



AFAM+ SETTING GUIDE

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AFAM+ Setting Guide



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*Thermo King has published this manual to assist its customers and others in the shipping industry in the operation of refrigerated containers equipped with Advanced Fresh Air Management ("AFAM+"). It contains various recommendations on oxygen and carbon dioxide levels that should be mechanically maintained in refrigerated containers to preserve fruits and vegetables in ocean voyages.

AFAM+ operators should understand that the oxygen and carbon dioxide levels recommended herein, and predictions made on the loads' responses to a change in gas levels, are merely guidelines, rather than hard science. Food responses vary with container temperature and also depend upon load mix, packaging, time in transit and storage, different maturities or ripeness stages, varieties, growing regions, growing conditions and previous storage history. Consequently, the guidelines must be adjusted when new conditions dictate.

The product setting guidelines contained in this manual were compiled by PEB Commodities, Inc. from highly regarded sources and research by PEB's principals. References are listed herewith. PEB Commodities made every reasonable effort to provide reliable data and guidelines, but PEB Commodities, for the reasons cited above, does not assume liability for the accuracy of the figures or for consequences caused by their use. Thermo King Corporation, publisher, disclaims any liability or responsibility for the accuracy of the guidelines or shipping results achieved at these settings.

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Introduction

Product Description

Your Thermo King Container Refrigeration unit equipped with Automated Fresh Air Exchange Management is designed for simple operation with the flexibility to handle a variety of commodities and situations. To take full advantage of these powerful options, it is important to understand how the system works, the variables that need to be set, and how these variables effect the operation of the refrigeration unit.

What are AFAM and AFAM+?

AFAM, or Automated Fresh Air Management, uses a small motor to set the fresh air exchange of a container thru the MP3000 controller. AFAM+ adds a gas analyzer to the unit to vary the air exchange based on CO₂ and O₂ levels.

How do they work? With AFAM, a door setpoint can be entered into the controller and the door can be delayed to open after the product is down to setpoint temperature. When the gas analyzer is added, the unit will monitor CO₂ and O₂ levels and constantly open and close the door in response to product respiration.

What are the advantages? Correct application of AFAM or AFAM+ can equate to faster pull down, decreased dehydration, increased shelf life, and improved product quality. This is accomplished by delaying the opening of the air exchange door, only using air exchange when needed, and/or reducing product respiration by maintaining elevated CO₂ levels for appropriate commodities.

Getting Started

Units equipped with AFAM and AFAM+ come configured to take advantage of these options. The below variables need to be set in the MP3000 microprocessor in accordance with product demand:

Configuration Menu

AFAM Units - Displayed air exchange units (M3 or CFM)

Setting the Configuration Menu

With the unit On/Off switch ON and the LCD display showing the standard display (setpoint):

1. Press the F3 key to enter the Main Menu.
2. Press F2 key to scroll through Main Menu until "CONFIGURATION" appears in LCD display.
3. Press F4 key to access the Configurations screen. Configurations screen appears with cursor in the In-Range menu line.
4. Press F3 key to scroll cursor to AFAM UNITS.
5. To set a new value, press F4 key. The Password screen appears.
6. Enter the password. Press F2 key, "A" key (password is "A"), F4 key and then EXIT key. An Enter Arrow appears in the line to be edited.
7. Type in the desired value or press the F3 key to toggle the value to the desired setting.
8. When the desired value appears in the display, press and hold the F4 key until the cursor stops flashing. The new value appears in the menu line.
9. Press ESC key to exit the Configurations screen.

Setpoint Menu

- OPTI-SET** - Allows all of the below variables to be set by selecting a specific commodity. If OPTI-SET is turned ON, a list of all available commodities will appear. The commodity selected will appear in the setpoint menu. If a change is made to any of the below variables after selecting a commodity, OPTI-SET will go from ON to CUSTOM and the displayed commodity will go away.
- TEMP. SETP.** - Temperature to be maintained in the container. This is settable from -30C to 30C.
- AFAM** - Can be set to UNITS, DEMAND, or OFF.
- UNITS will allow an air exchange rate to be set in the Setpoint Menu.
- DEMAND will allow a CO₂ ceiling and an O₂ floor to be set. OFF will override all settings and keep the AFAM door completely shut.
- AFAM Delay** - Hours the fresh air exchange door will remain closed before opening to desired exchange rate or opening due to gas sensor readings. This is settable from 1 to 72 hours. The unit will cancel the delay once the product has reached setpoint temperature.
- AFAM Rate** - Desired air exchange rate. (Active only when AFAM is set to UNITS)
- CO₂ Max** - Highest level of Carbon Dioxide allowed in the container. The AFAM door will open or close to maintain this level. (Active only when AFAM is set to DEMAND.) Settable from 0 - 25%
- O₂ Min** - Lowest level of Oxygen allowed in the container. The AFAM door will open or close to maintain this level. (Active only when AFAM is set to DEMAND.) Settable from 0 - 21%

Setting the Setpoint Menu

1. Press the SETPOINT key. The SETPOINT menu appears with the cursor in the "OPTI-SET" line.
2. Press F2 key to scroll to "AFAM" line.
3. To change the mode setting, press F4 key. Cursor moves to end of menu line and flashes.
4. Press F2 key to toggle between OFF, DEMAND and UNITS.
5. With UNITS in the menu line, press and hold F4 key until cursor stops flashing. "UNITS" now appears in display.
6. Press F3 to scroll to "AFAM Rate" line.
7. Press the F4 key to enter a new rate. Type the rate using the keypad.
8. Press and hold the F4 key to load the new air exchange rate.
9. Set the AFAM Delay using the same method. If AFAM is set to DEMAND, the CO₂ and O₂ limits would be set instead of an AFAM Rate.
10. Press ESC key to exit the SETPOINT screen.

Setting the Setpoint Menu using OPTI-SET

1. Press the SETPOINT key. The SETPOINT menu appears with the cursor in the "OPTI-SET" line.
2. Pressing F4 on the OPTI-SET or commodity line will display a list of available commodities.
3. Press F2 or F3 key to scroll to the desired commodity.
4. Press and hold F4 to enter the commodity. All setpoints for that commodity will now be set.
5. Press ESC key to exit the SETPOINT screen.

Now that you understand how AFAM and AFAM+ work, you can use the tables on the following pages to optimize your Thermo King unit to best protect your fresh cargo. Please refer to your Thermo King Maintenance Manual for questions in the operation of the MP3000 controller.

AFAM+ Unit Inspection Procedure

1. Flashload latest software if necessary. Follow instructions in Service Bulletin C056.
2. Verify door function. In the COMMANDS menu, go to MANUAL FUNCTION TEST, AFAM DOOR OPEN (verify that the door goes completely open in a smooth motion), and AFAM DOOR CLOSE (verify that the door goes completely closed in a smooth motion).
3. Make sure all drain plugs are closed or kazoos are in place.
4. Make sure the container is reasonably sealed against air leakage with no major damage, tight door seals, unit seal, etc.
5. After the unit has run for at least 15 minutes with the rear doors open, verify CO₂ and O₂ (if applicable) readings are reasonable.
6. Verify temperature, CO₂, O₂ and any other required setpoints (Note: Setpoints can change after 5 days of power off.)

Annona Species

Sugar Apple & Sweetsop, Atemoya, Cherimoya



Recommended Set Points

	Sugar Apple & Sweetsop	Atemoya	Cherimoya
Temperature	7.2°C (45°F)	12.8°C (55°F)	12.8°C (55°F)
Dehumidification	Off	Off	Off
CO ₂ Maximum	5%	10%	10%
O ₂ Minimum (if applicable)	16%	11%	11%

Fresh Air Exchange

Fresh Air			
Exchange Setting	50 (30cfm)	50 (30cfm)	100cmh (60cfm)
Maximum			
Opening Delay	18 hours	24 hours	12 hours

Injury level: These related fruits have similar temperature requirements and responses to carbon dioxide and oxygen. Carbon dioxide (>15%) and/or low oxygen (<1%) levels can cause off-flavors and uneven ripening to Annonas held at 8-12°C for up to 4 weeks. Low relative humidity levels can cause water and weight loss related defects.

Benefit: Annonas benefit from elevated carbon dioxide (5-10%) and reduced oxygen (3-5%). Elevated carbon dioxide and/or reduced oxygen retards ripening. Low oxygen also retards softening. High relative humidity (95%) helps minimize weight loss.

AFAM+: Annonas are suited for AFAM+ when shipped in a properly sealed refrigerated container. If we assume a RQ of 1, then the oxygen and carbon dioxide levels can be modified to about 10% carbon dioxide and 11 % oxygen for up to 2 weeks. Annonas benefit from elevated carbon dioxide and high levels of relative humidity (90-95%). AFAM+ will minimize the fresh air vent openings, which in turn limits water loss and permits for the buildup of relative humidity to optimal levels. In addition to maximizing the efficiency of temperature management, AFAM+ can also protect Annonas from low oxygen and elevated carbon dioxide injuries. Ethylene scrubbing is recommended.

Apples

General



Recommended Set Points

Temperature	-1° to 0.6°C (30-33°F)
Dehumidification.....	Off
CO ₂ Maximum	2%
O ₂ Minimum (if applicable)	19%

Fresh Air Exchange

Fresh Air Exchange Setting	75cmh (45cfm)
Maximum Opening Delay	0 hours

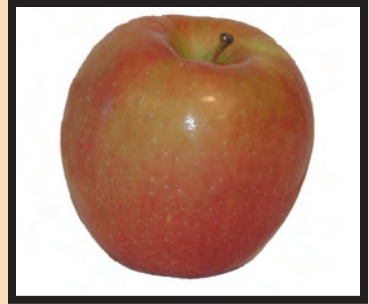
Injury level: Low oxygen (<1-2%) causes off-flavor due to alcoholic fermentation. Varieties differ in sensitivity to carbon dioxide over long term (> 1 month) storage with injury potentially occurring from core flush upon exposure to 5% carbon dioxide at 0°C. Symptoms include core and/or flesh browning. A carbon dioxide level of 2% would be safe for most varieties during shipping.

Benefit: Helps retain firmness, green color, and acidity.

AFAM+: Apples do not need CA for normal transit times. Therefore, they are very well suited for AFAM+ when shipped in a properly sealed refrigerated container. In addition to maximizing the efficiency of temperature management, AFAM+ can protect apples from low oxygen and elevated carbon dioxide injuries. The information below for individual apple varieties is a consensus for those varieties grown in many different parts of the world. Specific AFAM+ settings may differ for certain countries of origin. It is highly advisable to consult knowledgeable sources or reliable reference guides before attempting to use modified oxygen or carbon dioxide levels for conditions or apple varieties for which the shipper does not have previous commercial experience and success. Ethylene scrubbing is recommended.

Apple

Braeburn



Recommended Set Points

Temperature	0.0°C (32°F)
Dehumidification.....	Off
CO ₂ Maximum	1%
O ₂ Minimum (if applicable)	20%

Fresh Air Exchange

Fresh Air Exchange Setting	75cmh (45cfm)
Maximum Opening Delay.....	0 hours

Injury level: Late-harvested Braeburns are prone to an elevated (>1-1.5%) carbon dioxide injury called 'Braeburn browning disorder', which causes internal brown discoloration, especially if the fruit are not completely cooled prior to establishment of controlled atmosphere.

Benefit: Helps retain firmness, green color, and acidity.

AFAM+: Carbon dioxide levels should be kept below 1%.

Apple

Fuji



Recommended Set Points

Temperature.....	0.0°C (32°F)
Dehumidification.....	Off
CO ₂ Setting.....	0.5%
O ₂ Setting (if applicable).....	20.5%

Fresh Air Exchange

Fresh Air Exchange Setting	75cmh (45cfm)
Maximum Opening Delay.....	0 hours

Injury level: Fuji apples are very sensitive to elevated carbon dioxide and can develop internal browning at carbon dioxide levels above 0.5 to 1%, especially late season or high maturity fruit.

Benefit: Helps retain firmness, green color, and acidity.

AFAM+: Carbon dioxide levels should be kept below 1%.

Apple *Gala*



Recommended Set Points

Temperature.....	0.0°C (32°F)
Dehumidification.....	Off
CO ₂ maximum.....	2%
O ₂ Minimum (if applicable).....	19%

Fresh Air Exchange

Fresh Air Exchange Setting	75cmh (45cfm)
Maximum Opening Delay.....	0 hours

Injury level: Gala is more tolerant of elevated carbon dioxide than Braeburn or Fuji; the optimum carbon dioxide level for long-term storage is about 1.5 to 2% and Galas from some areas can tolerate up to 3-5% for several months.

Benefit: Helps retain firmness, green color, and acidity.

AFAM+: In the absence of specific information or experience, carbon dioxide levels should be maintained at or below 2%.

