

Please note that this information is for guidance and not regulatory. Specific circumstances may dictate deviations.

15 Feb 2024

**Basic Cooling Principles: (A. Standard for Apples and Pears & B. Loadshedding Contingency – Phase 4 and Higher)**

1. Cultivar differences must be recognised
2. Some apple cultivars develop internal disorders if stored below zero degrees (0.0°C) for long periods
3. Early fruit with low sugars is prone to freezing
4. Too fast cooling of some cultivars (e.g. Granny Smith) may lead to core flush
5. CO<sub>2</sub> generation is low at 0.0°C or lower but increases rapidly at higher temperatures (1.0 to 5.0°C)
6. Plastics bags are used to retain green colour.
7. Fruit in plastic bags cool slower than those without plastic bags
8. When pallets with different packaging are loaded into a container, the pallets with the poorer ventilation packs (e.g. plastic bags) must be loaded first because cooling at the door-end of the container is not as good as near the refrigeration unit.
9. Fruit in unperforated plastic bags must be loaded out within the set tolerances to avoid possible warming up inside containers
10. Some markets demand plastic bags (Far East/Africa)
11. If fruit is in plastics bags, the container vents can be closed (energy saving).
12. For fruit shipped below 0.0°C it is recommended that the vents be closed
13. Fruit treated with 1MCP may be stored at +1.0°C or higher compared to non-treated fruit.
14. Relative Humidity should be kept between 90 and 95%.

**REFER TABLES BELOW**

Regulatory information is available on PPECB's website ([www.ppecb.com](http://www.ppecb.com))  
*See Documents – Normal Shipments – HP28 Handling Procedure and Optimum Temperatures for Sea Exports of Pome Fruit*

## A. Standard Protocols

## Cooling Guidelines for Apples

15 Feb 2024

Risk Level	Cultivar	Type	Comments	Plastic Bags	Load out Temp	Set Point	Code	Vents
High Risk(HR)	Panorama Golden D(HR)	Early season	First week of the season ≤ week 12	Yes	0.0°C to +3.0°C	0.0°C	D0	Closed if in sealed bags
	Golden Delicious(HR)	Early season	First week of the season ≤ week 12	Yes	0.0°C to +3.0°C	0.0°C	D0	Closed if in sealed bags
	Granny Smith(HR)	Louterwater GS	Brix <11°Brix	Optional	0.0°C to +3.0°C	≥0.0°C	D0	Closed if in sealed bags
		Early Granny S						
	Fuji (HR)	IB prone areas	(Internal Browning)	If bags, it must be perforated	0.0°C to +3.0°C	≥0.0°C	D0 or D0.5	Open
	Joya	As per protocol						
	Envy	As per protocol	Do not cool below 0°C					
	Cripp's Red	Late picked						
	Cripp's Pink							
Pink Lady								
Moderate Risk (MR)	Fuji (B)		As per season's requirements	Optional	-0.5°C to +3.0°C	-0.5°C	D-0.5	Closed if in sealed bags
	Gala	Mutants		Optional	-0.5°C to +3.0°C	-0.5°C	D-0.5	Closed if in sealed bags
	Starking Topred							
	Braeburn							
	Panorama Golden D(MR)	Optimum maturity	Only first week's fruit	No	-0.5°C to +3.0°C	-0.5°C	D-0.5	Open
	Golden Delicious (MR)	Optimum Maturity	Only first week's fruit	No	-0.5°C to +3.0°C	-0.5°C	D-0.5	Open
Granny Smith (MR)	Optimum maturity	Only first week's fruit	No	-0.5°C to +3.0°C	-0.5°C	D-0.5	Open	
Low Risk	All treated with 1MCP		Handle at >0°C to save energy	Optional	-0.5°C to +3.0°C	-0.5°C	D-0.5	Closed if sealed bags

- Note:**
- Risk Level** refers to disorders and damage caused by too low temperatures. This includes freezing, cold damage, internal browning and scald related damage.
  - The information above is to be used as **guidelines**. Specific circumstances, markets and maturity may require deviations in the interest of quality.
  - Note that **early variants of main cultivars** such as Panorama Golden Delicious and Louterwater Granny Smith, as well as Golden Delicious/Granny Smith that are not fully matured (e.g. **first week of picking**), are considered as high risk and protocols must be adhered to. Low sugar levels often lead to cold damage.

## Cooling Guidelines for Pears

### A. Standard Protocols

			Comments	Plastic Bags	Load out Temp	Set point	Code	Vents
High Risk (HR)	Early Bon Chretien	Summer Pears	These pears are high respiration fruit and the cold chain must be maintained all cost	Most experience is with 37.5 µm bag	-0.5°C to +1.5°C	Some rules If full container with bags – can go down to minus 1.5°C. If sugar high >13° Brix: minus 1.0°C Without bags: -0.5°C	DP1	Closed if bags are unperforated
	Bon Chretien							Closed if DAT is below 0°C
	Bon Rouge & Victoria Blush							
	Rosemarie & Sempre							
	Flamingo & Sempre							
	Beurre Hardy							
	Doyenne du Comice							
	Cheeky & Cape Rose							
	Celina & Qutee							
	Packhams Triumph(HR)	DCA Stored	<i>(Dynamic Controlled Atmosphere) (some times they act as WBC)</i>	Yes		-1.0°C		
Moderate Risk (MR)	Early Season Packhams Truimph (MR)		Possible CO2 damage at 2°C and higher Low sugar levels are freezing prone		0.0°C to +2.0°C	0.0°C	D0	Closed if in sealed bags
Low Risk (LR)	Packham's Truimph(LR)	Winter Pears			-0.5°C to +2.0°C	-0.5°C	D-0.5	Closed if in sealed bags
	Abate Fetel							
	FEMA Forelle & Vermont Beauty							
	Beurre Bosc Golden Russet Bosc							
	Forelle & Vermont Beauty		Special protocols are to be followed.		0.0°C to +2.0C	0.0°C	D0	Closed if in sealed bags <i>(Choice of plastic bag is important. Lower microns (e.g. 20) reduce CO2 risk )</i>

