

# E-Zine



## Is My Controller Adjusted for Summer Ventilation?

It is always exciting to see summer coming after winter and spring conditions. After cold months, nobody complains when the outside thermometer is claiming up each day announcing really warm summer days. Pretty soon, the ventilation system of your barn will have to work at full capacity, and like any other piece of equipment, it will provide you with satisfaction only if it is well set and in really good working conditions. Before we get to those warm days, now is the perfect time to verify the operation of all system components and to ensure that your controller is well adjusted.

The temperature setpoint for grower-finisher pigs can essentially stay the same over summer and winter periods. It is sometime suggested that summer temperature setpoint should be slightly increased compared to winter recommendations to reduce daily temperature fluctuations occurring during hot periods. Two experiments conducted at Prairie Swine Centre Inc. and recently published indicated that healthy pigs could adequately deal with a large daily temperature fluctuation (up to 15°C) as long as this fluctuation is progressively achieved. In other words, pigs are very sensitive to a rapid temperature change but they do fine if the temperature is slowly increased or decreased.

For most of the ventilation controllers, the first parameter to set is the room temperature setpoint. Elevated barn temperatures will reduce growth rate of pigs by decreasing feed intake. Looking at previous researches, for every degree above 20°C, the average daily gain of finisher pigs decreases by 20 to 40 g/day. The ventilation system of a swine building is generally designed to maintain the indoor room temperature no more than 3°C above the outdoor temperature. As soon as the outdoor temperature rises close or above the room temperature setpoint, the room temperature starts to increase and the ventilation system gets to its maximum and cannot keep up. In the same way, if the room temperature setpoint is kept too hot already, the pig performance will be negatively affected. For pigs between 60 and 100 kg, the recommended temperature setpoints vary from 14 to 21°C but a typical setpoint recommendation would be 22°C for 25 kg pigs, with a gradual reduction to 15°C when pigs reach 75 kg.

Most controllers are what we call proportional controllers. For variable speed fans (generally the first two ventilation stages in grower-finisher rooms), it means that the fan rotation speed is progressively speeded up at the same time the room temperature

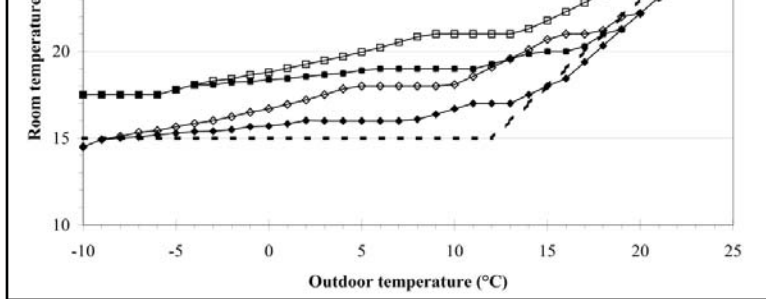


increases. The temperature interval over which the variable speed fan goes from its minimum to its maximum rotation speed is generally called the Proportional band (P-band) temperature value. One P-band value needs to be defined for each variable ventilation stages.

The ventilation system performance is heavily depending on P-band value settings. Two small P-band values (less than 1°C per stage) will make the whole system unstable (fan speed will increase and decrease too quickly) and can create undesirable air drafts at pig level. If the ventilation system is run with too large P-band values (more than 2°C per stage), fans react slowly and the average room temperature will be kept warmer, and can penalize pig performance. In practice and depending on the number of ventilation stages, the total temperature increment (TTI), starting from the room temperature setpoint and required to have all the fans running, should not exceed 3 to 4°C. As an example, for a room with two variable stages and two on/off stages, if P-band values for stages 1 and 2 are set at 1°C, those two stages will be running at full capacity when the room temperature is 2°C higher than the setpoint. If stages 3 and 4 are both set with a 1°C temperature offset (from the end of stages 2 and 3), it means that all fans will be running at maximum speed when the room temperature is 4°C above the setpoint. In this particular example, TTI would be equal to 4°C. Figure 1 shows the indoor temperature of a grower-finisher room calculated for 80

kg pigs according to the outdoor temperature and for different setpoint and P-band setting combinations. This particular room used for the calculations is provided with four ventilation stages where stages 1 and 2 are variable speed fans and stages 3 and 4 are on/off fans. Theoretically, the ventilation system should be capable of maintaining the 15°C setpoint until the outdoor temperature reaches 12°C (Tdesign curve on Fig. 1).

When the outdoor temperature exceeds 12°C, the room temperature should be 3°C warmer than the outdoor conditions. However, for a 15°C temperature setpoint and a 3°C TTI, the room temperature stays above the Tdesign curve when the outdoor temperature varies between -5 and 15°C (Fig. 1). This higher room temperature is the result of the controller settings, to accelerate the rotation speed of the first two ventilation stages, the room temperature should increase as well. Therefore, under spring and fall conditions, the room temperature will be, in average, warmer than the setpoint even if the ventilation system would have enough capacity to maintain room temperature at the setpoint. If a 7°C TTI is being used, the room temperature will be up to 4°C warmer than the Tdesign curve.



Obviously, an 18°C temperature setpoint with a 3°C TTI will further increase the average room temperature (Fig. 1). When a 7°C TTI is combined with an 18°C setpoint, the room temperature stays above 20°C as soon as the outdoor temperature exceeds 5°C. Someone should also keep in mind that the temperature sensor accuracy (typically  $\pm 1^\circ\text{C}$ ) of the controller will increase the variability of the actual room temperature. In this particular case, a 15°C temperature setpoint with a 3°C TTI provides a better temperature control than the other combinations presented on Figure 1.

To optimize pig performance over spring, summer and fall conditions, the ventilation controller should be set with a proper temperature setpoint. A too high setpoint will let the room temperature claiming up too early during the season and will penalize pig performance. Once a proper setpoint has been set, the P-band values need to be carefully defined to ensure the system stability without maintaining the room too warm. Typically, TTI is being set between 3 to 4°C with P-band values and temperature offsets of 1°C, and the optimum setting depends on the fan number and size. Finally, as the temperature sensor is driving all ventilation stages, its accuracy should be checked against an accurate thermometer. After these advices, if you are looking for some assistance in getting the best out of your ventilation equipment, contact an Agricultural Engineer that has the right expertise in livestock building ventilation. Hopefully, your pigs will grow under good temperature conditions so you can enjoy the nice and warm Prairie summer

Re-printed from the Prairie Swine Centre's PorkInsight database, the complete article can be found at: <http://www.prairieswine.com/is-my-controller-adjusted-for-summer-ventilation/>



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