Apple

Granny Smith



Recommended Set Points

Temperature	0.6°C (33°F)
Dehumidification.....	Off
CO ₂ Setting.....	2%
O ₂ Setting (if applicable)	19%

Fresh Air Exchange

Fresh Air Exchange Setting	75cmh (45cfm)
Maximum Opening Delay.....	0 hours

Injury level: Granny Smith apples can develop internal browning ('core flush') at carbon dioxide levels above 1%. Early season or low maturity Granny Smiths are also very susceptible to scald, which is reduced by low oxygen.

Benefit: Helps retain firmness, green color, and acidity, and reduces scald.

AFAM+: Carbon dioxide should be maintained no higher than 2%.

Asian Pear *Nashi*



Recommended Set Points

Temperature.....	1.1°C (34°F)
Dehumidification.....	Off
CO ₂ Setting.....	2%
O ₂ Setting (if applicable)	19%

Fresh Air Exchange

Fresh Air Exchange Setting	25cmh (15cfm)
Maximum Opening Delay	24 hours

Injury level: The injurious effects of carbon dioxide and reduced oxygen vary with variety, gas concentration and time in storage or transit. Generally, carbon dioxide (>2%) and/or low oxygen (<1%) levels for up to 4 months can be harmful to Asian pears. Elevated carbon dioxide can cause flesh browning, tissue damage and cavities at 1.1°C. Low oxygen can cause discolored skin.

Benefit: Asian pears can benefit from reduced oxygen (1-5% depending on variety). High relative humidity (95%) helps minimize water loss related defects.

AFAM+: Asian pears are suited for AFAM+ when shipped in a properly sealed refrigerated container. If we assume a RQ of 1, then the oxygen and carbon dioxide levels can be modified to about 2% carbon dioxide and 19 % oxygen for up to 4 months. AFAM+ will minimize the fresh air vent openings, which in turn limits water loss and permits for the buildup of relative humidity to optimal levels. In addition to maximizing the efficiency of temperature management, AFAM+ can also protect Asian pears from low oxygen and elevated carbon dioxide injuries, namely surface discoloration, internal browning and desiccation. Ethylene scrubbing is recommended.

Asparagus



Recommended Set Points

Temperature.....	2.5°C (36.5°F)
Dehumidification.....	Off
CO ₂ Maximum	10%
O ₂ Minimum (if applicable).....	11%

Fresh Air Exchange

Fresh Air Exchange Setting	60cmh (100cfm)
Maximum Opening Delay.....	12 hours

Injury level: Asparagus can tolerate 10-14% carbon dioxide for several weeks at 2.5°C. There is little or no benefit from oxygen. In fact, oxygen levels less than 10% can cause discoloration.

Benefit: Very high (10-14%) carbon dioxide treatment delays decay development and keep the spears green and tender.

AFAM+: Asparagus is very well suited for AFAM+ application when shipped in a properly sealed refrigerated container. If we assume a RQ of 1, then the oxygen and carbon dioxide levels can be modified to about 11% oxygen and 10% carbon dioxide, which is ideal. AFAM+ can protect asparagus from low oxygen and elevated carbon dioxide injuries.

Avocado

Fuerte, Hass



Recommended Set Points

Temperature.....	5.0°C (41°F)
Dehumidification.....	Off
CO ₂ Maximum	10%
O ₂ Minimum (if applicable)	11%

Fresh Air Exchange

Fresh Air Exchange Setting	50cmh (30cfm)
Maximum Opening Delay.....	24 hours

Injury level: Hass and Fuerte varieties can tolerate 25-30% carbon dioxide for 2-3 days and 15% carbon dioxide for 2 weeks at 7°C.

Benefit: A short (2-3 days) very high (25-30%) carbon dioxide treatment delays subsequent decay development. Lower carbon dioxide treatments also help retain firmness and reduce chilling injury at 5°C.

AFAM+: AFAM+ can protect avocados from low oxygen and elevated carbon dioxide injuries.

Banana

Green



Recommended Set Points

Temperature	14.4°C (58°F)
Dehumidification.....	Off
CO ₂ Maximum	5%
O ₂ Minimum (if applicable).....	16%

Fresh Air Exchange

Fresh Air Exchange Setting.....	25cmh (15cfm)
Maximum Opening Delay.....	24 hours

Injury level: Bananas can be injured by <2% oxygen or more than 5% carbon dioxide at 13-15°C. Lower oxygen levels can cause off-flavors, peel discoloration, and inhibit ripening. Higher carbon dioxide levels can result in fruit with green skin and soft flesh. Ethylene exposure is also very detrimental, causing premature ripening.

Benefit: Low oxygen and high carbon dioxide help to inhibit banana ripening mainly by interfering with ethylene synthesis and action. Elevated carbon dioxide also increases banana resistance to chilling injury (“under peel discoloration”).

AFAM+: AFAM+ can be a good supplement to ethylene scrubbing by maintaining elevated carbon dioxide levels and also by reducing temperature pulldown time, which helps prevent initiation of ethylene production. AFAM+ can also protect bananas from low oxygen and elevated carbon dioxide injuries and decrease the chances of chilling injury (“under peel discoloration”) occurring.

Bell Pepper



Recommended Set Points

Temperature	7.2°C (45°F)
Dehumidification.....	Off
CO ₂ Maximum	5%
O ₂ Minimum (if applicable)	16%

Fresh Air Exchange

Fresh Air Exchange Settings	25cmh (15cfm)
Maximum Opening Delay.....	24 hours

Injury level: Carbon dioxide (>5%) and/or low oxygen (<2%) levels can cause off-flavors for bell peppers held at 7-10°C for up to 4 weeks. Low relative humidity levels can cause water loss and loss of firmness. Elevated carbon dioxide (>5%) can cause softening and internal discoloration

Benefit: Bell peppers derive little benefit from low oxygen and elevated carbon dioxide. High relative humidity (>95%) helps retain the firmness. Elevated carbon dioxide suppresses color loss. Low oxygen has a marginal effect on quality but does retard aging and ripening.

AFAM+: Bell peppers are suited for AFAM+ when shipped in a properly sealed refrigerated container. If we assume a RQ of 1, then the oxygen and carbon dioxide levels can be modified to about 5% carbon dioxide and 16% oxygen for up to 4 weeks. Bell peppers benefit from high levels of relative humidity (>95%). Waxing and higher relative humidities (>95%) will help minimize water loss. AFAM+ will minimize the fresh air vent openings, which in turn limits water loss and permits for the buildup of relative humidity and carbon dioxide to optimal levels. In addition to maximizing the efficiency of temperature management, AFAM+ can also protect Bell peppers from low oxygen and elevated carbon dioxide injuries such as off-flavors, off-odors, pitting, discoloration and softening.

Broccoli



Recommended Set Points

Temperature	0.0°C (32°F)
Dehumidification.....	Off
CO ₂ Maximum	10%
O ₂ Minimum (if applicable).....	11%

Fresh Air Exchange

Fresh Air Exchange Setting.....	50cmh (30cfm)
Maximum Opening Delay.....	24 hours

Injury level: Broccoli can tolerate up to 15% carbon dioxide and about 1% oxygen at 0-2°C. Lower levels of oxygen can cause off-flavors.

Benefit: Broccoli benefits from low oxygen and elevated carbon dioxide. Elevated carbon dioxide should reduce decay and slow the onset of bud opening.

AFAM+: In addition to maximizing the efficiency of temperature management, AFAM+ can protect broccoli from low oxygen and elevated carbon dioxide injuries. Broccoli is well suited for AFAM+ applications when shipped in a properly sealed refrigerated container because elevated carbon dioxide reduces yellowing of the flower buds and decay. A carbon dioxide setting of 10% should work for broccoli. Oxygen is generally set at 1 to 3% for CA systems. However, the oxygen set point for AFAM+ should be set to protect the broccoli from excessively high levels of carbon dioxide. Assuming an RQ of 1, an oxygen setting of 11% is suggested.

Cabbage



Recommended Set Points

Temperature	0.0°C (32°F)
Dehumidification.....	Off
CO ₂ Maximum	6%
O ₂ Minimum (if applicable).....	15%

Fresh Air Exchange

Fresh Air Exchange Setting.....	25cmh (15cfm)
Maximum Opening Delay.....	24 hours

Injury level: Exposure to > 20% carbon dioxide or oxygen levels <2% for 2 months can cause off-odors and off-flavors. Elevated carbon dioxide can also cause internal discoloration. Water loss is a significant problem with cabbage that causes dehydration and wilting

Benefit: Elevated carbon dioxide (6%) at 0°C can suppress decay and sprouting whereas low oxygen inhibits growth of the inner stem and suppresses the loss of green color.

AFAM+: Cabbage benefits from elevated carbon dioxide (6%) and high levels of relative humidity (98%) at 0°C. If we assume a RQ of 1, then the oxygen and carbon dioxide levels can be modified to about 6% carbon dioxide and 15 % oxygen for up to 6 months for late season cabbage. Cabbage is suited for AFAM+ when shipped in a properly sealed refrigerated container because minimizing the fresh air vent openings will limit water loss and permit the buildup of carbon dioxide to optimal levels. At 98% relative humidity the cabbage is less impacted by decay. In addition to maximizing the efficiency of temperature management, AFAM+ can also protect cabbage from low oxygen and elevated carbon dioxide injuries. Types of cabbage held for different times in storage and transit can vary with regards to the effects of carbon dioxide and oxygen.

Cantaloupe



Recommended Set Points

Temperature.....	2.2°C (36°F)
Dehumidification.....	Off
CO ₂ Maximum	18%
O ₂ Minimum (if applicable)	3%

Fresh Air Exchange

Fresh Air Exchange Setting.....	25cmh (15cfm)
Maximum Opening Delay.....	48 hours

Injury level: Carbon dioxide in excess of 20% and/or low oxygen less than 1% can impair ripening and cause off-flavors and odors. Elevated carbon dioxide levels of 10-20% can also cause a carbonated flavor in the flesh of the fruit, which dissipates when held in normal air.

Benefit: Cantaloupes benefit from low oxygen and elevated carbon dioxide. Elevated carbon dioxide of 18% and low oxygen of 3% at 3°C will suppress the development of surface decay & molds, retard ripening, maintain sugars and reduce respiration.

AFAM+: Cantaloupes are suited for AFAM+ applications when shipped in a properly sealed refrigerated container. In addition to maximizing the efficiency of temperature management, AFAM+ can protect cantaloupes from injurious levels of oxygen and carbon dioxide. If we assume a RQ of 1, then the oxygen and carbon dioxide levels can be modified to about 3% and 18% respectively for up to 3 weeks. Elevated carbon dioxide is desirable for reducing decay and retarding ripening. Ethylene scrubbing is recommended.

Celery



Recommended Set Points

Temperature	0.0°C (32°F)
Dehumidification.....	Off
CO ₂ Maximum	5%
O ₂ Minimum (if applicable).....	16%

Fresh Air Exchange

Fresh Air Exchange Setting.....	25cmh (15cfm)
Maximum Opening Delay.....	24 hours

Injury level: Exposure to elevated carbon dioxide (>10%) or reduced oxygen (<1%) can cause off-odors and off-flavors. Elevated carbon dioxide can also cause internal browning. Water loss is a significant problem with celery that causes dehydration and wilting

Benefit: Use of 5% carbon dioxide at 0°C for up to 2 months can suppress decay whereas low oxygen is of minimal value.

AFAM+: Celery benefits from elevated carbon dioxide and high levels of relative humidity (95-100%). Therefore, celery is very well suited for AFAM+ when shipped in a properly sealed refrigerated container because minimizing the fresh air vent openings will limit water loss and permit the buildup of carbon dioxide to optimal levels. If we assume a RQ of 1, then the oxygen and carbon dioxide levels can be modified to about 5% carbon dioxide and 16% oxygen for up to 7 weeks. In addition to maximizing the efficiency of temperature management, AFAM+ can also protect celery from low oxygen and elevated carbon dioxide injuries.

Cherries

Sweet



Recommended Set Points

Temperature	0.0°C (32°F)
Dehumidification.....	Off
CO ₂ Maximum	15%
O ₂ Minimum (if applicable).....	6%

Fresh Air Exchange

Fresh Air Exchange Setting.....	25cmh (15cfm)
Maximum Opening Delay.....	48 hours

Injury level: Cherries can tolerate up to 20% carbon dioxide and 1% or greater oxygen at 0°C for up to 3 weeks. Lower levels of oxygen and higher levels of carbon dioxide can cause off-flavors, skin browning and skin pitting.

Benefit: Cherries can benefit from low oxygen and elevated carbon dioxide. Elevated carbon dioxide reduces decay and maintains freshness and low oxygen retains firmness.

AFAM+: Cherries are suited for the AFAM+ applications when shipped in properly sealed refrigerated containers. Cherries can benefit from AFAM+ because elevated carbon dioxide of 15-20% can retard decay and reduced oxygen at 6% can help reduce the respiratory activity and maintain freshness. If we assume an RQ of 1, then the oxygen and carbon dioxide levels can be modified to about 2% oxygen and 19% carbon dioxide, which is desirable.

