Final Report

AMPC
AUSTRALIAN MEAT PROCESSOR CORPORATION

Electric stunning box for beef

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Contents

1.0 Executive Summary

The objective of the project was to install a new electrical stunning system in the knocking box, ensuring safety, animal welfare, and compliance with animal welfare regulations. The system needed to operate within specific parameters, such as voltages under 300 Volts, currents under 3 Amps, and stun times within 3 seconds.
The project followed a systematic approach, starting with the assessment of the existing electrical stunning system. It then involved designing and implementing a new system equipped with the latest controls and technology. Structural improvements were made to the knocking box to accommodate the new system. Thorough testing and calibration were conducted to ensure its effectiveness and adherence to regulatory requirements.
The outcomes of the project have been significant. The new electrical stunning system prioritizes operator safety through the integration of advanced controls and interlocks. It also improves animal welfare by automating the activation of cylinders and components in the knocking box, optimizing stun sequencing, and reducing animal stress. The system meets the requirements of EU Reg 1099/2009 and local RSPCA obligations and Halal accreditation. Additionally, the system includes data logging capabilities, allowing for the collection and analysis of stunning data, and facilitating future monitoring, auditing, and continuous improvement.
The project has achieved successful results and findings. The new system consistently operates within the desired parameters, stunning cattle effectively while maintaining voltages under 300 Volts, currents under 3 Amps, and stun times within 3 seconds. The touchscreen interface enables operators to easily select pre-set optimum levels for different cattle categories, ensuring a quick stunning process.
The installation and implementation of the advanced electrical stunning system in the knocking box have significantly enhanced safety, animal welfare, and compliance with regulations. The project's outcomes, findings, and recommendations are valuable insights for both members and the wider industry.

2.0 Introduction

The project to implement electric stunning was initiated due to the shortcomings of the existing knocking box. The existing system had limitations in terms of outdated electronics, inadequate user interface, and lack of data-logging capabilities. The project aimed to improve safety, animal welfare, and compliance with regulations while integrating the latest technology. The scope included structural improvements, stun cycle sequencing automation & PLC programming, enhanced operator interface, and safety measures.

Through this project, the plant aimed to enhance safety, animal welfare, compliance, and data collection for continuous improvement. The following sections provide details on installation progress, the first-day test run, outcomes, findings, and recommendations for improving animal welfare and operational efficiency in beef processing.

3.0 Project Objectives

The project aimed to upgrade the electric stunning system in the knocking box at a processing plant with the following objectives Enhance system performance and functionality, ensure compliance with animal welfare regulations, improve user interface and controls for operators, prioritize animal welfare by minimizing stress and discomfort, develop a comprehensive data logging system for analysis and improvement, integrate advanced technology to optimize system operation. These objectives collectively aimed to improve the efficiency, effectiveness, and animal welfare standards of the electric stunning system.

The specific parameters required for the electric stunning system are stunning cattle effectively while maintaining voltages under 300 Volts, currents under 3 Amps, and stun times within 3 seconds.

3.1 Installation progress

All main components will be sent to site.

Prior to the install weekend, need to ensure -

1. All new cylinders have been installed.
2. All necessary reed switches mounted on cylinders and run to Junction box (termination if time permits).
3. All enclosures listed to be mounted.

- Main stun control cabinet in roof.
- SMC valve manifold cabinet above knock box.
- HMI touch screen enclosure for operator.
- J-box for reed switches.
- Multi core cables, power cables and ethernet/data to be run, through conduit if necessary (termination of cables not required).
- Ideally, if possible, termination of most cores could be completed, as they are numbered.

4. Existing Pneumatic valve cabinet and button panel removed, possibly Friday afternoon/evening.

This list is what will need to be done the weekend of the install.

- Connect and terminate all of the multicore cables to the Main control box.

