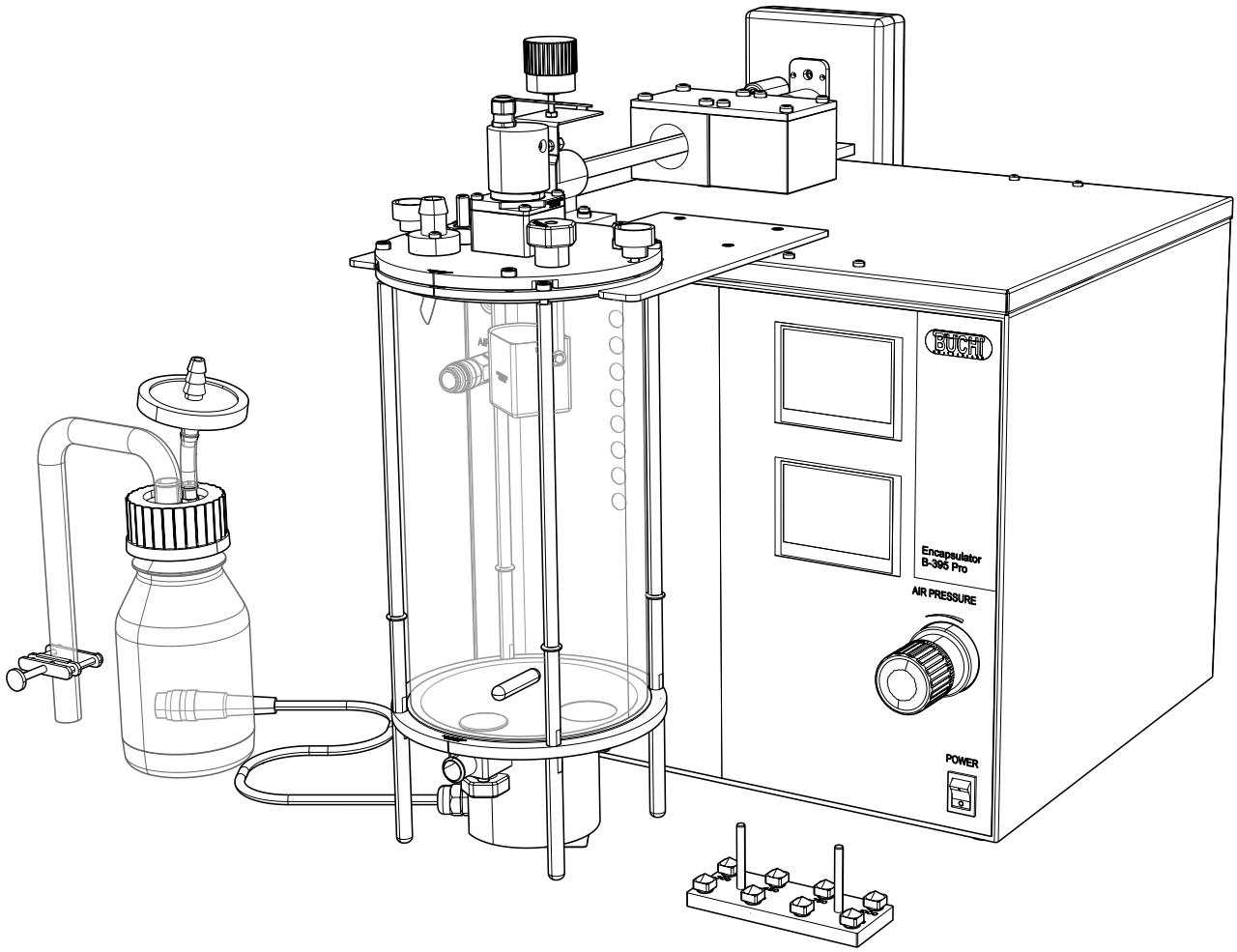
Encapsulator B-390 / B-395 Pro
Technical data sheet

The Encapsulator is the leading device for beads and capsules formation for sensitive materials in lab-scale R&D work. It is possible to encapsulate various materials into a polymeric or wax matrix. It offers the creative solutions using prilling by vibration technology to form beads and capsules, even with extremely sensitive and expensive materials.



