

# smaXtec animal care sales GmbH

## Intraruminal measuring system

Rumen fluid resistance

### DLG Test Report 5973 F



#### Registering company

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### Short description

- The tested materials are individual components of a special bolus equipped with a pH-sensor. This bolus is part of a rumen sensor.
- The pH-value of the rumen fluid can be measured continuously within the rumen for a longer period of time.
- The data are measured every 10 minutes, stored in the bolus, and automatically transmitted to a basis station when radio contact is established.
- The continuous monitoring of the rumen pH-value is intended to allow cases of rumen acidosis in cattle to be detected early on in order to provide the animal keeper with an early warning system which enables him to take countermeasures more quickly.



DLG e.V.  
Test Center  
Technology and Farm Inputs

## Test methods and test conditions

The test was carried out as a static immersion test in the laboratory based on the DIN EN ISO 175 standard for the determination of the resistance of plastic materials against liquid chemicals.

Each material was stored in a separate, covered container filled with the required medium and placed in a drying chamber for 28 days.

The medium was replaced weekly, and multiple measurements were taken. Two storage temperatures were chosen for each material and each medium:

- 40°C, which corresponds to the physiological conditions in the rumen and
- 60°C for the acceleration of the material test and the assessment of the results.

Before and after the immersion time of 28 days, the tested bodies were evaluated visually and examined for specific material properties such as mass, measurements, and Shore hardness. Property changes of the tested objects in percent of the initial value were used to evaluate the results.

### Test medium: artificial rumen fluid

The artificial rumen fluid simulates the chemical-physiological conditions in the rumen. This solution has been used for many years in a similar, slightly changed form in order to examine digestion processes in the rumen. The artificial rumen fluid consists of a buffer solution which simulates the "rumen saliva". Macro- and trace elements are added in order to imitate the osmotic conditions in the mucus membrane of the rumen. Chloride compounds are the main component of the trace element solution.

The artificial rumen fluid does not contain any microorganisms. Their natural reaction products and the resulting physiological conditions are known. These reaction products were added as a "fatty acid mixture". This has the advantage that the medium lasts longer and is easier to handle in the laboratory. The pH-value of the solution was set at 6.2 using the fatty acid mixture. This corresponds to a concentration of approximately 100 mMol/l.

In addition to the physiological conditions, the case of rumen acidosis was tested as the worst case scenario. For this purpose, lactic acid was used to lower the pH-value of the physiological artificial rumen solution to 5.2. In practice, a cow with a rumen pH-value of less than 5.2 would already be dead.

Fully desalted water (FD water) served as a reference solution for all examined conditions.

## Tested materials

Short term	Description
Plastic cage magnet	Plastic cover of a commercial cage magnet (reference standard)
Bolus coating, polished	Plastic test plate, polished (bolus casing)
Bolus coating, VDI	Plastic test plate VDI type (alternative bolus casing)
Filling	Filling material samples
O-ring	Sealing O-ring used in different diameters

In addition, the sensor tip and a stainless steel metal cap were examined as part of a rough orientation test.

The precise specifications are known to the customer. Only samples provided by the customer were tested.

## Test results

### Bolus coating

Both qualities of the plastic used for the bolus coating did not show any noticeable alteration of properties and were comparable with the results of the material used for conventional cage magnets. At raised temperatures, properties changed by a maximum of 0.25%. For this reason, both tested materials seem equally suitable for the planned application.

### Filling material

The filling material showed a noticeable alteration in surface colour and structure. With regard to weight changes, however, the behaviour of the filling material in both media was like in the standard solution (FD water). Under extreme conditions (acidosis case, 60°C), the material showed slight signs of softening. Due to the relatively constant mass, it is rather unlikely that larger molecular structures are

leached out of the material. However, this laboratory test does not show whether traces of chemical substances may be released. Since the filling material of the bolus will hardly ever be in direct material contact with the rumen fluid, it seems suitable for this specific purpose even though it must generally be classified as only conditionally resistant.

### O-rings

Under the simulated physiological rumen conditions, no significant deviations were detected in both O-ring sizes. They were in a range similar to standard FD water conditions. Only in the simulated acidosis case at a storage temperature of 40°C was swelling by a maximum of 11.5% measured. Swelling by 10-15% must generally be classified as borderline. However, this amount of swelling only occurred under accelerated extreme conditions. This means that the material

seems suitable for this specific purpose even though resistance in general must be classified as "conditionally suitable".

### Other components

The orientation test did not show any damage to the stainless steel cap due to the chloride concentration. Under the given conditions, no signs of pitting were visible.

The sensor tip did not show any noticeable signs of alteration.

### Evaluation

The tested components of an intraruminal measuring system were resistant to an artificial rumen fluid.

#### Evaluation

Rumen fluid resistance +

—  
Evaluation range:  
+ = resistant / ○ = conditionally resistant /  
- = non-resistant

### Individual evaluations of the tested materials

	Scenario: physiological pH-value: 6,2		Scenario: Acidosis pH-value: 5,2		Evaluation
	40°C	60°C	40°C	60°C	
<b>Plastic cage magnet</b>	resistant	resistant	resistant	resistant	resistant
<b>Bolus coating, polished</b>	resistant	resistant	resistant	resistant	resistant
<b>Bolus coatingl, VDI</b>	resistant	resistant	resistant	resistant	resistant
<b>Filling</b>	visual alteration	visual alteration	visual alteration	slight alteration	conditionally resistant, suitable under the present specific conditions
<b>O-ring</b>	resistant	resistant	resistant	slight swelling (11,5%)	conditionally resistant, suitable under the present specific conditions
<b>Sensor tip</b>	no visible changes				
<b>Stainless steel cap</b>	no pitting caused by rumen-physiological chloride concentration				

## Testing

The DLG FokusTest included chemical tests in the chemical-technical laboratory of the DLG Test Center. The chemical material resistance of individual components to an artificial rumen fluid were examined.

Other criteria were not tested.

### Realization of the tests

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