

DLG Test Report 7417

IMKO Micromodultechnik GmbH

TRIME®-GWs

Metering accuracy in wheat,
barley and oilseed rape



IMKO TRIME GWS
✓ Metering accuracy in wheat
✓ Metering accuracy in barley
✓ Metering accuracy in oilseed rape
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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 “Metering Accuracy” test of the IMKO grain moisture metering system was conducted in accordance with the DLG test framework. The test aimed at verifying the suitability of the product for moisture content measurement in various crops. Other criteria were not tested.



IMKO TRIME GWS

- ✓ Metering accuracy in wheat
- ✓ Metering accuracy in barley
- ✓ Metering accuracy in oilseed rape

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Assessment in brief

The TRIME®-GWs In-Line moisture metering system is suitable for moisture content measurements in wheat, barley and oilseed rape during continuous mass flow (in-line). The system can be used for monitoring moisture content in controlled systems, e.g. grain dryers.

Table 1 shows the test results.

Table 1:
Overview of results

DLG QUALITY PROFILE	Test result	Evaluation*
Metering accuracy in barley		
Mean deviation	minor	■ ■ ■ ■ ■
Scattering of results	little to average	■ ■ ■ □ □
Metering accuracy in wheat		
Mean deviation	very minor	■ ■ ■ ■ ■
Scattering of results	little to average	■ ■ ■ □ □
Metering accuracy in oilseed rape		
Mean deviation	in some cases	■ ■ ■ □ □
Scattering of results	little to average	■ ■ ■ □ □

* The DLG test framework provides the following options in its evaluation schemes:

■ ■ ■ or better = meets, exceeds or clearly exceeds the specified DLG standard, ■ ■ = meets the legal requirements for marketability, ■ = failed

The product

Manufacturer and applicant

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Product:

TRIME®-GWs In-Line moisture
metering system

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Description

The TRIME®-GWs In-Line moisture metering system is permanently installed in a dryer and connects to the electric mains. The in-line or in-process system consists of several instruments and components for measuring moisture content in wheat, barley and oilseed rape during continuous mass flow.

It can be used for quick moisture content measurement as one feature that determines the product value. As such, the information is used for making a management decision or as information for controlling the moisture monitoring process, for example.

The measurement is read out in digital format on a display screen; it can also be transmitted as an analogue signal to third-party instruments that do not form part of the system.

The TRIME®-GWs measures the dielectric constant (the electrical property of substances) of the material surrounding the probe. The dielectric constant is a function of the amount of water contained in the product – regardless of whether the material is at rest or in a continuous flow.

The electric measurement is transformed into moisture content data that is based on calibration functions that were empirically collected for the various crops.

Figure 2 shows the TRIME-GWs moisture metering system. Table 2 shows the major dimension and weight specifications of the system.

