1. BACKGROUND

The following PPECB recommendations and procedures for the handling of mangoes for sea transport are based on available industry data, commercial experience, existing procedures and available shipping equipment. It must be stressed that industry as well as basic technical research data is still insufficient in some areas to clearly specify most optimum procedures. These procedures will therefore be revised annually and must be considered the most optimum at present.

An attempt was made to summarise the recommended procedures in a chronological order. This in itself is difficult; because all the actions are performed with the end in mind e.g. pre-cooling inland must be done in line with the shipping requirements. This document must therefore be studied and applied in its totality. Everybody involved in mango handling, storage and transport are most welcome to contribute to the improvement of the total handling system to promote fruit quality and exports from South Africa.

2. PRESEASON ACTIONS

2.1 Cold stores

It is of utmost importance that a cold store is operated and loaded correctly. This will differ from cold store to cold store and must be determined for each set of operational conditions. The cold store operator shall accept full responsibility for effective fast and correct pre-cooling, re-cooling and storage.

2.1.1 Cold store certification

All cold stores used for pre-cooling and storage of export perishables must meet minimum international standards. The PPECB has the authority and responsibility to inspect and certify cold stores for export produce according to an ISO 9001-2008 system.

Exporters must ensure that all new cold stores are inspected and certified. Existing cold stores are re-inspected every year. Exporters must notify the applicable PPECB Regional Service Manager well in advance of all cold stores to be registered.

*Important note:*

The cooling capacity of the cold store must correlate with the peak volume intake of the packhorse concerned. Never overload a cold store because this may result in pulp temperatures in certain positions to increase while under cooling.

2.1.2 Calibration

All temperature controlling, recording and measuring devices must be calibrated frequently. The most accurate and practical calibration is done at the melting point of ice at a temperature of 0,0°C. *(PPECB ISO document PP04.10-01).*

The following deviations at 0,0°C should not be exceeded:

- Temperature control thermostat: 0,0 ± 0,5°C
- Temperature recorder: 0,0 ± 0,2°C
- Thermometer – electronic probe: 0,0 ± 0,1°C
- Thermometer – electronic thermocouple: 0,0 ± 0,5°C

2.1.3 Regular maintenance

Standard maintenance programs, as prescribed by the manufacturers of the equipment, must be followed. It is also of utmost importance to ensure that the insulation is kept intact and dry at all times. Special care must be taken to
eliminate heat ingress at doors, door seals etc.

2.2 Air management

The only “worker” that must remove the “warm” temperature from the fruit is the cold air coming off the cooler (evaporator) in the cold store. This cold air must come in direct contact with the warm fruit and must return to the cooler.

Effective cooling of the fruit can only be achieved by moving air at the correct temperature through the load. This requires a number of important actions such as:

2.2.1 Air circulation in cold store

Stacking of palletised fruit must be so planned to ensure maximum air circulation through the pallets. Air delivery and return plenums must be adequate and short-circuiting of the air must be reduced to the minimum. Cold store operators must follow the instructions of the manufacturer and must measure airflows to design the most optimum loading procedures and patterns.

2.2.2 Air circulation through the carton

Carton design must provide for maximum airflow in both the horizontal and vertical planes. The general recommendation is that carton ventilation slots must be at least 12% of the total surface area. All 6 sides should be ventilated.

2.2.3 Air circulation through pallets

Air should be able to move in all directions through the pallet. This includes the “short ends and carton bottoms”. Ventilation slots in pallet interleaves must match with holes in carton bottoms and tops. The label end of cartons must also be ventilated to allow air circulation.

3. BOOKINGS

3.1 Booking procedures

3.1.1 Exporters must book required shipping space directly with the shipping line, via their appointed export agent. It must be noted that:

3.1.2 Exporters or agents must be registered with the PPECB before bookings may be accepted.

3.1.3 The exporter must specify the required carrying temperature and the corresponding code. The following temperature codes shall apply (refer to par 8.1).

