

Title: Cold Pack Influence on Blood Bag Temperature and Time During Dispensing	Date: March 20, 2008	Technical Note #101
--	--------------------------------	--------------------------------------

Abstract:

The time required to dispense blood in a typical blood bank setting varies, depending on the routine and interruptions. A comparison of the time required for simulated blood bags (10% glycerol-water; 350cc) to warm from blood bank refrigerator temperature to upper compliance* temperature limits of 6°C and 10°C for storage and transport, respectively, was measured with and without the influence of a cold pack placed under the bag.

Summary Results:

These results are qualitative in nature with results for the two cases significant enough to indicate the use of cold packs is effective as an aid to help keep blood below upper temperature compliance limits. Variables such as gel versus no-gel cold packs and blood bag construction were not explicitly addressed in this study. However the follow summary results fairly state the observations:

- 1. The lower the starting temperature, the more time available to dispense blood.**
- 2. Use of a cold pack in the manner described increases time available to the dispensing procedure by about 40% before an upper compliance temperature is reached.**

Part I – No Cold Pack

Range °C	Average Time	Average Rate of Warming °C/min
3.3 - 6.0	11.7	0.23
4.2 - 6.0	8.4	0.21
5.0 - 6.0	4.7	0.20
6.0 - 10.0	22.6	0.18

Part II – Using a Cold Pack

Range °C	Average Time	Average Rate of Warming °C/min
3.3 - 6.0	16.9	0.18
4.2 - 6.0	11.9	0.17
5.0 - 6.0	6.4	0.16
6.0 - 10.0	33.5	0.12

Comparison

_ Time, min.	% _
5.2	44.4%
3.5	41.7%
1.7	36.2%
10.9	48.2%

Experimental - Part I: Blood bag placed on lab bench allowed to warm from 3°C to 10°C.

Time and temperature measurements were recorded for blood bags filled with 350 cc of 10% glycerol-water solution to approximate the density of blood. A thermister probe was inserted into each bag and positioned so as to record 'core' temperature of the liquid in the bag. DigiSense® electronic thermometers were used to record temperature. Accuracy of the probes = +/- 0.1°C; reported temperatures are corrected against a NIST traceable temperature standard. Experimental accuracy +/- 0.3°C. Room temperature = 21°C +/- 1°C (70°F +/- 2°F). Bags with probes pre-inserted were stored a minimum of 24 hours at 2 to 4°C, then removed to a lab bench with a laminate top on a composite base and placed label down on the surface.

Experimental - Part II: Cold pack under Blood bag on lab bench allowed to warm from 3°C to 10°C.

The same experimental set up used in Part I was utilized with the added procedure of using a refrigerated cold pack on which the blood bag was placed with label against the cold pack. The cold pack was stored for a minimum of 24 hours at 2 to 4°C. The label was placed against the cold pack on the assumption that current labeling covers a large percent of the bag surface on both sides of the bag. A variety of cold pack sizes from two manufacturers were used. At the end point temperature of 10°C, each bag was manipulated by hand for a few seconds to mix the liquid, then the core temperature was retaken, with an average temperature of 10.5°C, which is similar for bags without a cold pack in place.

Data from Part I: Blood bag placed on lab bench allowed to warm from 3°C to 10°C.

	temp	Temp	time	temp	temp	time	temp	temp	time	temp	temp	time
SET 1	3.4	6.0	13.0	4.1	6.0	10.0	5.0	6.0	6.0	5.9	9.9	24.0
	3.0	5.9	11.0	4.1	5.9	8.0	5.1	5.9	3.0	6.0	10.0	24.0
	3.6	6.0	9.0	4.4	6.0	7.0	5.0	6.0	4.0	6.0	10.0	21.0
	3.5	6.0	12.0	4.4	6.0	8.0	5.0	6.0	5.0	6.0	10.0	22.0
	3.0	6.0	15.0	4.4	6.0	8.0	5.0	6.0	5.0	5.9	10.1	21.0
	3.6	5.9	11.0	4.4	6.0	9.0	5.0	6.0	6.0	5.0	5.9	3.0
SET 2	2.9	5.9	11.0	4.1	6.0	8.0	4.9	5.9	5.0	6.0	10.0	24.0
				4.4	5.9	8.0	4.9	5.9	6.0	6.0	10.0	22.0
				3.7	6.0	10.0	5.0	6.0	5.0	5.9	9.9	22.0
				4.0	6.0	8.0	5.1	6.0	4.0	5.9	9.9	24.0
									6.0	10.0	23.0	
									6.0	10.0	22.0	
Avg =	3.3	6.0	11.7	4.2	6.0	8.4	5.0	6.0	4.7	6.0	10.0	22.6
	Rate =	0.23	°C/min	Rate =	0.21	°C/min	Rate =	0.20	°C/min	Rate =	0.18	°C/min
	n = 7			n = 10			n = 11			n = 11		

Rate = the warming rate; n = the number of samples

Data from Part II: Cold pack placed under blood bag on lab bench and allowed to warm from 3°C to 10°C.

B. Bag	Mftr.	CP Size	Wt	temp	temp	time	temp	temp	time	temp	temp	time	temp	temp	time
				1	2		1	2		1	2		1	2	
Pall Baxter	Nortech	5.5 X 5.5	12 oz	3.1	6.0	18.0	4.0	6.0	13.0	5.0	6.0	7.0	6.0	10.0	34
				2.9	6.0	20.0	4.0	6.0	13.0	5.0	6.0	7.0	6.0	10.0	38
				2.8	6.0	17.0	4.1	6.0	12.0	5.0	6.0	6.0	6.0	10.0	35
Pall	TCP	5 X 7	11 oz	3.1	6.0	17.0	4.0	6.0	12.0	5.0	6.0	7.0	6.0	10.0	43
							4.0	6.0	14.0	5.0	6.0	7.0	6.0	10.0	38
Pall	TCP	5.25 X 6	8 oz	3.0	6.3	16.0	4.0	6.3	11.0	5.0	6.3	7.0	6.3	10.0	24
Pall	Nortech	3.5 x 5.5	7 oz	3.0	6.0	16.0	4.0	6.0	11.0	5.0	6.0	6.0	6.0	10.0	32
				3.0	6.0	18.0	4.0	6.0	13.0	5.0	6.0	7.0	6.0	10.0	28
				3.0	6.0	15.0	4.0	6.0	10.0	5.0	6.0	5.0	6.0	10.1	32
				3.0	6.0	15.0	4.0	6.0	10.0	5.0	6.0	5.0	6.0	10.3	31
Pall	Nortech	4 x 6.75	4 oz	3.1	6.0	17.0	4.0	6.0	12.0	5.0	6.0	6.0	6.0	10.0	33
Avg =				3.0	6.0	16.9	4.0	6.0	11.9	5.0	6.0	6.4	6.0	10.0	33
				Rate =	0.18	°C/min	Rate =	0.17	°C/min	Rate =	0.16	°C/min	Rate =	0.12	°C/r
				n =	10		n =	11		n =	11		n =	11	

Nortech is a non-gel type cold pack.

TCP is a gel type cold pack.

Conclusion:

Use of readily available cold packs that can be easily stored in the blood bank refrigerator and removed with a blood bag for use during the dispensing routine will help keep blood below upper compliance* temperature limits described in *21 CFR 600.15 and the AABB *Standards for Blood Banks and Transfusion Services, 24th Edition.

