Recommended Animal Handling Guidelines and Audit Guide 2005 Edition

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Table of Contents

Executive Summary and Historical Perspective

The Humane Methods of Slaughter Act of 1958 was the first federal law governing the handling of livestock in meat plants. The 1958 law applied only to livestock that were slaughtered for sale to the government. In 1978, the Humane Methods of Slaughter Act was reauthorized and covered all livestock slaughtered in federally inspected meat plants. As a result of the Act, federal veterinarians are in meat packing plants continuously, monitoring compliance with humane slaughter regulations. Additional guidance is found in the Code of Federal Regulations and in specific USDA regulations and notices.

The AMI Foundation has a demonstrated commitment to voluntary animal handling programs that go above and beyond regulatory requirements.

In 1991, the American Meat Institute published *Recommended Animal Handling Guidelines for Meat Packers,* the first voluntary animal welfare guidelines for meat packing operations. Authored by Temple Grandin, Ph.D., of Colorado State University, the illustrated guidelines offered detailed information about optimal handling of animals, how to troubleshoot animal handling problems in packing plants, how to stun animals effectively and maintain equipment thoroughly and how to move non-ambulatory animals while minimizing stress. The guidelines were implemented widely by members of the meat packing industry.

In 1997, Dr. Grandin developed a new document called *Good Management Practices (GMPs) for Animal Handling and Stunning*. The new document detailed measurable, objective criteria that could be used to evaluate the well-being of livestock in meat packing plants. Self-audits using the criteria were recommended in an effort to identify and address any problems and sustain continuous improvement. When the GMPs were developed and implemented, they were envisioned as a tool for use voluntarily by meat companies. In the years that followed, major restaurant chains began developing animal welfare committees and conducting audits of their meat suppliers. They utilized the AMIF *Good Management Practices* as their audit tool. Beginning in 1999, compliance with AMIF's GMPs became part of many customer purchasing specifications.

In 2004, the American Meat Institute Animal Welfare Committee determined that the two animal welfare documents should be merged into a single, updated document. Also included are official AMI Foundation audits for pig, cattle and sheep slaughter. These forms can be recognized by the use of the official AMI Foundation logo. The forms can be reformatted to suit corporate needs, but any change to the numerical criteria on the forms would make the audit inconsistent with the AMIF audit.

Relative to other areas of scholarly research, only limited basic research has been conducted in the area of animal welfare. The objective criteria in the document were developed based on survey data collected over time in plants throughout the United States. The AMI Animal Welfare Committee, together with Dr. Temple Grandin, have determined what "targets" are reasonably achievable when plants employ good animal handling and stunning practices.

AMIF's audit guidelines recommend that companies conduct both internal (self-audits) and third party audits using the following criteria:

Effective Stunning – Cattle and sheep should be rendered insensible with one shot at least 95 percent of the time. For pigs, electrical wands should be placed in the proper position at least 99 percent of the time. For gas stunned pigs, no more than 4 percent of gondolas may be overloaded.

Hot Wanding (Pigs only) – No more than one percent of pigs should vocalize due to hot wanding. Hot wanding is defined as the application of electrodes that are already energized.

Bleed Rail Insensibility – A sensible animal on the bleed rail is an automatic failure. However, it is possible that over longer time spans, this may occur. Plants are encouraged to aggregate audit scores to monitor system performance. While the target is clearly zero, no more than two cattle per 1,000 and no more than one pig or sheep per 1,000 should be sensible on the bleed rail. Numbers in excess of this indicate a serious system problem. Animals showing any sign of return to sensibility should be immediately re-stunned. All animals must be completely insensible before procedures such as skinning, head removal or dehorning.

Slips and Falls – For both species, fewer than three percent of livestock should slip and fewer than one percent should fall down with the body touching the floor. A slip is when a knee touches the ground or a food loses contact with the ground.

Vocalizations – Vocalization levels should be monitored in the restrainer. Three percent or fewer of cattle should vocalize and 5 percent or fewer of pigs should vocalize. For pigs, room vocalizations (vocalizations heard throughout a room and not strictly in the restrainer) should be monitored for internal audits only. For pigs, noise should be heard during fewer than 50% of stunning cycles. Due to differences in plant acoustics and the potential for auditor variability, these numbers cannot be compared from plant to plant and should not be measured on third-party audits. Do not measure vocalizations for sheep as they are not meaningful.

Electric Prod Use – Prods should be used on 25% or less of cattle, pigs and sheep. Prods should never be used in CO_2 or group stunning systems.

Willful Acts of Abuse – Any willful act of abuse, like dragging a conscious animal, applying prods to sensitive parts of the animal, slamming gates on livestock, purposefully driving livestock on top of one another or hitting or beating an animal constitutes an automatic audit failure.

The Committee noted, however, that audits represent a "snapshot in time." Many variables can impact audit outcomes, especially when live animals are involved.

These can include:

- **Change in plant personnel.** It may take time for a new employee to become as skilled an animal handler as a more experienced employee. However, willful acts of abuse can NEVER be tolerated.
- **Breed, age and gender of livestock.** These factors all can affect temperament.
- **Previous handling or lack of handling and human contact at the farm level.** Animals that are accustomed to seeing people generally are less skittish at the plant.
- **Weather.** Livestock sometimes react to weather or seasonal changes, like a thunderstorm.
- **Auditor influence.** This includes reaction by staff, auditor expertise and management response to auditor presence.

For these reasons, it is essential that if a plant performs poorly on an audit, those results should be viewed in the context of historical performance to determine if this is an anomaly or a pattern. A plant's proposed corrective/preventive measures also should be considered.

Just as plants strive for continuous improvement based on new practices and information, so, too, the AMI Foundation will strive for continuous improvement and refinement of this document. The general recommendations and the audit criteria are based on real data and observation. However, as additional research is completed and new information is generated, the AMI Foundation will seek to improve and update these documents based upon new information.

Chapter One: Recommended Animal Handling Guidelines

Optimal livestock handling is extremely important to meat packers for obvious ethical reasons. Once livestock – cattle, pigs and sheep — arrive at packing plants, proper handling procedures are not only important for the animal's well-being, they can also mean the difference between profit and loss. Research clearly demonstrates that many meat quality benefits can be obtained with careful, quiet animal handling. In addition, the Humane Slaughter Act of 1978, the regulations that evolved from it, as well as more than two decades of directives and notices, dictates strict animal handling and slaughtering standards for packing plants. This booklet provides practical information that can be used to develop animal handling programs and to train employees in the principles of good animal handling practices.

Management Commitment

A key factor in establishing and maintaining optimal animal handling and stunning in plants is a clearly communicated management commitment to animal handling. Top management must play an active role. This can include:

- Development of an animal welfare mission statement that is widely circulated and/or posted visibly in various places in a plant.
- Ongoing monitoring and measurement of animal handling and stunning practices and outcomes (See Chapter 2).
- Regular internal training and providing opportunities to attend outside training programs.
- Recognition and rewards for jobs well done.

This manual provides employees and managers with information that will help them improve both handling and stunning. Properly handled animals are not only an important ethical goal, they also keep the meat industry running safely, efficiently and profitably.

Section 1: Trucking Practices

Managing the transportation and holding of livestock, including careful temperature management, can result in enhanced livestock welfare and improved meat quality.

The following items should be considered when transporting livestock.

Maintenance — Trailers should be kept in good repair, should be kept clean (which is especially helpful in preventing pig skin blemishes) and should have non-slip floors.

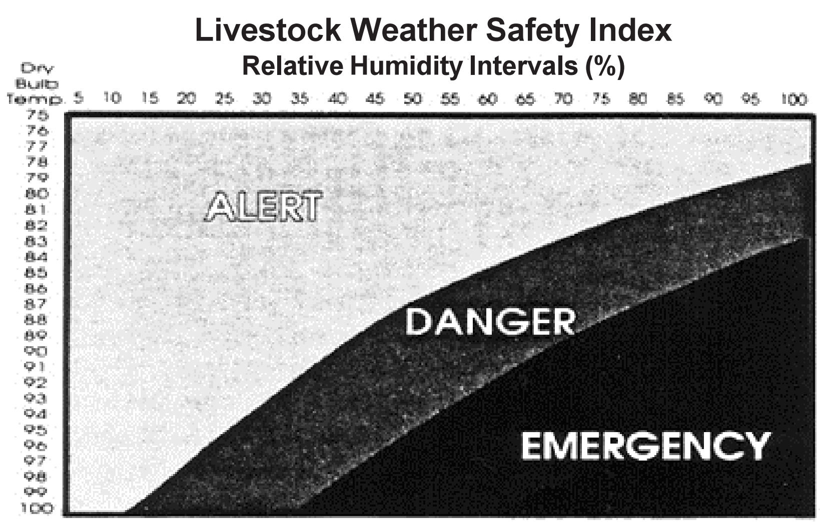
Truck Driving Practices — Careful truck driving helps prevent bruises, shrink and injuries. Sudden stops and acceleration that is too rapid increases injuries and stress. Selection of routes that are the most direct, but which minimize time on unpaved roads and avoidance of potholes will also provide benefits.

Design — It is essential that semi-trailers have sufficient height between decks to prevent back injuries. To comply with environmental regulations, truck floors should be leak proof to prevent urine and manure from dripping onto the highway.

Loading — Research shows that overloading livestock trucks can increase bruising. Overloading pig trucks can increase death losses and pale, soft exudative tissue (PSE).

Temperature Management

Temperature extremes can be harmful to livestock, but careful planning and temperature mitigation strategies can protect livestock.



Heat Stress Chart — The chart provides a guide for plant managers and truckers to help reduce heat stress of livestock. Hazard to the animal increases when both temperature and humidity increase. When conditions are in the alert zone, truckers need to be careful to keep livestock cool. When conditions get into the danger and emergency zone, try to shift loading schedules to avoid the hottest part of the day. Problems with heat stress in pigs may start as low as 60°F. (16°C.) Source: NIAA

Cold Temperature Management for Pigs

Freezing temperatures and wind chills can be dangerous as well as, particularly for pigs. The combination of cold ambient temperatures and wind speed can create significant wind chill. For example, if a truck is moving at 40 miles per hour (64 km per hour) in 40°F. (3.7°C.) weather, pigs are exposed to a wind chill that makes it feel to the pigs like it is 10°F. or -12.2°C. Rain can exacerbate these extremes. Wind protection should be provided when the air temperature drops below 32°F. or zero°C.

The following chart offers guidance or Truck set-up procedures during temperature extremes.

Truck Set–Up Procedures During Temperature Extremes

Air Temp (F)	Bedding	Side Slats	
Less than 10	Heavy	90% closed	10% open*
10 – 20	Medium	75% closed	25% open*
20 – 40	Medium	50% closed	50% open
40 – 50	Light	25% closed	75% open
More than 50	Light**	0% closed	100% open

*Minimum openings are needed for ventilation even in the coldest weather
**Consider using sand or wetting bedding if it is not too humid and trucks are moving

Source: National Pork Board, Trucker Quality Assurance Handbook

The chart on page 9 offers rough guidelines for the space that should be provided per running foot of truck floor for various pig weights when temperatures are below 75°F. When the Livestock Weather Safety Index is in the “Alert” condition, load 10 to 20% fewer pigs. Pigs that will travel more than 12 hours may need more space. Non-ambulatory pigs and dead pigs increase after 12 hours.

Recommended Transport Space Requirements

Average weight (lbs)	Number of Hogs Per Running Foot Of Truck Floor Normal Weather Truck or Trailer With (inches) 96 (243.8 cm)	102 (259 cm)	Square Feet Per Head
50 (22.7 kg)	5.23	5.56	1.53 (0.142 sq.m)
100 (45.4 kg)	3.44	3.66	2.32 (0.215 sq.m)
150 (68 kg)	2.71	2.88	2.95 (0.274 sq.m)
200 (90.7 kg)	2.30	2.44	3.48 (0.323 sq.m)
250 (113 kg)	1.88	1.99	4.26 (0.395 sq.m)
300 (136 kg)	1.67	1.77	4.79 (0.445 sq.m)
350 (159 kg)	1.45	1.55	5.48 (0.509 sq.m)
400 (181.4 kg)	1.25	1.33	6.39 (0.593 sq.m)

Source: National Pork Board, Trucker Quality Assurance Handbook

Cold Temperature Management for Cattle, Veal and Sheep

While cattle and sheep are less sensitive than pigs to cold weather, it is still important to manage temperatures to protect animals and ensure meat quality.

Keeping livestock dry when possible is essential to protecting them from wind chill. Veal calves also are particularly temperature sensitive and require special care during transport. Take care in cooler temperatures (below 60°F. / 16°C.) to provide straw bedding and plug some air holes so in trucks so the calves do not become too cold. Also, it is critical to keep calves dry. Wetting a calf is the equivalent of lowering the outside temperature by 40-50°F. (4.4 – 10°C.).

The charts below offers rough guidelines for the space that should be provided. These charts offer two approaches to calculating space: based upon square foot needed for various weights or per running foot of truck floor (based on 92-inch truck width) for various cattle, calf and sheep weights.

Recommended Truck Loading Densities

(Source: National Institute for Animal Agriculture)

Feedlot Fed Steers Or Cows, Avg. Wt.	Horned or Tipped or more than 10% Horned and Tipped	No Horns (polled)
800 lbs. (360 kg)	10.90 sq. ft. (1.01 sq m)	10.40 sq. ft. (0.97 sq m)
1000 lbs. (454 kg)	12.80 sq. ft. (1.20 sq m)	12.00 sq. ft. (1.11 sq m)
1200 lbs. (545 kg)	15.30 sq. ft. (1.42 sq m)	14.50 sq. ft. (1.35 sq m)
1400 lbs. (635 kg)	19.00 sq. ft. (1.76 sq m)	18.00 sq. ft. (1.67 sq m)

Slaughter Weight	Lambs and Sheep	Shorn Full Fleece
60 lbs. (27 kg)	2.13 sq. ft. (0.20 sq m)	2.24 sq. ft. (0.21 sq m)
80 lbs.(36 kg)	2.50 sq. ft. (0.23 sq m)	2.60 sq. ft. (0.24 sq m)
100 lbs. (45 kg)	2.80 sq. ft. (0.26 sq m)	2.95 sq. ft. (0.27 sq m)
120 lbs. (54 kg)	3.20 sq. ft. (0.30 sq m)	3.36 sq. ft. (0.31 sq m)

Truck Space Requirements for Cattle

(Cows, range animals or feedlot animals with horns or tipped horns; for feedlot steers and heifers without horns, increase by 5 percent)

Ave. Weight	Number Cattle per running foot of truck floor (92 in. internal truck width or 233.7 cm.)*
600 lbs. / 272 kg	.9
800 lbs. / 363 kg	.7
1,000 / 453 kg	.6
1,200 / 544 kg	.5
1,400 / 635 kg	.4

Examples (1,000 lb. cattle):

44 foot single deck trailer – 44 X 0.6 = 26 head horned, 27 head polled.

