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COOPERATIVE EXTENSION

UNDERSTANDING STATIC PRESSURE

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WHAT IS STATIC PRESSURE?

Static pressure is defined as "the pressure exerted by a still liquid or gas, especially water or air[1]." For turkey growers, this simply relates to the occurrence of a slight decrease in pressure within a turkey building relative to outside air pressure when one or more exhaust fans are turned on. It is important that we understand this concept because the use of exhaust fans, or negative pressure ventilation, is the most common form of power ventilating turkey buildings in Utah. Negative pressure ventilation is also the easiest and most efficient method to control air exchange.

WHY IS STATIC PRESSURE IMPORTANT?

Maintaining proper negative pressure in the brooder or growout allows air to enter the building at the right direction and speed for mixing with air already inside. Cold air entering through cracks, curtains, or vents is heavier than the inside warm air. If it does not shoot into the room with sufficient speed, this incoming cold air will immediately fall downward along the sidewalls and endwalls. That is why drafts of air often feel cooler in these areas in suboptimally ventilated turkey buildings. In buildings under proper static pressure, there will be fewer cold spots, fewer dead air pockets, and no drafts at bird level.

MEASURING STATIC PRESSURE

Static pressure is expressed as the difference between inside and outside air pressure in inches of water column (wc), and is measured with a manometer. Figures 1a and 1b show how a manometer works. Both inside and outside air pressure pushes down on a column of fluid within a tube extending through a solid wall. The less pressure that exists on the inside of the building (created by turning on more exhaust fans), the more the outside air pressure will push the liquid toward the inside portion of the open tube.

[1] American Heritage Dictionary, Fourth ed., Houghton Mifflin Company, 2000.

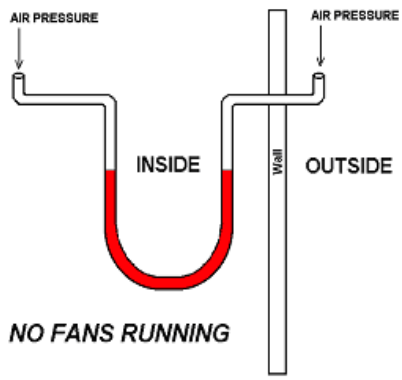

Figure 1a. No exhaust fans running (equal air pressure on inside and outside of building).

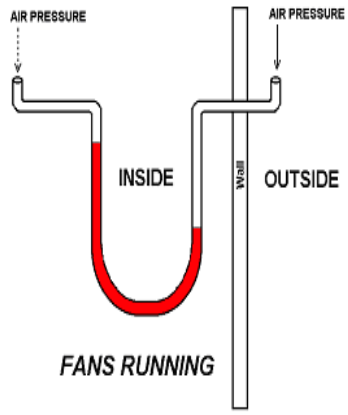

Figure 1b. Exhaust fans running (air pressure less inside building).

An inexpensive wall-mounted manometer can be purchased that will measure wc within ranges found in turkey buildings. The USU Turkey Research Center has found the Dwyer® MARK II[2] manometer very acceptable (Figure 2).

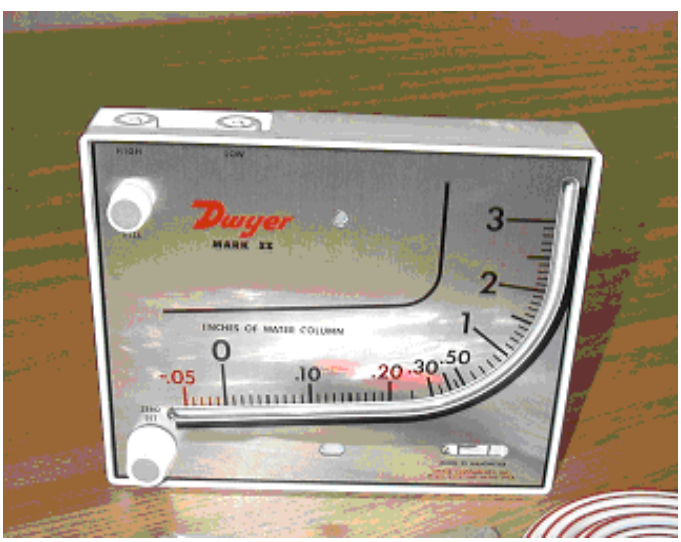

Figure 2. Manometer used for measuring static pressure in turkey buildings.

