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- Other measuring devices
Pipes and hoses
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- Bending/abrasion
Filtering
- Filter presence
- Cleaning, if applicable
- Filters inserts changeability

First European Workshop
on
Standardized Procedure for Inspection of Sprayers in Europe
-SPISE –

27 to 2004
Braunschweig

European Standard EN 13790 the basis for sprayer inspection in Europe

Dr.-Ing Heinz Ganzelmeier

European Standard EN 13790
Inspection of sprayers in use - Part 1

Agricultural machinery - Sprayers - Inspection of sprayers in use - - EN 13790

During recent years, several countries have developed systems for inspection of sprayers in use. Developments in this direction have been stimulated by public concern about risks, and the aim of reducing the use of crop protection products.

However, there are three main arguments for the inspection:

- test operator safety
- less potential risk of SPISE l contamination by crop protection products
- good control of the pest with the minimum possible input of crop protection product.

This European Standard consists of the following Parts, under the general title Agricultural machinery — Sprayers - Inspection of sprayers in use:

- Part 1: Field crop sprayers
- Part 2: Air-assisted sprayers for bush and tree crops

European Standard EN 13790
Inspection of sprayers in use - Part 1

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This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2003, and conflicting national standards shall be withdrawn at the latest by November 2003.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slova weden, Switzerland and the United Kingdom.

SPISE

The following Candidate Countries are already a member of CEN since 01 January 2004: Estonia, Lithuania, Latvia, Poland, Slovenia, Cyprus.

In order to use crop protection products in agricultural production in Europe safely, it is necessary to define the requirements and test methods for sprayers in use.

European Standard EN 13790
Inspection of sprayers in use - Part 1

This is a relevant step after having standardized the requirements for new equipment, in respect of safety hazards (see EN 907) and potential risks of environmental contamination (see EN 12761 Parts 1 to 3).

The inspection of sprayers in use can be done on a voluntary or mandatory basis.

In both cases further official or legal specifications are necessary, e.g. on the execution management of the inspection, which organisations are authoris[illegible]ut the inspection, time intervals between inspecti[illegible]

As the specifications of this European Standard are based on EN 907 and EN 12761, it may be the case that sprayers in use which were produced before EN 907 and EN 12761 came into force do not fulfil all the specifications given in this European Standard.

European Standard EN 13790
Inspection of sprayers in use - Part 1

Standardising the requirements and methods for inspection of sprayers in use, takes into consideration not only the original performance of the spraying equipment, but also its use, care and maintenance. This is the logical link between new equipment of good quality and well educated and concerned users.

This European Standard specifies the requirements and methods of their verification for the i[illegible] sprayers in use.

It relates mainly to the cor[illegible] sprayer in respect of safety hazards for the test operator, the potential risk of environmental contamination and opportunities to achieve good application.

The compliance with the requirements defined in the following clauses shall be checked by
--inspection,
--function tests and
--measurements.

European Standard EN 13790
Inspection of sprayers in use - Part 1

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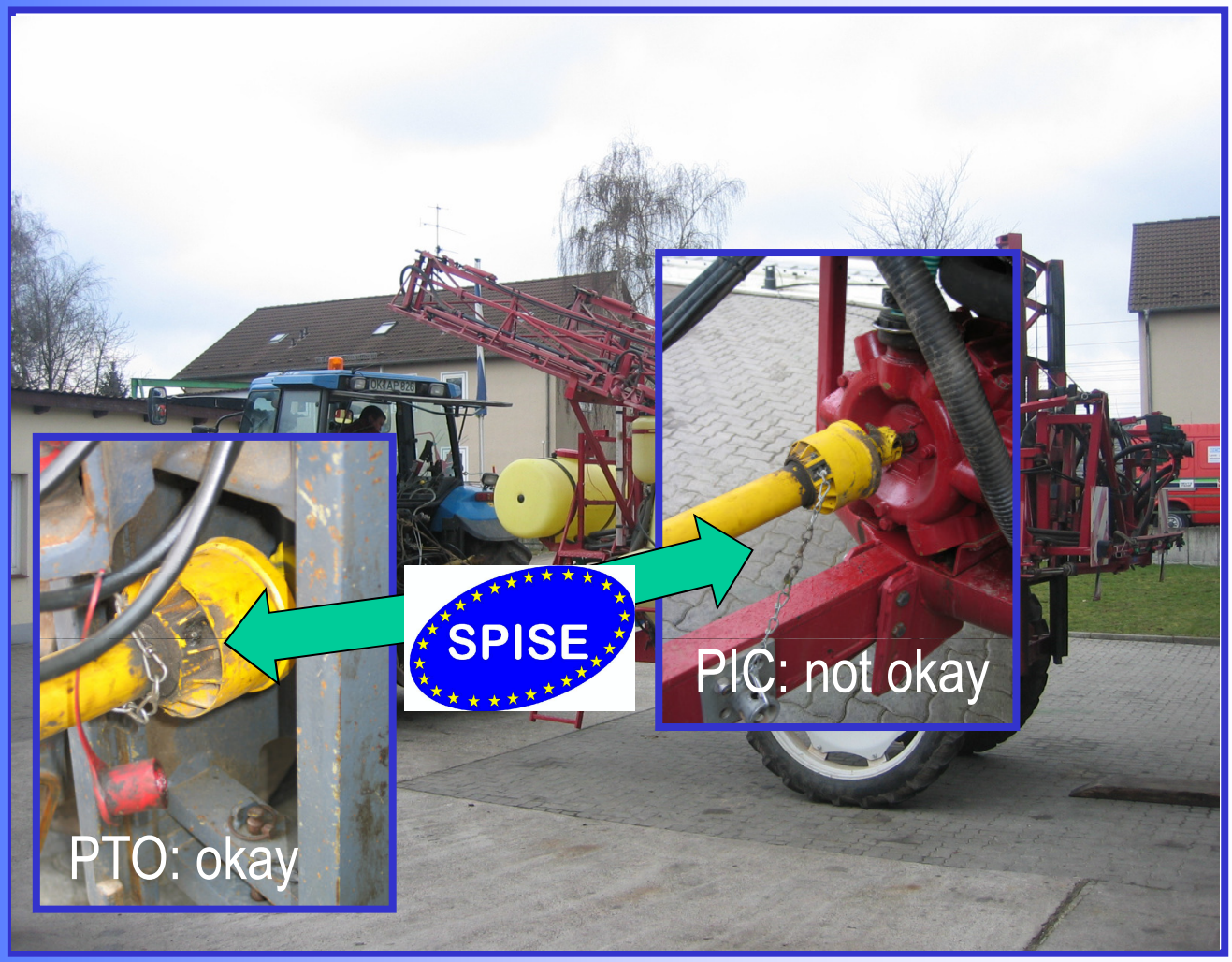

4.1.1
The power take-off (PTO) drive shaft guard and the guard of the power input connection (PIC) shall be fitted and in good condition:

The protective devices and any moving or rotating power transmission parts shall not be affected in their function.

Method of verification: inspection and function test.

European Standard EN 13790
Inspection of sprayers in use – Part 1

Power transmission parts
PTO drive shaft guard
supporting the PTO
Pump
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- Pressure safety valve, if applicable
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Agitation

Spray liquid tank
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Measuring systems, controls and regulation systems
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- Bending/abrasion

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- Filter presence
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4.2.1
The pump capacity shall be suited to the needs of the equipment.

a) The pump capacity shall be at least 90 % of its original nominal flow, given by the manufacturer of the sprayer.

Method of verification: measurement according to 5.2.1.a); or

European Standard EN 1
Inspection of sprayers in use

Power transmission parts
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Agitation

Spray liquid tank
- Leakages
- Strainer
- Grating, if applicable
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- Can cleaning device, if applicable

Measuring systems, controls and regulation systems
- Reliability/leakages
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Pipes and hoses
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- Bending/abrasion

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4.2.1

b) the pump shall have sufficient flow rate capacity in order to be able to spray at maximum working pressure as recommended by the sprayer or the nozzle manufacturer during test with the larges nozzles mounted on the boom while maintaining a visible agitation as specified in 4.3.

Method of verification: measurement according to 5.2.1.b).

European Standard EN 13790
Inspection of sprayers in use - Part 1

Power transmission parts
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- Leakages

Agitation
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Measuring systems, controls and regulation systems
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- Operation of controls
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- Other measuring devices

Pipes and hoses
- Leakages
- Bending/abrasion

Filtering
- Filter presence
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4.2.2
There shall be no visible pulsations caused by the pump.

Method of verification: inspection and function test.

