Overview of the DLG test framework 'Process-integrated measures for emission reduction (InDoor process)'

(as of September 2025)

The revision of the Technical Instructions on Air Quality Control (TA Luft 2021) means that the testing and certification of emission reduction technologies is now of great importance, as only quality-assured processes may be used in installations requiring approval. Mitigation techniques at or in the barn can include exhaust air purification systems or process-integrated mitigation measures (known as indoor processes). Outside of stable facilities, covers are used for open slurry tanks, for example. Testing frameworks for the aforementioned techniques are available from the DLG. This document provides an overview of the testing framework for indoor methods. Tests conducted in accordance with DLG testing standards and with corresponding certification are accepted by many authorities both in Germany and abroad. In this context, the DLG test framework is often cited as a guideline for conducting and evaluating the test. The key points of the DLG procedure are summarised below. The Technology and Equipment Test Centre of the DLG (German Agricultural Society) tests the practical value, i.e. the basic suitability of indoor processes under practical conditions, which are used in pig, cattle or poultry houses to reduce emissions. This means that the DLG test goes well beyond a simple emission measurement, with the advantage that all parties involved – approval authorities, manufacturers and farmers – can rely on the functionality of certified systems when operated correctly. The prerequisite for testing an indoor measure is approval of the facility in accordance with the Federal Immission Control Act (BImSchG) or building regulations, compliance with the requirements of the Animal Welfare Farm Animal Husbandry Ordinance, and the functionality of the procedure to be tested. The manufacturer is obliged to submit complete documentation of its process, including the technology used for testing.

Requirements for applying for a DLG test (requirements for the manufacturer)

The complete procedure description must be available and contain at least the following information:

a) A description of the housing system to be investigated, including details of the animal species, housing method, feeding, ventilation system and the integration of the mitigation measure into the specific housing system
b) A comprehensive operating manual including technical data with a detailed description of how the technology to be tested works, including dimensions (weight or quantity output, etc.)
c) An overview of the consumption data to be expected in practical operation (e.g. energy, labour, material use and costs, water consumption, bedding, etc.)
d) Proof of verification of proper operation via user manual or electronic monitoring, laboratory analyses, electronic loggers
e) Information on the disposal and recycling of input materials and residual materials
f) Information on occupational safety
g) Proof of the safety of the substances to be used

A) Requirements for conducting the examination

a) Accreditation of the participating testing and measurement laboratories in accordance with ISO 17025. The relevant measurement parameters (ammonia, methane, odour, etc.) must be

individually accredited. In addition, the consumption data and, if necessary, the required air volume flows must be reliably recorded and continuously stored by the measurement institute. The measurement institute must be able to measure the volume flows at the site accurately in accordance with the state of the art (i.e. tracer gas balancing in freely ventilated stables or outdoor runs, volume flow measurement by measuring fans or network measurement in accordance with VDI/VDE 2640 Sheet 1 in mechanically ventilated stables).

b) The test is supervised by an independent Technical Committee, which examines the technology to be tested, including the test environment and suitability of the test sites, before measurements are taken. In addition, the measurement plans to be drawn up are approved by the Technical Committee, the measurement reports submitted by the DLG Test center are reviewed and the results are evaluated.

c) There must be at least two different operating sites where the mitigation measure submitted by the applicant for testing is installed and where a reference compartment or stable is available in each case. The sites must comply with the legal requirements (TierSchNutztV, DIN 18910, AwSV, etc.), otherwise recognition is not possible. Compliance with these requirements is checked by the DLG.

B) Determination of the measurement programme

The measurement programme is determined in coordination with the DLG Technical Committee and the commissioned measurement laboratory during an inspection of the technology to be tested. In husbandry procedures involving adult animals, e.g. laying hens, dairy cows, breeding sows, at least six independent measurement weeks are usually specified throughout the year at the locations to be tested. For rearing procedures involving growing animals, e.g. poultry for fattening, pigs for fattening, piglet rearing, six measurement weeks (two measurement weeks within each outdoor temperature range) must be specified at the locations, which representatively reflect the live weight development. For broilers, three fattening cycles within the three temperature ranges can also be measured. In individual cases, the Technical Committee decides which measurement programme is to be used. The summer temperature range is defined as measurement days with a daily average temperature mostly above 16 °C, while the winter range is defined as daily average temperatures below 8 °C. Measurement days with a daily average temperature between 8 °C and 16 °C are classified as transitional.

