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# The world of beef processing

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# Take the guesswork out of processing

**In today's global marketplace, beef processing companies are often facing low-profit margins due to fluctuating supply from farmers on one side and pressure from influential retailers and consumers on the other.**

Beef companies are thus increasingly looking for smarter ways to compensate for diminishing labor supply and increasing costs of raw materials. Likewise, they also search for methods to meet consumer demands for higher quality products and diversity in a timely and cost-effective manner.

Answers to smart processing and meeting consumer demands lie in automation and efficiently controlling, monitoring and measuring virtually every aspect of their shop-floor operations from slaughtering to packing.

Factors such as data management and improving efficiency have increased focus on key performance indicators (KPIs), monitoring how effectively their plant is running e.g.

- Yield / Throughput
- Control / Traceability
- Food Quality / Safety
- Flexibility / Cost efficiency

## **Yield management**

The yield has a significant and direct impact on the bottom line, making it one of the most critical KPIs in fresh meat processing. The cost structure of the beef processing industry means 65–75% of a final product costs stem from raw materials.

Any inaccuracies in processes throughout the value chain (e.g. deboning, weighing or packing) can add up to significant losses every day.

Depending on production volumes, even small fluctuations in giveaway can result in substantial product and profit losses.

## **Food quality and safety**

Food quality and safety are two critical issues in beef processing that reflect consumer focus. Consequently, retailers are demanding certain quality parameters, traceability, and no underweight from suppliers, who must be able to deliver products that fully comply with the agreed specifications. To meet these requirements systems must be in place that detect, monitor, and link KPIs in the production flow such as bone detection, fat analysis, PH value, temperature and weight with traceability.

## **Stock movements**

For a fresh meat processing company, the stocks of raw materials, semi-processed, and finished products represent a considerable value. Naturally, these stocks have limited shelf life, which means that stringent monitoring and management of inventory is essential.

## **Health and safety**

In many countries, it is becoming more challenging to find skilled labor to work in beef production. Many employees may be discouraged by perceptions of the job that include; heavy lifting, awkward working positions and lack of performance information.

A lot of operator health and safety measures are often implemented in the production to ensure a good working environment. Such measures include equipment with good ergonomics and working positions.



# Smart processing with integrated lines



Marel works with meat during all stages of the production value chain – from primary through secondary and further processing. This is what makes us a truly unique supplier.

We understand how one part of the process can influence another. Therefore we design, create, and help companies implement the optimal integrated system for any red meat processing needs.

Our process experts are also at hand for training, support, and guidance on processing efficiency and optimum raw material utilization.

Our solutions are capable of meeting the entire spectrum of requirements from; live animal handling, killing, dehiding, evisceration, carcass splitting, deboning, trimming, meat preparation, portioning, value adding, further processing, packing, and labeling.

#### **Data management**

There will always be a strong focus on quality, yield, and throughput in meat processing, but we also see an increasing focus on automation and artificial intelligence. Moreover new

As a full line supplier, Marel's state-of-the-art beef processing equipment spans the entire production value chain, right from live cattle receipt to the dispatch of the finished product.

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product development moves at a much faster pace than before. Simultaneously, the global marketplace is demanding that products have thorough traceability to the source. For that data management is an increasingly important part.

Advances in software contribute significantly to automation in red meat processing, and factories are becoming smarter as software becomes an even bigger part of the production process. Data is increasingly valuable in today's hi-tech processing environment, and the ability to track and analyze data is key to

meat processors being competitive. Using the data generated by machines in real time is key to gaining full production control.

Innova Food Processing Software efficiently controls and monitors the whole processing value chain of meat from the farm to the supermarket, and gives meat processors peace of mind that they are equipped to deal with future challenges.



# Live animal handling and primary processing

Marel works closely with customers on these issues, delivering systems and equipment that improve production sustainability, both regarding animal welfare and raw material utilization as well as energy and water consumption.

Efficient and gentle handling of animals during pre-slaughter is not only best for the animals, but it is also essential for the best meat quality.

Marel designs stable and runway systems with animal welfare in mind. For example, we design runway systems and center track restrainer stunners based on Temple Grandin's humane handling designs.

We offer a variety of different cattle stunning options, including ritual stunning systems. These systems are developed and specified jointly with the customer to ensure that all national requirements and laws in connection with animal welfare are followed in the stunning and killing process.

Marel's cattle primary processing lines are available for capacities ranging from 10 to 165 cattle per hour.



