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1. INTRODUCTION

1.1 This document must be read in conjunction with document HP02. The HP02 document contains **inter alia** various definitions and also sets out the responsibilities of PPECB and other disciplines involved in the export chain.


1.2 The purpose of this document is to provide the industry with the latest information regarding the handling of South African **pome** fruit destined for export by sea. The information is based on many years of practical experience as well as ongoing research data, most of which originates from research funded by the industry via the Deciduous Fruit Producers' Trust. Without industry support in this endeavour, PPECB would be forced to make recommendations regarding the postharvest handling on experience only, which would obviously be to the detriment of the industry as a whole. For our industry to remain competitive internationally, we therefore need to continue investing in research, including all postharvest handling aspects.

1.3 The recommendations given in this document are based on a one week accumulation and pre-cooling period and a three week shipping and distribution period. The specific conditions have been selected to provide optimal fruit quality at that time. Individual exporters serving specific markets may need to deviate from the recommendations given here for very specific reasons. The PPECB is mandated and obliged by law to act in the best interests of the South African perishable industries as a whole and also mandated to enforce specific shipping temperatures. PPECB is also aware of the fact that different conditions than those specified in the regulations, must be considered. Exporters or their agents may therefore request in writing via the PPECB ISO 9001 - 2000 Form T13, to deviate from these recommendations on the following conditions:

- approval is based at their own risk, upon a written indemnification received by the PPECB prior to the loading of the product in the shipping space
- on condition that PPECB receives written consent from the supplier (grower) of the product
- on condition that the requested handling procedures and temperatures are not detrimental to the quality of the product
- on condition that the specifications fall within the technical and logistical capabilities of the carrier vessel and/or container

1.4 The procedures set out in this document are applicable to all South African ports. Special arrangements, especially regarding temperature and fruit mixes, can or must be made for certain African (West, Central and East) and Indian Ocean Island (IOI) destinations. Please refer to the PPECB General Loading and Carrying Temperature Instructions for perishable cargoes for more detail. This document is also on the PPECB website at www.ppecb.com.

1.5 Interested parties are requested to contact the PPECB well in advance for more detail to avoid delays in shipping, and other potential losses. A list of first line contact persons and their telephone numbers is attached to this document.

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2. PROCEDURES FOR LOADING OF CONTAINERS

2.1 Integral refrigerated containers

The containers are also commonly known as reefer containers. These containers are fitted with their **own cooling unit** as an integral part of the container. It must be remembered that an integral reefer container is a transport unit and **not a mobile cold store**.

The cooling unit is designed and built to take up as little space as possible and has therefore very limited refrigeration capacity to cool the product and can only lower pulp temperature over an extended period of time.

Cold air is supplied by the cooling unit via the "T-bar" floor to the container and warm air from the cargo is removed from the top.

2.2 The following are very important for all types of 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 extend 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

Integral containers need an external source of electricity (360-380V) to power the cooling unit and air circulating fans. Special plugs are provided on the ships, in container handling and port terminals and also some loading depots. Clip-on diesel powered electric generators (Gensets) are required to supply electricity during road and rail transport.

Some integral containers can be fitted with special equipment to maintain controlled atmosphere (CA) conditions.

2.4 Capacity

Integral containers are available in both 20 foot and 40 foot (12m) units - also known as FEU's. The FEU's (40 foot) usually take 20 ISO pallets but some of the older types only take 19 pallets with the 20th pallet stowed breakbulk at the door end. The TEU (20 foot) take 9 pallets, with the 10th pallet stowed breakbulk. So called "high cube" (FEU) integral containers, can take 20 pallets up to 2,35m high including the pallet base. These containers can take the equivalent of 23 pallets.


3. POME FRUIT TEMPERATURE REQUIREMENTS

3.1 Product Pulp Measurements (Refer to PPECB Work Instruction TWI01)

3.1.1 Maximum Pulp temperatures measured in the **center of the pallets** (with thermocouples or with penetration probes) at the time of loading into shipping spaces.

