The success of Targeted Temperature Management™ has become one of the most important new advances in critical care. It is through the work of many different people, working in all facets of the hospital, that the full potential of temperature management is realized. Upon completion of The Arctic Circle Clinical Resource Program, you become an important leader within your field operating at the center of the circle of care.

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The 24/7 Helpline is intended to assist healthcare professionals with technical questions they may have regarding the use of the Arctic Sun® Temperature Management System. While the Helpline is staffed by licensed critical care nurses, they are not able to provide medical or nursing advice or to prescribe treatment.
Prepare for the Clinical Resource Workshop by completing the Arctic Sun Electronic In-Service

To use the Arctic Sun® Electronic In-service* you will need access to the internet

www.medivance.com
Enter your name as a user name and password

This self-paced program takes about 14 minutes to complete

* The Arctic Sun Electronic In-service has been Six Sigma validated

Customer Service 877-267-2314
The Role of the Caregiver
The following information is intended to provide guidance to assist you in providing optimal skin care of patients treated with the Arctic Sun. This information is not intended to replace formal in-service training or the operator's manual. Please refer to the operator's manual for complete instructions, warnings and cautions pertaining to the use of the Arctic Sun.

Why use hydrogel for a temperature control device?
- Hydrogel is water based; provides excellent surface contact and transfers energy effectively
  - Fully conductive for optimal heat transfer efficiency
- Hydrogel has a gentle adhesive nature
  - It does not form a chemical bond like tape
- Hydrogel absorbs transpired moisture

ArcticGel™ Pad Construction

Applying ArcticGel Pads
- ArcticGel pads are packaged as a kit
  - Two torso, two leg
- A kit can accommodate patients between 16-100 kg (35-220 lbs)
- Universal pads (one – two) are supplemental pads for Bariatric patients
- Small Universal pads can be used for patients 2.5-16 kg (5.5-35 lbs)
  - If in doubt, use larger pads
- A complete kit should be used provide adequate coverage
- For above the knee amputees, use the two torso pads and one or both thigh pads

See Pad Sizing Chart on page 23
Applying ArcticGel Pads

- Use pads immediately after opening. Do not store pads once the kit has been opened.
- Place on intact skin. Do not place ArcticGel pads on skin that has signs of ulceration, burns, hives or rashes.
- While there are no known allergies to hydrogel materials, caution should be exercised with any patient who has a history of skin sensitivities or allergies.
- ArcticGel Pads are clean, but not sterile; do not place in a sterile field.
- Do not allow antibiotic agents to pool underneath the ArcticGel pads.
- Do not place bean bag or other firm positioning devices underneath the ArcticGel pads. Do not place positioning devices under the pad manifold or patient lines.
- Avoid oils, lotions and powders.
- Apply to dry skin.
- No need to shave; gel will not pull hair.
- Avoid covering or interfering with joint motion.
- Large breasts should clear the pad edges.

Document the date pads applied on label

Cautions

- Due to underlying medical or physiological conditions, some patients are more susceptible to skin damage from pressure, heat or cold. Patients at risk include those with poor tissue perfusion or poor skin integrity due to:
  - Diabetes
  - Peripheral vascular disease
  - Poor nutritional status
  - Steroid use
  - High dose vasopressor therapy
- Skin injury may occur as a cumulative result of pressure, time and temperature.
  - If the patient does not reach target temperature in a reasonable period of time or is not able to be maintained at target temperature, the skin may be exposed to low temperatures for an extended period of time which may increase the risk for skin injury.
  - If patient is not at target within 4 hours, OR if water temperature is below 10 degrees centigrade (50 degrees Fahrenheit) for 8 consecutive hours, follow the Decision Tree algorithm to determine why, and take action!

See Decision Tree on page 24

- Maximum system water temperature is 42°C (107.6°F). This setting can be decreased for patients with fragile skin or other medical conditions that put them at higher risk of skin injury.
- Minimum system water temperature is 4°C (39.2°F). This setting can be increased for patients with fragile skin or other medical conditions that put them at higher risk of skin injury.
- Do not place electrosurgical grounding (Bovie) pads under ArcticGel Pads. The combination of heat sources may result in skin burns.
Special Considerations

- Edematous patients
  - Avoid applying pads too tightly
  - Reposition pads as patient swells to avoid irritation at the edges and to provide some “give”
  - Skin integrity may be compromised and more vulnerable to mechanical injury

Use of Other Devices with the Arctic Sun

- Sequential compression boots
  - If indicated, are compatible with the Arctic Sun
- Specialty beds
  - If indicated, are compatible with the Arctic Sun
- Continuous passive movement devices (orthopedic patients)
  - May be used if indicated
  - Make certain there are no points of friction near the joint(s) being mobilized

Skin Inspection

- Examine the skin under the Arctic Gel Pads often, especially those at higher risk of skin injury.
- Recommend skin inspections every 4-6 hours or per hospital guidelines
  - Light skin- observe color: red, pallor, purple
  - Darker skin- look for darker hues
  - Check for capillary refill
  - Look for abnormalities
- Inspect areas over boney prominences
- Vasoconstriction
  - Skin will be vasoconstricted during cooling

Routine Skin Care

- Replace Pads – when the hydrogel no longer uniformly adheres to the skin. Replacing the pads at least every 5 days is recommended
- Bathing Skin – not required before application, make certain skin is dry before applying
- Clean open areas after pads are in place
- Inspect under the pads
- No need to bathe under pads

Incontinence

- Soil wipes easily from outer pad
- Always clear liquid soil from skin
- For unmanageable incontinence: replace soiled pad if necessary
Removing
- Gently lift up the edge
- Peel vs. pull
  - Peeling is more gentle
  - Avoid pulling
- Cold pads are stiffer and more adherent; peel cautiously and slowly

Summary
- Appropriate patient selection is essential.
- Understand and adhere to cautions.
- Place pads on intact skin only.
- Remove pads gently.
- Routinely inspect skin.
- Closely monitor patient response to treatment and water temperatures.
Can I defibrillate with the Arctic Sun on?

