Designation: E 641 – 85 (Reapproved 2000)

Standard Methods for Testing Agricultural Hydraulic Spray Nozzles[1]

This standard is issued under the fixed designation E 641; 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 (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 These methods cover procedures for testing agricultural spray nozzles. The procedures covered herein include the following performance parameters: nozzle flow rate, nozzle spray angle, liquid distribution, spray droplet size, and nozzle wearability.

1.2 The types of hydraulic nozzles covered in these methods are those producing patterns of the fan, hollow cone, and full cone type.

1.3 *This standard does not purport to address the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Terminology

2.1 *Definitions of Terms Specific to This Standard:*

2.1.1 The procedures set forth in these methods are for spray nozzles of the hydraulic energy type in which the spray material is forced through an orifice under pressure, providing fluid break-up into droplets. Droplet-producing elements that operate by means other than hydraulic energy are not a part of these methods.

2.1.2 The types of hydraulic spray nozzles considered are categorized according to spray characteristics, as follows:

2.1.2.1 *fan-type spray nozzle*—this nozzle provides a range of atomization throughout the pattern area. Its edges are tapered to permit the overlapping of spray patterns from adjacent nozzles, thereby providing relatively uniform overall distribution. These nozzles are popular on field-type crop sprayers where uniform coverage is desired across the swath.

2.1.2.2 *fan-type spray nozzle with even spray distribution*—this nozzle provides fine atomization and comparatively uniform distribution throughout where there is no requirement for overlap of adjacent spray patterns. It is used primarily to spray uniform strips or bands in fields.

2.1.2.3 *flooding or deflector-fan type spray nozzle*—this nozzle produces a wide-angle flat spray pattern with coarse atomization and relatively uniform distribution. It is used primarily on field-type sprayers when broad coverage at lower pressures is desired.

2.1.2.4 *conventional hollow cone nozzle and full cone nozzle*—the conventional hollow cone nozzle normally provides fine atomization throughout a hollow cone pattern area. The full cone nozzle, on the other hand, normally provides relatively uniform distribution throughout its full cone pattern. Both types are used extensively for the spraying of fruits and vegetables and of some row crops with pesticides and for aerial applications.

3. Significance and Use

3.1 The purpose of these methods is to provide uniform testing procedures for evaluating the performance criteria of hydraulic spray nozzles used for various purposes.

4. Apparatus

4.1 This section covers equipment used in testing hydraulic spray nozzles. The equipment and apparatus listed are sufficient to cover optional procedures and methods for examining each of the nozzles' spray characteristics.

4.2 Fundamental equipment common to all of the testing methods and procedures for evaluating spray performance are as follows:

4.2.1 *Water Reservoir or Retaining Vessel*—A water reservoir or vessel sufficiently large to provide smooth continuous flow to the nozzles throughout the duration of a particular test.

4.2.2 *Pump or Source of Water Pressure*— A pump or source of water pressure available and sufficient to conduct the performance tests at the required pressures, with no more than 10 % pulse deviations from nominal pressure as measured on a Bourdon-type gage.

4.2.3 *Pressure Gage*:

4.2.3.1 A pressure gage with an accuracy of ±2 % at the actual working pressure to be of a quality Bourdon-tube type with a minimum dial face diameter of 150 cm (6 in.). It should have a maximum pressure reading on the dial face such that the test pressure can be as near the midrange of the gage as possible.

4.2.3.2 The pressure gage should be calibrated prior to use at each of the required test pressures by using a Certified Dead Weight Gage calibrator or a suitable manometer capable of gage calibration.

[1] These methods are under the jurisdiction of ASTM Committee E-35 on Pesticides, and are the direct responsibility of Subcommittee E35.22 on Pesticide Formulations and Application Systems.

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4.3 General equipment and arrangement schematics used in testing each of the performance criteria are as follows. All equipment shall be kept clean and in good condition.

4.3.1 *Discharge Rate*:

4.3.1.1 *Apparatus Schematic*—See Fig. 1.

4.3.1.2 *Cylinders*, Accurately calibrated, laboratory graduated.

4.3.1.3 *Stop Watch*, readable in 0.5-s increments.

4.3.1.4 *Collecting Vessel*.

4.3.1.5 *Laboratory Beakers*, calibrated.

4.3.1.6 *Flowmeter*, calibrated.

4.3.1.7 *Weight Scale*, certified.

4.3.2 *Spray angle*:

4.3.2.1 *Apparatus Schematic*—See Fig. 2.

4.3.2.2 *Spray Pattern Distribution Testing Table*.

4.3.2.3 *Spray Protractor*, calibrated, with 300-mm (12-in.) long arms.

4.3.3 *Distribution*:

4.3.3.1 *Apparatus Schematic*—See Fig. 3 and Fig. 4.

4.3.3.2 *Spray Pattern Distribution Testing Table*.

4.3.3.3 *Spray Pattern Distribution Testing Racks, Troughs, and Beakers*.

4.3.3.4 *Weight Scale*, certified.

4.3.3.5 *Stop Watch*, as in 4.3.1.3.

4.3.4 *Particle Size*—Since there is no agreement on methods of sampling and measurement, this section is omitted at this time. (Note the section on reporting of measurements, 6.4.)

