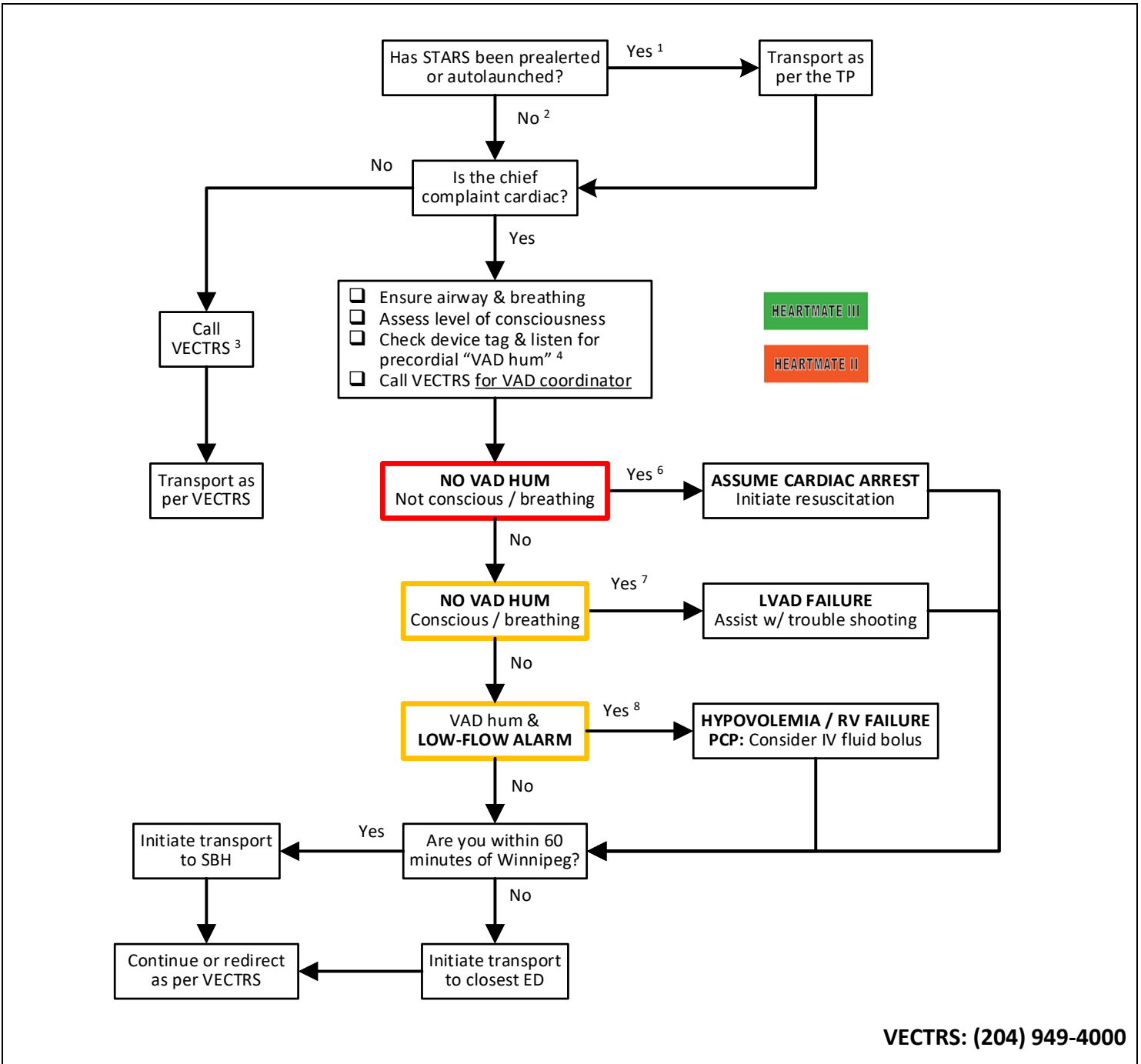
	<b>C08 - LEFT VENTRICULAR ASSIST DEVICE (LVAD)</b>			
	All ages		RESUSCITATION	
Version date: 2024-10-27		Effective date: 2024-11-05 (07:00)		
<b>ERS WORK SCOPE</b>	<b>EMR:</b> EMR only	<b>PCP:</b> PCP & ICP	<b>ICP:</b> ICP only	None - all providers



### INDICATIONS

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

### CONTRAINDICATIONS



- Not applicable

### NOTES

1. The Medical Transportation Coordination Center (MTCC) will notify the responding ground unit when the Shock Trauma Air Rescue Society (STARS) has been prealerted or autolaunched for the same call. MTCC will request an initial report from paramedics by radio as early as possible. The transport physician (TP) will decide to launch or stand down based on this report.  
  
If STARS responds to the call, the TP will be the most responsible physician (MRP) and paramedics will transport as directed by the TP.  
  
However, paramedics must still call the Virtual Emergency Care & Transport Resource Service (VECTRS) as soon as possible to access the VAD coordinator / cardiologist.
2. If STARS is not involved or is stood down, VECTRS will assume responsibility and the VECTRS emergency physician (EP) will assume the MRP role.  
  
Paramedics will transport as directed by the VECTRS EP or advanced care paramedic (ACP).  
  