Defibrillation Options
- Multi-purpose hands free pad: always place directly on skin and under the ArcticGel Pads
- Hands on defibrillation: apply saline or ArcticGel Pads directly on skin

How do I place the electrodes for telemetry monitoring?

EKG / Electrodes
- Limb lead electrodes may be placed under the ArcticGel Pads if necessary
- Electrosurgical grounding pads should never be placed under the ArcticGel Pads

Is the reservoir likely to grow microorganisms?
- Cleaning solution is added to the water when the device is initially filled
- The water should be drained and refilled with cleaning solution every 3 months
- Antimicrobial powder is in each new pad so the reservoir is re-dosed every time you attach a new pad kit
How do I weigh a patient with the ArcticGel Pads on?
• Weigh the patient with the full set of ArcticGel Pads on as long as the manifold and large gray hose are lifted off the weighing surface
• Use the ArcticGel weight chart to deduct the specific pad weight from the total weight
  See Quick Reference Guide on page 17

How do I cool a bariatric patient?
• Use the sizing chart to select appropriate pads; up to two universal pads may be added to the large set to ensure appropriate coverage
  See Pad Sizing Chart on page 23

Why is the PA catheter reading lower than the Arctic Sun?
• Foley and rectal probes do not always reflect core body temperature during hypothermia induction. It is not uncommon to see a lag time when comparing these probes to a PA catheter or esophageal probe, which better reflect core temperature within the body
• Due to this lag time, when using bladder or rectal temperature sites, actual patient core temperatures may be lower than measured. Therefore, the use of esophageal temperature is recommended for patient temperature control below 33°C
• Once cooling becomes generalized, these temperatures should correlate appropriately

Are you sure I should not remove the ArcticGel pads for Chest X-rays?
• No need to remove for radiographic imaging
• Even safe with water flowing
• MRI, CAT Scan, X-ray, Cath Lab

What should I do if my patient has no urine output and I am using a Foley probe?
• Foley probes require urine to read accurately (check with the manufacturer to determine minimum urine output necessary)
• You may consider switching to an esophageal/rectal probe
• When cooling to hypothermia, you may see a cold-induced diuresis, therefore it is imperative to closely monitor I and O’s
I need to transport my patient to the Cath Lab. Help!

Use Purge Mode to avoid water spills
- Purge cycle takes 30 seconds
- Pinch and push the connectors to release
- Leave the device on at the bedside to keep the chiller on
- Reminder: The Arctic Sun does not have a battery; for longer procedures, bring the device with you

The screen indicates that the device needs to be calibrated. What should we do?
- The Arctic Sun will display a message when it is due for calibration
- Biomed will need to properly calibrate the device and reset the calibration timer

Please explain the Patient Temperature Trend Indicator

- The Arctic Sun measures temperature in 0.01°C increments and can internally identify change before it is seen on the display screen
- The Patient Temperature Trend Indicator (circled above) provides indication in temperature change and increased metabolic rate (i.e. shivering)
**Patient Temperature Trend Indicator**

- Center circle – no change or less than 0.25°C (0.45°F) change per hour
- One arrow (up or down) – 0.25°C to 0.5°C (0.45°F to 0.96°F) change per hour
- Two arrows (up or down) – 0.5°C to 0.75°C (0.96°F to 1.35°F) change per hour
- Three arrows (up or down) – 0.75°C to 2.0°C (1.35°F to 3.6°F) change per hour
- Three arrows flashing simultaneously – > 2.0°C (> 3.6°F) change per hour

**This patient is thermoneutral**

**Patient Temperature Trend Indicator**

- Center circle – no change or less than 0.25°C (0.45°F) change per hour
- One arrow (up or down) – 0.25°C to 0.5°C (0.45°F to 0.96°F) change per hour
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- Three arrows (up or down) – 0.75°C to 2.0°C (1.35°F to 3.6°F) change per hour
- Three arrows flashing simultaneously – > 2.0°C (> 3.6°F) change per hour

**Good progression of hypothermia**
Patient Temperature Trend Indicator

- Center circle no change or less than 0.25°C (0.45°F) change per hour
- One arrow (up or down) - 0.25°C to 0.5°C (0.45°F to 0.96°F) change per hour
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- Three arrows flashing simultaneously - > 2.0°C (> 3.6°F) change per hour

Febrile patient generating heat!!!

Can you explain the significance of water temperature changes?

- Circulating water temperature will stay in the range of 4°C to 42°C (39.2°F to 107.6°F)
- By keeping the device in Automatic Mode, the Arctic Sun will modulate the water temperature through a feedback algorithm to either effectively cool or warm the patient

Record key parameters

Water Temperature Stabilization

- When a patient is maintained at target temperature, the water temperature will be maintained in a stable range (approximately 18°C to 25°C (64.4°F to 77°F))
- If the patient starts to gain or lose heat, the Arctic Sun will immediately change the water temperature to keep the patient at target temperature (in Automatic Mode)
Normothermia

• If a patient begins to generate excess heat, the water temperature of the Arctic Sun will decrease in order to keep the patient at target temperature

Hypothermia

• A change in water temperature greater than 10°C from baseline is significant
  – Check for shivering
  – Speak with care team about possible infectious process

Febrile patient generating heat!!!

What should I do if the water temperature stays cold an extended period of time?

• The Arctic Sun will drop the water temperature when cooling the patient to target temperature or when it is necessary to eliminate heat generation to maintain target temperature
• If the patient does not reach target temperature within 4 hours or if water temperature remains less than 10°C for 8 hours, refer to the Decision Tree

See Decision Tree on page 24
Shivering
• Shivering must be addressed; look for early signs of shivering
• Rationale
  – Shivering will increase metabolic rate
  – Shivering generates heat and will raise patient’s temperature
  – Heat will direct the Arctic Sun to deliver cool water
  – Avoid prolonged exposure to cold water
  – Follow the decision tree as a guide to avoid cold water exposure
• Treat as directed
• Contact physician if shivering is not abolished

Shivering Recognition
• Look at the arrows on the Patient Temperature Trend Indicator
• Look for irregularity of the baseline on your limb leads
• Visible shivering:
  – Mandible
  – Pectorals
  – Large or small muscle groups
• If patient is generating heat, the Arctic Sun will be triggered to deliver cold water

Rewarming
• Arctic Sun can be programmed to slowly rewarm the patient (as slowly as 0.05°C/hr)
Alarms
• When an Alarm occurs, there is a chance that a potentially unsafe condition has occurred, or could occur with respect to the Arctic Sun, the patient, or an improperly functioning system
• An alarm will interrupt therapy. If an alarm condition is not addressed and the problem persists the alarm will reoccur every 10 seconds until cleared.