**Animal welfare and handling are issues of the utmost importance in the meat industry. Consumers are conscientious and want products that are produced sustainably and ethically.**

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## Blood collection

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Marel's blood collection systems fully comply with the requirements and standards for blood for human use. Blood must be collected from the cattle with a hollow knife, hose and pump to direct the blood away from the stick wound straight into a covered stainless-steel container. Between each batch, all parts in contact with the blood are sanitized. It is also possible to make a batch-wise collection of blood with full traceability to allow post-mortem inspection.

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### Benefits

- The Marel blood collection systems fulfill EU and USDA veterinary and hygienic standards
  - The systems fulfill the Fresh Meat Directive for edible blood
  - Possible to hygienically collect up to 85% of an animal's blood
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## Pre-dehiding, udder removal and bung closure

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For carcass preparation steps such as pre-dehiding, udder removal, and bung closure, Marel supplies tools and ergonomic custom-made working platforms that can be automatically adjusted to allow the optimal working position for individual operators.

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### Benefits

- Ergonomic working platforms
  - Hygienic system design
  - Platform positions towards or parallel to the carcass
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## Dehiding and head removal

All Marel dehiders have a downward vertical movement to prevent carcass contamination from the dirty part of the hide.

Each dehider provides with two separate work platforms, which allow the employees to perform their work tasks correctly.

During the dehiding process back muscle stimulation of the carcass can be activated, preventing the vertebrae and muscles from being pulled apart or damaged.

After dehiding, the head is removed and registered in the software slaughter control system by scanning the ear tag. The head then goes to washing and veterinarian inspection.

Before moving further in the line, a separate tag is created – based on the ear tag scan - and attached to the carcass which then follows the carcass into the evisceration (dressing) process.

### Benefits

- Vertical downward moving platform technique minimizes contamination
- Carcass stimulants may be used to prevent possible damage
- Carcass dehiding and head removal is possible in the same process

## Evisceration

The process of eviscerating cattle requires proper body positioning and flexible movement. The Marel cattle evisceration work platforms are a custom-made design to optimize ergonomic working positions, maximizing slaughter efficiency while minimizing contamination. The stomach and organs are removed and conveyed separately in large trays for veterinarian inspection.

During the process, there is full traceability of the organs and the carcass by means of synchronized conveying. In this way, both organs and carcass may be removed in case of irregular findings.

### Benefits

- Efficient, consistent and reliable system design
- Unique ergonomic work-platform design
- Traceability of organs and carcass