## B. Loadshedding Contingency Protocols -Phase 4 and Higher

### Cooling Guidelines for Apples

Risk Level	Cultivar	Type	Comments	Plastic Bags	Load out Temp	Set Point	Code	Vents
High Risk (HR)	Panorama Golden D(HR)	Early season	First week of the season ≤ week 12	Yes	0.0°C to +5.0°C	0.0°C	D0	Closed if in sealed bags
	Golden Delicious(HR)	Early season	First week of the season ≤ week 12	Yes	0.0°C to +5.0°C	0.0°C	D0	Closed if in sealed bags
	Granny Smith(HR)	Louterwater GS	Brix <11°Brix	Optional	0.0°C to +5.0°C	≥0.0°C	D0	Closed if in sealed bags
		Early Granny S						
	Fuji (HR)	IB prone areas	(Internal Browning)					
	Joya	As per protocol						
	Envy	As per protocol	Do not cool below 0°C	If bags, it must be perforated	0.0°C to +5.0C	≥0.0°C	D0 or D0.5	Open
	Cripp's Red							
	Cripp's Pink Pink Lady	Late picked						
Moderate Risk (MR)	Fuji (B)		As per season's requirements	Optional	-0.5°C to +5.0°C	-0.5°C	D-0.5	Closed if in sealed bags
	Gala							
	Starking Topred	Mutants		Optional	-0.5°C to +5.0°C	-0.5°C	D-0.5	Closed if in sealed bags
	Braeburn							
	Panorama Golden D(MR)	Optimum maturity	Only first week's fruit	No	0.0°C to +5.0°C	≥0.0°C	D0.5	Open
	Golden Delicious(MR)	Optimum Maturity	Only first week's fruit	No	0.0°C to +5.0°C	≥0.0°C	D0.5	Open
Granny Smith(MR)	Optimum maturity	Only first week's fruit	No	0.0°C to 5°C	≥0.0°C	D0.5	Open	
Low Risk	All treated with 1MCP		Handle at >0°C to save energy	With bags	0.0°C to +5.0°C	≥0.5°C	D0.5	Optional
				Without bags	-0.5°C to +5.0°C	-1.0°C	D-1.0	Closed if sealed bags

- Note:**
1. Risk Level refers to disorders and damage caused by too low temperatures. This includes freezing, cold damage, internal browning and scald related damage.
  2. The information above is to be used as **guidelines**. Specific circumstances, markets and maturity may require deviations in the interest of quality.
  3. Note that **early variants of main cultivars** such as Panorama Golden Delicious and Louterwater Granny Smith, as well as Golden Delicious/Granny Smith that are not fully matured (e.g. **first week of picking**), are considered as high risk and protocols must be adhered to. Low sugar levels often lead to cold damage

## B. Loadshedding Contingency Protocols -Phase 4 and Higher

### Cooling Guidelines for Pears

Risk Level	Cultivar	Type	Comments	Plastic Bags	Load out Temp	Set point	Code	Vents
High	Early Bon Chretien	Summer Pears	These pears are high respiration fruit and the cold chain must be maintained all cost	No plastic bags	-0.5°C to +1.5°C	-1.0°C	DP1	Optional but keep possible CO <sub>2</sub> damage in mind
	Bon Chretien							
	Bon Rouge & Victoria Blush							
	Rosemarie & Sempre		Treat with 1MCP possible (riper fruit)					
	Flamingo & Sempre							
	Beurre Hardy							
	Doyenne du Comice							
	Cheeky & Cape Rose							
Celina & Qutee								
	Packhams Triumph(HR)	DCA Stored	<i>(Dynamic Controlled Atmosphere) (sometimes they act as WBC)</i>	Yes		-1.0°C	DP1	
Moderate (MR)	Early Season Packhams Truimph (MR)		Possible CO <sub>2</sub> damage at 2°C and higher Low sugar levels are freezing prone		0.0°C to +2.0°C	0.0°C	D0	Closed if in sealed bags
Moderate	Abate Fetel	Winter Pears			-0.5°C to +2.0°C	-0.5°C	D-0.5	Optional but keep possible CO <sub>2</sub> damage in mind
	FEMA Forelle & Vermont Beauty							
	Beurre Bosc Golden Russet Bosc							

Low Risk	Packham's Truimph(LR)		Treat with 1MCP if pressures are below 6kg	Preferably without plastic bags (beware of possible shrivelling)	With bags: +3.0°C  Without bags: +4.0°C	With bags: -1.0°C  Without bags: -0.5°C	DP1  D-0.5	Optional but keep possible CO2 damage in mind
Low Risk	Forelle & Vermont Beauty		Special protocols are to be followed		0.0°C to +2.0°C	0.0°C	DO	Closed if in sealed bags (NB: The choice of plastic bags (microns) is important. Lower microns (e.g. 20 microns) are more permeable and reduce the risk of CO2 damage)