

FATS AND OILS OF ANIMAL ORIGIN

Edible And Inedible Tallow's, Lard, Oils, And Greases

General

Animal fats are closely related, both in chemical and physical properties, to the vegetable fats and oils. They are deposited in various parts of the animal's bodies, where they serve partially as a food reserve and partially as a protective layer against climatic conditions. If fat tissue is examined under a microscope, it will appear in minute drops, each droplet being enclosed by walls of connective tissue and moisture. In general, the fatty tissues of animals average from 58 to 65 percent fat, the remainder consisting of cells of connective tissue and moisture. Animal fats are solid at ordinary temperatures, and therefore are commonly referred to as fats instead of oils.

There are a number of factors that influence the character of animal fats. The species of animal will determine to some extent the hardness or degree of saturation of its fats, although a softer fat may be produced by feeding the animal oleaginous seeds such as peanuts and soybeans. Carbohydrates and proteins are also a source of fat formation in the animal body and, when fed in excess of requirements, to some extent may be converted to fat and stored in the body. The fat so produced from these substances is hard, whereas when the oleaginous seeds are the chief food, the deposits of fat are noticeably softer

It has been found that animals in hot climates have fats of higher melting point than do animals of the same species in colder climates. The internal fats of the body are known to have a higher melting point than do fats deposited near the skin.

Beef Fats

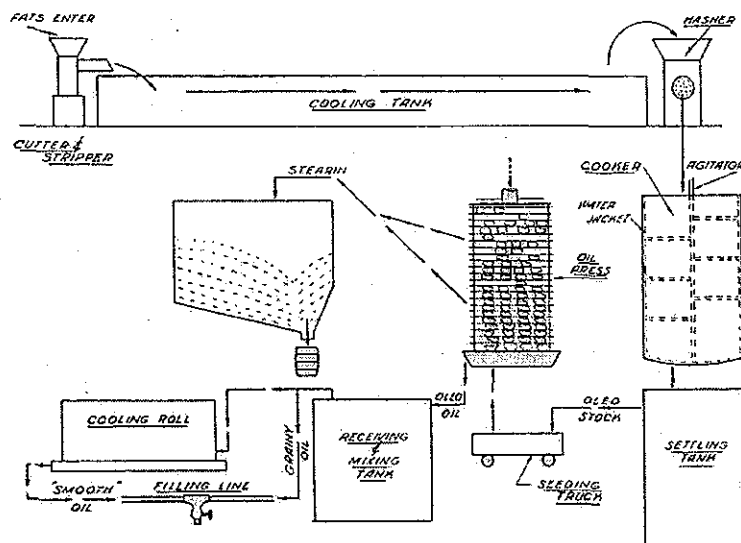


Figure 1 Rendering Beef Fat Into Oleo Oil and Oleo Stearin

The principal edible products made from beef fat are oleo stock, oleo oil, oleo stearin, and edible tallow. Oleo oil and oleo stearin are the products obtained by pressing oleo stock. Tallow is rendered from beef fat by another process, which will be described separately.

Killing and Cutting Fats

1. These are the raw materials used in the manufacture of oleo stock. A lower grade of oleo stock is prepared from mutton fat, but because of its pronounced characteristic flavor, it is not used as a source of high-grade oleo oil. Fats used for the preparation of oleo stock require prompt, sanitary, and efficient handling to ensure obtaining a high-grade product. Consequently, it is necessary that the observance of approved methods for handling the raw materials should begin at the source of supply—on the killing and cutting floors.
2. The best fats for preparing oleo stock come from the killing floor. These, in the order of their value for this purpose, are: caul, ruffle, pauch, peck, crotch, heart, chip, machine, pluck, and tongue fat. From the cutting floor, kidney, cod, brisket, and other fats are trimmed from the chilled carcasses. As a rule, the latter fats contain a higher free fatty acid content than those direct from the killing floor. A third class of fats known as "shop fats," which are the fats that accumulate in retail and wholesale markets in the process of cutting carcass beef or wholesale cuts into smaller cuts, are usually so high in free fatty acid and have attained such a "high" old or musty flavor that their use in an edible grade of oleo oil is impossible. Such fats are usually rendered into tallow for technical purposes.
3. Some small establishments have cold-water vats adjacent to the killing floors into which the killing fats are immersed as soon as possible after removal from the carcass. In the case of firms with large killing floors, the killing fats are transferred to the offal floor along with the viscera; there they are removed and transported in trucks to the chilling vats in the oleo oil department. To facilitate uniform and rapid chilling, the fats may be cut into strips by a cutting machine. Oleo fats are chilled in cold water in order to prevent their deterioration and so that they may be more easily hashed for rendering. Large modern chilling equipment consists of long metal or concrete tanks fitted with brine coils by which the

temperature of the water can be maintained at any desired degree. The most desirable temperature for the chilling water is 38° F to 44° F. If the pieces of fat are not too large and are constantly stirred, with the water maintained at 38° F; they may be thoroughly chilled in an hour. However, fats are ordinarily left in the water for from two to six hours and sometimes for a day. It is obviously important that the chilling water be changed sufficiently often to maintain sanitary conditions, and from time to time the tanks should be washed and sterilized with steam.

Methods of Preparing Beef Fats

1. **Rendering**—To facilitate rendering, the chilled and washed fat is run through a hasher that breaks up the fibrous framework of the fat tissues. The hashed fat is then transferred to open-top, jacketed kettles of from 1500 to 5000 pounds capacity that are equipped with mechanical agitating arms. The revolving arms are kept moving throughout the process of filling and melting to prevent scorching the fat that comes in contact with the sides of the kettle and to mix the fat so that heating and rendering will be uniform. The water in the kettle jacket is kept boiling during the melting process. The fat at the end of the operation reaches a temperature ranging from 150° to 160° F and this is reached in one to one and one-half hours after filling is completed. The movement of the agitator arms should be just enough to keep the kettle contents in motion (about ten revolutions per minute). A faster movement is liable to cause some emulsion of the liquid fat with the water. As the fats are not subjected to higher temperatures than boiling water, the process is usually referred to as melting rather than rendering. When this is completed, agitation is discontinued and the kettle contents are allowed to remain quiet until the scrap or solid residue has settled to the bottom of the kettle. Settling of the scrap and water is hastened by sprinkling a quantity of salt over the surface of the contents of the kettle. The resulting brine, being of greater specific gravity, separates more rapidly from the fat and carries much of the scrap to the lower portion of the kettle.
2. **Settling**—Directly beneath the melting kettles are other kettles of similar capacity that are known as settling kettles, or clarifiers. The stock is held here from one to three hours to complete the settling commenced in the melting kettles. The temperature of the stock in the settling kettle is maintained from 135° F to 140° F, and more salt is added to the stock in this kettle to further hasten the settling. In all, about one pound of salt to 100 pounds of stock is used. The clarified stock is drawn off from an outlet above the water and sediment line, filtered through flannel to remove any particles of scrap, and transferred to the seeding trucks.
 - A. Seeding the oleo stock with stearin is necessary in order to facilitate the crystallization of the stearin. The temperature of the seeding room is maintained at a point where the crystallization of the stearin will occur and yet leave the oleo oil (olein) in a liquid condition. This temperature is from 90° F to 92° F. The melted stock is run into the seeding trucks at about 135° F and placed in the constant temperature room until the stearin has crystallized; this requires about 72 hours. During this process, a thin crust of stearin remains at the surface and the balance of it is at the bottom of the truck, leaving a layer of clear oil between the two. Directly before pressing, the contents of the truck are thoroughly mixed to obtain a uniform mixture of the solid and liquid parts.
 - B. Seeding trucks are made of maple or other wood having a smooth, impervious surface that may be easily cleaned. Some establishments fit their trucks with galvanized iron linings that are removable to facilitate their cleaning. Formerly it was believed that a high-grade product could not be made using metal equipment, but now considerable metallic equipment is used.

Oleo Stock

General

Oleo stock is principally used for the manufacture of oleo stearin and oleo oil. The yield of oleo oil amounts to about one-third of the stock grained. Small quantities of oleo stock are used by some manufacturers of oleomargarine and by the baking industry.

