

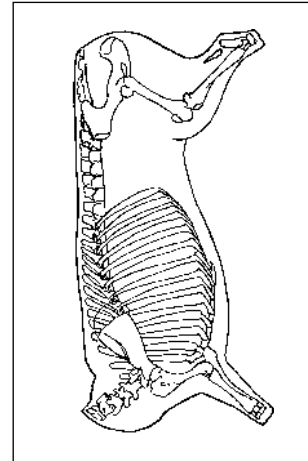
## TENDER STRETCH

A major cause of meat toughness is the contraction of muscles during rapid chilling, toughness caused by this muscle contraction can be prevented by hanging the carcass in a way that will both stretch the muscles and not allow them to contract.

The action of tenderstretch is to hang the carcass in a natural posture so a number of muscles are in a stretched position and therefore enter rigor in an extended state thus preventing cold shortening in these muscles.

### Method

- a) Sides are hung, preferably from the sacrosciatic ligament or from the obturator foramen (aitchbone). Whole carcasses are suspended from the pelvic girdle. In all cases the carcass to be tenderstretched must be rehung within 90 minutes of sticking and must not have the Achilles tendon cut.
- b) Carcasses must remain hanging in the specified manner for at least 24 hours or until rigor mortis is established.



Shape of Tenderstretched carcass

## AGEING

(For the purposes of AUS-MEAT Carcass Branding)

Product which has not been subject to Accelerated Conditioning, Temperature/pH treatment, or Tender Stretch can be branded subject to the product being aged for a minimum period of 7 days on plant in a non-frozen state.

Where ageing is practised for the purpose of AUS-MEAT Carcass Branding the Enterprise must have in place approved quality system procedures describing the method that will be used to maintain the integrity of the ageing process and branded product.

## CONTROLLED pH DECLINE SYSTEMS

An Enterprise may incorporate procedures within its approved Quality System to achieve a Temperature/pH relationship window as an optional alternative to the Electrical Stimulation requirements as set out within this appendix. Such procedures will only be approved on an individual basis and will be specific to each Enterprise. These regimes are designed to minimise meat toughening through both cold shortening and heat shortening.

Enterprise procedures must ensure that the following Temperature/pH relationship window can be consistently achieved:

The pH of the M. longissimus dorsi must:

- remain at or above pH 6.0 while the temperature of the muscle is at or above 35°C; and
- be below pH 6.0 prior to the temperature of the muscle falling below 15°C.

All submissions for approval must be prepared in accordance with procedures published by AUS-MEAT. Enterprises wishing to develop a Controlled pH Decline System submission should contact AUS-MEAT for further detail.

Each submission for a Controlled pH Decline System approval must include:

- A documented individual validation of each slaughter system's ability to meet the Temperature/pH Relationship window. (It should be noted that a number of variables interact to make each slaughtering/chilling unit functionally unique);
- Establishment of documented monitoring procedures by each Enterprise to verify continued effectiveness of the system;
- Documented standardised pH measuring procedures to ensure accuracy and repeatability of pH measuring equipment and techniques;
- Documented Quality System requirements that are needed to support individual enterprise systems; and
- The technical qualifications and or training and competency standards required for persons who are to engage in establishing, validating and monitoring individual Enterprises systems.

**Quality System procedures established by each Enterprise must address the following:**

- a) The approval for the Controlled pH Decline System must be available in the Quality System Records.
- b) The requirements of the approval must be regularly checked;
- c) The Quality System must include a procedure for reviewing the ongoing results of the Controlled pH Decline System;
- d) All post slaughter electrical inputs and chilling parameters must be detailed in, and monitored in accordance with, the Quality System; and
- e) Where significant variation occurs with the post slaughter electrical inputs and/or chilling regimes set out in a submission for approval, the Enterprise must conduct a validation decline for the new conditions and submit all updated data for approval by AUS-MEAT.

