ESCO HEALTHCARE

"Discovery to Delivery"

MiniTide®

The Tiny Titan of Adherent Bioprocessing

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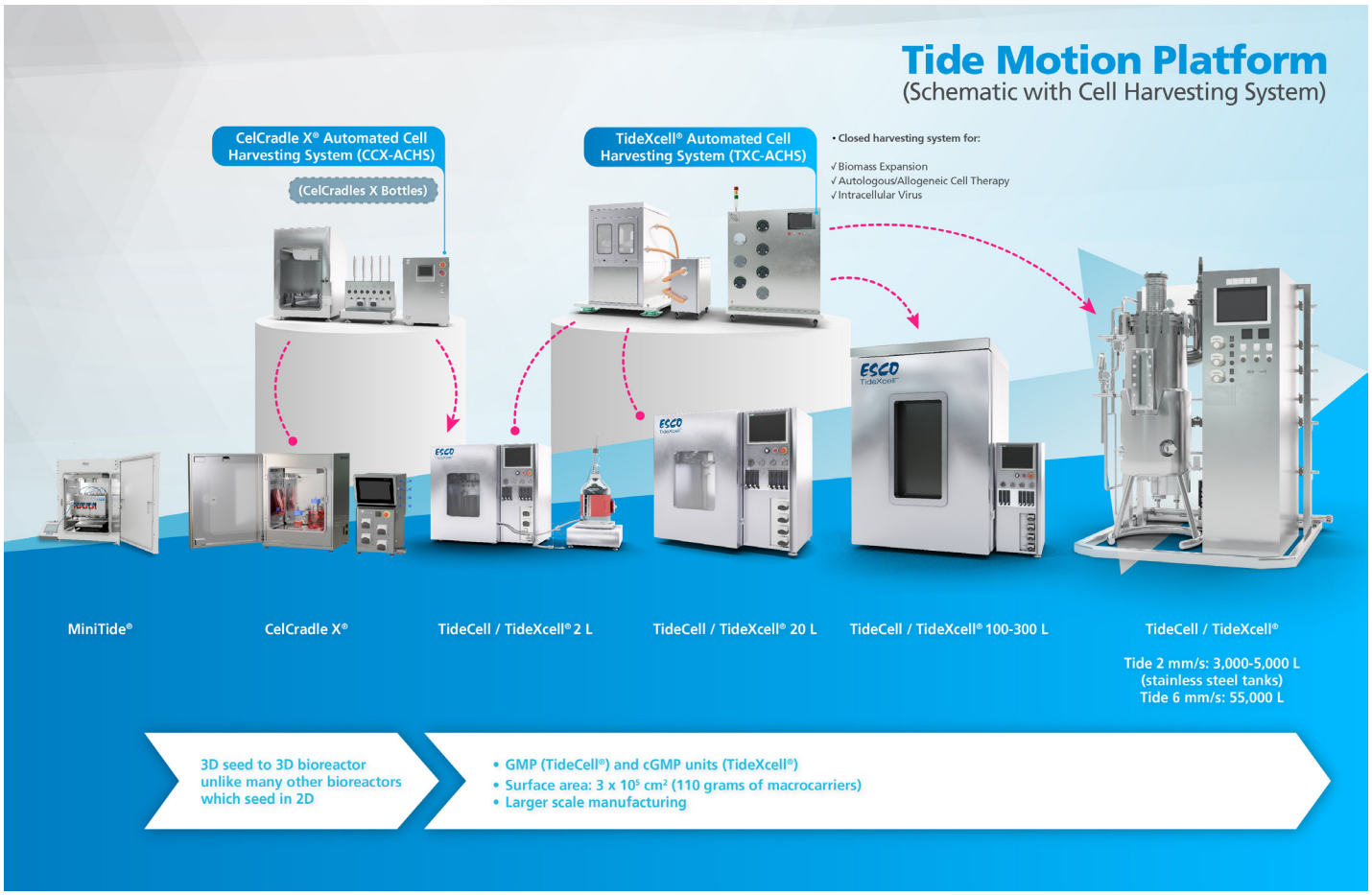
MiniTide® bioreactor leverages the proprietary Tide Motion® technology in a compact and user-friendly design. This facilitates linear scalability for research-oriented experiments. The streamlined bioprocess design expedites licensing due to the consistent application of the core Tide Motion® technology across all scales. This consistency ensures a seamless transition from initial discovery stages to *in-vivo* studies, GLP compliance testing, clinical trials, and ultimately, commercialization. This approach optimizes the patent lifespan by employing the same core technology throughout the entire development pipeline.