Corn *Sweet*



Recommended Set Points

Temperature	0.0°C (32°F)
Dehumidification.....	Off
CO ₂ Maximum	15%
O ₂ Minimum (if applicable).....	6%

Fresh Air Exchange

Fresh Air Exchange Setting.....	75cmh (45cfm)
Maximum Opening Delay.....	24 hours

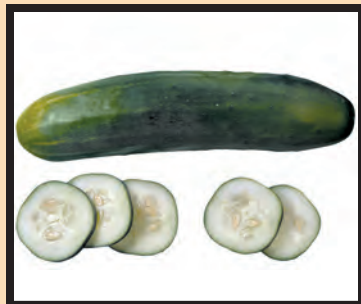
Injury level: Carbon dioxide (>20%) and/or low oxygen (<2%) levels can cause off-flavors and off-odors to sweet corn held at 0°C for up to 4 weeks depending on the variety. The postharvest life of supersweet corn with the shrunken-2 gene and other sweetness enhancing varieties is up to 4 weeks whereas normal corn is about 7 days. Low relative humidity levels can cause water and weight loss related defects.

Benefit: Normal sweet corn benefits more from reduced oxygen (3%) than supersweet corn varieties. Elevated carbon dioxide (10-15%) reduces decay on husks and silks and sucrose ("sugar") loss from kernels. Low oxygen also retards sugar loss. High relative humidity (98%) helps minimize weight loss.

AFAM+: Sweet corn is suited for AFAM+ when shipped in a properly sealed refrigerated container. Sweet corn benefits from elevated carbon dioxide and high levels of relative humidity (98%). AFAM+ will minimize the fresh air vent openings, which in turn limits water loss and permits for the buildup of carbon dioxide and relative humidity to optimal levels. If we assume a RQ of 1, then the oxygen and carbon dioxide levels can be modified to about 6% oxygen and 15% carbon dioxide for up to 2 weeks at 0°C. In addition to maximizing the efficiency of temperature management, AFAM+ can also protect sweet corn from low oxygen and elevated carbon dioxide injuries, namely off-favors and odors. AFAM+ will not offer the added benefits of low oxygen, namely reduction of sugar loss.

Cucumber

Pickling/Fresh



Recommended Set Points

	Pickling	Fresh
Temperature	4.4°C (40°F)	12.2°C (54°F)
Dehumidification.....	Off	Off
CO ₂ Maximum	5%	10%
O ₂ Minimum (if applicable).....	16%	11%

Fresh Air Exchange

Fresh Air Exchange Setting	50cmh (30cfm)	25cmh(15cfm)
Maximum Opening Delay..	0 hours	36 hours

Injury level: Exposure to > 10% carbon dioxide will cause surface lesions and discoloration (pitting) and more rapid softening. Low oxygen levels (<1%) can cause off-flavors.

Benefit: Elevated carbon dioxide is not beneficial for cucumbers. Low oxygen (1 to 4%) only slightly delays senescence and reduces respiration and yellowing.

AFAM+: In addition to maximizing the efficiency of temperature management, the primary benefit of AFAM+ is to protect cucumbers from low oxygen and elevated carbon dioxide injuries. There is little or no benefit from elevated carbon dioxide and/or low oxygen.

Durian

Ripe/Unripe



Recommended Set Points

	Ripe	Unripe
Temperature	4.4°C (40°F)	12.8°C (55°F)
Dehumidification.....	Off	Off
CO ₂ Maximum	10%	15%
O ₂ Minimum (if applicable).....	11%	6%

Fresh Air Exchange

Fresh Air Exchange Setting	50cmh (30cfm)	50cmh(30cfm)
Maximum Opening Delay..	24 hours	36 hours

Injury level: Carbon dioxide in excess of 20% and/or low oxygen less than 2% is harmful to durians. Low oxygen (<2%) impairs ripening and causes a gray discoloration of the pulp.

Benefit: Durians benefit from low oxygen and elevated carbon dioxide. Unripe durians must be transported at higher temperature than ripe durians in order to avoid chilling injury, but unripe fruit can tolerate much higher carbon dioxide levels at the higher temperature. Elevated carbon dioxide and low oxygen will retard ripening. Low oxygen reduces respiration and the production of ethylene gas.

AFAM+: Durians are well suited for the AFAM+ application when shipped in a properly sealed refrigerated container. In addition to maximizing the efficiency of temperature management, AFAM+ can protect durians from injurious levels of oxygen and carbon dioxide. If we assume an RQ of 1, then the oxygen and carbon dioxide levels can be modified to about 11% and 10% respectively, for up to 9 days (ripe durians). Elevated carbon dioxide in combination with low oxygen is desirable for retarding ripening. Ethylene scrubbing is recommended.

Eggplant



Recommended Set Points

Temperature	11.1°C (52°F)
Dehumidification.....	Off
CO ₂ Maximum	10%
O ₂ Minimum (if applicable).....	11%

Fresh Air Exchange

Fresh Air Exchange Setting.....	50cmh (30cfm)
Maximum Opening Delay.....	18 hours

Injury level: Carbon dioxide (>10%) and/or low oxygen (<1%) levels can be harmful to eggplants held at 10-12°C for up to 2 weeks. Low relative humidity levels can cause water and weight loss related defects.

Benefit: Eggplants derive no benefit from elevated carbon dioxide. High relative humidity (>95%) helps retard weight loss. Low oxygen helps retard aging and ripening.

AFAM+: Eggplants are suited for AFAM+ when shipped in a properly sealed refrigerated container. Eggplants benefit from high levels of relative humidity (95%). Higher relative humidities (95%) will help minimize water loss, weight loss, browning of the calyx, skin wrinkling, spongy flesh and loss of surface sheen. AFAM+ will minimize the fresh air vent openings, which in turn limits water loss and permits for the buildup of relative humidity to optimal levels. In addition to maximizing the efficiency of temperature management, AFAM+ can also protect eggplants from low oxygen and elevated carbon dioxide injuries.

Flower Bulbs



Recommended Set Points

Temperature	17°C (63°F)
Dehumidification.....	70%
CO ₂ Maximum	1%
O ₂ Minimum (if applicable)	20%

Fresh Air Exchange

Fresh Air Exchange Setting	250cmh (150cfm)
Maximum Opening Delay	0 hours

Injury level: Some flower bulbs, notably iris, lily and tulip have been reported to be tolerant of anaerobic (very low oxygen) atmospheres and high (around 20%) carbon dioxide. However, elevated carbon dioxide and/or reduced oxygen may also promote sprouting of flower bulbs. Flower bulbs can be extremely sensitive to ethylene exposure, which can cause floral abortion. Ethylene scrubbing is recommended.

Benefit: There is very little in the way of specific or reliable information regarding the benefits of elevated carbon dioxide and reduced oxygen on flower bulbs other than iris, lily and tulip. Low oxygen (10%) suppresses the occurrence of blind tulip bulbs and improves storage life. Low relative humidity (65%) helps minimize water loss.

AFAM+: Flower bulbs are suited for AFAM+ when shipped in a properly sealed refrigerated container because reduced oxygen and elevated carbon dioxide in storage or transit can damage flower bulbs. In addition to maximizing the efficiency of temperature management, the primary benefits of AFAM+ in combination with dehumidification are to limit water loss, suppress the onset of decay, retard carbon dioxide and low oxygen injuries and to maintain desired levels of relative humidity (65%). The postharvest handling of different varieties and types of flower bulbs can vary greatly so it is highly advisable to consult knowledgeable sources or reliable reference guides before attempting to use modified oxygen or carbon dioxide levels for conditions or flower bulbs for which the shipper does not have previous commercial experience and success. In the absence of such information, it is recommended that AFAM+ be used to avoid build-up of carbon dioxide in the container above 1%. If we assume a RQ of 1, then the oxygen and carbon dioxide levels can be modified to about 1% carbon dioxide and 20 % oxygen for greater than 6 weeks.

Flowers Cut



Recommended Set Points

Temperature	0°C (32°F)
Dehumidification.....	Off
CO ₂ Maximum	2%
O ₂ Minimum (if applicable)	19%

Fresh Air Exchange

Fresh Air Exchange Setting	125cmh (75cfm)
Maximum Opening Delay	10 hours

Injury level: Anthuriums, carnations, daffodils, Freesia, lilies, roses, and tulips all have similar responses to controlled atmospheres in that they are very tolerant of low oxygen levels (<2%). Carnations, Freesia, lilies, roses, and tulips are also tolerant of elevated carbon dioxide (>5-10%). Carnations are not damaged by as much as 20% carbon dioxide and roses tolerate 5 to 10% carbon dioxide depending on the variety. Low oxygen injury causes leaf discoloration and tissue collapse; high carbon dioxide injury causes bronzing of rose leaves and blueing of flower petals. The tolerance of anthuriums and daffodils to carbon dioxide is not known.

Benefit: Low oxygen (1-2%) delays senescence and 5 to 10% carbon dioxide reduces ethylene effects, to which both carnations and roses are very susceptible. Elevated (10%) carbon dioxide has also been reported to reduce gray mold decay on roses. Cut flowers are extremely sensitive to water loss and high relative humidity (95%) helps minimize water loss.

AFAM+: There are many differences among flower types and varieties in responses to low oxygen and elevated carbon dioxide. Those flowers that are tolerant of elevated carbon dioxide are well suited for AFAM+ when shipped in a properly sealed refrigerated container. AFAM+ will minimize the fresh air vent openings, which in turn limits water loss and permits for the buildup of carbon dioxide and relative humidity (95%) to optimal levels. In addition to maximizing the efficiency of temperature management, AFAM+ can also protect flowers from elevated carbon dioxide injuries. Ethylene scrubbing is recommended.

Flowering Potted Plants



Recommended Set Points

Temperature	15°C (59°F)
Dehumidification	Off
CO ₂ Maximum	1%
O ₂ Minimum (if applicable)	20%

Fresh Air Exchange

Fresh Air Exchange Setting.....	125cmh (75cfm)
Maximum Opening Delay.....	0 hours

Injury level: There is almost nothing known about the tolerance of potted plants to low oxygen or elevated carbon dioxide. It cannot be assumed that the whole plant will respond the same as the cut flowers, e.g., potted lilies or roses, because different parts of the plants may respond differently to low oxygen or elevated carbon dioxide. Most potted plants are sensitive to ethylene exposure and to the effects of water loss.

Benefit: The primary benefit of AFAM+ would be to limit water loss while avoiding the build-up of carbon dioxide and ethylene.

AFAM+: In the absence of specific knowledge or experience regarding low oxygen and elevated carbon dioxide responses, AFAM+ should be set to avoid carbon dioxide levels >1% from accumulating.

Foliage

Asparagus and Leatherleaf Ferns



Recommended Set Points

Temperature.....	1.1°C (34°F)
Dehumidification	Off
CO ₂ Maximum.....	5%
O ₂ Minimum (if applicable)	16%

Fresh Air Exchange

Fresh Air Exchange Setting.....	125cmh (75cfm)
Maximum Opening Delay.....	0 hours

Injury level: Asparagus fern can develop a bluish cast at <3% oxygen. Both asparagus and leatherleaf ferns tolerate 5-10% carbon dioxide for 2 weeks at 1°C. Ethylene can cause yellowing of asparagus fern, but leatherleaf fern is relatively insensitive to ethylene effects.

Benefit: Elevated carbon dioxide (5-10%) reduces yellowing of ferns, especially at higher temperature (4°C). Ferns are sensitive to water loss and high relative humidity (95%) helps minimize water loss.

AFAM+: Ferns benefit from elevated carbon dioxide and high levels of relative humidity (95-100%). Therefore, ferns are suited for AFAM+ when shipped in a properly sealed refrigerated container because minimizing the fresh air vent openings will limit water loss and permit the buildup of carbon dioxide to optimal levels (5-10%). In addition to maximizing the efficiency of temperature management, AFAM+ can also protect ferns from low oxygen and elevated carbon dioxide injuries. Ethylene scrubbing is recommended.

Garlic



Recommended Set Points

Temperature	0.0°C (32°F)
Dehumidification.....	70%
CO ₂ Maximum	10%
O ₂ Minimum (if applicable).....	11%

Fresh Air Exchange

Fresh Air Exchange Setting.....	25cmh (15cfm)
Maximum Opening Delay.....	36 hours

Injury level: Garlic can tolerate up to 10% carbon dioxide and 2-3% oxygen at 0-2°C. Higher carbon dioxide levels can cause translucent yellowish discoloration.

Benefit: Garlic benefits from low oxygen and elevated carbon dioxide. Elevated carbon dioxide should reduce sprouting, decay and root growth. Low oxygen may extend postharvest life.

AFAM+: Garlic is well suited for AFAM+ applications when shipped in a properly sealed refrigerated container because elevated carbon dioxide reduces sprouting, root growth and possibly decay. By minimizing the fresh air vent openings, AFAM+ will maximize the efficiency of temperature management, limit water loss and permit the buildup of carbon dioxide to optimal levels. In the absence of local research findings, a carbon dioxide setting of 10% should work for garlic. Oxygen is generally set at 1 to 3% for CA systems involving long-term storage. However, the oxygen set point for AFAM+ should be set to protect the garlic from excessively high levels of carbon dioxide. Assuming an RQ of 1, an oxygen setting of 11% and a carbon dioxide setting of 10% are suggested.