- Connect and terminate all of the multicore cables to the HMI enclosure.
- Connect and terminate all of the multicore cables to the JB1.
- Connect and terminate all reed switches and door switches to JB1.
- Mount the new button control panel on the stun box for the operator and terminate cables.
- Connect the pneumatic supply to the SMC cabinet.
- Install pneumatic fittings on cylinders and run new hoses/tubing.
- Connect all cylinder hoses/tubing to the new SMC cabinet.
- Connect data control to SMC cabinet.
- Connect and terminate electrical power for the SMC cabinet.
- Check/remount existing dual control stun cycle buttons.
- Mount the pneumatic override toggle control panel and connect all hoses to SMC cabinet.
- Once all components are connected, air can be turned on, system can be checked, started up.
- Testing will need to be carried out on every single cylinder/button/switch to ensure working, adjustments may need to be made.
- Program changes will need to be made regarding the interlocks from reed switches doors etc.
- Speeds of Cylinders to be adjusted.
- We will check the insulation resistance of the head contact plate again, in case ingression has occurred.
- Check stun cycle amps on our external stun tester to ensure delivered amps is correct.

Box Features

- Integration of electric stunner with moving components of the physical knocking box.
- Automated activation of cylinders and components in knocking box, stun cycle will actuate neck crush, chin lift, nose paddle and water sprays – controlled by sequence timers and interlocks. All return to home setting after stun cycle.
- New pneumatic cylinders to be installed on box.
- All pneumatic cylinders to have reed switches installed.
- Allen Bradley PLC for ease of use and spares utilisation.
- New pneumatic valve manifold, electric actuated via data cable input from updated PLC.
- New operator control panel (in process sequence) for easier operator use.
- Pneumatic overrides in case of power loss/redundancy controls.
- Physical stunning box needs to be raised, exit door enlarged with a higher opening.
- Interlock safety devices with operator safety and animal welfare in mind.
- Rewrite of PLC program with updated integration of interlocks and redundancy overrides for safety.

3.1.1 First-day test run

- Installation date 19/3/21 to 21/3/21
- Trial started on the 22/3/21 @ 10:30am
- Stunned 1st cow which was not effective had to use the captive bolt to stun.
- Stopped the trial and made changes to the amps and the time of stun, also adjusted the water pressure running down the nose plate.
- Stunned 2nd cow stun system worked stunning the animal effectively noticed that the sequencing of the stun occurred was not practical.
- Stopped the trial again for several hours making significant modifications to the stun sequencing, which included the chin lift timing and application of the nose plate to start the stunning sequence, modified the nose plate to fan the water across the nose plate to give better contact during the stun, setup the PLC to release all controls once the stun had been completed so that the operator could release the cow onto the cradle without delay,
- Once all completed started the trial again, we were able to stun 6-7 cattle in quick succession. Called the trial completed for the day and restarted the following shift in full production.

Commenced the stunning during full production was able to process without any problems with stunning. Ongoing daily information will be supplied, on progress and meat quality. This will be supplied in future milestones as collected

Box Images

Comprehensive data from the Stun box to be added, in the follow visits.

There have been no misfires, since adding this box into the production process. Comprehensive data is being gathered daily to, log successes.

Visits via Jarvis will continue to observe learnings from the new installation.