Esco MiniTide® simplifies the high-throughput screening of exosomes derived from diverse biological sources, covering primary tissues, cancer cells, and immortalized cell lines. This capacity is especially advantageous for the development of diagnostic and screening assays. It acknowledges the substantial variability in therapeutic potential between exosome populations, potentially influenced by culture conditions. The capability of MiniTide® to generate exosomes through cell culture enables researchers to investigate these contributing factors and pinpoint functionally potent exosome subsets.



Applications

- Culture of anchorage-dependent cells with BioNOC II® and BioMesh® macrocarriers
- Proof-of-concept for 3D carrier culture.
- MSC/EVs study or process optimization
- Vaccine/virus study or process optimization
- Tissue engineering

Features

- Single use
- Siemens HMI PLC-based monitoring system
- Offers significant advantages for research applications utilizing precious starting materials, high-cost culture media, and expensive analytical technique.
- Facilitates rapid exosome generation from various sources, including primary tissue, cancer cells and immortalized cell lines.

Tide Motion® Principle on **MiniTide®**

The Tide Motion bioprocessing technique leverages the cyclical rise and fall of culture medium within a bioreactor to mimic the natural ebb and flow of a tidal environment. This gentle, cyclical motion fosters optimal aeration and nutrient exchange for adherent cell cultures. The process effectively replicates the alternating exposure to nutrients and oxygen that these cells experience in their native environment.

Environmental Control

For normoxic or hypoxic cell cultures, temperature is meticulously maintained using Esco CO_2 incubators or compatible third-party CO_2 incubators. It is recommended that these incubators be equipped with HEPA or ULPA filters to ensure aseptic conditions.

