtaining a determination of compliance when the true mean consumption is equal to the applicable standard.

Given the solution value of n_2 , determine one of the following:

- (1) If the value of n_2 is less than or equal to zero and if the mean energy consumption of the first sample (\bar{x}_1) is either equal to or less than the upper control limit (UCL_1) or equal to or less than 105 percent of the applicable energy performance standard (EPS), whichever is less, i.e., if

$$n_2 \leq 0 \text{ and } \bar{x}_1 \leq \min(UCL_1, 1.05 \text{ EPS}),$$

the basic model is in compliance and testing is at an end.

- (2) If the value of n_2 is less than or equal to zero and the mean energy consumption of the first sample (\bar{x}_1) is greater than, the upper control limit (UCL_1), or more than 105 percent of the applicable energy performance standard (EPS), whichever is less, i.e., if

$$n_2 \leq 0 \text{ and } \bar{x}_1 > \min(UCL_1, 1.05 \text{ EPS}),$$

the basic model is in noncompliance and testing is at an end.

- (3) If the value of n_2 is greater than zero, then the value of the second sample size is determined to be the smallest integer than the solution value of n_2 for equation (6b). If the value of n_2 so calculated is greater than $20 - n_1$, set n_2 equal to $20 - n_1$.

Step 8. Compute the combined mean (\bar{x}_2) of the measured energy performance of the n_1 and n_2 units of the combined first and second samples as follows:

$$\bar{x}_2 = \frac{1}{n_1 + n_2} \left(\sum_{i=1}^{n_1+n_2} x_1 \right) \quad (7)$$

Step 9. Compute the standard error of the measured energy performance of the n_1 and n_2 units in the combined first and second samples as follows:

$$s_{\bar{x}_2} = \frac{s_1}{\sqrt{n_1 + n_2}} \quad (8)$$

Note – s_1 is the value obtained in Step 3.

Step 10A. For an Energy Efficiency Standard, compute the lower control limit (LCL_2) for the mean of the combined first and second samples using the DOE energy efficiency standard (EES) as the desired mean and a one-tailed probability level of 97.5 percent (equivalent of a two-tailed probability level of 95 percent used in Step 5 above) as follows:

$$LCL_2 = EPS - ts_{\bar{x}_2} \quad (9a)$$

Where the t-statistic has the value obtained in Step 5 above.

Step 10B. For the Energy Consumption Standard, compute the upper control limit (UCL_2) for the mean of the combined first and second samples using the DOE energy performance standard (EPS) as the desired mean and a one-tailed probability level of 102.5 (equivalent two-tailed probability level of 95 percent used in Step 5 above) as follows:

$$UCL_2 = EPS + ts_{\bar{x}_2} \quad (9b)$$

Where the t-statistic has the value obtained in Step 5 above,

Step 11a. For an Energy Efficiency Standard, compare the combined sample mean (\bar{x}_2) to the lower control limit (LCL_2) to find one of the following:

- (i) If the mean of the combined sample (\bar{x}_2) is less than the lower control limit (LCL_2) or 95 percent of the applicable energy efficiency standard (EES), whichever is greater, i.e., if

$$\bar{x}_2 \leq \max(LCL_2, 0.95 \text{ EES}),$$

the basic model is in noncompliance and testing is at an end.

- (ii) If the mean of the combined sample (\bar{x}_2) is equal to or greater than the lower control limit (LCL_2) or 95 percent of the applicable energy efficiency standard (EES), whichever is greater, i.e., if

$$\bar{x}_2 \geq \max(LCL_2, 0.95 \text{ EES}),$$

the basic model is in compliance and testing is at an end.

Step 11b. For an Energy Consumption Standard, compare the combined sample mean (\bar{x}_2) to the upper control limit (UCL₂) to find one of the following:

- (i) If the mean of the combined samples (\bar{x}_2) is greater than the upper control limit (UCL₂) or 105 percent of the applicable energy performance standard (EPS), whichever is less, i.e., if

$$\bar{x}_2 \geq \min (\text{UCL}_2 , 1.05 \text{ EPS})$$

the basic model is in noncompliance and testing is at an end.

- (ii) If the mean of the combined sample (\bar{x}_2) is equal to or less than the upper control limit (UCL₂) or 105 percent of the applicable energy performance standard (EPS), whichever is less, i.e., if

$$\bar{x}_2 \leq \min (\text{UCL}_2 , 1.05 \text{ EPS})$$

the basic model is in compliance and testing is at an end.

Manufacturer - Option Testing

If a determination of noncompliance is made in Steps 6, 7, or 11 above, the manufacturer may request that additional testing be conducted, in accordance with the following procedures.

