	Ordinary Handling Protocol - HP01 - Handling Procedures for Citrus Fruit	HP01
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Responsible Person:	National Manager Cold Chain Protocols and Standards (Bernard Henning)	
Approver:	General Manager Coastal (Vijan Chetty)	
Department:	Operations - Cold Chain	

1. INTRODUCTION

The responsibilities and actions to ensure optimum cold chain operations are summarised in the HP02 document. The HP02 and Shedule1/HP22 documents must be read jointly with the HP01 to ensure that all requirements are met.

PPECB does not claim that all the procedures and specifications in these documents are wide-ranging. The handling procedures are therefore continuously revised to suit the changing situations and requirements.

1.1 Approved facilities

All container and specialised refrigerated vessel (SRV) loading must take place from a PPECB approved loading facility.

1.2 Loading temperature requirements

Refer to the schedule 1/HP22 on the PPECB web site for the optimum set point regime codes for EU and non-EU destinations.

Optimum pulp temperatures are summarized in Table 1, pg.6.

Citrus fruit should be pre-cooled to the specified carrying temperature (Carrying Temperature Regime Codes) prior to loading. This will ensure maximum storage life and shelf life, reduce moisture loss, and reduce the incidence of decay.

1.3 Product Specific

A maximum pulp temperature of 3.0°C above the specified carrying temperature will be allowed e.g., if carrying at 3.5°C (set point, or delivery air temperature), pulp temperature may not exceed 6.5°C.

Open top-, telescopic cartons, crates or bulk bins must be pre-cooled to a maximum pulp temperature of 3.0°C above the specified shipping temperature. A maximum pulp temperature increase (on the outside of pallets) of 5.0°C above the specified carrying temperature will be allowed during the handling, loading and transport of the fruit, until re-cooling has recommenced.

For EU destinations the temperature regime codes, and allowable temperature tolerances stipulated in the Citrus False Codling Moth (FCM) Risk Management System document must be followed.


1.4 Loading of pre-cooled fruit

Product temperature increase must be kept to an absolute minimum once the cold chain has started. One of the important reasons is that exposure of the cold fruit to a warmer environment will result in the formation of condensation on the cold fruit surface. This will result in the fruit (and the packaging material) becoming moist. Moisture is a sure way of promoting decay (rots). Fluctuating temperatures also stimulate senescence, leading to associated quality losses. The practice to load citrus at a warmer temperature than the optimum carrying temperature is therefore not recommended.

1.5 Plastic Wrapping

Care must be exercised in the use of plastic or shrink wrapping (pallet securing) materials. Use only a loosely woven lattice type that when stretched over the cartons still allows for the horizontal penetration of air.

Alternative rapping in the top layer of cartons are allowed for EU shipments.

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1.6 Packaging Conditions

Cartons must be stacked/palletized neatly and in such a way that no cartons will protrude past the dimensions of the pallet base. The pallets must be strapped in at least three positions preferably more to ensure that the pallet/cartons remain squarely upright. It is strongly recommended to use pallet bases with a maximum of 9 slats thereby ensuring enough ventilation between the slats for vertical air flow. Pallets must in no way lean to one side.

Open top-, telescopic cartons, crates or bulk bin ventilation holes/openings must always be aligned as well with the pallet slats.

Refer to the CRI website, public downloads under packaging for the “Packaging Material Specifications and Palletisation Protocols”.

1.7 Temperature tolerance/increases allowed

All Citrus exclude soft citrus:

- In cold store: 3.0°C
- During loading, fruit in motion to loading bank or on quayside: 5.0°C

Only Soft Citrus:

- Cold store and during loading 3.0°C

2. PROCEDURES FOR LOADING OF CONTAINERS

2.1 The following are very important for all containers


- The total floor surface must be covered to avoid short-circuiting of cold air.
- Pallet height must not exceed the horizontal **RED** loading line.
- Last pallets loaded must not protrude beyond the vertical **RED** loading line at the door end or the end of the T-bar floor.
- Fan spaces and air passages must be unobstructed.
- It is compulsory in the case of EU shipments, the open floor space at the back at the door-end must be covered with a void plug.

