

Temperature logging for calculating the Refrigeration Index

March 2005

Under the new Export Control (Meat and Meat Products) Orders, which will be applicable from 1 July 2005, all export establishments will be required to calculate a refrigeration index (RI) for each of their processes. This will require the temperatures of carcasses and carcass parts to be logged at regular intervals (e.g. 15 min) until they are permanently reduced to 7°C or below.

This information sheet describes methods for location and insertion of temperature recording probes.

Site of microbiological concern

The meat temperature should be recorded at the 'site of microbiological concern'. This location varies between species and products.

Carcasses (beef)

During chilling, carcass surfaces dry and growth of bacteria is controlled by both the temperature and water activity of the surface tissue. During the initial stages of chilling when the temperature of the surface is high, growth of bacteria is predominantly controlled by water activity. Studies by Food Science Australia have shown that predicted growth of *E. coli* on thin portions of the carcass (e.g. neck, brisket or flank) is most representative of the observed growth. For beef carcasses, the neck or other sites such as the brisket or flank are the sites of microbiological concern at which temperature monitoring should be undertaken. The butt surface is normally slower to cool than these sites but it is more difficult to access and is consistently drier, resulting in slower growth of bacteria.

Carcasses (smallstock)

Bacterial growth data at the site of microbiological concern are not available for other classes of livestock. It is recommended that a worst-case scenario approach should be taken by choosing the site that cools most slowly. For sheep carcasses this is the surface of the tenderloin (inside the body cavity).

Cartons

For cartoned meat and offal, water activity is not limiting and the bacterial growth is controlled largely by temperature.



Figure 1: Placement of the temperature probe on the brisket of a beef side.

Therefore, the site of microbiological concern is the thermal centre of the carton.

For cartoned, whole muscle products the contact surfaces near the centre of the carton (which will be the site of slowest cooling) should be monitored.

The temperature logger should be inserted into a representative carcass or carton. Over time all product types and positions within a chamber should be sampled including known warm spots.

Insertion of temperature probes

The surface temperature should be recorded using a temperature logger with a probe approximately 3 mm diameter threaded under the surface tissue so that the sensing tip is evident and no more than 1 mm under the surface (Figures 1 & 2).

Temperature probes of various diameters are available. A trial measuring surface temperature with different probe sizes from 1 mm up to 4.5 mm showed that the size over that range had little

practical effect on the measured temperature (Figure 3).

In bulk-packed cartons of meat or offal, the probe should be placed at the thermal centre which will be at or slightly above the physical centre of the carton. One method, which allows removal of the probe from frozen product, is described in the AQIS Meat Notice on Hot Boning:

1. Pack meat into the carton until it is filled to halfway.
2. Place a sheet of polyfilm over the surface.
3. Place the probe flat with the tip near the centre of the carton and place a sheet of polyfilm over the probe.
4. Fill the carton making sure the meat is pressed firmly on the polyfilm to prevent air spaces.
5. Place the logger between the carton liner and the carton taking care not to entrap the lead in the meat.
6. Clearly identify the carton.
7. After freezing is complete, separate the two blocks and remove the probe.
8. Remove the polyfilm and replace the blocks in the carton.

An alternative is to use two carton liners, with the sensor between the liners, in place of the sheets of polythene. Care should be taken when folding the extra layers of liner at the top to minimise entrapment of air which could reduce heat transfer.

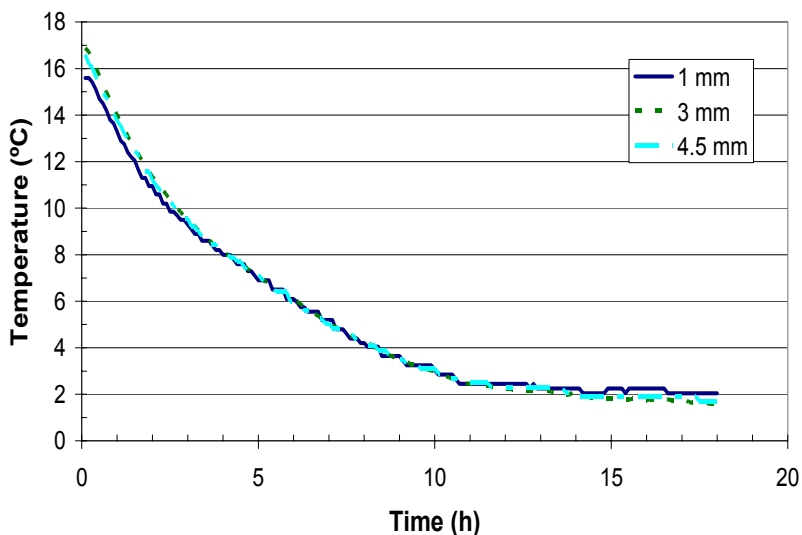


Figure 3: Effect of probe diameter on temperature measurement.

In the case of IW primal cuts or bagged offal items, the probe should be taped to the surface between two touching items so that the sensor is at approximately half the depth of the carton (Figure 4). In layer-packed items, the probe should be between layers near the carton centre.

When meat is packed in a palletcon, the product should be below 5°C before transport and dry ice is often added to achieve this. If this product is to be logged, the sensor should be placed between meat pieces well inside the load so that it is not in direct contact with a layer of dry ice. Robust stainless steel probes can be manufactured to a length suitable to reach the centre of a palletcon.



Figure 2: Placement of the temperature probe on the neck of a beef side

Recording interval

Temperature loggers can be set to record at almost any interval but the RI calculator has a default interval of 15 minutes. This can be altered, but for convenience, a logging interval of 15 minutes will be suitable for most situations.

Logger calibration

Portable electronic temperature loggers are normally accurate and stable. However, in order to ensure that accurate measurements are obtained and to conform with HACCP requirements, they should be calibrated at intervals. An information sheet prepared by Food Science Australia describing calibration procedures is available from www.meatupdate.csiro.au.



Figure 4: Sensor taped between touching surfaces of primal cuts