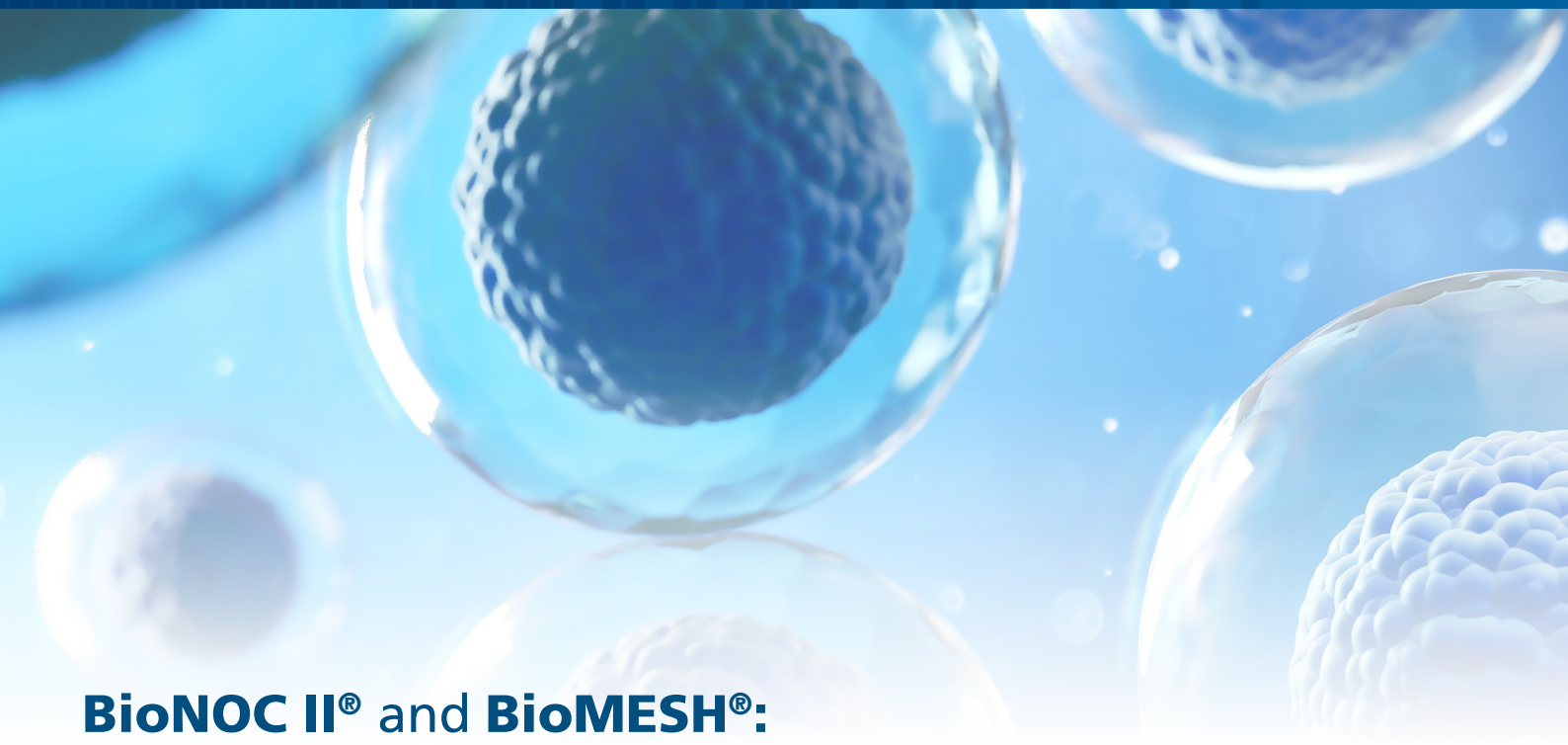
Top Holding Time

Top holding time refers to the phase in the Tide Motion® cycle where the macroporous carriers undergo nutrient exchange.

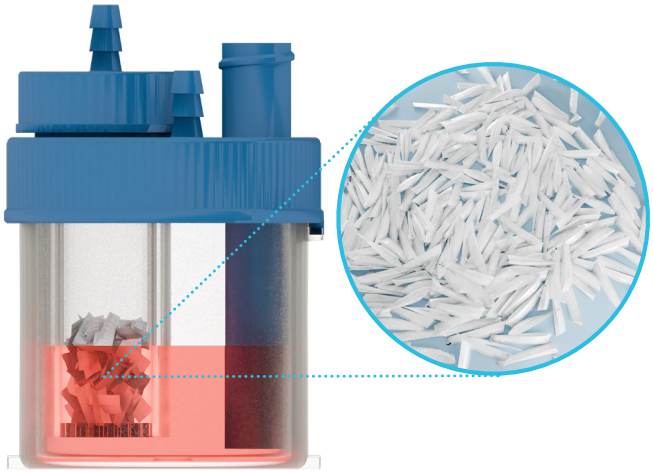
Bottom Holding Time

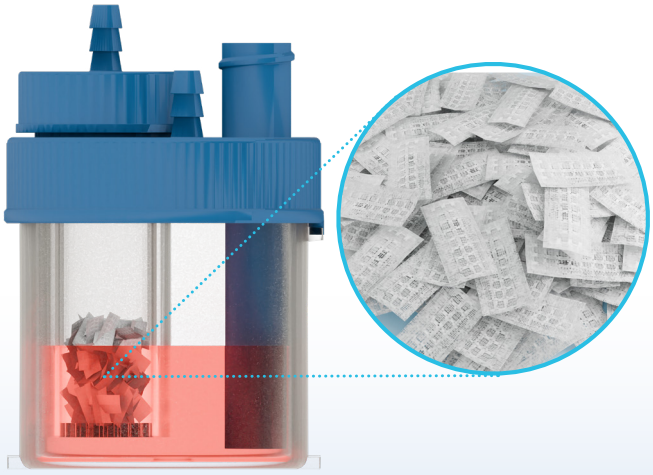
Bottom holding time refers to the phase in the Tide Motion® cycle where the macroporous carriers are exposed and transition into the oxygenation stage. During this phase, the oxygen or suppressed oxygen diffuse from the headspace within the vessel to the surface of the macroporous carriers.

Approximately 20% of the culture medium remains in contact with the macroporous carriers throughout the phase. This facilitates the passive diffusion of oxygen, or limited oxygen in the case of hypoxic cultures, from the surrounding air into the cell layer adjacent to the carriers, ultimately reaching the 3D cell culture within the macroporous matrix.



BioNOC II® and BioMESH®: The Heart of MiniTide®





Note: Surface area varies on the cell line used.

BioNOC II® Macrocarriers

BioNOC II® is a macroporous carrier that supports the growth of anchorage-dependent cells including animal, mammalian, and insect cells in either serum-containing or serum-free culture media.

It produces higher cell yields by providing a larger surface area (up to 2,730 cm^2/g) that allows the growth of up to 5 × 10^9 cells/0.1 L of BioNOC II® (for Vero cells). Due to >95% porosity (50-200 µm), adherent cells are easily exposed to the necessary amount of culture media and aeration.

BioNOC II® is made of 100% PET manufactured according to cGMP guidelines. With its structure, it has a high load-bearing capability to support packed-bed structure and a 45° angle that generates microscopic eddy for mixing. The special geometric design and surface treatment on the carrier enhance fluid mixing, immobilization efficiency, protection from shear forces, and nutrient transfer during cell culture.