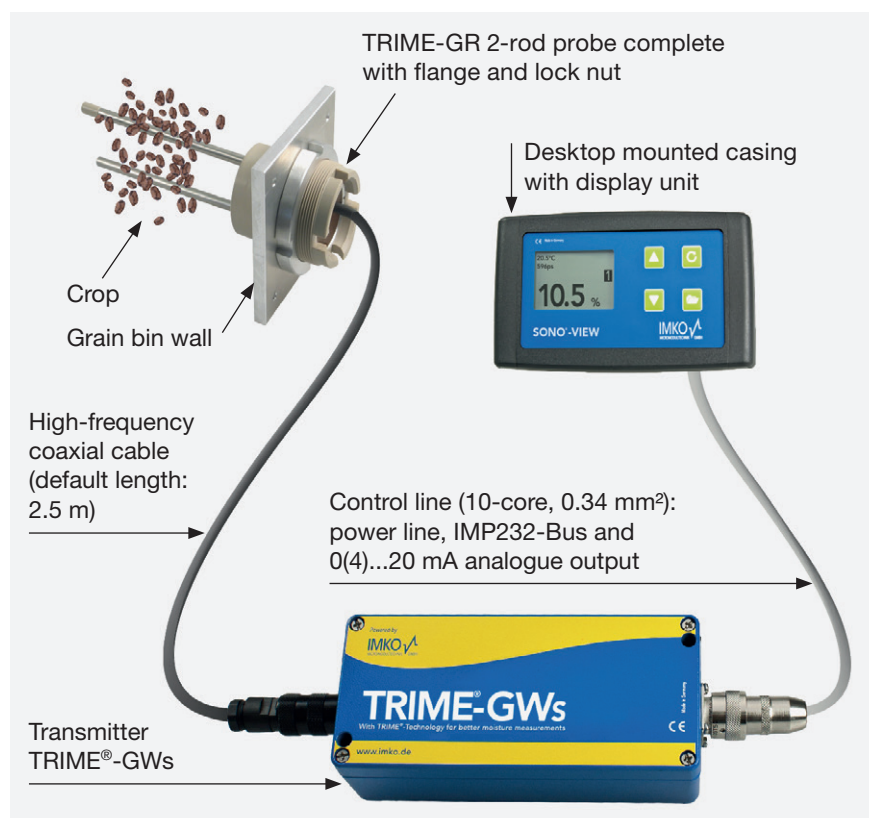


Figure 2:
The TRIME®-GWs In-Line moisture metering system for use
in grain dryers

Table 2:
TRIME®-GWs dimensions and weights

Transmitter	
Length/width/height	175/80/58 mm
Weight	0.64 kg
Display Unit	
Length/width/height	120/120/100 mm
Weight	0.15 kg
Probe	
Probe unit (diameter/height)	70/75 mm
Rods (spacing, diameter, length)	40/8/150mm
Weight	0.67 kg
Operating data	
Voltage (230V power supply unit)	9-24 V DC
Power input	max. 150 mA
Moisture content range	5 to 45 %
Transmitter temperature range	-10 to +70 °C
Probe temperature range	0 to +120 °C, temporarily 150 °C

The tested TRIME®-GWs In-Line moisture metering system consists of the transmitter, the probe, the display unit and various accessories.

The transmitter

The transmitter components are housed in a pressure resistant IP65 aluminium case. The case has holes for attaching it to a wall or bracket and ports for specific connectors:

- a flanged 6-pin connector for connecting the probe;
- a 6-pin MIL connector for electric power supply, for data communication and analogue signal output.

The probe

The probe consists of the following components:

- a cylindrical probe head that is made of high-temperature resistant plastic. The cylinder has a male coupler (M70 x 2), an aluminium flange with internal threading and a grooved nut as locking nut;
- two stainless steel rods that are threaded into the probe head;
- a 6-pin socket for the HF coaxial cable to the transmitter;
- IP68 protection rating.

The display unit

The display unit consists of a casing that houses a lit LCD display screen and a configuration unit and is either wall-mounted or positioned on a table top.

The display unit also stores the calibration testing functions for all common crops. The operator selects the required function from a menu and presses a button to confirm.

The accessories

The following accessories are supplied with the system:

- data logging and parameterisation software;
- a customised control line from transmitter to the display unit.

Optional accessories

The following accessories are supplied as an option:

- data logging and parameterisation software; evaluation and calibration testing software;
- a 4 m, 10 m or 25 m probe line.

Suitability

The TRIME®-GWs In-Line moisture metering system is suitable for measuring moisture content in wheat, barley and oilseed rape in a continuous (in-line) process.

It is permanently installed in an agricultural facility such as grain dryers, grain stores as well as crop reception and dispatch centres.

The moisture content measurement is continuously displayed on the digital display screen and can also be processed into an electrical signal for the following purposes:

- output and storage on / to a pc or printer.
- serve as a parameter for monitoring controlled systems, such as continuous flow dryers.
- serve as a switching signal that operates batch dryers or conveyors and discharge systems.

In large grain stores, the TRIME®-GWs moisture metering system can be installed at several test points. Depending on the purpose and the processing of the meas-

urements, the system may be used in conjunction with subordinate evaluation technology which is usually computer-based.

