

Functionality of CellTank Single-Use-Bioreactor

How does the CellTank cultivate suspension cell lines in perfusion?

It's easy to understand

1. Typically billions of cells are hosted in one large cavity - the glass/steel Stirred-Tank-Reactor
2. Think opposite - mobilized cells hosted in millions of small cavities in a matrix
3. Then think 500 cells in each cavity
4. It's that simple





Perfusion is a method for continuous cultivation, where cells are harboured inside a 3D matrix / scaffolding and a steady flow of nutrients are fed to the cells, giving a continuous harvest for an extended period.

The CerCore perfusion platform is engineered:

- to increase volumetric productivity by 10-50 times
- to allow perfusion cultivation for months
- to use conventional Process-Control-Systems (PCS)
- to eliminate gradients
- to retain cells in the matrix and hereby avoid external arranged cell retention membranes
- to accept a variety of scaffoldings / porous matrix materials hosted inside each envelope supporting adherent as well as suspension cell lines
- to integrate classical signal SUS pH sensors, DO / non-invasive well and future bio mass sensors
- to be precision E-beam sterilized and ready to use right out of the bag
- to operate with a variety of turntables or servo motors
- to avoid contact between aeration bubbles and cells
- to offer selectable cell bleeding depending on model

CerCore perfusion platform scalable 1:1000

Four different SUB sizes take advantage of the CerCore platform:

- CellCompact 15 ml (33 series - 1 discs)
- CellTank 150 ml (34 and 35 series - 2 discs)
- CellReactor 1,500 ml (36 series - 4 discs)
- CellDream 15,000 ml (38 series - 8 discs)

Photo of CellTank (34 series) shows:

- non-invasive well with inserted Hamilton DO sensor
- non-invasive well for temperature, (empty)
- single-use Hamilton pH sensor installed (blue tip)
- bio mass sensor installed (future white SUS shown)
- single-use mass flow rotameter (G) installed

How does CellTank work?

1. The CerCore platform is a reactor core A designed as a cylinder with stacked two slightly angled and circular envelopes B. The envelopes are arranged parallel with radial / axial inlet / outlet. As the envelope diameter and pair number are variable the incredible scalability is created. The volume span is from a 15 ml to >15,000 ml.
2. The shown CellTank 34 series use non-woven polyester fiber scaffolding / porous matrix F materials to create the millions of cavities to harbour both suspension and adherent cells. Other scaffolding materials may be introduced into the envelopes for specific needs.
3. Internal re-circulation of media inside the SUB insures constant, gradient free access to nutrient and gasses for constant expression of product.
4. Media pump inlet C is at the very bottom. The media passes the impeller D driven by external magnetic forces (not shown) and exits the pump into the reactor core centre E into the triangular volumes and flows further perpendicularly through each of the envelopes / matrix discs F. Having passed the matrix, media is collected in the hollow circumference collection volume in direct correspondence with the built-in media mass flow instrument G capable of 0.4 - 2.4 liter/min.
5. The centrifugal pump D flows 0-3 liter/min at 250-600 rpm depending on cell density ranging up to max practical 1.5×10^8 /ml matrix. Up to 25 Watt of power is required to overcome the 0-50 mBar pressure difference accros the cell packed matrix.
6. Each of the two envelopes B has 50 cm² inlet surface area and close to 80 ml volume. This is also how CerCore creates the 4 - 24 cm/min flux / media velocity accros the 18 mm thick envelopes B in order to avoid gradients.