- M08 – Carry at plus 8°C for the full duration of the voyage
- M09 – Carry at plus 9°C for the full duration of the voyage
- M10 – Carry at plus 10°C for the full duration of the voyage
- M12 – Carry at plus 12°C for the full duration of the voyage
- M13 – Carry at plus 13°C for the full duration of the voyage
- M0X – Carry at plus 12°C, 7 days after departure reduce the temperature to plus 10°C and maintain until discharge.
- M0Z – Carry at plus 10°C, 7 days after departure reduce the temperature to plus 8°C and maintain until discharge.

3.1.4 The exporter must specify the required fresh air ventilation rate, which is normally 15m³, although some exporters prefer
40m³, and closed when booked as a CA shipment. Refer (PAR. 3.1.10).

3.1.5 PPECB MUST be advised of the booking in order to ensure timeously planning of actions such as container inspection, loading supervision, temperature recording and monitoring.

3.1.6 PPECB communicates directly with the exporter or agent who has made the booking with the PPECB. The PPECB may however, under certain conditions such as rejections for quality and incorrect temperature, also communicate directly with the pack house or producer to finalise certain arrangements.

3.1.7 Bookings for vessels must be received three (3) days prior to the arrival of such a vessel in the first South African port of call.

3.1.8 Arrangements for conventional shipments must be made at least twenty-eight (28) days prior to the arrival of the vessel in the first South African port of call.

3.1.9 Any possible changes in bookings or shipping spaces must be communicated to the PPECB as soon as such changes can be confirmed. This will ensure that the necessary actions are taken in time.

3.1.10 Controlled atmosphere (CA). CA containers or other containers fitted with different CA systems must never be ventilated with the fresh air vents open while in transit. The fresh air ventilation valves/settings must be in the closed position.

3.2 Booking requirements

Exporters or their agents must specify the following in the written booking request to the shipping line and/or PPECB.

3.2.1 Integral containers

Exporters or their agents must indicate their specific ventilation specification, when making their bookings (par 3.1.4). This will enable the shipping lines, to instruct container depots to have the containers set at a specific setting. Refer to (par 8.4) for fresh air ventilation of porthole containers and conventional spaces.

➢ The personnel at a cold store or pack house must check the container on arrival. They should verify that the vent and temperature settings are according to the booking instructions. If the vents are not open, the shipping line or container depot must then be informed to rectify the setting. PPECB can provide a service to audit the above.

➢ Releasing of container. Depots must set the vents according to the clients’ specification, as indicated on the CTO issued by the operator or shipping line.

4. PICKING AND PACKING INTERFACE

4.1 Picking maturity

Picking maturity was shown to be one of the most important factors determining uniform market quality of mangoes. The lack of reliable practical maturity indices in the past resulted in a very wide range of ripeness stages in the market.

The South African Mango Growers Association (SAMGA) developed a series of maturity indices and parameters such as firmness, sugar content (refract meter readings) and defining external and internal fruit colour with the use of colour charts. These quality parameters are published by the National Department of Agriculture (NDA) and checked by the PPECB.

Exporters must apply these standards stringently to ensure most optimum maturity and absolute minimum maturity variation in a box and consignment.
4.2 REMOVAL OF FIELD HEAT

Available data confirms that maintenance of optimum pulp temperature is one of the most important factors ensuring most optimum post harvest quality. Fast, effective and uniform removal of field heat will:

- Reduce the ripening rate
- Reduce the incidence of decay
- Improve the overall eating quality of the product

Research must still be undertaken to establish the most effective methods (hydro cooling or forced air cooling) and cooling rates under commercial conditions.

Present recommendation

Best results were achieved when mangoes were placed under cooling within four hours from picking and cooled to a pulp temperature of 16°C or colder within twelve hours after picking.

4.3 Installation of thermocouple wires

A thermocouple wire must be installed in a mango in the centre of the pallet. The open end of the thermocouple must be taken to the outside of the pallet to allow pulp temperature measurements at different stages in the handling and transport chain.

