



Application expertise for your industry

## Meat refrigeration





### Market challenges and drivers in industrial refrigeration for meat preservation

Meat has been staple of the human diet for centuries, providing essential nutrients, including proteins, vitamins, and minerals that are vital for health and well-being. As global demand for high-quality protein continues to rise, the need for safe, efficient, and sustainable methods of preserving these perishable products becomes increasingly important. Ensuring that meat remain fresh throughout the supply chain is not only crucial for meeting consumer expectations but also for minimizing food waste and supporting food security worldwide. With proper preservation, businesses can ensure the longevity and safety of these vital food sources, while delivering the best possible products to their customers. Maintaining the quality of meat after slaughter is a critical aspect of the meat processing industry. Proper refrigeration is essential to achieve this goal.

- **Growing global meat consumption:** increased demand for meat products drives the need for efficient preservation methods.
- **Stricter food safety regulations:** compliance with health and safety standards requires advanced refrigeration systems.
- **Minimizing food waste:** reducing spoilage through effective refrigeration extends shelf life and supports sustainability.
- **Consumer expectations:** rising demand for high-quality, long-lasting meat products pushes the industry toward innovation.
- **Sustainability focus:** the need for energy-efficient and eco-friendly refrigeration solutions is growing.
- **Fluctuating energy costs:** rising energy prices impact operational costs for refrigeration systems.
- **Regulatory compliance:** meeting evolving environmental and food safety regulations requires continuous adaptation.
- **Technological advancements:** ensuring precise temperature control throughout the supply chain necessitates cutting-edge technologies.
- **Global competition:** intense market competition drives the need for greater efficiency and differentiation in refrigeration solutions.

## LU-VE Group industrial air coolers help your business tackle meat preservation challenges

**The LU-VE Group heat exchangers are at the forefront of meat preservation technology, ensuring superior quality and safety from slaughter to storage.**

With a commitment to innovation, energy efficiency, and reliability, our refrigeration systems are tailored to support the unique needs of the meat industry, guaranteeing safety and extending shelf life while reducing operational costs.

The precise control of temperature and humidity levels within our systems ensures that the good retains its natural color, texture, and moisture, delivering premium quality to consumers.



LU-VE Group is one of the three major manufacturers in the world and second largest in Europe in the air heat exchanger segment. The Group consists of 20 manufacturing facilities in 9 different countries (Italy, China, Finland, India, Poland, Czech Republic, Sweden, Russia and the USA) with a network of more than 30 sales offices in Europe, Asia, the Middle East and the USA.

- 4,000 qualified people
- 11,600,000 sqft total surface area
- 40,000 sqft Research & Development laboratories
- 80% of products exported to 100 countries
- Revenues USD 670 million (2023)
- Listed on the Milan Stock Exchange (STAR)

LU-VE Group is placed within a highly strategic sector that aims to support and guarantee a correct cold chain in different types of contexts, applications and geographical areas.

**The company's success in the international market stems from its research and development policy, its commitment to environmental protection, and its adherence to strict ethical and commercial principles.**

Respect for and protection of resources and the environment have always been important decision criteria in the development of new products. In practice, this approach has constantly been translated over the years into rigorous design that takes into account the performance and quality of the solutions and the entire product life cycle.



## Mastering meat refrigeration with LU-VE tailor-made solutions

### Optimized cold room design for superior meat preservation

Cold rooms for meat refrigeration are essential in preserving meat products, ensuring they remain fresh and safe for consumption. These temperature-controlled environments are designed to maintain a consistent, low temperature, typically ranging between 0 °C and 4 °C, which slows down bacterial growth and delays spoilage. Additionally, proper humidity control within the cold room helps minimize weight loss and prevents the

meat from drying out. These rooms play a vital role in meat processing and distribution, extending the shelf life of products and maintaining their quality until they reach consumers. For these reasons, cold rooms must be equipped with advanced refrigeration systems that guarantee optimal air circulation, prevent hot spots, and ensure uniform cooling throughout the storage area, upholding the highest standards of meat preservation.



