

World novelty for fine particles
from minimal sample quantities
at high yields!

Nano

Spray Dryer B-90



The Nano Spray Dryer B-90 – a pioneer for R&D studies, using small sample quantities



Nano Spray Dryer B-90 on the trolley with aspirator and inlet filter in open mode for spray drying of aqueous solutions in air.

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Nano Spray Dryer B-90 – the expert in generation of fine submicron particles

Since 1979, Büchi Labortechnik AG has offered the Mini Spray Dryers B-190, B-191 and B-290 systems and holds the worldwide market leader position in laboratory scale spray dryers. Over 2900 units have been installed at universities, R&D centers and powder specialists around the world. The next generation instrument – the Nano Spray Dryer B-90 – revolutionizes today's spray drying possibilities with the unique ability to generate particle sizes in the nano range for milligram sample quantities at high yields.



Spray drying is gaining greater attention as a gentle, continuous and scalable drying process to convert liquids to dry powders.

The new Nano Spray Dryer B-90 meets the needs in pharmaceutical, biotech, material and nanotech markets, where newest application trends focus on effective formulation of complex and valuable drugs (highly active pharmaceutical ingredients) and nanoparticulates.

Key features and benefits:

- Efficient spray process for minimum quantities (ml, mg)
- Innovative piezoelectric atomizing technology for fine particles in the submicron range
- Narrow particle size distribution
- Novel electrostatic particle collector for high yields of fine particles
- Modular glass assembly and visible spray process
- Short set-up times and simple cleaning
- Sterilization possibility

Markets:

- Pharmaceuticals
- Biotechnology
- Materials
- Nanotechnology

Application areas:

- Nanoparticle suspensions/nanoemulsions
- Micro- and nanoencapsulations/englobing
- Nanoparticle agglomerations
- Structural modifications
- Generation of nanoparticles with high recovery rates
- Spray drying of aqueous and organic solvent samples

Büchi's lab-scale spray drying competence:

- Professional product training courses and application help
- Feasibility studies with our customers in the spray drying applications test laboratory
- Free online Spray Dryer Application Database (www.buchi.com)

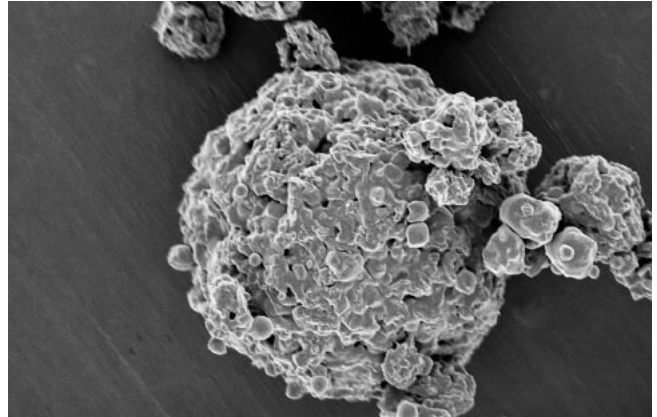
Wide variety of applications: a market leader in spray drying

New application trends in pharmaceutical formulation and nanotechnology demonstrate the need for fine particle generation from small sample quantities and very high yields. The Nano Spray Dryer B-90 is Buchi's 4th generation labscale spray dryer and is especially designed to evaluate spray drying during the early stages of product development. The modular and flexible glass design allows spray drying of a whole variety of applications, ideal for feasibility studies in R&D laboratories to dry milligrams of powder.

