Question to EURCAW-Pigs: Advice on electrode positioning
15 August 2023

Question
Received: 24 May 2023

EURCAW-Pigs received the following issue and questions from a regional executive office (Competent Authority):

"Is the point of attachment of electrodes at the forehead and the lower jaw (see Figure 1) effective to stun pigs, and is the onset of stunning reached fast enough (reaching the current needed within the first second) to not cause welfare violations? The context of the question is not a standard stunning situation but the emergency case, when an animal slips out of the correct electrode position just after placing them."

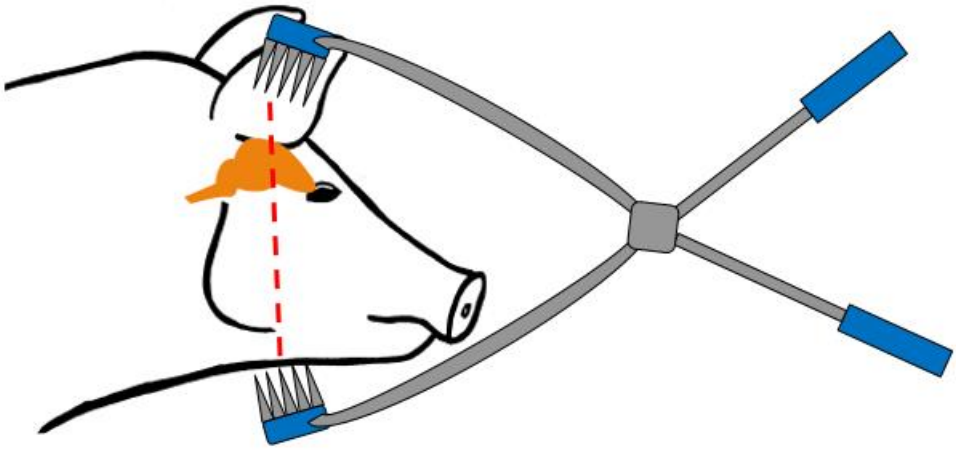

Figure 1: Schematic drawing which was modified after Handbuch Tierschutzüberwachung bei der Schlachtung und Tötung (2021; p. 93) and attached to the Q2E showing the placement of the electrodes

Several EURCAW-Pigs experts contributed to the response below. The EURCAW-Pigs secretariat did the final editing, and may be contacted for queries: info.pigs@eurcaw.eu.

Answer
In short, the answer is:
Head only electrical stunning shall be carried out by using 1,3A and the electrodes shall span the brain. The ideal position of the electrodes is when they are placed on the left and right side of the head between the eyes and the base of the ears. However, other positions where the electrodes span the brain, like the position on top of the forehead and under the jaw, may induce effective stunning. However, further research is needed about the minimum current needed and therefore this question cannot fully be answered. Effective stunning should in all individual cases be judged based on Animal Based Indicators (i.e., tonic-clonic seizures, immediate collapse, absence of breathing).

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Background

In principal, it can be said that for each individual case it must be checked if the initial stun was long (seconds) and strong (volts, ampere) enough to induce unconsciousness of the pig. This has to be monitored throughout the process by watching for the reactions of the pig (e.g. tonic-clonic convulsions; immediate collapse; and other animal-based indicators [ABIs]) (EFSA 2020).
According to Council Regulation (EC) No. 1099/2009 and based on the results of the study of Hoenderken (1978), head-only electrical stunning of pigs shall be carried out by using at least 1,3 A. Electrodes shall span the brain. Therefore, the ideal tong position is achieved when the electrodes are placed on both sides of the head between the eyes and base of the ears (Berghaus and Troeger, 1998).
Practical working conditions can make it harder to keep the electrodes in the ideal position during electrical stunning. Risk factors that can occur when applying manual stunning tongs are the wrong placement of the electrodes, poor electrical contact or too short exposure time (EFSA 2020). This can happen when the pig loses its balance falling on its side, due to the start of stunning. As a consequence, the stunner (person holding the stunning tongs) loses the contact with the pig and the stun process stops after a short time. This can be observed with manual stunning, e.g. in smaller abattoirs, or in case of on-farm stunning or killing, where the stunner is often unable to follow the sideways tipping of the pig in such a way that the electrodes remain firmly pressed against the pig's head. When the pig tilts, there is a relatively high weight on one of the tong legs, which causes the electrodes to slip or lose contact completely. Structural elements (i.e. walls) or other pigs often prevent the stunner from following the movement of the pig.
In general, all available measures must be taken in order to prevent a pig from slipping out of the grip of the stunning tongs. Restraining the animals or restricting the movements of animals will improve correct placement of the electrodes. However, duration of restraint should be as short as possible. However, animals should not be restrained or restricted until the operator is ready to stun and kill them (EFSA 2020).

