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Laboratory practice

Preparation and use of an ice point bath as a reference temperature

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Record of changes

Version	Date	Description
01	2005-11-01	Original release.
02	2008-05-14	Added “controlled copy” statement in the document header.
03	2009-06-03	Added clarification to the instructions.
04	2012-02-15	Added log sheet for ice point check.
05	2015-02-16	Introduced forms (QMS 325). General editorial corrections.
06	2015-07-27	Clarified the usage of the forms for lab and field.
07	2016-10-18	Added information on the availability of the applicable forms in section 2.4.1. Updated format.

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1 Introduction

1.1 Purpose

This laboratory practice describes a method of preparing, maintaining and using an ice point bath as a reference temperature bath.

1.2 Scope

This procedure can be used to realize the ice point (0 °C) as a reference temperature for the purpose of thermometer adjustment or as a check temperature for all thermometer types.

1.3 Applicable documents

Document number	Document title
GN-LP-003	Vocabulary of technical and metrological terms
TE-FM-001	Log sheet for general ice point check
TE-FM-002	Log sheet for 5-probe ice point check
TE-FM-003	Ice point check sheet for high accuracy thermometers

1.4 Abbreviations and symbols

mK	millikelvin (1 mK = 0.001 K, where K = °C + 273.15)

2 Procedure

2.1 Equipment required

2.1.1 Basic equipment

Equipment description	Description and performance requirements
Distilled water	4 L jug
Ice trays	4 × 1/3 L capacity
Blender with ice-crushing capability	1 L capacity
Wide-mouth vacuum-insulated thermal flask	1 L capacity
Plastic gloves	non-powdered
Utensils/forceps	
Beaker	0.5 L or larger

2.2 Safety requirements

Refer to applicable Measurement Canada health and safety documentation.

2.3 Set-up

All equipment that will come in contact with the water and ice and will be used in the preparation of an ice-point bath shall be cleaned and rinsed with distilled water before use. Ice trays should be filled with distilled water and put inside a freezer for sufficient supply of ice prior to the preparation process.

2.4 Instructions

Use either clean plastic gloves or cleaned and rinsed utensils to handle the ice and equipment.

Empty a tray of ice (made with distilled water) into the blender’s container. Add enough distilled water to have the ice float freely in the blender’s container. Put the lid on the container and crush the ice by using the appropriate setting on the blender. Add more

water if the crushed ice clings to the wall of the blender's container during the operation. The resulting mixture should be composed of only fine shavings of ice in water (no chunks).

Pour the water from the container into the beaker. Transfer all the shaved ice into the thermal flask making sure no ice pieces are present. When filling the bath with ice shavings, ensure that there are no air bubbles. Repeat the ice crushing until the flask is full. Gently pack the slushy mixture to release any trapped air in the flask and to fill in the voids.

Drain any excess water by tilting the flask until there is no free-flowing water. Ensure that the top layer of the ice remains moist (not white).

Cover the ice-point bath using its lid. Allow the contents and the flask to thermally equilibrate for 15 minutes before use.

Precool the temperature sensors in the beaker filled with any extra ice and cold distilled water obtained from the ice bath. Precooling reduces the time to reach equilibrium at the ice point and helps to preserve the bath at the ice point for prolonged use. Insert the sensor portion of the thermometer, such as the bulb of a liquid-in-glass thermometer or the sensing element of a probe, to a depth of at least 7 cm, or sufficient depth to eliminate immersion errors, below the bath liquid level (this does not apply to full-immersion type liquid-in-glass thermometers). Keep the sensor portion of the thermometer 3 to 4 cm above the bottom of the bath to avoid the zone at the bottom of the flask where the water will accumulate.

The melt water accumulating at the bottom of the flask has a temperature slightly greater than 0 °C and should therefore be drained frequently by tilting the bath. The bath will maintain a temperature of 0 °C for approximately 30 minutes, depending on usage and equipment.

Note: Impurities in ice and water usually lower the bath equilibrium temperature by several millikelvins. As denser melt water settles to the bottom, excessive amounts can reach higher local temperatures. Large chunks of very cold ice (not properly shaved) added to a bath can produce local temperature depressions.

Note: The ice point can be reproduced with an uncertainty of about 10 mK (0.01 °C). When prepared by the rigorous application of this procedure, the uncertainty can be reduced to approximately 2 mK (0.002 °C).

2.4.1 Records

Use applicable forms (TE-FM-001, TE-FM-002 or TE-FM-003) to record the ice point results. A copy of the applicable forms will be provided with every device calibrated.