BES Environmental Chambers.
The perfect solution for your testing needs.

Whether it's a 33 cubic foot single door chamber, a 74 cubic foot dual section cam-locking unit, or a 114 cubic foot cam-locking chamber with three sections, BES has the right size to meet your reach-in chamber requirements. Multi-door units offer a standard cam-locking feature to allow separation of sections for passage through narrow doorways and halls.

Overview

ICH, USP, ASTM, and TAPPI guidance documents reference the need for environmental testing. Bahnson Environmental Specialties offers a complete line of reach-in chambers for these industrial, research, and life science applications. BES offers a range of environmental chambers designed for high demand testing, processing, or conditioning. The ES2000 product line includes six standard models. Standard temperature capabilities range from −20°C to 70°C, with controlled humidification, lighting, and CO_2 available. Other performance options are available (refer to Options & Accessories). General features include:

- User friendly touchscreen control system
- High performance electronic and mechanical systems capable of accelerated heating, cooling, and recovery rates.
- Industrial-grade cabinet construction for continuous use in research, process, or storage.
- Heavy-duty refrigeration system featuring reserve heat removal capacity for quick response to door openings, internal heat loads, or unstable ambient conditions.

Specifications (subject to change without notice)

Bahnson Environmental Specialties can manufacture chambers to meet special size, voltage, or range requirements not accommodated below. Please speak with a Sales Associate to discuss your needs.

Interior Finish (All Models): 22 gauge stainless steel
Exterior Finish (All Models): Sprayed enamel over steel (optional stainless steel)

BENCHTOP MODEL

CHAMBER MODEL	INTERIOR VOLUME	TEMP. RANGE	HUMIDITY RANGE	VOLUMETRIC UNIFORMITY	4-WIRE ELECTRICAL VOLTS / Ø / AMPS	INT. DIMENSIONS WXDXH	EXT. DIMENSIONS WXDXH	SHELVES STD/MAX	WEIGHT LBS./KG.
ES2000 A-BT	12.0 ft.³ (335 liters)	35–70°C	N/A	±0.3°C (±0.6°F) ±3.0% RH	208–230 / 1 / 30	34 x 28.5 x 21.5 in. (87 x 73 x 55 cm.)	41 x 34.5 x 52.5 in. (104 x 88 x 133 cm.)	2/7	350/159
ES2000 AM-BT		35–70°C	10–96%		208–230 / 1 / 30				425/193
ES2000 C-BT		2–70°C	N/A		208–230 / 1 / 30				525/238
ES2000 CDM-BT		2–70°C	10–96%		208–230 / 1 / 30				570/259
ES2000 CDMD-BT		2–70°C	10–96%		208–230 / 1 / 30				600/272

UPRIGHT MODEL

CHAMBER MODEL	INTERIOR VOLUME	TEMP. RANGE	HUMIDITY RANGE	VOLUMETRIC UNIFORMITY	4-WIRE ELECTRICAL VOLTS / Ø / AMPS	INT. DIMENSIONS WXDXH	EXT. DIMENSIONS WXDXH	SHELVES STD/MAX	WEIGHT LBS./KG.
ES2000 A	33.8 ft.³ (957 liters)	35–70°C	N/A	±0.3°C (±0.6°F) ±3.0% RH	208–230 / 1 / 30	34 x 28.5 x 60 in. (87 x 73 x 153 cm.)	41 x 34.5 x 91.5 in. (104 x 88 x 233 cm.)	4/19	450/204
ES2000 AM		35–70°C	10–96%		208–230 / 1 / 30				525/238
ES2000 C		2–70°C	N/A		208–230 / 1 / 30				700/318
ES2000 CDM		2–70°C	10–96%		208–230 / 1 / 30				745/338
ES2000 CDMD		2–70°C	10–96%		208–230 / 1 / 30				775/352

