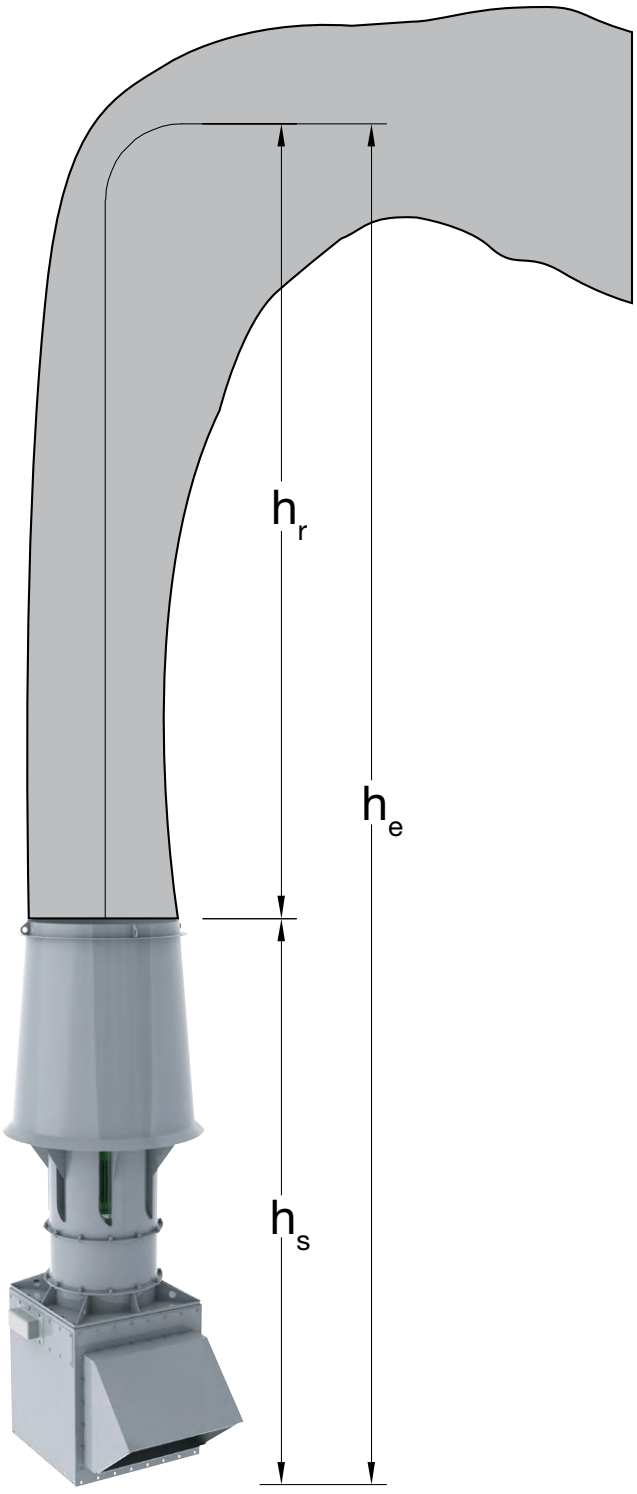
LAB EXHAUST

Information and Recommendations for the Engineer

Plume Height Calculation

Two of the most important factors in preventing re-entrainment of exhaust air are the Plume Rise and overall Effective Plume Height of your fume exhaust system. Your Plume Rise is the overall height that your plume rises above the outlet of your windband before it slows to a zero velocity. Your Effective Plume Height is your Plume Rise, plus the stack height of your fan (height from the roofline to outlet of the windband).