1. **Pressing**—The grained stock is transferred into press cloths made of twelve-ounce duck. The cloths are placed in forms and a dipperful, holding approximately five pounds of stock, is poured into the cloth. The ends of the cloth are folded over the stock, making a bundle measuring approximately $11\frac{1}{2} \times 9\frac{1}{2} \times 1\frac{1}{2} \times 1\frac{1}{2}$ inches, which is placed in the press. Eight cakes of stock are placed on each plate. The plates are of heavy galvanized iron and are 60 in number, placed one above the other. During the filling process, the plates are held at the top of the press by a number of pins and, as each plate is filled, the pin is withdrawn from under the next plate, allowing it to fall upon the one just filled. This procedure is followed until the press is full. Pressing is modulated at first; gradually the pressure is increased to a maximum speed toward the end of the operation. The oil is forced through the press cloths and runs over the edges of the plates into a receptacle below the press; it then flows to a large receiving tank where it is mixed with oleo oil from previous pressings. By so doing, a more uniform product is obtained than would be the case if each day's production were kept separate.
2. **Oleo oil**—Oleo oil is marketed in one of two forms—the method of cooling determines the physical condition of the product produced. The older type is referred to as "grainy." The oil is drawn off into tierces at temperatures from 110° F to 120° F and placed in a cool room at a temperature of 40° to 50° F to solidify. Establishments that use their own oil for making products are not so particular about the appearance. In the newer form in which oleo oil is marketed, it is solidified quickly by means of refrigerated lard rolls. This product is placed in tierces and held at 70° F until used. "Smooth" oleo oil, solidified under these conditions, has a consistency that is liked by the trade.
3. **Grades**—Manufacturers of oleo oil usually make two grades of oleo oil, which are designated as No. 1 and No. 2 oil. No. 1 is made from stock from the freshest, best quality beef fats. No. 2 is made from stock obtained from fats of lower quality, such as cutting, chip, shop, and machine fats, and, in addition, from five to ten percent of sheep fats also may be included. Oleo stock in this case is rendered at a temperature approximately 10° F higher than that used for the No. 1 product.
4. **Uses**—Oleo oil was formerly used in the manufacture of margarine, but is now used chiefly by the cracker and biscuit industry. Oleo oil of good quality should have a neutral, pleasant flavor that will combine with the other ingredients to produce a butter-like flavor in the product.
5. **Oleo stearin**—This is the solid fraction of the oleo as previously explained, separated from the oleo oil by graining and pressing. Oleo stearin is used largely now along with vegetable oils in the manufacture of shortening compounds. Some is used by the confectionery and baking trades, and some is used by soap makers.

Tallow

General

The selection of beef fats for the rendering of tallow will depend upon the facilities of the establishment for the manufacture of oleo oil. In smaller plants that do not usually make oleo oil, all of the edible fat-containing tissues are rendered for tallow. Establishments equipped for oleo oil production usually render for tallow such

edible beef fats as are not considered suitable for the manufacture of oleo oil. Ordinarily, these consist of beef-cutting fat and the residual scrap from the oleo stock kettles.

1. **Cooking**—Beef tallow is most commonly rendered in tanks similar to those used for rendering prime steam lard. Some tallow is rendered, however, in open kettles at lower temperatures for the production of oleo stock. The steam tank is thoroughly washed before it is filled. Bones are placed in the bottom of the tank and cold water is run into the tank during the charging. When the tank is about three-quarters full, steam is turned on and the contents parboiled. At this stage, almost all of the water is drawn off except enough to prevent packing of solids, then the tank is closed and the steam turned into it. The rendering is continued under a pressure of 40 pounds and is completed in about eight hours.
2. **Settling**—The same precautions that are taken in steam rendering lard must be observed in releasing the pressure from the tank and in drawing off the tallow. The hot tallow is drawn into cooling tanks constructed to permit the separation settling of any moisture and suspended solid matter present. The solid material obtained is dried and disposed of in the same manner as that from lard rendering and the cook water is condensed into "stick."
3. **Packaging**—The tallow is shipped either in tierces or tank cars. Some of the best grade is used for certain edible purposes, whereas the rest is used for technical purposes including soap manufacture. For various reasons, the use of tallow for edible purposes has declined notably in recent years. Some, however, is still used in the manufacture of lard compounds.

Sheep Fats

Rendering of sheep fat is of little commercial importance in comparison with beef and pork fats. Sheep fat has a higher melting point than those already discussed, and on that account, would serve well for use as a hardening agent; however, its resistance to deterioration is notably less than that of beef fat used for this purpose, and from a palatability viewpoint, it is less desirable. As the bulk of lamb and mutton is shipped from meat packers in the form of whole carcasses, the quantity of mutton tallow produced by them is not large. Fats derived from the slaughter of sheep are principally killing fats taken from the body cavities during slaughter. The methods for rendering these fats are the same as those employed for beef fats. In the trade, the term tallow refers to that produced from beef fat, whereas tallow rendered from sheep fat is always identified as mutton tallow. Some packers combine sheep fat in the amounts of five to ten percent with beef fat and render them to produce mixed tallow. The use of mutton tallow is very largely for technical purposes, including soap making.

Pork Fats

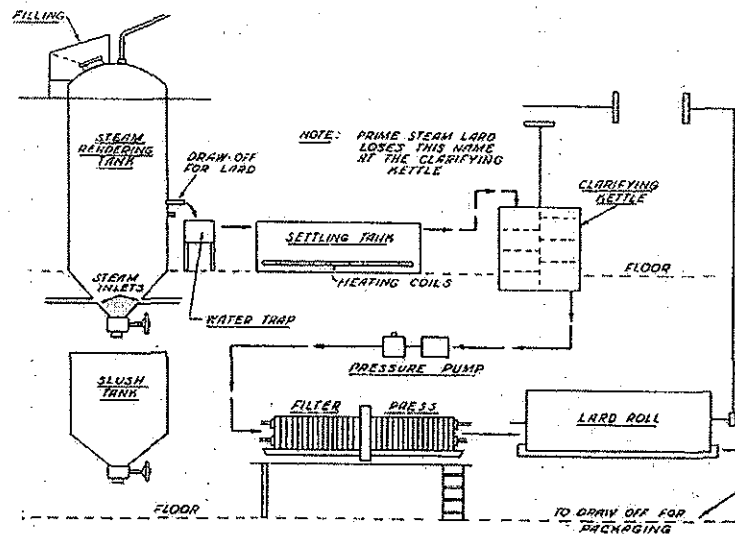


Figure 2 Rendering and Refining Steam Lard

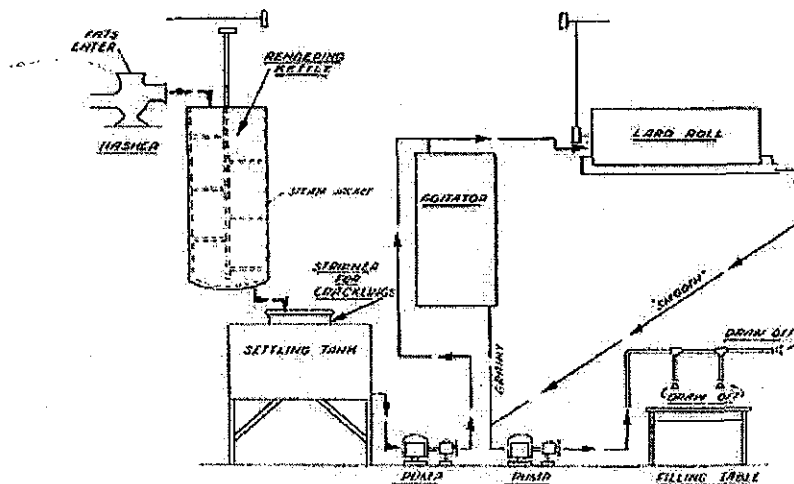


Figure 3 Open Kettle Rendering

Killing and cutting fats

1. During the slaughtering of hogs and the subsequent preparation of carcasses for marketing, excess fat is removed from various regions and rendered. These fat trimmings are classified either as killing fats or cutting fats, depending mainly on the origin and, to some extent, on how they are handled.