AUS-MEAT Area Managers will audit each Enterprise's approved Quality System procedures to ensure that the Controlled pH Decline System is approved, is correctly applied to carcasses, that monitoring results demonstrate the continued effectiveness of the Controlled pH Decline System and that the relevant approved procedures are implemented and maintained.

## **PROCEDURE**

### **Controlled pH Decline System Requirements**

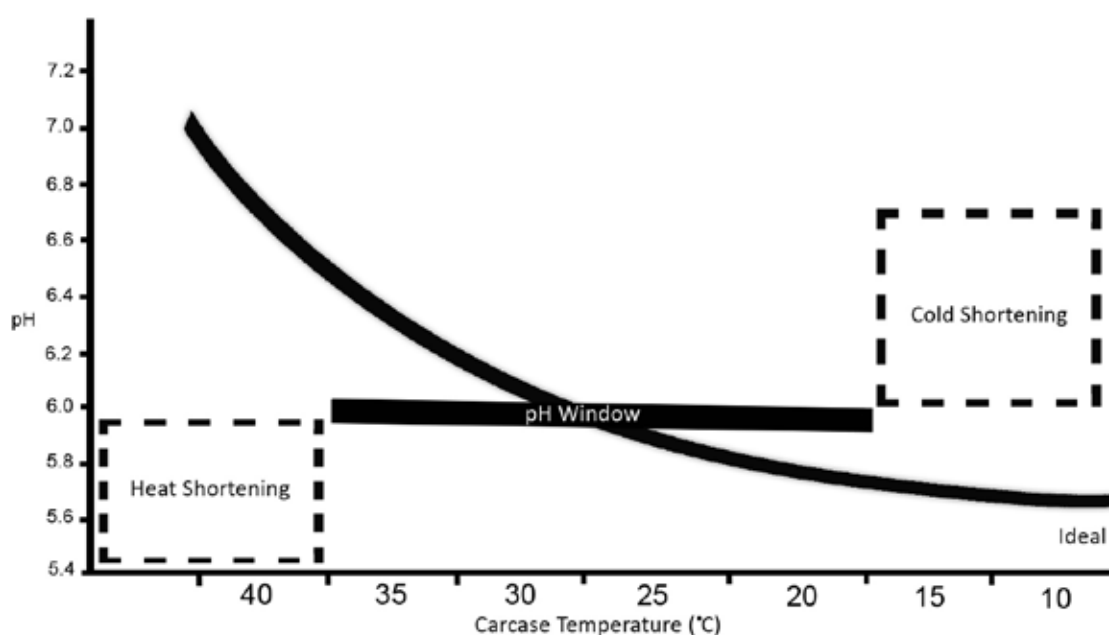
#### **Overview**

The rate of pH decline can impact on the predictability of eating quality, specifically by falling too slow and therefore increasing the potential for Cold Shortening or by falling too fast and increasing the probability of Heat Shortening.

The well documented “Cold shortening” effect can be controlled by ensuring that electrical input levels are set so that the pH of the M. Longissimus Dorsi falls to below 6.0 before the temperature falls below 15 degrees C.

The potential for “Heat Shortening” can be controlled by ensuring that electrical input levels are set so that the pH of the M. Longissimus Dorsi does not fall below pH 6.0 with the temperature above 35 Degrees C.

## pH/Temperature Window



To define the appropriate settings for electrical inputs and refrigeration it is necessary to perform regular weekly in-process monitoring of window conformance in conjunction with the detailed pH decline required, as part of an approval for Controlled pH decline Systems.

The rate of pH/ temperature decline can be controlled by two mechanisms.

These are;

1. The quantity of electrical input applied to the carcass. (The addition of electrical inputs accelerates the rate of pH decline.)  
It is important that all electrical inputs are taken into account. Eg. Hide puller, immobiliser probes and stimulation systems.  
It should be noted that the time between slaughter and stimulation also affects the rate of decline.
2. The rate of decrease in the temperature of the product.  
Temperature drop is affected by how quickly the carcasses are placed under refrigeration (chain speed), weight and fatness of carcasses, chiller load and airflow.

