The formula for the perfect burger – part 1

by the technical team, Provisur Technologies, USA.

Premium hamburgers are more popular today than ever before. Nearly every restaurant, from QSR to white tablecloth, has a premium burger offering. Some are big mega-burgers and some are small mini burgers, but there is clearly an emphasis on premium burgers in the market today.

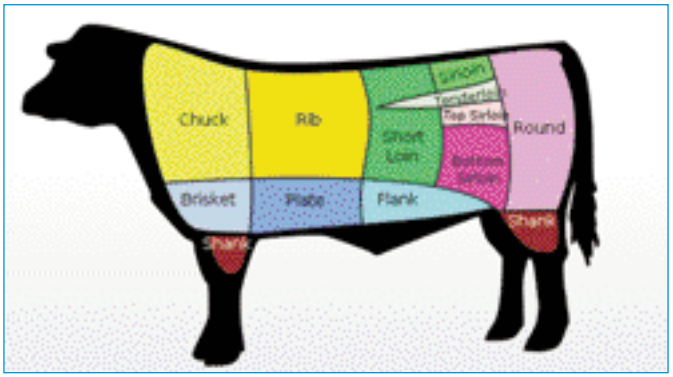
It is also fair to say that the definition of a 'premium' burger is changing. Five years ago, a 'premium' burger was simply a standard burger with premium toppings or a patty on a premium bun. Today's premium burgers are more focused on the meat of the burger itself: Angus, Kobe, Sirloin and Chuck. That is why premium burgers start with a premium process.

The process that transforms the product from raw materials to formed product is also more important now than ever before. It begins with the selection of the correct raw materials and every step in the process is essential in making a really great burger.

The 'perfect burger' can mean many different things to different people. At Provisur Technologies, the word 'perfect' means maximising the quality of the meat matrix to add value to the product mix and improve profitability.

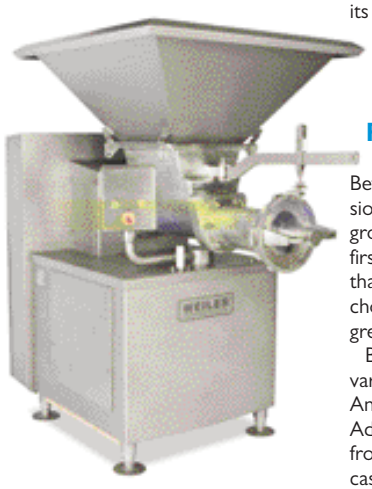
The advanced systems of Provisur Technologies and their family of proven brands are specifically designed to help processors produce the premium products their customers demand every day.

The superior mixing and grinding equipment from Weiler, the unmatched bone and hard tissue removal of Beehive and the precision forming equipment from Formax work together to elevate the quality of the raw materials and produce the 'perfect burger'.



Beef may be sourced from various locations on the carcase.

This article starts at the beginning with a look at mixing, grinding and bone/hard tissue removal. Part two will complete the process with how to choose the correct forming and filling system for your product. Part two will also look at the HomeStyle Patty System (HPS) and discuss how its use can help develop higher margin products with better product appearance and appeal.



Grinding equipment.

Product preparation

Before we can even begin a discussion about the best practices in ground beef processing, we must first determine the raw materials that will be used and why. The choices made at this point will greatly affect our final results.

Beef may be sourced from a wide variety of cattle breeds, including Angus, Cebu, Holstein or Hereford. Additionally, beef may be sourced from various locations on the carcase displaying different lean points.

These whole muscle cuts and trims include chuck, flank and round, to name a few. Other common raw materials include partially defatted beef tissue, often referred to as SLBT, BLBT or FRB.

Beef will come into the process in a fresh or frozen state. Frozen products may be tempered to various levels and may or may not be pre-broken. So, it is important to know that freezing processes and storage conditions have a significant impact on the quality of frozen beef as a raw material.

A great deal of the variation in the quality of the ground beef is attributable to the raw materials and is not directly affected by the equipment or processes used to convert the raw material into ground beef. Still, for any given quality level, raw materials must be managed to limit the variability associated with the raw materials utilised. In all cases, the key to consistency in the finished product is consistent raw material selection and preparation.