BioMESH® Macrocarriers

BioMESH® is a low-lint macrocarrier designed specifically for cell therapy applications. BioMESH® is often used when harvesting cells as the end product, such as skin fibroblasts, cardiac fibroblasts, mesenchymal stromal cells (also known as medicinal signaling cells or pericytes), pluripotent stem cells, epithelial cells, and chondrocytes.

Cells can grow undisturbed in 3D while maintaining a stable environment with minimal shear stress through Tide Motion® bioreactor that enables adherent cells to grow at high density and produce larger volumes of biomass, secreted or non-secreted products with low lint and particulate contamination.

Key Benefits

Highest Yield

MiniTide® employs advanced macroporous carriers, BioNOC II® and BioMESH®, to optimize cell culture applications. BioNOC II® offers a 100% PET, fibrous culture matrix, while BioMESH® utilizes a combination of polypropylene (PP) netting and PET mesh. These macrocarriers offer several advantages:

High surface area: The macroporous design provides cells with a significantly increased surface area for optimal attachment and growth.

Biomimetic environment: The 3D structure closely mimics a cell's natural in vivo environment, promoting healthy cell behavior.

Efficient mass transfer: The matrix vessel facilitates efficient exchange of oxygen and nutrients, ensuring optimal cell proliferation and high bioproduct yields.

Affordable Cost

MiniTide® scaled down bioreactor also offers significant advantages for research applications utilizing precious starting materials, high-cost culture media, or expensive analytical techniques. This translates to a substantial reduction in the overall cost per experiment.

Linearly Scalable Quality

Esco Adherent Cell Tide Motion® platform offers a groundbreaking solution for adherent cell cultures. This innovative, world-first packed bed bioreactor system boasts full linear scalability. Starting with research-scale units designed for standard CO_2 incubators, the platform seamlessly expands to production volumes while maintaining the core Tide Motion® principle. This ensures consistent and reliable cell growth throughout the development and manufacturing process.

Cells	Estimated Cell Number per MiniTide Vessel	Carriers
MSC*	1.2×10^6	BioNOC II®**
	$1.3 - 2.8 \times 10^7$	BioMESH®***
iPSC	$1.2 - 3.1 \times 10^6$	BioNOC II®
Fibroblast	1.2×10^7	BioNOC II®
Vero	6.2×10^6	BioNOC II®
HEK293	8.8×10^7	BioNOC II®
MDCK	3.5×10^7	BioNOC II®
BHK-21	1.5×10^8	BioNOC II®
Sf-9	1.7×10^8	BioNOC II®
Sf-21	1.2×10^7	BioNOC II®
HuH-7	7.1×10^7	BioNOC II®

*The density of MSCs varies depending on the tissue of origin, the donor's age and characteristics, and the composition of the culture medium.

**BioNoc II® is optimally suited for the culture of MSCs when the goal is to obtain secretomes or small exosomes as the final products.

***BioMESH® is optimally suited for the cultivation of MSCs when the primary goal is cell harvesting as the final product. However, in cases where it is essential to maintain the cells' morphology, particularly if they have been extensively characterized in a 2D environment, BioMESH® may be more appropriate for harvesting small exosomes.

The choice of carrier type will ultimately depend on the specific requirements of the client's final experiment.

MiniTide® Key Components

Cable Complete Set

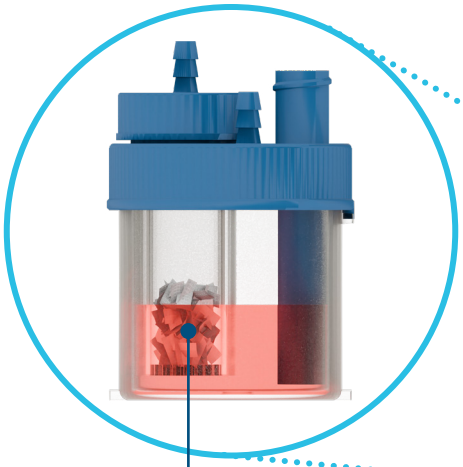
Connects the base frame to the main control box.