Operational areas: Universities, Laboratories, Institutes, Colleges, R&D centers



Dry powder inhalation



Nanoparticle agglomerate

Pharmaceutical Technology – Drug Delivery

- Inhalable drugs for dry powder inhalers (DPI's)
- Stabilization of vaccines in matrix materials
- Microencapsulation of liposomes
- Encapsulation of hydrophilic nanoparticles in hydrophobic carrier materials
- Biodegradable/biocompatible polymers (lactides, glycolides, PLGA, polyacrylates)
- Therapeutic carrier materials (insulin, growth hormones)
- Porous drug carriers from nanoparticle suspensions
- Nanocapsules of polymers (poly-caprolaktone, eudragit)
- Typically applied drug delivery systems: trehalose, lactose, HPMC, PVA, chitosan, cyclodextrin, maltodextrin, PLGA, starch, gelatine

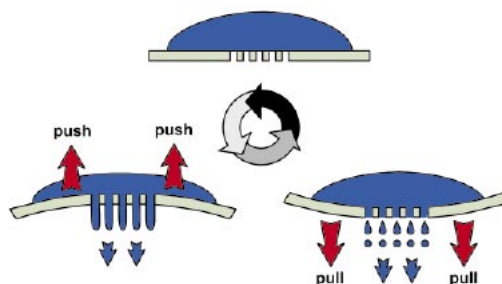
Materials and Nanotechnology

- Fine metal particles for novel catalysts
- Fine magnetic powders for electronic storage media
- Carbon nanotubes as additives for rubbers
- High performance ceramics with high specific surface area
- Nanosuspensions for fuel cell batteries
- Oxides particles for textiles as UV absorbers
- Silicon oxide nanoparticle agglomerates
- Finest pigments for paints and coatings
- Encapsulation of aromas, flavours or perfumes
- Nano food – functional additives

Principle of spray generation



Piezoelectric driven spray head nozzle incorporating a thin vibrating perforated membrane (mesh)



Functional principle of mesh vibration

- The droplet generation is based on a piezoelectric driven actuator, vibrating a thin, perforated, stainless steel membrane in a small spray cap.
- The membrane (spray mesh) features an array of precise, micron-sized holes manufactured by laser drilling.
- The actuator is driven at ultrasonic frequency, causing the membrane to vibrate, ejecting millions of precisely sized droplets every second with very narrow distribution.

Small quantities, fine particles and high yields

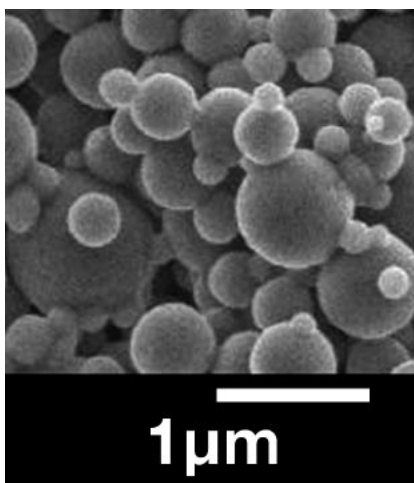
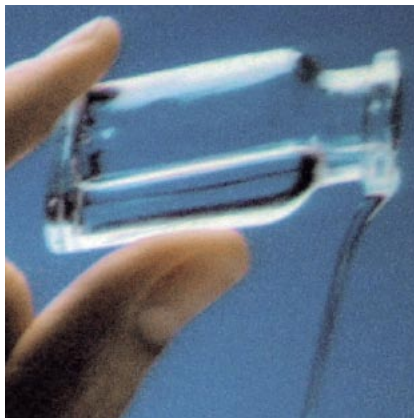
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The key benefits of the Nano Spray Dryer B-90: a fast process for the production of small quantities of homogenous powder products with high yields. Various applications can be accomplished with the Nano Spray Dryer B-90 in small scale, like spray drying of solutions, nanoemulsions, nanoparticle suspensions, structural transformations or micro- and nanoencapsulations.

Customer benefits

- Produce submicron- or even nanoparticles with very narrow size distribution for new breakthroughs in R&D
- Invest only a minimal sample amount of high value product to receive a dry powder
- Profit from minimal loss of high value products due to uniquely high yields
- Save process time thanks to simple assembling, easy cleaning and fast product switch
- Simple instrument adjustment to specific needs by taking advantage of the various accessories (e.g. spray drying organic solvents, controlling particle size)

Experience submicron spray drying



■ Small ml quantities

The Nano Spray Dryer B-90 is the ideal laboratory instrument for the processing of small quantities typically used in feasibility studies.