European Standard E
Inspection of sprayers in use

Power transmission parts
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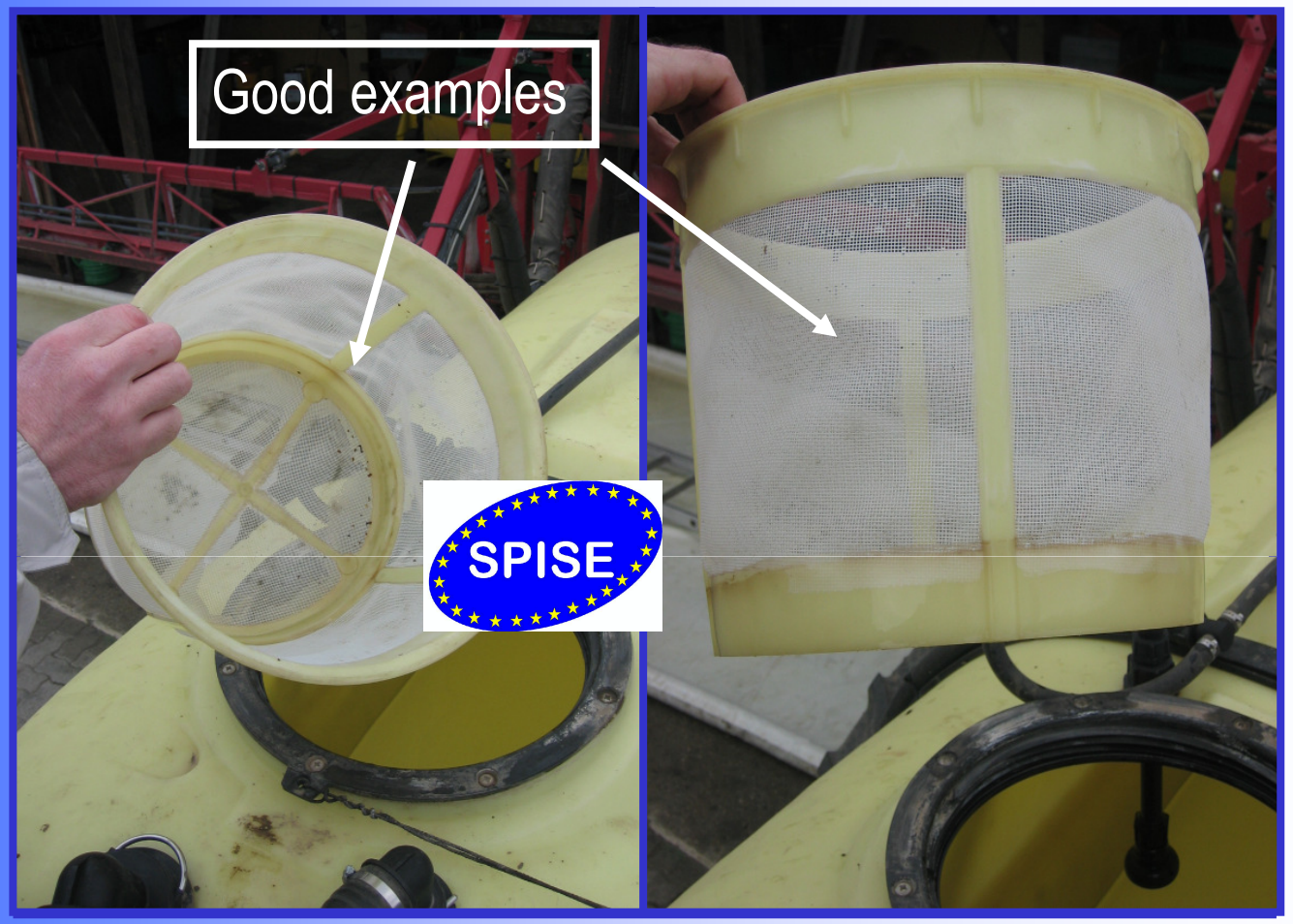

4.4.2
There shall be a strainer in good condition in the filling hole.

Method of verification: inspection.

European Standard EN 13790
Inspection of sprayers in use - Part 1

Power transmission parts
PTO drive shaft guard
supporting the PTO
Pump
- Capacity
- Pulsations
- Pressure safety valve, if applicable
- Leakages
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Spray liquid tank
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Measuring systems, controls and regulation systems
- Reliability/leakages
- Operation of controls
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Pipes and hoses
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- Bending/abrasion
Filtering
- Filter presence
- Cleaning, if applicable
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SPISE

4.4.5
There shall be a clearly readable liquid level indicator on the tank which is visible from the driver's position and from where the tank is filled.

Method of verification: inspection.

European Standard EN 13790
Inspection of sprayers in use - Part 1

Power transmission parts
PTO drive shaft guard
supporting the PTO
Pump
- Capacity
- Pulsations
- Pressure safety valve, if applicable
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Agitation
Spray liquid tank
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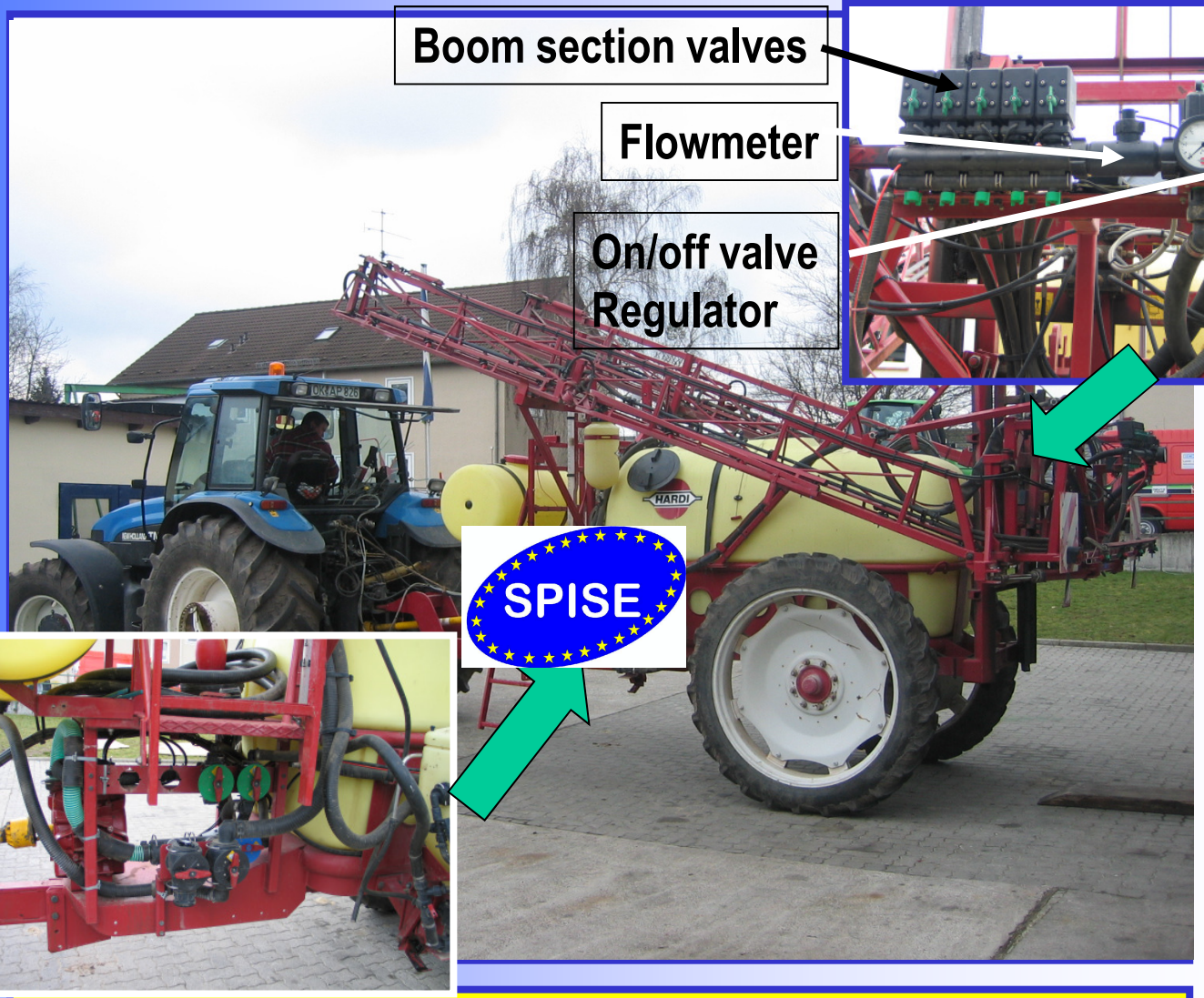
- Chemical introduction container, if applicable
- Can cleaning device, if applicable

Measuring systems, controls and regulation systems

- **Reliability/leakages**
- Operation of controls
- Pressure gauge
- Other measuring devices

Pipes and hoses
- Leakages
- Bending/abrasion

Filtering
- Filter presence
- Cleaning, if applicable
- Filters inserts changeability



4.5.1

All devices for measuring, switching on and off and adjusting pressure and/or flowrate shall work reliably and there shall be no leakages.

Method of verification: inspection and function test.

European Standard EN 13
Inspection of sprayers in use

Power transmission parts
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Measuring systems, controls and regulation systems
- Reliability/leakages
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- Pressure gauge
- Other measuring devices
Pipes and hoses
- Leakages
- Bending/abrasion
Filtering
- Filter presence
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- Filters inserts changeability

Turning of the head and the upper body is acceptable

SPISE

4.5.2
The controls necessary for spraying shall be mounted in such a way that they can be easily reached and operated during the application and information provided for example on displays that can be read respectively.
Switching off and on of all nozzles shall be possible simultaneously.

Method of verification: inspection

European Standard EN 13790
Inspection of sprayers in use - Part 1

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Measuring systems, controls and regulation systems
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- Operation of controls
- **Pressure gauge**
- Other measuring devices
Pipes and hoses
- Leakages
- Bending/abrasion
Filtering
- Filter presence
- Cleaning, if applicable
- Filters inserts changeability

The scale shall be marked:
<5 bar: 0,2 bar
5-20bar: 1,0 bar
>20 bar: 2,0 bar

4.5.3 / 4.5.4
The scale of the pressure gauge shall be clearly readable and suitable for the working pressure range used.

Method of verification: inspection.

European Standard EN 13790
Inspection of sprayers in use - Part 1

Minimum diameter: 63 mm

4.5.5
For analogue pressure gauges the minimum diameter of the pressure gauge cases shall be 63 mm.

Method of verification: measurement.