A simplified CellTank cut open through the center

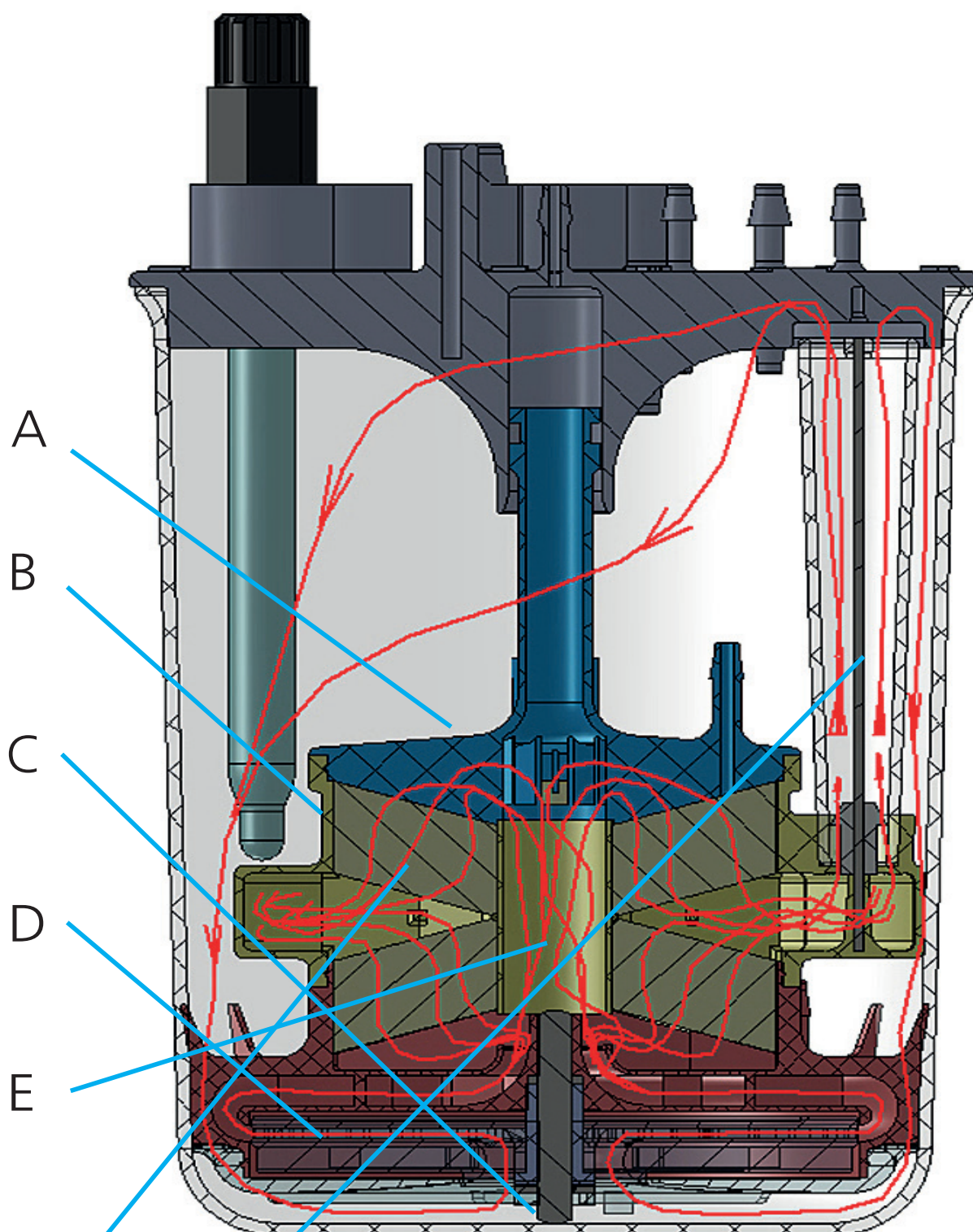
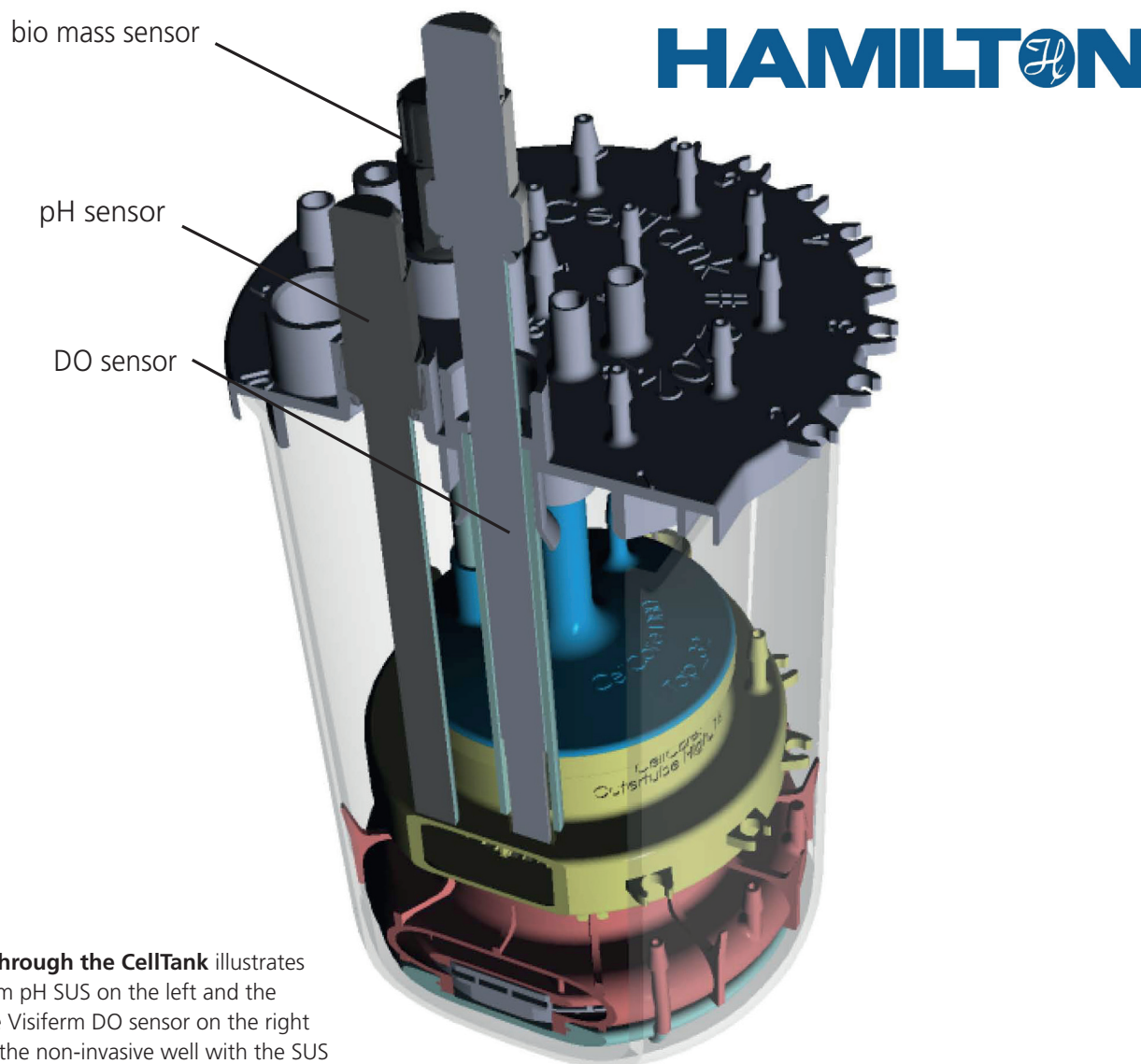