Scope of delivery

There are two main versions of the Encapsulator.

The Encapsulator B-390 is for microencapsulation under open working conditions with integrated nozzle heating and liquid pumping by air pressure. Standard polymers to produce the bead and capsules are alginate, gelatin, wax, gum, proteins, cellulose.

The Encapsulator B-395 Pro is for Bioencapsulation of cells and microbes under sterile working conditions in a reaction vessel and pumping by integrated syringe pump or air pressure. Standard polymers to produce the bead and capsules are alginate, gum, proteins, cellulose.

Components	Qty	B-390	B-395 Pro
Reaction vessel / for sterile work			●
Tool box		●	●
Single nozzle system / for bead production		●	●
Heating for hot prilling / for gelatin, wax, fat		●	
Syringe pump included			●
Magnet stirrer			●
Tubing set		●	●
Pressure bottle 500 mL		●	●
Pressure bottle 1000 mL			●
Vibration Coil		●	●
Bead charging electrode		●	●

Order code

Choose the configuration according to your needs:

1	1	0	5	8	2		

Encapsulator (100 - 240 V / 50 - 60 Hz)

10 B-390
20 B-395 Pro
30 B-395 Pro with GMP documentation

Technical data

Power consumption	max. 150 W
Connection voltage	100 - 240 VAC
Frequency	50/60 Hz
Nozzle diameter of single nozzles	0.08, 0.12, 0.15, 0.20, 0.30, 0.45, 0.75 and 1.00 mm
Nozzle diameter of shell nozzles	0.20, 0.30, 0.40, 0.50, 0.60, 0.70 and 0.90 mm
Droplet size range	0.15 - 2.00 mm
Vibration frequency	40 - 6,000 Hz
Electrode tension	250 - 2,500 V
Syringe pump rate	0.01 - 50 mL/min
Pump rate by air pressure	0.5 - 200 mL/min
Maximal allowed air pressure in the system	1.5 bar
Reactor gross volume	4.5 L
Reactor working volume	2 L
Pollution degree	2
Installation category	II
Dimensions (W x H x D)	32 × 38 × 48 cm
Weight	11 kg

Accessories

	Qty	Order no.
Concentric nozzle set Nozzle set for capsule production. Pulsation chamber shell vibrated plus a set of 7 external nozzles with high precision opening of 0.2, 0.3, 0.4, 0.5, 0.6, 0.7 and 0.9 mm made of stainless steel, incl. 1000 mL pressure bottle.	1	11058051
Single nozzle set Set of 8 single nozzles with high precision opening of 0.08, 0.12, 0.15, 0.20, 0.30, 0.45, 0.75 and 1.00 mm, made of stainless steel 316 L including nozzle rack.	1	11057918
Flow vibration nozzle Nozzle set for high viscose solutions and smaller beads. Pulsation chamber core vibrated plus a set of 7 external nozzles with high precision opening of 0.2, 0.3, 0.4, 0.5, 0.6, 0.7 and 0.9 mm made of stainless steel, incl. air flow controller.	1	11060030
Air dripping nozzle Nozzle set for agglomerates and islet cells. Chamber, core nozzle 0.4 mm, shell nozzle 1.5 mm, air flow controller, incl. 2 short glass cylinders.	1	11060033
Upgrade bigger capsules Upgrade for concentric nozzle set to produce bigger capsules up to 4 mm.	1	11060020
Reaction vessel Completely autoclavable reactor made of glass and stainless steel for the sterile production and collection of microcapsules, 2 L working volume.	1	11057890
Reaction vessel with GMP documenation Completely autoclavable reactor made of glass and stainless steel for the sterile production and collection of microcapsules with GMP documentation, 2 liter working volume.	1	11057879
Pressure bottle 500 mL Glass bottles with fittings, tubes and air filter, working pressure up to 1.5 bar, autoclavable.	1	11058190
Pressure bottle 1000 mL Glass bottles with fittings, tubes and air filter, working pressure up to 1.5 bar, autoclavable.	1	11058191
Bead collection flask 250 mL glass bottle with fittings, tubes and air filter, autoclavable.	1	11057956
Grounding set	1	11058189
O-ring set for single nozzle	1	11057954
O-ring set for concentric nozzle	1	11057955
O-ring set for reaction vessel	1	11057970
Pre-filters for nozzle, diameter 7 mm (10 pcs.)	1	11057957
Drain filters for reaction vessel, diameter 35 mm (10 pcs.)	1	11057958

