THE GLOBAL STANDARD
FOR LIVESTOCK DATA

# Appendix B5 of Section 10 of the ICAR Guidelines – Laboratory Test for Conventional Plastic Ear Tags

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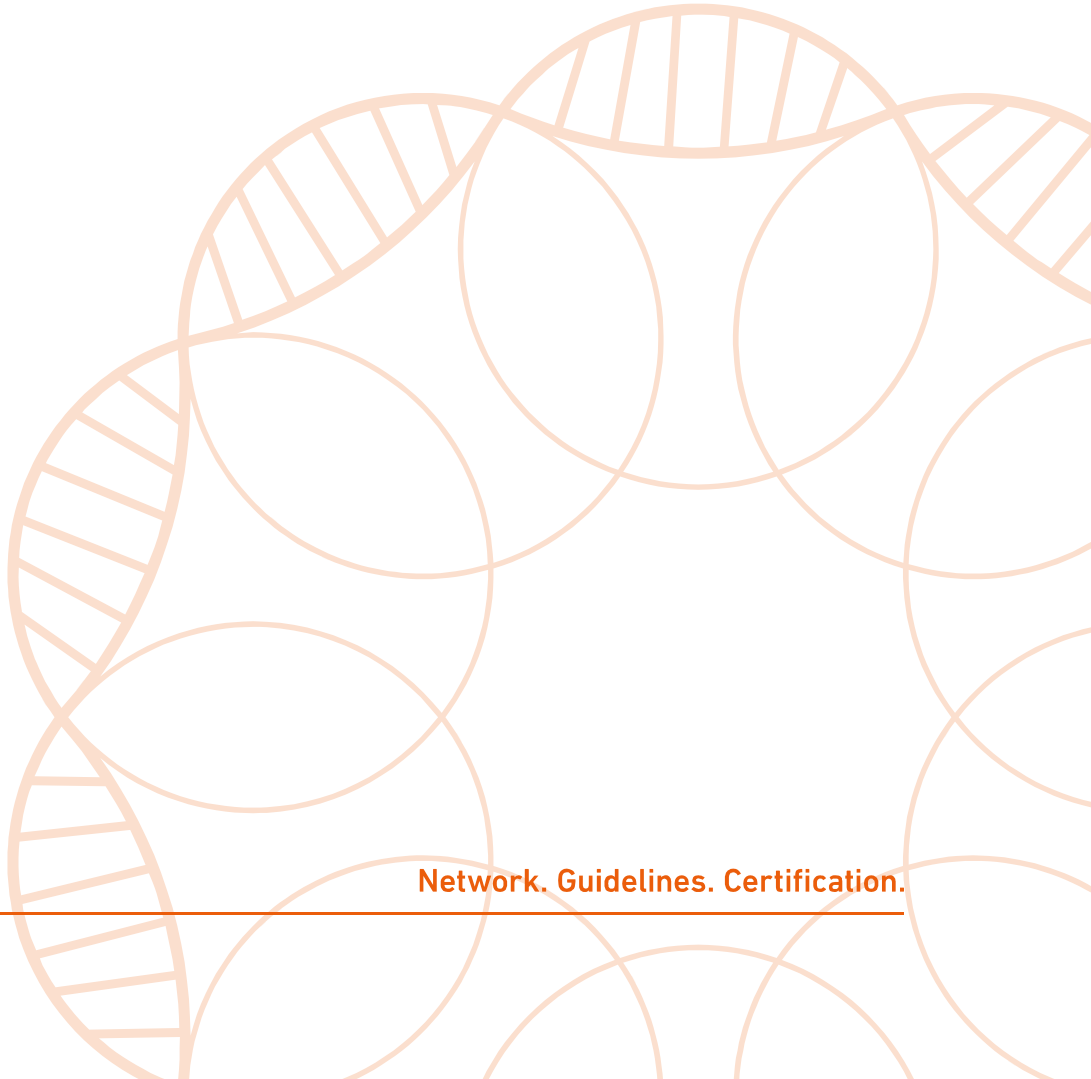
Version February, 2018