2. *Killing fats* are obtained principally from the fats in and around the body cavities—internal, such as the intestines (gut), mesentery (ruffle), in the omentum (caul), and the heart and lungs (pluck). Ham facings, jowl, and poll (pate) fats also may be included. Caul fat is at times not rendered, but it is kept separate to be used as an attractive dressing on meat specialties such as loaves and certain sausages. Killing fats have a higher melting point than cutting fats. This characteristic is carried through the rendering process to the extent that lard produced from killing fats has a higher melting point than that produced from cutting fats. Since killing fats are not chilled, it is necessary that they be rendered quickly in order that chances of deterioration may be reduced to a minimum.
3. *Cutting fats* are those derived from trimming cuts of meat for sale or preparatory to curing and canning. Fats from cured meat are never used for lard and seldom for rendered pork fat, as the packer finds it more advantageous to remove all surplus fat from cuts before placing them in cure. Many of the cutting fats bear pieces of skin, which has little, if any, effect on the lard, but skin bearing little or no underlying fat is not utilized for lard.
4. *Pure Leaf Lard* comes from “leaf fat,” the thick layer of fat lining the internal abdominal wall. It is valuable fat because of its high quality. The most frequent use of leaf fat is in a half-and-half combination, with back fat for kettle rendering. Leaf fat is usually chilled before rendering in order facilitate hashing. It may be classified as intermediate between killing fats and cutting fats, although because of its source and nature, it might well be considered the former.
5. *Killing and cutting fats* are usually rendered in separate tanks. The former is collected slowly as they pass down from the killing floor; four hours or longer may be required to accumulate a full tank. During this time, heat may be kept on the tank, or cold may be circulated through the fat in the tank to retard deterioration due to the animal heat in the fat. The cutting fats are transferred to the tank from the pork cutting room and handled in a similar manner during filling.
6. *Lard and rendered pork fat:*
 - A. From the commercial standpoint, the most important of edible animal fats is lard, which is derived from hogs. Lard is more adaptable to the requirements of cooking and baking than other fats of animal origin. Furthermore, the occurrence of fat in the carcass is in greater proportion to lean and bone in hogs than in other meat-producing animals. Fat of two or more inches in thickness is deposited immediately beneath the skin over the rump, back, and shoulders in the heavier hog carcasses. This characteristic is not common in other animals slaughtered for food purposes.
 - B. Under the definitions of the U.S. Department of Agriculture, a distinction is made in the rendered fats of hogs depending upon the tissues and organs from which they are derived. *Lard* is defined as “the fat rendered from fresh, clean, sound, fatty tissues from hogs in good health at the time of slaughter, with or without lard stearin or hardened lard. The tissues do not include bones, detached skin, head fat, ears, tails, organs, windpipes, large blood vessels, scrap fat, skimmings, settlings, pressings, and the like, and are reasonably free from muscle tissue and blood.” Practically all body tissues contain some fat, whether in microscopic amounts or visible to the naked eye. However, this definition excludes the less desirable tissues, which have a low fat content, from those tissues that are to be rendered for lard.
 - C. When the manufacturer desires to render tissues that are not specified for making lard, the rendered product must be labeled “rendered pork fat.” They are defined as follows: “The fat, other than lard, rendered from clean, sound carcasses, parts of carcasses, or edible organs from hogs in good health at the time of slaughter, except the stomachs, tails, bones from the head, and bones from cured or cooked pork. The tissues rendered are usually fresh, but may be cured, cooked, or otherwise

prepared and may contain some meat food products. Rendered pork fat may be hardened by use of lard stearin, hardened lard, and/or rendered pork fat stearin and/or hardened rendered fat."

- D. Manufacturers operating under the regulations of the Federal Meat Inspection service must comply with these definitions for their product to be legally shipped interstate or from one inspected establishment to another. The most common method of rendering hog fat is by the "prime steam" process, and the product obtained is known as Prime Steam Lard. It shall be solely the product of such selected fresh fat parts of the hog as are required by regulations of (and has been inspected and passed by) the Bureau of Animal Industry of the Department of Agriculture, rendered in tanks by the direct application of steam, and without subsequent change of grain or character by the use of agitator or other machinery except as such change may unavoidably come from transportation. It must have a proper color, flavor, and soundness for keeping. The name and location of the packer, the designation of the lard, and the month and year in which the lard has been made shall be plainly branded on each package at time of filling. Each tierce shall be properly filled and must be new, sound, and well-seasoned, reasonably free from dirt and stain, and hoops reasonably free from rust

Kettle Rendering

1. Open-kettle-rendered lard is the oldest type of lard known. This method has been handed down from the time when primitive peoples melted their hog fats in an open container over an outdoor fire. Kettle rendered lard is still widely popular, although not produced in quantities comparable to prime steam. Some packers make all of their lard by this method, others produce only leaf lard in open kettles, while a third group is not equipped to render by this method. In plants so equipped that a choice is available, the more easily rendered fat, such as leaf and back fat, are rendered in open kettles.
2. The rendering kettle, usually varying in capacity from 1500 to 7000 pounds, is cylindrical in form and provided with steam-jacketed walls and bottom. The kettle is equipped with mechanical agitating arms operating on a central axis, which extends down into the kettle through its open top. A protective cover may be used over the top of the kettle, but steam does not come in contact with the fat nor is pressure developed within the kettle. An outlet valve for emptying is located in the bottom, or an overhead swing pipe may be used to run off the lard by gravity.
3. Fat is hashed into small pieces -- by mechanical grinders to make it easier to heat in the kettle. A small amount of lard or water is usually placed in the kettle prior to filling. This limits the possibility of burning the fat as it comes in contact with the hot walls, and its presence assists the transfer of heat into the fat. The fat is agitated continuously during the filling period and also during the subsequent cooking period.
4. A steam pressure within the jacket of the kettle, varying from 15 to 30 pounds, is maintained during the cooking period. A temperature ranging from 235° to 250° F is thus produced, which renders the lard within three to six hours, depending upon the size of the kettle, season of year, type of fats, and the temperature at which they enter the kettle. Approximately three hours are required to render 3000 pounds of fat at a temperature of 250° F. The moisture in the fat is gradually driven off and agitation is continued until no further steam rises from the kettle. At this stage, the agitation is stopped and the light brown cracklings rise to the surface.
5. The cracklings resulting from the open kettle rendering may be pressed to free them of as much lard as possible, and then they are usually sold for animal food. Some packers add these cracklings to the steam tank before they are pressed to recover the edible fat contained in them.

6. Open-kettle-rendered lard may be filled into containers while still hot or after partially cooling in the settling tank prior to filling. In the absence of mechanical cooling and agitation, the lard acquires a "grainy" texture because of the variation in the melting points of its fat components. This grainy texture is a characteristic of kettle-rendered lard.
7. Kettle-rendered lard may be cooled on a lard roll in the same manner that refined steam lard is cooled. This produces lard with less grain and with a somewhat whiter color, due to the small amount of air being incorporated at the picker pan.

Prime Steam Rendering

1. Most lard is rendered by the prime steam method from all edible killing and cutting fats not used for other purposes. This method consists of cooking the fats in a closed tank using direct steam pressure.
2. Rendering tanks vary in size from 4 to 6 feet in diameter and stand 8 to 16 feet high. They are often cone-shaped at the bottom and have a convex head. The cone terminates with a 10- to 12-inch quick-opening gate valve. A 2-inch slush cock is placed 6 to 10 inches above the bottom and 1½-inch steam inlets are provided on both sides of the bottom of the cone. The head contains a manhole for charging the tank and a petcock, exhaust pipe, and pressure valve arrangement. The petcock is left open during operation to allow any vapors produced to escape. The side wall of the tank bears 2 draw-off lard cocks, the lower one being placed a little over one-third of the distance above the bottom of the shell, and the other 8 to 10 inches higher and to one side.
3. The tank must be thoroughly clean and sweet before using to assure a stable finished product. During the charging process, approximately one-third of the tank is filled with water. At the same time, cold water may be kept circulating or the fat may be heated during the filling operation. Each procedure is directed toward minimizing fat deterioration while charging. The tank is filled to within 2 feet of the top with materials to be rendered. The danger of overflowing can be avoided by removal of sufficient water from the bottom third of the tank. Thus one is able to adjust the top level to any desired point. The fat stock is next covered with water, and steam is introduced to bring the contents of the tank to the boiling point. After parboiling the contents, the water is drawn off through the slush cock, along with any blood or foreign material that may have adhered to the fat stock. Sufficient water to refill the cone is again added, and the head is closed. The exhaust valve is then opened and the steam is injected into the water in the cone. Thus the dry steam does not come directly in contact with the fats. The steam is introduced at a high velocity until all the air and gases in the tank have been expelled. This is indicated by the appearance of blue steam through the petcock. The exhaust valve is then closed.
4. The steam pressure used for prime steam lard varies from 30 to 60 pounds, and the time required for cooking may vary from 4 to 10 hours or longer. An average is about 40 pounds steam pressure (290° F) for 9 hours, although the trend today seems to be toward the use of higher pressures, which reduces the time required in cooking and increases the capacity of the tanks. During cooking, the surfaces of the tank are inspected for "sweating" areas, which indicate cold spots and result in sour lard. Cold spots are removed by shutting off the steam and drawing off as much excess water as possible through the slush cock.
5. When cooking is complete, the pressure within the tank must be released very gradually to prevent the water from violently expanding into steam and forming an emulsion with the lard. After the pressure is completely reduced, the head is removed from the tank and the lard is allowed to settle for 2 or 3 hours.
6. Salt is sometimes sprinkled on the surface of the lard in the final stage of settling because it removes residual moisture by absorption; the salt finally settles to the bottom and thus can be separated from the