44 ft. possum belly (four compartments, 10 ft. front compartment; two middle double decks, 25 ft. each; 9 ft. rear compartment, total of 69 ft. of lineal floor space) - 69 X .06 = 41 head of horned cattle and 43 head of polled cattle.

Measure the total lineal footage of floor space in YOUR truck. *In metric, this is the number of animals in each 31 cm. long segment of truck length.

Truck Space Requirements for Calves

(Applies to all animals in the 200 to 450 lb. / 90-203 kg. weight range)

Ave. Weight	Number of calves per running foot of truck floor (92 inch or 233.7 cm. internal truck width)*
200 lbs. / 90 kg.	2.0
250 lbs. / 113 kg	1.8
300 lbs. / 136 kg	1.6
350 lbs. / 159 kg	1.4
400 lbs. / 181 kg	1.2
450 lbs. / 204 kg	1.1

Examples (450 lb. calves)

44 ft. single deck trailer - 44 X 1.1 = 48 head 44 ft. double deck trailer - 88 Z 1.1 97 head.

***In metric, this is the number of animals in each 31 cm. long segment of truck length.**

Truck Space Requirements for Sheep

(Use for slaughter sheep, load 5 percent fewer if sheep have heavy or wet fleeces.)

Ave. Weight	Number Sheep per running foot of truck floor (92-in. or 233.7 cm. internal truck width)*
60 lbs. / 27 kg	3.6
80 lbs./ 36 kg	3.0
100 lbs./ 45 kg	2.7
120 lbs. / 54 kg	2.4

Example (120 lb. sheep)

44 ft. triple deck trailer - 44 X 3 X 2.4 = 317 shorn sheep, 302 wooly sheep.

***In metric, this is the number of animals in each 31 cm. long segment of truck length.**

Hot Weather Management for Pigs

According to federal regulation, all livestock must have access to clean drinking water in lairage. Water also can help prevent heat stress because it replaces fluids. Hot weather and humidity are deadly to pigs because they do not have functioning sweat glands. Therefore, special precautionary measures must be taken in hot weather conditions.
Use the following procedures to keep animals cool and eliminate unnecessary transport losses during extreme weather conditions.

1. Adjust your load conditions during temperature extremes.
2. If possible, schedule transportation early in the morning or at night when the temperature or relative humidity is cooler.
3. Never bed livestock with straw during hot weather, i.e. when the temperature is over 60°F (15°C), use wet sand or small amounts of wet shavings to keep pigs cool. Deep bedding in the summer may increase death losses.
4. If the temperature is 80°F (27°C) or higher, sprinkle pigs with water prior to loading at buying stations or on the farm (use a coarse heavy spray but not mist).
5. Remove grain slats from farm trucks.
6. Open nose vents.
7. Unplug ventilation holes and remove panels.
8. Load and unload promptly to avoid heat buildup.
9. Pigs are very sensitive to heat stress. Problems with heat stress may start to occur at 60°F. (16°C.). At 90°F. (32°C.) death losses almost double compared to 60°F. (16°C.).

Stockyards at packing plants should have sufficient capacity so that animals can be promptly unloaded from trucks. Heat builds up rapidly in a stationary vehicle. If trucks can't be unloaded, they may need to keep driving until they can.

In the stockyard pens, when the temperature is greater than 70°F (21° C.), facilities should be available and procedures for sprinkling pigs with water should be undertaken. For maximum cooling effect, the sprinklers should have a spray coarse enough to penetrate the hair and wet the skin. Sprinklers that create a fine mist can increase humidity without penetrating the hair and should not be used.

If it is not possible to follow these recommendations and protect the animals during hot conditions, make every effort to postpone the shipment until weather moderates.

When postponing is impossible, trucks should be kept moving and drivers should not be allowed to stop with a loaded trailer. When the truckers reach the plant, livestock must be unloaded promptly. Heat and humidity become extremely critical at 80°F. (27° C.)and 80% humidity.

Hot Weather Management for Cattle, Calves, Sheep and Goats

During hot weather, cattle, calves, sheep and goats should be hauled in early morning or at night whenever possible.

It is important to keep trucks moving and avoid any unnecessary stops. In addition, livestock should be unloaded promptly upon arrival at a plant and water should be provided.

Developing an Emergency Livestock Management Plan

It is essential that plants have an emergency livestock management plan in place. Each plant should assess potential vulnerabilities based on geographic location, climate and other issues that would require swift action to assure animal welfare. The plan should include:

- How food and water will be provided during an emergency like a major snowstorm.
- How electricity can be provided through backup generators should power be lost.
- What housing will be provided to livestock should housing become uninhabitable due to fire or weather conditions such as flood or snowstorm?
- How animals will be evacuated in an emergency like a fire or flood.

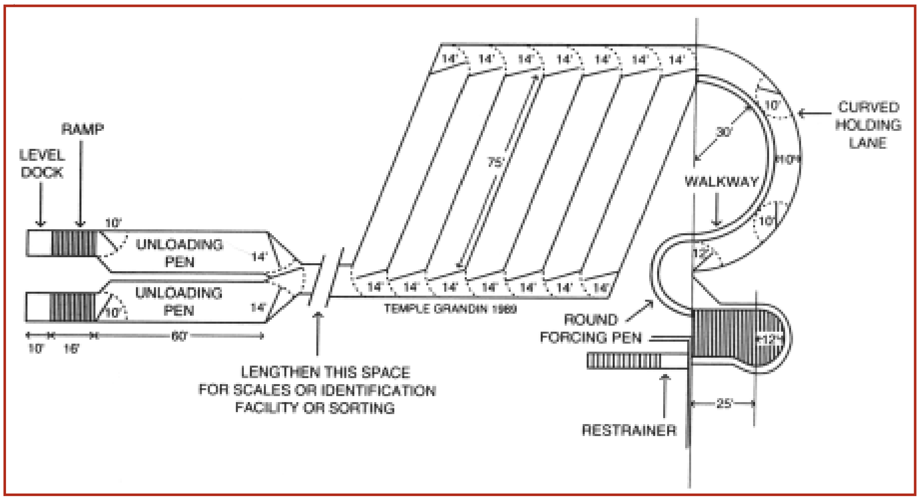
The plan should be kept in a visible location and should be reviewed at least annually.

The plant also should develop a contingency plan for truckers that may, for example, state that trucks should keep driving under certain conditions until unloading can occur or, if they park at a plant, that fans or water be used to keep the internal truck temperature at an optimal level.

Section 2: Pen Space and Facility Layout

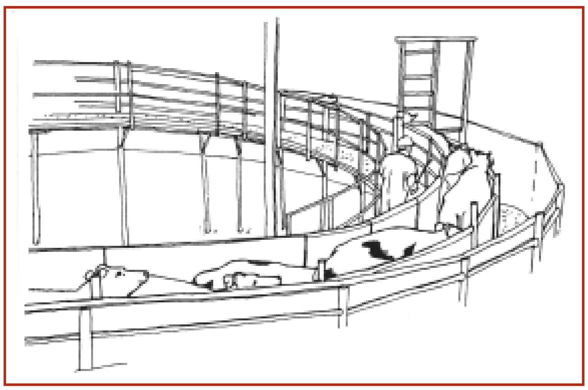
To improve meat quality, pigs should be rested two hours prior to stunning. When possible, animals should be kept in their transport groups. In large plants, pens should be designed to hold one or two truckloads. A few smaller pens will also be required for small lots. Pen space allocations may vary depending upon weather conditions, animal sizes and varying holding times. As a rough guideline, 20 sq. feet (1.87 sq. m) should be allotted for each 1,200-pound (545 kg) steer or cow and six sq. feet (.55 sq. m) per pig. Sows will require 11-12 sq. feet (1.03 – 1.12 sq. m) and boars require 40 sq. feet (3.74 sq. m). (Source: Swine Care Handbook, National Pork Board, 2003). These stocking rates will provide adequate room for “working space” when animals are moved out of the pen. If the animals are stocked in the pen more tightly, it will be more difficult for the handler to empty the pen. The recommended stocking rates provide adequate space for all animals to lie down.

Recommended Handling Facility Layout – This diagram illustrates a modern cattle stockyard and chute system. Animal movement is one-way and there is no cross traffic. Each long narrow pen holds one truckload. The animals enter through one end and leave through the other. The round crowd pen and curved chute facilitate movement of cattle to the stunner.



Facility Layout – Modern cattle facility with many good features. The unloading ramps have a 10-foot (3 meter) level dock for the animals to walk on before they go down the ramps. Each unloading pen can hold a full truck load. Unloading pens are recommended for both pig and cattle facilities to facilitate prompt unloading. Long, narrow diagonal pens eliminate sharp corners and provide one-way traffic flow.

The round crowd pen and curved single file chute take advantage of the natural tendency of cattle to circle. A curved chute is more efficient for cattle because it takes advantage of their natural circling behavior. It also prevents them from seeing the other end while they are standing in the crowd pen. A curved chute should be laid out correctly. Too sharp a bend at the junction between the single file chute and the crowd pen will create the appearance of a dead end. In fact, all species of livestock will balk if a chute looks like a dead end.

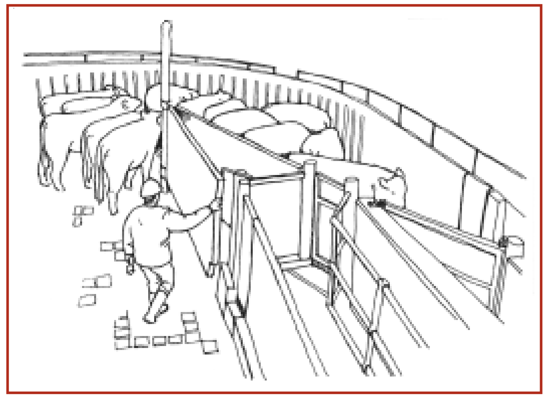


A well-designed, curved chute with solid sides for cattle.

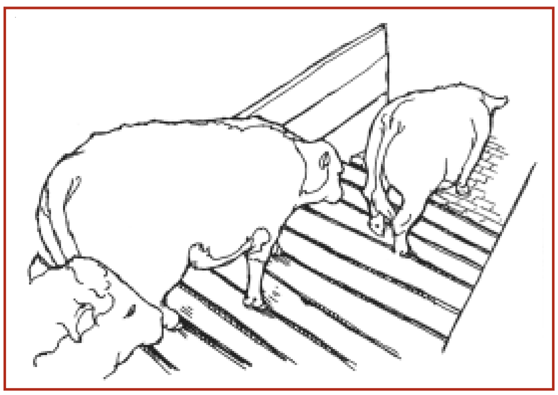
As a guideline, the recommended radii (length of crowd gate) are: Cattle, 12 feet; (3.5 m) pigs, 8 feet (2.5 m) and sheep, 8 feet (2.5 m). The basic layout principles are similar for all species, but there is one important difference. Cattle and sheep crowd pens should have a funnel entrance and pig crowd pens must have an abrupt entrance. Pigs will jam in a funnel. A crowd pen should never be installed on a ramp because animals will pile up in the crowd pen. If ramps have to be used, the sloped portion should be in the single file chutes. In pig facilities, level stockyards and chute systems with no ramp are most effective.

Unloading Animals Properly

For all species, a plant should have sufficient unloading ramp capacity so trucks can be unloaded promptly. Unloading ramps should have a level dock before the ramps go down so that animals have a level surface to walk on when they exit the truck. A good target for the slope of the ramp is no more than 20° (It may go up to 25° for pigs if the ramp is adjustable). With concrete ramps, stair steps are recommended because they provide better traction than cleats or grooves when ramps become dirty.



Round crowd pen with correct number of cattle



Well-designed unloading ramp

Truck drivers should seldom need to use an electric prod, also termed a hot shot, to unload a truck. Attempting to rush livestock during unloading can be a major cause of bruises, particularly loin bruises. Management should closely supervise truck unloading.

For cattle, the recommended stair step dimensions are 3 ½ inch (10 cm) rise and a 12-inch (30 cm) long tread. If space permits, an 18-inch (45 cm) long tread will create a more gradual ramp. For market pigs, a 2 ½ inch (6.5 cm) rise and a 10-inch (26 cm) tread works well. On adjustable ramps, cleats with 8 inches (20 cm) of space between them are recommended. All flooring and ramp surfaces should be non-slip to avoid injury.

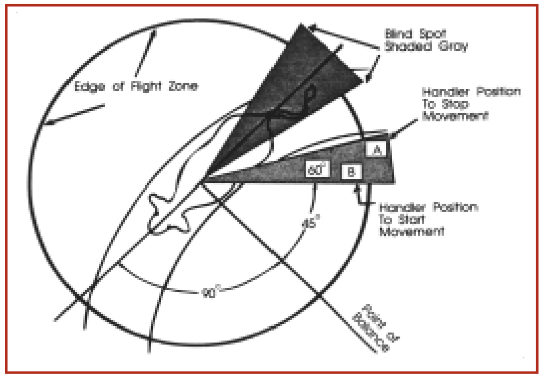
Section 3: Recommended Livestock Handling Principles

The principles of good livestock handling are similar for the different species. All livestock are herd animals and will become agitated when separated from the others. If a lone animal becomes agitated, place it with other animals where it is likely to become calmer. Never get in the crowd pen or other confined space with one or two agitated, excited livestock.

