



Medtronic

BIO-PUMP[®] PLUS

Centrifugal Blood Pump



There's Still Only One Bio-Pump[®]...Plus.

With a proven record of more than 3 million clinical uses and improved patient outcomes, the Bio-Pump® centrifugal blood pump is recognized worldwide as the market leader in arterial blood pumps. Through the skilled application of Computational Flow Dynamics (CFD), the Bio-Pump's proven design has been further enhanced to optimize blood with the refinement of a new, patented Vertical Cutwater Outlet design which has reduced outlet shear by 40% and reduced hemolysis by 20% from our original, industry-standard, BP-80 design¹. In addition, the latest Bio-Pump® Plus features even more robust construction, enhanced double-lip seal bearing designs, as well as new impact absorbing packaging for Custom Tubing Packs to provide the reliability you expect from Medtronic.

The Medtronic Bio-Pump® Plus centrifugal blood pump, available with or without Carmeda® BioActive Surface, uses the constrained forced-vortex pumping principle in which a series of smooth-surfaced rotating cones pull the blood into the vortex created by the rotation. As the blood flows towards the pump outlet, the vortex energy created by these cones transfers to the blood in the form of pressure and velocity. The Bio-Pump® Plus pump is constructed from molded polycarbonate parts and features a double-lip seal design over precision bearings for optimum strength, robust construction, and dependability.

The non-occlusive design of the Medtronic Bio-Pump® Plus promotes laminar flow, improving blood handling capabilities and decreasing blood trauma often associated with extracorporeal circulatory support experienced with cardiopulmonary bypass.²

The Bio-Pump® Plus centrifugal pump couples with the Medtronic Bio-Console® Pump System which includes speed control, flow and pressure measurement and associated alarm functions.

Carmeda® BioActive Surface is manufactured under license from Carmeda AB, Sweden. Carmeda is a registered trademark of Carmeda AB.

BIO-PUMP® PLUS BLOOD PUMP BENEFITS THAT SET THE STANDARD...AGAIN

GENTLE BLOOD HANDLING²

- Decreased platelet activation and better platelet preservation
- Reduced complement activation
- Reduced use of blood products
- Patented Vertical Cutwater Outlet Design, (when compared to former, standard-setting design)
 - Reduces shear by 40% in the cutwater region
 - Reduces hemolysis by 20% overall

REDUCED POSTOPERATIVE COMPLICATIONS²

- Decreased pulmonary complications
- Less microemboli generation
- Reduced neurological deficits
- Meta-analysis confirms improved clinical outcomes and lower overall patient costs

HIGH MARGIN OF SAFETY

- Smooth vortex cone design provides good micro air retention³
- Flow ceases with draining of venous reservoir preventing passage of gross air
- Vortex pump principle eliminates tubing spallation since tubing is used as a conduit, not a pumping chamber
- Pressure sensitivity prevents tubing circuit disruption
- Unique pressure sensitivity allows more gradual, physiological response to pressure changes compared to impeller designs
- Robust double-lip seal design adds sealing integrity, reduces air volume in bearing chamber and resists moisture ingress
- Robust, fixed-position magnet reduces chance for magnet movement
- Polycarbonate outer housing with new joint geometry provides increased strength and resistance to alcohol and other chemicals
- Increased strength of inlet/outlet ports minimizes risk of port breakage

EXTRACORPOREAL VERSATILITY

- Hardware configurations allow for easy adaptation to any CPB application

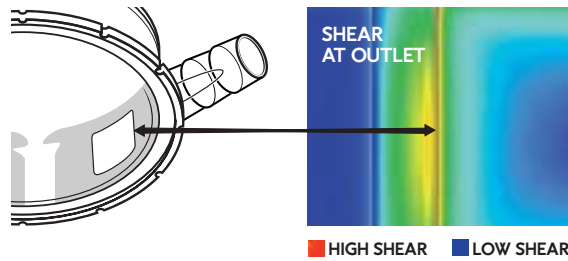
ENHANCED FOAM PACKAGING FOR CTP

- Aggressive adhesive attaches nest to tray
- Foam absorbs impact
- Greater protection during shipping and handling
- Only available with BPX-80 Phase II in CTP

