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Subject: Freezing of Glacial Acetic Acid

Physicochemical Properties:

1. **Purity:** Each of Avantor Performance Materials, Inc. products listed as Glacial Acetic Acid has an assay, or purity, 99.5 % min. or better.

2. **Freezing / Melting:** The Freezing (Melting) Point (i.e., the temperature at which a pure substance has its solid and liquid phases in equilibrium at atmospheric pressure (1 atm)[1]) of Glacial Acetic Acid is 16.7 deg C (63 deg F)[2,3]. As such, exposure of any of the above Acetic Acid products to temperatures less than 16.7 deg C (63 deg F) results in *freezing*, or solidification, of the initially pure liquid product. Freezing of Glacial Acetic Acid is quite common during winter months, in climates having temperatures falling below these values.

3. **Performance:** Freezing of Glacial Acetic Acid is totally reversible within the reasonable working / storage temperature range of +40 to -20 deg C (+104 to -4 deg F), on the condition that none of the initial liquid phase, the solidified product, or the 'reversed' liquid phase product was contaminated, especially by vapors of other organic chemicals. This is the case for an initially sealed bottle or container of Glacial Acetic Acid in its initially, pure liquid form.

   This means that all product specifications, physicochemical properties, and performance characteristics of Glacial Acetic Acid products are totally maintained if it is initially liquid, then frozen (solidified), then melted (liquefied), within the temperature range of +40 to -20 deg C (+104 to -4 deg F).

4. **Recommendations for Melting** (Glacial Acetic Acid)**:** Avantor has no single, formal 'set of instructions' or 'step-by-step procedure' for 'melting' any of the above Glacial Acetic Acid products which may have froze. Nevertheless, the following procedures and recommendations should be followed:

   <u>Important Note</u>: Be aware of, read about, and use, all appropriate safety and handling procedures, guidelines, and equipment indicated in the Avantor product MSDS, of Glacial Acetic Acid. Refer to additional standard chemical safety, handling, and applications references about Glacial Acetic Acid, if necessary.

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Method 1. Allow the frozen acetic acid, in its bottle or container, to thaw at room temperature (typically 20 - 25 deg C). This may require anywhere from a few hours, to a few days, depending upon the extent to which the initial liquid phase has frozen.

Alternatively, to expedite the 'melting' or 'thawing' process of the Acetic Acid product,

Method 2. Subject the frozen acetic acid to 'controlled' heating (e.g., thermostat controlled heated water bath), to no higher than +40 deg C (+104 deg F). For safety purposes, in order to prevent a hazardous build up of acetic acid vapor pressure, prior to heating, slightly loosen the cap of the Acetic Acid bottle or container. Perform the controlled heating procedure in a ventilated hood or ventilated laboratory area, away from chemicals incompatible with Acetic Acid, according to the product Material Safety Data Sheet (i.e., MSDS). Perform this procedure until a single, liquid phase of Acetic Acid, is observed in the bottle or container.

Following return of the frozen Acetic Acid product to a single, liquid phase, recommendation is to maintain the bottle or container at temperatures above 16.7 deg C (63 deg F), for short- or long-term storage.

If you have any question regarding this issue or if you require additional information, please contact technical service. Thank you.

Prepared by the Technical Service Department
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[1]Hawley's Chemical Dictionary, 12th edition, Van Nostrand Reinhold Co., NY, 1993, p.737.
[2]The Merck Index, 12th edition, Merck & Co., Inc., 1996, entry # 52, p. 10-11.
[3]Ullmann's Encyclopedia of Industrial Chemistry, 5th completely revised edition, Volume A 1, VCH, Germany, 1985, p. 45.

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