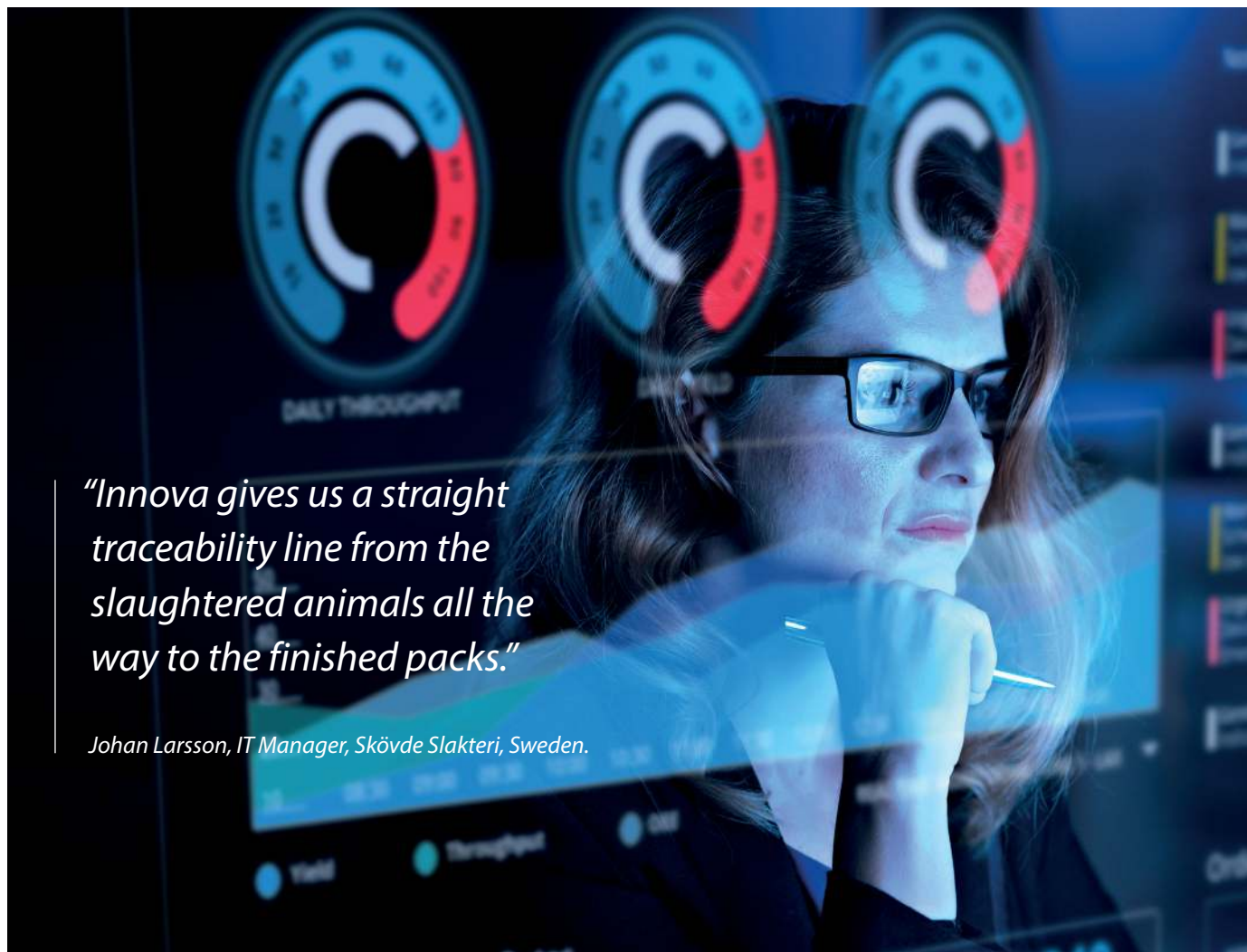
**Chilling and cooling**

- Flexible, automatic transport systems
- Optimum rail positioning for air circulation

Most meat processing plants are equipped with chill tunnels and cooling rooms to reduce the carcass temperatures very rapidly and so avoid unnecessary weight loss. Marel's carcass transport systems are automated and do not require any operator intervention to move carcasses to and from the chill tunnels or cooling rooms. The carcasses hang on rails aligned in the direction of air circulation and also avoid contact with each other.







*"Innova gives us a straight traceability line from the slaughtered animals all the way to the finished packs."*

*Johan Larsson, IT Manager, Skövde Slakteri, Sweden.*

## Innova primary processing software

The Innova primary processing control software was specifically designed to monitor, optimize, and control operations inside the primary processing hall from animal receipt all the way through to classification.

Upon receiving animals at the slaughterhouse, a touchscreen terminal is used to update and record all relevant information on each animal; including sex, weight, and grade.

As the animals pass through the primary processing hall, data is continuously collected at specific points in the process. For example, during the point of veterinary inspection, the carcass is

checked for defects or disease and via the system the veterinarian specifies if the animal should be further processed, detained, or destroyed.

Data from the entire primary processing process may be reviewed on control screens and in primary processing reports. Reports generated via Innova are customizable and typically include information about input/output registrations, veterinarian's remarks, and carcass yields. Innova has built in full animal traceability that provides data such as the day of production, shifts, production orders, lots, and resource areas.

### Benefits

- Providing real-time primary processing information
- Monitoring and controlling the complete primary processing process
- Animal traceability including veterinary remarks
- Enabling production decisions and planning downstream in the deboning and trimming hall (e.g. StreamLine).

**INNOVA**  
Food Processing Software

# Cutting and deboning



*"We have seen that a traditional pace line system takes approximately 20% more people to work it. The StreamLine system is very labor efficient, and more ergonomic as well. The operators do not need to reach for the products – they are led directly to their cutting stations."*

Frederico Muniz, Slaughterhouse Manager, La Anonima, Argentina.

## Intake and cut-down

After carcasses leave the cooling room, they are cut down into quarters and large primals. In the process of cutting down the carcass, a barcode is scanned into the system for traceability - with information such as animal ID, age, slaughter date, farmer, and PH value. Every subsequent cut performed on the primals relates back to that barcode.

After data capture, the carcasses are cut down into large primals according to individual specifications and then weighed. The weight of the primals is captured via barcode label scanning into such as the PaceLine or StreamLine deboning and trimming system.

