EmulsiFlex®
High Pressure Homogenizers
A high pressure pump (C) pushes the product through an adjustable homogenizing valve (D). The product can also be passed through a membrane (E). It can be collected (G) or recycled to the reservoir (A) via tubing/pipes or heat exchanger (F).

EmulsiFlex equipment can be delivered as:

1- High pressure homogenizer (A,C,D,F,G)
2- High pressure filter/extruder (A,C,E,G)
3- Homogenizer/filter/extruder combination (A,C,D,E,G)
4- Two-phase homogenizer/filter/extruder with precision metering pumps, or as shown to the left (A,B,C,D,E,F,G).

### Product Line

<table>
<thead>
<tr>
<th></th>
<th>Lab &amp; Pilot Level</th>
<th>Pilot Production</th>
<th>Production Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model</strong></td>
<td>C3</td>
<td>C5</td>
<td>C50</td>
</tr>
<tr>
<td><strong>Minimum Volume</strong></td>
<td>7mL</td>
<td>7mL</td>
<td>25mL</td>
</tr>
<tr>
<td><strong>Maximum Flow Rate</strong></td>
<td>3 L/hr</td>
<td>1~5 L/hr</td>
<td>15~50 L/hr</td>
</tr>
<tr>
<td><strong>Holdback Volume</strong></td>
<td>&lt; 1 mL</td>
<td>&lt; 1 mL</td>
<td>&lt; 4 mL</td>
</tr>
<tr>
<td><strong>Maximum Homogenizing Pressure</strong></td>
<td>30,000psi (207MPa) 2,000bar</td>
<td>30,000psi (207MPa) 2,000bar</td>
<td>30,000psi (207MPa) 2,000bar</td>
</tr>
<tr>
<td><strong>Pump Type</strong></td>
<td>Single-acting electric motor driven pump</td>
<td>Single-acting air-driven pump</td>
<td>Double-acting air-driven pump</td>
</tr>
</tbody>
</table>

[www.avestin.com](http://www.avestin.com)
Features

**High Pressure**
- Standard equipment up to 30,000psi/2,000bar
- Pneumatic pressure control with optional pressure transducer for precise measurement and electronic data acquisition
- Virtually NO pressure pulsation for triple-plunger EmulsiFlex homogenizers

**Homogenizing Valve**
- Fully adjustable through its maximum homogenizing pressure range
- Easily disassembled for cleaning or inspection
- Particles with diameters less than 50nm and an extremely narrow distribution can be achieved
- Pressure is independent from flow rate for electric powered equipment
- No clogging can occur

**Unique Design**
- No “O”-rings or gaskets in the entire product path
- All seals are precision metal to metal or metal to ceramic face seals
- SIP (Steam In Place) sterilizable
- All wetted parts can be autoclaved and FDA approvable

**Services**
- Fast delivery for standard equipment
- Free demonstration is available (some conditions apply). Please contact AVESTIN for details
- No voice mail. A qualified person will answer your call in the language of your choice: English, Deutsch, Francais, Chinese.

www.avestin.com
Applications

Cell Rupture

**Fig-1**: *S. pombe* yeast cells live

**Fig-2**: *S. pombe* ruptured @30,000psi

**Figure 3**: Rupturing efficiency of *S. pombe* yeast cells using the EmulsiFlex-C160. At 30,000psi there is only one pass necessary to rupture yeast almost 100% (99.7%)

**Bacterial Rupture**

**Rupture E.coli @20,000psi / 138 Mpa**

<table>
<thead>
<tr>
<th>Sample</th>
<th>cfu/mL</th>
<th>% viable</th>
<th>% not viable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>4.06 x 10^9</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>1 pass</td>
<td>1.77 x 10^7</td>
<td>0.44</td>
<td>99.56</td>
</tr>
<tr>
<td>2 passes</td>
<td>1.70 x 10^6</td>
<td>0.04</td>
<td>99.96</td>
</tr>
<tr>
<td>3 passes</td>
<td>2.40 x 10^4</td>
<td>5.90 x 10^-4</td>
<td>≈100</td>
</tr>
</tbody>
</table>

**Figure 4**: Rupturing efficiency of *E.coli* (BL21) using the EmulsiFlex C160. At 30,000psi only one pass is necessary to rupture yeast almost 100% (99.7%)