The moisture metering system is not calibratable. This means that according to grain price legislation the measurements cannot be used in trading or for product pricing.

Installation

The installation of the TRIME®-GW In-Line moisture metering system should be carried out by an authorised mechanic who has the appropriate qualification and in consultation with IMKO and the dryer manufacturer of the dryer, because there is no default position for the system in a plant. This must be found individually.

The probe head must be fitted in a position where it can take measurements that represent more or less the moisture of the entire batch and where only minor crop temperature variations are anticipated. Due to the limited length of the cord from the probe head to the transmitter, it is necessary to install the transmitter close to the probe.

No specific installation requirements apply for the display unit.

Furthermore:

- the probing rods must be completely immersed in the grain material to ensure correct measurement.
- a 50 mm radius around the rods must be free of metal parts and air pockets.
- the material flow past the rods must not exceed a certain velocity to avoid a major disturbance of mass flow cohesion.

The ambient temperature must not exceed 120 °C around the probe and 70 °C around the transmitter.

For technical reasons, the default length of the HF coaxial cable from the probe to the transmitter is 2.50 m.

Metering accuracy

For accurate and consistent measurements, there must be no variations in the type of crop, operating conditions and crop temperature.

The TRIME®-GWs moisture metering system takes only relative measurements.

These relative measurements are converted into “true” moisture content outputs by the transmitter which uses empiric calibration functions. These “true” data are read out on the display screen. For this, it is necessary that users know the “true” moisture content, i.e. it must be measured with a reasonably accurate moisture meter. This “true” measurement is then entered to the display unit. This calibrates the unit which from now on will display the moisture content measurements in digital format.

However, the readings are averaged values. Averaging takes place automatically and based

on a certain number of measurements that are taken at 0.5 sec intervals.

One averaged result reflects one minute of measuring. Operators can set this measuring period to a few seconds or to several minutes from the display unit or a pc. This gives the readings also the quality of an averaged value that represents a larger volume of grains flowing past the probe within the set time period. This method offers advantages and is particularly important in conditions where moisture levels and measurements vary.

The method

One TRIME®-GWs model was tested in a lab test at the DLG test centre in Gross-Umstadt. The first test took place in the time period from 1997 to 1999. This test was completed successfully. In 2017, a repeat measurement was carried out and successfully completed. The results are discussed in the chapter “Detailed account of the test results”.

The tests were carried out in wheat, barley and oilseed rape. The moisture content measurements by the TRIME®-GWs In-Line moisture metering system were compared with hot-air cabinet measurements (to ISO 712 for grain; to ISO 665 for oilseed rape) for which samples had been taken manually.

The suitability of the system for dryers was also tested in the same types of crops (tests carried out from 1997 to 1999). The repeat measurements were made by simulating dryer conditions at the lab. For this, wet material was filled into a sufficiently sized container (5l measuring cup) until this was completely filled. Then the probe of the TRIME-GWs moisture metering system was immersed into the wet material.

Then the test engineers selected the suitable calibration curve programmed to the TRIME®-GWs. An offset value was generated from the test results and used for calculating the measurement accuracy in each individual crop.

The TRIME®-GWs measurements were repeated three times in each crop and the results were averaged. The “true moisture content” was determined by applying the traditional reference method in a double test (hot-air cabinet to ISO 712 or ISO 665).

In the test that spanned the years 1997 to 1999, a total of 15 samples were taken from each crop and measured to the DLG test framework; in the repeat measurement in 2017, at least 5 samples per crop were measured.

Detailed account of the test results

The accuracy of the system was tested by comparing the system measurements with the lab measurements in samples that were taken manually.

The two parameters analysed were “Mean deviation” and “Scattering of measurements”. The measurements of this system were averaged and compared with the hot-air cabinet measurements. In all tested crops, it was found that the differences between the two systems were only small and mean.

The scattering of the measurements around the mean value varies by crop (see figures 3 to 8). The test parameter “Mean deviation” is the key parameter for assessing the suitability of the in-line moisture metering system TRIME®-GWs. By comparison, scattering is rather secondary. This means the system meets the requirements for measurement accuracy.

