



BOWEN Laboratory Spray-AireTM Spray Dryers & Processors

For Research, Development & Small Scale Production

BOWEN LABORATORY
EXTENDED CHAMBER SPRAY-AIRE

BOWEN LABORATORY
FLAT BOTTOM SPRAY-AIRE

BOWEN LABORATORY SPRAY-AIRE



Spray Drying and Spray Processing With Bowen Spray-Aires™

Spray drying is the modern method for drying a wide range of inorganic and organic chemicals, resins, foods, pharmaceuticals, colors, ceramics, clays, catalysts, and other products. Its major advantages—overall economy and improved product properties—have broadened the use of spray drying into all areas of the process industries.

The most important factor in the selection of laboratory sized spray dryers is the degree of successful operation possible on the widest range of products. For years Bowen's rugged laboratory units have been the most successful available. Some have been operating for over 20 years helping to develop new products and to extend existing products into profitable uses.

Several designs are provided to meet particular product requirements. Each of these designs is a prototype of Bowen's larger production units. Each provides optimum results in test and development and in small scale batch or continuous production.

Although principally used for spray drying, these units produce unique product characteristics that make them suitable for other spray processing operations such as reacting, chilling (congealing) and encapsulating. Particles formed are generally spherical, of uniform particle size and have a uniform mixture of components, resulting from the extremely fast action of the air on the fine droplets of sprayed feed.

THE BOWEN LABORATORY SPRAY-AIRE™

OPERATION

The range of water evaporation is 15 to 80 lb/hr depending on air inlet and outlet temperatures. Degree and pattern of feed spray can be varied using either nozzle or centrifugal atomizers—each available in several designs.

The flow of hot drying air enters through the top central inlet and directs the spray of feed down into the chamber—away from walls and roof. Chamber light and viewing ports aid visual control of operation.

Instruments are clustered on a panel for operating convenience and ease of control. Standard air heater is direct gas fired, started by automatic spark ignition and electrically monitored. Inlet air temperature is regulated automatically—maximum temperature 1000°F, minimum 150°F. Heater is located on opposite side of product collection point.

Product build-up on chamber walls is minimized by the air and spray flow pattern and by the turbulent air-spray mixing action that speeds drying (or other operation). Also, the chamber has no obstructions on which product can accumulate. This keeps the walls cleaner and simplifies cleaning operations. Quick disassembly of all interconnecting ducts and door with 20" x 16" opening provide easy access to all surfaces.

CONSTRUCTION

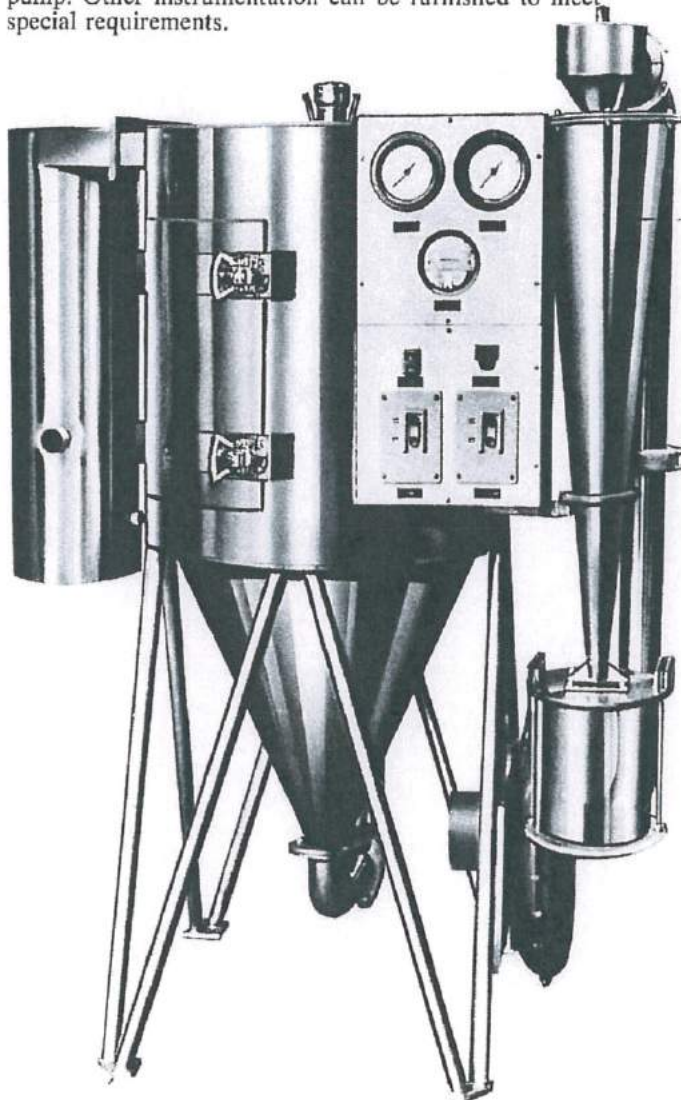
The 30 inch diameter drying chamber and other parts contacted by the feed or dry product are of Type 316 stainless steel for superior corrosion resistance. Insulation cover, exterior frame and structure are also of sanitary, maintenance-free stainless steel. Heavy duty, sanitary type quick disconnect couplings simplify disassembly of ducts for complete cleaning. The heater shell, hot air inlet duct and chamber cylinder and head plate are insulated to protect personnel and to minimize heat losses.