OUTLET DESIGN REDUCES SHEAR AND HEMOLYSIS

NEW VERTICAL PROFILE

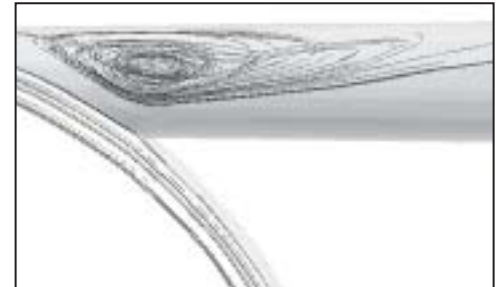
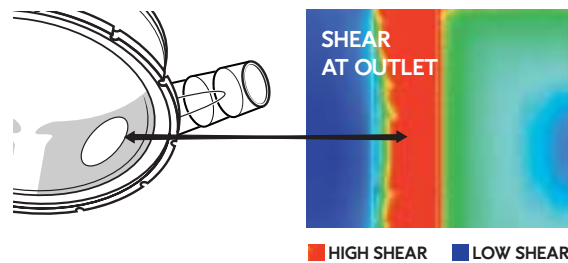
An outlet opening design has been created and evaluated using countless calculations governing fluid flow. The result is a vertical cutwater outlet design for the Bio-Pump® Plus blood pump that not only reduces hemolysis, but also reduces shear by an estimated 40 percent, defying conventional theory that circular outlets are more conducive to blood flow. CFD analysis shows the reduction in shear that is achieved by the straight vertical profile of the Bio-Pump® Plus blood pump.



Tapering the outlet tube and straightening the curved outlet to a near vertical line significantly reduced recirculation for more gentle blood flow.

HISTORICAL CURVED PROFILE

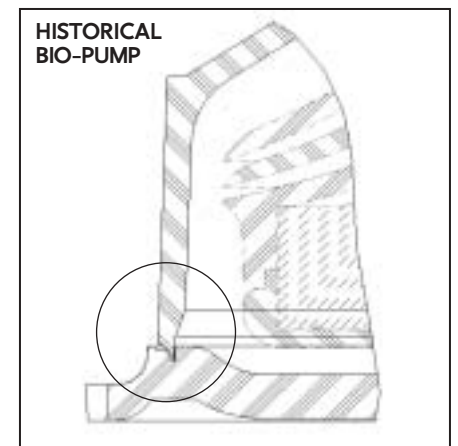
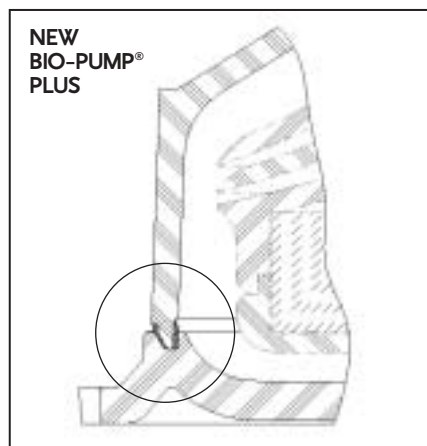
CFD analysis identified the curved outlet opening used in the original Bio-Pump® blood pump, and competitive pump designs, as an area of recirculation and shear stress that can contribute to cellular trauma.



CFD streamline drawings of the curved outlet connector and ellipse-shaped intersection of the Bio-Pump® pump housing identify areas of fluid recirculation.

NEW POLYCARBONATE OUTER HOUSING IMPROVES ALCOHOL RESISTANCE

The Bio-Pump® Plus centrifugal pump offers increased resistance to alcohol by utilizing polycarbonate plastic instead of acrylic. To further improve alcohol resistance, a joint geometry is designed to eliminate the sharp joint area between the outer housing and back plate. This design feature contributes to improving alcohol resistance and improves joint strength while maintaining excellent hemodynamics.



