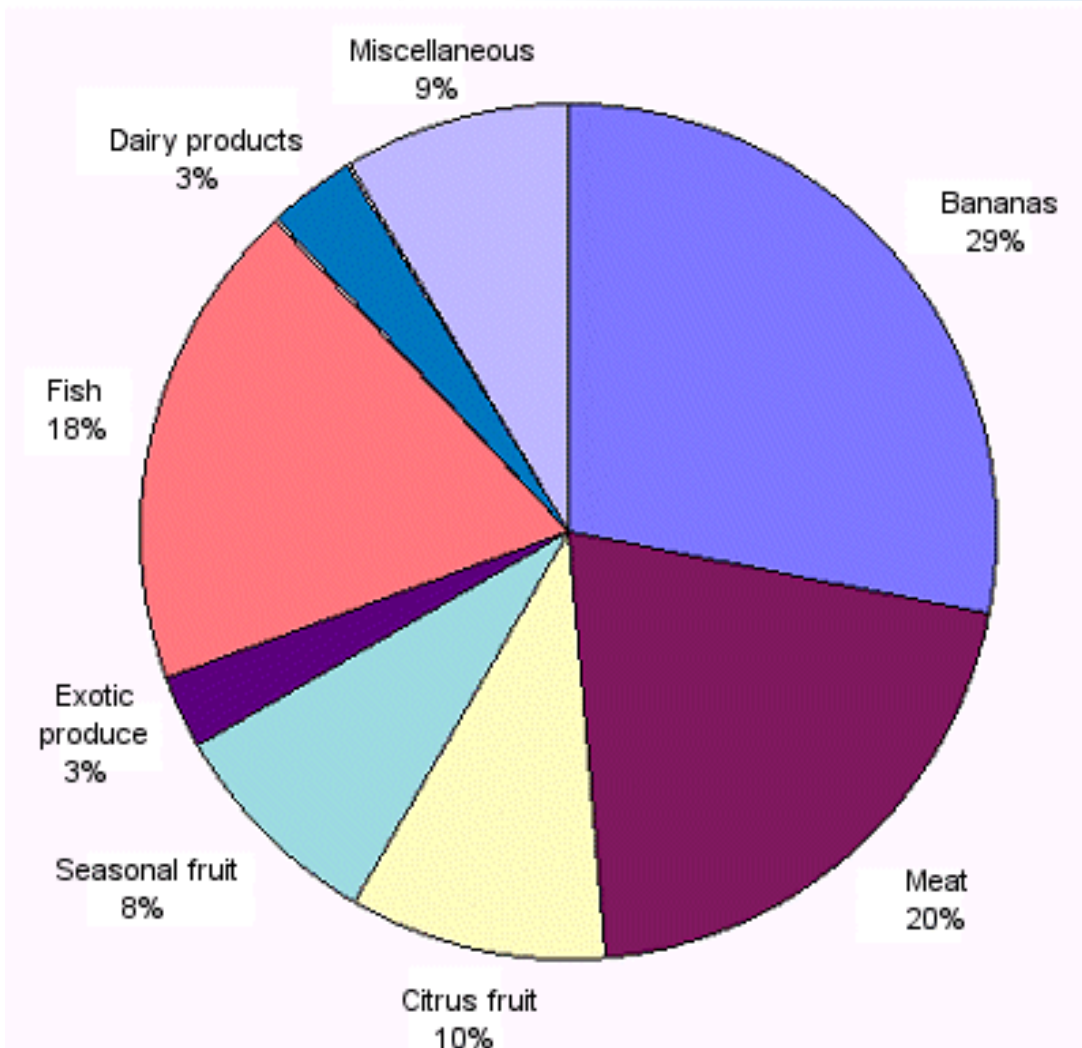


**The banana trade from
cultivation to consumption**

-

**The general requirements for the
transport of banana cargo**

TRADES



Bananas: 22 million ton export / 113 million ton production
Citrus: 7,5 million ton
Exotics: 5,65 million ton

30% Conventional reefer ships
70% Reefer containers

2018: 78% Reefer containers

A BANANA = CURVED & YELLOW?

- Origin of the banana
- Botanical description
- Terminology
- Varieties



PRODUCTION OF BANANAS

Plantation



PRODUCTION OF BANANAS

Harvest





PRODUCTION OF BANANAS

Packing stations



PRODUCTION OF BANANAS

Packing stations



PRODUCTION OF BANANAS

Packing stations



PRODUCTION OF BANANAS

Packing stations



LOADING OPERATIONS CONTAINERS

At the port / at packing stations



PRODUCTION OF BANANAS

Packing stations





TRADES



LOADING OPERATIONS REEFER VESSELS

At the port / by means of barges



LOADING OPERATIONS REEFER VESSELS

At the port / by means of barges



LOADING OPERATIONS REEFER VESSELS

Breakbulk / Palletized



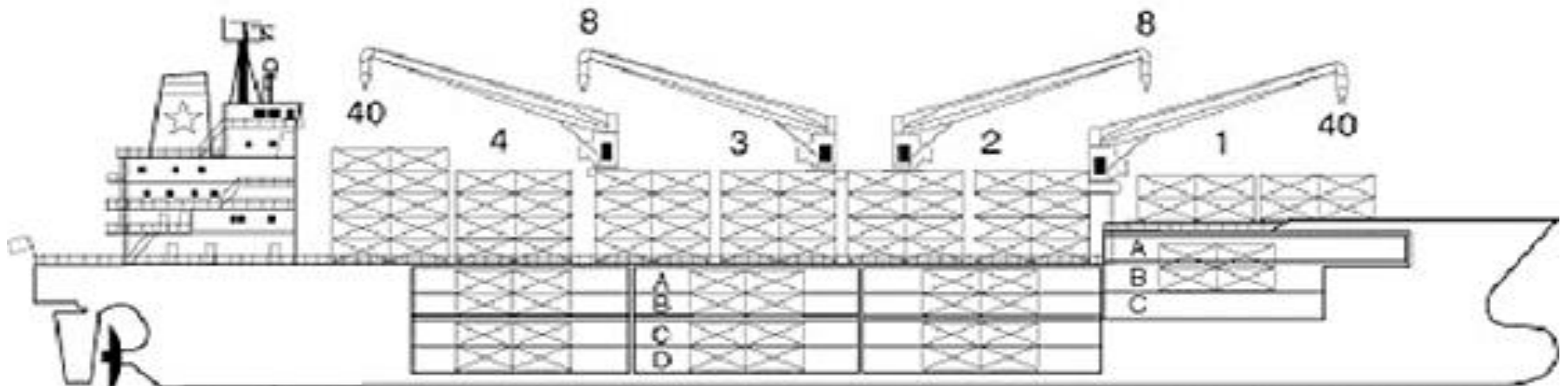
LOADING OPERATIONS REEFER VESSELS

- Pre-cooling holds
- Temperature + yellow control
- Stowage
- Airbags / foam



REEFER VESSELS

- 4 holds / 4 hatches / 3 to 5 cargo decks per hold
- 2 cooling compartments per hold - Insulated
- Temp range from -25 to +15°C
- Cranes & derricks SWL ranging from 12 to 40T
- Max capacity under deck 5179 pallets + 171 x 40' reefer containers



COOLING OF CARGO

Pre cooling of the cargo holds / Shock treatment of the fruit

- Fresh harvested fruit is often not pre-cooled.