European Standard EN 13790
Inspection of sprayers in use - Part 1

Power transmission parts
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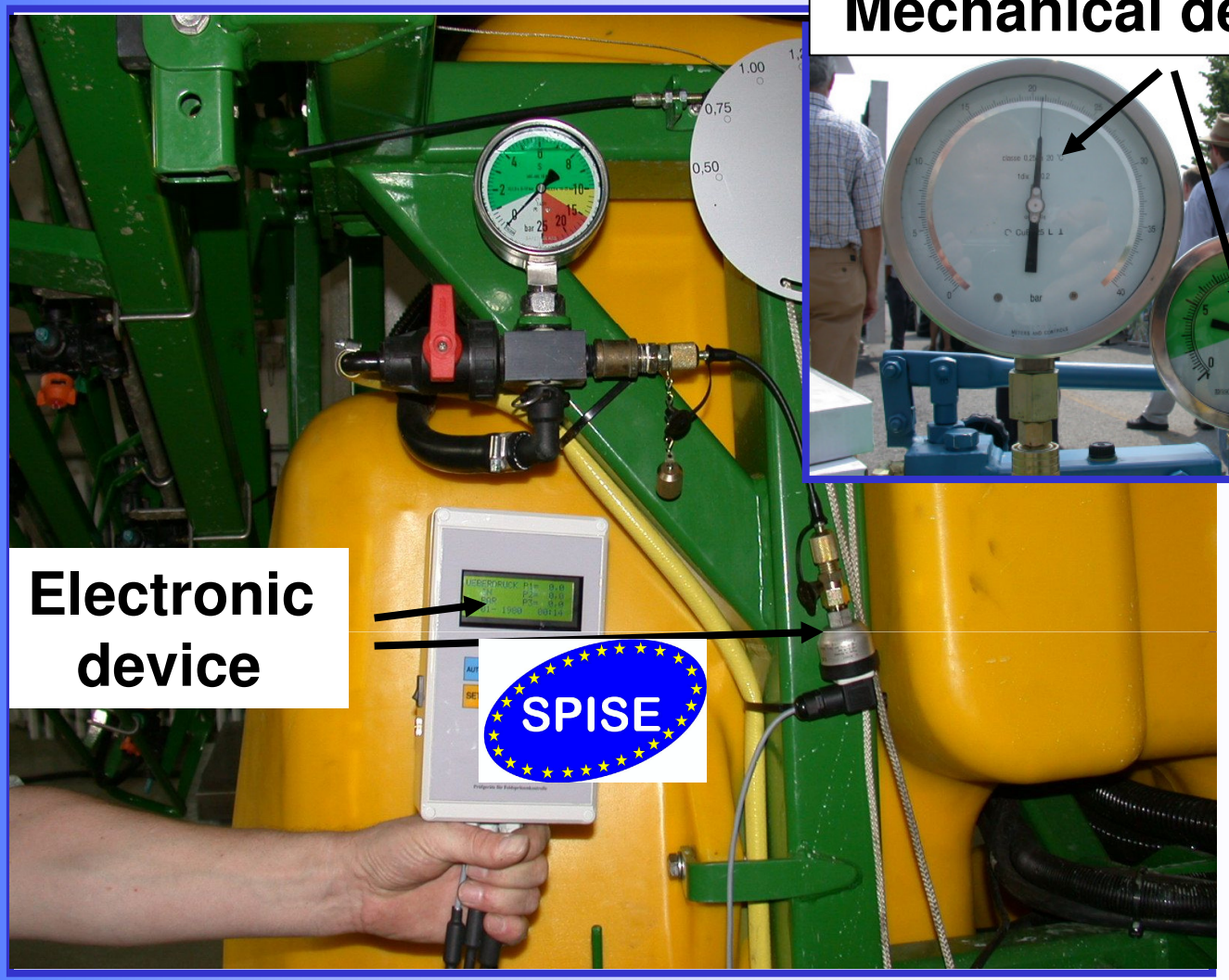

4.5.6
The accuracy of the pressure gauge shall be
± 0,2 bar for working pressures between 1 bar (included) and 2 bar,
± 10 % for working pressures > 2 bar.

Method of verification: according to 5.2.3.

European Standard EN
Inspection of sprayers in

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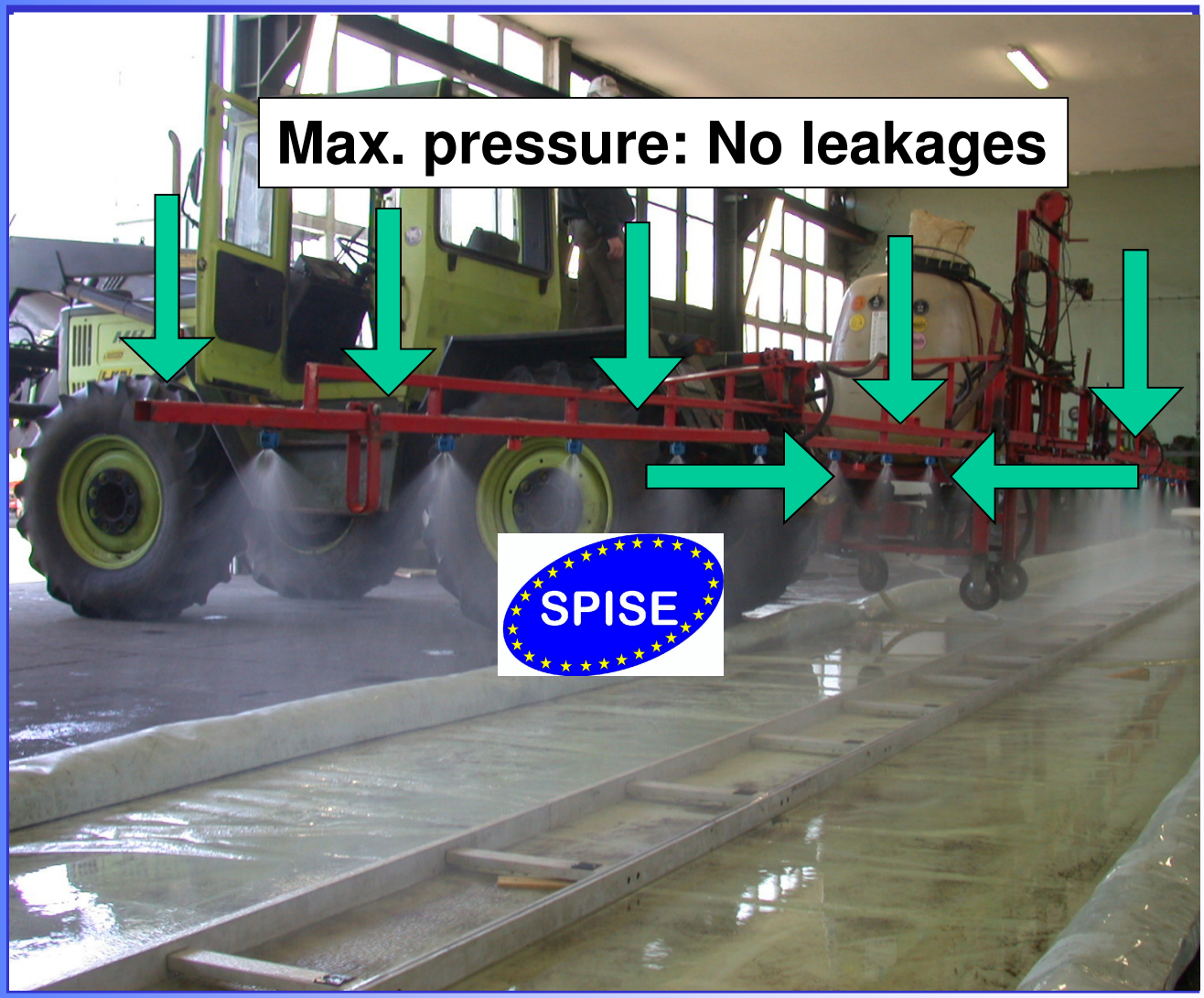


