

**ICE MANTLE MAKER
MODEL 452**
User Maintenance Manual/Handbook

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The company is always willing to give technical advice and assistance where appropriate. Equally, because of the programme of continual development and improvement we reserve the right to amend or alter characteristics and design without prior notice. This publication is for information only.

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GUARANTEE

This instrument has been manufactured to exacting standards and is guaranteed for twelve months against electrical break-down or mechanical failure caused through defective material or workmanship, provided the failure is not the result of misuse. In the event of failure covered by this guarantee, the instrument must be returned, carriage paid, to the supplier for examination and will be replaced or repaired at our option.

FRAGILE CERAMIC AND/OR GLASS PARTS ARE NOT COVERED BY THIS GUARANTEE

INTERFERENCE WITH OR FAILURE TO PROPERLY MAINTAIN THIS INSTRUMENT MAY INVALIDATE THIS GUARANTEE

RECOMMENDATION

The life of your **ISOTECH** Instrument will be prolonged if regular maintenance and cleaning to remove general dust and debris is carried out.

ISOTECH

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 **CAUTIONARY NOTE**

ISOTECH PRODUCTS ARE INTENDED FOR USE BY TECHNICALLY TRAINED AND COMPETENT PERSONNEL FAMILIAR WITH GOOD MEASUREMENT PRACTICES.

IT IS EXPECTED THAT PERSONNEL USING THIS EQUIPMENT WILL BE COMPETENT WITH THE MANAGEMENT OF APPARATUS WHICH MAY BE POWERED OR UNDER EXTREMES OF TEMPERATURE, AND ARE ABLE TO APPRECIATE THE HAZARDS WHICH MAY BE ASSOCIATED WITH, AND THE PRECAUTIONS TO BE TAKEN WITH, SUCH EQUIPMENT.

HEALTH AND SAFETY INSTRUCTIONS

1. Read this entire handbook before use.
2. Wear appropriate protective clothing.
3. Operators of this equipment should be adequately trained in the handling of hot and cold items and liquids.
4. Do not use the apparatus for jobs other than those for which it was designed.
5. Do not handle the apparatus when it is cold, unless wearing the appropriate protective clothing and having the necessary training.
6. Do not drill, modify or otherwise change the shape of the apparatus.
7. Do not dismantle the apparatus.
8. Do not use the apparatus outside its recommended temperature range.
9. There are no user serviceable parts inside. Contact your nearest Isotech agent for repair.
10. Ensure adequate ventilation when using liquid nitrogen, solid carbon dioxide and alcohols.
11. Ensure Dewar flasks used with liquid nitrogen and solid carbon dioxide have been specifically intended and manufactured for this purpose.

PROCEDURE FOR THE CONSTRUCTION OF A WATER TRIPLE POINT CELL MANTLE USING A HEAT PIPE

SCOPE

This procedure describes the creation of Water Triple Point Cell Ice Mantles using the Isotech Ice Mantle Maker Model 452.

The Ice Mantle Maker comprises a heat pipe of special construction designed to be especially efficient when used vertically. Diagram I shows the dimensions of the Ice Mantle Maker.

EQUIPMENT

With the Ice Mantle Maker the following items help to produce and control the shape of the Ice Mantle:-

A syringe with a fine tube or needle attached of sufficient length to reach the bottom of the water triple point's re-entrant tube.

An Aluminium collar specific to the cell outside diameter and of length to cover the water/vapour interface.

Alcohol (Methanol or Acetone)

A supply of liquid nitrogen (or solid Carbon Dioxide, if used).

A small Thermos or Dewar flask (suitable for use with Solid CO₂ or Liquid Nitrogen) ***on no account should Liquid Nitrogen be poured into an ordinary Thermos Flask.***

The cell itself should be pre-cooled to about 0°C, in for example a Dewar flask containing crushed ice. The cell should remain in this Dewar during production of the ice mantle, but removed occasionally to check the progress of the mantle.