PRE COOLING CARGO HOLDS

- Pre cooling of cargo holds prior to loading to $\pm 8^{\circ}\text{C}$

SHOCK TREATMENT

- Delivery air is lowered to about $+12^{\circ}\text{C}$ until RAT of $+13^{\circ}\text{C}$ is being reached.
- This procedure has to be followed closely to avoid chilling damage.

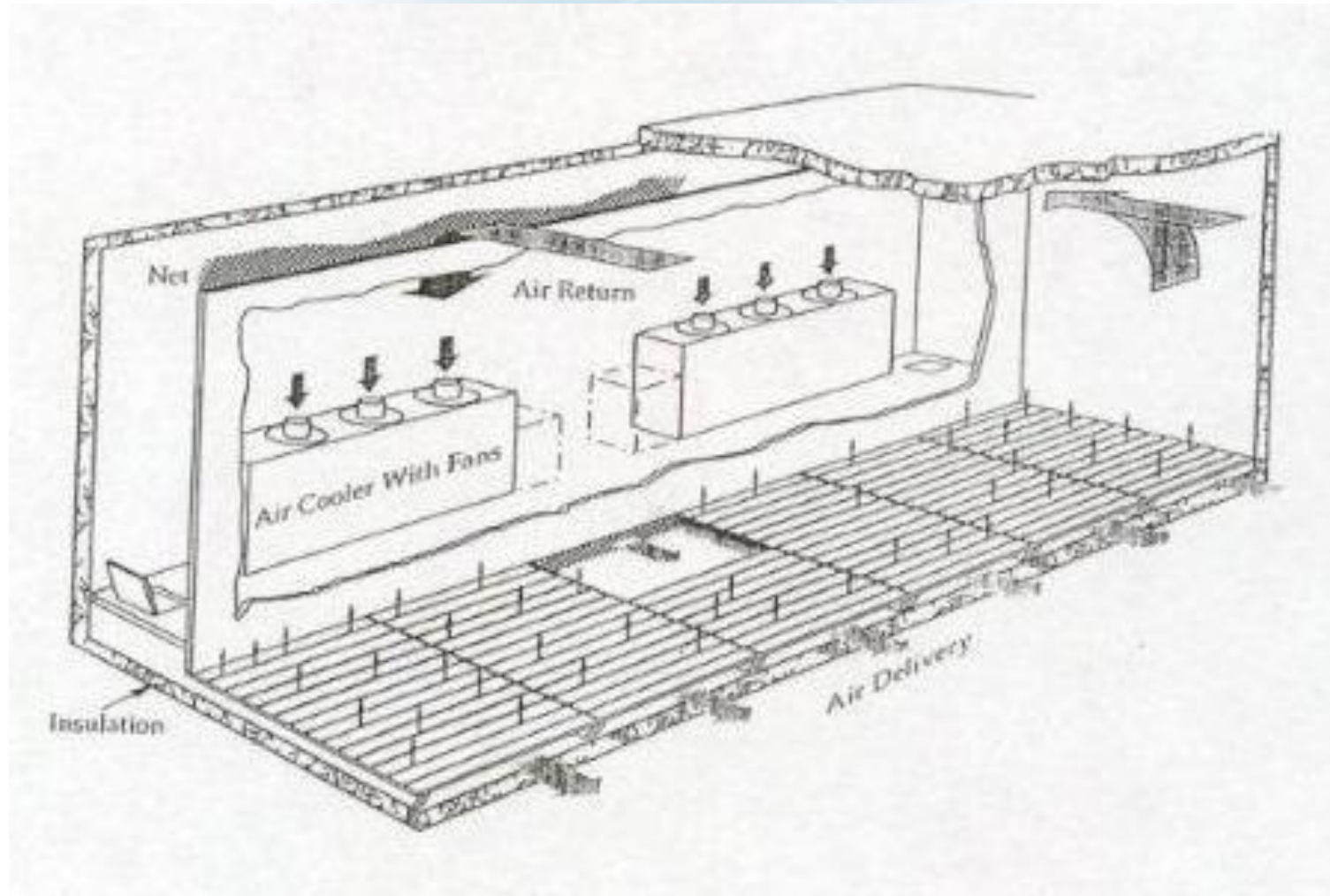
COOLING OF CARGO

Reduction period

- Immediately after completion of loading of a deck, the hatchcovers are closed and the cooling is started at full force with the fresh air ventilation closed.
- The delivery air is set at + 13 °C and the reduction period is completed as soon as the return air temperature reaches + 15 °C. Normally, a reduction period will take about 24 hours.
- Once the reduction period is complete, the delivery air temperature is raised to + 13.3 °C and the fresh air ventilation is opened.
- Important information for ship's staff: if required temperatures are not reached within 2/3 days, there could be a problem with the cooling capacity of the vessel or there could be a short-circuit in the air flow in the cargo hold.

