PILOT SCALE

ME-2.5

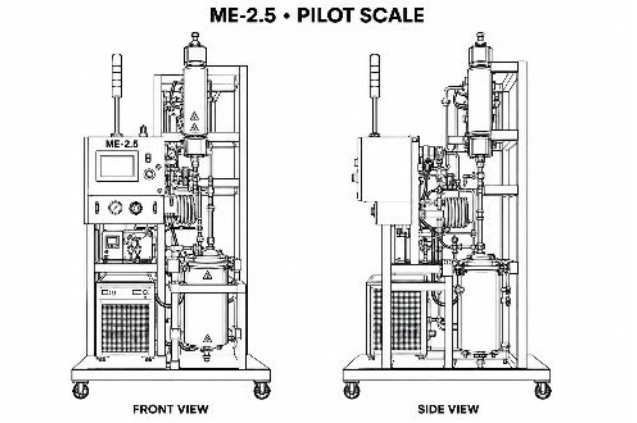
Molecular Encapsulator

CO_2-assisted formulation and particle engineering

The ME-2.5 brings CO_2-assisted formulation, encapsulation and particle engineering into one controlled system. Condition the active and carrier in a 2.5 L heated mixing vessel, then transfer through a configurable mixer and nozzle into a 10 L receiver for cyclonic separation and product recovery. Independent pressure and temperature settings let researchers develop and repeat formulation-specific processing methods.



ME-2.5 shown with optional process chiller and co-solvent pump.



Front and side reference views

2.5 L	10 L	276 bar / 27.6 MPa
PROCESS VESSEL	RECEIVER	BASE PROCESS PRESSURE

Formulation development for pharmaceuticals, foods, nutraceuticals, flavors, fragrances and specialty materials.

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SYSTEM FEATURES

Control the process and recover the product

Condition a formulation in the heated 2.5 L process vessel, establish CO_2 contact, then discharge through the selected mixer and nozzle into the 10 L receiver.

Pump-driven and pressure-pulsation mixing

Pump-driven and pressure-pulsation mixing eliminates rotating agitators and the associated issues with unreliable shaft seals. Bottom filling and repressurization mix the formulation with CO_2; contact time and pressure-pulse sequencing are selectable.

Independent mixer and receiver pressure

Control pressure independently in both the mixer and receiver. Set receiver back pressure for controlled discharge, cyclonic separation and removable powder recovery.

Interchangeable discharge nozzles

Select nozzle bore and geometry for the formulation and plugging tendency. Timed discharge governs transfer; the standard nozzle has no dedicated temperature controller.

Process and collection volumes	2.5 L process vessel / 10 L receiver
Base process pressure	Base operating pressure 276 bar / 27.6 MPa (4,000 psi), set by the base pump configuration. Mixer and receiver pressure are controlled independently.
Higher-pressure configuration	Available by quotation with a selected higher-capacity pump and coordinated valves, pressure protection and controls.
Inline preheating	100°C maximum; configurable up to 130°C when required.
Vessel temperatures	Mixer and receiver temperatures up to 100°C, with independent heater zones. Lower operating temperatures depend on the process chiller and formulation.
Automation	HMI/PLC recipes, automated valves, transfer timing, instrumentation and safety interlocks. Trends, alarms and data export.
Electrical supply	Single phase, 208–240 V, 50 or 60 Hz. Process chiller has a separate supply.
CO_2 and air	Compatible liquid CO_2 source and clean, dry regulated compressed air; connections and loads per utility drawing.

Inlet preheating, mixing-vessel temperature and collection temperature are controlled independently.

APPLICATION PATHWAYS

Develop the formulation around your target

Cyclodextrin inclusion

Investigate host–guest complexes and loading of compatible lipid-soluble actives onto cyclodextrin carriers.

Dry carriers and natural gums

Explore active loading onto gum arabic, other hydrocolloids and prepared carriers. Dry-feed routes can avoid introducing bulk water and its subsequent removal.

Precipitated and composite particles

Study CO_2-assisted precipitation, antisolvent methods and active–carrier composites using selected liquid feeds and recovery routes.

Liposomes and vesicle suspensions

Develop compatible phospholipid formulations for hydrophilic or lipophilic payloads. Aqueous routes recover a wet suspension; drying is a separate step.

Lipid and polymer particles

Investigate CO_2 conditioning and expansion of compatible lipids and polymers for particle-formulation research.

Custom carrier systems

Screen proteins, starches, polysaccharides and carrier blends against loading, recovery and final-product requirements.

Select and prepare	Choose the active, carrier, feed composition and desired output.
Process and recover	Set pressure, vessel temperature, preheating, CO_2 delivery, contact time and receiver conditions.
Characterize and refine	Measure loading, recovery, particle or vesicle properties and product performance; refine a repeatable recipe.

Extended feed configurations

Custom arrangements can use two separately metered feeds and a common mixing chamber, with an additional downstream receiver. Mixing, feed preparation and recovery equipment are specified for the application.

