Entrance Velocity Optimization for Modified Dust Cyclones

Authors: Paul A. Funk, S. Ed Hughs, Greg A. Holt
Pages: 178-182
Engineering and Ginning

Full Text PDF (58K)

Entrance air velocity affects both the fan energy consumption and the dust collection efficiency of cotton gin cyclones. Recent findings have resulted in changes in cyclone design recommendations. Entrance air velocity was varied on both conventional and modified cyclones to determine whether air velocity recommendations need to be updated for the new designs. High efficiency cyclones were constructed 30 cm (12 in) in diameter (D). The cyclone body was one D high, the cone section 3D high (1D3D). The cyclones either had a standard entrance D/8 wide by D tall, or a 2D2D-style entrance D/4 wide and D/2 tall. Trash outlets at the terminus of the cone section were either a standard D/4 or a modified D/3 wide. Four levels of entrance air velocity were tested from 13.2 to 17.8 m s^{-1} (2600 to 3500 ft min^{-1}). Dust collection efficiency was determined by weighing filters through which cyclone exhaust air had passed. There was not a statistically significant difference in dust collection due to entrance air velocity, but cyclone modifications clearly improved performance. Pressure drop, which relates to fan energy requirements, increased 20% with both modifications. Pressure drop was observed to increase linearly with entrance air velocity. There is insufficient evidence based on dust collection efficiency to change design velocity recommendations for either standard or modified 1D3D cyclones. However, the potential exists to save energy by reducing entrance velocity since the pressure drop in modified cyclones is 30% lower at 13.2 m s^{-1} (2600 ft min^{-1}) entrance velocity compared to 16.3 m s^{-1} (3200 ft min^{-1}).