The use of frozen, raw meat for further processing requires proper tempering and thawing to prevent purge or quality loss. Additionally, improper thawing allows for growth of spoilage and pathogenic bacteria.

Meat blocks must be reduced to a manageable size and shape before further processing. This can be accomplished with slicers or grinders, but they produce particles that vary in size and shape. Therefore, meat must be tempered, or the ice content of the meat be reduced, until the meat is suitable for further processing.

Meat ground at 18 degrees F "shatters" more than meat ground at 28 degrees F, producing three times the number of fragments. More fragments could result in excess purge and change the texture of processed or ground meats.

A research project modeled tempering meat at temperatures between 26 degrees F and 38 degrees F and air movements of high to low speeds. The results show that single-stage air tempering of single blocks of beef trimmings in boxes was a long process. In air at 38 degrees F and low wind velocity, meat blocks rose to temperatures of 15 degrees F and 26 degrees F after four and 22.5 hours, respectively. Under these conditions, the surface layers of the meat would have been thawed many hours, resulting in both increased drip loss and lower quality due to bacterial growth.

On the other hand, using lower temperatures avoids thawing the surface product much faster than the interior. Lower temperature thawing causes tempering times to be substantially extended. For example, times to reach a frozen meat block to internal temperatures of 15 degrees F and 26 degrees F using air temperatures of 30 degrees F and low wind speed were 4.8 and 37.5 hours, respectively.

Properly tempered meat will grind cleanly but still be rigid enough to prevent smearing. Here are common ways to temper meat, including advantages and disadvantages of each:

**Ambient Air Temperature**

The simplest method of tempering meat uses ambient air to temper pallet loads of boxes.

However, as pallets act as one combined thickness, tempering periods are long, and large temperature variations result. This allows meat blocks on the surface of the pallet to thaw during the process, while the center of the blocks can still be below the temperature required for further processing. Spoilage or pathogenic bacteria may grow on the surface of the meat in this situation.
**Forced Air**

A frequently used method of tempering meat employs one or more cold rooms at various air temperatures and incorporates air movement to achieve the desired result in a given time. Such systems give good control of temperature in the meat if correctly applied, but can be expensive both in terms of energy consumption and space requirements.

The rate at which the meat blocks are tempered in an air-based system is dependent upon the type of packaging, air movement and temperature. Warmer air temperatures result in faster heat transfer, but if combined with fast air movement, the surface temperature of the meat block may rise unacceptably. Another less obvious problem is significant thawing, which causes drip loss and inhibits the transfer of heat from the surface to the center of the meat.

**Water-based Thawing Systems**

The use of cold water to thaw meat is another practical method of tempering. It can reduce tempering times, but also requires some specialized equipment and space.

**Industrial Microwave Tempering Systems**

Industrial microwave tempering systems can provide a practical alternative to conventional air-based systems in many situations, especially if flexibility or large volumes of productions are important. Tempering times of three to seven minutes are possible depending on the fat content and starting temperature. However, capital and operational costs are high.