## **Important points to note;**

Larger or fatter carcasses will chill more slowly and subsequently may be at risk of heat shortening due to the reduced rate of temperature loss.

Under or overloading chillers will also affect the rate of carcass temperature loss and this may cause carcasses to fail to meet the pH temperature window.

Temperature variations within chillers may cause different rates of pH decline in similar carcasses placed in different areas of the chiller. Among other reasons, these temperature variations may occur due to inconsistent air flow patterns or due to proximity to open doors.

## **Approvals;**

In the case of AUS-MEAT Accredited Enterprises, an AUS-MEAT Approval is required for Enterprise based Controlled pH Decline Systems, where:

- Electrical Stimulation is less than 40 seconds and Chiller Assessment is undertaken prior to 18 hours (including MSA Grading.)
- Carcasses are nominated as having passed “Accelerated Conditioning” requirements due to being produced under a Controlled pH Decline system – including where this applies to Branding specifications.

Note: it is the responsibility of the Enterprise applying for a controlled pH decline approval to prove to the satisfaction of AUS-MEAT that the Enterprise is able to control the rate of pH reduction so that it minimises the chance of Cold or Heat Shortening and that ultimate pH is achieved prior to Chiller Assessment taking place.

## **Who can conduct this monitoring?**

QA staff or other Company Officers are deemed suitably qualified to conduct these declines upon completion of Module 4 “pH Measurement and Decline” (current edition) of the MSA Enterprise Training Requirements (or in the case of non MSA product, other recognized qualifications).

3rd party operators including MSA personnel, who have appropriate training, may also undertake the decline on behalf of the Enterprise.

## **pH Monitoring**

### **Types of Monitoring**

There are three types of monitoring required for a controlled pH decline approval. They are:

1. Monthly Monitoring: which is a complete test of the rate of pH decline involving hourly pH and Temperature measurements on a sample of representative carcasses. A satisfactory result will show that carcasses have passed a pH of 6.0 after cooling to 35c and before cooling to 12c. (the pH window)

2. Ultimate pH Monitoring: The pH of the carcasses Slaughtered according to Controlled pH decline System requirements must have reached Ultimate pH prior to any grading activities taking place.

3. Weekly Monitoring: Is a simple check of fall in pH conducted on 5 bodies per chiller, for each significant cattle type slaughtered under the MSA controlled pH decline system.

## **Monitoring frequency and sample size**

pH Declines must be conducted when the Enterprise changes any production method, which has the potential to affect the rate of pH decline.

Declines may also be conducted, as the Enterprise deems necessary to efficiently maintain the pH temperature window.

### **1. Monthly Monitoring:**

#### **Monitoring frequency:**

A detailed Monthly pH decline must be conducted by a trained operative monthly or as approved by the Authorised Authority on all cattle types. Applications for reduced levels of monitoring will be evaluated based upon the level of performance and control demonstrated by the Enterprise. (in the case of MSA cattle, MSA must agree to the reduced monitoring program.)

As individual chiller regimes can affect the rate of pH decline, each chiller that is used for chilling carcasses which have been treated according to controlled pH decline system requirements must be included in Monthly Monitoring on a rotational basis.

#### **Monthly pH decline:**

A full monthly pH decline must contain sufficient pH readings (of both pH and temperature), (conducted on the hour from chiller entry), to provide results for each carcass until a point where that carcass has fallen below pH 6.0. Ultimate pH (pHU) must also be taken.

Carcasses which do not achieve an ultimate pH of below six shall be excluded from the, but records must be kept of the number of carcasses dropped from each group.

Declines must be conducted on a minimum of 15 bodies per cattle type on a rotating chiller basis. Where there is less than 15 head killed per cattle type than the entire lot must be used in the decline.

#### **Time & Motion Monitoring:**

The following must accompany each set of detailed monthly pH decline data.

