

## Advice for the functional inspection of the dusters

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# SPISE

Standardized Procedure for the Inspection of Sprayers in Europe

# ADVICE

compiled by :  
SPISE Technical Working Group 8

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## Foreword

The SPISE Working Group was established in 2004 during the first SPISE workshop. There the participants welcomed the thought of Dr. Eng. Ganzelmeier (JKI) that a working group should work on further steps for the harmonization and mutual acceptance of equipment inspections. In the following years, thanks to SPISE engagement, a constant exchange of information has been made possible within the working group and consultations went on between the EC and MS on improving the sustainability of plant protection.

The founding members of the SPISE working group came from Belgium, France, Germany, Italy and the Netherlands.

In the ambit of SPISE working Group several Technical Working Groups (TWG) have been recently created with the aim to prepare **advice** about the items taken into account by the EU Directive 128/2009/EC but still not considered in the actual ISO/CEN Standards. SPISE TWG 8 in particular, has defined **advice** on what are the parts and the requirements of equipment and the criteria to use for the functional inspection of dusters.

The present document is intended to provide technical indications about the steps to follow for making the correct inspection of this equipment.

## INTRODUCTION

It is estimated that about 200000 dusters are actually in use in Europe, especially in the Southern zone. As required the EU Directive 128/2009/EC, this type of machines, employed mainly for distributing dry sulfur dust in vineyards, are subject to a mandatory functional inspection as all other kinds of equipment used for pesticide distribution.

All types of dusters actually in use, are characterized by a tank where the sulfur dust is contained and by a radial fan to generate the air flow for the dust distribution. The main difference between these, is represented by the dust extraction system from the tank wherewith it is possible to divide the equipment in two different categories:

- A) provided with a tank with internal air flow;
- B) provided with a tank without air flow.

The first category includes machines featured by two type of dust extraction system (figure 1) that consist in an adjustable opening at the bottom of the tank, from which the dust can fall on the radial fan simply by gravity or by a mechanical system. The sulfur coming from the opening is conveyed towards the spouts on the two sides of the machine by the air stream of the radial fan. In the first case (fallen by gravity) the precise dosage of the dust, is difficult due to the poor precision of the control system. Also the quality of dust distribution is generally poorly uniform (Marucco and Balsari, 2004), with deposits on leaves and bunches that generally are below 50% of the amount applied. The second type of dust extraction system allow a more precise dosing of the sulfur dust and can improve the quality of dust distribution with respect to the first one.

The second category of dusters regards a more advanced type of machines (figure 2), featured by pneumatic systems to extract the powder from the tank. This category and these provided with the mechanical dust extraction system allow a more precise dosing of the sulfur dust and can improve the quality of dust distribution respect to the conventional models (Marucco and Balsari, 2004).

Actually no EN or ISO Standards concerning the requirements and methods of brand new dusters performances' verification or for the functional inspection of those in use are available. This considered,

SPISE working Group members believe it is necessary to provide a specific **SPISE Advice** on how to make the functional inspection of dusters following, when possible, the harmonized Standard EN ISO 16122 (parts 1 for general components and part 3 for dosing systems, if provided) and some of the referring documents realized and used by some Member States, where this type of equipment are already inspected (Spanish manual for the functional inspection of the sprayers in use downloading at: [http://www.mapama.gob.es/es/agricultura/temas/medios-de-produccion/manualdeinspecciondeequiposdeacuerdoalanormaune-en13790\\_tcm7-422883.pdf](http://www.mapama.gob.es/es/agricultura/temas/medios-de-produccion/manualdeinspecciondeequiposdeacuerdoalanormaune-en13790_tcm7-422883.pdf)).

This SPISE advice is divided in two different sections, which refer respectively to the pre-inspection and to the inspection.

The first regards all the preliminary controls made by the inspector at the beginning of the inspection and mainly consists of visual checks. The parts of this section are common to both categories of dusters previously described (A and B).

The second section regards the test methods and the procedures to realize the functional check of the equipment and the instruments necessary to carry out the measurements. For this reason, in some part of the section, the test methods described are specific referred to each of the two categories of dusters.



Fig. 1 - Example of conventional duster (category A) (Photo: DiSAFA)



Fig. 2 - Example of pneumatic duster (category B) (Photo: DiSAFA)

## PRE-INSPECTION

### 3.1 Cleaning

The sprayer shall be clean externally and internally. Shall not be there any pesticide residues into the tank or on the external surface (figure 3) that can be a source of contamination for the inspector or the environment.

