

DLG Test Report 7228

FLIEGL Agrartechnik GmbH

FLIEGL SKATE 150 trailing shoe applicator with Fliegl auger distributors

Functionality, quality of work, handling, ease of operation,
service and maintenance



**FLIEGL SKATE 150 (15 METERS)
WITH FLIEGL AUGER DISTRIBUTORS**

- ✓ Functionality, quality of work
- ✓ Handling, ease of operation,
service and maintenance

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Overview

A test mark „DLG-APPROVED for individual criteria“ is awarded for agricultural products which have successfully fulfilled a scope-reduced usability testing conducted by DLG according to independent and recognised evaluation criteria. The test is intended to highlight particular innovations and key criteria of the test object. The test may contain criteria from the DLG test scope for overall tests, or focus on other value-determining characteristics and properties of the test subject. The minimum requirements, test conditions and procedures as well as the evaluation bases of the test results will be specified in consultation with an expert group of DLG. They correspond to the recognised rules of technology, as well as scientific and agricultural knowledge and requirements. The successful testing is concluded with the publication of a test report, as well as the awarding of the test mark which is valid for five years from the date of awarding.

The test carried out on a 15 m FLIEGL SKATE 150 trailing shoe applicator with two FLIEGL auger distributors consisted of the following two modules from the DLG test framework on slurry application: “Functionality and quality of work” and “Handling, ease of operation, service and maintenance”.

The DLG test module “Functionality and quality of work” measures the quality of distribution across rows (lateral distribution) on level ground and the spreading performance at application start (V pattern). This test module is carried out on the test stand and simulates the application of two types of slurry at two different rates. In the second test module “Handling, ease of operation, service and maintenance”, the test persons execute typical machine functions and frequent service and maintenance jobs. These operations are timed and described in terms of ease and tools required.

Other criteria were not tested.



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Assessment in brief

In both test modules, the FLIEGL SKATE 150 trailing shoe applicator with FLIEGL auger distributors met all the criteria that are laid down in the DLG test framework.

DLG test module

“Functionality and quality of work”

In all cross distribution tests, the machine achieved the best DLG score (++)*. At application start, it never took longer than 2.6 seconds until all outlets were supplied with slurry. This prompt delivery suggests that the full spreading width is achieved very quickly rather than a prolonged V pattern.

DLG test module

“Handling, ease of operation, service and maintenance”

In this DLG test module, several experienced operators carried out typical machine functions and

repetitive service jobs while the test engineers timed these operations and described the ease at which these functions were carried out. The system can be classified as very user-friendly. Particularly noteworthy details are the small number of grease nipples and the excellent access to all service points.

Table 1:

Overview of results

DLG QUALITY PROFILE	Score*
Functionality and quality of work	✓
Handling, ease of operation, service and maintenance	✓

* Evaluation range:

Requirements fulfilled (✓) / Requirements not fulfilled (✗)

The product

Manufacturer and applicant

FLIEGL Agrartechnik GmbH, Bürgermeister-Boch-Straße 1, 84453 Mühldorf am Inn, Germany

Product: FLIEGL SKATE 150 trailing shoe applicator (15 m) with FLIEGL auger distributors

Description and technical data

Trailing shoe applicator

The FLIEGL SKATE trailing shoe applicator is available in various working widths: 6 m, 7.5 m, 9 m, 12 m, 15 m, 18 m, 21 m and 24 m. The DLG test was carried out using the 15 m boom (FLIEGL SKATE 150). The hoses on this version are spaced at 25 cm. The applicator is attached either directly to the tank or to a 4-point linkage. Folded into transport position, it measures 2.6 m.

The boom has an integral catch mechanism, a passive anti-yaw damping system in the central frame and two jockey wheels. The shoes are formed to long spouts.



Figure 2:
The trailing shoe applicator in work position



Figure 3:
The trailing shoe applicator in transport position

Section control is either mechanical or hydraulic. On the headland, the booms are raised and angled up to the rear preventing slurry leaking from the shoes.