### Benefits

- Transfer point from chill room to cutting and deboning
- Carcass info is scanned into deboning hall software system
- Carcass cut-down to individual specifications

## Deboning & trimming (PaceLine)

The principle of PaceLine deboning is based on a conveyor belt transporting carcass portions through the cutting room. The conveyor belt not only transports product, it also serves as the deboner's work surface. The speed of the belt determines the pace of the work on the line. Each employee in the PaceLine has a specific task in the deboning process, which must be completed within the time frame of that piece of meat passing by. The deboned meat is fed into crates, or onto a conveyor belt, and transported for storage, packing, or further processing. succulent. All of this happens without either weight or thereby yield suffering.



After chilling, the carcasses are transferred to the deboning hall where they are cut up, deboned, and trimmed. The deboning and trimming can be done with a traditional paceline system or with StreamLine, our intelligent and flexible integrated deboning and trimming solution for efficiently monitoring, analyzing, and maximizing the processes taking place in the deboning hall. The deboning and trimming solutions are ergonomically designed to minimize operator stress and reduce work-related strain injuries.



## Intelligent deboning and trimming (StreamLine)

Carcasses from chill stock are weighed-in to the deboning hall. Upon entering the StreamLine, the meat primals are distributed to workstations, based on operator availability. At the workstation the meat is deboned, trimmed, and further processed according to individual product specifications and orders.

When the meat arrives at an operator's workstation, real-time instructions become available at a deboning and trimming station terminal in front of the operator, showing the type and task to be performed. All cuts are traceable down to the specific carcass and operator.

Yield, throughput, quality and other key performance indicators (KPIs) are registered and monitored online with the Innova deboning and trimming software module, which supports the StreamLine and all the processes before and following the line including; weighing, grading, portioning, quality assurance, inventory, and dispatch.

Integrated quality control inspection procedures are configurable in the StreamLine system for all products.

Functions such as skinning, sawing, grading, meat harvesting, trim handling, and meat preparation perfectly integrate into the StreamLine system set-up. Experience has shown that the payback time of a StreamLine deboning and trimming solution can be as little as 12 months.

### Benefits

- Individual product traceability through all processes.
- Monitoring of yield, throughput, and defects.
- Ergonomic and stress-free work environment.
- Monitoring of individual line operator performance.

*“It is all about trust. Our customers know that the meat we supply has a consistent quality and has been produced with the highest attention to product safety and hygiene. The Trim Management System is an important instrument in this.”*

*Michael McKay, General Manager at Foyle Food Group in Donegal, Ireland.*

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## Skinning

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Marel offers a variety of industry-leading skinners. The open-top skinners are for membrane or fat removal while providing the highest possible yields.

The conveyORIZED skinners are ideal for removing membrane or fat, without the loss of valuable meat, e.g. from flat sub-primals. The skinning process can be integrated as part of Marel's Paceline or StreamLine deboning and trimming system or a stand-alone process on the production floor.

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### Benefits

- High yield and market-leading performance
  - Simple to sanitize and operate
  - Ergonomically designed to maximize operator efficiency, and productivity
  - Low cost of ownership
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## Meat harvesting

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Yield loss from leaving muscle meat on the bone after the deboning process is expensive since good quality meat can still be collected from the bones\* for processing into end products such as hamburgers and sausages.

After deboning the leftover meat on the rejected bones can be harvested as high quality 3 mm manufacturing meat in a meat harvester. Under low pressure, the meat is removed while keeping the bones intact. The resulting 3 mm meat is comparable with manually obtained trimmings.

\* EU not allowed for beef and lamb

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### Benefits

- Harvesting residual meat at high quality and high yield
  - Linear technology with gentle press
  - High capacity systems: up to five tons of input per hour
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## Trim inspection

Trim from the deboning and trimming process is usually further processed into sausages or convenience products like hamburgers. Before going into the meat preparation and further processing, the trim passes through a trim inspection system such as Mare's SensorX Magna or SensorX Accuro system for fat/lean (CL) measure and bone detection. The trim handling systems use x-ray to measure the fat/lean ratio accurately and to detect and reject (down to 5 mm) bones and other hazardous contaminants in the trim meat. Based on the analysis, the trim meat is automatically sorted and batched according to the specifications for grinding and mixing.

### Benefits

- Accurate fat/lean ratio (CL) measurement
- Superior bone and contaminant detection
- Less lean giveaway
- Fewer complaints, claims and rework

## By-product packing

A by-product packing system brings a higher level of automation to the process of batching, packing, and check-weighing by-products. We have removed manual, labor-intensive tasks wherever possible giving processors a faster and more efficient way to bulk pack all kinds of by-products.

