



Laboratory Grade Refrigerators and Freezers Test Procedure Discussion

ENERGY STAR[®] Labeled Products Program

Washington, DC

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Purpose of Test Procedure

- Provide a consistent, repeatable method to determine energy consumption
- Emulate real world operating conditions
- Supply end users with information to compare products based on energy efficiency and other performance factors

ENERGY STAR specification cannot be developed until test method is agreed upon

ASHRAE 72: Background



- ASHRAE 72-2005 test procedure developed for commercial food grade applications
 - Energy use results reported in kWh/day
 - Referenced in ENERGY STAR commercial refrigeration spec
 - Some manufacturers already using on lab grade units
- Stakeholder review/comments indicate that test method cannot be applied to lab grade units as is
 - What changes are needed to apply to lab grade?

Discussion Goals



- Review issues/concerns brought forward by stakeholders re: applicability of ASHRAE 72 to lab grade units
 - Identify any additional discussion items
- Discuss ways in which the test method could be augmented to better emulate lab grade operation
- Determine next steps to drafting an amendment for purposes of ENERGY STAR testing
 - Review proposed testing/data collection schedule

Topics for Discussion



- Product coverage
- Manual switches/accessories
- Required defrost cycles
- Number of door openings
- Temperature uniformity
- Product loading and shelf placement
- Others?

1. Lab Grade Taxonomy



- Temperature Range
 - +4°C, -20°C, -30°C, -40°C
- Cabinet Size
 - i.e.- Undercounter (<6cuft), 7-12cuft, 13-18cuft, 19-24cuft, 25-30cuft, 31-40cuft, 41-55cuft, 56-70cuft, 70+cuft
 - Combination models are different design/lab application than single cabinet compartment models
- Manual Defrost vs. Automatic Defrost
 - Some laboratory samples can't tolerate temp changes during defrost cycles
 - Can exist in +4°C, -20°C, -30°C and -40°C as well as all different sizes
- Specialty Models vs. Standard Refrigerators and Freezers
 - Explosion-proof and flammable-proof models have different design/lab application requirements
 - Glass door and solid door models have different design/lab application requirements.

ENERGY STAR Coverage



- EPA would like test procedure coverage to be as robust as possible
- Data collection effort will determine which types are ripe for ENERGY STAR
 - ENERGY STAR does not work well for niche products
 - EPA will take functionality into account re: levels
- Are there any product types that cannot be tested by ASHRAE 72 because of niche application, etc?

2. Manual Switches/Accessories



- ASHRAE 72 is silent on this issue
- New Version 2.0 ENERGY STAR commercial refrigerator and freezer specification will require *"all factory-installed accessories (lighting, perimeter heat, pan heater, etc.) in the "ON" position if they are manually-controlled"*

Stakeholder Comments



- Some accessories should be excluded in testing:
 - Lighting is rarely used because of added heat and is enabled only when door is opened
 - Many freezers don't include lights
 - Most manufacturers are already using efficient fluorescent lighting

Discussion Questions



- What types of switches/accessories are used in lab grade units?
 - Sold with unit or sold separately?
- Are most accessories automatic or manual?
 - Enabled upon shipment or user enabled/disabled?
- How much energy is used by these features?
- *Test procedure clarification?*

3. Required Defrost Cycle



AHSRAE Requirement:

- Test procedure must start with a defrost period
- See Figure 6, page 8 for test cycle diagram

Stakeholder Comments



- Not all lab grade units use automatic defrost
 - Majority of -20/-30°C units use manual defrost
 - Some units (e.g., ultra low freezers) may never go into a defrost cycle
- Defrost requirements may need to vary based on product type

Discussion Questions



- Which product types use automatic defrost and which use manual defrost cycles?
 - How often is defrost used in practice?
 - Does the end user have control over the defrost?
- What parameters need to be set for the different product types?
- *Test procedure clarification?*

4. Door Openings



ASHRAE Requirement:

- Each door is fully open for 6 seconds, six times per hour, 8 consecutive hours
- Each door opened sequentially, one at a time
- Door opening period begins 3 hours after the start of the defrost period

Stakeholder Comments



- Current ASHRAE requirements are not representative of lab grade usage pattern
- Number of openings will depend on product type
 - E.g., for ULT openings may not be applicable

Discussion Questions



- What number of door openings would best emulate real world use?
 - Is there an average number per hour that can be used?
 - How might this differ between product types?
- If there is no defrost period, when would testing commence?
- *Test procedure clarification?*

5. Temperature Uniformity



- Temperature uniformity: temperature balance throughout the chamber
 - Different than “tolerance” which is the deviation from the controller set point
- ASHRAE does not currently address temperature uniformity

Stakeholder Comments



- From several discussions, EPA understands that temperature uniformity is one of the most important elements of a purchasing decision
 - This element should be considered when testing lab grade unit energy efficiency performance
- However, customers don't always set the uniformity by application in a consistent manner
 - Ordinary Needs/Basic Cabinet: ave. uniformity ($\sim 4^{\circ}\text{C}$ - 10°C)
 - Sensitive Sample Customers
 - High degree uniformity ($< \sim 4^{\circ}\text{C}$)
 - Validatable cabinet (accuracy, stability, uniformity)

6. Product Loading



ASHRAE Requirement

- Simulator is plastic container ≥ 473 mL with lid
 - Contents: natural OR artificial sponge material saturated with heat transfer solution of 50/50 distilled water & propylene glycol
- For each row, 2 simulators are placed at the left end, right end, and at each standard break between adjacent shelves
 - For each location, 1 is placed at front of shelf and the other at back of shelf

Loading/Shelf Placement



- Fillers are provided for remaining space
 - Material: water OR 50/50 mixture of distilled water & propylene glycol OR wood blocks with an overall density ≥ 30 lbs/ft³
 - Must occupy 70-90% of net useable volume & uniformly occupy space from front to rear (simulator and fillers)
 - Shelves should be loaded to simulate typical end use condition
- No requirements re: shelf placement
 - ASHRAE does offer an option to test unit without shelves
- See figure 4a, page 7 for simulator/filler locations

Stakeholder Comments



- Loading not representative of lab grade use
 - Typically units are tested empty, worst case scenario
 - Empty is not representative of real world performance
- Shelf placement impacts temperature uniformity
 - Should be standardized for purposes of testing

Discussion Questions



- Can uniformity be measured at the same time as energy consumption?
 - How would it be measured?
- Uniformity is becoming standardized in the pharmaceutical industry (e.g., +/- 2°C blood bank, +/- 3°C pharmaceutical, +/- 5°C ULT)
 - Can we use these targets for ENERGY STAR?
- Do we also need to set temperature tolerances?

Discussion Questions *cont.*



- Should lab grade units be tested full or empty?
- If tested full:
 - Are ASHRAE test simulators/filler package requirements (i.e. material) acceptable? If not what are some other options to best emulate lab product?
 - Where should they be placed for purposes of testing?
 - What additional requirements re: shelf placement are needed to ensure consistent and fair testing?
- *Test procedure clarifications?*

Thermo Fisher Slides

Additional Topics for Discussion

Proposed Schedule



- Draft amendment to test procedure: Feb. 13
- Comments due on draft amendment: March 6
- Final amendment released: April 3
- Testing and data collection: April 3 – June 26
 - Deadline to submit data to EPA: June 26
- Draft 1 specification released: July 17
- Comments due on Draft 1: August 14

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