

# Mini Spray Dryer B-290



# Mini Spray Dryer B-290 – Efficient and safe Spray Drying of aqueous and organic solutions



The Mini Spray Dryer B-290 is the laboratory equipment of your choice for the quick and gentle drying to powder of liquid end products. The impressive features of the Spray Dryer include its efficient performance with very short set-up times, an effective integrated nozzle cleaning mechanism and a high degree of flexibility thanks to the different cylinder geometries. Whether the requirement is the gentle drying of natural product dyestuffs, the isolation of highly effective pharmaceutical active agents, or the micro-encapsulation of aromas – the B-290's outstanding features greatly extends the number of applications that are possible with a spray drying process.

## Areas of application

Make sure you profit from the broad spectrum of applications:

- Spray drying from solutions
- Structure modifications
- Drying of suspensions
- Agglomeration
- Spray crystallization
- Micro-encapsulation and coating

# Spray Drying – a fascinating Process with many Advantages

Many products are preferentially used in solid form. This simplifies storage and metering, and it may be essential for the application for which the compound is to be used. Spray drying is a speedy, time-saving and gentle method of obtaining even the smallest quantities of substances in powder form. The advantages compared with freeze drying are the greater throughput rate and the short process times. The very short residence times and the cooling effect resulting from evaporation makes it possible to process even temperature-sensitive products in a gentle manner. If the use of organic solvents is involved, the thermal load is reduced to a minimum.

Not only does the Mini Spray Dryer B-290 make it possible to obtain powder directly from a solution but many other processes can also be completed in a single stage:

- Modification of particle size
- Agglomeration of nanoparticles
- Drying suspensions
- Particle coating
- Immobilization of liquids and solid materials in a matrix
- Manufacture of microcapsules

## The Mini Spray Dryer B-290 – innovative solutions for spray drying in the laboratory



The operating panel displays all the functions in a clear manner. In addition to the settings of the spray parameters, the input- and output temperatures are displayed. The integral nozzle-cleaning device permits automatic or manual cleaning at selected intervals, or allows the manual insertion of a needle through the nozzle to prevent blockages or to remedy them.



The assembly of the glass parts is amazingly fast, elegant and simple. The glass cylinder can be inserted with a single manual movement of a locking lever.

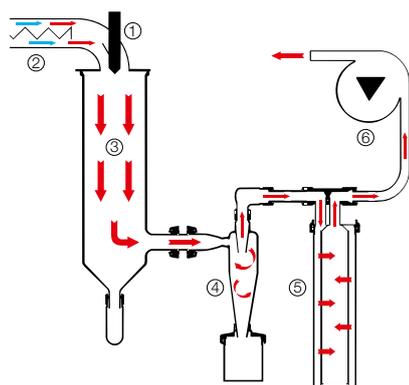
## Variable gas flow control for optimal operation

The standard method of operation for the Mini Spray Dryer B-290 is in a suction mode. The reduced-pressure environment within the system prevents any possible contamination in the case of a leakage. The system can be very easily converted to operate under pressure which prevents the aspirator from being attacked by corrosive media. All parts that come into contact with the product are readily accessible for cleaning.

The two-fluid nozzle is a superb illustration of what may be achieved by combination of novel design functionality and high precision manufacturing. A ruby with a highly precise aperture is set in the tip of the nozzle cap. This guarantees reproducible and trouble-free spraying over long periods. The nozzle may also be thermostatically controlled.



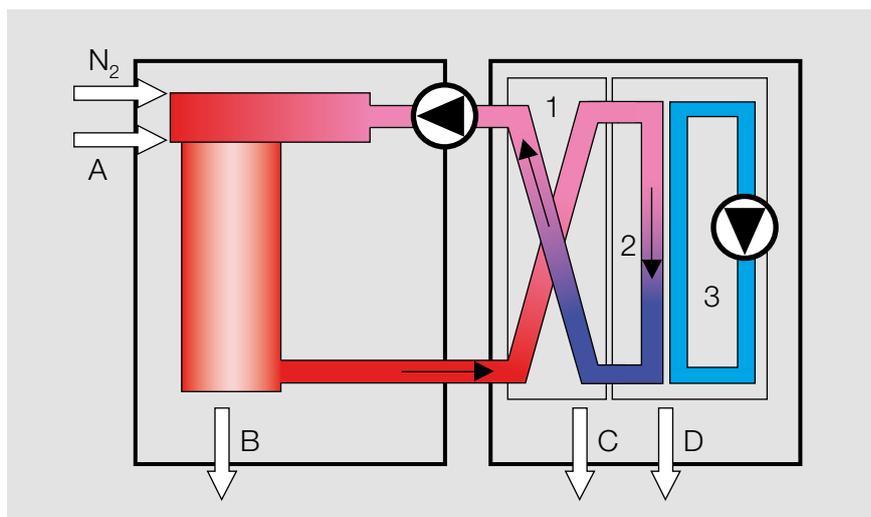
Two different versions of the glass cylinders make it possible to optimize the yield depending on the process. The lateral outlet cylinder is particularly suitable for aqueous products which are difficult to dry, whilst the second type of cylinder with a vertical outlet geometry is especially useful for work involving organic solvents.



