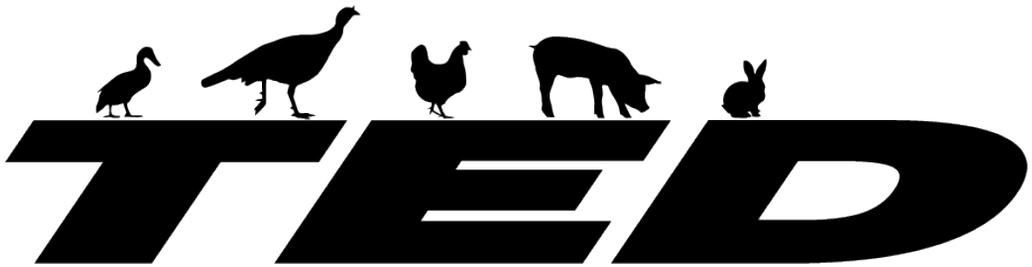


# Captive Bolt Technology





## Contents

- **Euthanasia**
- **Motivation**
- **AVMA Euthanasia Guidelines**
- **Euthanasia Evaluation**
- **The Captive Bolt**
- **Human Safety**
- **The TED Firing Sequence**
- **ANSI: American National Standards Institute**
- **Stunning Energy: Species & Age**
- **Stunning Energy: Subject Restraint**



# Animal Welfare



## Euthanasia

### **Euthanasia**

The term euthanasia is derived from the Greek terms **eu** meaning good and **thanatos**, meaning death. A “good death” would be one that occurs with minimal pain and distress.

### **Animal Euthanasia**

Animal euthanasia is the act of inducing humane death in animals.



## Motivation

### **Undercover Videos**

The nonaesthetic treatment of farm animals depicted in undercover videos emotionally engage the general public.

### **Farm Animal Euthanasia**

The specific graphic nature of some of the current animal euthanasia techniques, although technically humane, may be considered aesthetically offensive to the general public.

### **Retailers**

Separate from public perception, animal welfare is the systematic concern for animal well-being. Retailers are demanding animal welfare compliance throughout the supply chain.

### **Welfare Audits:** Example - *Global Animal Partnership, 5-Step Program: Step 2.16*

The following euthanasia methods are permitted:

- a) penetrating and non-penetrating captive bolt pistols**
- b) gunshot directed to the head
- c) turkeys <14 days, manual (non-mechanical) cervical dislocation
- d) turkeys 15 days < 5 weeks of age, mechanical stunning followed by cervical dislocation
- e) turkeys 5 weeks - 10 weeks, stunning immediately followed by cervical dislocation
- f) overdose of injectable anesthetics
- g) gas stunning and killing

### **American Veterinary Medical Association, AVMA**

AVMA publishes guidance on farm animal euthanasia for the U.S. The AVMA considered recent scientific studies and aesthetics as reasons for moving away from blunt-force trauma and cervical dislocation. Blunt-force trauma and cervical dislocation are considered best applicable for smaller / younger subjects.



# AVMA Euthanasia Guidelines

## **Approved Methods**

- Injectable anesthetics\*
- Inhaled agents
- Cervical dislocation
- **Captive bolt**
- Decapitation
- Manual blunt force trauma
- Electrocution
- Gun shot

## **Evaluation of Methods**

In evaluating methods of euthanasia, consider the following criteria: ability to induce loss of consciousness and death without causing pain, distress, anxiety, or apprehension.

- Time required to induce loss of consciousness
- Reliability
- Safety of personnel
- Irreversibility
- Compatibility with requirement and purpose
- Emotional effect on observers or operators
- Compatibility with subsequent evaluation, examination, use of tissue
- Drug availability and human abuse potential
- Compatibility with species, age, and health status
- Ability to maintain equipment in proper working order
- Safety for predators/scavengers should the carcass be consumed

\* Only method approved without conditions, AVMA Guidelines on Euthanasia



## Euthanasia Evaluation

### **Insensible**

- Complete loss of consciousness
- Lacking sensory perception or ability to react

### **Irreversible**

- Brain trauma sufficient so that the subject does not return to consciousness

### **Physical Signs of Insensibility**

The absence of brainstem reflexes are indicative of loss of brain function in animals, e.g. pupillary light and corneal reflexes

- 1) The pupillary light reflex is a reliable indicator of complete insensibility and is present when there is pupil constriction in response to light shone in the eye.
- 2) The corneal reflex can easily be observed as blinking or movement of the nictitating membrane.
- 3) Absence of the corneal reflex in addition to a fixed, dilated pupil indicates that there is reduced blood flow to the brainstem.
- 4) Behavioral indicators, such as the absence of neck tension.



