

APPENDIX 1 - PRECISIONS ON USE OF MECHANICAL DEVICES FOR DESTRUCTION OF ANIMALS

Important factors

- Handling and restraint facilities must meet current World Organisation for Animal Health (OIE)¹ and industry standards.
- Animals must be monitored for signs of sensibility and to ensure death has occurred.
- A backup device is always required if an equipment failure were to occur, and/or if the primary device is unsuitable.
- Pithing rods and intrathoracic bleeding are suitable secondary kill steps for animals that have been rendered insensible.
- It is unacceptable to exsanguinate or use a pithing rod on an animal that is demonstrating signs of sensibility (consciousness).
- Young swine have thin skulls. Growers have skulls of intermediate thickness. Mature animals, especially mature males have thick frontal bones overlaying the brain. Pigs have small brains relative to the size of their head (Figures 1 and 2).
- Plan the trajectory, so the projectile travels through the brain (cerebral hemispheres, midbrain, brainstem). The most significant of these are the brainstem and midbrain that are at the level of the bottom of the attachment of the ears and just medial to the internal acoustic meatus. (See 3 [b], [c], [d] and [e] below).
- Together, the **midbrain and brainstem** are responsible for eye movement and body movement, the level of consciousness, and for maintaining vital body functions such as breathing and heart rate. The cerebral hemispheres are associated with higher brain functions.
- There can be breed variation in head shape in mature animals. Yorkshire-type animals have a prominent curvature in the front of their head. (See 3 [e] below).

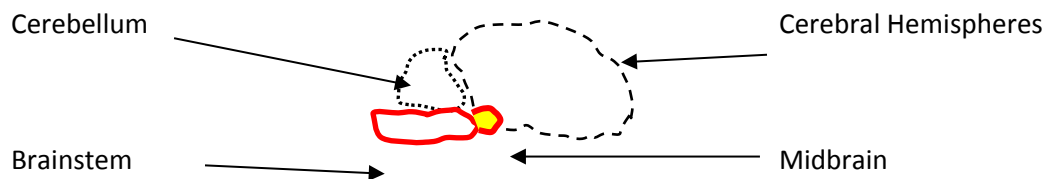


FIGURE 1 Diagram of the brain

¹ OIE Terrestrial Animal Health Code (2018), Section 7, Chapter 7.6 : <http://www.oie.int/en/standard-setting/terrestrial-code/access-online/>

Adequate placement of shot: Landmarks and approaches

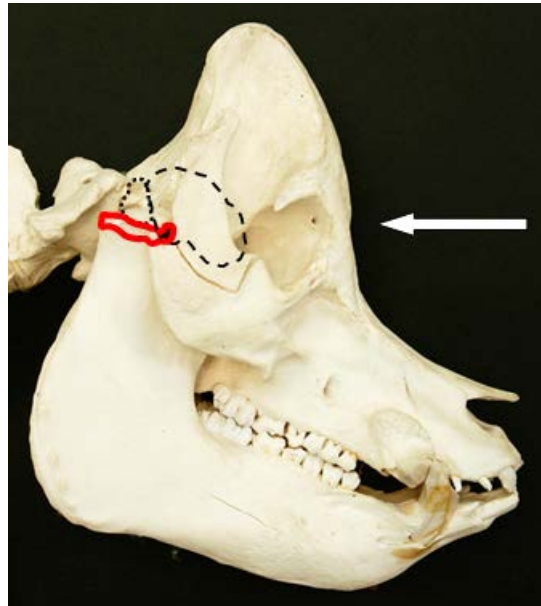




FIGURE 2 Hog skull with diagram of brain (including brainstem and midbrain) landmark

	Brain, including the brainstem and midbrain
	Landmark and angle relative to the front of the skull (head)

