



SD-BASIC SPRAY DRYER

ASSEMBLY & OPERATING INSTRUCTIONS

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(S.Rowe)

INTRODUCTION

The SD-Basic is a simple and effective laboratory scale spray dryer for product research and development.

The SD-Basic spray dryer is designed to enable initial product trials and evaluation to be carried out quickly and efficiently.

The unit is supplied with a complete set of glassware comprising of main drying chamber, cyclone, sample collection and waste collection bottles, clamps, seals and all necessary tubing.

The chemically resistant housing includes the blower, heater and the controls for inlet temperature and pump speed. The drying air volume is fixed at 70m³/hr.

SAFETY & COSHH REGULATIONS

Before proceeding to install commission or operate the equipment supplied you should be aware of potential hazards so that they may be avoided.

Although designed for safe operation, any equipment may involve processes or procedures, which are potentially hazardous. The major potential hazards associated with this particular equipment are listed below.

- **INJURY THROUGH MISUSE**
- **INJURY FROM ELECTRIC SHOCK**
- **INJURY FROM HOT SURFACES**
- **RISK OF INFECTION THROUGH LACK OF CLEANLINESS**

Accidents can be avoided provided that equipment is regularly maintained and operators are aware of potential hazards. A list of general safety rules are stated on page 4.

This list is intended to be for guidance only.

The COSHH Regulations (1988) - The Control of Substances Hazardous to Health

The COSHH regulations impose a duty on employers to protect employees and others from substances used at work which may be hazardous to health. The regulations require that you assess all operations which are liable to expose any person to hazardous solids, liquids, dusts, vapours, gases or micro-organisms. You are also required to introduce suitable procedures for handling these substances and to keep appropriate records.

The equipment supplied by LabPlant Ltd may involve the use of substances which can be hazardous (for example, cleaning fluids used for maintenance or chemicals used for particular applications) and it is essential that a person in authority is responsible for implementing COSHH regulations.

Part of these regulations is to ensure that the relevant health and safety data sheets are available for all hazardous substances used in the laboratory. Any person using a hazardous substance must be informed of the following:

- Physical data about the substances
- Any hazard from fire or explosion
- Any hazard to health
- Appropriate first aid treatment
- Any hazard from reaction with other substances
- How to clean/dispose of spillage
- Appropriate protective measures
- Appropriate storage and handling

Although these regulations may not be applicable in your country, it is strongly recommended that a similar approach is adopted for the protection of staff operating the equipment. Local regulations must also be considered.

GENERAL SAFETY RULES

Before attempting to install, commission or operate equipment the manufacturers instructions should be understood and implemented.

It is dangerous to misuse equipment or ignore instructions, regulations or warnings.

Do not exceed specified maximum operating conditions (e.g. temperature, pressure, speed etc.).

INSTALLATION

Use lifting tackle where possible to install heavy equipment.

Care should be exercised to avoid damage to the equipment during handling and unpacking.

Ensure that all services are compatible with the equipment and that independent isolators are always provided and labelled. Use reliable connections in all instances, do not improvise.

Ensure that all equipment is earthed and connected to an electrical supply at the correct voltage. The electrical supply must incorporate an earth leakage circuit breaker (ELCB) or residual current circuit breaker (RCCB) to protect the operator from electric shock in the event of misuse or accident.

Potential hazards should always be the first consideration when deciding on a suitable location for equipment. Leave sufficient space around equipment.

COMMISSIONING

Whilst it is a very simple procedure to set up and operate the SD-Basic, Labplant UK would advise that the equipment is commissioned and checked by a competent member of staff.

FEATURES AND COMPONENTS

Main Unit	Front control panel, inlet air filter, peristaltic pump, exhaust stack.
Glass Assembly	Standard drying chamber, cyclone, sample collection bottle, waste collection tube, screw adaptors, seals and clamp.
Atomiser	0.5mm nozzle assembly with manually operated de-blocking needle
Other Items	Silicone pump tubing, nylon compressed air tubing, thermoplastic ducting.

The SD-Basic requires an external compressed air supply. Minimum requirements 27 l/min@ 3 Bar, LabPlant UK offers a silent compressor as an accessory.

PACKING LIST

The apparatus should be carefully unpacked and the components checked against the delivery note.