# Captive Bolt Technology

## The Captive Bolt

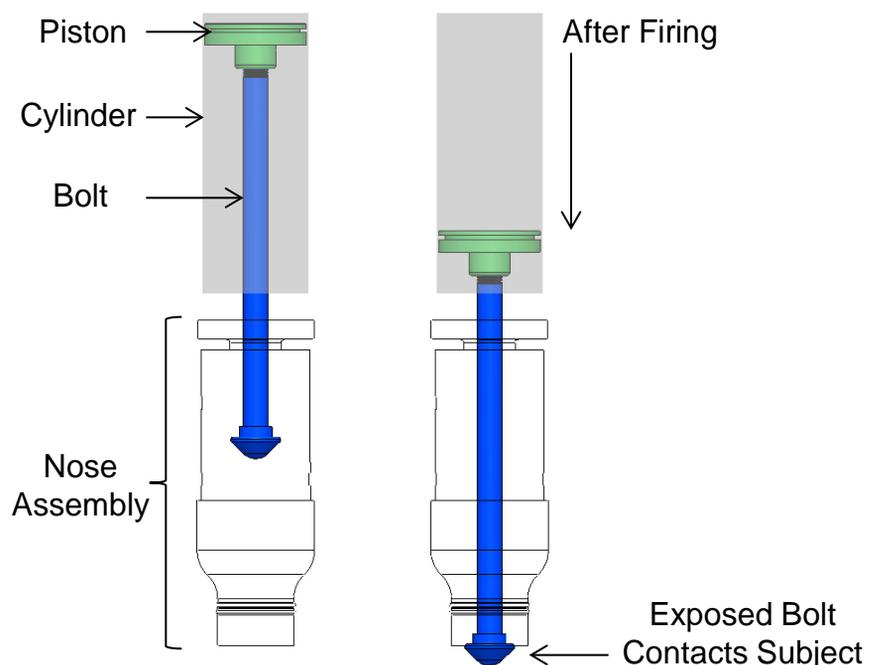
### Mode of Operation

Production of concussion and trauma to the cerebral hemisphere and brainstem, sufficient to induce sudden loss of consciousness and subsequent death.

### Captive Bolt (CB)

The modern captive bolt device and a conventional automobile engine have a similar means of converting the potential energy released from burning fuel: the piston. The CB piston is connected to the bolt. The piston-bolt assembly is held “captive” in the cylinder and cycles from one end of the cylinder to the other with each firing.

The energy produced from the burning fuel is carried by the moving piston-bolt assembly and transferred to the subject by the bolt. A sufficient energy impulse from the exposed bolt will cause instant irreversible insensibility.



