**Utility Test Protocol for Residential Clothes Dryers**

**A Combined Supplemental and DOE D2 Test Procedures**

Developed by ECOVA on behalf of NEEA and PG&E

Version 1.01

The Northwest Energy Efficiency Alliance (NEEA) and Pacific Gas and Electric (PG&E) commissioned Ecova to expand on the U.S. Department of Energy’s (DOE) new residential clothes dryer test procedure, Uniform Test Method for Measuring the Energy Consumption of Clothes Dryers - Appendix D2, to include a wider range of drying modes and settings, and a more diverse and challenging test load of mostly 100% cotton garments. This new, expanded group of dryer tests, finalized in August of 2014 and named the Utility Test Protocol, produces a final Utility Combined Energy Factor (UCEF). The UCEF is a weighted average the five combined energy factors (CEF) calculated from the results of the five tests described in this protocol.

NEEA and PG&E worked with Ecova to develop the Utility Test Protocol because the DOE’s Appendix D2 only assesses dryer performance in a single mode with a uniform test load composed of thin, half synthetic test cloths. NEEA collected field data showing that real world dryer operation was significantly different, with consumers drying clothing loads of varying size, cotton content, and clothing dimensionality under multiple dryer modes. The supplemental tests more fully account for real world use conditions by testing dryers in a variety of operational modes with a test load composed of realistic test articles. At this point, the supplemental tests are only for full-sized dryers with automatic termination capability.

Appendix D2 was designed to assess dryer performance during auto-terminating operation with a uniform test load and was added to Subpart B of Code of Federal Regulations Part 430, Uniform Test Method for Measuring the Energy Consumption of Clothes Dryers on August 13th, 2013. NEEA and PG&E modeled the Utility Test Protocol after Appendix D2 to ensure consistency of approach as much as possible, making it possible for laboratory technicians already familiar with Appendix D2 to carry out the Utility Test Protocol without the need for new equipment or retraining. This protocol remains largely unchanged from Appendix D2 in Sections 1 to 2.5 and Sections 3.5 to 4.8. Sections 2.6, 2.7 and 3.4 were modified with additional language for the new test loads, and Sections 3.3 and 4.9 for additional tests runs and post data processing.

These tests shall be performed on an individual unit (unit-to-unit variation does not need to be tested).

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# 1. DEFINITIONS

1.1 Active mode: Mode in which the clothes dryer is connected to a main power source, has been activated and is performing the main function of tumbling the clothing with or without heated or unheated forced air circulation to remove moisture from the clothing, remove wrinkles or prevent wrinkling of the clothing, or both.

1.2 AHAM: Association of Home Appliance Manufacturers.

1.3 AHAM HLD-1:The test standard published by the Association of Home Appliance Manufacturers, titled “Household Tumble Type Clothes Dryers,” (2009), AHAM HLD-1-2009 (incorporated by reference; see § 430.3).

1.4 Automatic termination control: Dryer control system with a sensor which monitors either the dryer load temperature or its moisture content and with a controller which automatically terminates the drying process. A mark, detent, or other visual indicator which indicates a preferred automatic termination control setting must be present if the dryer is to be classified as having an “automatic termination control.” A mark is a visible single control setting on one or more dryer controls.

1.5 Automatic termination control dryer: Clothes dryer which can be preset to carry out at least one sequence of operations to be terminated by means of a system assessing, directly or indirectly, the moisture content of the load. An automatic termination control dryer with supplementary timer or that may also be manually controlled shall be tested as an automatic termination control dryer.

1.6 Bone dry: Condition of a load of test clothes which has been dried in a dryer at maximum temperature for a minimum of 10 minutes, removed, and weighed before cool down, and then dried again for 10-minute periods until the final weight change of the load is 0.3 percent or less.

1.7 Compact/compact size: Clothes dryer with a drum capacity of less than 4.4 cubic feet.

1.8 Conventional clothes dryer: Clothes dryer that exhausts the evaporated moisture from the cabinet and generates heat by use of an electrical resistance heating element.

1.9 Cool down: Portion of the clothes drying cycle when the added gas or electric heat is terminated and the clothes continue to tumble and dry within the drum.

1.10 Cycle: Sequence of operation of a clothes dryer which performs a clothes drying operation, and may include variations or combinations of the functions of heating, tumbling, and drying.

1.11 Drum capacity: Volume of the drying drum in cubic feet.

1.12 “IEC 62301” (Second Edition) means the test standard published by the International Electrotechnical Commission (“IEC”) titled “Household electrical appliances—Measurement of standby power,” Publication 62301 (Edition 2.0 2011-01) (incorporated by reference; see § 430.3).

1.13 Inactive mode: Standby mode that facilitates the activation of active mode by remote switch (including remote control), internal sensor, or timer, or that provides continuous status display.

1.14 Moisture content: Ratio of the weight of water contained by the test load to the bone-dry weight of the test load, expressed as a percent.

1.15 Moisture sensing control: System which utilizes a moisture sensing element within the dryer drum that monitors the amount of moisture in the clothes and automatically terminates the dryer cycle.

1.16 Off mode: Mode in which the clothes dryer is connected to a main power source and is not providing any active or standby mode function, and where the mode may persist for an indefinite time. An indicator that only shows the user that the product is in the off position is included within the classification of an off mode.

1.17 Standard size: Clothes dryer with a drum capacity of 4.4 cubic feet or greater.

1.18 Standby mode: Any product mode where the energy using product is connected to a mains power source and offers one or more of the following user-oriented or protective functions which may persist for an indefinite time:

(a) To facilitate the activation of other modes (including activation or deactivation of active mode) by remote switch (including remote control), internal sensor, or timer.

(b) Continuous functions, including information or status displays (including clocks) or sensor-based functions. A timer is a continuous clock function (which may or may not be associated with a display) that provides regular scheduled tasks (*e.g.,* switching) and that operates on a continuous basis.

(c) To maintain connection to the internet or computer network that enabled external interaction with the dryer.

1.19 Temperature sensing control: System which monitors dryer exhaust air temperature and automatically terminates the dryer cycle.

1.20 Timer dryer: Clothes dryer that can be preset to carry out at least one operation to be terminated by a timer, but may also be manually controlled, and does not include any automatic termination function.

1.21 Ventless clothes dryer: Clothes dryer that uses a closed-loop system with an internal condenser to remove the evaporated moisture from the heated air. The moist air is not discharged from the cabinet.

1.22 Normal Program: Product mode in which the clothes dryer operates using a group of automated settings designated as normal. For dryers that do not have a “normal” program, the cycle recommended by the manufacturer for drying cotton or linen clothes shall be considered as “normal”.

