EN 13790 as a basic for inspection of pesticide application equipment (PAE) functioning similar to field crop and air-assisted sprayers.

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The standard EN 13790 – Inspection of sprayers in use – is available since the year 2003. EN 13790 specifies requirements and inspection procedures for field crop (part 1) and air-assisted sprayers (part 2). The article 8 of the Frame Work Directive obliged the Member States to ensure that PAE shall be subject to inspections at regular intervals. Except for the above called sprayers in the moment there is no EN standard available for inspection of all other types of PAE. From the SPISE Working Group point of view the EN standard can also applied to PAE which work similarly to field crop and air-assisted sprayers.

The working group developed in 2007 a guideline for testing of the followed listed PAE:

- Spray gun equipment,
- Mixing stations for aircrafts,
- Aircrafts,
- Interline sprayers,
- watering booms.

These PAE complies with the EN 13790 part 1 and 2. Also the inspection of spray trains is possible, but not yet integrated into the guideline. The table shows the available standard at the moment for the inspection of PAE and the possibilities with an enlargement of EN standard 13790.

Tab. 1 Available EN-Standards for the inspection of sprayers

EN-Standards / Inspection (February 2008)

Kind of sprayer	EN Standard available	EN Standard necessary	EN Standard to be developed
1) Field sprayer	Yes, EN 13790	yes	no
2) Air assisted sprayer	Yes, EN 13790	yes	no
3) Interline sprayer	Yes, EN 13790 (1)	Yes	no (1)
4) Airplane / helicopter	yes, EN 13790 (1)	yes	no (1)
5) Wheelbarrow sprayer	yes, EN 13790 (1)	Yes	no (1)
6) Spray gun equipment	yes, EN 13790 (1)	Yes	no (1)
7) Watering carriage	yes, EN 13790 (1)	yes	no (1)
8) Spray train	yes, EN 13790 (1)	yes	no (1)
9) Pedestrian motor-powered sprayer	no	yes	1
10) Fogging machines	no	yes	1
11) Granules distributor	no	yes	1
12) Knapsack sprayer	no	yes	1
13) Wiper	no	yes	2
14) Seed treatment equipment	no	yes	3
15) Injection system for nematodes	no	yes	4

(1) If the inspection method of EN 13790 will be extended to those equipment whose functioning is based on the same principle

The guideline takes the EN 13790 as a basic and includes special test features and hints and is also introduced with the help of some examples. The features are arranged by design groups of PAE and are numbered correspondingly. Following each feature the assignation to the type of equipment and the

applied test method is given. The features are completed, partly depending on the type of equipment with explanations, notes and examples for minor defects. Also features for equipment, which is not compulsory are given and are shown to a better differentiation in italic. The results of the test shall described in one test report which contains all information for all possible PAE. The assignation of the features are listed in figure 1.

Assignation of the features to the types of equipment and test methods

F	R	S	M	L	U	G	Inspection	Function test	Measurement	Additional equipment

F: Field Crop Sprayers
R: Air assisted sprayers
S: Spray gun equipment
M: Mixing stations
L: Aircraft
U: Interline sprayers
G: Watering booms

Fig. 1 Assignation of the features to the types of equipment and test methods

The concepts

"Inspection" = investigation by eye,
"Function test" = running the machine to simulate the usage,
"Measurement" = measure some items by using special equipment and
"Additional equipment" = additional design groups

should give an assistance for the inspection staff what is to be done with the respective design group. Some examples should make clear the sense and construction of the guideline:

Figure 2 shows the design group "Power transmission" with the feature "Function" and the original text of EN 13790. The feature is valid for the device groups " F"-field crop sprayers, "R"-air assisted sprayers, "S"- Spray gun equipment, "M"- Mixing stations, "L"-Aircraft and "U"-Interline sprayers, not for "G"- Watering booms. The procedures "Inspection" and "Function test" are emphasised, that means that the procedures must be carried out by the controlling staff. The explanations and notes helps in it.

