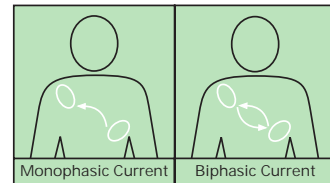


# What is Biphasic Defibrillation?

Defibrillation is the delivery of a lifesaving pulse of electrical current to a heart in ventricular fibrillation (VF). Electricity is passed through the heart from paddles or electrodes on the chest. Traditionally, defibrillators used a monophasic waveform in which current flowed between the electrodes in one direction only. With a biphasic waveform, current flows in one direction, then reverses and flows the other way.



## AMERICAN HEART ASSOCIATION AND ILCOR POSITION ON BIPHASIC WAVEFORMS, 2000

According to the Guidelines 2000, biphasic defibrillation shocks of  $\leq 200$  joules (J) are safe and have equal or greater efficacy for termination of ventricular fibrillation (VF) when compared to higher-energy monophasic shocks. However, specifications for optimal energies related to biphasic defibrillation have not yet been determined.<sup>1</sup>

## MEDTRONIC PHYSIO-CONTROL POSITION ON BIPHASIC WAVEFORMS, 2000

Low-energy biphasic waveforms ( $\leq 200$ J) are a good starting point. This is an adequate dose for people who are easy to defibrillate. Will it work in every case?

Our biphasic defibrillators have the ability to escalate above 200J for those people who fail to respond to a low-energy biphasic shock.

With the optimal energy levels still in question, our biphasic technology answers the guidelines of today with built-in flexibility so it won't be obsolete tomorrow.

## WHAT CONDITIONS MAY REQUIRE MORE THAN 200 JOULES?

### Heart attacks

Heart attacks are a common cause of cardiac arrest. Animal studies using biphasic shocks show that the energy required for defibrillation increases when cardiac arrest is caused by a heart attack—by as much as 150% to 300%.<sup>2,3</sup>

Clinical trials of new defibrillation waveforms on human beings do not simulate heart attack conditions. As a result, real-life defibrillation may require significantly higher energy levels.

### High-impedance

Impedance is the resistance to the flow of electrical current. Some of the reasons for high-impedance include a large chest, air in the lungs, chest hair, and flaky dry skin.

Impedance reduces the dose of current the heart receives. A doubling of impedance will result in the heart receiving half the electrical current.

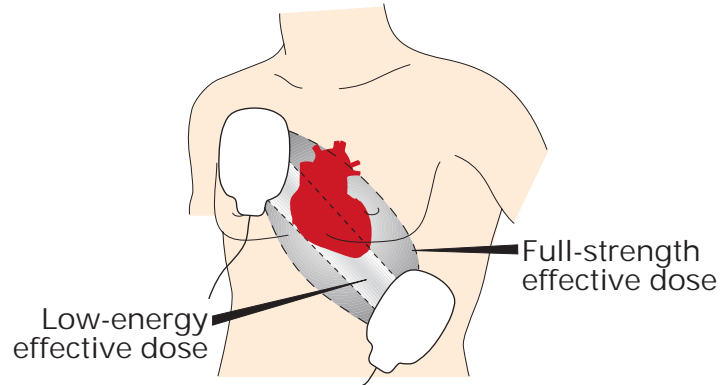
### Delays before the first shock

Defibrillation becomes more difficult as the time before delivery of the first shock increases. One recent laboratory study using biphasic waveforms showed that twice as much energy was required when VF lasted 10 minutes as compared to VF that lasted just 10 seconds.<sup>4</sup>

### Inaccurate electrode pad placement

Electrode pad placement may be less than ideal in an emergency situation. When this occurs, less of the defibrillation dose passes through the heart.

Higher-energy escalating shocks deliver an effective dose over a wider area, and are more forgiving of inaccurate electrode pad placement.



### References

- 1 "Guidelines 2000 for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care," *Circulation*. 2000; 102 (Suppl I): I-90-I-91.
- 2 C Killingsworth et al, "Biphasic Waveform Transthoracic Defibrillation Thresholds for Spontaneous Ventricular Defibrillation in a Porcine Model of Acute Ischemia," *JACC Abstracts*, Feb, 1999, 1156-1199.
- 3 C Killingsworth et al, "Comparison of Biphasic Waveform Transthoracic Defibrillation Thresholds for Electrically Induced and Spontaneous Ventricular Fibrillation in a Dog Model of Acute Ischemia and Reperfusion," *Circulation*, 1998; 98 (suppl I) 173. Abstract.
- 4 CT Leng, et al, "Resuscitation After Prolonged Ventricular Fibrillation With Use of Monophasic and Biphasic Waveform Pulses for External Defibrillation," *Circulation*, 2000; 101:2698-2974.



**Medtronic Physio-Control**  
11811 Willows Road Northeast  
P.O. Box 97006  
Redmond, WA 98073-9706 USA  
Tel: 425.867.4000  
Toll Free (USA Only): 800.442.1142  
Fax: 425.867.4146  
Internet: [www.medtronicphysiocontrol.com](http://www.medtronicphysiocontrol.com)

**Europe**  
Basingstoke, Great Britain  
Tel: 44.1256.782.727  
Fax: 44.1256.782.728

PHYSIO-CONTROL is a registered trademark of Medtronic Physio-Control Corp. Medtronic is a registered trademark of Medtronic, Inc. ©2000 Medtronic Physio-Control Corp.

PN 3201162-000