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Comparison of Test Procedures and Energy Efficiency Criteria in Selected International Standards & Labeling Programs for Clothes Washers, Water Dispensers, Vending Machines and CFLs

David Fridley
Nina Zheng
Nan Zhou

China Energy Group
Lawrence Berkeley National Laboratory
Environmental Energy Technologies Division

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Disclaimer

Table of Contents

Introduction

Since the late 1970s, energy labeling programs and mandatory energy performance standards have been used in many different countries to improve the efficiency levels of major residential and commercial equipment. As more countries and regions launch programs covering a greater range of products that are traded worldwide, greater attention has been given to harmonizing the specific efficiency criteria in these programs and the test methods for measurements. For example, an international compact fluorescent light (CFL) harmonization initiative was launched in 2006 to focus on collaboration between Australia, China, Europe and North America.

Given the long history of standards and labeling programs, most major energy-consuming residential appliances and commercial equipment are already covered under minimum energy performance standards (MEPS) and/or energy labels. For these products, such as clothes washers and CFLs, harmonization may still be possible when national MEPS or labeling thresholds are revised. Greater opportunity for harmonization exists in newer energy-consuming products that are not commonly regulated but are under consideration for new standards and labeling programs. This may include commercial products such as water dispensers and vending machines, which are only covered by MEPS or energy labels in a few countries or regions.

As China continues to expand its appliance standards and labeling programs and revise existing standards and labels, it is important to learn from recent international experiences with efficiency criteria and test procedures for the same products. Specifically, various types of standards and labeling programs already exist in North America, Europe and throughout Asia for products in China's 2010 standards and labeling programs, namely clothes washers, water dispensers, vending machines and CFLs. This report thus examines similarities and critical differences in energy efficiency values, test procedure specifications and other technical performance requirements in existing international programs in order to shed light on where Chinese programs currently stands and considerations for their 2010 programs.

Clothes Washers

Overview of Scope of International Standards and Labels

The major countries and regions with minimum energy performance standards (MEPS), mandatory and/or voluntary energy labels for household clothes washers include the United States, Canada, Korea, the European Union, Australia and New Zealand, Japan, Hong Kong and China. Most of the MEPS or labeling programs for clothes washers cover the two predominant types of horizontal axis and vertical axis washing machines. Horizontal axis machines are also known as front-load or drum type washing machines while the vertical axis washers include more traditional types of vertical impeller or agitator machines and top-loading washing machines. The type of washing machines that dominate the market varies in each country and as a result, the scope of standards and labels and national test procedures reflect national or regional market differences. For example, Korea's MEPS and mandatory energy label only applies to horizontal drum washing machines while Japan, which does not have specific requirements for energy use, has a test standard specific to vertical impeller machines. Although the European Union market is dominated by horizontal drum washing machines, its mandatory energy information label has a broader scope that excludes only special types such as manual washing machines with no spin capability and washer-dryer combination machines.

Major Test Procedures

Among the major countries with mandatory or voluntary energy standards and labeling programs for washing machines, there are several test procedures with variations in test performance requirements. These variations include the specific process test (wash performance, water extraction, etc.) during which energy consumption is measured, the type of sample cloth tested, and the water temperature before and during the wash cycle, which affects the amount of energy required for heating water.

The international standard, IEC 60456, is issued by the International Electrotechnical Commission and is currently undergoing revisions in the 5th Edition. IEC 60456 has been adapted entirely by the EU and by Australia and New Zealand, Hong Kong and China to varying degrees. Under the IEC standard, energy and water consumption is measured during the wash performance test, which tests the machine's ability to remove stains. Three load fabric types are used in the test, including cotton, polyester cotton and wool shrinkage loads. During the test, a control sample and four soiled samples of red wine, blood, chocolate, and oil are washed with a reference detergent at the machine's rated capacity. The wash performance is then measured in terms of reflectance ratios of soiled samples at the end of the test. The reference detergent has heat activated enzymes for stain removal that in turn requires water to be heated in the wash cycle with a specified water temperature of 60°C. In order to validate test results, five repeat tests are performed on the same unit.

Japan's test procedure is similar to IEC 60456 in that it is also a wash performance test but differs notably in the use of only cold water at 20°C for the test. This test procedure does not specify energy consumption measurements but rather, is intended to measure wash performance in terms of reflectance ratios and spin extraction performance or the remaining moisture of the cloth after the wash cycle.

IEC 60456 also differs significantly from test procedures used in the U.S. and Canada, which follows a standard set by the U.S. Association of Home Appliance Manufacturers (AHAM), and Japan's own JIS C 9606 test standard for vertical machines. The U.S. test procedure (AHAM HWL-1) does not include a wash performance test but rather, is based upon the remaining moisture content test in which water and energy consumption are measured. The remaining moisture content test intends to measure three different types of energy consumption in the washing cycle: the machine electrical energy consumption, the hot water energy consumption and the energy required for removal of the remaining moisture in the wash load. Total energy consumption is then expressed using the Modified Energy Factor (MEF), which is the rated capacity divided by the sum of the three types of energy use. The test cloth material used in this test is pure finished bleached cloth, composed of 50% cotton and 50% polyester. The test cloth samples are hemmed to specific dimensions with smaller stuffer cloth. Depending on the available temperature settings of the machine, multiple tests are performed at different temperatures to reflect a representative average set of wash conditions.

Moreover, Australia uses a national test procedure based on IEC 60456 for its MEPS and mandatory energy and water efficiency labeling programs but includes additional minimum performance requirements. Hong Kong also has a hybrid performance-based test procedure that combines IEC 60456 with Japan's JIS C 9606 test procedure for vertical impeller washing machines.

New and Upcoming Developments

As efficiency standards and labeling for clothes washers have been used worldwide for more than a decade, new revisions have been announced in the U.S. and Australia. In 2008, the U.S. Energy Star program announced new energy and water efficiency criteria for 2009 and 2011. For 2011, the MEF will be raised to 2 cubic feet per kWh per cycle and the new water factor limit will be 6 gallons per cycle per cubic feet of capacity, or 1.5 gallons lower than the current level. Canada has also adopted the U.S. Energy Star revisions.

In 2005, Australia adopted mandatory water efficiency label ratings with the maximum allowable limit set at 30 liters of water per kilogram of load capacity. For each subsequent 30% reduction in water consumption, the water rating improves by 1 level with the highest level of 6 having the lowest water consumption of 5 liters or less per kilogram of load capacity. The most efficient grade of 1 in China's current energy label for clothes washers is comparable to Australia's level 4.

In terms of test procedures, IEC 60456 has been undergoing revisions with the current 4th edition to be replaced by the 5th edition some time in 2010. The 5th edition of the standard aims to improve the overall structure and applicability of the standard to all technology types, including the vertical axis machines used in Asia and Australia. Specific changes include differentiating measurements for extra large or small loads, an extended test for stain removal, a simplified wool shrinkage test, and a low power mode definition for standby machines. Discussion on further revisions is also underway for the 6th edition of the standard, expected to be published in 2015.

Summary of International Clothes Washers Standards and Labeling Programs

	U.S. EnergyStar	U.S. MEPS	Canada MEPS	Korea MEPS; Mandatory Label	Hong Kong Mandatory Energy Label
Classification/Scope	Vertical Axis Compact (<1.6 ft3 or 45L capacity) Vertical Axis Standard (<1.6 ft3 or 45L capacity) Horizontal Axis Vertical Semi-Automatic Suds-saving	VAC: Vertical Axis Compact (<1.6 ft3 or 45L capacity) VAS: Vertical Axis Standard (<1.6 ft3 or 45L capacity) Horizontal Axis	Vertical Axis Compact (<45L capacity) Vertical Axis Standard (>45 L capacity) Horizontal Axis	Horizontal Drum with capacity < 15 kg	Horizontal drum type < 7 kg capacity Impeller/Agitator type < 7kg capacity
Effective Dates	07/1/2009; 1/1/2011	1/1/2004 - 1/1/2007 Revisions on 1/1/2007	1/1/2004; Tier II: 1/1/2007	1/1/2006; Tier II: 12/31/2007	3/19/2010
Energy Values	7/2009: MEF ≥ 1.8 ft3/kWh/cycle 1/2011: MEF ≥ 2.0 ft3/kWh/cycle	VAC: ≥ 18.4 L/kWh/cycle (0.65 ft3/kWh/cycle) VAS: ≥ 29.45 L/kWh/cycle (1.04 ft3/kWh/cycle) HA: ≥ 29.45 L/kWh/cycle (1.04 ft3/kWh/cycle) Post-2007 VAC: Same; ≥ 18.4 L/kWh/cycle (0.65 ft3/kWh/cycle) Post-2007 VAS: ≥ 35.68 L/kWh/cycle (1.26 ft3/kWh/cycle) Post-2007 HA: ≥ 35.68 L/kWh/cycle (1.26 ft3/kWh/cycle)	VAC: ≥ 18.4 L/kWh/cycle (0.65 ft3/kWh/cycle) VAS: ≥ 29.45 L/kWh/cycle (1.04 ft3/kWh/cycle) HA: ≥ 29.45 L/kWh/cycle (1.04 ft3/kWh/cycle) Tier II VAC: ≥ 18.4 L/kWh/cycle (0.65 ft3/kWh/cycle) Tier II VAS: ≥ 35.68 L/kWh/cycle (1.26 ft3/kWh/cycle) Tier II HA: ≥ 35.68 L/kWh/cycle (1.26 ft3/kWh/cycle)	0.125 kWh/kg load/cycle Tier II: 0.065 kWh/kg/cycle Label Grade 1: ≤ 0.065 Grade 2: 0.065 < C ≤ 0.080 Grade 3: 0.080 < C ≤ 0.095 Grade 4: 0.095 < C ≤ 0.110 Grade 5: 0.110 < C ≤ 0.125	Avg Specific Energy Consumption: Horizontal = 0.26 kWh/kg/cycle; Impeller= 0.0264 kWh/kg/cycle Grade 1: < 80% of Avg Specific Energy Grade 2: 80% < E < 95% of avg Grade 3: 95 < E < 110% of avg Grade 4: 110 < E < 125% of avg Grade 5: > 125% of avg
Water Values	7/2009: WF ≤ 7.5 gal/cycle/ft3 1/2011: WF ≤ 6.0 gal/cycle/ft3	None	None	None	None

	U.S. EnergyStar	U.S. MEPS	Canada MEPS	Korea	Hong Kong
Test Standard/Specs	Federal Register, Appendix J	Federal Register, Appendix J	CAN/CSA-C 360-03	KS C 9608	
Reference Test Standard	Assoc. of Home Appliance Manufacturers (AHAM) HWL-1	Assoc. of Home Appliance Manufacturers (AHAM) HWL-1	U.S. Standard	IEC 60456	IEC 60456 for horizontal drum; JIS 9606 for impeller
Supplied Water Temp	Cold Water: 60 ± 5˚F (15.6 ± 2.8˚C) Hot Water: 140 ± 5˚F (60.0 ±2.8˚C)	Cold Water: 60 ± 5˚F (15.6 ± 2.8˚C) Hot Water: 140 ± 5˚F (60.0 ±2.8˚C)	Cold Water: 60 ± 5˚F (15.6 ± 2.8˚C) Hot Water: 140 ± 5˚F (60.0 ±2.8˚C)	Unknown	Horizontal: 60.0˚C; Impeller: 30 ± 2°C
Test Cloth	Pure finished bleached cloth, made with 50% cotton and 50% polyester and weighing 195 g/m2 Test cloth hemmed to 24 in by 34 in., with smaller stuffer cloths hemmed to 12 in. by 12 in. 7lb load for max water level; 3 lb load for min. water level	Pure finished bleached cloth, made with 50% cotton and 50% polyester and weighing 195 g/m2 Test cloth hemmed to 24 in by 34 in., with smaller stuffer cloths hemmed to 12 in. by 12 in.	Pure finished bleached cloth, made with 50% cotton and 50% polyester and weighing 195 g/m2 Test cloth hemmed to 24 in by 34 in., with smaller stuffer cloths hemmed to 12 in. by 12 in. Standard use 3.18 kg load of energy clothes and stuffers; Compact uses 1.36 kg load	IEC 60456: Cotton, easy care (ply-cotton) and wool loads from 2 to 10 kg	Horizontal: cotton without pre-wash
Number of Tests	Multiple test performed for different temperature settings	N/A	N/A	N/A	N/A
Wash Time	Normal cycle wash time > 9.75 minutes	Normal cycle wash time > 9.75 minutes	N/A	N/A	Follow recommended times from manufacturer's instructions for rated capcaity
Agitation/Spin Speed	Set to Normal	Set to Normal	N/A	N/A	
Power Supply					380/220V, 50 Hz
Additional Requirements	Energy values include additional energy needed to dry clothes thru. Remaining Moisture Content measurement test	Energy values include additional energy needed to dry clothes thru. Remaining Moisture Content measurement test	Energy values include additional energy needed to dry clothes thru. Remaining Moisture Content measurement test		IEC and JIS washing performance and spin extraction performance requirements apply
Notes	Modified Energy Factor considers 3 types of energy used by washer: machine electrical energy consumption, hot water energy consumption and energy required for removal of the remaining moisture in the wash load	Modified Energy Factor considers 3 types of energy used by washer: machine electrical energy consumption, hot water energy consumption and energy required for removal of the remaining moisture in the wash load	Modified Energy Factor considers 3 types of energy used by washer: machine electrical energy consumption, hot water energy consumption and energy required for removal of the remaining moisture in the wash load		For horizontal drum type, energy consumption of washing, rinsing and spin extraction processes as well as heating water is included. For vertical impeller type, only measure energy consumption of washing, rinsing and spin extraction processes are to be shown on label.

	EU Energy Label/Eco-Label Mandatory, Voluntary Label	Australia/New Zealand EE and Water Efficiency Mandatory Label (WELS)	Japan Test Procedure Only; No MEPS or Label	Chinese 2004 Standard MEPS, Mandatory, Voluntary Label
Classification/Scope	Apply to electric mains operated household washing machines, except: -Machines with no spin capability -Machines with separate washing and spin drying vessels - Combined washer-dryers	Clothes washers intended for household or similar use		Impeller/Agitation Type < 13 kg capacity Drummer/HA (Horizontal Axis) Type < 13 kg capacity
Effective Dates	1996	Energy Label: 1998; 2000. WELS: 2005	1993	1989; 2004
Energy Values	A+/Ecolabel: ≤ 0.17 kWh/kg load/cycle A: ≤ 0.19 kWh/kg/cycle B: 0.19 < C ≤ 0.23 C: 0.23 < C ≤ 0.27 D: 0.27 < C ≤ 0.31 E: 0.31 < C ≤ 0.35 F: 0.35 < C ≤ 0.39 G: < 0.39	No MEPS, only categorical rating label	None	MEPS: Impeller: ≤ 0.032 kWh/cycle/kg MEPS: HA: ≤ 0.35 kWh/cycle/kg Label Grade 1: Impeller ≤ 0.012 kWh/cycle/kg; HA ≤ 0.19 kWh/cycle/kg Label Grade 2: Impeller ≤ 0.017 kWh/cycle/kg; HA ≤ 0.23 kWh/cycle/kg Label Grade 3: Impeller ≤ 0.022 kWh/cycle/kg; HA ≤ 0.27 kWh/cycle/kg Label Grade 4: Impeller ≤ 0.027 kWh/cycle/kg; HA ≤ 0.31 kWh/cycle/kg Label Grade 5: MEPS Voluntary Label: Grades 1 & 2
Water Values	Ecolabel: <12 L/kg load; Proposed Revision: <8.4 L/kg load	WELS rating: 0 (warning label): > 30 L/kg load (Per AS/NZS 6400: 2005) 1: 25.1 - 30.0 L/kg load capacity 1.5: 21.1 - 25.1 2: 17.7 - 21.0 L/kg load capacity 2.5: 14.8 - 17.6 3: 12.4 - 14.7 L/kg load capacity 3.5: 10.4 - 12.3 4: 8.7 - 10.3 L/kg load capacity 4.5: 7.3 - 8.6 5: 6.1 - 7.2 L/kg load capacity 5.5: 5 - 6 6: < 5.0 L/kg load capacity	None	MEPS: Impeller ≤ 36 L/cycle/kg MEPS: HA ≤ 20 L/cycle/kg Label Grade 1: Impeller ≤ 20 L/cycle/kg; HA ≤ 12 L/cycle/kg Label Grade 2: Impeller ≤ 24 L/cycle/kg; HA ≤ 14 L/cycle/kg Label Grade 3: Impeller ≤ 28 L/cycle/kg; HA ≤ 16 L/cycle/kg Label Grade 4: Impeller ≤ 32 L/cycle/kg; HA ≤ 18 L/cycle/kg Label Grade 5: MEPS Voluntary Label: Grades 1 & 2

	EU Energy Label	Australia/New Zealand	Japan	Chinese 2004 Standard
Test Standard/Specs	EN 60456-2005	AS/NZS2040 Part I	JIS 9606	GB/T 4288-2008
Reference Test Standard	EN ISO 60456:1999/ IEC 60456	IEC 60456, with variations	IEC 60456	IEC 60456
Supplied Water Temp		20.0˚C	20.0˚C (at 65% humidity)	30 ± 2°C (at 60-70% relative humidity)
	60.0˚C	60.0˚C		
Test Cloth	Test at rated capacity all-cotton load, with 5 soiled (mineral oil, blood, chocolate, red wine) square fabric samples to test cleaning performance Reference detergent that is activated in warm water must be used	IEC 60456: Cotton, easy care (ply-cotton) and wool shrinkage loads, test at rated capacity from 2 to 10 kg	Mixed cotton load with soil swatches at rated capacity	Test load includes linen, cloth napkins, and dress shirts
Number of Tests	5 repeat tests on same unit for valid result	1 test	N/A	N/A
Wash Time	N/A	N/A	N/A	N/A
Agitation/Spin Speed	N/A	N/A	N/A	N/A
Power Supply	N/A	240V, 50 Hz	N/A	N/A
Additional Requirements	1/7/2010: Off mode ≤ 1W; Standby Mode ≤ 1W (or 2W with info/status display) 1/7/2013: Off mode ≤ 0.5W; Standby Mode ≤ 0.5W (or 1W with info/status display)	Rinse performance requirement, based on measuring the mass of a marker, per kg of rated load, that is present in the rinse liquid that is retained in damp load	Spin extraction and washing performance requirements	Washing performance as measured by reflectance ratio relative to reference sample
Notes	IEC 60456: Energy and water consumption measured during washing performance (soil removal) test, which measures reflectance of soiled samples	Water efficiency rating and labeling linked to rinse performance		

Water Dispensers

As a relatively new product to be regulated, energy efficiency standards and/or labeling programs for hot and cold water dispensers are only in place in Asia (Korea, Hong Kong, Taiwan) and North America (U.S., Canada). In fact, the first (and only) efficiency standard for water dispenser was started in Korea in 2002, followed by recent adoptions of efficiency labeling programs in Taiwan in 2007, Hong Kong in 2008, and U.S. and Canada in 2010. Water dispenser MEPS were recommended for implementation in Australia in October of 2007 but has since been placed on hold.

Overview of Scope of International Standards and Labels

The major types of water dispensers are categorized by the temperature settings of the water dispensed. Although the specific temperatures of the dispensed water differ slightly amongst countries depending on test procedure requirements, there are four general categories of water dispensers: hot water only, cold water only, hot water and cold water, and hot water and water at room temperature (i.e., not chilled). On the international level, cultural beverage preferences play a major role in shaping the scope of products covered by water dispenser efficiency standard and labeling programs. In Asia where hot beverages such as tea and instant coffee are common, hot only and hot and cold water dispensers are more widespread and thus regulated by MEPS and/or energy labeling programs in Korea, Taiwan and Hong Kong. For the U.S. and Canada, in contrast, tea is less popular and with stronger cultural preferences for brewed, rather than instant, coffee and hot only water dispensers are thus not included in the Energy Star labeling programs. Moreover, since the consumption of chilled water is less common in Asia than in North America, only Hong Kong included cold only water dispensers in its labeling scope.

Energy Values in Existing Programs

Across the broad categories of water dispensers, similar and comparable efficiency levels are observed across most countries. Canada, Hong Kong and Australia (proposed) all follow U.S. Energy Star limit values for Cold Only dispensers and Hot and Cold only dispensers at 0.16 kWh per day and 1.2 kWh per day, respectively. Hong Kong has an additional energy value of 0.75 kWh per day for hot only water dispensers, which was adopted as a Tier II limit under Australia's proposed MEPS. Korea and Taiwan differ in having a volume-adjusted efficiency value for the water dispenser energy label. For a hot water dispenser with a typical storage capacity of 3.5 liters, Taiwan's limit of 1.54 kWh per day would put its energy use above both Australia and Hong Kong limits. Likewise, for a typical hot and cold water dispenser, the limiting value of 1.66 kWh per day in Taiwan is also much higher than other international levels. In contrast, without knowing the typical capacity size of a Korean hot and cold water dispenser, the Tier II MEPS of 0.10 kWh per day per liter of adjusted capacity of hot and cold water dispenser appears relatively low for dispensers with 10 liter or less storage capacity.