**Oil in Water Emulsion**

<table>
<thead>
<tr>
<th>Sample</th>
<th>Homogenizing Pressure</th>
<th>Product Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>-</td>
<td>656nm</td>
</tr>
<tr>
<td>1 pass</td>
<td>16,000 psi</td>
<td>77nm</td>
</tr>
<tr>
<td>3 passes</td>
<td>16,000 psi</td>
<td>59nm</td>
</tr>
<tr>
<td>5 passes</td>
<td>16,000 psi</td>
<td>42nm</td>
</tr>
</tbody>
</table>

**Figure 5**: Oil in water emulsion prepared using the EmulsiFlex high pressure homogenizer.

**Pharmaceutical Emulsion**

**Pharmaceutical Emulsion**

<table>
<thead>
<tr>
<th>Sample</th>
<th>Extruder Pore Diameter</th>
<th>Homogenizing Pressure</th>
<th>Product Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>control</td>
<td>-</td>
<td>-</td>
<td>435nm</td>
</tr>
<tr>
<td>3 passes</td>
<td>80nm</td>
<td>0 psi</td>
<td>85nm</td>
</tr>
<tr>
<td>3 passes</td>
<td>80nm</td>
<td>10,000psi</td>
<td>48nm</td>
</tr>
<tr>
<td>3 passes</td>
<td>80nm</td>
<td>18,000psi</td>
<td>33nm</td>
</tr>
</tbody>
</table>

**Figure 6**: Combined homogenization/extrusion led to liposomes with a particle size of 113.7nm in one pass and 89.9nm in two passes. The effective diameter was measured using the Brookhaven Instruments 90Plus Particle Size Analyzer.

**Figure 7**: Pharmaceutical emulsion prepared using the EmulsiFlex high pressure extruder and extruder/homogenizer combination.
**EmulsiFlex™ - C5**
High-Pressure Homogenizer

- Capacity: 1 ~ 5L/hr
- Pressure: Up to 30,000psi / 2,000bar
- Min. Volume: 7mL

**Capacity:** The EmulsiFlex-C5 has a capacity of 1-5L/hr. The flow rate depends upon the selected homogenizing pressure. Samples as small as 7mL can be processed with a hold back volume of less than 1mL.

**Pressure:** Adjustable between 500-30,000psi (30-2,000bar), which is high enough for virtually every homogenization application. Pneumatic pressure control. Pressure transducer for precision pressure measurement is also available.

**Unique Design:** The EmulsiFlex-C5 has an air/gas driven, single-acting, high-pressure pump. Quiet operation is due to a specially designed pump motor pilot valve. There are no “O”-rings and no gaskets in the entire product path. All face seals are precision-machined metal to metal or metal to ceramic.

**Temperature Control:** AVESTIN provides stainless steel heat exchangers to control inlet and outlet temperatures. The entire EmulsiFlex-C5 can be immersed in a water bath for temperature control.

**Filter/Extruder:** The EmulsiFlex-C5 can be equipped with a high-pressure filter/extruder. Applications include the extrusion of emulsions or liposome through membranes and sterile filtration at high pressure.

**Homogenizing Valve:** The EmulsiFlex-C5 is delivered with a dynamic homogenizing valve. The valve can be easily disassembled for cleaning or inspection. Submicron particles or droplets with diameters less than 50nm and extremely narrow size distributions can be achieved.

**Cleaning/Sterilization:** The equipment is Steam-In-Place (SIP) sterilizable. It is suitable for clean room and GMP manufacturing. All wetted parts are autoclavable. For inspection, all wetted parts can be disassembled and reassembled in a short time.

**Applications:** Pharmaceuticals, chemicals, cosmetics, coatings, inks, food, etc. Suitable for clean room and GMP manufacturing.

**Dimensions:**
- mm: 430 (L) * 160 (W) * 320 (H)
- inch: 17 (L) * 6.3 (W) * 12.6 (H)

**Weight:** 25Kg / 55lb

**Power:** electrical power is not required

**Air:** 7.0 SCFM@100psi (7bar)

www.avestin.com
EmulsiFlex™ - C3
High-Pressure Homogenizer

- Capacity: 3L/hr*
- Pressure: Up to 30,000psi / 2,000bar
- Min. Volume: 7mL
- Electric Motor Driven

Capacity: The EmulsiFlex-C3 has a capacity of 3L/hr. The flow rate is independent of homogenizing pressure. Minimum sample volume of 7mL with a holdback volume of less than 1mL.

Pressure: Adjustable between 500-30,000psi(30-2,000bar), which is high enough for virtually every homogenization application. Pneumatic pressure control with virtually no air consumption. Pressure transducer for precision pressure measurement is also available.