Market hog

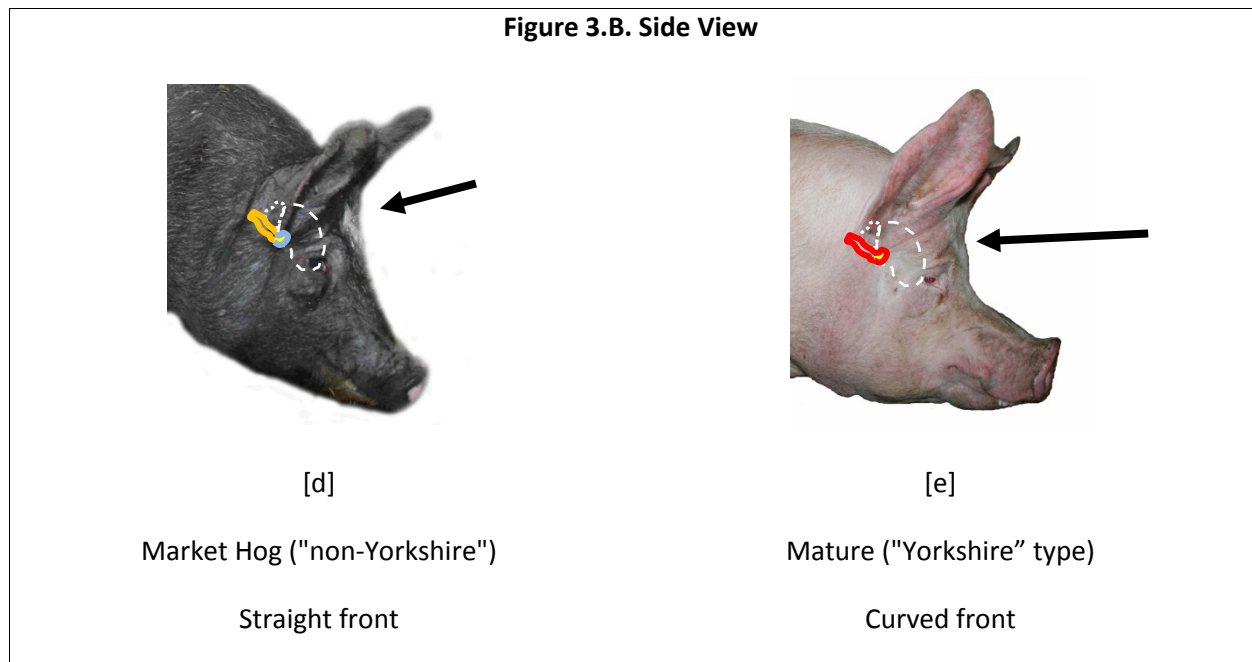
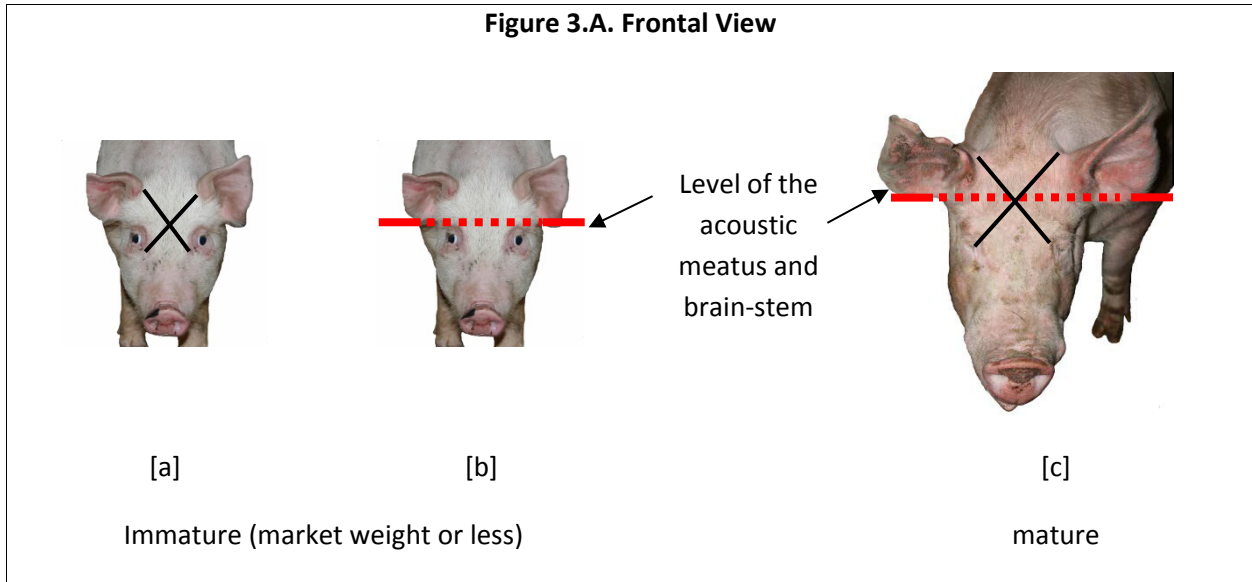
Intersection of diagonal lines from the **midpoint** of the attachment of each ear to the medial canthus (middle corner) of the opposite eye. This is approximately 2 ½ cm or 1" above the eyes. (Refer to Figure 3 [a] and [b].)

Sow or boar

Intersection of diagonal lines from the **top** of the attachment of each ear to the medial canthus (middle corner) of the opposite eye. (Refer to Figure 3 [c].)





Note: Regardless of the entry point, the angle of the stunning device with the front of the head must result in a path of the bullet or bolt which will intersect with an internal line from the base of one ear to the other, running through the brain stem. (Refer to Figure 3 [a], [b], [c], [d], and

[e].)