The distributor

Each of the two FLIEGL auger distributors inside the 15 m boom distribute the slurry to 24 outlets and their 40 mm ID hoses supplying the shoes. Each auger distributor has a brass gate valve which opens either manually or hydraulically from the cab for emptying fibrous material or objects from the trap, for example.

A FLIEGL SKATE trailing shoe applicator can take either the FLIEGL trailing shoes (figure 4), which were fitted to the tested boom, or so-called Twin nozzles (figure 5). Figure 6 is an illustration of the FLIEGL auger distributor inside the boom.



Figure 4:
FLIEGL SKATE trailing shoes



Figure 5:
FLIEGL SKATE trailing Twin nozzles (option)

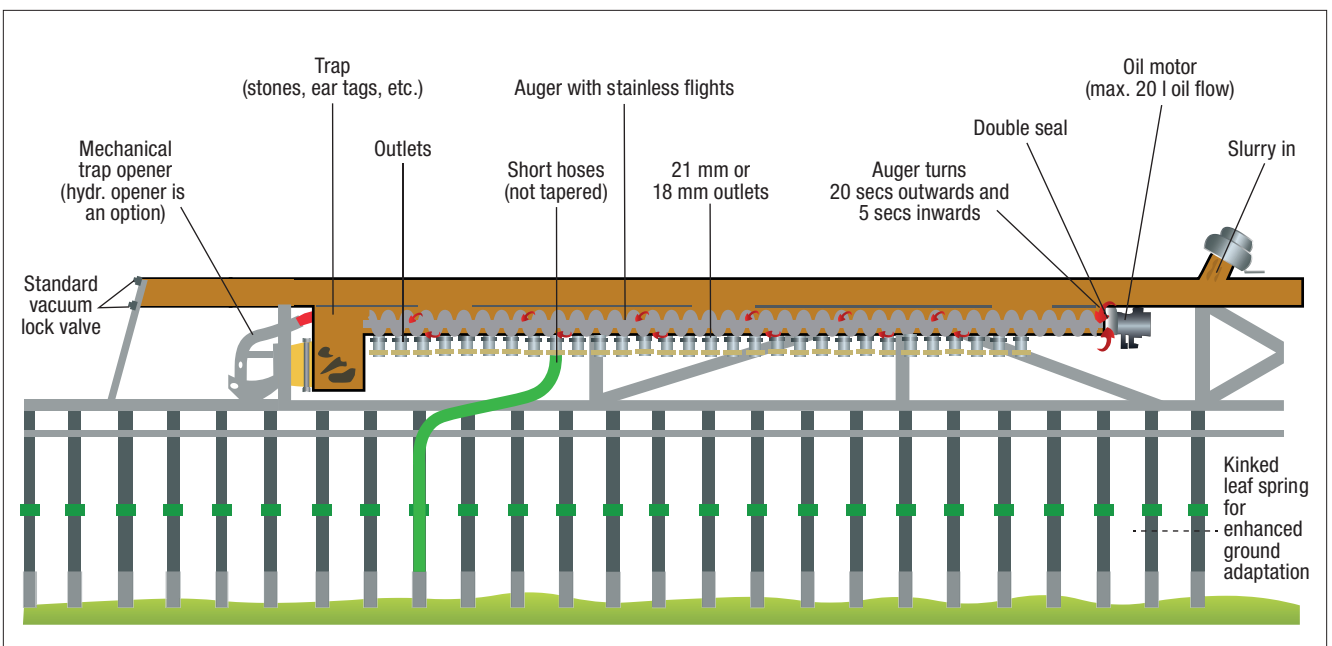


Figure 6:
FLIEGL auger distributor

The method

DLG test module

“Functionality and quality of work”

Accuracy of cattle and pig slurry lateral distribution

The accuracy of cattle and pig slurry application across rows (lateral distribution) at two different rates on level ground is measured on the test stand to DIN EN 13406 standards. In this test, slurry is applied during a specified period of time and collected into trays that are placed under each outlet. These trays are weighed afterwards.