If the stunner was not able to hold the tongs in the ideal stunning position (this is an exceptional situation), then the impact of the current was likely too short to be effective and immediate re-stunning is required. However, the lying position of the pig may now hamper correct replacement of the electrodes. As determined from the occurrence of tonic-clonic seizures, tong positions just behind the ears, which also spans the brain, were found to be effective to properly stun pigs (Anil and McKinstry, 1998). With the position of the electrodes on the forehead and under the head behind the mandibles, the animals showed return of rhythmic breathing after 43.1 s ± 1.24 s and a return of the corneal reflex after 46 ± 1.55 s, including strong convulsions. However, using the constant voltage device, very low currents of 0.4A and 0.7A were found at 150V and 250V, respectively, suggesting a higher resistance of up to 375 Ohm. This is well above the resistance normally expected in pigs, unless the current was discharged through the equipment used, for example.

In summary, a current flow through the brain does not seem improbable with the position mentioned above. The same applies to the requested position of the electrodes at the forehead and the lower jaw (positioning of the second electrode further cranially in comparison to Anil and McKinstry, 1998). In any case, the effectiveness of stunning must be monitored, in particular by

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testing animal-based indicators (see EFSA, 2020), and by taking the technical records of the stunning process into account. However, as these positions deviate from the ideal, further research is needed on the effective current flow through the brain and the necessary minimum current for effective stunning, considering the actual technical status of the devices (e.g., constant current devices) as well as the present animal collective. Without these further investigations, the question posed cannot be fully answered.

References:

Anil, M. H., & McKinstry, J. L. (1998). Variations in electrical stunning tong placements and relative consequences in slaughter pigs. *The Veterinary Journal*, *155*(1), 85-90. https://doi.org/10.1016/S1090-0233(98)80042-7

Berghaus, A., & Troeger, K. (1998). Electrical stunning of pigs: Minimum current flow time required to induce epilepsy at various frequencies. In *International Congress of Meat Science and Technology*, *44*, 1070-1073.

EFSA AHAW Panel (EFSA Panel on Animal Health and Welfare), Nielsen SS, Alvarez J, Bicout DJ, Calistri P, DepnerK, Drewe JA, Garin-Bastuji B, Gonzales Rojas JL, Gortazar Schmidt C, Michel V, Miranda Chueca, MA, Roberts,HC, Sihvonen LH, Spoolder H, Stahl K, Viltrop A, Winckler C, Candiani D, Fabris C, Van der Stede Y and Velarde A, (2020). Scientific Welfare of pigs during killing for purposes other than slaughter. EFSA Journal 2020;18(7):6195 doi: 10.2903/j.efsa.2020.6195

Hoenderken, R. (1978). *Elektrische bedwelming van slachtvarkens (Electrical stunning of slaughter pigs)*. Doctoral Dissertation, University of Utrecht, The Netherlands.

Regulation (EC) No 1099/2009 of 24 September 2009 on the protection of animals at the time of killing. *Official Journal of the European Union L*, *303*(18.11).

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