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# Change Summary

| Date of Change | Nature of Change |
|---|---|
| August 2017 | Removed the reference 'Chromium: 10 mg/kg' (section 1.2.2) |
| August 2017 | Replaced ISO 7724 with ISO 11664-4.<br>Replaced 10 with 15 CIELAB units (section 3.2). |
| August 2017 | Added reference to pig ear tags<br>Removed the phrase 'Broken or unfastened tags must not be re-usable' and replaced with 'None of the ear tags – neither male nor female part – must be re-usable. Male pin tips must break off and remain within the female caps (locking gap).'<br>Added the requirement 'The minimum breaking force applies to devices irrespective of treatments (artificial ageing, damp heat and cold)'<br>(section 3.3.3). |
| October 2017 | Corrected typos. Updated version to October. Cross-references corrected. |
| February 2018 | On Saturday 10th February, changes approved by the ICAR General Assembly in Auckland, New Zealand. |

# 1 Assessment of descriptive parameters

The parameters describing the ear tag will be assessed and compared to the information provided in the Application Form to ensure accuracy of description.

## 1.1 Weight and dimensions

The following measurements will be taken:

a. The weight of the complete locked ear tag

b. The dimensions of the front and rear plate (height, width and thickness)

c. The pin (length and diameter)

d. The entrance hole of the cap

The results of these measurements will be compared to the Preliminary Assessment test report to ensure the accuracy of the samples.

## 1.2 Composition

Because ear tags are attached to "food producing" animals, they must meet specific requirements set down by international laws and regulations. In addition to these requirements, substances affecting animal, human or environmental health need to be detected. As such, certain chemical and physical composition traits of the ear tag will be evaluated.

This evaluation will involve 20 ear tags.

### 1.2.1 Characteristics of the ear tag plate plastic

To characterise the basic component of the plastic raw material, one ear tag plate is submitted to an Attenuated Total Reflectance-Fourier Transform Infrared (ATR-FTIR) spectroscopy analysis. Sample preparation is not necessary as the ear tag plate is pressed directly against the ATR-crystal. After analysis, the resulting ATR spectrum will be compared with characteristic spectra stored in specific databases.

Following this analysis, a material sample is submitted to a Differential Scanning calorimetry (DSC) analysis to analyse the thermal characteristics of the material as per ISO 11357. This analysis allows the detection of overlapping IR curves, e.g. if an additional component of minor quality was used to stretch the main component. The test is performed in two heat-up phases:

a. Phase 1: 30°C - 200°C to obtain information about post cross linking of the plastic material to detect processing effects

b. Phase 2: 30°C - 400°C to analyse the thermal parameters.

### 1.2.2 Harmful substances

Pigmented plastics may contain critical heavy metals which must be recorded. These metals are: Cadmium (Cd), lead (Pb), mercury (Hg) and chromium (Cr). If chromium is detected, an additional analysis of carcinogenic hexavalent chromium will be done. The following limit values must not be exceeded:

a. Cadmium: 100 mg/kg

b. Lead: 10 mg/kg

c. Mercury: 1 mg/kg

d. Chromate (Cr VI): < 1 mg/kg

## 2 Pre-treatments

Various treatments are required to prepare tags for the testing of particular characteristics and are outlined in the following sections. These pre-treatments and ensuing performance assessments are summarized in the following table:

| | New tags | | | UV/rain aged tags | | Damp heat/cold aged tags |
|---|---|---|---|---|---|---|
| | Untreated | Acid bath | Alkaline bath | Untreated | Abraded | Untreated |
| Visual readability | | | | | | |
| Typography | × | | | × | × | |
| Colour contrast | × | | | × | | |
| Machine readability | | | | | | |
| Barcode scanning | × | × | × | × | × | × |
| Barcode quality check | × | | | | | |
| Resistance of the locking system | × | | | × | | × |

### 2.1 Acid bath treatment

Five ear tags are immersed for 3 weeks in a 50°C acid liquid (acetic acid, pH = 3) to ensure compliance with ISO 175 for thermoplastics and ISO 1817 for vulcanized elastomers.

This test will only be done on ear tags made of plastic materials other than polyurethane (PU).