These weighing results are used to determine the mean deviation (MD) and the coefficient of variation (CoV). The smaller these two parameters, the more accurate is the lateral distribution.

$$MA = 100 \cdot \frac{1}{n \cdot \bar{X}} \cdot \sum_{i=1}^n |X_i - \bar{X}|$$

The mean deviation is assessed by applying the following DLG assessment scheme.

Table 2:

Assessment of lateral distribution

Mean deviation	DLG score
≤ 5 %	++
≤ 10 %	+
≤ 15 %	○

Determining V patterns at application start

In this test, the testers time the seconds the unit takes until slurry is flowing through all outlets. The shorter this delay, the quicker the applicator achieves full-width spreading.

Slurry types applied in the test

The types of slurry that were used to carry out the test are characterised by dry matter content, ability to flow and density.

The dry matter content is determined gravimetrically in a lab. This is done by sampling the slurry as it is being applied in the test.

Its ability to flow is measured by means of a fluid meter. This is filled with slurry to a standardised volume. Then the fluid meter is emptied and the time this takes is measured.

This parameter is used for computing the ability to flow of the liquid.

The density is determined by taking multiple samples and filling these into a measuring cup. Then the density of each individual sample is determined by using the volume filled into the cup and the weight of this particular sample. These two parameters are used to compute the average density of the slurry.



Figure 7:

The test stand for measuring the lateral distribution



*Figure 8:
The fluid meter for determining the ability to
flow of the slurry*

DLG test module “Handling, ease of operation, service and maintenance”

In this test module, the following typical machine functions and repetitive service jobs are carried out by experienced operators. Each operation is timed with a stopwatch:

- Changing from transport into work position
- Changing from work into transport position
- Lubricating all grease points. The number and accessibility of grease points are noted down and the time required for servicing these is measured. The operator uses a grease can that is stored on the applicator next to the distributor. After all nipples are serviced, the can is put back and stored next to the distributor being tested.
- Emptying the traps: The test persons open the service unit and inspect the trap for fibrous or solid material. Then they close the service unit again as required.

All actions were carried out by several persons and the individual measurements were averaged. Each step and service job were described in terms of accessibility, ease of operation and tools required.

Detailed account of the test results

The test was carried out with a 15 m FLIEGL SKATE 150 trailing shoe applicator with two FLIEGL auger distributors.

The applicator has 60 shoes that are spaced at 25 cm and formed into spouts. Each of the two distributors has 30 outlets with 40 mm ID hoses. The boom was attached directly to the tank and required a 20-25 l/m oil flow.

The tank was a 18.5 m³ two-axle tank of FLIEGL AGRARTECHNIK with a pto powered rotary piston pump Vogelsang VX 186-260 Q. The application rate was controlled by the pto speed.

The test tractor was a John Deere 6190R.

Lateral distribution applying cattle and pig slurry

The lateral distribution was measured on the test stand on level ground. Table 3 shows the results for both types of slurry and various application rates. The testers found that the deviations were very small ranging between 3.0 % and 3.8 %.

All these results are “very good” (+ +) according to the DLG assessment scheme.

The figures 9 to 15 show the results in cattle slurry and pig slurry and both application rates.

Performance at application start

Table 4 lists the number of seconds that passed before all distributor outlets were supplying slurry. The higher the flow rates the sooner did the liquid arrive at the outlets. On the whole, all outlets were supplied very fast, which means the full application width was attained very quickly (short V pattern).

Table 5 shows details on the two types of slurry.

