

Ham (Leg), Fresh, Chilled and Frozen

Revised 2018

Storage Conditions

	Temperature	Storage Life
Chilled Ham	28 to 32°F (-2 to -1°C)	5-7 days
Frozen Ham	0 to -10°F (-18 to -23.3°C)	6 months

Fresh Ham

Whole, fresh hams (leg) may be received from the processing plant unwrapped in 1,000-2,000-lb (453-907 kg) combo containers for chilled or frozen storage. These items are normally being received for curing and/or smoking. The incoming product temperature should be 32°F (0°C) or colder. However, it would not be unusual for the product to be at a slightly warmer temperature. It is recommended that arrival date, time, weight, temperature, and ham condition are recorded when the combos are removed from the truck. Place the hams on clean pallets which have been covered with clean cardboard and poly film or a master poly film bag. Use a piece stacking pattern that will allow pallet stability yet provide sufficient air space so the hams will freeze rapidly to avoid souring. Stack bone-in ham one piece high per layer. Place the first layer skin side down and the top layer skin side up. Sheet poly, poly envelope, and/or disposable cardboard spacers should be used to cover the unsanitary spacers.

Unfrozen hams may also arrive at the warehouse in cartons. There are generally four hams or pieces in each carton. In some cases, the carton will have vent holes and/or hand holes which will aid in heat removal. Palletized cartons are generally stacked 5-6 layers high. Use spacers that allow 2 inches (5 cm) of air circulating space. Blast freezing should be done at -40°F (-40°C). Great care must be taken so as to provide 2 or more inches (5 or more cm) of air space around each carton.

Frozen Ham

Pork for curing or smoking is especially suitable for frozen storage because it becomes more porous upon thawing and readily takes up curing solution. Problems associated with ham freezing include souring, freezer burn, dehydration, and surface ice crystal formation.

Souring can occur when inadequately cooled ham in combos have been in transit for several days before they reach the warehouse. Souring is caused by growth of lactic acid bacteria, and is a direct result of the temperature history of the hams. Care must be taken to spread the hams on pallets for adequate cooling and freezing. Expect to keep hams at 32°F (-0°C) no more than 4-5 days. Even then, moisture loss will occur. Hams spread on pallets can take 5 days to freeze in still air, while those in forced air (150-200

ft/min or 46-61 m/min) can take 3 days, and blast freezing (250-300 ft/min or 76-91 m/min) can take 2 days. The faster meat is frozen, the less shrinkage that will occur and the less chance of microbial growth, resulting in a better quality product.

Dehydration or moisture loss is a constant problem for all meat products. Proper packaging provides good protection against moisture loss. Most hams are wrapped and placed in a carton. For maximum protection, the wrapping material should be impermeable to moisture, adhere to the product, and be tightly sealed. Weight loss from freezing of unwrapped hams is likely to be 0.75%, while loosely wrapped pork will lose 0.50%. High air velocity will cause greater shrinkage. For example: unwrapped hams held in forced air at -4°F (-20°C) for 1 year have been reported to shrink 8.2%, while in still air at -15°F (-26.1°C) shrinkage can be expected to be about 3.8%.

Effect of Freezing Method on Ham Shrinkage		
Freezing Method	Initial Freezing %	After Thawing %
Still Air	1.22	0.92
Forced Air	1.09	0.91
Blast Frozen	0.79	0.58

Freezer Burn develops in the form of light-colored tissue on the surface of exposed frozen meat when ice crystals evaporate from muscle tissue, leaving air pockets between the meat fibers. One method of preventing dehydration is to maintain high humidity and low temperature differential over the coil during cold storage. A traditional method of protecting hams, picnics, and bellies includes the use of a master poly bag.

Loose pork muscles, which are generally used for restructured hams, often arrive in large combos. Check the weight and condition of the product with the manifest for discrepancies. Remove hams from the combo and stack them on clean pallets covered with sheet film. Place a clean piece of cardboard under the empty pallet to prevent floor contamination.

In preparation for the first layer of hams, cover a 48 x 40 inches (122 x 101 cm) pallet with a clean sheet of poly film. Place the chilled hams, skin side down, on the film with the shank toward the center and the butt to the outside. Five bone-in hams can be placed along opposite sides of the pallet with 3 hams in the center. Load each pallet 6 layers high with 13 hams per layer. Place a clean divider between each layer to stabilize the load and allow air circulation between the layers. When the palletized hams have been frozen, pull a master poly bag up over the entire pallet and tie the bag before placing in storage at 0 to -10°F (-18 to -23.3°C). The poly bag helps to prevent freezer burn and moisture loss during storage. Another method of covering the frozen ham is to machine wrap the palletized hams with a flexible film. In some cases, the hams may be glazed with ice by spraying water over the pallet after freezing and prior to covering them with a flexible film. An ice coat provides increased protection against weight loss. Another method of glazing is to spray the palletized frozen ham with water. However, use of a protective flexible film is generally preferred. Ice crystals formed on the bagged ham serve to indicate that moisture has left the ham to form on the meat surface. They further indicate that the wrapper was not as tight as would be ideal.

Effect of Packaging on Total Shrinkage	
	After Thawing %
Glazed and Poly Bagged	0.74
Poly Bagged	0.87
Glazed	0.80

Tempering of frozen hams may be done in several ways depending upon the desired end result. It is recommended that frozen ham be placed in a room with an air movement of 250-300 ft/min (76-91 m/min) and a 10°F (-12°C) temperature elevation every 4 hours. Lower or remove the poly bag to achieve good air flow around the layered hams. One may expect the palletized ham to be thawed to 28°F (-2.2°C) in 3 days or less depending upon the efficiency of air flow.

See **Red Meats, Frozen** for information on pallets, palletizing, and freezing speed.

WFLO is indebted to Dr. Joe Sebranek, Iowa State University, and Dr. Stephen Neel, World Food Logistics Organization, for review and revision of this topic.