- ① Two-fluid nozzle, operated by compressed air to disperse the solution into fine droplets
- ② Electric heating of the drying medium
- ③ Spray cylinder for drying the droplets to solid particles
- ④ Separation of the particles in the cyclone
- ⑤ Outlet filter to remove fine particles
- ⑥ Aspirator for generating the flow

# Inert Loop B-295 – Spray drying with organic solvents

At last it is possible to safely carry out laboratory scale spray drying of organic solvents – by using the accessory Inert Loop B-295! Previously, spray drying of inflammable solvents was associated with the risk of explosion and was consequently prohibited. However, important new areas of research and applications necessitate the use of spray drying from an organic solvent base. To be able to respond to this challenge a new type of accessory has been developed which allows the user to work safely with almost all currently available solvents!



## Inert Loop B-295 – With the accent on safety

The cooling block is assembled as a mobile unit and is connected to the Mini Spray Dryer B-290 via two hose connections and a communication cable. Two signal lamps display the condition of the integrated oxygen and pressure monitoring system. Should a fault develop, the circuit automatically switches the equipment to a safe condition. The system has been certified by the Swiss Institute of Safety.

To safely spray dry inflammable solvents, a new operating principle is employed which uses a combination of the Spray Dryer B-290 and the Inert Loop B-295 to provide a closed loop circulation under inert conditions. The absence of oxygen prevents the formation of a ignitable mixture. At the same time, the solvent contained in the gas stream is cooled and consequently condensed. The regenerated flow is then returned again to the spray dryer.

### Schematic of the closed circuit:

- 1 Heat exchanger
  - 2 Condensation units
  - 3 Cooling aggregate
- A Initial solution  
B Product  
C Waste gas  
D Solvent

### The following solvents have been tested and can be used without reservation:

- Methanol
- Ethanol
- Toluene
- Hexane
- Acetone
- Ethylacetate
- Dichloromethane\*
- For water, we recommend to use the B-296 (see next page)

\* additional Cold Trap recommended



### Adsorption column

If mixtures of organic solvents and water are used, we strongly recommend the additional adsorption column in the closed loop system. The separation prevents water from freezing in the Inert Loop B-295 and potentially damaging the heat exchanger. The humidity is detected by a sensor. As soon as a critical threshold is exceeded as the column is saturated, the feed pump is stopped and the molecular sieve has to be exchanged or regenerated.

# Dehumidifier B-296 – Year round Reproducibility and closed loop operation



**The Dehumidifier B-296 is a versatile instrument for different applications:**

■ **Inlet air Conditioning**

Air humidity changes occurring between different seasons and regions affect the Spray drying process. By using the new Dehumidifier B-296, the drying conditions are exactly defined and made reproducible by removing the water content with a cold trap at 5 °C. The integrated hygrometer displays the air humidity.

■ **Closed loop with aqueous solutions**

For the use of aqueous solutions or mixtures with less than 50% organic solvents, we recommend the Dehumidifier B-296 due to the risk of freezing causing damage in the Inert Loop B-295. The additional pre-heat exchanger allows the efficient condensation resulting in a dry product.

■ **Inlet air chiller**

When using the spray chilling accessory (see next page) the inlet air can be cooled by the B-296 to produce optimal solidification, making the Dehumidifier the right choice for this application.

## Instruments

### Mini Spray Dryer B-290

For aqueous solutions; inclusive of nozzle, complete set of glassware and all necessary hosing.

Order number	
230 V, 50–60 Hz	44780
200 V, 50–60 Hz	44781

### Mini Spray Dryer B-290 Advanced

For aqueous and organic solutions (together with B-295). For the version to deal with organic solutions a set of peristaltic hosing for different solvents is provided. Both types of spray cylinders are included, together with the feed switch valve and the safety curtain.

Order number	
230 V, 50–60 Hz	44699
200 V, 50–60 Hz	44700

### Inert Loop B-295

Closed circulation for safe operation with solvents in association with the B-290 Advanced unit; comprises a cooling unit, pressure control and oxygen monitoring elements, communication cables to the B-290.

Order number	
230 V, 50 Hz	44701
230 V, 60 Hz	46344
200 V, 50 Hz	44779

### Dehumidifier B-296

The ideal instrument for inlet air conditioning, condensing of water in the closed loop or inlet air cooling for the spray chilling operation.

Order number	
230 V, 50–60 Hz	40188

# Accessories: Spray Chilling – World novelty in the lab-scale

Spray chilling can now be performed using this novel accessory to form particles directly from liquid samples by gas-phase solidification. Whether waxes, hard fats or glycerides as possible matrix substances – profit from this innovative encapsulation method now also performed at laboratory scale!



When a melting is dispersed into a cold gas stream, the droplets are solidified into particles and can thus be separated. The matrix substance and the active ingredients are heated above the melting point. The nozzle is also heated to prevent any blocking. No additional thermostat is required, as the existing heating control and peristaltic pump in the instrument are used. If the sample has a low melting point, then the inlet air is cooled to increase the temperature gradient. If lower temperatures than 10°C (provided by the B-296) are used, e.g. for hard fats, the inlet air can be cooled to -5°C by using a specially developed refrigeration unit. (Please contact your local distributor). Highest melting point is 70°C.