1. Power transmission

K.1.1 Function

The power take-off drive shaft guard and the guard of the power input connection (PIC) shall be fitted and in good condition.
The different parts of the shaft, the universal joints and locking systems shall not show any mark of excessive wear and shall operate correctly.
The function of the guard shall be obvious and the guard shall not show any wear marks, holes, deformations or tears.
The restraining device that prevents the rotation of the power take-off shaft guard shall be present and shall work reliably.
The protective devices and any moving or rotating power transmission parts shall not be affected in their function.

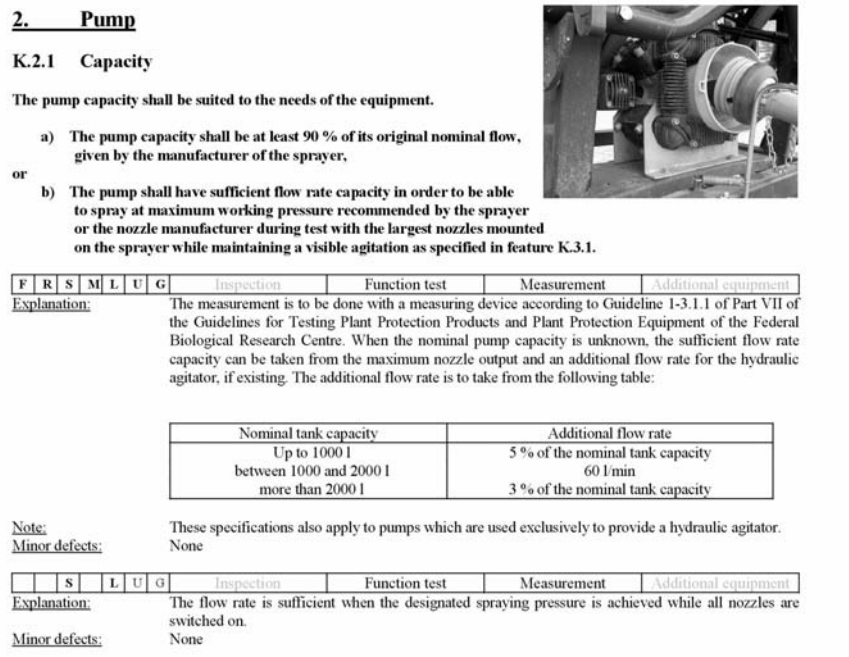
F	R	S	M	L	U		Inspection	Function test	Measurement	Additional equipment

Explanation: Transmission parts like PTO drive shaft, chain, chain wheels, belt, and gearbox have to be inspected.
Minor defects: Minor wear of the transmission parts, poor greasing of the chain, moderately damaged belt, low belt tension.
Notes: Take safety regulations into consideration! Instead of a PTO drive shaft also other transmission parts may be present.

Fig. 2 Function of the power transmission

Another example shows the requirement for the group "Pump" with the feature "Capacity" with the original text of EN 13790 (Figure 3). In this example the procedures "Function test" and "Measurement" are emphasised. The pump capacity is to measured if the pump capacity is known. If the nominal pump

capacity is unknown, the sufficient flow rate capacity can be taken from the maximum nozzle output plus an additional flow rate for the hydraulic agitator.



2. Pump

K.2.1 Capacity

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,**

or

b) **The pump shall have sufficient flow rate capacity in order to be able to spray at maximum working pressure recommended by the sprayer or the nozzle manufacturer during test with the largest nozzles mounted on the sprayer while maintaining a visible agitation as specified in feature K.3.1.**

F	R	S	M	L	U	G	Inspection	Function test	Measurement	Additional equipment

Explanation: The measurement is to be done with a measuring device according to Guideline 1-3.1.1 of Part VII of the Guidelines for Testing Plant Protection Products and Plant Protection Equipment of the Federal Biological Research Centre. When the nominal pump capacity is unknown, the sufficient flow rate capacity can be taken from the maximum nozzle output and an additional flow rate for the hydraulic agitator, if existing. The additional flow rate is to take from the following table:

Nominal tank capacity	Additional flow rate
Up to 1000 l	5 % of the nominal tank capacity
between 1000 and 2000 l	60 l/min
more than 2000 l	3 % of the nominal tank capacity

Note: These specifications also apply to pumps which are used exclusively to provide a hydraulic agitator.

