FINAL
DRAFT

INTERNATIONAL
STANDARD

**ISO/FDIS
16119-5**

ISO/TC **23**/SC **6**

Secretariat: AFNOR

Voting begins on:
2018-02-23

Voting terminates on:
2018-04-20

Agricultural and forestry machinery — Environmental requirements for sprayers —

Part 5: Aerial spray systems

Matériel agricole et forestier — Exigences environnementales pour les pulvérisateurs —
Partie 5: Systèmes aériens de pulvérisation

ISO/CEN PARALLEL PROCESSING

Reference number
ISO/FDIS 16119-5:2018(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Published in Switzerland

Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 6, *Equipment for crop protection*.

A list of all parts in the ISO 16119 series can be found on the ISO website.

Introduction

Significant areas are sprayed globally by fixed wing and rotary aircraft in order to overcome serious pest threats to agriculture and forestry. Aerial application is used where difficult terrain or crop (forests) dictate as well as for timely application to large areas, in order to maximize efficient use of crop protection products and minimize environmental impact.

Agricultural and forestry machinery — Environmental requirements for sprayers —

Part 5: Aerial spray systems

1 Scope

This document specifies requirements and the means for their verification for the design and performance of aerial fixed wing and rotary aircraft spray systems for agriculture, forestry, turf, and vegetation control in transport access ways (such as gas and electric lines) with regard to minimizing the potential risk of environmental contamination during use, including misuse foreseeable by the manufacturer.

It is intended to be used with ISO 16119-1, which gives general requirements common to all the sprayer types covered by ISO 16119. When requirements of this document are different from those stated in ISO 16119-1, the requirements of this document take precedence over the requirements of ISO 16119-1 for machines within the scope of this document.

This document does cover aerial safety aspects not covered by ISO 4254.

This document is not applicable to sprayers manufactured before the date of its publication, or unmanned aerial vehicles (such as drones).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1401:2016, *Rubber hoses for agricultural spraying*

ISO 5681, *Equipment for crop protection — Vocabulary*

ISO 5682-1, *Equipment for crop protection — Spraying equipment — Part 1: Test methods for sprayer nozzles*

ISO 5682-2, *Equipment for crop protection — Spraying equipment — Part 2: Test methods to assess the horizontal transverse distribution for hydraulic sprayers*

ISO 5682-3:2017, *Equipment for crop protection — Spraying equipment — Part 3: Test method to assess the performance of volume/area adjustment systems*

ISO 9357, *Equipment for crop protection — Agricultural sprayers — Tank nominal volume and filling hole diameter*

ISO 13440, *Equipment for crop protection — Agricultural sprayers — Determination of the volume of total residual*

ISO 16119-1, *Agricultural and forestry machinery — Environmental requirements for sprayers — Part 1: General*

ISO 22368-3, *Crop protection equipment — Test methods for the evaluation of cleaning systems — Part 3: Internal cleaning of tank*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5681 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
fixed wing aircraft
fixed wing aircraft approved by local or national authority equipped for the application of plant protection products and fertilizers on crops, including forestry and grasslands

3.2
rotary aircraft
helicopter (rotary) aircraft approved by local or national authority equipped for the application of plant protection products and fertilizers on crops, including forestry and grasslands

3.3
global navigation satellite system
GNSS
generic term for satellite navigation systems that provide autonomous geospatial positioning with global coverage

[SOURCE: ISO/TS 11356:2011, 3.2]

4 List of significant hazards

Table 1 specifies the significant hazards, the significant hazardous situations and significant hazardous event(s) covered by this document that have been identified by risk assessment as being relevant for this type of machine with regard to environmental contamination, and which require specific action by the designer or manufacturer to eliminate or to reduce environmental contamination.

Attention is drawn to the necessity to verify that the environmental requirements specified in both ISO 16119-1 and this document apply to each significant hazard presented by a given machine and to validate that the risk assessment is complete.

