Final Report

AMPC
AUSTRALIAN MEAT PROCESSOR CORPORATION

Smallstock RFID

Trial of New Lamb Gambrel RFID hooks at JBS Bordertown

Project Code
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1.0 Executive Summary

Developing reliable traceability through the entire Australian red meat supply chain is an important enabler for supply chain efficiency, equitable distribution of supply chain wealth, supply chain troubleshooting and demonstrating the supply chain sustainability framework credentials that consumers are expecting from mature supply chains.

This project focused on developing a reliable Smallstock RFID gambrel for the lamb gambrels used in most Australian harvest floors, chiller networks and fabrication floors. The aim was to repurpose existing non-RFID gambrels in an attempt to develop a proven process to reuse existing gambrels that all Australian lamb processors could benefit from. The aim was to use a combination of maintenance staff and staff on light duties and or staff without holiday periods available during shutdown periods.

A 3rd party vendor provided the RFID chips and JBS provided the staff to modify existing gambrels and fit the chips. A large number of the chips resulted in failure. JBS engaged a third-party investigator to ascertain the root cause (answer = fitment was too tight of the RFID chip in the gambrel). Although the chips have failed, the root cause has been ascertained and now a procedure developed for correct fitment.

JBS will follow this final report with a submission to rectify the issued identified within the current project.

2.0 Introduction

The author should include the following information in the introduction:

- The purpose of the research project, including any background information
- The scope of the research, including any previous research that is relevant to this project
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3.0 Project Objectives

The objectives of the project were for JBS and AMPC to establish if a new design of RFID chip can be retrofitted to existing lamb plastic RFID gambrels and:

1. Read 100% of the time (over a 12-month period) through normal production operation, daily cleaning and transport in wire mesh baskets.
2. The integral strength of the gambrel not be compromised through the modifications required to insert the RFID chip (evidence by gambrels not breaking under normal operating conditions).

Note; These objectives were not met.

4.0 Methodology

Purchase and install hardware, monitor over 12 months, and report of success of robustness after the first 12 months.

Note: An additional methodology step was added after the RFID chips began to fail, which was to contract an independent study to ascertain the cause of failure.

Retrofitting Process

JBS Bordertown engaged a team of 13 people (operational and maintenance staff) to perform the conversion.

- 2 were drilling,
- 2 were screwing,
- 1 was on the forklift and helping each group
- 8 were sorting hooks, removing chips, marking holes, scanning finished hooks etc.

They team worked from 6:00am – 5:00pm (9.5 effective hours)

This team of 13 were able to process the 10,000 hooks in 28.5 hours, or 350.88 hooks an hour

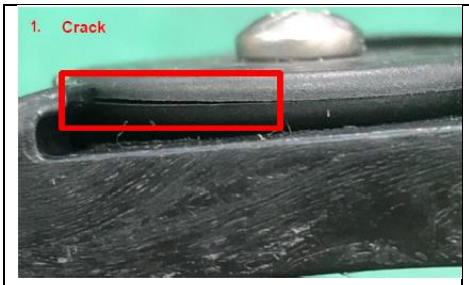
5.0 Project Outcomes

JBS noticed the newly installed RFID chips failing within 3 months of operation. Of the 10,000 RFID chips installed 20% failed within 3-5 months of operation.

5.1 Failure Testing (independent analysis)

10 x hooks fitted with tags had been returned to P+F for testing. After initial test, P+F Australia found 4 x good read tags and 6 x bad read (no read) tags and sent them for further in-depth analysis to our investigation team 3 x good read tags and 5 x bad read (no read) tags.

