

M-610 Series

Custom Specification Microfluidizer Production Equipment
for Continuous High Shear Fluid Processing

M-610 Production Scale Microfluidizer® Processor

Recommended for:

- *Immiscible Liquid Emulsions*
- *Solids in Liquid Suspensions*
- *Submicron Particle Size Reduction*
- *Cell Disruption*
- *Deagglomeration*

The M-610 Series Microfluidizer Processors are production-scale machines that provide ultra high shear rates above all available mixers and homogenizers on the market today. Each M-610 is custom-designed to provide the user a broad choice of operating pressures and product flow rates. The M-610 Series machines maximize the energy-per-unit fluid volume, resulting in uniform sub-micron particle and droplet sizes.

Using Microfluidics' fixed geometry interaction chamber technology, each M-610 model is easy to operate and is capable of processing a wide variety of fluids ranging from simple oil in water emulsions to highly abrasive solid-in-liquid suspensions.



The M-610 Series Microfluidizer processors use ultra high shear to achieve superior, scalable results with easy handling and cleaning

Key benefits:

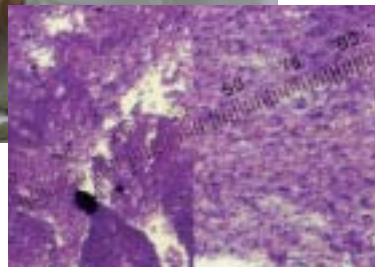
- Repeatabile, uniform results with guaranteed scale-up from your lab or pilot results
- Broad range of throughput — continuous or batch mode; the model M-610 is designed to meet your specific flow requirements.

Key features:

- Double-acting intensifier pump(s) provide near-constant pressure for repeatable results
- Patented, wear-resistant interaction chamber technology maximizes energy per unit volume of product
- Highest shear rates of all available mixers and homogenizers
- Easy in-line cleaning and simple maintenance



Patented Microfluidizer processors produce stable emulsions and uniform dispersions with sub-micron size particles



Before Processing After Processing

 **Microfluidics™**

A DIVISION OF **MFIC**
CORPORATION

Guaranteed scaleup from lab results

The Microfluidizer process equipment line is unique in the fluid processing industry in using the same interaction chamber technology throughout our line from laboratory to high-volume production models. This enables Microfluidics to guarantee that results you have obtained in your R&D are reproducible in higher volume production with the M-610 series. M-610 systems are built according to customer specifications. We will assist you in determining the optimal combination of flow and pressure rates, type of interaction chamber(s) and overall configuration.

In addition, Microfluidics is a service-oriented vendor; we work with you in sampling your formulas in our applications laboratory, providing full confidential documentation of results. You will receive qualitative and quantitative analysis, particle size measurement and distribution results, and recommendations on how to achieve desired results.

We work as your partner in product development and production, providing out-of-house expertise and ongoing applications assistance.

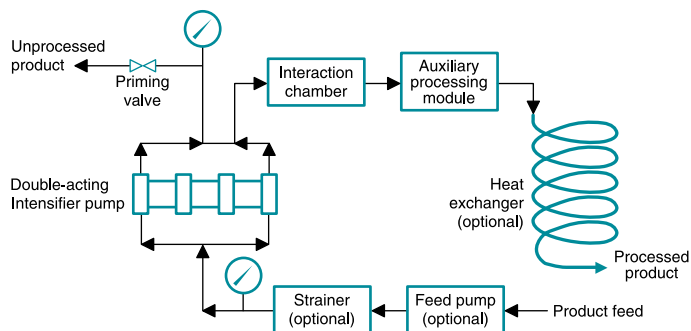
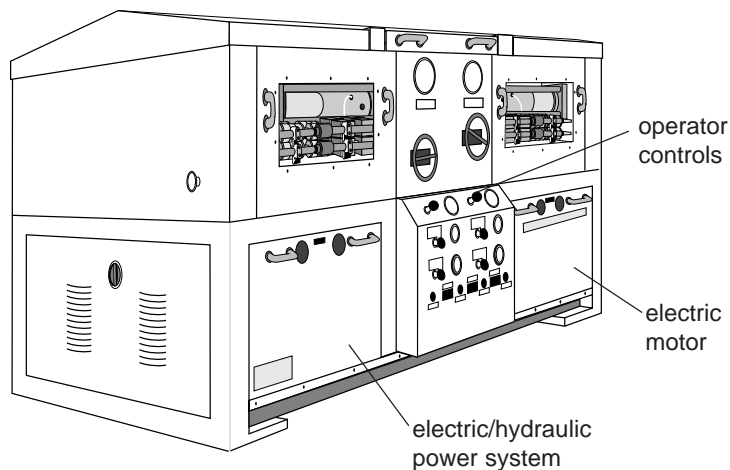
Operating principle

Each M-610 series machine contains one or more electric-hydraulic modules that provide power to double-acting intensifier pumps. Intensifier pumps amplify the hydraulic pressure and, in turn, impart that pressure to the product streams to create high velocity and high-shear product flow. Variable process pressures may be selected with the simple turn of a knob.

Each intensifier pump is designed to supply the desired pressure at a constant rate to the product stream. As the pump travels in one direction, it drives the product at constant pressure through one or more interaction chambers. Within each chamber are specially designed fixed-geometry micro-channels through which the product accelerates to high velocities, creating shear and impact forces as the product stream impinges upon itself and on wear-resistant surfaces, bringing about the desired results.

