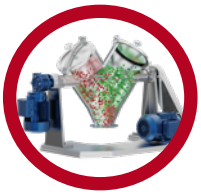
LABORATORY AND PILOT PLANT EQUIPMENT



We design equipment for your testing laboratory

Launching a new product to the market is a delicate process that requires multiple tests with highly precise technology. Lleal offers a wide range of laboratory and pilot plant-scale equipment to help you develop your product, conduct scaling studies, and even perform small batch manufacturing if needed.

Lleal offers laboratory versions of the entire range of processes in which we specialize.

Lleal

with you, step by step

Come test your product with our equipment

Lleal provides a fully equipped laboratory where you will find versions of the main processing equipment we manufacture, as well as a wide range of semi-industrial equipment.

Our **team of experts** will be with you to help and advise you during the development phase of your production process, ensuring its viability.

In our laboratory, you will also have the opportunity to test the efficiency of our equipment with your product and compare the performance of different technologies for the same process, allowing you to choose the best option with the highest guarantee of success. Additionally, you can conduct scaling studies based on pilot plant trials.

At the end of the testing and trial process, you will receive a detailed report of the results conducted in our laboratory, thanks to our state-of-the-art instrumentation and analysis equipment.

If your sector is cosmetics or pharmaceuticals, we offer our **ISO-8 certified clean room** to test your processes under the conditions required for your product.

In our laboratory, together we will find the solution that best suits your needs.

Lleal
with you, step by step

Summary

Agitation

ML-40 UNIVERSAL AGITATOR

The ML-40 is a laboratory agitator designed for specialized tasks. It features a 0.57 kW motor and a variable-speed rotor capable of operating from 0 to 6,000 rpm. It can accommodate containers ranging from 2 to 15 litres in size.

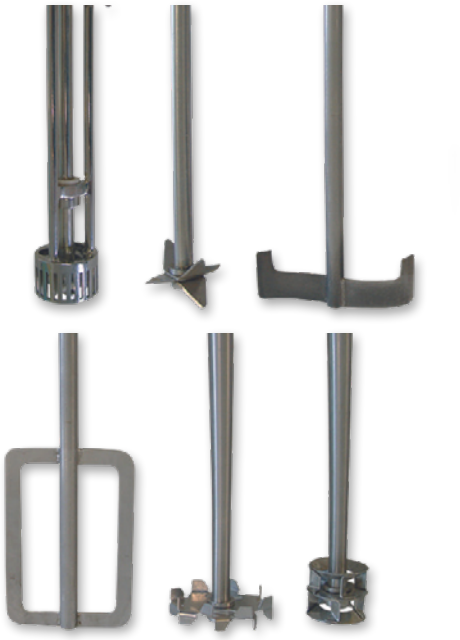
The great advantage of this equipment is its ability to interchange the agitation element, allowing for the installation of marine propellers, rotor/stator turbines, radial blades, among others.

It is supplied mounted on an adjustable height stand and includes a control panel with a tachometer, electronic speed controller, and ammeter.

It is an ideal equipment for formulation adjustment and development of new products, with results that can be fully extrapolated to industrial models.

ML-40 stirrer with Multident turbine

3D image of an ML-40 with integrated tank



Detail of the turbines for the laboratory agitator

Technical data

Model	Power (kW)	Speed range (rpm)	Bar length (mm)	Rotor diameter (mm)	Dimensions (mm)	Weight (kg)
ML-40	0.57	0 - 6,000	230	According to turbine	460 x 400 x 1.000	40

SL & ACML TURBO AGITATOR

The laboratory turbo agitator SL and ACML are designed for dispersing and mixing products with viscosities up to 65,000 cP in small batches (up to 25 kg). They are particularly suitable for use in laboratories, primarily for mixing liquids or preparing solutions and suspensions.