Alerts
• Alerts inform the clinician about patient and equipment status without interrupting the procedure
• An Alert will repeat itself every 2 minutes until cleared

Patient will not cool to target temperature
Determine if the mechanics are working properly:
• Are a minimum of four pads being used?
• Are they the appropriate size?
• Is flow rate a minimum of 2.3L/min?
• Is the water temperature low?
  – If water temperature is too high, what is the minimum water temperature set to?
  – There may have been inappropriate changes under Advanced Settings
• Was the therapy stopped?
  – Stopping the device resets the algorithm

If machine is working properly, determine external conditions:
• Is the patient shivering?
  – Arrows flashing upward on the Patient Temperature Trend Indicator reveals heat generation
• If using paralytics, is there some movement?
• If Foley temperature probe is being used, is drainage adequate?
• Have you checked the temperature reading with a secondary source?

• What are the environmental conditions?
  – Is the room temperature too high?
  – Is the oxygen (ventilator, mask or nasal prongs) heated?
  – Are there lights on the patient?
  – Are there warming blankets on the patient?

Factors Affecting Cooling
Medications/Fluids
• Paralytics
• Sedation
• Fluid resuscitation
• Iced saline infusion(s)
• Vasopressors
• Vasodilators
• Metabolism boosters

Physiologic
• Shivering
• Infection
• Hemodynamic instability
• Injured hypothalamus
• Burns
• Open wounds
• Dialysis, CVVH

Probe type
• Esophageal
• Foley
• Rectal

Environmental
• Room temperature
• Ventilator gas temperature
• Ice packs
• Moist/wet skin
• Blowing air
• Support surface temperature
• Exposed skin
Patient has overshoot below target temperature

Some patient-related questions to ask:
- Were vasoactive drugs administered?
  - Vasodilators may cause overshoot by moving cold blood from periphery to core
- At what point in the cooling process were sedatives and/or paralytics administered?
  - Late administration may lead to overshoot
- Did the patient experience hemodynamic changes?
  - Movement of blood to the target organs from the periphery may lead to overshoot

Patient has overshoot below target temperature

Some device questions to ask:
- Is the Arctic Sun in Automatic Mode?
- Is the water warming appropriately?
- What are the arrows on the Patient Temperature Trend Indicator doing?
- What is the flow rate?

Patient has overshoot above target temperature

- Ensure the Arctic Sun is in Automatic Mode
- Ensure the water temperature is decreasing appropriately
  - If not, it could be inappropriate settings with minimum water temperature under Advanced Settings
- Check the patient temperature with another site
- Ensure the flow rate is a minimum of 2.3L/min
- Is the patient generating heat through shivering or an infectious process?
  - Treat accordingly

The patient temperature is not displayed on the screen

- Ensure that the patient temperature probe is connected into Temp Probe 1
- Confirm placement of temperature probe
- If using Foley temperature probe, check for adequate urine
- Ensure that the connection between the temperature probe and the cable is secure
- Ensure the connection is not wet

The screen is blank

- Ensure the device is plugged in to a working outlet
- Ensure the connections are secure between the remote display and the device

The patient is rewarming too quickly

- Ensure the device is in Automatic Mode
- Check the set-up to ensure the warming rate is set appropriately
- Review the water temperature and Patient Temperature Trend Indicator arrows- is the patient generating heat from shivering or a fever?
- Maintain the Arctic Sun in Automatic Mode- the water will decrease appropriately to slow down rewarming

The flow is below 2.3L/min

- Is a full pad kit (four pads) being used?
  - Are they appropriate size?
- Check all connections and ensure they are secure and not kinked
- Look for air bubbles to assess if a pad is damaged
  - Check for damaged pad by disconnecting one pad at a time and waiting one minute; if flow increases during disconnect, replace the damaged pad with Universal Pad
Case Studies

Case Study 1
A patient is admitted and the Arctic Sun is set to cool the patient to 33°C. The patient's starting temperature was 37.1°C, but is now 32.3°C (3 hours later). They medicated the patient at the beginning of therapy with a Versed drip. The patient started to shiver at 35.6°C so they gave a bolus of Vecuronium (neuromuscular blockade). Nothing else has changed with the patient's drug regime- he remains on low dose Vasopressin for BP control. What questions will you ask regarding the overshoot?

Case Study 2
A patient is admitted with a temperature of 39.8°C. The staff have been attempting to cool this patient for about two hours to a target temperature of 37°C, but the temperature has only dropped to 38.8°C. What could be the issue?

Case Study 3
A patient in your unit is being maintained at normothermia with the Arctic Sun. The patient's nurse calls you to the bedside because the screen has gone blank. What will you do to “diagnose” the problem?

Case Study 4
You are cooling a patient on the Arctic Sun to a target temperature of 33°C. After returning from lunch break, you find the water flow to have dropped to 1.7L/min. What could be the issue?

Case Study 5
A patient is being cooled on the Arctic Sun to normothermia. The patient returns from a CT Scan and as you walk by the room a half hour later, you notice the patient's temperature at 37.9°C. What is going on?