Illustration of constant media re-circulation and flow pattern in CellTank insuring cells obtain gradient free access to nutrient.

- A - Reactor core body
- B - Envelope body, one of two opposite arranged envelopes
- C - Centrifugal pump inlet
- D - Centrifugal pump impeller
- E - Reactor core media distribution center
- F - Porous matrix / scaffold inside envelopes
- G - Mass flow rotameter 0.4 to 2.4 liter/min

Integrated Single-Use-Sensors



3D cut through the CellTank illustrates a 120 mm pH SUS on the left and the re-usable VisiFerm DO sensor on the right fitted to the non-invasive well with the SUS optical membrane in the front. The 120 mm bio mass sensor is seen behind the pH sensor.

Single-Use-Sensors (SUS) for DO and pH offer the following advantages:

- Integrated SUS eliminates contamination risk
- Saves hours of prep time and labor, as no autoclaving or cleaning is needed
- Enables SUS integrated SUB setup right on the bench – no biosafety cabinet / hood needed for operation
- Optical sensing principle integrated in non-invasive well for the re-usable VisiFerm DO classical sensor
- Extends DO sensor life, as it is never autoclaved
- Classical pH sensor for extended lifetime needed for months of perfusion cultivation
- Classical pH and DO sensor signal fits any PCS

More information at www.hamilton.ch

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