### Typical encapsulation examples are:

- Vitamins dissolved in fat
- Lyophilic active agents in glycerides
- Microcapsules for cosmetics
- Taste masking

### Spray Chilling

Liquifying bath, incl. heater, temperature probe and metering valve. Temperature range 20–150 °C, Batch volume 300 ml. Reverse compatibility for installed B-290 upon request.



Order number  
230 V, 50–60 Hz      40351

### Safety Curtain



If no fume hood is available and work is being carried out with inflammable or toxic products, the safety curtain is a highly reliable alternative. It is easy to unfold and the lamella permit inspection and access to the glass elements whilst the spray drying process is underway (incl. in B-290 Advanced).

Order number      44783

### Feed Switch Valve



Allows the automatic switching between pure solvent and sample feed-stock eliminating the need for manual changeover of hose connections. It is recommended that the unit be used with the Remote Control Unit (included in B-290 Advanced).

Order number      44725

### Remote Control Unit



Allows full control and the setting of all important parameters when the Spray Dryer is used in a fume hood.

Order number      44702

### Nozzle



Replacement nozzle. Reduces system down-time when there is a change of product.

Order number      44698

**Outlet filter**

Outlet filter with a polyester-deep bed filter and display of the pressure drop. Provides optimal protection for the aspirator and whilst permitting cleaning of the aspirator. The additional filter, made of a porous PTFE-membrane, also facilitates the recovery of the product by means of compressed air counter-pulses. A filter bag for each is included.

Order number

Discharge Filter complete	44754
Replacement Filter (6 items)	35004
PTFE-Membrane Filter	46316

**Inlet Filter**

Contaminants such as particles of dust, pollen or soot are filtered out of the air entering the equipment. It is an ultra filter made of glass fiber cloth, having an effective filtering surface area of 2.3 m<sup>2</sup>.

Order number 11235

**Cylinder Insulation**

Less product loss and closer to scale-up conditions.

Order number 40058

**Pre-heat exchanger**

To work in closed mode with the Dehumidifier B-296

Order Number 40059

**Pressure air supply**

Oilfree operated compressor for the feeding of the two-fluid nozzle 27907  
Air Maintenance Unit for clear, anhydrous pressurized air 04366

**Complete set of Glassware**

Complete set of glassware for alternating between cleaning and operational activities. Includes all connectors. Versions also available in brown glass for photosensitive products.

Complete set of glass elements 44680  
Complete set of brown glass elements 44758

**High-performance cyclone**

Increased separation of fines; designed for small quantities. Complete with small collection vessel.

Order number 46369

**Adsorption column**

Efficient water separation on the surface of a molecular sieve, incl. humidity sensor and 2.5 kg molecular sieve bag.

Adsorption column 46560  
Spare molecular sieve bag 46568

## Scale-up of Spray Drying Processes

Scale up is an important aspect in spray drying processes to easily translating initial trials in the research lab to full-scale industrial production. The two leading suppliers of spray drying systems, BÜCHI Labortechnik AG and Niro A/S are collaborating in offering customers their combined and comprehensive know-how.

Based on decades of experience and thousands of installations worldwide BUCHI and Niro simply help you scale your spray drying operation to any level – easily, efficiently and fast.



**GEA** Niro A/S



# Technical data

## Mini Spray Dryer B-290

Power Rating	2900 W
Voltage	200/230 V, 50–60 Hz
Evaporative Capacity	1.0 l/hr H <sub>2</sub> O, higher for organic solvents
Air Flow	Max. of 35 cu. m./hr
Motor Control	Frequency Converter
Max. Temperature Input	220 °C
Heating Capacity	2300 W
Heating Control	PT-100, Fuzzy Logic, Control Accuracy ± 3 °C
Interface	Serial port RS-232 for all parameters
Spray Gas	Compressed air or nitrogen, 200–1000 l/hr, 5–8 bar
Nozzle Diameter	0.7 mm Standard, 1.4 and 2.0 mm as accessories
Nozzle Cap	1.4 mm and 1.5 mm diameter
Mean Dwell Time	1.0–1.5 seconds
Possible particle diameter range	1–25 µm
Materials in contact with product	Acid-resistant stainless steel, 3.3 Borosilicate glass, FPM, Silicone
Dimensions LxWxH	60 x 50 x 110 cm
Weight	48 kg

## Inert Loop B-295

Power Rating	1 kW
Connection Voltage	200/230 V, 50–60 Hz
min. Outlet Temperature	down to –20 °C
Rate of Cooling	800 W at –10 °C
Dimensions LxWxH	60 x 70 x 77 cm
Weight	95 kg

## Dehumidifier B-296

Power Rating	700 W
Connection Voltage	200–230 V, 50–60 Hz
min. Outlet Temperature	+2 °C
Rate of Cooling	600 W at 0 °C
Dimensions LxWxH	35x40x60 cm
Weight	36 kg

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