General practices

Temperature is critical in grinding and mixing operations. As a general rule, the temperature of the raw materials in the grinding of fresh beef components should be as close as possible to, but not exceeding, the freezing point of the beef. Fresh components should be used as close to the primary process date as possible.

Frozen components should be stored at 0°F (-18°C) or below for the minimum time possible, such that the temperature fluctuation of the freezer should be minimised.

Maintenance factors

Properly maintained equipment, especially grinding equipment is critical to best practices for ground beef.

As with all equipment, general maintenance schedules should be followed. In the grinding operation, special attention must be given to:

- Plate sharpness and thickness tolerances.
- Head spacing.
- Spring tension.
- Pin, bushing and flute wear.
- Feedscrew condition and tolerances.
- Product contact surfaces.

When parts are overly worn, or tolerances are exceeded, there are the additional risks of:

- Product contamination.
- Inconsistent particle strand length.
- Fat/lean separation.
- Product degradation resulting from improper cutting action, loss of water-holding capacity, cook-yield loss and a generally poor ground appearance.

Pre-grinding

In almost all ground beef processes, pre-grinding is a common practice. The concept of pre-grinding is to reduce raw materials (whole muscle meats, substitute cuts and trim) to a size that will facilitate blending into a homogenous mass. Masses of pre-ground meat can then be sampled for lean point content and because the individual masses are now homogenous, the lean point will be representative of the entire amount of product in the blender/mixer.

The single most important concept in pre-grinding is determining the size of the hole-plate to be used. Provisur recommend using the largest hole-plate possible to accomplish the desired outcome. This would normally be a 19mm plate. The main reason for a larger pre-

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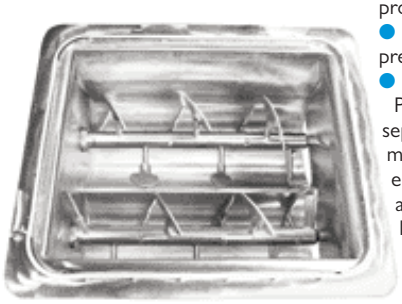
grind particle size is to reduce the exposed surface area of the particle itself.

Product ground through a 6mm hole-plate has 240% more exposed surface area than product ground through a 19mm hole-plate. This is significant because the smaller hole sizes increase the amount of meat-to-machine surface contact and the amount of meat-to-meat surface contact.

In extreme cases, the interaction of meat-to-machine or meat-to-meat contact results in fat-lean separation, abnormal temperature rise and even particle tearing. This interaction occurs in the transfer equipment or in the mixer/blender.

As with all grinding applications, the in-feed rate should match as closely as possible with the actual



Rotating paddles.

grind rate of the grinder. For example, if the output of a grinder is 363kg/minute, it would be appropriate to meter product to that grinder at a rate very close to 363kg/minute. This helps prevent the raw material from being subjected to unnecessary agitation and mechanical energy.

Hard tissue elimination at the final grinder is also enhanced by a larger particle being presented to the final grinder hole-plate. This is important because the bone or hard tissue is in a larger dimension and thus it resists entrance to the smaller hole at the final grind plate. The resistance allows time for the particle to migrate to the centre of the plate and be excluded from the main stream of the ground material.

Because pre-grinding involves large plate-hole sizes, hard tissue elimination is not effective at the pre-grind stage. Generally plate-hole sizes larger than 5mm are not effective. So, in effect, the larger the plate-hole size, the less effective the hard tissue elimination process.

Additionally, larger particle sizes allow for more efficient movement through the material handling equipment and facilitate more positive displacement through the final grinder.

Hard frozen blocks of whole muscle beef, beef trimmings, and blocks of partially defatted beef tissue (LFTB, SLBT, FRB, etc) are commonly utilised in the ground beef process. This is best accomplished in a robust grinder that can handle the high torque loads created by grinding meat at 0˚F (-18˚C). The grinder should efficiently break the blocks into smaller portions, which can then be presented to grinder head and plate.

For premium ground beef, a grinder should be utilised in this process instead of an extruder, because the cutting knives in the grinder reduce the high pressures created at the plate. In every case, the grinding process should be accomplished with the lowest amount of pressure build up and the lowest possible temperature rise.

