

EMS Guide

HeartWare Ventricular Assist System®



This guide is produced by ICCAC – The International Consortium of Circulatory Assist Clinicians. The ICCAC is the professional society for MCS Clinicians throughout the world. It has been vetted by experts in MCS, Air Medical Transport, and Emergency Services. It should not replace the device operating manual as a primary source of information.

Questions and Answers Ventricular Assist Device

What is a Ventricular Assist Device (VAD)?

A ventricular assist device (VAD) is a mechanical pump that's used to support heart function and blood flow in people who have weakened hearts.

How does a VAD work?

The device takes blood from a lower chamber of the heart and helps pump it to the body and vital organs, just as a healthy heart would.

What are the parts of a VAD?

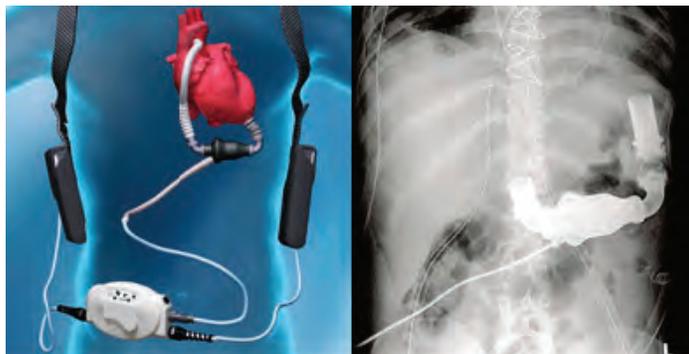
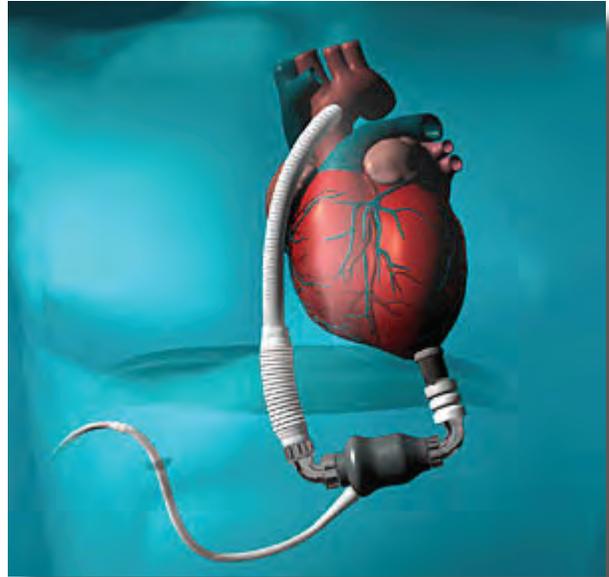
The basic parts of a VAD include: a small tube that carries blood out of your heart into a pump; another tube that carries blood from the pump to your blood vessels, which deliver the blood to your body; and a power source.

What is the power source?

The power source is either batteries or AC power. The power source is connected to a control unit that monitors the VAD's functions. The batteries are carried in a case usually located in a holster in a vest wrapped around the patients shoulders.

What does the control unit or controller do?

The control unit gives warnings, or alarms, if the power is low or if it senses that the device isn't working right. It is a computer.



The portability of the HeartMate II enables patients to resume many of their normal daily activities.

Color Coding System

MOST patients have a tag located on the controller around their waist that says what type of device it is, what institution put it in and a number to call. Most importantly is the color of the tag – it matches this EMS Field Guide and allows you to quickly locate the device you are caring for.

HEARTMATE III

HEARTMATE II

HEARTWARE

JARVIK 2000

FREEDOM DRIVER
Total Artificial Heart

Patient Management For VADs

1. **Assess the patients airway and intervene per your protocol.**
2. **Auscultate Heart Sounds to determine if the device is functioning and what type of device it is. If it is continuous flow device, you should hear a “whirling sound”.**
3. **Assess the device for any alarms.**
4. **Look on controller usually found around the waist of the patient and to see what color tag and device it is.**
5. **Match the color on the device tag to the EMS Guide.**
6. **Intervene appropriately based on the type of alarm, tag (device) and EMS Guide.**
7. **Start Large Bore IV.**
8. **Assess vital signs – Use Mean BP with Doppler – with the first sound you hear is the Mean Arterial Pressure (MAP).**
9. **If no Doppler, use the Mean on the non invasive blood pressure machine.**
10. **Transport to closest VAD center. Call the number on the device to get advice.**
11. **Bring all of the patients equipment.**
12. **Bring the significant other if possible to act as a expert on the device in the absence of consciousness in the patient.**

HeartWare® Ventricular Assist System

1. Can I do external CPR?

Chest compressions may pose a risk of dislodgment – use clinical judgment. If chest compressions are administered, confirm function and positioning of the pump.

