unopex

Operation Manual

Unopex B 15

Mini Spray Dryer

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Foreword

Dear Customer,

Thank you for choosing a Mini Spray Dryer from Unopex. You have made a good choice. Thank you for your trust.

This manual describes the Unopex B 15 Mini Spray Dryer, its accessories and the complementary units.

Please read this manual carefully, note the safety precautions before installing and putting the Unopex B 15 Mini Spray Dryer into operation. You will find all necessary information for the safe operation of the instrument in this manual.

Follow this manual with regard to installation, start-up, operation, cleaning, maintenance, repair, storage and disposal of the instrument.

Original language version of this manual is in Turkish and serves as basis for all translations into other languages.

The manufacture of any component with the aid of this manual is also prohibited.

1. Introduction

1.1 Details on the Declaration of Conformity

CE

The instrument complies with the requirements of the European Directives: 2006/42/EC (Machinery Directive) and 2014/35/EU (Low Voltage Directive).

1.2 Safety

The safety information in this operation manual is designed to protect the responsible body, operator and the instrument from damage.

1.2.1 Symbols Used for Safety Instructions

Safety instructions are marked by the below combinations of pictograms and signal words. The signal word describes the classification of the residual risk when disregarding the operation manual.

DANGER	**Denotes an immediate hazardous situation that will result in death or serious injuries.**
WARNING	**Denotes a general hazardous situation that may result in death or serious injuries.**
CAUTION	**Denotes a hazardous situation that can result in injuries.**
NOTE	**Denotes a situation that can result in property material damage.**
INFORMATION	**Denotes important notes and usable hints.**

Below are the supplementary safety information symbols and meanings used in this manual.

General warning

Electrical hazard

Hot surfaces

Fragile components

Explosive gases,

Explosive environments

Harmful to health and life

Wear protective goggles

Wear protective cloth

Wear protective gloves

Wear protective mask

1.2.2 Proper Use

DANGER

Using the instrument in potentially explosive environments

DEATH OR SERIOUS INJURIES THROUGH EXPLOSION

- The instrument is not for use in areas which require ex-protected instruments
- Do not install or start up the instrument in explosive environments
- Do not operate the instrument with explosive gas mixtures
- Ensure sufficient ventilation to directly withdraw released gases and gaseous substances

WARNING

Improper use

SERIOUS INJURY AND PROPERTY DAMAGE

- Store the operation manual where it is easy to access in close proximity to the instrument.
- Only adequately qualified operators may work with the instrument.
- Operators must be trained before handling the instrument.
- Check that the operators have read and understood the operation manual.
- Define precise responsibilities of the operators.
- Personal protective equipment must be provided to the operators.
- Be sure to follow the responsible body's safety rules.

NOTE

Modifications to the instrument by third-parties

DAMAGE TO THE INSTRUMENT

- Do not allow third parties to make technical modifications to the instrument.
- Modifications to the instrument are only permitted with the written approval of the manufacturer.
- Modifications and upgrades shall only be carried out by an authorized Unopex specialist. The manufacturer will decline any claim resulting from unauthorized modifications.
- In case of any modification of the instrument not approved by the manufacturer, the CE declaration of conformity becomes invalid.
- Only specialists trained by the manufacturer may carry out service, repairs or maintenance work.

The following must be observed without fail:

- Only use the instrument in a fault-free condition!
- Have start-up and repairs carried out only by specialists!
- Do not ignore, bypass, dismantle or disconnect any safety devices!

The technical specifications of the instrument is given in Section-2.

Unopex B 15 Mini Spray Dryer has been designed and manufactured as a laboratory instrument. It is addressed to laboratory personnel and operators for batch production in particular. It serves to spray-dry only aqueous solutions or suspensions.

With the Unopex Inert Cycle B 60 and Unopex B 45 Dehumidifier, it is possible to work with organic solvents in "closed cycle". Operation in "closed cycle" requires N_2 as an inert gas.

In case of using the instrument with potentially toxic or hazardous substances in 'open mode'; it has to be installed inside a closed fume hood. In order to avoid toxicities and other hazardous situations to the operator and the environment, handling and processing has to be performed within the ventilated box.

All possibly hazardous substances and fumes have to be removed from the working area. Exhausts leaving the exhaust gas tubing of the instrument have to be lead away instantly by a ventilation system which is equipped with safety devices and equipments to avoid contamination of the environment.

Handling and operation may require additional personal protective equipment. Be sure to operate the instrument and accessories/units in accordance with standard laboratory safety rules.

If the Unopex B 15 Mini Spray Dryer is used in combination with other optional accessories, all related manuals are to be fully observed and followed.

In all cases, electrostatic charges from both the product collection vessel and the cyclone are to be arrested via the grounding cable.

Additional cleaning measures (primary cleaning and in place disinfection) are required if the instrument is used pharma, food or cosmetic products.

The instrument must be installed and operated according to the instructions in this manual. Failure to comply with the operation manual is deemed improper use.

1.2.3 Improper Use

Unopex B 15 Mini Spray Dryer is permitted only for the purposes for which it was manufactured. Risks to users, property and the environment can arise when the instrument is damaged, used carelessly or improperly.

Use of the instrument for purposes other than the ones mentioned or beyond specified use limits shall relieve the manufacturer of all responsibility in case of damage to persons or things and invalidate the warranty.

The manufacturer accepts no liability for damage caused by technical modifications to the instrument, improper handling or use of if the operation manual is not observed.

Below uses are expressly forbidden:

- use of the instrument by insufficiently trained personnel
- use of gases with unknown chemical composition
- use of the instrument in areas which require ex-protected instruments
- use of the instrument without genuine parts and genuine consumables
- spray drying of biohazardous materials or toxic substances
- spray drying of substances which might explode or ignite due to the processing
- spray drying of feeds containing organic solvent in open mode
- spray drying of feeds containing organic solvent without Unopex B 45 Dehumidifier and Unopex B 60 Inert Cycle under inertization in closed mode
- spray drying without plexiglass safety curtain
- use of corrosive samples
- use of samples which might produce oxygen during the processing
- unattended operation

1.2.4 General Hazards and Safety Notices

Inhalation of inert gases

DEATH BY SERIOUS POISONING OR SUFFOCATION

- Only operate the instrument in sufficiently ventilated environments
- Do not inhale inert gases
- Ensure sufficient ventilation to directly withdraw released gases and gaseous substances
- Check all parts, connections and sealings for proper sealing before operation
- Exchange defective or worn out parts immediately

Working with harmful or hazardous substances or with substances of unknown composition

DEATH OR SERIOUS INJURY THROUGH EXPLOSION

DEATH OR SERIOUS POISONING BY CONTACT OR INCORPORATION

- Certain gases in or in the vicinity of the instrument are highly inflammable
- Always be aware of the poisoning and explosion risk when working with harmful or hazardous substances
- Always be aware of the poisoning and explosion risk when working with substances of unknown composition
- Before operation, check the instrument for correct installation and assembling
- Before operation, inspect parts, sealings and tubes for good condition
- Exchange defective or worn out parts immediately
- Exchange clogged filters immediately
- Only operate the instrument in ventilated environments
- Directly withdraw released gases and gaseous substances by sufficient ventilation
- Check for gas leakages by performing a dry-run without sample material
- Always provide sufficiently ventilated environments to operate the instrument

Incorporation or inhalation of dried particles

DEATH OR SERIOUS POISONING BY INHALATION OF PARTICLES

- Do not inhale dried particles
- Wear protective clothing
- Wear protective gloves
- Wear protective eye goggles
- Wear protective mask
- Wear non-slip shoes
- Check all parts for proper sealing before operation
- Only recover particles in sufficiently ventilated areas
- Do not open the drying circuit while drying gas flow continues
- Do not disperse the dried particles
- Do not use compressed air to clean dusty parts

Operation with bent hoses

SERIOUS INJURY AND PROPERTY DAMAGE

- Always inspect the instrument for bends or kinks in hoses
- Eliminate them prior to operation

CAUTION

Handling hot surfaces

RISK OF BURNINGS WHEN HANDLING HOT SURFACES

- Do not touch hot surfaces
- Allow all hot parts to cool down after operation

CAUTION

Inhalation of Ozone

RISK OF POISONING BY INHALATION OF OZONE

- Directly withdraw released gases and gaseous substances by sufficient ventilation
- Always be aware of the minor poisoning risk by inhalation of Ozone

NOTE

Liquid spill

PROPERTY DAMAGE

- Always be aware of the risk of instrument short-circuits and damage by liquids
- Do not put any liquid sample vessel on this instrument without reservoir-plate and ensure safe positioning of the vessel.
- Do not move the instrument when it is loaded with liquid
- Do not spill any liquids over the instrument or any parts of it
- Wipe off any liquids immediately
- Do not let the instrument vibrate

NOTE

Internal overpressure

PROPERTY DAMAGE

- External pressure supply must always meet the instrument specifications
- Do not use clogged filters, exchange them immediately
- Filter must be disposed immediately

NOTE

Wrong mains supply

PROPERTY DAMAGE

- External mains supply must always meet the instrument and accessories/units specifications
- Check for sufficient grounding

INFORMATION

Always wear the following personal protective equipments when working with the instrument or accessories/units

- protective clothing
- protective gloves
- protective eye goggles
- protective mask

1.2.5 Further Protective Safety Measures

INFORMATION

Emergency strategy
Disconnect the instrument from the power supply!

