

1. Door openings

We agree with some of the other stake holders to eliminate the door opening aspect of the test to reduce variability. We don't see any reason to have a higher ambient testing condition, eliminating the door opening will lead to a better comparison from manufacturer to manufacturer. The ANSI/ASHRAE Standard 72-2005 test utilizes units with simulated loads. These loads help to maintain the temperature and improve recovery during door openings. In the case of the test procedure for laboratory refrigerators and freezers the cabinet is empty so the entire volume of air is going to be lost during the door opening affecting the uniformity of the system. If it is left in the standard additional requirements, consideration needs to be given to how room airflow direction traverses the front of the cabinet when the door is open as well as a specification on how fast the door goes from a closed position to an open position so that the actual open time is equal for all units under test.

In regards to ULT we would not recommend opening all the inner doors or even one inner door. A typical user entering a ULT would at most only open one inner door to remove a sample unless they were emptying the entire cabinet for defrosting. The lab technicians are going to open the cabinet, remove their cells or reagents, close cabinet, and not enter the cabinet again until they have grown up their next generation of cell cultures, days from first entering the cabinet. In most labs they are careful about minimizing the time that they are in the cabinet so the more accurate energy usage is probably a steady state with no door openings. In the large freezer farms the samples are usually in for extended periods of time so door openings are minimal. When you open the door on a ULT since the air is so cold and dense the air instantly falls out of the cabinet. You can typically get one full volume of air exchange on a door opening. The volume of air lost or exchanged is based on the configuration of the inner doors and how tight the seals are on the doors. From a practical standpoint I am not sure how you could develop a mechanism to open the outer door then all the inner doors simultaneously without either costing a significant amount of money or interfering with the actual performance of the unit. The money to build the test fixture could be an issue for smaller privately owned business to afford, and test to the energy star guidelines. I don't think it is the intent for Energy Star® units to be only manufactured by the large corporations. Some very innovative solutions to today's energy usage problems have come from smaller more entrepreneurial businesses.

I also would not have some measurement based on box capacity. First ULT's are used for many types of storage, reagents, cells, bone, tissue and other biologics. The box is common but not exclusive and currently many of the larger ULT manufactures are marketing by box capacity so this may give them an unfair advantage in the market if Energy Star® comes out with a box/energy capacity measurement.

2. Testing without door openings

As stated above we believe it would be a sufficient measurement to test without door openings for refrigerators, freezers, and ULT's. We would recommend to use the

standard ambient for testing. An alternative would be to put a fixed load in the cabinet. A 40, 50, or 60 watt load could be placed in the cabinet. The load could be turned on once the unit met steady state conditions. The fixed cabinet load would then give you a more repeatable energy usage for a given load. This is a standard way for testing ULT performance and could be adapted for refrigerators. Most manufactures call this reserve capacity. The load would have to be modified and tested for different size cabinets since 50 watts in a 5cuft cabinet would have much different effects than 50 watts in a 40cuft cabinet. From a market standpoint the variance of door openings for customers are huge. We have customers in the same lab that open one refrigerator over 600 times a day and the refrigerator next to it they open 4 times a day. The applications are so varied I am not sure the value to the customer let alone the controls and costs that need to be developed and money spent to accurately test each individual configuration and size of cabinet.

3. Testing with configuration of boxes to have watts per box

As I mentioned above I would not have some measurement based on box capacity. First ULT's are used for many types of storage, reagents, cells, bone, tissue and other biologics. The box is common but not exclusive and currently many of the larger ULT manufactures are marketing by box capacity so this may give them an unfair advantage in the market if energy star comes out with a box/energy capacity measurement. I think using the standard for measuring internal volume should be utilized, as suggested by the current draft standard.

4. Testing with weighted or unweighted thermocouples

Helmer's position on this is the chamber could be tested with either weighted or unweighted thermocouples. The size or weight of the thermocouple load would be important. The issue that was more relevant was brought up by New Brunswick on the accuracy of the thermocouples. It is necessary to make sure you either accommodate for the inaccuracies of the thermocouples by calibrating the variance out of the measurement or accommodate for the variance. If it is decided to weight the thermocouples I would not use extreme amounts of weight. A very good reference for testing refrigerated units is a French standard. The standard is NF X15-140 (www.afnor.org). It has some excellent references on temperature measurements, allows for weighted thermocouples, and explains how to address the inaccuracies associated with the sensors used to measure the temperature. If it is decided to use thermocouples to measure the temperature it may be a good idea to specify the minimum gauge of thermocouple used for testing. If the gauge is too small the response could be so fast that you may have errors associated with the measurement technique not real response of the system. This is more relevant in refrigerated systems with internal fans or blowers than the cold wall ULT's.