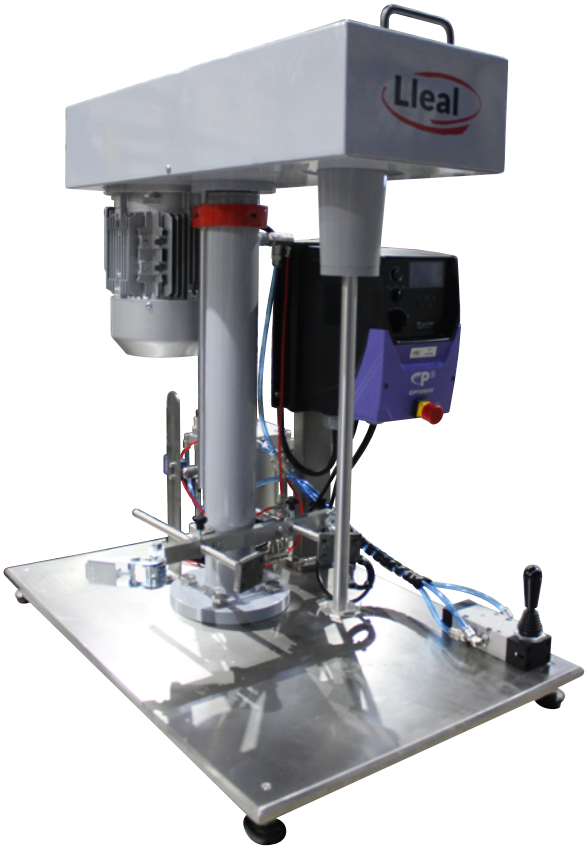
Turbo agitators are versatile equipment that can be fitted with motors ranging from 1.1 to 2.2 kW, with variable speed, and can work with vessels ranging from 2 to 50 litres.

Furthermore, they allow:

» To incorporate a cover, coupled to the disperser head. This can be prepared for operations under atmospheric pressure or vacuum (as needed).

» To assemble an auxiliary unit for slow agitation with a coaxially driven blade, completely independent of the main drive unit.

» To exchange agitation turbines, using a wide variety of agitation elements.



SL-1 dissolver with an electromechanical head lifting system.

ACML-2-RV turbo agitator, with coaxial scraping blade, special vacuum-lid, and a heated 20 L tank. All assembled on a stainless steel support table.

Other available turbines.

Kneading

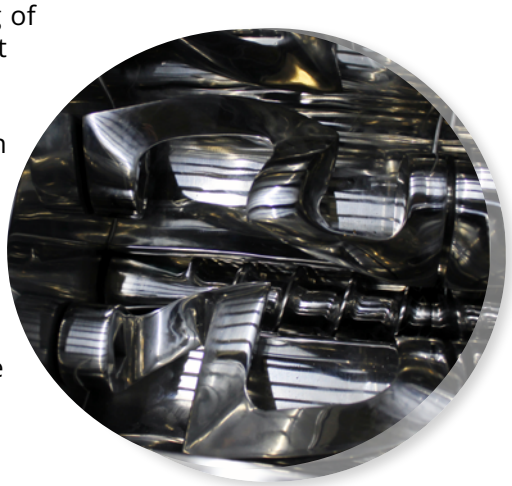
AM & AME DOUBLE SIGMA KNEADER

The double sigma kneader is specifically designed for kneading, mixing, and homogenizing wet or pasty products of very high viscosity in laboratories or pilot plants.

Its field of application is very broad, including the manufacturing of putties, hot-melts, ceramic pastes, explosives, as well as for meat casings and candy.

We have two series available: with discharge by tilting the trough (**AM**) or with an extruder screw (**AME**).

The mixing is done by the action of two double Sigma blades located at the bottom, which rotate at different speeds and in a converging direction, following a figure-eight pattern. These units can operate under vacuum and/or pressure, and optionally, they can be equipped with a jacket for heating or cooling both the trough and the end plates.



Detail of the Blades

Just like the industrial version, the laboratory kneaders can:

» Operate under vacuum and/or pressure.

» Optionally, they can be equipped with a jacket for heating or cooling both the trough and the end plates.

» In the extrusion version, the die or unloading nozzle of the screw can be designed according to the desired shape of the final extruded product.