DOUBLEWIDE MODEL

CHAMBER MODEL	INTERIOR VOLUME	TEMP. RANGE	HUMIDITY RANGE	VOLUMETRIC UNIFORMITY	4-WIRE ELECTRICAL VOLTS / Ø / AMPS	INT. DIMENSIONS WXDXH	EXT. DIMENSIONS WXDXH	SHELVES STD/MAX	WEIGHT LBS./KG.
ES2000 A-DW	74.2 ft.³ (2101 liters)	35–70°C	N/A	±1.0°C (±1.8°F) ±5.0% RH	208–230 / 1 / 30	75 x 28.5 x 60 in. (191 x 73 x 153 cm.)	82 x 34.5 x 91.5 in. (208 x 88 x 233 cm.)	8/38	1020/463
ES2000 AM-DW		35–70°C	10–96%		208–230 / 1 / 30				1060/481
ES2000 C-DW		2–70°C	N/A		208–230 / 1 / 30				1120/508
ES2000 CDM-DW		2–70°C	10–96%		208–230 / 1 / 30				1170/531
ES2000 CDMD-DW		2–70°C	10–96%		208–230 / 1 / 30				1200/544

TRIPLEWIDE MODEL

CHAMBER MODEL	INTERIOR VOLUME	TEMP. RANGE	HUMIDITY RANGE	VOLUMETRIC UNIFORMITY	4-WIRE ELECTRICAL VOLTS / Ø / AMPS	INT. DIMENSIONS WXDXH	EXT. DIMENSIONS WXDXH	SHELVES STD/MAX	WEIGHT LBS./KG.
ES2000 A-TW	114.8 ft.3 (3251 liters)	35–70°C	N/A	±1.0°C (±1.8°F) ±5.0% RH	208–230 / 1 / 30	116 x 28.5 x 60 in. (295 x 73 x 153 cm.)	123 x 34.5 x 91.5 in. (312 x 88 x 233 cm.)	12/57	1420/644
ES2000 AM-TW		35–70°C	10–96%		208–230 / 1 / 30				1460/662
ES2000 C-TW		2–70°C	N/A		208–230 / 1 / 30				1520/689
ES2000 CDM-TW		2–70°C	10–96%		208–230 / 1 / 30				1570/712
ES2000 CDMD-TW		2–70°C	10–96%		208–230 / 1 / 30				1600/726

Notes applicable to all models above:
1. Temperature and humidity ranges are based upon 25°C/50% RH ambient.
2. Refer to separate Humidity Performance Curves for specific range limitations of humidity control models.
3. Exterior height shown with casters (except benchtop model), and with leveling bolts (benchtop model). Door may be removed to decrease depth to 33".
4. Shelf quantities are: "standard" number supplied with unit, "maximum" number based on minimum 3" spacings as recommended by BES.
5. 50 Hz/220V, 120V, and other special voltages are available upon special request. Consult factory for more information.
6. "CDMD" models – A dessicant wheel drier is field mounted on the unit behind this model chamber. This requires an additional depth allowance of 12".
7. "CDM-AT" models – An air tower drier is field mounted on the unit behind this special model chamber. This requires an additional depth of 5" for the compressed air fed system.
8. "-LT" & "-SS" models – The suffixes are added to denote Low Temperature capability option (−25°C) and Stainless Steel exterior option.

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Environmental Chambers
ES2000 Reach-In Series

Bahnson
Environmental Specialties
An EMCOR Company

WALK-IN CHAMBERS • REACH-IN CHAMBERS • ULTRA-LOW FREEZERS • SERVICE AND VALIDATION

A Clever Solution to Meet Your Chamber Volume and Mobility Requirements.

Conditioning System

BES precise air control system ensures conditioned air is distributed uniformly across your product shelves. A stainless steel impeller moves the air through the conditioning components within the enclosed plenum. Air is then distributed and returned through the plenum's side wall ports which are specifically arranged for maximum uniformity and efficient thermal transfer. The conditioning system features include:

- Temperature control to within ±0.2°C
- Relative humidity control to within ±0.7% RH
- Temperature uniformity capability down to ±0.3°C*
- Relative humidity uniformity capability down to ±3.0%*

Note: See the Specification section for uniformities applicable to doublewide (74 c.f.) and triplewide (114 c.f.) models.

All models in the ES2000 series provide precise control of temperature and humidity (if applicable). The chambers feature full stainless steel liner, conditioning system cover, and air walls. Solid, reinforced stainless steel shelves are easily removable and repositionable.

