Incubator Selection Tailored To Lab Requirements

Perhaps nowhere better than in a laboratory does the old axiom apply that the better tool you have, the better job you can perform. And the better the results will be. Laboratory equipment, particularly controlled temperature equipment, must help ensure that the environment in which specimens or cell cultures are being studied is safe and contaminant-free, and that, above all, study results are reliable.

CO₂ incubators a popular choice

One of the essential pieces of controlled temperature equipment in any laboratory is an incubator. These days, the CO₂ incubator is among the most prevalent type. In most laboratories, technicians mainly are growing or sustaining mammalian cells. CO₂ incubators are intended for tissue and cell culture applications. These incubators work on three building blocks: carbon dioxide (CO₂), temperature and relative humidity (RH). The laboratory technician or scientist using a CO₂ incubator is trying to replicate the mammalian environment (in-vivo), outside (in-vitro) of its natural state. The incubator allows these elements to work together to create an ambient environment for cells to thrive. The result is a balanced controlled pH (7.2 - 7.4); stable temperature — 37 C; high relative humidity — 95%; and controlled CO₂ level — 5%.

Air-jacket vs. water-jacket: both offer benefits

The water-jacketed CO₂ incubator envelopes the unit's chamber, providing superior insulation while eliminating contamination and cold spots. In addition, the water-jacket is surrounded by insulation, which makes the incubator ideal for maintaining precise conditions. These essential conditions are why water-jacket technology was first invented and remains the standard in tissue/cell culture today.

Similar to the water-jacketed incubator, an air-jacketed CO₂ incubator has a heated inner chamber that is controlled by sophisticated microprocessors. These microprocessors constantly monitor and adjust program settings and allow calibrations of CO₂ and temperature. As a result, condensation on the inner glass door and back chamber wall is minimized.

For both types of incubators, the microcomputer controls include backup systems that prevent samples from overheating, plus alarms that monitor the out-of-tolerance conditions. Both air-jacketed or water-jacketed incubators will provide a controlled atmosphere for samples.

Copper deters contamination

In the challenge to eliminate contamination in incubators, whether they are air- or water-jacketed, some manufacturers have incorporated copper into the chamber design. As copper breaks down, it releases copper oxide, which destroys any microbes present in the chamber. Some incubator manufacturers offer copper shelves or a copper interior. Sheldon Manufacturing has taken still a different approach by designing copper into the housing that surrounds its High Efficiency Particulate Air Filtration System (HEPA). This patented feature destroys trapped particulates and eliminates contamination where it affects the incubator the most—in the chamber air.

Copper also is extensively used in the CO₂ line, water-jacket and sample port, again, to reduce the possibility of foreign bacteria contamination.

Size matters in CO₂ incubators

Once an incubator style is chosen, size becomes the next major consideration given the typically space-restricted condition of most laboratories. Personal air and water jacket incubators, for example, offer compact size, conserving valuable lab bench space, and are excellent for microbiological and cell culture research. At the other end of the spectrum, large CO₂ incubators and floor models are ideal for large volume incubation of valuable cells, tissues and cultures. The use of various apparatus inside the chamber, such as roller bottle systems and cell harvesters, is common. These incubators can range in capacity up to 60 cubic feet.

Types of CO₂ controls

To maintain the chamber environment for safe and reliable research, today's CO₂ incubators are equipped with precise automated controls. There are three separate types of controllers offered on CO₂ incubators: Continuous Flow, Thermal Conductivity (TC) and Infrared (IR). The IR sensor is to date the most sophisticated technology for CO₂ detection and control. It uses an infrared sensor to detect a change in CO₂ concentrations as little as 0.1%. Since the IR sensor is unaffected by changes in temperature and humidity, it is ideal for applications in which the incubator door is frequently opened, and provides nearly perfect culturing conditions.
for cell growth. The sensor continuously samples chamber atmosphere through a spectrophotometer flow cell, checking wavelength and instantly correcting an out-of-control condition. Also, CO₂ recovery is rapid and changes in CO₂ concentration are made within seconds.

The Thermal Conductivity (TC) Sensor is a more indirect method of CO₂ detection and control since it measures the level of CO₂ by sensing temperature differences as CO₂ is introduced into the chamber.

