A review of hatchery ventilation equipment options

When developing the basis for modern hatchery ventilation design we need to remember evaporative cooling units. These units were nothing more than fixed speed rotating blowers that supplied 100% fresh air into a hatchery room.

by Eng. Angel I. Salazar, Incubation Systems, Inc. www.incubationsystems.com

Essentially, external air in these units was cooled by forcing it across water soaked, cardboard or fibre pads. As the air moved through the wet pads, moisture would evaporate and absorb heat, thus, creating a cooling effect. This was much in the same fashion as tunnel ventilated broiler house, where cool cells and exhaust fans lower the temperature of the air they force through these houses.

The main disadvantage of evaporative coolers in wet tropical areas is the fact these units need to add moisture to the external air they provide to a room, thus, making high humidity ambient conditions even worse. Also, at the beginning, the turbine blowers on these units were not fitted with variable speed motor drives. Thus, they injected far greater volumes of air than were required which made static pressure hard to control effectively.

Modern day evaporative cooler units are still popular and highly effective in regions where desert-like or very dry conditions prevail year round.

Roof top HVAC units

As ventilation technology advanced, roof top HVAC units were developed. These units were fitted with more advanced and precise controls. These units were able to provide multiple stages for both cooling and heating. Frequently, they also had a hot gas bypass for dehumidification purposes.

Another feature on these units were modulating air intake dampers to provide different mixtures of fresh air and recirculated air to a hatchery room. This, in turn, made static pressure control much more efficient.

HVAC units required more advanced room control systems which also increased the level of operational know how and, the competency level of maintenance personnel in most hatcheries.

First, the technology on the controls for HVAC units evolved at a slow pace. The use of solid-state controls took place cautiously. These control devices offered several practical features which have become quite useful and advantageous.

Solid state relays (SSRs) are electronic switching devices that switch on or off when an external voltage (AC or DC), is applied across its control terminals. They serve the same function as electromechanical relays, but because solid-state relays have no moving parts, they have a longer operational lifetime.

An example of a room controller featuring proportional control.

This is also a good time to define the concept of proportional control. Proportional control is a control system technology which is based on a response which is in proportion to the difference between what is set as a desired process variable – or set point – and the actual value of a variable.

Proportional control is used where maintaining a process variable to a tight tolerance and timely responsiveness are required. Control systems in many industrial settings as well as some smart devices use proportional control.

When it became possible to exert proportional control on the operation of HVAC units, small deviations of pre-established set-points resulted in an immediate and accurate response to adjust the opening of the fresh intake damper on these units. Thus, precise control of the static pressure in any room was also made possible.

Hatchery ventilation/room conditions

The key factor to consider for the incubation process is the average incubation temperature and our ability to control its uniformity and stability as outside conditions change from cool to hot or the other way around.

Next, is the O2 level that we must always be able to supply and maintain inside the machines. Oxygen is the only catalyst, fuel, available for the embryo to metabolise and convert yolk nutrients into embryo body mass.

Our next concern should be the relative humidity and to control its uniformity throughout rooms, plenums, and inside incubators and hatchers.

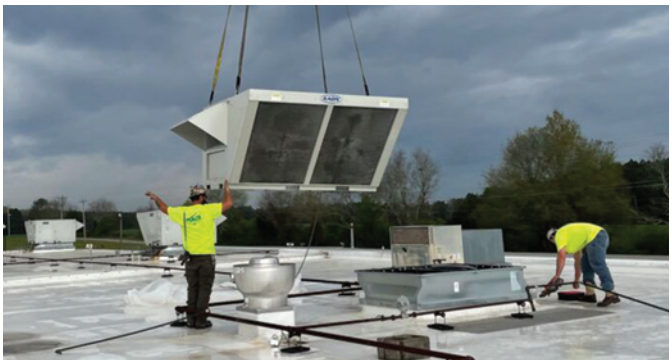
Often it is difficult to control humidity in the pressurised hallways where the machines get their air supply; we must operate with a reliable room control system and humidifiers within these areas.

We should consider our incubator and hatcher rooms as the incubators of our incubators and hatchers.

Continued on page 13

Evaporative cooling units were the first means of hatchery ventilation in modern times.

An incubator room plenum should be slightly negative (-0.010) in relation to the pressure in the sealed hallway of the incubator room.



Roof mounted HVAC units are still the most popular choice in US hatcheries. They require reliable and secure structures to facilitate inspection.

Continued from page 11

When hatching eggs are incubated at the correct temperature and humidity, they should lose 12-13% of their original weight after the first 18 days of the process. They should not lose more than 14.5% after 21 days of incubation.

