

Helpful information and tips from Temptime, makers of Safe-T-Vue® Temperature Indicators

Blood Bank Refrigerator Setpoints Matter

Understanding the time pressures of busy blood banks, it would be fair to say that ANY time/temperature “advantages” - such as revisiting the refrigerator setpoint - might be worth consideration.

Learn more in this VUEPOINT.

Learn about these important time/temperature correlations relative to your day-to-day blood bank operations

by Jeffrey Gutkind, Temptime

Over the past several months I’ve had the opportunity to visit some of the largest blood banks across the nation. In the course of talking with blood bankers about maintaining blood temperatures during storage, issue and transport, **I observed a wide range of refrigeration setpoints, anywhere from 1.5°C to 4.7°C.**

Reviewing my observations from these visits and reflecting on the AABB standard of 1.0°C to 6.0°C for storage, it brought me back to the “starting” temperature for blood when it’s removed from the refrigerator.

- *How does even a degree or two at a higher or lower storage temperature affect the blood temperature as it is dispensed and issued from the blood bank?*
- *More importantly, how does the refrigerator setpoint affect how much TIME you have before the blood reaches 6°C?*

How long does it take for refrigerated blood products to reach 6°C?

Blood Storage Temperature: 2°C vs. 4°C

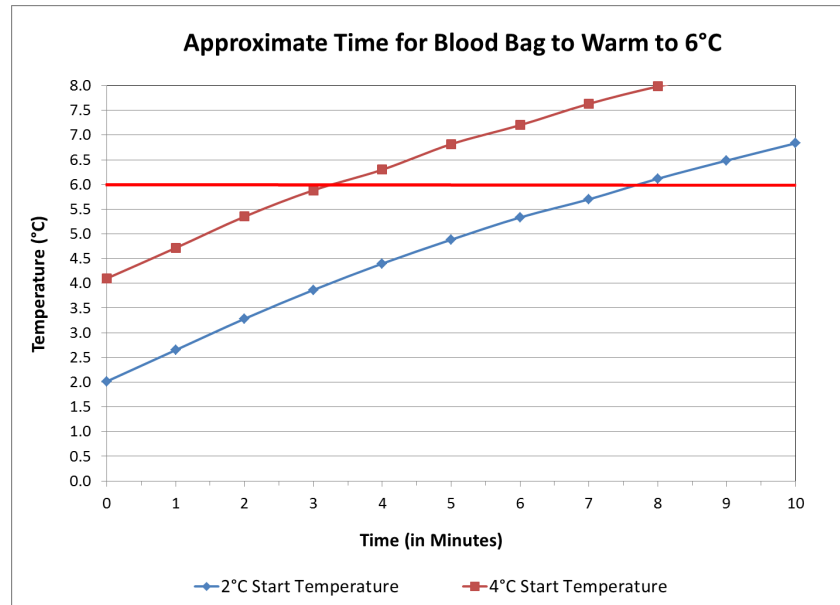
The following table and graph show the time it takes for the core temperature of a refrigerated blood bag to warm to 6°C when removed from refrigerated conditions (2°C or 4°C) and placed on a counter-top at room temperature.¹

Table 1:
Approximate Time for
Blood Bag to
Warm to 6°C¹

Refrigerated Blood Storage Temperature	Time
2°C	7.5 minutes
4°C	3.0 minutes

The graph demonstrates that the lower the refrigerated storage temperature, the more time it takes for the blood bag to reach 6°C when warming at room temperature conditions. While these results are specific to the test method and setup used, they should be typical.

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In terms of practical, day-to-day blood bank operations, what does this tell us?

Based on this test data, it suggests that blood bankers have over twice as much time to get blood issued and dispensed when the refrigerator setpoint is lower (2°C vs. 4°C). This represents a significant advantage for refrigerating blood at lower temperatures and longer times out of refrigeration before the blood goes out of specification.

Knowing that AABB guidelines state blood can be stored at 6°C for up to 42 days and transported between facilities below 10°C, and at the same time understanding the time pressures of busy blood banks, it would be fair to say that ANY time/temperature “advantages” such as revisiting the refrigerator setpoint might be worth consideration.

What do the blood refrigeration experts have to say?

After researching refrigerator setpoint specifications for a number of different vendors, we found that the factory setpoint is typically 4.0°C. Not being a refrigerator expert, I decided to reach out to Colleen Holtkamp Market Manager from [Helmer® Scientific](#), to learn more. Colleen graciously provided these thorough answers to my questions, as well as

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thoughtful guidance for your consideration on setpoints, alarms and refrigerator specifications. (*Colleen's responses are in blue following the questions*).