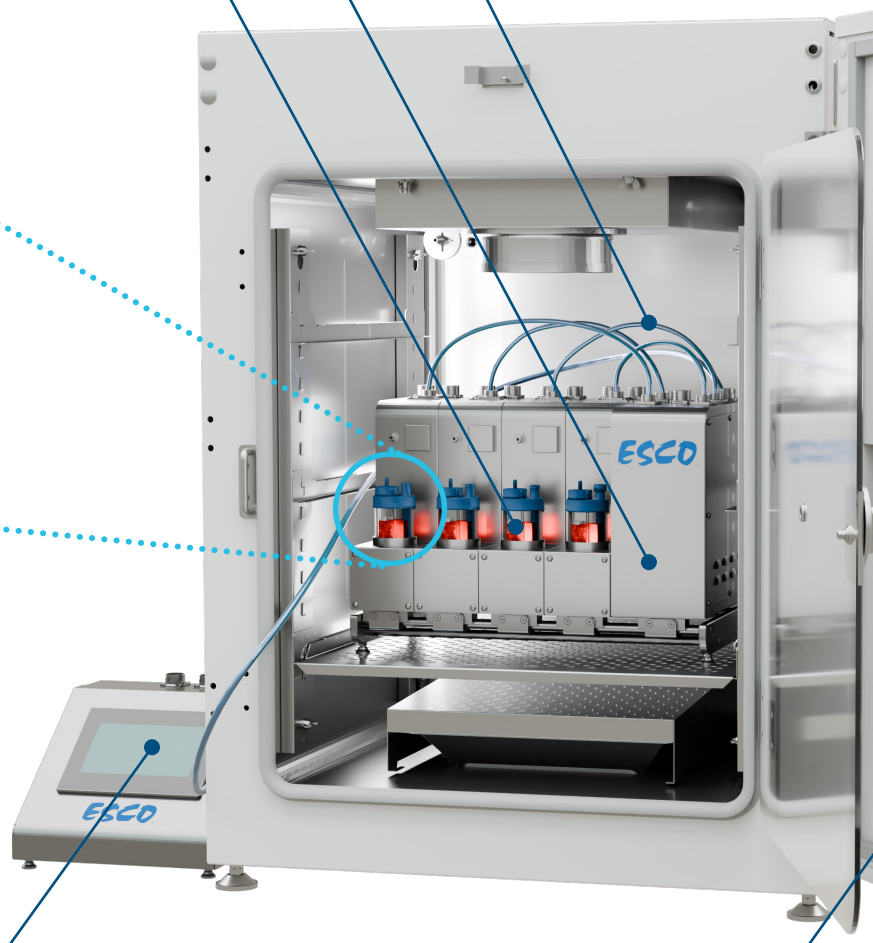
MiniTide® Culture Stage

Stainless steel 304 that can hold up to 4 MiniTide® vessels.

MiniTide® Matrix Vessel

Specialized containers that hold 35 mL of culture medium and promotes optimal cell growth and production.





BioNOC II® / BioMESH® (Packed Bed)

Cells remain entrapped in the carriers, simplifying media replacement and product harvesting.

HMI Box

MiniTide® HMI utilizes Siemens HMI KTP700/PLC 1214C, which allows for independent control of the experiment conditions.

CO_2 Incubators (optional)

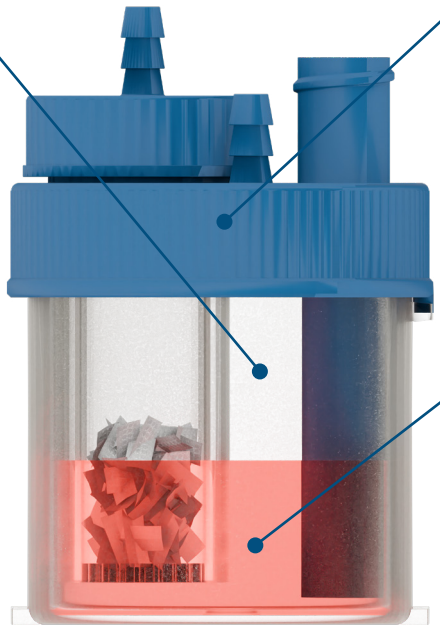
Esco CO_2 incubators have top-notch features, making it reliable choice to cradle precious cells.

MiniTide® Matrix Vessel

The MiniTide® system utilizes a multi-purpose culture vessel capable of holding up to 60 mL. However, for optimal performance, a working volume of 35 mL is recommended. The usable volume is further optimized based on the chosen macrocarriers, BioNOC II® or BioMESH®. This flexibility empowers scientists and researchers with the ability to tailor production processes, particularly advantageous for initial small-scale studies.

Polystyrene

Polystyrene stands out as a preferred choice for cell culture flasks. This selection is driven by its key properties: superior optical clarity, ensuring unobstructed observation, exceptional durability for reliable performance, and minimal cytotoxicity.