- The time in motion will include information regarding the time from knocking to:
  - Immobilisers (details of current, duration, effectiveness)
  - Stimulator (details of current, duration, effectiveness)
  - Hide puller (details of current, duration, effectiveness)
  - Chiller entry (this is usually the first reading)

Note: MSA has developed a reporting program for the above criteria which can be obtained by calling MSA on 1800 111 672. AUS-MEAT/MSA require the use of this tool for Monthly pH declines and as a method of retaining data as a Quality Assurance Record.

## 2. Ultimate pH Monitoring

The pH of the carcasses Slaughtered according to Controlled pH decline System requirements must have reached Ultimate pH prior to any grading activities taking place.

Enterprises must have a written procedure included within the Enterprise Quality System Manual, which defines the method of validation of the time taken to achieve pHu.

Validation of Ultimate pH for carcasses slaughtered according to Controlled pH Decline System requirements. (This can be conducted in conjunction with monthly monitoring.)

At least monthly Intervals, the pH of 10 carcasses in each chiller must be taken at the minimum Chiller Assessment time, (measured from slaughter). The pH of these carcasses will be taken again at a time of two hours from the initial measurement, and records shall be maintained for:

1. The date & the time from slaughter to first reading, and
2. The first & Second pH result.

A successful Validation is when there is no drop in pH (within experimental error) between the two readings

### Corrective action

Where a significant drop in pH is detected, a validation will be completed and a new corrected minimum time from slaughter to assessment will be nominated and recorded within the QA system records.

## 3. Weekly Monitoring:

In process monitoring of the rate of decline must be conducted at least once per week on a day that cattle are slaughtered using a Controlled pH decline System.

It is acceptable to monitor different cattle groups on separate days of the week, but all groups must be included within the one week period.

### Weekly monitoring sample size.

Sample size should be 5 bodies per chiller for each significant change of cattle type slaughtered under the Controlled pH Decline System.

A significant change in cattle type is defined as;

- Weight group, and or Fat depth group.
- Changes in feed type (grass, grain).

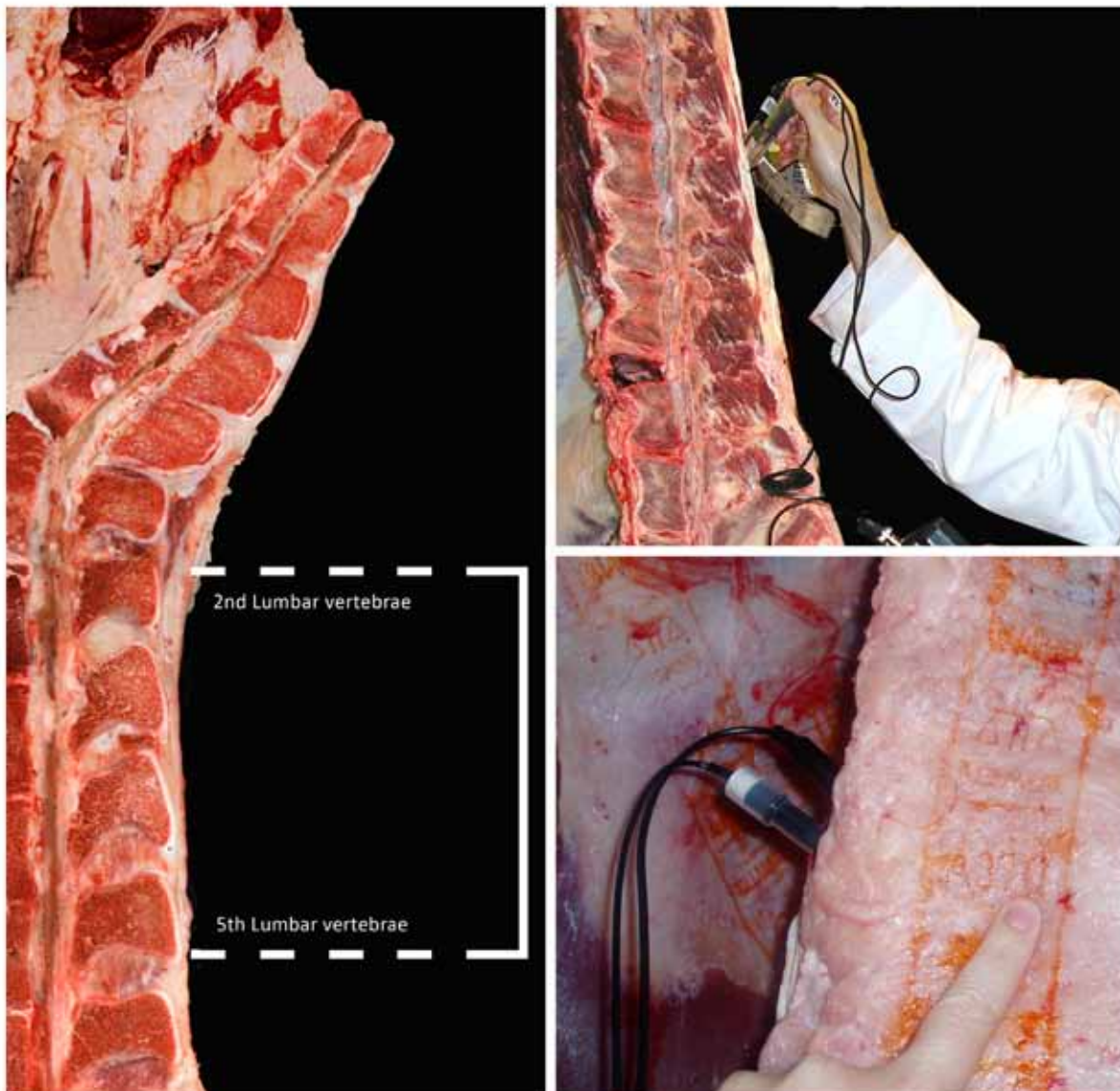
Grain fed is further defined as 70 day, 100 day, 150 day, 200 plus etc.