Spray drying of valuable substances within the submicron range is possible. Main fields for the innovative spray dryer are found in pharmaceutical, biotech, material- and nanotechnology applications.

■ Submicron particles

The innovative piezo crystal driven spray nozzle generates a mist of finest droplets with very narrow size distribution. Different spray caps with 4.0, 5.5 and 7.0 μm hole sizes are available to tune the average droplet size between 8 to 17 μm precisely.

Nanoparticle suspensions and nanoemulsions are typical applications for the Nano Spray Dryer B-90.

■ High yields up to 90%

The unique electrostatic particle collector offers excellent particle separation efficiency for submicron- and nanoparticles of milligram sample amounts.

Save high value and expensive materials in R&D studies and feasibility tests.

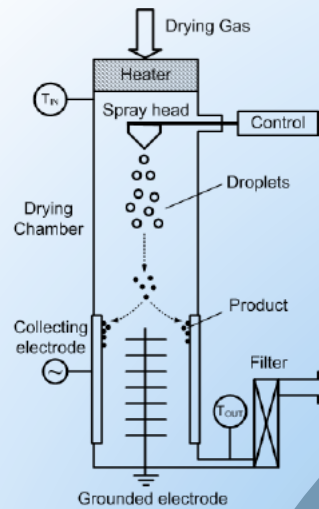
This unique technology is ideal for samples used in pharmaceuticals, medical products, advanced materials and innovative food ingredient industries.

The Nano Spray Dryer B-90 – a new innovation

The Nano Spray Dryer B-90 offers a fast drying process for temperature sensitive materials, excellent product yields and low energy consumption.

Principle

- The drying gas enters laminar from the top into the drying chamber and is heated up to the setting inlet temperature
- The piezodriven spray head generates finest droplets, which are gently dried to solid particles
- The dried solid particles are collected by electrostatic charging and are deflected to the collecting electrode
- The drying gas exits the spray dryer and is filtered



Heating system (patent pending)

- Compact porous metal foam for optimal energy input
- Short heat-up times up to 120 °C
- Generation of laminar gas flow in the drying section
- Convective heat transfer between droplets and gas
- Fast heating control by pluggable PT-1000 temperature sensor



Functional principle

Heating system

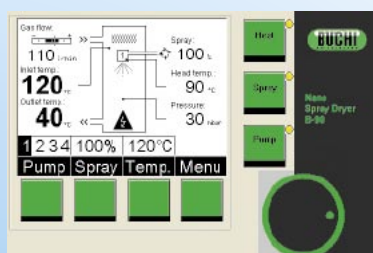
Modular design

Modular glass assembly of the spray cylinder

- Visibility of the complete spray process from droplet generation to particle collection
- Short instrument set-up to dry fine droplets and tall set-up for larger droplets and water based samples
- Angular spray head installation for heat sensitive materials and small sample amounts down to 1 ml
- Simple and ergonomic installation of modular glassware
- Easy cleaning and sterilization of the tabletop instrument



Buchi stands for quality in your hands. Customer needs are met with real product innovation, sophisticated design and outstanding technology.



Easy operation and instrument control

- Visualized process parameters and simple display control
- Convenient setting of inlet/outlet temperature, drying gas flow, spray rate and pressure on the front panel

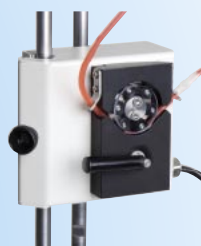
PC-software for online data monitoring and storage

- Data storage of experimental runs in a library
- Documentation of process data of experimental trials
- Export of process parameters for further data analysis

Operation control

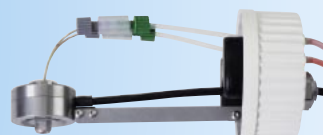
Droplet generation

Particle separation



Height adjustable peristaltic pump

- Sample feeding with pluggable peristaltic pump
- Continuous recirculation of the sample feed, from sample vessel to spray head and back
- Minimal dead volume in the feeding tubes