Table 3:

Results on level ground – lateral distribution of cattle and pig slurry

Type of slurry	Pto speed	Pump speed	Flow rate	Application rate	Coefficient of variation	Mean deviation	Score*
Cattle slurry	560 rpm	560 rpm	5,475 l/min	39.8 m ³ /ha at 5.5 km/h	3.9 %	3.1 %	++
Cattle slurry	390 rpm	390 rpm	3,871 l/min	19.4 m ³ /ha at 8.0 km/h	3.9 %	3.0 %	++
Pig slurry	560 rpm	560 rpm	5,196 l/min	40.0 m ³ /ha at 5.2 km/h	4.7 %	3.8 %	++
Pig slurry	390 rpm	390 rpm	3,640 l/min	18.2 m ³ /ha at 8.0 km/h	3.7 %	3.0 %	++

* Assessment scheme for mean deviation ++ = ≤ 5%, + = ≤ 10%, ○ = ≤ 15 %

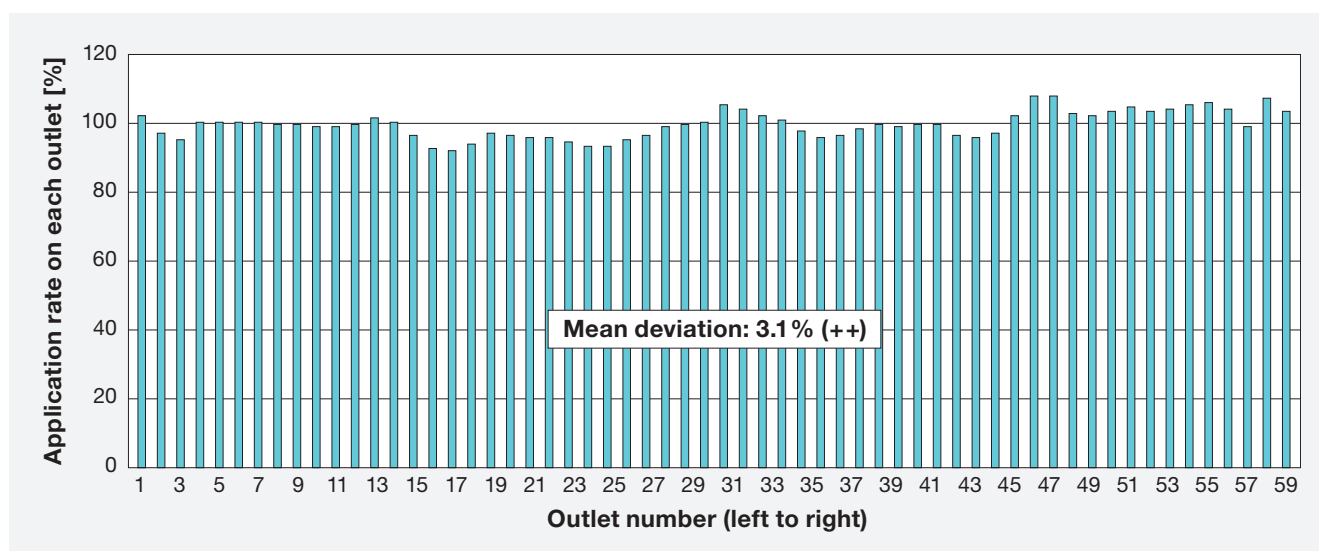


Figure 9:

Lateral distribution of cattle slurry on level ground at a 5,475 l/min flow rate (equates an application rate of 39.8 m³/ha at 5.5 km/h ground speed)

