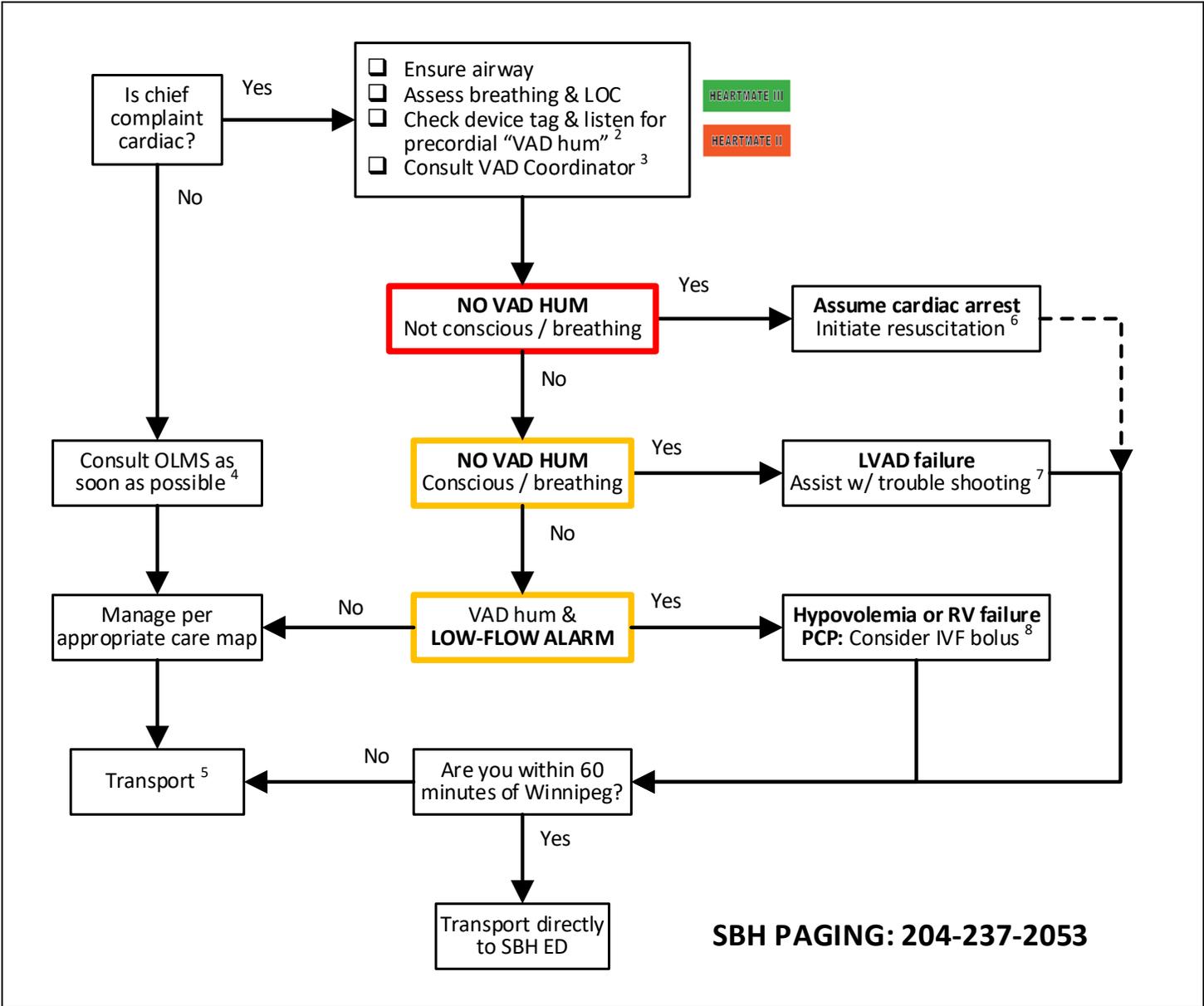


	C08 - LEFT VENTRICULAR ASSIST DEVICE (LVAD)	
	All ages	RESUSCITATION
Version date: 2023-11-18		Effective date: 2024-02-13 (0700)



IDENTIFIER:	EMR: EMR only	PCP: PCP & ICP	ICP: ICP only	None - All providers
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INDICATIONS

- All patients with a left ventricular assist device (LVAD) regardless of the chief complaint

CONTRAINDICATIONS

- Not applicable

NOTES

1. LVAD technical problems are rare. Major clinical conditions affecting LVAD patients include bleeding, sepsis and stroke.