Grapes Table



Recommended Set Points

Temperature	0.0°C (32°F)
Dehumidification.....	Off
CO ₂ Maximum	15%
O ₂ Minimum (if applicable).....	6%

Fresh Air Exchange

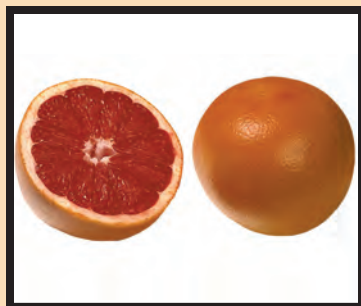
Fresh Air Exchange Setting	25cmh (15cfm)
Maximum Opening Delay.....	48 hours

Injury level: Exposure to > 15% carbon dioxide for more than 2 weeks at 0°C can cause browning of grape pedicels.

Benefit: Use of 10-15% carbon dioxide at 0°C can be an alternative to sulphur dioxide "SO₂" fumigation or SO₂-release packets for effective decay control.

AFAM+: Table grapes do not need CA for normal transit times if SO₂-release packets are used. Therefore, grapes are suited for AFAM+ when shipped in a properly sealed refrigerated container because minimizing the fresh air vent openings will limit water loss and permit the buildup of carbon dioxide to optimal levels. If we assume a RQ of 1, then the oxygen and carbon dioxide levels can be modified to about 15% carbon dioxide and 6% oxygen for up to 2 weeks and 10% carbon dioxide and 11% oxygen for up to 4 weeks. In addition to maximizing the efficiency of temperature management, AFAM+ can protect grapes from low oxygen and elevated carbon dioxide injuries.

Grapefruit



Recommended Set Points

	Dry Areas	Humid Areas
Temperature	14.4°C (58°F)	10-16.1°C (50-61°F)
Dehumidification	Off	Off
CO ₂ Maximum	5%	10%
O ₂ Minimum (if applicable).....	16%	11%

Fresh Air Exchange

Fresh Air Exchange Setting	50cmh (30cfm)	25cmh(15cfm)
Maximum Opening Delay.....	0 hours	36 hours

Injury level: Carbon dioxide levels greater than 10% and oxygen less than 3% can damage grapefruit following several weeks at recommended temperatures for different harvest times, varieties and growing areas. Elevated carbon dioxide and low oxygen can cause off-flavors. Elevated carbon dioxide can also damage the skin. Sensitivity to chilling injury changes during the season for grapefruit from humid areas such as Florida. Early season (before January 1) Florida fruit should be shipped at 16.1°C (61°F). USDA insect quarantine cold treatment can be used for late season, preconditioned (7 days at 61°F) fruit.

Benefit: Elevated carbon dioxide treatments up to 10% may suppress chilling injury symptoms (off-odors, surface lesions and pitting) and stem-end rind breakdown (a darkening of the epidermal tissues around the stem). Low oxygen can maintain firmness.

AFAM+: Grapefruit are suited for the AFAM+ application when shipped in a properly sealed refrigerated container. If we assume a RQ of 1, then the oxygen and carbon dioxide levels can be modified to about 11% oxygen and 10% carbon dioxide for up to 6 weeks depending on season and growing area. The elevated carbon dioxide is desirable for reducing chilling injury symptoms and a darkening of the epidermal tissues around the stem. In addition to maximizing the efficiency of temperature management, AFAM+ can protect grapefruit from low oxygen and elevated carbon dioxide injuries.

Honeydew Melons



Recommended Set Points

Temperature	7.2°C (45°F)
Dehumidification.....	Off
CO ₂ Maximum	10%
O ₂ Minimum (if applicable).....	11%

Fresh Air Exchange

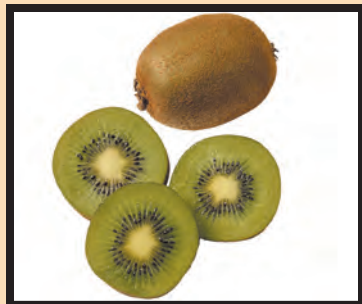
Fresh Air Exchange Setting.....	25cmh (15cfm)
Maximum Opening Delay.....	36 hours

Injury level: Carbon dioxide in excess of 20% and/or low oxygen less than 1% can impair ripening and cause off-flavors and odors. Elevated carbon dioxide levels of 10-20% can also cause a carbonated flavor in the flesh of the fruit, which dissipates when held in normal air.

Benefit: Honeydew melons benefit from low oxygen and elevated carbon dioxide. Elevated carbon dioxide of 10% and low oxygen of 3% will suppress the development of decay, retard ripening and reduce respiration.

AFAM+: Honeydew melons are suited for the AFAM+ application when shipped in a properly sealed refrigerated container. In addition to maximizing the efficiency of temperature management, AFAM+ can protect honeydew melons from injurious levels of oxygen and carbon dioxide. If we assume a RQ of 1, then the oxygen and carbon dioxide levels can be modified to about 11% and 10% respectively for up to 3 weeks at 7°C. Elevated carbon dioxide is desirable for reducing decay and retarding ripening. Ethylene scrubbing is recommended.

Kiwi Fruit



Recommended Set Points

Temperature	0.0°C (32°F)
Dehumidification.....	Off
CO ₂ Maximum	7%
O ₂ Minimum (if applicable).....	14%

Fresh Air Exchange

Fresh Air Exchange Setting.....	25cmh (15cfm)
Maximum Opening Delay.....	24 hours

Injury level: Kiwis can develop flesh breakdown if exposed to > 7% carbon dioxide for more than 1 month at 0°C. Low oxygen levels less than 1% can cause off-flavors.

Benefit: Greater than 3% carbon dioxide helps retain firmness and reduces decay.

AFAM+: Ethylene scrubbing is more critical than oxygen or carbon dioxide levels for kiwis within a typical transit timeframe. That is, CA is not necessary and AFAM+ would be beneficial. If we assume a RQ of 1, then the oxygen and carbon dioxide levels can be modified to about 7% carbon dioxide and 14% oxygen. In addition to maximizing the efficiency of temperature management, AFAM+ can protect kiwis from low oxygen and elevated carbon dioxide injuries. Ethylene scrubbing is recommended.

Lemons & Limes



Recommended Set Points

Temperature	11.1°C (52°F)
Dehumidification.....	Off
CO ₂ Maximum	10%
O ₂ Minimum (if applicable).....	11%

Fresh Air Exchange

Fresh Air Exchange Setting.....	25cmh (15cfm)
Maximum Opening Delay.....	36 hours

Injury level: Carbon dioxide greater than 10% and oxygen less than 5% can damage lemons & limes following several weeks at 10°C.

Benefit: Elevated carbon dioxide treatments of 10% may suppress decay and slow the loss of green color.

AFAM+: Lemons & limes are suited for the AFAM+ application when shipped in a properly sealed refrigerated container. If we assume a RQ of 1, then the oxygen and carbon dioxide levels can be modified to about 11% oxygen and 10% carbon dioxide, which is desirable for retarding decay and loss of green color. AFAM+ can protect lemons & limes from low oxygen and elevated carbon dioxide injuries.

Lettuce

Crisphead



Recommended Set Points

Temperature	0.0°C (32°F)
Dehumidification.....	Off
CO ₂ Maximum	1%
O ₂ Minimum (if applicable).....	20%

Fresh Air Exchange

Fresh Air Exchange Setting.....	25cmh (15cfm)
Maximum Opening Delay.....	0 hours

Injury level: Exposure to > 1% carbon dioxide or oxygen levels < 1% can cause quality loss. Elevated carbon dioxide can cause brown stain and the increased likelihood of decay. Low oxygen in combination with elevated carbon dioxide results in more serious brown stain symptoms than elevated carbon dioxide alone. Brown stain is most serious at lower, more desirable holding temperatures. Oxygen less than 1% can cause internal discoloration and off-odors. Water loss is a significant problem with lettuce that causes dehydration and wilting.

Benefit: In practice, elevated carbon dioxide at 0°C is of no value for lettuce because of the overriding negative effects of brown stain. However, low oxygen (1 to 3%) slows respiration, and suppresses pink rib.

AFAM+: Lettuce is well suited for AFAM+ when shipped in a properly sealed refrigerated container because lettuce benefits from low carbon dioxide and high levels of relative humidity (95-100%). In addition to maximizing the efficiency of temperature management, AFAM+ can also protect lettuce from low oxygen and elevated carbon dioxide injuries. If we assume a RQ of 1, then the oxygen and carbon dioxide levels can be modified to about 1% carbon dioxide and 20% oxygen for up to 3 weeks. By minimizing the fresh air vent openings, AFAM+ will limit water loss and permit the buildup of relative humidity to optimal levels. Types and varieties of lettuce can vary greatly with regards to the injurious effects of carbon dioxide. Moreover, whole crisphead lettuce is less tolerant to carbon dioxide than fresh-cut lettuce.

Lychee



Recommended Set Points

Temperature	2.2°C (36°F)
Dehumidification.....	Off
CO ₂ Maximum	5%
O ₂ Minimum (if applicable).....	16%

Fresh Air Exchange

Fresh Air Exchange Setting	25cmh (15cfm)
Maximum Opening Delay.....	24 hours

Injury level: Exposure to > 15% carbon dioxide or oxygen levels <1% can cause off-flavors. Elevated carbon dioxide can also cause a graying of the flesh. Water loss is a significant problem with lychees.

Benefit: Use of 5% carbon dioxide can maintain favorable nutritional and compositional attributes and low oxygen (5%) can suppress skin browning at 0°C for up to 5 weeks.

AFAM+: Lychees benefit from elevated carbon dioxide and high levels of relative humidity (95%). Lychees are suited for AFAM+ when shipped in a properly sealed refrigerated container because minimizing the fresh air vent openings will limit water loss and permit the buildup of carbon dioxide to optimal levels. If we assume a RQ of 1, then the oxygen and carbon dioxide levels can be modified to about 5% carbon dioxide and 16 % oxygen for up to 3 weeks. In addition to maximizing the efficiency of temperature management, AFAM+ can also protect lychees from low oxygen and elevated carbon dioxide injuries. AFAM+ will not offer the benefits of low oxygen, namely the suppression of skin browning.

Mangoes



Recommended Set Points

Temperature	12.8°C (55°F)
Dehumidification.....	Off
CO ₂ Maximum	10%
O ₂ Minimum (if applicable).....	11%

Fresh Air Exchange

Fresh Air Exchange Setting	50cmh (30cfm)
Maximum Opening Delay.....	24 hours

Injury level: Carbon dioxide in excess of 10% at 12-13°C can cause quality problems like off flavors, discoloration and softening of mature-green mangoes. Mango cultivars vary in their response to temperature, oxygen and carbon dioxide, and riper fruit benefit more from higher carbon dioxide levels (> 10%). Consequently, postharvest recommendations should be solicited from local extension workers or Universities for the cultivars of interest.

Benefit: Mangoes benefit from low oxygen and elevated carbon dioxide. Elevated carbon dioxide maintains firmness whereas low oxygen delays ripening.

AFAM+: In addition to maximizing the efficiency of temperature management, AFAM+ can protect mangoes from injurious levels of oxygen and carbon dioxide. For mangoes, the decision to use CA or AFAM+ may simply be a cost-benefit decision. In the case of mangoes, low oxygen (CA required) will delay mango ripening whereas elevated carbon dioxide (5-10%) will maintain the firmness when mangoes are shipped in a properly sealed refrigerated container. If we assume a RQ of 1, then the oxygen and carbon dioxide levels can be modified to about 10% carbon dioxide and 11% oxygen for up to 4 weeks. An added benefit of AFAM+ for mangoes is that undesirably high levels of carbon dioxide (greater than 10%) can be avoided. Ethylene scrubbing is recommended.

Okra



Recommended Set Points

Temperature	7.2°C (45°F)
Dehumidification.....	Off
CO ₂ Maximum	10%
O ₂ Minimum (if applicable).....	11%

Fresh Air Exchange

Fresh Air Exchange Setting.....	75cmh (45cfm)
Maximum Opening Delay.....	18 hours

Injury level: The injurious effect of carbon dioxide is off-odors even after cooking the okra. Generally, carbon dioxide (>10%) for 10 or more days in storage or transit at 7°C can be harmful to okra. Low relative humidity levels can cause water loss, weight loss and wilting.

Benefit: Okra can benefit from elevated carbon dioxide when held up to 10 days, but there is little or no benefit from reduced oxygen. Elevated carbon dioxide lengthens shelflife, suppresses decay and maintains green color, solids and mucilage. High relative humidity (95%) helps minimize water loss related defects.