COOLING OF CARGO

Cooling



COOLING OF CARGO

Ventilation



REFRIGERATED CONTAINERS



REFRIGERATED CONTAINERS

Year	Reefer Slots TEU
1994	276,000
2004	746,600
2014	1,435,786

**Reefer cargo is loaded in 40'
High Cubes (FEU)**

2002: m/v SANTA RAFAELA: 1200 TEU / 600 FEU

2006: m/v EMMA MAERSK: 1420 TEU / 710 FEU

2013: m/v CAP SAN NICOLAS: 3200 TEU / 1600 FEU

2014: m/v MAERSK MCKINNEY: 3600 TEU / 1800 FEU

REFRIGERATED CONTAINERS

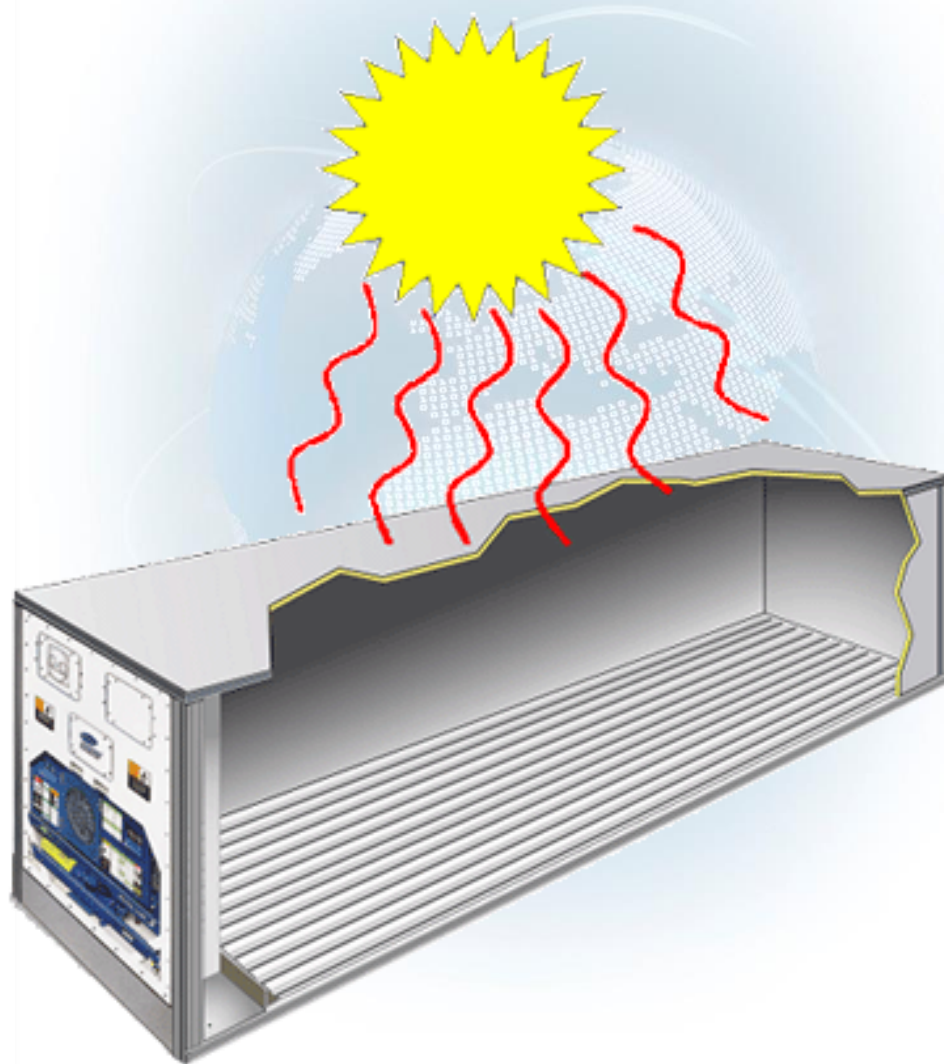
- 20 banana pallets / container – 1080 boxes - +- 20t bananas
- Insulated boxes with reefer unit
- Temp Range: -30°C to +29°C – Super freezies: -60°C
- Ventilation: 0 to 285Cbm / hour



REFRIGERATED CONTAINERS



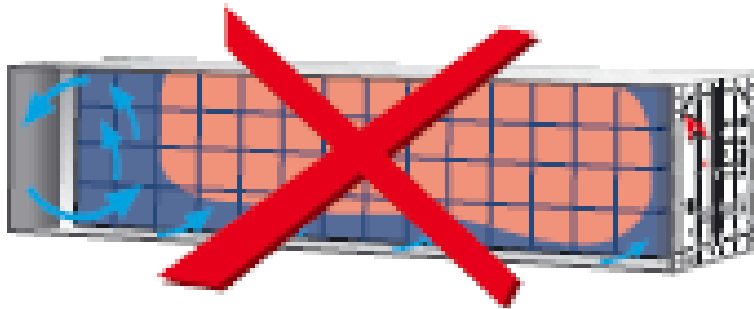
REFRIGERATED CONTAINERS



REFRIGERATED CONTAINERS



Any void floor spaces must be covered.



Do not stow above the red load line.



Do not leave any space between cargo and side walls.



