PHYTOSANITARY TREATMENTS FOR QUARANTINE PURPOSES MANUAL

2024 v.1

1. Hot Water Immersion Treatment of Fresh Fruits

1.1 Equipment and Authorization

- The facility responsible for applying the hot water treatment must be registered or accredited by the Ministry of Agriculture and Livestock (MAPA), in accordance with the provisions of SDA Ordinance No. 385/2021.
- The facility must be equipped with an automatic device for measuring the weight or size of the fruits in order to perform preliminary selection and exclude fruits exceeding the allowed weight before treatment.
- The treatment area and the storage area for treated fruits must be physically isolated using mesh screens of at least 10 mesh (i.e., mesh openings smaller than 2 mm), air curtains, and double-door systems to prevent the entry of fruit flies.
- The facilities must be designed to avoid any mixing between treated and untreated fruits.
- The facilities must demonstrate the capacity to raise and maintain the water temperature within the treatment tank with the precision necessary to meet the required treatment standards.
- Adequate water circulation must be ensured in the tank to maintain uniform temperature throughout the entire process.
-The design of the tank must allow fruits to remain submerged at a minimum depth of 10 cm below the water surface.
- There must be mechanisms in place to guarantee appropriate chlorine levels in the treatment water.
- The facility must have an automatic thermostatic control system that enables the setting and monitoring of reference temperatures (set points) obtained during performance testing.
- Real-time temperature reading and logging equipment must be available, capable of recording data at intervals of no more than two minutes and with a resolution of 0.1°C.
- The system must be able to report the treatment date, start time, duration, and end time, and should alert the user upon completion of the treatment to avoid overcooking.
- All monitoring equipment must be housed in a control room isolated from the treatment area, with glass panels providing full visibility of the process.
- The treatment tank must be equipped with at least two fixed resistance temperature detectors (RTDs) installed in the lower third of the tank.
- In tanks with multiple fruit baskets, a dedicated RTD must be installed in front of each basket, also in the lower third of the tank.

1.2 Annual Performance Test

- At the start of each export season, the treatment tank must undergo a performance test conducted by a Federal Agricultural Inspector (AFFA) from MAPA.
- The following equipment is required for this procedure:
    - a reference digital thermometer (standard), accurate to 0.1°C and annually calibrated by a laboratory certified by INMETRO;
    - a handheld digital thermometer with a pointed tip for measuring the internal pulp temperature of the fruits before the test;
    - a portable scale calibrated by a certified institution; and a minimum of twelve portable temperature sensors.

1.2.1 Calibration of Portable Sensors

- The water in the treatment tank must be maintained between 46.1°C and 47.8°C (115°F to 118°F) with the water circulation system fully operational.
- Each portable sensor must be numbered and identified on both ends of its cable.
- The sensors should be immersed alongside the reference thermometer and kept in that condition for five minutes for temperature equalization.
- The readings obtained from the portable sensors and the reference thermometer must be recorded on a table.
- Any sensor showing a deviation greater than ±0.3°C from the reference thermometer must be discarded and replaced.
- All deviations must be documented in a correction table and noted on the label of each corresponding sensor.

1.2.2 Calibration of Fixed Sensors in the Tank

- The water in the treatment tank must be maintained between 46.1°C and 47.8°C (115°F to 118°F) with the water circulation system fully operational.
- The portable sensor that exhibited the smallest deviation during the previous step must be selected as the reference.
- This sensor should be attached to a rod long enough to reach each fixed sensor installed in the tank.
- The reference sensor must be placed adjacent to each RTD, and both readings must be recorded.
- The reading from the portable sensor must be corrected based on the table from the previous step.
- This process must be repeated for each fixed RTD.
- The temperature differences observed are then used to calculate the corrected reference temperatures to be programmed into the thermostatic control system, which must not use any value lower than 46.1°C (115°F).

1.2.3 Selection of Fruits for Testing

- Fruits selected for the performance test must not belong to the highest weight category defined in section 1.4 (e.g., mangoes between 701 and 900 grams).
- The test must be performed using fruits with pulp temperature above 21.1°C (70°F).
- The pulp temperature is determined by inserting a handheld thermometer 1 cm deep from the fruit's skin.
- The average temperature is calculated from the readings of 10 fruits sampled from the coldest area of the lot.