Case Study 6
One of your colleagues calls you over to her patient's bedside. She has started rewarming her patient at .25°C/hour but after 2 hours, her patient has already warmed a full degree. What could be the issue?
Arctic Sun® Temperature Management System In-service Checklist

PRESENTER   DATE

FACILITY

NAME

CITY   STATE

CONTENT:
Quick reference guide provided with Arctic Sun device

Principles of cooling

ArcticGel™ Pads
• Patented three layered construction
• One-time patient use
• Place on clean, dry, intact skin
• One set may be used up to 5 days (120 hrs)
• Latex-free and radiolucent, MRI friendly
• Use with defib pads
• Available in five sizes; 2.5-100 kg (5.5-220+ lbs)
• Small Universal pad may be used for patients >5kg

Pad Placement
• No overlap at posterior areas, keep spine open
• Keep all manifold connections anterior

Water Flow
• Ensure minimum of 2.3L/flow occurs with 4 pads
• Low flow states: Check for disconnection, kinks or leaks

Temperature Monitoring
• May use esophageal, bladder (Foley) nasopharyngeal or rectal probe with YSI 400 compatible connection
• Always ensure temperature cable is connected at “Temperature Probe 1” on back of device

Patient Transport
• PURGE pads prior to disconnection from device
• Leave device turned on in patient room during short interruptions of therapy

Arctic Sun Device
• Connections in rear of device
• On/Off switch
• Four Keys
• Automatic Mode: Use for all therapy
• Manual Mode: Needs constant temperature monitoring; not recommended for general use
• Purge: Utilized to empty pads prior to disconnection
• Stop: Pauses the therapy; must be pressed prior to utilizing menu screens
• Menu screens
• Patient Temperature Trend Indicator

Set Target Temperature
• Review of patient temperature display, target temperature and water temperature
• Monitoring patient for heat generation through water temperature and Patient Temperature Trend Indicator

Set Warming Rate
• Slow rewarming is possible utilizing the target temperature and time to rewarmed screens

Filling the device with sterile or distilled water

Discontinuation of therapy and cleaning device

Clinical Documentation
• Patient temperature and water temperature every 1-2 hours
• Presence of shivering every 1-2 hours
• Skin assessment every 4-6 hours
• Verification of temperature with another source every shift

24-hour helpline
Contact Medivance with questions or concerns at 866-840-9776 while a patient is receiving the therapy with the Arctic Sun

COMMENTS

MEDIVANCE REPRESENTATIVE (Name and Position):  

HOSPITAL REPRESENTATIVE (Name and Position):  

* This in-service training does not replace the need to read the Operators Manual for complete instructions.
### Competency Checklist

<table>
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<th>Competencies</th>
<th>Demonstrated</th>
<th>Trainer Initials</th>
<th>Comments</th>
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<tr>
<td>Identifies appropriate patients to be placed on the Arctic Sun device (as per hospital protocol)</td>
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<td>Verbalizes hospital-wide location of Arctic Sun device(s), pads, and thermistor probes</td>
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<tr>
<td>Verbalizes percent of Body Surface Area to be covered with ArcticGel Pads for appropriate temperature management</td>
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<td>Appropriately demonstrates/verbalizes the following when given height/weight of “patient”: • Choice of pad size • Skin integrity and condition • Pad placement and need for universal pad</td>
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<td>Demonstrates appropriate connection of ArcticGel Pads and temperature probe to the Arctic Sun device (include slaving to monitor, if appropriate)</td>
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<tr>
<td>Demonstrates programming of following: • Setting target temperature and initiating therapy to cool • Steps to rewarm patient • Steps to discontinue therapy and disconnect device from patient for transport • Location and definition of Trend indicator as well as importance in trending alterations</td>
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<tr>
<td>Demonstrates appropriate steps to refill water in Arctic Sun with appropriate solution</td>
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<tr>
<td>Verbalizes importance and frequency of checking skin every 4-6 hours and water temperature every 1 hour</td>
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</tbody>
</table>

Employee Name: __________________________________________________________ Unit: ________________
Employee Signature: _______________________________________________________________________
Trainer Name: __________________________________________ Date: __________________
Trainer Signature: ________________________________________________________________________
## Site of Temperature Probe Placement

### ADVANTAGES AND DISADVANTAGES

<table>
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<tr>
<th>Site</th>
<th>Level of Accuracy</th>
<th>Average time lab between site and gold standard</th>
<th>Specific Advantages, problems and limitations</th>
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</thead>
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<tr>
<td>Pulmonary Artery</td>
<td>High</td>
<td>NA Cannot be used with cooling devices</td>
<td>High precision and quick temperature registration. Complex insertion procedure required. Needs to be removed after 72-96 hours.</td>
</tr>
<tr>
<td>Esophagus</td>
<td>High</td>
<td>5 minutes (range 3-10)</td>
<td>Most quick and accurate reflection of gold standard. Moderate risk of downward dislocation to stomach; leading to an increase in time lag and slight drop in registered core temperature (13°C) which is unlikely to be noticed immediately (because the deviation from the “true” core will be relatively small). Can be prevented by precise insertion to a depth of 32-38cm. Potential interference of diagnostic/therapeutic procedures (transesophageal echocardiography, gastroscopy, insertion of gastric tubes/feeding probes, etc.) Occasionally problematic probe insertion procedure.</td>
</tr>
<tr>
<td>Bladder</td>
<td>Fair/High***</td>
<td>20 minutes (range 10-60)*</td>
<td>Fairly easy probe insertion procedure. Low risk of dislocation. Combination with procedure (catheter insertion) that needs to take place anyway. Long time lag. Readings affected by rate of diuresis (which may be low in some patients after cardiac arrest). Probe movement into saline-filled balloon at tip of catheter, affecting temperature readings.</td>
</tr>
<tr>
<td>Rectum</td>
<td>Fair/High***</td>
<td>15 minutes (range 10-40)**</td>
<td>Quick and easy probe insertion procedure. High risk of dislocation (but dislocation is likely to be noticed quickly because the difference with “true” core temperature is large). Relatively long time lag.</td>
</tr>
<tr>
<td>Tympanic Membrane</td>
<td>Moderate/Fair</td>
<td>10 minutes (range 5-5)</td>
<td>Quick and easy probe insertion procedure. High risk of dislocation (but dislocation is likely to be noticed quickly because the difference with “true” core temperature is large). Relatively long time lag.</td>
</tr>
<tr>
<td>Axilla, groin, other peripheral sites</td>
<td>Completely inaccurate</td>
<td>No correlation with gold standard</td>
<td>Should not be used to guide hypothermia treatment.</td>
</tr>
</tbody>
</table>

