

**Ministry of Agriculture**  
**Export Abattoirs Inspection and Certification**  
**Directorate**



**Meat Transport and Storage Guidelines**  
**for Export Abattoirs**

**December, 2021**

**Addis Ababa**

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## Acronyms

Cm	Centimetre
°C	Degree Celsius
ECTAD	Emergency Centre for Transboundary Animal Diseases
FAO	Food and Agriculture Organization of the United Nations
MoARD	Ministry of Agriculture and Rural Development
Hrs	Hours
pH	Measure of acidity/alkalinity levels

## **Acknowledgements**

The first edition of this guidelines document, which served as the basis for the current revised version, was developed by Dr. Wondwosen Asfaw and Dr. Nega Tewelde while the current version was reviewed and updated by Dr. Amsalu Demissie. The contribution of Dr. Hassen Chaka (Coordinator, Improving Sanitary Capacity and Facilitating Export of Livestock and Livestock Products from Ethiopia Project of FAO-ECTAD Ethiopia), Dr. Ayalew Shumet (Director, Export Abattoirs Inspection and Certification Directorate, Ministry of Agriculture), Dr. Wondimagegn Dejene (Director, Quarantine Import Export Inspection and Certification Directorate inspectors, Ministry of Agriculture) and other technical experts of the Ministry of Agriculture for making this document to have its current form by providing insightful comments and suggestions at various stages of the review and revision process is highly appreciated.

## **Foreword**

This technical document entitled “Meat Transport and Storage Guidelines” is one of the documents in a series of guidelines and Standard Operating Procedures that were developed from 2008 to 2010 by the then Ministry of Agriculture and Rural Development in collaboration with the Ethiopian Sanitary and Phytosanitary and Livestock and Meat Marketing Program.

This Guidelines document is at present reviewed and updated by the Ministry of Agriculture in collaboration with the FAO-ECTAD Ethiopia, Improving Sanitary Capacity and Facilitating Export of Livestock and Livestock Products from Ethiopia Project. The main goal of project is to increase exports of meat and livestock to benefit Ethiopian livestock producers and exporters and to promote national economic development.

This guideline document is intended to assist export abattoir operators, meat truck drivers and airport cargo terminal workers in knowing and implementing appropriate procedures that will ensure maintaining the quality and safety status of meat during transportation and storage.

At this point, the Export Abattoirs Inspection and Certification Directorate of the Ministry of Agriculture would like to thank the FAO-ECTAD Ethiopia, Improving Sanitary Capacity and Facilitating Export of Livestock and Livestock Products from Ethiopia Project, for providing the necessary technical and financial support required for reviewing, updating and publishing this guidelines document.

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## **1. Introduction**

Meat is susceptible to contamination from a wide variety of physical, biological and chemical hazards. Because of its moisture, pH levels and high protein content, meat provides ideal environments for the growth of bacteria. Hence, meat is highly vulnerable, particularly, to microbiological hazards and should be handled, transported and stored carefully to prevent contamination. During transportation and storage, the key issue is to maintain proper refrigeration temperatures and to prevent the cold-chain from breaking down during loading, unloading, palletization and related practices.

This guidelines document is designed to aid meat transport truck drivers and airport cargo terminal workers in ensuring meat safety and maintaining cold chain of meat during transportation and storage. It provides a list of precautionary measures that can be taken to prevent meat contamination during loading, unloading, transportation, in transit storage, etc

## **2. Meat transport vehicles**

Currently, meat is transported from export abattoirs to the airport by trucks. Meat is then held at handling facilities at the airport. Because transportation and storage are vital links in keeping meat quality and safety, effective control measures are essential at each point to prevent contamination.