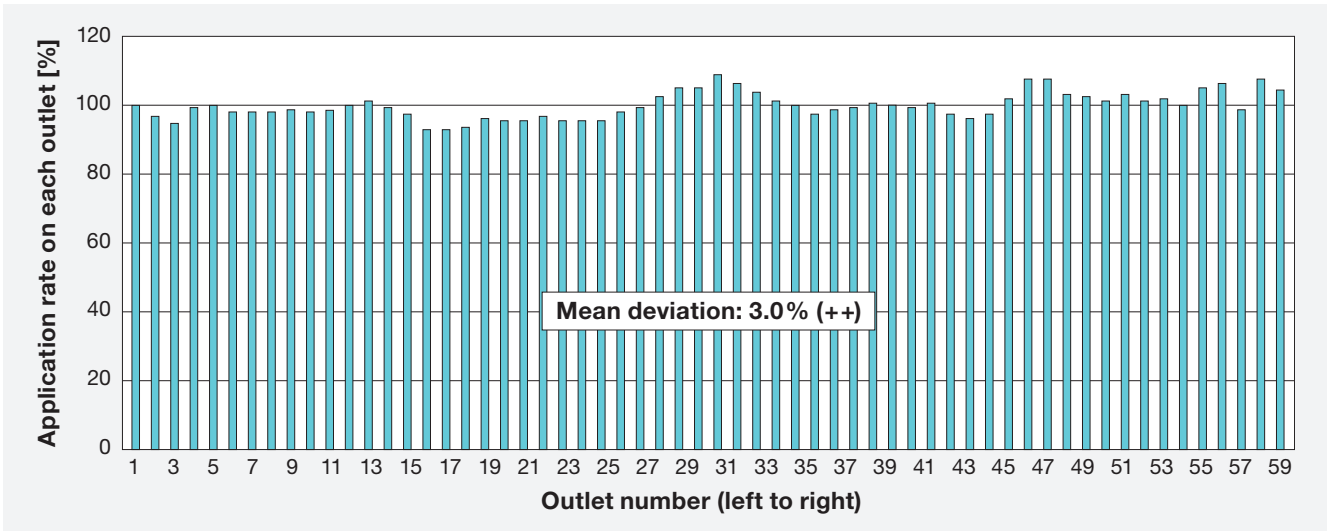


Figure 10:
Lateral distribution of cattle slurry on level ground at a 3,871 l/min flow rate
(equates an application rate of 19.4 m³/ha at 8.0 km/h ground speed)

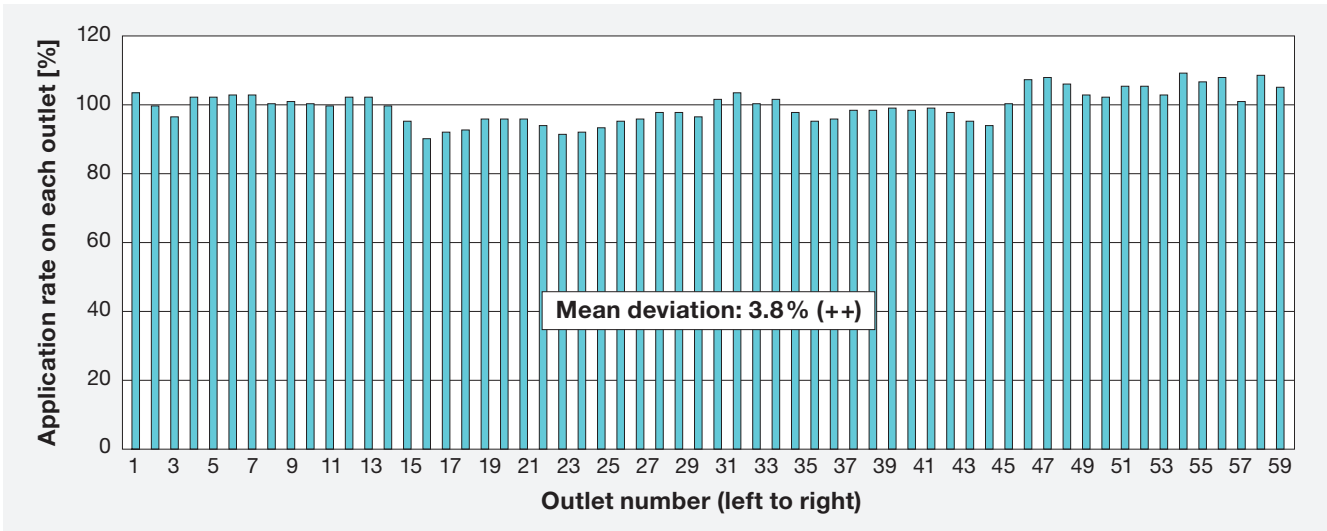


Figure 11:
Lateral distribution of pig slurry on level ground at a 5,196 l/min flow rate
(equates an application rate of 40.0 m³/ha at 5.2 km/h ground speed)