2.2 Capacity

Integral containers are available in both 20-foot (6m) and 40-foot (12m) units - also known as TEU's and FEU's. The FEU's usually take 20 ISO pallets. The TEU (20 foot) take 9 pallets, with the 10th pallet stowed breakbulk. So called “high cubed” (FEU) integral containers, can take 20 pallets up to ±2,35m high including the pallet base.

2.3 Maximum period without cooling (Time Temperature Tolerance)

- TTT for all pre-cooled citrus in integral containers is 16 hours.
- The TTT specifies the maximum cumulative time allowed from the time that the first pallet of fruit leaves the cold room for loading into a container, until the time that the full container is again connected to a power source.
- In the case of the integral container, the 16 hours TTT allows for ±one (1) hour loading from the cold store into the container, ±fourteen (14) hours transit time to the port and ±one (1) hour port handling and reconnecting to a power plug.
- Gensets must be used to supply electricity to the container if the transport time to the port is more than fourteen (14) hours.

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- Delays in connecting a container cooling unit to power must be avoided. Fruit must be placed under cooling as soon as possible. Fast re-cooling will quickly remove condensation, resulting in a reduced risk of decay.
- Also refer to the CBS-RMS document for cooling times to be applied

2.4 Dual container loading points is not recommended, but can be accommodated under the following guidelines

- The Exporter/Agent must notify PPECB booking section of both loading points at time of placing bookings.
- Maximum two loading points per container.
- Always start at the furthest point first.
- Distance between points must be such that the total cumulative (TTT) of 16 hours is not exceeded.
- If it will take more than 16 hours, then a generator unit must be attached.
- A maximum tolerance of 3.0°C will be allowed at both loading points for pre-cooled loads.
- Part-loads must be containerized in such a manner that the second loading point will not have trouble to complete the loading process.
- Suggest that cargo be secured/supported, so that it will not shift during transit to second point.

2.5 Fresh air intake/ventilation

A ventilation setting of minimum **15 cubic metres per hour (15m³/h)** or as per Exporter requirements for integral containers is required.

2.6 Procedure for loading of pre-cooled citrus shipments (*only applicable to the EU*)

- The fruit from CBS areas must reach the handling facility and or cold store and be under cooling within 6 days from PPECB pack house inspection.
- Citrus commodities including Citrus latifolia (Bears limes, Persian limes, and Tahiti limes) other than lemons and Citrus aurantifolia are subject to storage temperatures as specified in the Citrus FMS
- Kumquats do not fall under the EU FMS rules.
- The fruit shall be shipped at a delivery air temperature set point as specified in Schedule 1/HP22 document.
- Fruit from CBS areas shall be shipped within 18 days from the first PPECB inspection.
- Fruit older than 18 days up until 28 days, shall require re-inspection for export to the EU.
- Fruit from CBS areas that is still in the country after 28 days from first PPECB inspection can only be exported to non-EU member countries.
- Specialised Refrigerated vessels: If pallets are older than 18 days at this point in the cold chain, and the target temperature of 3.0°C has not yet been reached, they must be re-inspected for CBS. However, once all pallets in the cold room have reached ≤ 3.0°C they will be deemed as being shipped. No 18-day CBS re-inspection will be required during further cold storage.

2.7 Procedure for loading of pre-cooled citrus shipments to non-EU member countries


- The inspection validity period (fruit age) is 21 days for soft citrus and 28 days for other (hard) citrus fruits.

3. LOADING AMBIENT FRUIT

By accepting a W-booking, the relevant Shipping Line/s agrees upfront to the conditions of fruit being booked and loaded under ambient temperature (maximum 25°C) for a specific consignment.

3.1 Procedure for ambient loading of all citruses

- It is advisable to avoid mixing different types of citrus fruit and or cartons in the same shipping space.

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- Fruit pulp temperature not to exceed 25°C at time of loading.
- The use of “Super Vent”, open top or similar type cartons is advised.
- Carton ventilation holes must always be open.
- All pallet caps/tops and interlocking sheets must be intact and allow for proper ventilation.
- Cardboard bins and wooden crates must have ventilation openings at the base and caps at the top to promote convective cooling.
- Citrus fruit with a high risk of decay not recommended to be shipped ambient.
- It is recommended to not delay loading fruit for ambient shipment for more than 72 hours after packing.