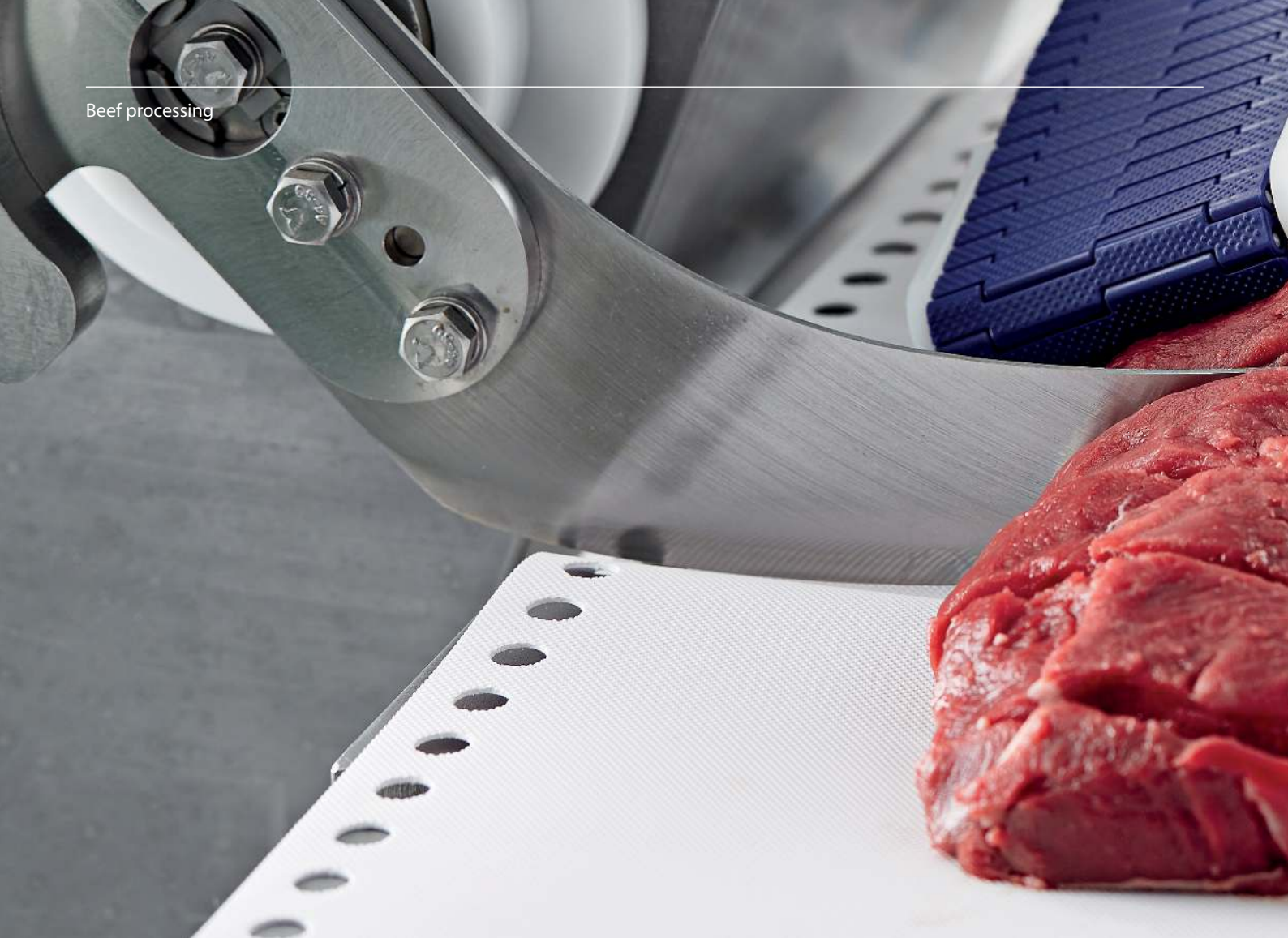
This exceptionally accurate by-product packing system batches at very high speed, allowing processors to minimize giveaway and deliver packs or boxes of an exact target weight to their customers

The by-product packing system is the ideal solution for bulk packing by-products, including:

- Heart
- Liver
- Kidney
- Tail
- Tongue

### Benefits

- Maximize efficiency in the packing flow
- Ideal for export bulk packing
- Speed up product and packaging changeovers
- Minimize giveaway with excellent batching performance



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## Portion cutting

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Good portion cutting is all about automated, high speed, high precision performance. Marel offers portion-cutting solutions for the high-speed production of fixed weight or fixed thickness boneless products. With a wide range of machines to choose from, it is possible to produce a wide range of products.