### 2.2 Alkaline bath treatment

Five ear tags are immersed for 3 weeks in a 50°C alkaline liquid (sodium hydroxide, pH = 12) to ensure compliance with ISO 175 for thermoplastics and ISO 1817 for vulcanized elastomers.

This test will only be done on ear tags made of plastic materials other than polyurethane (PU).

### 2.3 Ageing by damp heat and cold

In accordance with ISO 4611, 40 ear tags are placed into alternating cycles of 12 hours damp heat (40°C ± 2° / 95% RH) and 12 hours cold (-25°C ± 2°) for a duration of 3 weeks in a climatic chamber.

### 2.4 Resistance to artificial ageing

In accordance with EN ISO 4892-2, procedure A/cycle 1, 40 ear tags are tested against resistance to sunlight. The exposure chamber will be fitted with xenon-arc lamps according to EN ISO 4892-2 and operated continuously for 1,000 hours. These 1000 hours will consist of repeated cycles of 102 minutes of radiant exposure followed by 18 minutes of combined

irradiation and rain simulation. The irradiance level of the xenon-arc lamps will be 60 W/m² (at 300-400 nm).

### 2.5 Abrasive treatment

Five new, untreated ear tags and five artificially aged ear tags will be subjected to an abrasive treatment as per ISO 9352. These tags will receive 1500 cycles of abrasion in a 21°C ±2° laboratory environment.

The abrasive treatment uses CS17 abrasive wheels and a load of 1000 g (or 9.8 N). The front plates of the tags are cut to a disc of about 100 mm in diameter and mounted on the test plate of the Taber Abrader.

## 3 Performance Assessment

### 3.1 Typography readability

Five new, untreated tags and five tags from the following two treatment groups will be selected for assessment:

a. Group 1: Artificially aged tags not subjected to the abrasive treatment

b. Group 2: Artificially aged tags subjected to the abrasive treatment

Five randomly chosen numbers as given in Appendix B3 will be printed on five white pages of paper. The font size, print style and character spacing will replicate that used for the ear tags.

The test tags and the pages with the printed numbers will be placed on a vertical surface (viewing surface) at head height in an appropriately lit laboratory room. Five assessors will stand 15 metres from the viewing surface and then commence walking towards it. Each assessor will attempt to read the numbers on the different ear tags and pages and the distance at which each device (ear tag or page) can be read without error will be recorded on the evaluation sheet.

The mean reading distance for both the pages and the ear tags will be separately calculated for each assessor and for the average of the assessors.

The following requirements must be met:

a. New, untreated tags: The mean distance at which the reference printing is read on the ear tags must be at least 80 % of the mean distance at which the pages are read.

b. Artificially aged tags with and without the abrasive treatment: The mean distance at which the reference printing is read for the ear tags must be at least 65 % of the mean distance at which the pages are read.

### 3.2 Evaluation of colour contrast change

The colour difference of the ear tag plates and of the laser printing is measured and compared between three new ear tags and three artificially aged ear tags by use of spectral photometric measuring equipment according to ISO 11664-4.

After artificial ageing, the change in colour must be less than delta E* of 15 CIELAB units.

### 3.3 Evaluation of machine readability (optional)

This evaluation will occur if the manufacturer requests the machine readability testing in the Application Form (Appendix B1).

For ear tags with linear barcodes, the "Quiet Zone" or margin at each end of the barcode must be at least 5mm. The height of the barcode must be at least 8mm.

### 3.3.1 Barcode scanning

The ear tags subjected to the Phase 3 treatments will be scanned with three different handheld barcode readers. The barcode readers used for this test will be published on the ICAR website.

The treated ear tags will be scanned in sequence and after the initial ear tag is successfully read, the second tag is scanned until successfully read. Each ear tag will be scanned a maximum of four times. This procedure is repeated for each tag in the treatment group and after the last tag is scanned, the scanning is recommenced (Run 2) with the first tag. A total of 60 scans per treatment and reader type will be conducted to obtain sufficient data to assess performance.

The number of scans required to successfully read each tag (e.g. one, two, three or four) in each run is recorded.