4.6.1
There shall be no leakages from pipes or hoses when tested up to the maximum obtainable pressure for the system.

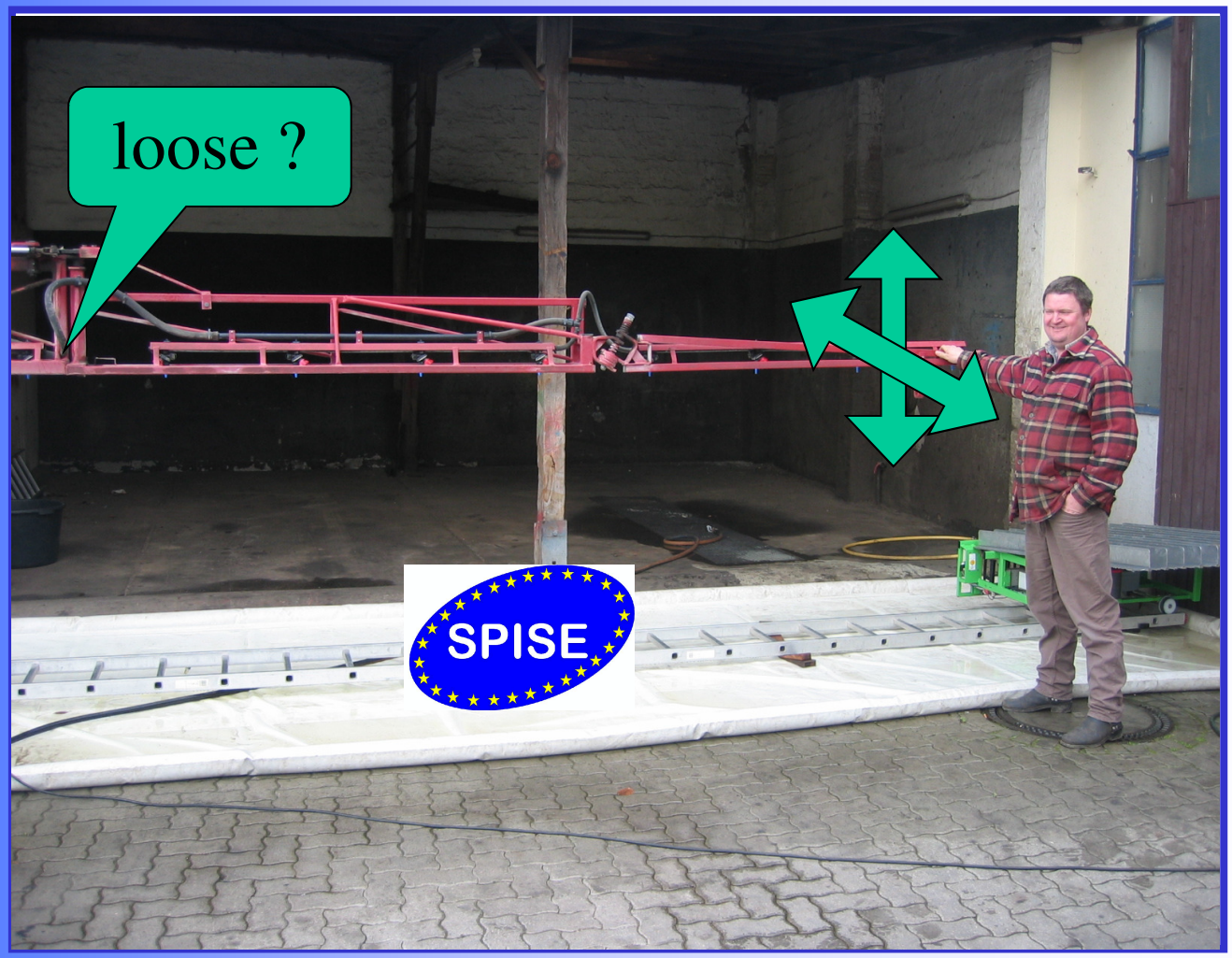
Method of verification: inspection and function test.

European Standard EN 13790
Inspection of sprayers in use - Part 1

Spray boom
- **Stable/Straight**
- Automatic resetting
- Safely lockable
- Nozzle spacing/ orientation
- Nozzle height
- Sprayer contamination by spray
- Prevention of nozzle damage
- Boom sections control
- Height adjustment
- Damping, slope compensation
- Pressure variations

Nozzles
- Identical
- Dripping

Distribution
- Measurement on patternator
- Flow rate measurement



4.8.1
The boom shall be stable in all directions, i.e. not loose in any joints and not be bent.
The right and the left parts of the boom shall be of the same length.

Method of verification: inspection.

European Standard EN 13790
Inspection of sprayers in use - Part 1

Spray boom
- Stable/Straight
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- Safely lockable
- Nozzle spacing/ orientation
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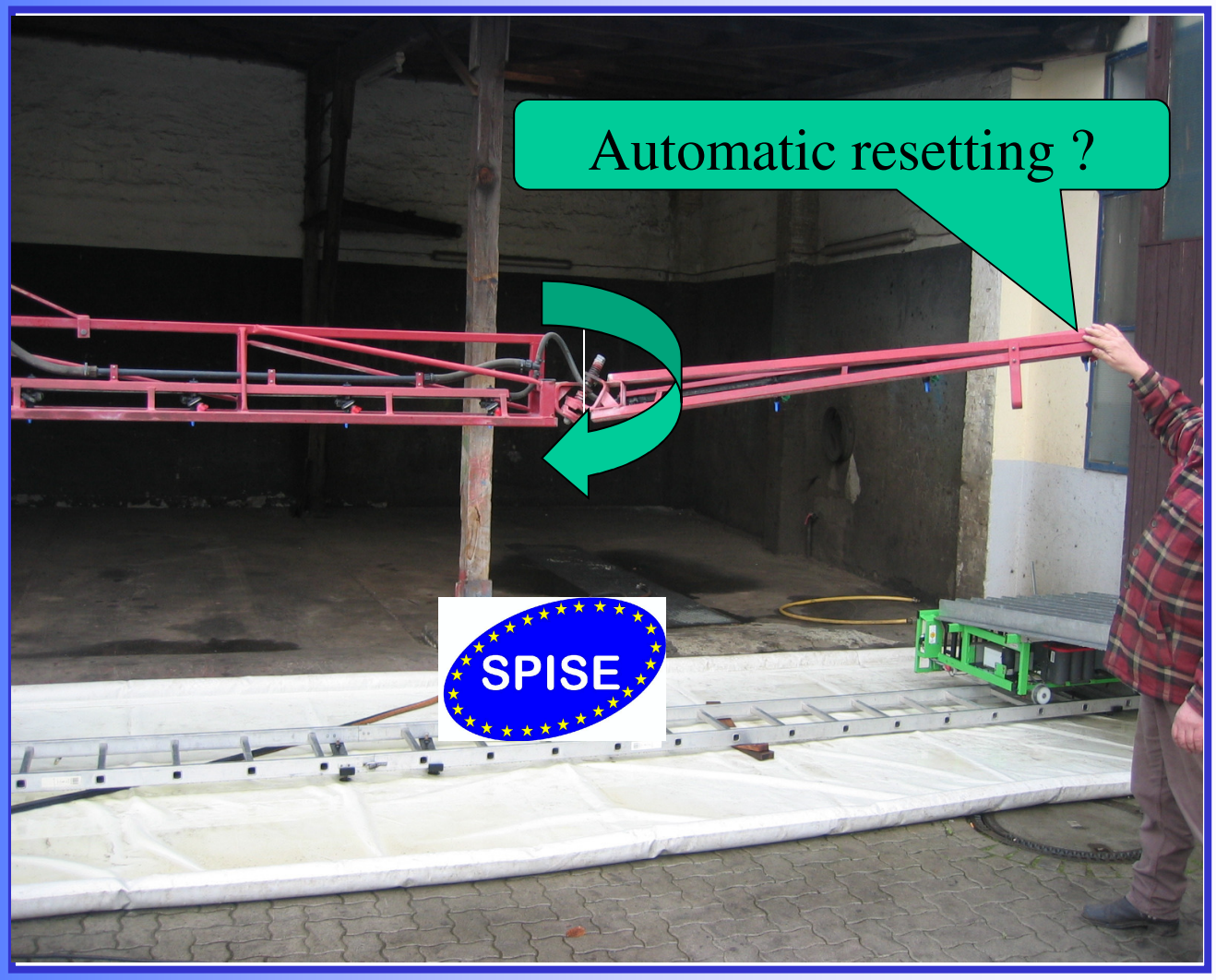
- Pressure variations

Nozzles
- Identical
- Dripping

Distribution
- Measurement on patternator
- Flow rate measurement



4.8.2
When provided, the automatic resetting of booms shall operate if fitted with the device, to move backwards and forwards, in case of contact with obstacles.

Method of verification: inspection and function test.

European Standard EN 13790
Inspection of sprayers in use - Part 1

Spray boom
- Stable/Straight
- Automatic resetting
- Safely lockable
- **Nozzle spacing/ orientation**
- Nozzle height
- Sprayer contamination by spray
- Prevention of nozzle damage
- Boom sections control
- Height adjustment
- Damping, slope compensation
- Pressure variations

Nozzles
- Identical
- Dripping

Distribution
- Measurement on patternator
- Flow rate measurement

4.8.4
The nozzle spacing and their orientation shall be uniform along the boom, except for special equipment such as border spraying.
By design, it shall not be possible to modify unintentionally the position of the nozzles in working conditions, for example by folding/unfolding the boom.

Method of verification: inspection and measurement.

European Standard EN 13790
Inspection of sprayers in use - Part 1

Spray boom
- Stable/Straight
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- Nozzle spacing/ orientation
- **Nozzle height**
- Sprayer contamination by spray
- Prevention of nozzle damage
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- Height adjustment
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- Pressure variations

Nozzles
- Identical
- Dripping

Distribution
- Measurement on patternator
- Flow rate measurement

4.8.5

When measured stationary on a level surface, the distance between the lower edges of the nozzles and the surface shall not vary more than 10 cm or 1 % of the half working width.

