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VENTILATION FOR SWINE BUILDINGS

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Animal Science Department

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Introduction

The trend in swine housing toward multiple farrowing systems and confinement growing and finishing units has brought about a need for an increased amount of environmental control. Close control of temperature, relative humidity, fresh air and sanitation has become a matter of prime importance. Of these factors, the control of temperature, relative humidity and fresh air through proper insulation and ventilation require the most precise planning and design in swine housing systems.

Ventilation is required to remove the moisture produced by the animals as well as to control temperature and odors. A properly planned ventilation system requires an adequately insulated building, good air distribution and some form of supplemental heat to maintain inside temperatures during cold weather.

Insulation Requirements

Insulation reduces the flow of heat through the walls and ceiling of a structure. Reduction of the loss of heat will result in warmer wall surface temperatures which will lessen the possibility of moisture condensation or frost accumulation. Adequate insulation will also conserve heat that is required for proper ventilation during cold weather.

Insulate the walls with at least a two-inch blanket type insulation or equivalent (R value of 7.4). Install a minimum of a four-inch blanket (R value

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of 14.8) in the ceiling. A vapor barrier must be installed between the insulation and the inside sheathing of the building. Materials such as 4-mil polyethylene, asphalt impregnated paper and metallic foils are considered to be effective vapor barriers. A warm floor is desirable in farrowing houses and can be obtained by installing perimeter insulation under the floor and between the floor and foundation. Usually a material such as expanded polystyrene or foamglass is used for this purpose. The illustrations shown are typical installations of perimeter insulation.

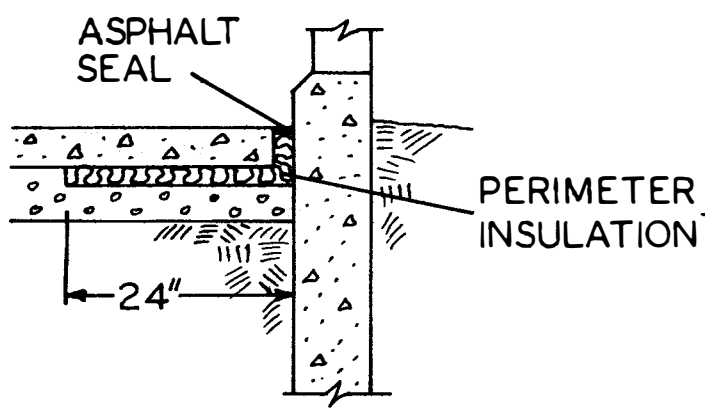

Figure 1. A typical installation of perimeter insulation.

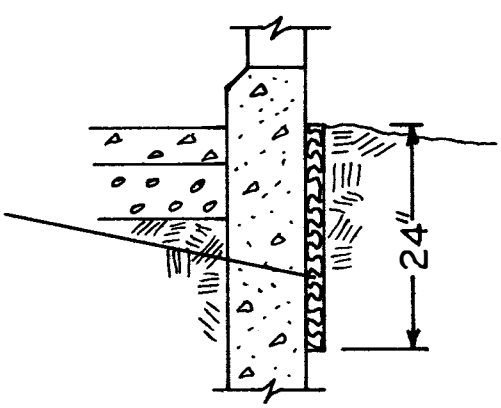

Figure 2. Alternate method of installing perimeter insulation in an existing building.

Air Distribution

While moving the desired amount of ventilation air through the building is necessary, this fact in itself will not assure satisfactory ventilation. It is vitally important that the incoming air is uniformly distributed to remove moisture from all areas of the building and to eliminate the possibility of drafts.

The most widely accepted ventilation system consists of an exhaust fan or fans which remove stale air and moisture and fresh air inlets to distribute the air uniformly to all parts of the building. The fans for winter ventilation

are normally located on one wall, usually on the south or east side of the structure. The fresh air inlets are located in the ceiling or on the side of the building opposite the exhaust fans.

The inlets must be located to direct fresh air to all parts of the building. The fresh air should enter at a low velocity near the ceiling and be directed in a manner that will prevent drafts. Inlets should not be located within eight feet of the exhaust fans.

Plan for 1'-8" of one-inch slot (20 square inches) inlet per sow and litter in the farrowing house. A growing unit will require 6" of one-inch slot inlet per animal and a finishing unit will require 12" of inlet length per animal.

Slot intakes can be constructed in the building as shown in figures 3 and 4. These slots should be constructed in such a manner that warm moist air will not be drawn into the attic where the moisture can condense and soak into the insulation. Reverse flow of air into the attic will normally occur during periods of low ventilation in very cold weather and is prevented by the use of a "back draft valve".

Drawing fresh air from the loft or attic space of a building offers the advantage of bringing tempered air into the structure rather than raw cold air from outside. Air in the attic is warmed by solar heat absorbed by the roof and heat that is transmitted through the ceiling. If the air is drawn from the attic, intake louvers must be provided in the gable ends of the building. The size of the louvers should be based on providing 36 square inches of louver area per 100 cubic feet per minute of exhaust fan capacity.