lard. Salting steam lard is not a general practice and is frowned upon by some manufacturers. If the tank has been properly charged and the contents carefully drawn off, -- definite lines of demarcation will form; the fibrous tissue will be on the bottom, the water will be in the middle, and the lard will be on top; the separation between water and lard will occur at about the level of the two draw-off cocks. However, under any circumstances, this line can be adjusted by carefully adding water to the tank, or by drawing off water from the lower draw-off cock so that the water-lard separation is at the desired level just below the lower cock. When this operation is done with care, nearly all the lard can be removed from the tank water without contamination. Otherwise, the lard may be run into a tank equipped with steam coils for maintaining its temperature where remaining moisture and sediment settles to the bottom. This tank is equipped with two draw-off valves near the bottom—the lower to remove settling accumulations that may be added to the next charge, the upper one to draw off the lard.

7. Usually a small amount of lard remains in the tank water and in the tankage. This may be recovered by dumping tank water and tankage into a dump box and allowing it to settle for several hours. The tank water is concentrated by evaporation and the resulting semi-fluid substance, known as concentrated tankage or "stick," is used in the manufacture of digester tankage or fertilizer. The fibrous residue of fat and bone remaining after the lard has been rendered, called tankage, is pressed to remove as much grease as possible, and it is then dried for stock feed or for fertilizer. Tankage should be pressed while hot in order to remove as much grease as possible. This inedible grease is recovered in catch basins and used for soap stock, etc. First class grease should have less than one percent of free fatty acids; second-class grease less than two percent. Much grease is pressed to obtain grease oil, which is used as a lubricant by die-cutters. The lard is poured into tierces and placed aside to cool slowly to develop its characteristic grain. However, lard that is intended for the consumer market is usually refined to a better color and smoother texture.

Dry Rendering

1. Dry rendering, which is becoming increasingly popular, is a modification of the open kettle method. Strictly speaking, kettle rendering is dry rendering, since water is not added to the fats. However, because kettle rendering is an old established method, it is not commonly referred to as a dry method, and it does not embody the modification seen in a dry melter. Advantages of dry rendering, as compared to the steam method, are the relatively short time required, the high quality of the cracklings produced, and the fact that no undesirable by-product such as "stick" is formed. The yield of lard by this method is relatively high.
2. A dry melter is a steam-jacketed cylindrical tank, supported in a horizontal position and equipped with a mechanical agitator. The tank is filled through a charging door located on the top near the center. A draw-off pipe and clean-out door are located at one end of the melter, beneath which is placed a receiving tank with a strainer attached. The melter is constructed so that it can be tightly closed. It is also equipped with an apparatus by which a partial vacuum can be drawn.
3. Fats may be hashed to effect a saving in rendering time, or dumped into the melter in the form received from the killing and cutting floors. The cooking operation is divided into two phases. In the first phase, the cooker is closed; heat is applied, and a slight pressure is developed within by converting the moisture in the fat to steam. This phase is allowed to continue until a partial digestion of the fibrous tissues has taken place. In the second phase of cooking, the internal pressure is first released, then the melter is securely closed and a partial vacuum is drawn. The purpose of the vacuum is to assist in the separation of the fat from the fatty tissues. This phase may be finished at a temperature as low as 180° F and is principally drying in its action.

4. When rendering is complete, the lard is drawn from the melter through the draw-off pipe and passes through a metal screen into a receiving tank, where it is allowed to remain until the sediment settles, after which it is refined, filtered, and cooled.
5. The cracklings produced by the dry rendering method are usually pressed to recover as much as lard as possible; then they are used as animal feed. It may be desirable; however, to render these cracklings in the steam tank before they are finally pressed. In that way, much more of the fat remaining in this material is recovered.

Drip Rendering

One other method of producing lard is that known as "drip rendering." In this process, the fat and water are separated from the tissue by a perforated plate placed in the bottom of the heating or rendering compartment of the cooker. While the melted fat drips through this plate into a second compartment of the cooker that is located below the rendering chamber, it is mixed with powdered activated carbon and bicarbonate of soda. By this means, the melted fat does not remain long in contact with the crackling residue after it is melted from the tissue. Off odors, flavor, and color also have less chance to be absorbed from the residue by this process than by the ones already described. Somewhat the same effect in regard to color and flavor may be obtained by mixing one-fourth to one-half of one percent of activated carbon with the raw material during steam rendering. It is a particularly useful method when pickle-trimming fat is being rendered. However, the effect of the carbon on the color of the tankage may be found, under certain circumstances, to be objectionable.

Neutral Lard Rendering

1. Neutral lard is rendered almost exclusively for use in the manufacture of oleomargarine, although small amounts are used for medicinal purposes. The equipment employed is essentially the same as that used in open kettle rendering; however, in place of steam in the kettle jacket, hot water is used as the source of heat. The fats used for the manufacture of neutral lard are either leaf fat; a combination of leaf and backfat; or backfat alone. When leaf fat alone is used, it is referred to as No. 1 Neutral. When a combination of leaf and backfat, or backfat alone is used, the product is known as No. 2 Neutral.
2. The fat to be used for making neutral lard is hashed into smaller pieces than that to be used for lard that is to be rendered by the open kettle method. In addition, it may be slightly heated during the hashing operation, but the temperature should not exceed 100° F during the filling process. In the kettle, the product is heated to a temperature between 120° F and 135° F, and it is constantly agitated during the time required for cooking. In making No. 1 neutral, a temperature of about 120° F is used. However, in making a No. 2 neutral, the rendering temperature is somewhat higher, ranging from 125° F to 135° F. The lard should be fairly free from fiber after about one and one-half hours of cooking. When the melting is finished, the scrap will come to the surface in a foamy mass, and after standing for about 30 minutes, the neutral lard can be drained off from beneath. As it is drained from the tank, it is strained through several thicknesses of cheesecloth and then run into a storage tank where it is allowed to settle for a short time before being slightly heated and skimmed. If the neutral lard is to be stored or shipped, it is run into containers and placed in dry storage at about 55° F and held at this temperature for ten days to two weeks to drain. Thereafter, the storage temperature should be lowered to 50° F.
3. The object of this process of rendering is to obtain fat that is sufficiently neutral in flavor and odor that it will not interfere with the milk or butter flavors of other ingredients used in the manufacture of oleomargarine. Neutral lard is white in appearance and has little taste. Good quality neutral lard is grainy and will have a slight characteristic nutty flavor. Leaf lard can be rendered to yield about 80 to 82 percent of neutral lard.