3.2 **Shipping temperatures** for apples and pears are specified under the relevant product relevant headings, and are summarised in **Tables 1**. These are optimum temperatures and the following tolerances are applicable:

3.2.1 Pre optimum code 1 (PC 1) Granny Smith apples may be loaded into containers and

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shipping spaces at plus 5°C for shipment at minus 0,5°C (refer par 4.2).

3.2.2 Maximum pulp temperatures for other Pome fruit into shipping spaces, are as follows:

3.2.2.1 Pulp temperatures shall not exceed plus 1.5°C, for both inland and port loading. This is a 2°C tolerance above the set point temperature.

Exceptions:

- The pulp temperature of Summer pears (DP1) (minus 1°C and DP2 minus 1.5°C) in bags, may not increase above plus 0.5°C which is a 1.5°C and 2.0°C tolerance above the set point (Minus 1.0°C and Minus 1.5°C) temperature;
- The temperature of apples in bags at a DA2 temperature regime may not increase above plus 0.5°C (refer par 4.3), which is a 2°C tolerance above the set point (Minus 1.5°C) temperature.

3.2.2.2 Conventional vessels, pulp temperatures shall not exceed plus 1.5°C,(which is 2°C tolerance above the setpoint temperature).


Exceptions:

- The temperature of Summer pears (DP1) (minus 1°C and DP2 minus 1.5°C) in bags, may not increase above plus 0.5°C which is a 1.5°C and 2.0°C tolerance above the set point (Minus 1.0°C and Minus 1.5°C) temperature;
- The temperature of apples in bags at a DA2 temperature regime may not increase above plus 0.5°C (refer par 4.3), which is a 2°C tolerance above the set point(Minus 1.5°C) temperature.

3.3 The Time Temperature Tolerances (TTT) in Table 2 as stipulated in Regulation 917 (Government Gazette, 4 May 1984), are the absolute maximums. Market and quality requirements, however dictate the following commercial maximum TTT's. It must be stressed that these TTT's are the total accepted time (cumulative) without cooling while being handled in the cold chain.

3.3.1 Containerized shipments. A maximum TTT of 6 hours after loading of the pre-cooled fruit shall apply after which re-cooling must commence. Container handling in the port area normally takes more than 3 hours. Although this means that the maximum period without cooling between removing the fruit from the cold store (± 1 hours) to the arrival of the container in the port (± 2 hours travelling) is 3 hours, the agreed maximum time may not exceed 2 hours in total. The practical implication of the TTT is that containers loaded inland at a point further than 2 hours travelling time to the port, must have gensets (generators) attached to allow for the running/cooling operation of the containers during transport to the port.

3.3.2 Conventional shipments. Loading of a deck or common decks normally take longer than 6 hours to complete, but it is however possible to measure fruit pulp temperatures of the fruit already loaded. Pulp temperature increases therefore become the main criteria and not so much the 6 hour TTT.

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Decks must be closed and re-cooling commenced as soon as the pulp temperatures-, measured on the outside of the pallets have increased to the following levels:

- All fruit not packed in polyethylene bags 12°C
- All fruit packed in polyethylene bags 8°C

Important:

No rise in pulp temperature should occur in the centre of the pallet, as taken with the thermocouples or penetration probe.

3.4 The PPECB Regional Service Manager – at the loading port shall keep daily records of each shipment and of all procedures and temperatures irrespective of whether consignments are passed or rejected.

3.5 The PPECB is responsible for all in-transit cold sterilization shipments (**refer Par. 7**).

3.6 The PPECB provides technical support to the industry in all matters pertaining to postharvest handling, including storage and shipping conditions.

4. APPLES


4.1 Optimum storage conditions: Temperature minus 0.5°C; 90-95% RH, vents closed. Golden Delicious and some of the red apples are sometimes commercially stored at minus 1,0°C to retain the green skin colour and crispness. Very special care must however be taken not to store or ship colder than minus 1,0°C. (See HP22 document for temperature regimes)

4.2 Pre-optimum code 1 (PC 1) Granny Smith apples may be as warm as 5°C and shipped at minus 0,5 °C at the beginning of the season. Special arrangements must be made when such shipments are planned.

