



ENERGY STAR®

Laboratory Grade Refrigerators and Freezers

Version 1.1 Draft Specification Webinar: *Adding Ultra-Low Temperature (ULT) Freezers*

U.S. Environmental Protection Agency
April 12, 2017





Introductions

- Melissa Fiffer– EPA Lab Grade R/F Product Lead
- John Clinger – ICF



Recap of Laboratory Grade Refrigeration V 1.0 Specification (Dec 2016)

Eligible Products:

– Laboratory Grade Refrigerator

- Storing non-volatile reagents and biological specimens at set point temperatures between **0 °C and 12 °C** (32 °F and 53.6 °F)
- Marketed through laboratory equipment supply stores for laboratory or medical use.
- High Performance: maximum peak variation in temperature no greater than 6 °C
- General Purpose: cannot support maximum peak variation equal to or less than 6 °C

– Laboratory Grade Freezer

- Storing volatile reagents and biological specimens at set point temperatures between **- 40 °C and 0 °C** (-40 °F and 32 °F)
- Marketed through laboratory equipment supply stores for laboratory or medical use.
- High Performance: maximum peak variation in temperature no greater than 10 °C
- General Purpose: cannot support maximum peak variation equal to or less than 10 °C



Recap of Laboratory Grade Refrigeration V 1.0 Specification (Dec 2016)

- Ineligible Products:
 - Ultra Low Temperature (ULT) Freezers
 - Excluded due to lack of sufficient data
 - Commercial Refrigerators and Freezers
 - These products should certify under ENERGY STAR V 4.0 Commercial Refrigerators and Freezers specification
 - Residential Refrigerators and Freezers
 - These products should certify under ENERGY STAR V 5.0 Residential Refrigerators and Freezers specification



Proposed V 1.1 Scope Clarification & Revision (April 2017)

- Clarify that refrigerators and freezers without compressors but otherwise meeting the definition of laboratory grade refrigerator or freezer are within scope.
 - Allows recognition of ongoing technology advancements in refrigeration, such as products earning the 2017 EPA ENERGY STAR Emerging Technology Award for solid-state refrigeration.
- Inclusion of ULT Freezers
 - A freezer designed for laboratory application that is capable of maintaining set point storage temperatures between **-70 °C and -80 °C** (-94 °F and -112 °F).



ULT Data Set (Thank you, partners and stakeholders!)

- Comprised of 15 data points gathered by MyGreenLabs, working together with manufacturers to measure ULTs on the market according to the ENERGY STAR Test Method for Laboratory Grade Refrigerators, Freezers, and ULTs.
 - Represents a range of volumes between 16 and 29 cubic feet.

ULT Freezer	Volume (ft ³)	Variance @ -80°C	Uniformity @ -80°C	Stability @ -80°C	Measured Energy Consumption @ -80°C (kWh/Day)	Measured Energy Consumption @ -70°C (kWh/Day)	Calculated Energy Consumption @ -75°C (kWh/day)	Normalized Energy Consumption @ -75°C kWh/day/ft ³
K	16	11.90	7.50	3.80	14.66	11.06	12.94	0.809
M	18	11.40	6.80	3.60	14.84	11.72	13.22	0.734
N	18.9	14.60	8.85	4.60	20.43	14.99	17.82	0.943
H	19.4	13.90	6.90	4.40	10.44	7.06	9.08	0.468
A	20.1	11.40	6.45	4.00	12.64	8.68	10.97	0.546
B	23	14.10	7.40	6.30	14.89	11.78	13.5	0.587
D	24	21.10	15.90	3.50	20.46	14.04	17.88	0.745
C	24.7	12.70	6.70	4.20	22.52	15.11	19.03	0.77
L	25.7	14.10	8.20	4.30	18.89	14.44	16.74	0.651
E	25.7	7.28	4.01	4.15	26.71	19.85	23.76	0.925
O	26	14.40	9.20	2.90	17.72	12.64	15.17	0.584
I	27.5	22.90	13.50	6.32	8.72	6.96	7.86	0.286
F	27.5	23.20	15.40	8.40	9.68	7.89	8.83	0.321
G	28.8	13.00	5.20	6.30	12.12	8.05	10.49	0.364
J	28.8	17.10	8.40	4.80	19.96	13.76	16.91	0.587



Proposed MDEC Requirement for ULTs (kWh/day/ft³)

- Based on normalized energy consumption at -75 °C as calculated by Equation 1 in the ENERGY STAR Test Method for Laboratory Grade Refrigerators, Freezers, and ULTs.

Equation 1. ULT Energy Consumption Calculation

$$\text{Energy consumption} = E1 + \left[(-75 - T1) \times \frac{(E2 - E1)}{(T2 - T1)} \right]$$

Where:

T1 = Overall average of all recorded interior temperature measurements over the course of the test at -70 °C test condition.

T2 = Overall average of all recorded interior temperature measurements over the course of the test at -80 °C test condition.

E1 = Total energy consumption during the test at -70 °C test condition.

E2 = Total energy consumption during the test at -80 °C test condition.



Proposed MDEC Requirement for ULTs (kWh/day/ft³)

- A volume normalized metric is the simplest and most straightforward requirement to apply to the ULT data on hand. The approach results in a desirable pass rate in ULTs across all applicable volumes.