*In case of severe shock, oliguria etc.
**In case of severe shock
***Usually high in maintenance phase when temperature is stable

Provided by Kees Polderman, M.D. Ph.D.
Therapeutic Hypothermia Supply Cart

TOP SHELF
Cart restocking list
Hypothermia protocol
Glucometer and testing supplies

DRAWER 1
Syringes
Tubes for blood draws
Needles for blood draws
ABG kits

DRAWER 2
IV insertion kit
IV tubing
Piggyback tubing
PCA tubing
Lactated Ringers
Normal Saline

DRAWER 3
Arterial line insertion kit
Pressure tubing
3-way stop-cock
Normal Saline
Pressure bag
ABG kit

DRAWER 4
Suction tubing
Oral suction tube
Pulse oximeter probe
PICC line or Central line insertion kit
Multipurpose pads (pacer/defib)

DRAWER 5
Foley
Esophageal/rectal probes
Nasogatric tube
Doppler and gel

DRAWER 6
Arctic Sun backup temperature cable
ArcticGel pads X-Small
ArcticGel pads Small
ArcticGel pads Medium
ArcticGel pads Large
Universal pads
Always operate in Automatic Mode
1. Turn device on at back of machine
2. Connect pads
3. Connect temperature probe
4. While in STOP Mode, Press DOWN arrow once to reach “Target Temp-
   Automatic Mode.” If target is set at desired temp, skip to step #8
5. Press “Enter” to change value
6. Hold DOWN arrow until target temperature is displayed
   33.0°C
7. Press “Enter” to save value
8. Press “Automatic Mode” to begin cooling

First change Target Temp
1. Place device in STOP Mode
2. Press DOWN arrow once
3. Press “Enter” to change value
4. Hold UP arrow until rewarming target temp is displayed
5. Press “Enter” to save value

Then change Warming Rate
6. Press DOWN arrow once, see display “Warm MAX- Automatic Mode”
7. Press “Enter” to change
8. Hold DOWN arrow until desired rewarming rate is displayed
9. Press “Enter” to save value
10. Press “Automatic Mode” to begin rewarming

ALWAYS PURGE PRIOR TO DISCONNECTING PADS
## Troubleshooting: Observational Issues

<table>
<thead>
<tr>
<th>ALARM CODE NUMBERS</th>
<th>ISSUE</th>
<th>ACTION</th>
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</table>
| **03, 04, 05, 06** | Reservoir is empty or almost empty | - Purge pads if connected  
- Refill reservoir |
| **10, 23** | Low Temperature Alarm: In “Automatic Mode,” if the patient temperature is 32.0°C (89.6°F) and water temperature is below 32.0°C (89.6°F), an alarm condition will occur and the system will return to stop mode (Patient Temperature 1 or 2) | - System will stop. Press “Automatic Mode” and observe water temperature to see if it has started to increase  
- Verify patient temperature from another source  
- Turn system off  
- Restart the device in “Automatic Mode”  
- If water temperature does not rise in response to patient temperature, shut system off and call Medivance Service |
| **09, 11, 22, 24** | The Patient Temperature reading is either equal, greater or lesser than the user-defined value established in the custom settings menu (Patient Temperature 1 or 2) | - Check patient temperature  
- Cancel alert  
- If system stopped, alert will reappear  
- Adjust Patient Low or High Temperature Alert in the custom menu if desired |
| **08, 21** | High Temperature Alarm: In “Automatic Mode,” if the patient temperature is 38.0°C (100.4°F) and water temperature is greater than 38.0°C (100.4°F), an alarm condition will occur and return to stop mode (Patient Temperature 1 or 2) | - System will stop. Press “Automatic Mode” and observe water temperature to see if the water temperature has started to decrease  
- Verify patient temperature from another source  
- Check that the vents on the side of the machine are not blocked  
- Turn system off  
- Restart the device in “Automatic Mode”  
- If water temperature does not decrease in response to patient temperature, shut system off and call Medivance Service |
| **13, 26** | Low Temperature Alarm: In “Manual Mode,” if the patient temperature is 32.0°C (89.6°F) and water temperature is below 32.0°C (89.6°F) (Patient Temperature 1 or 2) | - Verify patient temperature from another source  
- Increase Water Target Temperature |
| **14–20; 50, 51** | Temperature on display changes significantly within seconds OR patient temperature is not displayed on the screen | - Check the connection between the patient temperature probe and the temperature cable attached to the device  
- Ensure that the connection between the temperature probe and cable is thoroughly dry. If wet, replace cable  
- Check for secure placement of the probe  
- Replace temperature probe if necessary  
- If using Foley probe, ensure it is straight and retrograde urine flow is not occurring  
- Confirm patient temperature from second source  
- Ensure probe and cable are connected to Patient Temperature 1 and NOT Patient Temperature 2 input  
- If patient temperature is out of range, three dashes (---) will appear on the screen. [Patient temperature ranges are 10-42°C (50-107.6°F)]  
- Contact Medivance Service if alarm persists |
| **25, 12** | High Temperature Alert: In “Automatic Mode,” if the patient temperature is 38.0°C (100.4°F) and water temperature is greater than patient temperature (Patient Temperature 1 or 2) | - Verify patient temperature from another source  
- Decrease Water Target Temperature |
| **52, 53** | Cold Water Exposure Alert: In “Automatic or Manual Mode,” if the water temperature has remained below 10°C (50°F) for 8 of 10 hours of consecutive treatment, alert will occur every 4 hours until water temperature rises above 10°C (50°F) | - Cancel alert  
- Follow the decision tree  
- Consider discontinuation of treatment |
| **10, 23** | Low Temperature Alarm: In “Manual Mode,” if the patient temperature is 32.0°C (89.6°F) and water temperature is below 32.0°C (89.6°F) (Patient Temperature 1 or 2) | - Verify patient temperature from another source  
- Increase Water Target Temperature |
| **21** | Cold Water Exposure Alert: In “Automatic or Manual Mode,” if ten (10) cold water alerts have occurred since treatment began and water temperature has remained below 10°C (50°F) for 4 hours since the last alert, an alarm will occur and the system will return to STOP Mode | - System will stop. Follow decision tree  
- Consider discontinuation of treatment |
| **03, 04, 05, 06** | Reservoir is empty or almost empty | - Purge pads if connected  
- Refill reservoir |
| **10, 23** | Low Temperature Alarm: In “Automatic Mode,” if the patient temperature is 32.0°C (89.6°F) and water temperature is below 32.0°C (89.6°F) (Patient Temperature 1 or 2) | - Verify patient temperature from another source  
- Increase Water Target Temperature |

