Revising the U.S. Dishwasher Test Procedure: International Harmonization Issues and Projections

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International harmonization of test procedures is a global target offering potential trade benefits. In the U.S., manufacturers are currently working with the Department of Energy (DOE) and the National Institute of Standards and Technology to develop an alternative approach to adapt to new technological developments. This paper compares the current U.S. and European (CENELEC) dishwasher test procedures and broadly addresses changes to the U.S. and International dishwasher standards which are currently under review. The paper will summarize current U.S. efforts and project where the U.S. dishwasher test procedure is headed, highlighting key issues concerning manufacturers, environmentalists, and the U.S. DOE.

Performance testing and product labeling vary internationally, regardless of whether reporting is mandatory or voluntary. (In most cases, a test procedure is selected and the testing and labeling requirements are imposed on a country-by-country basis.) Historically, international dishwasher test procedures have combined energy and wash performance testing that are used for voluntary labeling, while the U.S. has focused solely on energy testing and imposed mandatory energy performance standards and labeling. In the U.S., an American National Standards Institute (ANSI) standard exists for dishwasher performance testing[0]. This method was developed by the Association of Home Appliance Manufacturers (AHAM), but it is primarily used by companies for their product testing with no performance results available to the general public.

In the U.S., the Energy Policy and Conservation Act, as amended by the National Energy Conservation Act, the National Appliance Energy Conservation Act, and the National Appliance Energy Conservation Amendments, prescribes energy conservation standards for certain major household appliances, and requires the DOE to administer an energy conservation program for these products. DOE must to develop and maintain uniform test procedures that are used to evaluate the energy performance of major household appliances and the Federal Trade Commission (FTC) must develop a labeling program, based on the results of the DOE test procedures. In addition, DOE is required to establish Federal minimum efficiency standards.

However, the current U.S. DOE test procedure for energy efficiency uses only a clean test load and therefore does not result in a realistic or typical wash cycle for adaptive control (e.g. soil-sensing) dishwashers[0] This has become inadequate because methods used to obtain energy performance for dishwashers must address common issues such as adaptive technologies and testing for level product comparisons (conventional models versus adaptive models). A soil-based test method for rating the energy and water consumption of dishwashers is needed. This need brings harmonization opportunities.

THE ISSUES

Fuzzy logic controlled appliances were available in the Far East for several years before similar technologies appeared in the U.S. market. Today several manufacturers of adaptive control machines have algorithms that are capable of reducing the wash time and energy consumption in the absence of soils. When consumers use their dishwashers at home and introduce soiled loads, it is likely that most of the adaptive control dishwashers will have energy consumption significantly higher than that currently reported on the mandatory energy labels. Therefore, the labels displayed on new machines and intended to assist consumers in making informed decisions, can be misleading. It is necessary to ensure that machines meet the mandatory energy performance standards under normal operating conditions, as intended by the current DOE test procedure. Hence, the challenge exists to develop a test procedure capable of accurately capturing the energy consumption of the machine under typical actual operating conditions while seeking to maintain a relatively low test burden.

Consumers need a basis for comparing various dishwasher models in order to make informed purchasing decisions. They are also increasingly conscious of the long term savings potential and payback benefits resulting from energy efficient models. The U.S. DOE, the U.S. Environmental Protection Agency, product manufacturers, local utilities, and retailers., through their involvement in the Energy Star®0 program have been working to provide incentives for consumers to purchase efficient products. Energy Star® is a voluntary partnership to help promote efficient products by labeling with the Energy Star® logo and educating consumers about the benefits of energy efficiency. This program also serves as an incentive to manufacturers who are recognized for their higher energy efficiency models. The success of such programs hinge on the accuracy of energy testing.

Numerous alternatives requiring less time and effort have been explored since adaptive control machines entered the market, but ultimately, a soil based test procedure appears to be the most effective means of capturing meaningful energy efficiency data for consumers. That said, there are many related issues that must be resolved such as the type of soils introduced, quantity of soils, adhesion to the test load, and loading patterns. In order to develop a test procedure that creates a level playing field, the method must be robust enough to handle all the existing forms of soil-sensing technology and capable –ideally - of keeping up with changing technologies. This can best be achieved by approximating real world conditions.