Understanding Flight Zone and Point of Balance

Handlers who understand the concepts of flight zone and point of balance will be able to move animals more easily. The flight zone is the animal's personal space and the size of the flight zone is determined by the wildness or tameness of the animal. Completely tame animals have no flight zone and people can touch them. Other animals will begin to move away when the handler penetrates the edge of the flight zone. If all the animals are facing the handler, the handler is outside the flight zone.

To keep animals calm and move them easily, the handler should work on the edge of the flight zone. The handler penetrates the flight zone to make the animals move and he backs up if he wants them to stop moving. The best positions are shown on the diagram. The handler should avoid the blind spot behind the animal's rear. Deep penetration of the flight zone should be avoided. Animals become upset when a person is inside their personal space and they are unable to move away. If cattle turn back and run past the handler while they are being driven down a drive alley in the stockyard, overly deep penetration of the flight zone is a likely cause. If animals start to turn back away from the handler, the handler should back up and increase distance between him and the animals. Backing up must be done at the first indication of a turn back.

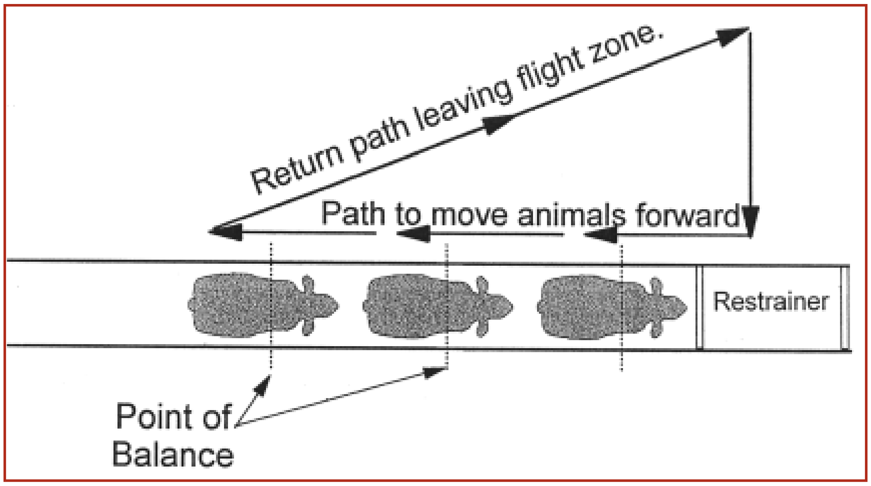


Flight Zone Diagram *– This diagram shows the correct positions for the handler to move livestock. To make an animal go forward, he should work on the edge of the flight zone in positions A and B. The handler should stand behind the point of balance to make an animal go forward and in front of the point of balance at the shoulder to make an animal back up.*

If a group of animals balk at a smell or a shadow up ahead, be patient and wait for the leader to cross the shadow. The rest of the animals will follow. If cattle rear up in the single file chute, back away from them. Do not touch them or hit them. They are rearing in an attempt to increase the distance between themselves and the handler. They will usually settle down if left alone.

Point of Balance

The point of balance is at the animal's shoulder. All species of livestock will move forward if the handler stands behind the point of balance. They will back up if the handler stands in front of the point of balance. Many handlers make the mistake of standing in front of the point of balance while attempting to make an animal move forward in a chute. Groups of cattle or pigs in a chute will often move forward without prodding when the handler walks past the point of balance in the opposite direction of each animal in the chute. If the animals are moving through the chute by themselves, leave them alone. It is not necessary and not recommended to prod every animal; often they can be moved by lightly tapping.

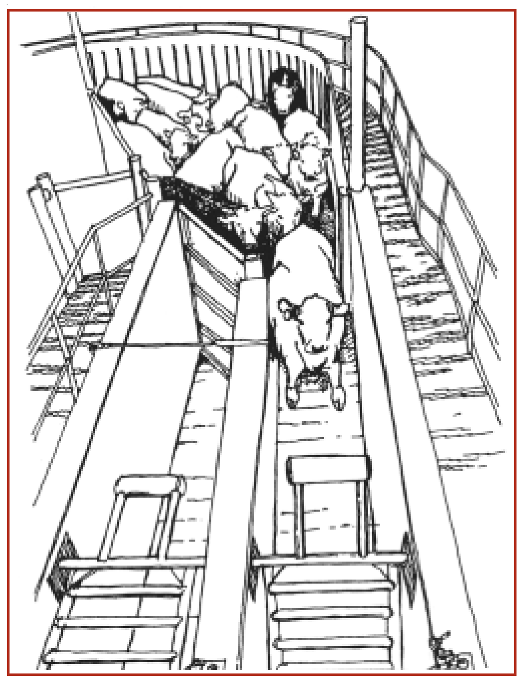


Cattle will move forward when the handler passes the point of balance at the shoulder of each animal. The handler walks in the opposite direction along side the single file race.

Moving Animals

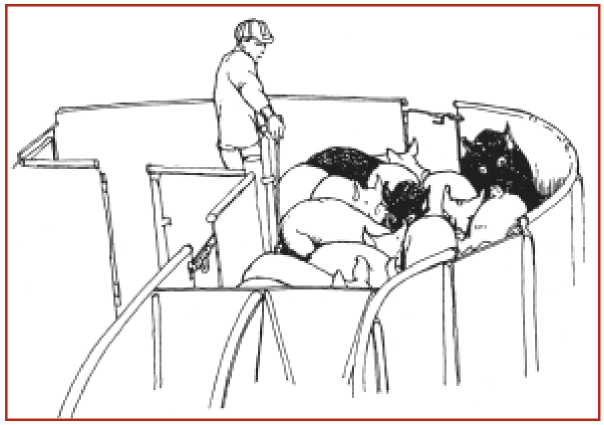
Livestock will follow the leader and handlers need to take advantage of this natural behavior to move animals easily. Animals will move more easily into the single file chute if it is allowed to become partially empty (though livestock must be able to see the animal ahead) before attempting to fill it. A partially empty chute provides room to take advantage of following behavior. Handlers are often reluctant to do this because they are afraid gaps will form in the line and slow the process. But once a handler learns to use this method, he will find that keeping up with the line will be easier. As animals enter the crowd pen, they will head right up the chute. Calm animals are easier to move than excited animals. Pigs hauled for a short, 15-minute trip may be harder to unload because they have not had sufficient time to calm down after being loaded on the farm. It takes 20 to 30 minutes for excited pigs or cattle to calm down.

One of the most common mistakes is overloading the crowd pen that leads to the single file chute. The crowd pen and the staging alley between the crowd pen and the yards should be filled half full so that animals have room to turn.

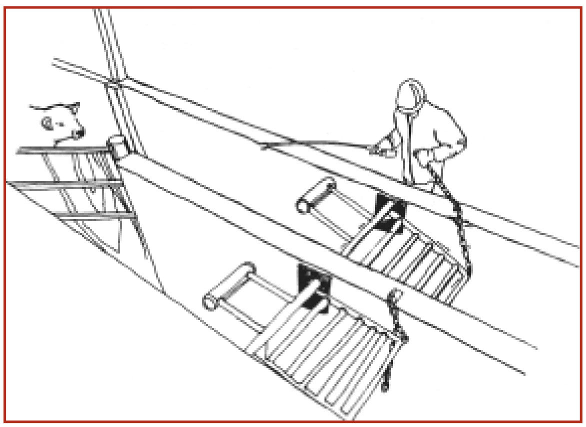


Cattle move into single file, following the leader.

Handlers must also be careful not to push the crowd gate up too tightly on the animals. It often works best to leave the crowd gate on the first notch and to let the animals flow into the single file chute. This will work after all the distractions have been removed from a facility. The crowd pen should become the "passing through" pen. The crowd gate may be used to follow the animals and should never be used to forcibly push them. The handler should concentrate on moving the leaders into the chute instead of pushing animals at the rear of the group. One-way or sliding gates at the entrance to the single file chute must be open when livestock are brought into the crowd pen. Cattle will balk at a closed gate.



Pig crowd pen with an abrupt entrance to prevent jamming.



Holding a one-way gate open to facilitate cattle entry into the chute.

One-way flapper gates can be equipped with a rope to open them by remote control from the crowd pen. When the crowd pen is operated correctly, electric prods can usually be eliminated and non-electric driving aids such as flags, paddles and sticks with streamers can be used. Animals can easily be turned with these aids. To turn an animal, block the vision on one side of its head with the aid. If the leader balks at the chute entrance, a single touch with the prod may be all that is required. Once the leader enters, the rest of the animals will follow.

Some highly excitable pigs are difficult to drive at the packing plant. These animals squeal, bunch and pile up and it can be difficult to make these pigs separate and walk up the chute. Highly excitable pigs can have severe pale, soft, exudative tissue or PSE due to agitation during handling, even though these pigs are negative on the genetic test for the halothane gene. Excitability problems can be reduced and pigs will be easier to drive if people walk through the finishing pens at least once a week. The person should walk quietly in a different random direction each time to train the pigs to get up quietly and flow around them. Playing a radio in the finishing barn also gets the animals accustomed to different kinds of sounds.

Preventing Injuries and Bruises

Non-slip flooring is essential to prevent falls and crippling injuries. Humane, efficient handling is very difficult on slick floors because animals can become agitated and excited when they lose their footing. All areas where livestock walk should have a non-slip surface. Existing floors can be roughened with a concrete grooving machine. Grooves should be ¼-inch (.64 cm) deep, ¼ inch (.64 cm) wide and spaced ¼ inch (.64 cm) apart. For pigs, steel bars may be used. Concrete flooring also can be used on weight scales to prevent slipping.

A good sample of non-slip flooring.

For cattle, on scales, crowd pens and other high traffic areas, a grid of one-inch steel bars will provide secure footing. Construct a 12-inch (30 cm) by 12-inch (30 cm) grid and weld each intersection. Use heavy rod to prevent the grid from bending. Non-slip flooring is particularly important in stunning boxes and restrainer entrances.

New concrete floors for cattle should have an 8-inch (20 cm) diamond or square pattern with deep 1-inch (2. 5 cm) grooves. For pigs and sheep, stamp the pattern of raised expanded metal into the wet concrete. A rough broom finish will become worn smooth. It is also essential to use the right concrete mix for maximum resistance to wear.

Smooth Edges and Surfaces — Gates, fences and chutes should have smooth surfaces to prevent bruises. Sharp edges with a small diameter, such as angle irons, exposed pipe ends and channels, will cause bruises. Round pipe posts with a diameter larger than 3 inches (8 cm) are less likely to bruise. Vertical slide gates in chutes should be counter-weighted to prevent back bruises. The bottom of these gates should be padded with cut tires or conveyor belting. The gate track should be recessed into the chute wall to eliminate a sharp edge that will bruise.

In pork plants, the bottom 18 inch (46 cm) to 24 inch (61 cm) of a vertical slide gate (guillotine) can be cut off and replaced with a curtain made from conveyor belting. The pigs will not attempt to go through the curtain. This change will prevent back injuries if the gate is closed on a pig.

This bad bruise point could cause damage to both hide and meat.

Pressing up against a smooth flat surface such as a concrete chute fence will not cause bruises. However, a protruding bolt or piece of metal will damage hides and bruise the meat. Bruise points can be detected by tufts of hair or a shiny surface. Contrary to popular belief, livestock can be bruised moments before slaughter until they are bled. The entrance to the restrainer should be inspected often for broken parts with sharp edges.

Surveys show that groups of horned cattle will have twice as many bruises as polled (hornless) cattle. A few horned animals can do a lot of damage. Cutting off the horn tips will not reduce bruising because the animal still has most of its horn length.

Improving Animal Movement

Calm animals are easier to handle and move than excited animals. Animals can become agitated very quickly, but it can require 20 to 30 minutes for them to become calm again. Calm animals will move naturally through well-designed systems with a minimum of driving and prodding. To keep animals calm, take the following steps:

- ✓ Handlers should be quiet and calm. Yelling and arm-waving excite and agitate animals.

- ✓ When handling sheep, never, ever grab or lift the animal by the wool.

- ✓ Use lighting to your advantage. Animals tend to move from a darker area to a more brightly lit area and may refuse to enter a dark place. Lamps can be used to attract animals into chutes. The light should illuminate the chute up ahead. It should never glare directly into the eyes of approaching animals. Another approach is illuminating the entire chute area. This approach eliminates patches of light and dark which may confuse animals. Animals may be difficult to drive out of the crowd pen if the pen is brightly illuminated by sunlight and the chute is inside a darker building. Another common lighting problem is that a handling system may work well when lamps are new, but the animals will balk more and more as the lamps dim with age. Experiment with portable lights to find the most efficient and consistent lighting.

- ✓ Eliminate visual distractions. Get down in the chutes to see them from the animal's perspective. Livestock balk at shadows, puddles of water or any object that stands in their way, from a coffee cup to a piece of paper. A drain or a metal plate running across an alley can cause animals to stop and should be located outside the areas where animals walk. Flapping objects, such as a coat hung over a fence or a hanging chain, will also make livestock balk. Install shields or strips of discarded conveyor belting to prevent animals from seeing movement up ahead as they approach the restrainer or stunning box.

- ✓ Redirect air flow. Air hissing and ventilation drafts blowing in the faces of approaching animals can seriously impede movement. Ventilation systems may need to be adjusted.

- ✓ Use solid sides in chutes and crowd pens leading up to chutes. Solid sides in these areas help prevent animals from becoming agitated when they see activity outside the fence – such as people. Cattle tend to be calmer in a chute with solid sides. The crowd gate on the crowd pen should also be solid to prevent animals from attempting to turn back towards the stockyard pens they just left.

- ✓ Reduce noise. Animals are very sensitive to noise. Reducing high-pitched motor and hydraulic system noise along with banging or reverberation can improve animal movement. Clanging and banging metal should be reduced and hissing air should be muffled.

- ✓ Move animals in small groups – When cattle and pigs are being handled, the crowd pen and the staging areas which lead up to the crowd pen should never be filled more than three-quarters full. Do not push crowd gates up tight against the animals as cattle and pigs need room to turn. For sheep, large groups may be moved and the crowd pen can be filled all the way up.

- ✓ Spray water from above. When wetting pigs in the chute, be sure not to spray the animal's face with water because they will back up.