4.3 All other apples will be cooled to minus 0,5°C prior to shipment. A maximum fruit pulp temperature of plus 1.5°C will be allowed when loading into shipping spaces that is carried at -0,5°C and plus 0,5°C for apples in bags which is carried at minus 1,5°C. Pulp temperature in the warmest position of apples in bulk bins shall be 5°C. These maximum temperature increases that will be allowed and are not to be confused with optimum precooled temperatures (minus 0,5°C).

4.4 All South African grown apples are cold stored, transported and shipped to distant markets at a pulp temperature of minus 0.5°C. Storage life of all cultivars grown for export exceeds four months and this can be extended to more than eight months by applying controlled atmosphere storage.

4.5 Some cultivars however are more sensitive to higher storage and transit temperatures. Yellowing and softening may become a problem later during the season while physiological disorders such as bitter pit are also temperature related. Maintenance of a pulp temperature at minus 0.5°C ± 0.5°C at all times is therefore important with cultivars such as Golden Delicious and all Red types.

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5. PEARS

- 5.1 Optimum storage conditions:** Temperature minus 0.5°C; 90 to 95% RH, vents closed. (See HP22 procedure for temperature regimes).
- 5.2** Storage life differs between cultivars, and ranges from ±10 weeks to ±10 months. Fast cooling to minus 0.5°C immediately after packing and maintenance of the cold chain is of paramount importance.
- 5.3** Summer pears¹ packed in plastic bags, as listed, are extremely sensitive to high temperatures, so special effort should be made to maintain the cold chain. This could include, but should not be limited to hydrocooling for rapid reduction of field heat. Transport to the docks in refrigerated vehicles is advisable rather than the conventional flat bed trucks. Pre-cooled to minus 1.5°C prior loading.
- 5.4** All pears except summer pears in bags, shall be pre-cooled to minus 0.5°C prior to loading into shipping spaces (containers or refrigerated ships).
- 5.5** The cargo must never be exposed to the direct sun during loading.
- 5.6** The following maximum pulp temperature will be allowed during the shipping process
- DP1 and DP2 – maximum of plus 0.5°C for pears in plastic bags only.
 - DO5 – maximum of plus 1.5°C for all other cultivars, including summer pears packed without plastic bags.
- 5.7** Only one conventional deck is to be loaded at any time (i.e. no up and down loading). A deck must therefore be finished and closed before loading can start in the next deck in the same hatch. Cooling must commence as soon as a deck or twin deck is closed.
- 5.8** Decks will be closed and recooling will be applied as soon as pulp temperatures in the warmest positions have increased to plus 8°C or plus 12°C for fruit packed with or without polyethylene bags respectively. All pulp temperatures must be reduced to below 0.0°C before loading can recommence.
- 5.9** Packaging in polyethylene bags has a beneficial effect on storage and shelf life, but restricts cooling ability. Forced air cooling and correct handling procedures are required to maintain quality.


6. DISPATCHING & RECEIVING SUMMER PEARS

6.1 Dispatch Depot

- Cool fruit to the optimum temperature of minus 0,5°C ± 0,5°C and maintain this temperature until dispatch.

¹ Summer Pear Cultivars

Early BC	Beurre Hardy
Bon Chretien	Doyenne du Comice
Bon Rouge	Sempré
Rosemarie	Victoria Blush
Flamingo	Harrow Delight

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- When dispatching fruit to the harbour for Conventional loading, insure that the consignment corresponds with the vessel loading specification and stowage plan.

6.2 Transport to point of loading (harbour)

- Only use trucks with closeable curtains.
- Keep to the booked time schedule on the way to the loading point.

6.3 Arrival at point of loading (harbour)

- Arrive according to planned schedules
- Fruit temperatures must be within protocol at arrival (**refer Par. 3.2.2**). Fruit warmer than plus 0,5°C will be rejected for loading and must be re-cooled
- Insure that all documents are correctly filled in to avoid administrative delays
- Do not remove trailer curtains prior to off loading
- Trucks must not stand unnecessary in the sun

6.4 Intake and loading onto vessel

- Fruit must be loaded directly onto the vessel after arrival.
- Fruit must not be left standing in the sun on the quayside.
- The fruit will be rejected for loading should the pulp temperatures increase to more than 0,5°C.