The Continuous Flow method provides manual control of the air and CO₂ flow rate through the use of precision-bore glass tube flow meters. This method requires an accessory air pump, which most incubator manufacturers sell separately.

**General-purpose incubators offer alternative**

If CO₂ is not a pre-requisite for incubator selection, then general-purpose incubators may be best. Applications of these systems include biochemical, bacteriology, and hematological studies. These units are offered in air-jacket or water-jacket options, in sizes from bench to floor models, and in economy styles with analog controls.

Water-jacketed general-purpose incubators are specified when ambient temperatures in the laboratory fluctuate, and for high-humidity applications. Incubator models are offered with different types of controllers, sizes, and types of construction.

The majority of units are air-jacketed models. Some suppliers offer gravity convection and convection or forced-air incubators. Gravity units rely on the principle that warm air rises, and have no fans or blowers. Convection units are equipped with a fan to move or circulate the warm air to enhance temperature uniformity. Unfortunately, in most convection units the fan also causes a negative side effect — drying of samples.

Sheldon Manufacturing offers both gravity-based units and a unique convection-style incubator that has a triple wall. The triple-wall construction offers five heaters and a fan located outside the chamber to enhance temperature uniformity, without the common problem of drying samples.

**Floor model incubators ideal for high volume applications**

Floor model incubators are used for high volume applications when apparatus is used inside the controlled temperature atmosphere. An electrical outlet is provided inside the chamber. In addition, a pre-wired chart recorder panel is provided to the right of the control panel to produce a hard copy of test results.

**Incubators for special low temp/B.O.D. applications**

A full line of incubators equipped with both heating and cooling capabilities can be obtained for a broad range of applications. These units are ideal for fish and insect work. Units are commonly operated close to ambient conditions, making refrigeration necessary. Also, many lab technicians do not want to work in a cold room environment and will choose an incubator for storing samples instead. Another use for these units is biological oxygen demand (B.O.D.) determinations, A.P.H.A. tests, serum studies and enzyme assays. It is important that units have safety features for both high limits and low limits.

**Some tests may require diurnal growth chambers**

The Diurnal Growth Chamber has both heating and refrigeration capabilities, plus a programmable light system. The unit can duplicate day/night growth testing, stability testing, and seed germination. Two 24-hour timers independently control temperatures and lighting in 15-minute increments, simulating a diurnal cycle. A typical cycle could be an 8-hour day (heat and light), and a 16-hour night (cold and dark).

**Anaerobic chamber saves money, turnaround time**

Another entirely unique and different type of incubator is one designed for laboratories that are studying, or wish to study, anaerobes (life forms in the absence of molecular oxygen). There are anaerobic chambers with built-in incubators available. These chambers enable lab technicians and scientists to conduct research in a strictly anaerobic environment, which is essential for reliable research results that could ultimately link anaerobes to certain infections leading to human diseases.

In fact, research and clinical laboratories performing even a limited number of anaerobic procedures save substantial amounts of money by using permanent systems rather than disposable pouches and jars. It is of equal importance that anaerobic chambers can cut up to 50% in turnaround time given their ease of use and efficient operability.

An anaerobic environmental chamber is designed to allow efficient and dexterous glove-free handling and inspection of samples. Modular systems within the chamber facilitate the completion of procedures from unpacking material to inoculation, incubation, inspection and recovery, all without a single exposure to oxygen.

The handling of specimens required for anaerobic study must be done carefully and delicately. For this reason, convenience in the way the chamber is designed for operation by the technician is paramount.

Sheldon Manufacturing offers in its Bactron line of anaerobic chambers a special patented cuff that permits the technician to work barehanded inside the chamber without compromising the oxygen-free atmosphere. This enables the technician to bring small items into the chamber through the glove-free sleeve system. The result is greatly increased operator comfort and significantly improved productivity.

Choosing the best incubator for today’s laboratory is a process that has been significant and helpfully by a large variety of equipment catering to differing applications, chamber capacity needs, and ease of sample study. Depending upon the application, having the right controlled temperature equipment will greatly enhance efficiency, increase productivity, and give substantial savings over manual disposable methods.

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