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Poultry Extension Collaborative newsletter

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Broiler Chicken Stunning Methods During Slaughter

What is Stunning? How is it Regulated?

Stunning is the process of rendering broilers unconscious or insensible before slaughter and various mechanisms may be used in facilities to achieve insensibility (Humane Slaughter Association, 2015). The methods used depend on the facility's location (on-farm vs. in a slaughter plant), the number of broilers slaughtered, and company program-specific criteria and restrictions.

The Humane Slaughter Act of 1978 was passed in the United States to protect livestock handling during slaughter. However, it does not address the slaughter of poultry. Instead, the U.S. requires that poultry slaughter establishments follow “good commercial practices”. Further, regulations require that good commercial practices must ensure a thorough bleeding of the poultry carcass and that breathing has stopped before scalding. As a result, stunning is common practice for broiler chicken processing in the U.S. (USDA-FSIS, 2015). This is a different regulatory system than the European Union, which has a specific legislation that requires broilers to be insensible to pain until death occurs (Official Journal of the European Union, 2009).

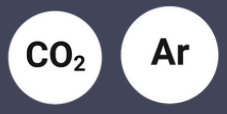
Why is Stunning Used?

Stunning is used to render birds insensible to the pain caused during the slaughter process. Stunning prevents unnecessary pain and prolonged distress (Bracke et al., 2020) during the processing phase. Not achieving insensibility is a major welfare concern, due to the pain and distress broilers would face during the cutting and bleed-out phases.

What are the Different Stunning Methods?

Waterbath Stunning

Controlled Atmospheric Stunning



Captive Bolt Stunning

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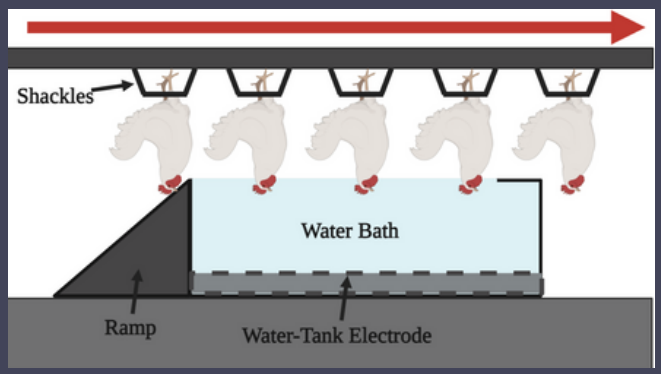
Waterbath Stunning (WBS)

Step-by-Step Process

1. Broilers are shackled by their legs, placing them into an inverted position while fully sensible.
2. Shackled broilers pass over an inclined ramp to approach the waterbath. The ramp is intended to prevent pre-stun shock from occurring.
3. Shackled broilers enter the waterbath, where their heads are submerged into the water.
4. Electrodes in the waterbath supply a strong current to the water, electrifying it. As broilers' heads touch the water, they are rendered unconscious.
5. Unconscious broilers exit the waterbath stunner to be exsanguinated and further processed.



What is it?

Waterbath stunning (WBS) is the most commonly used stunning method in broiler chicken slaughter facilities (Berg and Raj, 2015). In the United States, 92% of broiler slaughter operations use WBS (Vieira & Peacock, 2021) Broilers are rendered insensible following the step-by-step process outlined on the left, utilizing electrical current supplied to a waterbath. For stunning, the minimum electrical current necessary to induce unconsciousness and insensibility depends on the waveform and frequency of current used (Lambooij & Hindle, 2018). In a typical waterbath operation, the electric current ranges from 50-200 Hz (Humane Slaughter Association, 2015).

What are the Advantages?

- WBS is time efficient, allowing for the stunning of multiple broilers at once.
- The factors that induce insensibility (electrical current, water depth, etc.) are adjustable.
- The process of WBS is automated, decreasing operation costs.

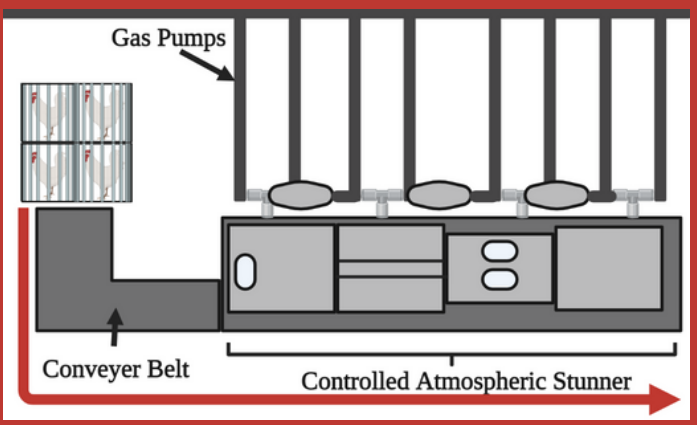
What are the Disadvantages?

- Shackling is required.
- During shackling, conscious inversion (i.e., holding broiler upside down) may cause distress shown by wing flapping, which could result in wing shock and electrically charged water could shock other birds (i.e. pre-stun shock).
- If the electrical currents are not strong enough (below 50 Hz), broilers may be electrocuted while still conscious.
- Unsuccessful stunning of conscious animals (i.e. the bird's head does not touch the water) is painful and prolongs shackling and inversion distress.