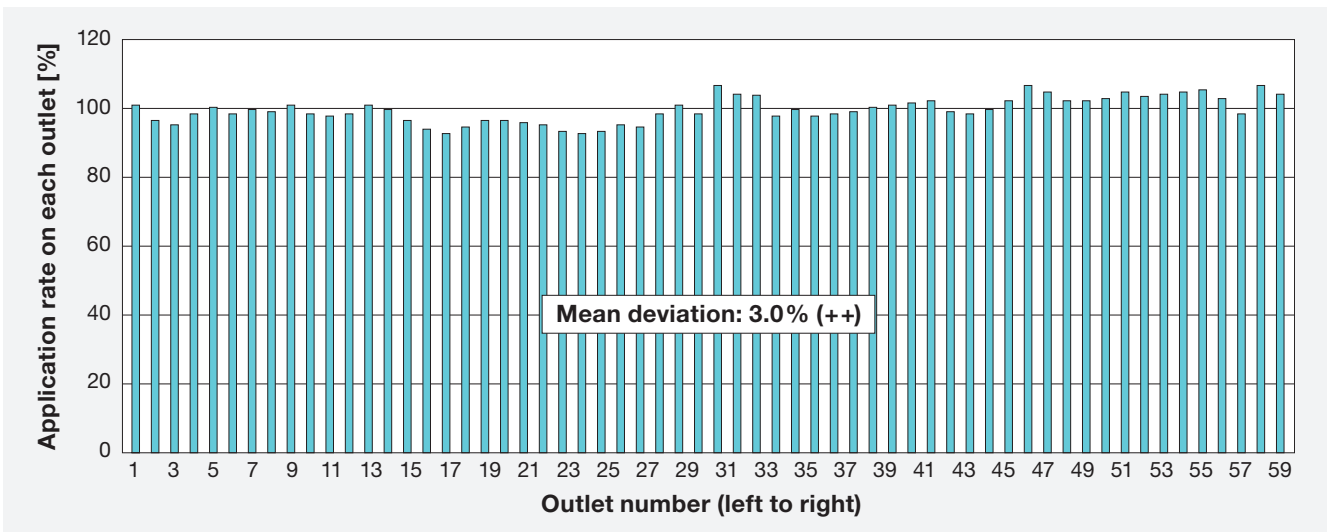


Figure 12:
Lateral distribution of pig slurry on level ground at a 3,640 l/min flow rate
(equates an application rate of 18.2 m³/ha at 8.0 km/h ground speed)

Table 4:

Time (seconds) taken until slurry flows through all distributor outlets

Test	Seconds
Cattle slurry, 5,475 l/min	1.7
Cattle slurry, 3,871 l/min	2.6
Pig slurry, 5,196 l/min	1.4
Pig slurry, 3,640 l/min	2.1

Table 5:

Cattle/pig slurry characteristics

Data		Cattle slurry	Pig slurry
DM content	[%]	7.7	4.1
Ability to flow	[s]	7.3	6.7
Density	[kg/dm ³]	0.96	0.99

Table 6:

Operation and service times

Machine functions / servicing		Test person					Measured and averaged time
		1	2	3	4	5	
Changing from transport into work position	[s]	26	26	26	26	26	26
Changing from work into transport position	[s]	28	28	28	28	28	28
Servicing all four grease points	[s]	66	63	79	65	75	70
Emptying the traps	[s]	7	5	5	5	7	6
Emptying the traps incl. visual inspection from the ground	[s]	36	36	38	38	40	38

Handling, ease of operation, service and maintenance

In this test module, the following typical functions and repetitive service jobs are carried out by experienced operators. Table 6 summarises the results.

Changing from transport into work position

Changing from transport to work position is done from the tractor cab using the ‘Easy’ comfort control unit with integral sequence control. ISOBUS operation is an

option. As a first step, the boom is raised slightly (transport lock). Then the two booms unfold. Next, the booms lower into work position. The folding rate is restricted as required by safety standards. The testers timed 26 seconds for the changeover.