AM-2 Kneader

AME-15 extruder kneader

Technical data

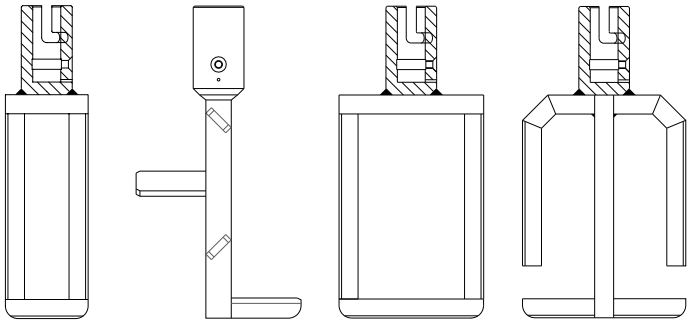
Model	Volume		Blade power* (kW)	Extruder Power* (kW)	Dimensions (mm)		
	Useful	Total			Length	Height	Depth
AM-1,5	0.6	1.5	0.5 / 1.1	--	1,140	850	750
AM-2	1.5	2	0.5 / 1.1	--	1,200	800	750
AM-5	3.5	5	0.5 / 1.1	--	1,375	910	855
AME-7	3.5	7	1.5	1.1	1,260	1,300	800
AME-15	7.5	15	4	4	1,730	1,450	1,020

PL& PLD PLAMIXER PLANETARY MIXER

The PLAMIXER planetary mixers are essential for working with high and medium viscosity products and are especially recommended for mixing difficult-to-process materials, such as mixtures with a high solid content in very small and hard-to-mix dispersion vehicles.

The main feature of these machines is their combined agitation system, which consists of a planetary mechanism. This mechanism includes a gearbox with a rotational movement, driven by a variable-speed motor unit.

The laboratory units feature one or two sets of mixing blades (depending on the model) that move in a circular movement within the planetary gearbox while simultaneously rotating on their own axes. Depending on the product, we offer different types of blades.



Detail of the blades

PLD-15 laboratory Plamixer
constructed entirely of stainless steel

The head cover is bell-shaped and equipped with a sealing gasket to operate under vacuum.

The process tanks can optionally be fitted with a double jacket for cooling and/or heating. Three laboratory models are manufactured with capacities of 8, 15, and 30 litres, respectively, each equipped with a monobloc cabinet to house the services.

To expand its range of applications, we offer two series: PL and PLD. The PLD series is equipped with a central high-speed Cowles-type disperser disc, which intensifies the mixing process.

Technical data

Model		Volume (L)		Power (kW)		Blade group	Dimensions (mm)			
		Useful	Total	Planetary	Disperser		Length	Depth	Height	Max. height
PL-8	**PLD-8**	5	7.8	0.75	0.75	1	1,002	824	790	1,040
PL-15	**PLD-15**	10	14	2.2	2.2	2	1,550	840	1,160	1,410
PL-30	**PLD-30**	22	31	3	4	3	1,650	945	1,220	1,470

Emulsion

TRI-AGI & BI-AGI EMULSIFYING MIXERS

Lleal's laboratory emulsifying mixers are highly versatile equipment widely used in the cosmetics, pharmaceutical, and food industries for formula development (R&D) and pilot plant operations. They allow precise control over all process parameters and scaling-up to industrial levels.

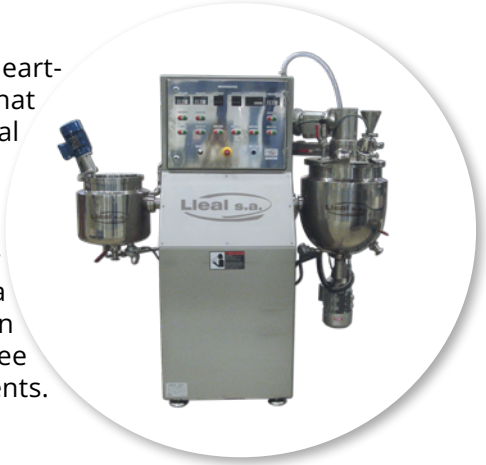
We manufacture two different series: one with a slow anchor agitator (BI-AGI) and the other with anchor and counter-rotating blades (TRI-AGI). Both series feature product discharge by tilting the tank and have a compact design intended to accommodate all services inside the equipment: vacuum pump, hydraulic unit, electrical panel... Additionally, they can be equipped with an integrated auxiliary fusing kettle on the opposite side of the equipment.