Novel piezoelectric driven droplet atomizing technology

- Ultrasonic atomization at 60 kHz driving frequency for gentle and soft droplet generation
- Choice of three different spray caps with 4.0, 5.5 or 7.0 μm mesh hole size
- Very narrow droplet size distribution
- Simple exchange of spray caps
- Easy cleaning of spray nozzle with detergents or in an ultrasonic bath



Spray caps with incorporated meshes of 4.0, 5.5 or 7.0 μm hole size

| Hole size | Mean water droplet size | Span | Water flow rate |
|-------------------|-------------------------|-------|-----------------|
| 4.0 μm | 8 μm | < 1.0 | 20 ml/h |
| 5.5 μm | 10 μm | < 1.2 | 60 ml/h |
| 7.0 μm | 17 μm | < 1.2 | 150 ml/h |

Innovative electrostatic particle collector for submicron- and nanoparticles

- Particle separation rate is independent from particle mass (as in cyclones) and allows collection of fine nanoparticles (separation efficiency >99%)
- Excellent product yields up to 90 % for small sample quantities <100 mg
- Simple particle collection with manual particle scraper
- Integrated outlet gas filter for user and environment protection



Instruments

**Nano Spray Dryer B-90
Basic**



For aqueous solutions; includes complete set-up with spray head nozzle, heater, electrical particle collector, glassware and all necessary hosing parts.

Order no. 11055320

**Nano Spray Dryer B-90
Advanced**



Ready to work with organic solvents in combination with the Inert Loop B-295; includes complete set-up, solvent resistant tubings, inert gas regulation and oxygen safety measure.

Order no. 11055321

Inert Loop B-295



Cooling unit for safe operation with solvents in closed mode configuration with the B-90 Advanced version; works as trolley on wheels, pressure control and oxygen gas monitoring, electrical communication with the B-90.

| | Order no. |
|--------------|-----------|
| 230 V, 50 Hz | 044701 |
| 230 V, 60 Hz | 046344 |
| 200 V, 50 Hz | 044779 |
| 200 V, 60 Hz | 046345 |

Dehumidifier B-296



The ideal instrument for reproducible inlet air conditioning or condensation of water in closed loop configuration.

| | Order no. |
|-----------------|-----------|
| 230 V, 50/60 Hz | 040188 |
| 200 V, 50/60 Hz | 040181 |

Accessories – maximal flexibility

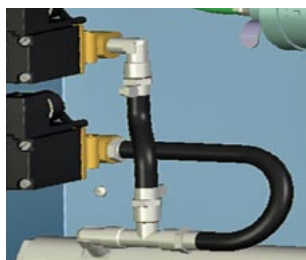
Aspirator with inlet filter



Corrosion resistant aspirator to generate the drying gas in open mode or to recirculate the gas in closed mode. Glass fiber filter to prevent contamination of inlet air by any kind of particles from the environment.

Order no. 11055325

Upgrade set closed cycle



Upgrade set for closed cycle operation with backpressure valve, hose connectors and compressed gas tubing for CO₂ and N₂.

Upgrade set Inert Loop B-295
Order no. 051783
Upgrade set Dehumidifier B-296
Order no. 051780

Air maintenance unit



Maintenance unit for clean and oil-free compressed air. Consists of an activated carbon filter, fine particle filter and water separator.

Order no. 004366

Trolley



Stable trolley for mobile and flexible installation of the Nano Spray Dryer B-90 in the lab. The shelf board offers space to place accessories e.g. the aspirator with inlet filter.

Order no. 041257

Spray cylinder



Spray cylinder with sideways flange for spray nozzle installation. For spray drying of temperature sensitive samples and minimal amounts spray caps 4.0, 5.5 and 7.0 µm.