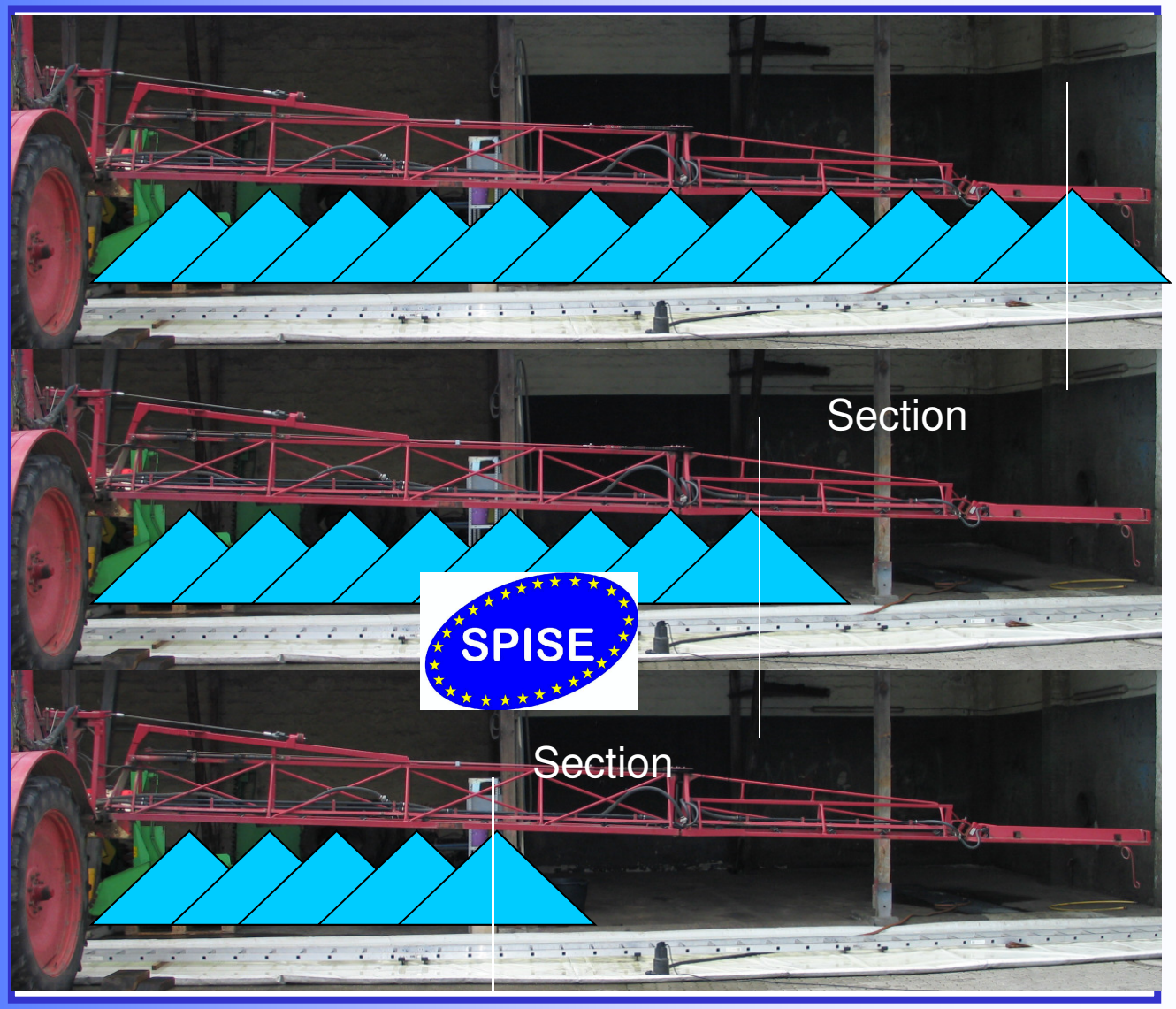
Method of verification: inspection and measurement.

European Standard EN 13790
Inspection of sprayers in use - Part 1

Spray boom
- Stable/Straight
- Automatic resetting
- Safely lockable
- Nozzle spacing/ orientation
- Nozzle height
- Sprayer contamination by spray
- Prevention of nozzle damage
- Boom sections control
- Height adjustment
- Damping, slope compensation
- Pressure variations

Nozzles
- Identical
- Dripping

Distribution
- Measurement on patternator
- Flow rate measurement



4.8.8

It shall be possible to switch on and off individual boom sections.

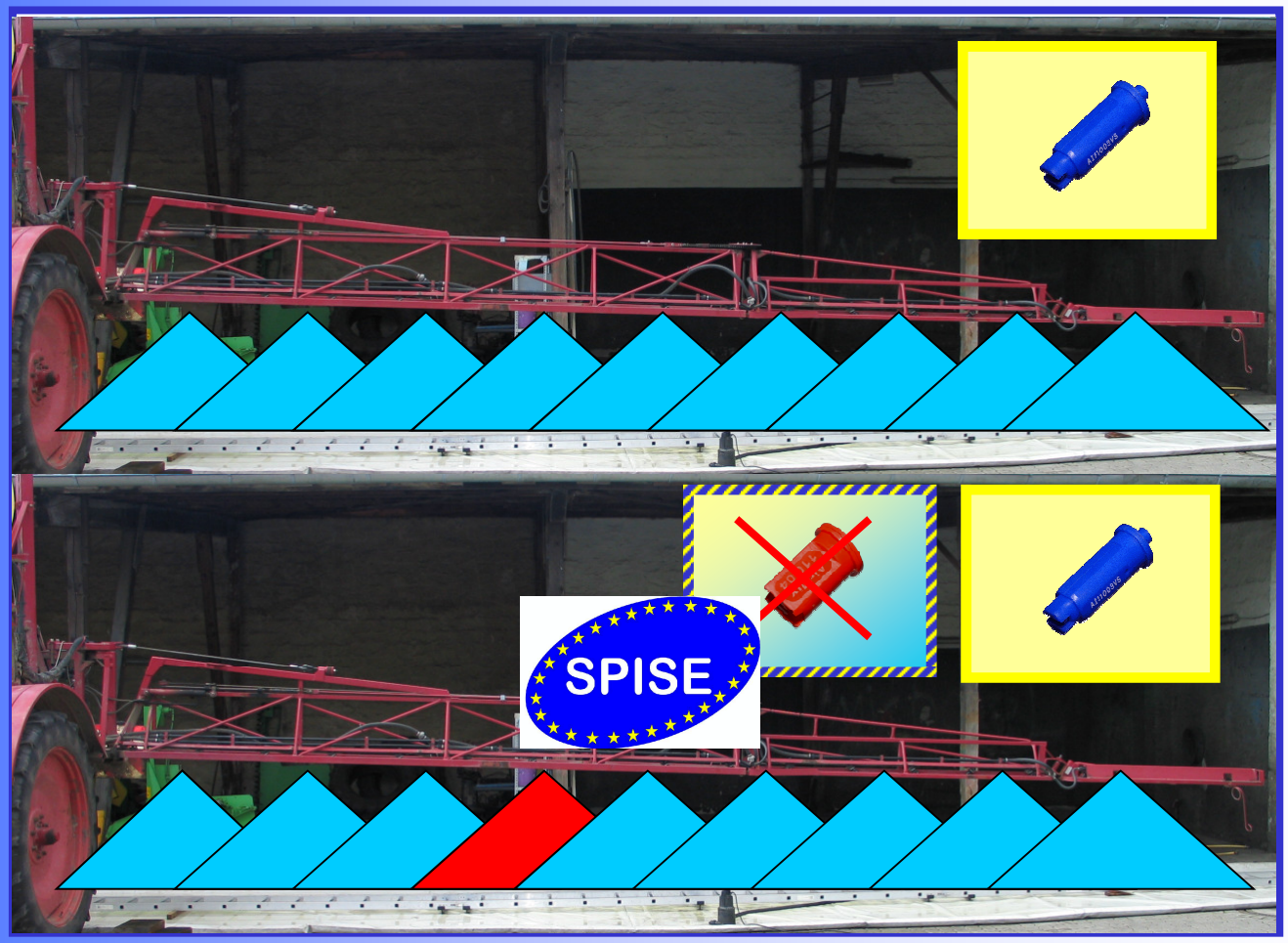
Method of verification: inspection and function test.

European Standard EN 13790
Inspection of sprayers in use - Part 1

Spray boom
- Stable/Straight
- Automatic resetting
- Safely lockable
- Nozzle spacing/ orientation
- Nozzle height
- Sprayer contamination by spray
- Prevention of nozzle damage
- Boom sections control
- Height adjustment
- Damping, slope compensation
- Pressure variations

Nozzles
- **Identical**
- Dripping

Distribution
- Measurement on patternator
- Flow rate measurement



4.9.1

All nozzles shall be identical (type, size, material and origin) all along the boom, except where they are intended for a special function for example the end nozzles for border spraying.
Other components (nozzle filters, anti drip devices) shall be equivalent all along the boom.

Method of verification: inspection.

European Standard EN 13790
Inspection of sprayers in use - Part 1

Spray boom
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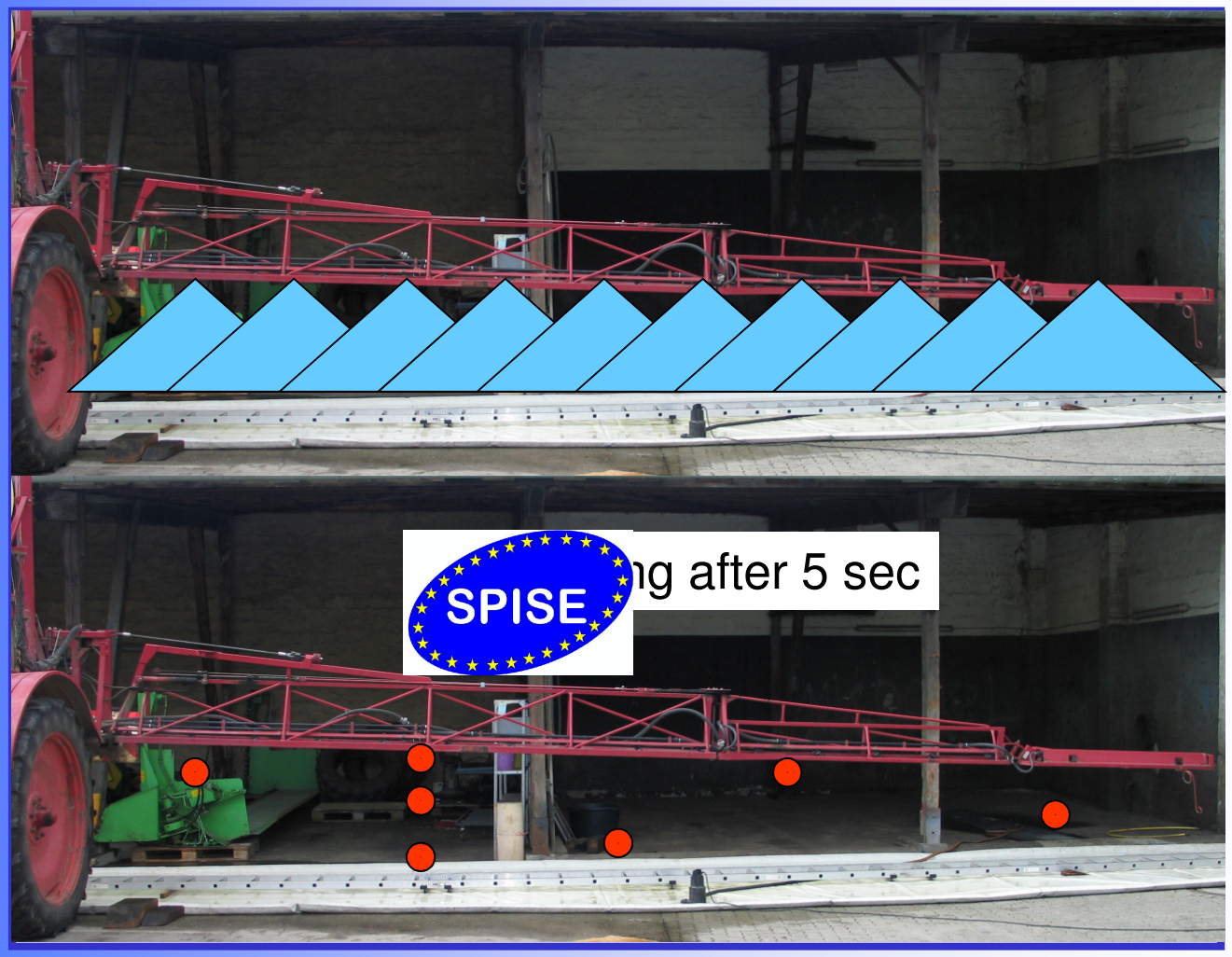
- Boom sections control
- Height adjustment
- Damping, slope compensation
- Pressure variations