The **BI-AGI** equipment features a slow agitation system equipped with an anchor with a transverse blade and self-adjusting scrapers that sweep the vessel's surface. At its bottom, it includes a Multident emulsifying turbine, specially designed for manufacturing various types of emulsions.

Technical data

Model	Volume		Slow agitation (kW)	Turbine (kW)	Dimensions (mm)		
	Useful	Total			Width	Height	Depth
BI-AGI 5	5	8	0.15	0.5	1,030	900	600
BI-AGI 10	10	15	0.37	1.1	1,230	1,000	600

Unlike the BI-AGI mixers, the **TRI-AGI** mixers are equipped with a heart-shaped anchor with transverse blades and self-adjusting scrapers that keep the mixer's working surface clean. They also feature a central shaft with transverse blades rotating in counter-rotation.



Following the design of industrial equipment, laboratory TRI-AGI mixers feature a semi-spherical bottom vessel designed for operation under pressure and vacuum. They are equipped with a double jacket for product cooling and/or heating. The emulsification turbine is installed at the bottom of the tank and is available in three different models, depending on the product's processing requirements.

Technical data

Model	Volume		Slow agitation (kW)	Turbine (kW)	Dimensions (mm)		
	Useful	Total			Width	Height	Depth
TRI-AGI 5	15	25	0.37	1.5	1,620	1,780	770
TRI-AGI 30	30	50	0.37	1.5	1,800	1,780	770

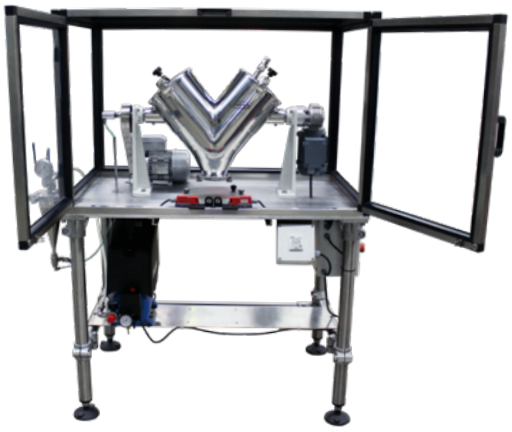
Solid mixing

BL & UVE-MIX V-BLENDER

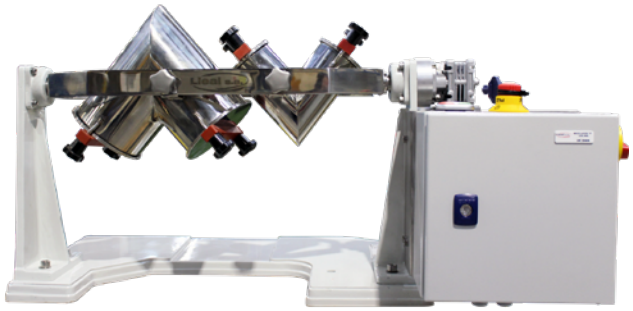
The V-blenders are designed to mix powdered solids, even of different densities and particle sizes, smoothly and precisely, resulting in a homogeneous mixture. We offer two models, both suitable for producing small batches of concentrates or for product research in R&D laboratories, which can later be scaled-up to industrial mixers.

It stands out for its speed, versatility, and high precision for mixing powdered or granulated solids, with the option of adding liquids.

Optionally, a lumpy break-up shaft and a detachable liquid injector can be attached to them. Depending on the temperature of the product to be injected, this is done either using a pump (for liquids at room temperature) or using a pressurized vessel (for hot liquids).



BL-16-CAI V-blender assembled inside a protective cabin, equipped with an intensifier mechanism and liquid injector.