5. REFRIGERATED ROAD MOTOR TRANSPORT

Standard PPECB specifications for Refrigerated Road Motor Truck (RRMT) units must be applied. These specifications comply to ISO 9001-2008 standards and are available from the PPECB on request. The following aspects are however highlighted to ensure correct temperature maintenance.

5.1 PPECB Certification

Any accredited certification society may calibrate and certify RRMT’s for the transport of products approved for export. The following must be checked and implemented:

- Temperature control thermostats must operate correctly within the maximum specified band of ±1°C from set point.
- Temperature control thermostats must be correctly calibrated at 0,0°C and operate correctly within the specified temperature range for mangoes.
- The temperature must be controlled in the delivery air and not in the return air.
- The cooling equipment functions correctly and within the specifications of the manufacturer and PPECB.
- Temperature recording equipment must be installed in the delivery air stream and functions accurately.
- External temperature measuring points (thermocouples) to calibrate temperature set points and to check delivery (DAT) and return (RAT) air temperatures must be installed.

PPECB certification also means that product and RRMT temperatures will be checked during off loading in the port. This is therefore a verification that the RRMT functioned correctly during the journey and also to ensure that product
temperatures were managed correctly. Basically this is a recertification check every time a RRMT off loads an export consignment and PPECB will withdraw the certificate should the RRMT not operate within the specifications.

5.2 RRMT inspection prior to loading

Exporters must ensure that the following procedures are followed prior to loading:

- The temperature control thermostat must be set at the required temperature and the RRMT be precooled to the required temperature for at least three (3) hours prior to commencement of loading.

- The temperature control thermostat must be set to deliver air at the required temperature by taking the DAT thermocouple reading and setting the thermostat to deliver air at the specified temperature as measured with the thermocouple installed in the delivery air stream. Please ensure that the correct procedures are followed when taking thermocouple temperature readings. (PPECB ISO 9001-2008 Procedure PP04.10-01).

- The RRMT must be clean, odourless and in a good internal and external condition. It is the responsibility of the consignee to check that the previous load did not damage or taint the RRMT, before it is used again. RRMT’s are used to carry various loads of chilled and deep frozen cargo. Exporters must be extremely careful and ensure that RRMT’s that carried frozen fish are thoroughly cleaned and odour free prior to loading mangoes. (Please see also par 7.4).

5.3 Loading of pallets into the RRMT

Cold air is normally delivered into the air plenum above the pallets. This air must pass through the pallets back to the cooling unit in the front end. Correct and adequate air circulation is of utmost importance and the following procedures must be applied:

- The RRMT cooling unit functions on the DAT/RAT differential. If fruit is not properly pre-cooled, the DAT will drop to unacceptably low levels to compensate for the high RAT, which will increase rapidly because of the warm fruit. This will cause cold damage, especially to the top layers of cartons. It is therefore of utmost importance that the fruit be properly cooled throughout the pallet, prior to loading into an RRMT.

- At least one pulp temperature reading (thermocouple) per pallet must be taken during loading. These temperatures must be recorded and copies be retained by the driver for scrutiny by the PPECB during off loading.

- Pallets must be loaded in such a way that the ventilation holes of the cartons are in the direction of the airflow in the RRMT.

- The loading of pallets must be in such a way that no openings are created for the cold air to short circuit directly to the cooler without moving through the pallets.

5.4 Mixed loads

Only fruit destined for export must be loaded into a RRMT. A mixed load of export fruit and local market fruit not only delay and complicates off loading, but may affect the temperature of export fruit. If not possible, ensure that local fruit is also precooled to the correct temperature and loaded in the front and not at the door end. This will allow for first and fast off loading of export pallets.