Test Procedures

Unlike clothes washers, there does not appear to an international test standard for water dispensers.[1] As the energy efficiency programs for water dispensers were all initiated within a close time range, the test procedures used in U.S., Canada, Hong Kong and Australia are very similar with only slight variations in ambient air temperature and dispensed water temperatures. Dispensed water temperature is a particularly important factor for measuring and comparing energy consumption across standards as it determines the energy needed to heat or cool water prior to being dispensed. U.S. and Canadian test procedures adopted ambient air temperatures of 23.8°C, while Australia found Korea's lower ambient temperature of 20°C more reasonable and adopted it for its test procedure. Hong Kong, Taiwan and China all have higher ambient temperatures of 25°C. In regards to dispensed water, the maximum cold water temperature of 10°C is consistent across U.S., Canada, and Hong Kong. However, Hong Kong's minimum hot water temperature of 85°C is higher than U.S. and Canada's minimum temperature of 73.9°C. China's test procedure included in the GB/T 22090-2008 product standard is even higher at a minimum of 90°C. These trends reflect Asia's demand for water hot enough to boil tea or coffee.

[1] Korea references IEC 60379 as its test standard but this standard is for testing electric storage water heaters, not specific to water dispensers with heating and chilling functions.

Water Dispensers: Summary of International Standards and Labeling Programs

	U.S. EnergyStar Voluntary Label	**Canada EnergyStar** Voluntary Label	**Hong Kong** Voluntary Label	**Australia (Proposed)** MEPS
Classification/Scope	Cold only Hot and Cold Cook (Room temperature) and Cold	Cold only Hot and Cold Cook (Room temperature) and Cold	Cold only Hot only Hot and Cold	Cold only Hot only Hot and Cold
Effective Date	Revised: 01/22/2010	Revised: 01/22/2010	4/17/2008 - 12/31/2010	On hold; Rec for 10/2007 with revisions 10/2011
Energy Values	Cold only and Cook&Cold: ≤ 0.16 kWh/d Hot and Cold: ≤ 1.2 kWh/d	Cold only and Cook&Cold: ≤ 0.16 kWh/d Hot and Cold: ≤ 1.2 kWh/d	Cold only: ≤ 0.16 kWh/d Hot only: ≤ 0.75 kWh/d Hot and Cold: ≤ 1.2 kWh/d	Cold only: ≤ 0.16 kWh/d; High EE/Rev: < 0.12 kWh/d Hot only: ≤ 1.0 kWh/d; High EE/Rev: < 0.75 kWh/d Hot and Cold: ≤ 1.2 kWh/d; EE/Rev: < 0.90 kWh/d
Test Standard/Specifications				
Ambient Temp	75 ± 2˚F (23.8 ±1˚C)	75 ± 2˚F (23.8 ±1˚C)	25 ±1˚C	20 ±1˚C
Relative Humidity			45% to 75%	N/A
Dispensed Water Temp	measured before test, with no adjustments during test Cold: < 50°F (10.0°C) Hot: > 165°F (73.9°C)	measured before test, with no adjustments during test Cold: < 50°F (10.0°C) Hot: > 165°F (73.9°C)	measured before test, with no adjustments during test Cold (refrigeration): < 50°F (10.0°C) Cold (electronic): < 15.0°C Hot: > 85°C	
Power Measurement	Total true power over 24 hour period	Total true power over 24 hour period	Total true power over 24 hour period 220V ± 2%; 50 Hz ± 2%	Total true power over 24 hour period

Water Dispensers: Summary of International Standards and Labeling Programs (contd.)

	Korea MEPS, Mandatory Label	**Taiwan** Voluntary Label	**China Test Procedure**
Classification/Scope	Hot and Cold	Hot only Hot and Cold	Hot and Cold Hot and Normal Cold and Normal
Effective Date	7/1/2002; Tier II 12/31/2008	10/22/2007	5/1/2009
Energy Values	E = Adjusted power consumption over 12 hours/adjusted capacity MEPS: 0.35 kWh/liter Tier II MEPS: 0.05 kWh/liter Label Grade 1: R ≤ 0.05 kWh/liter 2: 0.05 < R ≤ 0.10 kWh/liter 3: 0.10 < R ≤ 0.20 kWh/liter 4: 0.20 < R ≤ 0.30 kWh/liter 5: 0.30 < R ≤ 0.35 kWh/liter	Daily energy consumption: Hot Only: E=0.154*V + 1.0 Hot & Cold: E=0.146 (V1*K1+1/3*V2*K2) where E = kWh/day, V = water storage capacity in liters, V1=hot water storage capacity in liters, K1=hot water correction factor, V2=cold water storage capacity in liters, K2=cold water correction factor e.g., for a typical 3.5 liter capacity hot only dispenser, E = 1.54 kWh/day e.g., for a typical 2.3 liter hot, 1.3 liter cold capacity water dispenser, E=1.66 kWh/day	N/A
Test Standard/Specifications	IEC 60379	CNS 13516	In Product Std: GB/T 22090-2008
Ambient Temp	20 ±1˚C	25 ±1˚C	25 ±1˚C
Relative Humidity	N/A	N/A	45% to 75%
Dispensed Water Temp	N/A	N/A	Hot: ≥ 90°C Cold: ≤15°C
Power Measurement		Measured with voltage fluctuations at 110V±2% or 220V±1%	Measured with 220V at 50 Hz

Vending Machines

As newly regulated equipment with the first efficiency standard implemented in Japan's Top Runner Standards program in only 2002, only two other countries (U.S. and Canada) have MEPS and labeling programs in place for vending machines. MEPS have been proposed for Australia but the final standards have not yet been published or implemented. As a solely commercial product, there is no categorical consumer informational labeling program for vending machines and the U.S. Energy Star is the only energy labeling program for this product. Canada's existing MEPS and Australia's proposed MEPS are based largely on the U.S. Energy Star requirements and thus are very similar in their scope and test methodology.

Overview of Scope of International Standards and Labels

The scope of existing and newly proposed efficiency programs all cover beverage vending machines, but only the Canadian MEPS include combined snack and refrigerated beverage vending machines. Japan is also unique in that its large market and demand for vending machine products have resulted in Top Runner efficiency standards for 10 categories of vending machines. In general, however, there are two major types of beverage vending machines: a fully cooled beverage vending machine that is used indoors and a partially cooled vending machine that can be used indoors or outdoors. The vending machine intended for indoor use is characterized by a transparent glass door and tends to have a shelf layout that displays the multiple products being vended. The indoor/outdoor vending machine has a solid or opaque door that is often configured in stacked style where refrigerated air is directed only at the next to be vended product. Besides these two predominant types of machines, there are some regional variations with Japan notably covering vending machines of hot and cold beverages in bottles/cans as well as paper cups.

Energy Values in Existing Programs

As the second earliest efficiency program aimed at vending machines, the U.S. Energy Star Tier I and Tier II limits have served as the basis for the subsequent Canadian MEPS program and proposed Australia/New Zealand MEPS program. The U.S. Energy Star values are based on the machine's vendible capacity measured in terms of numbers of 355 millimeter cans and do not distinguish between the two different types of vending machines. For a medium sized indoor/outdoor machine with 650-can capacity, the Tier I limit value would equal 7.98 kWh per day and the Tier II value would equal 6.5 kWh per day. In adopting the U.S. Energy Star values as its MEPS values, Canada requires that only the Tier I limit be met for multi-package, indoor only vending machines and snack and refrigerated beverage vending machines. Australia also recommended using U.S. Energy Star values for its proposed MEPS programs, but without distinguishing between the two types of vending machines. The U.S. Energy Star, Canadian and draft Australian MEPS also require that vending machines be equipped with low power mode capabilities for lighting, cooling or both lighting and cooling.

Japan's Top Runner program for vending machines specifies the annual rather than daily maximum energy consumption as a function of volume, but with volume measured by the hot and/or cold storage compartment capacity in liters. For the combination hot and cold beverage machines, an adjusted internal volume is used to correct for differences in energy consumption due to different temperature requirements. Although detailed data on capacity of Japanese vending machines is not available, the weighted average energy consumption of vending machines meeting the current target appears lower than the typical U.S. machine with 1642 kWh used per year, as opposed to 2373 kWh per year under the Tier II limit.

Besides Energy Star, the U.S. also published in 2009 a final rule setting U.S. MEPS levels for vending machines that will take effect three years later on August 31, 2012. These new MEPS levels distinguish between the two types of machines with energy consumption limits based on refrigerated volume, rather than vendible capacity. Compared to the Tier II Energy Star limits that has been in place since 2007, the 2012 MEPS will be much more stringent with the same indoor/outdoor 650-can capacity vending machine only allowed to use 4.76 kWh per day. On an annual basis with 1737 kWh used per year, this is comparable to the current average energy consumption for Japanese vending machines. The U.S. MEPS does not include the low power mode capability requirement. Interestingly, no new revisions have been planned for U.S Energy Star values for vending machines despite the more stringent MEPS expected for 2012.

Comparison of Test Procedures

The U.S. Energy Star program follows the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) test procedure as published in ASHRAE Standard 32.1-2004. This test procedure has since been adopted by Canada, Australia and the U.S. for the MEPS program. Australia has its own national standard of AS/NZS 4864 but directly references the ASHRAE standard. The ASHRAE test procedure mandates an indoor ambient temperature of 23.9°C, outdoor ambient temperature of 32.2°C and average beverage temperature of 2.2°C for both types of machines. With a much more complex set of target standards for different types of vending machines, Japan has its own test procedure in the reference standard of JIS B8561: 2007. This test procedure uses a lower ambient temperature of 15°C and requires that hot beverages reach an average temperature of 55°C and cold canned or bottled beverages be at 4°C.

Vending Machines (VM): Summary of International Standards and Labeling Programs

	U.S. MEPS	U.S. EnergyStar	Canada MEPS (rev. 2004)
Classification/Scope	Class A: fully cooled beverage VM (transparent, shelf), indoor only Class B: partially cooled beverage VM (opaque front, stacked), indoor/outdoor	Indoor beverage VM, e.g. glass door Outdoor beverage VM, e.g. solid/opaque door Rebuilt beverage VM	Solid/Opaque-door beverage VM Multi-package VM (glass door): display and dispense >20 types of beverages Snack & refrigerated beverage VM: non-refrigerated snacks & 100 max bottles/cans at <50% vendible capacity
Effective Date	8/31/2012	Tier 1: 04/1/04 - 06/30/07 Tier 2: July 1, 2007	Solid/opaque door VM: **Jan. 1, 2007** (Tier 1) and January 2008 (Tier 2) Multi-package VM: **Jan. 1, 2007** (Tier 1 only) Beverage and snack VM: January 1, 2007 (Tier 1 only)
Energy Values	Daily Energy Use (kWh/day); V = refrigerated volume in ft3 A: 0.055*V + 2.56 B: 0.073*V + 3.16 e.g., a Class B 650-can capacity machine with 22 ft3 will have limit of 4.76 kWh/day (1737 kWh/yr)	Daily (kWh/day); C=vendible capacity (# 355mL cans) Tier I: 0.55*(8.66+(0.009*C)) Tier II: 0.45*(8.66+(0.009*C)) e.g., a 650-can capacity machine has Tier I limit of 7.98 kWh/day (2912 kWh/yr), and a Tier II limit of 6.5 kWh/day (2373 kWh/yr)	Daily (kWh/day); C=vendible capacity (# 355mL cans) Tier I: 0.55*(8.66+(0.009*C)) Tier II: 0.45*(8.66+(0.009*C)) e.g., a 650-can capacity machine has Tier I limit of 7.98 kWh/day (2912 kWh/yr), and a Tier II limit of 6.5 kWh/day (2373 kWh/yr)
Test Standard/Specs	ASHRAE Std. 32.1-2004	ASHRAE Std. 32.1-2004	ASHRAE Std. 32.1-2004
Ambient Temp	75 ± 2˚F (23.9 ± 1˚C)	Indoor: 75 ± 2˚F (23.9 ±1˚C); Outdoor: 90 ± 2˚F (32.2 ±1˚C)	Solid/Opaque: 90 ± 2˚F (32.2 ±1˚C); Others: 75 ± 2˚F (23.9 ±1˚C)
Relative Humidity	45 ± 5%	Indoor: 45 ± 5%; Outdoor: 65 ± 5%	Solid/Opaque: 65 ± 5%; Others: 45 ± 5%;
Avg. Beverage Temp	36 ± 1˚F (2.2 ±0.5˚C)	Both: 36 ± 1˚F (2.2 ±0.5˚C)	Both: 36 ± 1˚F (2.2 ±0.5˚C)
Additional Requirements:		Also requires low power mode capability for lighting, cooling, or both	All 3 low power modes (light, cooling, combined)

Vending Machines (VM): Summary of International Standards and Labeling Programs (contd.)

	Australia & New Zealand MEPS (Proposed)	Japan Target Standard Values
Classification/Scope	All except snack and beverage VM, hot/cold combination machines	Machines serving cold only or hot only beverages Machines serving hot and cold beverages Beverage in paper containers (hot, cold, hot & cold) Beverage in cups
Effective Date	Proposed to be in effect 10/1/2009	2002; standards revised with 2012 Target Year
Energy Values	Daily (kWh/day); C=vendible capacity (# 355mL cans) Tier I: 0.55*(8.66+(0.009*C)) Tier II: 0.45*(8.66+(0.009*C)) e.g., a 650-can capacity machine has Tier I limit of 7.98 kWh/day (2912 kWh/yr), and a Tier II limit of 6.5 kWh/day (2373 kWh/yr)	Annual Energy Use (kWh/year), *where Va=adjusted internal volume, in liters, with correction for difference in energy consumption assuming a hot storage compartment is replaced by cold; V=volume, in liters)* Hot or Cold only: 0.218*V + 401 Hot & Cold: 0.798*Va + 414 Hot & Cold (deeper than 400mm): 0.482*Va + 350 e.g., weighted average of energy consumption of machines meeting current 2005 standard is 1642 kWh/yr
Test Standard/Specs	AS/NZS 4864, References ASHRAE Std. 32.1-2004	JIS B8561: 2007
Ambient Temp	Unknown	All: 15°C ± 1°C
Relative Humidity	Unknown	N/A
Avg. Beverage Temp	Unknown	Cold bottles/cans: 4°C ± 2°C Hot bottles: 55°C ± 2°C Cold Paper Containers: 5°C ± 4°C Hot Paper Containers: 55°C ± 4°C
Additional Requirements:	Also requires low power mode capability for lighting, cooling, or both	

CFLs

Compact Fluorescent Lamps (CFLs) are an efficient lighting alternative to traditional incandescent light bulbs and have been actively promoted through different policies and initiatives. As CFL technology has matured, CFL efficiency levels have been regulated through mandatory MEPS, mandatory energy information labels and/or endorsement labels. China and Japan have MEPS for self-ballasted and pin-type CFLs while South Korea, Mexico and Australia have MEPS for self-ballasted CFLs. EU CFL MEPS were also proposed for 2009. Additionally, CFL endorsement labels are also widely used internationally, including in the UK, EU, U.S./Canada, Hong Kong, China, Taiwan, Canada, Brazil, Thailand, South Korea and Philippines. The EU, Brazil, South Korea and Australia also have mandatory energy information labels for CFLs. Of the major efficiency programs for CFLs, Brazil's labeling program was the earliest with its start in 1994, followed by Japan and the U.S. in 1998-1999, and Australia and the EU are the most recent to launch MEPS for CFLs.

Overview of Scope of International Standards and Labels

The scope of CFL international MEPS and labeling programs all included self-ballasted (or unitary) CFLs where electronic or magnetic ballast is integrated into the CFL and cannot be removed, although the U.S./Canada Energy Star program does not include CFLs with magnetic ballasts. Some programs, such as the Chinese MEPS and Energy Star, also specified the CFL ballast base type, which are often screw bases of different sizes including medium (Edison) screw known as E26 and E27 and smaller Candelabra screw bases known as E12 and E11 in North America and Europe, respectively. The Chinese MEPS program also includes bayonet or pin-type base socket while Japan and Brazil's programs cover modular CFLs where the pin-based bulb can be replaced while re-using the ballast. In the cases of China, U.S./Canada and Brazil, CFLs with covers or reflectors are also included in addition to bare bulb CFL.

Comparison of Energy Efficiency Values

In almost all the CFL standards and labeling programs, energy efficiency is defined as initial luminous efficacy as measured in terms of the luminous flux or light output (lumens) of a light source divided by the total power input (watts). The minimum or target luminous efficacy values for CFLs are further grouped by a range of rated power and in the cases of China, Japan, and Australia, subdivided by a Correlated Color Temperature (CCT) threshold. In general, China's initial efficacy levels are comparable if not more stringent than Energy Star and South Korea. For example, for bare-tube CFL rated at 9 to 14W, the Chinese MEPS level is set at 54 lm/W for CFLs with CCT > 4400 K and at 58 lm/W for CCT ≤ 4400K while the Energy Star level is set at 55 lm/W. South Korea's Target Energy Performance Level (equivalent to its energy label's most efficient Grade 1) is comparable to the Energy Star level, suggesting that its MEPS values are lower than current Chinese MEPS. Australia's MEPS levels are also lower than China since it has a separate Higher Efficiency level that is set at the Chinese MEPS levels. However, Japan's target standard for 2012 is the most stringent with a limit of 65 lm/W for CFLs with CCT of 3000 to 5000K and 60.8 lm/W for CFLs with CCT > 5000K while Brazil's program appears the most lax with endorsement label threshold of 45 lm/W for CFLs with rated power <15W. The EU programs express efficacy differently, specifying the maximum rated power allowed for given luminous flux rather than vice versa. However, efficacy values in lm/W equivalent published by the European Lamp Companies

Federation show values that are lower than Chinese MEPS, with 45 lm/W to 52.1 lm/W for 9-14W rated CFLs with CCT<5000K and 40.5 lm/W to 46.9 lm/W for CFLs with CCT>5000K. The EU MEPS program is based off of EU mandatory energy label, with the first phases of MEPS set at Class C equivalent of the label while the last phase after 2016 is set at the Class B equivalent value.

For measuring initial efficacy values, two key test procedures are used measuring power use and other important technical performance criteria. The most commonly used procedure is the international test procedure IEC 60969-2001 "Self-ballasted lamps for general lighting services – Performance requirements," off of which the Chinese, Japan, South Korea, Australia, Brazil and EU test procedures are based. A second edition of the IEC 60969 test procedure was scheduled to be released in 2010 but has since been cancelled due to lower priority compared to LED standards.[2] U.S. and Canada differs in following the American National Institute of Standards ANSI C78.5-1997 test procedure. The primary difference in the North American test procedure is the inclusion of a rapid cycle or stress test and interim life test. With both CFL test procedures, however, similar technical performance criteria are measured and include CFL lumen maintenance, rated lifetime, color rendering index, power factor, mercury content, start time and GLS incandescent equivalence.

Comparison of Technical Performance Criteria

Sample Size

Despite similar test procedures, test sample sizes differ slightly between countries and may have implications for technical performance measurements. China requires 12 samples while Brazil requires 11 and U.S./Canada and Australia requires 10 samples. The EU requires the largest test sample size with 20 samples.

Lumen Maintenance

Lumen maintenance measures luminous flux or lumen output at a given time in the life of the CFL and is expressed as a percentage of the initial 100-hour luminous flux. Besides Energy Star, all China, Australia, Brazil and EU programs specify lumen maintenance values in terms of a 2000 hour rating and have ratings of at least 80% initial output. Brazil's SEAL endorsement label and stage 1 of the EU MEPS specify higher lumen maintenance rating of 85% initial output and 2016 stage 5 of EU MEPS is even higher at 88%.

Rated Lifetime

Another important performance criterion is the rated lifetime of CFLs, or the average length of time during which 50% of CFLs are expected to reach the end of their lives. China, Energy Star, EU and Australia all set a minimum threshold of 6000 hours, with Australia also specifying a higher rated lifetime of at least 10,000 hours for higher efficiency CFLs and the EU specifying a higher survival rate of 70% at 6000 hours in stage 5 of the MEPS program. Brazil's rated lifetime is expressed differently as 1 failure in 10 bulbs after 2000 hours.

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[2] IEC. 2010. "International Electrotechnical Commission Project Detail: IEC 60969 Ed.2.0" Available at: http://www.iec.ch/cgi-bin/procgi.pl/www/iecwww.p?wwwlang=E&wwwprog=pro-det.p&He=IEC&Pu=60969&Pa=&Se=&Am=&Fr=&TR=&Ed=2

Color Rendition

CFL's color rendering is measured as its ability to render colors faithfully according to the color rendering index (CRI), which runs from 20 with severe color distortion to 100 with no color distortion. Generally, most programs including China, Energy Star, Australia and the EU require a minimum sample average CRI of at least 80. However, China allows lower CRI for CFLs of 3500K or above while Australia's CRI requirement only holds for high efficiency CFLs, not for MEPS. The EU MEPS also dictate that CFLs with CRI of greater than 90 must have an efficacy of at least 85% of CFLs with CRI between 80 and 90.