### **2.1. Vehicle compliance requirements**

- ❖ Vehicles used for the transport of meat and edible products should be used exclusively for this purpose and should be clean at the point of loading.
- ❖ Meat and carcasses should be transported from the abattoir to the port of exit in sealed and specially designed vehicles.
- ❖ Vehicle design should permit effective inspection, cleaning, disinfection, and temperature control.
- ❖ Vehicles should be fitted with refrigeration system and minimum and maximum thermometer or another temperature sensing or recording device to monitor cold chain inside the meat container.
- ❖ The temperature reader should be located in a place where the driver can monitor while driving.
- ❖ Refrigeration units should be serviced regularly and the cooling unit should be in good repair and operation.

- ❖ Vehicles should be designed and built to make locking and sealing easy; protect the cargo against extremes of heat and prevent infestation by pests.
- ❖ Vehicle body should be sufficiently insulated and be in good repair with no holes in the body that might allow heat, dust, etc to enter the cargo area.
- ❖ Vehicle doors and seals should be securely closed and that there will be no air leaks.
- ❖ Equipment or surfaces that contact meat products should be made of nontoxic, noncorrosive materials that can be effectively cleaned. For example, the surfaces may be made with stainless steel or be coated with food-grade epoxy resins.
- ❖ Vehicles should be pre-cooled for at least 1 hour before loading to remove residual heat from the insulation, inner lining and the air of the trailer and it should be capable of maintaining the required temperature of the meat during the journey.
- ❖ For pre-cooling, the doors should be closed and the temperature setting of the unit should be no higher than  $-3^{\circ}\text{C}$
- ❖ The cargo space should fulfill the following requirements:
  - Be totally enclosed, capable of being locked and if required, sealed.
  - Be completely separated from the driving cab;
  - Be dust and vermin proof.
  - Does not transmit odor or taste.
  - Be capable of withstanding repeated cleaning and sanitizing.
  - Be waterproof and with a closable drainage outlet.
  - Be adequately insulated and/or mechanically refrigerated to ensure that the temperature of the meat does not rise more than  $2^{\circ}\text{C}$  during transportation;
  - Internal surfaces including the floor should be light colored that allows visible contamination to be seen easily, impervious, corrosion resistant, non-toxic and made of a durable material that can be sanitized easily.
  - Floor to wall and wall to wall junctions should be rounded.
  - Should have an overhead rail for carcass transport.
  - The hooks on the rail should be of such a construction as to prevent the meat from falling down during transportation;
  - Minimum space between rails shall be 60 centimeters;

## **2.2. Sanitation and maintenance of vehicles**

- Meat and meat product transportation vehicles, accessories, and connections should be kept clean and free from dirt, debris, and any other substance or odor that may contaminate the product.
- Vehicles should be cleaned out and air dried daily. They should be disinfected as needed. Vehicle floors and walls can be washed and disinfected using soaps and detergents and leaving it in contact for 10 minutes.
- Water used to wash vehicles should be at least 82°C and used together with an approved sanitizer to reduce the number of microorganisms and dissolve any fat particles adhering to interior surfaces of vehicles.
- Only meat should be transported in the loading bay.
- The type of meat product to be transported and the cleaning procedure used should be recorded on daily and between shipments.

## **2.3. Vehicle inspection before loading**

- Trailer or truck body should be sufficiently insulated and be in good repair with no holes in the body that might allow heat, dust, or other adulterants to enter the cargo area.
- Trucks and trailers should be checked for residues of previous cargos.
- They should be checked for residues from cleaning and sanitizing compounds.
- The cooling unit should be in good repair and operating position. Both truck drivers and abattoir personnel should check the functioning of the trailer refrigeration unit.
- Vehicle thermometer and thermostat settings should be checked before loading to enable meat and meat products to be maintained at the required temperature during transport.
- Where temperature-controlled loading facilities are available, vehicles should be pre-cooled for at least 1 hour before loading to remove residual heat from the insulation, inner lining and the air of the trailer and it should be capable of maintaining the required temperature of the meat during the journey.
- For pre-cooling, the doors should be closed and the temperature setting of the unit should be no higher than -3°C.
- Trailers should be inspected prior to loading to determine that the air chutes are properly in place and that the ribbed floors are unclogged so that adequate air circulation can occur.