Combining the portion cutting equipment with Marel's Innova software offers additional easy-to-use remote programming, control, real-time monitoring and reports on actual performance. The Marel portion cutters are all very flexible and accurate.

Our series of portion cutters based on volumetric cutting ensure uniform shape of the products in addition to fixed weight. They deliver either single portions singulated or shingled portions in fixed weight batches for direct packing or further marinating, battering, and breading.

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### Benefits

- Cutting with optimal raw material utilization
  - Fixed weight and or fixed thickness
  - User-friendly and with flexible software support
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## Weighing and monitoring

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Marel manufactures industrial scales that provide outstanding levels of accuracy, durability, and ease of use. These industrial scales are constructed from stainless steel and other tough, hygienic and dependable materials approved for the food industry. The range of bench and floor scales are suitable as stand-alone installations or can be combined with Marel's comprehensive range of weighing indicators and computers, printers, labelers, and software to form a complete production management system.

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### Benefits

- Fast, robust and flexible
  - Easy connection with other equipment
  - Overload protection from all directions
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## Fixed-weight batching

There are many benefits to fixed-weight batching. It is especially important for meat processors to keep giveaway minimal while packing products and ensuring that an exact target weight is delivered to the customer. Our full range of batching systems, such as the Multihead Weigher, SpeedBatcher or TargetBatcher, batch fresh or frozen meat items of almost any size into fixed-weight packages. Our batching systems meet the most stringent industry food requirements, thanks to their versatility and easy-to-clean design.

### Benefits

- Wide range of flexible solutions
- Extremely low give-away
- Labor saving

## Marinating

The market for seasoned, ready to cook and ready to eat products continues to grow. Marinating and garnishing all kinds of meat products is very popular. These techniques add value to end products and introduce exciting possibilities for new tastes and applications.

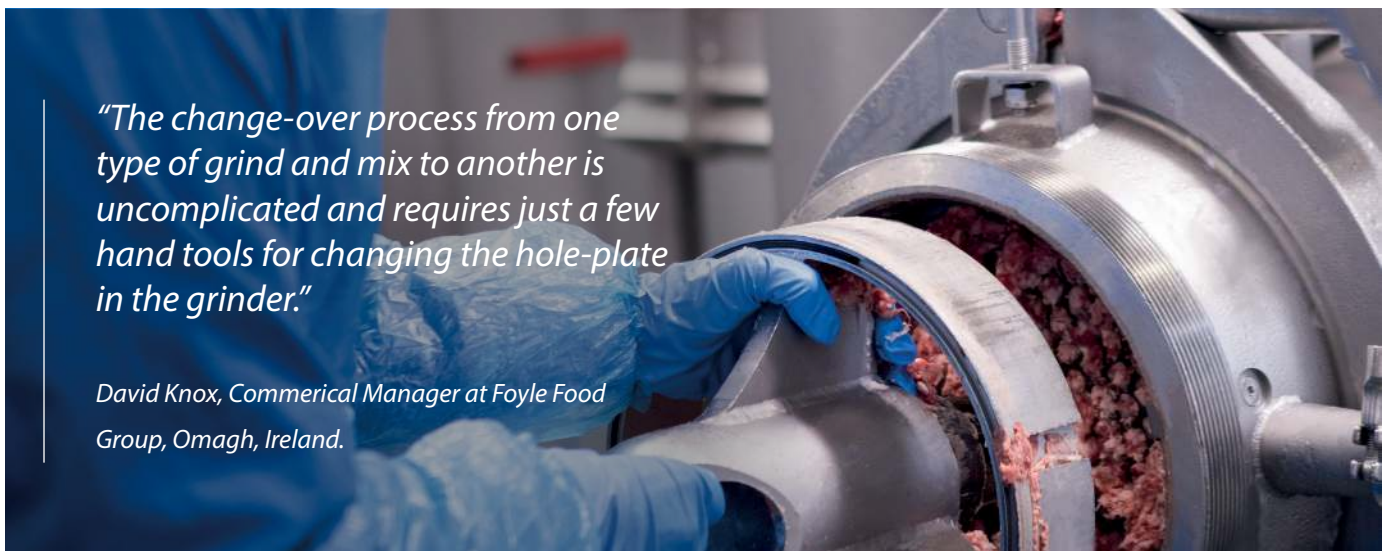
The spray marination unit was specifically designed for the in-line wet marinating of portioned and fragile meat (fresh, frozen, bone-in or boneless) with an accurate pick up and uniform distribution of marinade on coarse pieces.

