

The key advantages of forming whole muscle products



by Tom Tonra, product manager, forming, Provisur Technologies.

Processors throughout the world are always looking for ways to provide their customers with high quality products in a cost effective manner. Increasingly, meat and poultry processors are looking to get more value out of the high quality trim generated during the primary cut process.

At present, protein processors currently use a variety of methods for portion sizing, including:

- Hand cutting.
- Water jet cutting.
- Whole muscle forming.

There are key advantages to forming whole muscle products versus producing cut muscle pieces. First of all, further processing allows processors to do a more effective job of removing bone and hard tissue. Further processing improves the consistency of the bite and leads to optimum customer satisfaction with every portion.

Advantage number two is the measurable difference in portion size and weight control ($\pm 0.5\%$). Animals naturally vary in size and shape, and formed products afford meat and poultry processors the luxury of ensuring they can offer very consistent portions that please customers with better bun coverage and optimum eye appeal.

Consistent cooking and the related food safety concerns also favour whole muscle formed products. Exacting portion thickness allows the portion to cook far more evenly and consistently, making this product type the perfect choice for the food service industry.

By forming a whole muscle product, cooking and food safety concerns are minimised. Individual portions can be custom designed to have a common flat and/or 3-D profiles. And the even thickness of the portions ensures the product will cook more evenly

and retain more of its original juiciness throughout.

To produce a truly premium, whole muscle product it is important to follow each step in the process to maintain whole muscle integrity. Each step is easily repeatable and works consistently every time. These steps include:

- Proper product preparation.
- Proper machinery design and settings.
- Proper fill system/tooling design.

Proper product preparation

In order to produce a superior formed product with natural texture, begin with large, whole pieces in the product mix. In order to protect the product's texture, the individual pieces must be handled gently from the very start.

It is not realistic to expect forming equipment to restore the product's original texture if muscle integrity is damaged at any stage. Although there are different binders available to bind the pieces together, it is never possible for a damaged product to offer a true whole muscle bite or appearance. High quality, whole muscle product batches require a minimum of 80% whole muscle pieces and the appropriate mix of trim pieces.

With every 1% of trim added, it is correct to say the whole muscle integrity suffers. One of the most important considerations in whole muscle forming is the muscle pieces must be sized appropriately to the final formed portion.

There is no advantage in forming an 11g portion using a 200g muscle piece. To the contrary, it is a disadvantage. If muscle piece size reductions are not controlled during product preparation, the results will be unacceptable as the muscle pieces cannot be properly size reduced in the former. It is much better to control the size of the mus-

cle pieces in the product mix from the very beginning of the process.

Marinades and blending

In addition to the flavour added benefits of marination, the properties of the marinade also help to bind the muscle pieces together. Every marinade recipe is unique and should be treated individually. Marinade infusions should be at least 3% of the product volume and no more than 15% of the mix. When the percentage of marinade is too low, it presents the risk the product will not be properly flavoured or the muscle pieces will be incorrectly bound. If the percentage is too high, it may be impossible for the muscle pieces to absorb the flavouring properly, resulting in product inconsistencies.

Several different methods are available for properly blending the product and infusing the marinade. Clearly, processors must be able to apply vacuum, as well as chill, the raw material. The blending process must be gentle enough to maintain muscle integrity, and the choices include:

- Vacuum tumblers.
- Ribbon and paddle blenders.
- Mixers/blenders.

When selecting a technology, seek out the blending option resulting in the least negative impact to the muscle. The proper choice is vacuum during tumbling.

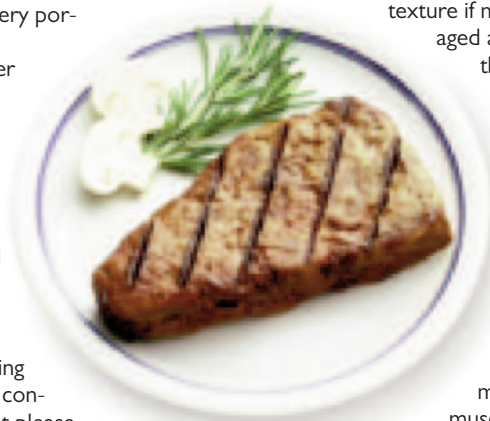
Product temperature

During the initial stages of preparation, maintaining the appropriate product temperature is critical. If muscle pieces are too cold or frozen, the marinade will not be easily absorbed by the muscle in the desired amount.

Moreover, an improperly chilled product is problematic because it increases mixing cycle times plus challenges muscle integrity. Experimentation shows the proper temperature range should be between 34-38°F.