Advancement in this area has been hindered in part by the significant differences in dishwasher design, consumer practices and market forces for each country. In addition, the impact varies for the countries involved, depending on whether they have voluntary participation in labeling and energy efficiency regulation, or mandated minimum energy and/or performance standards. An understanding of the technology implemented in dishwasher design, along with an overview of the existing and proposed standards, can promote a better understanding of the issues that must be resolved.

THE CURRENT STATE OF THE ART

Dishwashers in the U.S. use an average of over 30 L (8 gal) of water per cycle. U.S. dishwashers are expected to perform as a disposal for food soils, grinding large food particles and flushing them down the drain. In contrast, European designs are smaller in size, use less water, and capture large food particles in a basket that must be emptied out by the consumer. These global differences in dishwasher design make harmonizing test procedures more challenging.

Under the U.S. test procedure, energy consumption is directly proportional to water usage because of the energy intensive process of heating supply water. In an effort to provide added functionality and reduce energy consumption, six manufacturers have introduced soil-sensing dishwashers to the U.S. market. These represent high end products and offer additional savings potential for those households that typically run cycles that are longer and more energy intensive than is necessary to wash their dishes. This is achieved by implementing algorithms that respond to sensor measurements made during the wash. However, the energy savings potential for the average consumer is unknown.

Of the various types of soil-sensing models sold in the U.S., four basic parameters have been or are in use as inputs to the dishwasher algorithms. These parameters are: 1)turbidity, 2)conductivity, 3)temperature, and 4)pressure. Machines use combinations of some of these measurements to make decisions on whether to modify wash duration and intensity. Additionally, there are variations in the specific types of sensors that provide the inputs to the control logic. Examples of some sensor adaptations used to obtain input parameters are discussed below.

Turbidity sensing is used to determine the degree and/or character of particles within the water of the dishwasher. One example of a turbidity sensor uses a light emitting diode as the light source on one side of the fluid flow and a photo-transistor as a light sensing device on the other side of the fluid flow to “look” at the transparency/turbidity of the washing fluid. If the sensed turbidity is below a threshold value, the drain motor and the water valve are disabled to prevent the water from being drained and to prevent additional water from being introduced into the dishwasher.

Measuring reflected light is another way of measuring the level of particles in the wash fluid. In this case, the path of the light emitted from the source is reflected through the fluid and picked up by a reference light sensor.

In early models, turbidity and conductivity sensors were used to improve control. Dishwasher detergents are an example of a conductive substance when dissolved in water. By using the conductivity sensor, the presence of detergent may be determined. These readings characterize the nature of the fluid pumped throughout the dishwasher, typically a combination of water, detergent, and soil

Many of the later adaptive control models combined turbidity sensing with water temperature sensing and use measurements to decide what sequence the machine should select, to add heat, or delete a fill. Sensors are read at pre-selected periods in the cycle and the measurements are input parameters to the wash algorithm.

In one pressure based adaptive control dishwasher, wash fluid circulates throughout the dishwasher tub and passes through a soil collection chamber. This chamber is designed to capture the soil so that large particles suspended in the fluid do not return back to the tub. A pressure sensor is placed within the soil collection chamber to monitor the pressure which builds as soil begins to block the fine filter. Once the pressure sensor senses fluid pressure exceeding a threshold within the soil collection chamber, the dishwasher control will drain the soil water and add fresh water. This input also determines a sequence of events including energizing the thermal element to add heat and target hard to remove fats and oils.

Finally, temperature sensors are relatively inexpensive and provide valuable information on the melting of fats and oils present within the tub. Detergent manufacturers recommend higher wash temperatures to ensure a clean wash load. By using a temperature sensor in the tub, manufacturers can ensure that the desired wash temperatures are reached, regardless of the supply water temperature.

Designers continuously seek to improve performance and functionality with new sensor technology, and as a result the implementation of these and other types of sensors can vary from model to model. Some machines have a limited cycle (# of fills) while others are open ended cycles. Additionally, some machines are designed for discrete sensing at specific intervals in the cycle while others operate on a more continuous basis. In all cases, however, the control decisions are made in the time period of the cycle.

(U.S./EC STANDARDS

As stated previously, the U.S. DOE test procedure requires mandatory energy testing with a clean load, but the U.S. is moving to a soil based test in order to obtain meaningful results for consumers. This section looks at the existing U.S. and EC performance test procedures: ANSI/AHAM DW-1 1992[0] and European Committee for Electrotechnical Standardization (CENELEC)50242[0], respectively.

