Aspectos técnicos para un adecuado transporte de uva de mesa en contenedores

Prof. Luis Luchsinger L.

Especialista Postcosecha de Frutas, Ph.D.

lluchsin@uchile.cl

El contenedor es el peor sistema para mantener una adecuada temperatura en transito.

Por lo tanto, hay una serie de medidas técnicas que DEBEN ser tomadas en consideración

1

La fruta debe ser enfriada a la misma temperatura de transporte del aire del contenedor (set point)

Temperatura de congelación

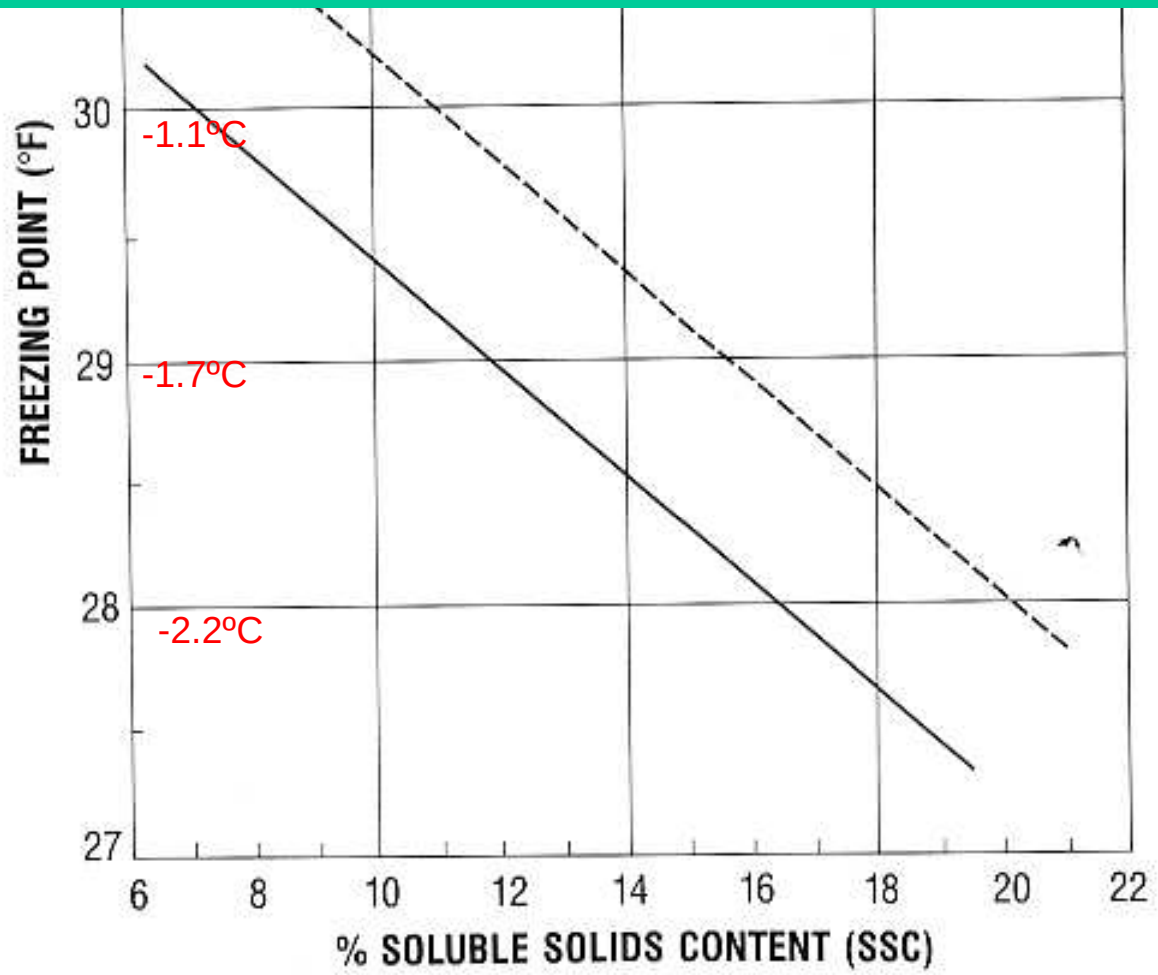
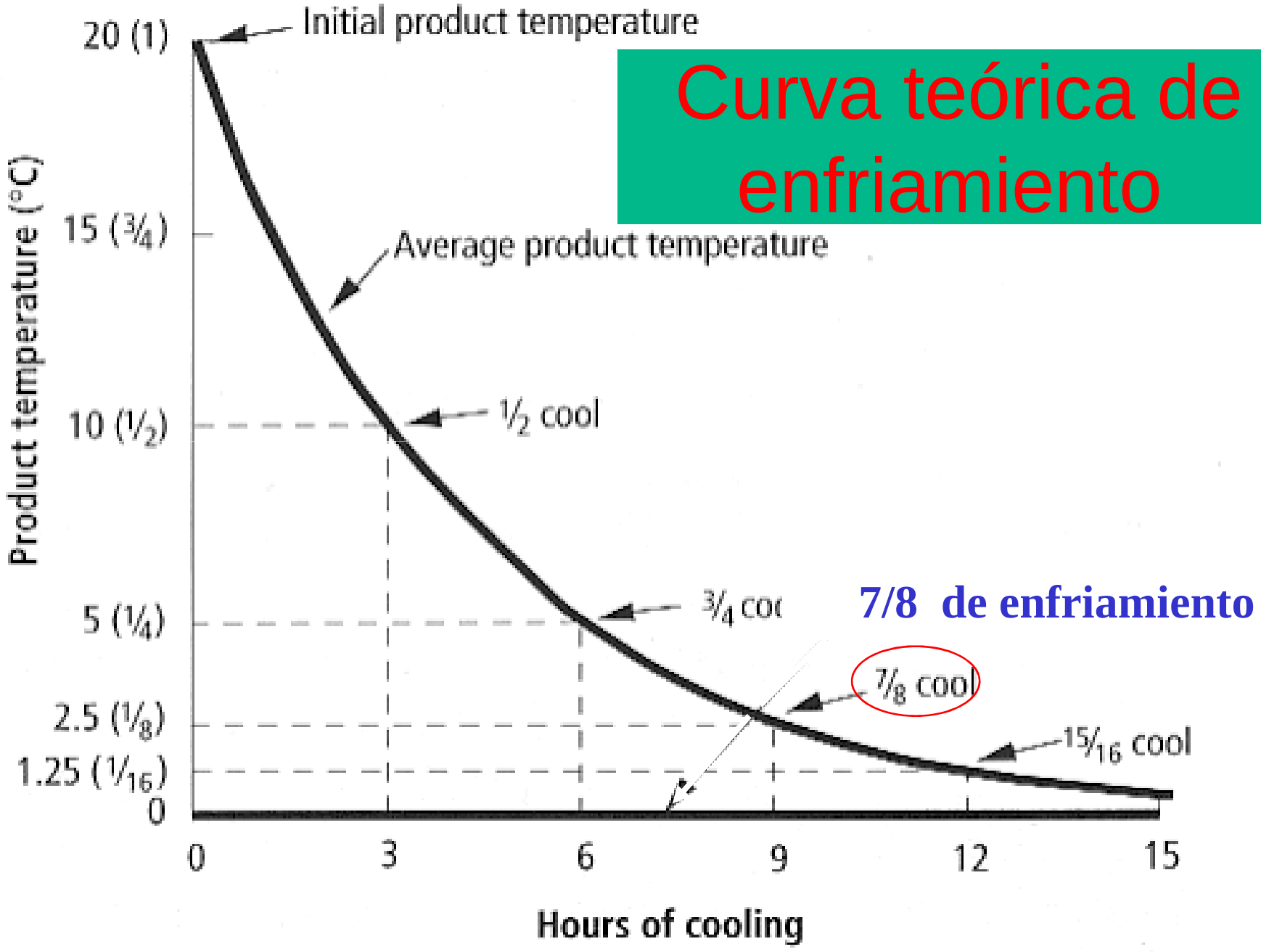