1.23 Eco Program: Eco Program: Product mode in which the clothes dryer operates using a group of automated settings to achieve energy savings above normal operation during the course of the dryer cycle. The eco program is a pre-determined setting advertised on the product by the manufacturer in order to save energy for a typical cotton/poly load (e.g. not “delicates” or other specialty load types). If more than one eco program exists, the test shall be run at the most efficient eco program available as specified by the manufacturer. If no advertised energy savings program exists, the “eco program” will be defined as by selecting a normal cycle setting and the lowest temperature setting available, excluding any no-heat settings.

1.24 Fastest Program: Product mode in which the clothes dryer operates using a group of automated settings to achieve the most rapid rate of drying during the course of the dryer cycle. The fastest program shall use the “HEAVY DUTY” cycle setting or a mode which the dryer applies the fastest drying rate possible to an eight and a half pound load composed of real clothing of varying thickness and cotton content (i.e. shortest cycle time). The fastest program may be created manually by selecting a cycle setting that allows the highest temperature and shortest drying time (commonly labeled as heavy-duty), excluding any cycles meant to sanitize clothing. If there are separate energy buttons, the fastest setting should be used, such as “speed.”

# 2. TESTING CONDITIONS

## 2.1 Installation.

2.1.1 ***All clothes dryers****.* For both conventional clothes dryers and ventless clothes dryers, as defined in sections 1.8 and 1.21 of this appendix, install the clothes dryer in accordance with manufacturer's instructions as shipped with the unit. If the manufacturer's instructions do not specify the installation requirements for a certain component, it shall be tested in the as-shipped condition. Where the manufacturer gives the option to use the dryer both with and without a duct, the dryer shall be tested without the exhaust simulator described in section 3.3.5.1 of AHAM HLD-1 (incorporated by reference; see § 430.3). All external joints should be taped to avoid air leakage. Control setting indicator lights showing the cycle progression, temperature or dryness settings, or other cycle functions that cannot be turned off during the test cycle shall not be disconnected during the active mode test cycle. For standby and off mode testing, the clothes dryer shall also be installed in accordance with section 5, paragraph 5.2 of IEC 62301 (Second Edition) (incorporated by reference; see § 430.3), disregarding the provisions regarding batteries and the determination, classification, and testing of relevant modes. For standby and off mode testing, all lighting systems shall remain connected.

2.1.2  ***Conventional clothes dryers****.* For conventional clothes dryers, as defined in section 1.8 of this appendix, the dryer exhaust shall be restricted by adding the AHAM exhaust simulator described in section 3.3.5.1 of AHAM HLD-1 (incorporated by reference; see § 430.3).

2.1.3  ***Ventless clothes dryers****.* For ventless clothes dryers, as defined in section 1.21, the dryer shall be tested without the AHAM exhaust simulator. If the manufacturer gives the option to use a ventless clothes dryer, with or without a condensation box, the dryer shall be tested with the condensation box installed.

## 2.2  Ambient temperature and humidity.

2.2.1 For drying testing, maintain the room ambient air temperature at 75 ± 3 ºF and the room relative humidity at 50 ±10 percent.

2.2.2 For standby and off mode testing, maintain room ambient air temperature conditions as specified in section 4, paragraph 4.2 of IEC 62301 (Second Edition) (incorporated by reference; see § 430.3).

## 2.3  Energy supply.

2.3.1  ***Electrical supply.*** Maintain the electrical supply at the clothes dryer terminal block within 1 percent of 120/240 or 120/208Y or 120 volts as applicable to the particular terminal block wiring system and within 1 percent of the nameplate frequency as specified by the manufacturer. If the dryer has a dual voltage conversion capability, conduct the test at the highest voltage specified by the manufacturer.

2.3.1.1 ***Supply voltage waveform.*** For the clothes dryer standby mode and off mode testing, maintain the electrical supply voltage waveform indicated in section 4, paragraph 4.3.2 of IEC 62301 (Second Edition) (incorporated by reference; see § 430.3). If the power measuring instrument used for testing is unable to measure and record the total harmonic content during the test measurement period, it is acceptable to measure and record the total harmonic content immediately before and after the test measurement period.

2.3.2 ***Gas supply****.*

2.3.2.1 ***Natural gas****.*  Maintain the gas supply to the clothes dryer immediately ahead of all controls at a pressure of 7 to 10 inches of water column. If the clothes dryer is equipped with a gas appliance pressure regulator for which the manufacturer specifies an outlet pressure, the regulator outlet pressure shall be within ±10 percent of the value recommended by the manufacturer in the installation manual, on the nameplate sticker, or wherever the manufacturer makes such a recommendation for the basic model. The hourly Btu rating of the burner shall be maintained within ±5 percent of the rating specified by the manufacturer. If the requirement to maintain the hourly Btu rating of the burner within ± 5 percent of the rating specified by the manufacturer cannot be achieved under the allowable range in gas inlet test pressure, the orifice of the gas burner should be modified as necessary to achieve the required Btu rating. The natural gas supplied should have a heating value of approximately 1,025 Btus per standard cubic foot. The actual heating value, H n 2, in Btus per standard cubic foot, for the natural gas to be used in the test shall be obtained either from measurements made by the manufacturer conducting the test using a standard continuous flow calorimeter as described in section 2.4.6 or by the purchase of bottled natural gas whose Btu rating is certified to be at least as accurate a rating as could be obtained from measurements with a standard continuous flow calorimeter as described in section 2.4.6.

2.3.2.2 ***Propane gas****.*  Maintain the gas supply to the clothes dryer immediately ahead of all controls at a pressure of 11 to 13 inches of water column. If the clothes dryer is equipped with a gas appliance pressure regulator for which the manufacturer specifies an outlet pressure, the regulator outlet pressure shall be within ±10 percent of the value recommended by the manufacturer in the installation manual, on the nameplate sticker, or wherever the manufacturer makes such a recommendation for the basic model. The hourly Btu rating of the burner shall be maintained within ±5 percent of the rating specified by the manufacturer. If the requirement to maintain the hourly Btu rating of the burner within ± 5 percent of the rating specified by the manufacturer cannot be achieved under the allowable range in gas inlet test pressure, the orifice of the gas burner should be modified as necessary to achieve the required Btu rating. The propane gas supplied should have a heating value of approximately 2,500 Btus per standard cubic foot. The actual heating value, H p, in Btus per standard cubic foot, for the propane gas to be used in the test shall be obtained either from measurements made by the manufacturer conducting the test using a standard continuous flow calorimeter as described in section 2.4.6 or by the purchase of bottled gas whose Btu rating is certified to be at least as accurate a rating as could be obtained from measurement with a standard continuous calorimeter as described in section 2.4.6.

## 2.4  Instrumentation.

Perform all test measurements using the following instruments as appropriate.