There is a fundamental difference in the soil loads between the U.S. and international standards; the ANSI/AHAM method is a re-deposition test involving a large amount of soils whereas the international test is one of adhesion. These test procedures, along with market research carried out by the industry, serve as catalysts to improve dishwasher design. Unfortunately, when test procedures do not reflect consumer use, they can hinder efforts for improved energy efficiency. For example, if a heavy soil load test is used to test performance, but without any connection to energy efficiency, then manufacturers are driven to design machine wash algorithms to increase water consumption and/or energy intensity to achieve good wash performance under an unrealistic demand. In particular, larger fills may be necessary to remove soils from the dishwasher. Ultimately, any increases in water consumption only serve to reduce the energy efficiency of the model when used in consumer households to clean average loads.

In the U.S., energy testing and reporting is mandatory and is carried out in two stages; compliance certification and labeling. DOE has the authority over compliance certification while the U.S. FTC has authority over labeling. This process (10CFR430) must be carried out for each model type. Models that do not meet the prescribed minimum energy performance standard cannot be distributed in the U.S. and any misrepresentation of product information on the FTC energy labels carry large financial penalties[0] ($100/day per unit). To establish greater confidence in compliance data submitted to DOE, manufacturers generally test a much larger number of units than is required by the DOE energy test procedure. Therefore, changes made to introduce a mandatory soil based test procedure represent a heavy test burden to manufacturers.

AHAM and the International Electrotechnical Commission (IEC) publish the two principal standards for performance testing of household dishwashers. These documents establish uniform testing procedures to measure and evaluate the performance of household electric dishwashers. The U.S. national standard for household dishwashers, ANSI/AHAM DW-1 1992, is undergoing a revision and is currently being reviewed. The following comparison will refer to the DW-1 1992 while the subsequent section will address known areas of revision.

On the international level, the IEC is the primary body covering dishwasher standards. In 1981, IEC 60436 became the standard for energy and performance testing to be used for any product labeling by member countries. It is a soil based performance test that can be run concurrently as an energy test with some modifications[0]. This method requires a minimum of three test runs per dishwasher, averaged and reported as one value. However, over years of use, several deficiencies arose which member countries sought to correct. Reproducibility was the major problem. In addition, the test did not discriminate well; the test was too easy resulting in a narrow band of high scores for most machines. Ultimately this test was abandoned as a labeling test and a new standard EN 50242 was developed and approved by CENELEC. A revision of IEC 436, based on CENELEC EN 50242 is underway and will be voted on this year.

In addition, a review was made of the Canadian standard, CAN/CSA-C373-92 AEnergy Consumption Test Methods for Household Dishwashers@.

ANSI/AHAM DW-1

Test procedures described in ANSI/AHAM DW-1[0] assess the washing and drying ability of dishwashers. Other areas covered by this standard but not discussed in this paper are the durability of inlet and drain tubing, requirements for nameplate information and drain connections, and safety and sanitation issues. References are made to the DOE test procedure for energy and water consumption not directly addressed in this standard.

Under the ANSI/AHAM DW-1, installation must follow the manufacturers instructions and require preconditioning before the start of each test. The preconditioning consists of running through two dishwasher cycles with the use of detergent and water and following each test, a cleanup cycle without a test load. The clean load is to be preconditioned separately, in a dishwasher other than the one to be tested, set on the normal cycle and using detergent and water only.

The ANSI/AHAM performance testing procedure requires the machine to be tested under controlled ambient conditions. During testing the room conditions are set to a temperature between 21 °C and 27 °C (70 EF and 80EF) and a relative humidity range of 25 % to 60 %. Conditions for water temperature 60 EC ∀3 EC, 49 EC ∀1EC, 10 EC ∀1 EC (140 EF ∀5 EF, 120EF ∀2EF, and 50 EF ∀2 EF) and water pressure 241.3 kPa ∀ 17.2 kPa (35 psi ∀2.5 psi) match those set forth by DOE test procedures. Water hardness must be maintained between 0 and 85 parts per million (ppm) and may be controlled by a cation water softener.

Detergent specifications detail the manufacturer and brand to be used at mass fraction of 0.5 %. based on the total weight of water in an average fill. The rinse agent for dishwashers having automatic rinse agent dispensers is as specified by the manufacturer. A standard 61 cm (24 in) wide dishwasher load consists of ten place settings and a set of serving pieces, and provisions are made for larger capacity dishwashers. Dishware specifications detail the manufacturer and brand to be used and includes a dinner plate, cup and saucer, bread and butter plate and bowl for each place setting. The test load also consists of clear 354.8 mL (12 fl oz) glasses without a pattern, obtained from a specific manufacturer, and stainless steel flatware.

