

## CritiCool™ Device for Infants in Newborn Intensive Care Unit (NICU)

### Guideline Responsibilities and Authorisation

<b>Department Responsible for Guideline</b>	NICU
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### Guideline Review History

Version	Updated by	Date Updated	Summary of Changes
3	Natali Ollington	June 2018	3 year update
2	Joyce Mok	April 2014	3 yearly update
1	Leanne Baker	Nov 2011	New version

## CritiCool™ Device for Infants in Newborn Intensive Care Unit (NICU)

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## CritiCool™ Device for Infants in Newborn Intensive Care Unit (NICU)

### 1 Overview

#### 1.1 Purpose

To ensure the CritiCool™ device is used safely to provide whole body therapeutic hypothermia to improve long-term outcomes in infants having evidence of both asphyxia and moderate to severe encephalopathy.

#### 1.2 Scope

Waikato DHB staff working in NICU

#### 1.3 Patient

Neonates

#### 1.4 Definitions

<b>BRAINZ monitor</b>	BRAINZ Monitor provides real time monitoring of brain function to assist with earlier diagnosis and treatment, and may assist in predicting outcomes.
<b>CritiCool™</b>	CritiCool™ is a temperature regulating systems, induces, maintains, and reverses hypothermia in an effective and precise manner. The system is composed of two elements, the CritiCool™ device, and the CureWrap™.
<b>CritiCool™ device</b>	The device functions as a control unit constantly monitoring the baby's core temperature and as a cooling/rewarming device which brings the circulating water to the required temperature by using its on-board body temperature control algorithm.
<b>CureWrap™</b>	This is a flexible 3-dimensional single piece design, through which the water circulates. It is designed to be in close contact with a large area of the body, thus allowing optimization of energy transfer.
<b>Hypoxic Ischaemic Encephalopathy (HIE)</b>	HIE in term infant is a result of an acute shortage of oxygen and blood flow in the perinatal period resulting in depression at birth and ongoing encephalopathy.
<b>CPAP</b>	Continuous positive airway pressure
<b>aEEG</b>	Amplitude-integrated electroencephalography (aEEG) is a method for continuous monitoring of brain activity. In its simplest form, aEEG is a processed single-channel electroencephalogram that is filtered and time-compressed.

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### 2 Clinical Management

#### 2.1 Competency required

- Registered nurse who has completed Level 3 CPAP and/or ventilator orientation.

#### 2.2 Equipment

- CritiCool™ device (in store room) with grey and green cables and 2 x water hoses (hoses for filling and emptying water)



- Cables and water hoses – NOT DISPOSABLE
- Bubble wrap: small piece for under head (in store room)
- Cooling wrap: CritiCool™ Infant CureWrap™ - 2 sizes available: < 4kg and 4-7kg (in store room)
- Access to 6L cold tap water (e.g. technician's workshop, gas room)
- Funnel + tubing + plastic measuring jug
- Rectal temperature probe – blue rectal probe is disposable (in store room)
- Skin (surface) probe cover
- Water-out connector, if none available, you can cut one (with a clamp) off used Cure Wrap

#### 2.3 Guideline

##### 2.3.1 Set up for whole body cooling:

##### 1. Preparing CritiCool™ Device

- Check treatment is prescribed.
- Fill reservoir in gas room/technician's workshop with 6 litres of cold tap water to level between two red lines.
- Assemble equipment at infant bedside.
- Ensure unit is plugged into blue UPS power, leave hoses and sensors disconnected from infant.
- Turn power on (power switch at back of machine).

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### 2. Setting up temperature on CritiCool™

- Wait until CritiCool™ self-test completed.
- Once self-test done unit will automatically default to cooling operational mode, panel will display a snowflake icon with temp set to 33°C.
- Manually adjust temp to 33.5°C.