The Enterprise or Establishment must monitor and record results for 5 head of each type of carcase. Readings are taken as per the detail below.

## Measuring pH and Temperature

### Where and How

The pH and temperature measurement site is in the M. Longissimus dorsi between the 2nd and 5th lumbar vertebrae. This is to avoid the reading being taken in the M. Spinalis which may provide inconsistent readings.



The pH and temperature probes will be inserted in such a way that the reading will be taken as close as possible to the center of the eye muscle (M. Longissimus dorsi). This is achieved by inserting the probes on a slightly downward angle. (Approximately 45 degrees.)

It is acceptable to insert the pH probe adjacent to the vertebral spinous processes. Small knife cuts may be made to accommodate the pH and temperature probes. The pH probe must be re-inserted and re-positioned for each set of measurements.

The pH and temperature readings are taken simultaneously at the required position and pH measurements are recorded to two decimal places. Temperature is to be recorded to one decimal place.

## Reporting and Quality Assurance

The monitoring procedure must be included in the Enterprise Quality Assurance Manual. The results and a record of conformance status of both daily and detailed pH measurements must be maintained in the QA records.

For Monthly pH Declines, the following details must be included:

- the name of the person who conducted the decline;
- the company name, site location and establishment number;
- the individual carcass characteristics for each carcass used in the decline;
- the stimulator setting;
- the status of other electrical inputs during the decline (hide pullers etc);
- the time from slaughter of each Temperature/ pH measurement;
- the time of chiller entry from slaughter;
- details of chiller temperature management;
- pH measurements are to be recorded to two decimal places;
- temperature measurements are recorded to one decimal place; and
- individual graph and lot average graphs of the pH/temperature window for each group of cattle.

In the case of MSA carcasses, all Detailed pH decline results must be sent to the MSA Quality Assurance Systems Administrator or the Authorised Authority electronically no later than 48 Hours after the decline was conducted.

Email: [ph\\_declines@mla.com.au](mailto:ph_declines@mla.com.au)

For weekly in process monitoring the following details must be recorded;

- Carcass Number
- Kill date
- Feed type
- Electrical inputs received
- Weight ( HSCW)
- P8 fat measurement
- Chiller Number
- pH measurements and associated temperatures
- Details of any corrective action taken when non-conformance is detected.

