

# SPISE

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Standardized Procedure for the Inspection of Sprayers in Europe

# ADVICE

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## **ADVICE for quality assurance of the workshop activity including test facilities**



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This document has been compiled by the SPISE Technical Working Group 4

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## 1 Foreword

The SPISE Working Group was established in 2004 during the first SPISE workshop. There the participants welcomed the thought of Dr. 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.

In the ambit of SPISE working Group several Technical Working Groups (TWG) have been recently created with the aim to prepare guidelines 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 4 (°), in particular, has defined guidelines on how certificate the activities of the workshops who performs the inspections. The guideline will contain an example of a quality assurance system, what will include the activities of the workshops but also the activities in the total inspection scheme needed to guarantee the constant quality of the performed inspections.

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## 2 Introduction

When introducing an inspection scheme for the periodical inspection of sprayers in use, important for the effectiveness of this system and for the acceptance and support of the inspections amongst the farmers, is the quality and uniformity of the performed inspections. The complete inspection scheme must provide all the needed materials, protocols and checks to ensure this quality and uniformity.

The base of the inspections are the requirements in the European Directive 2009/128 article 8 and Annex 2. For the most common sprayer types this requirements in Annex 2 are in detail specified in the harmonized standards of the EN-ISO 16122 series. The inspections have to be executed by inspectors who are well trained in how to use this standards and who's knowledge is also kept up to date by means of periodical refreshing courses. The measuring equipment used during the inspections has to be in line with the harmonized standards and accurate, but it must be ensured that during time, the accuracy and condition of the testing equipment stays on the required level.

To keep the quality of the performed inspections good and the output uniform, a system of quality assurance is needed. This system also has to include elements of quality control, both on the performed inspections as on the testing equipment.

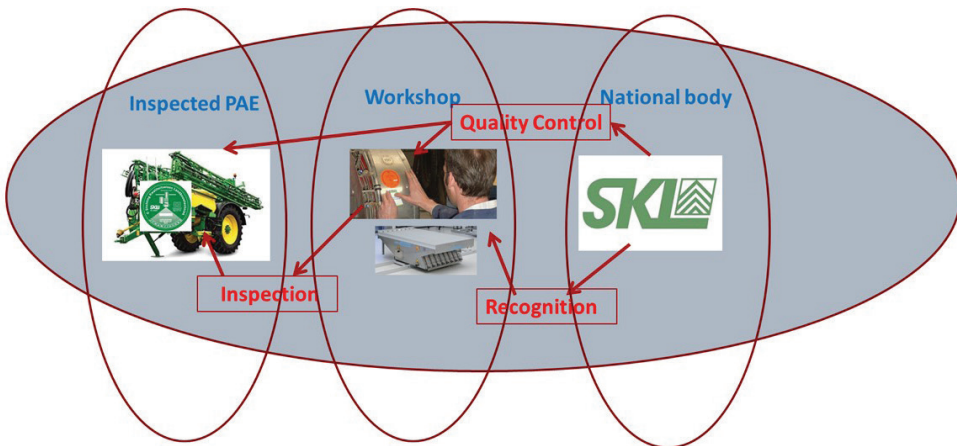
For mutual recognition of performed inspections between the different member states in the EU, trust in the different systems in Member States is essential. Therefore definition of the minimum requirements for the development of systems for quality assurance in all Member States is needed. This SPISE Advice will define this minimum requirements.

This Quality Assurance System will include elements like training of the inspectors, requirements of the workshop facilities, inspection procedure, quality control on the performed inspections, calibration of testing equipment, registration of the performed inspections and a procedure about how to deal with non-conformities.

The basic elements of such a quality assurance system needs to be implemented through all European countries in order to reach a working system of mutual recognition and a meaningful output of the effort to establish a system of periodical inspection of all sprayers in use with full support of the owners of sprayers.

### 3 Inspection scheme

How the inspection scheme is organized can differ from country to country. This depends on specific demands, history, national legislation and policy. But most general is organisation where national body is responsible for the correct organisation and supervision and recognized workshops who inspect the sprayers of the farmers.



