



TIPS & TOOLS

MEAT STANDARDS
AUSTRALIA

The effect of the pH–temperature decline on beef eating quality

What is the pH–temperature decline?

The pH decline is the rate at which the carcass pH level falls from 7.10 (live animal pH) to the level at which it will not fall any further (this is known as the ultimate pH). Temperature drops as the carcass is processed and then chilled. The ideal ‘window’ is a specification used to describe the relationship between carcass pH and temperature from slaughter to when ultimate pH is reached. If the rate of pH–temperature decline does not fall through the ideal window, then carcass eating quality can be severely compromised. With over 400 meals produced from every carcass it is an important consideration. The ultimate pH alone is also important for eating quality (See *MSA Tips & Tools: The effect of pH on beef eating quality*).

Where is the pH–temperature window assessed?

The window is assessed at the processor as part of MSA licensing conditions. The pH temperature decline begins on the slaughter floor and finishes in the chiller when the carcass has reached its ultimate pH. It is assessed by taking sequential pH and temperature readings using a combined pH/temperature meter. Readings are taken from a number of carcasses as they come off the slaughter floor and then at timed intervals until the pH reading is at the ultimate level in the chiller. The time the carcass takes to reach its ultimate pH level determines the rate of pH decline.

The pH–temperature window is periodically checked at every MSA licensed processor to ensure that it is always maintained for MSA cattle.

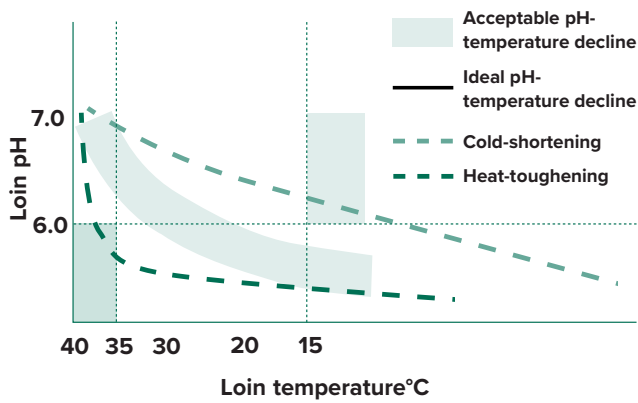
Key points

- The pH–temperature decline must fall through the ideal ‘window’ for eating quality.
- A pH–temperature decline that falls above the window, i.e. meat reaches pH 6.0 after the carcass temperature has fallen below 15°C, will result in cold-shortening.
- A pH–temperature decline that falls below the window, i.e. meat reaches pH 6.0 before the carcass temperature has fallen below 35°C, will result in heat-shortening.
- Both heat-toughened and cold-shortened meat are tough and unsatisfactory for the consumer.
- Electrical stimulation is a tool that can be used to manipulate the pH–temperature decline.

What is the pH-temperature decline specification?

The window requires the carcass pH to pass through 6.0 between 15°C and 35°C. The readings taken on the carcasses at the processor are plotted into a graph to determine the rate of the pH-temperature fall. If the current rate of pH-temperature decline falls through the window, no adjustments to the system are required. If it does not fall through the window, then a number of alterations can be made including the use of electrical stimulation, which accelerates the rate of pH decline. The rate can be adjusted by varying stimulation frequency and application duration.

pH-temperature decline window.



What happens if the decline does not fall through the ideal window?

If the pH decline is too slow, remaining high while the temperature falls, the carcass will cold-shorten. This is detrimental to the quality of the meat and will result in:

- Extremely tough meat (cold-shortened meat is described as inedible).

The widespread use of electrical stimulation has reduced the likelihood of cold-shortening in most processing plants.

If the pH decline is too fast and the ultimate level is reached while the temperature is still high, heat-toughening will result. This does not make the meat as tough as cold-shortening but has undesirable effects including:

- An increase in toughness
- Pale and sometimes watery meat (known in industry as Pale Soft Exudative – PSE – meat)
- ‘Two-toning’ in some cuts leading to unattractive retail appearance
- The prevention of ageing (the enzymes that enable meat to become more tender with age are denatured and will no longer work)
- Reduced water-holding capacity.

How does electrical stimulation work?

Electric currents applied to the carcass make the pH fall faster. It is not a tenderisation process by itself. In fact, if too much stimulation is used, the pH falls too fast resulting in heat-toughening. There can be a number of electrical

inputs on the slaughter floor, all of which need to be taken into account. These can include:

- stimulation applied through an immobiliser directly after stunning, to keep the body rigid to ensure safety during chain application,
- rigidity probes apply an electric current to keep the carcass rigid during hide removal.
- additional stimulation after bleeding can be applied.

This in itself can begin to increase the rate of pH fall. When determining processor requirements to maintain the ideal pH-temperature window, the amount of stimulation is varied to meet the window specifications.

Does anything else need to be considered?

The rate of pH decline varies with the pre-slaughter state of the animal, the number and type of electrical inputs used during processing, the speed of the slaughter-floor chain, chiller conditions and carcass weight and fatness. The amount of glycogen in the animal is very important in the pH-temperature relationship (See *MSA Tips & Tools: The effect of pH on beef eating quality*). It is also important that the processor has handling and receive facilities that minimise the amount of stress the animals’ experience. MSA accredited graders consider all of these inputs in determining the requirements for the processor to maintain an ideal pH-temperature decline and optimise the eating quality of the beef produced.

Can the producer play a role in keeping the pH-temperature decline in the window?

Yes! It is important that the animals reach the processor in as normal condition as possible. Minimising stress and ensuring animals have enough energy reserves will assist in achieving an ideal pH-temperature decline. By following the MSA guidelines (see *MSA Tips & Tools: MSA requirements for handling cattle*) and ensuring the cattle have adequate finish, producers can give their consignment the best possible opportunity to provide a satisfying eating experience for the consumer.

Further information

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