UVE-MIX assembled with a 3 L body and another of 1 L.

We manufacture a third model, the **UVE-MIX**, which allows the assembly of two V-shaped bodies of different total capacities, according to the following combinations:

- A 1-litre body with another of 2 or 3 litres.
- A 2-litre and 3-litre body with another of equal capacity.
- A 4-litre body, does not allow positioning another.

This equipment features a lightweight aluminium frame, equipped with a body holder frame ready to securely fasten any of the interchangeable and standardized V-shaped bodies.

Technical data

Model	Volume (L)		Body power (kW)	Intensifier power (kW)	Diameter (mm)		Dimensions (mm)			Weight (kg)
	Useful	Total			Loading inlet	Unloading outlet	Width	Height	Depth	
BL-8-CA	4	8	0.18	0.37	150	65	730	400	460	30
BL-16-CA	8	16	0.25	0.37	197	87	815	400	530	32

MB-70 RIBBON BLENDER

The MB-70 is a static horizontal mixer, ideal for homogeneous mixing of dry, powdery, or granular solids.

Its mixing system is based on two opposite spirals, designed so that their movements complement each other. This setup prevents particle accumulation at the ends of the mixer and ensures there are no dead zones without agitation.

Ability to incorporate small liquid doses by installing spray nozzles on the equipment lid connected to a transfer pump.

SMB-70-I ribbon dryer blender with double chamber andand prepared for vacuum operation. The equipment allows product discharge either through a bottom valve or by tilting.

Technical data

Model	Volume (L)*		Min. power** (kW)	Speed (rpm)
	Useful	Total		
MB-70	56	70	1.5	100

CON-Y-MIX CONICAL MIXER

The CON-Y-MIX conical mixer is a static mixer. Its main agitation element is an endless screw that performs a planetary movement inside the cone.

The CON-Y-MIX achieves precise mixing by generating a lifting movement of the product combined with displacement towards the centre of the mixer. This creates transport currents that ensure all material enters the action field of the endless screw in the shortest possible time.

Optionally, it can incorporate a Cowles disc in the centre of the cone to break up any agglomerates present in the mixture, either due to the physical characteristics of the raw material or by the addition of liquids to solids.

C-50 conical mixer, designed to work with high-density products.

Technical data

Model	Volume (L)		Power (kW)			Dimensions (mm)			
	Useful	Total	Screw	Arm	Intensifier	Maximum height	Body height	Length	Discharge
C-50	60	141	0.75	0.37	1.5	2,200	980	700	100
C-100	100	232	1.1	0.55	1.5	2,400	1,178	825	100

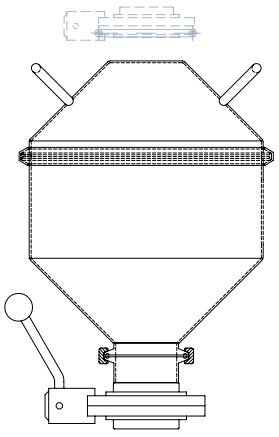
MIBL UNIVERSAL MIXER WITH INTERCHANGEABLE BODIES

For the gentle mixing of solids in small batches for R&D laboratory research, Lleal has designed a mixer with interchangeable bodies. This mixer allows the use of BIN-type drums, V-shaped bodies, or biconical bodies, with a capacity ranging from 1 to 35 litres total.

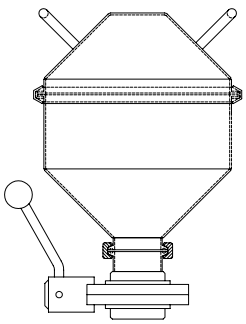
It consists of a bench where the drive unit and electrical panel are housed. This bench includes an arm for supporting and rotating the mixing bodies, which are attached to the drive shaft using a clamp mechanism.

For safety, the mixing body is surrounded by a protective polycarbonate cabin, designed to be tiltable.