**Figure 1** Example of a sprayer inspection scheme

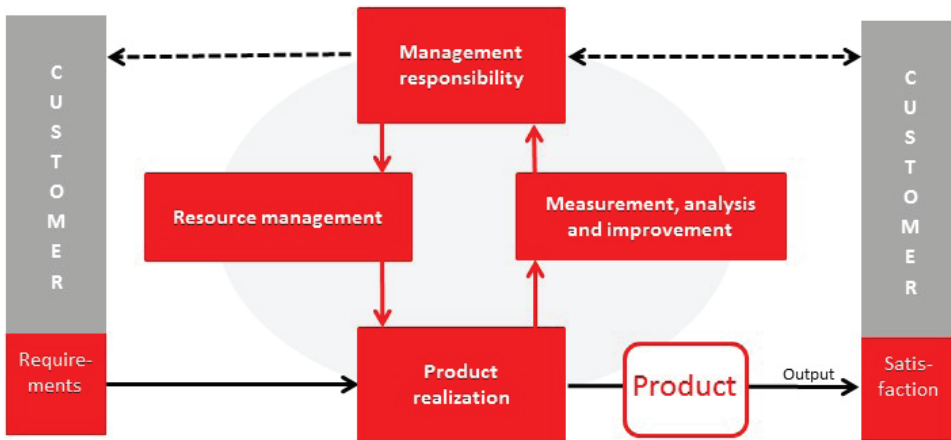
## 4 Quality Assurance System

### a. General

To guarantee the quality and uniformity of the inspected sprayers a Quality Management System is needed, what will cover all aspects and processes of the complete inspection scheme. From the development of criteria to the inspection them self, including the test report and sticker on the machine.

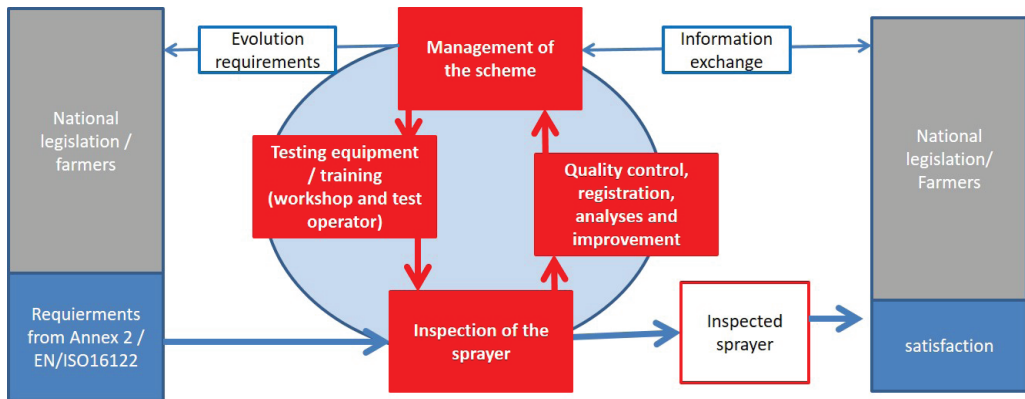
This SPISE Advice is not meant to develop a QMS ready for certification for ISO9001 or ISO17020, but is meant to create a QMS to perform the inspections in a right and uniform way. But the general principles of this management systems are included in this guideline.

A general figure for the layout of a QMS system bases on ISO9001 is:



**Figure 2** Typical layout of system acc. to ISO9001

When this layout is adapted to a sprayer inspection scheme it will be like this:



**Figure 3 General layout sprayer inspection scheme**

Where the inputs are:

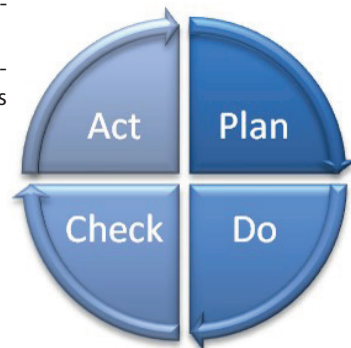
- The national implementation of the demands from Article 8 from the EU directive 2009/128/EC (i.e. frequency, types of sprayers what have to be tested, etc.)
- The requirements what are in Annex 2 of 2009/128/EC: Health and safety and environmental requirements relating to the inspection of pesticide application equipment. And for sprayer types where harmonized standards are developed for, the standard EN-ISO 16122.
- Specific national/regional demands, like national legislation, specific demands, specific organisational structures what are already available.

The output is:

- Inspected and approved sprayer according to the guidelines complete with test report and sticker.

Important is that the QMS is shaped according to the well known Plan-Do-Act circle, that the system is developed for a continuous improving of all elements, procedures and documents.