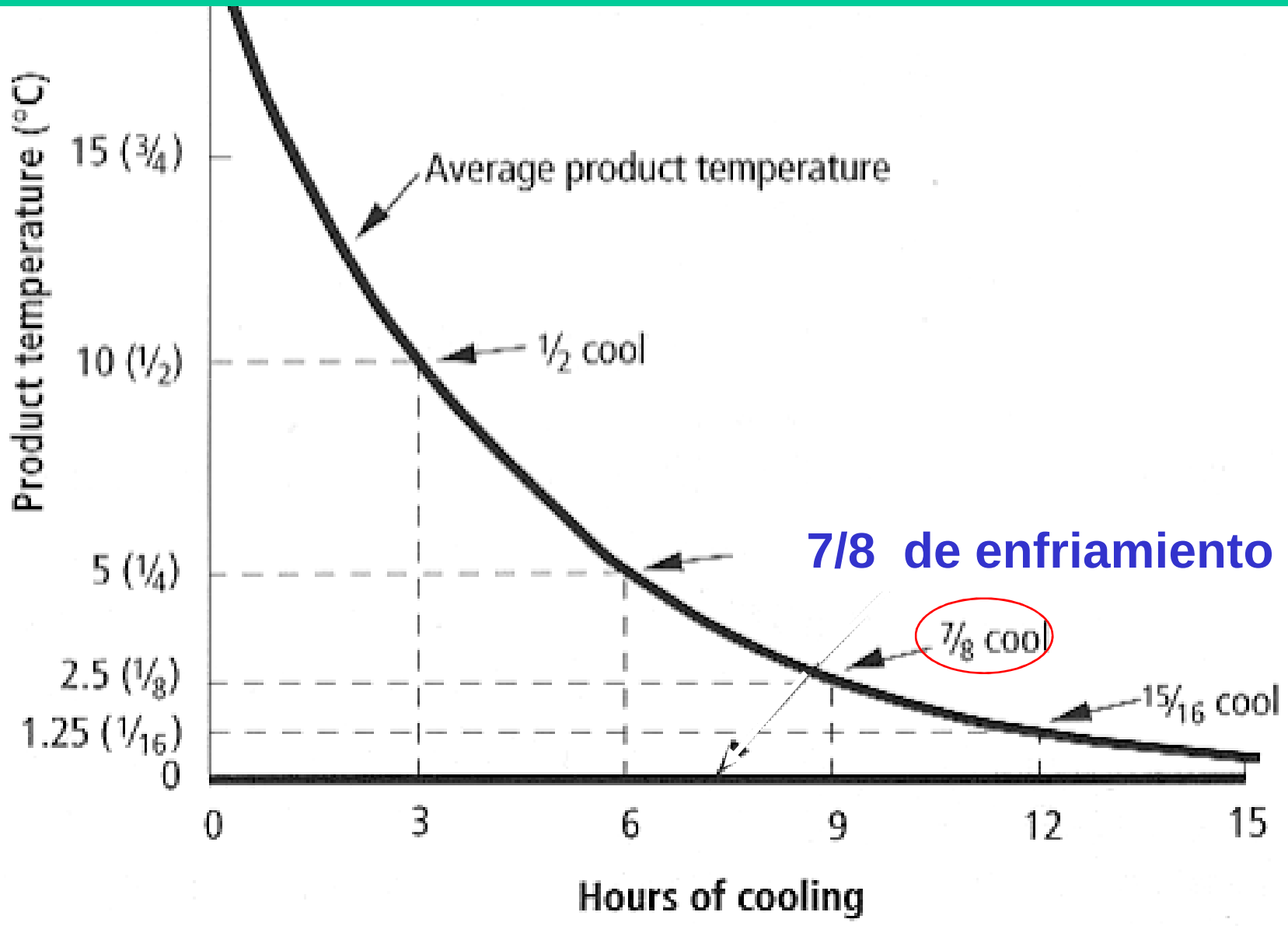
Fig. 28.1. Correlation between soluble solids content (SSC) and freezing point for 19 varieties of nectarine, peach, and plum. Dashed line represents the upper limit of a 95 percent zone of estimate for the data.

Curva teórica de enfriamiento



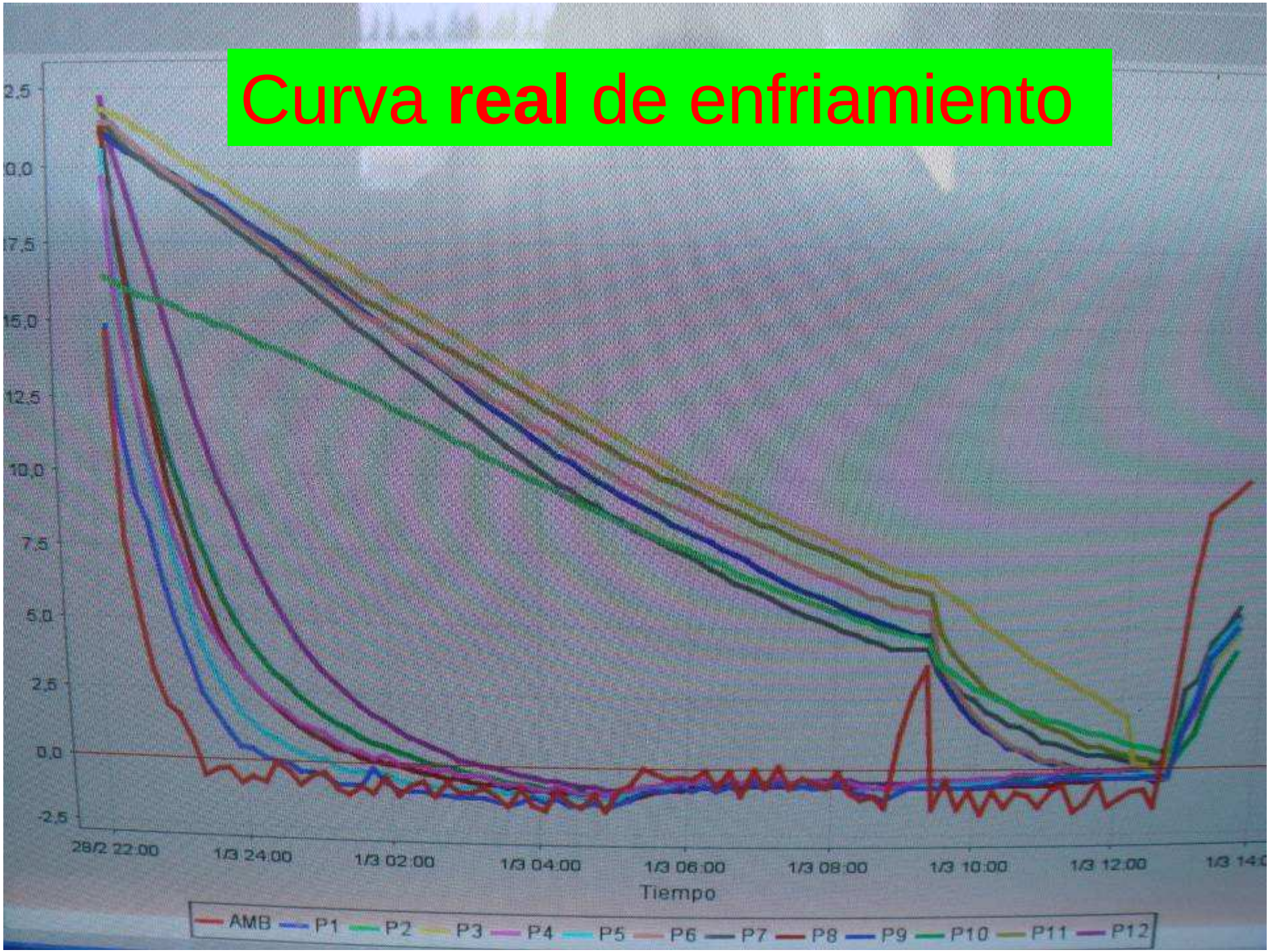
7/8 de enfriamiento

Error conceptual grave !!!!!



7/8 de enfriamiento

Curva **real** de enfriamiento



Nueva tendencia en el transporte marítimo:

contenedores

2,13 m

HC 2,45 m

~12 % más de carga ➡ menor costo flete

HC 2,45 m

2,13 m

~12 % más de carga térmica pre-fríos

Al existir gran diversidad de envases y embalajes, el enfriamiento es un proceso complejo.