Functional principle

Step 1 Mixing of active ingredient and polymer

Step 2 Pumping of mixture with syringe pump or air pressure

Step 3 Superimposition of vibration

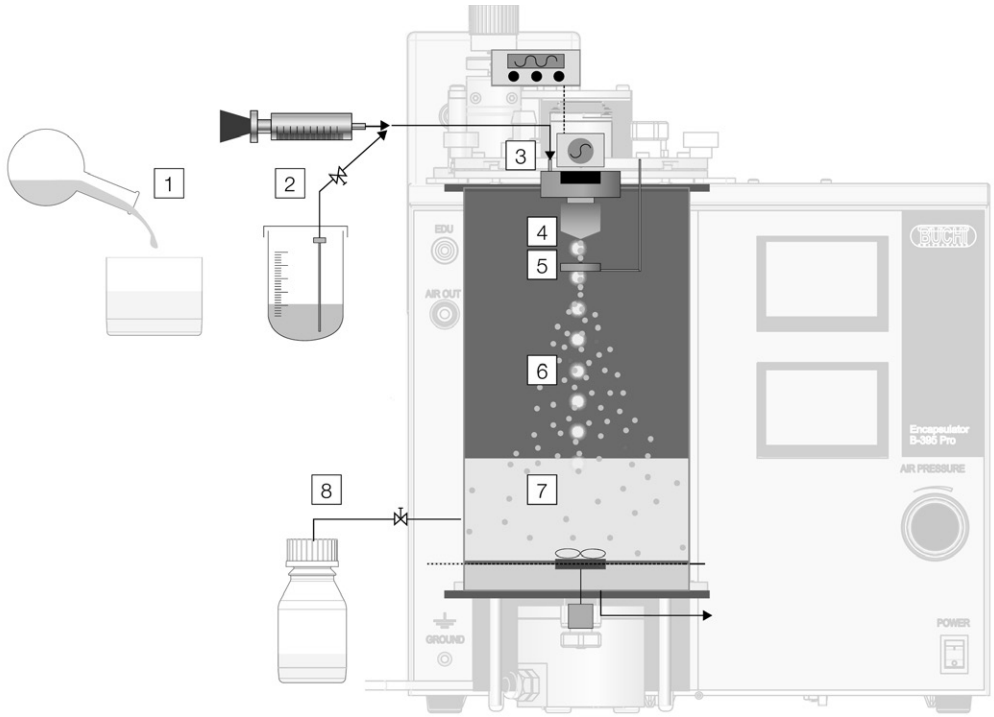
Step 4 Droplet formation

Step 5 Electrostatic charge of the droplets and dispersion of droplets

Step 6 Online process control of droplet formation in the light of the stroboscope lamp

Step 7 Bead formation in polymerization solution or by gelatination

Step 8 Collection of beads (matrix)

