



# Standard Guide for Determining Cross-Section Averaged Characteristics of a Spray Using Laser-Diffraction Instruments in a Wind Tunnel Apparatus<sup>1</sup>

This standard is issued under the fixed designation E2872; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## INTRODUCTION

In this guide, test methodologies are described specifically relating to the use of laser diffraction (LD) instrumentation to estimate the droplet-size distribution for liquid sprays released into moving air streams. This guide presented is primarily applicable to aerial agricultural spraying, aerial forest sprays, or air-blast spraying. Cases in which the spray is ejected into a quiescent gas environment that lacks the unifying effect of a well-defined gas co-flow may require different techniques or instrumentation or both. In this guide, an average droplet size distribution for the entire spray is determined. It requires that the spray be statistically steady in time, but it may be polydisperse and spatially non-uniform.

The droplet-size distribution used for characterization of a moving spray source must be determined from a “flux-sensitive sample” or equivalent. This is because a flux-sensitive sample provides the fraction of the total liquid flow rate contributed by each size class of droplets and, therefore, is directly related to the spray coverage. In contrast, the LD instrument derives its droplet-size distribution from a “spatial sample,” and therefore, its use for spray characterization is limited to test conditions under which equivalence between flux-sensitive samples and spatial samples can be established. Such equivalence exists when the velocity of all droplets of the spray is equal and creating these conditions is the basis of this guide.

All tests relating to this guide require a wind tunnel with a test section of sufficient size that it contains the entire spray plume up to the plane of measurement without droplets impacting the test section walls under the prescribed operating conditions. The unobstructed wind tunnel air stream shall be uniform and free of turbulence. The test air speed shall be chosen to match the relative speed of the spray to the ambient conditions.

## 1. Scope

1.1 The purpose of this guide is to define a test procedure for applying the laser diffraction (LD) method to estimate an average droplet size distribution that characterizes the flux of liquid droplets produced by a specified spray generation device under specified gas co-flow conditions using a specified liquid. The intended scope is limited to artificially generated sprays with high speed co-flow. The droplets are assumed to be in the size range of 1 to 2000  $\mu\text{m}$  in diameter and occur in sprays that

are contained within a volume as small as a few cubic centimetres or as large as a cubic metre. The droplet sizes are assumed to be distributed non-uniformly within the spray volume.

1.2 This guide is intended primarily to guide measurement of performance of nozzles and atomizers using LD instruments.

1.3 Non-uniform sprays require measurements across the entire spray cross section or through several chords providing a representative sample of the overall spray cross section. The aim of multiple-chord measurements is to obtain a single droplet size distribution that characterizes the whole spray rather than values from a single chordal measurement.

<sup>1</sup> This guide is under the jurisdiction of ASTM Committee E29 on Particle and Spray Characterization and is the direct responsibility of Subcommittee E29.02 on Non-Sieving Methods.

Current edition approved April 1, 2014. Published May 2014. DOI: 10.1520/E2872-14.