CFL Start Times

Another important performance factor for consumers is the amount of time it takes for a CFL to reach stabilized light output and its full light output. Of the three regions (China, EU, North America) that specify this criterion, China's start times appear the most lax with maximum allowable full start time of 40 minutes while North America has the strictest allowable full start time of 1 minute for bare lamps and 3 minutes for covered or outdoor reflector lamps. The EU start times are expressed differently with start time limit of 1 minute for reaching 60% rated light output in stage 1 and 40 seconds in stage 2. In comparison, China's current start time limit for reaching 80% rated output is 3 minutes.

Power Factors

Most standards and labeling programs have specified power factors for CFLs, except China, South Korea and Japan. The power factor values are relatively consistent across regions, with a minimum limit set at 0.50. In stage 2, the EU MEPS program will adopt a more stringent minimum power factor requirement of 0.55. Australia, Brazil and the EU have additional power factor requirements for high efficiency CFLs or CFLs with higher rated power. Australia's high efficiency power factor and the EU's power factor for CFLs rated at greater than 25W is set at 0.90 while Brazil's power factor for 30+W CFLs are set at 0.92.

Mercury Content

Although not a technical performance requirement, the mercury content of CFLs is an important health and safety concern for consumers and all programs except Brazil have set limits for the maximum mercury level. Of the programs that regulate mercury content, all except the EU have set its limit at 5 mg for CFLs with <25W rated power while the EU is more stringent at 4 mg for all CFLs. China, the U.S. and Japan also allow a slightly higher mercury content of 6 mg for CFLs with greater than 25W rated power.

GLS equivalence

Specific luminous flux values for claimed incandescent equivalency values are included in the Energy Star, Australia, Brazil and EU programs but not in the Chinese MEPS program. The specific luminous flux values for a given incandescent equivalent wattage differ slightly between the four programs, but are all within a given range. For example, the minimum luminous flux output for a 25W equivalent CFL range from 214 lumens in Australia to 250 lumens in U.S./Canada while on the higher end, the minimum luminous flux values for a 150W equivalent CFL range from 2009 to 2600 lumens. The Energy Star program also includes luminous flux values for two types of dimmable CFLs while Brazil and the EU included a luminous flux value for 15W equivalent CFLs.

CFLs: Summary of International Standards and Labeling Programs

		China 2003 MEPS MEPS	U.S./Canada EnergyStar Voluntary Label	South Korea MEPS, Mandatory Information Label	Japan Top Runner Standard
Scope		Unitary CFLs, screw or bayonet base, with electronic or magnetic ballasts, with covers or reflectors	Medium (Edison) or candelabra screw base CFL with integral electronic ballast or circline lamps with max diameter of 9 inches, with reflector or translucent cover.	Self-ballasted CFL	Self-ballasted CFL and pin-type CFL
Effective Date		2003	1999; Rev. 2008	2000	1998; Rev. 2009 with 2012 Target
EE (Initial Efficacy)	**Bare Lamp (fixed light output)**	Rated Power: 5 - 8W For CCT > 4400K: ≥ 46 lm/W For CCT ≤ 4400K: ≥ 50 lm/W	Rated Power: ≤ 10W Medium screw-base E26: 50 lm/W Candelabra screw-base E12: 50 lm/W	Rated Power: <10W MEPS: 42 lm/W TEPS: 48.3 lm/W	Rated Power: 10W CCT > 5000K: 55 lm/W CCT 3000 - 5000K: 58.1 lm/W CCT < 3000K: 60.6 lm/W
		Rated Power: 9 - 14W For CCT > 4400K: ≥ 54 lm/W For CCT ≤ 4400K: ≥ 58 lm/W	Rated Power: 10 - 15W E26: 55 lm/W E12: 55 lm/W	Rated Power: 10 - 15W MEPS: 48 lm/W TEPS: 55.2 lm/W	Rated Power: 15W CCT > 5000K: 60.8 lm/W CCT 3000 - 5000K: 65 lm/W CCT < 3000K: 67.5 lm/W
		Rated Power: 15 - 24W For CCT > 4400K: ≥ 61 lm/W For CCT ≤ 4400K: ≥ 65 lm/W	Rated Power: ≥ 15W E26: 65 lm/W E12: NA	Rated Power: 15 - 20W MEPS: 58 lm/W TEPS: 66.7 lm/W	Rated Power: 25W D-type CCT > 5000K: 65.2 lm/W CCT 3000 - 5000K: 69.5 lm/W CCT < 3000K: 72.4 lm/W
		Rated Power: 25 - 60W For CCT > 4400K: ≥ 67 lm/W For CCT ≤ 4400K: ≥ 70 lm/W			Rated Power: 25W Non-D type CCT > 5000K: 62.3 lm/W CCT 3000 - 5000K: 66.4 lm/W CCT < 3000K: 69.1 lm/W
	Bare Lamp (dimmable/2-way/3-way)		Rated Power: < 10W E26: 50 lm/W E12: 50 lm/W Rated Power: ≥ 15W E26: 60 lm/W E12: NA	**Energy Label Grades** Grade 1: R ≤ 1.00 Grade 2: 1.00 < R ≤ 1.06 Grade 3: 1.06 < R ≤ 1.09 Grade 4: 1.09 < R ≤ 1.12 Grade 5: 1.12 < R ≤ 1.15 where R = TEPS	

CFLs: Summary of International Standards and Labeling Programs (contd.)

	Australia	Brazil		EU	
	MEPS	ECL: information label	SEAL: endorsement label	Mandatory Energy Label	MEPS (proposed)
Scope	Unitary CFLs	Unitary or modular CFLs and circular fluorescents, with electronic or magnetic ballasts, with covers or reflectors.		filament and integral CFL, household linear and non-integral CFL. Excludes reflector lamps	Non-directional lamps, excluding fluorescent lamps without ballast and lamps with lumens <60 or >12000
Effective Date	11/1/2009	1994		2000	6 stages, from 2009-2016
EE (Initial Efficacy)	Rated Power: 5 - 8W	Rated Power: <15W		Class A, no ballast with lumen output Φ:	2009-2016 Clear Lamps (EN 50285)
	For CCT > 4400K MEPS > 36; HE > 46 lm/w	ECL:	≥ 40 lm/W	Power Input (W) $\le 0.15 \sqrt{\Phi} + 0.0097*\Phi$	$W \le 0.8*(0.88*\sqrt{\Phi} + 0.049*\Phi)$
	For CCT ≤ 4400K MEPS > 40; HE > 50 lm/w	SEAL:	≥ 45 lm/W		
				Class A, other lamps:	2009-16 Non-clear Lamps:
				Power Input (W) $\le 0.24 \sqrt{\Phi} + 0.0103*\Phi$	$W \le 0.24 \sqrt{\Phi} + 0.0103*\Phi$
	Rated Power: 9 - 14W	Rated Power ≥ 15W			
	For CCT > 4400K MEPS > 44; HE > 54 lm/w	ECL:	≥ 40 lm/W	Energy Efficiency Index, Ei:	Post 2016 Clear Lamps:
	For CCT ≤ 4400K MEPS > 48; HE > 58 lm/w	SEAL:	≥ 60 lm/W	Ei = W/Wr	$W \le 0.6*(0.88*\sqrt{\Phi} + 0.049*\Phi)$
				where reference wattage Wr = $Wr = 0.88*\sqrt{\Phi} + 0.049*\Phi$, when $\Phi > 34$ lumens	Post 2016 Non-clear Lamps:
	Rated Power: 15 - 24W			$Wr = 0.2*\Phi$, when $\Phi \le 34$ lumens	Same as 2009-16
	For CCT > 4400K MEPS > 51; HE > 61 lm/w For CCT ≤ 4400K MEPS > 55; HE > 65 lm/w			Class B: Ei < 60% Class C: 60% ≤ Ei < 80% Class D: 80% ≤ Ei < 95%	
	Rated Power: 25 - 60W			Class E: 95% ≤ Ei < 100%	
	For CCT > 4400K MEPS > 57; HE > 67 lm/w For CCT ≤ 4400K MEPS > 60; HE > 70 lm/w			Class F: 110% ≤ Ei < 130% Class G: Ei ≥ 130%	

CFLs: Summary of International Standards and Labeling Programs (contd.)

		China 2003 MEPS MEPS	U.S./Canada EnergyStar Voluntary Label	South Korea MEPS, Mandatory Information Label	Japan Top Runner Standard
	Covered Lamp without reflector		Rated Power: ≤ 7W E26: 40 lm/W E12: 35 lm/W Rated Power: 8 - 14W E26: 45 lm/W E12: 45 lm/W		
	Covered Lamp without reflector (contd.)		Rated Power: 15 - 24 W E26: 50 lm/W E12: NA Rated Power: ≥ 25W E26: 60 lm/W E12: NA		
	Outdoor Reflectors		Rated Power < 20W 33 lm/W Rated Power ≥ 20W 40 lm/W		
Test Procedure/ Standard		GB/T 17263-2002 (eq IEC 60969-2000)	ANSI C78.5-1997 (referencing 40 lm/W)	KS C 7621-99, KS C8100 (electronic ballasts), KS C7601 (fluroescent lamps), eq. JIS C8108 and JIS C7601 (ref IEC	JIS C 7601 (ref IEC 60901), JIS C 7801 and JIS C 7620-2
Test Sample		12, selected by manufacturers	10, selected by manufacturers	N/A	N/A
Lumen Maintenance	*1000 hour rating*	N/A	≥90% of initial (100-hr) avg. lumen output, with no more than 3/10 samples having < 85%	N/A	N/A
	2000 hour rating	≥80% of initial (100-hour) lumen output	NA	N/A	N/A
	40% Rated Lifetime	N/A	≥80% of initial (100 hr) avg. lumen output, no more than 3/10 samples <75%	N/A	N/A

CFLs: Summary of International Standards and Labeling Programs (contd.)

	Australia MEPS	Brazil ECL: information label	 SEAL: endorsement label	EU Mandatory Energy Label	 MEPS (proposed)
		Rated Power: < 15W ECL: ≥ 40 lm/W SEAL: ≥ 40 lm/W Rated Power: 15 - 18W ECL: ≥ 40 lm/W SEAL: ≥ 48 lm/W Rated Power: 19 - 24W ECL: ≥ 40 lm/W SEAL: ≥ 50 lm/W Rated Power: ≥ 25W ECL: ≥ 40 lm/W SEAL: ≥ 55 lm/W Lamps with reflectors should be tested without the same for the purposes of this table			
Test Procedure/ Standard	AS/NZS 60969 (ref IEC 60969-2001)	IEC 60901-1/97, NBR 14539-6/00		EN 5285, IEC/EN 60969 (self-ballasted lamps for general lighting services), CIE 84, CIE 97; IEC/EN 60901 (single-capped fluorescent lamps)	
Test Sample	10 samples	11: 10 for testing, 1 for control		20 samples	
Lumen Maintenance	N/A	N/A		N/A	
	≥ 80% of initial (100 hour) avg. lumen output. 8 out of 10 must comply for MEPS; 7 out of 10 must comply for High Efficiency	ECL ≥80% of initial (100-hour) lumen output.	SEAL ≥85% of initial (100-hour) lumen output.		Stage 1: ≥ 85%; Stage 5: ≥ 88% (CIE 97)
	N/A	N/A		N/A	

CFLs: Summary of International Standards and Labeling Programs (contd.)

	China 2003 MEPS MEPS	U.S./Canada EnergyStar Voluntary Label	South Korea MEPS, Mandatory Information Label	Japan Top Runner Standard
Rated Lifetime	≥ 6000 hours	≥ 6000 hours	N/A	N/A
Color Rendering Index	CCT > 4040K: CRI ≥ 76 3500 < CCT ≤ 4040K: CRI ≥ 78 CCT ≤ 3500K: CRI ≥ 80	Average of 10 samples > 80 No more than 3 samples can have CRI <	N/A	N/A
Ambient Conditions of Lifetime Test	10 - 40°C	N/A	N/A	Electrical Test: 25 ± 2°C
Rapid Cycle/Stress Test	N/A	Maximum of 1 failure out of 6 samples; cycles of 5 minutes on, 5 minutes off with 1 cycle for every 2 hrs of rated life	N/A	N/A
Interim Life Test	N/A	at 40% of rated life report on lamp life: 1 sample failure ok, 2 failure requires report, 3 failures does not qualify. Needed for initial qualification	N/A	N/A
Power Factor	N/A	≥ 0.5	N/A	N/A
Mercury Level	< 25W: ≤ 5 mg 25 - 40W: ≤ 6 mg	< 25W: ≤ 5 mg 25 - 40W: ≤ 6 mg	≤ 5 mg	< 25W: ≤ 5 mg ≥ 25W: ≤ 6 mg
Full Start Time	Magnetic ballast: 10 seconds Electronic ballast: 4 seconds	Average < 1 second	N/A	N/A

CFLs: Summary of International Standards and Labeling Programs (contd.)

	Australia		Brazil		EU	
	MEPS		ECL: information label	SEAL: endorsement label	Mandatory Energy Label	MEPS (proposed)
Rated Lifetime	MEPS ≥ 6000 hours	High Efficiency ≥ 10,000 hours	Max 1 failure in 10 bulbs after 2000 hours			Stage 1: >0.5 survival at 6000 hrs; Stage 5: > 0.7 survival (EN 60969)
Color Rendering I	MEPS: N/A	High Efficiency: CCT > 4400: CRI ≥ 80 CCT 2700-4400: CRI ≥ 82 CCT < 2700: CRI ≥ 84	N/A			CRI ≥80 (CIE 13.3) If CRI ≥ 90, efficiacy should be ≥85% of lamps with CRI of 80-90
Ambient Conditions of Lifetime Test	Electrical Test: 25 ± 1°C; RH 65%	Lumen maintenance test: 15 - 50°C	N/A			25°C
Rapid Cycle/Stress Test	N/A		N/A		N/A	
Interim Life Test	N/A		N/A		N/A	
Power Factor	MEPS: High Efficiency:	≥ 0.5 ≥ 0.9	All: CFL < 30 W (voluntary): (mandatory):	PF ≥ 0.50 high PF ≥ 0.92 high PF ≥ 0.92		Stage 1: ≥ 0.50 if P<25W ≥ 0.90 if P ≥ 25W Stage 2: ≥ 0.55 if P<25W ≥ 0.90 if P ≥ 25W
Mercury Level	All:	5 mg	N/A		≤ 4 mg (Commssion Decision 2002/747/EC)	
Full Start Time	N/A		N/A			Stage 1: < 2 sec (EN 60969) Stage 2: < 1.5 sec if P < 10W < 1.0 sec if P ≥ 10W

CFLs: Summary of International Standards and Labeling Programs (contd.)

	China 2003 MEPS MEPS	**U.S./Canada EnergyStar** Voluntary Label	**South Korea** MEPS, Mandatory Information Label	**Japan** Top Runner Standard
Start Time for Stablized Light Output	80% rated output: ≤ 3 minutes Full run-up: ≤ 40 minutes	Full run-up for bare lamps: < 1 minute Full run-up for covered, outdoor reflectors: <3 minutes	N/A	N/A
GLS Equivalence	N/A	*Rated Wattage of Equiv. GLS Filament Lamp* — *CFL Luminous Flux Claim (lm)* ≤ 25W — ≥ 250 lumens ≤ 40W — ≥ 450 lumens ≤ 60W — ≥ 800 lumens ≤ 75W — ≥ 1100 lumens ≤ 100W — ≥ 1600 lumens ≤ 125W — ≥ 2000 lumens ≤ 150W — ≥ 2600 lumens 30-70-100W — ≥ 1200 lumens 50-100-150W — ≥ 2150 lumens	N/A	N/A

CFLs: Summary of International Standards and Labeling Programs (contd.)

	Australia		Brazil			EU	
	MEPS		ECL: information label	SEAL: endorsement label		Mandatory Energy Label	MEPS (proposed)
Start Time for Stablized Light Output	N/A		N/A				60% rated ouptut: < 60s at stage 1 60% rated ouptut: < 40s at stage 2
GLS Equivalence	*Rated Wattage of Equiv. GLS Filament Lamp*	*CFL Luminous Flux Claim (lm)*	*Rated Wattage of Equiv. GLS Filament Lamp*	*CFL Luminous Flux at 127 V (lm)*	*CFL Luminous Flux at 220 V (lm)*	*Rated Wattage of Equiv. GLS Filament Lamp*	*CFL Luminous Flux Claim (lm) (CIE 84)*
	≤ 25W	≥ 214 lumens	≤ 15W	104	110	≤ 15W	≥ 125 lm
	≤ 40W	≥ 386 lumens	≤ 25W	214	220	≤ 25W	≥ 229 lm
	≤ 50W	≥ 530 lumens	≤ 40W	480	415	≤ 40W	≥ 432 lm
	≤ 60W	≥ 660 lumens	≤ 60W	804	715	≤ 60W	≥ 741 lm
	≤ 75W	≥ 874 lumens	≤ 75W	1018	890	≤ 75W	≥ 970 lm
	≤ 90W	≥ 1100 lumens	≤ 100W	1507	1350	≤ 100W	≥ 1398 lm
	≤ 100W	≥ 1246 lumens	≤ 150W	2330	2180	≤ 150W	≥ 2253 lm
	≤ 150W	≥ 2009 lumens	≤ 200W	3274	3090	≤ 200W	≥ 3172 lm

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Appendix A.1: U.S. and Canada Test Procedure for Clothes Washer

3330 Federal Register / Vol. 66, No. 9 / Friday, January 12, 2001 / Rules and Regulations

the potential for uncertainty and litigation arising from such uncertainty. Similarly, the Presidential memorandum of June 1, 1998 (63 FR 31883) directs the heads of executive departments and agencies to use plain language in all proposed and final rulemaking documents published in the **Federal Register**.

Today's rule uses the following general techniques to abide by Section 1(b)(12) of Executive Order 12866 and the Presidential memorandum of June 1, 1998:

• Organization of the material to serve the needs of the readers (stakeholders).
• Use of common, everyday words in short sentences.
• Shorter sentences and sections.

K. Congressional Notification

As required by 5 U.S.C. 801, DOE will submit to Congress a report regarding the issuance of today's final rule prior to the effective date set forth at the outset of this notice. DOE also will submit the supporting analyses to the Comptroller General (GAO) and make them available to each House of Congress. The report will state that it has been determined that the rule is a "major rule" as defined by 5 U.S.C. 804(2).

L. Review Under Section 32 of the Federal Energy Administration Act

The test procedure amendments finalized today incorporate the American Association of Textile Chemists and Colorists (AATCC) Test Methods 118—1997, "Oil Repellency: Hydrocarbon Resistance Test" (reaffirmed 1997), and 79—2000, "Absorbency of Bleached Textiles" (reaffirmed 2000), to determine whether a stain resistant or water repellent finish is present in a test cloth used to measure remaining moisture content and therefore the energy consumption of a clothes washer.

The findings required of DOE by section 32 of the Federal Energy Administration Act serve to alert the public and DOE regarding the use and background of commercial standards in the rulemaking process. DOE has evaluated the promulgation of AATCC Test Methods 118–1997 (reaffirmed 1997), and 79–2000 (reaffirmed 2000), in light of the public participation criteria of section 32(b). The Department is unable to conclude whether development of these standards fully complied with section 32(b) regarding the manner of public participation.

As required by section 32(c), DOE has consulted with the Attorney General and the Chairman of the Federal Trade Commission concerning the impact of these standards on competition, prior to prescribing final test procedures.

List of Subjects in 10 CFR Part 430

Administrative practice and procedure, Energy conservation, Household appliances, Incorporation by Reference.

Issued in Washington, D.C., on January 3, 2001.

Dan W. Reicher,

Assistant Secretary, Energy Efficiency and Renewable Energy.

For the reasons set forth in the preamble, part 430 of chapter II of title 10, Code of Federal Regulations is amended, as set forth below.

PART 430—ENERGY CONSERVATION PROGRAM FOR CONSUMER PRODUCTS

1. The authority citation for part 430 continues to read as follows:

Authority: 42 U.S.C. 6291–6309; 28 U.S.C. 2461 note.

Appendix J [Amended]

2. Appendix J to subpart B of part 430 is amended:

a. By adding a new sentence at the beginning of the introductory paragraph of this appendix.

b. In section 2, by adding paragraphs 2.3.1 and 2.3.2, and by revising paragraphs 2.6.1.3, 2.6.2, 2.10, 2.11, and 2.11.1.

c. In section 3, by revising paragraph 3.3.1.

d. By adding a new section 8.