- Trailer doors and seals should be examined to ensure that they can be secured and that there will be no air leaks.
- When shipping a mixed load of products, such as both frozen and chilled products, it may be necessary to use a trailer with compartments that accommodate different temperature or other handling requirements.

### **3. Loading of meat**

- Workers should wear clean protective clothing.
- Meat and meat products should not be removed from a chiller or freezer rooms for transport unless the vehicle surfaces are visibly dry.
- Ensure that carcasses and other meat products are chilled to a surface temperature of 4°C or less for carcasses and 2-3°C for meat products in a chilling room kept at temperature of 0 to 2°C at the slaughter facility before loading.
- Similarly, ensure that frozen carcasses and other meat products are frozen to a core temperature of -12°C in a freezer room kept at temperature of -18°C or less at the slaughter facility before loading.
- Check the pH of sampled meat and should be below 6 and results should be recorded.
- Loading surroundings and equipment should be ensured that they are clean from possible contamination.
- Loading should be done preferably in the evening or early morning to minimize the likelihood of products warming.
- Rough offal should not be loaded in the same loading space as carcasses, portions or red offal, unless such rough offal is kept in clean, waterproof containers with tight fitting lids.
- Rough offal only, may be transported in enclosed vehicles if held in clean containers without lids, if no spillage and splashing occurs.
- Cartoned products should not be loaded in the same loading space as exposed meat.
- Unwrapped meat shall not be loaded directly onto the floor.
- Random inspection of approximately 10% of the load should be carried out to check hygiene and/or contamination of meat.
- If meat is outside the temperature specification or contaminated, it should not be loaded.

- Minimum rail spacing for hindquarters and boned cut meat shall be 40 centimeters and for forequarters 35 centimeters;
- No person shall be allowed to stay in the compartment where meat is kept during transport.
- The engine of a carrier shall not be allowed to run whilst loading or un-loading is in process and all doors and lids shall be securely closed before the engine is started.
- Fueling of carriers shall not take place whilst the doors or the lids of a carrier are open.
- Chilled red meat carcasses, sides and quarters should be suspended without touching the floor.
- Appropriately packaged meat and meat products can be stacked, provided that air circulation is sufficient to maintain the temperature of the products during transport.
- Frozen red meat carcasses, sides and quarters may be stacked if adequately wrapped and packed;
- Loading time should be kept as short as possible to prevent temperature changes (increases or decreases) that could threaten the safety or quality of the meat.
- Doors should be closed immediately after the truck/trailer has pulled away from dock.
- The load out checks and any action taken should be recorded on Vehicle Log Sheet. This procedure is to be carried out on each load out.

#### **4. Transporting meat**

Appropriate temperatures should be continuously maintained throughout all phases of transport to ensure that meat and meat products are kept safe. For this:

- All persons involved in the transportation, storage, and handling of meat and meat products should be responsible for keeping them at appropriate temperatures and preventing any break in the cold chain.
- The driver should make sure that vehicle refrigeration units are operating satisfactorily.
- Meat and meat products should be kept protected from exposure to environmental contaminants such as microbes, dust, odors, smoke, moisture, or other physical contamination.

- Temperature of the vehicle during transport should be monitored to ensure that meat and meat products are kept refrigerated and protected from temperature changes.
- Air temperature of the meat carrying compartment should be monitored and recorded on the Vehicle Temperature Log during transportation.