Depending on the batch size and the amount of marinade infused, a period of 20-

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30 minutes is required to properly absorb the marinade under a good vacuum. Pulling a good vacuum demands an air tight drum seal. This is essential because if proper vacuum cannot be achieved, no amount of tumbling will properly infuse the marinade.

After the marinade has been thoroughly absorbed, the next critical step is the chilling process, as the whole muscle pieces will consist of different sizes and thickness. Proper chilling of the mix produces a more uniform temperature and texture, resulting in a more consistent, formed portion.

The target temperature for this step is 24-26°F. To ensure these temperatures are reached, the normal chilling cycle should be 8-12 minutes. When the muscle pieces are extremely large, alternating the chilling and vacuum cycles increases efficiency.

A post chill vacuum is also required from 8-10 minutes in order to disperse the chilling gases and improve temperature and texture consistency.

This step is often omitted, which results in inconsistent performance. Ignoring this step will result in an increase in holes and voids in the finished product, as well as inconsistent portion weights.

The target temperature at the end of the product preparation process should be 26-28°F. A properly prepared mix will result in a moist, tacky surface, with a minimal amount of free moisture. The muscle pieces should be moderately pliable.

Regular temperature monitoring is a must as temperature is an effective measurement of the product viscosity or resistance to movement. When a product is too cold, it is difficult to feed it through the former, and you will usually see a whiter appearance in the muscle coming out of the tumbler.

When the product is too warm, the muscle pieces may not properly hold the marinade, resulting in inconsistent formed portion texture and losses in yield.

The forming process

Formax forming systems are industry-leading due to their flexibility and consistent performance. By incorporating a Formax, the formed portions will be of identical sizes, shapes and weights every time. The higher flexibility of their formers translates into maximum productivity and lower ownership costs because the systems can be utilised for different products shift after shift.

As such, you can form whole muscle products in the morning and ground or emulsified products in the afternoon. Changeovers take just minutes to complete.

Formax forming systems, including the Maxum700, Ultra26 and NovaMax500, have greatly evolved in their ability to provide operators with the controls that are required for each step. Their mission has always been to form products with the least amount of quality degradation possible.

In today's systems, it is the innovations the

human eye does not see that truly make a difference in providing natural, whole muscle texture. The product path through the machine is one example.

Engineers have adjusted, refined and incorporated new technologies to minimise additional product blending and particle size reduction.

The feed screws deliver product to the fill area where the plunger(s) initiates the act of forming, and proper feed screw rotation is essential to the final product quality. The feed screw settings must be correct in both the amount of rotation and timing of the filling cycle to prevent undesired affects:

- Too much feed screw rotation will result in the product being 'over-worked' and muscle pieces becoming irregularly reduced in size.
- If the rotation timing is out of sync with the forming machine, the product will be pushed against the solid face of the filling chamber, resulting in damage and irregular muscle size reduction.

The filling process must also be correctly timed and the plates properly aligned. When product arrives at the filling area, the mix is moved to the individual mould plate cavities. At this point, the cavity can only be filled when the mould plate and fill plate are properly aligned.

Any attempt to fill the cavities when the mould plate and fill opening are not aligned will result in the product extruding through any clearances in the mould plates and resulting in excessive leakage.

Touchscreen control has become a major advantage in today's Formax Forming systems. It provides the ability to:

- Adjust many machine functions on the fly.
- Fine-tune adjustments for many product types.
- Store 100 product codes or more for specialized applications.

Individual product codes allow for adjusting fill timing, feed screw rotation, machine speed and filling pressure – which complements the system's flexibility and performance in a major way.

Formax Formers are designed to meet customer demand throughout the world, the touchscreen displays can be programmed in a variety of languages to make adjustments more easily.

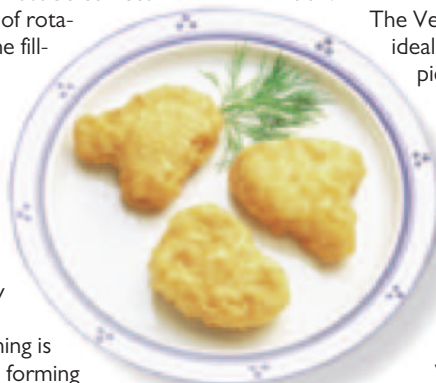
Proper fill system

At Formax the product determines the fill method and there are a multitude of fill methods available. The common fill methods for whole muscle forming are Standard Fill, Verti-Form and Port-Fill. These leading systems offer specific advantages for differ-

ent product mixes, both whole muscle and ground.

Standard Fill is most commonly used for ground or emulsified products. Most Formax customers choose the Standard Fill for 'economy' products, where muscle-particle identification is not required.

The narrow fill opening, or slot, is too narrow for large-muscle pieces to pass through the system easily. This is why Standard Fill cannot be used with large muscle pieces as it can result in excessive particle size reduction.