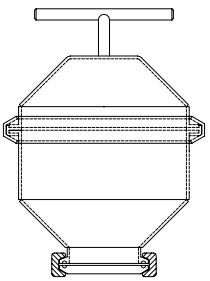
To facilitate the transportation of the entire equipment assembly, the base of the bench is equipped with wheels and a carrying handle.



10 L



5 L



1 L

SLFL/LAB FLUID BED DRYER

The SLFL/LAB fluid bed dryer has been designed for use in laboratories or pilot plants. It's a versatile equipment capable of drying, granulating, and even encapsulating particles of powdered products, whether pharmaceutical, chemical, or food-related.

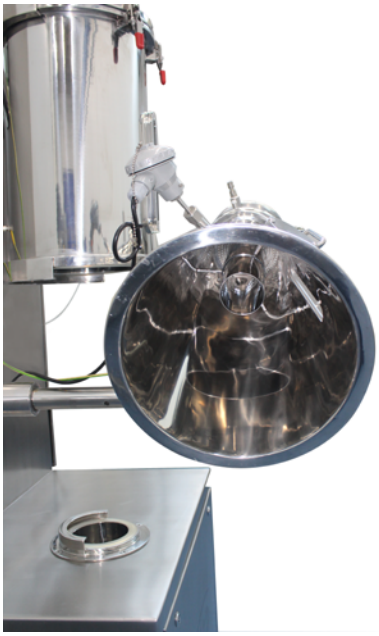
Operating principle

The air is taken from the room or an air treatment unit, sucked by a centrifugal fan, passes through a pre-filter to ensure cleanliness, and then is heated by an electric heater that accelerates the drying process.

Inside the dryer body, an air flow is generated to achieve product fluidisation. The air passes through a mesh where the product is located, rises along a hopper and the dryer body, exits through product retention filters installed in the dryer body. From there, it passes through an absolute filter and is extracted through the outlet duct.

If the process requires granulation and encapsulation, it is achieved by spraying through diffuser nozzles while the dust particles are suspended, mixing and drying. The result is uniform product granules.

SLFL/LAB Fluid bed dryer for laboratory.



Detail of the *Wurster* tube installed in the product hopper, in the discharge position.

Description

» **Monobloc bench**, with a support base housing all drive elements and equipment services, and a front panel with a touchscreen for dryer operation. Equipment services include: a centrifugal extraction fan (with airflow regulated by an electronic converter), an air filter (acts as a pre-filter ensuring clean air intake into the dryer body), and an electric resistor (heats the air before entering the mixing chamber, accelerating the drying process).

» **Product hopper**, where drying, granulation, and encapsulation take place. This hopper has a cylindrical-conical design, features an elongated sight glass for inspection, and a telescopic arm that facilitates loading and unloading processes. At the bottom of this hopper, a perforated plate is installed where the material sieve and mesh size required by the product are situated.

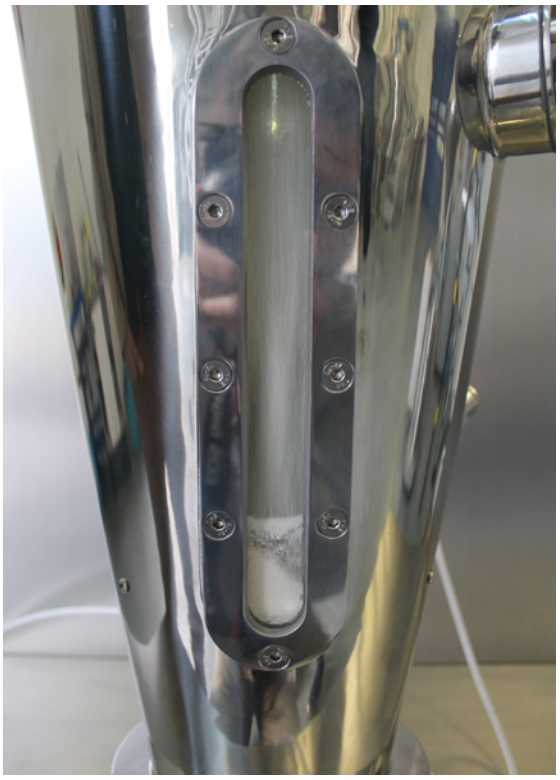
» **Cylindrical deceleration body**, where particles of lesser fineness lose kinetic energy and return to the drying hopper.