Polypropylene

Polypropylene exhibits exceptional resistance to moisture, a variety of acids, and alkalies. This material offers a robust combination of high impact strength and fatigue resistance, creating a favorable environment for cell growth and proliferation.

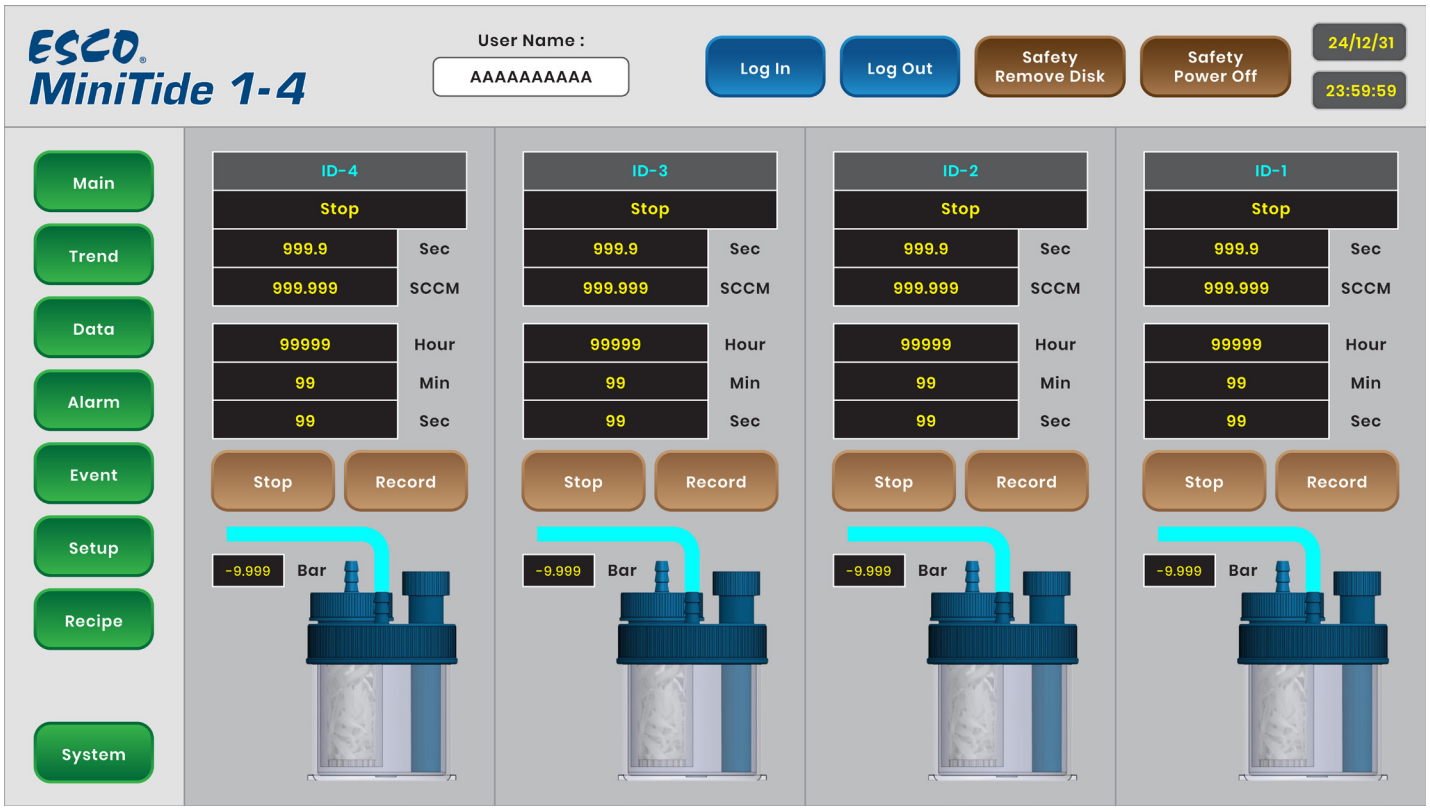
Working Volume

The MiniTide® system employs a versatile cell culture vessel with a maximum capacity of 60 mL, but a working volume of 35 mL is recommended.

