PREPARED BY		9/14/2007 KCW	BENCHTOP SERIES TEMPERATURE AND HUMIDITY CHAMBER SPECIFICATION	Model	Drawing No.	Spc. No.	ECSP07013	1/2
REVISION	F	7/10/12 NKD				ESPEC		
	G	4/12/13 BTP						
	H	8/22/14 RJT						
	I	5/06/15 MAR						
	J	03/22/17 BTP						

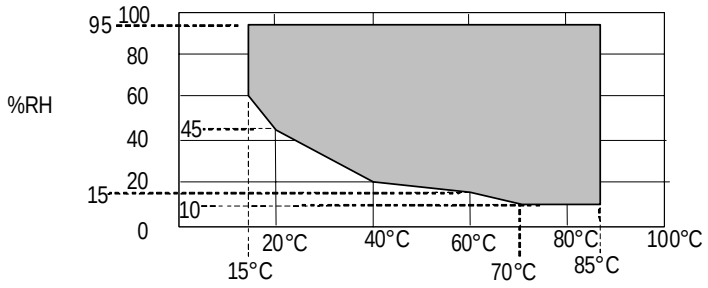
1. Performance

1.1. Temperature Range -20 to 180°C
1.2. Temperature Fluctuation[1] ± 0.5°C
1.3. Temperature Gradient[2] ± 1.5°C below 100°C
1.4. Temperature Rate of Change[1]

Model	Dry/Wet Heaters	Compressor	Heating °C/min Average Rate *	Cooling °C/min Average Rate *	Live Load Capacity	
					20°C	0°C
BTL-433	500 W / 500 W	1/3 hp	1.5	1.2	240 W	160 W

* At voltage specified in section 3.2

1.5. Air Circulation 4.0 cu.ft. chamber - 200 cu. ft./min.
1.6 Humidity Range 10 – 95% (without live load) per chart



1.7 Humidity Fluctuation[3] ± 5% RH
1.8 Humidity Gradient[3] ± 5% RH

[1] per IEC 60068 3-5 except measured in supply air
[2] per IEC 60068 3-5
[3] per IEC 60068 3-6

2. Dimensions

2.1. Exterior

Model	Dimensions (W x D x H)		Weight	
BTL-433	752 x 848 x 1161 mm	29.6" x 33.4" x 45.7"	147 kg	325 lbs.

2.2. Interior

Model	Dimensions (W x D x H)		Volume	
BTL-433	498 x 381 x 600 mm	19.6" x 15" x 23.6"	113 liter	4.0 cu. ft.

3. Site requirements

3.1. Ambient Temperature — Allowable range of operation: 5 to 35°C (41 to 95°F)
Range of assured performance: 18 to 27°C (65 to 80°F)

3.2. Electrical Service

Model	115V 1 ph 60 Hz 3 wire grounding
BTL-433	20 A

ETL listed electrical panel conforming to UL508A

3.4. Refrigeration Cooling

3.3.1 Air Cooled (Integral)

Model	Heat Rejection to Ambient	Noise Level**
BTL-433	3600 BTU/Hr	65 dBA

** Noise level measured 1 meter from front and at mid-point of door

3.5. Gravity Drain — ½" Hose barb

3.6 Humidity Water

3.6.1. Connection — 3/8" Hose barb

3.6.2. Flow [4] — Peak 1 L/min (30-50 psig)

3.6.3. Water Quality — 0.2 µS/cm to 10 µS/cm.
Maximum 2 mg/L free chlorine & filtered to 5 micron or less.

[4] Initial fill of an empty steam generator. See detailed specification document for actual humidity usage rate.

Note: The information provided here is a supplement to the equipment specifications for Benchtop series models.

1. Additional utilities information:

The recommended **power** on the equipment specification is the system's service size.
The system is provided with an 8 foot electrical power cord with plug. The plug style is as follows:

MODEL	Plug type
BTL-433	NEMA 5-20
BTX-475	NEMA 6-20
BTU-133	NEMA 5-20
BTU-433	NEMA 5-20
BTZ-133	NEMA 5-20
BTZ-175	NEMA 6-20
BTZ-475	NEMA 6-20

The installation spacing requirements for operation are as follows:
Sides: 4"
Rear: No clearance required for operation.
Top: 18"

The average **humidity water usage rate** varies depending on the set test conditions.

Model Size	**Example: continuous 85°C/85%**
BTL/X-4	1/3 to 1/2 gallon per day

Water used for humidification must be of high quality. Micro-Siemens (abbreviated µS on our specification) is a rating of conductivity for water. The lower the conductivity, the higher the quality of the water will be. ESPEC offers a "de-ionizing" filter option installed in-line to meet the minimum quality required, assuming low mineral content in the supply water. It is recommended to have your water quality analyzed by a water conditioning company for additional purification options. **Warning:** If the water is *too* pure, it can actually be corrosive, creating holes in the chamber's stainless steel liner.

2. Cabinet features:

The **chamber exterior** of the Criterion series is stainless steel 430, which is still magnetic for easy hanging of notices.
The **door latch** is an ergonomic designed combination cam latch system for convenience and positive door sealing.

The **interior** chamber liner is 304 stainless steel. The chamber is insulated with a combination of high temperature fiberglass and urethane foam. The interior is equipped with shelf pilasters to accept optional wire shelves.

The **doorframe** is made of an unsaturated polyester material that creates a thermal break between the test conditions inside and the ambient conditions outside.

Each model can be ordered with an optional multi-pane **window** installed in the door. The window is heated, to keep the viewing glass clear during low temperature or humidity conditions. An interior chamber lamp is provided to illuminate the workspace with the window option. Note: The standard model comes without a window and without a chamber light.