International loss adjusters & surveyors

REFRIGERATED CONTAINERS



REFRIGERATED CONTAINERS

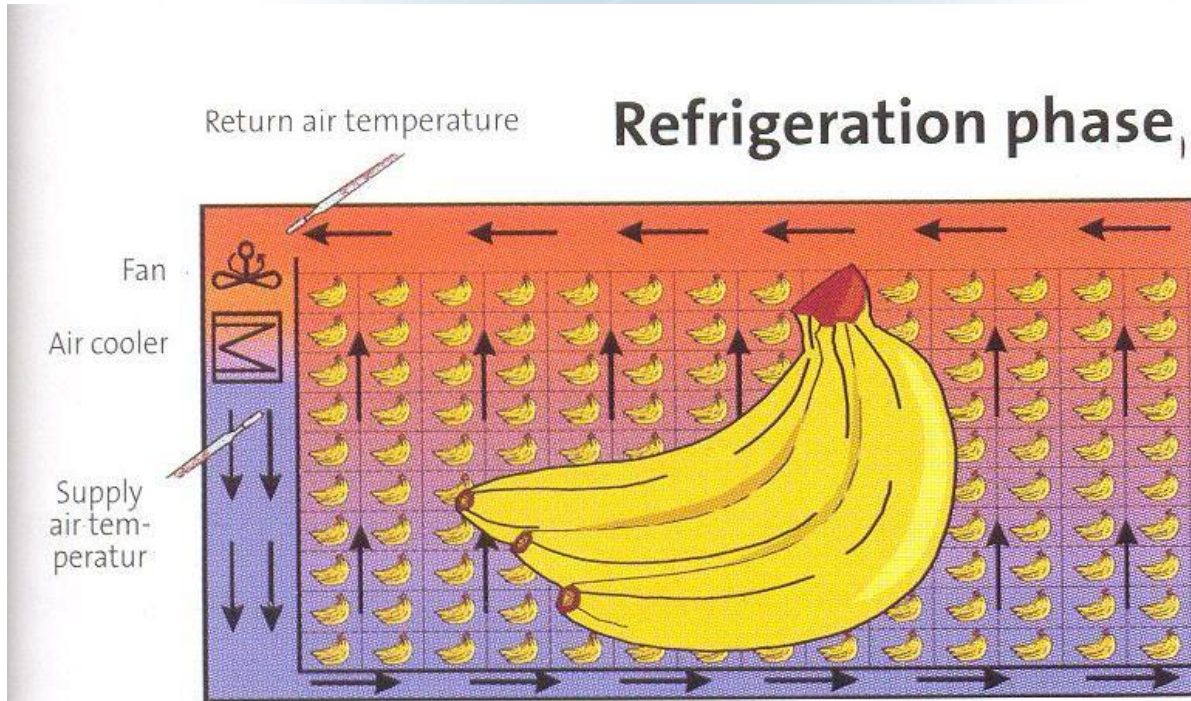
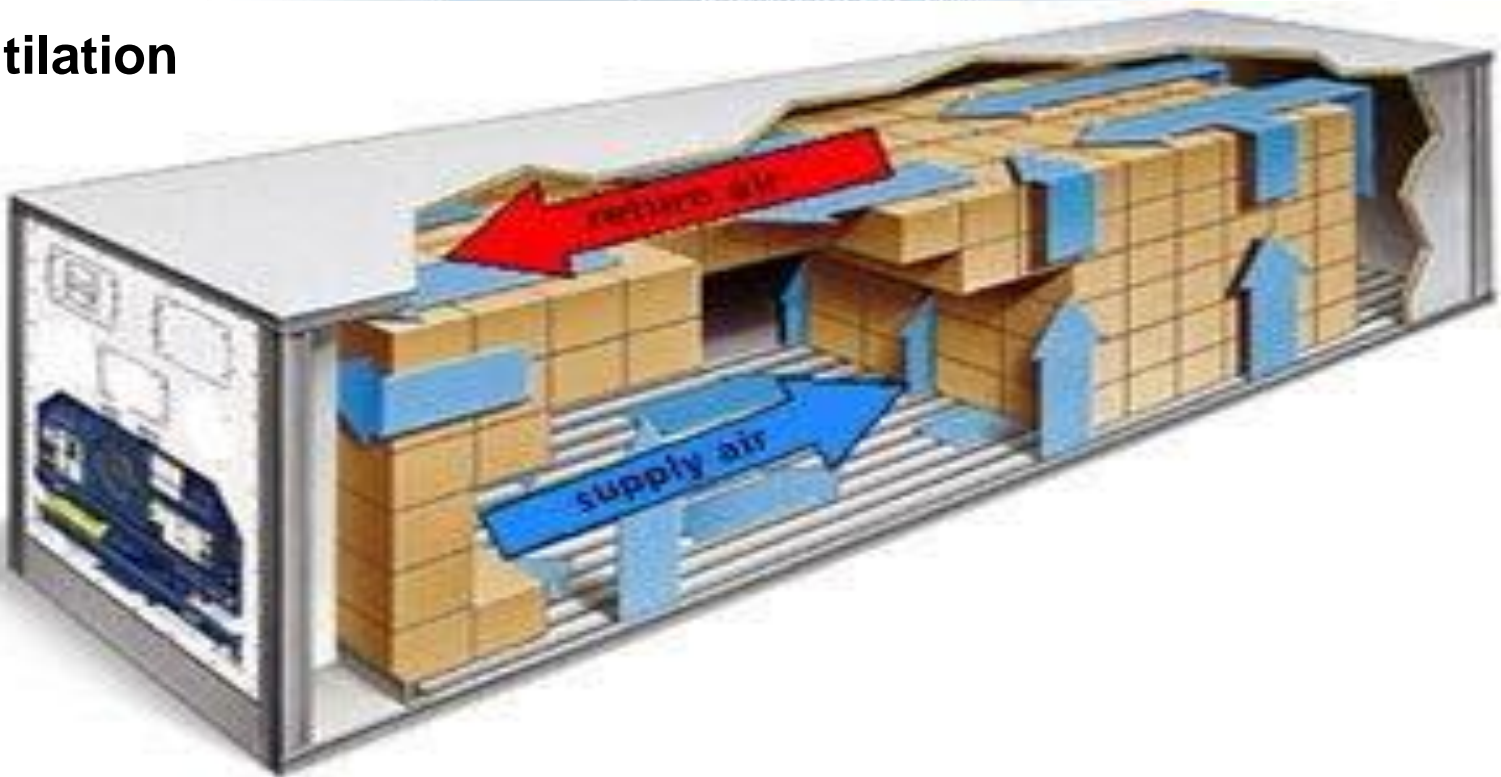


Figure 35: Air flow and temperature distribution in a refrigerated container during refrigerated operation

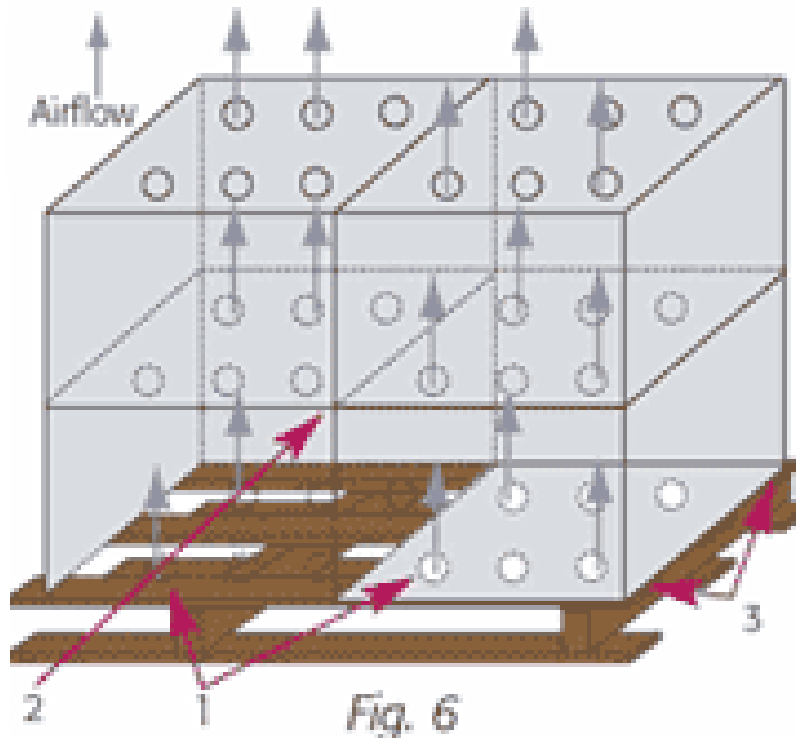
REFRIGERATED CONTAINERS

- Set point
- Delivery air temperature
- Return air temperature
- Ventilation



REFRIGERATED CONTAINERS

1. Carton alignment for unrestricted airflow
2. Strength of cartons in the corners
3. Corners of cartons supported



REFRIGERATED CONTAINERS



REFRIGERATED CONTAINERS

- Digital display – SP – DAT – RAT
- Daily check by crew / terminal operator
- Automated Cargo Control System on board
- Lack of spare parts on board (quantity of units / Types)
- Lack of technical knowledge crew
- Change settings by mistake / deliberate / cyber attack