Section 4: Livestock Driving Tools

Electric prods should be used sparingly to move livestock and should not be a person's primary driving tool. In most plants, the only place an electric prod is needed is at the entrance to the stun box or restrainer. Cattle and pigs can often be moved along a chute when the handler walks by them in the opposite direction of desired movement, taking advantage of the point of balance at the animal's shoulder. Electric prods should only be picked up and used on a stubborn animal and then put back down. Certainly, the need for electric prod use can vary depending on breeds of animals, production practices on the farm, gender, the group of animals, the day and the handling system used.

Many well-managed plants have totally eliminated electric prods in the holding pens and the crowd pen that leads to the single file chute. In beef plants with well-trained handlers, survey data showed that up to 95 percent of the animals could be moved through the entire plant without the use of an electric prod. Plants should strive to use the electric prod on 25 percent or fewer

Moving pigs with a plastic paddle and a large flag.

cattle, pigs and sheep. Plants that use prods on five percent or fewer cattle and pigs are achieving excellent scores. A well-designed plant that has eliminated distractions and other handling impediments detailed above can greatly reduce electric prods, though they may not be entirely eliminated.


Moving cattle with a flag.

Substitutions for electric prods are possible in many instances. They include plastic paddles, sticks with flags on the end or large flags for pigs. Plastic streamers or strips cut from garbage bags attached to a stick also can be used. Cattle can be easily turned and moved in the crowd pen by shaking the streamers near their heads. For moving pigs, a large flag on a short handle or rattle paddle work well. Rattles work well for moving sheep.

Flags can be made from lightweight plasticized tarp material and can vary in size from 20 inches x 20 inches to 30 inches x 30 inches (50 cm x 50 cm to 76 cm x 76 cm). Lightweight sorting boards can be used to move livestock, although they quickly become heavy for handlers to use. In addition, a new vibrating prod that does not use electrical stimulus is showing promise in moving animals with a minimum of stress.

Using Proper Electric Prod Voltage

USDA regulations require that electric prods have a voltage of 50 volts or less. If most livestock bellow or squal in direct response to being touched with the electric prod, the power may need to be reduced. Prods which have sufficient power to knock an animal down or paralyze it must not be used. Electric prods must never be applied to sensitive parts of the animal such as the eyes, ears, mouth, nose or anus. In practical terms, the proud should not be used on the animal’s head.

When used, electric prods must never be wired directly to house current. A transformer must be used; a doorbell transformer works well for pigs. Fifty volts is the maximum voltage for prods hooked to an overhead wire. Progressive managers have removed wired-in prods and use only battery-operated prods.

The prod voltage for pigs should be lower than for cattle, which can help reduce both PSE and blood spots in the meat. The voltage required to move an animal will vary depending on the wetness of the animal and the floor. Battery-operated prods are best for livestock handling because they provide a localized directional stimulus between two prongs. Prods also should have an off switch and not be on constantly.

Section 5: Proper Design and Use of Restraints

Pigs and cattle should enter a restraint device easily with a minimum of balking. Correcting problems with animal restraint devices can also help reduce bruises and meat quality defects such as blood splash. The basic principles of low stress restraint which will minimize vocalization and agitation are:

- For cattle, block the animal's vision with shields so that they do not see people or objects that move while they are entering the restrainer. Install metal shields around the animal's head on box-type restrainers to block the animal's vision.

- Block the animal's vision of an escape route until it is fully held in a restraint device. This is especially important on restrainer conveyors. A flexible curtain made from discarded conveyor belts at the discharge end of the conveyor works well. Cattle often become agitated in a conveyor restrainer if they can see out from under the solid hold down cover before their back feet are off the entrance ramp. Extending the solid hold down cover on a conveyor restrainer will usually have a calming effect and most animals will ride quietly. Solid hold-downs can also be beneficial for pigs on conveyor restrainers.

- Eliminate air hissing and other distractions such as clanging and banging. Refer to the section on distractions.

- The restraint device must be properly lighted. Animals will not enter a dark place or a place where direct glare from a light is blinding them. To reduce balking at the entrance of a conveyor restrainer, install a light above the entrance. The light should be above the lead-up chute. It should illuminate the entrance of the restrainer, but it must not glare into the eyes of approaching animals. Light coming up from under a conveyor restrainer should be blocked with a false floor to prevent animals from balking at the "visual cliff effect."

- Provide non-slip flooring in box-type restrainers and a non-slip, cleated entrance ramp on conveyor restrainers. Animals tend to panic and become agitated when they lose their footing. Stunning boxes should have a non-slip floor.

- Parts of a restrainer device operated by pneumatic or hydraulic cylinders that press against the animal's body should move with a slow steady motion. Sudden jerky motion excites animals. On existing equipment, install flow control valves to provide smooth steady movement of moving parts that press against the animal.

- Use the concept of optimum pressure. The restraint device must apply sufficient pressure to provide the feeling of being held, but excessive pressure that causes pain should be avoided. Install a pressure regulator to reduce the maximum pressure that can be applied. Very little pressure is required to hold an animal if it is fully supported by the device. If an animal bellows or squeals in direct response to the application of pressure, the pressure should be reduced.

- A restraint device must either fully support an animal or have non-slip footing so the animal can stand without slipping. Animals panic if they feel like they may fall.

- Restraint devices should hold fully sensible animals in a comfortable, upright position. Shackling and hoisting, shackling and dragging, trip floor boxes and leg clamping boxes are not accept able. Restrainers that rotate animals on their backs are used rarely in glatt Kosher operations in the United States, but more commonly in glatt Kosher operation in South America and Europe. For information on using and auditing these devices, refer to: www.grandin.com (Ritual Slaughter Section).

- Restraint devices must have controls that enable the operator to control the amount of pressure that is applied. Different sized animals may require differing amounts of pressure. Hydraulic or pneumatic systems should have controls that enable a cylinder on the device to be stopped in mid stroke.

- Never hold an animal in a head restraint device for more than a few seconds. The animal should be stunned or ritually slaughtered immediately after the head holder is applied. Head restraint is much more aversive than body restraint. Animals can be held in a comfortable body restraint for longer periods. The animal's reaction should be observed. If the animal struggles or vocalizes, it is an indication that the device is causing discomfort.

- Restraint devices should not have sharp edges that dig into an animal. Parts that contact the animal should have smooth rounded surfaces and be designed so that uncomfortable pressure points are avoided.

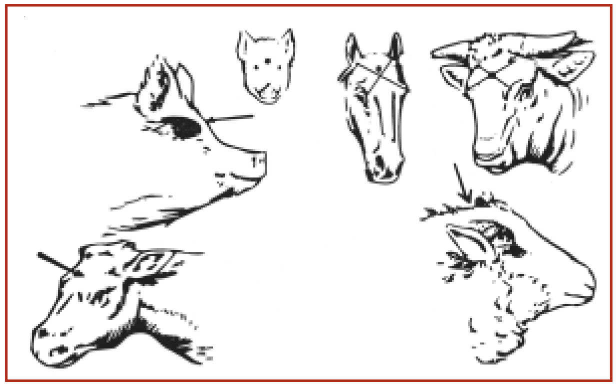
- On V conveyor restrainers, both sides should move at the same speed. To test this, mark each side with tape or a crayon. If after a minute of movement the marks do not appear in synch, the speed should be adjusted.

It is possible to modify existing restraint devices to lower vocalization and agitation scores. Balking at the entrance is also easy to reduce. Most of the modifications that would reduce animal agitation and vocalizations can be installed at a minimum expense. Floor grating, lighting and shields to block vision are examples of some relatively inexpensive but effective modifications.

Section 6: Recommended Stunning Practices

Good stunning practices are also required to achieve compliance with federal humane slaughter regulations. Good stunning also promotes animal welfare and meat quality. When stunning is done correctly, the animal feels no pain and it becomes instantly unconscious. Stunning an animal correctly also results in better meat quality. When using electric stunning systems, improper stunning will cause bloodspots in the meat and bone fractures.

Reduce Noise in Stunning Area

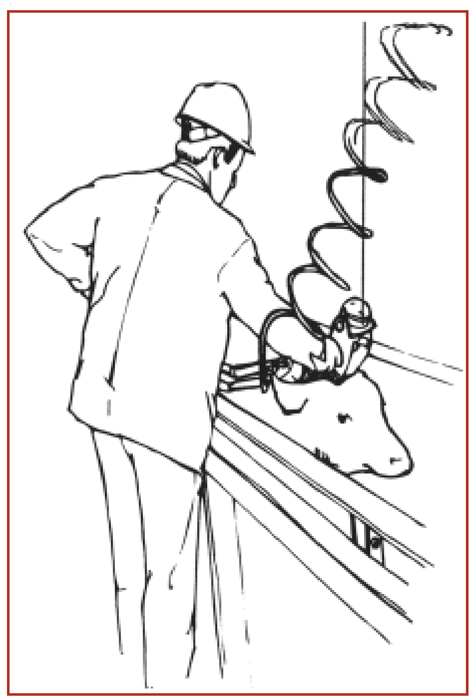


Proper captive bolt stunner placement positions.

Because animals are so sensitive to noises, it is important to reduce noise in the stunning area in particular. Calm animals facilitate accurate and effective stunning. As in other areas, mufflers can be used on air valve exhausts or they can be located outside. Rubber stops on gates can be used to stop clanging and braking devices on the shackle return improve safety and reduce noise.

In addition, consider replacing small with large diameter plumbing, which makes less noise, and replace pumps with quieter ones. Rubber hose connections between the power unit and metal plumbing will help prevent power unit noise from being transmitted throughout the facility. Any new equipment that is installed in animal holding or stunning areas should be engineered for quietness.

Captive Bolt Stunning



Captive bolt stunner placed on the head of a steer in the correct position.

To produce instantaneous unconsciousness, the bolt must penetrate the brain with a high concussive impact. The correct positions for stunner placement are shown in the diagram. For cattle, the stunner is placed on the middle of the forehead on an "X" formed between the eyes and the base of the horns. If a non-penetrating mushroom-head stunner is used, accurate aim is very critical to achieve instantaneous insensibility. A head-holding device may be needed to position the head for non-penetrating captive bolt.

For sheep, a captive bolt is placed on the top of the head. This position is more effective for sheep because they have a very thick skull over the forehead. For pigs, the captive bolt is placed on the forehead.

A good stunner operator learns not to chase the animal's head. He takes the time to aim and get one good, effective shot. The stunner must be placed squarely on the animal's head. All equipment manufacturers' recommendations and instructions must be followed.

Pneumatic stunners must have an adequate air supply. Low air pressure is one cause of poor stunning. The pressure gauge on the compressor should be checked to make sure that the stunner is receiving the air pressure recommended by the manufacturer. Heavy pneumatic stunners should be equipped with an ergonomic handle to aid positioning.

Poor maintenance of captive bolt stunners is a major cause of bad stunning. Stunners must be cleaned and maintained per the manufacturer's instructions. Good maintenance requires a person who has dedicated time each day to maintain stunners. A verified maintenance program where a mechanic signs off each day that he/she has tested the stunners is recommended. If a test stand is available for your brand of stunner, it should be used daily to test bolt velocity. It is important to keep stunner cartridges dry and the correct cartridge strength must be used. Store cartridges in a room with low humidity such as an office. Damp cartridges which have not been stored properly will cause poor stunning.

Captive Bolt Maintenance and Design

The most common cause of poor captive bolt stunning is poor maintenance of the captive bolt stunners. Stunners must be cleaned and serviced per the manufacturer's recommendations to maintain maximum hitting power and to prevent misfiring or partial firing. If a "test stand" to measure bolt velocity is available, daily use is strongly recommended. Each plant should develop a system of verified maintenance for captive bolt stunners.

Another major cause of failure to render animals insensible with one shot is a poor ergonomic design of bulky pneumatic stunners. Aversive methods of restraint, which cause three percent or more of the cattle or pigs to vocalize, must not be used as a substitute for improvements in gun ergonomics. Ergonomics for stunning in a conveyor or restrainer can be improved with a handle extension on the stunner and hanging the pneumatic stunner on an angle. Still another cause of poor stunning is damp cartridges. Cartridges must be stored in a dry place.

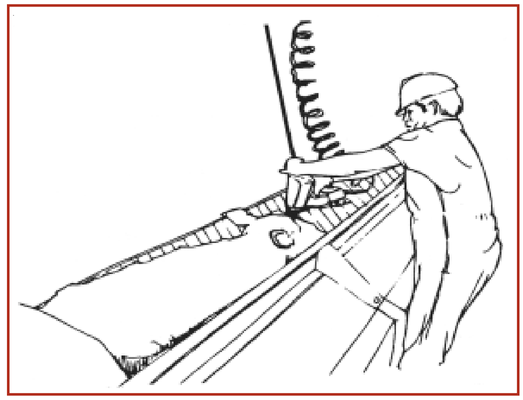
Another cause of missed captive bolt shots is an overworked or fatigued operator. Scoring at the end of the shift will pinpoint this problem. In some large plants two stunner operators may be required. Rotating the stunner operator to other jobs throughout the day may help prevent errors caused by fatigue.

Well-designed cattle stunning box.

Using electrical devices to cause immobilization prior to or during stunning is not recommended. Several scientific studies have shown that it is highly aversive. Vocalization scoring is impossible in electrically immobilized animals because paralysis prevents vocalization. Electrical immobilization must not be confused with electric stunning. Properly done, electric stunning passes high amperage current through the brain and induces instantaneous insensibility. Electrical immobilization keeps a sensible animal still by paralyzing the muscles. It does not induce epileptiform changes in an electroencephalogram (EEG).

Cattle Restraint for Stunning

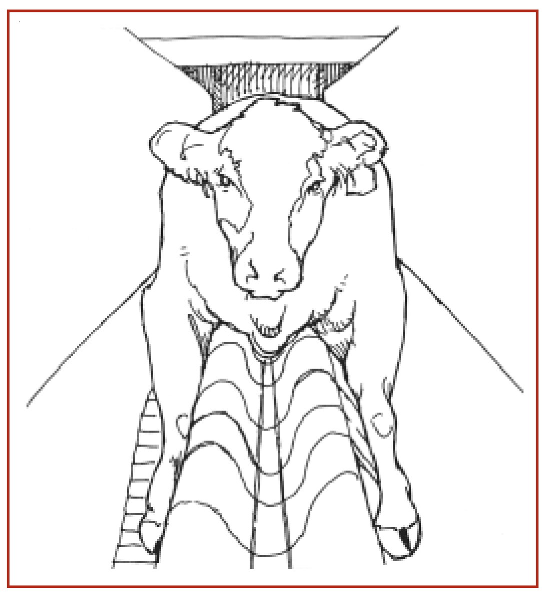
If a stunning box is used, it should be narrow enough to prevent the animal from turning around. The floor should be non-slip so the animal can stand without losing its footing. It is much easier to stun an animal that is standing quietly. Only one animal should be placed in each stunning box compartment to prevent animals from trampling each other.