Pre-mixing/pre-blending

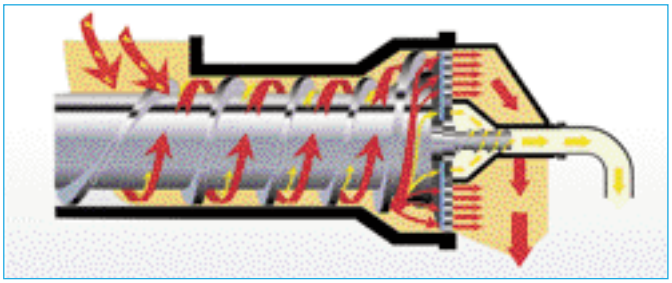
There are generally two methods practiced in the ground beef process:

- Pre-mixing/pre-blending (a true pre-blend).
- Pre-batch process.

Pre-blending requires at least two separate mixer/blenders. Each mixer/blender will contain a different lean point in order to make up a final mix of the two independent lean points for achieving a final desired lean point during the final mix/blend process.

The pre-batch process creates the final lean point in the initial mixer and then discharges the product to a final grinder with the appropriate lean point. Regardless of the pre-blending method of choice, the amount of mechanical energy applied to the raw materials must be minimised. Therefore:

- All product contact surfaces of the mixing equipment must be highly polished in order to reduce the effects of friction resulting from meat-to-equipment-surface contact.
- An overlapping and counter-rotating paddle configuration and an unload screw are advised. This ensures a homogenous mix with the least amount of mechanical energy transfer to the meat mass in the least amount of time. The design also maximises mixer/blender performance and makes an important contribution to a better patty.
- The RPM of the paddles should



Balanced flow arrows.

be kept to a minimum. An RPM of 13 has shown to be most efficient with the above mentioned design criteria. The total mix time (including chill time if appropriate) should not exceed three minutes. The paddles should only jog to level the meat mass while filling. The mix/chill time is initiated after the mixer/blender receives the entire batch.

- The mixing/blending system should quickly and efficiently discharge the contents of the mixer.

This is best accomplished with an unload screw rather than trying to discharge with paddles or ribbons through small doors. The system should transfer the meat from the mixer/blender to upstream equipment at a rate of approximately 816kg/minute.

Final mixing/blending

The purpose of final mixing/blending is to combine the contents of the pre-blenders/mixers containing pre-ground meats of known fat content and achieve a homogenous mix at the desired lean-point.

The same equipment requirements described for pre-blending similarly apply to the final mixer/blender: polished surfaces, overlapping-counter rotating paddles, low RPM and positive unloading achieved with an unload screw.

Total mix times should not exceed three minutes in order to avoid overworking the meat, as discussed previously. In most applications, there are requirements for chilling in the final mixer/blender. The exception is when sufficient frozen material is added to the mix to control the temperature. Bottom injection of liquid carbon dioxide or liquid nitrogen is the most efficient means to accomplish the chilling of the meat. Cooling requirements are best determined by monitoring amp loads in the equipment as current thermocouples do not have the reaction time to respond quickly enough to this chilling process.

The homogeneity of the batch is critical to assuring the proper lean-point is obtained in each patty, chub or tray as the beef reaches its final state. The standard deviation within the batch should not exceed 0.24% fat in the final mixer/blender. The batch is ready to move to the grinder once the batch is:

- Homogenous.
- Has the desired lean-point.
- Is at the proper temperature for the subsequent process.

The equipment for the final grind may be a stand-alone grinder, a mixer/grinder or a grinder with a large hopper and agitator.

Final grinding

The purpose of the final grinder is to reduce the particle size to the desired dimension. This may be anywhere from 1.6mm to 5mm and in certain applications even larger.

The innovative Dominator Series of grinders from Provisur Technologies/Weiler features balanced flow technology that improves product quality, increases grind rates, maximises bone and hard tissue removal and reduces operating costs.

Balanced flow is critical in the final grinding process. The volume of

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Table 1. Product quality troubleshooting guide for grinding.