Lard Stearin

1. Not many years ago, every large refinery produced lard stearin and lard oil. At that time, lard stearin was added to lard as a hardening agent to make it "stand up" in warm temperatures. However, present-day methods of manufacture produce lard of such firm consistency that the use of stearin for that purpose is no longer necessary. Consequently, that practice has virtually fallen into disuse.
2. Some white grease and other low-grade lards are pressed for the production of lard oil, and the stearin obtained is used by soap manufacturers and other industries. In preparing the oil, the lard is transferred in a liquid state into tierces or tank trucks and moved into the chill room to drain. It is held at a suitable temperature until the crystalizable higher melting glycerides have separated (or drained), then placed into forms lined with canvas press cloth. The cloth is folded over the lard and the filled cloth is placed on an iron plate with other similarly filled cloths. When the plate is covered, another plate is placed on top of the cloths, and so on, until the press is full. The filled press is then subjected to slowly increasing pressure. The liquid lard oil (olein) is gradually expressed and collected in a trough below while the stearin is retained in the press cloths. The stearin is taken from the press cloths and packed in tierces. It should be kept under moderate refrigeration if it is to be used for edible purposes. The yield of oil depends largely upon the composition of the lard and the temperature of the chill room.
3. Lard oil is used chiefly as a lubricant and sometimes as an illuminant. It is usually sold to conform to certain cold tests depending upon the use to be made of it.
4. Graining and pressing of greases for oil is done on a larger scale than that for edible lard. The grease, after draining, is placed into large forms, each of which holds as much as 100 pounds of grease, and is pressed using power driven presses. The stearin separated is melted and run into tank cars or tierces for shipment to soap or other manufacturers.

Hydrogenated Lard

1. Slight hydrogenation of lard is made by raising the melting point, thereby improving its quality. Oily or soft lard is not satisfactory for use as a shortening. Lard that is intended for storage, and that particularly for use in warm climates, may be fortified by the addition of four to eight percent of lard that has been highly hydrogenated. Prime steam lard is preferred for making hydrogenated lard flakes since it has a higher melting point and requires less hydrogen gas to become highly hydrogenated. The use of the term lard stearin when referring to lard flakes is objectionable because it is more applicable to the stearin that results from graining and pressing of lard for obtaining lard oil.
2. Hydrogenation of lard to the point necessary to produce lard flakes requires from six to eight hours. The temperature of the batch of lard in the hydrogenator is gradually increased to approximately 392° F in the final stages. The heated hydrogenated lard produced is then run over a lard roll to chill it. On account of its high melting point, it solidifies after it has gone around only about a quarter turn of the roll. The solid sheet of lard is scraped off the roll and reduced to small pieces or flakes. Lard flakes are usually stored in cloth bags until they are used. They will keep well for about one year when held at 60° F to 70° F. The lard flakes are added in measured amounts to the melted lard that is to be fortified in the bleaching kettle. After bleaching, the mixture is deodorized. Lard fortified in this manner has a higher melting point and is more resistant to rancidity than the original lard before the flakes were added. Therefore, as previously mentioned, it is more suitable for use in the tropics. If lard stearin were used for this purpose, it would require three to four times more than when lard flakes are used.

Packaging

1. Generally, lard is shipped to customers in either the smooth or grainy form. Before packaging, the smooth form lard is first cooled on the lard roll to about 60° F. Then it is agitated in the picker trough to impart a uniform texture and a more desirable color, and is packaged. If the lard falls off the roll into the picker trough in too liquid a condition, it never thoroughly sets up in the package; or if the lard in the picker trough is beaten too long or too fast, the consistency of the lard is permanently impaired. Lard that has been properly cooled on the roll is of such consistency that it may be filled into small, waxed-paper-lined cartons without leaking from or discoloring the package. Any of the usual sizes of lard containers can be used for the smooth form of lard. However, this form lends itself particularly well to packaging in the small, consumer cartons. The use of this carton for the grainy form of lard is not practical since such lard is filled without cooling.
2. Before the employment of refrigeration rolls or rotators, lard was filled into packages while still hot, and the cooling was so slow as to cause some of the stearin to separate before the remainder solidified, thereby developing a grainy texture. A certain type of trade still demands this grainy lard, believing that in order to be pure lard, it must be grainy. This form of lard is either filled into leak-proof containers while still hot and allowed to drain therein, or it may be run into a draining tank equipped with agitating arms and allowed to cool slowly before packaging.
3. Automatic filler machines are in common use today for filling the smaller one-half pound containers. These fillers may be adjusted, depending on the specific gravity of the lard, to deliver any desired volume. In addition, these automatic fillers are built so that 60 or more cartons may be filled per minute. The weight of individual cartons is checked at regular intervals so as to preclude short-weights or over-weights that may result from a change in consistency or specific gravity of the lard.
4. Small evenly balanced scales may be used for filling small cartons or cans. As these cartons are of a constant weight, the same tare, which is the combined weight of the lard and the carton, can be used to give a uniform gross weight to balance against the filled carton. The scales must be examined and the weights of packages checked frequently, especially in regard to the smaller cartons, since even minor discrepancies will involve a considerable quantity of lard after operating a day or two. The smaller packages are finally packed tightly in cases for shipping to minimize shifting or jostling during handling. When lard is filled into large containers such as tierces, barrels, or kegs, it is customary first to weigh the container, then fill and take the gross weight. After closing, both the gross and net weights are branded on the outside.
5. Wooden lard containers are usually coated on the inner surface with silicate or water glass to prevent loss by seepage of the lard through the wood and to prevent the absorption of odors from the new wood. It is customary to coat the outside of barrels and kegs with a gloss oil, paint, or varnish, which helps to preserve a clean attractive appearance and also prevents dirt from working into the wood as the containers are handled incidentally to transportation. Returnable steel drums having removable open-head covers generally are where larger containers are required. This is an ideal type of container in that it can be readily cleaned and re-used many times. The approximate capacity of these drums is 400 pounds. Lard that is to be subjected to tropical temperatures during storage can best be packaged in well-filled, hermetically sealed tin containers. The sizes of containers commonly used by the Army for this purpose are No. 10 cans, five and one-half pounds net weight, and a rectangular metal container having a net weight of 37 pounds. Suitable packing must be provided for these shipments to eliminate possible damage and puncture of these containers.

Storage

1. **Lard**—The most important point other than temperature control regarding the storage of lard is that the lard should be free from tissue particles and moisture. It may be mentioned that the re-processing or reconditioning of even slightly deteriorated lard for edible purposes is prohibited by federal meat inspection regulations. Lard produced during the peak of the producing season that is in excess of current consumer demands is stored in tierces or tanks by the packer. Prime steam lard will stay good longer than the refined product. A good grade of lard packaged in paper cartons or wooden tubs may be safely stored at 34° F for a period of about eight months. At higher storage temperatures, the length of time lard may be safely stored is shortened as would be expected. For example, at 50° F, the safe storage life is usually about five months, and at 75° F, about one month. These storage periods, at the various temperatures given, can be slightly increased by using airtight, metal containers. Such containers afford a more complete protection to the lard than the others mentioned, as shown by a storage life of about one year at 34° F, eight months at 50° F, three months at 75°F, and one month at 100°F. The incorporation of small quantities of suitable anti-oxidants in lard during its manufacture lengthens the time lard may be held in good condition in storage.
2. **Beef fats**—Rendered beef fat will keep for more than a year without appreciable deterioration if stored at temperatures of 45° F to 50° F. The keeping quality is reduced at higher temperatures. The same conditions apply to oleo stock. Stearin can be stored in a cool place in containers that exclude light and air. Edible tallow, as would be expected when properly stored, has keeping qualities similar to that of oleo stock. The inclusion of small amounts of sheep fats in beef tallow is reported to shorten its storage life.

Inspection of Lard

General

Lard is graded according to its color, texture, and flavor.

1. **Color**—Lard, when melted, should be free from turbidity, as this indicates the presence of undissolved moisture. Prime steam lard is darker in color than the refined product. Refined lard should have a bluish-white color. Neutral lard, cooled so as to have a grained appearance, is somewhat lighter in color than prime steam lard; quickly chilled lard is almost snow white. Open-kettle rendered lard is darker in color than refined lard. However, darker colored lard is indicative of the use of excessively high rendering temperature.
2. **Texture**—The solidified lard should be firm and moderately resistant to the pressure of the finger. Melted lard that is put in containers and allowed to solidify without agitation has a distinct "grain" that is produced by the crystallization of some of the glycerides in composing lard as it slowly cools. Lard cooled rapidly presents a smooth, homogeneous appearance. Thus, prime steam and open kettle rendered lard that have not been mechanically cooled have a grainy appearance.
3. **Flavor**—The flavor of lard is influenced by various factors. A strong flavor may indicate either a too-high temperature or too long of a rendering period. The sourness encountered in low-grade steam lard may be due to bacterial decomposition or to the lard not being well separated from tank water. Rancidity and a high free fatty acid content in fats are frequently confused. However, either may be present in fat without the other. The senses of smell and taste are used for determining whether or not a rancid condition exists. In some cases, the upper portion of lard in the container may be found to be rancid, while below this layer, it may be sound. However, lard cannot be rectified to make it edible. Burnt

flavors in open kettle rendered lard are due to overheating it. Lard should have a sweet, pleasant taste and odor. Experience is required in judging texture, color, and flavor.