Patients and their caregivers are well-trained in VAD trouble-shooting and management, and will likely have contacted the VAD Coordinator or on- cardiologist before calling 911.
2. The St. Boniface Hospital - Cardiac Sciences Program currently uses the Abbot Heartmate III (green tag) ventricular assist device. Paramedics may occasionally encounter a patient with an older Heartmate II (orange tag) unit.
A “humming” or “whirling” sound (heard best in the precordium) indicates that the pump is functioning.

Both devices have continuous flow pumps so you may not be able to feel a pulse. It may be difficult to measure the blood pressure (BP) with a manual cuff. Use a non-invasive BP machine to monitor the mean arterial pressure (MAP). A MAP of 70 to 90 mmHg is adequate for most patients.

A low pulse oximetry reading may reflect inadequate peripheral perfusion, rather than hypoxemia. A normal pulse oximetry waveform is likely to be accurate.
3. If the chief complaint is cardiac, consult the **VAD coordinator** first through the St. Boniface Hospital (SBH) paging operator at **204-237-2053**. They can provide support and direction regarding the device itself.
4. If the chief complaint is not cardiac, consult on-line medical support (OLMS) first. They may subsequently refer you to the VAD coordinator if necessary.
5. If you are within 60 minutes of Winnipeg proceed directly to the SBH emergency department (ED). If you are beyond 60 minutes, you must consult OLMS for destination decision-support.
6. It may be difficult to differentiate an extremely low perfusion from a true cardiac arrest. If a patient is not conscious and / or breathing and there is no VAD hum, assume the patient is in cardiac arrest and initiate resuscitation.

Chest compressions can be safely done if necessary. Patients can be defibrillated or paced while attached to the VAD. All resuscitation drugs can be administered if indicated. The pump will not affect electrocardiogram acquisition or continuous cardiac monitoring. **DO NOT DISCONTINUE RESUSCITATION BEFORE CONSULTING OLMS.**
7. The absence of a VAD hum indicates that the LVAD is not pumping. A stable patient may rapidly go into acute heart failure, pulmonary edema, or cardiogenic shock. Assist the patient or caregiver with device trouble-shooting and management (refer to appendix A). Trouble shooting includes the following steps:
 - Checking & securing all connections to the controller.
 - Replacing the batteries one at a time or connecting to the power base unit. Never remove both batteries at the same time as this may cause the pump to stop.

- Changing the controller. Paramedics will only change the controller under the direction of the patient, their caregiver or the VAD coordinator.
8. If the “red heart” alarm on the Heartmate III is flashing (appendix A, page 5) it indicates that the flow may be too low and the patient may be hypovolemic or have right heart failure. If the chest is clear consider administering intravenous fluid by bolus (5 to 10 ml/kg). Reassess after administration and repeat once if indicated.
 9. Ensure that all VAD equipment and the patient’s caregiver, if available, accompany the patient, and provide appropriate pre-arrival notification of receiving emergency department (ED) personnel.

LINKS
C01 - BASIC CARDIAC ARREST C02 - ADVANCED CARDIAC ARREST

APPROVED BY	
	
EMS Medical Director	EMS Associate Medical Director

VERSION CHANGES (refer to X03 for change tracking)
<ul style="list-style-type: none"> • Simplified flow chart • Identifier legend at bottom of flow chart replaces work scope statement in header

APPENDIX A:

CONTROLLERS

**CONDENSED FROM THE INTERNATIONAL
CONSORTIUM OF CIRCULATORY ARREST CLINICIANS
EMS GUIDE (JANUARY 2019)**

HEARTMATE III - POCKET CONTROLLER:



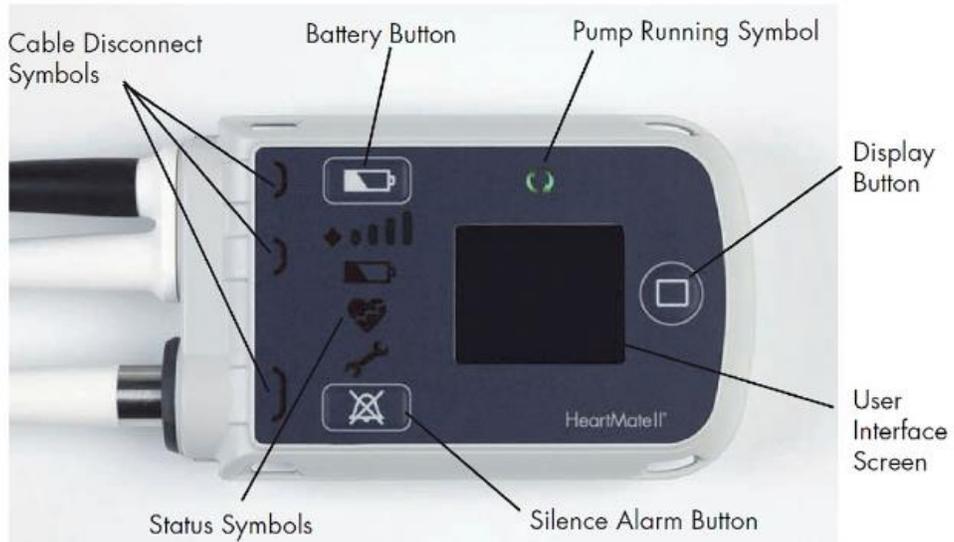
Yellow or Red Battery Alarm: Need to Change Batteries. See changing batteries section on next page.



Red Heart Flashing Alarm: This may indicate a Low Flow Hazard. Check patient—the flow may be too low. If patient is hypovolemic, give volume. If patient is in right heart failure— treat per protocol. If the pump has stopped check connections, batteries and controllers as instructed in the section above.



HEARTMATE II - POCKET CONTROLLER:



APPENDIX B:

**TROUBLE SHOOTING HEARTMATE II & III
CHANGING BATTERIES & CONTROLLERS**

**CONDENSED FROM THE INTERNATIONAL
CONSORTIUM OF CIRCULATORY ARREST CLINICIANS
EMS GUIDE (JANUARY 2019)**

NOTE: At December 2020, the SBH Cardiac Science Program no longer supplies patients with the external peripheral controller (EPC) for the Heartmate II device.

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Trouble Shooting HeartMate III®

Changing Batteries

WARNING: At least one power lead must be connected to a power source **AT ALL TIMES**. Do not remove both batteries at the same time or the pump will stop.

- Obtain two charged batteries from patient's accessory bag or battery charger. The charge level of each gray battery can be assessed by pressing the battery button on the battery. (Figures 1 and 2)
- Remove only **ONE** battery from the clip by pressing the button on the grey clip to unlock the battery. (Figure 3)
- Controller will start beeping and flashing yellow signals and will read **POWER DISCONNECT** on the front screen. (Figure 4)
- Replace with new battery by lining up **RED** arrows on battery and clip. Gently tug on battery to ensure connection. If battery is properly secured, the beeping and yellow flashing will stop. (Figure 5)
- Slide a new, fully-charged battery (Figure 4) into the empty battery clip by aligning the **RED** arrows. The battery will click into the clip. Gently tug at battery to ensure connection. If battery is properly secured, the beeping and green flashing will stop.
- Repeat previous steps with the second battery and battery clip.

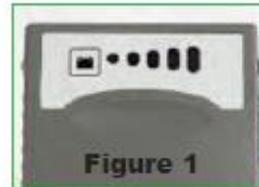


Figure 1



Figure 2



Figure 3



Figure 4



Figure 5

CAUTION—Investigational device. Limited by Federal (or United States) law to investigational use.

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Trouble Shooting HeartMate III[®] with Pocket Controllers

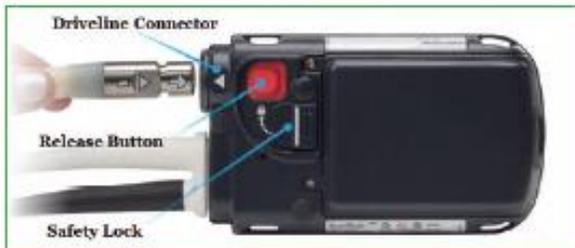
Changing Controllers

- Place the replacement Controller within easy reach, along with the batteries/battery clips. The spare Controller is usually found in the patient's travel case.
- Make sure patient is sitting or lying down since the pump will momentarily stop during this procedure.

- Attach the battery clips to the spare controller by lining up the half moons and gently pushing together and attach the batteries to the spare controller by aligning the **RED** arrows.



- On the back of the replacement controller, rotate down the perc lock so the red tab is fully visible. Repeat this step on the original controller until the red tab is fully visible.