The additions and revisions read as follows:

Appendix J to Subpart B of Part 430—Uniform Test Method for Measuring the Energy Consumption of Automatic and Semi-Automatic Clothes Washers

The provisions of this appendix J shall apply to products manufactured after February 12, 2001. * * *

* * * * *

2. * * *

2.3. * * *

2.3.1 *Supply water requirements for water and energy consumption testing.* For nonwater-heating clothes washers not equipped with thermostatically controlled water valves, the temperature of the hot and cold water supply shall be maintained at 100° ± 10°F (37.8°C ± 5.5°C). For nonwater-heating clothes washers equipped with thermostatically controlled water valves, the temperature of the hot water supply shall be maintained at 140°F ± 5°F (60.0°C ± 2.8 °C) and the cold water supply shall be maintained at 60°F ± 5F° (15.6°C ± 2.8°C). For water-heating clothes washers, the temperature of the hot water supply shall be maintained at 140°F ± 5°F (60.0°C ± 2.8°C) and the cold water supply shall not exceed 60°F (15.6°C). Water meters shall be installed in both the hot and cold water lines to measure water consumption.

2.3.2 *Supply water requirements for remaining moisture content testing.* For nonwater-heating clothes washers not equipped with thermostatically controlled water valves, the temperature of the hot water supply shall be maintained at 140°F ± 5°F and the cold water supply shall be maintained at 60°F ± 5°F. All other clothes washers shall be connected to water supply temperatures as stated in 2.3.1 of this appendix.

* * * * *

2.6.1.3 The number of test runs on the same energy test cloth shall not exceed 60 test runs. All energy test cloth must be permanently marked identifying the lot number of the material. Mixed lots of material shall not be used for testing the clothes washers.

2.6.2 *Energy Stuffer Cloth.* 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 (30.5 cm by 30.5 cm) and have been hemmed to 10 inches by 10 inches (25.4 cm by 25.4 cm) before washing. The maximum shrinkage after five washes shall not be more than four percent on the length and width. The number of test runs on the same energy suffer cloth shall not exceed 60 test runs. All energy stuffer cloth must be permanently marked identifying the lot number of the material. Mixed lots of material shall not be used for testing the clothes washers.

* * * * *

2.10 *Wash time (period of agitation or tumble) setting.* If the maximum available wash time in the normal cycle is greater than 9.75 minutes, the wash time shall be not less than 9.75 minutes. If the maximum available wash time in the normal cycle is less than 9.75 minutes, the wash time shall be the maximum available wash time.

2.11 *Agitation speed and spin speed settings.* Where controls are provided for agitation speed and spin speed selections, set them as follows:

2.11.1 For energy and water consumption tests, set at the normal cycle settings. If settings at the normal cycle are not offered, set the control settings to the maximum speed permitted on the clothes washer.

3. * * *

3.3. * * *

3.3.1 The wash temperature shall be the same as the rinse temperature for all testing. Cold rinse is the coldest rinse temperature available on the machine. Warm rinse is the hottest rinse temperature available on the machine.

* * * * *

8. Sunset

The provisions of this appendix J expire on December 31, 2003.

Appendix J1 [Amended]

3. Appendix J1 to subpart B of part 430 is amended:

a. By removing the Note after the heading and adding a new paragraph.

Source: U.S. Department of Energy. 2001. "Clothes Washer Energy Conservation Standards Final Rule, *Federal Register*, 66 FR 3314." Available at: http://www1.eere.energy.gov/buildings/appliance_standards/residential/clothes_washers.html

b. In section 1, by adding paragraphs 1.22 and 1.23.

c. In section 2, by revising paragraphs 2.6.1 and 2.6.2, and adding paragraphs 2.6.3 through 2.6.7.2.

d. In section 4, by revising the definition of "ER_x, ER_a, and ER_n" in paragraph 4.1.5.

The additions and revisions read as follows:

Appendix J1 to Subpart B of Part 430—Uniform Test Method for Measuring the Energy Consumption of Automatic and Semi-Automatic Clothes Washers

The provisions of this appendix J1 shall apply to products manufactured beginning January 1, 2004.

1. * * *

1.22 *Cold rinse* means the coldest rinse temperature available on the machine (and should be the same rinse temperature selection tested in 3.7 of this appendix).

1.23 *Warm rinse* means the hottest rinse temperature available on the machine (and should be the same rinse temperature selection tested in 3.7 of this appendix).

2. * * *

2.6. * * *

2.6.1 *Energy Test Cloth.* The energy test cloth shall be made from energy test cloth material, as specified in 2.6.4, that is 24 inches by 36 inches (61.0 cm by 91.4 cm) and has been hemmed to 22 inches by 34 inches (55.9 cm by 86.4 cm) before washing. The energy test cloth shall be clean and shall not be used for more than 60 test runs (after preconditioning as specified in 2.6.3 of this appendix). All energy test cloth must be permanently marked identifying the lot number of the material. Mixed lots of material shall not be used for testing the clothes washers.

* * * * *

2.6.2 *Energy Stuffer Cloth.* The energy stuffer cloth shall be made from energy test cloth material, as specified in 2.6.4, and shall consist of pieces of material that are 12 inches by 12 inches (30.5 cm by 30.5 cm) and have been hemmed to 10 inches by 10 inches (25.4 cm by 25.4 cm) before washing. The energy stuffer cloth shall be clean and shall not be used for more than 60 test runs (after preconditioning as specified in 2.6.3 of this appendix). All energy stuffer cloth must be permanently marked identifying the lot number of the material. Mixed lots of material shall not be used for testing the clothes washers.

2.6.3 *Preconditioning of Test Cloths.* The new test cloths, including energy test cloths and energy stuffer cloths, shall be pre-conditioned in a clothes washer in the following manner:

2.6.3.1 Perform 5 complete normal wash-rinse-spin cycles, the first two with AHAM Standard detergent 2A and the last three without detergent. Place the test cloth in a clothes washer set at the maximum water level. Wash the load for ten minutes in soft water (17 ppm hardness or less) using 6.0 grams per gallon of water of AHAM Standard detergent 2A. The wash temperature is to be controlled to 135°F ± 5°F (57.2°C ± 2.8°C) and the rinse temperature is to be controlled to 60°F ± 5°F (15.6°C ± 2.8°C). Repeat the cycle with detergent and then repeat the cycle three additional times without detergent, bone drying the load between cycles (total of five wash and rinse cycles).

2.6.4 *Energy test cloth material.* The energy test cloths and energy stuffer cloths shall be made from fabric meeting the following specifications. The material should come from a roll of material with a width of approximately 63 inches and approximately 500 yards per roll, however, other sizes maybe used if they fall within the specifications.

2.6.4.1 *Nominal fabric type.* Pure finished bleached cloth, made with a momie or granite weave, which is nominally 50 percent cotton and 50 percent polyester.

2.6.4.2 The fabric weight shall be 5.60 ounces per square yard (190.0 g/m²), ±5 percent.

2.6.4.3 The thread count shall be 61 × 54 per inch (warp × fill), ±2 percent.

2.6.4.4 The warp yarn and filling yarn shall each have fiber content of 50 percent ±4 percent cotton, with the balance being polyester, and be open end spun, 15/1 ±5 percent cotton count blended yarn.

2.6.4.5 Water repellent finishes, such as fluoropolymer stain resistant finishes shall not be applied to the test cloth. The absence of such finishes shall be verified by:

2.6.4.5.1 American Association of Textile Chemists and Colorists (AATCC) Test Method 118—1997, *Oil Repellency: Hydrocarbon Resistance Test* (reaffirmed 1997), of each new lot of test cloth (when purchased from the mill) to confirm the absence of Scotchguard™ or other water repellent finish (required scores of "D" across the board).

2.6.4.5.2 American Association of Textile Chemists and Colorists (AATCC) Test Method 79–2000, *Absorbency of Bleached Textiles* (reaffirmed 2000), of each new lot of test cloth (when purchased from the mill) to confirm the absence of Scotchguard™ or other water repellent finish (time to absorb one drop should be on the order of 1 second).

2.6.4.5.3 The standards listed in 2.6.4.5.1 and 2.6.4.5.2 of this appendix which are not otherwise set forth in this part 430 are incorporated by reference. The material listed in this paragraph has been approved for incorporation by reference by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR Part 51. Any subsequent amendment to a standard by the standard-setting organization will not affect the DOE test procedures unless and until amended by DOE. Material is incorporated as it exists on the date of the approval and notice of any change in the material will be published in the **Federal Register**. The standards incorporated by reference are the American Association of Textile Chemists and Colorists Test Method 118–1997, *Oil Repellency: Hydrocarbon Resistance Test* (reaffirmed 1997) and Test Method 79–2000, *Absorbency of Bleached Textiles* (reaffirmed 2000).

(a) The above standards incorporated by reference are available for inspection at:

(i) Office of the Federal Register, Information Center, 800 North Capitol Street, NW, Suite 700, Washington, DC;

(ii) U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Hearings and Dockets, "Energy Conservation Program for Consumer Products: Clothes Washer Energy Conservation Standards," Docket No. EE—RM–94–403, Forrestal Building, 1000 Independence Avenue, SW, Washington, DC.

(b) Copies of the above standards incorporated by reference can be obtained from the American Association of Textile Chemists and Colorists, P.O. Box 1215, Research Triangle Park, NC 27709, telephone (919) 549–8141, telefax (919) 549–8933, or electronic mail: *orders@aatcc.org*

2.6.4.6 The moisture absorption and retention shall be evaluated for each new lot of test cloth by the Standard Extractor Remaining Moisture Content (RMC) Test specified in 2.6.5 of this appendix.

2.6.4.6.1 Repeat the Standard Extractor RMC Test in 2.6.5 of this appendix three times.

2.6.4.6.2 An RMC correction curve shall be calculated as specified in 2.6.6 of this appendix.

2.6.5 *Standard Extractor RMC Test Procedure.* The following procedure is used to evaluate the moisture absorption and retention characteristics of a lot of test cloth by measuring the RMC in a standard extractor at a specified set of conditions. Table 2.6.5 of this appendix is the matrix of test conditions. The 500g requirement will only be used if a clothes washer design can achieve spin speeds in the 500g range. When this matrix is repeated 3 times, a total of 48 extractor RMC test runs are required. For the purpose of the extractor RMC test, the test cloths may be used for up to 60 test runs (after preconditioning as specified in 2.6.3 of this appendix).

TABLE 2.6.5.—MATRIX OF EXTRACTOR RMC TEST CONDITIONS

"g" Force	Warm soak		Cold soak	
	15 min. spin	4 min. spin	15 min. spin	14 min. spin
50				
200				
350				

TABLE 2.6.5.—MATRIX OF EXTRACTOR RMC TEST CONDITIONS—Continued

"g" Force	Warm soak		Cold soak	
	15 min. spin	4 min. spin	15 min. spin	14 min. spin
500				

2.6.5.1 The standard extractor RMC tests shall be run in a Bock Model 215 extractor (having a basket diameter of 19.5 inches, length of 12 inches, and volume of 2.1 ft^3), with a variable speed drive (Bock Engineered Products, P.O. Box 5127, Toledo, OH 43611) or an equivalent extractor with same basket design (*i.e.* diameter, length, volume, and hole configuration) and variable speed drive.

2.6.5.2 *Test Load.* Test cloths shall be preconditioned in accordance with 2.6.3 of this appendix. The load size shall be 8.4 lbs., consistent with 3.8.1 of this appendix.

2.6.5.3 *Procedure.*

2.6.5.3.1 Record the "bone-dry" weight of the test load (WI).

2.6.5.3.2 Soak the test load for 20 minutes in 10 gallons of soft (<17 ppm) water. The entire test load shall be submerged. The water temperature shall be 100°F ± 5°F.

2.6.5.3.3 Remove the test load and allow water to gravity drain off of the test cloths. Then manually place the test cloths in the basket of the extractor, distributing them evenly by eye. Spin the load at a fixed speed corresponding to the intended centripetal acceleration level (measured in units of the acceleration of gravity, g) ±1 g for the intended time period ±5 seconds.

2.6.5.3.4 Record the weight of the test load immediately after the completion of the extractor spin cycle (WC).

2.6.5.3.5 Calculate the RMC as (WC–WI)/WI.

2.6.5.3.6 The RMC of the test load shall be measured at three (3) g levels: 50g; 200g; and 350g, using two different spin times at each g level: 4 minutes; and 15 minutes. If a clothes washer design can achieve spin speeds in the 500g range than the RMC of the test load shall be measured at four (4) g levels: 50g; 200g; 350g; and 500g, using two different spin times at each g level: 4 minutes; and 15 minutes.

2.6.5.4 Repeat 2.6.5.3 of this appendix using soft (<17 ppm) water at 60°F ± 5°F.

2.6.6 *Calculation of RMC correction curve.*

2.6.6.1 Average the values of 3 test runs and fill in table 2.6.5 of this appendix. Perform a linear least-squares fit to relate the standard RMC ($RMC_{standard}$) values (shown in table 2.6.6.1 of this appendix) to the values measured in 2.6.5 of this appendix:

(RMC_{cloth}): $RMC_{standard} - A * RMC_{cloth} + B$
Where A and B are coefficients of the linear least-squares fit.

TABLE 2.6.6.1.—STANDARD RMC VALUES ($RMC_{standard}$)

G	RMC percent	Warm soak		Cold soak
		15 min. spin	4 min. spin	15 min. spin
50	50.4	55.7	52.8	59.0
200	35.6	40.4	37.9	43.1
350	29.6	33.1	30.6	35.8
500	24.2	28.7	25.5	30.0

2.6.6.2 Check accuracy of linear least-squares fit using the following method:

The root mean square value of

$$\left(\sum_{i=1}^{12}\frac{\left(RMC_{standard\_i}-RMC_{corr\_i}\right)^2}{10}\right)^{1/2}$$

shall be less than 2 percent, where a sum is taken over all of the different tests, where $RMC_{standard—i}$ is the RMC standard value measured for the I-th test, and $RMC_{corr—i}$ is the corrected RMC value for the I-th cloth test. This equation is valid only for the use with three (3) g force values therefore when using the 500g requirement; replace the 500g value instead of the 350g value.

2.6.7 *Application of RMC correction curve.*

2.6.7.1 Using the coefficients A and B calculated in 2.6.6.1 of this appendix:

$RMC_{corr} = A * RMC + B$

2.6.7.2 Substitute RMC_{corr} values in calculations in 3.8 of this appendix.

* * * * *

4. * * *

4. 1 * * *

4.1.5 * * *

ER_x, ER_a, ER_n, are reported electrical energy consumption values, in kilowatt-hours per cycle, at maximum, average, and minimum test loads, respectively, for the warm rinse cycle per definitions in 3.7.2 of this appendix.

* * * * *

§ 430.32 [Amended]

4. Section 430.32 is amended by revising paragraph (g) to read as follows:

§ 430.32 Energy and water conservation standards and effective dates.

* * * * *

(g) *Clothes washers.*

(1) Clothes washers manufactured before January 1, 2004, shall have an energy factor no less than:

Product Class	Energy factor (cu.ft./kWh/cycle)
i. Top-Loading, Compact (less than 1.6 ft.^{3} capacity).	0.9.
ii. Top-Loading, Standard (1.6 ft.^{3} or greater capacity).	1.18.
iii. Top-Loading, Semi-Automatic.	[1] Not Applicable.
iv. Front-Loading	[1] Not Applicable.
v. Suds-saving	[1] Not Applicable.

[1] Must have an unheated rinse water option.

(2) Clothes washers manufactured on or after January 1, 2004, and before January 1, 2007, shall have a modified energy factor no less than:

Product Class	Modified energy factor (cu.ft./kWh/cycle)
i. Top-Loading, Compact (less than 1.6 ft.^{3} capacity).	0.65.
ii. Top-Loading, Standard (1.6 ft.^{3} or greater capacity).	1.04.
iii. Top-Loading, Semi-Automatic.	[1] Not Applicable.
iv. Front-Loading	1.04.
v. Suds-saving	[1] Not Applicable.

[1] Must have an unheated rinse water option.

(3) Clothes washers manufactured on or after January 1, 2007, shall have a modified energy factor no less than:

Product Class	Modified energy factor (cu.ft./kWh/cycle)
i. Top-Loading, Compact (less than 1.6 ft.^{3} capacity).	0.65.
ii. Top-Loading, Standard (1.6 ft.^{3} or greater capacity).	1.26.
iii. Top-Loading, Semi-Automatic.	[1] Not Applicable.
iv. Front-Loading	1.26.
v. Suds-saving	[1] Not Applicable.

[1] Must have an unheated rinse water option.

* * * * *

Appendix

[The following letter from the Department of Justice will not appear in the Code of Federal Regulations.]

DEPARTMENT OF JUSTICE

Antitrust Division

Main Justice Building, 950 Pennsylvania Avenue, NW., Washington, DC 20530–0001, (202)514–2401/(202) 696–2645 (i), *Antitrust@justic.usdoj.gov* internet, *Http://www.usdoj.gov* (World Wide Web).

December 4, 2000.

Mary Anne Sullivan, General Counsel, Department of Energy, Washington, DC 20585.

Dear General Counsel Sullivan: I am responding to your October 16, 2000 letter seeking the views of the Attorney General about the potential impact on competition of two proposed energy efficiency standards: one for clothes washers and the other for residential central air conditioners and heat pumps. Your request was submitted pursuant to Section 325 (o)(2)(B)(i) of the Energy Policy and Conservation Act, 42 U.S.C. 6291 (''EPCA''), which requires the Attorney General to make a determination of the impact of any lessening of competition that is likely to result from the imposition of proposed energy efficiency standards. The Attorney General's responsibility for responding to requests from other departments about the effect of a program on competition has been delegated to the Assistant Attorney General for the Antitrust Division in 28 CFR 0.40 (g).

We have reviewed the proposed standards and the supplementary information published in the **Federal Register** notices and submitted to the Attorney General, which include information provided to the Department of Energy by manufacturers. We have additionally conducted interviews with members of the industries.

We have concluded that the proposed clothes washer standard would not adversely affect competition. In reaching this conclusion, we note that the proposed standard is based on a joint recommendation submitted to the Department of Energy by manufacturers and energy conservation advocates. That recommendation states that virtually all manufacturers of clothes washers who sell in the United States participated in arriving at the recommendation through their trade association, that the recommendation was developed in consultation with small manufacturers, and that the manufacturers believe the new standard would not likely reduce competition. We note further that, as the industry recommended, the proposed standard will be phased in over six years, which will allow companies that do not already have products that meet the proposed standard sufficient time to redesign their product lines.

* * * * *

Sincerely,

A. Douglas Melamed,

Acting Assistant Attorney General.

[FR Doc. 01–611 Filed 1–11–01; 8:45 am]

BILLING CODE 6450–01–P

Appendix A.2 Hong Kong Test Procedure for Clothes Washer

10.3 Classification of Washing Machines

All washing machines regulated under the Ordinance are classified in accordance with Table 10.1—

Table 10.1 – Classification of Washing Machines

Category	Description
1	Horizontal drum type washing machines
2	Impeller type or agitator type washing machines

10.4 Tests Required to be Carried Out

The tests specified in this clause are required to be carried out, in accordance with IEC 60456 or JIS C 9606 or other equivalent international standards approved by the Director, in order to find out the energy efficiency and performance characteristics of a washing machine. The importer or manufacturer shall clearly indicate which test standard(s) they follow in testing their washing machines:

(a) IEC 60456 applies to horizontal drum type washing machines (i.e. category 1)

(b) JIS C 9606 applies to impeller type or agitator type washing machines (i.e. category 2)

A test report required to be submitted to the Director under section 6 of the Ordinance shall contain the results of these tests:

(a) Energy consumption;

(b) Water consumption;

(c) Washing performance; and

(d) Spin extraction performance.

10.5 Test Methodology and Energy Efficiency Grading

10.5.1. Test Conditions

In carrying out the tests as specified in clause 10.4 of the Code, the washing machine shall be tested at a voltage of 380/220V and a frequency of 50Hz with tolerances as specified in the relevant IEC or JIS standards. Moreover, unless the Director

Source: Hong Kong Electrical and Mechanical Services Department. 2009. "The Hong Kong Voluntary Energy Efficiency Labeling Scheme for Washing Machines." Available at: http://www.emsd.gov.hk/emsd/e_download/pee/EELS_Washer_Eng_2009_Rev1.pdf approves otherwise, the following test conditions shall be followed:

(a) In testing horizontal drum type washing machines (category 1), the 60 °C cotton programme shall be used without pre-wash in accordance with the manufacturer's instruction.

(b) In testing impeller type or agitator type washing machines (category 2), at the start of the test, the temperature of water shall be 30 ± 2 °C.

In cases of washing machines without any programmes, the recommended times for washing, rinsing, and spin extracting operations shall be in accordance with the manufacturer's instructions for the rated washing capacity to be tested.

10.5.2. Measurement of Energy Consumption

The methodology for measuring energy consumption (kWh) shall be based on:

(a) IEC 60456;

(b) JIS C 9606; or

(c) Other equivalent international standards approved by the Director.

The specified international standards (IEC or JIS) shall be referred to for actual performance requirements and procedural descriptions.

The energy consumption shall be measured as follows:

(i) For horizontal drum type washing machine with built-in water heating device, the measured energy consumption (E) of the washing machine shall include the energy consumptions of both the washing function (including washing, rinsing and spin extraction processes) and the built-in water heating device for heating water. This measured energy consumption (E) shall be shown on the energy label after it is calculated to annual energy consumption based on 260 washes / year operation.