5. Testing loaded or unloaded chamber

Helmer's position on this is the chamber should be tested unloaded. There are a few reasons for this. One is the unloaded condition is a worst case condition for the cabinet

since there is no residual cold load to help with swings on the internal temperature of the cabinet. The second is many of these refrigerators are designed for storage of specific items, blood, pharmaceuticals, reagents, tissue, etc. So the internal racking, drawers, shelves are all different and configurable for each customer and each application. I am not sure how you could reasonable determine a configuration that would accurately represent normal usage by a customer. The third is that just placing the load in a cabinet causes inherent variation in test outcomes on cabinets. Placing loads in cabinets with internal fans could cause changes in airflow and this could affect the results of the temperature testing. Many customers actually validate the internal uniformity of the chamber using their own internal protocols based on the type of material they are planning to store inside of the refrigerator or freezer.

6. Questions on Steady State definition AA?

In reference to definition of Steady State(AA). Do you have a diagram of what you mean by refrigeration cycle? The reason for asking is I would see multiple refrigeration cycles within the 24 hour period so I want to make sure I understand how the .2°C is calculated. I also think that this is a very tight specification. I would think .5°C would be more reasonable.

7. Do blood banks also have to meet the requirements of AABB at the same time?

Blood banks are required to also meet standards by AABB. AABB has a temperature requirement for blood banks that states the temperature inside the cabinet needs to be between 1°C and 6°C. This is a minimum maximum on the uniformity of the cabinet. In the proposed standard (table 394) the average set point temperature is 4°+/-1°C. The set point is within the specification but the actual temperature swings during the test could be outside the AABB specification. If this happened you could have a cabinet with a low energy usage but did not meet the AABB specifications for a blood bank. I would propose that for blood banks that none of the temperature measurements during the test can be outside the AABB specifications.

Reference: Technical Manual, sixteenth Edition AABB, ISBN No. 978-1-56395-260-9, pg. 284

For set points on freezers I would recommend two -20°C and -30°C since both are used for different applications by customers.

8. Elimination of the radiation and the light requirement. Light requirement may be important if it is a glass door unit

It is our recommendation to eliminate the requirements for lighting and radiant heat as described in 4. Test setup. Line 142 – 149.

9. What does configuration really mean in respect to the product?

Line 238 under pre-test configuration states that each option needs to be tested. I am not sure what that really means. Helmer sells a standard configuration but customers are able to modify that unit with any choice of racks, shelves, drawers, or any combination of these in a single unit. I am not sure how to handle this specification for our refrigerators and freezers. A recent customer order had one drawer, two solid shelves, and 4 wire racks in the unit.

10. Stability – French standard

As stated above the French standard for testing refrigerated cabinets NF X15-140 is a good reference to address many of the issues surrounding the actual measurement technique.

11. Using 3D CAD data for measurements of the inside of cabinet.

The use of 3D CAD data for other types of analysis is very common. I don't see an issue with the certified body using that for calculating the internal volume but it would require them to have compatibility with the specific cad systems. There are probably 10 different 3D CAD systems used in industry and not sure how portable the outputs are for all the systems. If we don't transfer data in a native format we transfer 3D cad data using a STEP file format. I think you would also leave in the AHAM volume measurement incase the CAD data was not available.

12. Use of Third party to do testing

Can manufactures perform their own testing or does EPA require a third party(certification body) to do the testing? I have noticed UL advertising Energy Star® testing as a service and we are wondering can we test to the standard ourselves? If we use an outside lab is the EPA certifying the outside labs? Is there a list of approved third party labs? Are we responsible for annual testing or what are the criteria for retesting? If a change is made to improve the unit what size of change will constitute retesting and resubmittal. A possible answer to this is as long as the energy usage doesn't change by some percentage no resubmittal is required.

13. Miscellaneous

Do participants attend meetings at the EPA office for these standards? Can there be a schedule established so that we can plan ahead to attend? It would be nice to have at least a month notice on meetings but more is even better.

What is the typical sample size of a specific unit that needs to be tested? Is one unit sufficient or do you need to test multiple units of the same configuration?

Are there any accommodations for small units under 5cuft? Many of these units only have two shelves but the specification calls for 3 layers of thermocouples. Do we still need three layers or can we just have one at the center?

14. Placement of thermocouples in ULT.

Helmer would support the same placement of thermocouples in ULT's as recommended for refrigerators and freezers.

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