V restrainer system for cattle.

Most large plants restrain cattle and pigs in a conveyor restrainer system. There are two types of conveyor restraints: the V restrainer and the center track system, which is used in many beef plants. In a V restrainer system, the cattle or pigs are held between two angled conveyors. In the center track system the cattle ride astride a moving conveyor. The center track system provides the advantages of easier cattle stunning and improved ergonomics because the stunner operator can stand closer to the animal. Either type of restrainer system is much safer for workers than cattle in a stunning box. Restrainer conveyors are recommended for all plants that slaughter more than 100 head per hour.

Lighting over the top of the conveyor in the restrainer room will help induce cattle to raise their heads for the stunner. However, both cattle and pigs should not be able to see light coming up from under the restrainer because it may cause balking at the entrance. Restrainer systems should be equipped with a long, solid hold-down rack to prevent rearing. For cattle, the hold-down should be long enough so that the animal is fully settled down onto the conveyor before it emerges from under it. This hold-down should not press on the animal's back. It is a visual barrier.



Center track restrainer for cattle.

If an animal is walking into the restrainer by itself, do not poke it with an electric prod. Center track systems require less prodding to induce cattle to enter it. Workers need to break the "automatic prod reflex" habit.

Electric Stunning of Pigs and Sheep

Electric head-to-back stunner placed in the correct position on a pig in V restrainer.

To produce instantaneous, painless unconsciousness, sufficient amperage (current) must pass through the animal's brain to induce an epileptic seizure. Insufficient amperage or a current path that fails to go through the brain will be painful for the animal. It will feel a large electric shock or heart attack symptoms, even though it may be paralyzed and unable to move. When electric stunning is done correctly, the animal will feel nothing. Animals that are dehydrated also may have high electrical resistance and be difficult to stun.

There are two types of electric stunning: head only stunning, which is reversible, and head-to- back cardiac arrest stunning, which stops the heart.

When head only stunning is used, the electrodes may be either placed on the forehead or clamped over around the sides of the head like ear muffs. Pigs should be wetted prior to stunning. The stunning wand must be applied to the animal for two to three seconds to stun properly. Stunners should be equipped with a timer. Pigs and sheep that are stunned with a head only stunner must be bled within a maximum interval of 30 seconds to prevent them from regaining consciousness.
Most large plants use cardiac arrest head to back or head to side-of-body stunning. It produces a still carcass that is safer and easier to bleed. Cardiac arrest stunning requires the use of a restraining device to prevent the animal from falling away from the stunning wand before it receives the complete stun. Cardiac arrest stunning kills the animal by electrocution.

When cardiac arrest stunning is used, one electrode must be placed on either the forehead or in the hollow behind the ears. The other electrode is placed on either the back or the side of the body. The head electrode should not be allowed to slide back onto the neck or onto the pig's jowls.

Meat packers should use amperage, voltage and frequency settings, which will reliably induce unconsciousness. Both properly and improperly stunned cardiac arrested animals can look similar. Current flow through the spine masks the epileptic seizure.

To prevent bloodspots in the meat and pain to the animal, the wand must be pressed against the animal before the button is pushed. The operator must be careful not to break and re-make the circuit during the stun. This causes the animal's muscles to tense up more than once and bloodspots may increase. If the stunning wand is energized before it is in full contact with the pig, the pig will squeal. This is called "hot wanding." This is detrimental to pig welfare and is likely to increase blood spots in the meat. Stunning wands and wiring should be checked often for electrical continuity. A worn switch may break the circuit enough to cause bloodspots. Electrodes must be kept clean to provide a good electrical contact. Operators must never double stun animals or use the stunning wand as a prod.

Electrical Specifications for Electric Stunning of Pigs and Sheep

Electric stunning equipment must operate within the electrical parameters that have been verified by scientific research to induce instantaneous insensibility.

Modern stunning circuits use a constant amperage design. The amperage is set and the voltage varies with the pig or sheep's resistance. Older style circuits are voltage regulated. These circuits are inferior because they allow large amperage surges, which can fracture bones and cause blood splash. The distance between the head electrode and the back electrode should not exceed 14 inches. The most modern sheep stunners from New Zealand use water jets to conduct electricity down through the wool.

Amperage — Scientific research has shown that an electric stunner must have sufficient amperage to induce a grand mal seizure to insure that the animal will be made instantly insensible. Insufficient amperage can cause an animal to be paralyzed without losing sensibility. For market pigs (180 - 200 lbs. / 82-91 kg. — not mature sows or boars) a minimum of 1.25 amps is required (Stunning market pigs with less than 1.25 amps should not be permitted unless the results of lower amperages are verified by either electrical or neurotransmitter recordings taken from the brain). Large sows (more than 350 lbs. / more than 160 kg.) will require 2 or more amps. If lower amperages are used, the stunner may induce cardiac arrest but the animal will feel the shock because the seizure was not induced. For sheep a minimum of one amp is required. These amperages must be maintained for a minimum of one second to give instant insensibility.

The Council of Europe (1991) recommends the above minimum amperages. Some plants stun animals below the Council of Europe recommended minimum amperages in an attempt to reduce blood spots in the meat. Since only a one-second application at 1.25 amps is required to induce instant insensibility in market pigs, it is the author's opinion that plants should be permitted to use circuits that lower the amperage setting after an initial, one second stun at 1.25 amps for pigs and one amp for sheep. Plants should also be encouraged to use electronic constant amperage electronic circuits that prevent amperage spiking. Both practical experience and research has shown that these types of circuits greatly reduce petechial hemorrhages (blood spots).

Voltage — There must be sufficient voltage to deliver the recommended minimum amperage; 250 volts is the recommended minimum voltage for pigs to ensure insensibility. Amperage is the most important variable to measure. The voltage that will be required will depend on the type of stunner, the wetness of the animal and whether or not it is dehydrated. For sheep, a minimum of one amp is required.

Frequency — Research has shown that too high an electrical frequency will fail to induce insensibility. Research indicates that insensibility is most effectively induced at frequencies of 50 cycles. Frequencies from 2000 to 3000 hz failed to induce instant insensibility and may cause pain. However, in pigs weighing under 200 lbs (80 kg), research has shown that a high frequency 1592 hz sine-wave or 1642 hz square wave head; only stunning at 800 ma (0.80 amp) would induce seizure activity and insensibility in small pigs. One disadvantage is that the pigs regained sensibility more quickly compared to stunning at 50 to 60 cycles. The pigs in this experiment weighed one-third less than comparable U.S. market pigs and this probably explains why the lower amperages were effective.

Equipment is commercially available for stunning pigs at 800 hz applied across the head by two electrodes and a second stun with 50 to 60 hz from head to body. Research has shown that 800 hz is effective when applied by two electrodes across the head.

Research has shown that stunning pigs with frequencies higher than 50 to 60 cycles is effective. In this experiment, the pigs were stunned with a head only applicator. High frequency stunning has never been verified to induce instant insensibility when applied as a single stun with a head to body electrode. This is the type of electrode used in many large U.S. pork slaughter plants.

Vocalization As an Indicator of Stress

Vocalizations immediately prior to stunning, such as squeals in pigs, and moos and bellows in cattle and pigs, can be signs of discomfort and stress. To prevent vocalizations the electrodes must be in firm contact with the animal prior to being energized.

Squealing of pigs during electric stunning can be more frequent in plants that have return to sensibility problems. Research conducted in commercial pork slaughter plants where squealing was measured with a sound meter indicated that the intensity of pigs squealing in the stunning chute area is correlated with physiological measures of stress and poorer meat quality determined that the intensity of pig squeals is correlated with discomfort.

Due to natural vocalization behavior, vocalization scoring is not recommended for sheep.

Ensuring Insensibility Following Electric Stunning

Adequate electrical parameters for cardiac arrest stunning cannot be determined by clinical signs, because cardiac arrest masks the clinical signs of a seizure. Measurement of brain function is required to verify any new electrical parameters that may be used in the future. Common causes of a return to sensibility after electric stunning are:

1) Wrong position of the electrode
2) Amperage that is too low
3) Poor bleed out, or
4) Poor electrode contact with the animal

Other factors that may contribute to poor electrical stunning are: dirty electrodes, insufficient wetness, electrode contact area that is too small, animal dehydration, dirty animals and long hair or wool. Interrupted contact during the stun may also be a problem. For all species, processing plants with an excessively long stunning to bleed time are more likely to have return to sensibility problems.

Electrodes must be cleaned frequently to ensure a good electrical connection. The minimum cleaning schedule should be once a day. For personal safety, the electrode wand must be disconnected from the power supply before cleaning.

Electric Cattle Stunning

Unlike pigs and sheep, electrical stunning of cattle may require a two-phase stun. Due to the large size of cattle, a current should first be applied across the head to render the animal insensible before a second current is applied from the head to the body to induce cardiac arrest. Modern systems may have a third current to reduce convulsions . A single 400 volt, 1.5 amp current passed from the neck to the brisket failed to induce epileptic form changes in the brain. Observations in plants outside the U.S. indicate that a single current passed from the middle of the forehead to the body appears to be effective. Research is needed to verify this. To insure that the electrodes remain in firm contact with the bovine's head for the duration of the stun, the animal's head must be restrained in a mechanical apparatus. Due to the high electrical resistance of cattle hair, the electrode should be equipped with a water system to provide continuous wetting during the stun.

The Council of Europe (1991) requires a minimum of 2.5 amps applied across the head to induce immediate epileptiform activity in the electro-encephalogram (EEG) of large cattle. A frequency of 60 or 50 cycles should be used unless higher frequencies are verified in cattle by either electrical or neurotransmitter measurements taken from the brain. A more recent study has shown that 1.15 amps sinusoidal AC 50 Hz applied for one second across a bovine's head is effective to induce insensibility (Wotton et al., 2000). A longer application is usually required to depolarize the spine to reduce kicking (up to 15 seconds).

CO_2 Stunning

According to CFR 9, Section 313.5, CO_2 stunning may be used in swine to induce death or to result in a state of surgical anesthesia. These states are dependent on the relationship between exposure time and CO_2 concentration, and systems will produce pigs in both states.

Handlers must be careful not to overload the gondolas (elevator boxes) that hold groups of pigs. In a properly loaded gondola, the pigs must have sufficient room to stand or lie down without being on top of each other. Handlers must never overload the gondolas by forcing pigs to jump on top of each other.

CO_2 Stunning Parameters

In the scientific literature, there are conflicting results on how pigs react to the induction of CO_2 anesthesia. One researcher found that purebred Yorkshire pigs have a calm induction and that convulsions and excitation occur after the pig becomes unconscious. Some genetic types of pigs actively attempt to escape from the container when they first sniff the gas and others respond with a calm anesthetic induction. Other research has observed that the reaction of pigs to CO_2 was highly variable. A Dutch researcher found that the excitation phase occurred prior to the onset of unconsciousness. Australian researchers found that being shocked with an electric prod was more aversive than inhaling CO_2. Research in people indicates that genetics affect the aversiveness of CO_2 inhalation.

In evaluating gas stunning, one must look at the entire system, which includes the handling system and the gas mixture. One advantage of gas stunning is that these systems can be designed to eliminate the need for pigs to line up in single file chutes, which is contrary to their natural behavior. Regardless of gas type or mixture, the pigs should have little reaction when they first contact the gas and convulsions should not begin until after the pigs collapse.

If conscious pigs squeal, struggle vigorously or attempt to escape when they first contact the gas, this is a serious problem. Genetics may be a contributing factor and may require a different gas mixture or other adjustment. Observations in several plants indicate that elimination of the stress Halothane gene may reduce problems with stressful anesthetic induction. The gas parameters for each plant should be evaluated for ease of anesthesia induction by observing the behavior of the animals. The gas mixture is not acceptable if the pigs attempt to climb out of the container. It is normal to have violent kicking and convulsions after the pig falls over.

How to Determine Insensibility

In both captive bolt and electrically stunned animals, kicking will occur. Ignore the kicking and look at the head. To put it simply, **THE HEAD MUST BE DEAD**. When cattle are shot with a captive bolt, it is normal to have a spasm for 5 to 15 seconds. After the animal is rolled out of the box or hung up, its eyes should relax and be wide open.

When pigs are stunned using CO_2 to induce surgical anesthesia, some animals may have slow limb movement or gasping. This is permissible. However, there must be no spontaneous eye blinking, righting reflex or response to a painful stimulus applied to the nose.

Below are the signs of a properly stunned animal:

- ☐ The legs may kick, but the head and neck must be loose and floppy like a rag. A normal spasm may cause some neck flexing, generally to the side, but the neck should relax and the head should flop within about 20 seconds. Check eye reflexes if flexing continues. Animals stunned with gas stunning equipment should be completely limp and floppy, though animals may exhibit slow limb movement and gasping.

- ☐ The tongue should hang out and be straight and limp. A stiff curled tongue is a sign of possible return to sensibility. If the tongue goes in and out, this may be a sign of partial insensibility.

- ☐ For all methods of stunning, when the animal is hung on the rail, its head should hang straight down and the back must be straight. It must NOT have an arched back righting reflex. When a partially sensible animal is hung on the rail it will attempt to lift up its head. Sometimes the head will flop up momentarily when a back leg kicks. This should not be confused with a righting reflex.

- ☐ When captive bolt is used, the eyes should be wide open with a blank stare. There must be no eye movements. Immediately after electrical stunning, the animal will clamp its eyes shut, but they should relax into a blank stare.

