CHAPTER 4
PREPARATION OF CONTAINERS PRIOR TO LOADING

Containers for the transport of export perishable products must be absolutely clean to ensure food safety and must maintain optimum temperature and atmosphere conditions to minimise product quality loss. This requires that all aspects in the container handling chain be focused on the two basic requirements mentioned above. More detail is also documented in the PPECB Quality Management System (QMS).

1. REQUIREMENTS FOR CONTAINER HANDLING DEPOTS

National and International food safety and traceability legislation as well as Good Distribution Practices (GDP) are being instituted by the retail trade. These requirements and procedures require that all operations directly and indirectly associated with the handling and distribution of perishable and food products are according to approved standards and open to external auditing. There are two basic international requirements concerning the transport of perishable products i.e. the prevention of the distribution of quarantine pests and the protection of the cargo against contamination. The following are some of the more important aspects that need attention.

1.1 Stacking areas
Storage areas where containers are stacked prior to and after use must be well drained and level. It must be clean, protected against any type of pollution such as chemicals, water and dust. A solid or crushed stone (gravel) surface without any potholes is a minimum requirement.

1.2 Stacking heights
Worker safety is of prime importance and dictates stacking heights. It is also important to single stack containers for the pretrip procedure, the pretrip inspection (PTI) and cleanliness inspection.

1.3 Repair bays
All working areas must comply with national safety requirements. These areas must also have a concrete floor and must be under cover to prevent any contamination of the exposed insulation.

1.4 Wash bays
These areas must have a sloped solid and permanent surface to allow all wash water to drain from the container and away from the washing area to avoid any contamination of containers. The wash water must be handled according to the rules of the local authority to avoid any pollution of the environment.

2. DEPOT QUALITY MANAGEMENT SYSTEMS

Consumers of and the international trade in perishable products, are becoming extremely demanding on aspects directly or indirectly related to product quality, food safety and costs. The concept of due diligence is also becoming a basic requirement and everybody in the food handling and supply chain must accept responsibility for his or her actions. The only way to comply with these and other requirements is to implement and apply a quality management system. Some of the more important aspects that must be addressed in such a system are mentioned below.

2.1 In house quality control
It is extremely important that all depots handling and preparing containers for the export of perishable products maintain an in house quality control system. It is important that the system is well documented, the personnel well trained to apply the procedures and accurate records of all actions are kept. It is also important that the system is internally and externally audited by trained personnel and accredited auditors respectively. An in house quality control system must identify and minimize risk areas and can therefore be very cost effective for the container depot. It must also demonstrate due diligence in the areas of the correct functioning of the container, ensuring food safety and support traceability. An important function of in house quality control system is to do a thorough container inspection when the used container is delivered to the depot. The following three aspects are discussed in this chapter and need to be checked and special procedures must be followed if necessary:

- The hygiene condition of the container
- The container structure
- The condition of the cooling unit

2.2 Food safety requirements
Food safety requirements are highlighted in Chapter 1 par 3.1. It is however important to understand that the authorities of importing countries will stop all imports from any other country or a supplier of perishable products if there is even the slightest suspicion that the product is unsafe or not fit for human consumption. The three basic food safety factors, also known as hazards, are biological, chemical and physical contamination. Management systems must therefore ensure that:

- Containers are biologically clean. This means it must be free from all insects, bacteria, fungal spores and any material that may host any biological contaminant. This requires that the correct washing and cleaning procedures are followed and that all surfaces that may come into direct or indirect contact with the product

are sterilised. This includes the air handling systems such as the cooling coil (evaporator), the air circulation fans and the air ducting. Recontamination after cleaning must also be avoided.

- Containers must be chemically clean. This means it must be free from any traces of chemicals, taints, odors or any substance that may result in a chemical contamination of the product. Deposits from the washing water, oxidation of aluminum, steel or any other object are not allowed. Only approved detergents, sealing compounds and repair materials as well as approved methods must be used.
- Containers must be physically clean. This means that it must be free from any object such as sand, dust, glass, screws, nails, pop rivets, bolts, nuts or any object, even minute, that may get into or onto the product. This also applies to the cooling unit and air ducting where any foreign material such as dust and debris of packing material may accumulate and be reintroduced into the cargo area at a later state.

2.3 Traceability requirements

Traceability can be described as the ability to very quickly and correctly trace the origin, handling, storage, transporting and distribution pathways of a product. More details are given in Chapter 1 par 3.2. In the container transport context it means that:

- The identification of the container to be known and linked to the consignment at all times.
- The history of the container in terms of previous cargoes and destinations, cleaning, repair and inspection records, storage and transport conditions or any other factor that could affect the product be known and documented.
- Accurate and detailed records must be available to the exporter, the importer and other authorities pertaining to a specific container to ensure quick access of all relevant information.