Working Volume	35 mL	
Pre-Packed Carrier	BioNOC II®	0.17 ± 0.005 g
		25 pcs
	BioMESH®	0.5 ± 0.05 g
		Initially supplied as 10 BioMESH® sheets (24 × 9 mm). These sheets are bisected to yield a total of 20 BioMESH® sheets (12 × 9 mm).
Material	Cap	Polypropylene
	Bottle	Polystyrene

MiniTide® HMI Main Screen

MiniTide-4 features independent control, enabling researchers to design diverse experiments. This allows for the exploration of various parameters, including independent manipulation of top holding (nutrient exchange) and bottom holding (aeration phase) durations, as well as the investigation of the impact of different media types.



HMI Main Screen	Displays the main screen
Trend	Displays the trend graph
Data	Displays the data list
Alarm	Displays the alarm list
Event	Displays the operation history
Setup	Displays the programming settings page and the manual operation page
Recipe	Displays recipe operation page
System	Displays the system configuration settings page
Log In	Displays user login screen
Log Out	Logging out the current user
Safety Remove Disk	Ensuring the files are properly saved
Safety Power Off	Function key to confirm closing the background program

MiniTide® Product Specification

Esco Tide Motion® system bioreactors are a leading technology platform for global commercial production of human and animal vaccines. Additionally, Esco Tide Motion® system bioreactors play an essential role in clinical applications, supporting the development of adherent cell therapies and their derivatives. These derivatives include exosomes, extracellular vesicles, cell-derived nanovesicles, collagen for medical and cultivated meat applications, proteins for diagnostics and therapeutics, growth factors, and biomaterials like cultivated leather, all with applications in the biomedical field. MiniTide® is for research use or further manufacturing only and cGMP/GMP usage is subject to the site Quality Manufacturing Systems to be in place.

Note: MiniTide® needs to be placed in a cooled CO_2 incubator to offset the heat it produces.

Weight*	HMI Box**	6.5 kg
	Main control box + 1 MiniTide® Module unit	11 kg
	Main control box + 2 MiniTide® Module units	13.7 kg
	Main control box + 3 MiniTide® Module units	16.7 kg
	Main control box + 4 MiniTide® Module units	20 kg
Required space (W × H × D)	HMI Box**	290 × 360 × 290 mm
	Main control box + 1 MiniTide® Module unit	210 × 270 × 460 mm
	Main control box + 2 MiniTide® Module units	295 × 270 × 460 mm
	Main control box + 3 MiniTide® Module units	380 × 270 × 460 mm
	Main control box + 4 MiniTide® Module units	465 × 270 × 460 mm
Power supply	100-230 VAC, 50/60 Hz	
Housing	304 stainless steel	
Tide Motion® rate range	15 ~ 75 mL/min	
Accuracy	1.5 mL/min[1]	
Holding Time	0 ~ 9999 s	
Other properties	Data trend chart Data sheet Alarm list Recipe management User authority management Export in PDF and CSV format	

** The user needs to ensure that the third-party CO_2 incubator with a cooling function can withstand the weight*
*** The HMI box is placed outside of the CO_2 incubator*

Item Code	Model Code	Description
Main Unit		
2231110	MIT-1M10	1 VESSEL, MODULE, 110-230V, 50/60HZ, - M for Modular
2231111	MIT-2M10	2 VESSELS, MODULE, 110-230V, 50/60HZ
2231112	MIT-3M10	3 VESSELS, MODULE, 110-230V, 50/60HZ
2231113	MIT-4M10	4 VESSELS, MODULE, 110-230V, 50/60HZ
2231097	MINITIDE, MIT-16A-8	16 VESSELS, AUTO, 230V, 50/60HZ

Note: Existing MiniTide® from stages 1 through 4 are capable of being retrofitted as per user's requirement.

Consumables		
MiniTide Vessel (MTMV)		
1400309	MINITIDE VESSEL-E, MTMV-E	4 EMPTY VESSELS **Matrix depends on client's requirement/s*
1400310	MINITIDE-BIONOC II, MTMV-BII, 10 PCS	For virus and applications which are sensitive to pH 10 pieces of BioNOC II Matrix:Media Ratio is 1:20 4 Vessel/Pack
1400311	MINITIDE-BIONOC II, MTMV-BII, 25 PCS	25 pieces of BioNOC II Matrix:Media Ratio is 1:7 4 Vessel/Pack
1400312	MINITIDE-BIOMESH 50 MICRON, MTMV-BM50	MiniTide-BioMESH 50 micron Matrix:Media Ratio is 1:7 4 Vessel/Pack
1400313	MINITIDE-BIOMESH 200 MICRON, MTMV-BM200	MiniTide-BioMESH 200 micron Matrix:Media Ratio is 1:7 4 Vessel/Pack
MiniTide Base Frame		
5012040	BASE FRAME, MINITIDE-2	SS CARCASS ONLY
5012041	BASE FRAME, MINITIDE-3	SS CARCASS ONLY
5012042	BASE FRAME, MINITIDE-4	SS CARCASS ONLY