6.5 Procedure on vessel

- Only one deck at a time to be loaded
- It is not allowed to "jump" between decks
- Cooling must commence as soon as the loading of a deck has completed
- If pulp temperatures increase to those **prescribed in par 3.2.2**, loading will be stopped and the decks must be closed and cooling commenced. Only when the fruit is on temperature will the vessel be allowed to recommence loading


7. COLD STERILIZATION: APPLES AND PEARS

7.1 SPECIAL SHIPMENTS FOR INTRANSIT STERILIZATION

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

8. GENERAL

- 8.1** If fruit temperatures of minus 1.5°C or colder are recorded at any time in any port, then the shipping process must be stopped and all relevant information must be reported immediately to the responsible Manager of the facility. This also applies to any condition where freezing is suspect, therefore at least five (5) temperature readings in the coldest positions per pallet must be taken. These temperatures must be submitted to PPECB Regional Service Manager, for further action.

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- 8.2** Changing the temperature set point of integral containers during the voyage can only be done after consultation with the PPECB and shipping line. The Shipping Line will then reply in writing indicating whether or not the temperature can be changed. The final decision to change set points of an integral refrigerated container rests with the Master of the vessel and if necessary will consult with PPECB and the Exporter. The Master cannot be held responsible if requested changes are not made, due to dangerous conditions whilst en route.
- 8.3** PPECB will install USDA temperature sensors as and when required by the importing country's protocol. The Master will be instructed to report air and product pulp temperatures to the PPECB on a daily basis. This temperature data will be made available to exporters to assist temperature management as well as marketing strategy.
- 8.4** Any temperature discrepancy from the optimum conditions summarized in Table 1, or any deviation from the procedures as presented in this document, must be reported to the relevant PPECB Regional Service Manager in the port of intended export who is in the best position to assist immediately. Personnel in the Statutory Operational Department are available for consultation regarding pome fruit requirements.
- 8.5** PPECB Manager Cold Chain Services and Programme Manager POME AND STONE can be consulted should more information be required or a decision made regarding logistical matters and shipment. Exporters, their agents, cold store operators, container loading operators, etc., are invited to contact PPECB should they need to clarify any procedures.
- 8.6** The PPECB realises that the export business is very dynamic, and that plans are made and altered at short notice to adjust to changing marketing scenarios. Nevertheless, we are bound by legislation to perform the necessary quality maintenance steps in the process. In order to enable us to do this with the least disruption possible, an open line of communication must be maintained at all times.


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TABLE 1: SUMMARY OF OPTIMUM CARRYING CONDITIONS FOR DECIDUOUS FRUITS SHIPPED FROM SOUTH AFRICA

PRODUCT	OPTIMUM PRODUCT TEMP. °C	MINIMUM D.A.T. DURING COLD BLAST ONLY °C	HOURS OF FRESH AIR VENTILATION (PER 24 HOURS) – CONVENTIONAL SHIPMENTS	FRESH AIR VENTILATION SETTING - CONTAINERS
APPLES	Minus 0,5	Minus 1,5	NONE	Closed
ALL CULTIVARS				
GRANNY SMITH		Minus 1,5	NONE	Closed
PRE OPT CODE 1	1,5	Minus 1,5	NONE	Closed
PRE OPT CODE 2	Minus 0,5	Minus 1,5	NONE	Closed
PRE OPT CODE 3	Minus 0,5	Minus 1,5	NONE	Closed

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TABLE 2 TIME TEMPERATURE TOLERANCE FOR PERISHABLES IN CONTAINERS

PRODUCT	LOADING TEMP °C	MAX TRANSFER TIME IN HOURS	EXPECTED TEMP. RISE °C	CARRYING TEMP °C	PRECOOL PERIOD HOURS
Apples					
Un-chilled	Ambient	24		Minus 0,5	144
Chilled	0,0	18	10	Minus 0,5	48
Pears	Minus 0,5	12	5	Minus 0,5	48

NOTES:

It must be noted that the Deciduous fruit industry has decided on the following maximum TTT's for product handling in the port area.

Pallet loading: A maximum of six (6) hours before recooling must be applied.

Container handling: A maximum of six (6) hours, before recooling must be applied.