The Verti-Form filling system is ideal for trim or smaller muscle pieces. It produces a vertical filling process designed to automatically match up the mould plate cavity shape with the fill-plate opening. True Verti-Form fill allows product to pass quickly into the mould plate cavity with a minimal amount of restriction.

Verti-Form was specifically designed to produce smaller portions, such as nuggets, fingers, tenders or filets that originate with size reduced muscle pieces. When large muscle pieces are required in the forming batch, Verti-Form is not recommended as the system can expose the larger muscle pieces to more than one fill port at a time.

This use will result in irregularly sized muscle pieces. Whenever the target product is a whole muscle breast portion utilising large muscle pieces, the Port Fill system is recommended.

As a variation of Verti-Form, the Port-Fill filling system is specifically designed for larger whole muscle pieces. The Port-Fill system is different because it repositions the filling ports and adds an inset that directs the product into the mould plate cavity.

This design ensures the least amount of muscle integrity degradation. A properly prepared and formed product, using the Port-Fill filling system, will leave the larger muscle pieces visible in the finished product with little to no emulsification.

Tooling design

The tooling design determines much more than the size and shape of the finished portion. Tooling determines the product's cooking and freezing times. The design of your mould plates say a great deal about your products' quality as the shapes they produce ultimately create the right impression in the customers' eyes.

Formax offers the industry's widest range of tooling options for global processors. There are special designs, like the tooling used for conventional nuggets or fingers, which create portions that are flat on the top and bottom with sharp edges. There is

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also highly accurate, custom tooling for larger portions, such as whole muscle patties with a topographical shape.

Forming pressure

Clearly, the most debated topic surrounding whole muscle forming is determining the amount of forming pressure required to ensure the product's natural texture and quality. The questions are:

- What is the proper pressure for whole muscle products?
- How does pressure relate to a product's texture and bite?

Answering these questions makes it essential to understand the role forming pressure plays in the process itself. Forming pressure is a measurement of the product's resistance to flow or movement.

This is why the correct forming pressure is always the minimum amount required to completely fill the mould plate cavities. This level is primarily determined by the individual product mix or batch.

The three factors in determining forming pressure are:

- Product formulation.
- Product temperature.
- Fill method.

A product's temperature provides the processor with the critical data that is required for determining a mix's viscosity or resistance to flow.

By monitoring product temperature, it is easy to determine whether the moisture in the product is in a solid or liquid state (frozen or unfrozen). The following factors should also be taken into account:

- Depending on the composition of the marinade, a reading of 32°F may or may not be the point at which this moisture freezes.
- Salt is the one ingredient that can change the freezing point of a liquid. The freezing point of a product can change significantly by adding even a few percentage points of salt.

What is the correct forming pressure for your individual products? How does the forming pressure affect the natural texture and overall bite of the product?



Formax recommends starting with the minimum amount of filling pressure, and then slowly increasing the amount of pressure until the mould cavities fill properly. Individual pressure requirements may change from hour to hour and batch to batch. But newer forming systems not only make these adjustments easier, they elevate the level of operator control over individual products. Forming pressure does not determine the weight of formed portions. The true weight of the individual portions is determined by the volume of the mould plate cavity multiplied by the density of the product. When the mould plate cavity is filled, any increase in the forming pressure does not make the portion heavier.

However, too much pressure will increase the amount of raised or ragged edges as well as product leakage. Proper forming pressure is the minimum amount of pressure required to fill the mould plate cavity.

Conclusion

At a time when new innovations and technologies have transformed the process of whole muscle forming, Formax leads the world in helping customers enjoy a higher level of quality. It is the result of gaining more than 30 years of experience combined with innovative, state-of-the-art technologies designed for:

- Superior texture that satisfies customers' desire for the great taste, value and nutrition of poultry.

- Unprecedented productivity, flexibility and portion control, opening the way to produce chicken, beef, pork and other products with easy changeovers between shifts.

Their newest forming systems make it possible to form whole muscle portions with similar quality and texture as cut muscle.

The secret to whole muscle forming is unwavering consistency at every step:

- Proper product preparation.
- Machinery settings.
- Fill system selection.
- Tooling design.
- Proper filling pressure.

Processors of whole muscle products can now be more profitable and exceed the expectations of their customers with consistent portion sizes, shapes, texture and taste. ■

The key steps to forming whole muscle product.

- Rule 1: Start with whole muscle meat.
- Rule 2: Inconsistent muscle piece sizing leads to inconsistent portion texture.
- Rule 3: Marinate and blend product according to established guidelines.
- Rule 4: Measure temperatures for consistent performance.
- Rule 5: When it comes to performance, timing and touchscreen technology are everything.