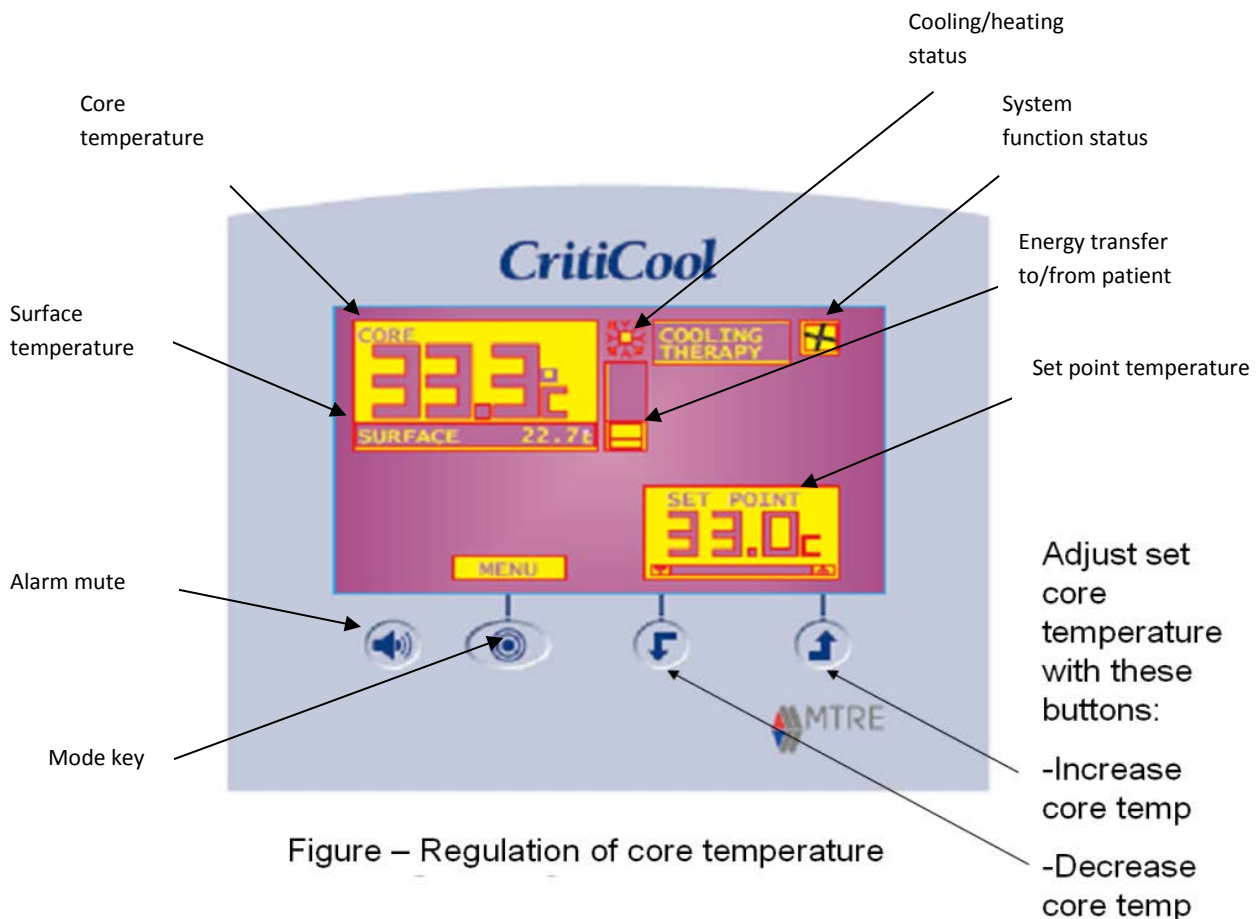


Figure – Regulation of core temperature

### 3. Preparing infant for cooling

- Turn off radiant warmer.
- Lay baby on unfilled cooling wrap.
- Do not secure cooling wrap around baby while empty because it will expand after filling, increase the risk of circulatory compromise if already fitted and becomes tight following filling.
- Ensure no folds or bends present that may occlude water flow or cause pressure areas.
- Hoses should exit wrap at infant head end.
- Place nappy on baby, urinary catheter may be insitu for some babies.