INSTALLATION

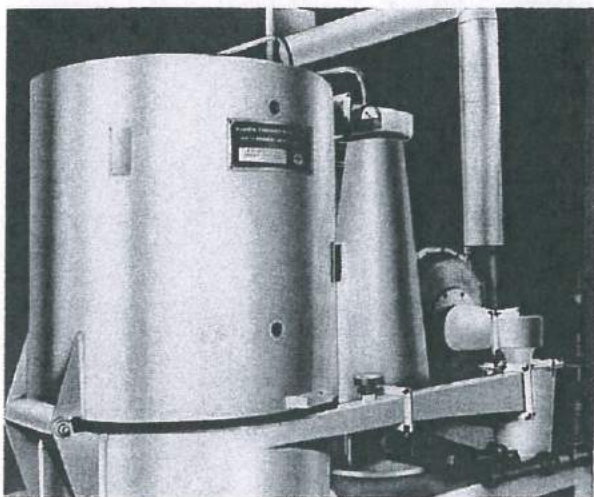
Compact dimensions simplify installation and re-location as required (3'7" x 5'3" and 6'10" height). Only one connection is required for each utility.

INSTRUMENTATION

Control panel houses the inlet and outlet temperature gauges, cyclone pressure drop indicator and on-off switches for burner ignition, fan, chamber light and feed pump. Other instrumentation can be furnished to meet special requirements.



BOWEN LABORATORY FLAT BOTTOM SPRAY-AIRE™



This unit fills the need for drying very heat sensitive products. Four cold air side inlets create a layer of cool air around the inner periphery of the chamber. Many products which melt or degrade below the outlet air temperature needed for drying can be handled. Dried, airborne particles are chilled in the layer of cool air and thus prevented from degrading or sticking to the chamber walls.

Additional ambient air enters through a sweeper that rotates just above the flat bottom. This aids in further cooling and removing the product — air conveying it to the high efficiency cyclone collector.

Atomization is by centrifugal atomizer and hot air enters through a top central vane ring as in the standard Laboratory Spray-Aire. The cylinder hinges open at the bottom, exposing all surfaces for easy cleaning.

BOWEN LABORATORY EXTENDED CHAMBER SPRAY-AIRE™

The drying chamber on this unit has a straight-side height of 6 ft. which gives increased drying distance (and time). Thus, larger particles can be produced—up to 80 microns and bigger, depending on the feed material and position of the atomizer. Most other features are the same as on the standard Laboratory Spray-Aire.

Standard atomization of feed is by two-fluid nozzle either at the top or bottom of the chamber. (Materials that are not heat sensitive can be atomized from the bottom to provide the longest possible exposure to the drying air as the particles are sprayed upward and then fall back down.) The main portion of large particles can be dropped into the chamber collector jar, while the fines fraction is air-conveyed to the jar under the cyclone collector. Alternately, all of the product can be collected by the cyclone.