AFAM+: Okra is well suited for AFAM+ when shipped in a properly sealed refrigerated container. If we assume a RQ of 1, then the oxygen and carbon dioxide levels can be modified to about 10% carbon dioxide and 11 % oxygen for up to 2 weeks. AFAM+ will minimize the fresh air vent openings, which in turn limits water loss and permits for the buildup of carbon dioxide (10%) and relative humidity (95%) to optimal levels. In addition to maximizing the efficiency of temperature management, AFAM+ can also protect okra from low oxygen and elevated carbon dioxide injuries, namely off-odors. There is no added benefit of low oxygen.

Onions

Bulb



Recommended Set Points

Temperature	0.0°C (32°F)
Dehumidification.....	70%
CO ₂ Maximum	5%
O ₂ Minimum (if applicable).....	16%

Fresh Air Exchange

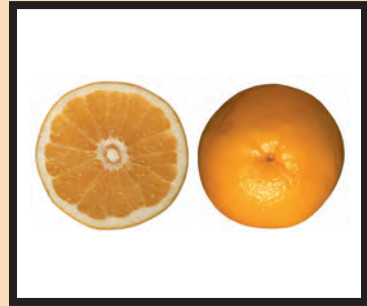
Fresh Air Exchange Setting.....	25cmh (15cfm)
Maximum Opening Delay.....	24 hours

Injury level: Onions can tolerate up to 10% carbon dioxide and 2-3% oxygen at 0-2°C. Higher carbon dioxide levels and lower oxygen levels can cause tissue softening or breakdown, and off odors.

Benefit: Onions benefit from low oxygen and elevated carbon dioxide. Elevated carbon dioxide reduces sprouting, decay and root growth. Low oxygen extends postharvest life.

AFAM+: Onions are well suited for AFAM+ applications when shipped in a properly sealed refrigerated container because elevated carbon dioxide reduces sprouting, root growth and possibly decay. By minimizing the fresh air vent openings, AFAM+ will maximize the efficiency of temperature management, limit water loss and permit the buildup of carbon dioxide to optimal levels. In the absence of local research findings, a carbon dioxide setting of 5% should work for onions. Oxygen is generally set at 1 to 3% for CA systems involving long-term storage. However, the oxygen set point for AFAM+ should be set to protect the onions from excessively high levels of carbon dioxide. Assuming an RQ of 1, an oxygen setting of 16% and a carbon dioxide setting of 5% are suggested.

Oranges



Recommended Set Points

	FL Valencia	CA Navel	AZ Dry Areas
Temperature	1.1°C (34°F)	5.0°C (41°F)	8.9°C (48°F)
Dehumidification	Off	Off	Off
CO ₂ Maximum.....	5%	5%	5%
O ₂ Minimum (if applicable)	16%	16%	16%

Fresh Air Exchange

Fresh Air	FL Valencia	CA Navel	AZ Dry Areas
Exchange Setting.....	25cmh (15cfm)	25cmh (15cfm)	25cmh (15cfm)
Maximum			
Opening Delay.....	24 hours	24 hours	24 hours

Injury level: Carbon dioxide levels greater than 5% and oxygen less than 5% can damage oranges following several weeks at recommended temperatures for different harvest times, varieties and growing areas. Elevated carbon dioxide and low oxygen can cause off-flavors.

Benefit: Elevated carbon dioxide treatments of up to 5% at 5 to 7°C (depends on variety and growing region) may suppress chilling injury symptoms (off-odors, surface lesions and pitting). Low oxygen can maintain firmness.

AFAM+: Oranges are suited for the AFAM+ application primarily as a means of maximizing the efficiency of temperature management and protecting the oranges from low oxygen and elevated carbon dioxide injuries. If we assume a RQ of 1, then the oxygen and carbon dioxide levels can be modified to about 5% carbon dioxide and 16 % oxygen for various times depending on the variety, season and growing area.

Papaya



Recommended Set Points

Temperature	12.8°C (55°F)
Dehumidification.....	Off
CO ₂ Maximum	10%
O ₂ Minimum (if applicable).....	11%

Fresh Air Exchange

Fresh Air Exchange Setting.....	25cmh (15cfm)
Maximum Opening Delay.....	48 hours

Injury level: Papayas can be damaged by oxygen less than 2% and carbon dioxide greater than 10% at 10-15°C (lower temperatures are used for riper fruit).

Benefit: Papayas benefit from desirable levels of oxygen (2%) and carbon dioxide (5-10%). Desirable levels of carbon dioxide (5-10%) maintain firmness whereas desirable levels oxygen (2%) delay softening, ripening and degreening.

AFAM+: In addition to maximizing the efficiency of temperature management, AFAM+ can protect papayas from low oxygen and elevated carbon dioxide injuries. For papayas, the decision to use CA or AFAM+ may simply be a cost-benefit decision. In the case of papayas, low oxygen (CA required) will delay ripening whereas elevated carbon dioxide (5-10%) will maintain the firmness when papayas are shipped in a properly sealed refrigerated container. An added benefit of AFAM+ for papayas is that undesirably high levels of carbon dioxide (greater than 10%) can be avoided. Carbon dioxide in excess of 10% can cause quality problems such as off flavors. Ethylene scrubbing is recommended.

Peach/Nectarine



Recommended Set Points

Temperature.....	0.0°C (32°F)
Dehumidification.....	Off
CO ₂ Maximum	10%
O ₂ Minimum (if applicable).....	11%

Fresh Air Exchange

Fresh Air Exchange Setting.....	25cmh (15cfm)
Maximum Opening Delay.....	36 hours

Injury level: Peaches and nectarines can be injured by < 2% oxygen and can develop flesh browning and either off-flavor or loss of flavor if exposed to > 10% carbon dioxide for more than 3 weeks at 0°C.

Benefit: Elevated carbon dioxide at (17%) for up to 2 weeks at 0°C helps retain firmness and reduces internal breakdown (chilling injury) in some varieties.

AFAM+: CA is useful for shipping peaches/nectarines with transit times of 2 weeks or more because of its effect in reducing internal breakdown in susceptible varieties. AFAM+ would not replace CA for those sensitive varieties, but would benefit those varieties that can be shipped successfully in normal air. If we assume an RQ of 1, then the oxygen and carbon dioxide levels can be modified to about 10% carbon dioxide and 11% oxygen for up to 3 weeks, or alternatively, the settings can be 17% carbon dioxide and 6% oxygen for up to 2 weeks. In addition to maximizing the efficiency of temperature management, AFAM+ can protect peaches/nectarines from low oxygen and elevated carbon dioxide injuries. Ethylene scrubbing is recommended.

Pears

General



Recommended Set Points

Temperature	-1.1°C (30°F)
Dehumidification.....	Off
CO ₂ Maximum	1 to 3%
O ₂ Minimum (if applicable)	18 to 20%

Fresh Air Exchange

Fresh Air Exchange Setting	25cmh (15cfm)
Maximum Opening Delay.....	0 hours

Injury level: Low oxygen (<1-2%) causes off-flavor due to alcoholic fermentation. Pears generally show injury from > 3% carbon dioxide if exposure exceeds 1 month at 0°C. Symptoms can include brown core, core flush, core cracking, cavitation of flesh, flesh browning, and surface cracking, depending on the variety. Susceptibility of pears to carbon dioxide injury increases with advanced maturity, delayed cooling, prolonged storage, and lower oxygen levels during storage.

Benefit: Use of 1-3% carbon dioxide helps retain firmness, green color, and acidity.

AFAM+: Pears do not need CA for normal transit times. Therefore, they are very well suited for AFAM+. In addition to maximizing the efficiency of temperature management, AFAM+ can protect pears from low oxygen and elevated carbon dioxide injuries. The information below for individual pear varieties is a consensus for those varieties grown in many different parts of the world. Specific AFAM+ settings may differ for certain countries of origin. It is highly advisable to consult knowledgeable sources or reliable reference guides before attempting to use modified oxygen or carbon dioxide levels for conditions or pear varieties for which the shipper does not have previous commercial experience and success. Ethylene scrubbing is recommended.

Pear

Anjou



Recommended Set Points

Temperature.....-1.1°C (30°F)

Dehumidification.....Off

CO₂ Maximum1%

O₂ Minimum (if applicable).....20%

Fresh Air Exchange

Fresh Air Exchange Setting25cmh (15cfm)

Maximum Opening Delay.....0 hours

Injury level: Carbon dioxide levels ranging from 0.5 to 1.5% during long-term storage may injure Anjou pears. They tend to show flesh cavitation when injured by carbon dioxide. There is some evidence that Anjou pears can tolerate a somewhat higher (+1%) carbon dioxide level at 1°C than at -1°C. Pretreatment of Anjou pears with 10 to 20% carbon dioxide for 10-12 days prior to long term storage can be beneficial in terms of maintaining the capacity of the fruit to ripen.

Benefit: Helps retain firmness, green color, and acidity and reduces scald.

AFAM+: Carbon dioxide levels should be kept at or below 1%. If we assume a RQ of 1, then the oxygen and carbon dioxide levels can be modified to about 1% carbon dioxide and 20% oxygen for up to 4 weeks. Higher carbon dioxide levels may be safe for fruit that have not been previously stored.

Pear *Bartlett*



Recommended Set Points

Temperature	-1.1°C (30°F)
Dehumidification.....	Off
CO ₂ Setting.....	3%
O ₂ Setting (if applicable)	18%

Fresh Air Exchange

Fresh Air Exchange Settings	25cmh (15cfm)
Maximum Opening Delay.....	0 hours

Injury level: Bartlett tolerance of elevated carbon dioxide varies from 1 to 5% depending on fruit maturity: early and midseason fruit are more tolerant and late season fruit less tolerant of elevated carbon dioxide levels. Carbon dioxide injury causes core and flesh browning and is more likely to occur when oxygen levels are lower than carbon dioxide levels.

Benefit: Helps retain firmness, green color, and acidity.

AFAM+: Since oxygen levels will not be extremely low in AFAM+, all but the most mature Bartletts can be transported in 3-5% carbon dioxide. If we assume a RQ of 1, then the oxygen and carbon dioxide levels can be modified to about 3% carbon dioxide and 18% oxygen for up to 2 months.

Pear

Bosc



Recommended Set Points

Temperature.....	-1.1°C (30°F)
Dehumidification.....	Off
CO ₂ Setting.....	1%
O ₂ Setting (if applicable).....	20%

Fresh Air Exchange

Fresh Air Exchange Setting	25cmh (15cfm)
Maximum Opening Delay.....	0 hours

Injury level: Bosc pears are very susceptible to carbon dioxide injury when stored in very low oxygen. They can be injured by carbon dioxide levels >0.1% when oxygen is <1%. However, when oxygen is at least 3%, Bosc can be held in 3% carbon dioxide. Symptoms of carbon dioxide injury include core flush and core cracking, surface pitting, and flesh discoloration.

Benefit: Helps retain firmness, green color, and acidity.

AFAM+: Since oxygen levels will not be extremely low in AFAM+, all but the most mature Bosc pears can be transported in 1-3% carbon dioxide. If we assume a RQ of 1, then the oxygen and carbon dioxide levels can be modified to about 1% carbon dioxide and 20% oxygen for up to 4 weeks.

Pear *Comice*



Recommended Set Points

Temperature.....	-1.1°C (30°F)
Dehumidification.....	Off
CO ₂ Setting.....	1%
O ₂ Setting (if applicable).....	20%

Fresh Air Exchange

Fresh Air Exchange Setting	25cmh (15cfm)
Maximum Opening Delay.....	0 hours

Injury level: Carbon dioxide levels ranging from 0.5 to 1.5% during long-term storage may injure Comice pears. They tend to show internal browning and flesh cavitation when injured by carbon dioxide.

Benefit: Helps retain firmness, green color, and acidity.

AFAM+: Carbon dioxide levels should be kept at or below 1%. If we assume an RQ of 1, then the oxygen and carbon dioxide levels can be modified to about 1% carbon dioxide and 20% oxygen for up to 4 weeks.

Persimmon



Recommended Set Points

Temperature	0.0°C (32°F)
Dehumidification.....	Off
CO ₂ Maximum	8%
O ₂ Minimum (if applicable).....	13%

Fresh Air Exchange

Fresh Air Exchange Setting.....	25cmh (15cfm)
Maximum Opening Delay.....	24 hours

Injury level: Carbon dioxide (>10%) and/or low oxygen (<3%) levels can cause off-flavors to persimmons held at 0°C for up to 3 months. Low relative humidity levels can cause water loss and skin browning.

Benefit: Persimmons can benefit from low oxygen (5%), elevated carbon dioxide (8%) and high humidity (95%). Elevated carbon dioxide suppresses chilling injury symptom development in fruit held between 5-15°C and helps maintain firmness at 0°C. Low oxygen retards ripening.