In the following graphs, the straight black line represents the evaluated regression line to the black test points (deviation). The colour lines (green-yellow-red) represent the limits of the DLG evaluation procedure. The blue line represents the regression line for which offset is not taken into account. The “Mean deviation” test requires the black regression line to run full length within the evaluation range. The “Scattering” test requires all black measuring points to be scattered within the evaluation range.

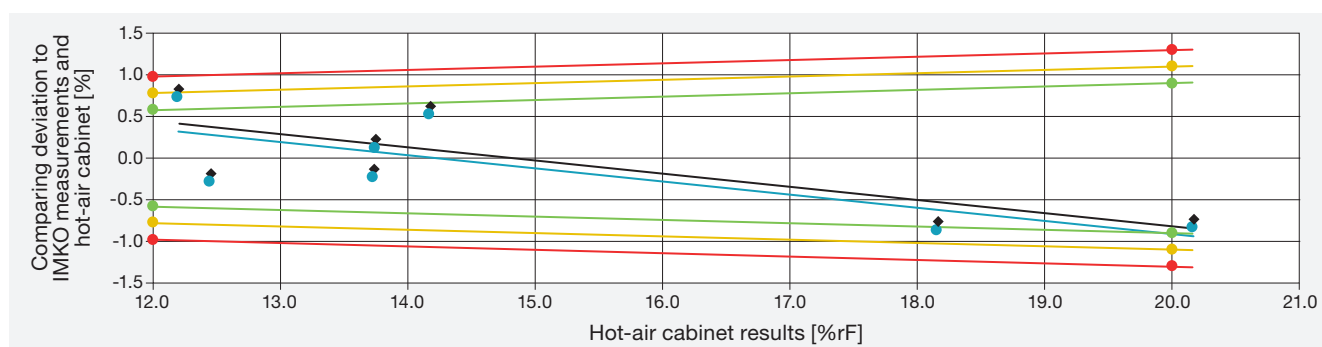


Figure 3: Scattering of measurements in winter barley (12-20 % moisture, +0.1 offset)

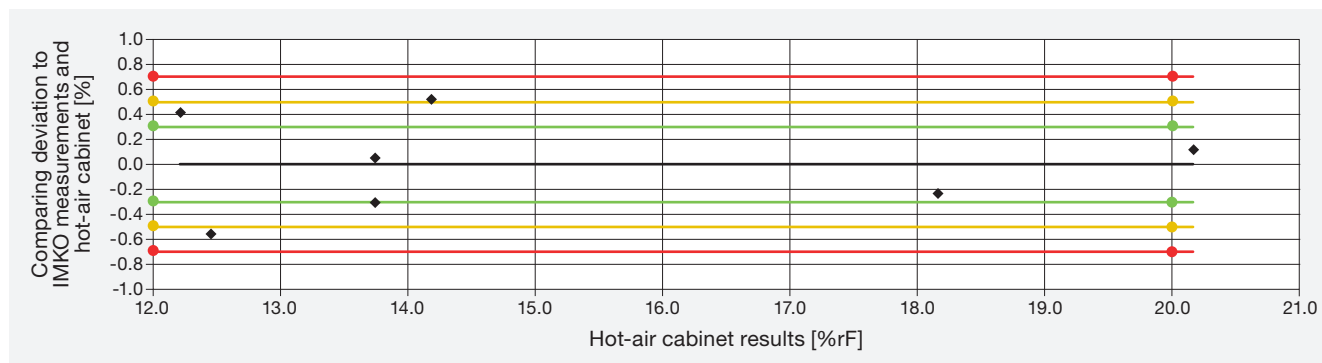


Figure 4: Scattering of measurements in winter barley (12-20 % moisture, +0.1 offset)