5.5 RRMT product loading temperatures

A RRMT is a transport unit and not a cold store. The fruit should therefore be cooled to the transport (carrying temperature) prior to loading into the RRMT.
The maximum pulp temperature of the load at time of loading into a RRMT should never be more than 3°C above the specified carrying (shipping) temperature (refer par 3.1.3 and 8.1). The temperature control thermostat of the RRMT must be set at the specified shipping temperature.

Should there be no other alternative to load warm fruit for recooling in the port, the temperature control thermostat must be set at the average temperature of the load. **Never set the thermostat colder than 3°C than the warmest fruit in the load**, because a colder set point will result in too low delivery air temperatures resulting in cold injury to the fruit in the top layers on pallets.

**WARNING**: Avoid loading warm fruit into a RRMT at all times.

6. LOADING OF INTEGRAL REFRIGERATED CONTAINERS

6.1 General comments

Inland loading procedures of refrigerated containers does not differ from port loading provided the container is connected to a power supply to continue the cold chain process. Container cooling performance and product loading specifications are therefore the same irrespective of where the container is loaded.

6.2 Technical checks prior to loading

6.2.1 Pretrip inspection (PTI)

A technical and cleanliness inspection is done by PPECB before the container leaves the container depot for loading. The following must be checked before produce is loading into the container:

- The PPECB PTI approval certificate (yellow sticker, attached on unit) is valid for 60 days where after a complete PTI must again be done.
- The PPECB cleanliness seal (attached onto door handle toggle) is valid for 60 days where after a cleanliness check must again be done.

6.2.2 Check on settings

The following two settings, specified during booking (par 3.1.3) must be checked before the container leaves the container depot for loading:

- Temperature set point
- Fresh air intake

6.3 Container loading

The following aspects are important and will be checked by PPECB:

6.3.1 Pulp temperatures and temperature tolerances

- Pulp temperatures, taken via the thermocouples, and with fruit pulp sensors (probes) will be taken and recorded.
- The maximum pulp temperature at time of container loading shall not be warmer than 3°C above the booked temperature (par 3.1.3 and par 8.1) specification.

6.3.2 Maximum cargo loading requirements

- “Red line” maximums i.e. a maximum pallet height of 2.1m will be allowed (horizontal red line approximately
150mm below ceiling. A vertical red line at the door end indicates the air return plenum at the door and pallets must not protrude beyond this red line.

- Maximum axle loads for the road transport of containers must be observed.

6.4 Time Temperature Tolerance (TTT)

Exporters reported quality losses with port handling TTT’s exceeding 3 hours, therefore should this happened, then containers will be rejected and must exporters apply for dispensation (T13), should they wish to proceed with the export. No information is available on TTT’s for inland loading, but industry agreed to apply a 4 hour TTT in the meantime. This means that:

- A container should be back under cooling within 4 hours after the first pallets being loaded.
- A Genset be used should the 4 hour TTT be exceeded.
- A record system be introduced by the packhouse/exporter to record the loading and cooling operations.
- The “inland 4 hour TTT” is over and above the “port 3 hour TTT” (par 9.2.1).

7. PORT HANDLING PROCEDURES FOR CONTAINERS

7.1 Container loading depots in port areas

Exporters and agents must:

- Avoid using more than one loading depot or also off load at a local market. Mixing of products in one consignment for more than one loading depot results in delays, temperature increases, loading errors and many other logistical problems.
- Ensure that loading depots are always informed of volumes and arrival times of RRMT’s. The loading depots must pass this information on to the PPECB not less than 24 hours prior to arrange for temperature checks, loading supervision and planning of the holding store, loading programme or port terminal movements.

7.2 Late arrival of produce

Produce cannot be containerised after stack closing, i.e. 12 hours before estimated time of arrival (ETA) of the vessel. Exporters or their agents must therefore:

- Dispatch produce as early as possible to avoid last minute loading and bottlenecks at loading depots.
- Precool the product to the carrying temperature (unless otherwise specified) and ensure that the product arrives at the correct temperature to avoid recooling and delays.