[2] Dwyer Instruments, Inc., P.O. Box 373, Michigan City, Indiana 46360 USA

SUGGESTIONS FOR USING STATIC PRESSURE EFFECTIVELY

1. Air must be controlled as it enters the building. This is best achieved by mounting rectangular vent boxes along the upper part of sidewalls that automatically adjust to variations in negative pressure. Proper installation of vent boxes will direct the incoming air slightly upwards where it will mix with warmer air and gently fall to bird level (Figure 3).

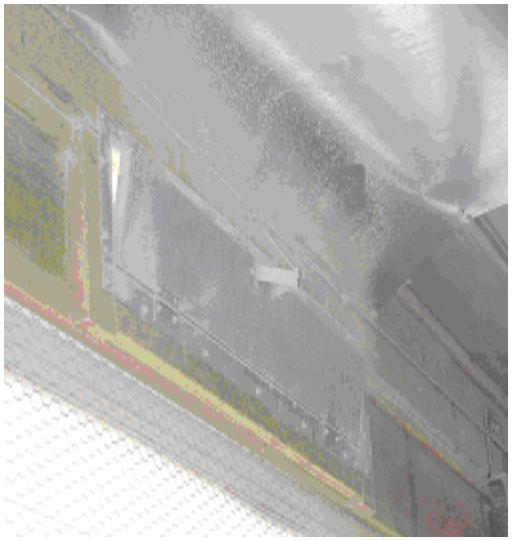

Figure 3. Typical vent box used for regulation of static pressure in turkey buildings.

2. Adjust building inlet area to number of cubic feet per minute (cfm) of air being moved by the fans. Under most circumstances, static pressure should be maintained between 0.05" and 0.08" wc. This may require sealing cracks and crevices to reduce amount of air entering the facility. Sealing these extraneous sources of leakage will also help keep incoming air entering through areas where you want it to come in. As a rule of thumb, one 2.41 to 2.44 ft^2 vent box opening will accommodate 1500 cfm of fan capacity.

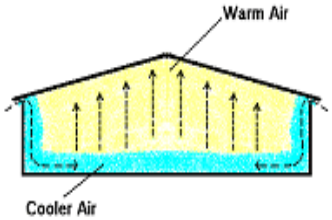

Figure 4a. Insufficient static pressure.

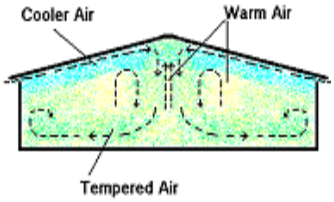

Figure 4b. Proper static pressure.

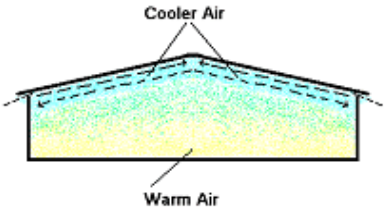

Figure 4c. Static pressure too high.

3. Insufficient static pressure will not allow the air to mix well. There will be stratification of warm air high and cold air low in the building. This is especially detrimental in the brooder. Optimal static pressure allows incoming air to mix and warm before reaching turkey level. Too high of a static pressure may also cause the air not to mix well. Incoming fresh air may shoot along the ceiling and never mix well with the air already present. (Figures 4a, 4b, and 4c).

4. Remember, static pressure is not an indicator of how much air is entering the turkey building, but only how much negative pressure the fans are creating as they pull air through the available inlets. In other words, it relates to the speed of incoming air, but not directly to the volume. Fan capacity dictates volume. As more fans turn on, larger openings are therefore needed to feed them and maintain the previous static pressure.

An understanding of the basic principle of static pressure is imperative to effectively take advantage of power ventilation in turkey production.

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