electro-tech systems, inc. www.electrotechsystems.com
3101 Mt. Carmel Avenue, Glenside, PA 19038 • Tel: (215) 887-2196 • Fax: (215) 887-0131

CONSIDERATIONS WHEN SELECTING A CONTROLLED ENVIRONMENT CHAMBER

by
Brian E. Hohman
Electro-Tech Systems, Inc. (ETS)

Any size chamber can be configured to perform virtually any environmental control function. The combination of Chamber, Controller and Operating Systems determines the performance of the environment. Understanding the characteristics and interaction of these components can be the difference between years of trouble free service and limited performance. Reviewing the following information will allow the end user to make a better informed decision when selecting or designing an environment.

SELECTING YOUR CHAMBER

Standard chambers are less expensive than custom systems. The chamber you select should be large enough to accommodate the samples, equipment or process along with any internally mounted systems (such as a heater assembly, fan, etc.). Sufficient space must also be given to allow proper circulation. When specifying chamber size, remember that the internal dimensions will typically be ½" to ¾" less than the external dimensions due to material thickness. System access ports, circulating fans, doors, power outlets, gloves, sensors, etc. will also utilize a portion of the internal space.

All ETS chambers include an access door along with system and cable pass-through ports. Chambers can be ordered with or without glove ports. Standard chambers can be modified to meet a specific requirement. Custom chambers, fabricated from acrylic or other materials, can be designed to meet virtually any customer requirement including storage, testing, weighing and fabrication. Chambers can be designed to house a specific item or can be built within a piece of equipment to provide a controlled testing environment.

To assist the user in selecting a system ETS offers several standard Option Packages for each series based on typical user applications. **Any chamber option package can be modified to meet a customer's specific needs.** ETS currently offers four standard and two custom chamber series.

Series 5503	4.75 cu. ft. (106 l)
Series 5506	9.00 cu. ft. (255 l)
Series 5518	13.0 cu. ft. (368 l)
Series 5532	13.0 cu. ft. (368 l)
Series 5500-8000	Custom Designed Chambers

SELECTING YOUR CONTROLLER

Controller functions, features and pricing varies widely. When making a selection, first determine the specific functions that are required. These can range from a single-point low humidity controller to dehumidify and hold 5% RH (ETS Model 5311) or full humidity and temperature control with computer interface and dual display (ETS Model 5200-441-431). Single function controllers can be user adjustable or factory preset to a single level. Dual function controllers, which control both humidity and temperature, offer the best combination of features and price.

Selecting a controller with additional capabilities such as temperature control or communication boards allows future expansion by simply adding the required operating system when needed. **Microprocessor PID controllers offer the greatest accuracy and can be used with or without software.** All ETS controllers include a sensor. ETS currently offers the following controller types:

Comparator	
Single-Point Dehumidification	Factory set at 5% RH. (not adjustable)
Adjustable Dehumidification	User Adjustable (ambient and below)
Microprocessor	
Single Function Controller	PID Control (Incr. & Dec.) Humidity *or* Temp
Dual Function Controller	PID Control (Incr. & Dec.) Humidity *and* Temp
Dual Function/Dual Display	PID Displays Both Level & Set Point

Do not assume the operational range of the controller and sensor will be the operational range of the chamber and operating systems. For example, a controller specification may state it can operate from 0-100% RH and from 0-100ºC. This means that this controller has the ability to perform over this range. The chamber and operating systems will have different ranges. ETS acrylic chambers are rated from 0 to 55ºC and each operating system will have its own specific performance range. The ability of the operating systems to humidify, dehumidify, heat or cool is determined by many factors covered later in this article. It is the combination of these three components that determines the performance of your system.

SELECTING YOUR OPERATING SYSTEMS (Heat, Cool, Humidify & Dehumidify)
Several choices are usually available for each function. Each system has its own unique benefits and limitations. Standard operating systems from ETS include humidification, dehumidification, heating, cooling and oxygen monitoring. System selection should be based on your conditioning time requirement (long term, short term), desired operational range and the range of multiple systems used at the same time (what humidity level needs to be maintained at what temperature and for how long). Please note that the specified range of each system is independent of what can be achieved when used in combination with other systems. **Ultimately, the levels that can be achieved depend on the operating system selected, size of the environment, conditioning time, equipment or samples inside the chamber, ambient conditions and set-point**.

The operational range of ETS systems are always specified at ambient conditions. While an environment may be able to maintain 5 to 95% RH at ambient laboratory conditions, when the temperature is elevated to 55ºC it may only be able to maintain 60-70% RH. **Before selecting an operating system it is critical to know the highest humidity/temperature and the lowest humidity/temperature combinations required.** This will allow the appropriate systems to be recommended or selected.