Order no. 051511

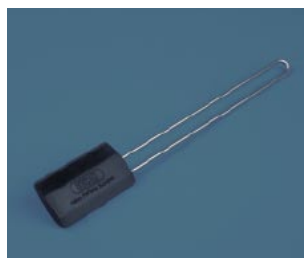
Glass cylinder



Glass cylinder to elongate the drying section. Suitable to dry bigger droplets (7.0 and 5.5 µm mesh) of aqueous samples and higher solvent throughput up to 200 ml/h.

Order no. 051549

Particle scraper



Manual cleaning tool for efficient particle recovery from the electrical particle collector.

Order no. 11055338

Particle collecting paper



Weighing paper in A4 format for simple particle collection.

Set of 5 blocks with 100 pages
Order no. 11055339

Spray head



Spray nozzle for vertical and angular positioning in the spray cylinder. Ready to use with the 4.0, 5.5 and 7.0 μm mesh sizes for different applications.

Order no. 051508

Spray caps



High-precision laser drilled spray meshes embedded in handy spray caps.

Set of 3 Spray caps 4.0 μm
Order no. 051747

Set of 3 Spray caps 5.5 μm
Order no. 051748

Set of 3 Spray caps 7.0 μm
Order no. 051749

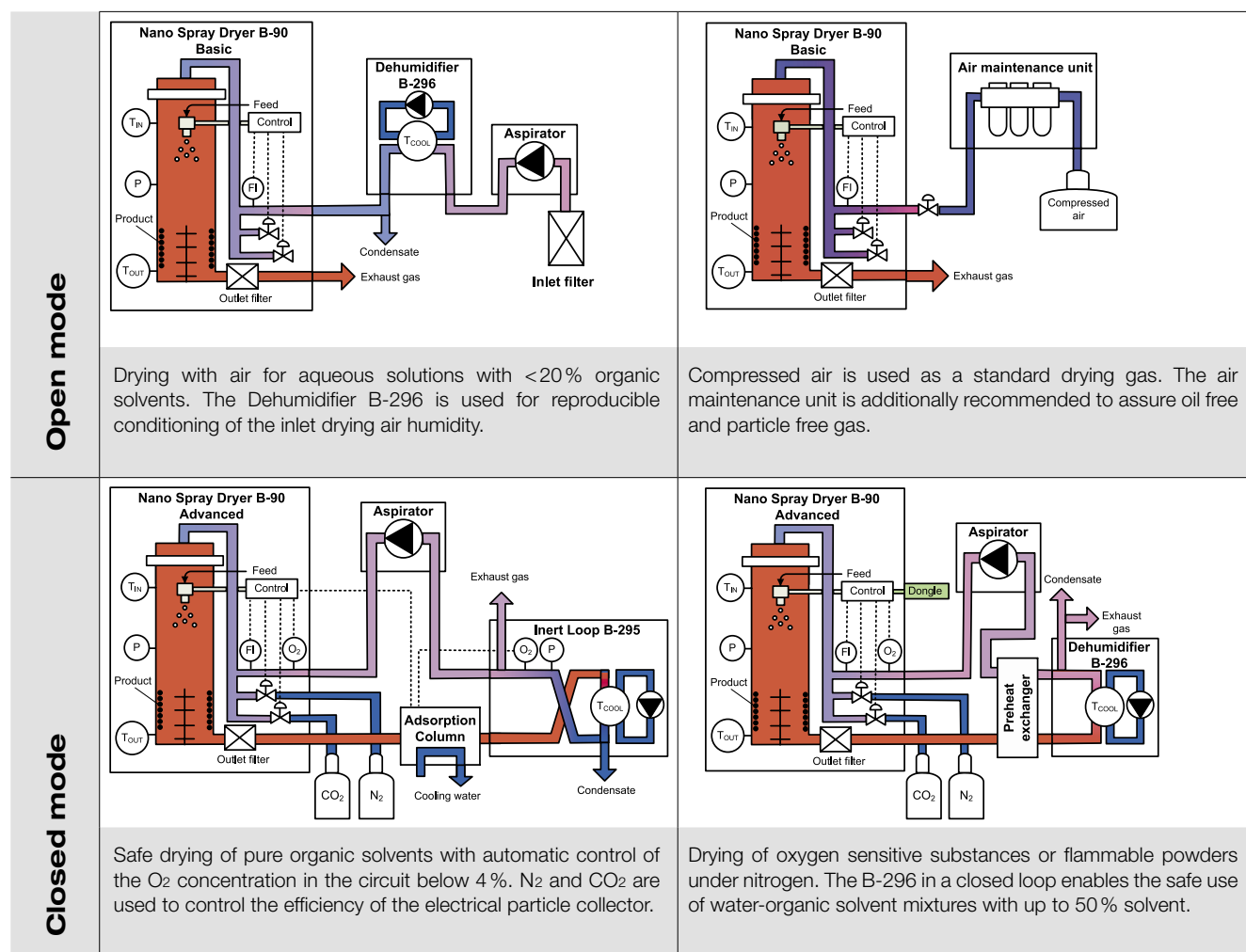
Stand plate



Height adjustable stand plate as holder for sample vessel and magnetic stirrer.

Order no. 051775

Nano Spray Dryer B-90 System configurations



The following organic solvents have been tested:

- Methanol, ethanol, propanol
- Acetone, dichloromethane, toluene, ethylacetate
- For water, the use of the B-296 is recommended

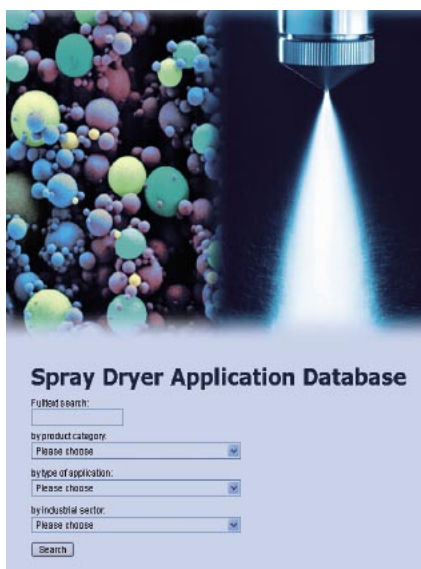
Spray dryer application test center – competence in the lab

Based on 30 years of experience, Buchi is the expert in both lab-scale spray drying and spray chilling with the innovative Mini Spray Dryer B-290 and Nano Spray Dryer B-90 systems and it's full compliment of accessories.



Are you not sure if spray drying is the right method to dry your sample?

- Buchi's application experts in our lab offer first-hand advice and service on lab-scale spray drying for fine particles and small sample amounts!
- We do feasibility tests for and with you. Send us your substance, or meet us directly at Buchi's test center.
- Our focused specialists show you directly how to dry your sample. Take the opportunity to discuss process optimization with our application experts.



We share our experience with you!

Take advantage of Buchi's new free on-line Spray Dryer Application Database on www.buchi.com to find out if your product has already been spray dried.

The application database features:

- an outstanding and helpful search tool to optimize your spray drying process in a quick and successful way
- an extensive knowledge database with over 400 application notes to produce initial trials of small powder quantities

- knowledge pool of R&D pioneers, studies from different market sectors (pharma, biotech, chemicals, food or nanomaterials)





Already a database user?

[▶ Enter the database](#)

Login on www.buchi.com

Complete line of professional solutions

Büchi Labortechnik AG is the leader in the production of laboratory scale spray dryers and offers the broadest application knowledge. Our partnership with GEA Process Engineering A/S makes scale-up possible and extends the entire process range from the first lab trials to industrial production. Depending upon application, sample volume and feed rate the suitable equipment is available.