Minor defects: None

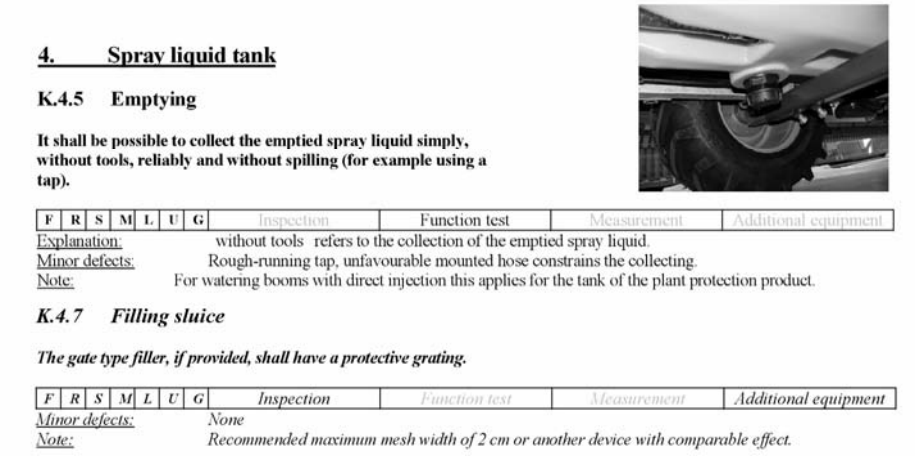
		S		L	U	G	Inspection	Function test	Measurement	Additional equipment

Explanation: The flow rate is sufficient when the designated spraying pressure is achieved while all nozzles are switched on.

Minor defects: None

Fig. 3 Pump capacity

The figure 4 shows some requirements from the group “Spray liquid tank” with the features “Emptying” and “Filling sluice”. The Emptying of the tank must be possible without tools and shout be inspected with a function test. This requirement is valid of course for all possible PAE, because everyone disposes of a tank for spray liquid. A “Filling sluice” is an additional equipment and is shown in italic. The state of the equipment can be examined without functional tests or measurements and are valid for all PAE.



4. Spray liquid tank

K.4.5 Emptying

It shall be possible to collect the emptied spray liquid simply, without tools, reliably and without spilling (for example using a tap).

F	R	S	M	L	U	G	Inspection	Function test	Measurement	Additional equipment

Explanation: without tools refers to the collection of the emptied spray liquid.

Minor defects: Rough-running tap, unfavourable mounted hose constrains the collecting.

Note: For watering booms with direct injection this applies for the tank of the plant protection product.

K.4.7 Filling sluice

The gate type filler, if provided, shall have a protective grating.

F	*R*	*S*	*M*	*L*	*U*	*G*	*Inspection*	*Function test*	*Measurement*	*Additional equipment*

Minor defects: *None*

Note: *Recommended maximum mesh width of 2 cm or another device with comparable effect.*

Fig. 4 Emptying of spray liquid tank

The test report brings all information of the inspected PAE in one document together and is subdivided into three parts:

The head of the report contains information about the PAE and the test station e.g. machine type, year of manufacture and equipment of the machine like spray tank volume, pump, agitator, controls, spray boom and nozzles with results of the cross distribution measurements.