### Issue: When cooling in “Automatic Mode,” water temperature begins to increase prior to reaching the target

**Action:**
- As the patient’s temperature decreases, the control algorithm will increase the water temperature to bring the patient to target with minimal overshoot. Water temperature increases or decreases to reach and maintain target

### Issue: When warming in “Automatic Mode,” water temperature begins to decrease prior to reaching the target

**Action:**
- As the patient’s temperature increases, the control algorithm will decrease the water temperature to bring the patient to target with minimal overshoot. Water temperature increases or decreases to reach and maintain target

---

**Medivance**

Committed to Restoring Life™
1. Choose appropriate size pads for patient.
   (See pad sizing chart)
2. Apply pads to clean dry intact skin
3. Roll the patient on his/her side
4. Align the first back pad parallel to the spine and wrap around the front of the abdomen (A & B)
5. Ensure that the curve of the pad is at least 2 inches below the underarm to allow proper range of motion. Keep breasts and skin folds clear of the pad edge
6. Wrap the appropriate (right or left) leg pad around the thigh (C)
7. Make sure the pad line is anterior and that it is pointed toward the foot of the bed and the pads are placed on the correct sides (right and left) (femoral access should be exposed)
8. Turn the patient and repeat

Connect patient pad lines to the fluid delivery line from the Arctic Sun

1. Connect each pad line to the receptor below on the manifold block shown
2. Fit connectors white side to white side, blue side to blue side
3. Passively insert connectors—do not touch fins during insertion

Terminate procedure

1. Press Purge Key to empty water from pads
2. Once purge complete message is displayed, squeeze or pinch fins, push, and then pull to remove pad connections from manifold block
3. Remove pads, discard, check fluid level of reservoir, then turn off Arctic Sun
Pad Sizing Chart

Women’s Sizes

Men’s Sizes

Universal Pad patients >100 kg
Small Universal Pad patients >2.5 kg
Set-Up
Verify that all custom parameters and patient set-up are correct:
• Patient target temperature is set
• “Automatic Mode” is activated
• “Automatic Mode”—minimum and maximum water temperature are set to the correct limits
• Time to target (cool and warm) is set to MAX
• A full set of (4) ArcticGel Pads of the appropriate size for the patient are being used and are well-adhered to the patient

System Performance
Verify, and if necessary, correct the following parameters:
• Water flow rate is greater than or equal to 2.3 L/min after at least 1 hour of continuous use (For flow rate troubleshooting, refer to the Arctic Sun Operator’s Manual, Section 5.3)
• The patient temperature probe is properly placed and is providing an accurate and stable temperature

Shivering Control
If the device set-up and technical performance is correct and Patient Target Temperature is still not reached and/or water temperature remains below 10°C (50°F), then the patient is generating excessive heat, most likely from shivering (which may or may not be visible):
• Administer additional medication for shivering control, adequate for the patient weight and magnitude of shivering
• Evaluate patient response to medication

Clinical Decisions
If all of the above considerations have been addressed and the patient still has not reached target temperature and/or the water temperature remains below 10°C (50°F), exposure of the skin to low water temperatures for an extended period of time may increase the risk of skin injury. The physician and nursing staff must determine whether:
• Minimum water temperature should be increased
• Lowest patient temperature achieved becomes the new target temperature
• Cooling therapy should be discontinued

Decision Tree for Optimal Patient Temperature Management
Follow this decision tree if:
• Patient has been cooled continuously for over 4 hours and has NOT reached target temperature or
• Water temperature has been below 10°C (50°F) for greater than 8 continuous hours or
• The cold water exposure alert appears (software version 3.05 and higher)
Documentation

Arctic Sun documentation should include the following:

**Initial:**
- Time of application and initiation of therapy
- Size of pads
- Target temp
- Probe type
- Patient’s current core temperature
- Mode of operation
- Integrity of patient’s skin

**Follow-up documentation**

Q 1-2 hours:
- Patient’s temperature
- Water temperature
- Presence of shivering

Q 4-6 hours/per hospital guidelines:
- Integrity of patient’s skin
- Administration of shivering meds and patient’s response
- Patient’s temperature from another source
- Time patient reaches target temperature
- Disconnection/interruption of therapy for any reason
- Time therapy is resumed

**Sample documentation chart:**

Initiation of rewarming:
- New target temperature
- Rate of rewarming as it appears on rewarming screen
- Patient’s temperature
- Mode of operation
- Water temperature

<table>
<thead>
<tr>
<th>ARCTIC SUN Patient Temperature Management Documentation</th>
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<tbody>
<tr>
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<tr>
<td>Time</td>
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¹ If Patient has been cooled continuously for over 4 hours and has NOT reached target temperature, refer to decision tree on reverse.

² If water temperature has been below 10ºC (50ºF) for greater than 8 continuous hours, refer to decision tree on reverse.

³ Shivering must be addressed. If shivering is present, consult with attending physician for additional shivering control orders.
Using the Helpline

In order to accurately provide assistance over the phone, the clinical resource will need current information relative to patient status, and Arctic Sun specifics (see examples below). This may require the caller to be in front of the Arctic Sun to respond to questions that will help with the trouble-shooting procedures. Knowing that this can be a stressful time due to the patient’s condition and intense clinical scenario, we appreciate your patience. Our clinical staff take calls 24/7 for the US and Canada and are committed to providing safe, effective therapeutic temperature management.