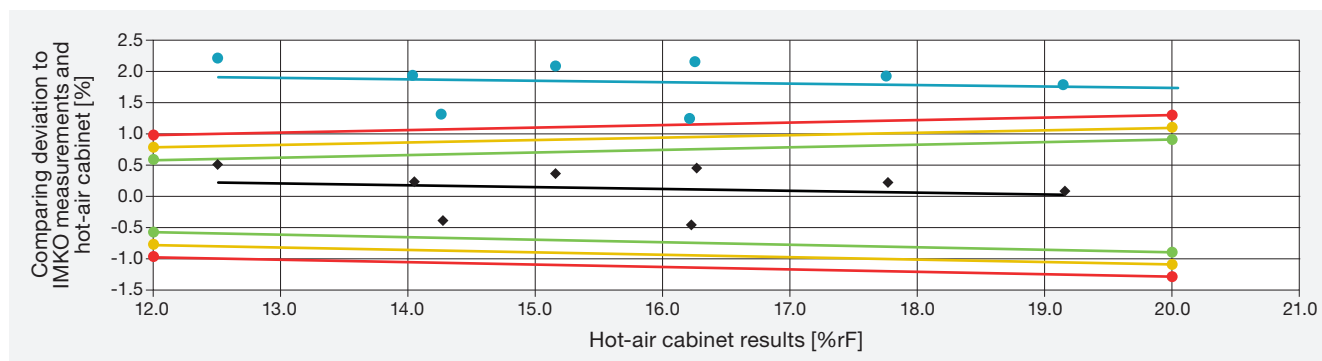


Figure 5: Mean deviation in wheat (12-20 % moisture, -1.7 offset)

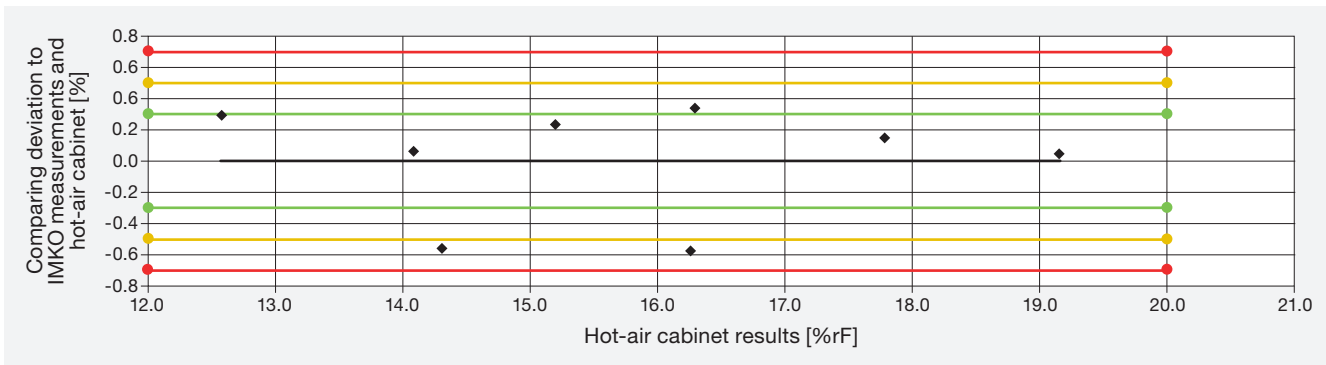


Figure 6: Scattering of measurements in wheat (12-20 % moisture, -1.7 offset)