2

Se debe registra la temperatura de pulpa de cada pallet

Chequeo de temp. al cargar

Mantener registro de toda
la cadena de frío

3

El seteo de temperatura (set point) del contenedor debería ser entre -1 y -0,5℃

Table 2. Approximate equivalents for Fahrenheit and Celsius temperatures

Fahrenheit to Celsius		Celsius to Fahrenheit	
°F	°C	°C	°F
31.0	–0.6	0	32.0
32.0	0.0	0.5	32.9
33.0	0.6	1.0	33.8
34.0	1.1	1.5	34.7
35.0	1.7	2.0	35.6
36.0	2.2	2.5	36.5
37.0	2.8	3.0	37.4
38.0	3.3	3.5	38.3
39.0	3.9	4.0	39.2
40.0	4.4	4.5	40.1
41.0	5.0	5.0	41.0
42.0	5.6	5.5	41.9
43.0	6.1	6.0	42.8
44.0	6.7	6.5	43.7
45.0	7.2	7.0	44.6
46.0	7.8	7.5	45.5
47.0	8.3	8.0	46.4
48.0	8.9	8.5	47.3
49.0	9.4	9.0	48.2
50.0	10.0	9.5	49.1
51.0	10.6	10.0	50.0
52.0	11.1	10.5	50.9
53.0	11.7	11.0	51.8
54.0	12.2	11.5	52.7
55.0	12.8	12.0	53.6
56.0	13.3	12.5	54.5
57.0	13.9	13.0	55.4
58.0	14.4	13.5	56.3
59.0	15.0	14.0	57.2
60.0	15.6	14.5	58.1
61.0	16.1	15.0	59.0
62.0	16.7	15.5	59.9
63.0	17.2	16.0	60.8
64.0	17.8	16.5	61.7
65.0	18.3	17.0	62.6
66.0	18.9	17.5	63.5
67.0	19.4	18.0	64.4
68.0	20.0	18.5	65.3
69.0	20.6	19.0	66.2
70.0	21.1	19.5	67.1

Si las Cias. Navieras utilizan el software de ahorro energético ‘QUEST’ el set point debe ser mas alto, para evitar congelación de la fruta.

4

Medir temperatura de corte del aire, en la zona de la puerta del contenedor


SITRANS
100805
FLORENS

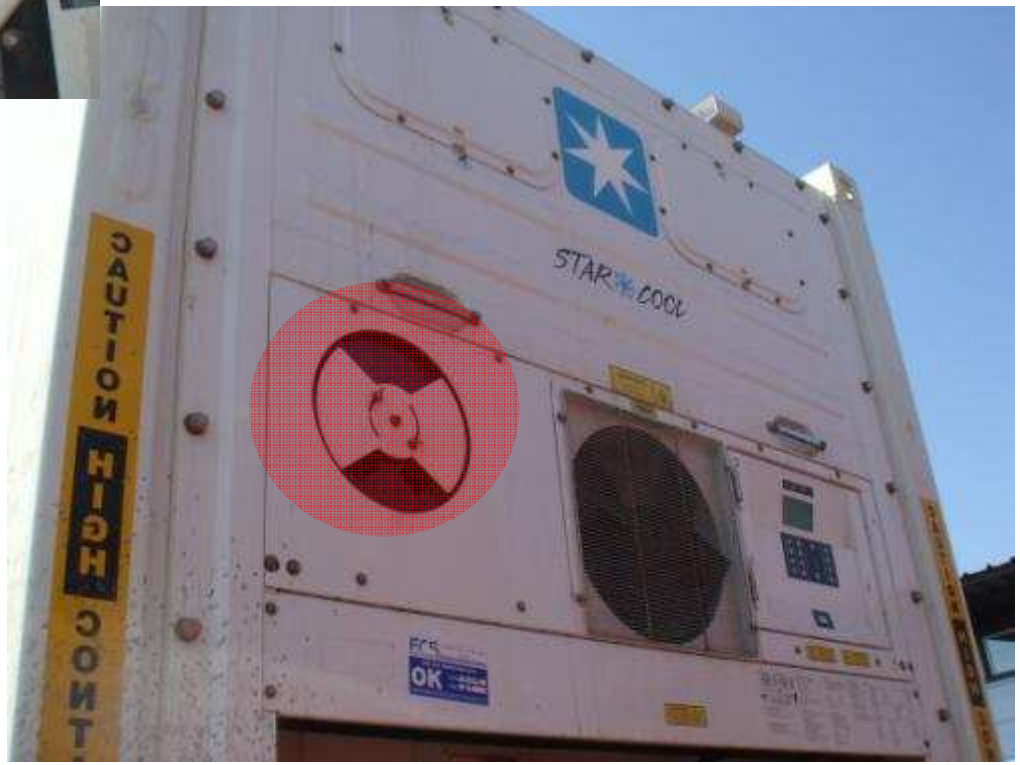

HUMIDITY SENSOR
ALARM CODES
STOP
START
ARRANQUE
DANGER
PELIGRO


Evolution

5

Solicitar una adecuada y ‘verdadera’ tasa de intercambio de aire del contenedor

Apertura ‘lampa’ Intercambio aire



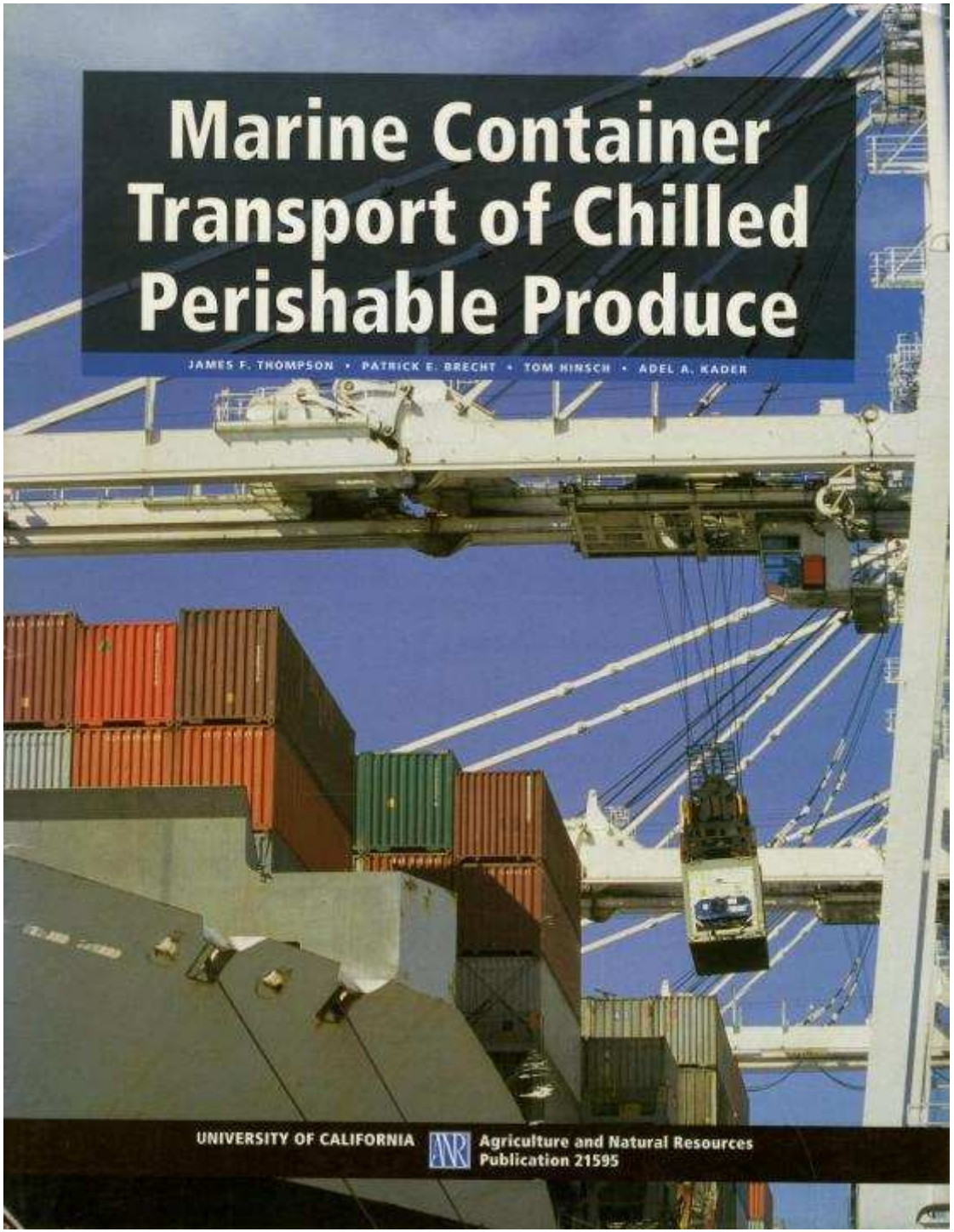

Marine Container Transport of Chilled Perishable Produce
JAMES F. THOMPSON • PATRICK E. BRECHT • TOM HINSCH • ADEL A. KADER
UNIVERSITY OF CALIFORNIA
ANR
Agriculture and Natural Resources
Publication 21595