- ☐ When captive bolt is used, the animal must NEVER blink or have an eye reflex in response to touch. In electrically stunned pigs, eye movements can be misinterpreted when untrained people indiscriminately poke at the eyes. It is often best to observe without touching the eye. For all stunning methods if the animal blinks with a natural blink where the eye closes and then re-opens, it is not properly stunned. If you are not sure what a natural blink looks like, look at live animals in the yards (lairage) before assessing insensibility.

- ☐ Rhythmic breathing must be absent. Intermittent gasping is a sign of a dying brain and is acceptable. A twitching nose (like a rabbit) may be a sign of partial sensibility.

- ☐ In captive bolt-stunned animals, insensibility may be questionable if the eyes are rolled back or they are vibrating (nystagmus). Nystagmus is permissible in electrically stunned animals, especially those stunned with frequencies higher than 50 to 60 cycles.

- ☐ Shortly after being hung on the rail, the tail should relax and hang down.

- ☐ No response to a nose pinch. When testing for response to a painful stimulus the pinch or prick must be applied to the nose to avoid confusion with spinal reflexes. Animals entering a scald tub must not make a movement that is in direct response to contact with the hot water. For all types of stunning, this is an indicator of possible return to sensibility.

- ☐ No vocalizations (moo, bellow or squeal).

- ☐ If an electrically stunned animal blinks within 5 seconds after stunning, this is a sign that the amperage is too low. In electrically stunned animals, blinking should be checked within 5 seconds and after 60 seconds. In most plants, blinking will not be found immediately after stunning because the plant is using the correct amperage. After it has been verified that the amperage is set correctly, the most important point to observe for signs of return to sensibility is 60 seconds after electrical stunning. This provides time for the eyes to relax after the epileptic seizure. Checking for signs of return to sensibility after bleeding ensures that the animal will not recover.

Order of the events indicating Return to Sensibility in head only electrically stunned pigs (In CO_2 stunned pigs, the order of the first two events is reversed):

1. Corneal reflexes in response to touch (not recommended for electric stunning).
2. Return of rhythmic breathing.

3. Spontaneous natural blinking without touching.
4. Response to a painful stimulus such as pricking the nose with a pin.
5. Righting reflex and raising the head.
6. Fully conscious and sensible. Complete return to sensibility can occur within 15 to 20 seconds after eye reflexes appear if an electrically stunned animal is not bled.

Stunning to Bleed Interval

Captive Bolt — Both penetrating and non-penetrating captive bolts are effective. However, non-penetrating bolts will cause less damage to the brain (Finnie et al., 2000). Practical experience has shown that for non-penetrating captive bolts to be effective the aim must be more precise. Animals stunned with a non-penetrating captive bolt should be bled within 60 seconds.
Electric Cardiac Arrest — Sixty seconds maximum. All large plants are already using less than this interval.
Head Only Reversible Electric — Fifteen seconds is strongly recommended (Blackmore and Newhook, 1981), 30 seconds maximum (Hoenderken, 1983). Scientific research clearly shows that pigs will start returning to sensibility after 30 seconds when stunned by the head only method. When frequencies of greater than 50 to 60 hz are used, these times may need to be shortened. When head only electric stunning is used for cattle or sheep the animal should be bled within 10 seconds.

Preventing Bloodsplash (Bloodspots)

Gentle handling prevents damage to small blood vessels caused by excited animals jamming against each other or equipment.

- ✓ Electric prod usage should be kept at a minimum.
- ✓ Animals should never be left in the restrainer system during breaks and lunch.
- ✓ Be sure that one side of a V restrainer does not run faster than the other. This causes stretching of the skin that damages blood vessels.
- ✓ Minimize time to bleeding after stunning to minimize meat damage.
- ✓ The slats on the V restrainer and hold-down rack and chutes should be insulated to prevent current leakage, which can cause bloodsplash.
- ✓ Rapid temperature fluctuations and periods of extremely hot weather can greatly increase the incidence of bloodsplash. In these circumstances, plants should take extra care in handling animals to minimize bloodsplash problems.

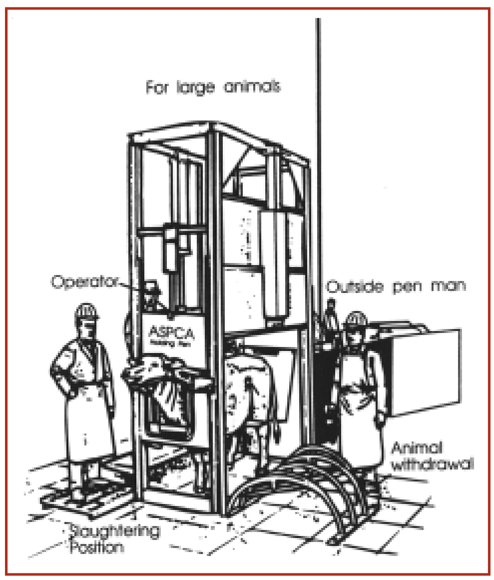
Section 7: Religious Slaughter (Kosher and Halal)

Cattle, calves, sheep or other animals that are ritually slaughtered without prior stunning should be restrained in a comfortable upright position. For both humane and safety reasons, plants should install modern upright restraining equipment whenever possible. Shackling and hoisting, shackling and dragging, trip floor boxes and leg clamping boxes should never be used. In a very limited number of glatt Kosher plants in the United States and more commonly in South America and Europe, restrainers that position animals on their backs are used. For information about these systems and evaluating animal welfare, refer to www.grandin.com (Ritual Slaughter Section).

The throat cut should be made immediately after the head is restrained (within 10 seconds). Small animals such as sheep and goats can be held manually by a person during ritual slaughter. Plants that conduct ritual slaughter should use the same scoring procedures except for stunning scoring, which should be omitted in plants that conduct ritual slaughter without stunning.

Cattle vocalization percentages should be five percent or less of the cattle in the crowd pen, lead up chute and restraint device. A slightly higher vocalization percentage is acceptable because the animal must be held longer in the restraint device compared to conventional slaughter. A five percent or less vocalization score can be reasonably achieved. Scoring criteria for electric prod use and slipping on the floor should be the same as for conventional slaughter.
Animals must be completely insensible before any other slaughter procedure is performed (shackling, hoisting, cutting, etc.) If the animal does not become insensible, it should be stunned with a captive bolt gun or other apparatus and designated as non-Kosher or non-Halal).

ASPCA Pen — This device consists of a narrow stall with an opening in the front for the animal's head. After the animal enters the box, it is nudged forward with a pusher gate and a belly lift comes up under the brisket. The head is restrained by a chin lift that holds it still for the throat cut. Vertical travel of the belly lift should be restricted to 28 inches (71.1 cm) so that it does not lift the animal off the floor. The rear pusher gate should be equipped with either a separate pressure regulator or special pilot-operated check valves to allow the operator to control the amount of pressure exerted on the animal. Pilot operated check valves enable the operator to stop the air cylinders that control the apparatus at mid stroke positions. The pen should be operated from the rear toward the front.



ASPCA Pen.

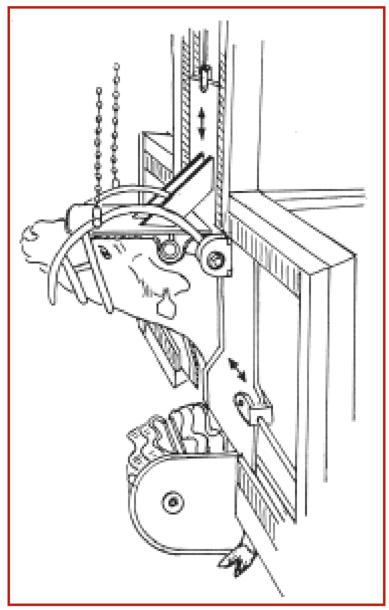
Head restraint is the last step. The operator should avoid sudden jerking of the controls. Many cattle will stand still if the box is slowly closed up around them and less pressure

will be required to hold them. Ritual slaughter should be performed immediately after the head is restrained **(within 10 seconds of restraint).**

An ASPCA pen can be easily installed in one weekend with minimum disruption of plant operations. It has a maximum capacity of 100 cattle per hour and it works best at 75 head per hour **or less**. A small version of this pen could be easily built for calf plants.

Conveyor Restrainer Systems — Either V restrainer or center track restrainer systems can be used for holding cattle, sheep or calves in an upright position during shehita or Halal slaughter. The restrainer is stopped for each animal and a head holder positions the head for the ritual slaughter official.
For cattle, a head holder similar to the front of the ASPCA pen can be used on the center track conveyor restrainer. A bi-parting chin lift is attached to two horizontal sliding doors.

Small Restrainer Systems — For small locker plants that ritually slaughter a few calves or sheep per week, an inexpensive rack constructed from pipe can be used to hold the animal in a manner similar to the center track restrainer. Animals must be allowed to bleed out and become completely insensible before any other slaughter procedure is performed (shackling, hoisting, cutting, etc.).



Center track restrainer being used for ritual slaughter.

Section 8: Recommended Handling of Disabled or Crippled Livestock

Aggressive handling can lead to injured, stressed or fatigued livestock. Although non-ambulatory animals (sometimes called "downers, slows or subjects") represent a small fraction of all livestock arriving at packing plants, they are significant because they require special attention in the areas of handling, transporting, holding pens and inspection. Trucks carrying non-ambulatory livestock should park as close to the slaughter area as possible and disabled animals should be inspected by a USDA veterinarian, stunned and either condemned or moved to slaughter quickly.

Since December 30, 2003, all non-ambulatory cattle arriving at packing plants are to be condemned. Non-ambulatory pigs may be slaughtered if inspected and passed by a USDA veterinarian.

Non-Ambulatory Cattle

A well-designed cart for moving crippled livestock.

Many incidents of non-ambulatory cattle can be prevented by better management at the dairy or ranch. If non-ambulatory cattle arrive on trucks, offload ambulatory cattle first, taking care not to compromise the non-ambulatory animals. Non-ambulatory cattle should be stunned with a captive bolt stunner on the truck and disposed of.
If a steer or cow becomes non-ambulatory after it has passed ante mortem inspection, the USDA veterinarian will make a decision about whether the animal must be condemned, or whether it may proceed to slaughter.
If a steer or cow – or any animal — becomes non-ambulatory in the single file chute that leads to the stunner, it must be stunned prior to dragging. A cartridge-fired captive bolt on a long handle is recommended. If blood gets on the chute, wash it off to prevent balking.

Mounting activity and animal fights can cause injuries that can cause animals to become non-ambulatory. This is a problem especially with bulls and boars. Bulls that are mounting other animals should be placed in separate pens. Mounting by bulls is a common cause of bruises and crippling injuries on cows. Producers need to work to reduce the occurrence of non-ambulatory animals that are caused by either poor management or neglect.

Non-Ambulatory Pigs

There are two basic types of non-ambulatory pigs. The first type is those that are in a poor physical state before leaving the farm, often older breeding stock. Another type is a fatigued pig that becomes non-ambulatory. According to the National Pork Board, a fatigued pig is defined as having temporarily lost the ability to walk but has a reasonable expectation to recover full locomotion with rest. These animals are often called "NANIs" or "non-ambulatory, non-injured". Many of these animals can recover and walk independently if given time to rest.

Trucks carrying disabled pigs should unload ambulatory animals first taking care not to compromise the non-ambulatory ones. Ambulatory pigs must not be driven over non-ambulatory pigs. Then, promptly unload the animals unable to walk. Delayed unloading can cause death losses and downer animals due to extreme temperatures, exposure and stress.

To offload a non-ambulatory pig from a truck, plants should use the truck exit nearest to the animal and should place as little stress as possible on the animal. Live pigs must never be dropped to the ground from a truck. In some cases, a slide board or cripple cart may be helpful. Animals may be rolled onto a wide piece of

conveyor belting that has been stiffened on one end with metal bars to prevent curling when the belting with the animal on it is dragged. The board can then be dragged off the truck and the animal loaded into a suitable mechanical device for transport to an inspection area.
Federal humane slaughter regulations prohibit dragging of downed or crippled livestock in the stockyards, crowd pen or stunning chute. (If the animal is stunned, it may be dragged). By using slideboards, sleds and cripple carts, animals can be transported humanely and efficiently to a pen or other area where they can be examined by an inspector, stunned and moved to slaughter. In order to prevent further injury to non-ambulatory animals by equipment or other animals, minimal movement may be required to roll the animal or slide it onto carts and other devices. The stress of this movement must be weighed against the potential harm to the animal if it is not moved promptly. In pig plants, the stunning chute should be equipped with side doors so that non-ambulatory pigs can be easily removed.

Inspection and Slaughtering Considerations

USDA rules require that any "suspect" animal – an animal with signs of abnormalities or diseases – must be held separately and examined by a USDA FSIS veterinarian. At pig plants, non-ambulatory animals must be held apart from other animals in a "suspect" pen for USDA inspection. "Suspect" pigs may be slaughtered separately so inspectors can conduct additional examinations.

Disabled or suspect animals should be segregated upon arrival for USDA inspection. Once the USDA inspector has examined the animal, plants should identify the earliest possible point in the production when that animal may be slaughtered "separately." This separation point should be discussed with the USDA inspector. It should be noted that plants need not always wait until the end of a shift to slaughter a "suspect" animal. Waiting can prolong a disabled animal's suffering. Plants and inspectors should cooperate to ensure non-ambulatory pigs are slaughtered as soon as possible after arrival.

At cattle plants, non-ambulatory cattle arriving on trucks should be stunned on the truck and removed from the truck for disposal. Some cattle may be deemed suspect and yet still be ambulatory. These cattle should be moved to separate pens for examination by USDA inspectors.

Chapter 2: Auditing Animal Handling and Stunning

"You manage what you measure." That is certainly true when it comes to assuring optimal animal welfare. A number of objective criteria can be used to measure animal welfare in packing plants. By measuring welfare indicators regularly, problems can be detected and continuous improvement achieved.

This chapter details what criteria to use in evaluating livestock welfare in packing plants. The AMI Foundation recommends conducting audits at least weekly and varying those audit days and times during shifts to assess the role that employee experience, behavior and fatigue may play in animal handling and stunning.