- The instrument is internally grounded to arrest electrostatic charges. Cyclone and the product collection vessel may also charge with static electricity depending on the substances used or operating conditions.
- Glass parts are made of heat resistant borosilicate glass. Proper couplings for glass connections are to prevent glass breakage.
- The instrument has automatic temperature control of the inlet temperature and excess temperature protection against uncontrolled overheating.
- Outlet filter is to protect the environment from contamination of fine dust particles.
- Warning messages on the touchscreen operating panel contain a message about the irregularity of the instrument, the operator is also warned when defined limit values for defined parameters are exceeded. The operator evaluates the relevance of the message and takes action where necessary.

1.3 Staff Qualification

Risks to users, property, and the environment can arise when the instrument or accessories/units are used carelessly or improperly.

1.3.1 Responsible Body

- The head of laboratory is the responsible body.
- This operation manual is to be stored where it is easy to access in close proximity to the instrument and must be made available at all times to the operating personnel.
- Operators must be trained before handling and operating the instrument. The head of laboratory is the responsible for training his personnel. Only adequately qualified operators must be permitted to work with the instrument.
- Check that the operators have read and understood the operation manual. Define precise responsibilities of the operators.
- System settings of the instrument are protected via passwords on the touchscreen operating panel and are shared only with the responsible body by the manufacturer. The responsible body must not share those passwords with anyone.
- The instrument meets the recognized safety standards. Integration into a system may give rise to hazards that are characteristic of the other system's design and beyond the control of Unopex. It is the responsibility of the responsible body to ensure that the overall system, into which this instrument is integrated, is safe.
- The responsible body must check whether local, national and federal regulations require any mandatory installation of further pollution control equipment for the instrument/the entire system.
- Personal protective equipment must be provided to the operators.

1.3.2 Operators

- Work on the instrument is reserved for appropriately qualified specialists, who have been assigned and trained by the responsible body to do so.
- Operators must be at least 18 years old. Under 18-year olds may operate the Mini Spray Dryer only under the supervision of a qualified specialist.
- The operator is responsible vis-a-vis third-parties in the work area.
- Carefully read the operation manual before operating the instrument.
- Legal regulations, such as local, national and federal laws applying to the instrument, installation and working area of the instrument must be strictly followed.
- Ensure that the instrument is operated in proper condition only.
- Observe all safety instructions and do not ignore, bypass, dismantle or disconnect any safety devices.
- When working with the instrument, always wear appropriate personal protective equipments (e.g. protective clothing, protective gloves, protective eye goggles, protective mask, non-slip shoes). Protect yourself from inhalation of fine particles by wearing protective mask. The personal protective equipment must meet all requirements of all data sheets for the chemicals and materials used. Choose and use adequate measures according to the applications, since some additional protective measures might be necessary.
- Modifications to the instrument and modifications to the spare parts used are only permitted with the prior written approval of the manufacturer. The manufacturer will decline any claim resulting from unauthorized modifications. Ensure that modifications and upgrades are carried out by authorized Unopex specialists only.
- Ensure that service, repairs or maintenance work are carried out with care and on schedule and by specialists trained by the manufacturer only.

2. Technical Specifications

2.1 Scope of Delivery

Unopex B 15 Mini Spray Dryer is delivered with complete standard accessories. Optional units & accessories are available.

Unopex B 15 Mini spray Dryer is suitable for spray drying feeds containing only water as solvent.

In order to work with formulations containing organic solvents, Unopex B 15 Mini spray Dryer must be used in closed cycle under nitrogen atmosphere in combination with the B 45 Dehumidifier and B 60 Inert Cycle.

Code	Standard Instrument
877100	B 15 Mini Spray Dryer, 220 V AC, 50 Hz

Code	Standard Components
52100	Touchscreen operating panel
42092	Glass assembly complete
40500	2-fluid nozzle complete with automatic nozzle de-blocking, 0.5 mm
41100	Peristaltic pump
47110	Peristaltic pump tubing, silicon (1 m)
44100	Outlet filter, complete
44200	Inlet filter, complete
45200	Feed valve
54150	Safety curtains, complete
49110	Operation Manual, English
49210	Quick Operation Guide, English

Code	Optional Accessories
108312	Oil-free Air Compressor, 220 V AC, 50Hz
108320	Trolley
117410	Spray cylinder insulation
42010	Spray cylinder, single outlet
42022	High performance cyclone
42095	Amber glass assembly complete (for light sensitive applications)

Code	Optional Accessories (continued)
47140	Peristaltic pump tubing, tygon (1 m)
47130	Peristaltic pump tubing, pharmed (1 m)
47330	Exhaust hose (2 m) with adapter and clamp, complete
109450	Heat Exchanger for B 45 Dehumidifier
44500	HEPA filter inlet, complete
44550	HEPA filter outlet, complete
120201	IQ/OQ documentation

Code	Complementary Units
877450	B 45 Dehumidifier, 220 V, 50 Hz
877600	B 60 Inert Cycle, 220 V, 50 Hz
877900	B 92 Spray Chilling, 220 V, 50 Hz

INFORMATION	For detailed product information, visit www.unopex.com or contact Unopex.

INFORMATION	Scope of delivery might change according to specific offers/quotations.

2.2 Technical Data

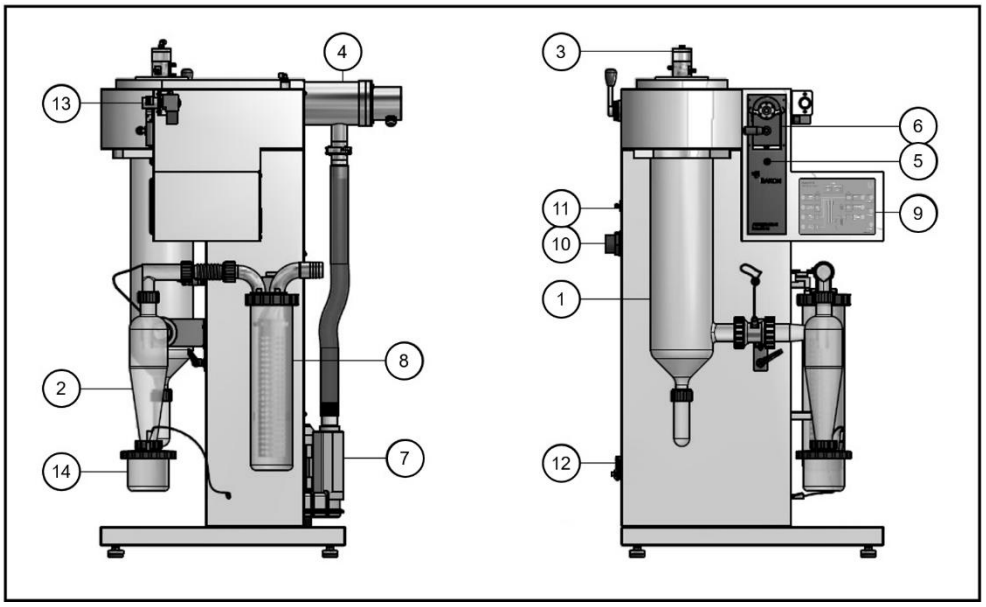
Model	Unopex B 15 Mini Spray Dryer
Evaporating capacity	1500 mL/h H_2O, higher for organic solvents
Max. inlet temperature	220 °C
Ambient conditions	for indoor use only altitude up to 2000 meters above sea level temperature: 5–40 °C relative humidity up to 31 °C max. 80% and decreasing linearly to 50% up to 40 °C
Feed pump	peristaltic, variable speed
Configuration	co-current
Spray gas	Compressed air or nitrogen, 3–6 bar, 600–800 L/h
Atomization	2-fluid nozzle with automatic nozzle de-blocking
Aspirator	variable speed
Material of construction	heat resistant borosilicate glass and stainless steel
Connection voltage, frequency	220 V AC
Heating	3 kW, PID controlled
Operating panel	touchscreen
Computer connection	data transfer with USB flash drive
Dimensions (LxWxH)	800x600x1400 mm