Nozzles
- Identical
- **Dripping**

Distribution
- Measurement on patternator
- Flow rate measurement



4.9.2

After being switched off, the nozzles shall not drip.

5 s after the spray jet has collapsed there shall be no dripping.

Method of verification: inspection.

European Standard EN 13790
Inspection of sprayers in use – Part 1

Spray boom
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- Boom sections control
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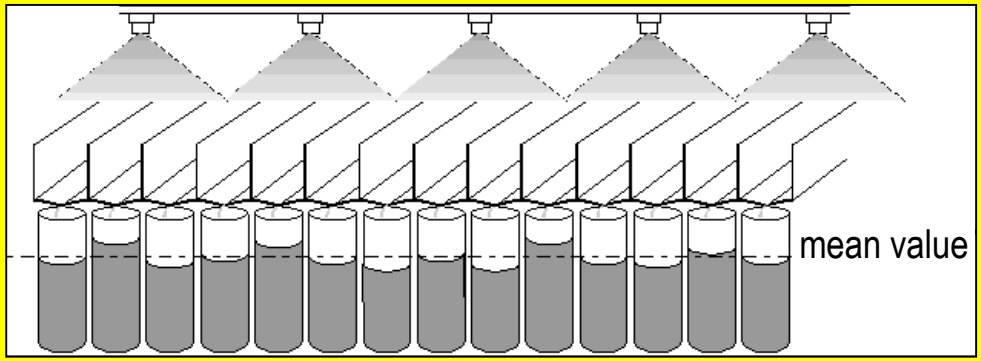
- Damping, slope compensation
- Pressure variations

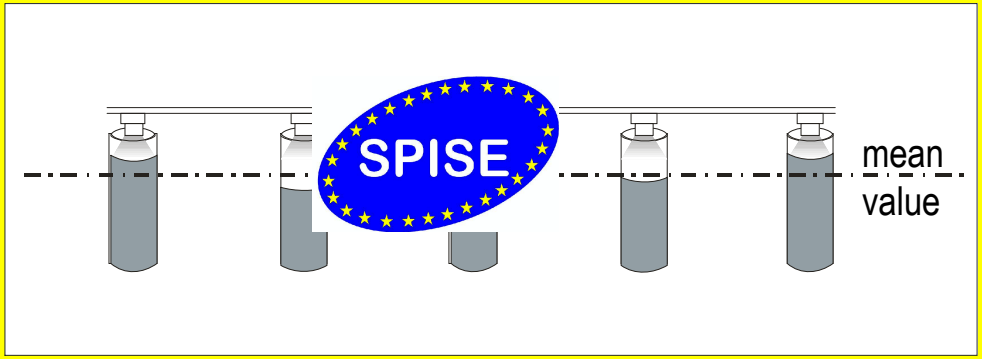
Nozzles
- Identical
- Dripping

Distribution
- Measurement on patternator
- Flow rate measurement

Testmethode 4.10.1



Testmethode 4.10.2



4.10

For the transverse distribution, the requirements and test methods of 4.10.1 or 4.10.2 shall apply.

NOTE 1: If nozzles are used on a boom to form a uniform spray, 4.10.1 or 4.10.2 applies; in other cases, 4.10.2 applies.

NOTE 2: A compared evaluation of the two methods given in 4.10.1 and 4.10.2 will be carried out during the revision of this standard to check whether preference may be given to one of these methods.

European Standard EN 13790
Inspection of sprayers in use - Part 1

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- Pressure variations

Nozzles
- Identical
- Dripping

Distribution
- **Measurement on patternator**
- Flow rate measurement

4.10.1

a) The transverse distribution, within the total overlapped range, shall be uniform. The transverse distribution is evaluated on the basis of the coefficient of variation which shall not exceed 10 %;

b) the amount of liquid collected by each patternator groove within the overlapped range shall not deviate more than ± 20 % of the total mean value.

Method of verification: measurement according to 5.2.4.

European Standard EN 13790
Inspection of sprayers in use - Part 1

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- Stable/Straight
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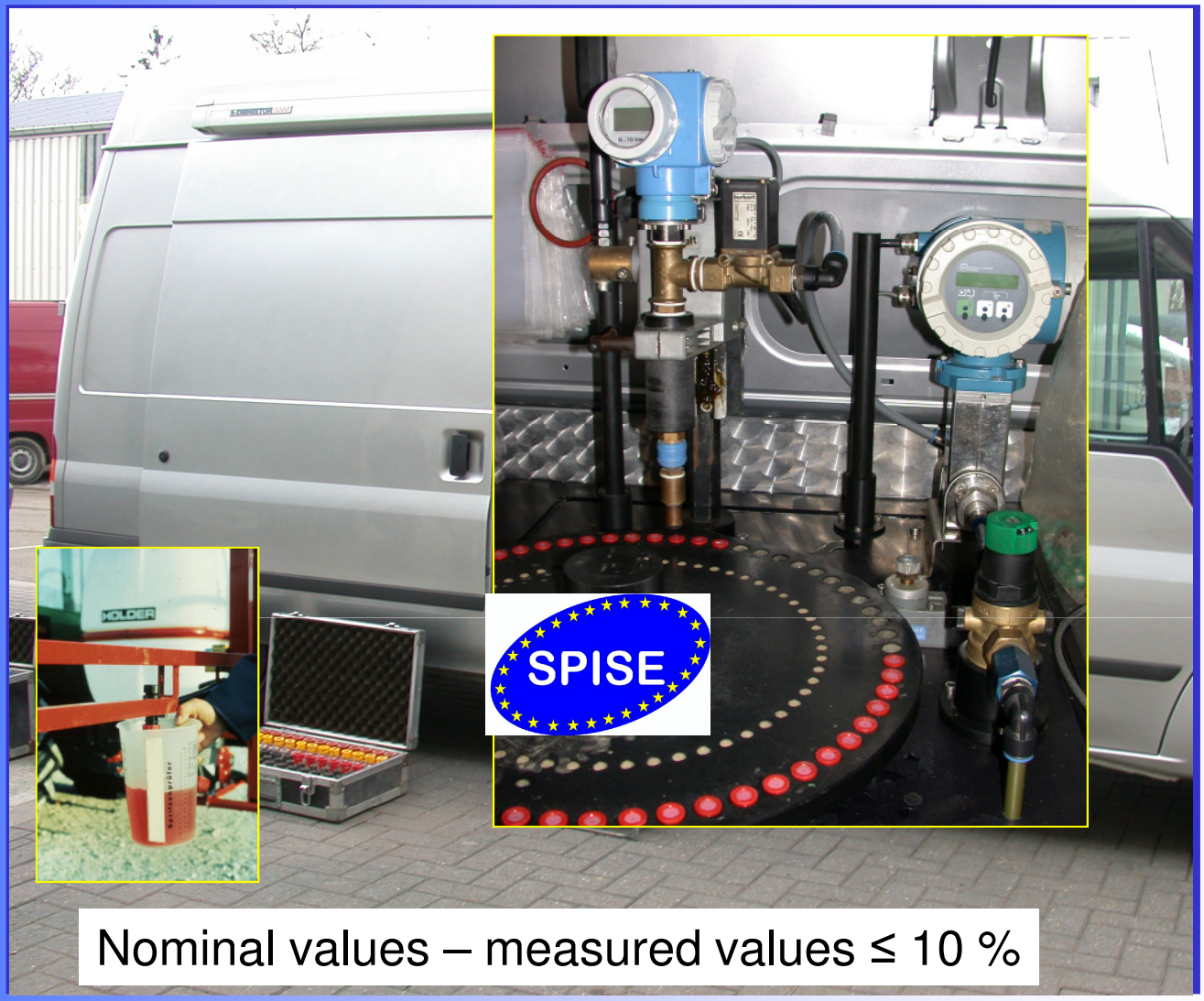
Nozzles
- Identical
- Dripping

Distribution
- Measurement on patternator
- **Flow rate measurement**



Nominal values – measured values ≤ 10 %

4.10.2.1

The deviation of the flow rate of each nozzle of the same type shall not exceed ± 10 % of the nominal flow rate indicated by the manufacturer.