The average characteristics of pork fat with varying degrees of hardness are shown in the following table.

Table 1 Characteristics of Pork Fat

Characteristics of Pork Fat			
Grade	Refractive Index	Iodine Value	Melting Point (Degrees C)
Hard	1.4593	63.0	38.0
Medium Hard	1.4599	68.0	36.5
Medium Soft	1.4603	71.0	35.0
Soft	1.4611	77.5	31.0
Oily	1.4623	88.0	24.0

Good quality lard should contain not more than one-half of one percent free fatty acids. Moisture and other volatile constituents should not exceed two-tenths of one percent.

SECTION 3—NATURAL SAUSAGE CASINGS

Glossary of Terms

Bundles	A measured unit of casings ready for sale in salted, pre-flushed, or tubed form; bundles will be either hog casings or sheep casings consisting of 91 meters (100 yards). Bundles can also refer to a customer-defined specification.
Green Weights	Represents approximate stuffing capacity of casings before cooking or smoking, per 91-meter lengths.
Hanks	Another essentially interchangeable term with the same meaning as Bundles, applying to hog and sheep casings.
Nodules	Pimples that appear on some beef rounds or beef bung caps.
Sets	A unit of beef casings ready for sale in salted form, consisting of 18-30 meters for beef rounds and 9-18 meters for beef middles.
Shirred	Refers to the result of applying a casing to a dummy transfer horn or to a flexible plastic sheath to expedite the stuffing process.
Tierce	A shipping container made of plastic with a packing volume to 208 liters (approximately 55 gallons).
Windows	Damage to casings caused by over crushing. Windows result in wall thicknesses being approximately half the thickness of the majority of the casing.
Whiskers	The capillary that holds the intestine in the fat and provides a flow of blood to the intestine. When removing the intestine with a knife, the capillary is not completely removed, creating a hair-like appearance on the surface of the casing.

Natural Casings are made from the submucosa, a largely collagen layer of the intestine. The fat and the inner mucosa lining are removed. Since small intestines are collagen in nature, they have many of the same characteristics common to all types of collagen, particularly the unique characteristic of variable permeability.

Natural Casings are hardened and rendered less permeable through drying and smoking processes. Moisture and heat make casings more porous and tend to soften them, which explains why smoking, cooking and humidity must be carefully controlled.

Special Qualities of Natural Casings

Natural Casings are the sausage maker's best choice because:

1. Natural Casings readily permit deep smoke penetration.
2. Natural Casings have excellent characteristics of elasticity and tensile strength, to allow for high efficiency production and expansion during filling.
3. Natural Casings protect the fine flavor of sausage, without contributing any conflicting flavorings of their own.
4. Natural Casing Sausage has that special "snap" and tender bite that's like no other man-made product, and is so highly demanded by today's knowledgeable consumers.

5. Sausage in Natural Casings stays tender and juicy.
6. The osmotic quality of Natural Casings permits superb cooking.
7. The term "Natural" is, and continues to be, one of the most powerful words influencing consumers' buying decisions.

For sausage makers, these characteristics yield high quality products that are uniform in flavor.

For retailers, the endothermic quality of natural casings means that the casing draws heat from the sausage and cools it below the temperature of surrounding air, providing better shelf life and maintaining a juicier, fresher appearance.

For consumers, the osmotic quality allows an intermingling of flavors inside and outside the sausage while sizzling in the skillet. It also allows the wonderful scent of fine sausage to enhance appetite appeal, whether cooking in a skillet, under a broiler, or over an open flame on the barbecue grill.

Other less well-known characteristics of natural casings are:

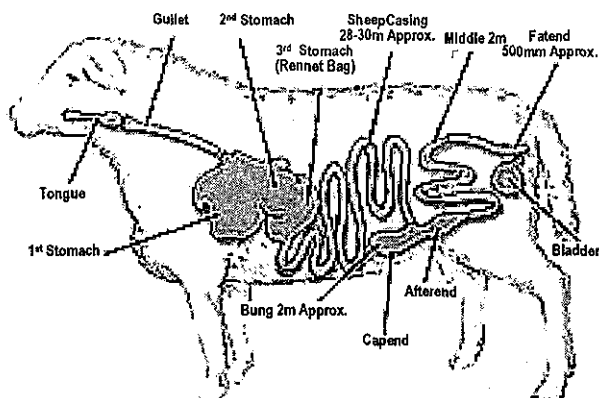
1. Superior tensile strength enables maximum yields.
2. Sausage in Natural Casings has a well-filled appearance.
3. Natural Casing Sausages have a fine appearance at link ends.
4. A variety of product shapes contribute to an inviting appearance, and give sausage in Natural Casings strong display appeal.

Before studying the numerous kinds of natural casings, it is important to understand that casings can vary in quality. Better casing suppliers and the sausage manufacturer will determine the specifications required based on the sausage manufacturer's purposes. These variables include:

1. Equipment used for filling
2. Type(s) of sausage being manufactured
3. Coarseness of the grind

Together, the casing supplier and sausage manufacturer can determine the criteria to be used when inspecting the casing.

Natural Casing Products - Sheep Casings



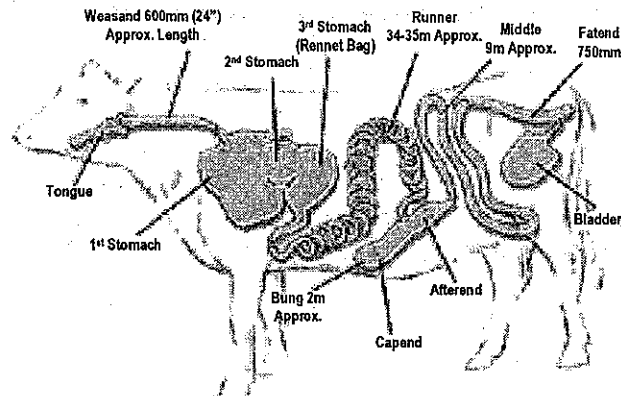
Sheep casings are the highest quality, small diameter casings used for the finest in sausages such as: bockwurst, frankfurters and port sausage. Tenderness and sufficient strength are combined in these casings to withstand the filling, cooking and smoking operations. Color varies according to country of origin and ranges from white to gray, but this variation does not indicate quality, strength, capability of smoke penetration, etc. Check with your casing supplier for the best casing origin that meets your requirements.

NOTE: All weights illustrated in charts are "Green Weights" and represent approximate stuffing capacity before cooking or smoking, per 91-meter lengths.

Table 2 Sheep Casing

Sheep Casing		
Caliber	Approx. Stuffing Capacity Before Cooking	Product Examples
16 – 18mm	15 – 16kg	Frankfurters, Beer Stix
18 – 20mm	17 – 18kg	Fresh Pork Sausages, Frankfurters
20 – 22mm	21 – 23kg	Fresh Pork Sausages, Frankfurters, Cabanosa
22 – 24mm	25 – 27kg	Frankfurters, Cabanosa, Chipolata
24 – 26mm	27 – 29kg	Frankfurters, Bockwurst, Cabanosa
26 – 28mm	29 – 31kg	Frankfurters, Bockwurst, Cabanosa
28mm/up	31 – 34kg	Frankfurters, Landjaeger

Natural Casing Products – Beef Casings



The three most used Beef Casings are: Beef Bung Caps, Beef Rounds and Beef Middles.

Beef Bung Caps are used for capocola, veal sausage, large bologna, Lebanon and cooked salami.