Any omissions or breakages should be notified to LabPlant Ltd **within three days of receipt.**

DESCRIPTION	QTY
Main SD-Basic unit	1
Main Chamber	1
Cyclone	1
Sample Collection Bottle	1
Waste Collection Tube	1
SVL Screw Connectors	2
PTFE Gaskets	2
Clamp for Chamber/Cyclone	1
Atomiser with 0.5mm nozzle assembly	1
Silicone Tube 5.0mm bore x 1.6mm wall	2.0 m
Thermoplastic ducting	2.0 m
Nylon Tube 6mm	2.0 m

CONNECTION TO ELECTRICAL SUPPLY

The LabPlant SD-Basic Spray Dryer is supplied for 220/240V, 50/60Hz use.

A 110/120V primary 240V secondary step up transformer is available as an option for 110V operation. The power requirement for the 240V unit is 13A and for the 110V unit is 30A.

Brown = Live

Blue = Neutral

Green/Yellow = Earth

The SD-Basic must always be connected to suitable earth points.

ASSEMBLY & PREPARATION

Fitting the glassware

The main chamber fits into the black clamp on the left hand side of the unit. Unscrew the knurled stainless nut until the clamp will open and slide the main chamber in towards the main housing with the 90° outlet of the main chamber facing right. Close the clamp and tighten the knurled stainless steel nut. Do not over tighten as this may cause damage to the glass. In addition some rotation of the main chamber may be necessary when clamping to the cyclone.

The cyclone fits directly into the exhaust stack on the right of the unit. Loosen the knurled cap on the end of the exhaust stack. Enter the top of the cyclone into the cap, push the cyclone upwards. There will be some resistance as the glass tube slides up through a rubber seal. The 90° inlet of the cyclone should face to the left.

Use the black anodised aluminium clamp to hold the main chamber and cyclone side arms together. No seal is required

Screw SVL connectors on to sample and waste collection bottles, place one of each of the PTFE seals into the SVL connector and then screw onto base of main chamber and cyclone.

Finally ensure that the glassware is held securely in place at the main chamber top clamp and the cyclone exhaust.

Fitting the atomiser

The atomiser fits into the top of the unit and is fastened in by a threaded ring. Align the liquid inlet and compressed air inlet as required. Fit the 6mm nylon tube into the push-fitting midway down the atomiser. The open end of the 6mm nylon tube must be connected to a suitable compressed air supply.

The silicone tube for the liquid sample is fitted on to the grooved inlet at the top of the atomiser. The remaining tube can be routed through the top of the main housing before fitted through the pump and the open end placed into the sample.

Fitting thermoplastic ducting

Fit the 50mm ducting over the exhaust outlet, fixing in place by tightening the supplied thumb clamp, and direct the other end to atmosphere or existing extraction system.

Fitting silicone tubing

Open the hinged plastic cover of the pump and leaving sufficient tube to connect to the jet, when it is in the top chamber, feed the silicon tubing into the peristaltic pump.

Open the white plastic clips which retain the tube in position, insert the tube fully and release the clips. The tube should now be regularly compressed by the pump rotors. Fit one end of the tube to the sample inlet.

CONTROLS



From left to right:

Mains indicator light from June 2014 onwards

Inlet temperature controller

Outlet temperature display only

Blower ON/OFF switch

Pump ON/OFF switch

Heater ON/OFF switch

Pump speed control (Rotary Knob)

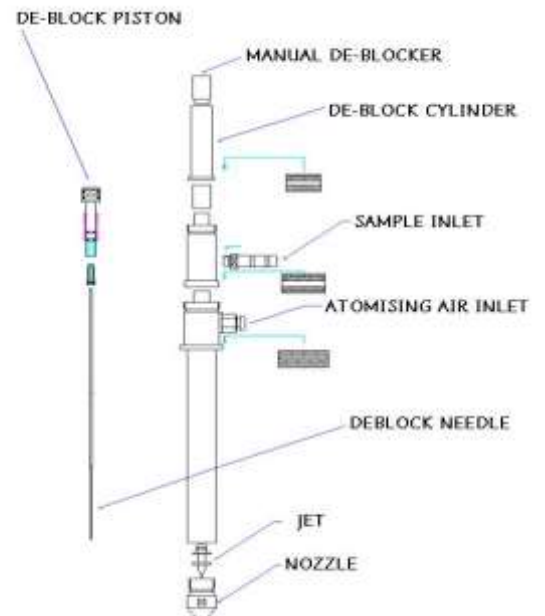
To set the inlet temperature press the * button and the 'up' or 'down' buttons to achieve the desired temperature.

Release the buttons and the actual inlet temperature is displayed.