- Disconnect the drive-line from the original controller by pressing down on the red tab and gently pulling on the metal end. The pump will stop and an alarm will sound. **Note:** The alarm will continue until the original controller is put to sleep. You can silence the alarm by pressing the silence button.



Getting the replacement controller connected and pump restarted is the first priority.

- Connect the replacement Controller by aligning the **BLACK ARROWS** on the driveline and replacement Controller and gently pushing



the driveline into the replacement Controller. The pump should restart, if not complete the following steps:

- Firmly press the Silence Alarm or Test Select Button to restart the pump.
- Check the power source to assure that power is going to the controller.
- Assure the perc lead is fully inserted into the socket by gently tugging on the metal end. **DO NOT** pull the lead.

- After the pump restarts, rotate up the perc lock on the new controller so the red tab is fully covered. If unable to engage perc lock to a fully locked position, gently push the driveline into the controller to assure proper connection. Retry to engage perc lock.

- Disconnect power from the original Controller. The original Controller will stop alarming once power is removed.

- Hold down battery symbol for 5 full seconds for complete shutdown of old controller.



Adapted from Sweet, L. and Wolfe, Jr., A. *Mechanical Circulatory Devices in Transport* In *ASTNA: Patient Transport Principles and Practice*, 4th ed., Mosby, 2010 in press.

CAUTION—Investigational device. Limited by Federal (or United States) law to investigational use.

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Trouble Shooting HeartMate II®

Changing Batteries

WARNING: At least one power lead must be connected to a power source **AT ALL TIMES**. Do not remove both batteries at the same time or the pump will stop.

- Obtain two charged batteries from patient's accessory bag or battery charger. The charge level of each gray battery can be assessed by pressing the battery button on the battery. (Figures 3 and 4)
- Remove only **ONE** battery from the clip by pressing the button on the grey clip to unlock the battery. (Figure 1)
- Controller will start beeping and flashing green signals.
- Replace with new battery by lining up **RED** arrows on battery and clip. (Figure 2)
- Slide a new, fully-charged battery (Figure 4) into the empty battery clip by aligning the **RED** arrows. The battery will click into the clip. Gently tug at battery to ensure connection. If battery is properly secured, the beeping and green flashing will stop.
- Repeat previous steps with the second battery and battery clip.



Figure 1



Figure 2

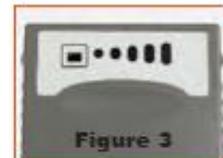


Figure 3

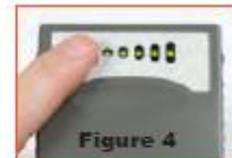


Figure 4

Changing Controllers

- Place the replacement Controller within easy reach, along with the batteries/battery clips. The spare Controller is usually found in the patient's travel case.
- Make sure patient is sitting or lying down since the pump will momentarily stop during this procedure.
- Attach the battery clips to the spare controller by lining up the half moons and gently pushing together and attach the batteries to the spare controller by aligning the **RED** arrows. **ALARMS WILL SOUND-THIS IS OK.**
- Depress the silence alarm button (upside-down bell with circle) until the alarm is silenced on the new, replacement Controller.
- Rotate the perc lock on the replacement controller in the direction of the "unlocked" icon until the perc lock clicks into the fully- unlocked position. Repeat this same step for the original Controller until the perc lock clicks into the unlocked position.
- Disconnect the perc lead/driveline from the original controller by pressing the metal release tab on the connector socket. The pump will stop and an alarm will sound.



Half-Moons



Perc Lock

Note: The alarm will continue until power is removed from the original Controller. *Getting the replacement Controller connected and the pump restarted is the first priority.*

- Connect the replacement Controller by aligning the **BLACK LINES** on the driveline and replacement Controller and gently pushing the driveline into the replacement Controller. The pump should restart, if not complete the following steps:

- Step 1. Firmly press the Silence Alarm or Test Select Button to restart the pump.
- Step 2. Check the powersource to assure that power is going to the controller.
- Step 3. Assure the perc lead is fully inserted into the socket by gently tugging on the metal end. **DO NOT** pull the lead.



Tug gently on metal end in this direction

Perc Lead

- After the pump restarts, rotate the perc lock on the new controller in the direction of the "locked" icon until the perc lock clicks into the fully-locked position. If unable to engage perc lock to the locked position, gently push the driveline into the controller to assure a proper connection. Retry to engage perc lock.
- Disconnect power from the original Controller. The original Controller will stop alarming once power is removed.

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