AMIF is committed to an audit program that is simple to conduct. Audits that are easy to understand and execute are more likely to be conducted with greater frequency and fewer errors. Each of AMIF's objective criteria is designed to measure a multitude of potential issues. For example, counting slips and falls can assess whether a ramp is too steep, whether animals are being driven too aggressively and whether a floor may be too slippery and need re-grooving. Measuring vocalization levels will indicate if prods are being overused, if restrainers are too small for livestock, and a host of other issues. Each of these individual items need not be evaluated on audits if the core criteria scores are within the target range, but notes may be taken to indicate which factors may have contributed to the score.

If a score falls below the acceptable range specified in these guidelines, plant management should take steps to correct the problem. The results of the 1996 Survey of Stunning and Handling in Federally Inspected Beef, Pork, Veal and Sheep Slaughter Plants (sponsored by USDA's Animal and Plant Health Inspection Service) indicated that the recommended minimum acceptable levels specified in this guide are reasonably achievable. Additional data collected during audits of beef and pork plants have further verified that the minimum standards are attainable.

Objective scoring of percentages should be done in the following areas that are the core criteria for good animal welfare (Grandin, 1998).

1. Percentage of cases in which stunner was misapplied to pigs, cattle, and sheep
2. Percentage of cattle stunned more than once with the captive bolt stunner.
3. Percentage of sensible and partially sensible animals on the bleed rail.
4. Percentage of animals falling down or slipping.
5. Percentage of cattle vocalizing in the stunning chute area, which includes the stunning box, restrainer, lead-up chute, and crowd pen.
6. Percentage of pigs vocalizing in the stunning pen or restrainer conveyor.
7. Percentage of animals prodded with an electric prod.
8. Non-ambulatory animal procedures.

Poor performance on any of these core criteria could result in reduced animal welfare. These guidelines also contain criteria and recommendations for stunning equipment, which will enable a plant to maintain acceptable welfare scores. Other areas of animal welfare concern that will be covered are ritual slaughter and the handling of non-ambulatory animals.

Chapter Three includes the AMI Foundation Pig and Cattle Slaughter Audit forms that can be used as part of a corporate animal welfare program.

Core Criteria 1: Effective Stunning

Core Criteria 1: Effective Captive Bolt Stunning of Cattle

When evaluating the effectiveness of captive bolt stunning, the auditor monitors whether or not an animal is rendered insensible with a single shot.
Score a minimum of 100 animals in large plants and 50 in small plants. In very small plants score one hour of production. For a more accurate assessment in small plants, data collected over a period of time should be averaged.

- Excellent – 99 to 100% instantly rendered insensible with one shot
- Acceptable – 95 to 98% instantly rendered insensible with one shot
- Not Acceptable – 90 to 94% instantly rendered insensible with one shot
- Serious Problem less than – 90% instantly rendered insensible with one shot

If one-shot efficacy falls below 95%, immediate action must be taken to improve the percentage.

Core Criteria 1: Effective Electrical Stunning of Pigs and Sheep

When evaluating effective electrical stunning, the auditor monitors the correct placement of stunning wands and tongs.

If head only stunning is used, the tongs must be placed so that the current passes through the brain. Tongs may be placed on both sides of the head or one tong on the top and the other on the bottom of the head. Another scientifically verified location for head only stunning is one electrode placed under the jaw and the other placed on the side of the neck, right behind the ears.

For cardiac arrest stunning of pigs and sheep with a single stunning current, one electrode must be placed on the body and the other one must be placed on the forehead, side of the head, top of the head, or in the hollow behind the ear. The head electrode must never be placed on the neck because this would cause the current to bypass the brain. Electrodes must not be applied to sensitive areas such as inside the ear or in the eye or rectum. Electrodes must be placed firmly against the animal because breaking electrical contact during the stun may reduce the effectiveness of the stun. In addition, it is essential that electrodes be fully energized only after they are in full and firm contact with animals. If electrodes are energized and then applied, animals will squeal. This is called "hot wanding." No more than one percent of animals should vocalize due to hot wanding. Hot wanding should not be measured for sheep.

Score a minimum of 100 pigs or sheep in large plants and 50 in small plants. In very small plants score 1 hour of production. Use the whole numbers for 100 and 50 animal audits. For data collection on large numbers of animals, the fractional percentages can also be used.

- Excellent – 99.5 to 100% correct placement of stunning wand or tongs and no vocalization due to energizing the electrode before it is firmly positioned.
- Acceptable – 99.4 to 99% correct placement and 1% or less of the animals vocalize in response to electrode placement.
- Not Acceptable – 98 to 96% correct placement and 2 to 3% of the animals vocalize due to energizing the electrodes before they are firmly positioned.
- Serious Problem – Less than 96% correct placement or more than 4% vocalization in response to electrode placement.

Core Criteria 1: CO_2 Stunning of Pigs

The efficacy of CO_2 and other types of gas stunning methods is determined when insensibility is scored. The core criterion is that the animal remains insensible after exiting the chamber. However, the gas system must also be evaluated for animal handling. The gondolas, elevator boxes or other apparatus used for moving the animals in and out of the gas must not be overloaded.

Score 50 gondolas in large plants to determine the percentage of gondolas (elevator boxes) that are overloaded. In small plants score 25 gondolas. A gondola or elevator is to be scored as overloaded if there is not sufficient space for the animals to stand or lie down without being on top of each other. Score on a per gondola basis:

- Excellent – No gondolas are overloaded on a 50 animal audit
- Acceptable – 4% of gondolas are overloaded
- Not Acceptable – More than 4% are overloaded
- Serious Problem – The person moving the animals forces more than one pig to jump on top of the other pigs in the gondolas with an electric prod or by hitting, shoving or kicking.

For gas systems where the animals ride head to tail on a continuous conveyor that does not have separate animal compartments, do not use this scoring system. Omit this score and score the percentage of animals prodded with an electric prod. Electric prod scoring is discussed in another section of these guidelines.

Stunning to Bleed Interval

This parameter does not have to be measured for welfare reasons unless non-penetrating captive bolt is used. To avoid return to sensibility, animals stunned with a non-penetrating captive bolt should be bled promptly, but no longer than 60 seconds after stunning.

Core Criteria 2: Bleed Rail Insensibility

Properly stunned animals should not display signs of sensibility on the bleed rail. Auditors should monitor a minimum of 100 animals in large plants and looking for signs of partial sensibility, like eye reflexes, nose twitches or the righting reflex. When a 100 animal audit is performed, 100% must be rendered insensible. There is a zero tolerance for beginning any slaughter procedure such as skinning the head, leg removal or scalding on an animal that shows any sign of return to sensibility. It must be immediately restunned.

The signs of returning to sensibility are: 1) rhythmic breathing, 2) vocalizations while hanging on the bleed rail, 3) eye reflexes in response to touch, 4) eye blinking, 5) arched back righting reflex with the head bent straight back. Animals will sometimes have a sideways neck flexion that relaxed in a few seconds. This must not be confused with a righting reflex.

Animals should hang straight on the rail and have a floppy head. A head that flops upward for a brief moment when the legs kick should not be confused with a righting reflex. Limb movements should be ignored. If the tongue is hanging straight out and is limp and soft, the animal is definitely insensible. Gasping is a sign of a dying brain and should be ignored. However, twitching noses, or the tongue moving in and out are signs of a possible return to sensibility.

Touching the eye and observing the corneal reflex is a good method for determining insensibility in animals stunned with captive bolt. Touching an electrically stunned pig's eye may cause it to pop open suddenly which may be misinterpreted as a blink. The person scoring insensibility should look for spontaneous natural blinks. A pig that blinks spontaneously would be scored as sensible. Nystagmus, or vibrating eyelids, is a sign of a poor stun in captive bolt stunned animals. However, in electrically stunned animals, it is permissible to have some animals with vibrating lids or eyes.

While no sensible animal should be observed on the bleed rail during a 100-head audit, on rare occasions, it is possible that a sensible animal will be observed. Use these figures when evaluating plant performance over time by averaging the scores of many audits.

Core Criteria 2: Cattle Insensibility

Excellent – 1 per 1,000 or less
Acceptable — 1 per 500 or less

Core Criteria 2: Pig and Sheep Insensibility

Excellent – 1 per 2,000 or less
Acceptable – 1 per 1,000 or less

Core Criteria 3: Slipping and Falling

Good animal welfare and quiet calm handling is impossible if animals slip or fall on the floor. All areas where animals walk should have non-slip footing. Animals should be observed during all phases of handling and if slipping or falling is observed, steps should be taken to correct the problem. Because survey results indicate that the greatest slipping and falling problems were in the stunning chute area, scoring should be done in this area.

Scoring of Slipping and Falling in the Stunning Chute Area (All Species) — Score a minimum of 50 animals in large plants. In most plants that have non-slip flooring, falling seldom occurs. In fact, problems with slipping or falling are usually either a big problem or almost no problem. Formal scoring should be done if slipping or falling is observed.

Score in the restrainer entrance, stunning box, lead up chute and crowd pen. Observation without formal scoring should be made in the stockyard pens, scales and unloading ramps.

- Excellent – No slipping or falling
- Acceptable – Fewer than 3 percent slipping; fewer than 1 percent falling (body touches floor)
- Not Acceptable – More than 3 percent slipping; more than 1 percent falling down
- Serious Problem – 5 percent falling down or 15% or more slipping

Core Criteria 4: Vocalization

Core Criteria 4: Cattle Vocalization Scoring in the Crowd Pen, Lead-up Chute, Stunning Box or Restraint Device

Vocalization is an indicator of cattle discomfort during handling, restraint and stunning.

(Score a minimum of 100 animals in large plants and 50 in smaller plants. For data collection on large numbers of animals, the fractional percentages can be used.)

- Excellent – 1 percent or less of the cattle vocalize
- Acceptable – 3 percent or less of the cattle vocalize
- Not Acceptable – between 3 and 10 percent vocalize
- Serious Problem – More than 10 percent vocalize

In Kosher/religious slaughter plants where head holders/restrainers are used, five percent vocalization is acceptable.

When vocalization is being evaluated, cattle from more than one feedlot or ranch should be observed. There are variations in the tendency of some cattle to vocalize. To make the scoring simpler, each animal should be classified as either a vocalizer or a non-vocalizer.
Cattle vocalizations should be tabulated during handling in the crowd pen, lead up chute, restrainer or stunning box while the animals are being actively handled. Vocalizations occurring in the yards should not be tabulated because cattle standing quietly in the yards will often vocalize to each other.

Cattle should be stunned immediately after they enter a stun box or restrainer. Isolated animals will often vocalize. The author has observed that vocalization scoring is very efficient for identifying plants with cattle handling or equipment problems. Vocalization scoring works well in packing plants because cattle are stunned quickly after they are restrained.

Core Criteria 4: Vocalization Scoring of Pigs

Because it is impossible to count individual pig squeals when a group of pigs is being handled, vocalization scoring of individual pigs can only be conducted in the restrainer. A group of pigs that excessively vocalizes should be assessed to identify the cause.

Another simple method for monitoring continuous improvement within a plant is estimating the percentage of time that the entire stunning room is quiet. As each pig is stunned the person doing the scoring checks off whether or not the room was quiet. The score is the percentage of stunning cycles where the room was quiet. When CO_2 stunning is evaluated, a stunning cycle consists of the time to fill a gondola. Because vocalization scores can vary by auditor, number of pigs and by room acoustics, vocalization scores are difficult to compare across plants.

However, one can conclude that a plant that has continuous constant squealing may have pig welfare problems. This method is excellent for internal plant monitoring over time.

Criteria for Vocalization of Pigs in Conveyor Restrainers

Do not score vocalizations that can be attributed to a mis-applied stunner. Score a minimum of 100 pigs in large plants and 50 pigs in smaller plants.

- Excellent – 2 percent or less of the pigs vocalize
- Acceptable – 5 percent or less of the pigs vocalize due to the restrainer; none due to a misapplied stunner
- Not Acceptable – 6 percent or more vocalize in the restrainer
- Serious Problem – 10% or more vocalize in the restrainer

When 50 or less pigs are scored, a single squealing pig is acceptable. When more data is collected and averaged used the 5% level for an acceptable rating.

Criteria for Room Vocalization

(Should be used in internal audits only and not compared across plants)

Score a minimum of 100 pigs in large plants and 50 pigs in smaller plants.

- Acceptable – 50% or less of the pigs in the room vocalize

Vocalization Scoring of Sheep

Observations at a sheep slaughter plant indicated that vocalization during handling is not an effective measure of handling problems in sheep. Sheep walking quietly up the stunning chute often vocalized to each other. Sheep which balked and had to be pushed by a person never vocalized. This is a species difference between cattle and sheep and neither the presence nor absence of vocalization should be used as a measure.

Core Criteria 5: Electric Prod Use

Reducing the use of electric prods will improve animal welfare. Shocking pigs with electric prods significantly raises heart rate, open mouth breathing and many other physiological measures. Many of the same effects can be observed in cattle.

Revisions to this standard are based on data collected from 26 plants that were audited by McDonald's during 1999 and 2000 (www.grandin.com). In 2000, 68 percent of the plants used no electric prods in the crowd pen and 62 percent used an electric prod on fifteen percent or less of the pigs at the restrainer entrance.

Core Criteria 5: Electric Prod Scoring Criteria for Cattle

Percentages of Animals Prodded	
Excellent	5 percent or less
Acceptable	25 percent or less
Not Acceptable	26 to 49 percent
Serious Problem	50 percent or more

Core Criteria 5: Electric Prod Scoring Criteria for Pigs

Percentages of Animals Prodded	
Excellent	10 percent or less
Acceptable	25 percent or less
Not Acceptable	26 percent to 79 percent
Serious Problem	80 percent or more

Core Criteria 5: CO_2/Group Stunning System for Pigs - No Single File Chute

Excellent/Acceptable 0 percent

Core Criteria 5: Electric Prod Scoring of Sheep

Electric prods should only rarely be used on sheep. The only place they should be used is at the restrainer entrance on large sheep that refuse to enter.

Core Criteria 6: Willful Acts of Abuse

Any willful act of abuse is automatic grounds for an audit failure.

In all species, these offenses include dragging a conscious, non-ambulatory animal, intentionally applying prods to sensitive parts of the animal like the eyes, ears, nose or rectum; deliberate slamming of gates on livestock; driving livestock on top of one another or hitting or beating an animal. In sheep operations, lifting an animal by the wool or throwing a sheep also is an act of abuse.