### Cold room criteria design

- **Storage temperature:** maintain appropriate temperature.
- **Insulation:** use high-quality insulation to minimize heat transfer and ensure consistent internal temperatures.
- **Cooling system:** properly size the refrigeration unit based on meat volume and door usage.
- **Air circulation:** ensure uniform temperature distribution with effective air circulation.
- **Humidity control:** maintain 85%-90% relative humidity to prevent meat dehydration and bacterial growth.
- **Load capacity:** design for sufficient storage space with shelves, hooks, and carts.
- **Accessibility:** facilitate easy loading/unloading, with features like automatic doors to reduce temperature loss.
- **Hygiene:** use easy-to-clean materials and ensure sanitation standards are met.
- **Food safety:** implement continuous temperature monitoring and HACCP compliance.
- **Energy efficiency:** utilize energy-efficient systems
- **Automation:** include automated control systems for temperature, humidity, and alerts.

LU-VE Group heat exchangers are engineered to meet the demanding requirements of meat refrigeration.

Whether in large-scale industrial operations or smaller, specialized facilities, LU-VE Group's solutions are designed to meet the rigorous standards required to maintain meat quality throughout the cooling process.

LU-VE evaporators are integral to effective cold room designs, addressing critical criteria such as maintaining consistent storage temperatures, minimizing heat transfer, ensuring uniform air circulation, and controlling humidity. LU-VE advanced systems rapidly lower the temperature of freshly slaughtered meat from 38-42 °C to a safe +7 °C in the hindquarters, preventing bacterial growth and preserving freshness, texture, and flavor. Systems are designed to optimize load capacity, enhance accessibility, and ensure hygiene through easy-to-clean materials.

These solutions ensure that LU-VE's equipment meets and exceeds the demands of modern cold rooms, offering tailored equipment for different cooling methods:

- Rapid Cooling for general preservation,
- Shock Cooling for faster processing,
- Intensive Shock Cooling for the highest quality preservation, particularly for long-term storage

Each refrigeration method plays a critical role in the meat processing industry, and LU-VE ensures their solutions are perfectly aligned with the specific needs of each task.

	Rapid cooling	Shock cooling	Secondary cooling	Shock + secondary cooling	Intensive cho	Compensatory cooling	Intensive + compensatory
Cooling requirements per m <sup>3</sup> (W)	250	450	110	-	600	50	650
Hourly air exchange	200	500	100	-	550	40	-
Room temperature (°C)	0 / +2	-6 / -10	0 / +2	-	-25 / -30	+4 / +6	-
Evaporation temperature (°C)	-10	-20	-10	-	-40	-5	-
Weight loss (%)	1.8	0.95	0.4	1.35	0.75	0.2	0.95
Cooling time, pork (h)	12	1.5	8	9.5	1.5	8	9.5
Cooling time, beef (h)	18-20	3.0	12-14	16	-	-	-
Distance between fins (mm)	10-12	15	8	-	15-20	8	-
Cold (air) consumption (%)	100	85	23	108	113	10.5	123.5
Power consumption (%)	100	121	22	143	268	9.3	277

Table: Comparison of the most common meat refrigeration methods



### Rapid cooling: preserving freshness quickly

Rapid cooling is aimed at reducing the temperature of the meat swiftly after slaughter. Rapid cooling not only preserves the quality of the meat but also extends its shelf life by inhibiting the growth of spoilage microorganisms.

Rapid cooling is the most common and cost-effective method, suitable for general meat preservation. Meat is chilled to 4 °C with an ambient temperature maintained between 0 and +1°C. This process employs a refrigeration load of 230-250 W/m<sup>3</sup> and ventilation rates of 150 to 250-fold, ensuring minimal weight loss (approximately 1.8%).

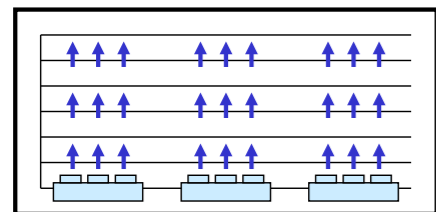
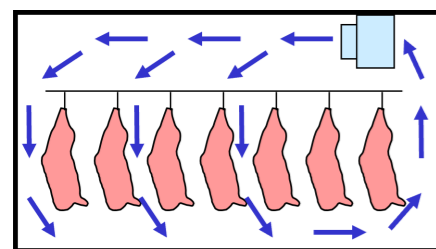
The meat in the cold room is suspended from a static tubular rail system. This ensures that the meat is evenly suspended, allowing for uniform cooling and reduced surface drying, which preserves the meat's appearance and quality.