7.3 Recording pulp temperatures on arrival in port

Specific temperature sampling procedures were laid down for produce arriving in the ports. These procedures differ for different modes of transport, different products and also for different types of shipping. The exporter or his agent must ensure that they are fully informed on any changes in the procedures and specifications.

The following procedures apply to all fresh produce arriving by RRMT at the container loading depot in the immediate port area:
The RRMT thermostat set point, recorded delivery air temperature (DAT), actual DAT and return air temperature (RAT) as per installed thermocouples will be recorded prior to opening the RRMT doors for off loading.

Four fruit pulp temperature readings, determined by a probe reading i.e. in pallets at the door (D), centre (C) and rear end (E) and any randomly selected pallet in the RRMT, will be recorded.

The above-mentioned four fruit temperature readings are the minimum. More readings will be taken to get a more reliable weighted average temperature should problems be detected.

Container loading shall only proceed if fruit temperatures are within the specified range. Recooling will have to be applied should the fruit be warmer than the specified maximum temperatures.

Fruit quality inspections will be conducted to ensure compliance to the minimum standard.

A PPECB fruit quality inspection shall not be done on fruit colder than 6°C and being rejected for shipment (par 9.1).

Fruit samples from which temperature readings (probed fruit) were taken, shall be left in the box.

The PPECB will liaise directly with the owner of the fruit so as to finalise a decision on loading and shipping procedures should deviations be found.

7.4 Required action if a foreign odour is detected in a RRMT at off loading point:

- Inform RRMT driver and intake supervisor.
- Do not off load vehicle.
- Keep vehicle doors closed.
- Place a PPECB container seal on doors and record seal number.
- Contact exporter, agent, RRMT operator.
- PPECB can ask for a SABS opinion at the cost of the exporter or RRMT operator.
- Report incident to NPM: Cold Chain Service for further action and for a decision.

8. CARRYING TEMPERATURE, LOADING, TOLERANCE AND VENTILATION

The shipping mode being used determines the maximum fruit pulp temperature at time of loading into the shipping space. Industry data confirm the following maximum loading temperatures as taken with the installed thermocouples on the fruit inside the pallet.

8.1 Carrying temperature

The following carrying temperature codes will be applicable for mangoes:

- M08 – Carry at plus 8°C for the full duration of the voyage
- M09 – Carry at plus 9°C for the full duration of the voyage
- M10 – Carry at plus 10°C for the full duration of the voyage
- M12 – Carry at plus 12°C for the full duration of the voyage
- M13 – Carry at plus 13°C for the full duration of the voyage
- M0X – Carry at plus 12°C, 7 days after departure reduce the temperature to plus 10°C and maintain until discharge.
- M02 – Carry at plus 10°C, 7 days after departure reduce the temperature to plus 8°C and maintain until discharge.

These temperature codes must be quoted when a booking for shipping space is made (par 3) and will be entered onto the shipping documents (reefer list, deck plan etc.) for the Master to apply as per PPECB instruction. The exporter
therefore selects the carrying temperature to be applied. PPECB will verify that the correct temperature is being applied (par 12) and will communicate the voyage temperatures as follows:

- Publish all reported delivery (DAT) and Return (RAT) air temperatures, as reported by the master, on www.ppecb.com.
- E-mail temperatures to those exporters who participate in the PPECB temperature management plan.

**IMPORTANT NOTE:**

It is the responsibility of the exporter to monitor the reported voyage temperature and to request PPECB in writing to instruct corrective actions should incorrect temperatures be applied or should the RAT indicates product warming.

### 8.2 Integral refrigerated containers

All mangoes not to be warmer than 3°C above the specified first phase carrying temperature i.e. 10°C or 8°C. (This specification is based on an assumption that the integral container may cool the fruit by approximately 1.5°C per every 24 hour period prior to taking the container on board). Product above +3°C and up to 7°C above the carrying set point, will be rejected and placed under pre-cooling prior shipment. Readings greater than +7°C above set point will be rejected for export. A dispensation (T13) may be granted to have these products re-cooled prior shipment to within the maximum +3°C tolerance.