Tabla 3. Recomended air- exchange rates for 40-foot* marine container transport of perishables

Produce respiration (see Appendix B)	Air exchange† ft³/min	m³/hr	Comments
L (low)	15	25	
M (medium)	30	50	Use 30 ft³/min if respiration rate is not known.
H (high)	45	75	Use 45 ft³/min for commodities with H ethylene sensitivity that are mixed with H or VH ethylene producers.
VH (very high)	60	100	

*Air exchange for 20-foot containers should be one half the amounts listed.

† Recommended air exchange rates will keep CO_2 levels below 0.3% in a well sealed container when commodity is at recommended transport temperature.

Common name (other common name)	Scientific name	Storage temperature °C	Storage temperature °F	Relative humidity %	Highest freezing temperature °C	Highest freezing temperature °F	Ethylene production*	Ethylene sensitivity†	Respiration rate**	Approximate postharvest life	Observations and beneficial controlled atmosphere (CA) conditions
Acerola (Barbados cherry)	*Malpighia glabra*	0	32	85–90	–1.4	29.5				6–8 weeks	
African horned melon (kiwano)	*Cucumis africanus*	13–15	55–59	90			L	M		6 months	
Amaranth (pigweed)	*Amaranthus* spp.	0–2	32–36	95–100			VL	M		10–14 days	
Anise (fennel)	*Foeniculum vulgare*	0–2	32–36	90–95	–1.1	30.0				2–3 weeks	
Apple											
Not chilling sensitive	*Malus pumila*	–1	30	90–95	–1.5	29.3	VH	H	L	3–6 months	2–3% O_2 + 1–2% CO_2
Chilling sensitive	*Malus pumila* cv. Yellow Newton, Grimes golden, McIntosh	4	40	90–95	–1.5	29.3	VH	H	L	1–2 months	2–3% O_2 + 1–2% CO_2
Apricot	*Prunus armeniaca*	–0.5 to 0	31–32	90–95	–1.1	30.0	M	M	L	1–3 weeks	2–3% O_2 + 2–3% CO_2
Artichoke											
Globe artichoke	*Cynara acolymus*	0	32	95–100	–1.2	29.8	VL	L	H	2–3 weeks	2–3% O_2 + 3–5% CO_2
Chinese artichoke	*Stachys affinia*	0	32	90–95			VL	VL		1–2 weeks	
Jerusalem artichoke	*Helianthus tuberosus*	–0.5 to 0	31–32	90–95	–2.5	27.5	VL	L	L	4 months	

*ETHYLENE PRODUCTION RATE:

VL = very low (<0.1 µL/kg-hr at 20°C)
L = low (0.1–1.0 µL/kg-hr)
M = moderate (1.0–10.0 µL/kg-hr)
H = high (10–100 µL/kg-hr)
VH = very high (>100 µL/kg-hr)

†ETHYLENE SENSITIVITY (detrimental effects include yellowing, softening, increased decay, abscission, browning):

L = low sensitivity
M = moderately sensitive
H = highly sensitive

**RESPIRATION RATE (at recommended storage temperature)

L = low (<20 mg CO_2/kg-hr)
M = moderate (<40 mg CO_2/kg-hr)
H = high (<60 mg CO_2/kg-hr)
VH = very high (>60 mg CO_2/kg-hr)

Appendix B. Long-Term Storage of Fresh Fruits and Vegetables, cont.

Common name (other common name)	Scientific name	Storage temperature °C	Storage temperature °F	Relative humidity %	Highest freezing temperature °C	Highest freezing temperature °F	Ethylene production*	Ethylene sensitivity†	Respiration rate**	Approximate postharvest life	Observations and beneficial controlled atmosphere (CA) conditions
Endive (escarole)	*Cichorium endivia*	0	32	95–100	–0.1	31.6	VL	M	H	2–4 weeks	
Belgian endive (Witloof chicory)	*Cichorium intybus*	2–3	36–37	95–98			VL	M		2–4 weeks	light causes greening; 3–4% O_2 + 4–5% CO_2
Feijoa (pineapple guava)	*Feijoa sellowiana*	5–10	41–50	90			M	L		2–3 weeks	
Fennel	see Anise										
Fig, fresh	*Ficus carica*	–0.5 to 0	31–32	85–90	–2.4	27.7	M	L	L	7–10 days	5–10% O_2 + 15–20% CO_2
Garlic	*Allium sativum*	0	32	65–70	–0.8	30.5	VL	L	L	6–7 months	0.5% O_2 + 5–10% CO_2
Ginger	*Zingiber officinale*	13	55	65			VL	L		6 months	no CA benefit
Gooseberry	*Ribes grossularia*	–0.5 to 0	31–32	90–95	–1.1	30.0	L	L	L	3–4 weeks	
Granadilla	see Passionfruit										
Grape											
Table grape	*Vitis vinifera*	–0.5 to 0	31–32	90–95	–2.7	27.1	VL	L	L	2–8 weeks	2–5% O_2 + 1–3% CO_2; to 4 wks, 5–10% O_2 + 10–15% CO_2
American grape	*Vitis labrusca*	–1 to –0.5	30–31	90–95	–1.4	29.5	VL	L	L	1–6 months	
Grapefruit	see Citrus								L		
Guava	*Psidium guajava*	5–10	41–50	90			L	M	M	2–3 weeks	
Herbs, fresh culinary											5–10% O_2 + 5–10% CO_2
Basil	*Ocimum basilicum*	10	50	90			VL	H		7 days	
Chives	*Allium schoenorasum*	0	32	95–100	–0.9	30.4	L	M			
Dill	*Anethum graveolens*	0	32	95–100	–0.7	30.7	VL	H		1–2 weeks	
Epazote	*Chenopodium ambrosioides*	0–5	32–41	90–95			VL	M		1–2 weeks	
Mint	*Mentha* spp.	0	32	95–100			VL	H		2–3 weeks	
Oregano	*Origanum vulgare*	0–5	32–41	90–95			VL	M		1–2 weeks	
Parsley	*Petroselinum crispum*	0	32	95–100	–1.1	30.0	VL	H	VH	1–2 months	
Perilla (shiso)	*Perilla frutescens*	10	50	95			VL	M		7 days	
Sage	*Salvia officinalis*	0	32	90–95						2–3 weeks	
Thyme	*Thymus vulgaris*	0	32	90–95						2–3 weeks	
Horseradish	*Armoracia rusticana*	–1 to 0	30–32	98–100	–1.8	28.7	VL	L		10–12 mo.	
Husk tomato	see Tomatillo										
Jaboticaba	*Myrciaria cauliflora*= *Eugenia cauliflora*	13–15	55–59	90–95						2–3 days	
Jackfruit	*Artocarpus heterophyllus*	13	55	85–90			M	M		2–6 weeks	
Jerusalem artichoke	see Artichoke										
Jicama (yambean)	*Pachyrrhizus erosus*	13–18	55–65	85–90			VL	L	L	1–2 months	
Jujube (Chinese date)	*Ziziphus jujuba*	2.5–10	36.5–50	85–90	–1.6	29.1	L	M		1 month	
Kaki	see Persimmon										


Customs
seal here


AIR EXCHANGE
100%
75%
50%
25%
ATMOSPHERE
SAMPLING PORT
0%
KEEP CLOSED UNLESS
OTHERWISE SPECIFIED
OZONE
PROTECTION


(100%) 250
(90%) 225
(80%) 200
(70%) 175
(60%) 150
(50%) 125
(40%) 100
(30%) 75
(20%) 50
(12%) 30
(4%) 10
m³/h
CLOSE


CLOSED
CO2
ADAPTER
DO NOT OPEN BELOW 0°C 32°F
15 m³/h
9 CFM
5%
35 m³/h
21 CFM
10%
50 m³/h
30 CFM
20%
75 m³/h
45 CFM
25%
100 m³/h
60 CFM
35%
125m³/h
75 CFM
45%
280 m³/h
165CFM
100%

No usar %

6

La carga del contenedor debe ser realizada con anden de carga, y la zona de carga debe estar fría.