Core Criteria 7: Access to Water

All livestock should have access to clean water in holding pens in plants.

Scoring of Very Small Plants

Small beef plants that process 25 or fewer beef cattle per hour may need adjustments in scoring due to small sample size and differences in cattle behavior. Ideally 50 or more cattle should be scored, but this is often not practical in a plant that processes 5 to 10 cattle per hour. For a plant's own internal audit, data should be pooled and averaged. Pooled small data sets can be scored per the American Meat Institute Foundation's guidelines. When an outside auditor audits a small plant, sometimes only 10 to 20 cattle are observed. If one stun were missed the plant would not achieve the 95% acceptable score. If passing or failing the stunning audit is based on a single small data set, one miss should be permitted. However on pooled data the 95% first shot efficacy score must be maintained. On small data sets of 10 to 20 cattle, all cattle (100%) must be rendered insensible prior to hoisting to pass the audit.

In very small beef plants with line speeds of less than 25 cattle per hour, the animals may stand for long periods in the single file chute (race) and "talk" to each other. Their "talking" vocalizations are not scored. "Talking" vocalizations in the handling system occur more often at slow line speeds. An animal should be scored as a vocalizer if the vocalization is associated with:

1. Poking with an electric prod.
2. Slipping or falling.
3. Vocalizing in the stun box.
4. Poking by sharp edges on equipment.
5. Hitting with gate.
6. Excessive pressure from a restraint device.
7. Missed stuns.
8. Physical abuse by a person.
9. Signs of agitation such as rearing, jumping, repeated backing up in the single file race or frantic attempts to escape.
10. Isolation of a single animal away from other cattle.

Conclusion

An acceptable level of animal welfare can be maintained if scores for the core criteria for stunning, animal insensibility, slipping and falling, vocalization and electric prod use are in the acceptable range. Scoring performance on these variables is simple and easy to do under commercial plant conditions.

In conclusion, managers must be committed to good animal welfare. Plants that have managers who insist on good handling and stunning practices tend to have better results. Positive and negative feedback also is very important. You manage the things that you measure, which is why auditing is important. To maintain good handling and stunning practices requires continuous measurement, monitoring and management.

Chapter Three: Official AMI Foundation Audit Forms

Official AMI Foundation Audit Forms are included in the following section and are indicated with the AMI Foundation logo. These forms are dated. Updates to these forms may be made based upon new information and user feedback. Any updated forms will be posted on www.animalhandling.org

Chapter Four: Troubleshooting Guides

Finding Distractions That Hinder Easy Movement

Problem: Animal refuses to move through an alley, chute or race.

Possible Causes:

If animals refuse to move through an alley, chute or race, there may be a very simple solution. Once the area is clear, step into the race to see what distractions may be hindering movement. Any one of these items on the following list may cause animals to stop moving or back up and prevent a properly designed facility from working efficiently. In some facilities, two or three different distractions must be removed before animals will move easily. Often, identifying the problem requires trial and error.

Look for:

- ✓ Sparkling reflections on puddles that can be eliminated by moving a ceiling lamp
- ✓ Reflections on smooth metal that can be minimized through lighting changes.
- ✓ Chains that jiggle and can be fastened.
- ✓ Metal clanging or banging that can be secured. Rubber stops can be used on gates, for example, to prevent clanging.
- ✓ High pitched noises and other loud or reverberating noises that can be silenced
- ✓ Air hissing, which can be silenced with mufflers or piped outside
- ✓ Air drafts blowing toward approaching animals, which can be redirected away from them.
- ✓ Clothing hung on the fence that can be removed.
- ✓ Moving piece of plastic that can be secured or removed.
- ✓ Fan blade movement. Install a shield to block the animals' view.
- ✓ Seeing people moving up ahead. Install a shield so approaching animals cannot see them.

- ✓ Small object on the floor such as a coffee cup, hose or paper.
- ✓ Changes in flooring and texture, which can be made uniform.
- ✓ Drain grate on the floor, which can be moved to another location outside races.
- ✓ Sudden changes in the color of equipment or flooring. Colors with high contrast like yellow are the worst. Use of single colors on floors and walls can facilitate movement.
- ✓ Race entrance is too dark. Animals prefer to move from a darker place to a brighter place.
- ✓ Bright light such as blinding sun. Animals will move from a darker place to a brighter place, but they will not move toward blinding light. Examples of blinding light are looking into the sun or a bare light bulb.
- ✓ One-way and back-up gates. Install them two to three body lengths away from the crowd pen. Equip the one-way gate near the crowd pen with a remote controlled rope so that they can be held open when the single file race is filled. Many facilities have too many backup gates. Try tying them open.

Resolving Problems in Center Track Conveyor Restrainer Systems and V Belt Restrainer Systems for Cattle, Pigs, and Sheep

Problem: Animal stops at entrance and refuses to enter.

Possible Causes:

1. Hold-down rack is too low and the animal bumps its shoulder as it enters. Raise hold-down so that there is approximately 4 in. (10 cm) of clearance for the tallest animal. The hold down should be solid to block vision.

2. Entrance is too dark – install a light that illuminates the entrance. The light must not shine in an approaching animal's eyes.

3. Slick Floor – Animals panic when they slip. Weld rods to floor to provide a non-slip floor. The entrance ramp into the restrainer must be non-slip.

4. Entrance ramp missing – Reinstall entrance ramp. See diagrams on *www.grandin.com.* Forcing an animal to jump into a restrainer frightens it.

5. Leg spreader is too wide and it bumps the inside of the animals' legs. This problem only occurs in center track restrainers. See diagrams on *www.grandin.com.*

6. No False Floor - on all types of restrainers, animals will be afraid to enter if they see a steep drop off (visual cliff) below the restrainer. Install a solid false floor approximately six inches (15 cm) below the feet of the largest animal. See diagrams on *www.grandin.com.*

7. No belly rails – on center track restrainers belly rails keep the animal centered over the leg spreader bar. See diagrams on *www.grandin.com.*

8. Distractions in plant – install a curtain at the exit end of the restrainer. Look through the Restrainer and see if you can see distractions such as moving conveyor, a yellow apron or sparkling reflections on a moving piece of equipment.

9. Broken sharp edges in entrance – repair or replace entrance parts.

If an animal is walking into the restrainer by itself, do not poke it with an electric prod. Center track systems require less prodding to induce cattle to enter it. Workers need to break the "automatic prod reflex" habit.

Resolving Problems in Center Track Conveyor Restrainer Systems and V Belt Restrainer Systems for Cattle, Pigs and Sheep

Problem: Animals struggle in the restrainer

Causes:

1. V conveyor sides run at different speeds **-** Both sides must run at the same speed.

2. Hold down too short – on all types of restrainers, the animal must be completely restrained and riding on the conveyor with its feet off the entrance ramp **BEFORE** its head emerges from under the hold down. The principle is blocking vision until the animal is fully restrained.

3. Broken slats and other parts – sharp edges that stick into animals will cause struggling. On the center track restrainer, the metal guides along the conveyor must not be bent. Replace broken or bent slats. Slats must line up and provide a smooth continuous surface.

4. Hold-down too high – This is most likely to be a problem when small animals are handled. Install a rubber curtain made from conveyor belting on the discharge end of the hold down rack to block the vision of smaller animals.

5. Adjustable sides not centered **-** Struggling is more likely to occur if the adjustable sides of the center track conveyor push the animal to one side and make it feel off balance. Adjustable sides should be at the same setting on both sides.

Resolving Electrical Stunning Problems

Problem: Animal blinks within 5 seconds after stunning

Possible Causes:

1. Electrode is placed in the wrong position and the electrical current fails to go through the brain. The animal blinks because the stunner failed to induce a grand mal epileptic seizure that is required to induce instant insensibility.

2. The electrical amperage may be too low. Even though the electrode is in the correct position, there is not enough current passing through the brain to induce a grand mal epileptic seizure. The amper age and/or voltage should be checked and may need to be increased.

3. High electric resistance of the animal. This is especially a problem in old sows or dehydrated animals.

4. Electrode contact area is too small or the electrodes are dirty. Increase surface area of electrode or clean them.

5. The animal is too dry, which results in high electrical resistance. This is most likely to be a problem in cattle or sheep and continuous wetting during the stun may be required in these two species.

Problem: The initial stun appears to be done correctly but the animal blinks or shows other signs of return to sensibility 30 to 90 seconds after stunning.

Possible Causes:

1. The stunning-to-bleed interval is too long. This is especially a problem with head only reversible stunning. The solution is to shorten the interval between stunning and bleeding.

2. Poor bleeding if an animal shows a sign of return to sensibility after it has been bled. This can occur in cardiac arrested animals because there are always a few animals in which the heart is not stopped. Training of the person doing the bleeding will usually solve this problem.

3. Poor initial contact results in the animal receiving a stunning time that is too short. A common cause is a fatigued operator.

4. Interrupted contact – The stunning wand or tongs may bounce or slide during the stun and result in a stunning time that is too short. Poor design of the stunning wand is a likely cause. An other cause can be an overloaded stunner operator who is stunning more animals than he can easily handle.

5. Placement of the head electrodes in the wrong position on the head. Reposition the electrodes so that the electrical current will pass through the brain.

Resolving Captive Bolt Stunning Problems

Possible Reasons for Poor Stunning

1. Stunner has not been maintained. A dirty stunner will lose bolt velocity. High bolt velocity is required for an effective stun.

2. Damp cartridges for a cartridge fired stunner. Cartridges must be kept in a dry place. Do not store them in the slaughter room.

3. An overheated cartridge fired stunner will lose bolt velocity. Rotate cartridge fired stunners to prevent overheating.

4. Worn cylinder bore on a pneumatic stunner. Even when the stunner has been serviced correctly, the machined cylinder bore eventually wears out and the stunner will lose hitting power. At this point the stunner will have to be replaced. A clean air supply will help prevent cylinder wear.

5. Poor ergonomics of bulky pneumatic stunners. Adding additional handles will aid positioning. When a pneumatic stunner is used with a conveyor restrainer, it is often easier to position the stunner if it is hung from the balancer on a 30-degree angle.

6. Stunner operator chases the animal's head. The operator should be trained to wait for the animal to stop moving and then position the stunner. Chasing the head will result in poor stunning.

7. Excited animals. Careful quiet handling and driving of animals into the stun box or restrainer will provide calm animals that are easier to stun correctly.

8. Air pressure too low to power a pneumatic stunner. Use the air pressure setting recommended by the manufacturer. This usually requires a dedicated compressor, which powers only the stunner.

9. Slick floor in stunning box causes cattle to become agitated.

10. Poor placement. Stunner is not placing the captive bolt square against the center of the head or not placing the bolt in the "X" between the base of the horn (poll) and the eye.

Resolving CO_2 Stunning Problems

Problem: Stunning Ineffective, animals not completely insensible

Possible Causes:

1. Low CO_2 concentration. Increase the gas concentration.

2. Exposure time is too short. Slow down the number of pigs which are moved through the system.

3. The time between the exit from the CO_2 chamber and bleeding is too long. To prevent recovery from the anesthesia, bleed the animals more quickly.

4. Poor bleeding technique. If animals show signs of return to sensibility after bleeding, the person doing the bleeding may need more training.

Chapter 5: Worker Safety Tips for Animal Handlers and Stunners

Working with livestock in a plant setting can be challenging and unpredictable. It is essential that safety be a priority when handling and stunning animals. Below are a series of safety tips that can help protect employees.

Livestock Facility and Trucking

1. Battery operated prods are recommended. If prods are wired into the house current, they must always be wired through a transformer. A light bulb wired in series is dangerous to both people and livestock.

2. Man gates and other devices must be installed so people can easily escape from agitated cattle. This is especially important for areas with solid fences. In concrete fences, toeholds can be formed in the walls.

3. Be alert around the unloading dock. A truck driver backing in may not be able to see you.

4. Handle cattle quietly. Excited animals are more likely to cause accidents.

Electric Stunning of Sheep and Pigs

1. The stunner operator's station must be kept dry.

2. Stunning wands should be designed so that they can be operated with one hand. Avoid designs where the two electrodes are held separately in each hand. These can increase the hazard of an electrocution shock across the chest.

3. The operator should wear rubber boots and stand on non-conductive plastic grating. Hand stunning should be done with the operator standing on cement.

4. The restrainer frame and worker walkway structure should be grounded to a perfect ground. However, the side of the restrainer that the stunner operator can touch should be covered with heavy insulating materials such as a plastic meat cutting board.

Captive Bolt Stunning

1. Cartridge-fired stunners must ALWAYS be uncocked before they are set down.

2. NEVER, EVER throw a cartridge-fired stunner to another person.

3. Inspect latches on stunning boxes to make sure they latch securely. Before the next animal is admitted to the box, check the latch.

4. All guards must be kept in place over exposed pinch points that could be easily touched by employees during normal operation of the restrainer system equipment.

5. If a worker has to get inside a restrainer conveyor system to unjam it, lock it out first to prevent somebody else from turning it on.

6. Cartridge-fired stunners must always be kept unloaded when they are carried away from the stunning area.

7. Good maintenance is essential with pneumatic stunners to prevent excessive recoil, which can strain and injure the operator's hands, arm or back.

8. The use of a cartridge gun holder is considered a best practice. Do not lay a gun on the edge of a stun box.

Safe Livestock Handling

1. A single, lone, agitated steer is very dangerous. Many serious cattle handling injuries are caused by a single agitated steer or cow. Never leave a single animal alone during break.

2. Escaped cattle must never be chased. An animal that is loose on the plant grounds will return to the stockyard if it is left alone. If an animal gets loose inside the plant, employees should stay quiet while one designated person either stuns it or eases it out a door.

3. Stay out of the blind spot behind a steer's rear end. If he cannot see you, he is likely to kick you.

4. Install a safety fence consisting of upright posts around the cattle shackling area to prevent cattle from entering other parts of the plant.

5. Do not try to stop a pig that is running back from a group as a person may be knocked down or injure his or her knees.

Ritual Slaughter Practices

Shackling and hoisting unstunned cattle and calves can be very dangerous. It has caused many serious accidents. In one plant, replacement of the shackle hoist with a restrainer resulted in a dramatic reduction in accidents. Shackling and hoisting of live sheep is also hazardous.

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