Step A. The manufacturer requests that an additional number, n_3 of units be tested, with n_3 chosen such that $n_1 + n_2 + n_3$ does not exceed 20.

Step B. Compute the mean energy performance, standard error, and lower or upper control limit of the new combined sample in accordance with the procedures prescribed in Steps 8, 9, and 10 above.

Step C. Compare the mean performance of the new combined sample to the revised lower or upper control limit to determine one of the following:

- a.1. For an Energy Efficiency Standard, if the new combined sample mean is equal to or greater than the lower control limit or 95 percent of the applicable energy efficiency standard, whichever is greater, the basic model is in compliance and testing is at an end.
- a.2. For an Energy Consumption Standard, if the new combined standard is equal to or less than the upper control limit or 105 percent of the applicable energy consumption standard, whichever is less, the basic model is in compliance and

testing is at an end.

- b.1. For an Energy Efficiency Standard, if the new combined sample mean is less than the lower control limit or 95 percent of the applicable energy efficiency standard, whichever is greater, and the value of $n_1 + n_2 + n_3$ is less than 20, the manufacturer may request that additional units be tested. The total of all units tested may not exceed 20. Steps A, B, and C are then repeated.
- b.2. For an Energy Consumption Standard, if the new combined sample mean is greater than the upper control limit or 105 percent of the applicable energy consumption standard, whichever is less, and the value of $n_1 + n_2 + n_3$ is less than 20, the manufacturer may request that additional units be tested. The total of all units tested may not exceed 20. Steps A, B, and C are then repeated.
- c. Otherwise the basic model is determined to be in noncompliance.



GAMA – An Association of Appliance & Equipment Manufacturers
 35 Russo Place • P.O. Box 218 • Berkeley Heights, New Jersey 07922
 908-464-8200; FAX: 908-464-7818
 www.gamanet.org • certification@gamanet.org

Form DR Rev04.04



CERTIFICATION SERVICES

REPRESENTATIVE ASSIGNMENT FORM

Designated Representative	Alternate Representative	Payment Contact
_____ Name	_____ Name	_____ Name
_____ Title	_____ Title	_____ Title
_____ Company	_____ Company	_____ Company
_____ Street Address	_____ Street Address	_____ Street Address
_____ City, State, Zip	_____ City, State, Zip	_____ City, State, Zip
_____ Country	_____ Country	_____ Country
_____ Telephone Number	_____ Telephone Number	_____ Telephone Number
_____ Fax Number	_____ Fax Number	_____ Fax Number
_____ E-Mail Address	_____ E-Mail Address	_____ E-Mail Address

Please identify products and locations from which testing selections should occur:

Please identify any companies or private branders associated with these products:

Certification communication and invoices shall be addressed to the Designated Representative, or if unavailable, the Alternate, named above. GAMA shall contact the Payment Contact for questions regarding the status of payment of certification program fees. This authorization revokes and cancels all other previous authorizations.

Signature (Designated Representative)

Date

Return to GAMA Headquarters: 2107 Wilson Boulevard • Suite 600 • Arlington, VA 22201; FAX: 703-525-6790; email: accounting@gamanet.org
 INTERNAL USE ONLY: [] CFO → [] Billing → [] Stats → [] Cert Mgr → [] Cert Admin



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 www.gamanet.org

WHFS Rev01.06



CERTIFICATION SERVICES

WATER HEATER CERTIFICATION PROGRAM FEE SCHEDULE

INITIAL ENROLLMENT FEES

The following fees are assessed to participants entering the program to cover administration expenses. Please refer to section 2.1.2.1 of the Procedural Guide for additional information.

Manufacturers entering the program:.....	\$500
Private brand manufacturers entering the program:	\$100

NOTE: Private brand manufacturers entering the program with previously uncertified models are considered the original equipment manufacturer. Please refer to section 2.1.3.5 of the Procedural Guide for additional information.

MONTHLY REMITTANCE FEES

The following monthly fees are assessed to all manufacturers to cover operational expenses. Please refer to section 2.1 of the Procedural Guide and the monthly remittance form for additional information.

Residential Water Heaters

Gas, oil and electric storage and instantaneous water heaters.....	\$0.03/unit shipped
Heat pump type water heaters	\$0.05/unit shipped

Commercial Water Heaters

Gas, oil and electric storage and instantaneous water heaters.....	\$0.10/unit shipped
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NOTE: Private brand manufacturers entering the program with previously uncertified models are considered the original equipment manufacturer. Please refer to section 2.1.3.5 of the Procedural Guide for additional information.

FAILED MODEL ADMINISTRATION FEE

The following fee is assessed to participants to cover administrative costs associated with test sample failures when second and additional units are selected for program testing.

All water heater types	\$115
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