Note: Breed and age effect on curvature of the front of the head, lateral view (see 3 [d] and [e]).

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	Level of the brainstem in the middle of the skull – located between the attachments of the ears.
	Level of the brain stem and midbrain in the middle of the skull - located between the bases of the attachment of the ears.
	Intersection of the diagonal lines indicates the entry point or “target” for the bolt of a captive bolt pistol, or the bullet or slug fired from a gun held perpendicular to the front of the skull.
	Trajectory of the projectile (bolt or bullet) as it travels to the midbrain and brainstem

Precisions on Firearms

The following tables provide guidance for selection of the appropriate firearm/ammunition combination for the specific purpose of humane destruction of livestock.

TABLE 1. Energy requirements			
Animal (by species and size)	Minimum Energy		Examples: suitable firearms
	ft./lbs.	Joules	
Bison calves	137	186	.22 Long rifle
Bison – male and female	651–1865	882–2528	.410 and 20 gauge shotguns, .30-30 win. rifle
Bison – very large males	1827–2401	2477–3255	20 gauge shotgun, .30-30 win., .303 British rifles*
Cattle – calves and yearlings	137	186	.22 Long rifle
Cattle – mature cows (≥2 years)	324	439	.22 Magnum rifle
Cattle – mature bulls (≥2 years)	651–1865	882–2528	.410 and 20 gauge shotguns, .375 rifle, .44 Mag rifle, .30-30 win.
Cervid – female elk	137-324	186–439	.22 Long rifle, .22 Magnum rifle
Cervid – male elk	324–788	439–882	.22 Magnum rifle, .45 Colt rifle, .410 shotgun with 2 ½ inch slug
Cervid – deer	137	186	.22 Long rifle
Equine – all- lower energy on small and young	137– 651	186–882	.22 Long rifle, .45 Colt rifle, .410 Shotgun with 2 ½ inch slug
Sheep and goats	137	186	.22 Long rifle
Pigs – small < 5 kg	77	104	.22 Short
Pigs – weanlings and grower finisher 5–100 kg	137	186	.22 Long rifle
Pigs – sows and boars	324	439	.22 Magnum rifle
Pigs – large boars	651–1865	882–2528	.410 and 20 gauge shotguns, .30-30 win.

*.303 British rifles: Use in very large bison males only; plan trajectory and backstops accordingly.

TABLE 2 Comparison of example bullet energies						
Ammunition	Bullet / Shot (weight in)		Velocity (at muzzle)		Energy (at muzzle)	
	grains	grams	ft./s	m/s	ft./lbs.	Joules
.410 shotgun 3-inch slug	108	6.7	1800	549	788	1068
.410 shotgun with 2½-inch slug	87	5.4	1830	558	651	882
20 gauge shotgun rifled slug	324	20	1600	488	1865	2528
20 gauge shotgun 2¾ Sabot	270	16	1400	427	1162	1575
.22 Short Win. 29 grain bullet	29	1.8	1095	334	77	104
.22 Long rifle, Federal, American Eagle solid lead.	40	2.5	1240	378	137	186
.22 Mag. rifle, Win. X22WM 40 gr supr. j. h.pt.	40	2.5	1910	582	324	439
.223 Rem. rifle, Win. p.pt.	64	4	3050	930	1322	1792
.30-30 Win. rifle, Fed. s.pt.r.n.	170	10	2200	671	1827	2477
.303 British s.pt.	150	9	2685	823	2401	3255
.375 Magnum rifle	140	8.75	1850	567	1064	1442
.44 Magnum rifle	225	14	1870	574	1747	2367
.45 Colt	225	14	1000	307	500	678

Table 3 Abbreviations			
Abbreviation		Abbreviation	
Fed.	Federal	Rem.	Remington
ga.	Gauge	s.pt.	soft point
h.pt.	hollow point	s.pt.r.n.	soft point rounded nose
j. h.pt.	jacketed hollow point	sa.	Sabot
mag.	Magnum	sl.	Slug
p.pt.	power point	Supr.	Supreme
pl. h.pt.	plated hollow point	Win.	Winchester

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Notes:

- Use the slowest velocity and minimum energy required to effectively euthanize the animal.
- Be aware that the type of firearm and energy of the ammunition vary, depending on the size and age of the animal.
- Know that planning the trajectory is important, particularly if the operator is shooting from a standing position on the ground. Refer to landmarks above.
- Other possible options include low energy 20 gauge shotgun shells and .30-30 Winchester.
- Be aware of ricochet and “through and through” with higher energy options.
- For safety purposes, always assess backstopping before initiating any action.