1. What is the typical factory setpoint temperature of your refrigerators when they go into the field? Are these setpoints easily changed, or does it have to be reset by the factory?

"The typical setpoint for Blood Bank Refrigerators is 4°C. Per AABB Standards, the acceptable temperature for storage of whole blood and most red cell components is 1°C to 6°C. Setting the temperature to 4°C, close to the middle of the range, is standard practice for blood bank refrigeration.

It should be noted that the alarm setpoints are important, as well. AABB Standards state that alarms should be set to activate before blood components are exposed to unacceptable conditions. For example, since the lower limit for blood storage is 1°C, it makes sense to set the low alarm to 1.5°C (and since the upper limit is 6°C, a high alarm setting of 5.5°C is appropriate).

The ability to change the temperature setpoint depends on the manufacturer/brand of the refrigerator, as does the process for changing the alarm settings (instructions should be included in the refrigerator's user manual).

Helmer Scientific Blood Bank Refrigerators enable the operating setpoint and alarm settings to be changed at the facility (they do not have to be reset by the factory). With temperature and alarm settings, it's important to remember that while it should be reasonably convenient to modify them, it shouldn't be so easy that they tend to be changed by mistake. A safeguard such as password protection for the refrigerator settings offers the best of both worlds – security and ease of use."

2. Is there some type of statistic that you would use to say if the door is open for 3 minutes per hour; it will take XX minutes to get back down to the original setpoint?

As an example: If the refrigerator is set to 3.0°C and the door is open for 2 minutes, how long will it take for the refrigerator to get back down to the 3.0°C setpoint?

"There isn't a standard method for measuring temperature recovery after a door opening. It can be impacted by variables such as ambient temperature and how much cold product is stored in the refrigerator at the time. What is important is that the unit has a heavy-duty, forced air

refrigeration system and that the fan stops running while the door is open so that it does not blow out the cold air. In addition, the refrigeration system should be powerful enough to circulate the air inside the cabinet multiple times shortly after the door is closed, ensuring quick temperature recovery.

Another consideration is the importance of alarms. Having both a door open alarm and a high temperature alarm provides two layers of protection against temperature excursions due to door openings.”

3. What is the typical tolerance for blood bank refrigerators? (we found this information difficult to find in our online research).

“Blood Bank requires the tightest temperature uniformity of any cold storage application. The typical temperature uniformity specification for Blood Bank Refrigerators is +/-1°C. While not necessarily a regulatory requirement, many Blood Banks have written this specification into their internal protocols/SOPs. Therefore, it has become a community standard that drives performance expectations for Blood Bank Refrigerators.”

Before a Blood Bank considers changing refrigerator setpoints from 4°C to 2°C, it is critical to think about the following information. If a blood refrigerator is set to 2°C, with uniformity of +/-1°C, the temperature inside the unit might reach the lower limit of the acceptable range (1°C). Also, if the low alarm is set to 1.5°C (which is advisable because AABB standards state that alarms should activate before blood is exposed to unacceptable conditions), it may be triggered by operation at 2°C. Helmer Scientific’s priority is to optimize the temperature of the blood bag while it is stored in our units. The setpoints and alarms are established to protect the blood while it is in the refrigerator.

When it comes to blood bank refrigeration setpoints, what have we learned?

- The *typical* factory setpoint for blood bank refrigerators when delivered from the manufacturer is 4.0°C
- The ability to change the refrigerator setpoint at the blood bank varies by manufacturer
- Blood that is stored at 2°C takes over twice as long (approximate, based on our test) to reach 6°C at ambient, when compared to blood stored at 4°C
- Temperature recovery of refrigerators is affected by a number of variables (door opening, amount of stored cold product, ambient operating temperature)
- Low and high alarms, as well as open door alarms, are important and recommended by the manufacturers

If you have any recommendations, experiences, questions or ideas relative to refrigerator storage temperatures and your blood bank, we'd love to hear from you. Please POST A COMMENT or email us.

Sincerely,

Jeffrey Gutkind
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¹Test Details

At each storage temperature, a total of six (6) simulated blood bags were tested. Each 600mL PVC blood bag (Charter Medical) was filled with 350mL of a mixture of 10% glycerol and 90% water, to simulate red blood cell volume. The bags were removed from refrigerated storage (at 2°C and 4°C) and then placed lying flat on a counter-top at room temperature (at approximately 21°C with 30% R.H). The temperature was measured by placing a calibrated temperature-sensing probe in the center of the simulated blood mixture inside the bag and the temperature was monitored using a calibrated Oakton Thermistor Thermometer. Temperature readings were recorded at 1 minute intervals.

The data represents the time needed for the simulated blood mixture (10% glycerol with 90% water) to warm to 6°C

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