The performance evaluation is executed for a minimum of three runs on a dishwasher, with a soiled load, set on the normal cycle. Testing is conducted until the mean of the sample performance measurement is within 10% of the true mean with a probability of at least 0.8. The quantity, brand, instruction for preparation, and order and location of application of each soil type is specified to maintain repeatability. Soiling ingredients are the following: 1)corn, 2)eggs, 3)coffee grounds, 4)ground beef mixture, 5)margarine, 6)milk, 7)oatmeal, 8)peanut butter, 9)potatoes, 10)preserves, 11)salt, 12)tomato juice, and 13)tomato paste. The process of applying the soils to the test load must be completed within 1 h and a 2 h drying period begins after applying the oatmeal soil. After air drying, the load is stacked and loaded in the dishwasher with a consistent loading pattern maintained consistently for all tests.

Once the cycle has terminated, the dinnerware, glassware, and flatware is removed, evaluated, and scored. The washing index for dishware and flatware is based on particles scored according to size and number. Glasses are examined for spots, tine marks, and particles. The scoring considers the depth of the tine marks, frequency of markings, and size of any water spots present. Points accrued from this evaluation are used to calculate a washing index for the test run. This washing index, combined with the washing indices from a minimum of two other runs, determines the overall washability index (weighted arithmetic mean). This is a basis on which to compare and evaluate different brands or models of electric dishwashers.

CENELEC EN 50242

The EC standard, CENELEC EN 50242[0], is a comprehensive test procedure for dishwashers. CENELEC EN 50242 was developed for the purpose of measuring cleaning performance, drying performance, energy and water consumption, and airborne acoustical noise. The standard sets no performance requirements. In broad scope, the U.S. (ANSI/AHAM) and international (CENELEC) standards both seek to be rigorous performance tests, but have significant technical differences. The most notable is that the CENELEC procedure requires parallel testing of a reference machine. The reference machine is a specific model whose energy and performance characteristics have been thoroughly tested and documented. Testing laboratories must purchase one of the reference machines and, prior to use as a reference, test the machines performance and verify that it meets the criteria (tolerances) specified in the standard.

The CENELEC performance testing procedure requires the machines (reference and test units) to be tested under controlled ambient conditions, (23±2) °C and (55±10) % RH. The dishwashers must be installed following manufacturers' instructions but the standard provides specific instructions for special installation cases. The water supply must be maintained to (15±2) °C and a water hardness of (0.9 to 3.0) mmol/L, at a manufacturer specified pressure. For machines without a water softener, the hardest water permitted according to manufacturers' instructions must be used. The standard describes the reference detergents to be used in amounts recommended by the manufacturer but places a cap on the maximum allowable detergent per place setting load. Similarly, rinse agent use follows manufacturer recommendation but is set to a minimum if no instructions are given.

The test load is specified by name, diameter, form, item number, and supplier. The soiling of the test load is a exacting process under both U.S. and EC standards, and numerous factors need to be consistent between tests to ensure repeatability. The test soils are 1) ultra heat treated milk, 2) tea, 3) minced meat, 4) egg, 5) porridge, 6) spinach, and 7) margarine. Detailed soil application and sequencing instructions are given and an introductory video serves to introduce people to the procedure. Specific brands, order of application, and amounts are chosen to maintain consistency of the soiling agents for various tests. During the soiling procedure, half-filled tea cups are pre-dried in the oven for 1 h at 80 °C. Once the soiling procedure is complete, the tea is emptied out and the entire test load, with the exception of the oval plate soiled with margarine, is placed in the oven for a 2 h drying period at 80 °C.

This is a significant difference over the way AHAM dries soils. The items are loaded from the oven to the dishwashers and must cool for 30 min prior to running the test cycle. The oval platter is then loaded and a normal cycle is run. Machines are cooled down with open doors for at least 30 min in between tests. Once the cycle is completed, each item is assessed of its cleanliness. For scoring cleanliness, each item is viewed for a maximum of 10 s and rated on a scale of 0 to 5 based on the number and size of remaining soil particles. Five cleaning cycles are performed without cleaning the dishwashers between test cycles unless additional testing is required.

