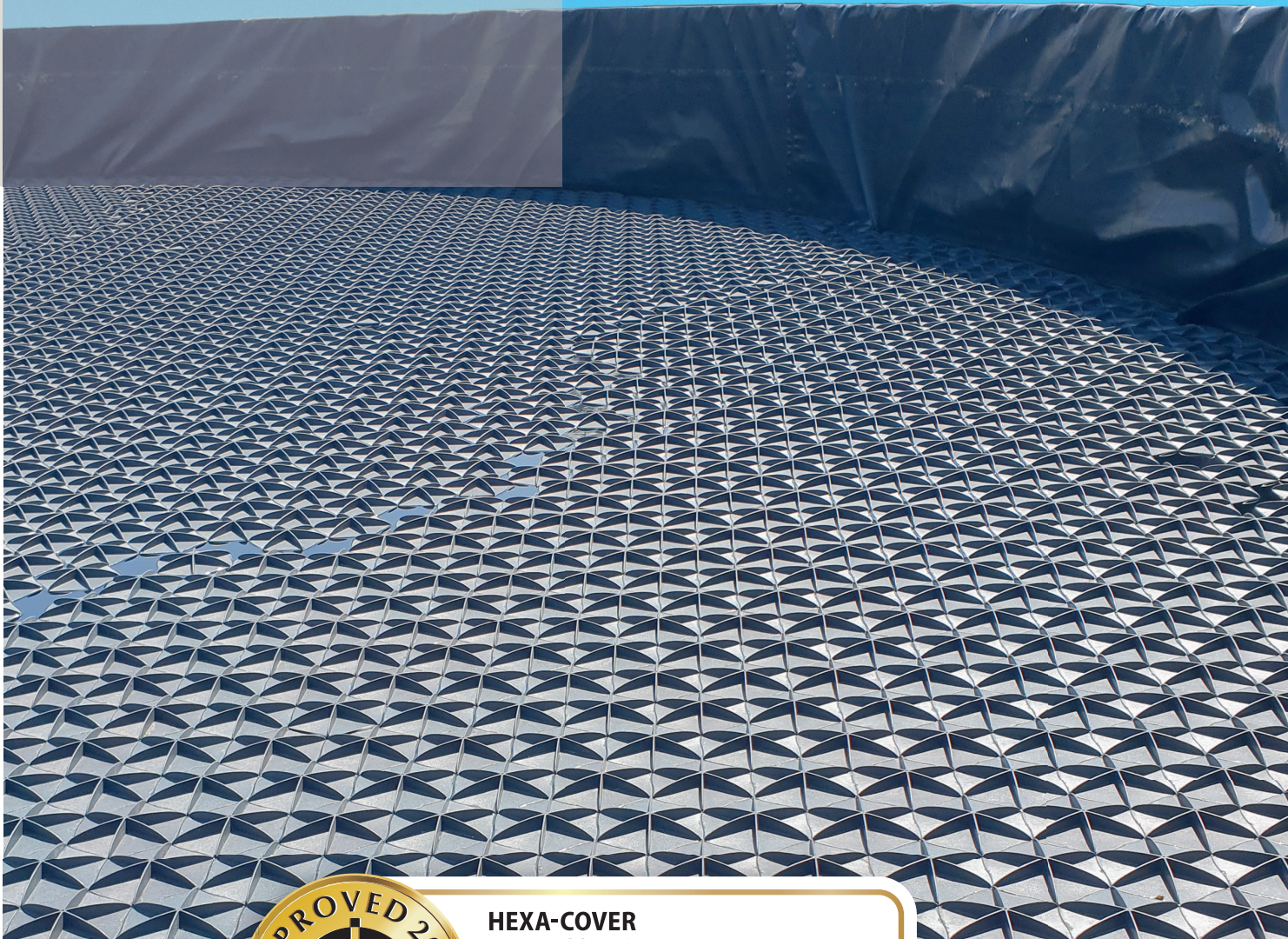


Hexa-Cover A/S

Hexa-Cover R114 covering system for manure tanks with pig slurry

Reduction of Ammonia and Odour Emission



HEXA-COVER
HEXA-COVER R114

- ✓ Reduction of Ammonia Emission
- ✓ Reduction of Odour Emission

DLG Certificate 7593



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.