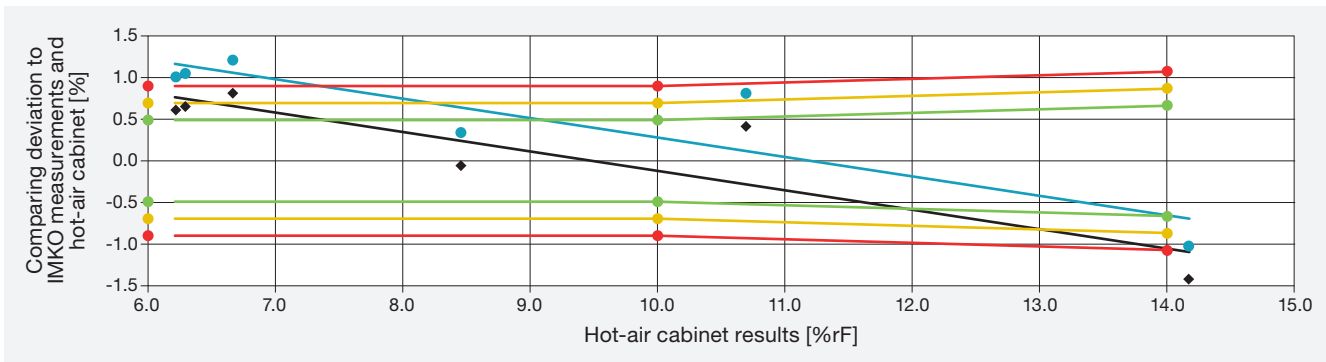


Figure 7: Mean deviation in oilseed rape (6-14 % moisture, -0.4 offset)

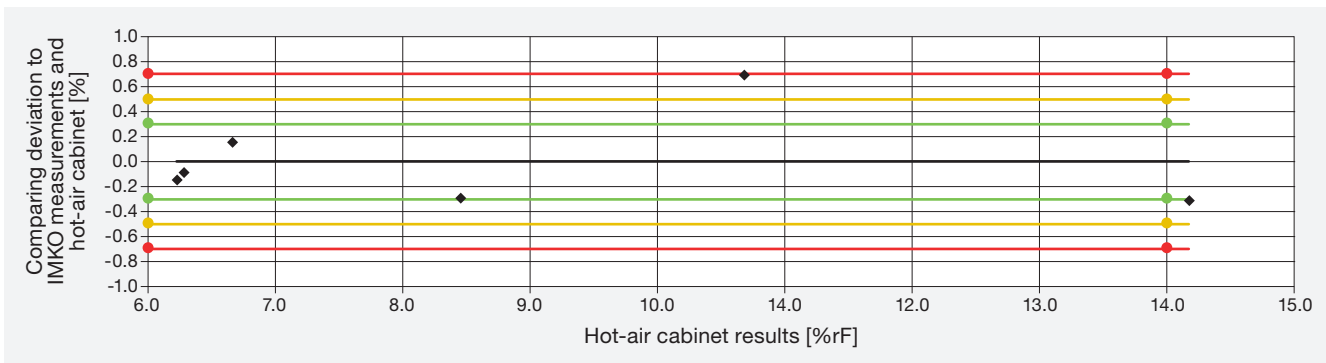


Figure 8: Scattering of measurements in oilseed rape (6-14 % moisture, -0.4 offset)

Summary

The above results show that the TRIME®-GWs In-Line moisture metering system from IMKO Micromodul-technik GmbH meets the requirements of the test schemes on “Metering accuracy in barley”, “Metering accuracy in wheat” and “Metering accuracy in oilseed rape”.

This performance qualifies the product for receiving the DLG-APPROVED quality seal. Hence, it can be assumed that this system is suitable for producing reliable moisture content measurements in barley, wheat and oilseed rape. No other criteria were tested in this test.

Further information

Testing agency

DLG TestService GmbH, Gross-Umstadt site,
Germany

The tests are conducted on behalf of DLG e.V.

DLG test framework

“Moisture meters for post-harvest grain processing
and storage”. Date of issue 07/2023.

Department

Agriculture

Project Manager

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Test engineer(s)

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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.

Leaders in the testing of agricultural equipment and input products

The DLG Test Center Technology and Farm Inputs and its test methods, test profiles and quality seals hold a leading position in testing and certifying equipment and inputs for the agricultural industry. Our test methods and test profiles are developed by an independent and impartial commission to simulate in-field applications of the products. All tests are carried out using state-of-the-art measuring and test methods applying also international standards.

The TRIME®-GWs moisture detection system was first tested in 1997 to 1999 and passed successfully (DLG test report 4866). As part of a product adaptation, the measuring device was tested again in 2017 to 2018 and also successfully passed the re-measurement for the tested fruit types (test report 6936). According to the manufacturer, the TRIME®-GWs is produced unchanged in the tested version.

Internal test code DLG: 2307-0026

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