» **Cylindrical retention body**, located above the deceleration body. Here, the air is separated from any solid particles. It consists of a metal mesh with mesh size appropriate for the particle size to be encapsulated or granulated; a concave retention plate that alters the trajectory of particles that achieve passing from the deceleration body; and a pneumatic-driven mesh cleaning device.

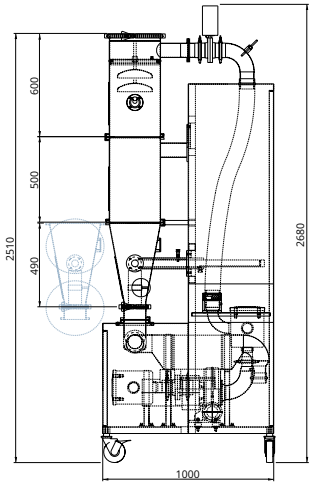
To ensure sealing between the three bodies that make up the fluid bed, an inflatable gasket system is installed.

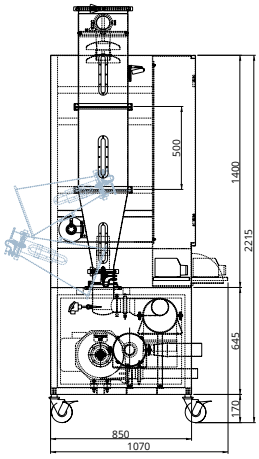
» For processes that require not only drying but also granulation and encapsulation, the fluid bed can be equipped with a **spraying system** consisting of: a peristaltic pump, silicone tubing, a binary spray gun (top spray), a *Wurster* tube, and a diffuser nozzle at the bottom (bottom spray).

» To prevent over-exposure of the product, Lleal's fluid bed incorporates **measuring probes** that allow monitoring of temperature, air flow, and humidity. This precise control enables determining the exact endpoint of the process.



Product hopper detail. The product in fluidisation is visible from the sight glass.





Technical data

Model	SLFL/LAB
Total capacity of the vessel	17
Range of working volume (L)*	1 - 5
Heating power (kW)	3
Fan power (kW)	1.1
Maximum air flow rate (m^3/h)	500
Cylinder diameter (mm)	300

* Production depending on the density, particle size, moisture content, etc., of the product. These values represent the minimum and maximum production rates.

MGR TRI-CHOP GRANULATOR MIXER

The TRI-CHOP granulator mixers have been developed to optimize the processes of mixing, granulation, and drying of powdered solids in a clean and manipulation-free environment. We offer two models, both suitable for small batch production or product research in R&D laboratories, which can be scaled-up to industrial granulators.

Its main advantages are:

- A short mixing time (less than 3 minutes).
- All processes are integrated into a compact, easy-to-clean unit.

We manufacture a third duplex model, which allows for the assembly of two bodies of different capacities, offering the possibility to perform two separate batches in the same equipment.

Optionally, these equipment can incorporate a fluidisation system at the bottom of the tank which helps to dry more quickly with the use of dry air.

MGR-1 TRI-CHOP granulator installed in a cleanroom.

MGR-1/5 TRI-CHOP duplex granulator

Technical data

Model	Volume (L)		Tri-blade power (kW)	Chopper power (kW)
	Useful	Total		
MGR-1	0.5 - 1.5	2.5	0.37	0.37
MGR-5	2 - 7	10	0.75	0.75
MGR-1/5	0.5 - 1.5 / 2 - 7	2.5 / 10	0.37 / 0.75	0.37 / 0.75

PBL & SBCL ROTARY PROCESS DRYERS

The laboratory solids processor is a comprehensive system for solid material treatment that enables precise and gentle mixing of powdered material at any ratio, even with different densities and particle sizes. Additionally, it can extract up to the required moisture value, the water from the mixing process.