Method of verification: visual check.



Fig. 3 - Examp



### 3.2 Power transmission parts and moving parts of the equipment

The power take-off (PTO) drive shaft, the power input connection (PIC) and the universal joints shall be equipped with suitable and undamaged guards and protective devices, that shall work properly (figure 4).

Method of verification: visual check.



Fig. 4 - Example of t

AFA)

### 3.3 Structural parts and framework

Structural parts and framework of the duster shall be without permanent deformation, significant corrosion or considerable defects.

The hitching device shall be in good condition and shall work properly.

Method of verification: visual check.

### 3.4 Lockable foldable parts

Locking of foldable parts of the duster, if present, shall works properly and without defects.

Method of verification: visual check.

### 3.5 Blower

#### 3.5.1 General

The blower (fan, casing) shall be without mechanical deformations, excessive wear and corrosion that could be able to significant vibration or malfunctions. (figure 5)

Moreover it shall be verified that:

- all blades are present and without damages;
- guarding to prevent access to the fan is present and in good conditions.

Method of verification: visual and functional check. Measurement according to 4.6.



Fig. 5 - Example of the blower and its guarding (Photo: DiSAFA; Spanish manual for the inspection of the sprayers in use)

#### 3.5.2 Clutch

If the blower is provided with a clutch to switched off it separately from other driven parts of the sprayer, this device shall function properly (figure 6).

Method of verification: visual and functional check.



Fig. 6 - Example of the clutch to switched off the blower (Photo: Spanish manual for the inspection of the sprayers in use)

### 3.6 Static discharge devices

All metallic parts of the equipment that can conduct static electricity (framework, screw conveyor, blower, controls and regulation systems, cables) shall be connected with a static discharge device (figure 7).

Method of verification: visual check according to 5.1.



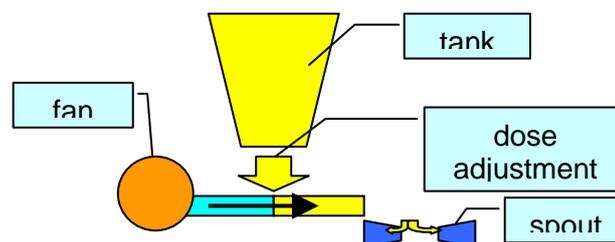
Fig. 7 – Example of static discharge devices (Photo: Spanish manual for the inspection of the sprayers in use)

## INSPECTION

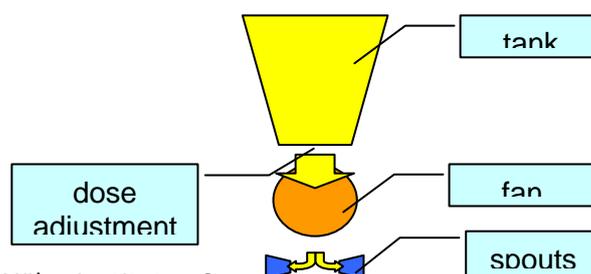
### 4.1 Tank

The inspection of the tank is different between the two dust extraction systems available.

- Tank without internal air flow (A- conventional duster: mechanical and gravity dust extraction) (figure 8)
- Tank with internal air flow (B- pneumatic duster: pneumatic dust extraction) (figure 9)



**Mechanical dust extraction**



**Gravity dust extraction**

Fig. 8 – Scheme of the two type of tank without internal air flow (Photo DiSAFA)