| | Nano Spray Dryer B-90  | Mini Spray Dryer B-290  | Mobile Minor™  |
|--------------------------------------|--|--|--|
| Scale-up | | |  |
| Main benefit | for minimal sample quantities, submicron particles and high yields | for classical spray drying in laboratory scale | the next step pilot plant for scale-up and production |
| Particle size | 300 nm–5 µm | 2–25 µm | 2–80 µm |
| Typical yield | high, up to 90 % | good, 60–70 % | good, 80 % |
| Evaporation capacity (water) | 0.2 kg/h, higher for organic solvents | 1.0 kg/h, higher for organic solvents | 0.5–6.0 kg/h, higher for organic solvents |
| Sample volume | 1 mL–200 mL | 30 mL–1 L | 100 mL–10 L |
| Drying gas | up to 10 m³/h | up to 35 m³/h | 80 m³/h at 200 °C |
| Atomization gas | no | 0.1–1.0 kg/h | 4–25 m³/h |
| Heating power | 1.4 kW | 2.3 kW | 9 kW |
| Max inlet temperature | 120 °C | 220 °C | 350 °C |
| Dimensions (W x H x D) | 58 x 110/150 x 55 cm | 60 x 110 x 50 cm | 250 x 200 x 230 cm |
| Weight | 65/70 kg | 48 kg | 250 kg |
| Nozzle types | Spray nozzle (piezo technology, ultrasonic) | two-fluid nozzle with cleaning mechanism | rotary atomizer, two-fluid nozzle, fountain mode |
| Particle separation principle | Electrostatic particle collector | Cyclone | Cyclone |

Scale-up of spray drying processes

Scale-up is an important aspect in spray drying processes to easily translate results from initial trials in the research lab to full-scale industrial production.

The two leading suppliers of spray drying systems, Büchi Labortechnik AG in lab-scale and GEA Process Engineering A/S in industrial scale collaborate in offering customers their combined and comprehensive knowhow.

Based on decades of experience and thousands of installations worldwide we simply help you to scale your spray drying process to any label – easily, efficiently and fast.

GEA Niro



Technical data

Nano Spray Dryer B-90

| | |
|------------------------------|---|
| Power consumption | max. 1500 W |
| Connection voltage | 110–240 V \pm 10 % |
| Frequency | 50/60 Hz |
| Heating capacity | max. 1400 W |
| Heating control | Thermocouple PT-1000 \pm 1 °C |
| Max. inlet temperature | 120 °C |
| Temperature accuracy | \pm 0.5 °C |
| Evaporating capacity | max. 0.2 l/h H ₂ O, higher for solvents |
| Drying gas flow | 40–160 l/min |
| Spray caps (Hole diameters) | 4 μ m, 5.5 μ m, 7 μ m |
| Possible droplet size range | 8–17 μ m |
| Possible particle size range | 300 nm–5 μ m |
| Mean residence time | 1–4 sec. |
| Interface | USB II |
| Degree of protection | IP 42 |
| Pollution degree | 2 |
| Environmental conditions | for indoor use only |
| Temperature | 5–40 °C |
| Altitude | up to 2000 m |
| Humidity | max. relative humidity 80 % for temperatures up to 31 °C, and then linearly decreasing to 50 % at 40 °C |
| Dimensions (W x H x D) | 58 x 110 x 55 cm (short set-up)/58 x 150 x 55 cm (tall set-up) |
| Weight | 65 kg (short set-up) / 70 kg (tall set-up) |

Inert Loop B-295

| | |
|-------------------------|----------------------|
| Power consumption | max 1.4 kW |
| Connection voltage | 200–230 V \pm 10 % |
| Frequency | 50/60 Hz |
| Min. outlet temperature | down to –25 °C |
| Rate of cooling | 800 Watt at –10 °C |
| Dimensions (W x H x D) | 60 x 70 x 84.5 cm |
| Weight | 95 kg |

Dehumidifier B-296

| | |
|-------------------------|----------------------|
| Power consumption | 700 W |
| Connection voltage | 200–230 V \pm 10 % |
| Frequency | 50/60 Hz |
| Min. outlet temperature | + 2 °C |
| Rate of cooling | 600 Watt at 0 °C |
| Dimensions (W x H x D) | 35 x 40 x 60 cm |
| Weight | 36 kg |

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Quality in your hands