In the context of a hatchery building, we need to control temperature, humidity, and static pressure. Thus, we need to get a basic understanding of these three factors. What is pressure? It is the differential between two reference points. Thus, when we measure and control pressure differential, it assures the correct amount of fresh air is supplied into a room.

When measuring two reference points and we want our incubator room to be positive, we reference to the atmosphere. Thus, to maintain our setter room positive, we reference to the outside of the hatchery building.

If we need to operate a negative exhaust plenum it should be referenced back to the room where the incubators or hatcher are located. Nowadays, it is possible to configure each HVAC or air handling unit to supply the specific operational/ventilation requirements of each room in the hatchery.

There are several industrial brands for room controls available. It is especially important these room controls and their internal components, such as pressure gauges/modules, be reliable and fully compatible with the operational conditions prevalent in a hatchery plant.

Individual HVAC units

HVACs are also referred to as air handling units. Commonly, these units are installed on the roof of the hatchery building or are mounted on raised platforms, along the perimeter of the hatchery.

An HVAC ventilation system that has been properly sized assures the right volumes of previously conditioned air, in terms of temperature and humidity, are supplied to incubator and hatcher rooms on a constant basis.

Once this goal is accomplished, incubators and hatchers will operate very efficiently only needing small adjustments in temperature, humidity and the air volumes required for optimal incubation results.

A ventilation system based on individual HVAC units will condition the air supply into the hatchery, heating incoming air during winter, and cooling it during the summer. At the same time, it will adjust the humidity level required for proper embryo weight loss throughout the incubation process.

- The most popular choice for poultry hatcheries is HVAC units that inject a mixture of fresh and recirculated air into the rooms they control. These HVAC units are fitted with a modulating fresh air, intake damper that controls the quantities of fresh and recirculated air, the unit will inject into any hatchery room.
- Under most weather conditions, these units work with a mixture of 50% fresh and 50% recirculated air. This mixture can get to a maximum of 75% recirculated air and 25% fresh air. When the HVAC unit is reconditioning recirculated air from a hatchery room, operational costs are lower.
- In the context of a hatchery, return air is the air which is diverted from the exhaust route, mixed with incoming outside air, conditioned, and then delivered to the conditioned space. Recycling the air circulating through an HVAC system reduces energy requirements.
- If the static pressure level in a hatchery room is close to surpass its pre-established set-point, the modulating intake damper on this type of HVAC unit will decrease its opening and will inject a greater volume of recirculated air from the room.
- On the contrary, if the static pressure level in a hatchery room falls below its pre-established set-point, the modulating intake damper on this type of HVAC unit will increase its opening and will inject a greater volume of external air from the outside to raise the static pressure in the room.
- The other type of HVAC or air handling units only use and inject external air into a room, these units do not use recirculated or return air. In order to meet the static pressure setpoint, these units accelerate or slow down their internal blower by means of a variable frequency drive.
- Thus, if the static pressure level in a hatchery room exceeds its pre-established set-point, this type of HVAC unit will reduce the RPMs or slow down their internal blower and inject a smaller volume of air into the controlled room. On the contrary, if the static pressure level in a hatchery room is falling below its pre-established set-point, the unit will accelerate its internal blower and inject a greater air volume into the room.
- Locating HVAC units on top of raised platforms, along the perimeter of the hatchery building adjacent to the room they will attend, is practical and convenient. In such a way, these units are in plain sight and are easy to access for maintenance (air filters, motor belts) and cleaning purposes.
- Roof top HVAC units demand specific construction requirements for roofing structures which are likely to increase building costs. For maintenance purposes, remember the saying, out of sight, out of mind.
- Most hatchery room control systems are designed to be fully compatible with HVAC units that inject a mixture of external and recycled or return air.
- The amount of external air supplied to an incubator or hatcher hall is constantly being adjusted and tunned to the operational cycle the incubation equipment is undergoing at any given time. The reason for this is to optimise the operational costs of incubators and hatchers.
- There are many choices for room controls available. It is especially important that these units and their internal components, such as pressure gauges, be reliable and compatible with the operational conditions prevalent in a poultry hatchery.

Locating HVAC units on raised platforms along the perimeter of the hatchery building, adjacent to the room they will control, is practical and convenient. In such a way, these units are in plain sight and are easy to access for maintenance (air filters, motor belts) and cleaning purposes.

The importance of controlling the ambient conditions in a hatchery operation goes beyond conditioning the air, the incubation systems are taking in from their respective rooms. It is also critical we exert permanent control over the physical attributes of the air we inject into every room, from the egg storage room all the way to chick loading and delivery from our hatchery.

It is always a smart idea to consider incubator and hatcher halls as the incubators of our incubation equipment.

Under this perspective, room ambient conditions will optimise chick quality and production costs in our operation. ■

References are available from the author on request