3. PREPARATION OF INTEGRAL REFRIGERATED CONTAINERS

The in-house internal quality control system must identify all structural and mechanical defects as well as special procedures that must be followed to ensure that all containers are correctly prepared for the carriage of perishable products. It is essential that all containers have a valid ISO (Paris) registered identification number and a valid safety certificate (CSC plate).

3.1 Structural-maintenance and repairs

All containers must be inspected for structural and physical defects:

- The container frame must be in a sound rust free condition to carry the load especially when handled and transported.
- The external side panels must be dry and may not bulge (extend) by more than 40 mm beyond the steel framework. All joints between panels and between the steel frameworks must be intact and properly sealed.
- The roof sagging and floor bulging must not exceed 25% (or hinder loading) while all joints must be intact, correctly sealed and watertight.
- Doors may not be damaged, door hinges and closing mechanisms must operate freely and door seals must be properly fixed, intact and provide an air tight seal all round.
- The internal side panels must be intact and securely laminated (bonded) to the insulation. International recommendations are that delamination should not be more than one square meter (1m²) per side panel. Some shipping lines however allow a maximum of 25% delamination of the total area of a specific side, within the container. The insulation must be completely dry at all times.
- No internal bulging, sharp edges, loose panel or cargo fixing devices shall be present as these may damage the cargo or restrict airflow. All joints must be intact, properly sealed and air tight.
- The T-bar floor must not be damaged, all joints (especially at the door) must be intact, and no floor movement must be present during loading.
- The insulation must be intact and dry. Damaged insulation must be removed and replaced with insulation of the same specification. The protecting panels must be correctly fitted and must not allow any migration of moisture into the insulation.
- Repairs: All necessary structural repairs must be made by trained and competent personnel and only internationally approved materials and methods must be used. Materials that may give off taints must not be used because the product will absorb these taints rendering the total load useless.
- Repairs and maintenance procedures must be completed and documented before the container is moved to the washing bay.

3.2 Cooling unit – maintenance and repairs

All refrigeration (cooling) units of containers must be inspected for defects, accuracy of control and recording systems and the necessary repairs and adjustments done.

- A visual check must be done to check for possible damage such as loose components, damaged cables and wiring.
- The motor and compressor must be checked for smooth operation and possible overheating.
- Oil and gas levels must be checked and adjusted if necessary.
- Air circulating fans (i.e. both condenser and evaporator) must operate correctly without any abnormal noise and correct direction of airflow.

- The thermostat temperature controller must be accurately calibrated to control the temperature within plus/minus 0,5°C from the set point. **Note**: The temperature in the chill mode shall be controlled on delivery air and in the frozen mode on return air.
- The sensors for recording of the delivery (DAT) and return (RAT) air temperature must be accurately calibrated and functioning correctly.
- The defrost system must be operational and the drain pipe open.
- All indicator lights, fuses, back up batteries etc. must be fully functional.
- The fresh air ventilation valve must be easy to operate and functioning correctly.
- The air ducts shall be unobstructed and clean to avoid contamination of the cargo and to ensure effective airflow.

All maintenance must be carried out by qualified personnel to the specification of the container owner. Only specified and approved materials, spares and components may be used.

3.3 Cleaning of containers

It is important that the container is thoroughly cleaned after every load. Every container depot must follow its own cleaning protocols and procedures. The following are however important aspects that must form part of such a cleaning procedure.

- Well-designed and constructed wash bays are required. It is important that the wash area has a solid sloped surface to allow fast draining of the wash water. The container must be positioned with the door in the lower position.
- All dry material such as dust and remains of packaging material must be swept or vacuumed.
- All stains must be removed before the container is washed.
- The inside of the container must be thoroughly cleaned. Various methods can be considered, depending on the condition of the container. These include steam cleaning, and high-pressure water jets. Only approved and registered detergents may be used.
- All free water, especially in the T-bar floor must be removed preferably by using high-pressure air.

4. CONTAINER INSPECTION AND STORAGE

Each and every container must be inspected and approved by the PPECB before it may be used for the carriage of perishable products. The PPECB may however decide to perform a system audit should the relevant container depot demonstrates that it consistently and reliably operates an approved system of Best Operating Practices (BOP) or in-house quality control programme.