(ii) For horizontal drum type washing machine without built-in water heating device, only the measured energy consumption (E) of the washing machine shall be shown on the energy label after it is calculated to annual energy consumption based on 260 washes / year operation.

(iii) For impeller type or agitator type washing machine, only the measured energy consumption (E) of the washing function (including washing, rinsing and spin extraction processes) shall be shown on the energy label after it is calculated to annual energy consumption based on 260 washes / year operation.

In cases of washing machines combined with built-in dryers for drying textiles by means of heating, only the energy consumption (E) of the washing machine shall be measured and the drying function is excluded.

10.5.3. Measurement of Water Consumption

The water consumption (litres/cycle) shall be measured during the energy consumption test in accordance with IEC 60456, JIS C 9606, or other equivalent international standards approved by the Director.

10.5.4. Measurement of Washing Performance and Spin Extraction Performance

The washing performance and spin extraction performance shall be measured and evaluated during the test period in accordance with IEC 60456, JIS C 9606, or other equivalent international standards approved by the Director.

10.5.5. Calculation of Specific Energy Consumption

The specific energy consumption of a washing machine shall be calculated as follows:

(a) For horizontal drum type washing machine with built-in water heating device and impeller type or agitator type washing machine, the specific energy consumption is calculated as follows:

$$\text{Specific Energy Consumption } (E_{sp}) = \frac{E}{W_r} \quad \text{.........................(eq. 1)}$$

where E *= measured energy consumption per cycle (kWh/cycle)*

W_r *= rated washing capacity (kg)*

(b) For horizontal drum type washing machine without built-in water heating device, the specific energy consumption is calculated as follows:

$$\text{Specific Energy Consumption } (E_{sp}) = \frac{E + W_h}{W_r} \quad \text{.....................(eq. 2)}$$

where E *= measured energy consumption per cycle (kWh/cycle)*

W_r *= rated washing capacity (kg)*

W_h *= calculated hot water energy (kWh/cycle)*

The calculated hot water energy is the theoretical energy requirement for heating water from 15 °C to 60 °C and shall be calculated as follows:

$$W_h = \frac{(V_h \times (t_h - 15))}{860} \quad \text{.........................(eq. 3)}$$

where W_h = the calculated hot water energy in kWh for the operation

V_h = the volume of external hot water used in litres during the operation

t_h = the hot water inlet temperature in °C, i.e. 60 °C

10.5.6. Average Specific Energy Consumption

The average specific energy consumption (E_{av}) figures for washing machines are shown in Table 10.2.

Table 10.2 – Average specific energy consumption

Washing Machine Category	**Average Specific Energy Consumption (kWh/kg/cycle)**
Category 1	$E_{av} = 0.26$
Category 2	$E_{av} = 0.0264$

10.5.7. Energy Efficiency Grading

(a) Energy Consumption Index (I_e)

The energy consumption index (I_e) of a washing machine is defined as the ratio of the specific energy consumption (E_{sp}) of the washing machine to the average specific energy consumption (E_{av}) (as found from the associated average specific energy consumption in clause 10.5.6 of the Code). The indices are expressed in percentages. Thus, within a category, a washing machine with a lower energy consumption index (i.e. a lower percentage) consumes less energy than a washing machine with a higher energy consumption index (i.e. a higher percentage). The energy consumption index is calculated as follows—

$$\text{Energy Consumption Index } (I_e) = \frac{E_{sp}}{E_{av}} \times 100\% \quad \text{......................(eq. 4)}$$

where E_{sp} *= specific energy consumption as determined in clause 10.5.5*

E_{av} *= average specific energy consumption as determined from Table 10.2*

(b) Energy Efficiency Grading

The energy efficiency grading of a washing machine shall be determined as shown in Table 10.3, with Grade 1 having the best performance and Grade 5 having the worst performance.

Table 10.3 – Derivation of energy efficiency grades

Energy Consumption Index: I_E (%)	Energy Efficiency Grade
$I_E \leq 80$	1
$80 < I_E \leq 95$	2
$95 < I_E \leq 110$	3
$110 < I_E \leq 125$	4
$125 < I_E$	5

Note:

In order to obtain Grade 1 to 4, the washing machine concerned shall also meet all the performance requirements as stipulated in clause 10.6.1(c), i.e. washing performance and spin extraction performance. Only Grade 5 will be accorded if the washing machine does not meet anyone of these performance requirements or $I_E > 125$.

An example illustrating the method on how to determine the energy efficiency grade of a washing machine is shown in Appendix 4A. *(to be provided)*

10.6 Performance Requirements

10.6.1. In the test report submitted to the Director under section 6 of the Ordinance, the results of the tests carried out in accordance with IEC 60456 or JIS C 9606 or other equivalent international standards approved by the Director shall show that the concerned model conforms with the following performance requirements—

(a) The measured energy consumption (kWh/cycle) shall not be greater than the rated energy consumption by more than 15%.

(b) The measured water consumption (litres/cycle) shall not be greater than the rated water consumption by more than 15%.

(c) The measured washing performance and measured spin extraction performance shall conform with the minimum requirements in accordance with the respective test standards as shown in Table 10.4 for Grade 1 to 4:

Table 10.4 – Performance Requirements

Category	Category 1	Category 2
Performance Requirements Note (1)		
Test Standard	**IEC 60456**	**JIS C 9606**
Washing Performance Note (2)	q ≧ 0.7	C ≧ 0.55
Spin Extraction Performance Note (3)	RM ≦ 1.1	Water extracting efficiency ≧ 0.47

Note:

(1) *Each of the performance shall be determined in accordance with the test standard of the respective category.*

(2) *The washing performance shall be determined in accordance with the following equations (extracted from the respective test standards):*

$$q = \frac{\overline{C}_{test}}{\overline{C}_{ref}} \qquad or \qquad C = \frac{D_r}{D_s}$$

where q = *ratio of the average sum of the reflectance values*

$\overline{C}_{test}$ = *average sum of the reflectance values for the washing machine under test*

$\overline{C}_{ref}$ = *average sum of the reflectance values for the reference washing machine*

C = *washability ratio*

D_r = *washability by the washing machine under test*

D_s = *washability by the reference washing machine*

For details on the definitions of the parameters and their calculation, the respective test standards shall be referred to.

(3) *The spin extraction performance shall be determined in accordance with*

the following equations (extracted from the respective test standards):

$$RM = \frac{M_r - M}{M} \quad , or$$

$$Water\ extracting\ efficiency = \frac{Mass\ of\ cloth\ in\ dry\ state}{Mass\ of\ cloth\ after\ water\ extraction}$$

where RM = *remaining moisture*

M = *the mass of the conditioned base load*

M_r = *the mass of the base load after spin extraction*

For details on the definitions of the parameters and their calculation, the respective test standards shall be referred to.

(4) *In order to obtain Grade 1 to 4, the washing machine concerned shall also meet all the above performance requirements, i.e. washing performance and spin extraction performance. Only Grade 5 will be accorded if the washing machine does not meet anyone of the above performance requirements or* $I_e > 125$.

10.6.2. The rated energy consumption and rated water consumption as declared by the manufacturer or importer shall meet the requirements specified in clause 10.6.1 of the Code.

10.7 Safety Requirements

In addition to the energy efficiency performance requirements, all washing machines shall comply with the Electrical Products (Safety) Regulation, Chapter 406G of the Laws of Hong Kong, and the safety standards specified under the Regulation, and all other legislations concerning the safety of the washing machines.

10.8 Number of Samples to be Tested

10.8.1. For submission of product information of a model under section 6 of the Ordinance, subject to clause 10.8.2 of the Code, a test report on one sample of the model shall be submitted.

10.8.2. However, if the test results of one sample indicate that the measured energy consumption is greater than the rated energy consumption by more than 10%, the test report shall include the tests of two samples of the same model. In such case, each individual sample shall meet all the performance requirements in clause 10.6 of the Code. Also, the information on the energy label shall be based on the test results of the tested sample with a higher energy consumption index (I_e).

10.9 Energy Label

10.9.1. The specification of the energy label for washing machines shown in Appendix 4B. After a reference number has been assigned to a product model in the name of a specified person and included in the Director's record, the specified person shall produce the energy label for his/her products of the listed model showing the energy efficiency grade and associated information in accordance with the requirements in Appendix 4B.

10.9.2. (a) Subject to clause 10.9.2(c), the energy label is to be attached or affixed to a prominent position of the washing machine and is to be clearly visible.

(b) For the avoidance of doubt, if only part of the washing machine is being exhibited, the energy label is to be attached or affixed to a prominent position of that part and is to be clearly visible.

(c) The energy label may be attached to the washing machine or its packaging in a manner specified by the Director where the Director has approved its being so attached.

10.9.3. The energy label shall be of cardboard, if it is to be attached as a swing tag, or be self-adhesive and shall be cut to the outline shown in Appendix 4B. A trim or die cut margin of up to 2 mm around the energy label is acceptable.

10.9.4. The paper used for the energy label shall be durable with good wear and tear characteristics.

10.10 Compliance

10.10.1. During the compliance monitoring testing carried out by the Director, a listed model of washing machine will be accepted as conformance if the test results of a single sample of the listed model meet the following criteria:

(a) The tested energy consumption (kWh/cycle) shall not be greater than the rated energy consumption by more than 15%.

(b) The tested water consumption (litres/cycle) shall not be greater than the rated water consumption by more than 15%.

(c) The tested washing performance and tested spin extraction performance shall conform with the minimum requirements in accordance with the respective test standards as shown in Table 10.4 for Grade 1 to 4.

Appendix B.1 U.S. and Canada Test Procedure for Water Dispensers

ENERGY STAR® Program Requirements for Water Coolers

Eligibility Criteria Version 1.2

Below is the Version 1.2 product specification for ENERGY STAR qualified water coolers. A product must meet all of the identified criteria if it is to earn the ENERGY STAR.

1) Definitions: Below are the definitions of the relevant terms in this document.

   A. Water Cooler: A freestanding device that consumes energy to cool and/or heat water for human consumption. Both bottled and bottle-less water cooler types are covered under this category. Bottle-less water coolers include Point-of-Use (POU) and air-source water generating units. Units that provide pressurized water are included as long as they are free standing, i.e., not wall mounted, under sink, or otherwise building integrated.

   B. Compartment-Type Bottled Water Cooler: A bottled water cooler which, in addition to the primary function of cooling and dispensing potable water, includes a refrigerated compartment with or without provisions for making ice.

   C. Standby Energy Consumption: The required energy to maintain cold and/or hot water at appropriate dispensing temperatures with no water being withdrawn.

2) Qualifying Products: For the purposes of ENERGY STAR, water coolers include the following:

   A. Cold Only Units: These units dispense cold water only. These units have a refrigeration cycle.

   B. Hot and Cold Units: These units dispense both hot and cold water. Some units may have a third room-temperature tap. These units have both an electric resistance heater and a refrigeration cycle.

   C. Cook and Cold Units: These units dispense both cold and room-temperature water. These units have a refrigeration cycle

3) Energy-Efficiency Specifications for Qualifying Products: Only those products listed in Section 2 that meet the criteria outlined in Table 1 below may qualify as ENERGY STAR.

Table 1: Energy-Efficiency Criteria for ENERGY STAR Qualified Water Coolers

Water Cooler Category	Energy Use Under Test Conditions
cold only and cook and cold units	$\leq$ 0.16 kW-hours/day
hot and cold units	$\leq$ 1.20 kW-hours/day

4) Test Criteria: Test conditions are described below. Tests will focus on overall standby losses and water will not be withdrawn during the testing procedure.

   Standby conditions under manufacturer control during the test period must mimic conditions that the unit will experience during typical use. All temperature and other settings shall be the same as when

Source: U.S. Environmental Protection Agency. 2010. "Energy Star Program Requirement for Water Coolers, version 1.2." Available at: http://www.energystar.gov/index.cfm?c=product_specs.pt_product_specs the unit will be shipped.

A. Power Measurement: Energy use shall be measured as the total true power (kilowatt-hours) consumed in one 24-hour period. The Wattmeter used to measure the power consumption should have a minimum resolution of 1 Watt and precision +/- 2%.

B. Starting Conditions: Before the power measurements are recorded, the unit should be at operating conditions, with water temperatures as defined in item (F) below.

C. Water Withdrawal: No water may be withdrawn from the unit during the test.

D. Timer Usage: If the unit has an integral, automatic timer, occupancy sensor, or other feature designed to reduce the number of hours during the day the unit is running, the unit shall be tested with these features enabled only if the unit is shipped with these features enabled.

E. Ambient Temperature: Ambient air temperature must be 75° ± 2°F [23.8 ± 1.2°C].

F. Dispensed Water Temperatures: Cold water temperature shall not exceed 50°F [10.0°C] and hot water temperature shall be at least 165°F [73.9°C]. These temperatures shall be measured before conducting the standby energy use test described in this specification when the respective function, compressor, or heating element turns on. The unit shall not be turned off, or have any settings adjusted at any time during the test. The cold and hot water temperature settings used during the test must be the default settings at which the unit is shipped. Units designed to provide hot or cold water on demand, as opposed to maintaining a supply of hot or cold water, must provide water meeting these temperature requirements within three minutes of a user calling for hot or cold water.

G. Cooler Location: The unit must be no more than 6 inches (152 mm) from a wall at least 7 feet (2,134 mm) high and extending horizontally at least 2 feet (610 mm) from each side of the unit.

H. Airflow: Airflow around the unit must be natural; no artificial means of increasing the airflow are permitted. Airflow created by components integral to the unit itself, such as internal fans, are permitted.

I. Compartment Temperature: If the unit being tested is a compartment-type water cooler, during the test, there shall be no melting of ice, nor shall the average temperature exceed 46.0°F [7.8°C] in the refrigerated compartment[1].

J. Dual-configuration Units: Water coolers that can serve as both a bottled unit and a POU, depending on the configuration as shipped by the manufacturer, must be tested in each configuration. That is, the unit will need to be tested both in the bottled water configuration and the POU configuration and have the results from both tests meet ENERGY STAR criteria.

5) Effective Date: The date that products must meet the requirements specified under the Version 1.2 Water Cooler specification will be defined as the *effective date* of the agreement. Any previously executed agreement on the subject of ENERGY STAR qualified water coolers shall no longer be in effect.

A. Qualifying and Marking Products under the Version 1.2 Specification: The effective date for the Version 1.2 ENERGY STAR Program Requirements for Water Coolers is January 22, 2010. All products, including models originally qualified under the previous Version 1.1 specification, with a date of manufacture on or after the applicable Version 1.2 effective date must meet the Version 1.2 requirements in order to qualify for ENERGY STAR. The date of manufacture is specific to each unit and is the date (e.g., month and year) on which a unit is considered to be completely assembled.

[1] ARI 2002 Standard 1010 for Self-Contained Mechanically-Refrigerated Drinking-Water Coolers

Appendix B.2: Hong Kong Test Procedure for Water Dispensers

5 Technical Standards

Energy Efficiency Specifications for Qualifying Products

5.1 The technical requirement focuses on reducing standby energy consumption. Those products listed in section 3 that meet the criteria outlined in Table 1 below shall qualify for this scheme.

Table 1: Energy-Efficiency Criteria for Qualified Bottled Water Dispensers

Product Category	Energy Consumption Under Test Conditions
Cold bottled units	< 0.16 kW-hours/day
Hot bottled units	< 0.75 kW-hours/day
Hot and cold bottled units	< 1.20 kW-hours/day

5.2 The aforesaid energy consumptions refer to values measured in accordance with the test methods as specified in this document.

6 Test Methods

General

6.1 All test methods specified in this document are only related to checking compliance with the standby power rating. It is not the intention of this document to detail out the test standards and requirements for checking compliance with the Electrical Products (Safety) Regulation of the HKSAR. The participant should conduct appropriate tests, where necessary, in addition to those specified in this document in order to comply with the requirements stipulated in the aforesaid Electrical Products (Safety) Regulation.

Compliance with Safety Requirements

6.2 The testing standards for checking compliance with the safety requirements are based on the following international standards. For detailed requirements and procedural descriptions, one should refer to the respective standards.

(a) IEC 60335-1, Household and similar electrical appliances – Safety – Part 1: General requirements.

(b) IEC 60335-2-24, Particular requirements for refrigerating appliances, ice-cream appliances and ice-makers.

(c) IEC 60335-2-15, Particular requirements for appliances for heating liquids.

(d) IEC 60335-2-75, Particular requirements for commercial dispensing appliances and vending machines.

Source: Hong Kong Electrical and Mechanical Services Department. 2010. "The Hong Kong Voluntary Energy Efficiency Scheme for Hot/Cold Bottled Water Dispensers." Available at: www.emsd.gov.hk/emsd/e_download/pee/eels_water_dispensers.pdf

6.3 To the extent that definitions in the IEC standard do not conflict with the definitions of this document, the definitions in the aforesaid standard shall be included.

Test Conditions

6.4 For all hot/cold bottled water dispensers, the test conditions shall be as follows:

(a)	Electrical supply	220V ± 2%;
(b)	Frequency	50Hz ± 2%;
(c)	Line impedance	< 0.25 ohm;
(d)	Total harmonic distortion	< 5% (voltage);
(e)	Test room temperature	25 °C ± 1 °C;
(f)	Test room relative humidity	45% to 75%;
(g)	Distance from platform walls	300 mm; and
(h)	Platform distance from ground	300 mm

Test Criteria

6.5 Tests will focus on overall standby losses and water will not be withdrawn during the testing procedure.

(a) Power Measurement: Energy use shall be measured as the total true power (kilowatt-hours) consumed in one 24-hour period;

(b) Starting Conditions: Before starting the energy measurements, the unit should be at operating conditions, with water temperatures as defined in item (f) below.

(c) Water Withdrawal: No water may be withdrawn from the unit during the test.

(d) Timer Usage: If the unit has an integral, automatic timer, the timer can be set to turn off the unit for not more than 10 hours in the 24-hour test period. The unit must operate for the last 2 hours of the 24-hour test to ensure that it fully warms up or cools down after the shut-off period.

(e) Starting water temperature must be 25 °C ± 1 °C

(f) Dispensed Water Temperatures: Cold water temperature shall not exceed 10 °C for refrigeration type units, cold water temperature shall not exceed 15 °C for electronic type units, and hot water temperature shall be at least 85 °C. These temperatures shall be measured before conducting the standby energy use test described in this specification when the respective function, compressor, or heating element turns on.

(g) Measurement of Dispensed Water Temperatures: After the disposal of the initial 100 ml water, a 250 ml ± 5 ml container shall be used to collect water and average water temperatures shall be measured at 100ml, 150ml and 200 ml water levels.

(h) Dispenser Location: The tested unit must be placed on a platform, where the side walls and back wall shall be painted with black and extended to cover the tested dispenser over 300mm height.

(i) Airflow: Airflow around the unit must not be greater than 0.25 m/s; no artificial means of increasing the airflow is permitted. Airflow created by components integral to the unit itself, such as internal fan, is permitted.

(j) Compartment Temperature: If the unit being tested is a compartment-type bottled water cooler, during the test, there shall be no melting of ice, nor shall the average temperature exceed 7.8 °C in the refrigerated compartment.

6.6 A wattmeter shall be used to measure the power consumption of the hot/cold bottled water dispenser under test. The wattmeter shall be capable of reading the power drawn by the hot/cold bottled without disrupting the electrical power supply.

6.7 The wattmeter should have a frequency response of at least 3 kHz and should provide resolution of 0.1 W and accuracy of ± 1%. In addition, the meter should be capable of reading the current drawn by the hot/cold bottled water dispenser without causing internal peak distortion (i.e. clipping off the top of the current wave). The use of a wattmeter with higher crest factors and more current range choices should be preferred.

Appendix B.3 Taiwan Test Procedure for Warm-Hot Drinking Water Dispensers

Energy Conservation Labeling Program Requirements for Warm-Hot Drinking Water Dispensers

(Revision promulgated and in effect October 22, 2007)

I. The scope of application, energy consumption test method and energy consumption criteria for the warm-hot water dispensers ("products") applying for Energy Label certification shall meet the following requirements:

(I) Scope

The applicable products shall be warm-hot water dispensers which meet the requirements of CNS-13516-C4469.

(II) Energy consumption test conditions and method

1. Ambient conditions: The ambient temperature shall be maintained at 25±1ºC. The distance between the wall and the sides, front and top of the product shall be at least 300 mm (as shown in the Figure 1 below); and the distance between the wall and the back side shall be at least 65 mm. When the temperature difference between the ground temperature and the ambient temperature is greater than 2ºC, the product shall be placed on a platform with a height of at least 100 mm.

2. 24-hr energy consumption E_{24} (kWh/day): The power supply voltage fluctuations shall be within 110V±2% or 220V±1%. The test method shall be based on Section 10.3.1 of CNS-13516. After the hot water system has switched to the keep-warm mode, the continuous measurement of power consumption for a 24-hour period shall be conducted in accordance with Sections 4.10 and 8.4 of CNS-13516, under the ambient conditions as stated in this method.