Drying performance measurements are not made in conjunction with cleaning performance measurements. To assess drying performance, the same procedure is followed, with the exceptions that no soils are introduced and the dishwasher door is kept closed and latched for 30 min following completion of the wash cycle. To score drying performance, each item is visually inspected for a maximum of 3 s. Each piece is judged to be "dry" (completely free of moisture) with a score of 2, "intermediate" (having 1-2 drops or 1 wet streak) with a score of 1, or "wet" (having more than 2 drops of water or 1 drop and 1 wet streak or 2 streaks, or water in glass or cup cavity) with a score 0. Five cleaning cycles are performed unless additional testing is required. Every item has the same evaluation scale for cleanliness and dryness based on particle size and water droplets whereas the U.S. standard has a different evaluation scheme for: flatware, dishware, and glassware and includes scoring standards for watermarks and tine marks in the evaluation.

European standards are referenced for the measurement and determination of acoustical noise.

The completed test report includes:
- identification of the dishwasher;
- number of place settings;
- name of the test cycle;
- supply voltage;
- amount of detergent used;
- ambient temperature and RH;
- water supply data;
- cleaning performance;
- drying performance;
- energy consumption;
- water consumption;
- cycle time; and
- airborne noise, if tested.

This revised test procedure makes significant improvements over the IEC 436 test procedure. The CENELEC standard introduced tighter tolerances, the use of a reference machine, a new reference detergent, a new test method for cleaning performance, and revised scoring for cleaning and drying performance. The use of a reference machine was introduced to allow for a direct comparison of test results to ensure test consistency

CAN/CSA-C373-92

The Canadian standard[0], CAN/CSA-C373-92, provides testing methods identical to that of the DOE test procedure and refers to both the DOE and AHAM standards. One significant difference is found in section 7.2 Feature Requirement that states AAll dishwashers shall be equipped with an option to dry without heat@ This same requirement was mandated by DOE standards for dishwashers manufactured between January 1, 1988 and May 14, 1994 and later removed as the minimum energy standard requirement took effect.

WHAT HAS BEEN PROPOSED? (AHAM/IEC)

The proposed test procedures improve testing to better capture the performance differences between models that consumers are interested in and to approach real world use. AHAM is in the final stages of reviewing proposed revisions to ANSI/AHAM DW-1-1992. If approved in early 2001, it will be reviewed under the ANSI accredited canvass method. Under this method, AHAM conducts a canvass of organizations or individuals that are known to be affected by the standard to determine their position on the proposed recognition of the revised DW-1 as an American National Standard.

At the time of publication of this paper, the revisions were at the second stage of AHAM's internal review[0]. Although no versions have been made public as of yet, the nature of the proposed revisions have been discussed and are summarized below. Overall, the revisions are substantial, but they do not change the nature of the test. Modifications were made to make the standard easier to read/follow and to clarify some areas of conflict related to the application of soils. Other issues that are being addressed are: 1) test load number of place settings and type, 2) detergent, and 3) scoring.

Specifically, the current standard specifies a minimum of 10 place settings, yet most manufacturers have standard dishwashers with a 12 place setting capacity. Allowances are made for testing with a higher number of place settings; manufacturers state the place setting capacity and test to that limit. Regarding dishware specifications, the model specified in DW-1 1992 is no longer available, and there have been some problems with changes to the glazing finish following a factory switch to lead-free glazing. The new specifications are designed to more closely parallel the IEC place settings with the exception of the serving bowls which will remain the same brand name, and the soup bowls which are not as wide and shallow as the IEC specified soup bowls.

AHAM proposes that the detergent concentration specification be eliminated, leaving the detergent level to be specified by the manufacturers' instructions. Also, there is a change in the scoring method, intended to make the scoring more rigorous by adding the scoring of spots and streaks to areas that were not previously scored. This would provide a larger scoring spread for models out on the market today. Note: no new soils have been proposed in the revisions.

In 1996, the IEC subcommittee 59A: Electric Dishwashers formed a new Working Group 2 to consider an international dishwasher performance standard, using CENELEC EN 50242 as the basis. The new standard was to take into account the needs of countries outside the EC and to determine the repeatability and reproducibility of the method by means of a ring test program. The ring test, also known as a round robin test, involves testing the same machine at various laboratories. In this case, four laboratories participated with the goal of comparing repeatability and reproducibility and evaluating "low-end" and "high-end" dishwashers. Tests were conducted using EN 50242 with an oven dry method and also with a 15 h air dry method to determine if required use of an oven is justified.

