



THIRD PARTY CERTIFICATION IMPLEMENTATION

ENERGY STAR® PRODUCTS

SUBJECT: ENERGY STAR Verification Testing for Certification Bodies -
Test Sample Sizes and Determining Testing Failures (Non-Lighting Products)

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Introduction

The third-party certification requirements put in place by the U.S. Environmental Protection Agency (EPA) for ENERGY STAR products include provisions for verifying the performance of qualified products through verification and challenge testing. In conjunction with the verification program being run by certification bodies (CBs), The U.S. Department of Energy (DOE) intends to continue to operate a parallel, targeted verification testing program for ENERGY STAR products that also evaluates how models comply with Federal energy conservation standards. More information on DOE's program is available at http://www1.eere.energy.gov/buildings/appliance_standards/.

Consumers who rely on the ENERGY STAR label in making a purchase decision expect that the unit they purchase will meet ENERGY STAR requirements. EPA has traditionally established program testing requirements with the intention of fulfilling that consumer expectation and ensuring that all units of a qualified model, irrespective of manufacturing and testing variability, meet the ENERGY STAR performance requirements. For certain product categories currently subject to Federal energy conservation standards, the ENERGY STAR specification has allowed for testing consistent with DOE standards, which require testing a sample comprised of no less than two units, and using statistical methods to determine the certified rating of each basic model. Recognizing this variation in sample size approach for qualification, EPA and DOE require that products be tested for purposes of verification consistent with how they were tested for purposes of qualification using one of the following approaches:

1. If a product was qualified based on a single test, which ENERGY STAR specifications require for products not subject to Federal energy conservation standards, then verification testing will involve a single test.¹
2. If a product was qualified based on multiple test samples, (e.g., per DOE certification sampling plan associated with Federal energy conservation standards²), then four units will be procured at once for verification testing. A spot check will be performed on the first unit. If the test result of the spot check fails by 5% or more, the additional 3 units will be tested and statistical methods applied to the results for purposes of determining a failure.

Testing failures will be referred to EPA for further consideration and a final determination regarding ENERGY STAR compliance. Testing failures that indicate a potential issue with respect to Federal energy conservation standards will be referred to DOE for further testing consistent with DOE's sampling plans for enforcement testing of products as outlined in 10 CFR Part 429.

¹Approach 1 will apply if multiple tests are required to determine qualification, but all units must individually meet the ENERGY STAR requirements (e.g., displays, imaging equipment).

² Approach 2 may also apply to products not subject to Federal energy conservation standards if the ENERGY STAR specification allows for and the manufacturer chooses to qualify a product based on a statistical combination of tests on multiple units.

Determination of Testing Failure for the ENERGY STAR Verification Program

The following approaches will be applied by DOE and CBs when conducting verification testing of ENERGY STAR products, depending on how the product was originally qualified.

Approach 1: Manufacturer qualifies product for ENERGY STAR based on one representative model

One unit will be selected, obtained, and tested. Consistent with requirements for ENERGY STAR qualification, the measured performance must be equal to or better than the ENERGY STAR specification requirements.

$$Consumption_{Test} \leq ESTAR \text{ consumption specification}$$

$$Efficiency_{Test} \geq ESTAR \text{ efficiency specification}$$

Approach 2: Manufacturer qualifies product for ENERGY STAR based on multiple test samples

Four units will be selected and obtained at once. One unit will initially be tested for a spot check. If the tested unit fails to meet the requirement by less than 5% of the applicable ENERGY STAR specification, no further tests will be conducted and the model will be considered to meet ENERGY STAR requirements. If the measured performance is not within this range, the three additional units will be tested immediately. In this case, manufacturers shall not be notified of the spot check test results until all four units are tested, at which time a testing failure can be determined.

Test results from the four units will be used to determine if the model meets the ENERGY STAR specification. DOE may also use these results for evaluation of compliance with Federal energy conservation standards.

The following will be calculated on the sample of four units:

Mean (x)	$x = \frac{1}{n} \left(\sum_{i=1}^n x_i \right)$	$n = 4$ (number of units tested) X_i = measured energy efficiency or consumption from test i
Standard Deviation (s)	$s = \sqrt{\frac{\sum_{i=1}^n (x_i - x)^2}{n - 1}}$	
Standard Error (s_x)	$s_x = \frac{s}{\sqrt{n}}$	
Lower Confidence Limit (LCL)	$LCL = EES - ts_x$	EES = energy efficiency specification or standard $t = 3.182$ (97.5% one-sided student's t statistic for a sample size of 4)
Upper Confidence Limit (UCL)	$UCL = ECS + ts_x$	ECS = energy consumption specification or standard
5% tolerance on LCL	$LCL(0.05) = 0.95 * EES$	
5% tolerance on UCL	$UCL(0.05) = 1.05 * ECS$	

For an energy efficiency specification, the LCL and $LCL(0.05)$ are compared, and the greater value is compared to the mean (\bar{x}). The model meets the ENERGY STAR specification if the sample mean is equal to or greater than the lower control limit.

$$\text{Mean } (\bar{x}) \geq LCL \text{ or } LCL(0.05), \text{ whichever is greater}$$

For an energy consumption specification, the UCL and $UCL(0.05)$ are compared, and the smaller value is compared to the mean (\bar{x}). The model meets the ENERGY STAR specification if the sample mean is equal to or less than the upper control limit.

$$\text{Mean } (\bar{x}) \leq UCL \text{ or } UCL(0.05), \text{ whichever is smaller}$$

Consequences of Testing Failures

CBs are required to report testing failures to EPA within 2 days of determining a testing failure. EPA will then notify the manufacturer and provide 20 days for a written response. This may include the submission of additional relevant information to EPA. EPA will review submitted information from the manufacturer and determine if any additional evaluation is necessary. Where applicable, EPA will consult DOE regarding the appropriate application of test methods.

EPA will provide additional time to resolve questions of potential non-compliance as appropriate. If a decision is made to disqualify the product, the manufacturer will be required to discontinue labeling of the product and institute other corrective actions as directed by EPA.

Relationship to Enforcement of Federal energy conservation standards

If verification testing performed in support of the ENERGY STAR program suggests that a model is not compliant with Federal energy conservation standards, DOE will proceed in accordance with 10 CFR Part 429, as appropriate.

Relationship to Enforcement of DOE Certified Ratings

If verification testing performed in support of the ENERGY STAR program suggests that the test data do not support the DOE certified rating, DOE will proceed in accordance with 10 CFR Part 429, as appropriate.