CONTROLLERS AND SENSORS

Integrated control systems exist to provide continuous monitoring of the thermal environment in the barn to achieve the optimum thermal conditions for pork production. This level of integration allows for control of the barn environment related to air temperature, but also for humidity and airflow levels to assess and control the effective environment of the pig. Electronic controllers have stages that work in unison where supplemental heat is interlocked to operate only when cooling is at a minimum. The newest trend is to have controllers integrated into a computer system that can adjust parameters based on a new self-learning (artificial intelligence) function.

Regardless of the type of system used, the control system is only as good as its sensors. Therefore, proper placement of controllers and sensors is essential to effective climate control within the barn. The following is a list of the 'do's and don'ts' of controllers and sensors:

Controller for an individual room

Centralized controller system for an entire barn

DO

- Avoid radiant heat sources, drafts, direct sunlight or stagnant air when mounting controller sensors.
- Place thermostatic controller sensors midway between the inlet and exhaust hanging from the ceiling. If on a plywood panel, hang the controller sensor parallel to the airflow.
- Place one minimum/maximum thermometer beside the controller sensor and check it often. This thermometer is essential to accurately calibrate and monitor thermostats.
- Step thermostatic controls to prevent simultaneous operation of heating and ventilation equipment. This is accomplished by setting moisture control ventilation controllers at least 3°C above minimum winter building temperature.
- Interlock heat and ventilation controllers to prevent overventilation while heating.
- Be aware of temperature and humidity readings levels. Tell the system what the humidity reading is within the barn by adjusting minimum fan speed or the minimum ventilation rate. Adjust the system to desired humidity levels in the room by adjusting the minimum fan speed or the minimum ventilation rate. For example, if it is too damp, input a higher minimum ventilation rate that is independent of temperature. This will activate the heater to add supplemental heat to the room. Readjust the minimum ventilation rate when conditions improve so as not to waste heat energy.

DON'T

- Locate controller sensors on large pieces of plywood set perpendicular to building airflow or up on a beam out of the way. In these positions, the unit cannot accurately sense the room air temperature and can result in either over-ventilation and/or overheating and wasted energy.
- Rely on commercial control systems with advanced technology. These systems often lack the ability to adequately monitor and manage energy efficiently (Example: CPU – automatic computer-controlled ventilation system). A computerized system is no replacement for a manager with the proper training and know-how. He or she will be most accurate in terms of setting minimum fan and heating rates to optimize energy usage and animal comfort.

What's the cost?

Let's consider a theoretical example with a 200-head grower-finish room with dimensions 42' x 45' x 10'. This surface area works out to 9.45 ft2/pig including pens and alleyways. Assume that this room within a barn is located in Saskatoon and the month is January. For the purpose of this exercise, the room will have 60 kg pigs, an inside temperature of 18°C (RH 70%) and an outdoor temperature of –19°C (RH 60%).

This outdoor temperature is an average January temperature for Saskatoon taken over a period of several years. The minimum ventilation rate to control the specific temperatures and relative humidity used in this example is 568 L/sec. Heating must also be provided at a rate of 4117 watts (W) ($3.06/day or $94.95 for the month) to maintain these conditions. If the controller within this room is improperly set or calibrated, minimum ventilation rate will increase beyond optimum.

What is the outcome?

- if minimum ventilation rate increases by 10% an additional 2,526 W of heat is required for the room. Based on a natural gas price of $0.031/kWh, heating costs for the room will increase to **$4.94/day** or **$153.14** for the month, or an additional $1.88/day over the optimum ventilation setting.
- if minimum ventilation rate increases by 20% an additional 5,052 W of heat will be required. Again, cost to heat this room will increase to **$6.82/day** and to **$211.42** for the month, or an additional $3.76/day over optimum ventilation settings.