2.4.1  ***Weighing scale for test cloth****.* The scale shall have a range of 0 to a maximum of at least 30 pounds with a resolution of at least 0.2 ounces and a maximum error no greater than 0.3 percent of any measured value within the range of 3 to 15 pounds.

2.4.1.2 ***Weighing scale for drum capacity measurements****.* The scale should have a range of 0 to a maximum of at least 600 pounds with resolution of 0.50 pounds and a maximum error no greater than 0.5 percent of the measured value.

2.4.2  ***Kilowatt-hour meter****.* The kilowatt-hour meter shall have a resolution of 0.001 kilowatt-hours and a maximum error no greater than 0.5 percent of the measured value.

2.4.3  ***Gas meter****.* The gas meter shall have a resolution of 0.001 cubic feet and a maximum error no greater than 0.5 percent of the measured value.

2.4.4  ***Dry and wet bulb psychrometer****.* The dry and wet bulb psychrometer shall have an error no greater than ±1 °F. A relative humidity meter with a maximum error tolerance expressed in °F equivalent to the requirements for the dry and wet bulb psychrometer or with a maximum error tolerance of ± 2 percent relative humidity would be acceptable for measuring the ambient humidity.

2.4.5  ***Temperature****.* The temperature sensor shall have an error no greater than ±1 °F.

2.4.6  ***Standard Continuous Flow Calorimeter****.* The calorimeter shall have an operating range of 750 to 3,500 Btu per cubic foot. The maximum error of the basic calorimeter shall be no greater than 0.2 percent of the actual heating value of the gas used in the test. The indicator readout shall have a maximum error no greater than 0.5 percent of the measured value within the operating range and a resolution of 0.2 percent of the full-scale reading of the indicator instrument.

2.4.7  ***Standby mode and off mode watt meter****.* The watt meter used to measure standby mode and off mode power consumption shall meet the requirements specified in section 4, paragraph 4.4 of IEC 62301 (Second Edition) (incorporated by reference; see § 430.3). If the power measuring instrument used for testing is unable to measure and record the crest factor, power factor, or maximum current ratio during the test measurement period, it is acceptable to measure the crest factor, power factor, and maximum current ratio immediately before and after the test measurement period.

## 2.5  Lint Trap(s).

Clean the lint trap(s) thoroughly before each test run.

## 2.6  Test Cloths.

2.6.1  ***Energy test cloth for DOE test****.* The energy test cloth shall be clean and consist of the following:

(a) Pure finished bleached cloth, made with a momie or granite weave, which is a blended fabric of 50-percent cotton and 50-percent polyester and weighs within ±10 percent of 5.75 ounces per square yard after test cloth preconditioning, and has 65 ends on the warp and 57 picks on the fill. The individual warp and fill yarns are a blend of 50-percent cotton and 50-percent polyester fibers.

(b) Cloth material that is 24 inches by 36 inches and has been hemmed to 22 inches by 34 inches before washing. The maximum shrinkage after five washes shall not be more than 4 percent on the length and width.

(c) The number of test runs on the same energy test cloth shall not exceed 25 runs.

2.6.2  ***Energy stuffer cloths for DOE test****.* The energy stuffer cloths shall be made from energy test cloth material, and shall consist of pieces of material that are 12 inches by 12 inches and have been hemmed to 10 inches by 10 inches before washing. The maximum shrinkage after five washes shall not be more than 4 percent on the length and width. The number of test runs on the same energy stuffer cloth shall not exceed 25 runs after test cloth preconditioning.

2.6.3.1 ***Supplemental test clothes*.** The following supplemental test clothing shall be purchased from Lands’ End Clothing catalog. Clothing dimension measurements shall be measured as described in section 3.4.9 of this test procedure using a standard scale (in pounds).

(a) Article: V-neck T-shirt (Model # 411453-AH2)

Specifications: Regular fit, Short Sleeve, Relaxed

Size: Medium

Color: Black

Cotton content: 100%

Dimensions: 24”x 20” ±8%

Bone dry weight after conditioning: 0.318lbs ±0.032 lbs

(b) Article: Dress Socks (pair) (Model #: 412010-AH5)

Size: Medium

Color: Navy

Cotton content: 70%

Dimensions (per sock):16.5”x 2.5” ±8%

Bone dry weight after conditioning (per pair) 0.116lbs ±0.012 lbs

(c) Article: Boxer Shorts (Model #: 385086-AH0)

Size: 42

Color: Pearl gray

Cotton content: 100%

Dimensions: 16”x 17” ±8%

Bone dry weight after conditioning: 0.294lbs ±0.029 lbs

(d) Article: Corduroy Leggings (Model #: 420127-AH0)

Specifications: Regular Fit 2 Sport

Size: Medium

Color: Deep Black

Cotton content: 73%

Dimensions: 34”x 15” ±8%.

Bone dry weight after conditioning: 0.642lbs ±0.064 lbs

(e) Article: Bath Towel (Model #: 400365-AHX)

Size: Bath Towel

Color: Orchid Petal

Cotton content: 100%

Dimensions: 53”x 28” ±8%

Bone dry weight after conditioning: 1.498lbs ±0.15 lbs

(f) Article: Blue Jeans (Model #: 307460-AH3)

Specifications: Medium, Uncuffed

Size: 30” x 30” (length x inseam)

Color: Indigo

Cotton content: 100%

Dimensions: 39”x 16” ±8%

Bone dry weight after conditioning: 1.422lbs ±0.14 lbs

2.6.3.2 ***Test clothing life.***

The number of test runs on the same article of clothing shall not exceed 25 runs.

2.6.4 ***DOE Test Cloth Preconditioning****.*

All new test cloth load and energy stuffer cloths shall be treated as follows:

(1) Bone dry the load to a weight change of ± 1 percent, or less, as prescribed in section 1.6 of this appendix.

(2) Place the test cloth load in a standard clothes washer set at the maximum water fill level. Wash the load for 10 minutes in soft water (17 parts per million hardness or less), using 60.8 grams of AHAM standard test detergent Formula 3. Wash water temperature should be maintained at 140 °F ±5 °F (60 °C ±2.7 °C). Rinse water temperature is to be controlled at 100 °F ±5 °F (37.7 °C ±2.7 °C).

(3) Rinse the load again at the same water temperature.

(4) Bone dry the load as prescribed in section 1.6 of this appendix and weigh the load.

(5) Steps (2)-(4) are repeated until there is a weight change of 1 percent or less.

(6) A final cycle is to be a hot water wash with no detergent, followed by two warm water rinses.

(7) Bone dry the load once again, as prescribed in section 1.6 of this appendix, and weigh the load before using the load for testing.