Latest Data retrieved from the harvesting Unit

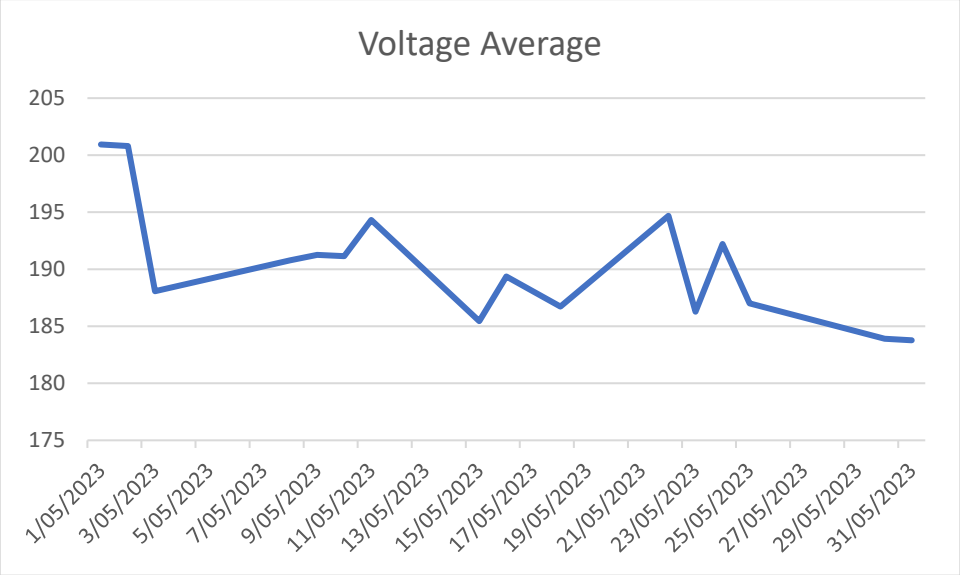
4.0 Methodology

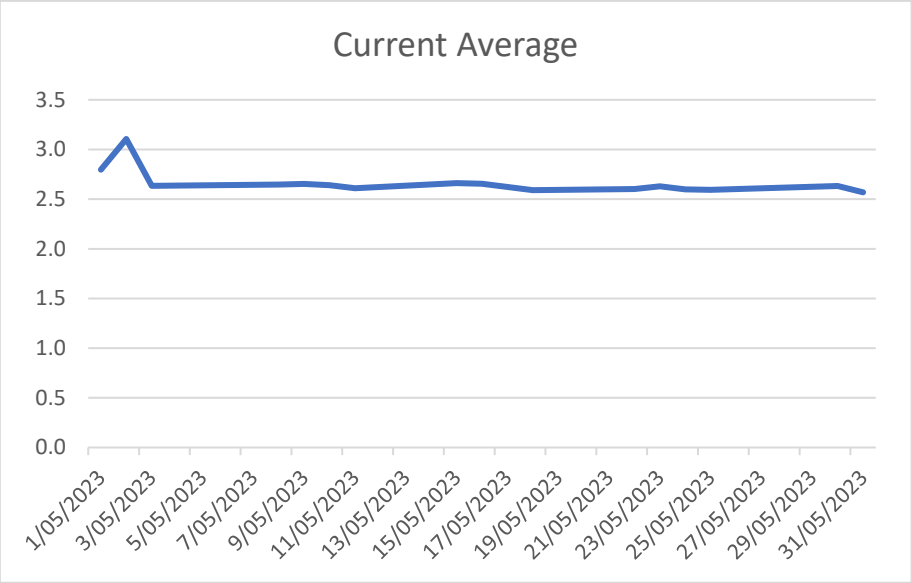
Performance of the system was measured using the new control system installed with the upgrade, we were able to capture raw data from the controls which includes Date, time of day, Stun duration (seconds) , Current (A), Voltage (V) and Animal number. These measurements were used to provide data for the most recent month of operation.