### 8.3 Conventional shipments

All mangoes not to be warmer than 2.0°C above the specified first phase carrying temperature. Special care must be taken to ensure maximum air circulation through the pallets. This means preferably only ISO pallets (1000 mm x 1200 mm) should be used for conventional shipments and that air bags must be installed to seal off all vertical openings between pallets and deck sides.

### 8.4 Fresh air ventilation

The following fresh air ventilation clauses shall apply:

- Integral containers: A minimum vent setting of 15m³ per hour with a maximum of 40m³ per hour for the total voyage shall apply – exporters to specify.

- Conventional decks: [Continuous fresh air ventilation 24 hours per day](#).

### 9. HANDLING PROCEDURES AND REQUIREMENTS IN THE PORT

#### 9.1 General aspects

- All pulp temperature specifications refer to pulp temperatures in the centre of pallets as taken with thermocouples, or probe readings.

- All fruit at or colder than 6°C on arrival of the RRMT in the port will be rejected for export due to potential cold damage. PPECB will not evaluate for potential cold damage because cold damage will not be visible at the time of arrival and may only develop afterwards.

#### 9.2 Time temperature tolerances (TTT) to be applied in the ports
The TTT is the total cumulative time that the product may be without cooling during the transport, loading, handling and shipping period.

Product temperature must be maintained after the container is loaded. This is very critical because the in-transit or shipping equipment cannot remove any heat build up.

9.2.1 Requirements for integral containers

A TTT of three (3) hours shall apply.

In practice this means that an integral container of mangoes must be back under re-cooling within a maximum period of three (3) hours from loading the first pallet out of the cold store. Container re-cooling in the port terminal must commence within one (1) hour from arrival in the port.

Should any container stand without cooling for more than 3 hours, it will be rejected for export. Should the exporter wish to export then a process of dispensation (PP04.02-02F01) must be followed. If possible and still at the Loading point, then product temperatures at the door end could be monitored for assistance. Should the temperatures still be within protocol, then shipment will proceed. If outside protocol then the product must be offloaded and re-cooled prior shipment.

Please refer to par 6.4 for TTT requirements for inland loading of integral containers.

9.2.2 Requirements for conventional vessels

Loading operations must stop, hatches closed and re-cooling must commence as soon as a pulp temperature of more than 4°C above the specified carrying temperature is recorded (i.e. thermocouple temperature) or probe temperatures.

9.3 Re-cooling in the port

Port handling facilities and cold stores are designed to hold the product for relatively short periods. Cold storage space and cooling capacity are, therefore, very limited. Recooling can also only be done if sufficient time is available before the product must be shipped. Exporters must also appreciate the fact that port handling facilities handle large volumes of other export and import produce and may not be able to apply different procedures to non-conforming products.

Re-cooling in the port must, therefore, be avoided at all times by ensuring adequate pre-cooling throughout the total load prior to dispatch to the port.

9.3.1 Re-cooling procedures

The cold store operator in the port must inform the exporter or his agent if re-cooling is required and what temperature will be applied.

Fruit not on temperature must be kept separately in the cold store awaiting the final decision on re-cooling and shipping.

Re-cooling will only be considered if sufficient time is available to reduce the actual pulp temperatures to within the tolerances specified.

The exporter must inform the PPECB in writing if fruit must be shipped on the next vessel or diverted to the local market should it not be possible to re-cool in time.

9.4 Communication of temperature problems
PPECB will inform the exporter regarding the nature and extent of the temperature problem in a specific consignment, RRMT or container.

The RRMT delivering fruit outside the temperature specifications will be inspected and the owner be informed of the problems found.

RRMT’s with faulty temperature controlling or recording equipment must be rectified before collecting a next load.

PPECB will report temperature deviations on a weekly basis to the industry.