2.6.5 ***Supplemental Test Clothes Preconditioning****.*

All new test clothing loads shall be treated as follows:

(1) Bone dry the load to a weight change of ± 0.3 percent, or less, as prescribed in section 1.6 of this appendix.

(2) Place the test cloth load in a standard clothes washer set at the maximum water fill level. Wash the load for 10 minutes in soft water (17 parts per million hardness or less), using 60.8 grams of AHAM standard test detergent Formula 3. Wash water temperature should be maintained at 140 °F ±5 °F (60 °C ±2.7 °C). Rinse water temperature is to be controlled at 100 °F ±5 °F (37.7 °C ±2.7 °C).

(3) Rinse the load again at the same water temperature.

(4) Bone dry the load as prescribed in section 1.6 of this appendix and weigh the load.

(5) Steps (2)-(4) are repeated until there is a weight change of 0.5 percent or less.

(6) A final cycle is to be a hot water wash with no detergent, followed by two warm water rinses.

(7) Bone dry the load once again, as prescribed in section 1.6 of this appendix, and weigh the load before using the load for testing.

## 2.7  Test Loads.

2.7.1  ***DOE Test Cloths - Compact size dryer load****.* Prepare a bone-dry test load of energy cloths that weighs 3.00 pounds ± .03 pounds. The test load can be adjusted to achieve proper weight by adding energy stuffer cloths, but no more than **five** stuffer cloths may be added per load. Dampen the load by agitating it in water whose temperature is 60 °F ± 5 °F and consists of 0 to 17 parts per million hardness for approximately 2 minutes to saturate the fabric. Then, extract water from the wet test load by spinning the load until the moisture content of the load is between 52.5 and 57.5 percent of the bone-dry weight of the test load. Make a final mass adjustment, such that the moisture content is 57.5 percent ± 0.33 percent by adding water uniformly distributed among all of the test clothes in a very fine spray using a spray bottle.

2.7.2  ***DOE Test Cloths - Standard size dryer load****.*

Prepare a bone-dry test load of energy cloths that weighs 8.45 pounds ± .085 pounds. The test load can be adjusted to achieve proper weight by adding stuffer cloths, but no more than five stuffer cloths may be added per load. Dampen the load by agitating it in water whose temperature is 60 °F ± 5 °F and consists of 0 to 17 parts per million hardness for approximately 2 minutes to saturate the fabric. Then, extract water from the wet test load by spinning the load until the moisture content of the load is between 52.5 and 57.5 percent of the bone-dry weight of the test load. Make a final mass adjustment, such that the moisture content is 57.5 percent ± 0.33 percent by adding water uniformly distributed among all of the test clothes in a very fine spray using a spray bottle.

2.7.3  ***Supplemental Test Loads****.*

2.7.3.1 ***Small Supplemental Test Load***. Prepare a bone-dry test load of the supplemental test clothes, composed of one of each article of supplemental test clothes (a pair of socks constitutes one article), referenced in section 2.6.3 a-f of this appendix, for a total weight of 4.22 lbs ±0.085 lbs. If, through use, the bone dry weight of the load falls below 4.16 lbs, the load shall be discarded.

2.7.3.2 ***Medium Supplemental Test Load***. Prepare a bone-dry test load of the supplemental test clothes, composed of two of each article of supplemental test clothes, referenced in section 2.6.3 a-f of this appendix (a pair of socks constitutes one article), for a total weight of 8.45 lbs ±0.17 lbs. If, through use, the bone dry weight of the load falls below 8.28 lbs, the load shall be discarded.

2.7.3.3 ***Large Supplemental Test Load***. Prepare a bone-dry test load of the supplemental test clothes, composed of four of each article of supplemental test clothes (a pair of socks constitutes one article), referenced in section 2.6.3 a-f of this appendix, for a total weight of 16.90 lbs ±0.34 lbs. If, through use, the bone dry weight of the load falls below 16.56 lbs, the load shall be discarded.

2.7.4 ***Method of wetting clothing.*** Dampen the load by agitating it in water whose temperature is 60 °F ± 5 °F and consists of 0 to 17 parts per million hardness for approximately 2 minutes to saturate the fabric. Then, extract water from the wet test load by spinning the load in a top-load washer until the moisture content of the load is between 60% and 64% of the bone dry weight of the test load. If moisture target is not reached by the end of the damping process, DO NOT make any adjustments. Restart the damping process in washer from the start until desired moisture is reached.

2.7.5  ***Method of loading****.* Load the energy test cloths by grasping them in the center, shaking them to hang loosely, and then dropping them in the dryer at random.

## 2.8 Clothes dryer preconditioning.

2.8.1  ***Conventional non-heat pump clothes dryers****.* For conventional clothes dryers, before any test cycle, operate the dryer without a test load in the non-heat mode for 15 minutes or until the discharge air temperature is varying less than 1 °F for 10 minutes—whichever is longer—in the test installation location with the ambient conditions within the specified test condition tolerances of section 2.2 in the appendix.

2.8.2  ***Ventless and heat pump clothes dryers****.* For ventless and heat pump clothes dryers, before any test cycle, the steady-state temperature measured at the compressor inlet and outlet must be within the ambient room temperature range described in section 2.2.1 of the appendix for a minimum of ten minutes. The machine may be left at ambient room conditions for at least 6 hours between tests as an alternative to measuring compressor inlet and outlet temperature.

# 3. TEST PROCEDURES AND MEASUREMENTS

## 3.1 Drum Capacity.

Measure the drum capacity by sealing all openings in the drum except the loading port with a plastic bag, and ensuring that all corners and depressions are filled and that there are no extrusions of the plastic bag through any openings in the interior of the drum. Fill the drum with water to a level determined by the intersection of the door plane and the loading port (*i.e.,* the uppermost edge of the drum that is in contact with the door seal). Record the temperature of the water and then the weight of the dryer with the added water and then determine the mass of the water in pounds. Add the appropriate volume to account for any space in the drum interior not measured by water fill (e.g., the space above the uppermost edge of the drum within a curved door) and subtract the appropriate volume to account for the space that is measured by water fill but cannot be used when the door is closed (e.g., space occupied by the door when closed). The drum capacity is calculated as follows:

*C=* w/d +/− volume adjustment

*C*= capacity in cubic feet.

*w*= mass of water in pounds.

*d*= density of water at the measured temperature in pounds per cubic foot.

## 3.2 Dryer Loading.

Load the dryer as specified in 2.7.