2.3 Material of Construction for Product Contact Parts

Feed tubing	silicone / tygon / pharmed
2-fluid nozzle	stainless steel (AISI 316L/AISI 316)
Hot air duct	stainless steel (AISI 304/AISI 316)
Glass parts	heat resistant borosilicate glass

3. Product Description

3.1 Description of the Instrument

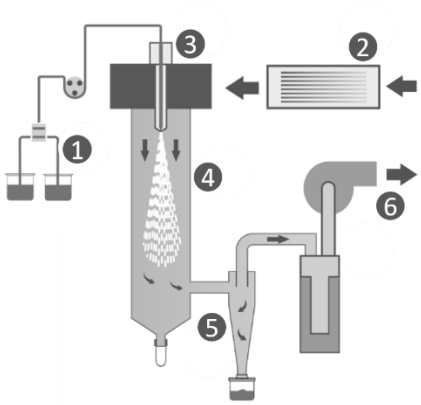


1	Spray cylinder	8	Outlet filter
2	Cyclone	9	Touchscreen operating panel
3	2-fluid nozzle	10	Pressure air regulator
4	Heater	11	Atomizing air flowmeter
5	Power switch	12	Compressed air inlet
6	Peristaltic pump	13	Feed valve
7	Aspirator	14	Product collection vessel

INFORMATION Components, parts and images might change according to specific offers and scope of delivery.

3.1.1 Working principle

Unopex B 15 Mini Spray Dryer operates in co-current flow configuration where the drying gas flows in the same direction with the sprayed sample product.



1. Solution or suspension is injected into the drying chamber through a nozzle.
2. Drying gas is injected into the drying chamber.
3. The nozzle atomizes the solution into small droplets.
4. As the droplets of solution fall through the chamber, moisture evaporates from the droplets and they become particles.
5. The drying gas carries the particles to the cyclone where the particles are separated from the gas. Powder is collected.
6. The drying gas is filtered and exhausted.

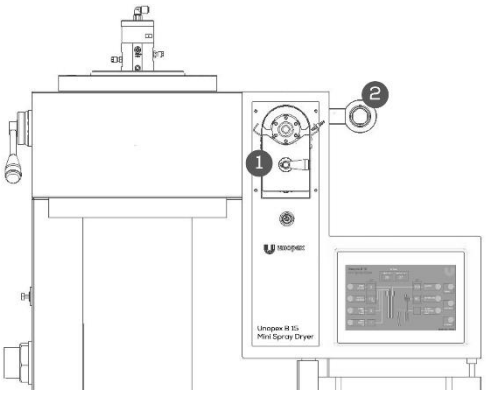
3.1.2 Nozzle atomizer

Unopex B 15 Mini Spray Dryer has 2-fluid nozzle with automatic nozzle cleaner. It produces fine droplets from sample solutions.

3.1.3 Outlet filter

The polyester outlet filter recovers small particles so that they don't get released into the environment.

3.1.4 Peristaltic pump and feed valve

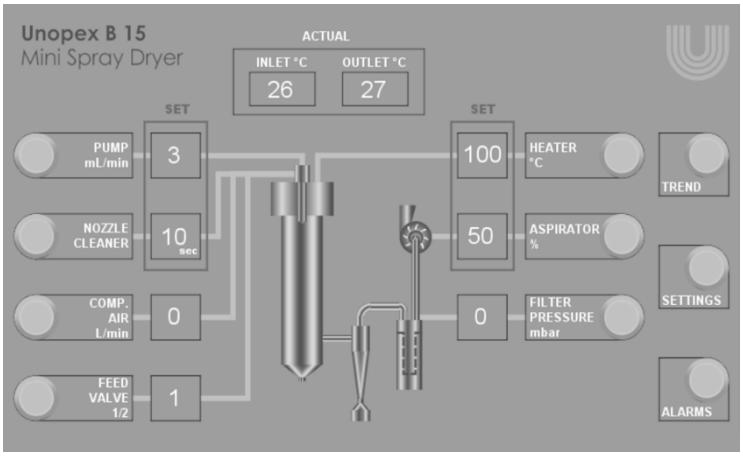


- The peristaltic pump (1) recirculates the solution to be sprayed between the sample solution vessel and the nozzle atomizer. The wheel of the peristaltic pump causes the diameter of a pipe to increase and decrease by turns, pushing the liquid in the tubing forwards.
- Feed valve (2) enables the changeover from a pure solvent feed to sample solution feed.

3.1.5 Touchscreen operating panel

Unopex B 15 Mini Spray Dryer has a touchscreen operating panel. This panel allows the user

- to start/stop the heater, aspirator, air compressor, nozzle cleaner, feed pump and feed valve
- to see or control the process parameters such as drying gas inlet temperature, outlet temperature, feed flowrate, drying gas flowrate, compressed air flowrate, nozzle cleaning intervals etc.



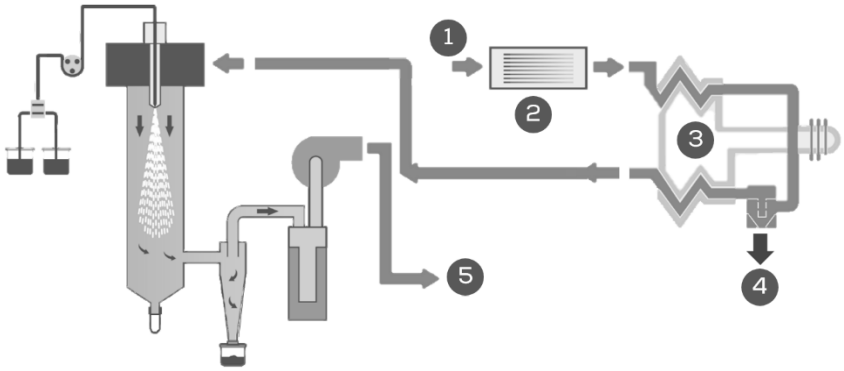
- to calibrate the peristaltic pump flow

3.2 Description of the Complementary Units

3.2.1 B 45 Dehumidifier

Unopex B 45 Dehumidifier can be used to condition drying air, to work continuously with water and organic solvent mixtures and for inlet air cooling in spray chilling operation.

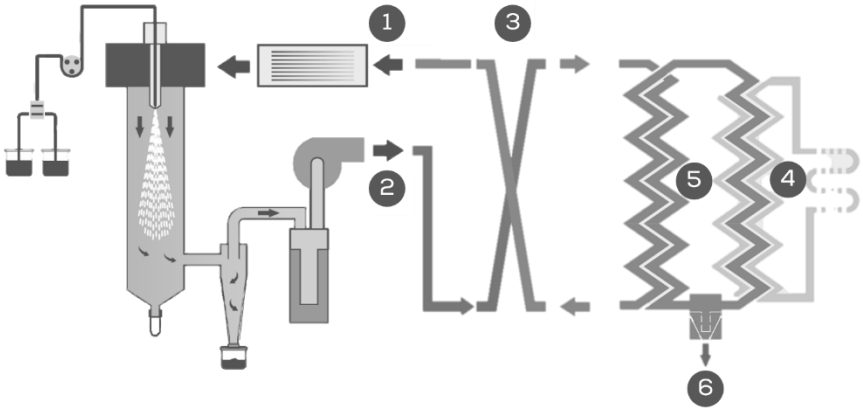
Use in open mode in combination with Unopex B 15 Mini Spray Dryer enables spray drying under constant and reproducible humidity conditions.