This means that the feedback from workshops, authorities, inspectors and farmers will be used as input for this improvement.



**Figure 4 The Plan-Do-Check-Act-Circle**

b. Outline of the total inspection scheme:

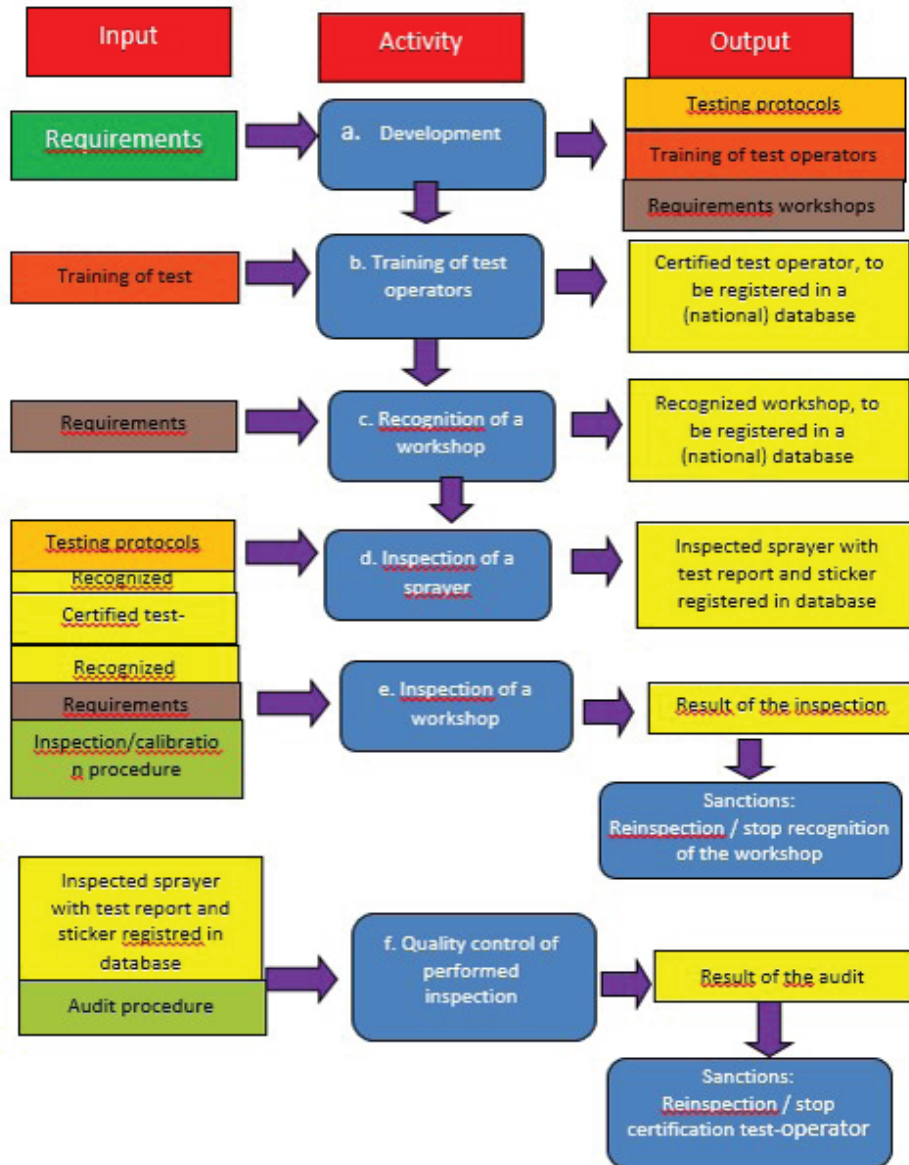


Figure 5 The outline of the total inspection scheme

In the following paragraphs the activities, documents and procedures will be described.



### c. QMS: Activities

In the Quality Management System (QMS) the following activities are present:

#### a. Management/development documents and procedures

The objective of this activity is to manage the system, to develop and maintain the procedures and to develop and maintain the guidelines gathered around 3 theme's:

##### 1. Testing protocols

- a. Testing protocols for all types of sprayers
- b. Inspection procedure (incl. registration of the results)
- c. Test – reports (content / layout) and stickers (content / layout)

##### 2. Training of the inspectors

- a. Entrance level
- b. Content and length of the training
- c. Definition of the entrance level and the end level the trainees have to reach.
- d. Refreshing courses (frequency / content)

##### 3. Requirements workshops

- a. Requirements workshops
- b. Requirements testing equipment
- c. Requirements for the periodical calibration of the testing equipment

#### b. Training of the test-operators

The aim of this activity is a proper training of the test operators. Important is that they have enough skill to perform the inspections in line with the formulated testing protocols, give the correct interpretation of the measuring results of the testing equipment, give the owner of the sprayer a clear advice and fill in the test report in the right way.