Setting the standard...again.

When compared with the former standard-setting design, the enhanced Bio-Pump® Plus blood pump now provides a rounded joint between the outer housing and the back plate, while maintaining a smooth pathway for blood flow inside the pump.

MANUFACTURED FOR RELIABILITY AND REPEATABILITY

Every Bio-Pump® Plus pump is backed by Medtronic's extensive manufacturing experience and expertise that comes with producing more than three millions units. Medtronic's computer-controlled manufacturing processes are refined to the smallest detail to ensure reliability and repeatability, pump after pump, case after case.



The AFFINITY® Holder with External Drive Extension allows for greater circuit flexibility and shorter tubing lengths when using the Bio-Pump® Plus blood pump.



The 550 Bio-Console Pump Speed Controller provides a state-of-the-art control and monitoring system for the Bio-Pump® Plus centrifugal blood pump.

ORDERING INFORMATION

BPX-80	Bio-Pump® Plus Centrifugal Blood Pump
550	Bio-Console Pump Speed Controller
TX-50	Flow Transducer
540T	External Drive Motor
95229	AFFINITY Holder with External Drive Extension

SPECIFICATIONS

BPX-80 Bio-Pump® Plus Centrifugal Blood Pump	
Priming Volume	86 ml
Inlet/Outlet I.D.	3/8" (9.5 mm)
Maximum Operating Pressure	1100 mmHg
Outer Housing	Polycarbonate

REFERENCES

1. Data on file at Medtronic Perfusion Systems.
2. Meta-analysis data on file at Medtronic Perfusion Systems.
3. Pederson TH, Karlsen HM, An In-Vitro Study of The New Medtronic BioMedicus BPX80 Centrifugal Pump with respect to The Handling of Free Micro-Gas bubbles. A technical report by Medisnske Teknisk Sikkerhetskonstroll, Oslo, Norway, January 21, 1998.

Meta-analysis is a statistical methodology that integrates findings from smaller groups into one large sample for statistical analysis. It provides a method of more accurately predicting outcomes in a general population.



Medtronic

When Life Depends on Medical Technology

Medtronic Perfusion Systems

7611 Northland Drive
Minneapolis, MN 55428-1088
Internet: www.perfusionsystems.com
FAX: (763) 391-9100
Information Toll-Free
1-877-383-2227
Customer Service and Product Orders
Toll-free at 1-800-854-3570

World Headquarters

Medtronic, Inc.
710 Medtronic Parkway
Minneapolis, MN 55432-5604
USA
Internet: www.medtronic.com
Telephone: (763) 514-4000
FAX: (763) 514-4879

Medtronic USA, Inc.
Toll-free: 1-800-328-2518

Europe

Medtronic Europe Sàrl
Case Postale
Route du Molliau 31
CH-1131 Tolochenaz-Switzerland
Telephone: (41 21) 802 7000
FAX: (41 21) 802 7900

Canada

Medtronic of Canada Ltd.
6733 Kitimat Road
Mississauga, Ontario L5N 1W3
Canada
Telephone: (905) 826-6020
FAX: (905) 826-6620
Toll-free: 1-800-268-5346

Asia-Pacific

Medtronic International, Ltd.
Suite 1602 16/F.
Manulife Plaza
The Lee Gardens, 33 Hysan Avenue
Causeway Bay
Hong Kong
Telephone: (852) 2891 4456
FAX: (852) 2891 6830

Latin America

Medtronic, Inc.
2700 S. Commerce Parkway Ste. 105
Weston, FL 33331
USA
Internet: www.medtronic.com
Telephone: (954) 384-4500
FAX: (954) 306-0176

For more information on
Perfusion Systems visit:
www.perfusionsystems.com

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