Introductions

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Agenda

• Background
• Activities to Date
• Purpose of Revision
• Review of Changes Reflected in the Draft 1 Proposal
• Analysis & Results
• Q&A
Background
Market Characteristics
U.S. Unit Shipments

Total ENERGY STAR Shipments (2017): 50,751
Total U.S. Unit Shipments (2017): 75,725

- **Single Tank Door**: 43.58%
- **Under Counter**: 45.48%
- **Single Tank Rack Conveyor**: 8.18%
- **Multiple Tank Rack Conveyor**: 1.70%
- **Single Tank Flight Type**: 0.29%
- **Multiple Tank Flight Type**: 0.15%
- **Pots, Pans, Utensils**: 0.62%

Market penetration: 67%
Commercial Dishwasher Equipment

Undercounter
45% of market

Rack conveyor

Single tank, door type
44% of market
Activities to Date
Commercial Dishwasher
Version 3.0 Specification

- Version 1.0 effective date – October 2007
- Version 2.0 effective date – February 2013
- Data Assembly Template & Discussion Guide issued – July 14, 2017
- Data Assembly deadline – October 15, 2017
- Data Assembly extended deadline* – February 28, 2018
- Draft 1 Version 3.0 Publication – April 3, 2019
- Draft 1 Version 3.0 Webinar – April 25, 2019
- Draft 1 Version 3.0 Comments Due Date – May 9, 2019

Product Development Website
# History of Commercial Dishwasher Specs

<table>
<thead>
<tr>
<th>Specification Version</th>
<th>Effective Date</th>
<th>Scope/Details</th>
</tr>
</thead>
</table>
| Version 1.0           | October 2007   | - Product types included: Under counter, Stationary single tank, Single tank conveyor, multiple tank conveyor  
|                       |                | - Defined idle energy & water consumption performance criteria, for both high temp & low temp products |
| Version 2.0           | February 2013  | - Expanded scope to include flight type machines  
|                       |                | - Revised idle energy and water consumption performance levels |
| Version 3.0           | 2019           | - (Proposed Updates) Adopting new test methods — add metric for washing energy performance  
|                       |                | - Revising idle energy and water consumption performance levels |
Purpose of Revision
Guiding Principles That Drive Specification Revisions

- New or revised test methods
- Significant increase in ENERGY STAR market penetration
- Change in Federal minimum efficiency standards
- Technological advancements
- Product performance or quality concerns
Review of Changes to the Draft 1 Proposal
Summary of Proposed Revisions

• Terms and definitions
• Scope changes
• Updated test method references
• Update idle energy rate (kW) metrics
• Update water consumption (gal/rack) metrics
• Addition of washing energy (kWh/rack) metric
• Voltage testing guidance
Definitions

• **Heat Recovery Machine (term & definition):**
  A sub-type of high temperature, stationary rack or conveyor machine that includes a heat recovery system for the purpose of heating potable water and may not require a dedicated ventilation hood.

• **Washing Energy (term & definition):**
  The rate of energy consumed by the dishwasher while “washing” or “sanitizing” dish loads, as expressed in kWh/rack.

• **Water Consumption (definition)**
  Gallons per rack, per square foot, or per hour depending on the machine type monitored during testing to determine the rate of water usage.
Scope

- V2.0 Scope (electric; high and low temp):
  - Undercounter
  - Stationary Door Type
  - Pot, Pan, Utensil (PPU)
  - Single Tank Conveyor
  - Multiple Tank Conveyor
  - Single Tank Flight Type
  - Multiple Tank Flight Type

- Proposed V3.0 Draft 1 Scope Reduction
  - PPU (low temp)
  - Flight Type (low temp)
Test Methods

• Current Version 2.0 Specification
  – ENERGY STAR Test Method for Commercial Dishwashers (Rev. May-2012)

• Proposed Version 3.0 Specification
# Requirements Stemming from Updated ASTM Test Method

<table>
<thead>
<tr>
<th>Metric</th>
<th>Current ENERGY STAR test method requirement</th>
<th>New ASTM test method requirement</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Washing Energy Performance Test</td>
<td>Washing Energy Performance (expressed in total kWh/rack)</td>
<td>N/A</td>
<td>Described in ASTM F1696-15 (Section 10.7) and ASTM F1920-15 (Section 10.8)</td>
</tr>
<tr>
<td>Tested Voltage Configuration</td>
<td>Volts</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Test Guidance

• Washing Energy (Booster Heater)
  – The total washing energy shall include internal or external booster heater energy in addition to the tank, heat, motor, control, and any additional auxiliary energy, expressed in kWh/rack

• Idle Energy (Booster Heater)
  – Booster heater (internal or external) energy consumption should not be part of this measurement unless it cannot be separately monitored per ASTM F1696-18 and ASTM F1920-15 Sections 10.8 and 10.9, respectively
Additional V3.0 Comments

• Water Consumption
  – EPA proposed to retain the water consumption metrics, expressed in GPR, GPSF (PPU), and GPH (Flight)

• Dump and Fill Machines
  – All stationary, tank type machines remain in the same category, including dump and fill machines
Additional V3.0 Comments

• Heat Recovery Machines
  – EPA proposed to maintain same metric levels for each respective sub-type of dishwasher with or without a heat recovery technology
  – Proposed additional recognition on Product Finder for ENERGY STAR certified dishwashers with heat recovery
AdditionaV3.0 Comments

• Voltage
  – For dishwashers with multiple voltage-versatility and those that are available in different voltage configurations, the representative model shall be tested at the most energy consumptive (worst case scenario) rating, according to the manufacturer.
Analysis & Results
Approach for Determining V3.0 Proposed Levels

• **Building the Dataset:** EPA assembled idle energy, water consumption, and wash energy test results
  
  • Performance data sources:
    
    – ENERGY STAR QPL/Product Finder and stakeholder-submitted data
  
  • EPA has substantial data for idle energy and water consumption since these are the current metrics used for certification
  
  • EPA has a select set of wash energy data points and, as such, has taken a conservative approach when setting wash energy levels
  
  • 308 models total
Approach for 3D Dataset

• 3 Criteria: **idle** + **water** + wash

• Shifted within 25\(^{th}\) quantile of idle + water data (majority of dataset)

• Overlaid wash data (where available) and made adjustments to the above limits

• Set wash energy threshold based on available data
  – Conservative approach using max levels instead of median
  – Wash energy threshold \(\leq 0.15-0.80\) kWh/rack

• Applied all three criteria in the validation steps and used best professional judgement for determining all three criteria thresholds
  – Tolerance across all three criteria \(\sim 0.05-0.1\) kWh/rack
Stationary Rack, Single Tank-Door Type

- 44% of market
- Models in dataset: 119
Under Counter

- 45% of market
- Models in dataset: 57
Rack Conveyor, Single Tank

- 8% of market
- Models in dataset: 57
Rack Conveyor, Multi Tank

- 2% of market
- Models in dataset: 35
Pot, Pan, Utensil (high temp only)

- <1% of market
- Models in dataset: 16

![Graph showing the comparison between Current ENERGY STAR level and Proposed ENERGY STAR level for Pot Pan (High Temp).](image)
Flight Types (high temp)

- <1% of market
- Models in dataset: 5 (ST); 19 (MT)
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Water vs. Wash

Low Temp: Water vs Wash

High Temp: Water vs Wash

Type
- Flight_MTB
- RackConv_MT
- RackConv_ST
- StatDoor
- UnderC

Weight
- 0.4
- 0.6
- 0.8
- 1.0