Unique Design: The EmulsiFlex-C3 has an electric gear motor driven, single-acting, high-pressure pump. Almost noiseless. Runs with 220V or 110V power. The motor is only 1HP (0.75kW). There are no “O”-rings in the high pressure product path. The instrument can be installed and run almost anywhere.

Temperature Control: AVESTIN provides stainless steel heat exchangers to control inlet and outlet temperatures.

Filter/Extruder: The EmulsiFlex-C3 can be equipped with a high pressure filter/extruder. Applications include the extrusion of emulsions or liposome through membranes and sterile filtration at high pressure.

Homogenizing Valve: The EmulsiFlex-C3 is delivered with a dynamic homogenizing valve. The valve can be easily disassembled for cleaning or inspection. Submicron particles or droplets with diameters less than 50nm and extremely narrow size distributions can be achieved.

Cleaning/Sterilization: The equipment is Steam-In-Place (SIP) sterilizable. It is suitable for clean room and GMP manufacturing. All wetted parts are autoclavable. For inspection, all wetted parts can be disassembled and reassembled in a short time.

Applications: Pharmaceuticals, chemicals, cosmetics, coatings, inks, food, etc. Suitable for clean room and GMP manufacturing.

Dimensions:
- mm: 380 (L) * 630 (W) * 530 (H)
- inch: 15 (L) * 24.8 (W) * 21 (H)

Weight: 120Kg / 264lb
Power: 110~220V, 50/60Hz, 1hp/0.75kW
Air: 60-120psi, virtually no air consumption

* running at 60Hz

www.avestin.com
EmulsiFlex™ - C50
High-Pressure Homogenizer

- Capacity: 15~50L/hr
- Pressure: Up to 30,000psi / 2,000bar
- Min. Volume: 25ml

Cell Rupture  Emulsions  Nanoparticles  Liposome

**Capacity:** The EmulsiFlex-C50 has a capacity of 15-50L/hr. The flow rate depends upon the selected homogenizing pressure. Samples as small as 25mL can be processed with a hold back volume of less than 4mL.

**Pressure:** Adjustable between 500-30,000psi or 30-2,000bar, which is high enough for virtually every homogenization application. Pneumatic pressure control. Pressure transducer for precision measurement is also available.

**Unique Design:** The EmulsiFlex-C50 has an air/gas driven, double-acting, high-pressure pump. There is no air-operated pilot valve, making it possibly the quietest air-driven pump of its type on the market today. No “O”-rings or gaskets in the entire product path. All face seals are precision-machined metal to metal or metal to ceramic.

**Temperature Control:** AVESTIN provides stainless steel heat exchangers to control inlet and outlet temperatures. The EmulsiFlex-C50 can be operated in a cold room to minimize temperature increases.

**Filter/Extruder:** The EmulsiFlex-C50 can be equipped with a high pressure filter/extruder. Applications include the extrusion of emulsions or liposome through membranes and sterile filtration at high pressure.

**Homogenizing Valve:** The EmulsiFlex-C50 is delivered with a dynamic homogenizing valve. The valve can be easily disassembled for cleaning or inspection. Submicron particles or droplets with diameters less than 50nm and extremely narrow size distributions can be achieved.

**Cleaning/Sterilization:** The equipment is Steam-In-Place (SIP) sterilizable. It is suitable for clean room and GMP manufacturing. All wetted parts are autoclavable. For inspection, all wetted parts can be disassembled and reassembled in a short time. The EmulsiFlex-C50 is designed such that wetted parts can be separated from the controls for clean room operation.

**Applications:** Scale-up production of pharmaceuticals, chemicals, coatings, inks, cosmetics, food. Suitable for clean room and GMP manufacturing.

**Dimensions:**
- mm: 610 (L) * 530 (W) * 260 (H)
- inch: 24 (L) * 20.8 (W) * 10.2 (H)

**Weight:** 80Kg / 176lb

**Power:** 110/230V, 50/60Hz (for control panel)

**Air:** 45 SCFM @100psi (7bar)

www.avestin.com
EmulsiFlex™ - C55
High-Pressure Homogenizer

- Capacity: 55L/hr*
- Pressure: Up to 30,000psi / 2,000bar
- Min. Volume: 30ml
- Electric Motor Driven

Capacity: The EmulsiFlex-C55 has a capacity of 55L/hr. The flow rate is independent of homogenizing pressure. Minimum sample volume of 30mL with a holdback volume of less than 6mL.

Pressure: Adjustable between 500-30,000psi or 30-2,000bar, which is high enough for virtually every homogenization application. Pneumatic pressure control with virtually no air consumption. Pressure transducer for precision pressure measurement is also available.