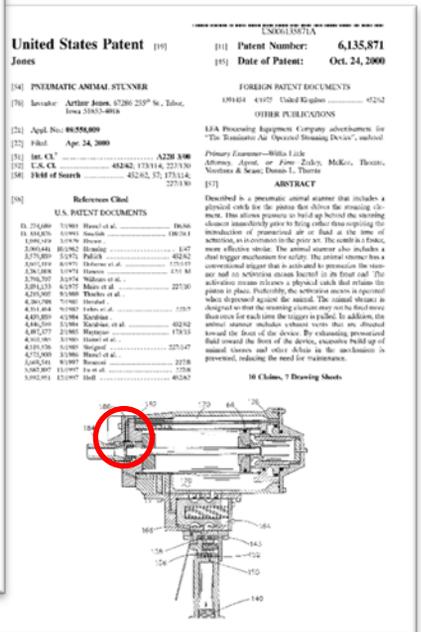
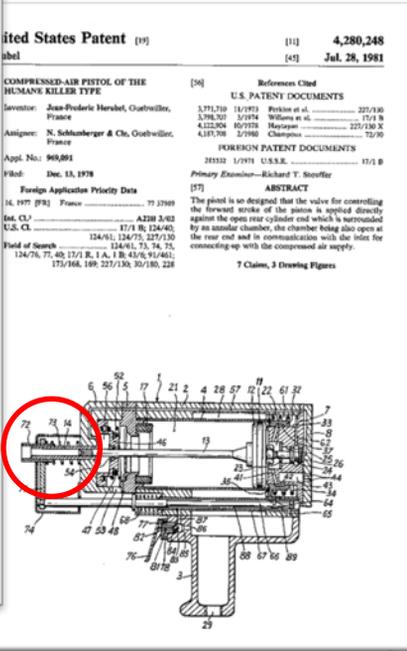
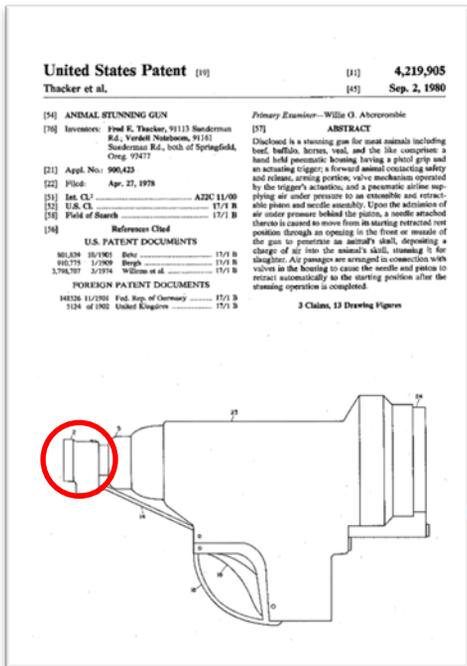
# Human Safety

## Operator Safety

Operator safety is the highest design priority. Multiple and redundant safety interlocks help ensure the CB device is not fired unintentionally. The ideal safety system automatically returns the device to “SAFE” without operator intervention after each firing.

To confirm the CB device is located on the subject, patented CB devices feature a safety interlock know as an *activator* (highlighted below). The activator arms the CB trigger when subject contact is confirmed. By ensuring close contact with the subject, the activator also enhances stunning repeatability across operators.

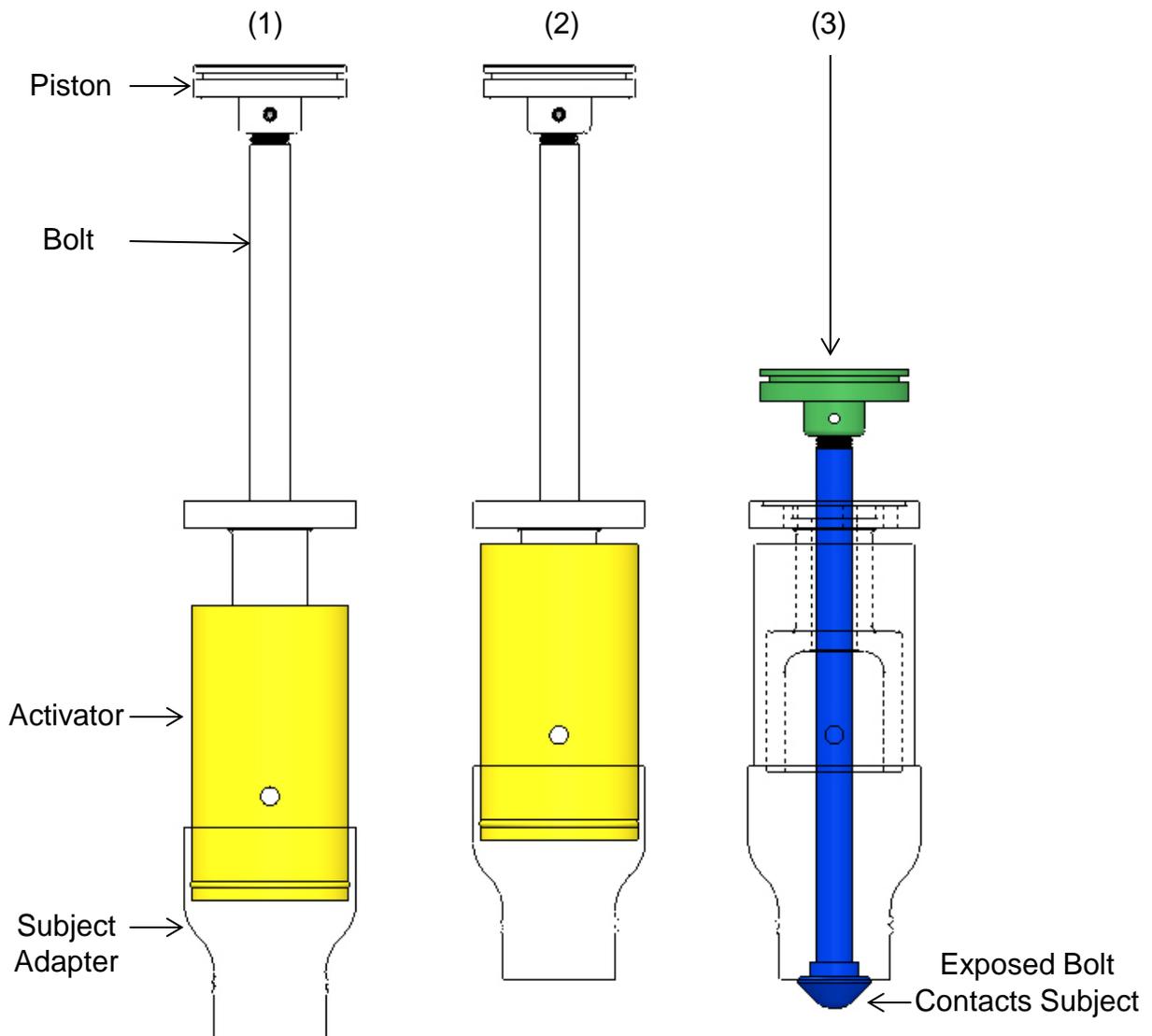
The TED *activator* is in compliance with ANSI-SNT-101-2002, SECTION 3.3.2: full sequential action.