2. If not, is there a “hand pump” or external device to use?

No.

3. If the device slows down (low flow state), what alarms will go off?

The device runs at a fixed speed. If a low flow state occurs, an alarm will be heard, and the controller display will show a yellow triangle and “Low Flow – Call” message.



4. How can I speed up the rate of the device?

It is not possible to adjust the pump speed in the prehospital setting. Okay to give IV fluids.

5. Do I need to heparinize the patient if it slows down?

Call the accepting VAD facility for guidance.

6. Can the patient be defibrillated while connected to the device?

Yes.

7. If the patient can be defibrillated, is there anything I have to disconnect before defibrillating?

No, defibrillate per protocol.

8. Does the patient have a pulse with this device?

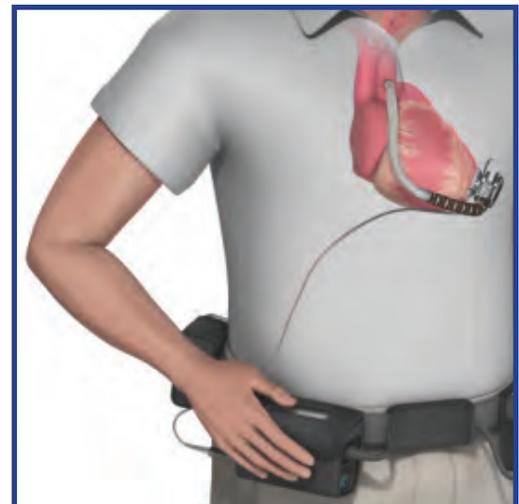
The patient may not have a palpable pulse. Depending on the patient's own heart function, you may be able to feel a thready pulse.

9. What are acceptable vital sign parameters?

Goal Mean Arterial Pressure (MAP) is <85 mmHg. Use a Doppler as the first option to assess blood pressure. If you are using a Doppler, place the blood pressure cuff on the patient arm. As you release the pressure in the blood pressure cuff, the first sound you hear with the Doppler is the MAP. If that is not available, use a non-invasive BP (NIBP).

10. Can this patient be externally paced?

Yes



FAQs

- May not be able to obtain cuff pressure (continuous flow pump)
- Pump connected to electric line (driveline) exiting patient's abdominal area and is attached to computer (controller) which runs the pump.
- Pump does not affect EKG, but patient may or may not be symptomatic even with ventricular arrhythmias.
- All ACLS drugs may be given.
- No hand pump is available. This is a rotary (continuous flow) pump with typical speed ranges of 2400 – 3200 RPMs. The patient should have back-up equipment.
- The controller draws power from one battery at a time. A fully charged battery will provide 4-6 hours of power. Both the battery and controller have status lights to indicate the amount of power remaining.
- Transport by ground to implanting facility if possible.
- Be sure to bring **ALL** of the patient's equipment with them.

HeartWare® Ventricular Assist System Emergency Operation



ALARM ADAPTER

- Used to silence the internal NO POWER ALARM.
- Should only be used on a controller that is NOT connected to a patient's pump.
- Must be inserted into the blue connector of the original controller after a controller exchange BUT before the power sources are disconnected or the NO Power alarm will sound for up to two hours.



DRIVELINE CONNECTION

To Connect to Controller:

- Align the two red marks and push together. An audible click will be heard confirming proper connection. (Figure A)
- The Driveline Cover must completely cover the Controller's silver driveline connector to protect against static discharge. (Figure B)
- NOTE: an audible click should be heard when connecting the Driveline or Driveline extension to the controller. Failure to use the Driveline Cover may cause an Electrical Fault Alarm.