1. Dryer gas inlet 2. Inlet filter 3. Cooling unit 4. Condensed water 5. Dryer gas outlet

3.2.2 B 60 Inert Cycle

Unopex B 60 Inert Cycle enables safe operation of B 15 Mini Spray Dryer with 100% organic solvents under inert conditions.

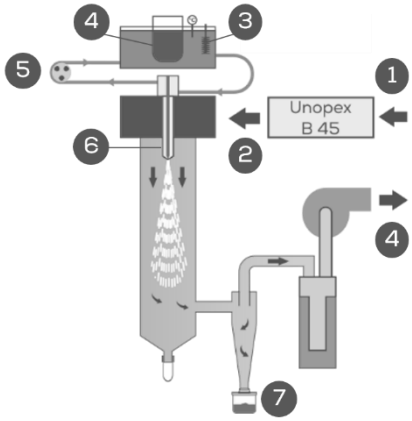


1. Dryer gas inlet 2. Dryer gas outlet 3. Heat exchanger
4. Cooling unit 5. Condenser 6. Solvent drain

Use in closed cycle in combination with B 15 Mini Spray Dryer, B 45 Dehumidifier and external heat exchanger enables to work with water/organic solvent mixtures safely.

3.2.3 B 92 Spray Chilling

Unopex Spray Chilling Unit is used in combination with B 15 Mini Spray Dryer to make powders directly from molten feed samples by solidification.



1. Air inlet 2. Cooled air 3. Heater

4. Molten feed sample 5. Heating liquid circulation

6. Spraying nozzle 7. Solidified powder product

4. Preparations Before Operation

Starting up a damaged instrument, accessories/units.

MORTAL DANGER FROM ELECTRIC SHOCK

- Do not operate a damaged instrument and accessories/units
- Please contact the Customer Support

Death or serious injuries by use in explosive environments.

- Do not install or operate the instrument and accessories/units in explosive environments
- Do not install or operate the instrument and accessories/units with explosive gas mixtures without inertization
- Check all gas connections for correct installation before operation,
- Withdraw released gases and gaseous substances directly by sufficient ventilation

Unsuitable ambient conditions/unsuitable installation

SERIOUS INJURY DUE TO CRUSHING

- Comply with the all requirements

Risk of minor or moderate injury by heavy weight of the instrument, accessories/units

- Get help from others where you need
- Do not drop the instrument and accessories/units
- Place the instrument and accessories/units on stable, horizontal and vibration-free surface
- Keep limbs out of crushing zone
- Do not move the instrument and accessories/units with glass parts assembled

Risk of minor or moderate cuts by sharp edges.

- Check for damages to glass parts
- Do not touch defective or broken glassware or thin metal edges

4.1 Un-packing

- Check for damage to the packaging. Damage can indicate property damage to the instrument and accessories/units.
- Check for any transport damage when unpacking the instrument, accessories/units.
- If necessary, prepare a status report immediately and always contact your forwarding agent regarding the settlement of claims.
- Follow the instructions under “Chapter 8.2” for the disposal of packaging material.
- Keep the original packaging for future transportation.

4.2 Ambient & Installation Conditions

Consider the ambient conditions under "Chapter 2.2".

Take into consideration of the dimensions and weight of the instrument, accessories/units.

Maintain wall and ceiling clearance for adequate air exchange (dissipation of waste heat, supply of fresh air for the instrument, accessories/units and work area). Do not operate the instrument, accessories/units in an inadequately dimensioned area.

Install the instrument and accessories/units upright on a stable, horizontal surface where you can easily reach.

INFORMATION

Use required sealing rings and gaskets for each connection and consider the correct mounting directions

Screw all threaded connections tightly

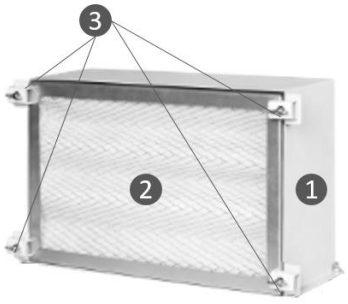
For disassembling proceed in reverse order

4.3 Installing the inlet filter

NOTE

Risk of instrument damage by internal overpressure

- External supply pressure must meet the system specifications
- Exchange immediately defective or clogged filters
- Dispose of defective or clogged filter immediately



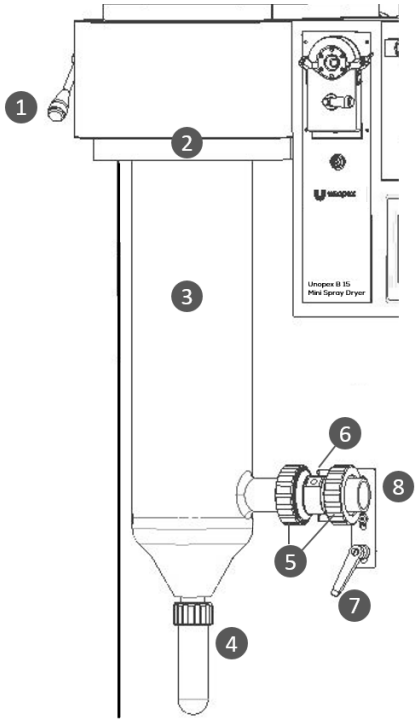
- Place the Inlet filter element (2) onto the inlet filter casing (1) mounted under the trolley
- Screw butterfly nuts (3) on inlet filter (2)
- Install the connecting hose between inlet filter casing and the aspirator inlet

4.4 Installing the air compressor

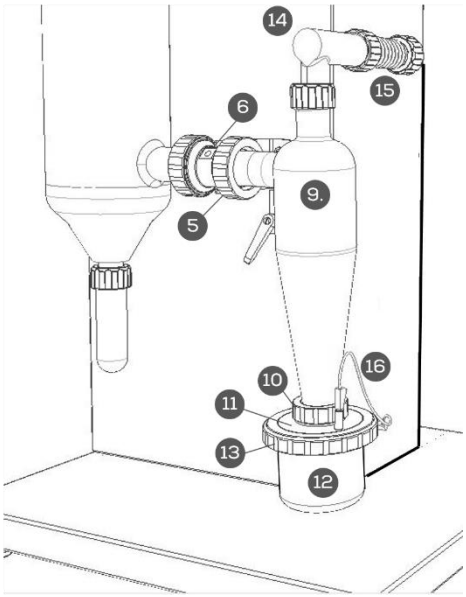
A pressure air compressor is provided with the instrument to supply oil-free compressed air to the nozzle atomizer.

- Place the air compressor onto the lower step of the trolley
- Connect the outlet of the compressor to the compressed air inlet (1) on the side panel of the instrument with the compressed gas tube by means of quick coupling

4.5 Installing the glass parts

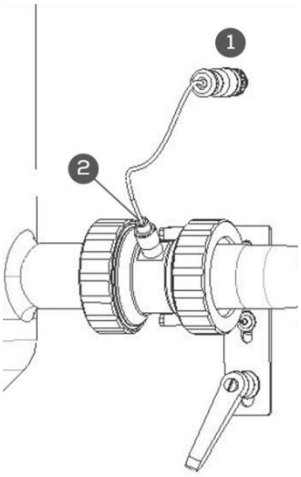


- Keep the lever (1) on the up side
- Place the o-ring into the seal holder (2)
- Attach screw coupling (5) and tension spring on the spray cylinder outlet flange respectively
- Hold the glass cylinder (3) carefully and insert it into the instrument, make sure that upper flange of the cylinder properly contacts with the seal holder (2) and the cylinder aligns horizontally and vertically
- Push the lever (1) carefully on the lower side so that the upper flange of the cylinder is held firmly
- Connect the spray cylinder bottom flask (4) to the glass cylinder (3) by means of screw coupling
- Open the fixation (7)
- Attach the screw coupling flange (6) to the spray cylinder outlet flange
- Adjust the level of the support element (8) and close the fixation (7)



- Attach screw couplings (5, 10) and tension springs on side outlet and bottom outlet flanges of the cyclone
- Connect metal cover (11) to the product collection vessel (12) by means of screw coupling (13)
- Attach the product collection vessel together with the cover to the cyclone bottom outlet flange
- Connect the grounding cable (16) to the instrument housing and to the metal cover of the product collection vessel
- Screw the glass angle piece (14) onto the top of the cyclone
- Screw the flextube to the glass angle piece