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### 4. Applying temperature probes

- Insert rectal temperature probe to approximately 5cm, secure to inner thigh of infant and plug into cooling unit *via grey sensor* to provide continuous core temperature monitoring during therapy – unit will adjust function to maintain infant temperature at set level.



Plug connect to grey sensor

Blue smooth end of probe inserted into baby's rectum

- Secure skin temperature probe to baby's skin **outside of the CureWrap™**, e.g. **upper chest / arm / leg** and connect to device *via green sensor*.

### 5. Filling cooling wrap

- Attach blue hoses to cooling unit and to cooling wrap.
- Open clamps – cooling wrap will automatically fill and a clicking sound should be heard.
- Check cooling wrap for signs of leakage during filling, and replace if leaking.

### 6. Securing cooling wrap

- Wrap and secure the filled Infant CureWrap™ around infant.
- Place a piece of bubble wrap under and around head where wrap is touching skin because it helps maintain consistent head temperature during periods when cooling wrap temperature is fluctuating.
- Do not use hats.
- Circulation is confirmed when the "flow icon" (top right of display is turning).
- Ensure you have core and surface temperature readings. The infant's temperature should now be managed by the CritiCool™.

#### Special notes:

1. If baby using BRAINZ monitor with needle electrodes, ensure electrodes adequately covered or consider using gel electrodes.
2. Be aware that needle electrodes can pierce cooling wrap if dislodged.
3. Do not use cooling wrap to lift or move baby.
4. Make sure cooling wrap is not folded or clamped.
5. Avoid handling cooling wrap with sharp objects.

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### 2.3.2 Observations during treatment

#### 1. Continuous monitoring of infant

- Monitor continuously and document hourly according to Waikato DHB Clinical management NICU Nursing Procedure: *Admission to Level 3 intensive care nursery (4571)*.

In addition:

- Rectal temperature and skin temperature
- Axilla temperature 4 hourly
- Heart rate (HR), respirations, pulse oximetry, blood pressure, invasive blood pressure monitoring if possible
- HR alarms may need to be adjusted if HR slows during hypothermia: discuss with medical staff because heart rate may reduce during cooling as a normal physiological response as metabolism and activity slows
- aEEG monitoring

#### 2. Assessment of infant

- Assess pain & sedation score and sedation management is appropriate, according to Waikato DHB Clinical management NICU Nursing guideline: *Neonatal pain and sedation: Assessment and nursing management (1684)*.
- Report any difficulty in maintaining temperature at 33.5°C to ensure infant receives optimum therapy benefit.
- Document recordings and report deviations to prescribed parameters.
- Monitor skin integrity during cares and positioning to identify any compromised perfusion.

#### 3. Medical review

Infant undergoing cooling should have a review by Registrar/Nurse Practitioner/Nurse Specialist if there is:

- Difficulty in maintaining core temperature between 33.5-34°C throughout the 72hr cooling period.
- Persistent bradycardia <75bpm or abnormal rhythm – may need increase temperature.
- Persistent hypoxaemia despite appropriate support – may need increase temperature.
- Persistent hypotension despite appropriate management – may need increase temperature.
- Break-through seizures on re-warming – may need to prolong cooling (to be discussed with on-call Neonatologist).

#### 4. Observations on cooling equipment

- Monitor water level in CritiCool™ device – needs to remain between the two red marks in water level indicator.
- Ensure no kinking in the water tubes that may occlude water flow or folds and bends in CureWrap™ that cause pressure areas.

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### 2.3.3 Rewarming

#### 1. Prescriptions

- Start 72 hours after commencing hypothermia (not after delivery) unless specified by on-call Neonatologist.
- Medical staff chart start time on Daily Treatment Sheet (T1481HWF)
- Re-warming should be gradual.

#### 2. Re-warming

- Leave cooling wrap and bubble wrap in place.
- Increase set temperature manually by 0.1°C every 20 minutes to re-warm slowly, i.e. warming rate of 0.3°C/hr.

#### Special notes:

- Re-warming should take approximately 6-10 hours. Slow rewarming is necessary to avoid peripheral vasodilation and blood pressure instability.
- Do not use automatic warming programme as this warms the baby faster than recommended.