AFAM+: Persimmons are suited for AFAM+ when shipped in a properly sealed refrigerated container. If we assume a RQ of 1, then the oxygen and carbon dioxide levels can be modified to about 8% carbon dioxide and 13 % oxygen for up to 3 months. Persimmons benefit from high levels of relative humidity (95%). Higher relative humidities (95%) will help minimize water loss. AFAM+ will minimize the fresh air vent openings, which in turn limits water loss and permits for the buildup of relative humidity to optimal levels. In addition to maximizing the efficiency of temperature management, AFAM+ can also protect persimmons from low oxygen and elevated carbon dioxide injuries such as off-flavors. AFAM+ will not offer the benefits of low oxygen, namely suppressing ripening. Ethylene scrubbing is recommended.

Pineapple



Recommended Set Points

Temperature	12.8°C (55°F)
Dehumidification.....	Off
CO ₂ Maximum	10%
O ₂ Minimum (if applicable).....	11%

Fresh Air Exchange

Fresh Air Exchange Setting.....	25cmh (15cfm)
Maximum Opening Delay.....	48 hours

Injury level: Carbon dioxide in excess of 10% and/or low oxygen less than 2% is harmful to pineapples. Low oxygen and/or elevated carbon dioxide cause off-flavors.

Benefit: Pineapples can benefit from low oxygen and elevated carbon dioxide. Elevated carbon dioxide of 5-10% and low oxygen of 5% at 7.2 (full ripe) to 12.8°C (¼-ripe) will slow aging and suppress chilling injury symptoms and degreening. Chilling injury symptoms, in part, are water soaked flesh, browning of the core and center of the pineapple, decay, water loss and improper ripening.

AFAM+: Pineapples are suited for AFAM+ applications when shipped in a properly sealed refrigerated container. In addition to maximizing the efficiency of temperature management, AFAM+ can protect pineapples from injurious levels of oxygen and carbon dioxide. If we assume a RQ of 1, then the oxygen and carbon dioxide levels can be modified to about 10% carbon dioxide and 11 % oxygen for up to 4 weeks. This level of carbon dioxide (10%) will lessen the sensitivity of the pineapples to chilling injury and slow the degreening process. AFAM+ will not offer the benefits of low oxygen, namely suppressing ripening.

Plums



Recommended Set Points

Temperature	0.0°C (32°F)
Dehumidification.....	Off
CO ₂ Maximum	5%
O ₂ Minimum (if applicable).....	16%

Fresh Air Exchange

Fresh Air Exchange Setting.....	25cmh (15cfm)
Maximum Opening Delay.....	24 hours

Injury level: Flesh browning can occur if plums are exposed to > 5% carbon dioxide for more than 1 month at 0°C. Oxygen levels lower than 1% can cause off-flavors and failure to ripen.

Benefit: Proper levels of carbon dioxide help retain plum firmness at 0°C.

AFAM+: CA is useful for shipping plums with transit times of 2 weeks or more because of its effect in reducing internal breakdown in susceptible varieties. AFAM+ would not replace CA for those sensitive varieties, but would benefit those varieties that can be shipped successfully in normal air. If we assume a RQ of 1, then the oxygen and carbon dioxide levels can be modified to about 5% carbon dioxide and 16% oxygen for up to 4 weeks. In addition to maximizing the efficiency of temperature management, AFAM+ can protect plums from low oxygen and elevated carbon dioxide injuries. Ethylene scrubbing is recommended.

Potato



Recommended Set Points

	Late	Early
Temperature	5.0°C (41°F)	12.8°C (55°F)
Dehumidification.....	Off	Off
CO ₂ Maximum	1%	10%
O ₂ Minimum (if applicable).....	20%	11%

Fresh Air Exchange

Fresh Air Exchange Setting.	25cmh (15cfm)	25cmh(15cfm)
Maximum Opening Delay...	0 hours	36 hours

Injury level: Carbon dioxide and/or low oxygen levels can be harmful to potatoes and can cause sprouting problems. Low oxygen levels less than 1.5% or carbon dioxide greater than 10% can also cause off-flavors and odors, black heart and decay. Early crop (spring/early summer harvest) potatoes are very perishable. They are usually not cured and are more sensitive to chilling injury, water loss and physical injury than late crop potatoes. Oxygen below 5% and carbon dioxide above 1% inhibit curing of late crop potatoes.

Benefit: There is little or no benefit of reduced oxygen or elevated carbon dioxide for potatoes.

AFAM+: Potatoes are well suited for AFAM+ applications. If we assume a RQ of 1, then the oxygen and carbon dioxide levels can be modified to about 10% carbon dioxide and 11 % oxygen for up to 3 weeks for early crop potatoes and 1% carbon dioxide and 20 % oxygen for up to 5 months for late crop potatoes. In addition to maximizing the efficiency of temperature management, AFAM+ can protect potatoes from injurious levels of oxygen and carbon dioxide.

Rambutan



Recommended Set Points

Temperature	12.2°C (54°F)
Dehumidification	Off
CO ₂ Maximum	12%
O ₂ Minimum (if applicable).....	9%

Fresh Air Exchange

Fresh Air Exchange Setting.....	50cmh (30cfm)
Maximum Opening Delay.....	24 hours

Injury level: Carbon dioxide (>20%) and/or low oxygen (<1%) levels can be harmful to rambutans held at 12.2°C for up to 14 days. Low relative humidity levels can cause water loss and skin browning.

Benefit: Rambutans can benefit from low oxygen (3%), elevated carbon dioxide (12%) and high humidity (95%). Elevated carbon dioxide retards color loss and low oxygen will slow aging.

AFAM+: Rambutans are suited for AFAM+ when shipped in a properly sealed refrigerated container. If we assume a RQ of 1, then the oxygen and carbon dioxide levels can be modified to about 12% carbon dioxide and 9 % oxygen for up to 2 weeks. Rambutans benefit from elevated carbon dioxide and high levels of relative humidity (95%). Higher relative humidities (95%) will help minimize skin browning and water loss. AFAM+ will minimize the fresh air vent openings, which in turn limits water loss and permits for the buildup of relative humidity and carbon dioxide to optimal levels. In addition to maximizing the efficiency of temperature management, AFAM+ can also protect rambutans from low oxygen and elevated carbon dioxide injuries such as red color loss and decay. AFAM+ will not offer the benefits of low oxygen, namely slowing the aging process. Ethylene scrubbing is recommended.

Summer Squash (Zucchini)



Recommended Set Points

Temperature	7.2°C (45°F)
Dehumidification.....	Off
CO ₂ Setting.....	10%
O ₂ Setting (if applicable)	11%

Fresh Air Exchange

Fresh Air Exchange Setting	25cmh (15cfm)
Maximum Opening Delay.....	36 hours

Injury level: Carbon dioxide (>10%) and/or low oxygen (<1%) levels can be harmful to zucchini at 7-10°C for 14 days.

Benefit: There is little benefit of reduced oxygen or elevated carbon dioxide for zucchini. Carbon dioxide greater than 5% may suppress chilling injury.

AFAM+: Zucchini is well suited for AFAM+ applications. If we assume a RQ of 1, then the oxygen and carbon dioxide levels can be modified to about 10% carbon dioxide and 11% oxygen for up to 2 weeks. In addition to maximizing the efficiency of temperature management, AFAM+ can protect zucchinis from injurious levels of oxygen and carbon dioxide.

Tomato

Firm Ripe



Recommended Set Points

	Firm Ripe	Mature Green
Temperature	10.0°C (50°F)	12.8°C (55°F)
Dehumidification.....	Off	Off
CO ₂ Maximum	5%	3%
O ₂ Minimum (if applicable).....	16%	18%

Fresh Air Exchange

Fresh Air Exchange Setting.	25cmh (15cfm)	25cmh(15cfm)
Maximum Opening Delay...	24 hours	0 hours

Injury level: Elevated carbon dioxide and/or low oxygen levels can be harmful to tomatoes and can cause off-flavors and ripening problems. Carbon dioxide levels greater than 3% and 5% may damage mature green and turning tomatoes, respectively. Low oxygen levels of 2% or less can cause internal browning, surface scars and off-flavors.

Benefit: Tomatoes can benefit from low oxygen and elevated carbon dioxide. Elevated carbon dioxide levels of 3-5% and reduced oxygen levels of 2-4% will slow ripening of tomatoes.

AFAM+: Tomatoes are suited for AFAM+ applications when shipped in a properly sealed refrigerated container. If we assume a RQ of 1, then the oxygen and carbon dioxide levels can be modified to about 5% carbon dioxide and 16% oxygen for up to 1 week for mature green tomatoes and to about 5% carbon dioxide and 16% oxygen for up to 1 week for firm ripe tomatoes. In addition to maximizing the efficiency of temperature management, AFAM+ can protect tomatoes from injurious levels of oxygen and carbon dioxide. Carbon dioxide levels modified to about 3-5% will slow the ripening process. AFAM+ will not offer the benefits of low oxygen, namely suppressing ripening. Ethylene scrubbing is recommended.

AFAM+ Guidelines

Compiled by Drs. Patrick E Brecht and Jeffrey K Brecht

Code	Product	Carrying Temperature C (F)	Handling Guidelines						
			RH (%)	AFAM			AFAM+		Max. Time at temp./CO2
			cfm	cmh	Delay hrs	CO2 max%	O2 min%		
1.00	Beef, fresh	- 1.7 to 0 (29 to 32)	85-92	0	0	0			
	Beef, carcass	0 to 3.9 (32 to 39)	85-90	0	0	0			
	Horse	- 1.7 to 0 (29 to 32)	85-90	0	0	0			
	Liver	0 (32)	90	0	0	0			
	Veal	0 to 1.1 (32 to 34)	90	0	0	0			
	Fresh Lamb	0 to 1.1 (32 to 34)	85-90	0	0	0			
	Choice lamb	0 (32)	85	0	0	0			
	Leg, Choice	0 (32)	95	0	0	0			
	Pork	0 to 1.1 (32 to 34)	85-90	0	0	0			
	Poultry- ice packed	- 2.2 to 0 (28 to 32)	95-100	0	0	0			
	Poultry- Fresh	- 2.2 to 0 (28 to 32)	95-100	0	0	0			
	Chicken, all classes	- 2.2 to 0 (28 to 32)	95-100	0	0	0			
	Turkey, all classes	- 2.2 to 0 (28 to 32)	95-100	0	0	0			
	Duck	- 2.2 to 0 (28 to 32)	95-100	0	0	0			
Veal	0 to 1.1 (32 to 34)	95-100	0	0	0				
Rabbit	0 to 1.1 (32 to 34)	90-95	0	0	0				
2.00	Canned, non-perishable	- 3.3 to - 1.1 (26 to 30)	70 or less	0	0	0			
	Dried, chipped	10 to 15 (50 to 59)	15	0	0	0			
	Ham, cured	- 3.3 (26)	-	0	0	0			
	Bacon, medium fat	2.8 to 5 (37 to 41)	80-85	0	0	0			
	Bacon, cured, farm style	16.1 to 17.8 (61 to 64)	85	0	0	0			

Handling Guidelines

Code	Product	Carrying Temperature C (F)	RH	AFAM			AFAM+		Max. Time at temp./CO2
			(%)	cfm	cmh	Delay	CO2	O2	
						hrs	max%	min%	
	Bacon, Packer style	1.1 to 3.9 (34 to 39)	85	0	0	0			
3.00	Beef	- 35 to - 17.8 (-31 to 0)	N/A	0	0	0			
	Horse	- 35 to - 17.8 (- 31 to 0)	N/A	0	0	0			
	Lamb	- 35 to - 17.8 (- 31 to 0)	N/A	0	0	0			
	Bacon	- 23.3 to - 17.8 (- 10 to 0)	N/A	0	0	0			
	Ham, fresh, frozen	- 23.3 to - 17.8 (- 10 to 0)	N/A	0	0	0			
	Ham, cured	- 23.3 to - 17.8 (- 10 to 0)	N/A	0	0	0			
	Pork	- 35 to - 17.8 (- 31 to 0)	N/A	0	0	0			
	Poultry	- 23.3 to - 17.8 (- 10 to 0)	N/A	0	0	0			
4.00	Haddock, Cod, Perch	- 0.6 to 1.1 (31 to 34)	95-100	0	0	0			
	Hake, Whiting	0 to 1.1 (32 to 34)	95-100	0	0	0			
	Halibut	- 0.6 to 1.1 (31 to 34)	95-100	0	0	0			
	Herring, Kipperd, Smkd	0 to 2.2 (32 to 36)	80-90	0	0	0			
	Mackerel	0 to 1.1 (32 to 34)	95-100	0	0	0			
	Menhaden	1.1 to 5 (34 to 41)	95-100	0	0	0			
	Salmon	- 0.6 to 1.1 (31 to 34)	95-100	0	0	0			