<table>
<thead>
<tr>
<th>Patient-related questions:</th>
<th>Arctic Sun-related questions:</th>
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<tr>
<td>Current core temperature</td>
<td>Type of temp probe</td>
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<td>Target Temp, Water Temp,</td>
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<td>Administered Medications</td>
<td>Flow Rate</td>
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<tr>
<td>Protocol specifics</td>
<td>Number &amp; Size of ArcticGel pads</td>
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<td>Hemodynamic Status</td>
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## Conversion and Pad Weight Charts

### ArcticGel Pad Weights

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<th></th>
<th>317-05 (Small)</th>
<th>317-07 (Medium)</th>
<th>317-09 (Large)</th>
<th>317-00 (Universal)</th>
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<tr>
<td>Empty</td>
<td>3.1 lbs 1.41 kg</td>
<td>3.2 lbs 1.46 kg</td>
<td>3.6 lbs 1.6 kg</td>
<td>0.5 lbs 0.24 kg</td>
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<td>With water</td>
<td>4.6 lbs 2.07 kg</td>
<td>4.7 lbs 2.15 kg</td>
<td>5.3 lbs 2.39 kg</td>
<td>0.8 lbs 0.35 kg</td>
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### °C to °F Conversion Table

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\[ C \times 1.8 + 32 = °F \text{ or } (°F - 32) \times .555 = °C \]
Filling the Reservoir

- Purge and disconnect the ArcticGel Pads
- Use sterile or distilled water only
- Place fill tube located on back of device into water supply
- Scroll menu to “Fill Screen” and follow instructions
- For complete instructions, consult the Operator’s Manual, Section 3

Refer to the Operator’s Manual for complete instructions for using the Arctic Sun 2000
Frequently Asked Questions

ArcticGel PADS

Do I have to use all four pads?
Yes, a complete ArcticGel pad kit should be used to provide adequate coverage.

If a patient has an AKA, do I need to use all four pads?
For above the knee amputees, use the two torso pads, and one or both of the leg pads.

Do I have to change the pads every five days?
Yes, the water content of the hydrogel affects the pad's adhesion to the skin and conductivity, and therefore, the efficiency of controlling patient temperature. Periodically check that pads remain moist and adherent. Replace pads when the hydrogel no longer uniformly adheres to the skin. Replacing pads at least every 5 days is recommended.

Can I ever re-use the pads on a different patient?
No, the pads are single patient use.

Do I have to wash a patient before I apply the pads?
No, however the ArcticGel Pads need to be placed on clean, dry intact skin. Otherwise, the hydrogel will absorb water from the skin and lose its adhesive properties.

Do I have to remove the pads daily to wash a patient underneath the pads?
• Hydrogel provides a physiologically balanced environment so washing under the pads daily is not necessary.
• The skin under the pads should be inspected as per normal nursing routine.

What about placing ArcticGel Pads on friable skin (i.e. skin tears, ascitis, and edematous areas)?
• It is important to place the ArcticGel Pads on intact skin.
• Hydrogel is biocompatible and when used per the Manufacturer's recommendations, will not pull hair or skin.
• Hydrogel is clean, but not sterile; therefore it should not be placed on open wounds.
• It is important to continue to check the skin under the ArcticGel Pads frequently (i.e. every 4-6 hours or per your hospital's protocol).

Will the ArcticGel Pads interfere with defibrillation pads or paddle placement?
• A small amount of body surface area will be sacrificed with the multipurpose or pacemaker pads in place, but should not affect clinical care.
• Always place the defibrillator pads directly on the patient's skin, with the ArcticGel Pads on top.

What if the patient sweats?
• Hydrogel can absorb normal moisture loss from the skin.
• The cool water running through the pads should minimize the diaphoresis.
• It is important to dry the patient thoroughly before applying the ArcticGel Pads.

What about chest tube or G-tube dressings?
• Fold the corresponding pad flap away from the area or utilize a strip of the white liner provided to cover the area of hydrogel above the dressing. This will minimize adherence to the dressing.
• The tubing can then be placed between the two pad flaps.

What if the patient has an abdominal incision?
• Fold the pads away from the incision edges, leaving the incision area uncovered.
• The ArcticGel Pads must be placed on intact skin.

What if the patient has stool incontinence?
• If the outer foam portion of the ArcticGel Pads becomes soiled, it can be cleansed with soap and water.
• If the hydrogel becomes soiled, the pad will need replacement (you may substitute a universal pad for a thigh pad to complete the cooling procedure, if necessary).
TEMPERATURE MONITORING

When I first connected the Foley probe to the Arctic Sun controller, the temperature read-out was quite low. Why?

- It takes a few minutes for the Foley thermistor to acclimate to the patient’s body temperature— it will be cool coming out of the package.
- It is not unusual to see small increases in the temperature reading as late as 15 minutes after Foley placement while the thermistor reading stabilizes. In this situation, this is not an indication of temperature spike or shivering. The Arctic Sun will not begin the cooling process until it recognizes a stable patient temperature.

If the Foley probes require a minimum amount of urine flow for accuracy, will there be an issue if a patient has low urine output post-code?

- Hypothermia usually causes diuresis, so you should see an increase in urine output. However, if the urine output drops below 30cc/hour, please check with the manufacturer to find out the minimum flow rate required for accurate readings.
- Some institutions will utilize a bladder infusion to assist with bladder temperatures; however it is important to keep in mind that the temperature accuracy may be impacted by this practice.
- The accuracy of a bladder probe is dependent on urine output. Continue to monitor output guidelines from the bladder probe manufacturer to obtain an accurate temperature reading.

There is a metal filament in the Foley probe or rectal probe—does this cause an issue in the MRI suite?

- Written documentation is available regarding the Foley probes made by Smith/Level 1 utilized by Medivance indicating they are MRI-safe.¹
- For other Foley probes, please check with the manufacturer for MRI compatibility information.²
- The Arctic Sun In cable and the rectal probes offered through Medivance are not MRI safe, and need to be removed prior to the procedure. Please check with the manufacturer for MRI compatibility information.

Can you control the Arctic Sun from a PA line (Swan-Ganz) with a thermistor port or a Licox catheter?

No, the Arctic Sun accommodates YSI-400 compatible probes. Typically, the PA line does not match this interface requirement.