Table 1 — List of significant hazards

Hazard		Hazardous situation/event	Clause/subclause of this document
4.1	Spillages	Filling, Filters	5.1; 5.1.6; 5.5
		Mixing of plant protection product	5.1.6; 5.10.1
4.2	Contamination of the water supply	Filling	5.1.6; 5.10
4.3	Leakages	Transport and application	5.1.6; 5.6; 5.2
4.4	Overfilling	Filling	5.1; 5.1.4; 5.1.6
4.5	Dispersal of spray mix residues or plant protection products	Drainage	5.1.3; 5.1.4; 5.10.1
		Cleaning and rinsing	5.1.3;5.5; 5.10
4.6	Accidental leakages	Accidental opening of tank outlet Hose leaks	5.1.4; 5.4; 5.2
4.7	Over-dosing	Heterogeneous mixing	5.1.5
....		Overlapping	5.8; 5.9

Table 1 *(continued)*

Hazard		Hazardous situation/event	Clause/subclause of this document
		Sprayer adjustment/control	5.9.1
		Sprayer maintenance/service	5.7.2; 6
		Unintended deposition	5.4
4.8	Unintended spraying outside the target area	Deposition outside the target area	5.4; 5.9
		Spraying stop control	5.6
4.9	Drift	Spraying	5.9
4.10	Dispersal of spray mix	Intervention on the sprayer during application or service	5.8, 6,
4.11	Dripping	Spraying stop control	5.6
4.12	Aircraft collision (wire strikes)	Aircraft working	5.4

5 Requirements

5.1 General

General requirements common to all sprayer types are covered by ISO 16119-1.

5.2 Sprayer tanks

The total tank volume shall be at least 5 % more than its nominal volume for open top filling, to prevent spillage as a result of overfilling. For filling via hose connections, such as auto closing fill valves and closed transfer dry-breaks, the total tank volume shall be at least 1 % more than its nominal volume.

5.2.1 Materials

Materials used shall be resistant to plant protection products (PPP) and approved by manufacture for intended use.

5.2.2 Tank openings

The filling hole or inspection port diameter or width shall be at least 300 mm for spray tanks with a nominal volume smaller than 300 l and preferably greater than 450 mm for bigger spray tanks. Alternate means to inspect tanks may be used for tanks with smaller fill openings. To limit the risk of access into the tank, any tank opening greater than 400 mm in diameter — or, if it is rectangular, of more than 400 mm × 300 mm — shall be provided with a grating which can only be removed by the use of tools. The openings in the grating shall not exceed the above-mentioned dimensions.

The opening lid shall be sealed to avoid spillage.

5.2.3 Emptying

5.2.3.1 Tank emptying device

An emptying device shall allow the complete emptying of the residual in the tank when the aircraft is parked in a horizontal position. Complete emptying of the residual is considered to have been achieved when there are no visible puddles at the bottom of the tank after 5 min drainage.

The tank outlet shall, be guarded against accidental opening.

5.2.3.2 Residual volume

The volume of total residual volume as defined in ISO 13440:1996, 2.1 shall not exceed 2 % of the nominal tank volume. The volume of total residual shall be determined in accordance with ISO 13440 for the horizontal position only as it is readily available for aircraft.

5.2.4 Tank contents indicator(s)

The indication of contents shall correspond to ISO 9357. It shall be compatible with PPP and readable from the pilot or operator's position and from where the tank is filled. Turning of the head is acceptable.

Other means of checking the contents of the tank are allowed if they achieve equivalent accuracy.

5.2.5 Agitation

Tanks shall be designed (e.g. including recirculation/agitation systems) to ensure an even concentration of mixture. The maximum allowable mixture concentration deviation is ±15 % when tested in accordance with ISO 5682-2.