"Beef Rounds" derive their name from their characteristic "ring" or "round" shape. Beef Rounds are used for ring bologna, ring liver sausage, mettwurst, Polish sausage, blood sausage, kishka and holsteiner. Stuffing capacities indicated are approximate "Green Weights." Beef Rounds are measured into sets or bundles of 9, 18 and 30 meters.

Table 3 Beef Bung Caps

Beef Bung Caps		
Width	Length	Approx. Stuffing Capacity Before Cooking
76-89mm	46-51cm	2-1/2 - 2-3/4 kg
89-102mm	46-51cm	2-3/4 - 3 kg
102-114mm	46-51cm	3-1/4 - 3-1/2 kg
114-127mm	46-51cm	3-1/2 - 3-3/4 kg
127mm/up	46-51cm	4 kg / up

Table 4 Beef Rounds

Beef Rounds	
Average Approx. Diameter	Average Approx. Stuffing
35-38mm	30 kg
38-40mm	33-34 kg
40-43mm	36-37 kg
43-46mm	39-40 kg
46mm/up	41 kg / up

Beef Rounds

"Beef Middles" - can be used for Leona style sausage, all other types of bologna, dry and semi-dry cervelats, dry and cooked salami and veal sausage. beef Middles are measured in sets or bundles of 9 and 18 meters (29-30 feet and 57-60 feet) each.

Beef Middles can be sewn so that they have a uniform diameter and a uniform length, with or without a hanger (stitching loop).

Table 5 Beef Middles

Beef Middles	
Average Approx Diameter	Average Approx. Stuffing Capacity per 18-meter Set
45-50mm	29-32 kg
50-55mm	32-36 kg
55-60mm	36-41 kg
60-65mm	41-45 kg
65mm/up	45 kg +

"Beef Bladders" are the largest diameter casings from cattle: they are oval in shape and will hold from 2.5 to 6.5 kg (5 to 14 pounds) of sausage. They are used chiefly for minced specialty sausage and mortadella, either

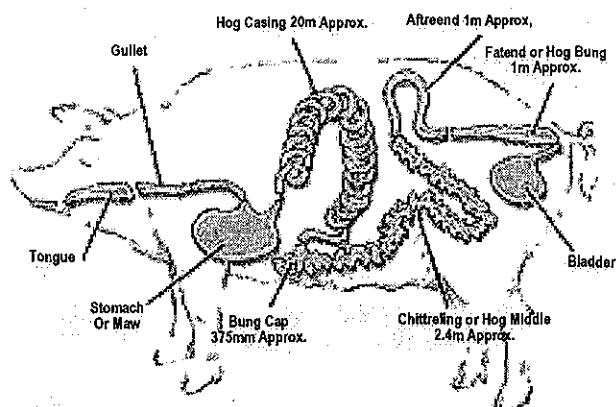
in their natural oval form, in square molds for sandwich slices, or in the flat, pear-shaped styles. There is no satisfactory substitute for quality beef bladders.

Wall thickness is largely determined by the amount of fat left on finished casing. Beef casings with a heavy textured wall will have some fat on the casing wall, while casings with thin texture will have virtually no fat.

Table 6 Beef Bladders

Beef Bladders			
Grade	Kind	Approx. Diameter	Approx. Stuffing Capacity Before Cooking
Extra Small -- 8 / down	Salted	130mm down Inflated	2-1/4 kg down
Small -- 8 / 10	Salted	130-162mm Inflated	2-1/4 - 3-1/4 kg
Medium -- 10 / 12	Salted	162-194mm Inflated	3-1/4 - 5 kg
Large -- 12 / up	Dried	194+ Over-Inflated	5 - 6 1/4 kg

Natural Casing Products - Hog Casings



Hog casings are used for cooked sausage, country style sausage, fresh pork sausage, pepperoni, Italian sausage, large frankfurters, kishka, kielbasa and bratwurst...to name just some of the best-selling items.

Hog casings are sold in "bundles" or "hanks." This unit of measure equals approximately 91 meters.

Hog Casings are also sold in bundles called "shorts." Shorts are 1 to 2 meter lengths and usually are classified as 35mm and up or 35mm and down. **NOTE:** "Green Weights" refers to the weight of a stuffed casing, prior to cooking or smoking, per 91-meter lengths.

Table 7 Hog Casings by Bundle or Hank

Hog Casings by Bundle or Hank		
Range of Diameter	Approximate Capacity/Bundle -- Green Weight.	Product Examples
30 mm/down	41 kg/down	Pork Sausage
30-32 mm	41-45 kg	Frankfurters, Italian Sausage
32-35 mm	48-52 kg	Pork Sausage, Bratwurst, Frankfurters, Italian Sausage
35-38 mm	52-57 kg	Smoked Sausage, Pepperoni, Bratwurst, Italian Sausage
38-42 mm	57-61 kg	Smoked Sausage, Kielbasa, Pepperoni, Rope Sausage
42-44 mm	59-64 kg	Smoked Sausage, Kielbasa, Pepperoni
44 mm/up	61-68 kg	Specialty Items

HOG BUNGS: Regular and Sewn, Hog Bungs & Hog Bung Ends

"Regular Hog Bungs" are sold as individual pieces and are used primarily for Liver Sausage and Branschweiger.

"Sewn (or Sewed) Hog Bungs" are produced in double-walled and single-walled varieties. All varieties are made by sewing two or more pieces of smaller sizes of regular hog bungs together

To obtain a larger, more uniform finished product, these casings are custom made and can be purchased in almost any shape or size suitable to the needs of the processors. Most of the products are used exclusively for liver sausage, Braunschweiger, Genoa or thuringer, summer sausage, and cervelats.

Table 8 Regular Hog Bungs or Fat Ends

Regular Hog Bungs or Fat Ends			
Caliber/ Size/Grade	Length (cm)	Stuffing Capacity	Product Examples
50-55mm	50cm	600-700g	Braunschweiger
55-60mm	50cm	800-900g	Braunschweiger
60-65mm	50cm	1000-1100g	Braunschweiger
65-70mm	55cm	1200-1300g	Braunschweiger
70-80mm	60cm	1500-1800g	Braunschweiger
Light Sow --75mm	60cm	1800-2200g	Liver Sausage
Normal Sow --80mm	60cm	2000-2500g	Liver Sausage
Heavy Sow --90mm	60cm	2500-3000g	Liver Sausage

Hog Middles/Chitterlings

"Hog Middles/Chitterlings" are put up in three calibers: wide, medium, or narrow. The size is determined by the location of the item within the animal. There are normally 9-10 one-meter pieces to a bundle. Hog Middles are easily recognizable by their curly appearance. Chitterlings are also available in 5mm calibers.

Table 9 Hog Middles/Chitterlings

Hog Middles/Chitterlings	
Sizes	Product Examples
Wide	Cooked Braunschweiler
Medium	Liver Sausage, Dry Salami
Narrow	Italian Salami (Frisses)

Table 10 Sewn Hog Bungs

Sewn Hog Bungs—Paper Lined, Beef Middle Lined, and Beef Bung End			
Width (mm)	Length (cm)	Approx. Stuffing Capacity	Product Examples
90mm	60cm	4 – 3¼ kg	Liver Sausage
100mm	60cm	3 – 3¼kg	Liver Sausage
110mm	60cm	4 – 4½kg	Liver Sausage

Table 11 Graded Hog Middles/Chitterlings

Hog Middles/Chitterlings are also available graded	
Sizes	Product Examples
45 – 50	Italian Salami (Frisses)
50 – 55	Liver Sausage, Dry Salami
55 – 60	Liver Sausage, Dry Salami
60 – 65	Cook Braunschweiler
65 – 70	Cooked Braunschweiler
70+	Cooked Braunschweiler

Table 12 Double Wall Genoa Sacs

Double Wall Genoa Sacs			
89-95mm	25cm	2¼ - 2½kg	Genoa Salami
83 - 102mm	25cm	2½ - 2¾kg	Genoa Salami
Single Wall/Double Wall Hog Bungs or Beef Middles			
89 - 102mm	76 - 81cm	4 - 4½kg	Thuringer, Summer
76 - 89mm	76 - 81cm	3 - 3½kg	Thuringer, Summer
64 - 76mm	76 - 81cm	2½ - 2¾kg	Thuringer, Summer

Laminated Casings

Laminated Casings are mainly used for dry or semi-dry sausage and may also be used for cooked deli products.