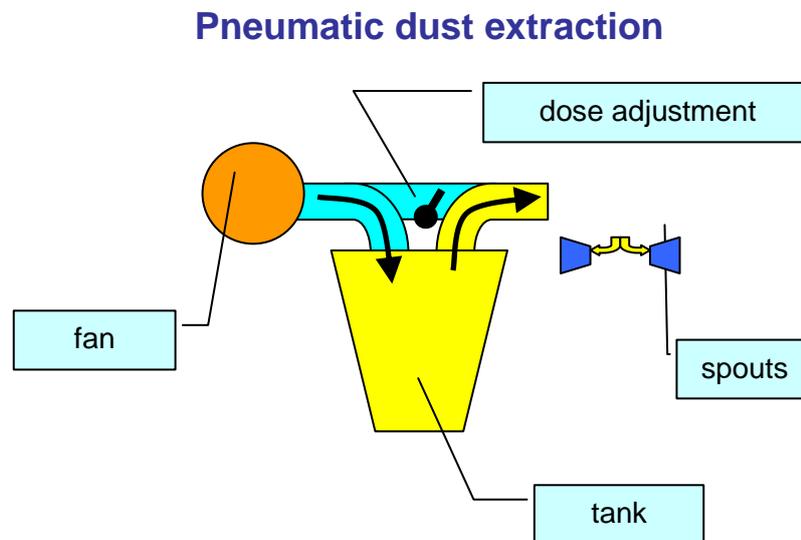


Fig. 9 – Scheme of the tank with internal air flow (Photo DiSAFA)

#### 4.1.1 Lid (For tank category A and B)

The duster tank shall be provided with a suitable lid that shall be tightly sealed to prevent any dust dispersion and shall avoid unintended opening (figure 10).

Method of verification: visual check



Fig. 10 – Example of lid and filling hole (Photo DiSAFA)

#### 4.2 Filling hole

The diameter of the tank filling hole should allow a safe and easy introduction of the dust in the tank.

Method of verification: visual check

#### 4.3 Tank agitation system

##### 4.3.1 Tank category A (tank without internal air flow)

The mechanical agitation system in the tank, if present, shall work properly (figure 11).

Method of verification: functional check. Measurement according to 5.2.1.

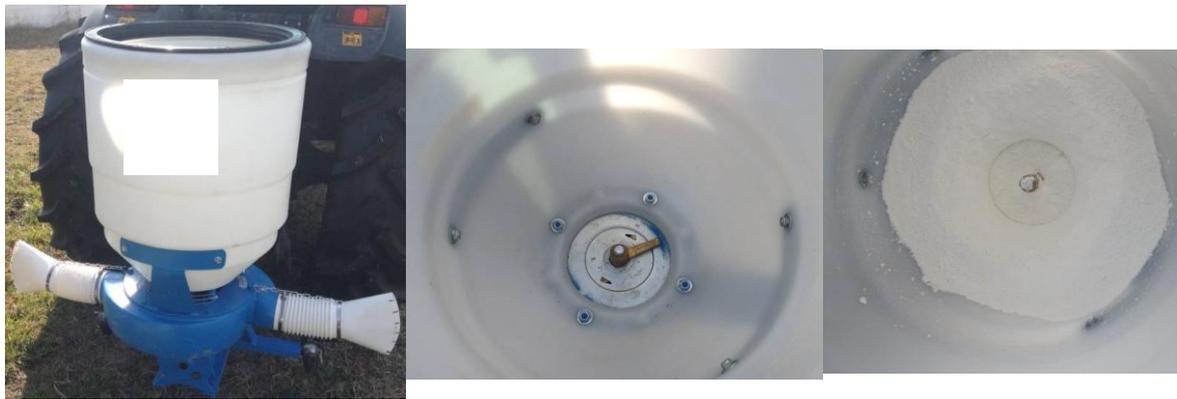


Fig. 11 – Example of mechanical agitation system (Photo DiSAFA)

#### 4.3.2 Duster category B (tank with internal air flow)

The agitation system in the tank, generated by the internal air flow it shall assure a correct agitation (figure 12).

No leakages shall be present from the tank.

The lid shall be airtight (pressurized tank).

Method of verification: functional check. Measurement according to 5.2.2.



Fig. 12 – Example of agitation system generated by the internal air flow (Photo DiSAFA)

#### 4.4 Pipes and hoses for the dust extraction and distribution (Equipment category A and B)

Shall not be present air leakages from pipes and hoses for the dust extraction.

Method of verification: functional check. Measurement according to 5.3.

#### 4.5 Controls and regulation systems

##### 4.5.1 System for switching on/off the dust distribution

The system for switching on or off the dust distribution shall operate properly.

The duster must be equipped with a system which allows to carry out the distribution from one side only (figure 13).

Method of verification: functional check.