4.6 Installing the outlet temperature sensor



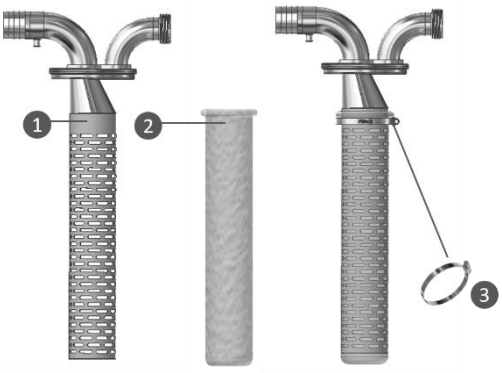
- Connect and screw the outlet temperature sensor (2) to the spray cylinder screw coupling flange and to the plug (1) in the side panel of the instrument

4.7 Installing the outlet filter

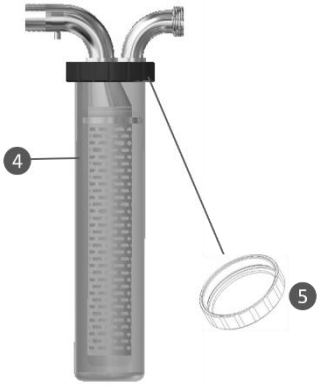
NOTE

Risk of instrument damage by internal overpressure.

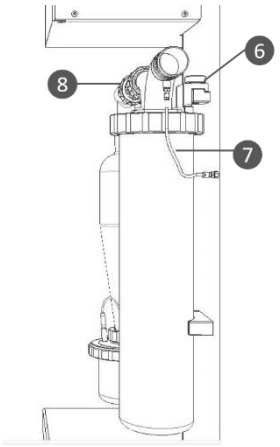
- External supply pressure must meet the system specifications
- Exchange immediately defective or clogged filters
- Dispose of defective or clogged filter immediately



- Insert outlet filter cartridge (1) into the polyester filter bag (2) and fix with clamp (3)

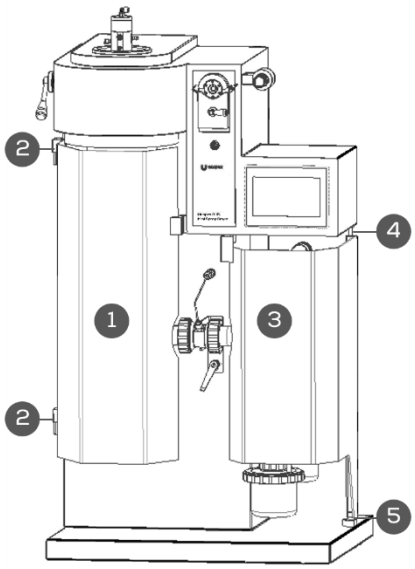


- Connect the filter cartridge together with filter bag to the housing glass (4) by means of screw coupling



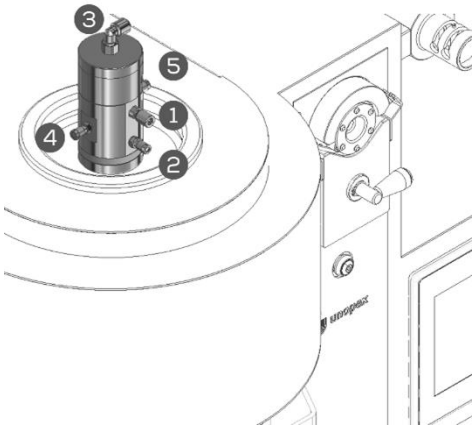
- Connect the complete filter to the holder on the side panel of the instrument and screw the bolt (6) to fix
- Install the gas tubing (7) for pressure sensor between the filter outlet pipe and the side panel of the instrument by means of quick couplings
- Screw the flextube (8) to the outlet filter inlet pipe

4.8 Installing the safety curtains



- Connect the large safety curtain (1) to the instrument housing by inserting the pins on the side panel to the pin holes (2) on the curtain
- Push down the curtain carefully so that it is held firmly
- Connect the small safety curtain (3) to the instrument housing by inserting the upper pin on the curtain to the pin hole (4) on the side panel
- Insert the bottom pin on the curtain to the pin hole (5) on the side panel
- Push down the curtain carefully so that it is held firmly

4.9 Installing the nozzle atomizer



- Insert the 2-fluid nozzle into the gap on top of the instrument
- connect the feed tubing to FEED INLET (1) on the nozzle by means of screw coupling
- connect the atomizing air (or nitrogen) tubing to the ATOMIZING AIR (2) inlet on the nozzle by means of quick coupling
- connect the nozzle cleaner air (or nitrogen) tubing to NOZZLE CLEANING AIR (3) inlet on top of the nozzle by means of quick coupling
- for optional cooling/heating of the nozzle there are two additional connections (4, 5) which can be used with an external thermostat

4.10 Feed tubing selection

NOTE

Risk of instrument damage by the use of unsuitable tubing

- Only use feed tubing in standard size
- Only use silicone, tygon or pharmed feed tubing
- Exchange immediately worn or defective tubing
- Dispose of worn or defective tubing immediately

Peristaltic pump bed is adjusted ex works to the standard silicone tubing and a stopper between two feed tubing are provided to prevent slipping.

Choose the feed tubing according to the following table and adjust the pump bed with an allen key when using different tubes, e.g. tygon or pharmed tubing.

Solvent	Silicone	Tygon	Pharmed
Water	✓	✓	✓
Ethanol	✓	✓	✓
Methanol	✗	✗	✓
Acetone	✗	✓	✗
Ethyl acetate	✗	✗	✓

4.11 Calibrating the pump flow

Pump flow calibration process is very simple and takes short time.

Dip one end of the tubing into a beaker filled with distilled water and place the other end into an empty measuring cylinder. Place the tubing onto the pump bed and adjust the bed.

Press “SETTING” at home page on touchscreen operating panel and enter the “PUMP CALIBRATION” button. Use the following instructions on touchscreen operating panel for calibration of the pump.

4.12 Connecting to the power supply

NOTE

Risk of instrument damage by wrong mains supply

- External mains supply must meet the voltage and the current specified on the name plate
- Check for sufficient grounding.

INFORMATION

Additional electrical safety measures might be necessary to meet local laws and regulation!

External power or emergency stop switches must meet the requirements of the related standards, be accessible at any time and clearly labeled.

External connections and extension lines must be provided with a grounded conductor lead and power cords must meet the input power requirements.

Mains plug must be accessible at any time to cut the power in case of emergency by unplugging,

Unopex B 15 Mini Spray Dryer and the complementary units are shipped with flexible power cords. Connect the power cords to the mains supply meeting the proper voltage and current specified on the name plates. The mains circuit must handle the load of the connected instruments, accessories/units and must be equipped with all electrical safety measures including proper grounding. After the installation, electrical safety tests are recommended to verify safe system condition such as sufficient grounding.

5. Operation

5.1 Installation Check Before Operation

Carry out an installation check after a successful installation and prior to spray drying process.

- Check the instrument and accessories/units for correct assembling
- Check o-rings, sealings, hoses and tubes for good condition and tight connection
- Inspect all glass parts visually for possible damage
- Exchange worn out or defective parts or components immediately
- Make sure that the outlet temperature sensor with the o-ring has been connected correctly.
- Check the electrical connections
- Make sure that the product collection vessel has been connected to the instrument by means of the grounding cable for arresting electrostatic charges

Inhalation or incorporation of dried particles during spray process.

DEATH OR SERIOUS POISONING

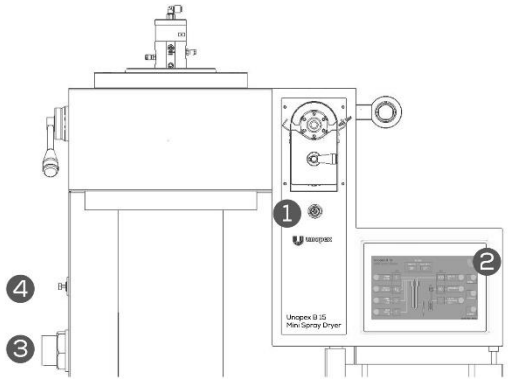
- Wear appropriate personal protective equipments (e.g. protective clothing, protective gloves, protective eye goggles, protective mask, non-slip shoes).
  The personal protective equipment must meet all requirements of all data sheets for the chemicals and materials used. Choose and use adequate measures according to the applications, since some additional protective measures might be necessary.
- Check for proper sealing before use
- Do not inhale dried particles
- Stop drying gas flow before opening the drying circuit

Contact or incorporation of harmful substances at use.