4. PROCEDURES FOR LOADING OF SPECIALISED REFRIGERATED VESSELS (SRV)

SRV's have several hatch and deck configurations. Cold air is supplied to the bottom of the palletised fruit (high pressure) and removed from the top of the pallets (low pressure). Cold air is therefore circulated from the bottom vertically up through and around the pallets.

Most modern reefer vessels have high cooling capacities, attention should be paid to ensure uniform cooling. The reason for this is that product heat must be transported from inside the pallet to the cooling coil. The medium that removes this heat is the cold circulating air.

Any factor that may reduce air circulation around the fruit will also reduce the cooling efficiency of the system. The nature of the telescopic citrus carton is such that the pallet becomes a big densely packed carton with much insulating material (cardboard). It is therefore impossible to circulate cold air around the fruit - the object to be cooled. This results in slow cooling and re-cooling and even hot spots of excessive temperature increases (as much as 20°C warmer than the actual air delivery temperature under extreme conditions).


Efficient uniform pre-cooling of vessel spaces prior to loading into reefer vessels (and for that matter into any refrigerated transport space) is an absolute prerequisite for minimum quality loss during transport and storage.

Some citrus fruit however, under certain conditions, can be loaded directly (un-cooled) into containers and specialized refrigerated vessel decks. This includes some **early season grapefruit, lemons, oranges (Valencia's, and Navels)** to allow breakdown of green background colour in the skin.

4.1 Shipping arrangements for SRV

The following arrangements will be applicable during the shipment into SRV's:

- Same packaging conditions as for container shipments refer par 1.6.
- Always start loading partly loaded decks from the evaporator/cooling end.
- Plastic or similar sheeting must cover the floor in partly loaded decks to avoid air short-circuiting the cargo.
- Avoid mixing soft citrus in same cooling compartment with those carrying fruit at ambient conditions.
- Jumping of decks should be limited and will only be allowed under certain conditions and all floor spaces must be covered. It is the responsibility of the captain to ensure that partly loaded cargo is well protected and receive proper pre-cooling. Next loading port must have partly loaded cargo covered during the stowing of bottom decks.
- Loading shall be as quick as possible. If delays do occur the decks must be closed, and cooling commenced.
- Completed decks must be closed and cooling applied as soon as practically possible.
- The following special shipping arrangements will be for specific vessels and instructions will be given to the captain, during the season for:
 - Specific fan speed arrangements
 - Ventilation setting requirements

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- Temperature set point arrangements
- Probing of certain decks
- Constant en-route reporting and monitoring

4.2 Fresh air ventilation:

4.2.1 Precooled fruit loaded into decks

Fresh air must always be introduced into the shipping spaces (decks) at such a rate to maintain the carbon dioxide (CO₂) level below 0,5%, or as per specific arrangement.

4.2.2 Ambient loaded decks

To assist the re-cooling of complete ambient decks, it is recommended not to have any ventilation for the 1st 24 hours after completing a deck, thereafter, to reset ventilation to maintain carbon dioxide (CO₂) level below 0,5%.

4.3 Air circulation rate

Cold air must be circulated in the shipping space at a rate of at least 60 complete air changes per hour based on the empty volume of the space, or as specific arrangement.

4.4 Lower temperature set points

Should it be necessary, Exporters, with the approval of all parties can ship warmer fruit at lower set points, to assist cooling of warm decks. This will be done through special arrangement.

4.5 Compromise temperatures in specialised refrigerated vessel decks

Most optimum carrying temperatures for citrus are summarised in Table 1, pg.6. Under certain conditions, however, different types of citrus fruit may be mixed in the same SRV deck.

The following general guidelines will be followed:

- The warmest specified temperature will apply for the fruit concerned provided the proportion of that fruit exceeds **25%** of the total load.
- Compromise temperatures are also dictated by fruit quality.

5. INTRANSIT COLD TREATMENT SHIPMENTS


Several countries require very strict pre-cooling and shipping temperature control to comply to quarantine requirements. These cold treatment protocols are government-to-government, Directives and Permit agreements and are therefore not open to debate. The protocols are covered in separate documents, obtainable from the various PPECB port offices or from the PPECB website at www.ppecb.com.