Problem	Probable cause	Remedy
Low output	Loose ring or improperly assembled	Tighten ring. If ring wobbles during grinding, inspect threads on ring and head
	Knife inserts worn or dull	Change inserts if they are worn. Check flatness of knife holder blades if insert wear is uneven
	Dull plate and/or thickness work excessively	Sharpen plate, reverse to sharp side, or replace
Poor particle definition	Wrong feedscrew configuration, RPM, plate hole size, plate blockage	Same as low output. Consult the Provisur Technologies/Weiler service group
Excessive temperature rise	Plate holes too small, RPM too fast, product overworking or overmixing	Inspect knife and plate condition. Larger plate holes may reduce temperature rise. Consult the Provisur Technologies/Weiler service group

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meat presented to the grinding plate by the feedscrew should always balance with the grind rate through the grinder. More than 95% of the meat should pass through the grinding plate on the first pass (>95% efficiency). Thus, the grinder selected for processing the raw product should be in excess of 95% efficient.

High efficiency:

- Minimises roll-back in the head.
- Ensures uniform cutting of the strands.
- Produces less fat/lean separation, lower pressure at the plate, less temperature rise.
- Allows for optimum hard-tissue elimination.

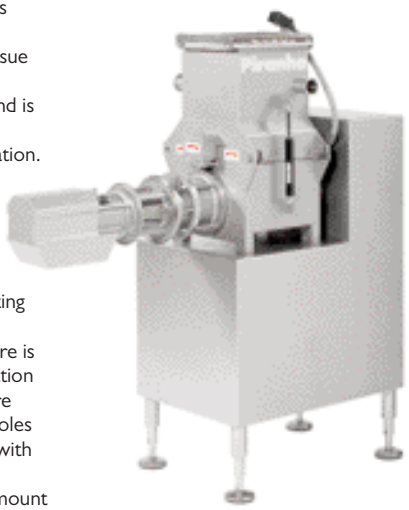
A key element of the final grind is hard tissue elimination (bone removal) in a continuous operation.

An efficient hard-tissue elimination process will not be interrupted by pauses i.e. air actuated valves or intermittent flow interruptions of any kind.

The key to success is preventing hard tissue from accumulating behind the grinding plate. If there is too much hard tissue accumulation on the system, it becomes more likely the tissue will enter the holes in the plate and be discharged with the ground beef.

Furthermore, an excessive amount of hard tissue accumulation behind the plate will lower the output of the grinder because it effectively blocks the holes. This can result in the blades being forced away from the plate – impairing the cutting action and increasing the risk of a temperature rise, unsatisfactory fat/lean separation and poor particle definition.

Another important design feature of Dominator technology is Weiler's design of the grinder's plate, auger and cone which allow bone and hard tissue to migrate easily to large, contoured removal ports in the centre of the plate – further maintaining optimal output.



The Piranha Desinewer/filter.

In order to maximise the efficiency of the bone and hard tissue removal process, we recommend that extraction take place early in the production cycle rather than later.

Some final grinding systems, that are less advanced, will remove only very small amounts of this material and discard the material at the end. Obviously this has a negative impact on the quality of the finished patty. With Dominator technology from Weiler and the meat recovery capabilities of the Piranha desinewer/filter from Beehive, processors can remove a higher volume of quality product from the grinding system and still enjoy higher overall yields.

The Piranha facilitates the recovery of the highest percentage of ground meat from the bone collection system, resulting in a total yield of over 99%.

Care in transporting materials is also crucial because the final ground product has such a high surface area as compared to pre-ground material. Low impact methods that reduce meat-to-equipment and meat-to-meat interactions are recommended. Because meat carts, vats, combos and belt type conveyors have very little affect on the material, they are the preferred means of material handling after the final grind. Other methods for product movement can increase friction and have a negative effect on the product. These include vacuum transfer in pipes, positive displacement pumps and screw conveyors.

Conclusion

Utilising the above procedures and practices will result in ground beef with optimum quality with the desired characteristics and texture for forming.

Close adherence to the practices will yield a consistent product batch after batch. Each of these critical points needs to be observed for optimum ground beef production.

After the proper materials have been selected, properly mixed and ground, we move to the forming process. This will be covered in part two of the article in the next issue of International Meat Topics.

The selection of the correct forming machine and filling system will further maximise the quality of the raw materials. Just as improper product preparation can adversely affect the quality of the raw materials, the choice of the wrong forming machine or filling system can cause premium materials to produce an inferior quality formed portion. ■