HEXA-COVER
HEXA-COVER R114
✓ Reduction of Ammonia Emission
✓ Reduction of Odour Emission
DLG Certificate 7593

For obtaining the test mark, the Hexa-Cover® R114 covering system from Hexa-Cover A/S was tested for its suitability to reduce emissions of ammonia and odour through the formation of a floating layer in open manure tanks with pig manure or degassed manure.

The minimum requirements according to the current TA Luft for existing plants have been met and partly exceeded. As a result, the covering system from the company Hexa-Cover for pig manure and degassed manure could be certified.

Other criteria were not investigated.

The product

Manufacturer and Applicant

Hexa-Cover A/S, Vilhelmsborgvej 5, 7700 Thisted, Denmark

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Product: Cover system Hexa-Cover R114 for pig manure and degassed manure in open manure tanks

Description and technical data

The covering system from Hexa-Cover is suitable for the formation of a floating layer in open manure tanks. Table 1 shows the most important product properties.

Table 1:
Product specifications

Floating cover units	
Shape	hexagonal disc with starformed ribs on both sides
Material	recycled plastic, 100 % polypropylene
Dimensions	diameter: 228 mm; height: 60 mm
Coverage	about 28 pieces/m ²
Weight	243 g per unit

Assessment in brief

The covering system from the company Hexa-Cover A/S consists of individual buoyant elements to be applied as a floating cover for open manure tanks, mainly for pig manure or degassed manure. This forms a floating layer, with the flotation bodies arranged closely on the surface of the manure. The individual elements are applied to the surface of the manure using mobile technology and then largely arrange themselves in a form-fitting manner.

The examination was carried out on two agricultural farms with pig manure and degassed manure. Under test conditions, a reduction level of ammonia of 98 % could be detected. In practice, this corresponds to a manure storage with a diameter of 30 m. Manure storages with a diameter of 10 m or more achieves a reduction rate of ammonia > 90 %.

The reduction of emissions of odour depends very much on the maximum odorant concentration in the uncovered manure storage. The higher the concentrations, the higher the possible reduction rate. In the test, 81-96 % was achieved. On average across all measurements, a reduction of 88.6 % can be indicated. The test results are given in Table 2. The mechanical coverage was 95-98 % in all measurements.

Thus, this covering system meets also the current legal requirements of the TA Luft regarding existing installations. With regard to ammonia, the requirements of the TA Luft are also met for new plants, provided that a coverage rate of at least 93 % can be maintained. This corresponds to a container diameter of at least 10 m.

Table 2:
Overview of the results

DLG QUALITY PROFIL		Test result	Evaluation*
Reduction of emission			
Odour	--	81-96 %	N/A
Odour, average	--	88.6 %	
Ammonia	container diameter Ø > 10 m	> 90 %	
Ammonia	container diameter Ø > 20 m	> 95 %	
Ammonia	container diameter Ø > 30 m	98 %	

* DLG Evaluation range:

 or better = meets, exceeds or significantly exceeds the established DLG standards,

 = meets the legal requirements for marketability,  = failed

N/A = not assessed

The method

The basis of the evaluation by the DLG Technical Committee (TC) are the measurements from the year 2004. The TC acknowledges the quality of the measurements at that time. The deviations from the current DLG test framework are tolerated and accepted as acceptable.

The changes made to the product in the meantime (reduced product height as well as lower weight) are not expected by the TC to result in any relevant change in effect.

The test included measuring of the emission reduction of odour and ammonia under laboratory conditions. The examinations (see test conditions Table 3) were carried out independently by two measuring laboratories using liquid pig manure. In the marginal area of the storage container, partially cut floaters were used.

To assess the emission reduction, the efficiency was determined from measurements between uncovered pig manure and pig manure covered with the Hexa-Cover covering system.

Odour

The odorant concentration measurement was carried out according to DIN EN 13725.

Ammonia

The ammonia concentrations were determined using the impinger method. Constant portions of the airflow were drawn through the laboratory bottles using a vacuum pump. The increase of the liquid in the acid separators was measured and its ammonium content was determined by the indophenol method.

Before the indophenol analyses, the samples were diluted 20-fold or 100-fold with deionized water. This dilution reduced the effects of the sulphate ions and other chemical components in the acid separator liquids.

Degree of covering

To illustrate the connection between ammonia emission and the degree of covering, lower degrees of covering have been used in the laboratory test than what is normally to be achieved by the cover system.

By means of the hereby resulting mathematical combination, intermediate values can be calculated.

