Overview of the DLG Testing Framework ‚Lights in stables‘

(status: March 2023)

The requirements for barn equipment have been adapted to the state of the art in recent years. More and more farms are installing energy-saving electrical devices in the animal area. LED lighting systems, for example, are more economical and last longer than conventional barn lights. The DLG test is intended to demonstrate whether the effectiveness of electrical devices used in stables can also be ensured over a certain lifetime.

There are various gases in the stable air. In addition to the respiratory gas carbon dioxide (CO2) and traces of nitrogen oxides (NOx), nitrous oxide (N_2O) and carbon monoxide (CO), barn air mainly contains ammonia (NH_3), methane (CH_4) and dust.
Depending on the animal species, husbandry method, animal mass, air exchange rate and measurement location, the stable exhaust air is subject to considerable fluctuations. In addition, stable air is characterized by relatively high and strongly fluctuating air flows, depending on the outside climate and housing conditions.
The temperatures of the exhaust air from pig houses normally vary between 15 and 32 °C the relative humidity between 20 and more than 70%.

The cornerstones of the DLG procedure for testing barn lights can be summarized as follows:

A) Resistance to ammonia

The ammonia resistance of the luminaire is determined by a laboratory test with at least one type of luminaire according to the patented DLG test standard for agricultural use. The laboratory test is designed to replicate the conditions of a usage period of about 10 years exposure to animal living areas. The test is carried out in a climate chamber under the following climate conditions:

Test duration	*1500 h*
Air temperature	*70 °C*
Relative humidity	*70 % rH*
Ammonia concentration	*750 ppm*

For assessing the ammonia resistance, each luminaire is examined visually, gravimetrically and the plastic parts additionally through measurement of the hardness (Shore D) before and after the climate testing. The active tested luminaires (two out of four test samples) are additionally following a cycle of operation predefined by DLG (three hours on, one hour off) in order to evaluate any thermal impacts caused by switch-on and -off procedures during ammonia fumigation. Furthermore the luminous flux was measured according to DIN EN 13032 before and after the fumigation in order to get additional information regarding the aging process.
In order to avoid overheating (> 70 °C), the luminaires could be operated at a reduced power level during the testing period after consultation with the DLG.
Four lights are always tested for each type of light, with an additional test sample serving as a reference sample.

Test results resistance to ammonia:

Visual check resistance to ammonia	***Evaluation***
resistant *(no damages, no discolorations and no material changes, no reduction of the functionality)*	
Conditionally resistant/partly resistant *(weak discolorations, weak material changes, no reduction of the functionality)*	
Non-resistant *(damages, corrosion effects, cracks and fractures, strong discolorations and material changes, loss of function)*	

Photometric check resistance to ammonia	***Evaluation***
Preservation of the luminous flux ≥ 90%	
Preservation of the luminous flux ≥ 80%	
Preservation of the luminous flux ≥ 70%	
Preservation of the luminous flux < 70%	

B) Cleaning distance

During test bench examinations of the mechanical resistance to high-pressure cleaners, the minimum cleaning distance is determined. The minimum cleaning distance is defined as the distance between nozzle and surface when no damages can be observed at the housing surface.

The test is conducted under the conditions presented in the following table:

Line pressure	*approx. 150 bar*
Water	*cold, approx. 1.000 l/h, no detergents*
Nozzle type	*Flat spray nozzle, 25°*
Exposition time	*1 minute*
Distance	*200 mm, 150 mm, 100 mm, 50 mm*
Ambient temperature	*10-20 °C*

Two lights of one type are always tested. On request, material compatibility with regard to cleaning agents (e.g. disinfectants) can also be tested.

Test results of Cleaning distance:

Visual check Cleaning distance	***Evaluation***
Water ingress or material damaged?	
Minimal cleaning distance	
Cleaning distance of ≤ 5 cm	🟩🟩🟩🟩🟩
Cleaning distance of ≤ 10 cm	🟩🟩🟩🟩
Cleaning distance of ≤ 15 cm	🟩🟩🟩
Cleaning distance of ≥ 20 cm and/or water ingress	🟥

C) Flicker free

Imperceptibly unstable light also places strain on the eye muscles and the nervous system of animals and disturbs the processing of sensory stimuli in the brain. Such stress factors can also trigger behavioural disorders.

The frequency and modulation depth of the flicker of two test samples for each type of luminaire were measured and assessed at full power. If the luminaire provided is dimmable and dimming is also recommended for practical use, the above tests were also carried ot at 50% and 10% of the nominal power.

Test results Flicker free:

Flicker free	***Evaluation****
Flicker frequency ≥ 90 Hz and modulation depth ≤ 1%	🟩🟩🟩🟩🟩
Flicker frequency ≥ 1000 Hz and modulation depth ≤ 3.3 % *or* *Flicker frequency ≥ 3000 Hz*	🟩🟩🟩🟩
Modulation depth ≤ 1% *or* *flicker frequency ≥ 1000 Hz* *or* *Flicker frequency ≥ 90 Hz and modulation depth ≤ 3.3 %*	🟩🟩🟩
Flicker frequency < 90 Hz and modulation depth > 1 % *or* *Flicker frequency < 1000 Hz and modulation depth > 3.3 %*	🟥

* DLG Evaluation range:
🟩🟩🟩 or better = meets, exceeds or significantly exceeds the established DLG standards
🟨🟨 = meets the legal requirements for marketability, 🟥 = failed

Other test criteria are also possible on request.

After a successful test, a DLG test report is created, which is published in at least two languages under the following link, from where it can be downloaded free of charge:

DLG test reports Lighting systems