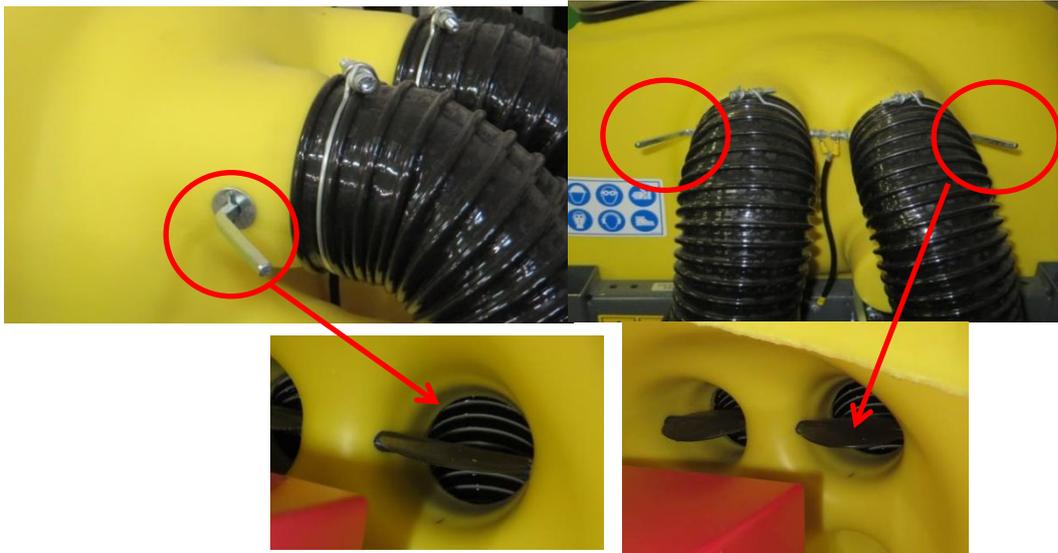


Fig. 13 – Example of system for switching on or off the dust distribution from one side only (Photo: DiSAFA)

#### 4.5.2 Device for adjusting the dust rate

##### 4.5.2.1 General

Device for adjusting the dust rate shall work properly.

This device shall be lockable in the intended dose rate position and shall be provided with a zero position that enables to switch off the machine without spreading any dust from the spouts (figure 14).

Method of verification: visual and functional check



Fig. 14 – Example of device for adjusting the dust rate provided with a zero position that enables to switch off the machine without spreading any dust from the spouts (Photo: DiSAFA)

#### 4.5.2.2 Indications to select the intended rate

The device for adjusting the dust rate shall be provided with clear indications (marks) to select the intended rate and shall be operated from the operator's position during working (figure 15).

Method of verification: visual check.



Fig. 15 – Example of device for adjusting the dust rate (Photo: DiSAFA)

### 4.6 Blower

#### 4.6.1 Air speed outlet symmetry

The air speed outlet shall be symmetrical on the left and right hand side

The measurement (optional) of the air speed has to be carried out at the spouts and 1.5 m away from them.

The maximum difference of the average air speed between the corresponding measurement position at the two sides shall be  $\pm 20\%$ .

Method of verification: Visual check. Optional functional check according to 5.5.1.

#### 4.6.2 Fan rotational speed

The blower shall be checked verifying the absence of vibrations (due to imbalance), friction between the body and the fan or wrong orientation of the blades.

The fan rotational speed shall not differ by more than  $\pm 10\%$  compared to values indicated by the manufacturer.

Method of verification: visual check. Optional functional check according to 5.5.2

## TEST METHODS

### Check of static discharge devices

The static discharge devices shall be checked with a visual inspection of the connection of all the metallic parts of the dusters.

## Check of the agitation system

### 5.2.1 Tank category A (tank without internal air flow)

Verify the movement (rotation and frequency) of the mechanical agitation devices into the tank (without using dust) with the machine working at the PTO rotation speed indicated by the manufacturer.

### 5.2.2 Tank category B (tank with internal air flow)

Shall not be present air leakages from the tank. To check it, it is necessary to use the fan at the maximum velocity indicated by the manufacturer (without dust into the tank), measuring the leakages along the tank surface with an anemometer at a distance of 5 cm (figure 16).



Fig. 16 – Check of the tank leakages using an anemometer

(Photo: Spanish manual for the inspection of the sprayers in use)

## Check of pipes and hoses for the dust extraction and distribution

The leakages have been checked with a functional/visual inspection.

## Check of device for adjusting the dust rate

### Duster with mechanical extraction

- If the device is equipped with an adjustable outlet, it is necessary to test that the different positions of the dosing system (maximum, minimum and average opening) corresponding with those indicated by the manufacturer.