REFRIGERATED CONTAINERS

- **Conventional Cooling**
- **Controlled Atmosphere:**
 - **Reduced O₂ / Increased CO₂**
- **Star Care: high respiration fruit (bananas)**
- **Star Fresh: Lower respiration, injection nitrogen (stone fruit, berries)**
- **Quest I & Quest II:**
 - **Self regulating control systems**
 - **Reduction CO₂ emission**
- **Cold Treatment (CT)**
- **Automated Cold Treatment (ACT)**
- **Automated Set Point Change (ASC)**
- **Advanced Fresh Air Management (AFAM & AFAM+)**
- **.....**

CA-CONTAINERS



Oxygen: 4-6% instead of 21%

Carbon Dioxide: 2,5% instead of 0,04%

Slowing down respiration process

39% of bananas is shipped under CA

REFRIGERATED CONTAINERS

Useful tips to load and stow cargo in order to maintain quality:

- Do not leave open floor space at the front / end bulkhead or side walls.
- Do not run the refrigerator unit with doors open.
- Do not load cargo up to the ceiling. Leave 15 cm of free space – red load line.
- Set unit at optimal carrying temperature. A set point below the required carrying temperature does not speed up / ameliorate the cooling process.
- Pre cool the cargo prior to loading if possible.
- Assure that floor and drains are free of debris.
- Assure that the weight of the cargo is properly distributed in the container for maximum stability.
- If palletized cargo and free spaces are left open, block these areas with pallets and / or air bags.
- Place plastic liner from pallets at the doors underneath the doors in order to force cooling air to penetrate through the cargo.

DISCHARGE AT DESTINATION – REEFER VESSELS



DISCHARGE AT DESTINATION – REEFER VESSELS



DELIVERY TO CONSIGNEE



QUALITY INSPECTIONS

At the packing station



Before loading on board

At discharge

At consignee's premises



QUALITY INSPECTIONS

As per commercial contract between
exporter & importer

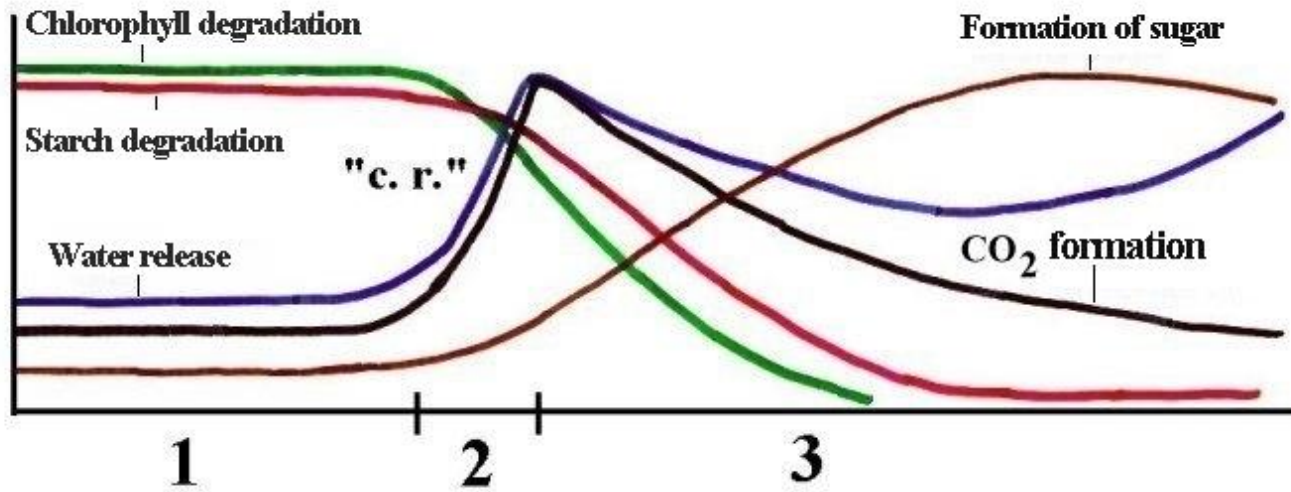
As per EU / International Regulations:

- Weight
- Length / Grade
- “Bananas must be sound, clean, fresh, free of foreign odours & taste and undamaged”



BANANA = LIVING ORGANISM

A banana, a climacteric fruit



CONTROLLED RIPENING



GREEN VERSUS RIPE

Externally: Colour scale

Internally: starch into sugar, creamy pulp



DAMAGES:

PRE-SHIPMENT RELATED PROBLEMS

- Lack of age control
- Insufficient disease control
- Improper fungicide treatment at packing station
- Poor sanitary condition
- Improper handling