	Tuna	0 to 2.2 (32 to 36)	95-100	0	0	0			
5.00	Clams	- 1.7 (29)	85-90	0	0	0			
	Crabmeat, Pasteurized	0 to 1.1 (32 to 34)	-	0	0	0			
	Scallop meat	0 to 1.1 (32 to 34)	95-100	0	0	0			
	Shrimp	- 0.6 to 1.1 (31 to 34)	95-100	0	0	0			
	Lobster, live	5 to 10 (41 to 50)	In Water	0	0	0			
	Lobster, fresh meat	- 1.1 to 0 (30 to 32)	90-95	0	0	0			
	Oysters, meat, liq	0 to 2.2 (32 to 36)	100	0	0	0			
	Oysters, clams in shell	5 to 10 (41 to 50)	95-100	0	0	0			
6.00	Fatty	- 35 to - 23.3 (- 31 to - 10)		0	0	0			
	Lean	- 35 to - 23.3 (- 31 to - 10)		0	0	0			
	Shrimp	- 35 to - 23.3 (- 31 to - 10)		0	0	0			
	Scallops	- 35 to - 23.3 (- 31 to - 10)		0	0	0			
	Crab	- 35 to - 23.3 (- 31 to - 10)		0	0	0			
	Lobsters	-35 to - 23.3 (- 31 to - 10)		0	0	0			
7.00	Fresh Eggs, shell	- 1.7 to - 0.6 (29 to 31)	85-92	0	0	0			
8.00	Natural	0 to 1.1 (32 to 34)	65	0	0	0			
	Processed	0 to 1.1 (32 to 34)	65	0	0	0			
	Roquefort	0 to 1.1 (32 to 34)	65	0	0	0			
	Swiss	0 to 1.1 (32 to 34)	65	0	0	0			

Handling Guidelines									
Code	Product	Carrying Temperature C (F)	RH	AFAM			AFAM+		Max. Time at temp./CO2
			(%)	cfm	cmh	Delay	CO2	O2	
						hrs	max%	min%	
	Cheese Foods	4.4 to 7.2 (40 to 45)	65	0	0	0			
9.00	Fresh	0 (32)	70-75	0	0	0			
	Frozen	- 23.3 (- 10)	N/A	0	0	0			
	Margarine	1.7 (35)	70-75	0	0	0			
10.00	Whole	0 to 1.1 (32 to 34)		0	0	0			
	Dried, whole	7.2 to 21.1 (45 to 70)	Low	0	0	0			
	Dried, non-fat	7.2 to 21.1 (45 to 70)	Low	0	0	0			
	Evaporated	4.4 (40)		0	0	0			
	Condensed, sweetened	4.4 (40)		0	0	0			
	Cream, fresh, pasteurized	0 to 2.2 (32 to 36)		0	0	0			
	Cream, sour	- 2.2 to 0 (28 to 32)		0	0	0			
	Cream, sweetened	- 23.3 (- 10)		0	0	0			
	Whey, dried	21.1 (70)	Low	0	0	0			
11.00	Ice Cream	- 28.9 or lower (- 20 or lower)		0	0	0			
	Frozen Dairy Desserts	- 35 to - 26.1 (-31 to - 15)		0	0	0			
12.00	Juice	- 23.3 to - 17.8 (- 10 to 0)		0	0	0			
13.00	French Fries	- 23.3 to - 17.8 (- 10 to 0)		0	0	0			

	Fruits	- 23.3 to - 17.8 (- 10 to 0)		0	0	0			
	Vegetables	- 23.3 to - 17.8 (- 10 to 0)		0	0	0			
14.00	Acerola/Barbados cherry	0 (32)	90	30	50	0			
	African horned melon/kiwano	15 (59)	90	30	50	0			
	Alfalfa Sprouts	0 (32)	98	30	50	0			
	Amaranth/pigweed	0 (32)	98	30	50	0			
	Anise/fennel	0 (32)	95	30	50	0			
	Apples, chilling sensitive	4.4 (40)	95	15	25	0	2	19	3 mo
	Apples, not chilling sensitive	- 1.1 (30)	95	45	75	0	2	19	4 mo
	Apricot	0.0	95	15	25	24	5	16	2 wk
	Artichoke, globe	0 (32)	98	45	75	0	3	18	3 wk
	Arugula	0 (32)	98	45	75	0			
	Asian pear/Nashi	1.1 (34)	95	15	25	24	2	19	4 mo
	Asparagus, green or white	2.5 (36.5)	98	60	100	12	10	11	3 wk
	Atemoya	12.8 (55)	90	30	50	24	10	11	4 wk
	Avocado, Booth, Lula	4.4 (40)	95	30	50	24	10	11	4 wk
	Avocado, Fuchs, Pollock	12.8 (55)	90	30	50	24	10	11	2 wk
	Avocado, Fuerte, Hass	5 (41)	90	30	50	24	10	11	18 d
	Babaco/mountain papaya	7.2 (45)	90	30	50	0			
	Banana, green	14.4 (58)	95	15	25	24	5	16	3 wk
	Barbados cherry/acerola	0.0	90	30	50	0			
	Basil	10 (50)	90	30	50	18	5	16	10 d
	Bean sprouts, Mung	0 (32)	98	30	50	36	15	6	10 d
	Beets, bunched	0 (32)	98	15	25	0	4	17	2 wk
	Beets, topped	0 (32)	98	15	25	0	4	17	4 mo
	Belgian endive/witloof chicory	2.2 (36)	98	45	75	0	5	16	4 wk
	Bell/green pepper/paprika	7.2 (45)	98	15	25	24	5	16	4 wk

Handling Guidelines

Code	Product	Carrying Temperature C (F)	RH	AFAM			AFAM+		Max. Time at temp./CO2
			(%)	cfm	cmh	Delay	CO2	O2	
						hrs	max%	min%	
	Bittergourd/bittermelon	10 (50)	90	30	50	36	15	6	2 wk
	Bittermelon/bittergourd	10 (50)	90	30	50	36	15	6	2 wk
	Black salsify/scorzonera	0 (32)	98	15	25	0	3	18	6 mo
	Black sapote	13.9 (57)	90	30	50	0			
	Blackberry	0 (32)	95	30	50	36	20	2	1 wk
	Blood orange	6.7 (44)	95	15	25	0			
	Blueberry	0 (32)	95	15	25	36	20	2	2 wk
	Bok choy	0 (32)	98	30	50	0	5	16	3 wk
	Breadfruit	15 (59)	90	30	50	0	5	16	3 wk
	Broad bean/fava bean	0 (32)	95	30	50	0			
	Broccoli	0 (32)	98	30	50	24	10	11	4 wk
	Brussels sprouts	0 (32)	98	30	50	18	7	14	5 wk
	Cabbage, early crop	0 (32)	98	15	25	24	6	15	6 wk
	Cabbage, late crop	0 (32)	98	15	25	24	6	15	6 mo
	Cactus fruit/prickly pear fruit	5 (41)	90	30	50	18	5	16	3 wk
	Cactus leaves/nopalito	5 (41)	95	30	50	18	5	16	3 wk
	Caimito/star apple	2.8 (37)	90	30	50	0			
	Calabash squash/winter (hard rind)	12.2 (54)	60	15	25	36	10	11	2 mo
	Calamondin orange	10 (50)	90	15	25	0			
	Canistel/eggfruit	15 (59)	90	30	50	0			
	Cantaloupe/netted melons	2.2 (36)	95	15	25	48	18	3	3 wk
	Carambola/starfruit, color break	5 (41)	90	15	25	0	3	18	4 wk
	Carambola/starfruit, ripe	1.1 (34)	90	15	25	24	6	15	4 wk
	Carrots, bunched;immature	0 (32)	98	30	50	0	4	17	2 wk
	Carrots, topped	0 (32)	98	15	25	0	4	17	7 wk
	Casaba melon	10 (50)	90	30	50	24	10	11	3 wk

Cashew apple	2.2 (36)	90	30	50	0			
Cassava/yucca/manioc	5 (41)	90	15	25	0			
Cauliflower	0 (32)	98	30	50	0	4	17	3 wk
Celeriac	0 (32)	98	15	25	0	4	17	7 wk
Celery	0 (32)	98	15	25	24	5	16	2 mo
Chard	0 (32)	98	30	50	0			
Chayote	7.2 (45)	90	15	25	0			
Cherimoya/custard apple	12.8 (55)	95	60	100	12	10	11	2 wk
Cherry, sour	0 (32)	95	15	25	0	12	9	1 wk
Cherry, sweet	0 (32)	95	15	25	48	15	6	3 wk
Chicosapote/sapodilla	15.6 (60)	90	30	50	24	10	11	2 wk
Chilis/hot pepper	7.2 (45)	95	30	50	36	15	6	3 wk
Chinese artichoke	0 (32)	98	30	50	0			
Chinese broccoli/Gailan	0 (32)	98	30	50	0			
Chinese cabbage/Napa	0 (32)	98	15	25	0	1	20	2 mo
Chinese date/jujube	3.3 (38)	90	30	50	0			
Chinese gooseberries/kiwifruit	0 (32)	95	15	25	24	7	14	3 mo
Chinese okra/luffa	12.2 (54)	95	30	50	0			
Chinese parsley/cilantro	2.2 (36)	98	45	75	18	10	11	2 wk
Chives	0 (32)	98	30	50	0			
Cilantro/Chinese parsley	2.2 (36)	98	45	75	18	10	11	2 wk
Clementine/tangerine/mandarine	4.4 (40)	95	15	25	24	5	16	4 wk
Coconut	2.2 (36)	85	30	50	0			
Cocoyam/eddoe/dasheen/taro	8.9 (48)	90	15	25	0			
Collards	0 (32)	98	30	50	0	10	11	2 wk
Corn, Baby	0 (32)	98	45	75	0			
Corn, Supersweet	0 (32)	98	45	75	24	15	6	4 wk
Corn, Sweet	0 (32)	98	45	75	24	15	6	2 wk
Courgette/summer squash (soft rind)	7.2 (45)	95	15	25	36	10	11	2 wk
Cowpea/southern pea	4.4 (40)	95	30	50	0			

Handling Guidelines

Code	Product	Carrying Temperature C (F)	RH	AFAM			AFAM+		Max. Time at temp./CO2
			(%)	cfm	cmh	Delay	CO2	O2	
						hrs	max%	min%	
	Cranberry	2.8 (37)	95	15	25	0	3	18	4 mo
	Crenshaw melon	7.2 (45)	90	30	50	24	10	11	2 wk
	Cucumber, fresh	12.2 (54)	90	15	25	36	10	11	2 wk
	Cucumber, pickling	4.4 (40)	95	30	50	0	5	16	1 wk
	Currant, Black	0 (32)	95	30	50	0	20	2	3 wk
	Currant, Red	0 (32)	95	30	50	0	20	2	8 wk
	Custard apple/cherimoya	12.8 (55)	95	60	100	12	10	11	2 wk
	Custard apples/sweetsop/sugar apple	7.2 (45)	90	30	50	18	5	16	4 wk
	Daikon/Oriental radish/lo bok	0 (32)	98	30	50	0			
	Dasheen/taro/cocoyam/eddoe	8.9 (48)	90	15	25	0			
	Dates	0 (32)	75	15	25	0			
	Dewberry	0 (32)	95	30	50	0			
	Dill	0 (32)	98	15	25	0			
	Durian, ripe	4.4 (40)	90	30	50	24	10	11	9 d
	Durian, unripe	12.8 (55)	90	30	50	36	15	6	5 wk
	Eddoe/dasheen/taro/cocoyam	8.9 (48)	90	15	25	0			
	Eggfruit/canistel	15 (59)	90	30	50	0			
	Eggplant	11.1 (52)	95	30	50	18	10	11	2 wk
	Elderberry	0 (32)	95	30	50	0			
	Endive/escarole	0 (32)	98	45	75	0			
	Epazote	2.2 (36)	95	30	50	0			
	Escarole/endive	0 (32)	98	45	75	0			
	Fava bean/broad bean	0 (32)	95	30	50	0			
	Feijoa/pineapple guava	5 (41)	90	30	50	0			
	Fennel/anise	0 (32)	95	30	50	0			
	Fig, fresh	0 (32)	90	15	25	0	20	2	4 wk

Gailan/Chinese broccoli	0 (32)	98	30	50	0			
Garden cress/watercress	0 (32)	98	45	75	0			
Garlic	0 (32)	70	15	25	36	10	11	6 mo
Ginger	12.8 (55)	65	30	50	0			
Globe artichoke	0 (32)	98	45	75	0	3	18	3 wk
Gooseberry	0 (32)	95	15	25	0	20	2	6 wk
Grapefruit, CA/AZ/dry areas	14.4 (58)	90	30	50	0	5	16	6 wk
Grapefruit, FL/humid areas	10 to 16.1 (50 to 61)	90	15	25	36	10	11	6 wk
Grapes, American	- 0.6 (31)	95	15	25	0			
Grapes, Table option 1	0 (32)	95	15	25	36	10	11	4 wk
Grapes, Table option 2	0 (32)	95	15	25	48	15	6	2 wk
Green/snap/wax beans	7.2 (45)	95	30	50	18	8	13	2 wk
Guava	7.8 (46)	90	30	50	0			
Guava, pineapple/feijoa	5 (41)	90	30	50	0			
Hogplum/spondias/mombin/wi apple/jobo	12.8 (55)	90	30	50	0			
Honeydew melon	7.2 (45)	90	15	25	36	10	11	3 wk
Horseradish	- 0.6 (31)	98	15	25	0	8	13	2 mo
Jaboticaba	12.8 (55)	95	30	50	0			
Jackfruit	12.8 (55)	90	30	50	0			
Jerusalem artichoke	0 (32)	95	15	25	0			
Jicama/yambean	12.8 (55)	90	15	25	0	10	11	2 mo
Jobo/hogplum/spondias/mombin/wi apple	12.8 (55)	90	30	50	0			
Jujube/Chinese date	3.3 (38)	90	30	50	0			
Kakis/persimmon, Fuyu, Hachiya	0 (32)	95	15	25	24	8	13	3 mo
Kale	0 (32)	98	45	75	0	10	11	2 wk
Kiwano/African horned melon	15 (59)	90	30	50	0			
Kiwifruit/Chinese gooseberry	0 (32)	95	15	25	24	7	14	3 mo
Kohlrabi	0 (32)	98	15	25	0			
Kumquat	4.4 (40)	95	15	25	0			
Langsat/lanzone	14.4 (58)	90	30	50	0			