Records of corrective action and the effectiveness of corrective action taken when a non-conformance is detected are required to be kept. In the case of MSA Cattle, MSA requires copies of these records / results.

If results of weekly monitoring show a trend where greater than three of the 5 sample carcasses have pH falls outside of the temperature window, another sample size of 10 carcasses must be taken".

If the results of daily checks continue the trend, a full pH Decline (see monthly monitoring) must be initiated.

In the case of MSA Cattle, MSA must be notified of the trends and the results of the pH Decline together any recommended changes to the Controlled pH Decline System. The Enterprise will then take the agreed action to correct the pH fall. (see below)

In the case of non-MSA carcasses, the enterprise will modify the Temperature/pH regimes to adjust the rate of pH fall so that the carcasses achieve the pH window requirements.

In the case of all carcasses (MSA and non-MSA), a further pH decline will be carried out after each modification so that the results of the change can be validated.

## MSA requirements for validation of changes

In the case of MSA carcasses, upon receipt of monitoring requirements, approval and recommendations will be forwarded to the Enterprise. Approval must be retained in the Enterprise Quality Assurance records and available at time of audit.

## Recommended equipment

Only temperature compensated pH meters are approved for use. Suggested meters are the TPS WP-80 and the TPS WP-80M. pH probes for these meters are the IONODE IJ44 & IJ46. A temperature probe must be used at all times when pH is being measured.

For the measurement of ultimate pH a TPS WP-80M is equipped with the "Bendalls" function.

Battery powered meters must be sufficiently charged before use.

## Calibration

- A two-point (minimum) calibration must be conducted prior to use. Most pH meters use a two point calibration with buffers of pH 6.88 (approximately) and pH 4.0 (approximately).
- It is important to ensure that the probe has plenty of potassium chloride (KCl) fluid in it prior to use.
- Meters must be calibrated every two hours during the decline.
- Meters must be calibrated in accordance with the manufacturers' instructions at the beginning of each day. Calibrations are to be conducted with the buffer solutions and the pH meter at a temperature as close as possible to the temperature of the carcasses that are to be measured. Calibrations must be done in an environment that has a similar temperature to the area in which the pH meter will be used.
- Buffer solutions used for calibration are to be kept fresh and the use-by date on the buffers carefully monitored. All solutions used for daily calibration must be discarded after use.
- Temperature probes shall always be used when calibrating and measuring.
- Temperature probes shall be calibrated against a certified mercury/glass thermometer on a monthly basis or whenever a new probe is used.
- The results of these calibrations shall be stored in the Quality Records.
- Bendalls function to be switched **off** for calibration and pH decline monitoring.  
switched **on** for ultimate pH readings.

## Care and Storage

- Extreme care is to be taken with the pH meters and probes at all times. The meters are not to be left in the sun or in a place where they may be exposed to excessive moisture.
- The tip of the pH probe must be kept moist at all times. The well in the body of the pH probe at the base of the sheath must be kept full of KCl, which must be replaced with fresh solution every day.
- For short-term storage (overnight or over the weekend) store the electrode in a protein cleaning solution. Change KCl electrolyte and rinse well with water before calibrating your probe. Long-term storage can be in the wetting cap supplied with each probe.
- The wetting cap must be filled with a small quantity of KCl.
- It is recommended that you store your pH probe and buffer solutions in the cold room/fridge.

## **Cleaning**

Attention is drawn to the need to inspect probes between measurements for fat or foreign material. The probe should be gently wiped clean when necessary with tissue paper, being careful not to completely dry out the tip of the probe.

If any meat, fat etc gets under the sheath, remove the sheath and rinse off the contaminants with water (warm and soapy water can be used but make sure the soap is rinsed off).

Rinse with a little KCl (this can be done using a small dropper bottle) and then fill the well, replace the sleeve and continue. Recalibration will be necessary if there is any concern that the pH meter is not reading correctly.