All resetted settings found on RRMT’s after being dispatched, must be reported by PPECB to the specific owner of the product. Off loading process will be suspended, until approval has been given to proceed.

9.5 Port handling procedures of conventional shipments

Conventional shipments of mangoes to the United Kingdom and Europe must be arranged between the exporter and the shipping line.

9.6 Preplanning

Exporters must still book shipping space with the PPECB despite the fact that PPECB is not involved in space and freight agreements between the exporter and the shipping line. The PPECB booking confirmation triggers all the port handling and transport logistics activities.

Pallets for conventional shipping of mangoes will only be handled at fruit terminals in the ports.

The exporter must decide on which cold store to be used and must make own arrangements for storage space.

The fruit must be in the cold store and on temperature prior to the arrival of the vessel. Direct loading from RRMT’s should never be considered due to the risks of temperature increases, condensation and delays in cooling.

Only one discharge port is recommended. The discharge port may however change during the voyage depending on port situation, market requirements or logistical factors.

Exporters must make their own transport arrangements from discharge ports to the market.

9.7 Pre cooling of conventional shipping spaces

The standard PPECB requirements will apply, viz.:

The decks must be pre-cooled to and maintained at 0,0°C for at least 24 hours prior to commencement of loading.

A PPECB technical survey of all shipping spaces shall be done before commencement of loading to ensure that the spaces are clean, odour and taint free and meet standard safety and other structural requirements.

The temperature controlling and recording equipment will be inspected for calibration accuracy. A calibration in melting ice may be required especially if the master cannot prove accuracy of the temperature equipment.

9.8 Loading procedures

Pallets to be shipped in reefer ships (conventional) must be pre-planned and sorted prior to commencement of loading. The exporter or his agent must therefore indicate to the port cold store which pallets must be shipped
conventionally.

- Exporters must arrange for placement of temperature recording equipment in cartons prior to commencement of shipping, should such recorders be required.

9.9 TTT during loading

- All fruit to be pre-cooled to within 2°C above agreed shipping temperature.
- Decks will be closed and fruit re-cooled if the weighted average pulp temperature increases to more than 4°C above the shipping temperature.

9.10 Recording of loading temperatures

- PPECB will take pulp temperatures of the fruit in the cold store to decide on commencement of loading.
- PPECB will also take pulp temperatures of fruit on the quayside and in the decks. Re-cooling will be instructed if pulp temperatures are 4°C or warmer than the shipping temperature.
- PPECB will inform the exporter of any pulp temperature problem, will reject fruit that are already in the shipping process and that are at or above 4°C of the shipping temperature and will record temperatures and other detail for future reference and analysis.

9.11 Loading temperature tolerances

- Maximum temperature tolerance as per (par 8.2) shall apply.
- Random temperature checks will be done during loading. At least four readings (of the fruit on the outside of pallets) per 30 pallets will be taken to arrive at a weighted average.
- Fruit warmer than specified will be rejected for export or will have to be re-cooled and re-inspected for quality by PPECB and, when approved, be shipped as soon as possible.
- Fruit at or colder than plus 6°C will not be shipped due to the high risk of chilling injury. Such fruit will not be re-inspected (refer par 9.1).

9.11.1 Notification of rejections

- The PPECB will immediately inform the cold store operator and the exporter of fruit that cannot be shipped.
- The exporter must inform the PPECB if other fruit must be shipped.
- The exporter must arrange with the cold store operator for re-cooling should it be possible to ship the fruit on the next vessel.

9.12 Replacement of damaged pallets and cartons

The exporter or his agent must arrange to replace any damaged fruit, cartons and pallets. Damaged fruit or other material will not be shipped and the exporter will be liable for any fruit short shipped if replacements are not supplied.

10. FRUIT AGE

Mangoes will be rejected for export if the fruit is older than 12 days between picking and the ETA of the vessel at time of
commencement of picking for the specific voyage.