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						hrs	max%	min%	
	Lanzone/langsat	14.4 (58)	90	30	50	0			
	Leafy greens cool season	0 (32)	98	30	50	0			
	Leafy greens, warm season	7.2 (45)	95	30	50	0			
	Leek	0 (32)	98	30	50	0	5	16	2 mo
	Lemon	11.1 (52)	90	15	25	36	10	11	4 wk
	Lettuce	0 (32)	98	15	25	0	1	20	3 wk
	Lima bean	5 (41)	95	30	50	0			
	Lime, Mexican/Tahiti/Persian	10 (50)	90	15	25	36	10	11	6 wk
	Litchi/lychee	2.2 (36)	95	15	25	24	5	16	3 wk
	Lo bok/daikon/Oriental radish	0 (32)	98	30	50	0			
	Loganberry	0 (32)	95	30	50	0			
	Longan	2.2 (36)	95	30	50	0			
	Loquat	0 (32)	90	30	50	0			
	Luffa/Chinese okra	12.2 (54)	95	30	50	0			
	Lychee/litchi	2.2 (36)	95	15	25	24	5	16	3 wk
	Malanga/tania/new cocoyam	7.2 (45)	80	30	50	0			
	Mamey sapote	13.9 (57)	95	30	50	0			
	Mandarine/Clementine/tangerine	4.4 (40)	95	15	25	24	5	16	4 wk
	Mango	12.8 (55)	90	30	50	24	10	11	4 wk
	Mangosteen	12.8 (55)	90	30	50	0	5	16	4 wk
	Manioc/cassava/yucca	5 (41)	90	15	25	0			
	Melon pear/pepino	8.9 (48)	95	30	50	0			
	Minneola tangelo	7.2 (45)	95	15	25	24			
	Mint	0 (32)	98	30	50	0			
	Mombin/wi apple/jobob/hogplum/spondias	12.8 (55)	90	30	50	0			
	Mountain papaya/babaco	7.2 (45)	90	30	50	0			

Mushrooms	0 (32)	90	45	75	24	15	6	2 wk
Mustard greens	0 (32)	95	30	50	0			
Napa/Chinese cabbage	0 (32)	98	15	25	0	1	20	2 mo
Nashi/asian pear	1.1 (34)	95	15	25	24	2	19	4 wk
Nectarine, option 1	0 (32)	95	15	25	36	10	11	3 wk
Nectarine, option 2	0 (32)	95	15	25	48	17	4	2 wk
Netted melon/cantaloupe	2.2 (36)	95	15	25	48	18	3	3 wk
New cocoyam/malanga/tania	7.2 (45)	80	30	50	0			
Nopalito/cactus leaves	5 (41)	95	30	50	18	5	16	3 wk
Okra	7.2 (45)	95	45	75	18	10	11	2 wk
Olive, fresh green	5 (41)	90	15	25	24	5	16	4 wk
Onions, green	0 (32)	98	30	50	36	20	2	3 wk
Onions, mature bulbs, dry	0 (32)	70	15	25	24	5	16	2 mo
Orange flesh melons	7.2 (45)	90	15	25	36	10	11	3 wk
Oranges, Ariz./dry areas	8.9 (48)	90	15	25	24	5	16	4 wk
Oranges, California, Navel	5 (41)	90	15	25	24	5	16	2 mo
Oranges, Florida/humid regions, Valencia	1.1 (34)	90	15	25	24	5	16	3 mo
Orange flesh melons/honeydews	7.2 (45)	90	15	25	36	10	11	3 wk
Oregano	0 (32)	95	30	50	0			
Oriental radish/daikon/lo bok	0 (32)	98	30	50	0			
Oyster, vegetable/salsify	0 (32)	98	15	25	0	3	18	2 mo
Papaya	12.8 (55)	90	15	25	48	10	11	3 wk
Paprika, green/bell pepper	7.2 (45)	98	15	25	24	5	16	4 wk
Parsley	0 (32)	98	60	100	6	5	16	3 wk
Parsnips	0 (32)	98	15	25	0			
Passionfruit	10 (50)	90	60	100	0			
Peach option 1	0 (32)	95	15	25	36	10	11	3 wk
Peach option 2	0 (32)	95	15	25	48	17	4	2 wk
Pear, Anjou, Bosc, Comice, late Barletts	- 1.1 (30)	95	15	25	0	1	20	4 wk
Pear, Bartlett	- 1.1 (30)	95	15	25	0	3	18	2 mo

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	Peas in pods: snow, snap & sugar peas	0 (32)	98	60	100	0	3	18	2 wk
	Pepino/melon pear	8.9 (48)	95	30	50	0			
	Pepper, Bell/paprika, green	7.2 (45)	98	15	25	24	5	16	4 wk
	Pepper, colored	5 (41)	98	15	25	24	5	16	3 wk
	Peppers, Hot/chilis	7.2 (45)	95	30	50	36	15	6	3 wk
	Perilla/shiso	10 (50)	95	30	50	0			
	Persian melon	7.2 (45)	90	30	50	24	10	11	2 wk
	Persimmon/kakis, Fuyu,Hachiya	0 (32)	95	15	25	24	8	13	3 mo
	Pigweed/amaranth	0 (32)	98	30	50	0			
	Pineapple	12.8 (55)	90	15	25	48	10	11	4 wk
	Plantain	15 (59)	95	30	50	18	5	16	3 wk
	Plum	0 (32)	95	15	25	24	5	16	4 wk
	Pomegranate	5 (41)	95	15	25	36	10	11	2 mo
	Potato, early crop	12.8 (55)	95	15	25	36	10	11	3 wk
	Potato, late crop	5 (41)	98	15	25	0	1	20	5 mo
	Prickly pear fruit/cactus fruit	5 (41)	90	30	50	18	5	16	3 wk
	Prune	0 (32)	95	15	25	24	5	16	4 wk
	Pummelo	7.2 (45)	90	15	25	0			
	Pumpkin/squash	12.2 (54)	60	15	25	36	10	11	2 mo
	Quince	0 (32)	90	30	50	0			
	Raddichio	0 (32)	98	30	50	18	5	16	3 wk
	Radish sprouts	0 (32)	98	30	50	0			
	Radish, topped	0 (32)	98	15	25	0	3	18	4 wk
	Rambutan	12.2 (54)	95	30	50	24	12	9	2 wk
	Raspberry	0 (32)	95	30	50	36	20	2	1 wk
	Rhubarb	0 (32)	98	15	25	0			

Rutabaga	0 (32)	98	15	25	0	8	13	4 mo
Sage	0 (32)	95	30	50	0			
Salsify/vegetable oyster	0 (32)	98	15	25	0	3	18	2 mo
Sapodilla/chicosapote	15.6 (60)	90	30	50	24	10	11	2 wk
Scorzonera/black salsify	0 (32)	98	15	25	0	3	18	6 mo
Seville/sour oranges	10 (50)	90	15	25	36	10	11	4 wk
Shallot	1.1 (34)	70	30	50	0			
Shiso/perilla	10 (50)	95	30	50	0			
Snap/wax/green beans	7.2 (45)	95	30	50	18	8	13	2 wk
Sour/Seville oranges	10 (50)	90	15	25	36	10	11	4 wk
Soursop	12.8 (55)	90	30	50	0			
Southern pea/cowpea	4.4 (40)	95	30	50	0			
Spinach	0 (32)	98	15	25	36	10	11	2 wk
Spondias/mombin/wi apple/jobo/hogplum	12.8 (55)	90	30	50	0			
Squash/pumpkin	12.2 (54)	60	15	25	36	10	11	2 mo
Squash/winter(hard rind)/calabash	12.2 (54)	60	15	25	36	10	11	2 mo
Star apple/caimito	2.8 (37)	90	30	50	0			
Starfruit/carambola, color break	5 (41)	90	15	25	0	3	18	4 wk
Starfruit/carambola, ripe	1.1 (34)	90	15	25	24	6	15	4 wk
Strawberry	0 (32)	95	15	25	36	20	2	2 wk
Sugar apple/custard apple/sweetsop	7.2 (45)	90	30	50	18	5	16	4 wk
Summer squash (soft rind)/courgette	7.2 (45)	95	15	25	36	10	11	2 wk
Sweetpotato/"yam"	12.8 (55)	90	15	25	36	10	11	4 mo
Sweetsop/sugar apple/custard apple	7.2 (45)	90	30	50	18	5	16	4 wk
Tamarillo/tree tomato	3.9 (39)	95	30	50	0			
Tamarind	7.2 (45)	95	30	50	0			
Tangerine/mandarine/Clementine	4.4 (40)	95	15	25	24	5	16	4 wk
Tania/new cocoyam/malanga	7.2 (45)	80	30	50	0			
Taro/cocoyam/eddoe/dasheen	8.9 (48)	90	15	25	0			
Thyme	0 (32)	95	30	50	0			

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	Tomatillo/husk tomato	10 (50)	90	15	25	0			
	Tomato, firm ripe	10 (50)	90	15	25	24	5	16	1 wk
	Tomato, mature green	12.8 (55)	95	15	25	0	3	18	2 wk
	Tree tomato/tamarillo	3.9 (39)	95	30	50	0			
	Turnip root	0 (32)	95	15	25	0			
	Valencia oranges/ Florida/humid regions	1.1 (34)	90	15	25	24	5	16	3 mo
	Water chestnut	1.1 (34)	90	30	50	0			
	Watercress/garden cress	0 (32)	98	45	75	0			
	Watermelon	10 (50)	90	15	25	0			
	Wax/green/snap beans	7.2 (45)	95	30	50	18	8	13	2 wk
	White sapote	20 (68)	90	30	50	0			
	Wi apple/jobo/hogplum/spondias/mombin	12.8 (55)	90	30	50	0			
	Winged bean	10 (50)	90	30	50	0			
	Witloof chicory/belgian endive	2.2 (36)	98	45	75	0			
	Yam (true yam)	59 (15)	80	15	25	0			
	Yam/sweetpotato	12.8 (55)	90	15	25	36	10	11	4 mo
	Yambean/jicama	12.8 (55)	90	15	25	0			
	Yard-long bean	6.1 (43)	95	30	50	0			
	Yucca/cassava/manioc	5 (41)	90	15	25	0			
15.00	Anthurium, cut	10 (50)	85	75	125	0			
	Asparagus fern, cut	1.1 (34)	95	75	125	0	5	16	4 wk
	Carnation, cut	0 (32)	95	75	125	0	10	11	6 wk
	Chrysanthemum, cut	0 (32)	95	75	125	0	2	19	4 wk
	Chrysanthemum, potted	2.8 (37)	95	75	125	0			
	Crocus	17.2 (63)	70	150	250	0	1	20	>6 wk

Daffodil	17.2 (63)	70	150	250	0	1	20	>6 wk	
Easter lily, cut	1.1 (34)	95	75	125	0	10	11	3 wk	
Easter lily, potted	3.9 (39)	95	75	125	0				
Flower bulbs/crocus,daffodil,iris,tulip	17.2 (63)	70	150	250	0	1	20	>6 wk	
Flowering and foliage plants	15 (59)	95	75	125	0	1	20	>6 wk	
Gladiolus, cut	1.1 (34)	95	75	125	0	5	16	3 wk	
Hyacinth bulbs	10 (50)	70	150	250	0	1	20	>6 wk	
Iris	17.2 (63)	70	150	250	0	1	20	>6 wk	
Leatherleaf fern, cut	1.1 (34)	95	75	125	0	5	16	4 wk	
Lily bulbs	2.2 (36)	70	150	250	0	1	20	>6 wk	
Rose, cut	0 (32)	95	75	125	0	3	18	3 wk	
Rose, potted	1.7 (35)	95	75	125	0				
Tulip	17.2 (63)	70	150	250	0	1	20	>6 wk	
NOTE: All chilled cargo guidelines are given for discharge air controllers and freeze cargo guidelines are for return air controllers.									

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