CSAV


FRENOS DE AIRE

Movimiento del aire en los contenedores.
Como es el flujo del aire ??

Movimiento de aire en contenedores refrigerados

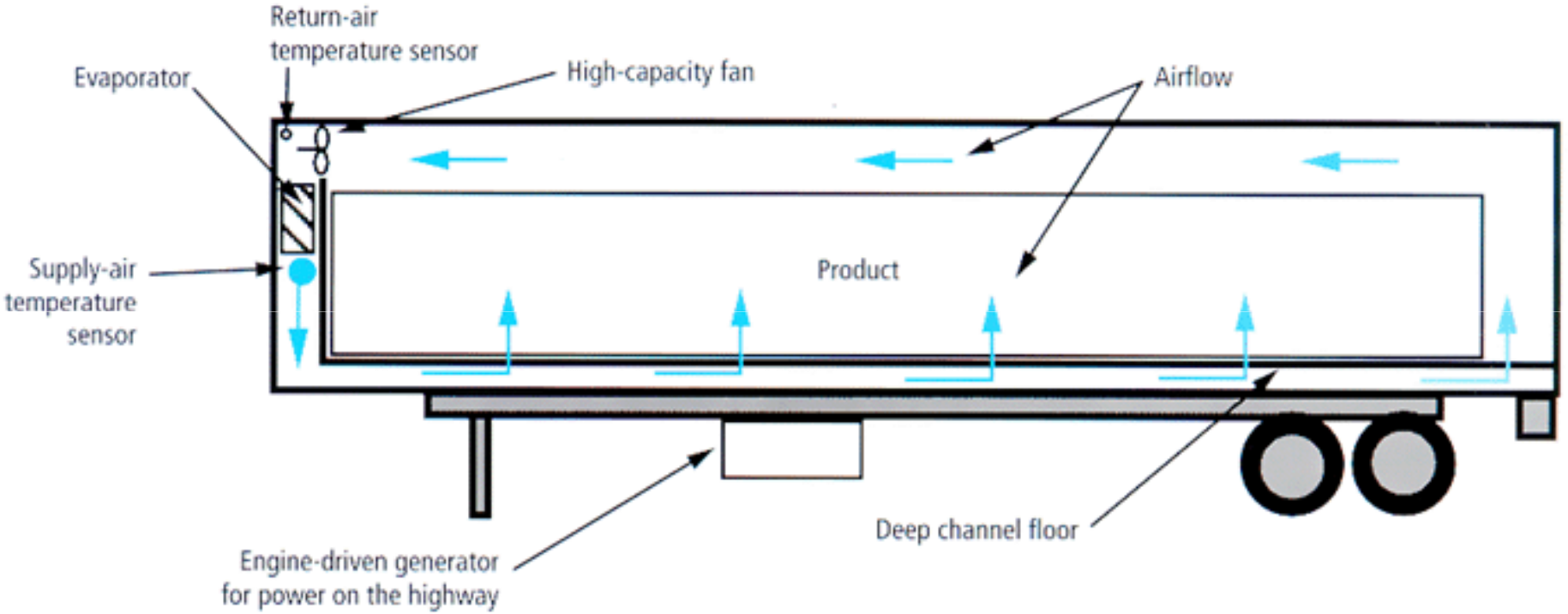


Figure 2. Airflow and refrigeration system in a typical refrigerated marine container.

Descarga

Nota originadora: F

TempTale4: Ambiente N° serie de etiqueta 0 N° serie de monitor 3414401864

27,2° C
25,0° C
20,0° C
15,0° C
10,0° C
5,0° C
0,0° C
-3,3° C

08-01-2007 13-01-2007 18-01-2007 23-01-2007 28-01-2007

Inicio: 17:18:37 06-01-2007 Fin: 19:41:07 29-01-2007

N° de punto 1 888 de 888 N° de punto 888

Información comercial confidencial

Zona motores (front)

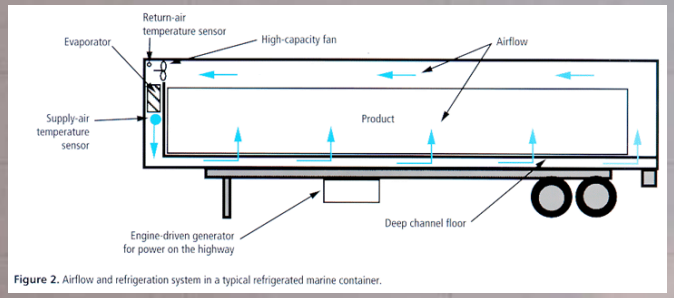


Figure 2. Airflow and refrigeration system in a typical refrigerated marine container.

15,0° C
10,0° C
5,0° C
0,0° C
-3,3° C

08-01-2007 13-01-2007 18-01-2007 23-01-2007 28-01-2007

Inicio: 17:53:16 06-01-2007 Fin: 19:38:16 29-01-2007

N° de punto 1 887 de 887 N° de punto 887

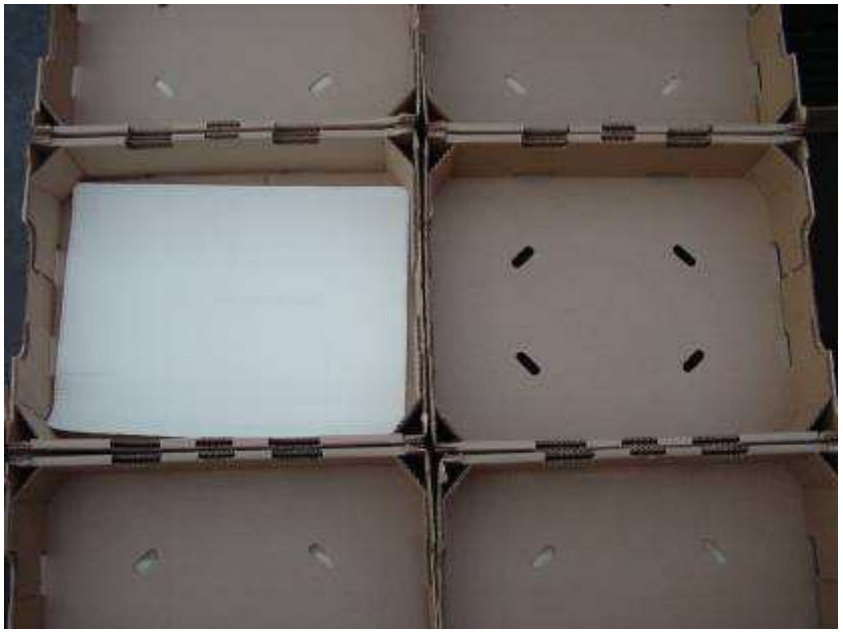
Información comercial confidencial

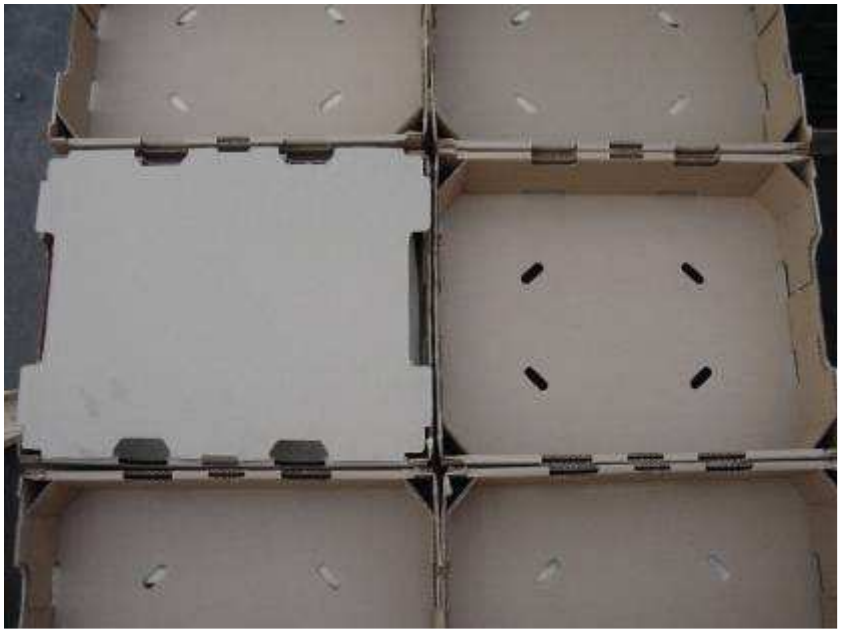
Zona puertas (rear)