3. Hot-water system's average temperature Tw (℃): In accordance with Section 10.3.1 of CNS-13516, after the hot water system has switched to the keep-warm mode, the water temperature of the hot water system during the aforementioned 24-hour period shall be measured based on Section 10.11 of CNS 13516. The average hot water system temperature Tw shall be determined as the average water temperature measured during the 24-hour continuous measurement period. (The measurement error for the average hot water system temperature in this test method shall be within ±0.5℃.)

4. The temperature correction coefficient K (dimensionless) is defined by the following equation:

$$K = (Tw - \text{ambient temperature}) / (100 - \text{ambient temperature})$$

5. The capacity for the water storage container shall be measured in accordance with Section 10.17 of CNS-13516. Also, based on Section 4.16 of CNS-13516, the hot water container's storage capacity V (in unit of L) shall be at least 95% of the rated volume.

Source: Taiwan Ministry of Economic Affairs Bureau of Energy. 2007. "Energy Conservation Labeling Program Requirements for Warm-Hot Drinking Water Dispensers." Available at: http://www.energylabel.org.tw/application_en/efficiency/upt.asp?cid=12#A70

6. Standardized 24-hour energy consumption $E_{st,24}$ (kWh/day):

$E_{st,24}$(kWh/day) = E_{24}/K

(E_{24}: measured energy consumption during the 24-hr period; K: temperature correction coefficient)

(III) Energy consumption criterion E (kWh/day) for warm-hot water dispensers:

$E = 0.154 \times V + 1.000$

(V: water storage capacity for hot-water system (L))

(IV) The standardized 24-hour energy consumption $E_{st,24}$shall be no higher than the energy consumption criterion E for warm-hot water dispensers.

Appendix B.4 Taiwan Test Procedure for Cold-Warm-Hot Drinking Water Dispensers

能技字第 09604025030 號

96 年 11 月 16 日起公告施行

冰溫熱型開飲機節能標章能源耗用基準及標示方法

一、冰溫 熱型開飲機申請節能標章認證，其適用範圍、能源耗用試驗條件與測試方法及能源耗用基準應符合下列規定：

(一)適用範圍

開飲機應符合中華民 國國家標準 CNS-13516-C4469 之產品。

(二)能源耗用測試條件、方法及程序

1.環境測試條件：本測試方法之條件，其周圍環境 溫度為 25±1℃，開飲機各側面、前面及上面與牆壁間，須如圖 1 所示相距 300 mm 以上，背面距離須超過 65 mm。地面溫度與周圍溫度差有 2°C以上時，開飲機須放置於高度 100 mm 以上之平木台上。

2.24 小時能源耗用值 E_{24}(度 /天)：在電壓變動值為 110V 在±2%以內、220V 在±1%以內之條件下，依 CNS-13516 第 10.3.1 節規定，熱水系統切換至保溫狀態，且冰 水系統運轉至致冷元件(壓縮機、致冷晶片)停止運轉後，測定 24 小時連續運轉中之保溫模式消耗電量，須符合 CNS-13516 第 4.10 節、第 8.4 節， 以及本測試方法關於周圍溫度試驗條件之規定。

3.熱水系統平均水溫 Th(°C)：依 CNS-13516 第 10.3.1 節規定，熱水系統切換至保溫 後，測定 24 小時連續運轉中之熱水系統水溫，並依 CNS-13516 第 10.11 節方法執行。熱水系統平均水溫係前述 24 小時連續運轉所量測熱水溫度之平 均值(Th)。(本測試方法熱水系統平均水溫之量測誤差須在±0.5°C以內。)

4.冰水系統平均水溫 Tc(°C)：依 CNS-13516 第 10.3.2 節規定，於測定 24 小時能源耗用值(E_{24})後，且致冷元件(壓縮機、致冷晶片)停止運轉後，以玻璃或隔熱效果良好之 量桶盛接冰水，依 CNS-13516 第 10.11 節方法量測冰水水溫。

Source: Taiwan Ministry of Economic Affairs Bureau of Energy. 2007. “Energy Conservation Labeling Program Requirements for Cold-Warm-Hot Drinking Water Dispensers (In Chinese).” Available at: http://www.energylabel.org.tw/applying/efficiency/upt.asp?cid=13

5.熱水膽溫度校正係數 K1 (無因次)，直接定義如下式：

$$K_1 = \frac{T_h - 周圍溫度}{100 - 周圍溫度} \qquad (1)$$

6. 冰水膽溫度校正係數 K2 (無因次)，直接定義如下式：

$$K_2 = \frac{周圍溫度 - T_c}{周圍溫度} \qquad (2)$$

依 CNS-13516 第 10.17 節量測儲水桶容量，並依第 4.16 節規定之熱水系統儲水桶容量，以符號 V_1(公升)表示；冰水系統 儲水桶容量，以符號 V_2(公升)表示，各儲水桶容量應在標示值的 95%以上。

(三)冰溫熱型開飲機能源耗用基準值 E(度/ 天)

$$\mathrm{E} = 0.146 \times (V_1 \times K_1 + \frac{1}{3} V_2 \times K_2) + 1.312$$

E： 冰溫熱型開飲機能源耗用基準值(度/天)

V_1：熱水系統儲水桶容量(公升)

V_2：冰水系統 儲水桶容量(公升)

(四)冰溫熱型開飲機 24 小時能源耗用值(E_{24})不得高於冰溫熱型開飲機能源耗用基準值(E)。

二、 前點節能標章能源耗用之標示，應注意下列事項：

(一)標章使用者之名稱及住址須清楚記載於產品或包裝上。

(二)標章使用者若為代理商，其 製造者之名稱及地址須一併記載於產品或包裝上。

(三)產品型錄上應標示產品 24 小時能源耗用值(E_{24})。

(四) 產品 24 小時能源耗用值(E_{24})及能源耗用基準值(E)，計算小數點後第三位，小數點後第四位四

捨五入。

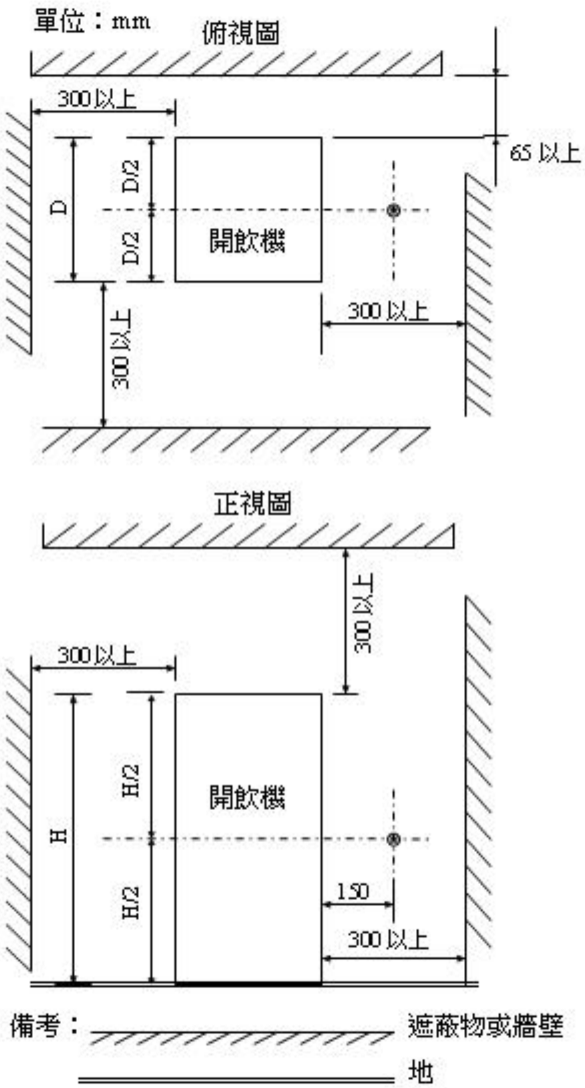

圖 1 開飲機性能試驗配置圖

1. 冰溫熱型開飲機產品依據公告之試驗方法，進行周圍溫度、熱水系統儲水桶容量 V_1、冰水系統儲水桶容量 V_2、二十四小時保溫消耗電量 Wd、熱水系統平均水溫 T_1 與冰水系統平均水溫 T_2 之檢測。檢測結果計算出熱水膽等效容積換算係數 K_1 (如公式(1))、冰水膽等效容積換算係數 K_2 (如公式(2))、冰溫熱開飲機等效內容積 $V_1 \cdot K_1 + \frac{1}{3}V_2 \cdot K_2$ 與能源因數值 EF_{test}(如公式(3))，再將冰溫熱開飲機等效內容積 $V_1 \cdot K_1 + \frac{1}{3}V_2 \cdot K_2$ 代入公式(4)，計算出能源因數基準值 EF_{base}，必須符合 $EF_{test} \geq EF_{base}$。

$$K_1 = \frac{\text{熱水系統平均水溫} - \text{周圍溫度}}{100 - \text{周圍溫度}} \quad (1)$$

$$K_2 = \frac{\text{周圍溫度} - \text{冰水系統平均水溫}}{\text{周圍溫度}} \quad (2)$$

$$EF_{test} = \frac{\text{冰溫熱開飲機等效內容積(公升)}}{\text{每日消耗電量(度/天)}} \quad (3)$$

$$EF_{base} = \left(V_1 \cdot K_1 + \frac{1}{3}V_2 \cdot K_2\right) \Big/ \left(0.146\left(V_1 \cdot K_1 + \frac{1}{3}V_2 \cdot K_2\right) + 1.312\right) \quad (4)$$

2. 產品標示之注意事項：

   a. 標章使用者之名稱及地址須清楚記載於產品或包裝上。標章使用者若爲代理商，其製造者之名稱及地址須一併記載於產品或包裝上。

   b. 產品型錄上應標示產品之能源因數值 EF_{test} 與二十四小時保溫消耗電量 Wd。

   c. 能源因數值 EF_{test} 之單位爲 公升/(度/天) 或 L/(kWh/day)，二十四小時保溫消耗電量 Wd 之單位爲 度/天 或 kWh/day，兩者數值標示至小數點第 2 位，第 3 位即四捨五入。

Appendix C.1 U.S. MEPS Test Procedure for Vending Machines

generally applicable regulations that apply to various types of products or equipment covered by standards, as well as a limited number of product-specific requirements. DOE has not adopted requirements that apply to beverage vending machines (an EPACT 2005 addition to the program). DOE is developing enforcement regulations for the EPACT 2005 equipment, which it expects will be based on the existing enforcement regulations that require manufacturers to certify compliance with the standards by filing two separate documents: (1) A compliance statement in which the manufacturer certifies its equipment meets the requirements; and (2) a certification report in which the manufacturer provides equipment-specific information, such as the model number, energy consumption and other model specific information that would enable DOE to determine which equipment class and standard the equipment is subject to and whether the equipment meets the standard.

In instances where there are questions whether equipment meets the standards, existing regulations require DOE to consult with the manufacturer. If DOE remains unsatisfied with the manufacturer's explanation for the alleged noncompliance, DOE may test units of the allegedly non-complying product or equipment, to determine whether it meets the applicable standard. After DOE has completed testing, the manufacturer has the option to conduct additional tests for DOE to consider. DOE has never had to conduct enforcement testing, as it has been able to resolve all issues with manufacturers prior to taking that step.

The beverage vending machine standards will go into effect 3 years after the publication of the final rule. DOE anticipates that it will have enforcement regulations in place, applicable to beverage vending machines, by that time. But if such regulations are not in place when the standards go into effect, manufacturers will not be required to report to DOE. Moreover, if there is a question regarding compliance with the standards, DOE will confer with the manufacturer before pursuing enforcement action. A violation of these standards could subject a manufacturer to injunctive action or other relief. *See* 42 U.S.C. 6302–6305.

III. General Discussion

A. Test Procedures

On December 8, 2006, DOE published a final rule (the December 2006 final rule) in the **Federal Register** that incorporated by reference ANSI/ASHRAE Standard 32.1–2004, with two modifications, as the DOE test procedure for this equipment. 71 FR 71340, 71375; 10 CFR 431.294. In section 6.2 of ANSI/ASHRAE Standard 32.1–2004, Voltage and Frequency, the first modification specifies that equipment with dual nameplate voltages must be tested at the lower of the two voltages only. 71 FR 71340, 71355 The second modification specifies that (1) any measurement of "vendible capacity" of refrigerated bottled or canned beverage vending machines must be in accordance with the second paragraph of section 5 of ANSI/ASHRAE Standard 32.1–2004, Vending Machine Capacity; and (2) any measurement of "refrigerated volume" of refrigerated bottled or canned beverage vending machines must be in accordance with the methodology specified in section 5.2, Total Refrigerated Volume (excluding subsections 5.2.2.2 through 5.2.2.4) of ANSI/AHAM HRF–1–2004, "Energy, Performance and Capacity of Household Refrigerators, Refrigerator-Freezers and Freezers."

The current version of ANSI/ASHRAE Standard 32.1–2004 defines standard bottled, canned, or other sealed beverage storage capacity; establishes uniform methods of testing for determining laboratory performance of vending machines for bottled, canned, or other sealed beverages; and defines three tests/test conditions, as seen in Table III.1.

TABLE III.1—ANSI/ASHRAE STANDARD 32.1–2004—STANDARD TEST CONDITIONS

Test and pretest conditions	Energy consumption tests	Vend test	Recovery test
Ambient Temperature	Perform twice: At 90 ± 2 °F (32.2 ± 1 °C) and at 75 °F ± 2 °F (23.9 ± 1 °C).	90 ± 2 °F (32.2 ± 1 °C)	90 ± 2 °F (32.2 ± 1 °C).
Relative Humidity	65 ± 5% for 90 ± 2 °F test and 45 ± 5% for 75 ± 2 °F test.	65 ± 5%	65 ± 5%.
Reloaded Product Temperature		90 ± 1 °F (32.2 ± 0.5 °C)	90 ± 1 °F (32.2 ± 0.5 °C).
Average Beverage Temperature (for test).	36 ± 1 °F (2.2 ± 0.5 °C) Throughout Test.	40 °F or less (4.4 °C or less) Final Temperature.	33–40 °F (0.6–4.4 °C) Final Temperature.
Average Beverage Temperature (for pretest conditions).	Not Applicable	36 ± 1 °F (2.2 ± 0.6 °C) Pretest Conditions.	36 ± 1 °F (2.2 ± 0.6 °C) Pretest Conditions.

During the NOPR public meeting, ASAP stated that DOE's test procedures for beverage vending machines should be revised to capture technologies such as variable speed technologies and advanced controls. ASAP stated that there are energy savings that are not being achieved because the test procedure does not account for these types of technologies. (ASAP, Public Meeting Transcript, No. 56 at p. 36) In addition, Coca-Cola stated that the DOE test procedure does not accurately reflect actual operating conditions, because it does not regulate or dictate the control of the operating methods for all the powered elements in the equipment. (Coca-Cola, Public Meeting Transcript, No. 56 at p. 147) Coca-Cola also stated that lighting controls would not save as much energy in real world applications as the test procedure indicates, resulting in "artificially low" test results. (Coca-Cola, No. 63 at p. 1) Coca-Cola commented that very few of its vending machines go into applications where they are inactive for long periods of time. (Coca-Cola, Public Meeting Transcript, No. 56 at p. 193) For these reasons, Coca-Cola and NAMA conclude that TSL 6 for Class A machines is not "practically feasible." (Coca-Cola, No. 63 at p. 1 and NAMA, No. 65 at p. 3) The Joint Comment recommends that the next revision to the current test procedure address; (1) the limitations of steady-state testing conditions, (2) the current test procedure's insufficient representation of real world conditions, and (3) the capture of increased energy use as a result of future, energy intensive beverage vending machine features, such as interactive displays. (Joint Comment, No. 67 at p. 4) Elstat stated that prohibiting the use of standby and off mode power does not support the goal of reduced energy consumption in

Source: U.S. Department of Energy. 2009. "Energy Conservation Standards for Refrigerated Bottled or Canned Beverage Vending Machines, Final Rule." *Federal Register* FR 74 44914. Available at: http://www1.eere.energy.gov/buildings/appliance_standards/commercial/beverage_machines.html beverage vending machines, and recommends that DOE revisit the use of energy management controls in 2010, or within one year of the rule statutory deadline (Elstat, No. 62 at p. 1) DOE notes, however, that it is not prohibiting the use of standby and off mode power consumption, but rather is not including standby mode and off mode power consumption in its calculation of energy use. As stated in the May 2009 NOPR, DOE has decided to address these additional requirements when the energy conservation standards for beverage vending machines are reviewed in August 2015 (*see* section II.B.1) and, as described below, must review the test procedures by 2013.

As stated above, DOE's test procedure for refrigerated beverage vending machines is based on ANSI/ASHRAE Standard 32.1–2004. Section 302(a) of EISA 2007 amended section 323 of EPCA, in part, by adding new subsection 323(b)(1). (42 U.S.C. 6293(b)(1)) This subsection provides that the Secretary shall review test procedures at least once every 7 years. Therefore, the test procedure for refrigerated beverage vending machines must be reviewed by December 8, 2013, to determine whether an amendment is necessary. In addition, DOE is aware that ASHRAE, via its Standards Project Committee 32.1, is working on an update to ANSI/ASHRAE Standard 32.1–2004. While specific changes to ASHRAE Standard 32.1–2004 are unknown at this time, DOE understands that the beverage vending machine industry is working closely with ASHRAE to develop an update to this test procedure. As part of the 7-year review of the test procedures for refrigerated beverage vending machines, DOE will consider any updates to ASHRAE Standard 32.1 standard, as well as any technologies to reduce energy consumption and/or increase energy efficiency and determine whether the test procedure and/or measure of energy efficiency warrant revisions.

B. Technological Feasibility

1. General

As stated above, any standards that DOE establishes for beverage vending machines must be technologically feasible. (42 U.S.C. 6295(o)(2)(A) and (o)(3)(B); 42 U.S.C. 6316(e)(1)) DOE considers a design option to be technologically feasible if it is in use by the respective industry or if research has progressed to the development of a working prototype. "Technologies incorporated in commercially available equipment or in working prototypes will be considered technologically feasible." 10 CFR part 430, subpart C, appendix A, section 4(a)(4)(i).

This final rule considers the same design options as those evaluated in the May 2009 NOPR. (*See* chapter 4 of the TSD.) All the evaluated technologies have been used (or are being used) in commercially available products or working prototypes. Therefore, DOE has determined that all of the efficiency levels evaluated in this notice are technologically feasible.

2. Maximum Technologically Feasible Levels

As required by EPCA, (42 U.S.C. 6295(p)(2) and 42 U.S.C. 6316(e)(1)) in developing the May 2009 NOPR, DOE identified the energy use levels that would achieve the maximum reductions in energy use that are technologically feasible ("max-tech" levels) for beverage vending machines. 74 FR 26025. For today's final rule, the max-tech levels for all classes are the levels provided in Table III.2. DOE identified these maximum technologically feasible levels for the equipment classes analyzed as part of the engineering analysis (chapter 5 of the TSD). For both equipment classes, DOE applied the most efficient design options available for energy-consuming components.

TABLE III.2—MAX-TECH ENERGY USE LEVELS

Equipment class	Max-tech level *kWh/day* *
A	MDEC = 0.045 × V + 2.42.
B	MDEC = 0.068 × V + 2.63.

"V" is the refrigerated volume of the refrigerated bottled or canned beverage vending machine, as measured by ANSI/AHAM HRF–1–2004.

* Kilowatt hours per day.

C. Energy Savings

DOE forecasted energy savings in its national energy savings (NES) analysis through the use of a spreadsheet tool discussed in the May 2009 NOPR. 74 FR 26020, 26039–43, 26057.

One criterion that governs DOE's adoption of standards for refrigerated beverage vending machines is the standard must result in "significant conservation of energy." (42 U.S.C. 6295(o)(3)(B) and 42 U.S.C. 6316(e)(1)) While EPCA does not define the term "significant," the U.S. Court of Appeals in *Natural Resources Defense Council* v. *Herrington* 768 F.2d 1355, 1373 (DC Cir. 1985) indicated that Congress intended "significant" energy savings in this context to be savings that were not "genuinely trivial." DOE's estimates of the energy savings for energy conservation standards at each of the TSLs in today's final rule indicate that the energy savings each would achieve are nontrivial. Therefore, DOE considers these savings "significant" within the meaning of section 325 of EPCA.

