

# Cagewash Exhaust

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*We have a cagewash area with extremely poor exhaust design. The space is, on average, at 95% relative humidity. What are the typical environmental operating parameters of a cagewash area? What are ideal velocities in the duct and what is the ideal slope of said duct?*

The HVAC systems serving animal cagewash areas are required to overcome extremely harsh conditions such as radiated equipment heat release, periodic equipment steam release, and animal caging odors. These systems need to be designed to maintain space pressure relationships, reduce odors, capture steam, and maintain reasonable comfort conditions for the cagewash custodians.

For persons working in vivarium cagewash areas, thermal comfort depends on many factors including metabolic rates of occupants, type of clothing, room air temperature, radiant heat from cagewash equipment, air speed, and room humidity. Using the Computer Model Method defined by ASHRAE1, the upper limit for acceptable conditions in a typical animal cagewash area is 80°F dry bulb temperature at 55% relative humidity. We recommend that HVAC systems be designed to maintain animal cagewash areas at or below these thermal comfort threshold conditions. The primary purpose of exhaust systems serving animal cagewash areas is to capture and remove high temperature, vapor-laden air, and discharge it to the exterior of the building. Proper design of these exhaust systems includes selecting appropriate duct materials and managing the condensation that naturally occurs within the ductwork.

For cagewash exhaust applications, aluminum and stainless steel are the most appropriate duct materials. The bottom and sides of horizontal ductwork should be made from single sheets to eliminate longitudinal seams. Also, all traverse seams should be welded. To eliminate pooling of water within the ductwork, we recommend that horizontal ductwork be installed with a minimum 1/8 inch per foot downward slope in the direction of the cage washing appliances. In cases where significant horizontal runs of ductwork will not allow for a continuous slope, ductwork should be sloped to intermediate low points where condensate drains should be installed.

Exhaust ductwork conveying vapors is typically sized using the equal friction method. In this method, ductwork is sized to maintain a relatively equal friction loss expressed in units of inches of water per 100 feet of duct. For cagewash exhaust systems, we recommend a friction drop of 0.1"/100 ft. A typical cagewash area with a cage rack washer, tunnel washer, and bulk autoclave will require approximately 5000 cubic feet per minute (cfm) of total exhaust with a minimum exhaust register size of 500 cfm. For these assumed air volumes and using a friction drop of 0.1"/100 ft., the exhaust duct velocities will range from 850 to 1500 feet per minute. Because the ductwork is designed to accommodate internal condensation, there is no value

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in designing for higher duct velocities in an attempt to keep condensation from occurring.

### **References:**

1. ASHRAE Standard 55-2004 – Thermal Environmental Conditions for Human Occupancy.

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*Jeffrey Linde will be presenting “HVAC Design for Animal Cagewash Areas” at the 2006 TurnKey Conference.*

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