VECTRS may conference in the TP and air medical crew (AMC) for consideration of air intercept. Paramedics may be directed to an alternate location for rendezvous.
3. Call VECTRS regardless of the patient's chief complaint(s) or your geographic location, and indicate that you have a patient with an LVAD. At some point, VECTRS may involve the VAD coordinator, depending on the nature of the complaint.
4. 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.
  - Both devices have continuous flow pumps so you may not be able to feel a pulse, and it may be difficult to measure the blood pressure (BP) with a manual cuff. **A "humming" or "whirling" sound (heard best in the precordium) indicates that the pump is functioning.**
  - When assessing the patient, 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. Low pulse oximetry may reflect inadequate peripheral perfusion rather than hypoxemia.
5. While technical problems are rare, most health care providers will be unfamiliar with the device. Patients and their caregivers are always well-trained in trouble-shooting and management, and will likely have already contacted the VAD coordinator before even calling 911.  
  
Non-technical issues include bleeding, sepsis, and stroke, and the management of them may be somewhat different from the ERS care maps.

6. It may be difficult to differentiate extremely low perfusion from a true cardiac arrest. If there is no VAD hum and the patient is not conscious and / or breathing, 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 LVAD will not affect electrocardiogram acquisition or continuous cardiac monitoring.
- All paramedics must call VECTRS before discontinuing resuscitation on a patient with an LVAD.
7. The absence of an audible 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 will cause the pump to stop).
  - Changing the controller (paramedics will only change the controller under the direction of the VAD coordinator, the patient, or their caregiver).
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. If you have not already done so, call VECTRS as soon as possible during transport and continue or redirect as advised. VECTRS may conference in the TP and air medical crew (AMC) for consideration of air intercept and / or subsequent IFT.
10. Paramedics will provide notification (including an estimated time of arrival) to receiving ED staff at an appropriate interval before arrival. Transport all LVAD equipment, documents, and the patient’s caregiver with them.

LINKS
<ul style="list-style-type: none"> <li>• C01 - BASIC CARDIAC ARREST</li> <li>• C02 - ADVANCED CARDIAC ARREST</li> </ul>

APPROVED BY	
	
EMS Medical Director	EMS Associate Medical Director

**VERSION CHANGES (refer to X03 for change tracking)**

- Paramedics will radio MTCC if STARS has been pre-alerted or autolaunched
- Paramedics will contact VECTRS to access the VAD coordinator

**APPENDIX A:**

**CONTROLLERS**

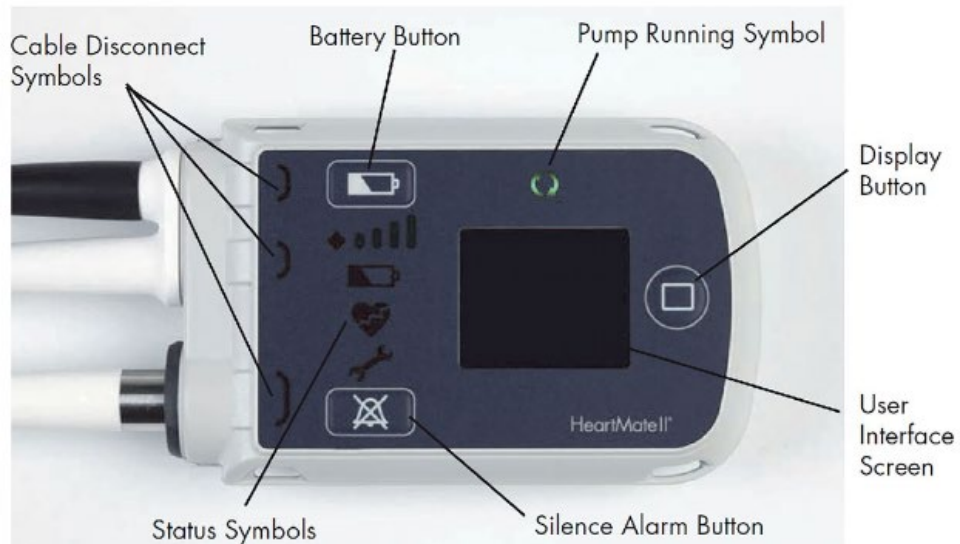
**CONDENSED FROM THE INTERNATIONAL  
CONSORTIUM OF CIRCULATORY ARREST CLINICIANS  
EMS GUIDE (JANUARY 2019)**

**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.

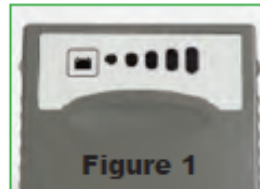


Figure 1

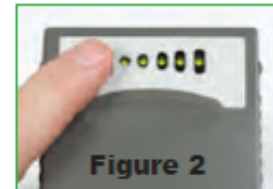


Figure 2

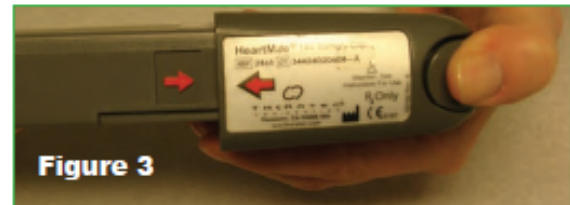


Figure 3



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<sup>®</sup> with Pocket Controllers

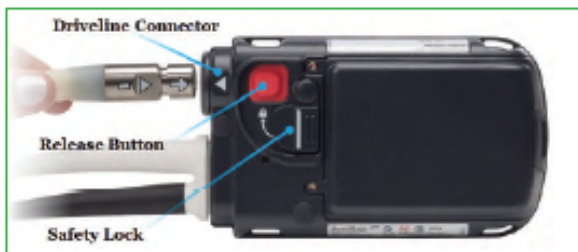
## Changing Controllers

- 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

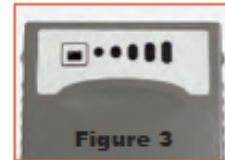


Figure 3



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

- 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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