#### 3. Observe for seizures and temperature instability

- Monitor continuously and document hourly infant's vital signs, according to Waikato DHB Clinical management NICU Nursing Procedure - *Admission to Level 3 intensive care nursery (4571)*.
- Observe for seizure activity during re-warming.
- Report seizure activity to medical staff immediately because infant may need to be re-cooled.
- Monitor temperature after normothermia is achieved to avoid hyperthermia (>37°C).
- Assess pain & sedation score and sedation management is appropriate.

#### 4. On completion of re-warming

- Remove cooling wrap when core temperature reaches 36.5°C.
- Turn off CritiCool™ or switch to standby.
- Wait a few seconds then close cooling wrap clamps to stop water leaking from wrap once disconnected.
- Disconnect water tubes from cooling wrap.
- Unwrap baby.
- Discard wrap.
- Disconnect hoses.
- Disconnect core temperature and surface temperature sensors.
- Disconnect cables from cooling wrap and CritiCool™ device.

**NB: the hoses and cable of CritiCool™ device are not disposable.**

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- Turn radiant warmer on to “Baby Mode” to ensure infant stays within normothermic range.
- Allow time for core temperature to stabilise and maintain.
- Connect rectal probe to Phillips™ monitor.
- Remove rectal probe once temperature is stable at 37°C.
- Discard short blue rectal temp probe.

### 5. Emptying water after use

- Empty water – use hose labelled water out (under grey sensor cable).
- Position hose over bucket/sink.
- Plug in the water-out coupling connector (in plastic bag in basket attached to unit).  
**Note:** Water-out connector: if none available, you can cut one (with a clamp) off from the used CureWrap™.
- Turn unit on and water will automatically drain.

### 6. Cleaning of CritiCool™: Nurses' responsibility

- Clean with Tuffie wipes the CritiCool™ device after use, including the basket, cooling hoses, cables and sensor cables
- Restock basket with
  - cooling wrap
  - bubble wrap
  - rectal temperature probe
  - probe cover
  - water-out connector
- Put the CritiCool™ device + accessories in store room ready for next use.

## 2.4 Potential complications

- Bradycardia
- Potential for pulmonary hypertension
- Potential increase in BP support
- Potential disturbance of coagulation cascade

## 2.5 Audit

- Indicators – CritiCool™ device has the label “Safety tested to required NZ standards for use on medical equipment only”

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### 3 Evidence base

#### 3.1 References

- Auckland DHB (2014). Criticool cooling device set up and management. *National Women's Newborn Services Clinical Guideline*. Retrieved August 27, 2018 from <http://www.adhb.govt.nz/newborn/Guidelines/Neurology/CriticooolDevice.htm>
- BeBop East of England Perinatal Networks (2012). *Management of suspected HIE guideline, appendix 5*. Retrieved January 16, 2015 from <http://bebop.nhs.uk/wp-content/uploads/Eastern-EoEHIE-Guidelinev1.2.pdf>.
- MTRE (2016). *CritiCool® User Manual*. Retrieved on August 27, 2018 from <http://mtre.com/wp-content/uploads/2016/08/DDT136000-Rev-L.-CritiCool-6.1-User-Manual-June-2016-WEB.pdf>
- Staffordshire, Shropshire and Black Country Neonatal Operational Delivery Network and Southern West Midlands Neonatal Operational Delivery Network (2018). Hypoxic ischaemic encephalopathy (HIE). *Neonatal Guidelines 2017-19* (7th Ed.), p168-171. Retrieved on August 27, 2019 from <https://www.networks.nhs.uk/nhs-networks/staffordshire-shropshire-and-black-country-newborn/neonatal-guidelines>

#### 3.2 Associated Waikato DHB Documents

- Waikato DHB NICU Medical Protocol: Hypoxic Ischaemic Encephalopathy Protocol (1588)
- Waikato DHB NICU Nursing Procedure: Admission to Level 3 intensive care nursery in NICU (4571)
- Waikato DHB NICU Nursing Guideline: Neonatal pain and sedation: Assessment and nursing management in NICU (1684).

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