11. **LOADING OF CONTAINERS ON VESSELS**

11.1 **Limitations**

A very strict temperature management program must be followed by the Chief Engineer to minimise quality loss. It must however be remembered that:

- The DAT can only be controlled within the specified minimum and maximum temperature ranges.
- Pulp temperatures are not known during the voyage.
- The refrigeration staff must also take care of other refrigerated cargo and containers on the vessel and cannot always supervise temperatures.
- Cold blasts must never be lower than 1°C below the requested DAT. (Conventional decks).

11.2 **Procedures during loading of integral containers on vessels**

- PPECB will verify the carrying temperature specified on the reefer list/manifest to ensure that the original booking request of the exporter is applied.
- PPECB will instruct the Master in writing to apply the carrying temperature and fresh air ventilation as booked by the exporter (par 3.1).

12. **ALL OTHER SHIPPING SPACES**

Carrying temperature specification:

- PPECB will issue a final temperature letter in which the carrying temperatures are specified as per the booking code (par 3.1.3 and 8.1). This letter will be handed to the Master or his representative prior to departure.
- The Chief Engineer will be required to accurately control the DAT as specified in the temperature letter or otherwise instructed by the PPECB.

12.1 **During the voyage**

The Master will be required to report air and pulp temperatures (where taken) to the PPECB Cape Town Port Office on the following occasions:

- At approximately 08:00 ships time every day during the entire voyage.
- Any deviations from the specification must be reported to the PPECB immediately when identified.
- PPECB will capture and publish temperatures received from the Master on www.ppecb.com.

12.2 **Corrective actions**

The Master and/or the Chief Engineer must report all deviations to the PPECB Cape Town Port Office. PPECB personnel will evaluate reported temperatures. The following actions must be taken:

- The Chief Engineer must apply stipulated actions as outlined in the PPECB temperature letter (cold blasts, etc.).
Exporters (or Industry representatives), together with PPECB will formulate corrective procedures.

PPECB will inform the Master of the required corrective actions as soon as such actions are formulated and agreed upon.

The Master must apply corrective procedures immediately on receipt of PPECB’s instruction.

Cold blasts must never be lower than 1°C below the requested DAT.

13. POST DISCHARGE HANDLING

It is the responsibility of the exporter to ensure that his importing agent in the port of discharge is informed of the correct procedures required.

13.1 TTT application advise

The importing agent must ensure that the product is put under cooling as soon as possible after discharge. Recooling must be applied within two (2) hours after discharge if the product is not removed from the port area.

13.2 Cooling procedure in the discharge port

The importing agent must ensure that:

- The cooling unit (cold store) is correctly set to deliver air at the last DAT specification to the Master of the vessel immediately prior to discharge from the vessel.
- Liquid Nitrogen cooling units may not be used at any time.
- DAT’s and RAT’s are recorded at least every four (4) hours while cooling is applied and such temperature logs must be retained for later reference.

14. SAMGA FEEDBACK

Quality reports from the SAMGA Overseas Technical Officer are invaluable in decision making on temperature management. The following procedures must be followed:

14.1 Initial quality report

The initial overall impression and other relevant information must be communicated to the PPECB as soon as possible. This information is required to decide on any immediate actions to be taken by vessels already en route as well as preshipment handling.

14.2 Quality parameters

All quality parameters must be accurately defined to avoid any misunderstanding. Aspects such as fruit ripeness, firmness, fruit colour (internal and external), cold injury, waste and shelf life must be recorded and passed on to SAMGA and PPECB.

Special care must be taken to identify samples in such a way that it can be linked to pallets and containers. International Traceability procedures shall apply at all times.

14.3 Quality evaluation
PPECB and SAMGA will evaluate all temperature and quality data at the end of the season. All research results will also be considered and the handling procedures revised for application during the next season.

15. GENERAL

The recommendations and procedures outlined in this document are based on present experience and industry results. Much information is still required and everybody with an interest in the mango industry is requested to comment, suggest improvements and propose changes.