

ANSI/ASAE EP282.2 FEB1993 (R2013)

Design Values for Emergency Ventilation and Care of Livestock and Poultry



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Developed by the ASAE Emergency Preparedness Committee; approved by the ASAE Structures and Environment Division Standards Committee; adopted by ASAE as a Recommendation December 1964; withdrawn December 1970; revised and reinstated February 1973; reclassified as an Engineering Practice December 1977; reconfirmed December 1982, December 1987; December 1988, December 1991; revised February 1993; approved as an American National Standard September 1993; reaffirmed by ASAE December 1997, December 1998; reaffirmed by ANSI June 2000; reaffirmed by ASAE February 2004; reaffirmed by ANSI March 2004; reaffirmed by ASABE February 2009; reaffirmed by ANSI April 2009; reaffirmed by ASABE December 2013; reaffirmed by ANSI January 2014.

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1 Purpose and Scope

Many natural, man-made, and unexpected events (i.e., power interruptions, equipment failures, extreme weather conditions, storms, and natural disasters) occur requiring temporary emergency ventilation and care of livestock and poultry. These events may require either short term (i.e., minutes to days) or long term (i.e., weeks to months) temporary emergency ventilation. The purpose of this Engineering Practice is to provide data and guidelines to assist designing emergency ventilation, feeding, watering, and lighting systems for livestock and poultry.

2 Normative References

The following standards contain provisions which, through reference in this text, constitute provisions of this Engineering Practice. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this Engineering Practice are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Standards organizations maintain registers of currently valid standards.

ASAE EP270.5, Design of Ventilation Systems for Poultry and Livestock Shelters

ASAE EP294.2, Computing Electrical Demands for Farms

ASAE EP364.1 FEB93, Installation and Maintenance of Farm Standby Electric Power

ASAE S417.1, Specifications for Alarm Systems Utilized in Agricultural Structures

3 Ventilation Requirements

3.1 Ventilating air:

- supplies oxygen for feed metabolism;
- dilutes carbon dioxide and other potentially noxious gases;
- acts as a vehicle for removal of water vapor;
- acts as a vehicle for removal of heat;
- acts as a vehicle for removal of pathogens and dust.

3.2 Ventilation failure in enclosed animal facilities can create life-threatening conditions in minutes. Alarms to quickly alert caretaker of a ventilation system failure and the need for corrective action are highly recommended for environmentally controlled enclosed animal facilities which are naturally or mechanically ventilated. Alarm systems should be designed and maintained in accordance with ASAE S417 and recommendations in 3.3.8 of ASAE EP270. Alarms can be used to monitor power supply interruption, high temperature limits, and low temperature limits. Since alarm systems can fail, they should be checked regularly.

3.3 Ventilation requirements during ventilation system failures should be calculated according to ASAE EP270. Ventilation needs depend on many factors including animal load and outside temperature. Both cold and hot weather ventilation needs should be considered.

3.4 Emergency ventilation may be provided either with a standby electric generator (see clause 8) or possibly with emergency natural ventilation openings. A standby electrical generator is the method of choice for buildings mechanically ventilated year-round.

3.5 Emergency air exchange provided by natural ventilation is called emergency natural ventilation. Natural ventilation, caused by what is commonly called “stack” effect, takes place due to buoyancy. The temperature difference between inside and outside, the difference in height between air inlets and higher outlets, and the size of the inlets and outlets are the main factors that affect natural ventilation. Wind also can cause natural ventilation. Wind caused natural ventilation is not included in this procedure for sizing inlets and outlets because wind is variable and cannot reliably contribute to the emergency natural ventilation when needed.

3.5.1 Emergency natural ventilation openings should be sized to ensure that animals receive sufficient fresh air in an emergency. A formula for calculating the ridge and sidewall opening area based on thermal buoyancy is derived from Bruce, 1978:

$$\frac{1}{A_i^2} + \frac{1}{A_o^2} = \frac{2c^2 g H \Delta T}{T_i V^2}$$

The formula for the determination of air exchange rate is as follows:

$$Nq = PC_p V \Delta T + \Delta T \sum_{s=1}^n A_s U_s$$

where:

A_i is inlet area of vents, m^2

A_o is outlet area of vents, m^2 ;

c is discharge coefficient of vents (normally 0.6 to 0.65);

g is acceleration due to gravity, $9.81 \text{ m} \cdot \text{s}^{-2}$;

H is difference in height between inlet and outlet, m ;

T_i is inlet air temperature, $K (273 + ^\circ C)$;