Figure A

Figure B

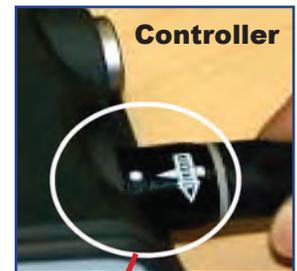
TO DISCONNECT A DEPLETED BATTERY

- Make sure there is a fully charged battery available to replace the depleted one.
- Disconnect the depleted battery by turning the connector counterclockwise until it stops.
- Pull the connector straight out from the controller.

CONNECTING POWER TO CONTROLLER

To Connect a Charged Battery:

- Grasp the cable of the charged battery at the back end of the connector (leaving front end of connector free to rotate)
- Line up the solid white arrow on the connector with the white dot on the Controller.
- Gently push (but DO NOT twist) the battery cable into the Controller until it naturally locks into place; you should hear an audible click.
- Confirm that the battery cable is properly locked on the controller by gently pulling the cable near the controller power connector.
- DO NOT force the battery cable into the controller connector without correct alignment as it may result in damaged connectors .



HeartWare® Ventricular Assist System Emergency Operation

STEPS TO EXCHANGE THE CONTROLLER

Step 1: Have the patient sit or lie down.

Step 2: Place the new controller within easy reach.

Step 3: Connect back-up power sources (batteries or AC Power) to the new controller.

- Confirm that the power cables are properly locked on the controller by gently pulling on the cable near the connector.
- A "Power Disconnect" alarm will activate if a second power source is not connected to the new controller within 20 seconds of controller power up
- A "VAD Stopped" alarm will activate if the pump driveline is not connected to the new controller within 10 seconds - this alarm will resolve once the pump driveline is connected

Step 4: Pull back the white driveline cover from the original controller's silver connector.

Step 5: Disconnect the driveline from the original controller by pulling the silver connector away from the controller. Do not disconnect by pulling on the driveline cable. A "VAD Stopped" alarm may activate. Don't panic. You can silence the alarm after restarting the pump, which is the priority.

Step 6: Connect the driveline to the new controller (align the two red marks and push together). If the "VAD Stopped" alarm was active on the new controller, it will now resolve.

Step 7: The pump should restart. Verify the pump is working (RPM, L/min, Watts).

Step 8: IF THE PUMP DOES NOT RESTART, CALL FOR MEDICAL ASSISTANCE IMMEDIATELY.

Step 9: Insert the Alarm Adapter into the blue connector on the original controller.

- Disconnect both power sources from the original controller.
- The controller will be turned off and all alarms silenced.

Step 10: Slide the white driveline cover up to cover new controller's silver connector.

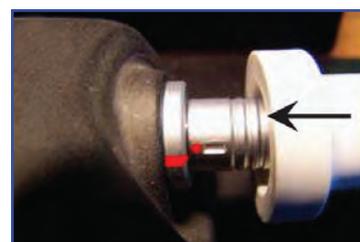
Step 11: Contact the VAD Center or Implanting hospital for a new backup controller.



Step 3



Step 4



Step 6



Step 9



Step 10

HeartWare® Ventricular Assist System Troubleshooting

| ALARM TYPE | ALARM DISPLAY (Line 1) | ACTION (Line 2) |
|-----------------------------------|------------------------|-----------------------------|
| High - Critical (FLASHING RED) | VAD STOPPED | CONNECT DRIVELINE |
| | VAD STOPPED | CHANGE CONTROLLER |
| | CRITICAL BATTERY 1 | REPLACE BATTERY 1 |
| | CRITICAL BATTERY 2 | REPLACE BATTERY 2 |
| | CONTROLLER FAILED | CHANGE CONTROLLER |
| MEDIUM (FLASHING YELLOW) | CONTROLLER FAULT | CALL ACCEPTING VAD HOSPITAL |
| | CONTROLLER FAULT | CALL: ALARMS OFF |
| | HIGH WATTS | CALL ACCEPTING VAD HOSPITAL |
| | ELECTRICAL FAULT | CALL ACCEPTING VAD HOSPITAL |
| | LOW FLOW | CALL ACCEPTING VAD HOSPITAL |
| | SUCTION | CALL ACCEPTING VAD HOSPITAL |
| LOW (SOLID YELLOW) | LOW BATTERY 1 | REPLACE BATTERY 1 |
| | LOW BATTERY 2 | REPLACE BATTERY 2 |
| | POWER DISCONNECT | RECONNECT POWER 1 |
| | POWER DISCONNECT | RECONNECT POWER 2 |