ENERGY STAR® Commercial Dishwasher Version 2.0 Discussion
Flight Type Machines
May 23, 2011
Chicago, IL
NAFEM Flight Type Discussion

• EPA discussed ideas for evaluating flight type performance at February stakeholder meeting

Water Consumption Metric

• Consider conveyor speed because this gets to cost of operation (e.g., gal/100 dishes)
  – Challenges using slowest speed (worst case scenario), NSF certifies at max speed/min water use
  – Pick a fixed speed to compare apples to apples, but may not be representative and what is a fair speed
  – Peg spacing too variable, could result in gaming
NAFEM Discussion cont.

- Suggested square foot of belt metric
- Consider narrow vs. wide belt requirements or use a metric based on conveyor width
- Break out single and multi tank, similar to other conveyors
- EPA agreed to plot several metrics to determine any trends compared to GPH
  - Conveyor width, chamber volume, etc.
Idle Energy

- Feedback is mixed regarding time spent in idle
- EPA has received no data points for flight type
- Should be similar to other conveyors in terms of tank heater(s) – use proposed Draft 2 conveyor levels
ENERGY STAR Options

- **Option 1:** Address flight type machines under Version 2.0
  - Only if it doesn’t delay process for other types
  - EPA could finalize all other requirements in next draft and do another reiteration just for flights
  - Must decide on a metric and propose levels by the next draft version
  - EPA prefers this option to give flight types access to ENERGY STAR and rewards efficient designs available now
ENERGY STAR Options cont.

• **Option 2:** Address flight type under Version 3.0 once ASTM procedures are final
  – Lumped in with total machine consumption effort
  – Assumes the ASTM conveyor method can be used for flight type with minimal changes, if not could be further delays
EPA Analysis

- EPA evaluated several different metrics to determine if there are any strong relationships.
- Plotted against GPH to determine trends.
- Sources included:
  - NSF Directory
  - Manufacturer spec sheets
  - Discussions with manufacturers
GPH vs. Conveyor Width

Total Conveyor Width vs GPH

Graph showing the relationship between Total Conveyor Width (in) and Final Rinse Water Usage (GPH) for Multiple-Tank and Single Tank Conveyor Areas. The graph includes linear regression lines with the equations and R² values:

- Multiple-Tank Conveyor Area: $y = -7.5351x + 403.74$, $R² = 0.0441$
- Single Tank Conveyor Area: $y = -3.0559x + 227$, $R² = 0.0107$
GPH vs. Conveyor Volume

Flight Type
GPH vs Conveyor Volume

Final Rinse Water Usage (GPH)

Conveyor Chamber Volume (cubic ft)

Multi Tank
-y = -0.302x + 205.36
R² = 0.0028

Single Tank
-y = 0.6639x + 84.817
R² = 0.108
GPH vs Rinse Chamber Volume

Flight Type
GPH vs Rinse Chamber Volume

Final Rinse Water Usage (GPH)

Rinse Chamber Volume (cubic ft)

- Multi Tank
- Single Tank

Linear (Multi Tank): $y = 2.7036x + 170.27$, $R^2 = 0.0097$

Linear (Single Tank): $y = 0.9551x + 100.19$, $R^2 = 0.0516$
GPH vs. Total Conveyor Area

![Graph showing GPH vs. Total Conveyor Area. The graph includes data points and trend lines for Multi Tank and Single Tank flight types. The equations for the trend lines are provided: y = -2.4294x + 191.69 (R² = 0.0055) for Multi Tank, and y = -4.2829x + 313.71 (R² = 0.0725) for Single Tank.]
GPH vs. Total Final Rinse Area

Flight Type
GPH vs Total Final Rinse Area

Final Rinse Water Usage (GPH)

Total Rinse Area (square ft)

Multi Tank
Single Tank

Linear (Multi Tank)
Linear (Single Tank)

\[ y = 2.8752x + 178 \]
\[ R^2 = 0.0041 \]

\[ y = 2.7585x + 133.55 \]
\[ R^2 = 0.0033 \]
GPH vs Percentage of Belt Area Passing Per Hour

Flight Type
GPH vs % Belt Area Passing Per Hour

- Multi Tank
- Single Tank
- Linear (Multi Tank)
- Linear (Single Tank)

Equations:
- Multi Tank: $y = 0.022x + 81.056$, $R^2 = 0.0953$
- Single Tank: $y = 0.026x + 22.161$, $R^2 = 0.0335$
GPH vs. Conveyor Speed

Flight Type
GPH vs Conveyor Speed

Final Rinse Water Usage (gph)

Conveyor Speed (max ft/min)

- MultiTank
- SingleTank

y = 5.7562x + 134.75
R² = 0.0396

y = 15.796x + 31.858
R² = 0.0692

EPA
GPH vs. Unit

Overall Rackless Conveyor
GPH vs. Unit

Final Rinse Water Usage (GPH)

- Multi Tank
- Single-Tank
- Proposed Level (25%)
Potential ENERGY STAR Levels
Additional Questions

• How do product families work?
  – Does EPA need to define representative model?
  – How are these products sold and installed?
  – Could there be a situation where the product meets during testing but not in the field?

• Does the ENERGY STAR rinse water test method apply to flight type? Are there any tweaks that need to be made?
Proposed Timeline

- Draft 2 comments due June 3
- Draft 3 released June/July
  - Finalize requirements for all other product types
  - Proposed levels for flight types
- Draft 3 comments early August
- Final Draft released early September
- Specification finalized by October
ENERGY STAR Contacts

- Christopher Kent, EPA
  - (202) 343-9036
  - Kent.christopher@epa.gov
- Rebecca Duff, ICF International
  - (434) 202-7878
  - rduff@icfi.com