DAMAGES: PROBLEMS RELATED TO TRANSPORT OVERSEAS

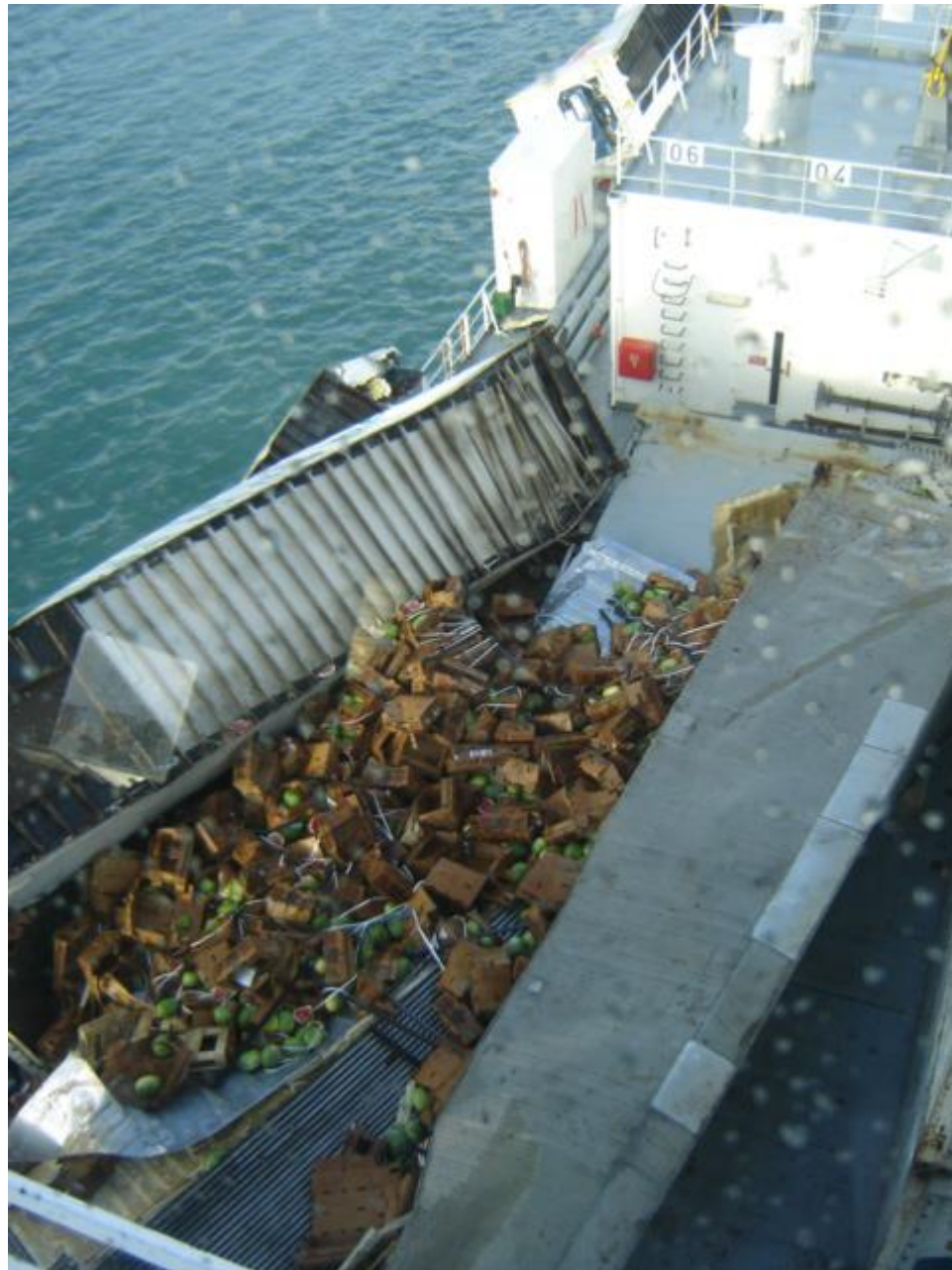
- Temperature problems: R&T or Chilling
- Storm damage
- Damage due to improper vessel maintenance
- Delays in transit













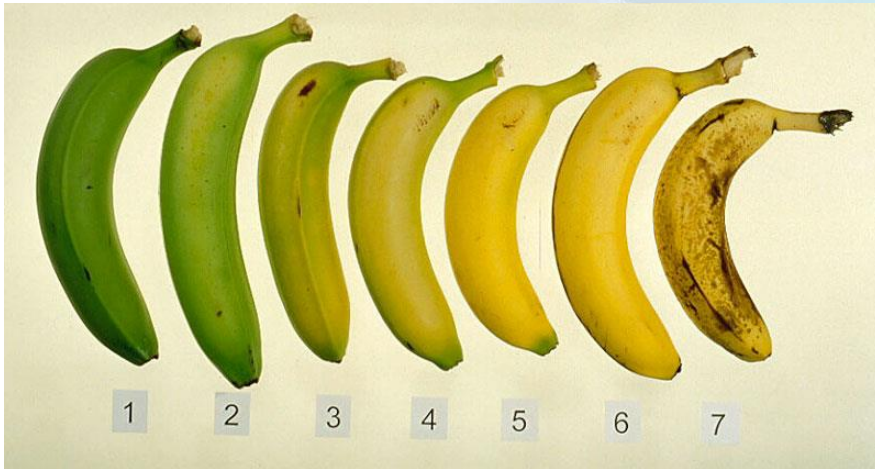




DAMAGES:

POST-SHIPMENT RELATED PROBLEMS

- Problems during transport inland
- Carry Over / Excessive storage period
- Improper ripening



TEMPERATURE REGISTRATION

History

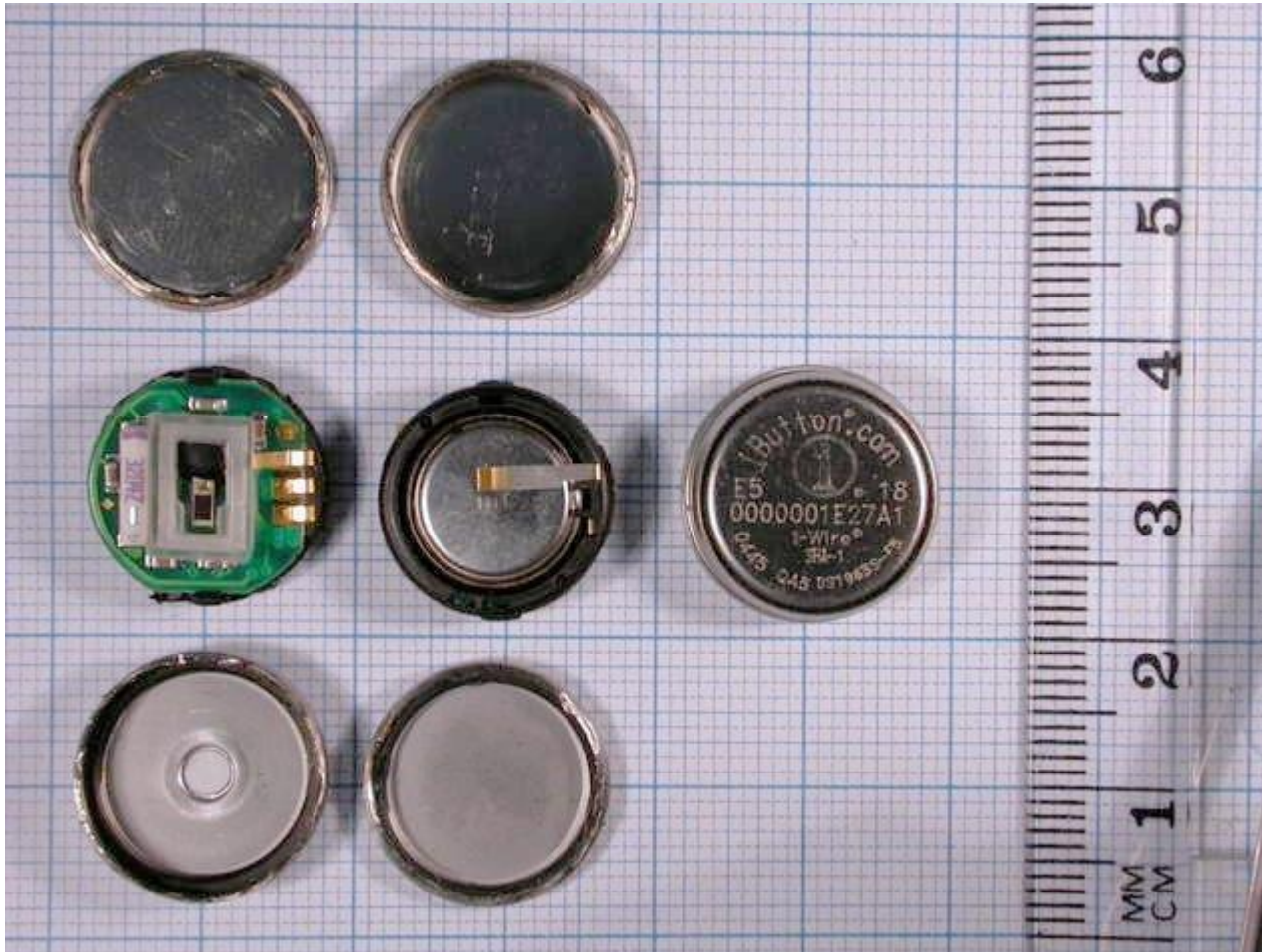
- Only done by carriers
- No information for receivers
- In case of problems, info to be asked to carriers
- Solution: implementation of portable temperature recorders
- Remote Container Management (RCM)