Unique Design: The EmulsiFlex-C55 has an electric gear motor driven, triplex, high pressure pump designed to minimize the fluctuation of homogenizing pressure. There are no “O”-rings and gaskets in the high pressure product path. All face seals are precision-machined metal to metal or metal to ceramic.

Temperature Control: AVESTIN provides stainless steel heat exchangers to control inlet and outlet temperatures.

Filter/Extruder: The EmulsiFlex-C55 can be equipped with a high pressure filter/extruder. Applications include the extrusion of emulsions or liposomes through membranes and sterile filtration at high pressure.

Homogenizing Valve: The EmulsiFlex-C55 is delivered with a dynamic homogenizing valve. The valve can be easily disassembled for cleaning or inspection. Submicron particles or droplets with diameters less than 50nm and extremely narrow size distributions can be achieved.

Cleaning/Sterilization: The equipment is Steam-In-Place (SIP) sterilizable. It is suitable for clean room and GMP manufacturing. All wetted parts are autoclavable. For inspection, all wetted parts can be disassembled and reassembled in a short time.

Applications: Scale-up production of pharmaceuticals, chemicals, coatings, inks, cosmetics, food. Suitable for clean room and GMP manufacturing.

Dimensions:  
- mm: 480 (L) * 530 (W) * 780 (H)  
- inch: 18.9(L) * 20.8 (W) * 30.7 (H)

Weight: 220Kg /480lb

Power:  
- 208/230/380/460V, 50/60Hz,3-phase, 7.5hp/5.5kW

Air: 60-120psi, virtually no air consumption

* running at 60Hz

www.avestin.com
**EmulsiFlex™ - C160**  
**High-Pressure Homogenizer**

- **Capacity:** 160L/hr*
- **Pressure:** Up to 30,000psi / 2,000bar
- **Min. Volume:** 35ml
- **Electric Motor Driven**

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**Capacity:** The standard EmulsiFlex-C160 has a capacity of 160L/hr/(0.7GPM). The flow rate is independent of the homogenizing pressure. Minimum sample volume of 35mL with a hold back volume of less than 8mL.

**Pressure:** Adjustable between 500-20,000psi/30-1,330bar (EmulsiFlex-C160A) or between 500-30,000psi/30-2,000bar (EmulsiFlex-C160B). A variable speed version, the EmulsiFlex-C160/VS, processes at flow rates between 80L/hr and 160L/hr. The flow rate is infinitely adjustable within this range and easily controlled. The EmulsiFlex-C160/VS will homogenize and meter the product at the same time.

**Unique Design:** The EmulsiFlex-C160 has an electric gear motor driven, triplex, high pressure pump designed to minimize the fluctuation of homogenizing pressure. There are no “O”-rings and gaskets in the high pressure product path. All face seals are precision-machined metal to metal or metal to ceramic.

**Temperature Control:** AVESTIN provides stainless steel heat exchangers to control inlet and outlet temperatures.

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**Homogenizing Valve:** The EmulsiFlex-C160 is delivered with a dynamic homogenizing valve. The valve can be easily disassembled for cleaning or inspection. Submicron particles or droplets with diameters less than 50nm and extremely narrow size distributions can be achieved.

**Cleaning/Sterilization:** The equipment is Steam-In-Place (SIP) sterilizable. It is suitable for clean room and GMP manufacturing. All wetted parts are autoclavable. For inspection, all wetted parts can be disassembled and reassembled in a short time. The pump inlets can be connected to a compressed air/nitrogen cylinder to flush out the entire product path.

**Applications:** Production of pharmaceuticals, chemicals, coatings, inks, cosmetics, food. Suitable for clean room and GMP manufacturing.

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**Dimensions:**

- mm: 1250 (L) * 750 (W) * 820 (H)
- inch: 49(L) * 30 (W) * 32.2 (H)

**Weight:** 500Kg / 1,100 lb

**Power:**

- 208/230/380/460V, 50/60Hz, 3-phase, 15hp/11kW

**Air:** 60-120psi, virtually no air consumption

* running at 60Hz

www.avestin.com
EmulsiFlex™ - C1000
High-Pressure Homogenizer

- Capacity: 1,000L/hr*
- Pressure: Up to 30,000psi / 2,000bar
- Electric Motor Driven

Cell Rupture  Emulsions  Nanoparticles  Liposome

**Capacity:** The standard EmulsiFlex-C1000 has a capacity of 1000L/hr (4.4GPM). The flow rate is independent of the homogenizing pressure. Minimum sample volume of 5L with a hold back volume of less than 15mL.