Table 3:
Test conditions

	Odour	MEASURING	Ammonia
Storage tank			
Number		2 units	
Diameter/height		1.45 m/1.0 m	
Height of filling		0.6 m	
Liquid manure	pig manure	pig manure I (from piglets, value adjusted) pig manure II (degassed from biogas plant)	
Liquid manure test conditions			
test temperature	12, 14 and 18 °C		10 ± 3 °C
Ventilation	0, 120 and 240 m³/h		50 to 75 m³/h
Covering systems			
Number of floating cover units	46.5		48
mechanical covering degree	95 %		98 %

Detailed account of the test results

The test was carried out at two agricultural farms. The test results are based on comparison between containers covered by Hexa-Cover system and uncovered containers, filled with identical pig manure. The results are summarized below.

Odour

Table 4:

Measuring results of the odour concentration

	Ventilation (m³/h)	Odour concentration (OU/m³)		Efficiency (%)
		uncovered	Hexa-Cover	
Temperature 12 °C	0	2,203	285	87
	120	2,062	317	85
	240	865	94	89
Temperature 14 °C	0	8,520	803	91
	120	491	83	83
	240	372	70	81
Temperature 18 °C	0	10,368	645	94
	120	5,550	513	91
	240	5,033	187	96

The odorant concentrations generated by the uncovered manure ranged from 372 to 10,378 OU/m³, depending on temperature and ventilation. With the Hexa-Cover cover system, the measured concentrations ranged from 70 to 803 OU/m³. This results in a reduction degree of the individual samples of 81 to 96 % (Table 5). On average, a reduction degree of 88.6 % can be indicated. The degree of reduction increases at higher odorant concentrations (Figure 2).

This effect, caused by the increase in the initial concentration, is simulated by the higher temperature and lower ventilation and corresponds to the increase in odor emissions from the surface of the manure during calm weather conditions in summer.

From this, the following can be derived for the practical application of the Hexa-Cover covering system to determine the values for the emission mass flow.

Assumption:

Flow value = 10 m³/(m²·h)

Container diameter = 15 m

Example 1:

Summer 18 °C

With a reduction of the odor substance concentration from 10,000 OU/m³ to 700 OU/m³, an emission mass flow of 1.2 MOU/h arises under the above assumptions.

Example 2:

Average annual temperature 12 °C

With a reduction of the odorant concentration from 2,000 OU/m³ to 200 OU/m³, an emission mass flow of 0.35 kOU/h results under the above assumptions.

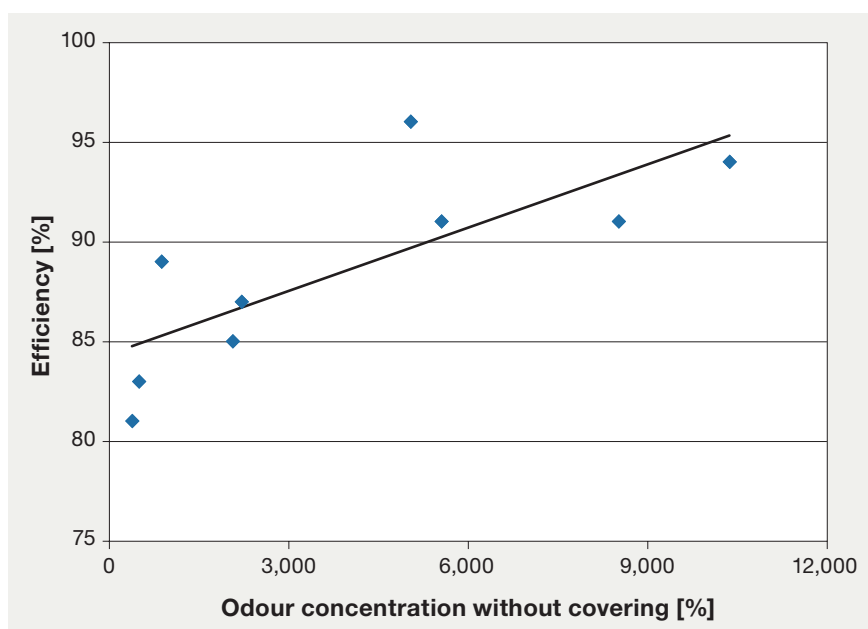


Figure 2:
Reduction level of the Hexa-Cover system on liquid pig manure

Ammonia

The measurement of ammonia emissions showed, with a covering of 98 % of the surface, an emission reduction of 96 to 99 % for pig manure I and II (manure from piglet rearing, pH value adjusted/degassed from biogas plant).