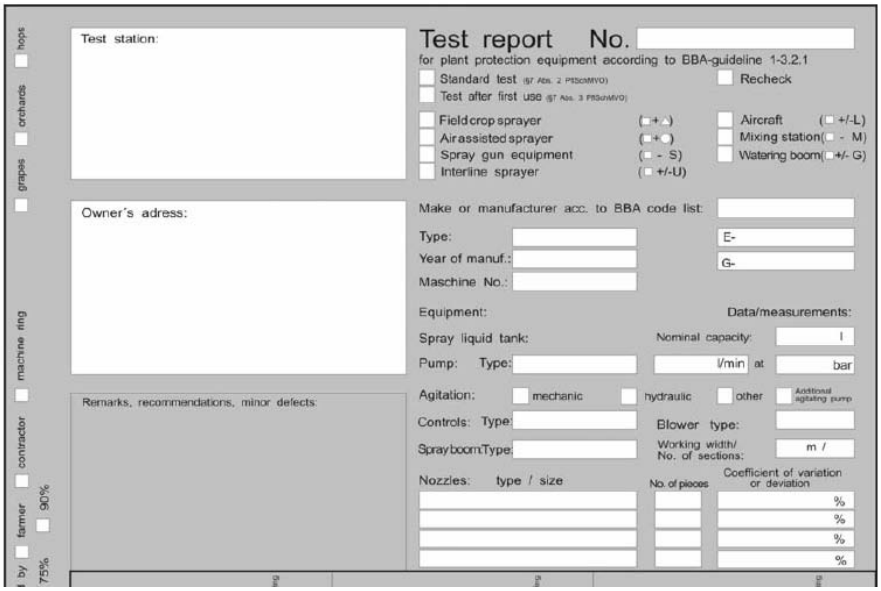


Fig. 5 Head of the test report

All results of the inspection procedure are summarised into the middle part of the report in detail and weak points are marked.

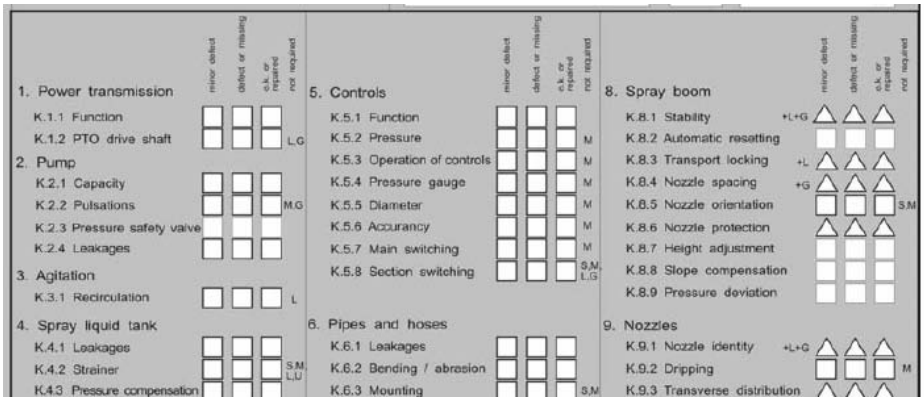


Fig. 6 Middle part of the test report

On the bottom of the report we will find the signature of the inspection staff and the information about the inspection result, e. g. label “yes” or “no”. Several additional information over the PAE is summarised on the left side of the report, e. g. whether it concerns a mounted, trailed or self propelled sprayer or whether it is equipped with drift reducing equipment.

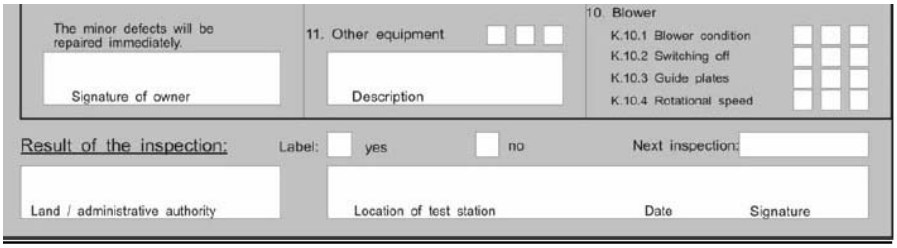


Fig. 7 Bottom of the test report

Summary

The standard EN 13790 is usable not only for the inspection of field sprayers and air assisted sprayers, but also usable for the inspection of other PAE which functioning similar. The guideline of SPISE working group could be harmonized and later on a basic for the inspection process in the European Member States. Therefore the scope of EN 13790 should be extended so that other types of PAE should be included, because this is much more less time consuming than working out a complete new standard.