Laser sheet imaging of high-velocity air atomised water sprays

P. L. Garlick*
Bournemouth, Dorset, UK
A. K. Jasuja
Cranfield University, Bedfordshire MK43 0AL, UK

Abstract

The flow structure in the near-nozzle region of a spray finishing atomizer is investigated. The analysis is based on flow visualization data obtained using laser sheet imaging. The liquid Reynolds number and aerodynamic Weber number are used to characterise the operating conditions. Both are varied in the range 1,000 to 10,000. An additional parameter, the momentum flux ratio M, is calculated for each test case. It is observed that for high values of the momentum flux ratio (M>20) a film forms on the front face of the nozzle and the liquid flows towards the air in a radial direction. For low values of the momentum flux ratio (M<2) a liquid jet is formed and the two streams do not meet until further downstream. For intermediate values of the momentum flux ratio (2<M<20) both flow regimes are present. The intact length of the liquid stream is also considered. Analysis of the entrainment process at the interface leads to the prediction that the intact length is inversely proportional to the mass flow ratio m. Close comparison is found between the observed and predicted lengths over the range 0.1<m<1.0.

Key words: laser sheet imaging, flow visualization, liquid break-up

*Corresponding author, pgarlick@dircon.co.uk