Therefore a basic trainings course with both clear entrance – and end levels is needed. To keep the knowledge and skills of the test operator's periodical refreshing courses are needed.

Independency between the inspector and the owner of a sprayer is important

#### c. Recognition of the workshops

The aim of this activity is to establish workshops who full fill the defined requirements, have the correct, calibrated and maintained testing equipment. The process is the initial audits of a potential workshop and the recognition if this workshop full fills all requirements.

It must be possible that the inspector can take independently decisions regarding the inspection of the machines, that there is no psychological or economical pressure on the inspector what can influence his decisions. The organisation of the workshop has to be in such a way that this is possible.

#### d. Inspection of the sprayers

This activity is the heart of all the defined activities. A trained test operator at a recognized workshop (which includes well calibrated testing equipment) inspect the sprayer following the guidelines and register the results of the inspection in the right manner. This registration of the results includes the issuing of the test reports. In article 8.6 of 2009/128/EC is stated that the national organisation issues the certificates of approved sprayers. But this registration system is also needed to create an overview of the issued certificates to inform the European Commission. The statistical information gathered from the test reports can also be used to both improve the inspection scheme and inform the owners of sprayers.

**e. Inspection of the workshop**

To have valid tests of the sprayers, it is important that the workshops and the inspectors follow the right procedures and that the testing equipment is in good condition and well calibrated. Therefore workshops have to be inspected periodically to make sure that the workshops still fulfill all requirements and that their testing equipment is in good condition. During this visit workshops will be audited on the following areas:

- Condition and calibration of the testing equipment, only with reliable and accurate testing equipment good tests of sprayers can be made.
- The testing site shall meet the minimum requirements regarding influence of weather on the testing results, treatment of used water and working circumstances for the inspectors
- The workshop management should be verified
- The inspectors shall be supervised, to check if they follow the agreed procedures before, during and after the execution of an inspection and to see if they have a valid certificate of training.

Input from the workshops and the inspectors can also be used to improve the inspection scheme.

**f. Quality control of the inspected sprayers**

To keep the quality of the performed inspections uniform, audits of the result of the inspections (i.e. inspected sprayers) are needed. The results of these audits can be used both for improvement of the system and for a sanctioning system for the workshops and/or test-operators.

These audits can be done in different ways:

- By means of an administrative control, this will be an analysis of the results of the performed inspections of the workshop, eventually compared to the national results or the results of comparable workshops or from other years
- By means of visits of the workshops while they are performing an inspection, during this visit an inspector can overlook the real execution of an inspection.
- By means of audits of already inspected machines at the farmyard. This audit has to be as short after the inspection as possible.

Also a mixture of these three possibilities can be chosen.

#### d. QMS: documents

As input for the other activities in the first activity some basic documents have to be developed. But not only developed, they have to be maintained, following the Continuous Improvement Circle. Input can come from different sources: from participants in the inspections scheme, from audits, from owners of sprayers or from developments in National or European legislation or standardisation.

The different documents are:

##### 1. TESTING PROTOCOLS

###### a. Testing protocols for all types of sprayers

For all relevant types of sprayer specific testing protocols have to be developed. This protocol can be based on harmonized standards (like EN-ISO 16122) or Annex 2 of 2009/128/EC combined with elements from harmonized standards for types of sprayers for which no harmonized standard is available. This testing protocol should contain also the pre-inspection as mentioned in EN-ISO 16122:1 (2015)

###### b. Test –report (content / layout)

Based on EN-ISO 16122:1 (2015) the test report shall contain at minimum the following information:

- Recognized workshop / test team what executed the inspection;
- Reference to EN-ISO 16122 and deviations, if any;
- Owner's identity;
- Owner's address;
- Sprayer manufacturer;
- Type of sprayer;
- Serial number or other unique identification;
- Year of construction;
- Drive (i.e. Mounted/trailed /self-propelled);
- Name and contact details of the inspector and where different the testing organization and Signature;
- Date of inspection;
- Any malfunction of the sprayer. If the malfunction is a result of sprayer design this should be noted;
- Any information on malfunctions of the sprayer useful to identify the corrective work required;
- Results of measurements.
- Final conclusion of the inspection
  - Accepted for x years (depending on national legislation)
  - Rejected, re-inspection within x weeks (depending on national legislation)