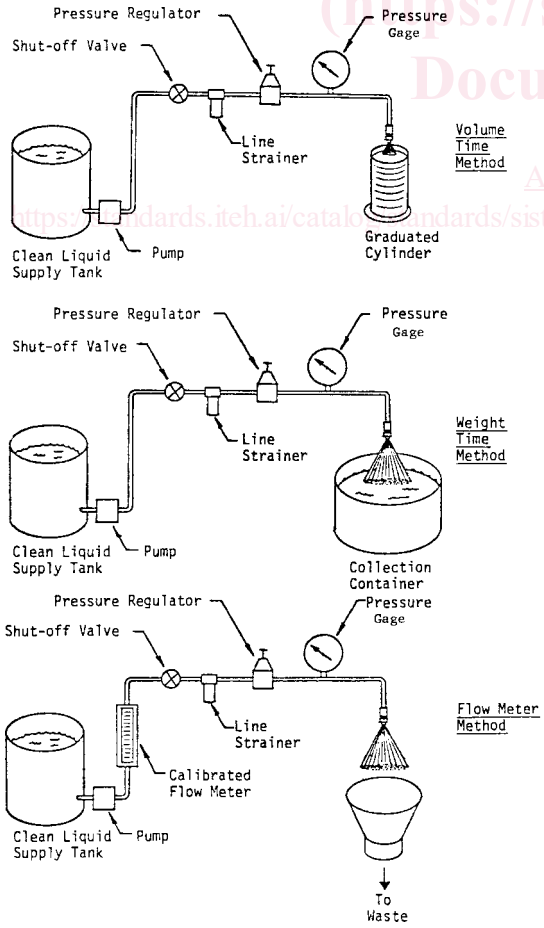

FIG. 1 Discharge Rate Test Equipment

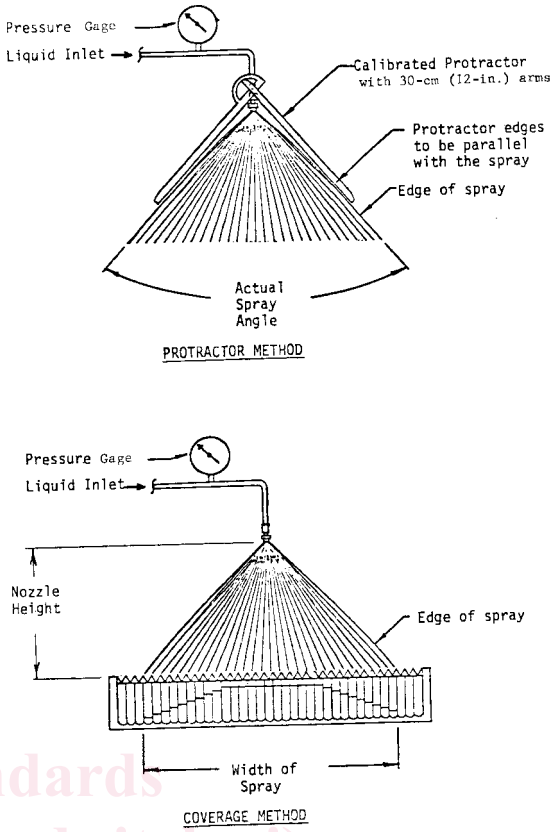

FIG. 2 Spray Angle Test Equipment

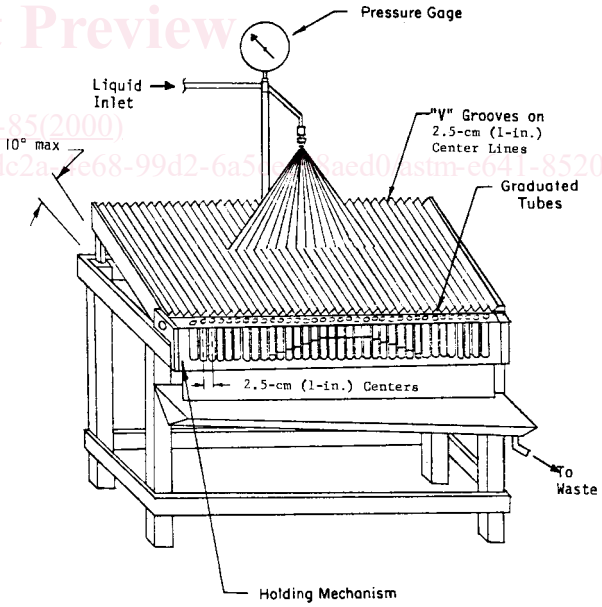

FIG. 3 Distribution Table

4.3.5 *Wearability*:

4.3.5.1 *Apparatus Schematic*—See Fig. 5.

4.3.5.2 *Pressure Tank*, with agitator and air regulator.

4.3.5.3 *Wear Media*.

4.3.5.4 *Imhoff Settling Cone*, 1000-ml.

4.3.5.5 *Spray Pattern Distribution Testing Table*.

4.3.5.6 *Containers*, water-collecting.

4.3.5.7 *Weight Scale*, certified.