COMPARATIVE SPECIFICATIONS

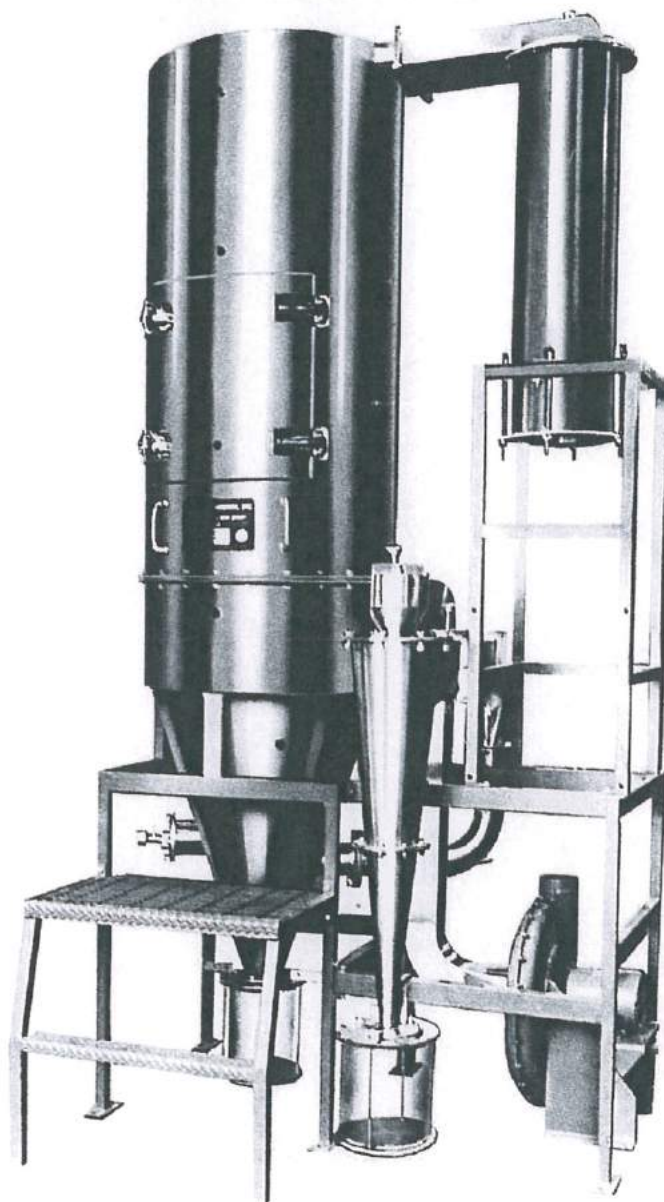
MODEL	WIDTH	LENGTH	HEIGHT
Spray-Aire	3'7"	5'3"	6'10" (1)
Flat Bottom Spray-Aire	3'0"	6'0"	7'0" (2)
Extended Chamber Spray-Aire	3'7"	5'3"	10'6" (1)

(1) Approximately 18" additional height required for operating.

(2) Total height with chamber open is 10'0".

Chamber diameter on all Laboratory Spray-Aires is 30".

WATER EVAPORATION RATE: 15 to 80 lb/hr depending on air temperatures with air flow rate of 250 cfm. (Flat Bottom Spray-Aire capacity is approximately 1/3 less.)



Partial List of
Materials
Successfully
Dried in the
Bowen Laboratory

FOODS

Beef broth
Bouillon
Cheese
Chicken broth
Cocoa
Coffee
Corn syrup
Dairy by-products
Eggs
Enzymes
Food colors
Food flavorings
Gelatin
Ice cream mix
Licorice
Liver extract
Malt syrup
Milk
Proteins
Molasses
Soups
Soy bean protein
Sugar
Tea
Vegetable extracts
Vitamins
Whey

PHARMACEUTICALS AND
NATURAL PRODUCTS

Albumin
Aluminum hydroxide gels
Amino acids
Ascorbic acid
Aureomycin
Bacitracin
Bark extracts
Blood
Casein hydrolysate
Cellulose modifications
Chlorophyll
Dextran
Distillery by-products
Enzymes
Fish hydrolysates
Glues
Gluten
Penicillin salts
Protein hydrolysate
Quebracho
Shellac
Starches
Streptomycin
Sulfate spent liquors
Sulfite spent liquors
Tannin
Tartaric acid
Thiamin
Tobacco extracts
Trisilicate, Mg
Yeast hydrolysates

CERAMICS, CLAYS,
CATALYSTS, ABRASIVES

Alumina gels
Aluminas
Barium titanates
Bentonite
Beryllias
Chrome-iron oxides
Ceramic colors
China clays
Feldspar
Ferrites
Forsterites
Glass
Kaolin clays
Lead zirconate
Plastic clay
Porcelains
Refractory clays
Rutile
Shift catalysts
Silica-alumina gels
Silicon carbide
Steatites
Talc
Titanates
Wall tiles
Zirconates

RESINS, POLYMERS, ETC.

ABS resins
Epoxy resins
Formaldehyde resins
(urea, phenol, mel.)
Polyethylene
Polymethacrylate
Polypropylene
Polystyrene
Polyvinyl acetate
Polyvinyl chloride
Polyvinyl fluoride
Polyvinyl pyrrolidone

ORGANICS, MISC.

Acetates, Ca, Pb, K, Na
Acrylates, Ca, Mg
Alcohols, amino, nitro
Benzozate, sodium
Bleaches
Gacodylic acid
Carbowax
Carboxymethylcellulose
Caseinate, sodium
Cellulotics
Chelates
Detergents
Dyes
Fabric softeners
Fertilizers
Formate, sodium
Fungicides
Gums
Herbicides
Insecticides
Metallic soaps
Methacrylates
Microballoons
Oxalic acid
Pantothenate, calcium
Pentachlorophenolate
Photographic emulsions
Pigments
Propionate, Ca, Na
Quaternary salts
Rubber chemicals
Rubber latex
Salicylate, NH₄, Na
Sequestering agents
Soaps
Stearates
Stearic acid
Sulfonates
Surface active agents
Tannic acid
Tartrates
Undecylenates
Waste products
Wetting agents

INORGANICS, MISC.

