

# Breath Air Flow Rates During Treadmill Walking Using Filter Respirators

I. Holmér, K. Kuklane, and C. Gao

Lund University, Department of Ergonomics  
Box 118, Lund 22100, Sweden  
Email: [ingvar.holmer@design.lth.se](mailto:ingvar.holmer@design.lth.se)

Respiratory minute volumes and instantaneous breath flow rates were measured in 8 subjects during treadmill work using (a) a particle filter respirator (Sundstroem SR200) and (b) a control breathing mask (Metamax I, Cortex). Work comprised five consecutive bouts of walking at 5 km/h with an increase in elevation of the treadmill by 5 % every 5 minutes. Minute ventilation increased in a curvilinear manner with oxygen uptake and reached  $88 \pm 20$  and  $93 \pm 20$  l/min at 5 km/h (20%) with the control mask and SR200, respectively. Peak inspiratory flow rate (PIFR), measured as the average of several breath cycles (in 30 sec), was  $273 \pm 38$  for Control and  $300 \pm 36$  for SR200 at the same work rate. During standardized speech communication, minute volumes decreased. In contrast, PIFR increased by about 100 % at low work rates and about 30 % at 5 km/h (20%) compared to no speech condition, reaching a highest value of  $373 \pm 42$  for Control and  $407 \pm 48$  for SR200. The time of the inhalation cycle was between 50-60 % of the total breath cycle in Control and 46-53 % in SR200. During speech inhalation time was 14 and 19 % at the lowest work rate for Control and SR200, respectively. Corresponding values for the highest work rate were 38 and 33 % of total breath time. At the highest work rate mean inspiratory flow rate was  $192 \pm 43$  l/min for SR200. It was calculated that at the three highest work rates the mask air flow rate exceeded 95 l/min for more than 60 % of the inhalation time. During speech conditions this result was valid also for the two lowest work rates.