4.1 Condition and cleanliness inspection

It is recommended that the PPECB condition and cleanliness inspection be done before the pretrip (cooling) inspection. This will allow the depot to return the container for repairs should it be necessary. Taints are also easier to detect when the internal atmosphere is at ambient temperature. The following aspects shall be checked:

- The container must have a valid safety certificate (CSC plate), an ISO registration number and a compliance certificate issued by Lloyds or any other approved classification society.
- The steel frame must be in a sound, rust free condition and the side panels may not bulge outside the outer edge of the steel frame.
- The side panels, roof and floor shall be intact, smooth, all joints be properly sealed and clean.
- The doors must open and close easily and properly, the door seals must be intact to provide an air tight seal with the frame and the locking mechanism shall operate freely.
- The inside of the container shall be clean, dry and free from any foreign odor or taint.
- The insulation panels shall be clean, intact, dry and without any bulging.
- A maximum of 25% delamination, **based on the total area of a specific internal side** shall be allowed provided that the insulation is absolutely dry. (The International recommendation is a maximum delamination of 1m² per panel.)
- The T-bar floor shall be in a good state of repair to allow cargo handling and to avoid any ingress of moisture.
- Drain holes shall be clean and properly plugged.
- A PPECB assessor shall seal the container doors with a PPECB cleanliness seal after completion of inspection.

4.2 Pretrip Inspection

The purpose of container pretrip inspection (PTI) is to ensure the correct functioning of the cooling unit as well as the temperature control and recording devices. Two PTI procedures i.e. manual and automatic, are applied on the older and newer types of containers respectively. Both procedures however require that a visual check of the refrigeration equipment is done and special attention is paid to the overall condition and functioning of the unit including a check to ensure that all defrost drain pipes are open.

4.2.1 Manual PTI

Basic requirements are:

- A new temperature chart (Partlow) is fitted on the temperature recorder prior to commencement of the PTI.
- The thermostat must be set to control the temperature on 0,0°C in the chill mode and minus 20,0°C in the deepfreeze mode.

- The set point temperature must be maintained within plus/minus 0,5°C (±0,5°C). The PTI must be done in both modes if the cargo type (chilled or deep frozen) to be carried to be carried is not known at the time of the PTI.
- Check that at least one defrost cycle occurred during the PTI and that the defrost water has drained to the outside of the container.
- Containers to be used for in-transit cold treatment must be set at the specified carrying temperature (usually between minus 1,0°C and 0,0°C) for the PTI procedure.

4.2.2 **Auto PTI**

Two types of automatic (auto) PTI procedures can be distinguished i.e.:

- Partly automatic or PTI-one. The Partlow chart recorder must be used as for the manual PTI described in par 4.2.1 above.
- Fully automatic PTI-two and PTI-three. The method for PTI-two and PTI-three is exactly the same except that PTI-two is done in the chill (0,0°C) mode whereas PTI-three is done in the deep freeze (minus 20°C) mode. This usually is one continuous process.

The Auto PTI-two and Auto PTI-three process includes the following actions:

- The Partlow chart recorder, if fitted, must be ignored or preferably removed.
- The auto PTI-two process must be initiated to allow the microprocessor to perform all the checks on the cooling unit and the air circulating fans. This process may take some hours to complete.
- The results of the auto PTI must be saved and made available to the PPECB for verification.
- The PPECB shall verify the container number and that the specified container passed all the PTI-two checks.
- The PPECB shall issue a PTI approval sticker if the container has passed all the checks.

4.2.3 **Temperature Run method – Microlink**

Some container cooling units are fitted with a so-called “Microlink” temperature and operating processor. This system allows for two types of PTI procedures i.e.: A manual PTI or “temperature run” process requires that:

- The temperature control thermostat is set at 0,0°C (chill mode) or minus 20°C (deep freeze mode).
- The cooling unit is run for approximately 6 hours or longer if in the deep freeze mode.
- A manual check based on the Partlow chart or electronic download is done approximately 6 hours to ensure that the temperature has stabilized at 0,0 ± 0,5°C or at minus 20°C or colder.
- At least one defrost cycle must occur during the temperature pull down process.

The auto PTI process is exactly the same as the fully auto PTI (PTI-two and PTI-three) process described in the above paragraph 4.2.2. PPECB shall verify all readings and if in compliance, will approve the unit and issue the PPECB PTI approval sticker, indicating the temperature setting.

Storage of container

Approved containers may be stored in the depot for later use. The PPECB cleanliness and PTI certificates are valid for sixty (60) days – where after both procedures must again be executed. Care must be taken that the containers are not damaged or contaminated in any way during the storage period.