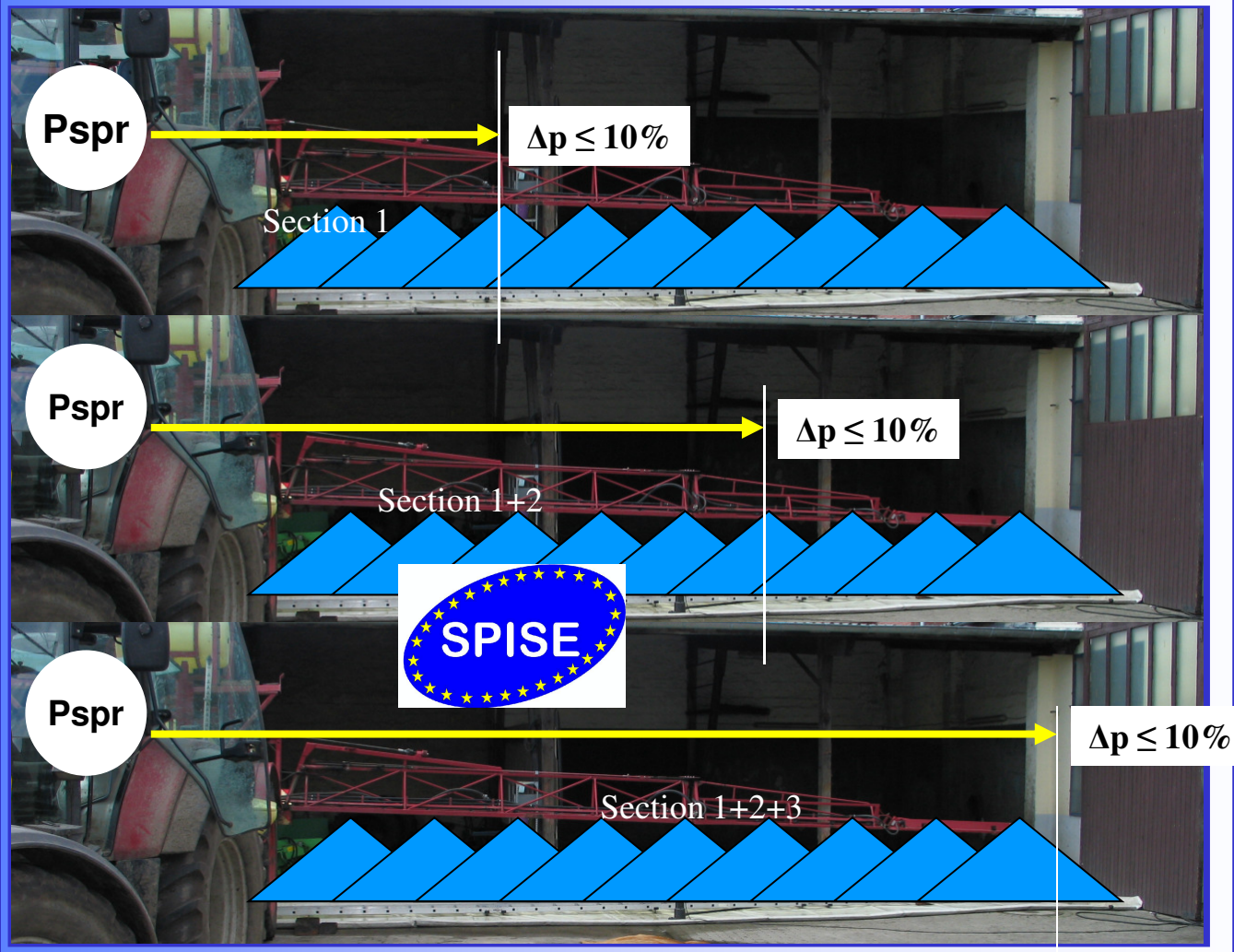
Method of verification: measurement according to 5.2.5.

European Standard EN 13790
Inspection of sprayers in use – Part 1

Spray boom
- Stable/Straight
- Automatic resetting
- Safely lockable
- Nozzle spacing/ orientation
- Nozzle height
- Sprayer contamination by spray
- Prevention of nozzle damage
- Boom sections control
- Height adjustment
- Damping, slope compensation
- Pressure variations

Nozzles
- Identical
- Dripping

Distribution
- Measurement on patternator
- **Flow rate measurement**



4.10.2.2
The pressure drop between the measuring point for pressure on the sprayer and the end of each boom section width shall not exceed 10 % of the pressure shown on the pressure gauge.

Method of verification: measurement according to 5.2.6.

European Standard EN 13790
Inspection of sprayers in use - Part 1

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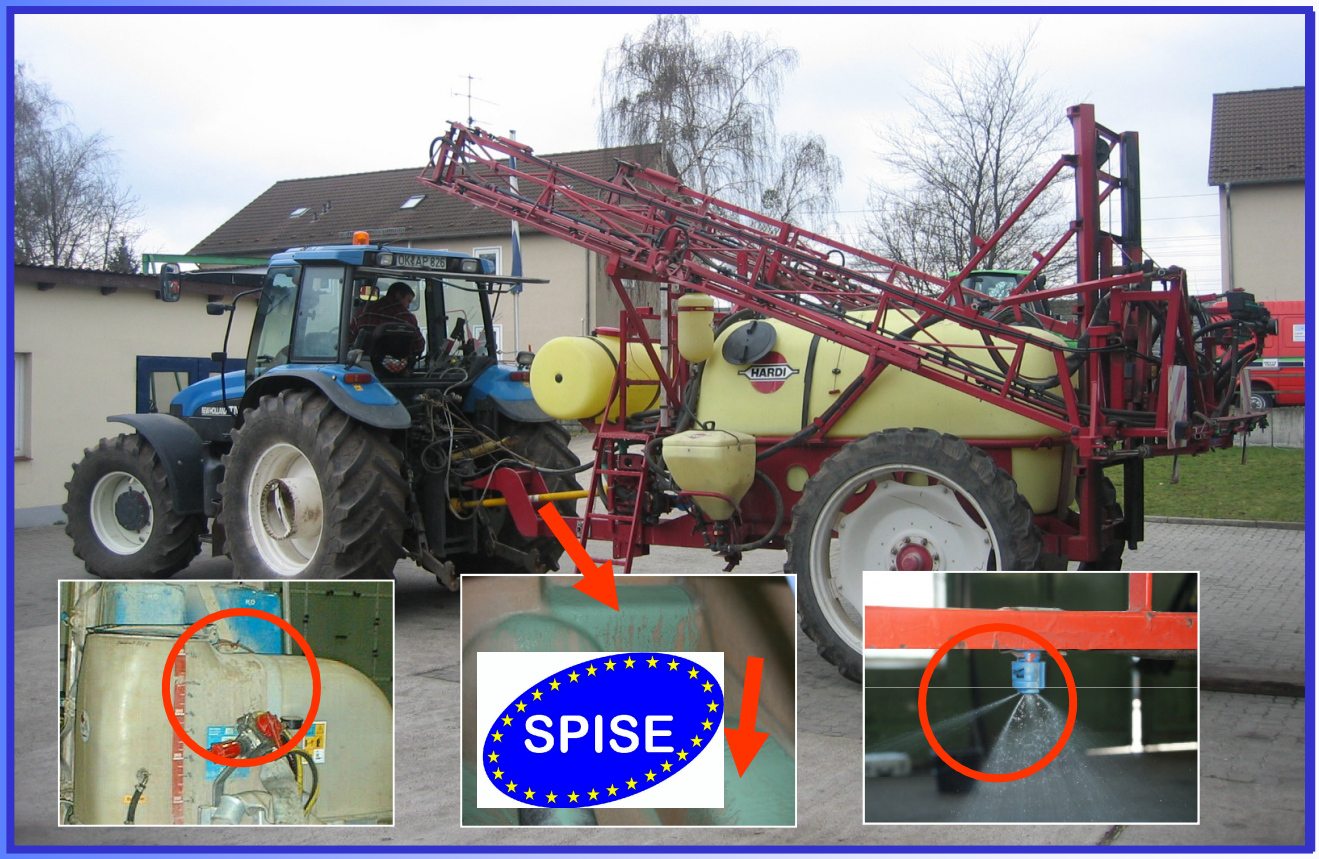
Nozzles
- Identical
- Dripping

Distribution
- Measurement on patternator
- Flow rate measurement

Test methods
- **Preparation of sprayer**
- Test facilities and methods

Test report

Inspection sticker



5.1

Before the inspection takes place, the sprayer shall be carefully cleaned. Certain attention shall be paid to rinsing and internal cleaning of the sprayer including filters and filters inserts, and external cleaning of those parts of the sprayer that are most exposed to the crop protection product when spraying.

Visible and other known faults should preferably be repaired before the inspection. A preparatory "rough inspection" should be done at the site of the ordinary inspection, in order to avoid wasting time making measurements on sprayers with very obvious serious faults.

The owner/operator of the sprayer should preferably be present at the inspection.

Spray boom
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- Pressure variations

Nozzles
- Identical
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Distribution
- Measurement on patternator
- Flow rate measurement

Test methods
- Preparation of sprayer
- **Test facilities and methods**

Test report

Inspection sticker

5.2 Test facilities and methods
5.2.1 Pump capacity measurement
5.2.2 Verification of the sprayers pressure gauges
5.2.3 Flow meters for controlling the volume / hectare rate
5.2.4 Measurement of the uniformity of the transverse volume
5.2.5 Measurement of the flow rate
5.2.6 Measurement of pressure drop
5.2.7 Measurement of pressure variation when the sections are closed
5.2.8 Other test facilities

European Standard EN 13790
Inspection of sprayers in use - Part 1

Test station:	**Test Report** **for the inspection of field crop sprayers** **according to EN 13790-1**
Owner's identity:	
Owner's address:	Manufacturer ..... Type ..... Serial-No ..... Year of construction ..... ☐ Mounted ☐ trailed ☐ self-propelled sprayer Owned by ractor ☐ machine ring
Remarks:	
Result of the inspection	Signature.....
☐ no defect ☐ minor defect ☐ critical defects	Label ☐ yes ☐ no Date .....

