Ventilating Flat Barn Milking Parlors

Brian J. Holmes
Biological Systems Engineering Department
University of Wisconsin-Madison
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The desire to improve milking efficiency has resulted in the conversion of many stall barns into flat-barn milking parlors with holding areas. The original negative pressure ventilating system (fan exhaust) probably does not work effectively in these new systems because doors must be left open for cows to enter and leave the milking area. A way to improve this condition is to upgrade the ventilation system to a positive pressure (fans blow in) ventilation system. Rotating fans (to blow in) within their existing housings will accomplish an exchange of air but may prove to be too drafty in cold weather. A positive pressure duct system is more effective at providing a uniform distribution of cold winter air and it minimizes drafts.

Figure 1 shows a positive pressure duct installed in the attic/mow above a flat barn parlor/holding area Cows enter the holding area from one end of the barn and exit from that same end. The doors on these openings will remain open while animals more through them. These doors allow air forced into the milking area to exit the building. If both doors are closed during milking, an alternative air exit must be provided since fans are expected to force air into the barn.

Air forced into the duct by the fan(s) enters the parlor/holding area through a slot formed in the ceiling (Figures 2 and 3). The size of the opening must be controlled to assure uniform distribution throughout the duct. The opening formed in Figure 2 will cause air to be directed to the floor while that of Figure 3 will cause air to be directed across the ceiling. The across-the-ceiling system costs more to construct but will direct winter ventilation air away from the milkers in the parlor. Rigid board insulation (2 inches thick) within the inlet limits condensation on ventilation system components.

Use Table 1 to size the ventilation system for a flat barn and Table 2 to size the system for a holding area. When sizing a system to serve both, add the values in the tables. For example, assume a flat barn parlor has four milking units per side, and two cows stand at each milking unit. There are 16 cows in the flat barn ($4 \times 2 \times 2$). From Table 1, the minimum ventilation rate is 800 cfm and the intermediate cumulative ventilation rate is 1,600 cfm. Assume 50 cows fill the holding area after the 16 cows are in the parlor. The minimum ventilation rate from Table 2 is 2,500 cfm, while the intermediate cumulative ventilation rate is 8,500 cfm. The total minimum airflow for both systems is 3,300 cfm (2,500 + 800), while the cumulative intermediate rate is 10,100 cfm (8,500 + 1,600). If two fans are used to provide these two ventilation rates, the first should deliver about 3,300 cfm, while the second must provide 6,800 cfm (10,100 – 3,300). The first fan should be controlled by a manual switch and the second fan by a thermostat.

Since air will blow back through the second stage fan opening when the fan is off, this fan should have a back-draft damper. This damper is a set of louvers that are either forced to open by the fan discharge air or by a motor that operates when electricity is delivered to the fan motor.

The size of the inlet opening from the ventilation duct should be adjusted based on the air delivery

rate of the fan(s). If the opening is too small, the air delivery rate could be reduced due to the high static pressure that must be overcome by the fan. If the inlet is too large, more air will be delivered closer to the fans and less at the other end of the duct. In the ideal case, the opening is automatically controlled. The opening would be adjusted in proportion to air delivery rate of the fan(s). Most producers will elect to adjust the size of the opening manually. In this case, a winch and cable system makes the process more convenient. Locating the winch in the flat barn will facilitate adjustments. A manometer measuring static pressure in the duct can reduce guesswork about where to position the baffle. Plan to operate the duct at 0.05- to 0.10-inch static pressure.

For operator comfort on cold days, a unit heater in the flat barn area can heat the air to a desirable temperature. Locate the unit heater to provide good air mixing, but keep it away from animal and operator traffic. The location (H) in Figure 1 satisfies these criteria.

This same positive pressure duct system could be used for summer ventilation, but duct size would have to be appreciably larger to accommodate greater airflow. For summer, consider installing fans (blowing in) in the end wall of the flat barn or along the sidewalls. This high velocity air will provide animal and operator comfort by forcing heat and moisture from the area. Make sure there are openings large enough (1 ft^2/500 cfm) to allow summer ventilating air to exit the barn.

Table 1. Design values for positive pressure ventilation in a flat barn parlor.

Cows in Parlor	**Minimum Airflow Rate** (cfm)	**Cumulative Intermediate* Airflow Rate** (cfm)	**Minimum Duct Area** (ft^2)
8	400	800	0.8
10	500	1000	1.0
12	600	1200	1.2
14	700	1400	1.4
16	800	1600	1.6
18	900	1800	1.8
20	1000	2000	2.0
22	1100	2200	2.2
24	1200	2400	2.4

* Spring/fall outside air temperatures.

Table 2. Design values for positive pressure ventilation in the holding area.

Cows in Holding Area	**Minimum Airflow Rate** (cfm)	**Cumulative Intermediate* Airflow Rate** (cfm)	**Minimum Duct Area** (ft^2)
30	1500	5,000	5.0
40	2000	7,000	7.0
50	2500	8,500	8.5
60	3000	10,000	10.0
70	3500	12,000	12.0
80	4000	13,500	13.5
100	5000	17,500	17.0

* Spring/fall outside air temperatures.