## 3.3 Test Cycle.

*3.3.1.* ***Test Cycle Dryer Settings****.*

The following table provides a general description each of the five different test cycles used. Refer to specific text in section 3.1.1 for explicit definitions.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test | Common Test Name | Load Type | Cycle Setting | Cycle Temp | Nominal Weight (lbs) | IMC | RMC |
| DOE Test (3.3.1.1) | D2 | Standard DOE Test Load | Default | High | 8.45 | 57.5% | 2% |
| One (3.3.1.2) | Small | Small Supplemental Test Load | Normal | Medium | 4.2 | 62% | 4% |
| Two (3.3.1.3) | Large | Large Supplemental Test Load | Normal | Medium | 16.8 | 62% | 4% |
| Three (3.3.1.4) | Eco | Medium Supplemental Test Load | Mfr Defined | Mfr Defined | 8.4 | 62% | 4% |
| Four (3.3.1.5) | Fastest | Medium Supplemental Test Load | Heavy Duty | High | 8.4 | 62% | 4% |

3.3.1.1 ***DOE Test*.** For timer dryers, as defined in section 1.20 of this appendix, operate the clothes dryer at the maximum temperature setting and, if equipped with a timer, at the maximum time setting. Any other optional cycle settings that do not affect the temperature or time settings shall be tested in the as-shipped position. If the clothes dryer does not have a separate temperature setting selection on the control panel, the maximum time setting should be used for the drying test cycle. For automatic termination control dryers, as defined in section 1.5 of this appendix, a “normal” program shall be selected for the test cycle using the DOE Medium Test Load defined in section 2.7.2 a. For dryers that do not have a “normal” program, the cycle recommended by the manufacturer for drying cotton or linen clothes shall be selected. Where the drying temperature setting can be chosen independently of the program, it shall be set to the maximum.

Where the dryness level setting can be chosen independently of the program, it shall be set to the “normal” or “medium” dryness level setting. If such designation is not provided, then the dryness level shall be set at the mid-point between the minimum and maximum settings. Any other optional cycle settings that do not affect the program, temperature or dryness settings shall be tested in the as-shipped position. If the final moisture content is greater than the target RMC value of 2%, the test shall be invalid and a new run shall be conducted using the highest dryness level setting. If the final RMC is still above 2%, the test will be considered invalid.

*3.3.1.2* ***Supplemental Test One.*** *The purpose of this test condition is to evaluate dryer performance with a* ***small*** *supplemental test load operating in the dryer’s “normal” setting for cotton/linen loads.* A “normal” mode, as defined in section 1.22, shall be selected for the test cycle using the Small Supplemental Test Load (4.22 lb) defined in section 2.7.2.1. For dryers that do not have a “normal” program, the cycle recommended by the manufacturer for drying cotton or linen clothes shall be selected. Where the drying temperature setting can be chosen independently of the program, it shall be set to medium.

Where the dryness level setting can be chosen independently of the program, it shall be set to the “normal” or “medium” dryness level setting. If such designation is not provided, then the dryness level shall be set at the mid-point between the minimum and maximum settings. Any other optional cycle settings that do not affect the program, temperature or dryness settings shall be tested in the as-shipped position. If the final moisture content is greater than the targeted RMC value of 4%, the test shall be invalid and a new run shall be conducted using the highest dryness level setting. If the final RMC is still above 4% when the highest dryness setting is used, the clothing shall be placed back into the dryer and dried using 10 minute timed-dry cycle and maximum dryness settings. At the end of the timed-dry cycle, the clothing shall be removed and RMC measured. Clothing shall be placed back into the dryer and the 10 minute timed-dry repeated until the target RMC is reached. Final energy use and drying time calculations shall include all 10 minute timed-dry runs needed to reach the target RMC.

*3.3.1.3* ***Supplemental Test Two.*** *The purpose of this test condition is to evaluate dryer performance with a* ***large*** *supplemental test load operating in the dryer’s “normal” setting for cotton/linen loads.* A “normal” program, as defined in section 1.22, shall be selected for the test cycle using the Large Supplemental Test Load (16.90 lbs) defined in section 2.7.2.3. For dryers that do not have a “normal” program, the cycle recommended by the manufacturer for drying cotton or linen clothes shall be selected. Where the drying temperature setting can be chosen independently of the program, it shall be set to medium.

Where the dryness level setting can be chosen independently of the program, it shall be set to the “normal” or “medium” dryness level setting. If such designation is not provided, then the dryness level shall be set at the mid-point between the minimum and maximum settings. Any other optional cycle settings that do not affect the program, temperature or dryness settings shall be tested in the as-shipped position. If the final moisture content is greater than the targeted RMC value of 4%, the test shall be invalid and a new run shall be conducted using the highest dryness level setting. If the final RMC is still above 4% when the highest dryness setting is used, the clothing shall be placed back into the dryer and dried using 10 minute timed-dry cycle and maximum dryness settings. At the end of the timed-dry cycle, the clothing shall be removed and RMC measured. Clothing shall be placed back into the dryer and the 10 minute timed-dry repeated until the target RMC is reached. Final energy use and drying time calculations shall include all 10 minute timed-dry runs needed to reach the target RMC.

*3.3.1.4* ***Supplemental Test Three****. The purpose of this test is to evaluate dryer performance with a medium supplemental test load operated in the dyer’s* ***most efficient*** *operating setting for cotton/linen loads. In addition to evaluating a dryer’s most efficient mode of operation, this test will also become the basis for any utility-imposed drying cycle time limit.* An “Eco program”, as defined in section 1.23 of this test procedure, shall be selected for the test cycle using the Medium Supplemental Test Load (8.45 lbs) defined in section 2.7.2.2. For dryers that do not have a “Eco” program efficient setting, the test shall be run by selecting a normal cycle setting and the lowest temperature setting available, excluding any no-heat settings.

Where the dryness level setting can be chosen independently of the program, it shall be set to the “normal” or “medium” dryness level setting. If such designation is not provided, then the dryness level shall be set at the mid-point between the minimum and maximum settings. Any other optional cycle settings that do not affect the program, temperature or dryness settings, shall be tested in the most efficient setting position. If the final moisture content is greater than the targeted RMC value of 4%, the test shall be invalid and a new run shall be conducted using the highest dryness level setting. If the final RMC is still above 4% when the highest dryness setting is used, the clothing shall be placed back into the dryer and dried using 10 minute timed-dry cycle and maximum dryness settings. At the end of the timed-dry cycle, the clothing shall be removed and RMC measured. Clothing shall be placed back into the dryer and the 10 minute timed-dry repeated until the target RMC is reached. Final energy use and drying time calculations shall include all 10 minute timed-dry runs needed to reach the target RMC.

*3.3.1.5* ***Supplemental Test Four.*** *The purpose of this test is to evaluate dryer performance with a medium supplemental test load operated in the dyer’s* ***most rapid drying rate*** *for cotton/linen loads.* The “Fastest” program, as defined in section 1.24 of this test procedure, shall be selected for the test cycle using the Medium Supplemental Test Load (8.45 lbs) defined in section 2.7.2.2.