D. Economic Justification

1. Specific Criteria

As noted earlier, EPCA provides seven factors to evaluate in determining whether an energy conservation standard for refrigerated beverage vending machines is economically justified. (42 U.S.C. 6295(o)(2)(B)(i) and 42 U.S.C. 6316(e)(1)) The following sections discuss how DOE has addressed each of those seven factors in this rulemaking.

a. Economic Impact on Commercial Customers and Manufacturers

DOE considered the economic impact of the new refrigerated beverage vending machines standards on commercial customers and manufacturers. For customers, DOE measured the economic impact as the change in installed cost and life-cycle operating costs, *i.e.*, the LCC. (*See* sections IV.F and VI.C.1.a and chapter 8 of the TSD.) DOE investigated the impacts on manufacturers through the manufacturer impact analysis (MIA). (See sections IV.J and VI.C.2, and chapter 13 of the TSD.) The economic impact on commercial customers and manufacturers is discussed in detail in the May 2009 NOPR. 74 FR 26033–38, 26039–26044, 26044–47, 26050–53, 26053–56, 26063–67.

b. Life-Cycle Costs

DOE considered life-cycle costs of beverage vending machines, as discussed in the May 2009 NOPR. 74 FR at 26033–38, 26050–53

DOE calculated the sum of the purchase price and the operating expense (discounted over the lifetime of the equipment) to estimate the range in LCC benefits that commercial customers would expect to achieve due to the standards.

c. Energy Savings

Although significant conservation of energy is a separate statutory requirement for imposing an energy conservation standard, EPCA also requires DOE, in determining the economic justification of a standard, to consider the total projected energy savings that are expected to result directly from the standard. (42 U.S.C. 6295(o)(2)(B)(i)(III) and 42 U.S.C. 6316(e)(1)) As in the May 2009 NOPR (74 FR 26056–57), for today's final rule, DOE used the NES spreadsheet results in its consideration of total projected

Appendix C.2 U.S. Energy Star and Canadian MEPS Test Procedure for Vending Machines

Note: EPA's goal in including these low power mode requirements is to ensure that existing machine software capabilities are available and may be used to their fullest potential based on the individual requirements of the host site. However, machines that are vending temperature sensitive product, such as milk, must not have the refrigeration low power state enabled on site by the vending operator or machine owner due to the risk of product spoilage.

4) **Test Criteria:** ENERGY STAR Partners are required to perform tests, according to the requirements included in this Version 2.0 specification, and then submit qualifying model information to EPA for approval.

A. In performing these tests, Partner agrees to measure a model's daily energy consumption according to ASHRAE Standard 32.1-2004, *Methods of Testing for Rating Vending Machines for Bottled, Canned, and Other Sealed Beverages,* using the test conditions provided in Section 6 of the standard:

1. Machines marked "For Indoor Use Only" must be tested at 75±2 °F (23.9±1 °C); 45±5% relative humidity; and 36±1 °F (2.2±0.5 °C) average beverage temperature throughout the test.

2. Machines marked "Suitable for Outdoor Use" or "Suitable For Protected Locations" must be tested at 90±2 °F (32.2±1 °C); 65±5% relative humidity; and 36±1 °F (2.2±0.5 °C) average beverage temperature throughout the test.

B. Test results must be reported to EPA using the Refrigerated Beverage Vending Machine Qualifying Product Information (QPI) Version 2.0 form.

5) **Additional Qualification and Certification Procedures for Rebuilt Vending Machines:** Each rebuilt vending machine model number should be distinct and representative of a particular model and rebuilding kit combination that has been tested and qualified for ENERGY STAR. For example, the Partner may submit multiple component and/or rebuilding kit options for one vending machine model but each combination must be supported by individual test results and represented by separate model numbers. EPA reserves the right to request additional information on ENERGY STAR qualified rebuilt machines should an issue arise regarding their performance and qualification. When qualifying and reporting rebuilt machines:

- Partner will be responsible for identifying and testing each component and/or rebuilding kit within each machine model to determine which combination(s) will meet the ENERGY STAR energy-efficiency specifications. It is also the responsibility of the Partner to verify UL or equivalent safety requirements and that the components are Listed, Recognized, Classified, etc., as applicable for each component.

- Partner must test a representative machine for *each model and component combination* to ASHRAE Standard 32.1-2004 and report the results to EPA using the Refrigerated Beverage Vending Machines QPI Version 2.0 form for review. Once EPA has approved the rebuilt model, the Partner may begin remanufacturing machines with the energy-saving components and/or "kits" and labeling the resulting rebuilt models as ENERGY STAR.

- When rebuilding machines for ENERGY STAR qualification, the Partner must use only those components that have been tested and approved for use in specific ENERGY STAR configurations, as identified by the Partner; and meet the applicable UL or equivalent safety requirements, including Listed, Recognized, Classified, etc. as applicable. In addition, it is the responsibility of the Partner to ensure that installation is performed according to the appropriate machine guidelines.

ENERGY STAR Version 2.0 Program Requirements for Refrigerated Beverage Vending Machines 5

Source: U.S. Environmental Protection Agency. 2007. "Energy Star Program Requirement for Vending Machines, version 2.0." Available at: http://www.energystar.gov/index.cfm?c=product_specs.pt_product_specs

Appendix C.3: Japan Test Procedure for Vending Machines

Attachment 5

Energy Consumption Efficiency of Vending Machines and Measurement Method

1. Basic Concept

In Year 2002, when vending machines for canned/bottled beverages were designated as the designated machineries and products for Top Runner Standards, "annual energy consumption" was adopted as a realistic indicator of energy consumption efficiency. The annual energy consumption shall be the value measured by the method specified in JIS B8561: 2000 "Annex (Specifications): Energy Consumption Test" (hereinafter referred to as "JIS B8561").

However, the measurement method specified in JIS B8561: 2000 does not cover vending machines for beverage in paper containers and vending machines for beverage served in cups. In addition, the setting conditions, etc. have deviated from the reality, along with the changes in actual usage of vending machines and other factors. For these reasons, JIS B8561: 2000 was reviewed, and the new JIS B8561: 2007 was publicly notified on May 21, 2007.

2. Specific Definition of Energy Consumption Efficiency and the Measurement Method

Energy consumption efficiency of vending machines shall be annual energy consumption, which is measured as specified in JIS B8561: 2007.

28

Source: Japan ese Energy Conservation Center. 2007. "Final Report: Vending Machines Evaluation Standard Subcommittee, Energy Efficiency Standards Subcommittee of the Advisory Committee of Natural Resources and Energy." Available at: www.eccj.or.jp/top_runner/pdf/tr_vending_machines_may2007.pdf

(Reference 1)

Energy Consumption: List of Measurement and Calculation Conditions

<table>
<tr><th>Item</th><th>Vending Machine for Canned/Bottled Beverages</th><th>Vending Machine for Beverage in Paper Containers</th><th>Vending Machine for Beverage in Served in Cups</th></tr>
<tr><td>Control Procedure</td><td colspan="3">JIS B8561: 2007</td></tr>
<tr><td>Goods to be Sold</td><td>Canned, bottled, and/or PET bottled beverages</td><td>Beverages in paper containers and/or canned beverages</td><td>Beverages served in cups</td></tr>
<tr><td>Subject Products</td><td>(a) Machines serving cold only
(b) Machines serving hot or cold
(c) Machines serving hot & cold</td><td>(a) Type A, machines serving cold only (goods selection by dummy)
(b) Type A, machines serving hot & cold (goods selection by dummy)
(c) Type B, machines serving cold only (selection by actual goods)
(d) Type B, machines serving hot & cold (selection by actual goods)</td><td>(a) Machines serving cold only
(b) Machines serving hot only
(c) Machines serving hot & cold</td></tr>
<tr><td>Setting Conditions</td><td colspan="2">Clearance from the wall shall be at least 30 cm on the left, right, front and top of vending machine, and at least 5 cm on the rear.</td><td>Clearance from the wall shall be at least 30 cm on the left, right, front and top of vending machine, and at least 10 cm on the rear.</td></tr>
<tr><td>Ambient Temperature</td><td colspan="3">15°C ± 1°C</td></tr>
<tr><td>Temperature of Supply Water</td><td colspan="2">Since beverages are in containers, there is no water supply.</td><td>15°C ± 1°C</td></tr>
<tr><td>Setting of Internal Storage Compartments</td><td>(a) Machines serving cold only: all compartments for cold storage
(b) Machines serving hot or cold: all compartments for cold storage
(c) Machines serving hot & cold: half of the compartments for cold storage and the rest for hot storage (*1)</td><td>(a) Machines serving cold only: all compartments for cold storage
(b) Machines serving hot & cold with 2 compartments: all compartments for cold storage, or one compartment for cold storage & the other for hot storage
(c) Machines serving hot & cold with 3 compartments: 2 compartments for cold storage and the other for hot storage (*2)</td><td>There is no internal storage compartment setting, because beverages are prepared for each sale.</td></tr>
<tr><td>Loaded Goods</td><td>Goods having the greatest load</td><td>Cold storage: 250 ml paper container, Hot storage: 350 ml can</td><td>Raw materials of the goods that result in the largest energy consumption</td></tr>
<tr><td>Temperature of Goods Sold</td><td>Cold storage: 4°C ± 2°C
Hot storage: 55°C ± 2°C</td><td>Cold storage: 5°C ± 4°C (*3)
Hot storage: 55°C ± 4°C</td><td>Cold beverages: 5°C or lower (with ice)
10°C or lower (without ice)
Hot beverages: First cup is 65°C or higher, second and following cups are 70°C or higher.</td></tr>
<tr><td>Operating Conditions</td><td colspan="3">Normal operation mode including power-saving functions (*4)</td></tr>
<tr><td>Goods Selling Test</td><td>2 cans/bottles from each column</td><td>Type A: 2 packs/cans from each column
Type B: 1 pack/can from each column</td><td>Continuous sales of 30 minutes for both cold and hot beverages</td></tr>
<tr><td>Lighting Time</td><td colspan="3">12 hours</td></tr>
<tr><td>Dimming Control</td><td colspan="3">Dimming level at the default setting</td></tr>
<tr><td>Power Supply Frequency</td><td colspan="3">Either 50 Hz or 60 Hz which results in larger energy consumption</td></tr>
<tr><td>Measurement Conditions and Calculation Formula</td><td>WA: energy consumption in 24 hours after startup
WB: energy consumption in 24 hours following WA
WF: energy consumption of lighting per day

Energy consumption per day: Wd
Wd = (WA + WB × 13)/14 + WF
Annual energy consumption = Wd × 365</td><td>[Machines serving cold only, Machines serving hot & cold with 3 compartments]
Same as those for vending machines for canned/bottled beverages
[Machines serving hot & cold machine with 2 compartments]
WA1: energy consumption in 24 hours after startup with all compartments set for cold storage
WB1: energy consumption in 24 hours following WA with all compartments set for cold storage
WA2: energy consumption in 24 hours after startup with one compartment set for cold storage and the other set for hot storage
WB2: energy consumption in 24 hours following WA with one compartment set for cold storage and the other set for hot storage
WF: energy consumption of lighting per day

Energy consumption per day with cold/cold setting: Wd1
Wd1 = (WA1 + WB1 × 13)/14 + WF
Energy consumption per day with hot/cold setting: Wd2
Wd2 = (WA2 + WB2 × 13)/14 + WF
Annual energy consumption = Wd1 × 275 + Wd2 × 90</td><td>WA: energy consumption in standby per day
WBH: energy consumption per selling a cup of hot beverage
WBC: energy consumption per selling a cup of cold beverage
WF: energy consumption of lighting per day
H: Average sales quantity of hot beverages per day
C: Average sales quantity of cold beverages per day
<table><tr><th></th><th>H</th><th>C</th></tr><tr><td>Cold only</td><td>0</td><td>50</td></tr><tr><td>Hot only</td><td>50</td><td>0</td></tr><tr><td>Hot & Cold</td><td>25</td><td>25</td></tr></table>
Energy consumption per day: Wd
Wd = WA + WBH × H + WBC × C + WF
Annual energy consumption = Wd × 365</td></tr>
<tr><td>Note</td><td>(*1) If compartments cannot be divided into two groups, an excess compartment shall be set for cold storage. In the case of 3 compartments, the middle compartment is set for cold storage.</td><td>(*2) Middle compartment is set for cold storage. If both of the others are capable of hot setting, the compartment having a greater net internal volume shall be set for cold storage.
(*3) Compartments for cold goods shall be set so as to keep all of the goods in the specified temperature.</td><td>(*4) Concerning power-saving functions such as a "human sensor" and "weekly timer," if they are the default as shipped, the vending machines shall be measured with the default settings.</td></tr>
</table>

<table>
<tr><td rowspan="2">Temperature of Goods Sold</td><td>Can, Bottle</td><td>Cold storage: 4°C ± 3°C
Hot storage: 55°C ± 3°C</td><td>Cold storage: 4°C ± 2°C
Hot storage: 55°C ± 2°C</td><td>Considering a survey result on the temperature of goods sold in each column of vending machines for canned/bottled beverages, it was decided to narrow the tolerance from 3°C to 2°C.
<table>
<tr><td></td><td>Current tolerance</td><td>Vender A
30 selections</td><td>Vender B
25 selections</td><td>Vender C
20 selections</td></tr>
<tr><td>Can, Cold</td><td>4 ± 3</td><td>4.1 ± 0.8</td><td>3.9 ± 0.8</td><td>4.5 ± <u>1.4</u></td></tr>
<tr><td>Can, Hot</td><td>55 ± 3</td><td>55.1 ± <u>1.3</u></td><td>54.9 ± 1.1</td><td>55.3 ± 1.2</td></tr>
</table>
As for vending machines for beverage in paper containers, the survey result on the temperature of goods sold in each column indicated that it is difficult to narrow the tolerance, and thus it remains the same as at present.
<table>
<tr><td></td><td>Current tolerance</td><td>Vender A
24 selections</td><td>Vender B
25 selections</td><td>Vender C
20 selections</td></tr>
<tr><td>Paper container, Type A , Cold</td><td>5 ± 4</td><td>5.1 ± 0.8</td><td>5.6 ± <u>2.0</u></td><td>5.3 ± 1.6</td></tr>
<tr><td>Paper container, Type A , Hot</td><td>55 ± 4</td><td>53.6 ± 3</td><td>56.8 ± 3.4</td><td>53.3 ± <u>3.4</u></td></tr>
</table>
<table>
<tr><td></td><td>Current tolerance</td><td>Vender A</td><td>Vender B</td><td>Vender C</td></tr>
<tr><td>Paper container, Type B , Cold</td><td>5 ± 4</td><td>5.7 ± <u>3.1</u></td><td>5.3 ± 2.7</td><td>4.7 ± 2.3</td></tr>
<tr><td>Paper container, Type B , Hot</td><td>55 ± 4</td><td></td><td>56.2 ± 1.6</td><td>54.3 ± <u>3.1</u></td></tr>
</table>
(Note)
Paper container, Type A: vending machines with goods selection by using dummies
Paper container, Type B: vending machines with goods selection by using actual goods</td></tr>
<tr><td>Cup</td><td>Cold beverages: 5°C or lower (with ice)
10°C or lower (without ice)
Hot beverages: 65°C or higher.</td><td>Cold beverages:
5°C or lower (with ice)
10°C or lower (without ice)
Hot beverages:
First cup is 65°C or higher, second and following cups are 70°C or higher.</td><td>As for the first cup, the beverage runs through cold pipes experiencing a big temperature drop. For this reason, the specification remains the same as at present. For the second and following cups, the pipes being already warmed, high temperature of beverage can be maintained. Therefore, the specification is revised to 70°C or higher.</td></tr>
<tr><td rowspan="2">Goods Selling Test</td><td>Can, Bottle</td><td>2 cans/bottles from each column</td><td>Same as at present</td><td>Statistics of vending machines for canned/bottled beverages in FY 2005:
Sales values : 2,349,062,100,000 yen … (a)
Installed machines : 2,280,000 units … (b)
Unit price of goods : 130 yen … (c)
((a) / (b))/ 365 days / (c) ≈ 22 bottles (daily sales quantity per machine)
Sales quantity per column, assuming an average number of columns to be 27:
22 bottles / 27 columns ≈ <u>0.8 bottles</u> (sales quantity per column)
From the above, the slightly higher estimation of 2 bottles is thought to be appropriate for the sales quantity per column.</td></tr>
<tr><td>Paper Container</td><td>Type A: 2 packs from each column
Type B: 1 pack from each column</td><td>Same as at present</td><td>Statistics of vending machines for beverage in paper containers in FY 2005:
Sales values : 172,380,780,000 yen … (a)
Installed machines : 181,000 units … (b)
Unit price of goods : 100 yen … (c)
((a) / (b)) / 365 days / (c) ≈ 26 packs (daily sales quantity per machine)
Average number of columns on Type A machines: 21 columns
26 packs / 21 columns ≈ <u>1.2 packs</u> (sales quantity per column)
Average number of columns on Type B machines: 42 columns
26 packs / 42 columns ≈ <u>0.6 packs</u> (sales quantity per column)
From the above, the current sales quantity is thought to be appropriate.</td></tr>
<tr><td>Lighting Time</td><td>Can, Bottle
Paper Container
Cup</td><td>12 hours (per day)</td><td>Same as at present</td><td>As a hearing conducted to vending machine service companies on the reality of operations, the response was obtained that the average lighting time is shorter than 12 hours, because the increasing number of vending machines always turn off the lighting in indoor locations and because vending machines installed in outdoor locations control the lighting by using timer settings. Thus, the slightly higher estimation of 12 hours (per day) is thought to be appropriate.</td></tr>
</table>

Appendix D.1: U.S. Test Procedure for CFLs

4A) <u>BARE, COVERED, GLOBE, AND OUTDOOR REFLECTOR CFLS: PHOTOMETRIC TESTING REQUIREMENTS:</u>

Criteria Item	ENERGY STAR Requirements		Sample Size /Specific Requirements	Laboratory Requirement
Lamp Power (Watts) & Configuration[1]	**Minimum Efficacy:** Lumens/watt (Based on initial lumen data[2])		10 units per model – 5 base-up/5 base-down unless the manufacturer restricts specific use or position. If position restricted, manufacturer must test all 10 samples in restricted position. For dimmable/2-way/3-way products, measurements must be made at the highest wattage setting listed for the model.	Must use a laboratory accredited by the National Voluntary Laboratory Accreditation Program (NVLAP)[3]
	Efficacy requirements Medium screw-base	**Efficacy requirements Candelabra screw-base**		
<u>Bare lamp (fixed light output):</u> Lamp power < 10 10 ≤ Lamp power < 15 Lamp power ≥ 15	**50** **55** **65**	**50** **55** **NA**		
<u>Bare lamp (Dimmable/2-way/3-way):</u> Lamp power < 15 Lamp power ≥ 15	**50** **60**	**50** **NA**		
<u>Covered lamp (no reflector):</u> Lamp power ≤ 7 7 < Lamp power < 15 15 ≤ lamp power < 25 Lamp power ≥ 25	**40** **45** **50** **60**	**35** **45** **NA** **NA**		
<u>Outdoor Reflectors</u>: Lamp power < 20 Lamp power ≥ 20	**33** **40**	**N/A**		
Color Rendering Index (CRI)	Average of the 10 samples tested must be greater than **80**, and no more than 3 individual samples can have a CRI less than 77.	Average of the 10 samples tested must be greater than **80**, and no more than 3 individual samples can have a CRI less than 77.		
Correlated Color Temperature (CCT)	PARTNER must identify one of the following designated correlated color temperatures to market their product as: 2700K, 3000K, 3500K, 4100K, 5000K, or 6500K, and at least 9 out of the 10 samples tested must fall within a 7-step ANSI MacAdam ellipse for that color temperature at the 100-hour lumen measurement. Please refer to Section 11 for CCT quality assurance requirements and Appendix C/ANSI Color Ellipses.			
1,000-hour Lumen Maintenance	Average lumen output measurement of the 10 lamps tested must be greater than 90% of initial (100-hour) average lumen output measurement @ 1,000 hours of rated life, and no more than 3 individual samples can have a lumen output measurement less than 85%.			
Lumen Maintenance at 40% of Rated Life	Average lumen output measurement of the 10 samples tested must be greater than 80% of initial (100-hour) average lumen output measurement at 40% of the model's rated life (Per ANSI C78.5, Clause 4.10), and no more than 3 individual samples can have a lumen output less than 75%.			

[1] Take performance and electrical requirements at the end of the 100-hour aging period according to ANSI C78.5. The lamp efficacy shall be the average of the lesser of the lumens per watt measured in the base-up and base-down positions or other specified/restricted position. Use wattages placed on packaging to select proper criteria efficacy in this table, not measured wattage.
[2] Efficacies are based on measured values for lumens and wattages from pertinent test data. Wattages and lumens placed on packages may not be used in calculation and are not governed by this criterion. For multi-level, such as 3-way, or dimmable systems, measurement must be at the <u>highest wattage setting listed for model</u>. Acceptable efficacy, 1,000-hour and lumen maintenance at 40% of rated life average lumen output measurement error is – 3.0%.
[3] For a list of NVLAP accredited labs, visit http://ts.nist.gov/Standards/scopes/eellt.htm.