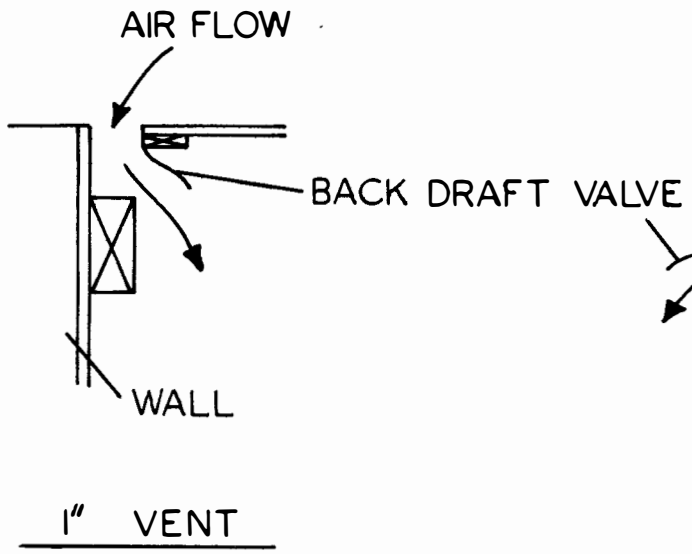

Figure 3. Slot intake construction in buildings less than 32' wide

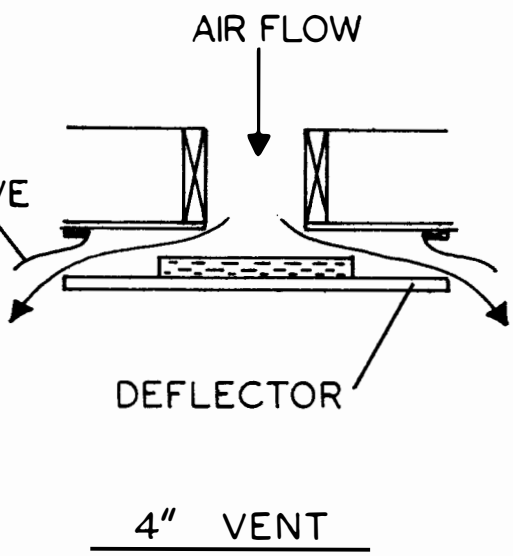

Figure 4. Slot intake construction in buildings 32' or wider.

Exhaust Fan Capacity

The table shown below gives the required ventilation capacity per pig or per sow and litter for satisfactory cold weather operation.

	Inside temperature	Fan capacity
Sow and litter	50 F	80 CFM
	60 F	50 CFM
100# pigs	60 F	15 CFM
200# pigs	50 F	25 CFM
	60 F	15 CFM

Select ventilation fans that are rated to deliver the required amount of air at 1/8-inch static pressure.

Summer ventilation becomes a matter of removing as much heat as possible from the building and, in some cases, circulating air over the pigs at a sufficient velocity to create a cooling effect. In most cases it is recommended

to reverse the direction of air flow and to open up the building as much as possible. Ventilation rates must be increased considerably to obtain adequate air movement. The ventilation rate for the farrowing house should be increased to 120 cubic feet per minute per sow and litter. Summer ventilation in growing and finishing units will require a rate equal to 50 air changes per hour. One air change is equal to the volume of the building. (Length x width x ceiling height)

Fan Selection and Controls

An ideal exhaust fan system would be one that would operate continuously and adjust itself automatically to any small change between inside and outside temperature. Unfortunately, no single fan or control will meet this requirement. The best approach is to use a multiple fan system that will exhaust the maximum amount of air as required in mild weather and can be throttled down by thermostats which stop and start the fans as temperatures fluctuate. This will require two or more fans, each separately controlled, to meet the wide variations between minimum and maximum output needed to meet the variable temperatures of a typical South Dakota winter.

A fan system for winter ventilation is designed so that the total capacity is needed at an outside temperature of approximately 40 degrees. When the temperature drops to 10 degrees below zero the amount of ventilation should be reduced to about 20 per cent of the maximum requirement. This variability in ventilation requirements can best be met by selecting one fan having 20 per cent of the total required ventilation capacity and a second fan or fans large enough to furnish the remaining 80 per cent.

The low volume fan may be operated in one of three different ways, it may operate continuously, it may be controlled by a thermostat or it may be

operated by an interval timer that is usually connected in parallel with a thermostat so the fan can be controlled to operate for selected percentages of a ten minute interval. The high volume fans are controlled by thermostats and are adjusted to operate when the temperature in the building reaches a predetermined level.

Supplemental Heat

While proper insulation does conserve a considerable amount of the heat produced by the hogs, this heat will not be sufficient to maintain an adequate temperature in swine housing during subzero weather. Ventilation at a rate sufficient for moisture removal will require more heat than the animals can produce. In some housing systems it may be possible to reduce the ventilation rate and accept the fact that for a short period of time an excessive amount of moisture will accumulate in the building. Farrowing systems will require supplemental heat, however, since it is highly undesirable to have the inside temperature drop below 50 degrees or to have moisture accumulation in the building.

Supplemental heat should be planned at the rate of 2,500 BTU's per hour per sow and litter in the farrowing house. If supplemental heat is desired in growing or finishing units, it should be supplied at the rate of 425 BTU's per hour per animal in the growing unit and at the rate of 750 BTU's per hour per animal in the finishing unit.

It is well to remember that careful management of heating and ventilation controls is necessary to prevent wasting heat. The heating system should operate only when the low volume fan is functioning, thus the thermostat on the heater should be set at least five degrees below the cut-in temperature of the high volume ventilation.