Carrier compatibility and process configuration determine performance. Nozzle bore does not establish finished particle size; particle-size and throughput targets are demonstrated through application development.

Configure the system for your application

Main CO_2 pump	Included in the base system. Higher-pressure system configuration available by quotation.
Co-solvent pump	Optional liquid feed up to 300 mL/min.
Injection pump	Optional low-flow liquid injection up to 5 mL/min.
Cooling and collection	Separate process chiller; removable transfer basket / product container.
CO_2 supply	Tank and cage; separate CO_2 supply pump / MPCart booster.
Pressure control	Independent mixer and receiver pressure settings.
Critical spares	Model-specific seals, valve and BPR parts, rupture discs and base-pump service parts; optional feed-pump service module.
Annual maintenance	Three onsite rebuild visits, valve and seal rebuilding, parts, labor and firmware upgrades. Travel additional.

Materials of construction

304 stainless-steel frame and brushed stainless-steel control enclosure; 316/316L process tubing and fittings. Wetted pump metals, seals and polymers follow the selected configuration and materials register.

GMP documentation and qualification

Optional controlled turnover package includes drawings, manuals, SOPs, wetted-metal and polymer traceability, heat/lot records and instrument calibration certificates. Select commissioning, FAT, SAT, DQ, IQ, OQ and installation training individually or as a package.

Certification packages

PED inspection, ASME pressure-vessel certification, CE marking, UL 508A panel, complete-equipment UL/ETL approval, Canadian CRN pressure registration and CSA/cUL/cETL or field inspection are available by quotation. Company ISO 9001 certificate documentation is included.

Custom design engineering, PQ/process validation, computerized-system validation and cleaning-validation support are scoped case by case. Additional turnover copies are available.

Options & Add-ons

The following options and add-ons are available for the ME-2.5.

Hardware

- Internal transfer basket / product container – removable basket for collecting and transferring recovered product.
- Co-solvent pump – liquid feed up to 300 mL/min with a 316 stainless-steel pump head; pressure rating and wetted materials matched to the selected configuration.
- Injection pump – low-flow liquid injection up to 5 mL/min.
- Process chiller – separate chiller for process cooling; a customer-supplied chiller can also be used.
- CO_2 bulk-storage tank and cage – on-site liquid CO_2 storage with protective cage.
- CO_2 supply pump / MPCart booster – separate pump to boost the liquid CO_2 supply to the system.

- 450 bar higher-pressure configuration – custom option with a selected higher-capacity pump and coordinated valves, pressure protection and controls. 276 bar is the standard operating pressure.

Spares

- Critical spares kit – model-specific seals, base-pump service parts, back-pressure regulator components, rupture discs and selected fittings.
- Co-solvent pump service spares module – service parts for the optional co-solvent pump.

Service

- Installation support and training – onsite installation assistance and operator training, by the day; travel additional.
- Annual maintenance package – three onsite rebuild visits per year, firmware upgrades and all valve and seal parts and labor; travel additional.
- Custom design engineering – engineering outside the standard scope, defined case by case.
- PQ and process validation support – scoped case by case.
- Computerized system validation support – scoped case by case.
- Cleaning validation support – scoped case by case.
- Additional turnover copy – an extra copy of the approved turnover package.

Documentation & qualification

- GMP equipment documentation / turnover package – materials and calibration traceability, including wetted metal and polymer traceability and instrument calibration certificates.
- Commissioning – one day onsite to bring the system into service; travel additional.
- Factory acceptance testing (FAT) – system testing at our facility before shipment.
- Site acceptance testing (SAT) – system testing at your site after installation.
- Design qualification (DQ) – documented verification that the design meets your requirements.
- Installation qualification (IQ) – documented verification of correct installation.
- Operational qualification (OQ) – documented verification of operation across the specified ranges.

Packages

- Startup and acceptance – commissioning, FAT and SAT.
- Equipment qualification – GMP documentation, DQ, IQ, OQ, FAT, SAT and commissioning.
- Qualification and training – the equipment qualification package plus three training days; travel additional.

Certification

- PED conformity assessment and inspection – Pressure Equipment Directive assessment for EU installations.
- ASME pressure-vessel certification – ASME certification of the pressure vessels.
- CE conformity and marking package – CE conformity documentation and marking.
- UL 508A control panel – control panel built to UL 508A, covered within the US approval scope.
- UL or ETL complete-equipment approval – listing of the complete system.
- Canadian pressure registration (CRN) – pressure-equipment registration for Canadian installations.
- Canadian electrical approval (CSA/cUL/cETL) – electrical approval for Canadian installations.
- Canadian field inspection (SPE-1000) – onsite field evaluation of the equipment.

Pricing available by quotation.

Share your active, carrier, feed composition and target product form. We will define the equipment, selected options and development pathway.

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Equipment and service scope, pricing and company terms are provided in the quotation menu.