7

A test report shall be given to the user directly following the inspection at the inspection site.

This report shall mention any malfunctions of the sprayer and inform the user of the repairs required to be made to his equipment.

The test report shall also include the results of the measurements

An example of a test report is given in annex B.

European Standard EN 13790
Inspection of sprayers in use - Part 1

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- Measurement on patternator
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Test methods
- Preparation of sprayer
- Test facilities and methods

Test report

Inspection sticker

			Defect				General remarks on the state of the sprayer
Subject	**Description**	**Requirement** [a]	no	minor defects	critical	repaired	
1.Power transmission		Guards	☐	☐	☐	☐	
2. Pump	☐ Piston : :	Capacity	☐	☐	☐	☐	
3. Agitation	☐ mechanic ☐ hydraulic	Recirculation	☐	☐	☐	☐	
4. Spray liquid tank	Volume ..... : :l	Leakages	☐	☐	☐	☐	
5. Measuring systems, controls and regulation systems			☐	☐	☐	☐	
6. Pipes and hoses		Leakages : :	☐	☐	☐	☐	
7. Filtering		Filter presence : :	☐	☐	☐	☐	
8. Spray boom	Working width ..... m : :	Stability/straightness : :	☐	☐	☐	☐	
9. Nozzles	Number of nozzles ..... :	Identical :	☐	☐	☐	☐	
10. Transverse distribution	Actual C_V ..... %	Coefficient of variation (≤ 10 %) : :	☐	☐	☐	☐	

[a] if applicable

European Standard EN 13790
Inspection of sprayers in use – Part 1

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Nozzles
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Distribution
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Test methods
- Preparation of sprayer
- Test facilities and methods

Test report

Inspection sticker

Test station:

Owner's identity:

Owner's address:

Manufacturer ...

Serial-No .....

☐ Mounted

Owned by ☐ farmer ☐ co...tor ☐ machine ring

...elled sprayer

Remarks:

SPISE

Result of the inspection

Signature .....

☐ no defect ☐ minor defect ☐ critical defects Label ☒ yes ☐ no Date .....

8 (proposal)

The inspection service fills the sticker in with address…and sticks it on the sprayer after the inspection has shown that the sprayer functions without fault.

The sticker may also handed out if the sprayer has minor defects which the owner undertakes to remove immediately

European Standard EN 13790
Inspection of sprayers in use – Part 1

Power transmission parts and blower
Pump
- Capacity
- Pulsations
- Pressure safety valve, if applicable
- Leakages
Agitation
Spray liquid tank
- Leakages
- Strainer
- Grating, if applicable
- Pressure compensation
- Level indicator
- Emptying
- Non return device
- Chemical introduction container, if applicable
- Can cleaning device, if applicable
Measuring systems, controls and regulation systems
- Reliability/leakages
- Constant working pressure
- Operation of controls
- Application to one side only
- Pressure gauge
- Other measuring devices
Pipes and hoses
- Leakages
- Bending/abrasion
- Out of spray
Filtering
- Filter presence
- Cleaning, if applicable
- Filters inserts changeability

Agricultural machinery - Sprayers - Inspection of sprayers in use - EN 13790

SPISE

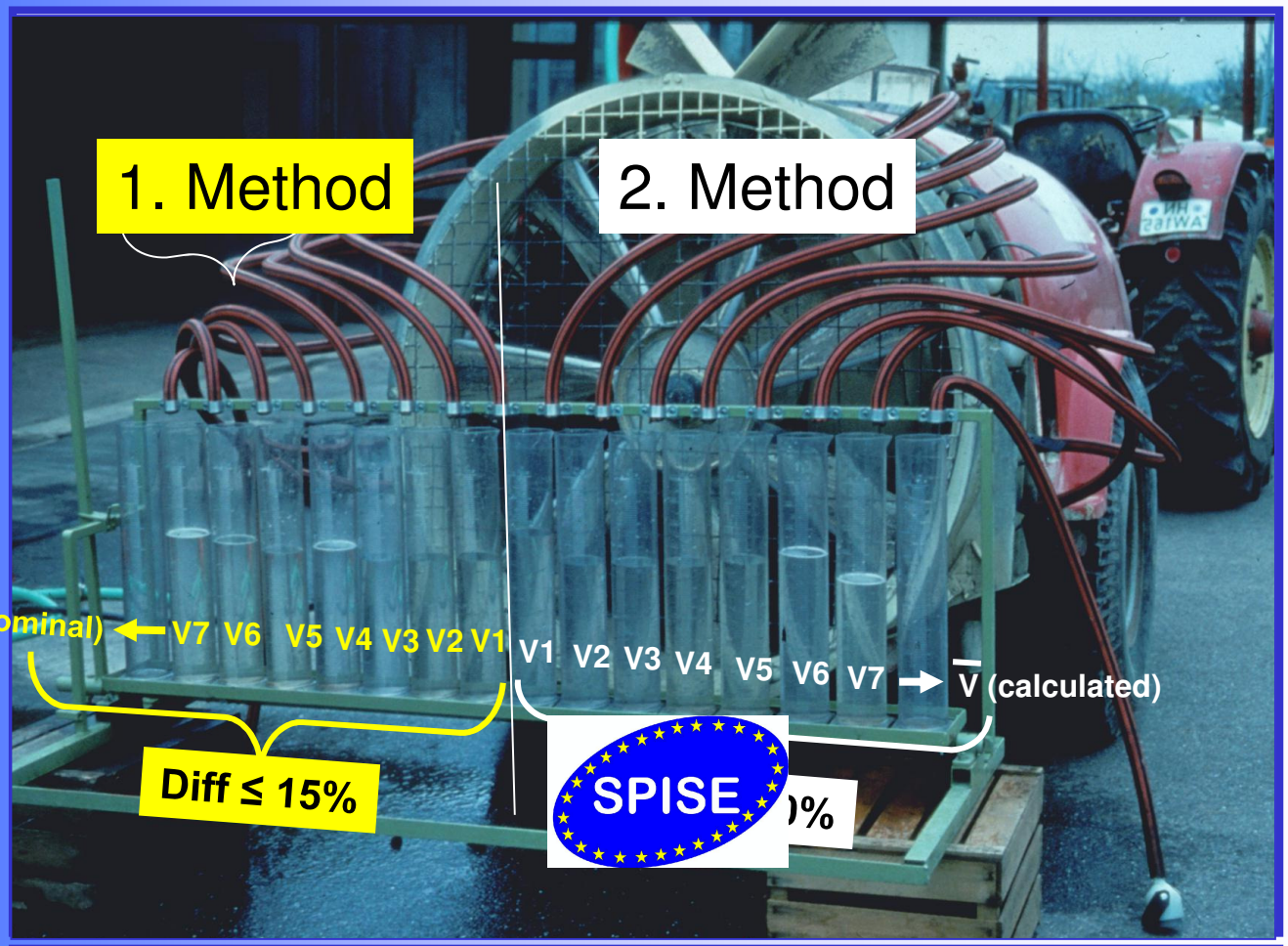
Air-assisted sprayers for bush and tree crops

European Standard EN 13790
Inspection of sprayers in use - Part 2

Nozzles
- Suittability
- Symmetry
- Dripping
- Switching off
- Adjustment

Distribution
- Uniformity of spray jet
- **Nozzle output/sector output**
- Pressure difference
- Optional patternator measurement

Blower
- Rotational speed
- Switching off
- Guide plates
- Dripping



4.9.2

The output of each nozzle with the same marking shall not deviate more than 15 % from the nominal output or 10 % from the mean output of all nozzles within the same identification.

For symmetrical spraying, the difference between the left and right hand sides mean output shall be a maximum of ≤10 %.

Method of verification: measurement according to 5.2.4.

European Standard EN 13790
Inspection of sprayers in use – Part 2

Nozzles
- Suittability
- Symmetry
- Dripping
- Switching off
- Adjustment

Distribution
- Uniformity of spray jet
- Nozzle output/sector output
- Pressure difference
- Optional patternator measurement

Blower
- Rotational speed
- Switching off
- Guide plates
- Dripping

Optional patternator measurement

4.9.4
NOTE: In order to provide the owner/operator with further information in addition to 4.9.1 to 4.9.3, the spray distribution may be measured by using a vertical patternator test bench according to 4.10.1 of EN 13790-1:2003.

European Standard EN 13790
Inspection of sprayers in use – Part 2

Spray boom
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- Pressure variations

Nozzles
- Identical
- Dripping

Distribution
- Measurement on patternator
- Flow rate measurement

Test methods
- Preparation of sprayer
- Test facilities and methods

Test report

Inspection sticker

Concluding remarks

EN 13790 continues to be characterised by the fact that

- it brings together in one standard the different procedures, findings and technical requirements which have existed in the Member States up to now
- it is established on the basis of test methods and requirements which have proved reliable in the Member States in the past
- it achieves a high 

el whilst not consuming unnecessary time
- the Member States are obliged to apply this standard and to withdraw respective national standards
- it represents a basis for the harmonisation of sprayer inspections and the future mutual acceptance of inspections between the Member States
- it determines technical requirements but does not anticipate regulatory decisions made by the EU and Member States.

European Standard EN 13790
Inspection of sprayers in use - Part 1