ATOMISER ASSEMBLY

The stainless steel atomiser is a double fluid nozzle where the inner nozzle develops the liquid jet and the outer the compressed air jet. The compressed air atomises the liquid as it emerges from the jet to form the required fine spray. The jet and outer nozzle can be unscrewed from the main assembly for cleaning as required. Always be careful not to damage the inner jet nozzle (which is only 0.5mm □ thin wall stainless steel) as any slight misalignment will affect the efficiency of the spray.

The atomiser is easy to disassemble by unscrewing the knurled rings



ATOMISER CLEANING

Disassembled atomiser taken apart for cleaning.



Assembly order

Insert the plunger/needle in to the sample inlet component of the atomiser.



Screw the compressed air inlet component on top of the sample component.



VERY carefully take the above assembly and place it in to the main body of the atomiser, and tighten knurled ring.



0.5mm Nozzle Assembly, inner and outer jets pictured.



The nozzle end of the atomiser body, showing the de-blocker needle poking out.



Carefully feed the needle through the inner part of the nozzle, push in to place.



Finally screw on the outer nozzle and tighten.



OPERATION

Select the product you wish to spray dry but always start and end the process by using clean or distilled water, and thoroughly clean the SD-Basic, atomiser and all glassware before and after each run.

Switch the mains switch on (bottom right side of machine).



Once turned on the current inlet temperature and outlet temperature will be displayed.

Adjust the inlet temperature to 150°C and allow the unit to warm up for 10-15 minutes, prior to running any samples through the machine.

Set the temperature to the desired amount for your product, before commencing your run.

With the inlet temperature display showing your desired temperature, turn on your compressed air supply, and set the pressure to a desired rate between 1 & 3 Bar.

Now with the silicone tubing connected to the atomiser at one end and the other in your sample vessel, turn the pump on and adjust the dial to 10, watch the fluid start pumping through the tubing and up towards the atomiser, just before it reaches the atomiser, quickly turn the dial down to 2.

Once the fluid has entered the atomiser you should be able to see a very fine spray appearing in the chamber, and after a few seconds the spiralling of the product can be seen in the cyclone, then finally the product will be building up in the collection bottle.

Once spray drying has commenced varying the parameters of temperature, atomiser pressure and pump speed, must be tried to improve the process.

GENERAL ADVICE

Always start a trial with a medium inlet temperature (120-150°C) and a slow pump rate.

Observe the bottom of the main chamber for wetting and either reduce the pumping rate or increase the temperature if the product is not completely drying.

The optimum pumping/temperature rates are achieved when no wet spotting of the product is observed (this assumes water as the solvent)

If the sample is a liquid with solids in suspension it may be necessary to keep it continually agitated with a magnetic or overhead stirrer. If the sample is pumped from the bench top the product may separate as it is being pumped upwards in the silicone tube.

Most spray drying processes lose fine particles in the exhaust. The amount lost usually depends on air flow and particle weight. The particle size/weight can often be increased by using a larger jet size.

If the sprayed sample is light coloured it may be more easily observed by placing a dark card behind the cyclone.

The ideal flow path through the cyclone should be a continuous spiral. If product accumulates on the cyclone wall try alterations to the compressor pressure or the jet size.

Some samples may require pre-heating before spraying.

Peristaltic pumping always creates a pulsing liquid flow. If this is a problem the pulsing effect can be reduced by connecting a small glass expansion bulb in the tube between the pump and the jet.

Generally the most efficient drying is achieved using the highest temperatures compatible with the product.

A variable over temperature protection cut out is fitted and is factory set to actuate at approximately 270°C (if actuated allow to cool down and re-set the trip located in main housing above peristaltic pump)

APPROXIMATE PUMP FLOW RATES

The graph below shows the volume of liquid flow via the peristaltic pump in millilitres, tested over a one minute period; these figures are for guidance only.

Pump Speed	Millilitres
1	1.5
2	3.5
3	6.3
4	9.25
5	12.5
6	16.5
7	20
8	23.75
9	26.25
10	26.50
11	26.75

ACCESSORIES & SPARES

0.5mm jet is supplied as standard. 1.0mm, 2.0mm and custom jets are available on request.

Amber stained glassware is available for products which are light sensitive.

Spares kit, which contains glassware and atomiser parts.

External transformer units for any specified voltage.