4.3 Setting of Carrying Conditions

Containers must be correctly set to maintain the carrying conditions as specified by the exporter. New backup batteries must be fitted to view the settings.

4.3.1 **Temperature set point**

- The required temperature in degrees Centigrade (°C) must be set.
- The temperature controlling thermostat must accurately control the temperature within a maximum of plus/minus 0,5°C from the temperature set point (set point ±0,5°C).
- The temperature of chilled cargo shall be controlled on the delivery air.
- The temperature of deep frozen cargo shall be controlled on the return air.
- A sticker indicating the temperature set point must be affixed next to the display unit on the cooler.
- It is the responsibility of the container depot to correctly set the cooling unit’s temperature setting.

4.3.2 **Fresh air ventilation**

The fresh air intake valve must be set according to the booking specification supplied by the exporter and verified by the PPECB. Optimum fresh air ventilation rates are given in chapter 8. It is the responsibility of the container depot to correctly set the fresh air ventilation rate.

4.3.3 **Controlled atmosphere conditions**

Controlled atmosphere (CA) requires a gas tight container as well as special gas generating and controlling devices. These devices and controllers must be correctly calibrated and set by the depot personnel according to the specifications of the shipping line.

WARNING: CA does not support life and nobody must enter a CA container or carry out any maintenance on the cooling unit and fans unless normal atmosphere has been restored.

4.3.4 **Modified Atmosphere conditions**
Modified atmosphere (MA) conditions are also sometimes used for specific products or conditions. If the container is used to create MA conditions, special generating and controlling devices must be fitted. The specifications of the shipping line and the MA service provider must be followed.

> WARNING: MA conditions do not sustain life and the normal atmosphere must be established before entering or servicing the container.

4.3.5 **Humidification**
The standard integral refrigerated container is designed to maintain a RH of 90 ±5% at temperature equilibrium. Some containers are fitted or can be fitted with humidity controlling devices. The term “humidification” can be misleading because it usually refers to a condition of lower relative humidity (RH). A reduced RH of approximately 70% is used for the carriage of most flower bulbs and products such as onions and garlic. An increased RH of approximately 95% to 98% is sometimes used for certain flower species and some of the leafy vegetables. A RH of more than 95% may however result in condensation that may weaken the packaging material or cause fungal growth.

5. SPECIAL REQUIREMENTS FOR IN-TRANSIT COLD TREATMENT

Some importing countries e.g. the USA, Japan, South Korea, Taiwan and Israel require special cold treatments to kill certain quarantine insects that may occur on or in perishable produce. These special specifications and procedures form part of bilateral agreements between the South African National Department of Agriculture (DoA) and the quarantine authorities of the importing country. Detailed handling protocols and equipment specification were prepared and are regularly updated by PPECB. Some of the more important aspects are highlighted below.

5.1 Container certification
The container must be specially certified for the purpose of in-transit cold treatment. The USA and some other countries require a special certificate issued by the United States Department of Agriculture (USDA). Other countries however require a PPECB certificate. The PPECB must ensure that containers for in-transit cold treatment shall comply with the following requirements:

- Accurate and steady delivery air temperature (DAT) across the entire width of the air delivery plenum to control the delivery air temperature within 0,5°C of the thermostat set point.
- Sufficient refrigeration capacity to recool the fruit that has gained heat during loading.
- Sufficient refrigeration and thermal capacity to maintain the fruit at a temperature of minus 0,6°C for at least 22 days.
- A defrost cycle and temperature maintenance procedure to ensure that the fruit pulp temperature will be maintained at minus 0,6°C or cooler.

The cold treatment certificate is valid for a period of three (3) years where after it must again be renewed by an authorised certification body.

5.2 Temperature sensors

5.2.1 **Air temperature sensors**

- DAT and RAT temperature sensors connected to a permanent on board temperature data logger system shall have an accuracy of not more than plus/minus 0,1°C at 0,0°C (0,0 ± 0,1°C) and shall continuously log the DAT and RAT for the full duration of the cold treatment. The data logger shall have a memory capacity of at least 30 days.
- Cargo temperature sensors and data loggers are a requirement either as a permanently fixed or separate system. Only certified cargo temperature data logging systems may be used and these systems must be calibrated in melting ice at 0,0°C by PPECB prior to every cold treatment process. (See Chapter 2 par 4.3.3 for detail).
- Some countries require three (3) while other countries require four (4) cargo temperature sensors. These sensors must be placed in the fruit in specified positions by the PPECB. The cargo temperature logging device shall have an accuracy of not more than plus/minus 0,1°C at 0,0° (0,0 ± 0,1°C). Cargo temperatures shall be logged at least once every hour in units of 0,1°C.