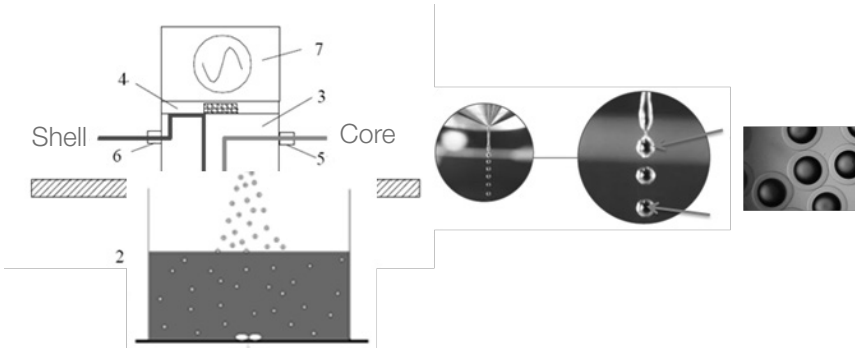


Functional principle of concentric nozzle system

The concentric nozzle is a standard nozzle configuration to produce core-shell capsules in a single step process in the laboratory. The Encapsulator setup is similar with the main difference being the replacement of single nozzle system with concentric one, with the latter requiring two liquid feeds, one for the outer nozzle (the shell material) and one for the inner nozzle (the core material).

Step 1 Core and shell material are placed in respective delivery mechanism

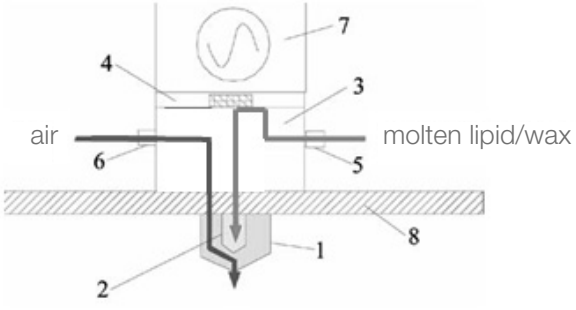
Step 2 Core and shell material are pumped to nozzle and form a concentric liquid jet.



Specially designed and developed concentric nozzle system used to produce smaller matrix microcapsules compared to the same nozzle sizes on the single nozzle system, while also enabling more viscous solutions to be used to produce the particles. The matrix material is pumped through the inner nozzle to form liquid jet, which is subsequently vibrated to enable the production of equally sized droplets. Air which is pumped at a controllable rate through the outer nozzle causes smaller diameter liquid jets to be produced compared to pressure extrusion alone, which subsequently break up (due to the applied vibrational frequency) into smaller droplets compared to production process using vibration alone.

Note: A standard concentric nozzle system cannot be used as described above as in this setup only the outer flow of material is vibrated (in case the air) and not the inner flow. Using the standard concentric system would result in the formation of heterogenous particles with a very large standard size deviation due to the matrix material not being vibrated at a controlled frequency.

Functional principle of the flow vibration system



Functional principle of the sterile (autoclavable) reaction vessel

The B-395 Pro model can be used to produce fully sterile bead and capsules. This is achieved by using a glass reaction (casing) vessel which fits around and completely encloses the bead/capsule production unit. This glass casing along with all other parts which come into contact with the microcapsules producing solutions are fully autoclavable, which ensures fully sterile conditions are obtained during the production process.

Characteristics of the produced particles (using all nozzles systems) and the production technique

Characteristic of beads/capsules	Value/compliance
Dispersion	Mono and singly dispersed
Shape	Sperical
Homogeny (uniformity)	Homogenous
Single and concentric nozzle	150 µm – 2 mm
Flow vibration system	50 µm – 2 mm*
Big capsules	3 - 4 mm
Sterility	Sterile or non-sterile particles
Cell viability within capsules	Very high due to the low shear stress and mild conditions
Process	One step

Process control	Fully controllable and immediately obtainable
Operation and setup	Simple operation and easy setup
Batch sizes	2 - 60 mL when using syringe pump 5 mL – 2 liters when using air pressure system
Production rates	1 mL/min up to 40 mL/min (up to 6000 beads per second and depends on conditions employed)
GMP	GMP compliant
Viscosity limit	Will depend on nozzle size and system used
Encapsulation yield	≥ 95% can be obtained in many cases

* In many cases particle size can be closely determined before production begins