Accuracy and stability are important factors which can vary greatly from system to system. For example when cooling, liquid CO_2 offers the user a low cost, short-term solution but sacrifices stability and humidity control. Thermoelectric cooling systems offer unmatched stability and precision but are expensive and provide limited cooling capability.

Users often ask, “How long will the desiccant, deionized water, etc. last”. The length of time varies greatly for each location and application. It is influenced by the ambient conditions, test material placed inside the chamber, length of conditioning time, set-point, how frequently and for how long the door is opened, sealing of the ports and many other factors.

Most operating systems require periodic maintenance (filling, changing or cleaning) to maintain peak performance. Before selecting a system, check and see if you have access to any existing systems at your facility. Dry nitrogen, if available, is an excellent choice for lowering humidity levels from ambient to less than 2% RH. Renewable desiccant, dry house air or self-regenerating molecular sieve systems may also be available for dehumidification.

COMPUTER CONTROL

Software can be a very useful addition to your environmental control capabilities and is available as an option for all ETS microprocessor controllers. **Adding computer control gives the end user the ability to monitor environmental stability over virtually any period of time and to remotely change the parameters.** For some applications such as ramping and soaking it is a must.

Computer control requires the installation of communications boards, software, and depending upon the setup, RS485/RS232 converter, gender changer, computer interface and y-cable. A single function microprocessor controller has one communication board and a dual controller two. The user must decide between an RS232 or RS485 communication boards. ETS recommends RS485 boards be used in most instances. This will allow multiple modules to be linked together. An RS232 board may be used when a single microprocessor module is used and there are no plans to expand in the future.

ETS currently offers two software versions: CalComm and CalGraphix. Each version is designed for use with a different application and offers a unique set of features.

AIR FILTRATION

Some applications such as filter weighing and powder analysis require chamber air to be as clean as possible. Many operating systems (open-loop type) utilize outside air to achieve the required parameters. Filters are available to trap micro-particles at input, vent and/or recirculated air. In-line units with replaceable filters prevent desiccant dust from entering the dried air stream. These can also be used in venting if exhaust assist is used. HEPA media filters with gaskets can trap particles as small as 0.3 microns and generally are used in recirculation and venting applications. Filtering requirements should be reviewed before purchasing a system.

CHAMBER CONSTRUCTION

ETS uses clear and white acrylic as our material of choice. Alternate materials such as static dissipative acrylic, polycarbonate, steel or other material can also be provided. Acrylic has excellent visual characteristics and can be easily fabricated into virtually any form needed. Standard chambers are fabricated using PS30 (a welded seam) construction. This is the highest quality joint available and is commonly referred to as “museum quality”. Poron gaskets, which are resistant to a permanent set, are used for all door and hinged access port openings. Stainless steel latches are used to seal the doors and a variety of fittings are used to interface with the various systems.

CONCLUSIONS

By reviewing your requirements in detail and understanding the advantages and limitations of each system, the user can select or design a system to meet their needs today and long into the future. Additional information can be found online by visiting our web site at www.electrotechsystems.com.

Points To Remember

1. Any size chamber can be configured to perform virtually any environmental control function.
2. Standard chambers are typically less expensive than customs.
3. Do not assume the operational range of a controller or sensor is the operational range of the entire system. They will be different.
4. The operating system(s) selected helps to determine the actual performance of the environment.
5. Before selecting a system, it is critical to know the highest humidity/temp and the lowest humidity/temp combinations required.
6. The specific range of each operating system is independent of what can be achieved when used in combination with other systems.
7. The time it takes to reach the set-point varies greatly for each location and application. It is influenced by ambient conditions, test conditions, material/equipment placed inside the chamber, conditioning time, how frequently and for how long the door is opened, proper sealing or venting of the ports and other factors.
8. You can elevate the humidity level much faster than you can lower the level. At ambient conditions, elevating the RH level can be accomplished in minutes while lowering the level from 50% to 12% RH can take a few hours depending on the size of the environment and operating system used.
9. If your chamber is set to maintain a high relative humidity level and you wish to perform another test at low humidity levels it will be faster and more efficient to open the chamber door to allow the chamber to drop to ambient levels and then close the door to allow the dehumidifier to drop the remainder. (If testing allows this step).
10. Elevating and decreasing the temperature has an impact on the humidity level that can be achieved within the chamber. Unless stated otherwise the operational humidity range for ETS chambers is listed at ambient conditions.
11. ETS Acrylic Chambers are limited to a maximum operating temperature of 55°C.
12. Adding computer control gives the end user the ability to monitor environmental stability over virtually any period of time and to remotely change the parameters.
13. Operating systems require periodic maintenance (filling, changing or cleaning) to maintain peak performance.

10_12 BEH

Electro-Tech Systems, Inc. (ETS) 3101 Mt. Carmel Avenue Glenside, PA 19038 USA
Tel: 215-887-2196 x215 Fax: 215-887-0131 Web: www.electrotechsystems.com