Its main advantage is that it combines both mixing and drying processes in a single unit, thereby reducing operating costs.

We have two types of rotary solid processors for laboratory use: the **PBL** with a V-shaped body and the **SBCL** with a bi-conical body.

These equipments incorporate a vacuum system and a double jacket (for heating and cooling), which combined with a rotary mechanism, enables the recirculation of hot fluids to ensure the drying of the product being processed..

PBL-150 V-shaped processor.

SBCL-50 biconical process dryer for pharmaceutical use.

Technical data

Model	Volume (L)		Power (kW)		Dimensions (mm)	
	Useful	Total	Mixing body	Intensifying shaft	Length	Height
PB-150-CAIVR	75	150	1.5	3	3,110	1,992
PB-250-CAIVR	125	250	2	3.7	3,400	2,058
SBC-50-CA	32	50	0.55	0.75	1,400	1,395
SBC-100-CA	65	100	1.5	3	1,650	1,505

Liquid-phase grinding

MIL IMMERSION MILL

Highly versatile equipment designed for wet grinding and dispersion of pigments in small batches (up to 10 kg) or for various types of dispersions, emulsions, suspensions, thanks to the possibility of exchanging process shafts.

Molino de inmersión MIL-1

As a milling equipment, it is used to replicate, at a pilot scale, the processes of fine grinding of liquid or semi-viscous products, reducing the particle size of the solids in the formula. Its operating principle is based on breaking down solid agglomerates within the formula and fully wetting the surface of the individual particles.

FEATURES

» Grinding system Rotor. The rotor is equipped with pins that promote the circulation of grinding elements.

» Rotor speed adjustable via frequency converter (IP-55 or ATEX execution).

» Sieve with a large outlet area, located on the side and bottom of the grinding basket.

» Batch process without a pump.

» Materials in contact with the product are anti-abrasive and stainless.

» Includes stainless steel tank with double jacket for cooling.

» Includes ceramic ball charge plus one spare.

» Ease of cleaning for colour changes.

Technical data

Model	Power (kW)	Grinding chamber volume (ml)	Tanks (L)		Weight (Kg)
			Min.	Max.	
MIL-1	0.75	50	1	3.5	80
MIL-1,5	1.1	220	4	15	120

MIL-1,5 immersion mill with hydraulic lift

MHL-1,5 ROTOMILL HORIZONTAL MILL

The MHL-1,5 Rotomill is the ideal mill for conducting ultrafine grinding trials on solid dispersions in a liquid vehicle. Its horizontal design ensures uniform distribution of the bead charge, thereby enhancing its effectiveness.

The continuous grinding process takes place inside a closed chamber with external cooling to prevent product overheating. Material loading is accomplished using a pump with adjustable flow rate capability.

These types of mills allow achieving fineness between 2 and 10 µm, depending on the initial particle size and the beads used.

With the Rotomill mill, glass or ceramic balls can be used, depending on the characteristics of the product to be ground.

MHL-1,5 laboratory Rotomill with DL-15 diaphragm pump.

Technical Data

Model	Power KW	Volume of grinding chamber (L)	Weight (Kg)
MHL-1,5	4	1.5	90

MCV-1 VERTICAL COLLOIDAL MILL

The MCV-1 has been designed to meet laboratory needs in grinding processes for solid products dispersed in a liquid medium, as well as for preparing stable suspensions. It is an efficient system that is easy to clean.

The colloid mill operates by hydraulic shear effect on a thin film of the product being processed. Its basic operational components include a body with a double chamber for cooling or heating, which helps maintain a constant grinding temperature, and two conical grindstones: a rotor and a stator.

Like its industrial counterpart, it features a micrometer vernier to adjust the gap between the grindstones and achieve the desired fineness degree. The grindstones can be made of either corundum or stainless steel, depending on the type of product being processed.

Technical data

Model	Power (KW)	Speed (rpm)	Grindstones diameter (mm)	Base diameter (mm)	Height (mm)	Weight (kg)
MCV-1	1.1 / 1.5	3,000	50	502 x 284	794	57

40.000 m^2

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