The following are usually measured or recorded **continuously:**

a) Ammonia in the animal area, in the supply and exhaust air
b) Other gaseous substances such as carbon dioxide, methane and, if applicable, nitrous oxide
c) Volume flow in the stable areas or facilities to be tested
d) Number and weight of animals
e) Temperature/humidity in the livestock housing and in the outdoor area
f) Air pressure, differential pressures if applicable
g) Quantities of feed/litter, where relevant
h) Energy consumption of the technology used
i) Consumables and input materials (water, acids, additives)

The following should be measured **weekly (at least once a week):**

a) Dust (total dust, fine dust PM_{10}, $PM_{2,5}$)
b) Odour, insofar as necessary for the objective of the mitigation measure

In individual cases, it may be necessary to record additional or different parameters (e.g. pH value, substrate temperatures, etc.). Some of the parameters listed above may need to be measured more frequently. In addition, feed and manure samples are taken at the beginning and end of each measurement period, and feed consumption and manure production are determined at the end of each cycle in order to establish a nitrogen balance. Following the audited fattening cycle, the impact of manure removal on emissions is also generally recorded.
N balancing is carried out for each measurement period or each fattening cycle. N balancing serves several purposes: evidence of the whereabouts of the nitrogen from the ammonia (NH_3-N) the avoidance of secondary emissions the plausibility check of the procedure.

C) Proof of proper operation

The use of emission reduction technologies must also be verifiable retrospectively, i.e. the operator of a relevant practice must be able to prove to the approval authorities that the technology was actually used at his premises. Continuous measurements of separation behaviour can be expensive and time-consuming. However, sensors or counters can often be installed in conjunction with a logging system to verify the proper use of an indoor measure. With some indoor technologies, electronic monitoring is not readily possible. In the case of litter or feed additives, for example, it is usually advisable to record and document the delivery notes. In addition, samples can be sent regularly for laboratory analysis to verify the active ingredients in the feed or litter. The manufacturer's specifications are checked by the Technical Committee.

D) Evaluation and calculation of efficiency

Efficiency is always measured and calculated using a case-control approach. This means that a reference compartment or barn (without InDoor technology) is always sampled alongside a comparable test compartment or barn (with InDoor technology), and both units are then compared with each other. The above parameters are measured in both units. Mass flows are calculated from concentration and volume flow, which can be directly compared between the reference and test houses, provided that the operational management (in particular temperature and air volume flow) and the animal-specific data (live weights, number of animals, etc.) were comparable in both houses during the test period.

All measurement data is processed (e.g. consideration of pre-loading, procedure for measurement gaps, consideration of device-specific determination limits, meteorological data, etc.) in accordance with the specifications of the Technical Committee. Volume flows and concentrations are standardised during calculation (1013.25 hPa, 0 °C).

E) Minimum requirements for cleaning performance and other requirements

The efficiency, i.e. the difference between treated and untreated stables or compartments, must be at least 10 %. The overall efficiency, i.e. the average value across all measurement periods and all farms tested, applies here. The efficiency levels per measurement period should be positive. Negative or neutral efficiency levels can be accepted provided that the overall efficiency level is positive. However, these must be clearly documented. The Technical Committee will decide on a case-by-case basis.

The following table shows the DLG requirements.

Overall efficiency	Evaluation
≥ 40 %	🟩🟩🟩🟩🟩
≥ 25…< 40 %	🟩🟩🟩🟩
≥ 10…< 25 %	🟩🟩🟩
< 10 %	🟥

F) Review of plant safety with regard to personal protection (occupational safety)

If the mitigation technology is implemented as a structural modification (e.g. heat exchangers or recirculation units in the barn), the safety of the system must be checked. The mitigation technology is checked on site by the employers' liability insurance association (SVLFG), the German Testing and Certification Centre for Agriculture and Forestry (DPLF) or by suitable experts. All relevant guidelines and standards are taken into account. Once the occupational safety review has been completed and all safety deficiencies have been rectified, a final report or certificate is issued.

G) Compliance with legal regulations and review of environmental aspects

If waste materials or by-products are generated, these must be evaluated. In addition, disposal instructions must be provided.

H) Assessment of measurements

The measurements are assessed by the DLG Technical Committee. The Technical Committee works on a voluntary basis, independently and competently. External measurement laboratories involved provide the DLG with their test reports and complete measurement data. The data is processed and submitted to the Technical Committee for assessment. After successful completion, the DLG will issue a test report containing a summary of the measured values. The report also includes an evaluation of the determined media consumption and animal-specific observations (mortality rate, feed conversion). This test report is published in German and at least one other language and can be downloaded free of charge at the following link:

https://www.dlg.org/de/landwirtschaft/tests/suche-nach-pruefberichten/?unterkategorie=293&page=1&pruefgebiet=3

This publication is based on the current version of the DLG test framework (version 4.0 from March 2025).