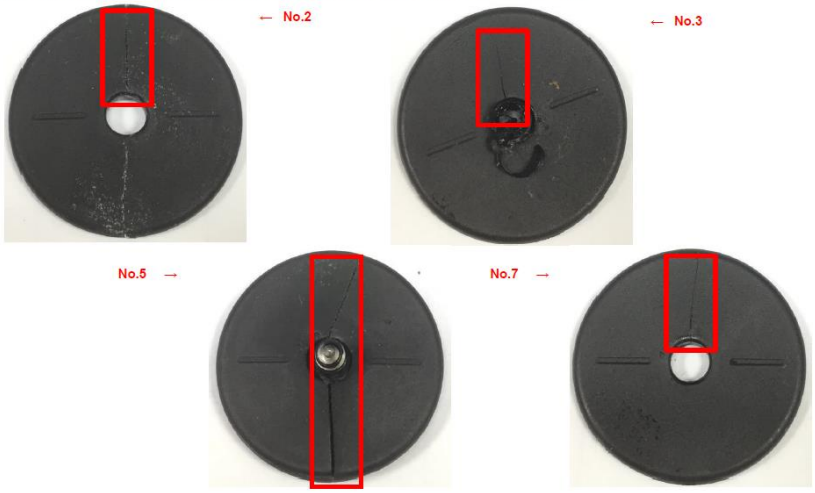
Visual Observations of Returned Tags

		
Crack at the edge	The tag has been bent	Extruded plastic from the screw hole

Observations up disassembly

What we have observed:

We disassembled the tag from the hook and found cracks on the tag



Reading ability of tag once removed from 10 gambrels

The result of measurement:

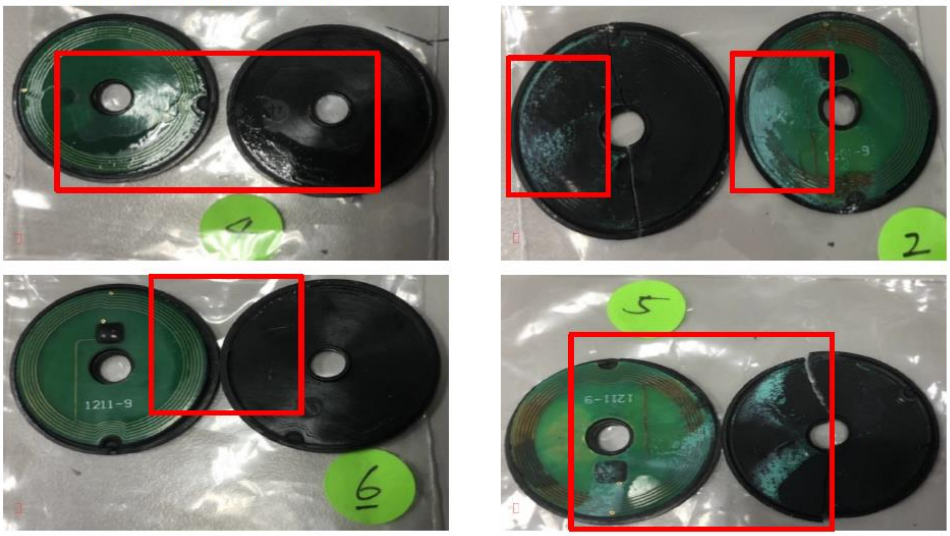
Only Tag No.2 is OK, others are NG (No Good)

No.	Frequency (13.56±0.5MHz)	Reader
2	13.6	OK
3	25.65	NG
4	25.72	NG
5	13.7	NG
6	27.47	NG
7	25.86	NG
8	25.58	NG
9	25.02	NG

Removed RFID chips internal inspection

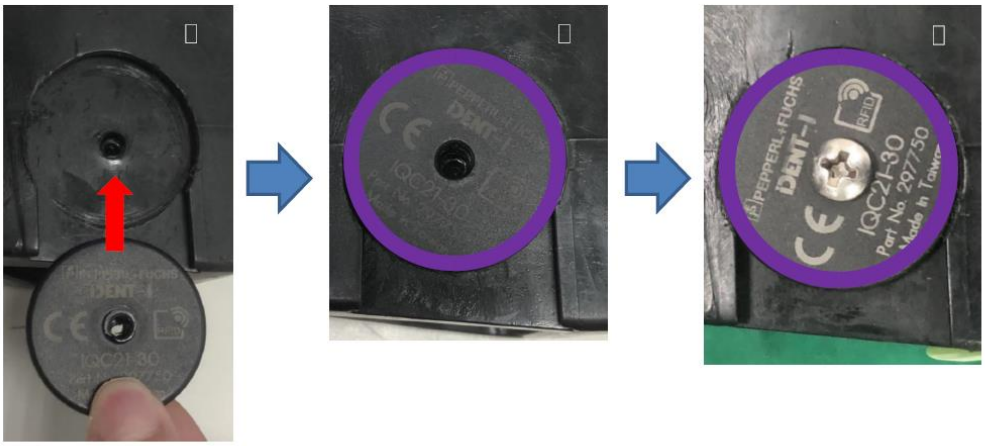
We disassembled the tags and found that there was liquid inside the e-unit.