7

Los envases y TODOS los materiales de embalaje deben permitir el flujo de aire vertical

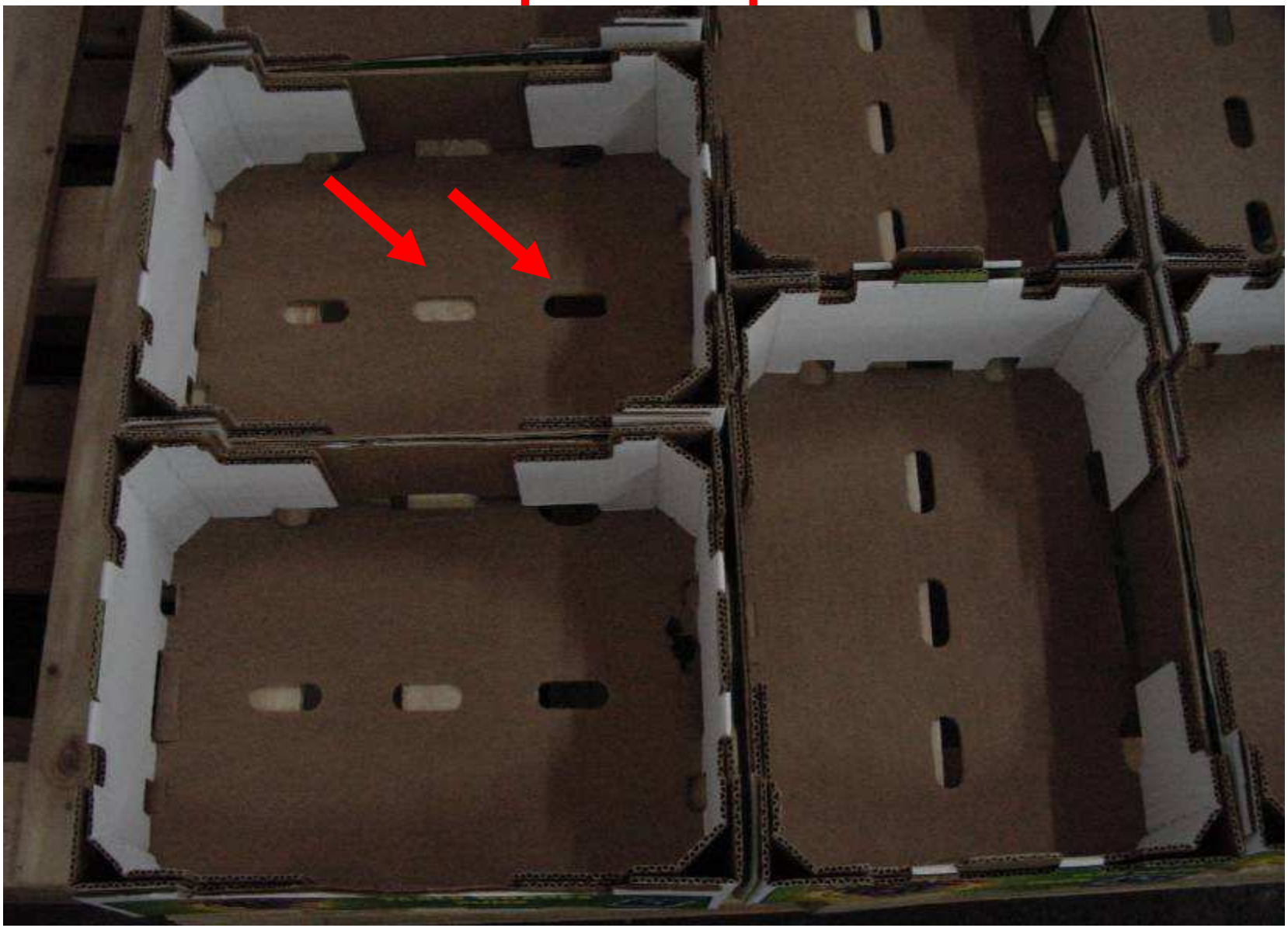
Facilitar el paso del aire vertical





Parrillas perforadas

Tablas en base de pallet no deben bloquear paso del aire



8

Los pallets deben ser estibados con grúa horquilla

La estiba de contenedores DEBE hacerse con grúa horquilla.

NO con transpaleta

9

Eficiente estiba del contenedor: ubicación de los pallets en el contenedor.

Debe existir un plano de estiba.