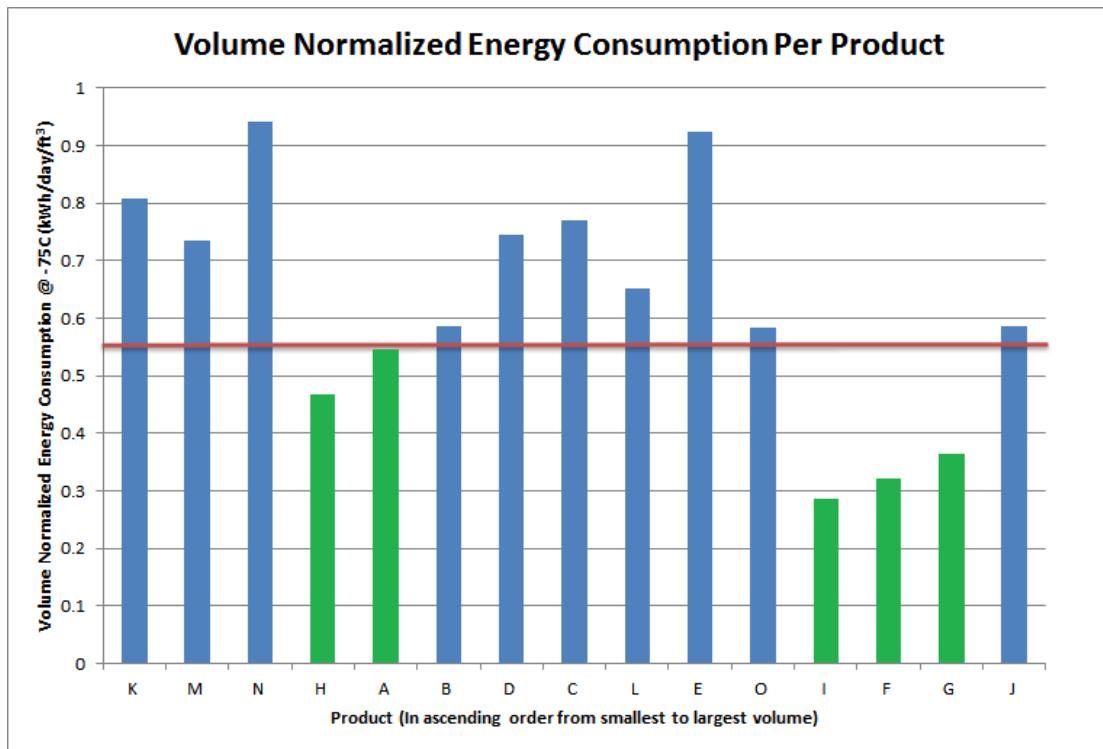
Table 3: Maximum Daily Energy Consumption (MDEC) Requirements (kWh/day/ft ³) for ENERGY STAR Certified Ultra-Low Temperature Freezers @ -75 °C
0.55

- Example: ULT with volume of 18 cubic feet and calculated energy consumption of 15 kWh/day at -75 °C per Equation 1 results in a normalized energy consumption value of 0.83, failing to meet the proposed requirement above.



Proposed MDEC Requirement for ULTs (kWh/day/ft³)

- The chart below shows the breakdown of data in ascending order by volume (red line = requirement, green = pass, blue = fail):





Any Questions? Discussion of V 1.1 Proposed Revisions



Reminder on ULT Calibration

- EPA has received stakeholder feedback that not all test laboratories may be using temperature calibration equipment that is sufficiently accurate at $-80\text{ }^{\circ}\text{C}$.
- EPA encourages partners and CBs to work with the test laboratories to ensure that the calibration equipment follows the accuracy required in the test method for the $-80\text{ }^{\circ}\text{C}$ testing.



Finalizing Version 1.1 & Future Outlook

- The ULT requirements proposed in the Version 1.1 Draft Specification will become effective upon finalization of the Version 1.1 Specification, targeted for **May 2017**.
 - Manufacturers will be able to immediately begin working with CBs to certify ULT products.
- Topics planned for further investigation in Version 2.0 as more product energy data becomes available include:
 - Temperature set point for freezers; assessing the validity of separate requirements for freezers designed to operate at -20 °C, -30 °C, and -40 °C.
 - Solid vs. transparent doors for refrigerators; identifying if more data shows a differentiation based on this characteristic that is seen in commercial refrigeration.



Version 1.1 Comment Deadline

- Please send written feedback to labgraderefrigeration@energystar.gov

Comment Deadline

Wednesday, April 26, 2017



New Opportunity: Promoting ENERGY STAR Lab Grade Products

- Is your marketing team excited to promote your newly certified (or soon to be certified) ENERGY STAR lab grade refrigerators, freezers, and/or ULTs?
- Please contact our lead for ENERGY STAR lab grade sales & marketing, and we'd be happy to talk through ideas for working together to get the word out!
 - Kirsten Hesla, U.S. EPA
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Thank You!

- Questions on specification development:

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- Questions on the ENERGY STAR Test Method for Laboratory Grade Refrigerators, Freezers, and ULTs:

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