PREFERRED METHOD USING LIQUID NITROGEN

PREPARATION OF THE CELL

1. The cell is first pre-cooled and maintained at 0°C (see above).
2. Any water which may have collected in the re-entrant tube is evacuated using the syringe and attached tube.
3. Alcohol is introduced into the re-entrant tube so that is approximately $\frac{3}{4}$ full, using the syringe to 'flush' the alcohol over all surfaces of the re-entrant tube so as to eliminate any remaining water.
4. Next a metal rod pre-cooled in liquid nitrogen is introduced into the re-entrant tube of the Water Triple Point Cell. This initiates the formation of ice around the re-entrant tube prior to use of the Mantle Maker. If no ice has been seen to have formed replace the first rod with another rod pre-cooled in liquid nitrogen, until ice has been seen to have formed.

FORMATION OF ICE USING THE MANTLE-MAKER

Once ice has been seen to have formed around the re-entrant tube, the metal rod is removed and the Mantle Maker placed fully into the cell's re-entrant tube.

Liquid nitrogen is now poured carefully into the metal container of the Mantle Maker apparatus; taking care not to splash any since it can burn skin.

The level of alcohol in the re-entrant tube of the cell should be adjusted if necessary to be level with the top of the water in the cell.

All that is required now is to occasionally top up the liquid nitrogen level in the Mantle Maker, check for ice bridge formation (see note below) at the surface of the water in the cell and eventually, the final thickness of the mantle formed (**which should not extend to the outer wall of the cell, as this can rupture the glass**).

The ice mantle will be complete in approximately 20 minutes dependent on the size of the cell. In any case the mantle should be approximately $\frac{3}{4}$ of the distance from the re-entrant tube to the outer glass wall of the cell, in thickness, but more.

It may be necessary to gently tip the cell to one side to check the thickness of the mantle since the magnifying effect of the glass and water can make it appear larger than it actually is.

ICE BRIDGE

By nature of water, ice preferentially forms at its surface. Ice in a Water Triple Point Cell forms a bridge between the re-entrant tube and the Cell's outer wall. This is natural, but can eventually crack the glass wall of the cell.

There are various ways to melt this Ice Bridge, with your hand, by holding the cell at the point where the Ice Bridge forms until it melts or more conveniently by sliding a warm object or sleeve over the cell. This we provide in the form of an Aluminium Collar that you can re-warm in warm water.

ALTERNATIVE METHOD USING SOLID CARBON DIOXIDE

Take a small Thermos or Dewar flask half fill it with alcohol and add solid Carbon Dioxide (dry ice) until the alcohol has cooled to the Carbon Dioxide temperature i.e. pieces of CO₂ remain in the flask.

Transfer sufficient cooled alcohol from the flask to fill the Ice Mantle Maker to within 10mm of its metal container's rim.

INITIATING THE FREEZE INSIDE THE WATER TRIPLE POINT CELL

Pour about 1 cc of pre-cooled alcohol into the Water Triple Point Cell's re-entrant tube.

Place the Ice Mantle Maker fully into the re-entrant tube.

Ice will begin to form around the bottom of the Water Triple Point Cell's re-entrant tube.

More pre-cooled alcohol can be added to form even heat transfer from the Mantle Maker and create a uniform Ice Mantle.

The alcohol in the top container of the Ice Mantle Maker should be approximately -75°C to begin with. Very quickly as heat is exchanged with the ice in the cell, the alcohol will begin to warm. To prevent this continue to add solid CO₂.

The Ice Mantle will be complete in 20 to 30 minutes. As before, any formation of an ice bridge should be dealt with as described previously.

CELL USE

Once made the water triple point cell should be maintained at 0°C for at least 2 hours prior to use but preferably overnight. The alcohol in the re-entrant tube should be removed and replaced with water. A metal rod at ambient temperature placed carefully into the re-entrant tube of the cell will free the ice-mantle ready for use.