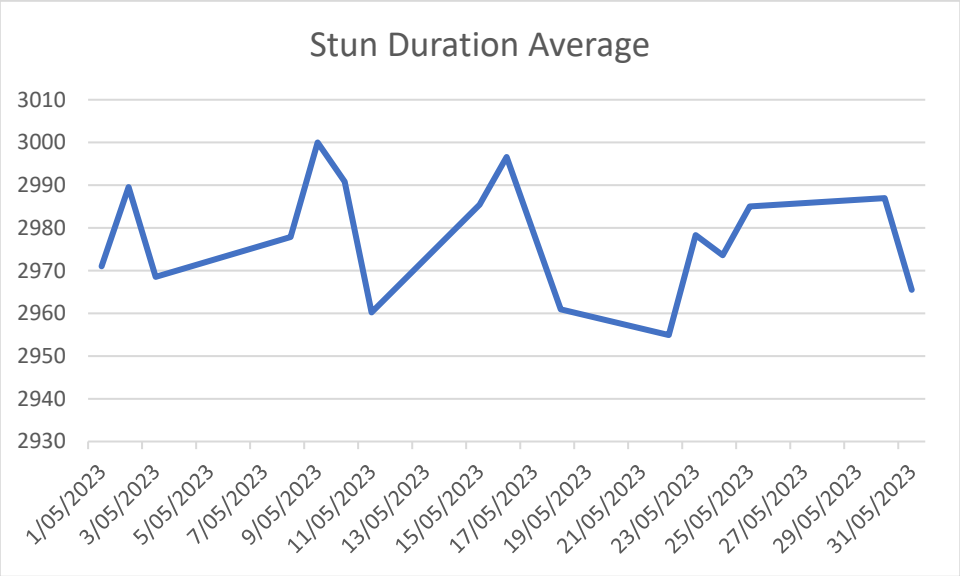
5.0 Project Outcomes

The main outcomes that we aimed to achieve were to stun cattle effectively while maintaining voltages under 300 Volts, currents under 3 Amps, and stun times within 3 seconds and meet animal welfare requirements. The data sets below clearly show that this objective was achieved and is still operating consistently. Below set out are the average of the 3 key targets set for the month of May 2023.

Date	Number of Cows	Voltage Average	Current Average	Choke	Stun Duration Average
1/05/2023	319	201	2.8	5	2971
2/05/2023	301	201	3.1	4	2990
3/05/2023	288	188	2.6	6	2969
8/05/2023	272	191	2.6	6	2978
9/05/2023	314	191	2.7	6	3000
10/05/2023	327	191	2.6	6	2991
11/05/2023	313	194	2.6	6	2960
15/05/2023	309	185	2.7	6	2985
16/05/2023	294	189	2.7	6	2997
18/05/2023	291	187	2.6	6	2961
22/05/2023	320	195	2.6	6	2955
23/05/2023	318	186	2.6	6	2978
24/05/2023	320	192	2.6	6	2974
25/05/2023	320	187	2.6	6	2985
30/05/2023	332	184	2.6	6	2987
31/05/2023	307	184	2.6	6	2966







Some inconsistent results have been recorded from time to time which are insignificant and were determined to be a difficult animal that resulted in being shot with a captive bolt or a mechanical failure inside the box resulting in a captive bolt stun. However, as you can see from the data below, the performance of the stunning system alone without outside variables is very consistent.

6.0 Discussion

The project outcomes offer significant insights into the performance and effectiveness of the upgraded electric stunning system. Through the collection and analysis of key data sets, valuable information has been obtained regarding the system's operation and its impact on animal welfare.

The statistical analysis conducted on the data sets has provided quantitative measures of various parameters, such as Date, time of day, Stun duration (seconds) , Current (A), Voltage (V) and Animal number. This analysis has enabled a comprehensive evaluation of the system's performance in terms of its ability to deliver the necessary electric shock to ensure effectiveness while minimizing potential harm to animals. These findings contribute to a deeper understanding of the system's functionality and assist in identifying areas where further improvements can be made.

The discussion provides a comprehensive interpretation of the project results. The analysis of the key data sets revealed consistent voltage delivery within the desired range, ensuring effective stunning. Similarly, the recorded current values consistently met the requirements for effective stunning, although slight variations were observed. These findings highlight the importance of regular monitoring and adjustment to maintain optimal performance. The choke setting remained the same and did not require adjustment since inception of the new controls, indicating the system's reliability in achieving the desired level of stunning.

The results support the conclusion that the upgraded electric stunning system is effective in delivering the necessary voltage, current, and stun duration and allows us to historically record this data. The interpretation of the project results provides valuable insights for improving animal welfare practices and informs the efficacy of the electric stunning system.

7.0 Conclusions / Recommendations

The project on the upgraded electric stunning system has yielded significant insights and outcomes. The system consistently delivers the required voltage range, ensuring effective animal stunning.

As with all systems there are many variables outside of the machinery’s control and it’s noted that certain variables such as the nature of the animal and its compliance to the stun process can effect the ability to stun as well as the possibility of mechanical/electrical failures due to the nature of the environment that the machinery operates in. However, outside of the rare occurrence of a component failure or compliance of an animal the recorded current values meet the standards for stunning practices. The stun duration times demonstrate the system's conformability and compliance. The upgraded system holds promise for improving animal welfare practices in the industry and promoting responsible and ethical approaches.

It would be recommended that other operations investigate the option of installing this system in their facilities.

8.0 Bibliography

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