As the intensifier pump continues its travel in one direction, a series of check valves allow product to be drawn into the opposite end of the pump. As the intensifier pump completes its stroke, it reverses direction and the new volume of product is pressurized repeating the process. This creates a near-constant flow of product at constant pressure through the interaction chamber.

Upon exiting the interaction chamber, the product may be directed through an optional heat exchanger, recirculated through the system for further processing or directed externally to the next step in the process, bringing about the desired results.



Interaction chamber choices



The interaction chamber is a patented device which allows you to achieve formulations with characteristics that would not be possible or economical with other available techniques. Interaction chambers are of fixed internal geometries through which materials are processed at extreme pressures (up to 40,000 psi) and velocities creating shear rates that are orders of magnitude greater than any other conventional means. All of the product experiences uniform processing conditions resulting in narrow distributions of sub-micron particle and droplet sizes, effective deagglomeration and highly efficient cell disruption.

Typical Results Achieved

Using M-610 Microfluidizer Processing Equipment

Sample	Pressure	Passes	Results
EMULSIONS			
Oil-in-water emulsion 10% Mineral oil, 1% HLB 12 in water	10,000 psi	1 pass	Small, uniform particle distribution (175 nm +/- 37%) resulting in long-term stability
Cellulose Fibers	20,000 psi	3 passes	Formed a thick, creamy emulsion.
Ketchup	2,000 psi	1 pass	Increased viscosity. Resulted in smoother, more homogenous ketchup with improved mouth feel, greater yield.
DISPERSIONS			
Dispersion of steroids/water	22,000 psi	6 passes	Starting size 0-100 microns. Achieved average particle size of 0-2 microns
Cosmetic Color Dispersion	19,500 psi	1 pass	Reduced particle size, increased uniformity and enhanced color intensity.
30% Iron Oxides (Fe ₃ O ₄) in solvent	10,000 psi	1 pass	Total deagglomeration in one pass for magnetic coating. Continuous process.
Phthalocyanina pigment (blue) in polymer and solvent	15,000 psi	3 passes	Deagglomerated and dispersed polymer/pigment uniformly in solvent
Gasket Materials: Carbon Black and rubber in MEK and other solvents	18,000 psi	4 passes	Replaced media mill; easy to operate and clean with no media contamination. Produced better, smoother dispersion for making gasket compound.
LIPOSOMES			
Diagnostic Liposomes 300 u.mo/ml Phosphatidycholine and Cholesterol	5,000 psi	1 pass	Ability to process a very viscuous, high concentration of liposomes continuously to achieve a size distribution of 161 nm +/- 40%.
Cosmetic Liposomes 11% Soy Lecithin with Amino Acids	18,000 psi	1 pass	Current method used to process a commercial product with a resulting particle size of 71 nm +/- 31%.
CELL DISRUPTION			
E coli	11,000 psi	1 pass	Achieved 90%+ rupture rate while maintaining the process temperature at 15°C. Continuous operation at a flow rate of 30 gph.
Brewers Yeast	20,000 psi	5 passes 10 passes	90% rupture 98% rupture

Standard features

- Dimensionally fixed Interaction Chamber employs no moving parts—abrasion resistant ceramic or diamond construction
- Highly durable intensifier pumping system—efficient at ultrahigh pressures
- High-pressure plunger seals and check valves—made to withstand abrasive and corrosive formulations. Both seals and check valves are accessible and can be replaced easily
- Isolation of the process fluid from the hydraulic fluid—prevents cross contamination.
- Coned and threaded tubing and fittings—these connections provide a high degree of reliability and cleanability
- Stainless steel frame and enclosure—protects the high pressure components from damage, contains spills and features panels which are easily removable
- Simple and efficient fluid power drive system
- Materials of construction—wetted parts of: 316 stainless steel, Tungsten Carbide, alumina (Al₂O₃), Ultra High Molecular Weight Polyethylene (UHMWPE), Teflon[®] (PTFE), Polyetheretherketone (PEEK), 17.4 PH stainless steel, Nitronic 60, 15.5 PH stainless steel

Equipment Options

- Plunger seals—Teflon (PTFE) seals are available for high temperatures of up to 300°F
- Outlet heat exchanger
- Chamber sets—additional sets of interaction chambers are available in different sizes or diamond interiors to suit application requirements
- Steam sterility package
- Ultra Clean in Place (UCIP)
- Solvent seal quench
- Flush diaphragm pressure transducer—for electronic readings of the system pressure
- Explosion-proof system and remote panels available
- Alternate finishes—to meet sanitary standards
- CE compliance (Europe)
- Full automation



M-610 system used in processing highly abrasive slurry at 9 gallons per minute at 15,000 psi.

M-610 General Specifications

Operating Pressure Range	up to 40,000 psi (2755 bar)
Nominal Flow Rate	Depends upon product characteristics and operating pressure)
Sample Size	1 gallon to continuous
Power Requirements	3 phase electric service, 208/230/460V up to 200 hp
Utility Requirement	Cooling water for hydraulic oil heat exchanger and optional process product heat exchanger, compressed air (50-150 psi 1scfm @ 50 psi, pressure dew point of 0-35°F)
Dimensions	varies with design
Weight	varies with design



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