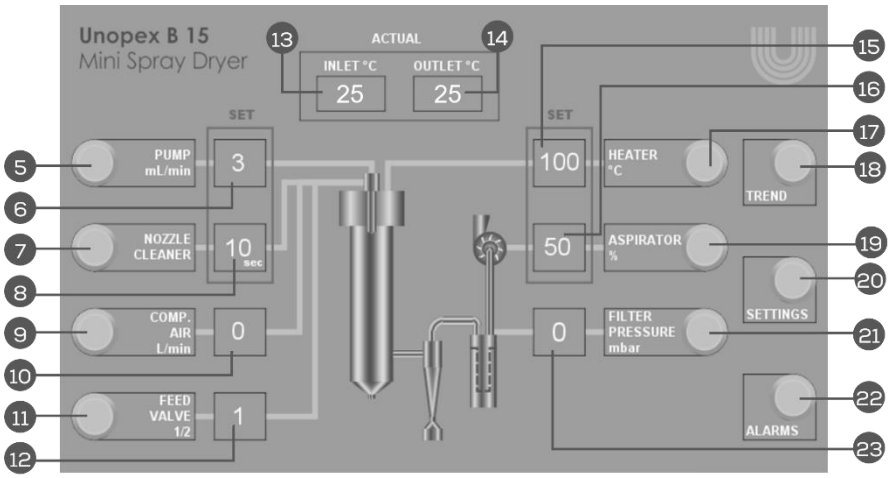
DEATH OR SERIOUS POISONING

- Exchange clogged filters immediately
- Operate the instrument in only ventilated environments
- Directly withdraw released gases and gaseous substances by sufficient ventilation
- Check for gas leakages by performing a dry-run without sample material

5.2 Operating Elements and Touchscreen Operating Panel



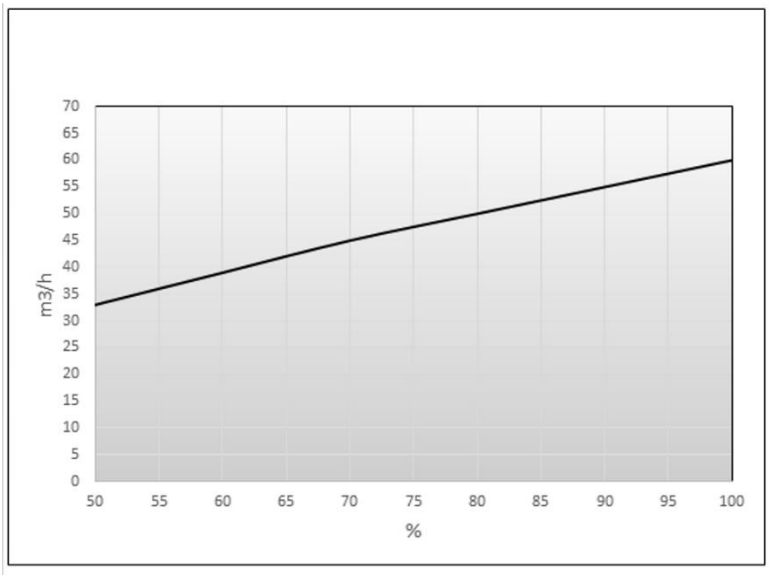
(1) ON/OFF switch
(2) Touchscreen operating panel
(3) Pressure air regulator
(4) Atomizing air flowmeter



(5) peristaltic pump ON/OFF
(6) set value peristaltic pump
(7) nozzle cleaner ON/OFF
(8) set value nozzle cleaner
(9) compressed air
(10) display area compressed air flow
(11) feed valve to change feed selection
(12) display area valve (1/2)
(13) display area inlet temperature
(14) display area outlet temperature
(15) set value inlet temperature
(16) set value aspirator output (in % of max. aspirator rate)
(17) heater ON/OFF
(18) trend page entering
(19) aspirator ON/OFF
(20) settings page entering
(21) filter pressure offsetting
(22) alarms page entering
(23) display area filter pressure

5.3 Conversion Table for Aspirator

The diagram shows the aspirator settings versus throughput. Maximum gas volume flowrate of the aspirator is around 60 m^3/h.



The flow depends on the overall system pressure drop. Exact volume flow could be measured with a suitable gas flow meter.

5.4 Starting a Spray Drying Process in Open Mode

CAUTION

Risk of minor or moderate burnings when handling hot parts.

- All glass parts and some components can get hot during operation
  Do not touch hot surfaces
- Allow all hot parts to cool down after operation

INFORMATION

This section describes spray drying with aqueous feed samples in open mode. For spray drying with feed samples containing organic solvents in closed mode which requires nitrogen gas inertization, see Unopex B 60 Inert Cycle Operation Manual

1. Switch on the instrument.
2. On the touchscreen operating panel, turn on the aspirator. The aspirator default rate is 50%. Then set aspirator to desired rate.
3. Set the inlet temperature.
4. Turn on the heater. Wait for the system reaching steady conditions.

INFORMATION

Heater cannot be turned on if the aspirator is turned off.

5. Start the compressed air flow. Adjust compressed air pressure by turning the pressure air regulator (typical set point is between 0.08 and 0.10 MPa) and set the compressed air flowrate for the feed dispersion by the atomizing air flowmeter (typical set point is between 7 and 9 L/min)

6. The process should start with pure solvent (distilled water in case of aqueous solutions) to get steady process conditions. Place the tubing onto the pump bed and close the pump bed. Set the pump flow to minimum value and turn on the pump, distilled water will be sprayed into the spray cylinder.
7. The outlet temperature will decrease due to the consumption of energy by the evaporation. Spray flow strongly influences the outlet temperature as water draws energy from the air by evaporation. The outlet temperature should be set to the desired value by varying the quantity of sprayed solution by changing the set value of the pump on the touchscreen operating panel.

INFORMATION

The outlet temperature can be regarded as the upper thermal load of the product.

Do not allow the product to be damaged as a result of an excessively high outlet temperature.

8. Set the set value nozzle cleaner and turn on the nozzle cleaner.
9. When the desired operating conditions are reached and have stabilized, transfer the feed tubing from the distilled water to the sample solution.

INFORMATION

The relevant parameters (Inlet temperature, pump flow and aspirator rate) for the spray drying process depend on each other. For optimization; inlet temperature, pump flow or aspirator rate need to be adjusted according to the requirements of the sample and product.

INFORMATION

During the start of the spray process, the feed tubing has to be transferred from pure solvent to sample solution. At the end the spray process, it has to be transferred from sample solution to pure solvent. This can be automated by means of the feed valve. Compressed air supply is required for the feed valve to operate. A Y-connector is provided to separate the feed tubing into two lines between pump and feed switch valve.

5.5 Finishing a Spray Drying Process

1. At the end of the spray drying process, change tubing from sample solution to pure solvent (distilled water in case of aqueous solutions) and continue to feeding for a short time to clean the tubing and the nozzle.
2. Turn off the heater.
3. In order to keep the outlet temperature constant, reduce the pump flow slowly and gradually. When the inlet temperature drops below boiling temperature of the pure solvent or the pump flow is reduced gradually down to the minimum set value; turn off the pump, lower the pump bed and turn off the nozzle cleaner.
4. Stop the compressed air flow.
5. Turn off the aspirator when the inlet temperature decreases below 70 °C. (If the aspirator is turned off on the touchscreen while the inlet temperature is above 70 °C, it will automatically continue to operate as soon as the inlet temperature decreases below 70 °C)

INFORMATION

Aspirator cannot be turned off if the heater is turned on.

6. The product collection vessel now can be removed.

INFORMATION

Stop drying gas flow before removing the product collection vessel. Otherwise, air stream might blow the product out of the product collection vessel.

7. The instrument now can be switched off.

6. Cleaning - Maintenance and Repairs

Inhalation or incorporation of dried particles during cleaning, maintenance and repairs

DEATH OR SERIOUS POISONING

- Wear appropriate personal protective equipments (e.g. protective clothing, protective gloves, protective eye goggles, protective mask, non-slip shoes).