The scanning success rate of tags from each treatment group is expressed in a percentage value and based on the number of scans required for a successful read. The performance of the tag is assessed against the minimum performance standards shown below:

| No. of scans required | Proportion of tags successfully read at each scan |
|---|---|
| 1 | 95 % |
| 2 | 98 % |
| 3 | 99.7 % |

The scanning performance achieved for each treatment is included in the ICAR report sent to Service-ICAR at the conclusion of the laboratory tests.

### 3.3.2 Barcode Print Quality Assessment

Print quality assessment will be undertaken on ten new, untreated tags using the protocols described below.

Using an ISO 15426-1 barcode verifier the linear barcodes are assessed for print quality according to ISO 15416. Every ear tag will be scanned ten times to build average grades.

An ANSI scale of A (highly satisfactory) to F (unsatisfactory) will be used to grade the print quality for each characteristic. When determining the overall print quality, the final score for the code on a tag is the worst grade recorded for any of the assessed characteristics. Failure reasons will be given in the test report.

The following linear barcode print quality specifications must be met:

a. Decode (the only grades used are A and F): A
b. Decodability: minimum D meaning >25%
c. Check Character (if available): OK
d. Symbol Contrast (Rmax - Rmin): minimum D meaning >25%

In the print contrast component of the test for 2D barcodes, the QR code and DM symbols are assessed for print quality using a barcode verifier that complies with the AIM International standards, Section "M" under Matrix Code Print Quality Guideline.

A scale of A (highly satisfactory) to F (unsatisfactory) will be used to grade the print quality for each characteristic. When determining the overall print quality, the final score for the code on a tag is the worst grade recorded for any of the assessed characteristics.

The following 2D barcode print quality specifications must be met:

a. Decode (the only grades used are A and F): A
b. Symbol contrast: minimum D, meaning >25%
c. Print growth X axis and Y axis: A/A, A/B or B/A
d. Axial non-uniformity: A

The standard of symbols must be no more than one print quality grade below that for each parameter on an unused tag without treatment.

### 3.3.3 Evaluation of the resistance of the locking system

30 new, untreated ear tags, 30 artificially aged ear tags and 30 ear tags submitted to the damp heat and cold treatment will be subjected to increasing forces to determine the force required to cause breakage or unfastening of the ear tag.

On cattle and on sheep and goat ear tags as well the test is performed at -25°C (± 2°), 21°C (±2°C) and 55°C (± 2°C) combined with 50% RH[1] (when the temperature is higher than 0°C) with 10 ear tags from the three treatment variations.

On pig ear tags the test is performed at -10 °C (± 2°), 21 °C (± 2°) and 55 °C (± 2°) combined with 50% RH (when the temperature is higher than 0°C) with 10 ear tags from the three treatment variations.

For tags which are used for both sheep/goat and pigs, the test is performed at -25°C (± 2°), -10 °C (± 2°), 21°C (± 2°C), and 55°C (± 2°C) combined with 50% RH (when the temperature is higher than 0°C) with 10 ear tags from the three treatment variations.

The forces will be applied at a rate of 500 mm/min within 10 seconds after the tags are removed from the climatic chamber. The force applied to cause breakage or unfastening of each ear tag will be recorded.

**Requirements:**

a. None of the ear tags – neither male nor female part – must be re-usable. Male pin tips must break off and remain within the female caps (locking gap).
b. At 21°C (± 2°C), no breakage should occur in:
   - Tags designed to be used in cattle with the application of a force lower than 280 Newton

[1] For ear tags made of moisture-sensitive material like PA (polyamide), the test must be carried out at the same laboratory humidity (50 % ± 10 %) like used during the preconditioning.

- tags designed to be used in sheep and / or goats with the application of a force lower than 200 Newton
- tags designed to be used in pigs with the application of a force lower than 200 Newton

c. The minimum breaking force applies to devices irrespective of treatments (artificial ageing, damp heat and cold).

Additionally, the distortion occurring in the ear tag at the time of breakage or unfastening will be recorded during the tensile tests as an indicator for any changes in the mechanical properties of the plastic after exposure to the artificial ageing and the damp heat/cold treatments.