ENERGY STAR Program Requirements and Criteria for CFLs – Version 4.0 *Page 6*
Final Version – March 7, 2008

Source: U.S. Environmental Protection Agency. 2008. "Energy Star Program Requirement for CFLs, version 4.0." Available at: http://www.energystar.gov/index.cfm?c=product_specs.pt_product_specs

4B) BARE, COVERED, GLOBE, AND OUTDOOR REFLECTOR CFLS: ELECTRONIC TESTING REQUIREMENTS[4]:

Criteria Item	ENERGY STAR Requirements	Sample Size/Specific Requirements	Laboratory Requirement
Power Factor	Average of 10 samples tested must be greater than 0.5.	10 units per model – 5 base-up/5 base-down unless the manufacturer restricts specific use or position. If position restricted, manufacturer must test all 10 samples in restricted position.	Use NVLAP or A2LA[5] accredited labs
Run-up Time: **Bare (Non-amalgam)**	Average of 10 samples tested must be less than 1.0 minute per ANSI C78.5, clause 3.11 and 4.8.		
Run-up Time: **Bare (amalgam), Covered, and Outdoor Reflectors**	Average of 10 samples tested must be less than 3.0 minutes per ANSI C78.5, clause 3.11 and 4.8. Partners qualifying bare products must specify if their product contains amalgam during the qualification submission process to be eligible for this requirement.		
Starting Time	Time after switching on until full start (and remain lighted), average of 10 samples shall be less than 1.00 second.		
Transient Protection	Per ANSI/IEEE C62.41 (01-May-1991), Category A, 7 strikes <u>Note:</u> One failure to meet 7 strikes will result in test failure and therefore, failure to meet the criteria.	A minimum of five (5) lamps tested in the <u>base up</u> position unless the product is labeled as a position-restricted by the manufacturer. If position restricted, test lamps in specified position (*Must be unique sample for this test only).*	Self-certification[6]
Operating Frequency	≥ 40.0 kHz	1 unit per model	Self-certification
Electromagnetic Interference	Compliance with FCC 47 CFR including Part 2 *(Equipment Authorization)* and Part 18 *(Technical Standards and Emission Limits)* for consumer RF Lighting Equipment requirements for consumer limits	1 unit per model	FCC laboratory or manufacturer's laboratory[7]
Base	Candelabra base – E12 Medium (Edison) screw base - E26	Self-certification[6]	
Maximum Mercury Content	Lamps less than 25 watts: ≤ 5 milligrams (mg) per lamp Lamps 25 to 40 watts: ≤ 6 milligrams (mg) per lamp *Note: Mercury labeling requirements can be found in Part 4C.*	Commitment form must be on file with NEMA Voluntary Commitment to Limit Mercury Content in Compact Fluorescent Lights at <u>www.cfl-mercury.org.</u> In addition, the product may not be present on the manufacturer's list of non-conforming products.	

[4] Input voltage must be 120 V and frequency must be 60 Hz.
[5] For a list of American Association for Laboratory Accreditation (A2LA), visit http://www.a2la.org/.
[6] Self-certification is a declaration of conformance by the manufacturer to the requirement. For self-certification where data are required (sample size is specified in the requirement), the manufacturer may use data obtained directly from the manufacturer's own facilities that are neither NVLAP nor A2LA accredited.
[7] Laboratory must be listed on FCC Office of Engineering & Technology web site, and with either NVLAP or A2LA accreditation.

4C) <u>BARE, COVERED, GLOBE, AND OUTDOOR REFLECTOR CFLS: LIFETIME PERFORMANCE TESTING AND PACKAGING REQUIREMENTS:</u>

Criteria Item and Submission	ENERGY STAR Requirements	Sample Size/Specific Requirements	Laboratory Requirement
Interim Life Test	@ 40% of rated life report on lamp life: o **One sample failure**, acceptable; o **Two sample failures,** requires submission of a product failure report from the manufacturer that describes in detail the specific reasons for the sample product failures. o **Three sample failures**, does not qualify	10 units per model, 5 base-up/ 5 base-down, unless specific use or position appears on packaging. *Interim and final average rated lifetime tests must use the same samples.*	NVLAP, A2LA, or ISO9000 certified laboratories or facilities
Average Rated Lamp Life *(Final qualification)* *PARTNER must complete lifetime test to stated rated lamp life on packaging*	≥ 6,000 hours as declared by the manufacturer on submitted packaging and qualification form *≥ 8,000 hours as declared by the manufacturer on submitted packaging and qualification form for all bare medium screw base compact fluorescent lamps (will go into effect 365 days after the effective date of these criteria).*		
Rapid Cycle Stress Test	Per ANSI C78.5 and IESNA LM-65 (clauses 2,3,5, and 6) <u>Exception:</u> Cycle times must be 5 minutes on, 5 minutes off. Lamp will be cycled once for every two hours of rated lamp life. At least 5 out of the 6 sample lamps <u>must meet or exceed</u> the minimum number of cycles.	6 units, base up or down as stated by manufacturer. *Must be unique sample for this test.*	NVLAP, A2LA, or ISO9000 certified laboratories or facilities
End of Life Protection	*Specific new EOLL testing requirements are currently under consideration for inclusion in the UL safety standard for SB CFLs (UL1993). DOE will require all Energy Star CFLs to meet these EOLL requirements under the time frame specified by UL as this standard is amended by UL.*	*To be determined*	*To be determined*
Warranty	Product packaging must state "Warranty" or "Limited Warranty" and have an "800" number, or mailing address, or web site address *(if applicable)* for consumer complaint resolution. <u>**For Residential Applications:**</u> Warranty or limited warranty statement must cover at least a minimum of **24 months, or 2 years,** from date of purchase based on **no less than 3 hour per day of use** (follow the chart below). <u>**For Commercial Applications:**</u> Warranty or limited warranty statement must cover at least a minimum of **12 months, or 1 year,** from date of purchase.	**Product Packaging**: Must submit electronic draft or hard-copy draft of specific CFL model. Packaging must include the following information: *- Model number* *- Wattage* *- Lumen output (must be 100 hour average)* *- Average rated lifetime* *- Correlated color temperature* *- Warranty (based on application type and standard average hours/day)* *- 800 number, or address, or web address* *- Equivalency to incandescent (if required)* *- Starting temperature* *- Electromagnetic interference* *- Known incompatibility with controls and application exceptions* *- Mercury Labeling*	Self-certification
Product Packaging Language	In English, or English with additional languages. For products that will be sold in Canada, packaging must include both English & French.		
FTC Labeling Requirements	ENERGY STAR qualified compact fluorescent lamps and lamp systems must comply with the labeling requirements of the U.S. Federal Trade Commission Packaging Laws - FTC 16CFR Part 305.1-.19[8].		
Starting Temperature	Package <u>must</u> state the minimum starting temperatures or geographical zone of use and any other conditions for reliable starting to meet the starting time requirements of ANSI C78.5, Clause 4.7.		
Incompatibility with Controls and Application Exceptions	Lamp package <u>must clearly state</u> any known incompatibility with photo controls, dimmers or timing devices. In addition, packaging should state specific applications exceptions. (e.g., applications that the CFL should not be used in).		

[8] For information on how CFLs must comply with the FTC's Appliance labeling act, visit http://www.ftc.gov/bcp/edu/pubs/business/energy/bus26.shtm

Criteria Item and Submission	ENERGY STAR Requirements	Sample Size/Specific Requirements	Laboratory Requirement
Mercury Labeling	Required product packaging language for mercury content must include the following: • the symbol "Hg" within a circle • "Lamp Contains Mercury" • www.epa.gov/bulbrecycling Alternatively, www.lamprecycle.org may be printed in place of www.epa.gov/bulbrecycling, so long as a prominent hyperlink to the EPA's web site is maintained on the alternate's home page.		
CFL/Incandescent Equivalency[9]	PARTNER must use the chart below to declare an incandescent equivalency based on the initial average 100-hour lumen output measurement. If the luminous flux falls outside of the specified range, either do not display an incandescent equivalent or display the lower incandescent wattage equivalence. *If displaying an incandescent equivalent for **Globe, Decorative, or reflector CFL product**, the initial luminous flux for both the CFL and the appropriate incandescent bulb must be displayed side by side in a comparison panel, along with the wattage ratings for both CFL incandescent.*	Average of data used from 100-hour lumen output measurement	NVLAP only

ENERGY STAR Qualified CFL Warranty and Lifetime Statements Chart
Residential Use Only

ENERGY STAR Qualified CFL Rated Lifetime	Number of Years Claim *(Based on minimum use of 3 hours/day)*
6,000 hours	5 years
8,000 hours	7 years
10,000 hours	9 years
12,000 hours	11 years
15,000 hours	13 years

ENERGY STAR QUALIFIED CFL/INCANDESCENT EQUIVALENCY CHART

A-Shaped Incandescent bulb (Watts)	Typical Luminous Flux (Lumens)† *† Lumens must be 100 hr, initial values for CFLs* *Note: excludes globes, reflectors, or decorative CFLs. Lumens for 3-way lamps correspond to maximum equivalency shown.*
25	Minimum of 250
40	Minimum of 450
60	Minimum of 800
75	Minimum of 1,100
100	Minimum of 1,600
125	Minimum of 2,000
150	Minimum of 2,600
30-70-100	Minimum of 1,200
50-100-150	Minimum of 2,150

[9] If displaying an incandescent equivalence for commonly used A-shaped bulbs (for all bare type models and covered type models that replace an A-shaped incandescent bulb), the CFL initial 100-hour average luminous flux or lumen output must meet or exceed the levels in the table. The table shows typical luminous flux for A-shaped, soft white, incandescent bulbs. Based on research conducted by NLPIP (http://www.lrc.rpi.edu/programs/NLPIP/index.asp) luminous flux varies considerably among bulbs. The table is intended to aid in consumer choice and in no way supercedes or replaces any requirement for product performance contained in this specification.

Appendix D.2 Australia Test Procedure for CFLs

Summary of recommended specifications for self-ballasted CFLs

	MEPS Self-ballast		High Efficiency Self-ballast	
Efficiency level	L/w		L/w	
Rating (W)	Colour temperature: > 4400		Colour temperature: > 4400	
5 - 8	36		46	
9 - 14	44		54	
15 - 24	51		61	
25 - 60	57		67	
Rating (W)	Colour temperature: < 4400		Colour temperature: < 4400	
5 - 8	40		50	
9 - 14	48		58	
15 - 24	55		65	
25 - 60	60		70	
Sample:	*10: at least 8 must comply*		*10: at least 8 must comply*	
Test Methods	AS/NZS 60969 (2001)		AS/NZS 60969 (2001)	
Lumen Maintenance	After 2000h testing lumen maintenance (l_m) must be ≥ 80% $l_{(100)}$.		After 2000h testing lumen maintenance (l_m) must be ≥ 80% $l_{(100)}$.	
	Note: the test is conducted with lamps switched off for 15 minutes after every 2 hours 45 minutes on.		Note: the test is conducted with lamps switched off for 15 minutes after every 2 hours 45 minutes on.	
Sample:	*10: at least 8 must comply*		*10: at least 7 must comply*	
Rated Average Lifetime	> 6000 hours		≥ 10,000 hours	
CFL Lifetime Claims	CFL Rated Lifetime		Lifetime Claim	
	6,000 hours		4 years	
	8,000 hours		5 years	
	10,000 hours		7 years	
	12,000 hours		8 years	
	15,000 hours		10 years	
Lamp Position	No specific requirement		Declaration of orientation(s) which cause > 5% luminous flux output is required	
Power Factor	0.5		0.9	
Colour rendering	No specific requirement		> 4400: CRI ≥ 80 2700-4400: CRI ≥ 82 < 2700: CRI ≥ 84	
Mercury level	5mg per lamp	5mg per lamp	5mg per lamp	5mg per lamp
GLS Equivalence	CFL Luminous Flux Claim (lm)		Rated Wattage of Equivalent GLS Filament Lamp	
Where a claim is made that the rated luminous flux of the CFL is equivalent to, or exceeds that, of an equivalent GLS filament lamp, the lamp rating must comply with the following requirements	≥ 214		≤ 25 W	
	≥ 386		≤ 40 W	
	≥ 530		≤ 50 W	
	≥ 660		≤ 60 W	
	≥ 874		≤ 75 W	
	≥ 1100		≤ 90 W	
	≥ 1246		≤ 100 W	
	≥ 2009		≤ 150 W	

Source: Ellis, Mark. 2005. "Compact Fluorescent Lamps: Assessment of Minimum Energy Performance and Labeling Options." Available at: www.energyrating.gov.au/library/pubs/200512-mepscfls.pdf

Appendix D.3 Brazil Procel Test Procedure for CFLs

Item	Requirements				Measurement Method
Operating voltage	127 or 220 V				
Test data source	• Testing undertaken by authorised testing laboratories. • Sample size of 10 for testing, plus 1 control selected by manufacturers.				
Energy efficiency (Initial efficacy)	**Lamp type**	**Rated Input Power**	**ECL**	**SEAL**	IEC 60901-1/97, NBR 14539-6/00
	Bare-tube	< 15 W ≥ 15 W	≥ 40 lm/W ≥ 40 lm/W	≥ 45 lm/W ≥ 60 lm/W	
	With translucent cover	< 15 W 15 -18 W 19 - 24 W ≥ 25 W	≥ 40 lm/W ≥ 40 lm/W ≥ 40 lm/W ≥ 40 lm/W	≥ 40 lm/W ≥ 48 lm/W ≥ 50 lm/W ≥ 55 lm/W	
	With reflector	"Lamps with reflectors should be tested without the same for the purposes of this table"			
Lumen maintenance	ECL: 2000-hour rating ≥ 80% of initial output (100 hrs) SEAL: 2000-hour rating ≥ 85% of initial output (100 hrs				IEC 60901-1/97, NBR 14539-6/00
Rated life	maximum 1 failure in 10 bulbs in 2000 hours				NBR IEC 60901-1/97, NBR 14539-6/00
Power factor	PF ≥ 0.5 CFL < 30 W (voluntary): High power factor ≥ 0.92 CFL ≥ 30 W (mandatory): High power factor ≥ 0.92				
Harmonic distortion	CFL < 30 W (voluntary): Total harmonic dist. ≤ 33% CFL ≥ 30 W (mandatory): Total harmonic dist. ≤ 33%				NBR 14539-2000; CISPR 15/96
CFL vs. GSL Illuminance Equivalency	**Rated wattage of filament lamp equivalent (W)**	**Luminous flow for 127 V (lm)**	**Luminous flow for 220 V (lm)**		
	15 25 40 60 75 100 150 200	104 214 480 804 1018 1507 2330 3274	110 220 415 715 890 1350 2180 3090		
Cold temperature reporting and labelling	< 3300K : Warm 3300 to 5000K : Neutral >5000K: Cold				

Source: Ellis, Mark. 2005. "Compact Fluorescent Lamps: Assessment of Minimum Energy Performance and Labeling Options." Available at: www.energyrating.gov.au/library/pubs/200512-mepscfls.pdf

Appendix D.4 European Union Technical Specifications for CFLs

Where the rated lamp lifetime is higher than 2000h, the Stage 1 requirements for the parameters "Rated lamp lifetime", "Lamp Survival Factor" and "Lumen maintenance" in Tables 4 and 5 are only applicable as from Stage 2.

For the purposes of testing the number of times the lamp can be switched on and off before failure, the switching cycle shall consist of periods comprising 1 minute on and 3 minutes off, while the other test conditions are defined according to Annex III. For the purposes of testing lamp lifetime, lamp survival factor, lumen maintenance and premature failure, the standard switching cycle according to Annex III shall be used.

Table 4 – Functionality requirements for compact fluorescent lamps

Functionality parameter	Stage 1	Stage 5
Lamp Survival Factor at 6000h	≥ 0.50	≥ 0.70
Lumen maintenance	At 2000h : ≥ 85% (≥ 80% for lamps with second lamp envelope)	At 2000h: ≥ 88% (≥ 83% for lamps with second lamp envelope) At 6000h: ≥70%
Number of switching cycles before failure	≥ half the lamp lifetime expressed in hours ≥ 10000 if lamp starting time > 0.3s	≥ lamp lifetime expressed in hours ≥ 30000 if lamp starting time > 0.3s
Starting time	< 2.0s	< 1.5s if P < 10W < 1.0s if P ≥ 10W
Lamp warm-up time to 60% Φ	< 60s or < 120s for lamps containing mercury in amalgam form	< 40s or < 100s for lamps containing mercury in amalgam form
Premature failure rate	≤ 2.0% at 200h	≤ 2.0% at 400h
UVA+UVB radiation	≤ 2.0 mW/klm	≤ 2.0 mW/klm
UVC radiation	≤ 0.01 mW/klm	≤ 0.01 mW/klm
Lamp power factor	≥ 0.50 if P < 25W ≥ 0.90 if P ≥ 25W	≥ 0.55 if P < 25W ≥ 0.90 if P ≥ 25W
Colour rendering (Ra)	≥ 80	≥ 80

Source: European Commission. 2009. "Draft Commission Regulation implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for non-directional household lamps – CFLs." Available at: http://ec.europa.eu/energy/efficiency/ecodesign/doc/committee/2008_12_08/draft_domestic_lighting_products_regulation_en.pdf

(b) Nominal life time of the lamp in hours (not higher than the rated life time);

(c) Number of switching cycles before premature lamp failure;

(d) Colour temperature (also expressed as a value in Kelvins);

(e) Warm-up time up to 60% of the full light output (may be indicated as "instant full light" if less than 1 second);

(f) A warning if the lamp cannot be dimmed or can be dimmed only on specific dimmers;

(g) If designed for optimal use in non-standard conditions (such as ambient temperature Ta ≠ 25 °C), information on those conditions;

(h) Lamp dimensions in millimeters (length and diameter);

(i) If equivalence with an incandescent lamp is claimed on the packaging, the claimed equivalent incandescent lamp power (rounded to 1W) shall be that corresponding in Table 6 to the luminous flux of the lamp contained in the packaging.

The intermediate values of both the luminous flux and the claimed incandescent lamp power (rounded to 1W) shall be calculated by linear interpolation between the two adjacent values.

Table 6

Rated lamp luminous flux Φ [lm]			**Claimed equivalent incandescent lamp power**
CFL	**Halogen**	**LED and other lamps**	**[W]**
125	119	136	15
229	217	249	25
432	410	470	40
741	702	806	60
970	920	1055	75
1398	1326	1521	100
2253	2137	2452	150
3172	3009	3452	200

ANNEX III
Verification procedure for market surveillance purposes

Member State authorities shall test a sample batch of minimum twenty lamps of the same model from the same manufacturer randomly selected.

The batch shall be considered to comply with the provisions set out in Annex II as applicable, of this Regulation if the average results of the batch do not vary from the limit, threshold or declared values by more than 10%.

Otherwise, the model shall be considered not to comply.

For the purposes of checking conformity with the requirements, the authorities of the Member States shall use accurate and reliable state-of-the-art measurement methods which deliver reproducible results, including:

- where available, harmonised standards the reference numbers of which have been published for that purpose in the Official Journal of the European Union in accordance with Articles 9 and 10 of Directive 2005/32/EC,

- otherwise, the methods set out in the following documents:

Measured parameter	**Organisation**[5]	**Reference**	**Title**
Lamp mercury content	European Commission	Decision 2002/747/EC (Annex)	Commission Decision 2002/747/EC of 9 September 2002 establishing revised ecological criteria for the award of the Community eco-label to light bulbs and amending Decision 1999/568/EC
Luminous efficacy	Cenelec	EN 50285:1999	Energy efficiency of electric lamps for household use - Measurement methods
Lamp caps	Cenelec	EN 60061:1993 All amendments up to A40:2008	Lamp caps and holders together with gauges for the control of interchangeability and safety -- Part 1: Lamp caps

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5 Cenelec: rue de Stassart/De Stassartstraat 35, B-1050 Brussels, tel. (32-2) 519 68 71, fax (32-2) 519 69 19 (http://www.cenelec.org).
International Commission on Illumination: CIE Central Bureau Kegelgasse 27 A-1030 Vienna AUSTRIA tel: +43 1 714 31 87 0 fax: +43 1 714 31 87 18 (http://www.cie.co.at/).

Lamp lifetime	Cenelec	EN 60064:1995 Amendments A2:2003 A3:2006 A4:2007 A11:2007	Tungsten filament lamps for domestic and similar general lighting purposes - Performance requirements
	Cenelec	EN 60357:2003 Amendment A1:2008	Tungsten halogen lamps (non-vehicle) - Performance specifications
	Cenelec	EN 60969:1993 Amendments A1:1993 A2:2000	Self-ballasted lamps for general lighting services - Performance requirements
Lamp start time / warmup time	Cenelec	EN 60969:1993 Amendments A1:1993 A2:2000	Self-ballasted lamps for general lighting services - Performance requirements
Power factor	Cenelec	EN 61000-3-2:2006	Electromagnetic compatibility (EMC) -- Part 3-2: Limits - Limits for harmonic current emissions (equipment input current <= 16 A per phase)
Specific effective radiant UV power	Cenelec	EN 62471:2008	Photobiological safety of lamps and lamp systems
Colour rendering	International Commission on Illumination	CIE 13.3:1995	Method of Measuring and Specifying Colour Rendering Properties of Light Sources
Chromaticity Correlated Colour Temperature (Tc [K])	International Commission on Illumination	CIE 15:2004	Colorimetry
Luminance	International Commission on Illumination	CIE 18.2:1983	The Basis of Physical Photometry

Luminous flux	International Commission on Illumination	CIE 84:1989	The Measurement of Luminous Flux
Lamp Lumen Maintenance Factor (LLMF) Lamp Survival Factor (LSF)	International Commission on Illumination	CIE 97:2005	Maintenance of indoor electric lighting systems