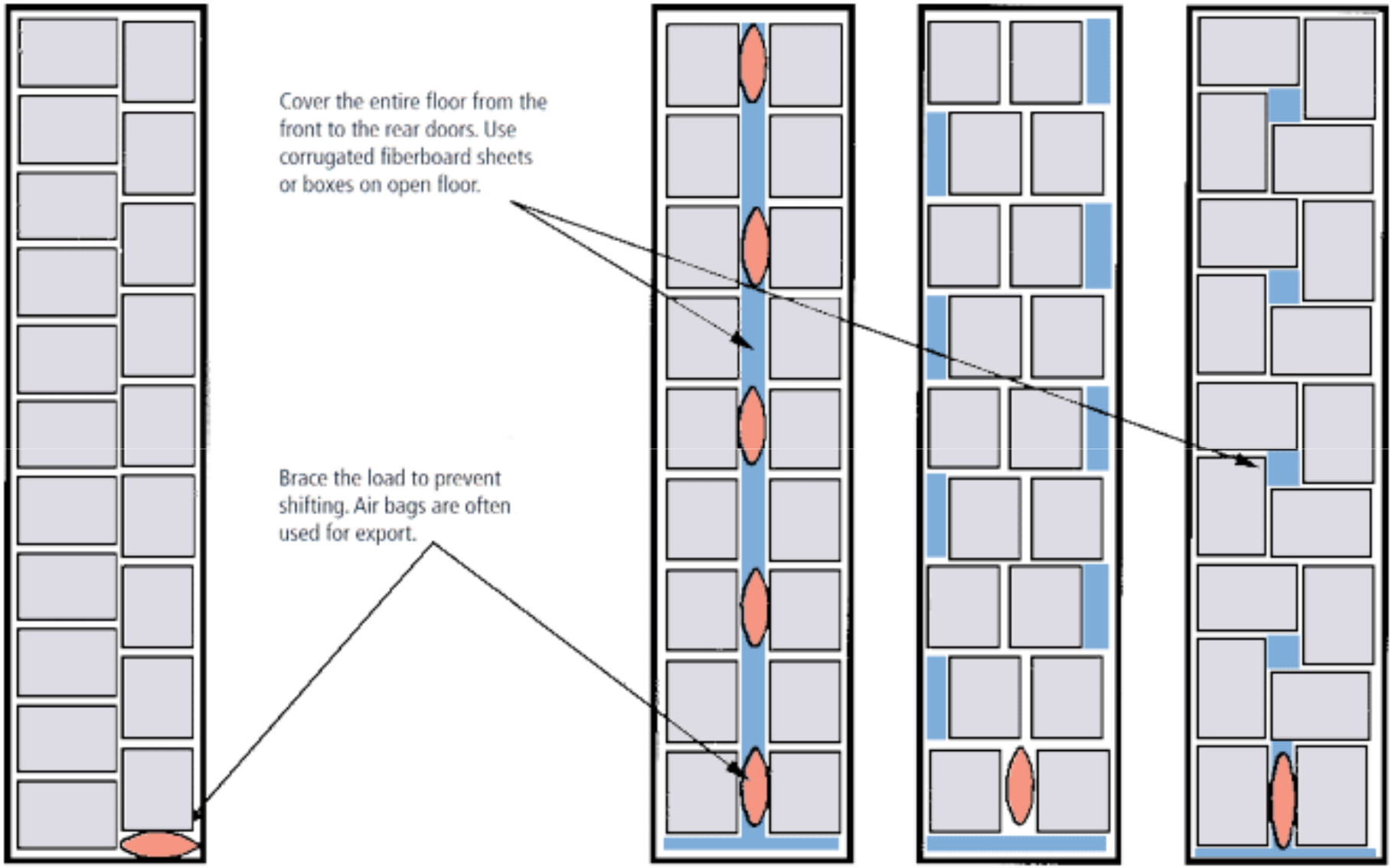


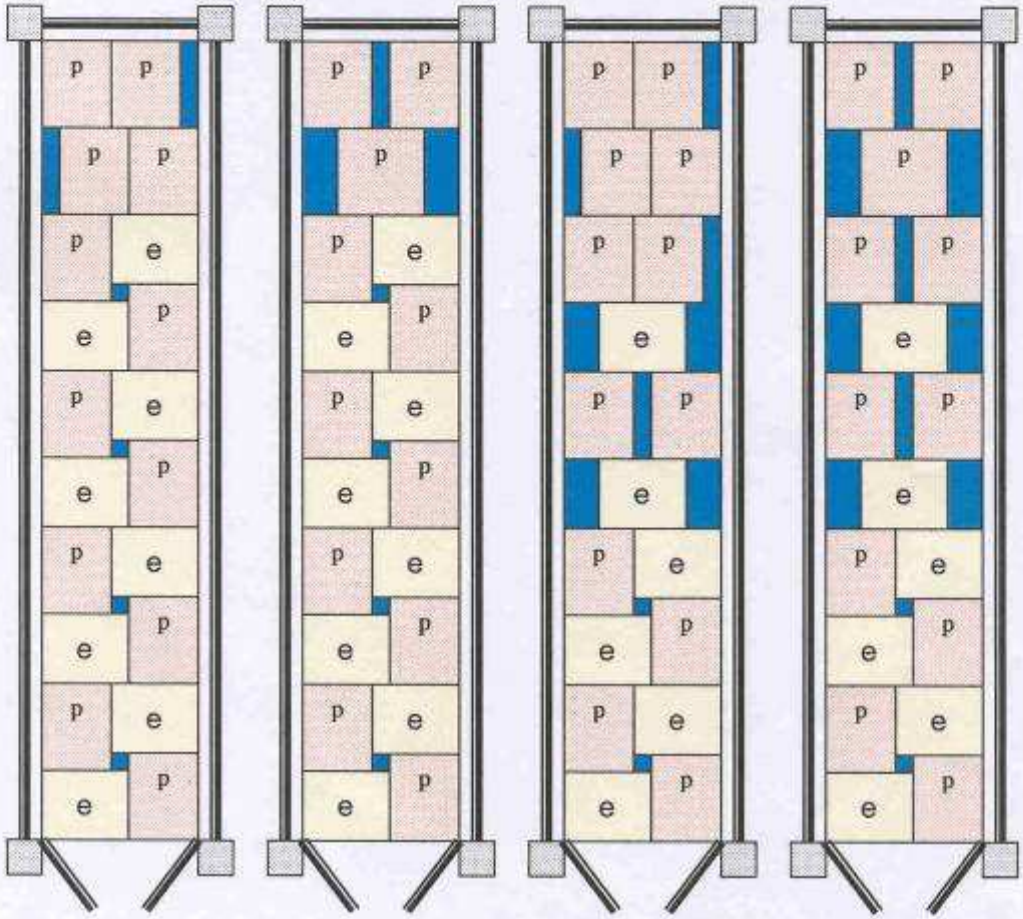
Figure 3. Pallet location and orientation for stable loads.


CAT. 1
Grower, Packer, Shipper
Sociedad Agrícola Drokasa S.A.
Panamericana Sur Km
www.agrokasa.
FARM SITE SIZE
LC C-9 117
VARIETY
SUGRAONE SEEDLESS
Sociedad Agrícola
Panamericana Su
FARM SITE
LC C-9
VARIETY
SUGRAONE

TIFICADO
NSPECCION
07038692

- **Diferentes formas de consolidar pallets con base de dimensión Americana.**

Vista Superior. Contenedor Reefer de 40`pies de largo.

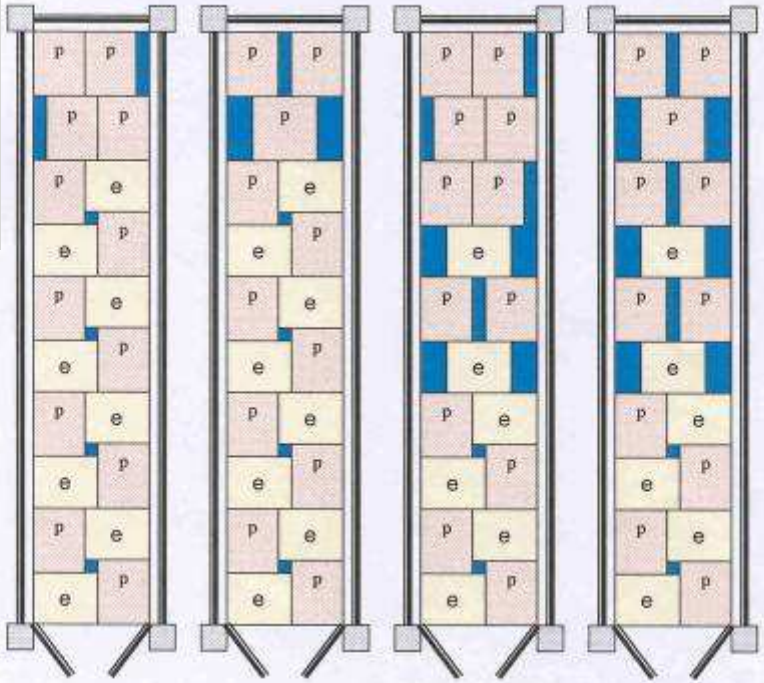


p = Pallets de Punta

e = Pallets de Espejo

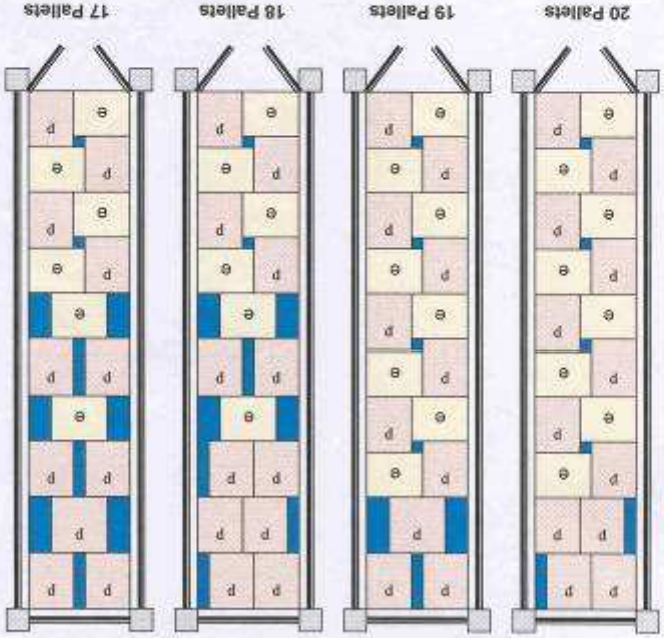
- **Diferentes formas de consolidar pallets con base de dimensión Americana.**

Vista Superior. Contenedor Reefer de 40´pies de largo.