What kind of temperature probe connections can the probe adapter cable accept?

- A phono jack connector (Bard) and/or a double prong connector (Nellcor).

We don’t use Centigrade/Celsius. Can the device be set to Fahrenheit?

- Yes. Go to Advanced Settings to change.
- A Fahrenheit/Celsius conversion chart is attached to the device.

PATIENT MANAGEMENT

What if the patient is on a specialty bed for pressure ulcer prevention?

- The Arctic Sun is compatible with all specialty beds.
- The ArcticGel Pads must be placed on intact skin only.

The patient target is set for 34°C, the patient is now at 33.6°C. What should I do?

- Continue to operate the device in Automatic Mode, monitor and document the patient temperature and water temperature every hour.
- The Arctic Sun is constantly monitoring changes in the patient’s temperature and will automatically react by appropriately adjusting the water temperature to bring the patient to the target temperature.
- Some factors that may lead to overshoot include: late initiation of sedation; changes in sedation; administration of vasoactive medications and hemodynamic variability.

What do I need to know about use of the Arctic Sun with vasopressors?

- Hypothermia and vasopressors both cause vasoconstriction and will decrease blood flow to the periphery, therefore concomitant use should be done cautiously.
- Cutaneous vasoconstriction will occur through arteriovenous shunts in the hands and feet in response to periods of hypothermia or when cold is applied to the skin. However, this flow is separate from capillary flow and therefore should not interrupt skin perfusion.³
- Multiple vasopressors can lead to disproportionate cutaneous vasoconstriction and hence, reversible skin mottling and erythema.⁴
If the water is getting cold: Could the patient get freezer burns?
• The coldest the water goes is 4°C, which is not freezing.
• The coldest the water temperature reaches with the Arctic Sun is 4°C, which is above freezing.
• When exposed to cold temperatures, the skin vasoconstricts, however it does not shut down microcirculation or capillary flow.

What would cause the water temperature to stay below 10°C?
• When a patient suffers from a hypothalamic injury, heat may be generated in an attempt to increase the patient's actual temperature to the new set point. The water temperature automatically adjusts to maintain target temperature. If the injury is extensive, the water temperature can be maintained less than 10°C for an extended period of time.
• Shivering increases metabolism and generates heat. Prolonged shivering may cause extended decreases in water temperature.
• A fever from an infectious source will lead to heat generation and a decrease in the Arctic Sun’s water temperature.

If this therapy masks temperature spikes, how can we detect if the patient is having a fever related to infection? When should we collect blood cultures?
After a successful period of treatment, the patient temperature should arrive in a thermo neutral zone. A drop in Arctic Sun water temperature is indicative of heat generation by the patient. Record the Arctic Sun water temperature when you record the patient’s temperature hourly. The patient is generating heat when the water temperature is low. It means the Arctic Sun is working hard to keep the patient cool. Assess for risk and symptoms of infection including indicative lab values. Collect blood cultures if infection is suspected.

When is it appropriate to use a target of 32°C?
If the practitioner would like to cool the patient to 32°C, the Arctic Sun software (version 4.0 or later) can accommodate temperature ranges from 32°C-38.5°C (89.6°F-101.3°F). The “advanced setting” menu needs to be set to “Strategy 3” - contact a Medivance representative to assist with this process. The utilization of esophageal probes is recommended to decrease the incidence of overshoot.

When is it appropriate to use a target above 37°C?
• Some physicians may desire to cool a patient, but would like to set the target slightly above normothermia to decrease the incidence of shivering.

SHIVERING

Will my patient shiver?
• Physiologic cooling may cause shivering when the shivering threshold is crossed, independent of the therapy utilized. In patients with a hypothalamic injury, all set points may be increased including the shivering threshold, therefore cooling the patient to normothermia may cause shivering. In hypothermia induction, the shivering threshold is always crossed, therefore it is important to be proactive and treat shivering aggressively.
• Not all patients will shiver when treating fever, however prepare for shivering before you cool the patient.

When recording the Arctic Sun water temperature if there is a sudden drop in water temperature how can I tell the difference between a fever spike and shivering?
• When a patient is generating heat, nursing and medical judgment are required to discern the difference between a fever spike and shivering.
  - Observe the patient’s risk for infection. Look for signs of infection and address it accordingly.
  - Assess if the patient is shivering. When patients cool, they will drop down to their shivering threshold. Shivering will need to be controlled during the induction phase and throughout the cooling process. To rule out shivering, ask the following questions: When did the patient receive their last dose of medication to control shivering? Are your limb leads picking up extra electromechanical activity? Is the mandible, or pectoralis muscles vassiculating? Have the arrows on the “trend Indicator” changed? If you can answer yes to any of the above consider addressing shivering control.
ARCTIC SUN DEVICE

Is there battery back up?
• There is no battery back up. The Arctic Sun can be turned off and moved to other areas of the hospital. Remember to reset the prescribed settings when re-initiating your cooling procedure and to purge the pads prior to disconnecting.
• When the device is turned off, your settings will not be saved.
• It is important to note that when the device is stopped and restarted, the patient temperature control algorithm is restarted. Therefore, water temperature may fluctuate for a short time.

How do I keep bacteria from growing in the reservoir?
• The reservoir is instilled with an antimicrobial/antifungal cleaning agent. To avoid the agent from becoming diluted with ongoing refills, each pad contains a small amount of the agent and replenishes the circuit every time it is used on a patient.
• If your hospital owns the Arctic Sun, your Biomed department should drain and re-fill the reservoir with sterile or distilled water and an antimicrobial/antifungal agent every 3 months to reestablish proper concentration.

How do I keep microorganisms from growing in the fill tube?
• The fill tube is automatically cleared after each fill cycle.

How do I end a procedure?
• Purge the ArcticGel Pads, and then carefully remove them from the patient’s skin, avoiding aggressive removal of the pad.
• Discard the used pads in accordance with hospital procedure.
• Wipe the fluid delivery line and console down with a hospital approved disinfectant.

REFERENCES
1. Letter from Smiths Medical ASD, Inc. 12/05
Clinical Resource
PROGRAM MANUAL

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Patent #6,197,045
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