Based on a container diameter of 30 m with a resulting coverage rate of 98 %, an average reduction rate of 98 % can therefore be stated.

Relationship between coverage level and ammonia emission

The coverage level achievable with the Hexa-Cover covering system depends on the diameter of the manure tank. In Figure 3, the relationship between coverage rate and ammonia reduction rate is shown graphically.

Taking into account the results according to Figure 3, the following ammonia emission reduction values are to be expected in practice depending on the tank diameter (see Table 5).

Miscellaneous

The test took place under laboratory conditions, with the test results being applied to practical operations. An examination under real practical conditions did not take place. Also, at the time of the examination, a survey among the users could not be conducted. It is recommended to read the manual and follow the instructions.

The minor changes to the product are not expected to result in any change in effect; however, it cannot be ruled out that there is a slight influence on the penetration depth and thus possibly on the even distribution in the manure tank.

Table 5:
Expected ammonia emission reduction values
depending on container diameter

Container diameter (m)	Covering degree (%)	Ammonia reduction (%)
10	93	90
15	95	94
20	96	96
25	97	97
30	98	98

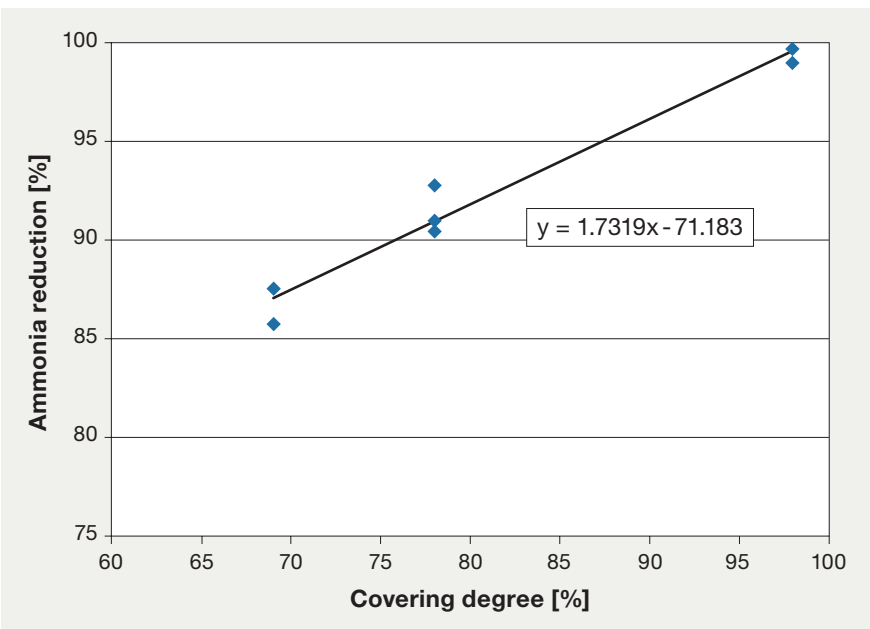


Figure 3:
Reduction of ammonia emissions depending
on the degree of coverage

Summary

The examination included technical measurements for reducing odour and ammonia emissions from pig manure under laboratory conditions. The covering system was not tested in practical use.

Based on the present results, the Hexa-Cover covering system meets the requirements for the award of the test mark DLG APPROVED with regard to the test criteria "Ammonia and odour emission reduction".

Other criteria were not investigated.

Further information

Testing agency

DLG TestService GmbH,
Groß-Umstadt location, Germany
The tests are conducted on behalf of DLG e.V.

Labor and emissions measurements

Odour:
ECOMA GmbH, Consult Mannebeck,
Harvighorster Weg 12, 24211 Honigsee, Germany

Ammonia:
LugtTec A/S, Niels Pedersen Alle 2, 8830 Tjele,
Denmark

DLG test framework

DLG APPROVED test
“Reducing emissions from manure tanks”
(current as of 10/2022)

Department

Farm Inputs

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Dr. Michael Eise

Test engineer(s)

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* Author

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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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The original measurement took place in 2004 and was first published in test report 5451F (“FokusTest”). In 2026 the report was transferred into the new design and republished as test report 7593 (“DLG APPROVED”).

Internal test code DLG: 2603-0036

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