## **5. Meat unloading**

- ❖ Unloading of meat in the airport should be conducted in the presence of veterinary inspectors.
- ❖ Air temperature of meat compartment should be monitored on arrival.
- ❖ The condition of the meat should be checked for contamination.
- ❖ The findings should be recorded on the Vehicle Log Sheet.
- ❖ If the temperature or condition of the meat has deteriorated the veterinary inspectors should take corrective actions which may include increasing refrigeration settings or disposal of the meat if spoiled and cleaning of vehicle of any contamination.
- ❖ Meat returned to an abattoir or cold storage facility may be received only after re-inspection by the regulatory inspector, and may only be sorted and salvaged for human consumption under conditions determined by the veterinary inspector.
- ❖ Unloading of meat should be started as soon as possible within a short time interval and should be done in an appropriately chilled environment.
- ❖ Workers should wear clean protective clothing and properly follow all required personal hygienic procedures (refer to Personal Hygiene Guidelines).
- ❖ Meat handlers at the airport should wash hands and exposed portions of arms thoroughly in an adequate hand-washing facility before unloading, and as often as necessary—especially after smoking, drinking or using the toilet or urinal.
- ❖ Meat handlers should not eat, drink or use tobacco in any form while unloading.

## **6. Cold chain requirements at airport**

- ❖ Once a meat shipment is inspected and certified by the Meat Inspectors, it should be immediately transferred to the cargo or placed in the airport storage facility.
- ❖ Before storing, the storage freezer should be checked to assure it is in good working order.
- ❖ No substances known to be toxic or harmful should be stored or maintained in the meat storage areas.

- ❖ A refrigerated room used for the storage of chilled carcasses, sides, quarters or portions should be maintained within the range of 0 to 2°C and the mean air speed over the product shall be maintained above 0.75 meters per second and the relative humidity shall be maintained below 95%. If the product is to be stored for longer than 72 hours, the relative humidity should be maintained below 90%.
- ❖ A refrigerated room used for the storage of offal should be maintained at a temperature below –2°C. If the offal is to be stored for longer than 72 hours, the temperature should be maintained below -10°C
- ❖ A refrigerated room used for the storage of a frozen carcass, side, quarter or portion, shall be maintained at a temperature below –18°C.
- ❖ Adequate and proper cold air circulation is required for maintaining the desired uniform temperature in all areas of the freezers and refrigerators where meat is stored.
- ❖ Chillers should be sanitized before a fresh load of meat is loaded.
- ❖ Freezers should be defrosted and thoroughly sanitized at least once a year or more often if required by the regulatory inspector.

## **7. Dispatching meat for freight**

- ❖ As much as practicable, all products should be loaded onto aircraft as soon as possible.
- ❖ Cargo pallets, load securing devices, and loading equipment should be kept clean and free of potential food contaminants and be regularly washed and sanitized.
- ❖ Equipment used in transferring meat and meat products, such as hand trucks, containers, conveyors, and forklifts, should be well maintained and kept in a sanitary condition.
- ❖ Loading time should be kept as short as possible to prevent temperature changes that could threaten the safety or quality of the meat.

## **Annex I. Calibration of thermometers**

- ❖ Mix ice and water in a thermos flask or an appropriate receptacle, allowing 5–10 minutes to equilibrate.
- ❖ Stir the closed receptacle for at least a minute to aid equilibration.
- ❖ Carefully insert the testing thermometer into the ice water slurry, ensuring the thermometer is inserted sufficiently into the slurry.
- ❖ Gently swirl the receptacle for a minute.
- ❖ After a further minute, record the temperature of the thermometer. The testing thermometer should read 0 °C.
- ❖ Place the calibrated thermometer inside the meat-carrying compartment next to the vehicle's thermometer probe. After a minute check that the vehicle's thermometer has the same reading as the calibrated thermometer.
- ❖ Calibration is carried out at least once every 12 months and results are kept.
- ❖ If the thermometer reading differs from 0°C more than 1°C the thermometer should be recalibrated.
- ❖ If there is still a difference in the accuracy of the thermometer:
  - the difference should be noted, or
  - an adjustment should be made to the thermometer by the adjustment nut at the back of the thermometer.
  - any corrective action should be noted in the Vehicle Calibration Record.
  - If it cannot be calibrated, replace the thermometer.