5.2.6 Filling pre-mix tank

A ground placed filling supply shall be available at the flight site (mixing/loading site) to enable proper pre-mixing of the spray liquid and filling of the aircraft spray tank. The ground filling supply shall be equipped with:

— measuring equipment like scale or flow measurement device for metering the plant protection product;

— a tank with an appropriate shape and filling opening suitable to mix the spray liquid without spillage, equipped with a tank content indicator corresponding to ISO 9357, clearly readable from the operator's position;

— a tank agitator providing a uniform concentration of PPP in the spray liquid (max ±15 % deviation when tested in accordance with ISO 5682-2);

— tank, hoses and valves that tightly close and do not leak;

— device(s) for collecting accidental leakages;

— non-pressurized filling devices shall be designed to avoid any return of liquid from the tank to the filling supply, e.g. include vacuum break design or air gap separation.

5.3 Hoses and lines

The bending radius of hoses shall be within limits recommended by the hose manufacturer. Hoses fitted or supplied with the sprayer shall comply with Type A of ISO 1401:2016. They shall be recommended for agricultural crop protection product use. All pressurized hoses shall be directly and durably marked with the maximum working pressure. Hoses and lines shall not have any deformation which can disturb the liquid. Hoses shall not be located in the aircraft cockpit or pilot's compartment. Devices in the cockpit and their accompanying hoses shall be protected, so that possible leakage cannot come into contact with the pilot.

Pressure (spray boom) lines shall be equipped with quick-acting shut-off devices that allow suction back return to the spray tank for instant de-pressurization of the spray boom, unless liquid flow is controlled by starting and stopping the pump.

5.4 Spray boom

5.4.1 Design and location

Spray booms shall have the option for non-uniform location of nozzles on propeller driven fixed wing aircraft to adjust for propeller wash and fuselage air turbulence on the spray.

For fixed wing aircraft the spray boom location shall be located in a position providing sufficient distance from the trailing edge of the wings to avoid air turbulence for normal operational spraying. For rotary aircraft the boom should preferably be forward of the rotor axis or equivalent design in order to minimize rotor wake effect. Nozzles shall be positioned to avoid wing tip or rotor vortices for agricultural applications. Deep canopy spraying, such as forestry spraying, may require nozzles and boom be positioned to utilize wake turbulence to achieve penetration and deposition on interior surfaces.

The pressure drop between the measuring point on the spray boom and hydraulic pressure nozzles/atomizers (including anti-drip device) or the orifice plate for the last open nozzle shall not exceed 10 % of the pressure shown on the pressure indicator. This test shall be performed at maximum flow rate as indicated by the manufacturer. For non-pressure-based nozzles/atomizers the pressure drop should be measured to the inlet of any flow restrictor determining flow. These test may be conducted with the spray boom dismounted from the aircraft.

5.4.2 Adjustment

It shall be possible to adjust the number and location of nozzles to optimize the spray pattern distribution.

5.5 Safety factors

Fixed wing aircraft shall be equipped with wire strike cutters, or deflectors or equivalent protective scheme, to reduce probability of loss of aircraft and spray operation control.

All operational controls shall have ergonomic considerations for location and ease of use from the normal position of the pilot and/or operator. If an emergency dump valve control is present, it shall have significantly different look and feel from other controls to prevent unintended operation.

Installed radio communication and avionics shall conform to necessary local or national air traffic regulations for transit to and from the flight site as well as the spray location.

5.6 Filters

A strainer shall be included in the filling system and shall have a mesh size less than 2 mm.

On the pressure side, the liquid going to the nozzles shall be filtered by means of central filter(s) or filters in the lines of boom sections. The size of filters shall correspond to the size of nozzles fitted on the sprayer.

The pilot or operator shall be able to detect blockages, for example by an appropriate positioning of the central pressure filters and pressure indicator(s).

Filters shall be accessible and filter insets shall be removable or flushable. It shall be possible, with the tank filled to its nominal volume, to clean central filters without any spray liquid leaking out except for that which may be present in the filter casing and any connected lines.

5.7 Nozzles/atomizers

It shall be possible to fix nozzles/atomizers in predetermined positions. Each nozzle/atomizer shall be equipped with a fast closing anti-drip device (e.g. a check-valve). It shall be possible to shut off the flow from each nozzle immediately e.g. with a fast closing anti drip device or nozzle valve. The flow rate of