p = Pallets de Punta

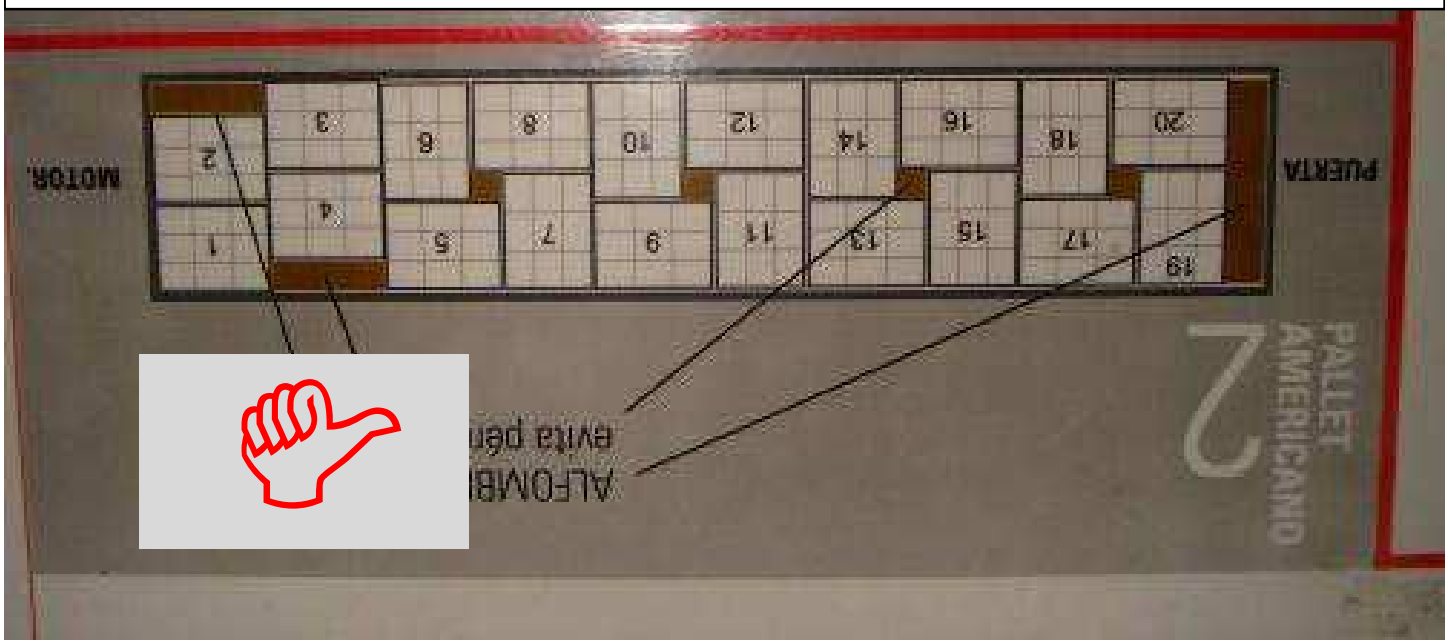
e = Pallets de Espejo



Vista Superior. Contenedor Reefer de 40´pies de largo.

- Diferentes formas de consolidar pallets con base de dimensión Americana.


PALLET AMERICANO
ALFOMBRA DE CARTÓN
evita pérdida de aire.
PUERTA
MOTOR
19
17
15
13
11
9
7
5
1
20
18
16
14
12
10
8
6
4
3
2


MOTOR
PUERTA
PALLET AMERICANO

10

No sobrepasar la altura máxima de carga del contenedor (línea roja).


NO CARGO ABOVE THIS LINE WHEN USED AS REEFER
GRAPES
GRAPES
GRAPES
GRAPES

11

Correcta colocación de cartón para tapar piso T del contenedor y base de pallets.


XL
SEEDLESS
CENTER CODE OF PACKING
CODE PRODUCTION PLACE
002-006-16-1°C
002-061B2-01
"BETA 006"


SIZE
XL
SEEDLESS
CENTER CODE OF PACKING
CODE PRODUCTION PLACE


SIZE
COLOR
XL
CENTER CODE OF PACKING
CODE PRODUCTION PLACE

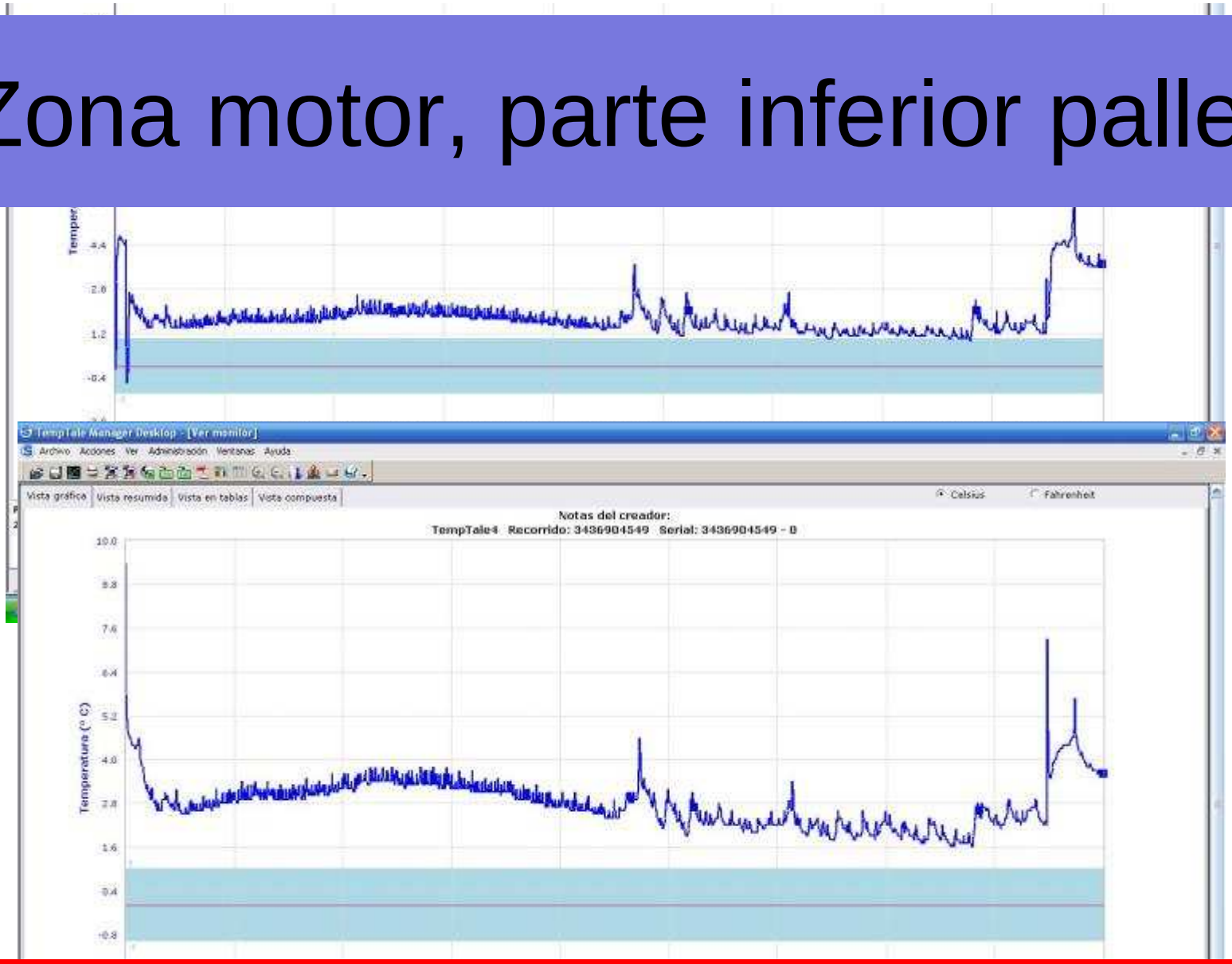

ANDES
JA·99·98
CHILE

12

Ubicación estratégica de 2 termógrafos, para medir temperatura del aire más baja y alta, dentro del contenedor.

Registrador de temperatura dentro de la caja, pero fuera de la bolsa camisa.

Zona motor, parte inferior pallet



Zona puerta, parte superior pallet

Los termógrafos deben ser:

- Recuperados en destino
- Leídos (bajar información)
- Enviar información al Depto. Técnico
- Analizados