Where the drying temperature setting can be chosen independently of the program, it shall be set to the maximum. Where the dryness level setting can be chosen independently of the program, it shall be set to the “normal” or “medium” dryness level setting. If such designation is not provided, then the dryness level shall be set at the mid-point between the minimum and maximum settings. Any other optional cycle settings that do not affect the program, such as temperature or dryness settings, shall be tested in the as-shipped position. If the final moisture content is greater than the targeted RMC value of 4%, the test shall be invalid and a new run shall be conducted using the highest dryness level setting. If the final RMC is still above 4% when the highest dryness setting is used, the clothing shall be placed back into the dryer and dried using 10 minute timed-dry cycle and maximum dryness settings. At the end of the timed-dry cycle, the clothing shall be removed and RMC measured. Clothing shall be placed back into the dryer and the 10 minute timed-dry repeated until the target RMC is reached. Final energy use and drying time calculations shall include all 10 minute timed-dry runs needed to reach the target RMC.

3.3.2  ***Timer dryers (DOE cloth test only)****.* Dry the load until the moisture content of the test load is between 1 and 2.5 percent of the bone-dry weight of the test load, at which point the test cycle is stopped, but do not permit the dryer to advance into cool down. If required, reset the timer to increase the length of the drying cycle. After stopping the test cycle, remove and weigh the test load. The clothes dryer shall not be stopped intermittently in the middle of the test cycle for any reason. Record the data specified by section 3.4 of this appendix. If the dryer automatically stops during a cycle because the condensation box is full of water, the test is stopped, and the test run is invalid, in which case the condensation box shall be emptied and the test re-run from the beginning. For ventless dryers, as defined in section 1.21 of this appendix, during the time between two cycles, the door of the dryer shall be closed except for loading (and unloading).

3.3.3  ***Automatic termination control dryers****.* Operate the clothes dryer until the completion of the programmed cycle, including the cool down period. The cycle shall be considered complete when the dryer indicates to the user that the cycle has finished (by means of a display, indicator light, audible signal, or other signal) and the heater and drum/fan motor shuts off for the final time. If the clothes dryer is equipped with a wrinkle prevention mode (*i.e.,* that continuously or intermittently tumbles the clothes dryer drum after the clothes dryer indicates to the user that the cycle has finished) that is activated by default in the as-shipped position or if manufacturers' instructions specify that the feature is recommended to be activated for normal use, the cycle shall be considered complete after the end of the wrinkle prevention mode. After the completion of the test cycle, remove and weigh the test load. Record the data specified in section 3.4 of this appendix. If the final moisture content is greater than the target RMC value for the test, the test shall be invalid and a new run shall be conducted using the highest dryness level setting. The technician should empty the condensation box before running a test. If the dryer automatically stops during a cycle because the condensation box is full of water, the test is stopped, and the test run is invalid, in which case the condensation box shall be emptied and the test re-run from the beginning. During the time between two cycles, the door of the dryer shall be closed except for loading (and unloading).

## 3.4 Data recording.

Record for each test cycle:

3.4.1 Bone-dry weight of the test load described in section 2.7.

3.4.2 Moisture content of the wet test load before the test, as described in section 2.7.

3.4.3 Moisture content of the dry test load obtained after the test described in section 3.3.

3.4.4 Test room conditions, temperature, and percent relative humidity described in section 2.2.1.

3.4.5 ***For electric dryers*** — the total kilowatt-hours of electric energy, E t, consumed during the test described in section 3.3.

3.4.6 ***For gas dryers*** —

3.4.6.1 Total kilowatt-hours of electrical energy, E te, consumed during the test described in section 3.3.

3.4.6.2 Cubic feet of gas per cycle, E tg, consumed during the test described in section 3.3.

3.4.6.3 Correct the gas heating value, GEF, as measured in sections 2.3.2.1 and 2.3.2.2, to standard pressure and temperature conditions in accordance with U.S. Bureau of Standards, circular C417, 1938.

3.4.7 ***Cycle settings.*** Select clothing settings in accordance with section 3.3.2 for the automatic termination control dryer test.

3.4.8 ***Test duration.*** Record the total duration of the test, T A, described in section 3.3 from the start of the cycle to cycle completion.

3.4.9. ***Clothing Dimensions***. To obtain the clothing dimensions, first shake and lay the articles flat, then measure the length by the width of all test articles as shown below in Table 1:

## Table 1. Supplemental test clothing dimensions and measurement instructions.

|  |  |
| --- | --- |
| **Clothing Article** | **Measurement Instructions** |
| V-Neck T-shirt | X Measurement: along bottom edge of shirt |
| Y Measurement: from bottom edge to bottom seam of sleeve |
| Boxer Shorts | X Measurement: along waistband |
| Y Measurement: from top of waistband to bottom corner of leg ‘sleeve’ |
| Blue Jeans | X Measurement: along waistband |
| Y Measurement: top of waistband to bottom of pants sleeve |

*Table 1 continued.*

|  |  |
| --- | --- |
| Corduroy Leggings | X Measurement: along waistband |
| Y Measurement: top of waistband to bottom of pants ‘sleeve’ |
| Dress Socks | X Measurement: from edge of heel to top of tip |
| Y Measurement: from bottom of sock tip to top of sock band |
| Bath Towel | X Measurement: along bottom edge of towel |
| Y Measurement: along left edge of towel |

Individual articles must remain within a ±8% range of specified article length and width, as referenced in the supplemental test clothes section 2.6.3 of this appendix.

## 3.5  Standby Mode and Off Mode Power.

Establish the testing conditions set forth in Section 2 “Testing Conditions” of this appendix. For clothes dryers that take some time to enter a stable state from a higher power state as discussed in Section 5, Paragraph 5.1, Note 1 of IEC 62301 (Second Edition *)* (incorporated by reference; see § 430.3), allow sufficient time for the clothes dryer to reach the lower power state before proceeding with the test measurement. Follow the test procedure specified in section 5, paragraph 5.3.2 of IEC 62301 (Second Edition*)* for testing in each possible mode as described in sections 3.5.1 and 3.5.2 of this appendix.

3.5.1 If a clothes dryer has an inactive mode, as defined in section 1.13 of this appendix, measure and record the average inactive mode power of the clothes dryer, P IA, in watts.

3.5.2 If a clothes dryer has an off mode, as defined in section 1.16 of this appendix, measure and record the average off mode power of the clothes dryer, P OFF, in watts.

# 4. CALCULATION OF DERIVED RESULTS FROM TEST MEASUREMENTS

## 4.1  DOE Test calculations.

Calculation of derived results for measurements gathered during the DOE Test as described in section 3.3.1.1.