Cabinet Construction

Our doublewall chamber construction provides you with years of continued, trouble-free use. The polished 304 #3 finish interior is heliarc-welded at the seams to form a hermetic seal which prevents moisture from migrating into the insulation. Each chamber size is proportioned to allow you ease of passage through a standard doorway. Construction features and options include:

- Heavy-gauge stainless steel interior with scratch-resistant enamel on exterior of cabinet.
- Closed-cell urethane insulation for superior high/low temperature stability and minimal heat transfer. The door is also completely foamed for thermal performance and rigidity.
- Heavy-duty door hinges, full peripheral magnetic door gaskets and positive action latch with a lock to maintain a secure, uniform seal.
- Removable stainless steel plenum cover and wall air chases for ease in cleaning and maintenance.
- Heavy-duty 2" casters (on floor models) and adjustable leveling feet for ease in installation.

Product Shelving

Solid, reinforced stainless steel shelves are provided standard with each chamber, with additional shelves available upon request. The shelves slide in via shelf brackets which are easily relocatable on 1 1/2" centers.* The location and quantity flexibility can accommodate alternative inventory systems, racks, carts, or other load requirements. Each shelf can support up to 130 lb. of distributed load, and offers over 6 sq. ft. of usable area.

Note: While the spacing is variable on 1 1/2" increments, BES does recommend a minimum of 3" center-to-center spacing on shelf locations. See the Specifications section for maximum recommended shelf capacities of each chamber size.

Proportional Refrigeration System

BES incorporates a proportional liquid/hot gas refrigeration design to maintain close tolerance temperature control and rapid acceleration to your setpoint. The compressor life is extended by modulating refrigerant flow as required. The proportional refrigeration system features are as follows:

- Air-cooled, hermetically sealed compressor with environmentally safe, non-toxic, CFC-free refrigerants. Optional water-cooled units are available.
- Expansion valve refrigeration control provides higher heat removal capacity than conventional capillary tube designs and provides immediate response to added heat loads.
- Automatic time or temperature actuated hot gas/electric defrost provided with "intelligent" adaptive defrost timer; time or temperature initiated and time or temperature terminated. By sensing chamber coil temperature, the timer allows for minimum temperature rise due to a defrost cycle.

Temperature & Humidity Control

BES user-friendly touchscreen control system. Backlit, alphanumeric LCD color touchscreen display provides operator access to all system parameters through intuitive, Windows® style drop down menus. The display is compatible with low to high room light levels. Menu selections and on-screen instructions with on screen help are of sufficient detail to allow for typical day-to-day use without reference manuals. Features include:

- Temperature display configuration in °C or °F.
- Relative humidity configuration in % RH (if applicable).
- Precision, platinum RTD temperature sensor calibrated per NIST-traceable standards.
- Solid-state variable capacitance humidity sensor calibrated per NIST traceable standards.

Humidification / Dehumidification

Our solid-state controlled electric steam humidifier offers additive humidity, and our 'latent coil', or desiccant drier, models offer lower humidity control. High and low humidity capability is dependent on your model selection. See the Humidity Performance Curve sheets for specific ranges on each model. The humidity system features:

- High output vapor generator providing precisely controlled humidification. A fully stainless steel tank (type 316), incoloy heater, and float switch actuated solenoid fill system are notable features.
- Separate 'latent coil' design offering mid-range dehumidification capability.
- Compressed air tower (CDM-AT) or desiccant-wheel drier (CDMD) models offering extended low range dehumidification capability.
- "Intelligent" enabling / disabling of humidification and dehumidification. Humidification is disabled below freezing, and dehumidification is disabled at factory-selected conditions where drying is not required.

Heating System

Supplemental heating is provided by a low watt density heating element encased in a stainless steel frame. The heat output is proportionally controlled between hot gas injection and the electric heater. Heating system features include:

- Nichrome wire duct-style heater providing quick, accurate response.
- Modular plug-in element design for quick disconnect capability.
- Dual overtemp safeties provided for chamber, compressor, and product protection.

- Adjustable electric heater on-delay. A percent-delay setting allows the electric heat to stage in earlier or later depending upon heat demand and control capability of the refrigeration hot gas. This feature ensures that the refrigeration system is efficiently used to control the chamber temperature, resulting in lower operating costs and steam usage when the chamber has humidity control.