MOST COMMON TYPES USED – PORTABLE TEMP RECORDERS



MOST COMMON TYPES USED – iBUTTON



WHERE TO PLACE A TEMPERATURE RECORDER



ON BOARD

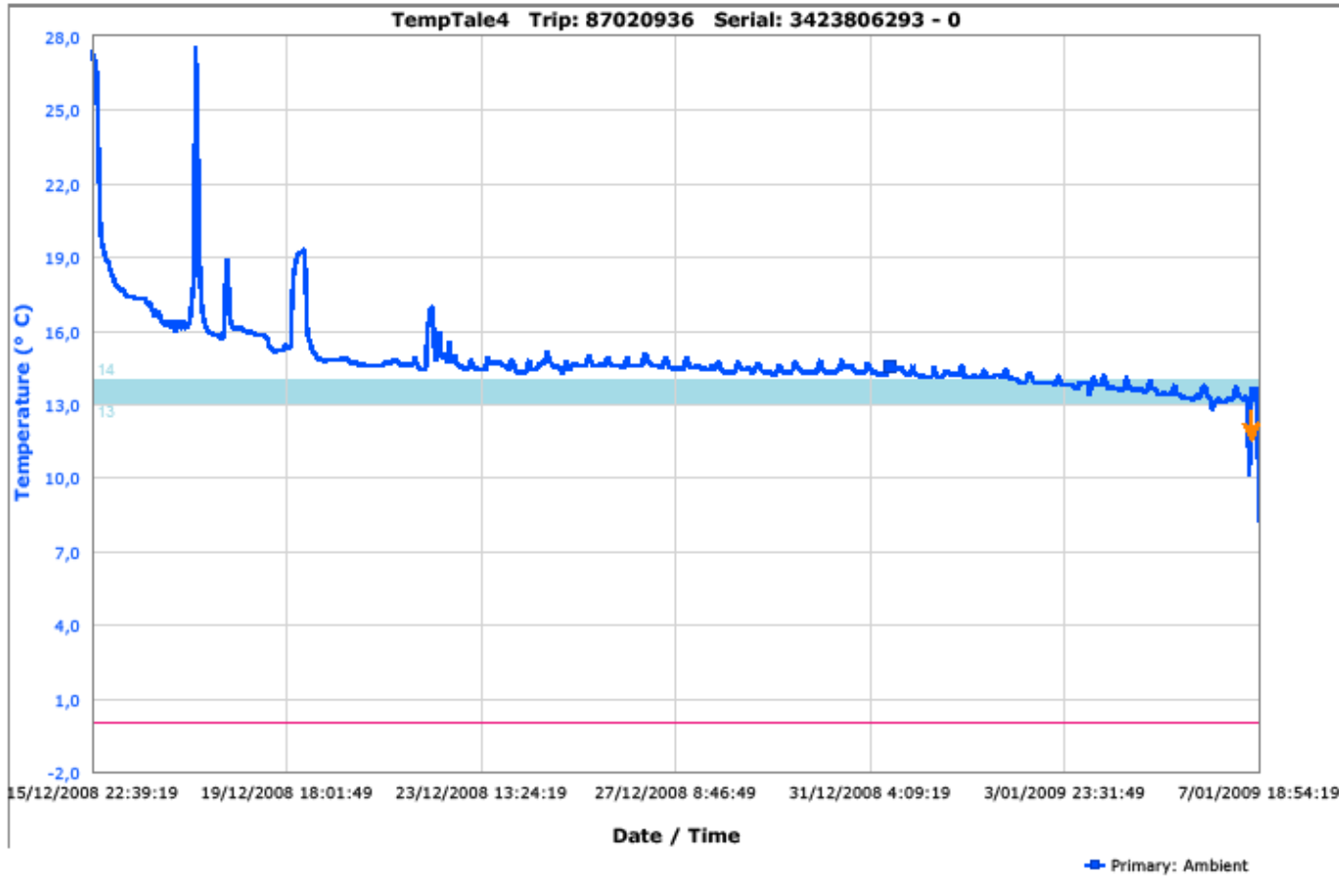
WHERE TO PLACE A TEMPERATURE RECORDER



IN A CONTAINER

HOW TO READ A TEMPTALE RECORDER

CRLU550241-9



First Recorded Point: 15/12/2008 22:39:19 Last Recorded Point: 12/01/2009 9:09:19
Zoomed between Points: 1 - 732 out of 879 points

Comments:



HOW TO READ A TEMPTALE RECORDER

Download			
Label Serial #	18042630	First Point Recorded:	00:03:47 14/03/2009
Monitor Serial #	3499805117	Stop Time:	09:48:47 03/04/2009
Date When Printed:	09:58:34 03/04/2009	TempTale Type:	TempTale4
Monitor Recordings			
Summary Data Points: 1 to 654			
Ambient			
Minimum Temp:	7,9°C @ 09:03:47 03/04/2009		
Maximum Temp:	36,3°C @ 00:03:47 14/03/2009		
Average Temp:	14,5°C		
Standard Deviation:	2,0°C		
Time Below Low alarm:	6 hour(s) 0 sec		
Time Above High alarm:	13 day45 min 0 sec		
Longest Time Below Low alarm:	6 hour(s) 0 sec		
	@ 03:48:47 03/04/2009		
Longest Time Above High alarm:	10 day6 hour(s) 0 sec		
	@ 17:16:47 17/03/2009		
Degree Minutes Below Low alarm:	1.172,5 °C-min		
Degree Minutes Above High alarm:	18.317,5 °C-min		
# Events Below Low alarm:	1		
# Events Above High alarm:	7		
Monitor Configuration			
TempTale4:	Ambient	Startup Delay:	30,0 min
Monitor Serial #	3499805117	Measurement Interval:	45 min
Label Serial #	18042630	Maximum Duration:	60 day
Ideal Low Temp.:	13,0°C	# of Points Available:	19 20
Ideal High Temp.:	14,0°C	# of Points Recorded:	65 4
Low Alarm Type:	Time - cumulative	High Alarm Type:	Time - cumulative
Low Alarm Threshold:	135,0 min	High Alarm Threshold:	135,0 min
Low Alarm Trigger Time:	05:18 03/04/2009	High Alarm Trigger Time:	01:33 14/03/2009
TempTale 4 Note			
TempTale software uses only temperature data to generate graphs, tables, and summary data.			
Originator Note:			
<none>			
Comments			
<none>			
Miscellaneous			
The Read Time is based on the local PC clock			
Time When Read: 09:55:19 03/04/2009			



International loss adjusters & surveyors

HOW TO READ A TEMPTALE RECORDER

Download							
Label Serial #		18042756		First Point Recorded:		06:36:02 15/03/2009	
Monitor Serial #		3499809061		Stop Time:		09:36:02 03/04/2009	
Originator Note:		<none>		TempTale Type:		TempTale4	
Page 1 of 5							
Point	Date	Time	Ambient	Point	Date	Time	Ambient
1	15/03/2009	06:36:02	28,2°C	67	17/03/2009	08:06:02	19,0°C
2	15/03/2009	07:21:02	26,6°C	68	17/03/2009	08:51:02	19,2°C
3	15/03/2009	08:06:02	18,1°C	69	17/03/2009	09:36:02	19,4°C
4	15/03/2009	08:51:02	21,3°C	70	17/03/2009	10:21:02	19,6°C
5	15/03/2009	09:36:02	22,9°C	71	17/03/2009	11:06:02	19,7°C
6	15/03/2009	10:21:02	16,3°C	72	17/03/2009	11:51:02	19,8°C
7	15/03/2009	11:06:02	15,7°C	73	17/03/2009	12:36:02	19,9°C
8	15/03/2009	11:51:02	15,4°C	74	17/03/2009	13:21:02	20,1°C
9	15/03/2009	12:36:02	15,3°C	75	17/03/2009	14:06:02	20,2°C
10	15/03/2009	13:21:02	15,1°C	76	17/03/2009	14:51:02	20,3°C
11	15/03/2009	14:06:02	15,0°C	77	17/03/2009	15:36:02	20,4°C
12	15/03/2009	14:51:02	14,9°C	78	17/03/2009	16:21:02	20,5°C
13	15/03/2009	15:36:02	14,8°C	79	17/03/2009	17:06:02	17,8°C
14	15/03/2009	16:21:02	14,8°C	80	17/03/2009	17:51:02	14,8°C
15	15/03/2009	17:06:02	14,7°C	81	17/03/2009	18:36:02	17,8°C
16	15/03/2009	17:51:02	14,7°C	82	17/03/2009	19:21:02	19,0°C
17	15/03/2009	18:36:02	14,7°C	83	17/03/2009	20:06:02	14,6°C
18	15/03/2009	19:21:02	17,9°C	84	17/03/2009	20:51:02	14,3°C
19	15/03/2009	20:06:02	21,3°C	85	17/03/2009	21:36:02	14,2°C
20	15/03/2009	20:51:02	22,9°C	86	17/03/2009	22:21:02	14,2°C
21	15/03/2009	21:36:02	23,9°C	87	17/03/2009	23:06:02	14,1°C
22	15/03/2009	22:21:02	24,6°C	88	17/03/2009	23:51:02	14,1°C
23	15/03/2009	23:06:02	24,8°C	89	18/03/2009	00:36:02	15,0°C
24	15/03/2009	23:51:02	18,3°C	90	18/03/2009	01:21:02	14,4°C
25	16/03/2009	00:36:02	15,4°C	91	18/03/2009	02:06:02	14,0°C
26	16/03/2009	01:21:02	15,0°C	92	18/03/2009	02:51:02	14,0°C
27	16/03/2009	02:06:02	14,8°C	93	18/03/2009	03:36:02	14,0°C
28	16/03/2009	02:51:02	14,7°C	94	18/03/2009	04:21:02	13,9°C
29	16/03/2009	03:36:02	14,6°C	95	18/03/2009	05:06:02	13,9°C
30	16/03/2009	04:21:02	14,6°C	96	18/03/2009	05:51:02	13,9°C
31	16/03/2009	05:06:02	14,5°C	97	18/03/2009	06:36:02	13,9°C
32	16/03/2009	05:51:02	14,4°C	98	18/03/2009	07:21:02	13,9°C
33	16/03/2009	06:36:02	14,4°C	99	18/03/2009	08:06:02	13,9°C
34	16/03/2009	07:21:02	14,3°C	100	18/03/2009	08:51:02	13,9°C
35	16/03/2009	08:06:02	14,3°C	101	18/03/2009	09:36:02	13,9°C
36	16/03/2009	08:51:02	14,3°C	102	18/03/2009	10:21:02	13,9°C
37	16/03/2009	09:36:02	14,3°C	103	18/03/2009	11:06:02	13,9°C
38	16/03/2009	10:21:02	14,2°C	104	18/03/2009	11:51:02	13,9°C
39	16/03/2009	11:06:02	14,2°C	105	18/03/2009	12:36:02	13,9°C
40	16/03/2009	11:51:02	14,2°C	106	18/03/2009	13:21:02	13,9°C

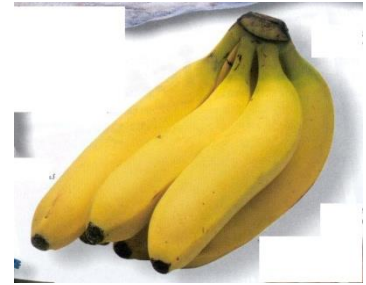
WHY IS IT USEFUL?





A BANANA = CURVED & YELLOW?

CONCLUSION



- Bananas are very sensitive products, must be handled with care and at the correct carrying instructions.
- It remains one of the most wanted fresh fruit for export, seen the nutritional value, the profit margin and the whole year round availability.
- Bananas are a challenge for the shipper, consignee, insurer and surveyor.

QUESTIONS & ANSWERS