**LU-VE Group systems feature various arrangements of evaporators, each strategically positioned to ensure optimal air circulation and even cooling.**

#### Cylinder-cased evaporators

Usually installed inside the ceiling along the longest wall of the chillroom. Air is blown across the rail stack. The air flows in between the ceiling and the rail

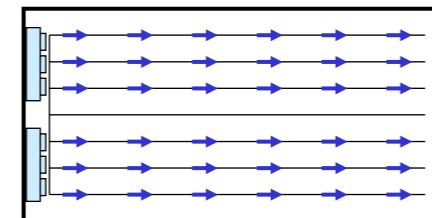
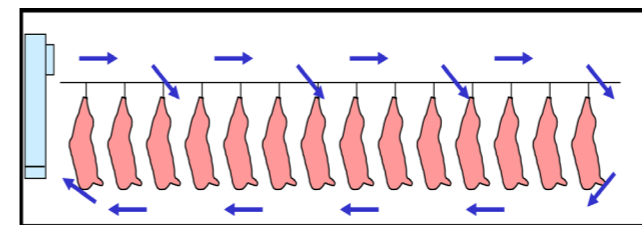


#### Draw-through air direction

- Better air distribution over the coil, hence higher coil efficiency
- Longer air throw
- Frost build-up visible on air inlet side

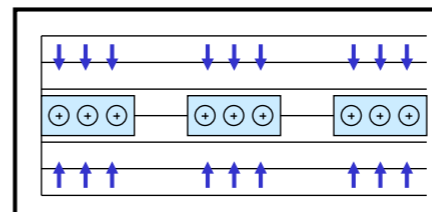
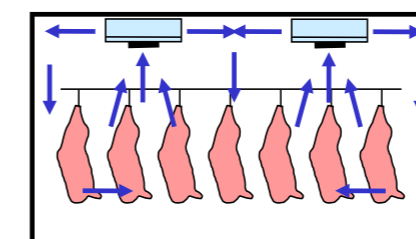
#### Wall evaporators

Installed along the shorter wall of the chillroom. Air stream is parallel to the rail. The air flows in between the ceiling and the rail



#### Ceiling evaporators

Installed in between the ceiling and the rail track. Dual discharge blow-through systems enhance air distribution and accelerate the cooling process across the space.



#### Blow-through air direction

- Higher DTML, higher cooling capacity
- Large air outlet surface, more even air flow
- Higher RH in air outlet (less product dehydration)



### Shock cooling: intensive cooling for enhanced quality

Shock cooling provides a faster cooling process, ideal for meats that need quicker processing or where bacterial control is crucial.

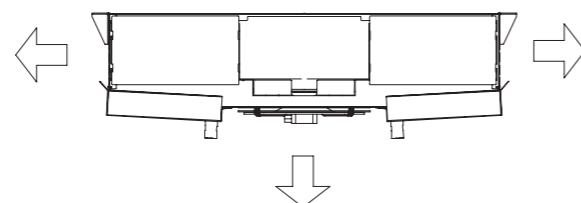
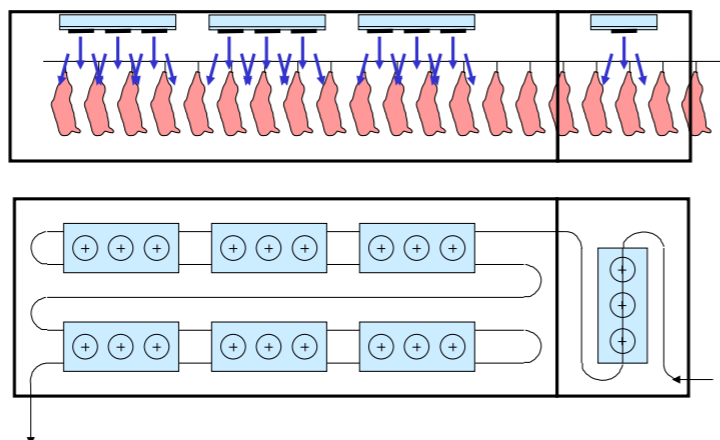
Freshly slaughtered meat is quickly cooled by suspending it from a moving rail within a shock tunnel. This method typically results in a moderate drop in core temperature, with pork dropping by approximately 6-9 °C and beef by 4-5 °C.

Smaller sections of meat, such as the back or belly, experience a more significant temperature reduction, measured as an "average meat heat" decrease of about 22 °C.