6. CARRYING TEMPERATURES

6.1 Carrying temperature instruction

PPECB prepares a written carrying temperature instruction based on the booking for shipping space by the Exporter, loading information and Shipping Line's documentation.

The ship's planner must inform the PPECB port office in writing of any changes in the requested and agreed carrying temperature or stowage plans. He will present a proper Reefer List, or Bay plan or Deck plan to

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PPECB and the Master. The **PPECB then audit all information and together with ship's planner**, verify all changes, before PPECB hands over the final covering coded temperature letter to the Master.

The PPECB will, verbally and in writing, instruct the Master or the Chief Engineer of the required temperatures to be maintained during the voyage. It must, however, be remembered that:

- The Master has control over the delivery air temperature (DAT) only and has no means to control the return air temperature (RAT) other than applying cold blasts as specified by PPECB in the temperature letter.
- The Master has the right of refusal to reset integral container DAT set points and will only do so if it is safe for his crew to get access to the container.
- The fact that the DAT was kept within the specified 0.5°C tolerance does not guarantee optimum pulp temperatures. Insufficient ventilation through the carton and the pallet, heat build-up due to product respiration, warm loading temperatures and several other factors have a big influence on the RAT and pulp temperatures. These and other factors cannot be controlled by the Master.

6.2 Temperature recording

The ship must be fitted with the prescribed number of air (and preferably also pulp) temperature sensors connected to a temperature recorder or data logger. The temperature recording devices as well as temperature control thermostats must be regularly calibrated and must be accurate within $\pm 0.5^{\circ}\text{C}$.

6.3 Temperature logs

The Shipping Line must ensure that the temperature logs or charts for the entire voyage is returned to the PPECB once requested. Failure to do so confirms non-compliance to the PPECB instruction and the Shipping Line will be held responsible for any temperature related quality losses.

6.4 Reporting on temperature


PPECB will, on receipt of a written request and confirmation (notification number that an insurance claim was instituted), compile a technical report on pre-shipment and voyage temperature conditions.

7. OPTIMUM CARRIAGE TEMPERATURES CITRUS FRUIT

TABLE 1

Optimum carrying temperatures ($^{\circ}\text{C}$) recommended for well and poorly coloured citrus fruit as well as the maximum time between packing and reaching optimum pulp temperature for citrus fruit to be shipped from South Africa in conventional vessels and containers.

TYPE	OPTIMUM PULP TEMPERATURE		MAX. TIME TO REACH OPTIMUM PULP TEMPERATURE
	WELL COLOURED	POORLY COLOURED	
	$^{\circ}\text{C}$	$^{\circ}\text{C}$	DAYS
Oranges Navels	2.0 to 4.0	4.0 to 10	7 days
Oranges other	2.0 to 4.0	4.0 to 10	12 days
Soft citrus – all	2.0 to 4.0	4.0 to 10	6 days
Grapefruit	4.0 to 10	10 to 16	12 days
Lemons / Limes	4.0 to 7.0	10 to 11	12 days
Citrus other	4.0 to 7.0	10	7 days

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Please find all regimes and ventilation requirements in the Schedule 1/HP22 protocol, also published, and updated on the PPECB website - www.ppecb.com

8. REQUIREMENTS TO LOAD TO EUROPEAN UNION (EU) COUNTRIES

The European Union countries require very strict pre-cooling and shipping temperature control to comply to quarantine requirements.

The Citrus FCM Management System (Citrus FMS) incorporates the Citrus FCM Systems Approach (Citrus FCM SA). The Citrus FCM SA has been developed in accordance with relevant guidelines provided by the International Plant Protection Convention (<https://www.ippc.int/en/core-activities/standards-setting/ispms/>) and its International Standards for Phytosanitary Measures (ISPMs), specific refer to ISPM 14. The Citrus Systems Approach combines multiple measures that cumulatively provide phytosanitary protection required to be able to certify qualifying export consignments as compliant with trading partner phytosanitary import requirements.

The Citrus FCM SA has been developed to ensure compliance with relevant phytosanitary import regulations, equivalent to that obtained through application of a post-harvest disinfestation treatment. The protocols for summarising the container and specialised refrigerated vessels (SRV) procedures are covered in separate SOP documents and can be obtained from the PPECB website at www.ppecb.com or contact as below.

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