Aluminate, sodium
Arsenic acid
Blast furnace slag
Bleaches
Borate, sodium
Carbon black, coke, etc.
Carbonate, Ca, Mg, K, Na
Carnallite
Chloride, NH₄, Ca, Cu, Fe,
Li, Mg, Mn, Ni, Na, Sr
Chromate, Ca, K, Na
Cyanide, sodium
Dioxide, Ti, U
Disulfide, Mo
Fertilizers
Fluoborate, sodium
Fluoride, Ba, Ca
Hydride, magnesium
Hydroxide, Al, Ba, Ca,
Mg, K, Na
Hydroxides (carbonation)
Hypochlorite, Ca, Na
Molybdate, NH₄, Na
Nitrate, NH₄, Ca, U, Zr
Nitrates (denitration)
Oxides, Cr, Fe
(See Ceramics)
Peroxide, lead
Phosphates, Ca, Fe, Mg,
K, Na
Phosphors
Pigments
Selenides
Silicates, Ca, Mg, Na
Sulfates, Al, NH₄, Ba, Cr,
Cu, Fe, Mn, Na, Zn
Sulfides, Cu, Mo, Zn
Zeolites

OPTIONS

Standard and Optional Equipment Available for Each of the Three Spray-Aire Types

ATOMIZATION: Standard on the Spray-Aire and the Extended Chamber Spray-Aire is a two fluid nozzle requiring 15 scfm (max.) of compressed air at about 100 psig.

Optional—(Standard on the Flat Bottom Spray-Aire) — centrifugal, air turbine operated at nominal 50,000 rpm requiring 18 scfm at about 100 psig and a small flow of cooling water (1/4" connection).

The two types of atomization equipment are interchangeable.

HEATER: Standard — direct gas-fired with automatic control of inlet air temperature using any fuel gas. Data on this and optional heaters:

Heater Type	Max. Air Temp.	Maximum Requirement
Gas, direct fired	1000°F	230,000 Btu/hr any fuel gas at 6" WG min.
Gas, indirect fired	550°F	230,000 Btu/hr any fuel gas at 6" WG min.
Electric	600°F	42 KW, 230/460 volts, 3 phase, 60 cycle
Steam, 100 psig	310°F	67 lbs/hr
Steam, 150 psig	340°F	76 lbs/hr
Steam, 200 psig	360°F	83 lbs/hr

FAN: Centrifugal blower with direct drive, 3600 rpm 2 HP, 230/460 volt, 3 phase, 60 cycle open drip-proof motor. (3 HP motor furnished if secondary collector added.) Other motor characteristics available.

COLLECTOR: Standard — high efficiency cyclone with 2 gallon collector jar.

Optional, secondary collector can be added: cloth filter type, wet scrubber, etc.

COLD AIR INLETS on the drying chamber are standard on Flat Bottom Spray-Aire, optional on the others.

OTHER OPTIONS can be furnished for special requirements. A few of these are:

Spark proof and explosion proof features
Closed cycle arrangement, including solvent recovery equipment

Automatic control instrumentation for continuous production

Feed pump with variable speed drive

Packaged feed system including holding tank with agitator and pump

2000ml Pyrex graduate for gravity feeding

Complete air compressor package to meet any of the atomization requirements of these laboratory units.

BOWEN SUSPEND-AIRE™ SYSTEMS

Bowen has a comprehensive capability in all air-suspended processing operations — spray, flash and fluid bed drying, reacting, heating, cooling, congealing, agglomerating and encapsulating. These operations offer solutions to many of the problems encountered in the process industries, and Bowen offers an unbiased treatment of them.

Thus the best equipment type (or combination) can be found to meet the particular

needs of your project. Requirements may range from a single demonstration test to a long evaluation program. The optimum approach may involve testing at Bowen's Test Center, or rental of a unit, or purchase of one of the Laboratory Spray-Aires or other Suspend-Aire unit. Bowen is in a unique position to assist and to advise with over 45 years experience in air-suspended techniques.

TEST FACILITIES AT BOWEN

The relationship between variables in drying is so complex that practical design equations have never been developed. It is usually necessary to run tests in laboratory and/or pilot plant equipment. These tests demonstrate feasibility, provide design data and produce samples for product and market evaluations.

The Bowen Test Center has an experienced staff and the most complete and

versatile air-suspended equipment available for testing customer's materials on a fee basis. In addition to spray, flash and fluid bed drying, other process operations are conducted in these Suspend-Aire units. Equipment includes spray dryers of various designs and flash and fluid bed units all with a variety of feeding methods. A comprehensive and objective test report is submitted that describes all the important factors and tabulates the data.

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