5.2 Calibration of temperature loggers
Temperature data loggers can be a permanent container fixture (on board) or separate (loose). Both types must be calibrated by the PPECB prior to loading. The total accuracy of the temperature sensor, cable and logger unit shall be less than plus/minus 0,25°C (±0,25°C). See Chapter 2 par 4.3.3 for more detail.

5.3 Precooling of the container
Containers to be used for in-transit cold treatment shall be set at the specified carrying temperature and precooled for at least six (6) hours prior to loading. Some countries may require that only precooled containers be loaded. This means that the containers must be on cooling until ready (pick up) for loading.

3. PREDISPATCH CHECK

All containers to be used for the export of perishable products must be checked before it leaves the gate (gate out check) of the container depot.

3.1.1 Container transport documents

A container terminal order (CTO) in the case of port area loading and a container transport document (TPD) for inland loading must be delivered to the depot. All the necessary information as well as the container settings must be specified in the document.
It is the responsibility of the depot to accurately verify all the information and to ensure:

- The correct temperature set point
- The correct fresh air ventilation setting
- The correct CA settings if required
- That all the necessary additional controlling and recording devices are correctly installed

Notes
1. Only original and unchanged transport documents are acceptable.
2. Incorrect containers, containers with incorrect settings or containers not accompanied by a transport document or accom-panied by a changed transport document shall not be loaded and shall be returned to the depot at the cost of the depot.

6.2 PPECB seals

Only containers with valid PPECB seals to certify compliance to cleanliness and PTI specifications shall be allowed to leave the container depot.

7. CONTAINERS FOR VENTILATED TRANSPORT

Ventilated transport and shipment of certain perishable products can only be done under very specific conditions with certain equipment and to certain destinations. Some of the main problems with ventilated transport are:

- High humidity at sea especially fog, and a big fluctuation in day/night temperatures, especially on the West Coast of Africa, can cause considerable condensation on the product. Condensation on the ceiling of the container can cause droplets of water (rain) falling onto the cargo and packaging.
- Rain and seawater can enter the container and cause damage.
- Delays in departures and transshipments can result in extended storage. This can result in rejections should the maximum permissible voyage be exceeded.

> PPECB does not, considering the risk involved, recommend ventilated shipping of perishable products.

7.1 Types of ventilated containers and specific requirements

7.1.1 **Open door containers** – Standard General Purpose (GP) containers are used for open door shipments. It is a requirement that the doors of the containers are kept open except during raining conditions and high seas to prevent water from entering. These containers must be fitted with tarpaulins to cover the door opening when rain is expected. A system to secure the cargo from moving must also be installed. Prescribed cargo packaging and loading procedures must also be followed.

Open door containers shall:
- Have a valid ISO identification number
- Have a valid safety certificate (CSC plate)
- Be sound and rust free with all load bearing surfaces in a good condition
- Be clean, dry, free from any taint and must pass a PPECB cleanliness inspection at least 24 hours before anticipated loading.
- Have a cargo securing system e.g. hooks at the door end.

7.1.2 **Open side containers** – the long side of a standard GP container is removed, additional weight bearing and strengthening structures welded in and the side permanently covered with a galvanised steel screen. The doors of open side containers must be closed because fresh air can circulate freely along the entire length of the container. Tarpaulins must be fitted to be rolled down to prevent entering of rain and seawater. The same requirements as for open door containers shall apply.

7.1.3 **Fan- or ventainers** – These can be insulated or standard GP containers with an extraction fan fitted to actively circulate air through the load. The extraction fan can be a permanent fixture, usually in the bulkhead of the container or a loose fan fitted in an opening between the two doors. The basic requirement is that air is continuously and actively sucked through the load. The same requirements as for open door containers shall apply except that tarpaulins are not required.

7.1.4 **Passive ventilated containers** – These containers are fitted with covered air vents on the long sides at both the bottom and top. The vents allow convection flow of air on the inner sides of the container. Passive ventilated containers cannot be used for the shipment of perishable products.

7.1.5 **Flat racks** – These are flat steel structures of the same horizontal dimensions as a 12-meter (40 ft) container. Cargo is loaded directly onto the steel base and secured by a wire mesh or tarpaulins. Flat racks are not readily available for the South African trade but can be used for ventilated cargo.