A tumble marinating system is an alternative system for in-line marinating. It is based on a batch tumbling principle that leads to more efficiency and consistent product quality when marinating small, firm meat products like shawarma meat.

### Benefits

- Fully automated in-line process
- Uniform distribution of additives
- Limited manual handling

# Further processing



*“The change-over process from one type of grind and mix to another is uncomplicated and requires just a few hand tools for changing the hole-plate in the grinder.”*

*David Knox, Commercial Manager at Foyle Food Group, Omagh, Ireland.*

## Meat preparation

After fat/lean (CL) measuring and foreign body detection, trim meat typically enters the meat preparation process where it is ground to customer specifications and mixed with ingredients such as spices, water and flour to a uniform and consistent meat mass. The Marel Meat Preparation systems are incredibly flexible, and several types of convenience products can easily be made with a few modifications to the recipe and grinding specifications.

### Benefits

- Fast, robust and flexible
- Easy connection with other equipment
- Overload protection from all directions

## Fresh sausage production

Marel provides a broad range of solutions for the production of traditional fresh beef sausages with natural, prefab collagen or alginate casings.

The sausage making systems are very flexible and allow fast casing changeovers between different products, e.g. for length or diameter.

The meat mass for the sausage is prepared in the grinding and mixing system, where it is pumped into sausage stuffers and linking systems. Subsequently, the sausages are loaded into trays up to four layers high.

### Benefits

- Flexible automated process
- Different casing possibilities – natural, prefab collagen or alginate
- Savings on labor and casings



Global meat consumption is increasing, as growing economic prosperity and shifting demographics lead to an increasing demand for meat and more variety of products. Meanwhile, time spent cooking is decreasing and concerns about such as food safety and health are becoming more critical. Marel offers meat producers and further processors an array of solutions in facing these new challenges. The product offer includes full-line solutions from meat preparation, forming and coating to frying and cooking.



## Forming of hamburger and convenience products

Once the selected product is prepared to the specified meat mass, it is formed into an endless variety of form and weight consistent convenience products - typically hamburger. The Marel forming systems use a gentle low-pressure technology that preserves the meat structure and texture and ensures efficient portioning and uniformity where the focus is on the bite and feel of the final product. The Marel formers release the product using only air instead of pushers and water. This benefits end-product quality and guarantees a clean working environment. Besides low pressure portioning systems, Marel also offers ultra-low pressure forming systems, to create hamburgers with a homemade look.

### Benefits

- Gentle low-pressure technology
- Quick and easy to use
- Hygienic product release by using air

## Packing and end-of-line

Whole muscle beef products (e.g. beef loins, rump, and flank) may be automatically prepared and labeled for distribution for individual or bulk in the deboning and trimming hall.

End-of-line systems perform the final operations to complete the packing process and provide customer specified presentation, e.g. skin pack, tray packs or bulk boxes.

The End-of-line equipment comprises a combination of well-proven units and can be tailored to customer requirements.

Marel labelers provide base, top, side, single, double or 3-panel application, non-contact or in-line printing and application.

Our weigh price labelers provide excellent performance with low running costs through class-leading printhead life. Designed for a wide range of applications, they can handle most current pack sizes at up to 160 packs per minute.

### Benefits

- Digital weighing accuracy, precision, and reliability
- Labeling solutions for a wide range of products and capacities
- Easy label editing with drag and drop touchscreen



# Case Ready and Food Service

**Purchasing packs of cutlets and pork steaks in fixed weight portions or fixed length is growing in popularity in the case ready and food service sectors.**

**Marel supplies a full range of highly flexible case ready/ food service lines connected to our Innova Food Processing Software for the most accurate processing monitoring and control available.**

Our highly efficient, accurate and flexible case ready and food service lines are modular and designed to meet different production needs concerning capacity, processing flexibility, and supply regulations.

The lines are designed to minimize manual handling and achieve a highly efficient in-line process which speeds up processing time, saves manual labour and improves product quality.