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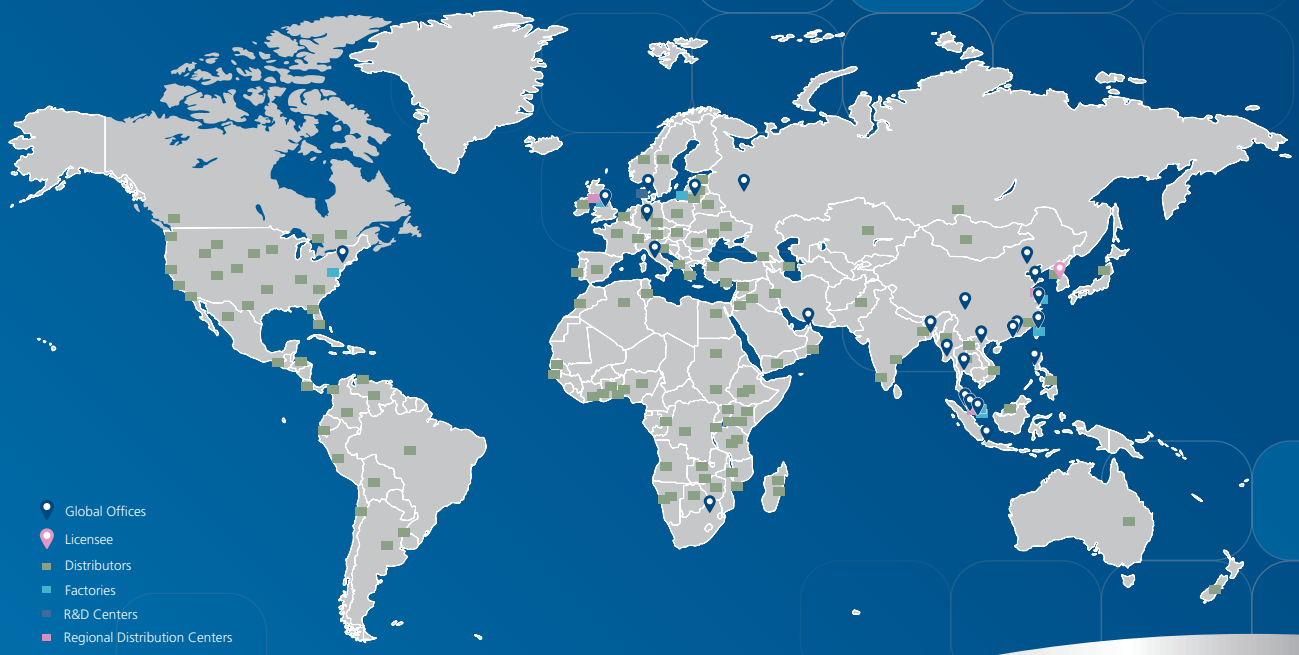
ESCO LIFESCIENCES GROUP NETWORK

42 Locations in 21 Countries All Over the World



Air Shower
Aseptic Containment Isolator (ACTI)
Ceiling Laminar Airflow Units
Cleanroom Transfer Hatch
Containment Barrier Isolator (CBI)
Downflow Booth (DFB)
Dynamic Floor Laminar Hatch
Dynamic Pass Box
Evidence Drying Cabinet
Garment Storage Cabinet
General Processing Platform Isolator (GPPI)
Laminar Flow Horizontal Trolley
Laminar Flow Straddle Units, Single and Double
Laminar Flow Vertical Trolley
Pass Box
Soft Wall Cleanroom
Sputum Booth
Ventilated Balance Enclosure (VBE)
Weighing and Dispensing Containment Isolator (WDCI)

Since 1978, Esco has emerged as a leader in the development of controlled environment, laboratory and pharmaceutical equipment solutions. Products sold in more than 100 countries include biological safety cabinets, fume hoods, ductless fume hoods, laminar flow clean benches, animal containment workstations, cytotoxic cabinets, hospital pharmacy isolators, and PCR cabinets and instrumentation. With the most extensive product line in the industry, Esco has passed more tests, in more languages, for more certifications, throughout more countries than any biosafety cabinet manufacturer in the world. Esco remains dedicated to delivering innovative solutions for the clinical, life science, research and industrial laboratory community. www.lifesciences.com.

ESCO HEALTHCARE "Discovery to Delivery"

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