  The personal protective equipment must meet all requirements of all data sheets for the chemicals and materials used. Choose and use adequate measures according to the applications, since some additional protective measures might be necessary.
- Clean all parts and components
- Do not inhale dried particles
- Stop drying gas flow before opening the drying circuit
- Only maintain the instrument in sufficiently ventilated environments

Injuries caused by compressed air and gases

DEATH OR SERIOUS INJURIES

- Depressurize air and gas circuit
- Wear protective eye goggles

Burning by electric current

DEATH OR SERIOUS BURNING

- Switch off the instrument, disconnect the power cord and prevent unintentional restart before removing housing or parts of it
- Do not spill any liquids over any electronic parts or components
- Do not touch parts inside the instrument with wet hands
- Do not squeeze cables, tubes or other items at reassembling
- Exchange defective cabling or tubing before reassembling

Risk of minor or moderate burnings and

- All glass parts and some components can get hot during operation
  Do not touch hot surfaces
- Allow all hot parts to cool down before cleaning

Risk of instrument damage by liquids and detergents

- Do not move the instrument when it is loaded with liquid
- Do not spill any liquids over the instrument, accessories/units, any parts or components
- Wipe off any liquid immediately
- Use soapy water as detergent only
- Chlorine solutions must never be used

NOTE

Risk of minor or moderate cuts when handling damaged glass parts

- Handle glass parts with care
- Visually inspect every glass part before mounting
- Exchange damaged glass parts immediately
- Do not touch cracks or bits of broken glass with bare hands

NOTE

Risk of instrument damage by internal overpressure

- External supply pressure must meet the system specifications
- Exchange clogged filters immediately
- Safely dispose filter immediately

6.1 Housing

Check the housing for visible defects (switches, plugs, cracks, etc) and carefully clean it regularly with a damp cloth.

6.2 Glass Parts

Clean the glass parts after each spray process. The glassware components can be taken out and cleaned manually with water and mild soap solution or in an ultrasonic bath. It is recommended to clean carefully all glass parts and rinse them with distilled water.

Check the glass parts for damage, replace damaged parts with the new ones, use only glassware in perfect condition. After reassembling, it is recommended to dry the components by leading warm air through the system for 3-5 minutes.

6.3 Tubing

Clean the feed tubing after each spray process. Consider the compatible chart for solvents specified under “Chapter 4.10”.

6.4 Nozzle Atomizer

The nozzle head and its components can be taken out and cleaned manually with water and mild soap solution or in an ultrasonic bath.

6.5 Sealings

All sealings are recommended to be checked yearly when replacing the seals, take care not to damage any of them.

To prevent damaging the seals never apply grease and never touch them with sharp objects. To prolong the lifetime of the seals, rinse them routinely with water to avoid unwanted sample contamination to occur. Dry the cleaned seals with a soft, lint-free cloth.

6.6 Filters

The inlet filter element gets dirty over time depending on the ambient conditions and use. Do not use clogged filter element, replace it by a new one immediately.

When the outlet filter gets dirty, a signal appears on the touchscreen operating panel to warn the user that the outlet filter bag needs to be cleaned or replaced. When the signal appears, take the filter bag out to wash it manually or replace it by a new one immediately.

6.7 Pressure Air Compressor

Drain condensate for releasing built-up moisture, after every use, or, for frequent users, at least once daily. To drain the condensate; turn on the compressor, reach back side of the compressor and open the air tank drain valve. Close the air tank drain valve when the air tank pressure gauge reaches 0 psi.

6.8 Customer service

Service and repair work on the instrument and accessories/units must be performed with care by authorized personnel only. These authorized personnel have a comprehensive technical training and knowledge of possible dangers which might arise from the instrument and accessories/units.

Contact Unopex customer service for spare parts delivery, repairs or technical advice. Contact information is given on the website www.unopex.com

7. Troubleshooting

7.1 Alarm Messages and Remedy

Alarm Number	Alarm Description	Possible cause	Remedy
ARM101	Inlet temperature is high	Inlet temperature above operation limit (> 225 °C)	Switch off the heater, alarm should disappear below 225 °C.
		Inlet temperature below operation limit (< 225 °C)	Defective heating control or heating relay, contact the Unopex customer service
ARM102	Inlet temperature is too high, safety protection	Inlet temperature above operation limit (> 227 °C)	Switch off the heater, alarm should disappear below 227 °C.
		Inlet temperature below operation limit (< 227 °C)	Defective heating control or heating relay, contact the Unopex customer service
ARM103	Outlet temperature sensor failure	Sensor not connected, defective sensor, sensor cable or internal wiring	Plug in the outlet temperature sensor correctly
			Switch off the device and try again
			Replace the outlet temperature sensor
			Contact the Unopex customer service
ARM104	Clogged outlet filter bag	Clogged outlet filter bag	Take the filter bag out to wash it manually or replace it by a new one
ARM105	B 60 alarm (while B 60 connected)	Oxygen rate above the alarm set point	Check the nitrogen supply to the system
			Make sure that the system is gas tight
			Wait until threshold rate is reached
			Replace the oxygen sensor
		Cooling not switched on	Make sure that the cooling is switched on
			Contact the Unopex customer service
ARM106	Temperature limits exceeded (while B 60 connected)	Inlet or outlet temperature above its alarm set point	Switch off the heater, alarm should disappear below alarm set temperature.
ARM107	Frequency converter failure (pump)	Defective frequency converter or wiring of pump	Contact the Unopex customer service

Alarm Number	Alarm Description	Possible cause	Remedy
ARM108	Frequency converter failure (aspirator)	Defective frequency converter or wiring of aspirator	Contact the Unopex customer service
ARM109	Inlet temperature sensor failure	Defective sensor, sensor cable or internal wiring	Switch off the device and try again Contact the Unopex customer service

7.2 Malfunctions and Remedy

Malfunction	Possible cause	Remedy
Instrument cannot be switched on	No voltage	Insert mains plug
Peristaltic pump does not deliver	No sample solution in the sample solution vessel	Put sample solution into the vessel
	No pure solvent (distilled water) in the pure solvent vessel	Put pure solvent (distilled water) into the vessel
	Tubing is not dipped into the vessels	Dip the tubing into the vessels
	Defective tubing	Check the peristaltic pump tubing and replace it if necessary
	The rollers are not in contact with the running surface	Adjust the pump bed
	Peristaltic pump handle has become loose	Tighten the handle
Product is delivered after the spray flow is switched on although the pump is switched off	Pump bed is not closed	Close the pump bed
	The pressure of the rollers on the running surface is too weak	Adjust the pump bed
System does not heat up	Heating is not turned on	Turn on the heater (heater cannot be turned on if the aspirator is turned off)
	Inlet temperature set point is below room temperature	Set a new inlet temperature above room temperature
	Heater defective	Contact the Unopex customer service
Irregular or pulsed spraying	Insufficient spray flow	Check and adjust the air pressure and rate of gas spray
Product drips in spray chamber	No spray flow	Check the compressed air pressure, flowmeter
	Insufficient spray flow	Check the air pressure
Outlet temperature does not rise	Outlet temperature sensor not connected	Connect the outlet temperature sensor with the o-ring correctly
	Fault in peristaltic pump delivery system	See above remedy for “Peristaltic pump does not deliver”

Malfunction	Possible cause	Remedy
Clogging of nozzle	Nozzle cleaner is not switched on	Switch on nozzle cleaner
	Insufficient number of pulses for nozzle cleaner	Decrease the nozzle cleaning interval
	Concentration change of in sample product	Agitate sample solution to obtain uniform concentration
	Sample solution is too concentrated	Use a diluted sample product
	Nozzle is not clean	Dismantle the nozzle head and clean with water
	Nozzle is defective	Replace nozzle or defective components
Deposits on the spray cylinder	Product related deposits	No remedy possible related to the device
	Nozzle is not clean	Dismantle the nozzle head and clean with water
	Nozzle is defective	Replace nozzle or defective components
	Wide spray angle deposits	Narrow the spray angle by adjusting the rate of gas spray
Deposits in the cyclone	Product related deposits	No remedy possible related to the device
	Static charge build-up	Plug in grounding cable
	Product too moist	Increase outlet temperature to dry the product
		Decrease aspirator flowrate to increase the drying residence time of product
		Reduce pump flowrate
Insufficient aspirator performance	Outlet filter blocked	Clean or replace the outlet filter bag
Outlet temperature too high	No liquid feed	Switch on peristaltic pump
	No sample solution in the sample solution vessel	Put sample solution into the vessel
	No pure solvent (distilled water) in the pure solvent vessel	Put pure solvent (distilled water) into the vessel
	Tubing is not dipped into the vessels	Dip the tubing into the vessels
	Nozzle clogged	See above remedy for “Clogging of nozzle”
	Concentration change of in sample product	Agitate sample solution to obtain uniform concentration
Outlet temperature falls	No heating	See above remedy for “System does not heat up”
	High feed flow	Decrease peristaltic pump flowrate

8. Taking out of operation

Death or serious poisoning by contact or incorporation of harmful substances

- Wear appropriate personal protective equipments (e.g. protective clothing, protective gloves, protective eye goggles, etc).
- Remove all liquids and dusty residues from the instrument, accessories/units to remove possibly dangerous substances
- Do not use compressed air for removing dusty residues

8.1 Storage, Packing and Transport

Switch off the instrument, remove the power cord, clean the instrument thoroughly.