Glassware

SDS2018	Standard Main Spray Chamber – 215mm OD x 500mm long
SDS2020	Large Main Spray Chamber – 215mm OD x 800mm long
SDS2022	Cyclone
SDS2006	Sample Collection Bottle - 500ml
SDS2021	Sample Collection Bottle - 1000ml
SDS2010	Waste Collection Tube

Metal ware

SDS2046	Atomiser complete with any specified standard jet size
SD1004	0.5mm Stainless Steel Jet Nozzle Assembly (Inner Jet and Outer Nozzle)
SD1006	1.0mm Stainless Steel Jet Nozzle Assembly (Inner Jet and Outer Nozzle)
SD1008	2.0mm Stainless Steel Jet Nozzle Assembly (Inner Jet and Outer Nozzle)
SDS1010	Custom size nozzle assembly
SDS2040	Plunger for de-blocking needles.
SDS2041	De-blocking needle for 1.0 – 2.0mm nozzles
SDS2042	De-blocking needle for 0.5mm nozzles
SDS0021	Clamp for Chamber/Cyclone
SDS2002	Thermoplastic ducting 2 metre length

Other

SDS2011	SVL Double Screw Cap Adapter
SDS2012	PTFE Gasket Seal
SDS2031	Peristaltic Pump Silicone Tube – 5.0mm ID x 1.6mm wall per metre
SDS2057	Nylon atomiser tubing 6mm
SDS2033	Pack of Assorted O Rings for Jet Assembly
SD1010	Transformer to convert operation to and given voltage and frequency
KITBASIC	Spares Kit Comprises; SDS2018, SDS2022, SDS2006, SDS2031 (x2) SDS2011 (x2), SDS2012 (x2), SDS2042 & SDS2033.

MAINTENANCE

Regular maintenance of this equipment ensures maximum trouble-free life.

It is recommended you carry our basic maintenance after each use. The most basic of which is to keep the equipment clean!

No matter how regularly your equipment is in use always find time to thoroughly clean it.

Periodically vacuuming of the rear air filter and replacement every 6 months will prolong performance.

Seals in the jet assembly should be checked when cleaning and replaced as necessary.

EC DECLARATION OF CONFORMITY

Equipment/Machine Type	Laboratory Scale Spray Dryer SD-Basic
Machine Serial Number	#SDB
Date of Manufacture	:

Lab-Plant UK Limited declare that the above mentioned equipment/machine (not being of interchangeable type) complies with the essential health and safety requirements of the Machinery Directive (89/392/EEC) – (91/368/EEC) and (93/44/EEC) enacted in the United Kingdom by the supply of Machinery (Safety) Regulations 1992.

This machinery has been designed and manufactured in accordance with the following transposed harmonised European Standards by Lab-Plant UK Ltd.

EN292 parts 1 & 2, 1991 Safety of Machinery. Basic concepts, general principles for design.

EN60204 part 1, 1993 Safety of Machinery. Electrical equipment of machines. 89/336/EEC–Electro– Magnetic compatibility.

EN418 1992 Safety of Machinery. Emergency stop equipment, functional aspects, principles for design.

PR EN 954-1 Safety of machinery 1993 – Principles for the design of fail safe control systems

BS EN 953 Guarding (design and construction) 1993

PR EN 1088 Guarding (interlocking and locking) 1993

BS EN 1050 Safety of machinery – risk assessment

Place of Issue: Hunmanby England



Barry Waters
Managing Director

Declaration: I declare that as the authorised representative for Labplant UK, the above information in relation to the supply and manufacture of this product, is in conformity with the stated standards and other related documents following the provisions of (89/392/EEC)

DECLARATION OF CONFORMITY

DESCRIPTION OF PRODUCT

Equipment/Machine Type	Laboratory Scale Spray Dryer SD-Basic
Machine Serial Number	#SDB
Date of Manufacture	:

STANDARDS

BS EN 292 Basic Principles of Design 1993
BS EN 60204 Electrical Equipment of Industrial Machines 1993
PR EN 954-1 Safety of Machinery 1993 – Principles for the Design of fail-safe Control Systems
BS EN 418 Principles of Design of Emergency Stop Equipment 1993
BS EN 953 Guarding (Design and Construction) 1993
PR EN 1088 Guarding (Interlocking and Locking) 1993
BS EN1050 Safety of Machinery – Risk assessment

Place of Issue:
Hunmanby, England

Name of Authorised Representative:
Barry Waters

Position of Authorised Representative:
Managing Director

Declaration: I declare that as the authorized Representative,. The above information in relation to the supply/manufacture of this product, is in conformity with the stated standards and other related documents following the provisions of (89/382/EEC)



Barry Waters
Managing Director