Some countries found the oven drying method to be unrealistic and too adhesive. In the case of sensor based dishwashers, this may effectively push up energy and water usage so manufacturers can achieve good performance results. Some countries consider the air drying method to be more realistic, but it requires humidity controlled rooms, drying space, and reduces the number of tests per week that can be run.

Although individual countries had strong preferences for a particular method, the consensus of the working group was to recommend that both drying methods be drafted due to results showing no significant difference in performance results, due to the leveling effects of the reference machine. Ultimately the proposed standard offers both methods, leaving it to individual countries to decide which of the two methods will be used for their programs.

The proposed IEC test procedure specifies that the cleaning performance test and energy/water consumption measurements are carried out at the same time, rather than merely prescribing that the same test cycle is to be used. There is no notable change to the ambient conditions, test load, test soils or scoring, but additional details are given regarding the preparation and measurement of applied soils. The IEC test procedure does tighten tolerances on water hardness and adds a specification for water pressure.

This proposed international standard is a committee document within the IEC. It is currently out for comment until April 2001. If no significant comments exist, the Working Group will prepare the document for a vote in October 2001.

WHERE IS THE U.S. HEADED?

Developing a soil-based dishwasher test procedure has been considered for several years. However, the U.S. DOE put aside this effort in order to work with manufacturers who wanted a test procedure that did not require testing with soils. Major concerns for the manufacturers included the expense related to running soil based tests, repeatability issues, and trying to resolve testing issues such as consumer usage patterns. The U.S. manufacturers recommended a procedure which required forcing the test units into maximum and minimum energy use cycles, and using weighting factors to obtain energy use values that would approximate typical consumer use. However, this and other alternatives have proved unsuitable, and manufacturers now seem to believe that a soil based test procedure is needed and are working to resolve testing issues.

The IEC, CENELEC, and AHAM have all spent years in testing and development to address repeatability and reproducibility for performance based test procedures. Having participated in the development of both the AHAM and IEC test procedures, several U.S. manufacturers are familiar with the soiling procedures and have testing environments that can acheive the required tolerances. Members of the IEC WG2, including U.S. representatives, have identified potential problems that may exist in testing U.S. machines using the proposed IEC 60436. Other problems exist in using AHAM test procedures for use with an energy test[0].

With the IEC test procedure, there was some concern that different drying methods may cause different reactions in the soil-sensing machines. For example, the 15 h air drying method has the soils come off the plates in the pre-wash portion of the cycle. The 2 h oven dry method changes the adhesion of the soil and causes most soils to be released in the main wash of the cycle. This may solicit a different reaction in one machine due to sensor readings. Looking at the AHAM test load, a question arises: Can we extrapolate the performance at high soil levels to look at normal soil levels (normal cycle) and still see the same performance comparisons? And how do these machines work relative to consumer use patters? This is unknown.

The DOE is using a contractor to review consumer use survey data, provided confidentially by manufacturers through AHAM, to determine washing patterns in the U.S. This includes wash frequency, cycle used, dish load, soil load, loading patterns, and energy use. With this information DOE will seek to approximate a “normal soil load”. Knowing typical quantities and types of soils, a test could be formulated to balance the re-deposition aspects of the AHAM test and the tenacity aspects of the IEC test. It is anticipated that the results of the analysis of consumer use data will be available in June 2001 at which point DOE will continue work with NIST and stakeholders to develop a soil-based test procedure.

If the new IEC standard is completed at the time of the next AHAM review of dishwasher test procedures, then AHAM will likely review it to determine if they wish to adopt it. Similarly, ANSI looks at all existing standards when it decides what to adopt as the American National Standard.

The U.S. DOE will likely incorporate a soil-based test into the next version of the test procedure to come up with energy performance ratings[0]. DOE will choose whatever test procedure, or portions of test procedures that best capture the energy performance of the machines. Regardless of whether the test procedure adopted by DOE is a soil-based test procedure intended for rating energy and wash performance, such as the IEC 60436, DOE’s authority only extends to energy performance. Therefore, any test procedure developed or adopted by DOE will not cover cleaning performance or drying performance and will not add cleaning or drying performance data to labeling.

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