###### c. Sticker (content / layout)

By means of the content of the sticker it shall be clear for the owner of the sprayer:

- Reference to national body
- Date of expiring
- Preferably a unique number

**d. Testing procedure (incl. registration of the results)**

In this procedure the procedure how the test shall be performed, including preparation aspects as announcing an inspection in advance to authorities, formal order confirmation to the owner of the sprayers.

Also the registration aspects and the processing of the results of the test shall be part of this procedure. Included shall also aspects how to deal with stickers to be placed on the approved sprayers.

**2. TRAINING OF THE INSPECTORS****a. Content and length of the training**

Central in the course shall be how to implement the testing protocols for the different types of sprayers and how to use the testing equipment and interpreting the measuring results. Extended by knowledge about the testing scheme and legislation. Dependent on the entrance level it can be extended by knowledge of sprayers/spraying technique or it can be extended with knowledge about calibration/adjustment of sprayers.

**b. Definition of the entrance level and the end level the trainees have to reach.**

Important is that there are general entrance levels for the participants of the courses. General knowledge about and practical skills with sprayers, spraying technique and nozzle should be known.

The end level to trainees shall reach shall be clear defined and tested by means of a clear theoretical and practical examination.

**c. Refreshing courses (frequency / content)**

To keep the level of the test operators up to date, refreshing courses with a reasonable interval are important. The content should focus on new developments and new techniques but also a rehearsal of the testing protocols.

**3. REQUIREMENTS WORKSHOPS****a. Requirements workshops**

The requirements the workshops have to meet shall be clear defined:

- Type, size and focus of the enterprise
- Number of test operators
- Test location (safe and environmentally friendly testing)

**b. Requirements testing equipment**

The requirements for the testing equipment are mostly defined in relevant parts of the standard EN-ISO 16122. Important to define is if a type approval is needed, how to deal with testing equipment what is already certified in another Member State and how to deal with homemade testing equipment.

## e. QMS: procedures

The following procedures are needed:

### 1. **Development of documents**

Input of this procedure are the requirements as defined in 4.1 General. The output are the documents. This is a continuous process fed by input from sources like results from audits workshops and inspected sprayers, developments in legislation, standardisation, spraying technique and testing equipment.

### 2. **Training of test operators**

Input of this procedure are the documents with the demands for the content and end-levels of the training. Result shall be certified test operators. Based on the evaluation of the trainings and changing demands from technique, standards and legislation the content and lay-out of the training can be changed/ The certified test operators shall be registered in a central database in a uniform way. This information is used both for the recognition of workshops and for the registration of results of the inspections. SPISE TWG 5 is dealing with this subject.

### 3. **Recognition of a workshop**

Workshops shall be recognized following the demands for the workshops, the testing equipment, the testing area and the availability of a certified test-operator a potential workshop can be recognized and become an authorized workshop. This workshops has to registered in a central database.

### 4. **Inspection of sprayers**

Sprayers shall be inspected by recognized workshops by certified test operators following the relevant testing protocol. The results of the inspection shall put on a test report. Only sprayers what meet all requirements shall be approved.

### 5. **Calibration of testing equipment**

Testing equipment shall be periodical calibrated or checked on correct and accurate operation. This calibration can be done by independent laboratories, the official organisation or other to be defined organisation. Important is to describe the asked accuracy of reference methods / instruments used to the calibration.

### 6. **Registration of recognized workshops**

The recognized workshops shall be registered in a central database, this list of workshops shall be visible for the owners of sprayers.

### 7. **Inspection of a workshop procedure**

Workshops shall be periodically inspected. Their condition and calibration shall be checked and measured. The exact procedure can be found in Annex 1.

### 8. **Inspection audit procedure**

Periodical audits of the process the test operator is following when testing a sprayer or the result of this inspection (the tested and approved (or disapproved) sprayer) are needed in order the keep the quality uniform. The output of this procedure will be used in the procedure of recognition of the workshops.