- If the device depends on the rotation speed of the extraction system, with the rotation activated and the tank empty (without dust), it is necessary to test the velocity corresponding to each gear.

Then the gear sequence detected shall be checked with those indicated by the manufacturer.

### Duster with an air flow extraction

With the tank empty (without dust), setting subsequently the maximum and minimum positions of the dosing system, and then check if these correspond to those indicated by the manufacturer.

## 5.5 Check of the blower (optional)

### *Air speed outlet (symmetry)*

Measurements shall be carried out on the two sides of the machine with an anemometer.

The machine shall be positioned with the center of the spouts at a height of 0.5 m from the ground and with a PTO speed of 540 rpm.

The air velocity shall be measured in correspondence of the edge of the spouts.

The vane probe of the anemometer shall be positioned in at least 6 different positions along the spout profile and at a distance of 1.5 m from the center of the machine (considering a typical vineyard inter-row distance of 3 m) at three different heights from the ground (referred to typical vineyard canopy heights): 0.5; 1.0 and 1.5 m (figure 19).

Requirements of the instrument to be used for test (anemometer) are:

Accuracy: 0,1 m/s

Scale end value: 60 m/s

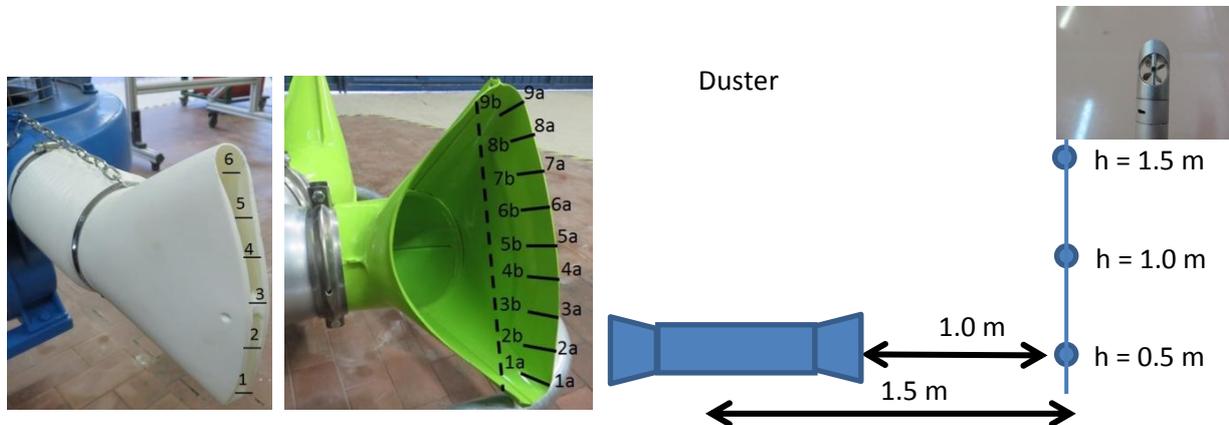


Fig. 17 – Positions of the anemometer along the spouts profile, and distance from the machine, during measures (optional) of the air speed outlet symmetry (Photo: DiSAFA tests, 2016).

### **Fan speed (optional)**

The fan rotational speed shall be measured at the nominal working range of PTO velocity indicated by the manufacturer.

To carry out the test, using a tachymeter measuring the revolution of the fan shaft or considering the revolution of one of the fan blades (figure 18).

Requirements of the instrument to be used for test (tachymeter) are:

Accuracy: 1 rev/min

Scale end value: 5000 rev/min



Fig. 18 - Check of the fan rotational speed with the tachymeter (optional)

(Photo: Spanish manual for the inspection of the sprayers in use)

## REFERENCES

EN ISO 16122-1 (2015) - Agricultural and forestry machinery - Inspection of sprayers in use - Part 1: General.

EN ISO 16122-3 (2015) - Agricultural and forestry machinery - Inspection of sprayers in use - Part 3: Sprayers for bush and tree crops.

Marucco P., Balsari P. (2004) – Tecnologie innovative per la distribuzione dello zolfo in polvere in vigneto. Atti Giornate Fitopatologiche 2004, Montesilvano (Pescara, Italia), 4-6 maggio 2004, Vol. 1, 273-278.

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