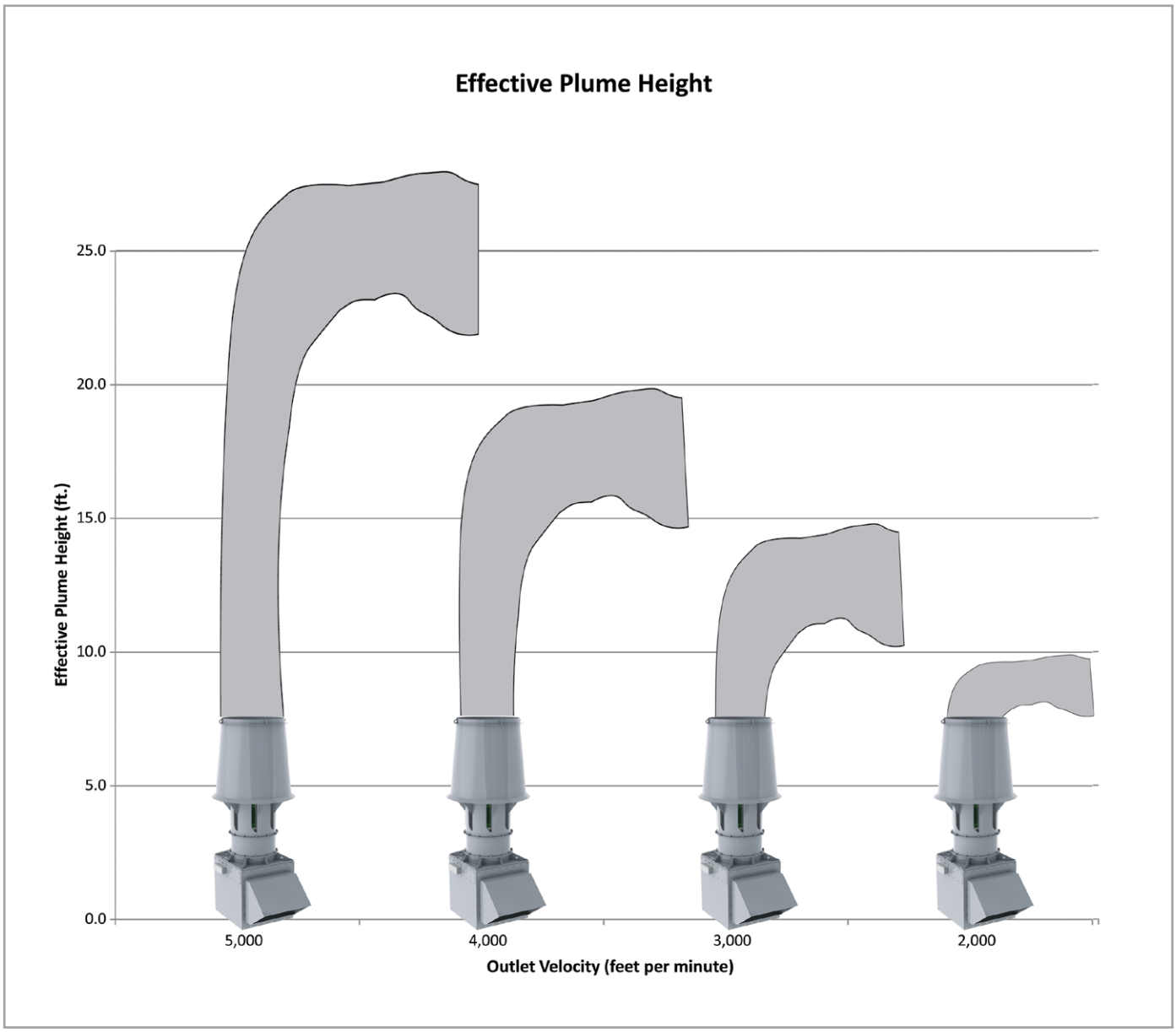
$h_e = h_r + h_s$*
$h_e = [3.0 \times (V \times d/U)] + h_s$
h_e = Effective plume height (ft)
h_r = Plume rise (ft)
h_s = Stack height (height from roof to outlet of windband) (ft)
V = Windband exit velocity (ft/min)
d = Windband outlet diameter (ft)
U = Crosswind speed (ft/min)

Note: Plume height calculations are typically calculated based on a 10 or 15 mph crosswind.

* Equation taken from ASHRAE Laboratory Design Guide, Equation 9-2.

A high Effective Plume Height prevents excessive downwash and prevents the need for unsightly & tall low velocity exhaust stacks.

Example: Moving 5000 cfm of air through a high velocity fan with wheel diameter of 22 inches and an outlet nozzle with a diameter of 16 inches (1.33 feet) would have a plume rise of 16.1 feet beyond the outlet of the fan based on a crosswind of 10 mph. That is equivalent to a low velocity stack height of over 16 feet in addition to the height of your fan!



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