4.1.1  ***Total per-cycle electric dryer energy consumption for DOE.***

Calculate the total electric dryer energy consumption per cycle, E ce, expressed in kilowatt-hours per cycle and defined as:

E ce= E t,

for automatic termination control dryers, and,

E ce= [55.5/(W w− W d)] × E t× field use,

for timer dryers

*Where:*

55.5 = an experimentally established value for the percent reduction in the moisture content of the test load during a laboratory test cycle expressed as a percent.

E t= the energy recorded in section 3.4.5 of this appendix

field use = 1.18, the field use factor for clothes dryers with time termination control systems only without any automatic termination control functions.

W w= the moisture content of the wet test load in percent as recorded in section 3.4.2 of this appendix.

W d= the moisture content of the dry test load in percent as recorded in section 3.4.3 of this appendix.

4.1.2  ***Per-cycle gas dryer electrical energy consumption for DOE.***

Calculate the gas dryer electrical energy consumption per cycle, E ge, expressed in kilowatt-hours per cycle and defined as:

E ge= E te,

for automatic termination control dryers, and,

E ge= [55.5/(W w−W d)] × E te× field use,

for timer dryers

*Where:*

E te= the energy recorded in section 3.4.6.1 of this appendix.

field use, 55.5, W w, W d as defined in section 4.1.1 of this appendix.

4.1.3  ***Per-cycle gas dryer gas energy consumption for DOE.***

Calculate the gas dryer gas energy consumption per cycle, E ge, expressed in Btus per cycle and defined as:

E gg= E tg× GEF

for automatic termination control dryers, and,

E gg= [55.5/(W w−W d)] × E tg× field use × GEF

for timer dryers

*Where:*

E tg= the energy recorded in section 3.4.6.2 of this appendix.

GEF = corrected gas heat value (Btu per cubic foot) as defined in section 3.4.6.3 of this appendix,

field use, 55.5, W w, W d as defined in section 4.1.1 of this appendix.

4.1.4  ***Total per-cycle gas dryer energy consumption expressed in kilowatt-hours for DOE.***

Calculate the total gas dryer energy consumption per cycle, E cg, expressed in kilowatt-hours per cycle and defined as:

E cg= E ge+ (E gg/3412 Btu/kWh)

*Where:*

E ge= the energy calculated in section 4.1.2 of this appendix

E gg= the energy calculated in section 4.1.3 of this appendix

4.1.5  ***Per-cycle standby mode and off mode energy consumption for DOE.***

Calculate the dryer inactive mode and off mode energy consumption per cycle, E TSO, expressed in kWh per cycle and defined as:

E TSO= [(P IA× S IA) + (P OFF× S OFF)] × K/283

*Where:*

P IA= dryer inactive mode power, in watts, as measured in section 3.5.1;

P OFF= dryer off mode power, in watts, as measured in section 3.5.2.

If the clothes dryer has both inactive mode and off mode, S IA and S OFF both equal 8,620 ÷ 2 = 4,310, where 8,620 is the total inactive and off mode annual hours;

If the clothes dryer has an inactive mode but no off mode, the inactive mode annual hours, S IA, is equal to 8,620 and the off mode annual hours, S OFF, is equal to 0;

If the clothes dryer has an off mode but no inactive mode, S IA is equal to 0 and S OFF is equal to 8,620

*Where:*

K = 0.001 kWh/Wh conversion factor for watt-hours to kilowatt-hours; and

283 = representative average number of clothes dryer cycles in a year.

4.1.6  ***Per-cycle combined total energy consumption expressed in kilowatt-hours for DOE.***

Calculate the per-cycle combined total energy consumption, E CC, expressed in kilowatt-hours per cycle and defined for an electric clothes dryer as:

E CC= E ce+ E TSO

*Where:*

E ce= the energy calculated in section 4.1.1 of this appendix, and

E TSO= the energy calculated in section 4.1.5 of this appendix, and defined for a gas clothes dryer as:

E CC= E cg+ E TSO

*Where:*

E cg= the energy calculated in section 4.1.4 of this appendix, and

E TSO= the energy calculated in section 4.1.5 of this appendix.

4.1.7  ***Per-cycle Energy Factor in pounds per kilowatt-hour for DOE.***

Calculate the energy factor, EF, expressed in pounds per kilowatt-hour and defined for an electric clothes dryer as:

EF = W bonedry/E ce

*Where:*

W bonedry= the bone dry test load weight recorded in section 3.4.1 of this appendix, and

E ce= the energy calculated in section 4.1.1 of this appendix, and defined for a gas clothes dryer as:

EF = W bonedry/E cg

*Where:*

W bonedry= the bone dry test load weight recorded in section 3.4.1 of this appendix, and

E cg= the energy calculated in section 4.1.4 of this appendix.

4.1.8  ***Per-cycle Combined Energy Factor in pounds per kilowatt-hour for DOE.***

Calculate the combined energy factor, CEF, expressed in pounds per kilowatt-hour and defined as follows:

CEF = W bonedry/E CC

*Where:*

W bonedry= the bone dry test load weight recorded in section 3.4.1 of this appendix, and

E CC= the energy calculated in section 4.1.6 of this appendix.

If the test run was invalid, the CEF shall be given a value of 0.

4.1.9  ***Per-cycle Test Duration in minutes.***

Calculate the per-cycle test duration, T A, expressed in minutes and defined as follows:

T A = T D

For automatic termination dryers and

T A = [55.5/(W w – W d)] × T D

for timer dryers.

*Where:*

T D = the duration of the dryer test case in minutes as measured in section 3.4.9

55.5, W w, W d as defined in section 4.1.1 of this appendix.

## 4.2  Supplemental Test calculations.

Repeat sections 4.2.1 through 4.2.9 a total of four times, once for each supplemental test (sections 3.3.1.2 through 3.3.1.5).

4.2.1  ***Total per-cycle electric dryer energy consumption.***

Calculate the total electric dryer energy consumption per cycle, E ce, expressed in kilowatt-hours per cycle and defined as:

E ce = [PD/(W w− W dt)] × E t,

*Where:*

PD = 58% for tests conducted during sections 3.3.1.2 through 3.3.1.5;

E t = the energy recorded in section 3.4.5 of this appendix;

W w = the moisture content of the wet test load in percent as recorded in section 3.4.2 of this appendix;

W dt = target dry weight of 4% for tests conducted during sections 3.3.1.2 through 3.3.1.5; and

4.2.2  ***Per-cycle gas dryer electrical energy consumption.***

Calculate the gas dryer electrical energy consumption per cycle, E ge, expressed in kilowatt-hours per cycle and defined as:

E ge= [PD/(W w−W dt)] × E te,

*Where:*

E te= the energy recorded in section 3.4.6.1 of this appendix.