**Pressure:** Adjustable between 500-20,000psi/30-1,330bar (EmulsiFlex-C1000A) or between 500-30,000psi/30-2,000bar (EmulsiFlex-C1000B). The flow rate is infinitely adjustable between 850L/hr to 1,000L/hr.

**Unique Design:** The EmulsiFlex-C1000 has an electric gear motor driven, triplex, high pressure pump designed to minimize the fluctuation of homogenizing pressure. There are no “O”-rings and gaskets in the high pressure product path. All face seals are precision-machined metal to metal or metal to ceramic.

**Temperature Control:** AVESTIN provides sanitary and electropolished stainless steel heat exchangers to control inlet and outlet temperatures.

**Homogenizing Valve:** The EmulsiFlex-C1000 is delivered with a dynamic homogenizing valve. The valve can be easily disassembled for cleaning or inspection. Submicron particles or droplets with diameters less than 50nm and extremely narrow size distributions can be achieved.

**Cleaning/Sterilization:** The equipment is Steam-In-Place (SIP) sterilizable. It is suitable for clean room and GMP manufacturing. All wetted parts are autoclavable. For inspection, all wetted parts can be disassembled and reassembled in a short time. The pump inlets can be connected to a compressed air/nitrogen cylinder to flush out the entire product path.

**Applications:** Production of pharmaceuticals, chemicals, coatings, inks, cosmetics, food. Suitable for clean room and GMP manufacturing.

**Dimensions:**
- mm: 1110 (L) * 838 (W) * 1550 (H)
- inch: 44(L) * 33 (W) * 61 (H)
- Weight: 1,000Kg /2,200lb
- Power: Various 3-phase, 50/60Hz, 100hp/75kW
- Air: 60-120psi, virtually no air consumption

* running at 60Hz

www.avestin.com
LiposoFast™

- Prepare unilamellar homogeneous liposome in 5 minutes
- Capacity: 0.2ml to 1.0ml
- Over 6,000 instruments sold worldwide

**Unilamellar Liposome Membrane Extruder**

**Principle of Operation:** The LiposoFast-Basic produces unilamellar liposomes by the manual extrusion of a multilamellar liposome suspension through a polycarbonate membrane of defined pore size, using gas-tight, glass syringes. The sample is passed through the membrane by pushing the sample back and forth between two syringes. Depending on the formulation, 11-21 passes are usually sufficient to produce liposomes of a uniform size.

**Capacity:** The instrument’s capacity is from 0.2 to 1.0mL, making it extremely useful for preparing large numbers of small samples for research. The LiposoFast-Basic has virtually no dead-volume, allowing for almost complete sample recovery. The standard LiposoFast-Basic comes with two 0.5mL gas-tight syringes. 0.25mL and 1.0mL syringes are also available.

**Temperature Control:** The entire LiposoFast-Basic can be immersed in a water bath for use with high transition temperature lipids or heat sensitive compounds.

**Cleaning and Sterilization:** All LiposoFast products are easily cleaned and can be autoclaved.

**LiposoFast-Stabilizer:** Facilitates the repetitive use and extrusion of highly concentrated emulsions.

**LiposoFast Pneumatic-Actuator:** Place the LiposoFast Basic hand-held extruder in The LiposoFast Pneumatic-Actuator to process large numbers of samples with little effort. A source of low pressure compressed air is all that is needed to process volumes up to 1mL.

LiposoFast products are available for a FREE trial. Visit [www.avestin.com](http://www.avestin.com) for more information.
AVESTIN designs and manufactures high pressure filter / extruders (diameter: 47mm or 90mm) for most EmulsiFlex homogenizers.

Applications include extrusion of emulsions or liposomes through membranes and sterile filtration at pressure up to 6500psi/260bar.

AVESTIN provides a range of heat exchangers which can be used to control product temperatures. Heat transfer fluids in the range of –25 to 200 °C / -13 to 400 °F can be used. Simple cooling coils can be fitted where less stringent temperature control is acceptable.

All heat exchangers are made of stainless steel to a high quality standard. Heat exchangers are easily and rapidly removed or replaced as required.

AVESTIN manufactures a unique, electronic peak reset meter to process the signals generated by an autoclavable pressure transducer for sterile applications.

The peak pressure is displayed and reset every 3 seconds. Provisions are made to output pressure measurements to a recorder for monitoring or automating processing.

AVESTIN provides a variety of sample containers for particular applications.

The second container from the right is an example of a sanitary vessel, jacketed for homogenizer inlet temperature control.