Store the instrument and its accessories and complementary units in a dry location.

The original packaging has been designed for the transportation of the instrument as well as the glass parts and accessories. Only the original packaging must be used for any possible further transport.

INFORMATION

When returning the instrument or a complementary unit to the manufacturer for repair work, visit www.unopex.com and download the safety clearance form, then complete and send it with the instrument or the unit.

8.2 Disposal

For environmentally friendly disposal of the instrument, construction materials of the most important parts are specified under Chapter 2.3. So that the parts can be properly separated and recycled.

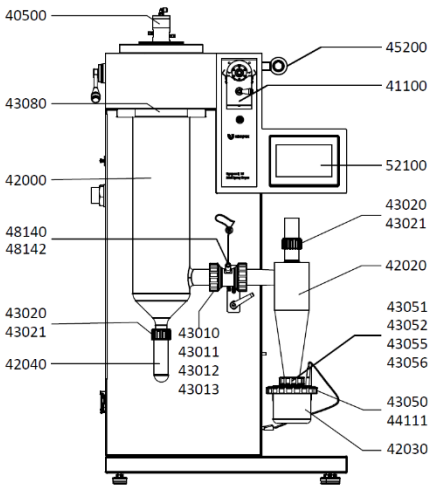
Do comply with all regional and local disposal regulations applicable for you.

INFORMATION

Contact your local authorities for any questions concerning disposal

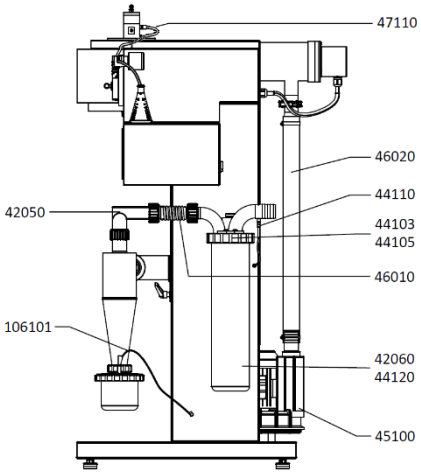
9. Spare Parts and Consumables

Use only genuine spare parts and genuine consumables ordered from Unopex to maintain warranty period, to assure continued system performance and reliability. Any modifications of the instrument, complementary units, accessories, or parts need prior written permission of the manufacturer.

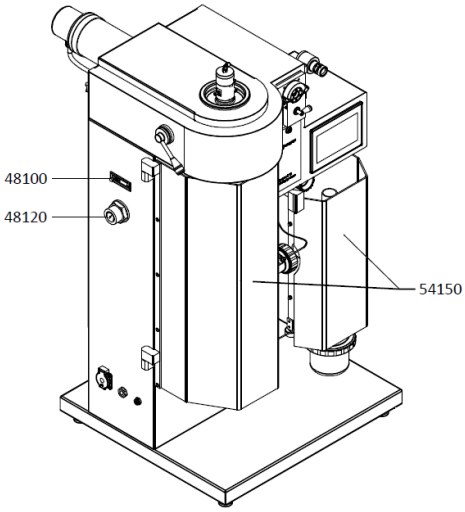


Code	Description
41100	Peristaltic pump
42000	Spray cylinder, double outlet
42010	Spray cylinder, single outlet
42020	Standard cyclone
42022	High performance cyclone
42030	Product collection vessel
42040	Spray cylinder bottom flask
42092	Glass assembly complete for B 15 Excellent
42093	Glass assembly complete for B 15 Essential
42095	Amber glass assembly complete (for light sensitive apps)
43010	Screw adapter flange set (2 pcs)
43011	Screw adapter o-ring set (2x2 pcs)
43012	Screw adapter tension spring set (2x2 pcs)
43013	Screw adapter
43020	Screw cap
43021	Seal set to screw caps (2x2 pcs)
43050	Collection vessel screw coupling
43051	Collection vessel screw coupling o-ring (3x1 pcs)
43052	Collection vessel screw coupling tension spring (2x1 pcs)
43055	Collection vessel screw coupling flange large
43056	Collection vessel screw coupling flange small
43080	Spray cylinder o-ring (2x1 pcs)
44111	Product collection vessel o-ring (3x1 pcs)
44115	O-ring set, complete for B 15 Excellent (7 pcs)
44116	O-ring set, complete for B 15 Essential (6 pcs)
44200	Inlet filter, complete
44210	Inlet filter element
44500	HEPA filter inlet, complete
44550	HEPA filter outlet, complete
45200	Feed valve
48140	Outlet temperature sensor
48142	Outlet temperature sensor o-ring (3x1 pcs)
52100	Touchscreen operating panel

Code	Description
40500	2-fluid nozzle complete with automatic nozzle de-blocking
40105	Nozzle head tip
40216	Nozzle head cap
40303	Needle for nozzle cleaning
40401	2-fluid nozzle o-ring set (4 pcs)
48030	Cleaning brush for nozzle



Code	Description
42050	Glass angle piece
42060	Outlet filter glass
44100	Outlet filter, complete
44103	Outlet filter o-ring (3x1 pcs)
44105	Outlet filter flange
44110	Outlet filter, pressure sensor
44120	Polyester filter bag for outlet filter (2x1 pcs)
45100	Aspirator
46010	Cyclone outlet flextube
46020	Heater inlet flextube
47110	Peristaltic pump tubing, silicone (1 m)
47130	Peristaltic pump tubing, pharmed (1 m)
47140	Peristaltic pump tubing, tygon (1 m)
106101	Grounding cable



Code	Description
48100	Pressure air flowmeter
48120	Pressure air regulator
54150	Safety curtains, complete
108320	Trolley
47330	Exhaust hose (2 m) with adapter and clamp, complete
47355	Hose for complementary unit connections (1 m)
49110	Operation Manual, English
49210	Quick Operation Guide, English
108312	Oil Free Air Compressor, 220 V, 50Hz
109450	Heat Exchanger for B 45 Dehumidifier
117410	Spray cylinder insulation
120201	IQ/OQ documentation

10. Declaration of Conformity

unopex

Declaration of Conformity

Directives	2006/42/EC (machinery directive) 2014/35/EU (low voltage directive) 2014/30/EU (EMC directive)
Manufacturer	BAKON PROSES MAKİNALARI ANONİM ŞİRKETİ Izmir / Turkiye
Certification	FQC STANDARD UYGUNLUK DEĞERLENDİRME A.Ş. İçerenköy Mah. Bahçelerarası Sk. No: 43 Kat 14/A Ataşehir/İSTANBUL
Equipment	Mini Spray Dryer - Unopex B 15 Unopex B 15-C, Unopex B 45, Unopex B 60 Unopex B 70, Unopex B 90, Unopex B 92
Standards	EN ISO 12100:2010 Safety of machinery - General principles for design - Risk assessment and risk reduction EN 60204-1:2018 Safety of machinery - Electrical equipment of machines - Part 1: General requirements EN IEC 61326-1:2021 Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements

We hereby certify under our sole responsibility that the equipment described herein has been manufactured and tested in accordance with the above directives and standards.

Izmir, October 19th, 2023

Işıl Saygan
Quality Management

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