Controlled Atmospheric Stunning (CAS)

Step-by-Step Process

1. **Crated broilers are loaded onto a conveyer belt.**
2. **A conveyer belt leads the holding unit filled with broilers into the atmospheric stunner.**
3. **Inside the atmospheric stunner, the air is filled with inert gases decreasing concentrations of available oxygen.**
4. **The combination of anoxia and the inhalation of inert gases render the broilers unconscious.**
5. **Unconscious broilers exit the atmospheric stunning machine for further processing.**



What is it?

Controlled atmospheric stunning (CAS) is a stunning method that is more common in Europe than in the U.S. where approximately 7% of broiler slaughter operations use CAS (Vieira & Peacock, 2021). The CAS method is a system consisting of a sealed chamber where the concentration of inert gas (such as carbon dioxide and argon) is carefully controlled, replacing the oxygen in the chamber (Abeyesinghe et al., 2007) and is described in the step-by-step process on the left. As oxygen is replaced, the onset of anoxia occurs rendering the broilers unconscious. This process typically takes minutes to occur, depending on the concentration of gas supplied to the chamber. When carbon dioxide only is used, the gas is administered in two phases. First, birds are exposed to low concentrations (40% by volume in air) and once unconscious, are exposed to a higher concentration (80%-90% by volume of air) (Berg & Raj, 2015). CAS differs from low atmospheric pressure stunning (LAPS), which is the gradual decompression of the atmosphere in the chamber to induce hypoxia, without the use of inert gasses.

What are the Advantages?

- CAS is automated, requiring less labor.
- Shackling and inverting broilers is not required, reducing stress.
- With appropriate use, 100% of the birds are rendered insensible before shackling.

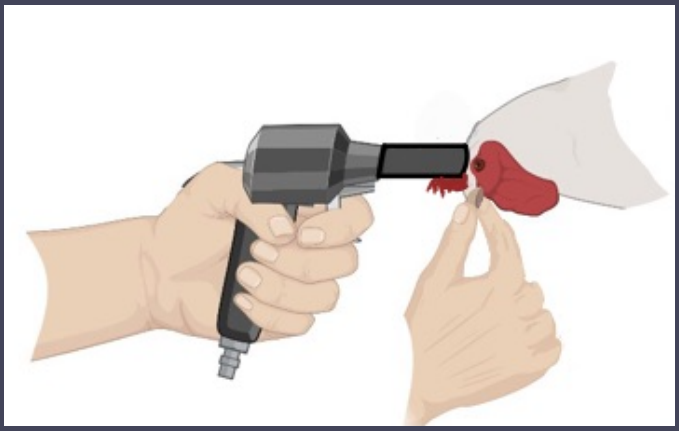
What are the Disadvantages?

- The CAS method is more expensive than WBS.
- The induction of insensibility is not immediate, therefore broilers supplied increased concentrations of inert gas (CAS) or decreased concentrations of oxygen (LAPS) may experience distress (Berg & Raj, 2015).
- Mixtures with high ratios of argon to carbon dioxide or carbon dioxide to oxygen may be less effective in stunning. For instance, a mixture of 70:30 argon to carbon dioxide could result in broilers regaining sensibility (Webster & Fletcher, 2001). A ratio of 60:40 carbon dioxide to oxygen may cause distress due to hypercapnia (Webster & Fletcher, 2001).

Captive Bolt Stunning (CBS)

Step-by-Step Process

1. Broilers are shackled or placed in cones by handler.
2. Stunner is placed onto the base of the head of the broiler.
3. The stunner bolt strikes the base of the broiler's head.
4. As bolt extends, bolt may enter skull (penetrative) OR blunt force trauma occurs (non-penetrative).
5. Bolt damages brain, culling the broiler via penetrative CBS. Non-penetrative CBS results in trauma to the brain and immediate unconsciousness, which is successful stunning.



What is it?

Captive bolt stunning (CBS) may be penetrative or non-penetrative and is used for small-scale poultry operations (see our previous newsletter) and is not commonly used for stunning in US poultry processing plants.

Penetrative stunning damages the skull and brain, while non-penetrative stunning is a percussive blunt force stunning method that does not penetrate the skull. Broilers are rendered insensible following the step-by-step process outlined on the left. Insensibility and brain death via CBS should be immediate (Woolcott et al., 2018). Standard CBS devices include the TED and Zephyr. Both the Turkey Euthanasia Device (TED) and Zephyr are effective and reliable CBS devices (Woolcott et al., 2018).

What are the Advantages?

- CBS is effective for stunning broilers when done by trained personnel.
- Stunning of broilers is immediate.
- CBS equipment is the most affordable method for small-scale producers.
- CBS equipment is portable, allowing producers flexibility for stunning locations.

What are the Disadvantages?

- CBS is not feasible for large scale operations that process multiple flocks due to efficiency as broilers must be stunned **individually and manually.**
- CBS requires more labor to stun individuals.
- The captive bolt gun requires training, as stunning without proper alignment on the head leads to an unsuccessful stun.
- Broilers must be restrained, usually in cones or shackles, which may result in distress and discomfort.

Why Does Stunning Matter?

The stunning of broilers before slaughter helps ensure that broiler welfare is protected. In addition, stunning renders broilers unconscious to permit enough time for the bleeding phase (i.e., cutting of the ventral arteries) to occur (Bracke et al., 2020). Without stunning, unnecessary pain and distress would be experienced by broilers, leading to animal welfare concerns. Each stunning method has advantages and disadvantages in terms of in terms of economic (labor) and animal welfare considerations (pain, distress, success rate). The chosen method must demonstrate successful stunning while being feasible for the producer.

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