PD, W w, W dt as defined in section 4.2.1 of this appendix.

4.2.3  ***Per-cycle gas dryer gas energy consumption.***

Calculate the gas dryer gas energy consumption per cycle, E ge, expressed in Btus per cycle and defined as:

E gg= [PD/(W w−W dt)] × E tg × GEF

*Where:*

E tg= the energy recorded in section 3.4.6.2 of this appendix.

GEF = corrected gas heat value (Btu per cubic foot) as defined in section 3.4.6.3 of this appendix,

PD, W w, W dt as defined in section 4.2.1 of this appendix.

4.2.4  ***Total per-cycle gas dryer energy consumption expressed in kilowatt-hours.***

Calculate the total gas dryer energy consumption per cycle, E cg, expressed in kilowatt-hours per cycle and defined as:

E cg= E ge+ (E gg/3412 Btu/kWh)

*Where:*

E ge= the energy calculated in section 4.2.2 of this appendix

E gg= the energy calculated in section 4.2.3 of this appendix

4.2.5  ***Per-cycle standby mode and off mode energy consumption.***

Calculate the dryer inactive mode and off mode energy consumption per cycle, E TSO, expressed in kWh per cycle and defined as:

E TSO= [(P IA× S IA) + (P OFF× S OFF)] × K/283

*Where:*

P IA= dryer inactive mode power, in watts, as measured in section 3.5.1;

P OFF= dryer off mode power, in watts, as measured in section 3.5.2.

If the clothes dryer has both inactive mode and off mode, S IA and S OFF both equal 8,620 ÷ 2 = 4,310, where 8,620 is the total inactive and off mode annual hours;

If the clothes dryer has an inactive mode but no off mode, the inactive mode annual hours, S IA, is equal to 8,620 and the off mode annual hours, S OFF, is equal to 0;

If the clothes dryer has an off mode but no inactive mode, S IA is equal to 0 and S OFF is equal to 8,620

*Where:*

K = 0.001 kWh/Wh conversion factor for watt-hours to kilowatt-hours; and

283 = representative average number of clothes dryer cycles in a year.

4.2.6  ***Per-cycle combined total energy consumption expressed in kilowatt-hours.***

Calculate the per-cycle combined total energy consumption, E CC, expressed in kilowatt-hours per cycle and defined for an electric clothes dryer as:

E CC= E ce+ E TSO

*Where:*

E ce= the energy calculated in section 4.2.1 of this appendix, and

E TSO= the energy calculated in section 4.2.5 of this appendix, and defined for a gas clothes dryer as:

E CC= E cg+ E TSO

*Where:*

E cg= the energy calculated in section 4.2.4 of this appendix, and

E TSO= the energy calculated in section 4.2.5 of this appendix.

4.2.7  ***Per-cycle Energy Factor in pounds per kilowatt-hour.***

Calculate the energy factor, EF, expressed in pounds per kilowatt-hour and defined for an electric clothes dryer as:

EF = W bonedry/E ce

*Where:*

W bonedry= the bone dry test load weight recorded in section 3.4.1 of this appendix, and

E ce= the energy calculated in section 4.2.1 of this appendix, and defined for a gas clothes dryer as:

EF = W bonedry/E cg

*Where:*

W bonedry= the bone dry test load weight recorded in section 3.4.1 of this appendix, and

E cg= the energy calculated in section 4.2.4 of this appendix.

4.2.8 ***Per-cycle Combined Energy Factor in pounds per kilowatt-hour.***

Calculate the combined energy factor, CEF, expressed in pounds per kilowatt-hour and defined as follows:

CEF = W bonedry/E CC

*Where:*

W bonedry= the bone dry test load weight recorded in section 3.4.1 of this appendix, and

E CC= the energy calculated in section 4.2.6 of this appendix.

If the test run was invalid, the CEF shall be given a value of 0.

4.2.9 ***Per-cycle Test Duration in minutes.***

Calculate the per-cycle test duration, T A, expressed in minutes and defined as follows:

T A = [PD/(W w – W dt)] × T D

*Where:*

T D = the duration of the dryer test case as measured in section 3.4.9

PD, W w, W dt as defined in section 4.2.1 of this appendix.

## 4.3  Utility Combined Energy Factor (UCEF) in pounds per kilowatt-hour.

*[NOTE – This section is provided herein for general reference and is not specifically related to dryer testing. The UCEF value is calculated from the test results of the test protocol. The weighting factors and UCEF credit values shown here may have changed ]*

Calculate the Utility Combined Energy Factor, UCEF, expressed in pounds per kilowatt-hour and defined as:

UCEF = α × CEF 1 + β × CEF 2 + γ × CEF 3 + δ × CEF 4 + ε × CEF 5 + UCEF CREDIT

*Where:*

UCEF = the Utility Combined Energy Factor, a weighted average of the CEF calculated for the four supplemental tests and DOE D2 CEFs

α = the Supplemental Test One weighting factor, see table below

CEF 1 = the calculated combined energy factor for Supplemental Test One, calculated in section 4.2.8 for the test case described in section 3.3.1.2

β = the Supplemental Test Two weighting factor, see table below

CEF 2 = the calculated combined energy factor for Supplemental Test Two, calculated in section 4.2.8 for the test case described in section 3.3.1.3

γ = the Supplemental Test Three weighting factor, see table below

CEF 3 = the calculated combined energy factor for Supplemental Test Three, calculated in section 4.2.8 for the test case described in section 3.3.1.4

δ = the Supplemental Test Four weighting factor, see table below

CEF 4 = the calculated combined energy factor for Supplemental Test Four, calculated in section 4.2.8 for the test case described in section 3.3.1.5

ε = the DOE D2 weighting factor, see table below

CEF 5 = the calculated combined energy factor for DOE D2, calculated in 4.1.8 for the test case described in section 3.3.1.1

UCEF CREDIT = Functionality credits as defined by utility programs

***Weighting Factors Table***

Weighting factors were set to reflect results most consistent settings used in various field testing. Because no direct correlation exists between the 5 utility tests and all possible combinations of all possible dryers designs, the weighting factors are representative, not specific settings.

Weighting factors are divided into two different product categories, “non-ENERGYSTAR dryers” and “efficient dryers”. This is done because efficient dryers have settings the are designed provide energy savings, whereas non-ENERGYSTAR dryers do not typically have such consumer options. Efficient dryers will be more likely used in their efficient mode (because they have them, and because consumers presumably purchased them at least in part because they wanted that feature). Table 2 below provides weighting factors for both dryer categories.



Table 2