Changing from work into transport position

Moving the unit from work into transport position is also done from the cab-based ‘Easy’ comfort control unit (ISOBUS operation is an option).

As a first step, the booms fold to the vertical and then into the direction of travel.

After that they lower into the catch hooks. Like the unfolding rate, the folding rate is also restricted as required by safety regulations. The testers measured 28 seconds as the maximum.



Figure 13:

Catch hooks on the Fliegl SKATE 150 that accommodate the booms during transport

Lubricating all grease points

On the whole, there are four grease points that need to be attended on the FLIEGL SKATE 150 trailing shoe applicator. These are on the two transport catch hooks on both sides of the tank and on the two carrier brackets for the slope compensation.

All service points are greased with a brush. There are no grease nipples that would require a grease gun. All grease points are easily accessible and are serviced with the operator in a standing position and the boom in working position.

It took our testers 63 to 79 seconds to service all grease points.

Emptying the traps

There is a trap at the end of each auger distributor. The augers feed fibrous material that does not pass through the outlets to these traps. These have brass gate valves that opened hydraulically on the test machine for emptying the fibrous material. The trap is serviced with the boom in headland position. Emptying the traps took 5 to 7 seconds on average after the operator triggered the function on the control unit.

Emptying the traps incl. visual checks from the ground

After operators open the two brass sliders on the traps by operating a button on the control unit, they dismount the tractor and give each trap a visual inspection. Then they remount the tractor and close the two sliders by pressing a button on the control unit. This service job is carried out with the boom in headland position and took 36 to 40 seconds in the test.



*Figure 14:
FLIEGL auger distributors on trailing shoe applicator FLIEGL SKATE 150 with hydraulically opening brass slide valve for emptying the traps*

Summary

Applying cattle and pig slurry, the FLIEGL SKATE 150 trailing shoe applicator (with two FLIEGL auger distributors) demonstrated excellent distribution qualities in the test. The averaged deviations that describe the quality of distribution were less than 5 % in all four test runs, which means that all test results were assessed as “very good” (+ +). The time measurements show that there is only a very short delay until slurry flows through all distributor outlets. As such, the applicator achieves its full working width very quickly after spreading has started.

The FLIEGL SKATE 150 trailing shoe applicator (with auger distributors) also produces convincing results in the DLG test module “Handling, ease of operation, service and maintenance”. Access to all service points is excellent and most services are carried out in an upright position. The various operations are straightforward and require no specialist tools.

Based on these test results, the FLIEGL SKATE 150 trailing shoe applicator (with auger distributors) is awarded the DLG APPROVED quality mark in the test modules “Functionality and quality of work” and “Handling, ease of operation, service and maintenance”.

Further information

Testing agency

DLG TestService GmbH,
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The tests are conducted on behalf of DLG e.V.

DLG test framework

Slurry applicators (dated 05/2018)

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Agriculture

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Dr. Ulrich Rubenschuh

Test engineer(s)

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Figures and graphics

DLG and FLIEGL Agrartechnik GmbH

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DLG – the open network and professional voice

Founded in 1885 by the German engineer Max Eyth, DLG (Deutsche Landwirtschafts-Gesellschaft – German Agricultural Society) is an expert organisation in the fields of agriculture, agribusiness and the food sector. Its mission is to promote progress through the transfer of knowledge, quality standards and technology. As such, DLG is an open network and acts as the professional voice of the agricultural, agribusiness and food sectors.

As one of the leading organisations in the agricultural and food market, DLG organises international trade fairs and events in the specialist areas of crop production, animal husbandry, machinery and equipment for farming and forestry work as well as energy supply and food technology. DLG's quality tests for food, agricultural equipment and farm inputs are highly acclaimed around the world.

For more than 130 years, our mission has also been to promote dialogue between academia, farmers and the general public across disciplines and national borders. As an open and independent organisation, our network of experts collaborate with farmers, academics, consultants, policymakers and specialists in administration in the development of future-proof solutions for the challenges facing the agriculture and the food industry.

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