## 5 Conclusion

The requirements for the sprayers in Annex 2 of the EU directive 2009/128/EC and the harmonized standards of the EN-ISO 16122 series are a good base for testing sprayers in the EU. But to have within a member state and between member states uniform inspections of a high level of quality, which is needed to reach enough support among the owners of sprayers and for an effective mutual recognition, a system of Quality Assurance is needed. This paper gives an outline and base of a future SPISE Advice on this topic. It is based on the harmonized EN-ISO standards and includes other SPISE advises on the different topics.

## Annex 1: Inspection workshop procedure

### A. Introduction

It is important that the inspections are done by workshops that meet the requirements in terms of administrative requirements, testing equipment and skills of the test-operators.

Important is that all workshops are inspected periodically. According to the standard EN ISO 16122 the testing equipment must be inspected/calibrated yearly.

During the inspections of the workshops the following items will be dealt with:

1. Check of the administrative demands, including skills of the test-operators.
2. Check if the testing site meets the requirements.
3. Registration, check of the presence, condition and performance of the testing equipment.
4. Discussion of the results of the inspection visit with the test-operators and responsible person at the workshops.

The results of this inspection will be registered using a standard checklist, which can be a part of the central registration system.

### B. Inspection procedure

1. Check of the administrative demands, including skills of the test-operators

On base of a standard checklist, the administrative requirements to the workshops will be checked.

- Administrative demands
- Commitment of the management to the sprayer inspection scheme
- Independency of decision making of the test-operators
- Others

2. Check if the testing site meets the requirements

On base of a standard checklist based on the demands of EN-ISO16122:1(2015) combined with nation/regional demand the testing site will be checked. Elements that guarantees labour-safety and environmental friendly inspections.

- Influence of weather circumstances on the measuring results
- Collection of used water during the inspection
- Discharge of exhaust gasses (if tested inside)
- Space enough for unfolding complete spray-boom

3. Check of the presence, condition and performance of the testing equipment.
  - Registration of the data of all testing equipment. All relevant data of the testing equipment will be noted and registered.
    - Type of equipment
    - Brand and type
    - Serial number
    - Year of construction
    - Further specifications
  - Check on the presence of all required testing equipment:
    - Reference manometer(s) and manometer test bench
    - Reference flowmeter and pump tester
    - Nozzle flow-rate measurement equipment
    - Mechanical patternator
    - Electronic patternator
    - Additional standard measuring equipment as in EN-ISO 16122:2, -:3 and -:4
  - Check on the condition and accuracy of the testing equipment:
  - Reference manometer(s) and test bench
    - The reference manometer will be checked to be sure that it will meet the minimum requirements as stated in 5.2.2.1. of EN-ISO 16122:2(2015)
    - Checking the condition and functioning of the manometer test-bench
    - Checking the diameter, scale and scale division and class of the reference manometer.
    - Measurement of the accuracy of the reference manometer by comparing this reference manometer with an inspection manometer (for specifications see here under) within the relevant measuring range (field crop sprayers 1-10 bar and orchard sprayers 5-15 bar)
  - Reference flow meter and pump-tester
    - The reference flowmeter will be checked to be sure that it will meet the minimum requirements as stated in 5.2.1. and 5.2.3. of EN-ISO 16122:2(2015)
    - Check of the condition of general functioning of the pump-tester and reference flowmeter
    - Check of the specifications of the reference flowmeter (flow range / pressure / predicted accuracy)
    - Measurement of the accuracy of the reference flowmeter by comparing this meter with an inspection flowmeter within the relevant measuring range (from 50-250 l/min)



- Nozzle flow-rate measuring equipment
    - The nozzle flow-rate measurement will be checked to be sure that it will meet the minimum requirements as stated in 5.2.5. of EN-ISO 16122:2(2015)
    - Mechanical measuring equipment:
      - Condition and functioning of connection to the nozzles
      - Condition of the hoses
      - Condition, content, scale division and complete emptying of measuring glasses
  - Electronic measuring equipment
    - Check on general condition
    - Check on connection to the nozzle
    - Measurement of the accuracy by comparing the results of the measuring device to a reference (with a scale/measuring glass or reference device) with the relevant measuring range (0.50 l/min to 2.0 l/min)
  - Patternator
    - The patternator will be checked to be sure that it will meet the minimum requirements as stated in 5.2.4. of EN-ISO 16122:2(2015)
    - Mechanical patternator
      - Check on general condition, functioning and dimensions
      - Check on condition gutters
      - Check on condition measuring glasses
      - Measurement of distance between top of gutters
    - Electronic patternator
      - Check of the rails (general condition, flatness and spacing of the reference points)
      - Check on the general condition of the measuring wagon
      - Check on tightness of the measuring glasses
      - Check on functioning of the sensors
      - Measurement of the accuracy of the measurement following the procedure as described by the manufacturer
4. Discussion of the results of the inspection visit with the test-operators and responsible person at the workshops.