Pieces of hog casings or sheep casings are cut open and laminated on a form or mold. This sausage-shaped mold may be made to accommodate a variety of calibers. During the processing operation, high temperatures are used to eliminate any bacterial growth. The natural binding quality of the casing protein causes coagulation. After cooling, the casings are removed from the form or mold.

If desired, various nettings may be applied on the casings during processing. These tend to enhance appearance and serve to allow the hanging of these sausage products for easy display.

Table 13 Laminated Casings

Laminated Casings		
Diameter (mm)	Max. Length (cm)	Approx. Stuffing Weight (grams)
42mm	30cm	275 g
45mm	50cm	320 g
48mm	25cm	410 g
52mm	50cm	550 g

Continued on next page

58mm	50cm	680 g
65mm	50cm	1400 g
70mm	50cm	1800 g
78mm	50cm	1650 g
85mm	50cm	2000 g
90mm	60cm	2400 g
95mm	60cm	2900 g
105mm	60cm	3300 g
110mm	50cm	4400 g
115mm	50cm	4800 g
130mm	50cm	5800 g
135mm	50cm	6200 g
45 / 62mm	42cm	900 g
48 / 82mm	55cm	1800 g
65 / 90mm	60cm	2700 g
65 / 100mm	60cm	3200 g

Handling Casings

Today, casing recovery, most often done in large slaughtering facilities, are both a precise science and an elaborate process. It requires high-level expertise, state-of-the-art machinery, and maximum sanitation and quality control procedures.

As the intrinsic value of the raw material represents a large part of the finished casing product, every inch of tract needs to be utilized. In the slaughterhouse, the viscera of each animal are removed, and the various parts of the intestinal tract are separated. This separation of parts is instrumental in creating a variety of products ranging all the way from pig chitterlings to sheep appendixes for pharmaceutical products.

The casings are prepared for the removal of manure, mucosca (raw material for the anticoagulant "heparin") and any undesirable elements such as fat, threads, and animal fluids. This removal, facilitated in a series of both hot and cold-water soaks, is accomplished by machine crushing under close "hands-on/eyes-on" scrutiny.

The fully cleaned casings are placed in a saturated salt environment to prepare for further processing. The casings are then sorted into various grades and diameters. The selection process is dictated by such factors as type of animal, criteria set by the casing processor, and ultimately the sausage producers.

Measuring Casings - After selection, all casings are carefully measured, either by machine or by hand. Regardless of measurement method, both must be accurate since the measured unit becomes the sales pricing criterion.

Hog casings and sheep casings are prepared in 91-meter (100 yard) hanks or bundles. Beef casings, if not sold by the piece, are sold in 18-30 meter bundles for beef rounds, and 9-18 meter sets for beef middles.

Determining Quality - Quality is determined in several precise and labor-intensive ways.

In sheep, for example, an "A" quality casing is determined during selection, and is defined as a casing with no holes or weakness. This casing can be used for the finest frankfurter emulsion. "B" quality casings are of acceptable strength and quality for coarse ground emulsions such as those used in pork sausage.

With beef casings, the term "Export Quality" is sometimes used. This term describes casings as free of nodules (pimples) or scores (windows).

With hog casings, there is a single quality standard with several specifications for length. Where the various hog casings originate from—taking into consideration factors of species, climate, and diet—will generally determine the different characteristics of the casings. Some will be "white" or virtually transparent/clear; others will be darker and more opaque and will have more visible veining. These characteristics also have an effect on the tenderness or "bite" of the casing.

Clear hog casings are generally used for fresh products. Thicker and stronger casings such as Chinese hog casings are generally best suited for smoked products, because these casings better withstand the smoking process and because casing appearance is not as critical a selling feature, due to the smoking process itself.

Test Procedures - The traditional methods for grading and testing natural casings are: water testing for sheep and hog casings, and air testing for beef casings.

The casings are appropriately filled with water or air and periodically expanded under pressure, to check for size and quality. The casings are then cut to final sizes and quality specifications are confirmed during quality control.

Shipping Casings - Casings are prepared and preserved in various forms for shipping to the sausage makers. Some examples include:

- **Dry Salt Pack:** Excess moisture is removed for semi-dry state. This is usually appropriate for long distance travel or prolonged storage at ambient temperatures.
- **Slush or Preflushed Packed:** In this convenient form, casings are very soft and flexible and do not require flushing prior to use.
- **Pre-tubed Casings:** Each strand is shirred on a tube to allow one-step loading of the casing directly on the sausage filling horn—without the need for flushing—by the processor.

Casings should be stored in a controlled, cool environment. Special care should be taken to avoid excessive heat. A neutral temperature of 40-50° F (4-10° C) is ideal.

Drying & Moisturizing

Principles of Drying & Moisturizing - Once the product has been stuffed and moved into the smokehouse, the initial critical steps of drying and smoke application must be monitored very carefully. Before smoke is applied, the casing should be dried to the point where it is tacky.

- If the casing is not sufficiently dried, the smoke will penetrate the casing and will be deposited on the meat surface, thereby permitting casing separation and causing a pale, dull appearance.
- If the sausage casing is over dried, the smoke will essentially be deposited only on the outside surface with very little flavor penetration.

Tenderness of animal casings varies. Sheep casings, which are used for small diameter products, are the most tender and should be handled very carefully.

Making Sausage

Preparing the Casings - There are four basic steps to preparing casings for stuffing.

Salted:

1. Salt is rinsed from casings with fresh water.
2. Casings are softened by soaking in fresh water at room temperature (approximately 70° F for 45 minutes to 1 hour. Hanks are placed in water and are gently hand massaged to separate the strands and prevent dry spots which may adversely affect the stuffing process.
3. Casings are then moved to a stuffing table and placed in bath of fresh water. This water should be warmer to render a little of the natural fat in the casing. This will help to allow the casing to slide from the stuffing horn more readily.
4. The casings are pre-flushed by introducing water into the casings and allowing it to run through them in order to facilitate getting the casing onto the filling horn and moving the casing smoothly during the filling process.

Pre-Flushed In Slush:

Somewhat less labor and time is required before stuffing, but all four steps should be followed.

Pre-Flushed Wet Pack

Goods are packed in brine with lesser amounts of salt. Only steps 3 and 4 are required. Pre-tubed goods (casings on plastic tubes to speed production) usually come this way. A charge of water may be required for tubed goods after they are on the stuffing horn; this is done using a horn made specifically for that purpose.

Pre-Flushed In Solution:

No soaking time is required. Only steps 3 and 4 need to be performed. Casings packed this way are more prone to damage in shipping or from temperature changes. These casings should be purchased in smaller amounts—usually a 2- to 3-month supply, although they can be kept longer. Barrels should be carefully inspected, with leakers used first, employing steps 3 and 4.

Mechanical Applications

While somewhat more expensive due to up-front labor, pre-flushed and pre-tubed casings (shirred onto a plastic tube and ready for the stuffer) are also available. As with all casings, these should at least be rinsed before use.

It is always a good idea to compare costs involved in preparing a casing for stuffing before you decide whether or not to use pre-flushed or pre-tubed casings. You might also want to explore pre-tubing on reusable stainless pipes in your own casing operation, thereby saving time at the stuffer, and allowing the stuffing process to run more efficiently, which typically results in higher productivity and better return-on-investment.

A Word or Two on "Whiskering"

"Whiskers" are the capillaries that hold the intestine in the fat and provide a flow of blood to the intestine. When removing the intestine with a knife, the capillary is not completely removed, creating a hair-like appearance on the surface of the casing. After cooking, these whiskers generally disappear.

Preparing to Stuff Casing

In general, all casings can be handled in essentially the same manner; however, there are a few intrinsic variations. For example, beef casings, being more fleshy, can withstand more soaking and warmer water than sheep casings.

Beef Rounds:

Beef rounds should be soaked overnight in cold water. Then, thirty minutes before use, they are put in 100° F water.

Hog Casings:

Hog casings are first rinsed with fresh water. They then are soaked in 85-90° F water for at least thirty minutes prior to use; it is also typical to soak them over night.

Sheep Casings:

Sheep casings are first rinsed with fresh water. They then are soaked in 85-90° F water for thirty minutes prior to use.