## The TED Firing Sequence

### The Activator Based Safety Interlock

- The TED activator slides from position (1) to position (2), when contact with the subject is confirmed.
- The firing trigger is armed only when the activator is in position (2).
- Position (3) shows the bolt travel when fired; contacting the subject.
- After firing, the bolt and activator automatically return to position (1).



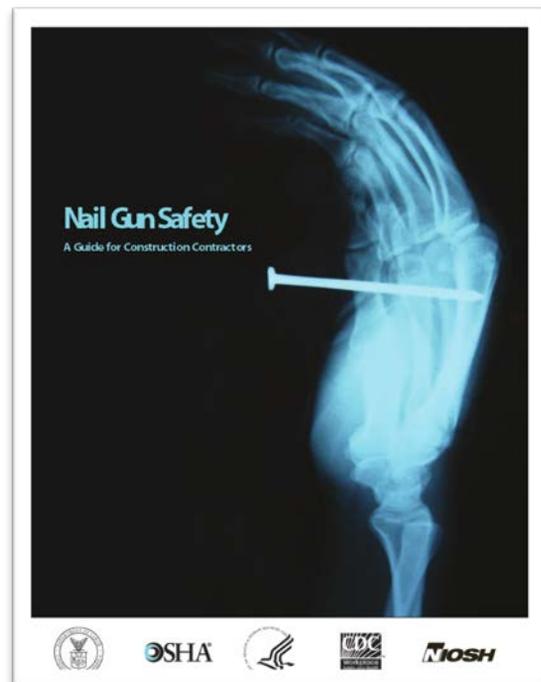
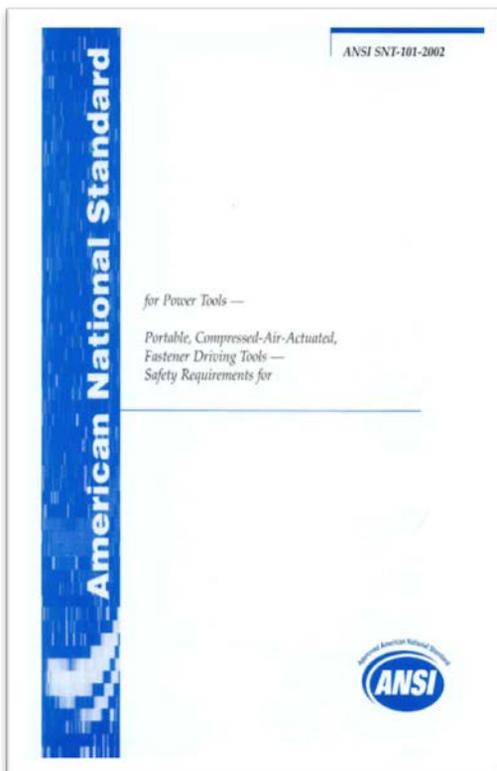
## ANSI: American National Standards Institute

### **ANSI Mission**

To enhance both the global competitiveness of U.S. business and the U.S. quality of life by promoting and facilitating voluntary consensus standards and conformity assessment systems, and safeguarding their integrity.