After this initial phase, the meat undergoes secondary cooling where the meat is transferred to a secondary chill room with a temperature maintained between 0 °C and 2 °C.

This stage further cools the meat to ensure that the core temperature reaches the desired level, typically around 7 °C in the thickest parts like the hindquarters.

This gradual cooling ensures that the meat's internal temperature is uniformly reduced, enhancing both its quality and safety for storage or further processing.



Dual discharge units with draw-through fans available as special configuration.

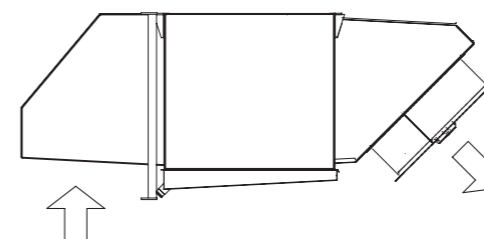
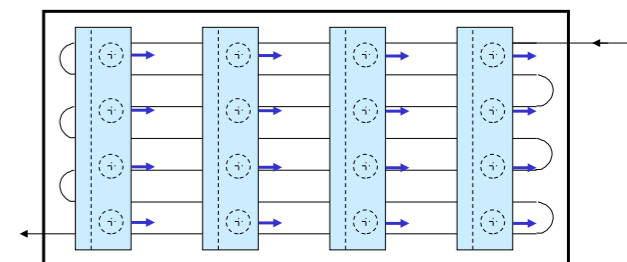
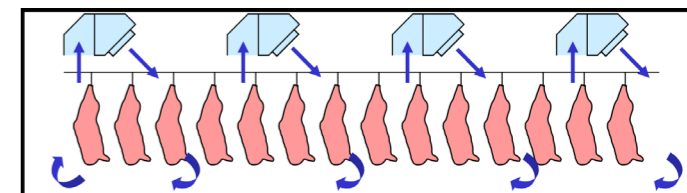
### Intensive Shock Cooling: for maximum preservation

Intensive shock cooling is a specialized cooling process primarily used for pork.

The method involves placing the meat in a tunnel with temperatures between -25 °C and -30 °C.

Using intensive shock coolers equipped with extraction hoods and a directed downward airflow at a 45° angle, the top 5-8 mm of the meat's surface is frozen within 1.2 to 1.5 hours. After this initial stage, the meat is transferred to a compensatory cooler for approximately 8 hours to achieve the desired core temperature of +7 °C.

Intensive shock cooling minimizes weight loss and maintains the meat's structural integrity and appearance, making it ideal for high-quality meat products, though it is slightly more expensive than traditional methods.



**Suction hood** on the air inlet side can be used to enhance defrost efficiency in combination with a shut-up sock.

**Fan casing** for uniform temperature and air distribution for shock cooling applications. For draw-through units only.



## LU-VE industrial air coolers: great coolers for great food



# plair

Our easy-to-use configurator software [Plair](#) helps you select the most suitable solution for your specific application. Selection output includes all relevant technical data, dimensional drawings and pricing. Combined with worldwide sales, technical support and service in local languages we offer you total confidence throughout the entire lifetime of your product.

### Construction

- Coil frame and casing pre-galvanized sheet steel, epoxy coated RAL 9003
- Stainless steel fixing materials
- Stainless steel or Cu tubes
- Al, Cu or corrosion protected fins
- Hinged side panels
- Standard design guarantees a large plenum

### Fans

- Fan shroud optimisation
- High efficiency EC fan motors for easy speed control and low noise
- 0-10V speed control
- Modbus control
- Radial fans as option

### Refrigerants

Configured for all common refrigerants in both direct expansion and pumped systems.

- HFC
- Ammonia
- CO<sub>2</sub>
- Brine

### Options

- Stainless steel casing and frame
- Fan streamer
- Hinged fans
- Drain tray insulation
- Suction hood 45° and 90°
- Fan casing 45° and 90°
- Shut-up sock
- Top connections
- Motorized defrost damper

### Electrical accessories

- Fan ring heater
- On/Off switch
- Central connection box



### Defrost system

- Air defrost
- Electric defrost
- Hot-gas defrost
- Glycol defrost

### Space and transport savings

- Overall dimension and weight reduction

### Efficiency

- Energy savings thanks to EC fan motors
- Reduction of refrigerant charge

### Time saving

- Easy installation and maintenance
- High quality design
- Maximum reliability of all components