Alarm/Monitoring System

Our CCS control system features independent, adjustable high/low visual and audible alarms for temperature and humidity. Automatic alarms disable specific controlled devices (heaters, blowers, steam generators, etc.) The alarm monitoring features include:

- Alarm notification through a red screen background, activation of an audible alarm, the switching of a remote alarm contact set, and the creation of an alarm log with time, date and type of alarm.
- Alarm silence function on all parameters with up to 60 minutes of delay time (individually adjusted for each parameter). The alarm mode deactivates on return to normal operating limits.
- Independent time delay action for each alarm parameter. Alarm action delays and audible alarm delays are each adjustable from 0 to 60 minutes in 1 minute increments. 'Common alarm' contact activates after alarm action delay (N.O. /N.C. contact provided).

Electrical/Control System

Our CCS control system is fully enclosed and wired in accordance with NEMA 1, NEC, and UL/MET specifications. All control circuits and branch circuits are individually fuse protected. RFI and EMI interference is isolated through solid-state, zero voltage switching technology. The electrical system features include:

- Quick-disconnect wiring for easy installation and removal of most mechanical and electrical assemblies.
- Detailed computer generated schematic provided with Operation Manual to aid in field servicing and troubleshooting.

CCS Touchscreen Control System features include:

- Realtime trending of temperature and humidity parameters and setpoints. The touchscreen provides autoscaled and user definable scaled plots over a 1 minute to 12 hour time period. A 'drag and zoom' feature allows for magnified views within a specific plot period. Historical data logging is provided with the paperless recording capability.
- Interface USB port for data transfer to printer or removable memory stick to maintain local 'paper trail' requirements. A touchscreen 'print' icon allows one touch printout of data trends in report or graphic format. The removable

Microprocessor based I/O hardware with programmed logic running on Windows CE® platform. Control logic program is stored on a non-volatile, high capacity memory card EE-prom. All control parameter settings, alarms and setpoints are maintained during power failure, and restart is automatic upon power restoration.

Conformance to the FDA 21 CFR 11 requirements for data recording, audit trails of controller settings modification, alarm history logs, operator event logs and secure file transfers. Operating data is encrypted and stored in user defined time length log files, and can be viewed on the touchscreen, or remotely by PC. Password protection provides multiple levels of user access and defined rights. Password aging and re-authentication for process changes are also provided per 21 CFR 11 specifications. High level encryption and digital signatures are supported for paperless operation.

memory stick allows export and import of profiles, alarm files, audit trail files, and other data files.

- Ethernet connectivity. This allows for remote viewing of chamber process variables and alarms through a web browser. These include: actual temperature, actual humidity, process setpoints, and system alarms with name and date/time of alarms. Data is "read only", and the internal stored data cannot be altered.

Maintenance Service

BES environmental chambers will provide you with years of reliable use with factory recommended preventive maintenance measures. These can be performed by your staff or by our factory-trained personnel available through a PM/CAL (preventative maintenance / calibration) contract from Bahnson Environmental Specialties. Contact us for more information on our various PM/CAL programs.

Repair Service

We have factory-direct or authorized services for our complete product line. A 24-hour emergency call-in number is available for assistance. BES stocks most replacement parts at the factory, on local service trucks, and at regional centers to assure you minimal down time.

Validation Services

BES can provide complete performance qualifications on ES and competitive chambers. Our staff writes your IQ, OQ, and PQ Protocols and trained technicians perform field tests and validation qualification tests. Calibrations and test equipment used during qualifications are NIST-traceable and are provided as part of your validation services. Comprehensive reports are written to summarize your data for quick reference by your company and for regulatory agencies. Please contact a member of our Sales Department for more details on how we can customize the testing you need.

Chamber Warranty

A thirteen-month warranty on parts and labor is included with all BES chambers to provide you with assurance of our commitment to quality. An optional five-year compressor warranty is also available.

Options & Accessories

> **Access Ports:** Ports are available in nominal sizes of 1", 2" and 3"; a 1" port is standard with your order. Additional quantities and sizes are factory installed at customer specified locations.

> **Chart Recorder:** A recorder can be factory installed into the control panel, for permanent record of chamber conditions. The recorder types include 10" circular or 12" circular.

> **Classified/Hazardous Interior:** The chamber interior may be constructed to Class I Division II requirements, per NEC guidelines. Note: This applies to interior construction only and does not apply to chambers located within hazardous areas.