1. Wet liquid
2. Dried and crystallized liquid



Based on the hook we have received, we presumed this is how the end customer attach the RFID tags on the hook:

1. Slide the tag into the cavity from the track
2. Make sure the tag is sitting in the cavity
3. Screw the tag tightly



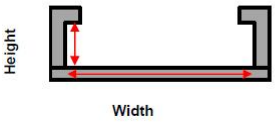
Hook and RFID Tag

Here's the side view and measurement of the track and cavity designed on the hook where to equip the RFID Tag.

Removed RFID chips installation technique inspection (after the event)

1. The height of the track: 2.07mm
2. The width of the cavity: 29.03mm

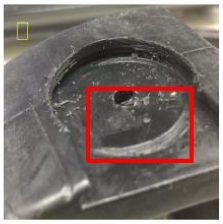
Side View

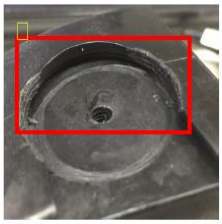


We measured the dimension of the tag to check if it was larger than size. As per below table the tag could not be fitted into the cavity of the hook as cavity size is lower than tag diameter.

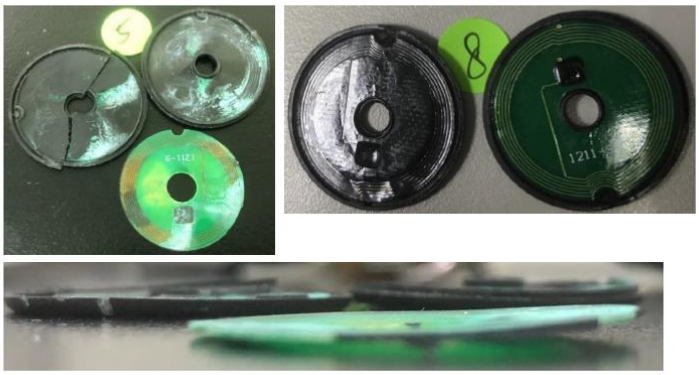
No.	Diameter(mm) $30^{+}_{-}0.2$mm	Thickness(mm) $3^{+}_{-}0.2$mm
2	30	3.04
3	29.97	2.98
4	29.97	2.97
5	30.02	3.02
6	29.95	2.9
7	29.94	2.99
8	29.98	2.93
9	29.96	2.95

Apparently, the cavity and the track are smaller than the tag, so the tag cannot be slid into the track successfully, neither be fitted into the cavity appropriately.
According to the picture shown below, there was damage on the edge of the cavity which we assume was caused by excessive force in order to press the tag into the cavity.





According to the tests we have done, we confirmed that the root cause of NG (No Good) tags was excessive force to press the tags down into a smaller cavity on the hook and other possible impacts. So, the tags were damaged during the assembly process and further aggravated when got impacts during the falling into the chute process. The chemical solution has permeated into the tags from the cracks. Some of the PCB have deformed and destroyed. So, the e-units were damaged and lost function gradually after repeated chemical washing cycles.



6.0 Discussion

It is evident that without clear instructions to modify existing gambrels for correct insertion tolerances, that this has led to the failure rate of the RFID trial at Bordertown.

Note: A question, for future consideration and other processors, arises that even if exacting tolerances and instructions could have been provided to Bordertown prior to the modification process, would Bordertown have the onsite tooling and staff skill availability to then perform this conversion on site to the now known exacting standards?

With this knowledge in hand, JBS now has a clear understanding of how to modify gambrels for these 3rd party chip supply.

JBS is in discussion with RFID and gambrel providers to ascertain the best rectification step as the objectives of the project are yet to be achieved.

The three approaches under consideration are:

1. Turn key third-party supply (gambrel and RFID chip) as a turnkey solution.
2. Purchasing new gambrels and RFID chips and retrofitting under now established work instructions at JBS Bordertown, with suitable tooling and staff skills.
3. Repurposing existing gambrels, remove old RFID chips, increasing tolerances, reinstalling new RFID chips.

7.0 Conclusions / Recommendations

The project has not concluded successfully. The root cause of failure has been established. JBS is currently working with providers to ascertain the next best steps to bring the outcome to a positive closure.

JBS intend to make an R&D funding submission to AMPC to support further developments and learnings in this area.

8.0 Bibliography

None

9.0 Appendices

None