## **Standard solutions**

- **Portioning and automatic packing of boneless meat**  
This line features portioning, styling and loading of meat slices (marinated or natural) into pre-formed trays, often 2-10 shingled slices with a thickness variation from 4 to 40mm. This highly automated case ready line is suited for high volume production runs with only a few Stock Keeping Units (SKU) produced on the line per day.
- **Portioning and manual packing of boneless meat**  
This flexible case ready line with automatic portion cutting and a manual packing targets the meat packing industry with small to medium production lots requiring frequent

product type changeover or many Stock Keeping Units (SKUs) per shift. It caters for both catch weight or fixed weight packing (marinated or natural) and suits any kind of tray styling method, from simple to complex styling patterns.

- **Portioning and semi-automatic packing of boneless meat**  
This case ready line is ideal for all the typical beef primals which are portioned to fixed-weight slices and packed into premade trays.  
This line is well suited for simple styling patterns – such as flat packing, shingled style or upright styling – and for medium to high volume dedicated production one or a few stock keeping units (SKU's) per day.
- **Automatic marinating, batching and packing of meat**  
The in-line marinating a batching solution marinades meat products, such as strips, dices and slices, with either dry or wet marinade or spices and continues to create and load fixed-weight batches directly into trays or thermoformer.
- **Automatic portioning and coating line for schnitzel**  
The schnitzel production starts with e.g. the veal loin trimming. The loin then continues through portion cutting of uniform fresh slices, gentle flattening, effective battering and breading and finally packing into trays. With Marel's Schnitzel line, optimal raw material utilization is ensured with minimal manual handling of products.

# Intra- logistics

**As more meat processors transition to automation, there is a growing need for cost-effective intra-logistics systems to manage complex distribution needs to deliver the freshest products possible to retailers and consumers.**

Intralogsitics systems from Marel are a modular concept allowing them to fit into existing plants and grow as needs dictate. The systems range from small conveying systems to large integrated turnkey projects. The systems interface seamlessly with Innova Food Processing Software to ensure full control of the products throughout the complete processing, storage, and distribution processes.

- Conveying systems (belt conveyors, roller conveyors, and accumulation conveyors)
- Material handling equipment (sorters, de-stackers, palletizers, and de-palletizers, lifts and robots)
- Automatic storage and retrieval systems (automatic high-speed cranes, and racking) including warehouse management systems
- Order picking and labeling systems
- Empty crate buffer systems
- Crate washing systems

Finished goods are moved into inventory or directly to stock during the packing process. Products can be palletized and located within the stock. Stock levels are known at each point in time with all relevant data available, such as age, expiration dates, and time in stock.





# Water treatment

We are passionate about helping food processors around the world better manage their treatment of industrial wastewater.



**Water is a precious resource—and at Marel we treat it as such. Water treatment has become a significant topic in contemporary meat processing. Processors all over the world, face significant challenges concerning water supply, energy use, increasing operating costs, and higher concentrations of pollutants. All of these issues require proficient water treatment solutions and systems that comply with local laws and regulations.**

The wastewater produced during the production of meat is challenging to clean because of contaminants such as proteins, fats, carbohydrates, blood and meat particles. Marel Water Treatment offers a range of cost-effective and energy efficient systems capable of purifying water to any desired degree of purification, customized to each situation – from simple discharge to sewer all the way to re-use of water and sludge composting.

Marel supports a wide array of processors with sustainable wastewater treatment to help them save on water use while promoting ecologically friendly choices that are more profitable and energy saving.



# Service and support

The Marel service organization operates under the principle of a global reach with a local focus. With offices and subsidiaries in some 30 countries, Marel is in a unique position to serve its customers wherever they are. Regional teams work closely with their customers, facilitating faster on-site response times, while the international online support team offers remote technical support directly with the site and even the equipment when possible.

## Maintain maximum uptime

Marel's comprehensive preventive maintenance program offers a structured way to reduce the risk of unexpected breakdowns and helps maintain the maximum performance of the equipment. Maintenance costs become more predictable, and routine tune-ups are scheduled to fit into your production cycle.

## Spare parts services

Marel offers flexible spare parts packages tailored to different needs. Customers may choose to maintain a full range of commonly used replacement parts specific to their on-site equipment, keep spare parts kits for planned maintenance of individual items, or receive individual parts as they are needed.

*"Any company that invests in such a big and advanced solution as ours [StreamLine deboning and trimming system] has to consider that they cannot save money by just keeping it as it is. They have to properly run and maintain it."*

Frederico Muniz, Slaughterhouse Manager, La Anonima, Argentina.



TRANSFORMING FOOD PROCESSING



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