> **CO2 Control:** This system allows for CO2 control from low 'ppm' to high '%' levels. A high quality, infrared technology gas sensor allows for excellent repeatability, linearity, and control.

> **Condensate Pump:** A shallow pan pump can be provided to move condensate/drain water to remote locations (within 15' vertically). The pump operates on standard 120V receptacle power.

> **Data Communications:** Data communications allow for remote computer monitoring of any controlled parameter. The RS-485 option offers monitoring and control of the parameter(s), while the 4-20 mA option offers remote monitoring (only). Both are compatible with most monitoring SCADA systems (SCADA-Supervisory Control and Data Acquisition Systems).

> **Dry Air Tower:** A dry air tower is available for extended low humidity performance without drier reject heat, or for frost-free operation below 0°C. This is designated as the "AT" option, and is indicated as a suffix.

> **Duplex Receptacle:** A single 3A receptacle may be provided on the interior back wall of the chamber for small electric/electronic equipment. Note: Higher amperage loads require special review for cooling system requirements.

> **Electrofin Coil Coating:** Electrofin coil coating option provides for ultra-high corrosion resistance to strongly acidic atmospheres.

> **Glass Door/View Window:** A factory installed, triple-pane glass window is available for easy viewing of products in test. The nominal sizes are 23" x 47" for upright chambers, and 23" x 23" for the benchtop chamber. Note: This option limits the low end range to 0°C.

> **Heated Condensate Pan:** A heating pan can be provided to evaporate condensate/drain water. This is an ideal alternative to the condensate pump. The pan operates on standard 120V receptacle power.

> **International/Special Voltages:** All models and sizes are available in 50 Hz 220–240V design. This option includes the internationally recognized CE mark, and special crating system for air/ sea shipments. Other special voltages (120V) are available upon request.

> **Lighting Control:** For light testing applications, refer to the Photostability Chambers literature for detailed information on this complete line of high quality light chambers. For general lighting applications, consult the factory for various lamp and fixture options.

> **Low Temperature:** All chamber models can be provided with –30°C capability. This is designated as the "LT" option, and is indicated as a suffix on the standard model code.

> **Mechanical Redundancy:** The doublewide and triplewide models (74 & 114 ft.³) may be provided with a duplicate refrigeration and airflow system. The control system periodically switches between the (2) systems, and will automatically lock on one system upon detection of a fault with the other.

> **NEMA Cord Set:** The chambers may be purchased with the optional plug & receptacle set to allow for plug-in capability, as opposed to standard hardwire. The plug-in capability allows for easy movement to different areas within a building.

> **Programmable/Ramping Control:** Ramp/soak profile capability through drop down menus. Up to 99 steps with cycle repeats are available to provide a virtually unlimited number of profile steps and unlimited number of profiles (programs). Setup of each profile requires desired setpoints, event output state, ramp/soak times, and number of cycles. Help menus provide assistance as needed. Multiple profiles can be named and stored on the internal memory card for future use. The profiles can also be configured to start at a specific time and day of month.

> **Single Chamber Water System:** A water purification system is available to protect your chamber's humidification system from deposit build-up from untreated tap water.

> **Stainless Benchtop Stand:** The benchtop size chamber can be complemented with a 33" high stainless steel single-unit stand with casters.

> **Stainless Cabinet Exterior:** Chambers may be provided with 316 polished stainless steel exteriors and interiors. This option allows for more aggressive cleaning agents generally used on a periodic basis for interior and exterior decontamination.

> **Stainless Shelves:** Refer to the Product Shelving paragraph for details. This option is available as standard for 130 lb distributed load, or "heavy duty" reinforced design for higher loads (specified at time of request).

> **UPS Backup Power:** This option offers uninterruptable backup power for the controls and recording device (if applicable). In the event of power loss, the control system will continue to display process values, and record or retransmit values for monitoring purposes. Standard UPS models range from 20 minute backup to over 1 hour (specified at time of request).

> **Water Cooled Refrigeration System:** The water cooled option can take advantage of building water (chilled or tap) to provide efficient cooling and low heat rejection to your room. This option should be considered for chamber environments that have very low air exchange and/or low cooling capacity.