The TED actuation system is in compliance with ANSI-SNT-101-2002, SECTION 3.3.2: full sequential action.

Full sequential action systems have more than one operating controls that must be activated in a specific sequence to actuate the device. Additional actuation can occur only when all operating controls are released and re-activated in the same sequence.



## Stunning Energy: Species & Age

### **Adapting Captive Bolt Devices for Species and Age**

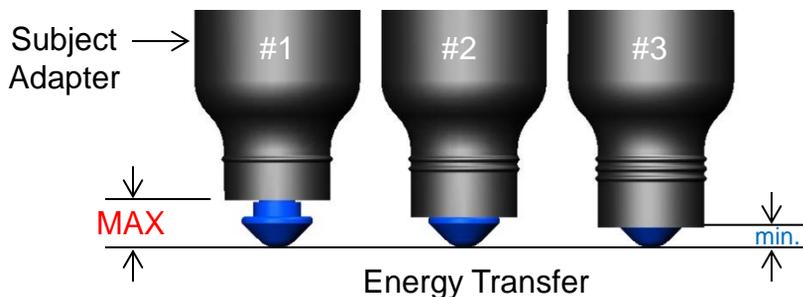
The amount of stunning energy required to produce irreversible insensibility (death) relates to the species and age of the subject. Large subjects require more stunning energy than small subjects.

The stunning energy received by the subject is determined by:

- Controlling the amount of energy initially generated or,
- Controlling the amount of energy transferred during bolt contact.

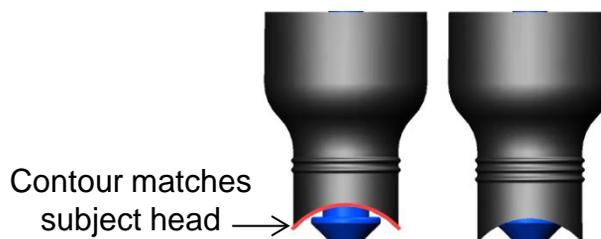
### **Subject: Large Birds or Small Pigs**

The subject adapters (SA) varying in length to controlling the amount of energy transferred during bolt contact. For example, older subjects require more stunning energy than younger subjects. SA#1 allows the greatest bolt travel and transfers the maximum energy to the subject.



### **Subject: Small Bird**

The small bird adapters have a curved contact-end that fits securely behind the comb and matches the contour of the small head.



## Stunning Energy: Subject Restraint

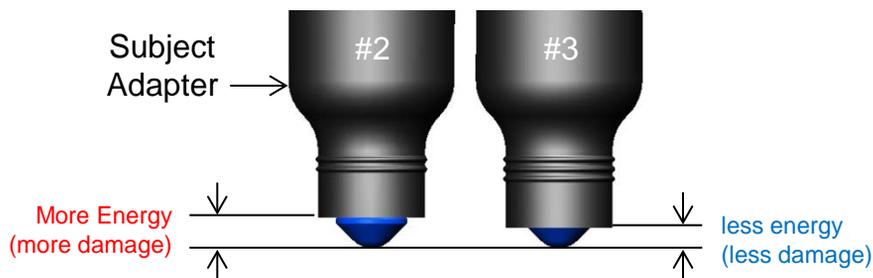
### What Type of Material is Supporting the Subject?

The amount of stunning energy required to produce irreversible insensibility relates to the species, age, and **restraint** of the subject. Restraining the subject includes consideration of the type of material under the subject.

### Adapting Captive Bolt Devices for Subject Restraint

Operators are encouraged to change the subject adapter (SA) to adjust the total stunning energy transferred, depending on the type of material immediately under the subject.

- Softer floors subtract from the total stunning energy transferred, therefore more total stunning energy is needed: use SA#2.
- Since a concrete floor would not subtract from the total stunning energy transferred: use SA#3 .



### Beyond Effectiveness... Consider Aesthetics

- Assume SA#2 is effective on a litter floor. SA#2 will likely have excessive subject damage on a concrete floor. *Therefore, decrease stunning energy by changing to SA#3.*