The results of the inspection of the workshops testing site and equipment will be discussed with the test-operator and the owner of the workshop.

**C. Specifications measuring equipment**

1. Reference manometer
  - According to EN-837:1(1997), 10.2. the accuracy of the calibration equipment must be 3 or 4 times as accurate as the device to be checked.
  - The reference device must be calibrated annually by a certified calibration laboratory
2. Reference flow meter
  - As for the reference manometer also the reference flow meter must be 3 to 4 times as accurate as the flow meter to be tested. This means that the accuracy of the reference flow meter must be 0,5% in the range of 25-250 l/min
  - The reference device must be calibrated annually by a certified calibration laboratory
3. Reference for checking electronic nozzle flow rate measuring device
  - If a scale is used, this scale must also be 3 to 4 times as accurate as the measuring device. This means 0,5% in the area of 500 – 2000 gr.
  - If a special device is used, this must have an accuracy of 0,5% in the range of 0,5 – 2,0 l/min
4. Reference for checking electronic patternators
  - No standard measuring device is on the market, but the procedure including the measuring device to be used shall guarantee the accuracy that is 3 to 4 times as accurate as the measuring devices.

## Annex 2: Example of a checklist

<b>Administrative demands:</b>		
Is the workshop recognized	Yes	No
Has the inspector a valid certificate	Yes	No
Has the workshop the correct documents	Yes	No
<b>Test site</b>		
Is the testing site protected against weather circumstances (wind/rain)	Yes	No
Is the used water collected and treated properly	Yes	No
(when testing inside) Are the exhaust gasses discharged properly	Yes	No
Has the test site enough space to perform the inspection properly (folding booms) and safe?	Yes	No
<b>Testing equipment</b>		
<b>A. Reference manometer(s)</b>		
• Diameter (analogue)	Yes	No
• Scale (analogue)	Yes	No
• Class	Yes	No
• Accuracy	Yes	No
• Functioning test bench/connection to sprayer	Yes	No
<b>B. Reference flowmeter/pump tester</b>		
• Scale (analogue)	Yes	No
• Range	Yes	No
• Accuracy	Yes	No
• General functioning complete testing installation (connecting to sprayer/transparent part/safety valve/pressure adjusting device/pressure gauge)	Yes	No
<b>a. Patternator (mechanical)</b>		
• General condition/functioning/dimension	Yes	No
• Condition gutters	Yes	No
• Distance gutters	Yes	No
• Condition and accuracy measuring glasses	Yes	No
<b>b. Patternator (electronic)</b>		
• Condition of rails (general condition/flatness/spacing reference points)	Yes	No
• Condition and functioning of measuring wagon	Yes	No
• Distance upper points separation plates	Yes	No
• Condition and tightness of measuring glasses (incl. opening/closing system)	Yes	No
• Accuracy of the measurements	Yes	No
<b>c. Nozzle flow-rate tester (mechanical)</b>		
• Condition and en functioning of the connection to nozzles	Yes	No
• Condition of hoses	Yes	No
• Condition and accuracy of measuring glasses	Yes	No
• General condition	Yes	No
<b>d. Nozzle-flow rate tester (electronic)</b>		
• Condition and functioning of the connection to nozzles	Yes	No
• Accuracy of the measurements	Yes	No

## **SPISE – Standardized Procedure for the Inspection of Sprayers in Europe**

Established in 2004 by founding members from Belgium, France, Germany, Italy and the Netherlands, the SPISE Working Group aims to further the harmonisation and mutual acceptance of equipment inspections. In regular meetings, several Technical Working Groups (TWG) 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. The present document is intended to provide technical instructions and describes a procedure which is not mandatory but can be voluntarily adopted in the course of inspection or calibration.

Further information can be found at <https://spise.julius-kuehn.de>

An electronic version of this document is freely available at [https://www.openagrar.de/receive/openagrar\\_mods\\_00033080](https://www.openagrar.de/receive/openagrar_mods_00033080)

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