A **cable port** is provided to allow users to run wires and other lines into the chamber. This 2" (50mm) diameter port comes with one flexible silicone port plug (impervious to water), which can be used to seal the port. The exterior comes equipped with a screw on cap for sealing the port when it is not in use. Additional ports can be added as an option on left, right, or top. ESPEC uses a non-metallic sleeve as a thermal break between the interior and exterior with all cable ports.

All models include heavy-duty **vibration isolation** feet. Primary service panels are lift-off style for convenient access.

Items found on **the front face of the electrical enclosure**: Controller/programmer, and product temperature protector. A separate interface panel**, on the left side**, allows access to external relays, option recorder connection, and communication connections.

3. Refrigeration systems:

Model Prefix	Refrigerant(s)*	Ultimate low temperature	Refrigeration type	Number of compressors
BTL, BTU	R-404A	-20°C	Single-stage	1
BTL, BTU	R-449A	-20°C	Single-stage	1
BTX, BTZ	R-404A and R-508B	-70°C	Cascade	2
BTX, BTZ	R-449A and R-508B	-70°C	Cascade	2

* The refrigerants used are identified on the quote, order, and nameplate.

- The refrigeration system is installed below and behind the chamber to provide for more ergonomic product loading heights when placed on a 30" high bench. The refrigeration system is modular to allow for high quality construction methods and ease of service.
- Refrigeration system is hermetically sealed for low potential for leak and high reliability.
- All models use **air-cooled condenser** for unit placement flexibility. The top exhaust system for the condenser allows the unit to be placed directly against a wall, minimizing the required footprint.
- MSDS documents for the refrigerants: R-449A / R-404A / R-508B

4. Operational features:

Humidity controlled models (BTL or BTX) will have a **humidity generator**:

Model Size	Humidity generation method
BTL/X-4	External steam generator, accessible from the machine room. Steam generator is housed in a cylindrical enclosure, to allow for easier cleaning. Water level control is located in the rear of the chamber.

Recirculating airflow is generated by one externally-mounted **blower motor**. The motor has a direct shaft into the chamber's plenum with a fan blade attached. The airflow in the specification (paragraph 1.5) is measured, not calculated. The number and type of blowers:

Model(s)	Number of blowers	Blower motor
BT-1	1 x 4"	30 Watts
BT-4	1 x 5"	30 Watts

The **temperature sensor** is a type-T thermocouple.
The **humidity sensor** is a type-T thermocouple with a wet wick. The humidity is calculated based on standard psychometric formulas. This allows for high accuracy readings at high humidity conditions without potential saturation of the sensor.

Safety features:

- Three levels of overheat protection, two settable by the user.
  1. Overheat limit in Watlow settings.
  2. Independent overheat sensor and setting by the user.
  3. Overheat protection module with thermocouple in the plenum to protect the chamber.
- Overcool protection, settable by the user.
- The failure of the blower motor is integrated with system shutdown to avoid risk of damage due to overheating.
- System power circuits are protected with circuit breakers allowing for easy reset if an overload occurs.
- ETL listed electrical panel conforming to UL508A.

5. Accessories:

- Operations manual, programmer manual, and parts list / schematics.
- Box of wicks (24 wicks per box) for humidity models

6. System programmer / controller features

Model	**Watlow F4T**
Display	4.3-Inch color, graphical touch pad. Quickly and easily identify process, alarm, and set point values
Control Method	PID (Proportional, Integral, Derivative)
Communications	Ethernet is standard. RS-485, or RS-232 optional Only one interface type may be installed.
Operating Modes	STOP chamber off, programmer on CONSTANT runs at set value continually PGM runs selected test profile
Program Capacity	50 total steps, 40 profiles With ramp and soak functionality
Programming Capabilities	• Up to 50 steps can be programmed into as many as 40 nameable profiles • Profiles can be programmed to wait for events or up to three different process variables. • Guaranteed soak control delays timer until set point is reached
Additional Functions	• High/low limit alarm functions • Digital inputs can be programmed to remotely start, pause, or terminate profiles. • A real-time clock can be used to start a profile at any time • Controller is UL/CUL & CE listed
Constant mode	• Used for quickly setting a single operating condition. Chamber will continue to run this condition until stopped. Program and other settings may be entered while the system is running.

7. Optional Equipment

- Communications hardware
  - RS-232
  - RS-485
- Access ports (available on the right or left side walls)
  - 2" (50 mm) port
  - 4" (100 mm) port
  - Custom feed-through per customer requirements
- Safety related
  - Emergency stop palm button to de-energize all hazardous voltages leaving the electrical box.
- Shelves
  - Shelves are designed for 11 lb. (5 kg) load and come with one set of rails.
- Sensors
  - Solid state humidity sensor in lieu of wet bulb sensor. (humidity models only)
  - Sensor output for external recorder. Included with all recorder options.
- Recorders (Cart mounted for sensors provided on the chamber)
  - Circular chart recorders are available in 12” diameter and 1 to 4 input channels. (2 channel is standard)
  - Data acquisition recorders are paperless units available in 6 or 12 channels. (6 channel is standard)
- Carts
  - Chamber cart designed at 30” high with locations to install recorder, water treatment cartridge.
- Water Tank
  - Provides water to the humidity circuit from a reservoir. Automatic water pump feeds water only when there is demand from chamber.
- Cart with integrated water tank
- Performance
  - Liquid nitrogen injection system to boost cooling rate.
- Door with window
  - Heated window
    - 6" x 6"H 1.5 cubic foot models
    - 6" x 12"H 4 cubic foot models
  - Includes interior chamber light
- Dry air purge
  - 3 CFM; Limits frost or condensation on product during pull-down
- Ultra low humidity (humidity models only)
  - Controlled low humidity
- Water Purification (humidity models only) wall-mount
  - DI cartridge filter system
  - Spare DI cartridges