1.2.4 Placement of Portable Sensors

- At least twelve portable sensors must be used during the performance test:
    - 3 for measuring pulp temperature, and:
    - 9 for measuring water temperature.
- These sensors should be distributed throughout the tank, considering areas likely to be colder.
- Their positions must be represented in a diagram.
- Each water sensor should be attached to the exterior of a fruit using adhesive tape, ensuring that the sensor tip is not covered.

- The largest fruits in the lot must be selected for pulp measurements.
- These sensors must be inserted 1 cm deep and sealed with insulating tape to prevent water infiltration.

1.2.5 Execution of the Test

- Once all portable and fixed sensors are calibrated, the test should proceed according to the immersion time and temperature parameters defined in section 1.4.
- Fruits must remain submerged at least 10 cm below the water surface.
- Sensor readings must be taken at minutes 5, 10, 15, 20, 30, 45, 60, 75, and 90, if applicable.
- From minute 5 onward, none of the water sensors may show temperatures below 46.1°C (115°F).
- At the end of the test, the pulp sensors must show temperatures of at least 45°C (113°F).
-Any test failing to meet these criteria is considered invalid.

1.2.6 Tank Certification

- Upon completion of the execution test, the AFFA must issue a performance test report including:
    - the facility's name, address, and registration code;
    - a table with fruit weights;
    - a table with pulp temperatures before and after treatment;
    - calibration tables for both portable and fixed sensors;
    - a diagram of sensor locations;
    - sensor readings at the specified intervals;
    - corrected temperature tables;
    - the minimum pulp temperature determined for valid treatments;
    - the reference temperatures to be used in the thermostatic system;
    - the inspector’s signature; and the test date.
- A copy of this report must be visibly posted in the control room.

1.3 Treatment Procedure

- The treatment must be previously communicated to MAPA as per SDA Ordinance No. 385/2021.
- Each day before treatment begins, the fixed sensors must be recalibrated, following the procedures outlined in section 1.2.2.
- The reference temperatures used in the thermostatic system must be adjusted based on the most recent performance test.
- The pulp temperature of the fruits must be higher than the minimum temperature recorded during the performance test.
- The treatment water must be clean and contain between 50 and 200 ppm of active chlorine.
-To determine the treatment time, five of the largest fruits from the lot must be weighed, and the appropriate treatment time must be identified using the immersion time versus weight table in section 1.4.
- Fruits must remain submerged at least 10 cm below the water surface during the entire treatment.

- The treatment will be deemed invalid if any two thermostatic sensors show a temperature difference greater than 1°C at any point after the first 5 minutes.
- Treated fruits must be allowed to cool naturally for at least 30 minutes.
- If forced cooling is applied, an additional 10 minutes must be added to the treatment time.
- Treated fruits must remain in a quarantine area until shipment.
- At the end of the treatment, the registered or accredited entity must issue a Phytosanitary Treatment Certificate for Quarantine Purposes, as established in SDA Ordinance No. 385/2021.
- All treatments must be reported to MAPA by the tenth business day of the following month.

1.4 Immersion Time and Temperature

The immersion time and water temperature for hot water treatment must comply with the following parameters for each of the following fruit.

Mango *(Mangifera indica)*:

Weight (g)	**Immersion Time (min)**	**Treatment Temperature (°C)**
up to 375	65	46.1 (115°F)
376 to 500	75	46.1 (115°F)
501 to 700	90	46.1 (115°F)
701 to 900	110	46.1 (115°F)

Notes:

1. The required water temperature must be reached by the end of the first 5 minutes of treatment.
2. Treatments in which the temperature falls below this threshold after 5 minutes shall be considered invalid.

2. In-Transit Cold Treatment of Fresh Fruits in Refrigerated Container

2.1 Equipment and Authorization

- The facility applying the cold treatment must be registered or accredited with the Ministry of Agriculture and Livestock (MAPA), in accordance with the provisions set forth in SDA Ordinance No. 385/2021.
- The refrigerated container used for the treatment must be equipped with a temperature recording device capable of logging the date, time, and temperature during both calibration and treatment, at intervals no greater than one hour.
- The temperature logging system must be capable of operating within a temperature range of -3°C to 3°C, with a minimum resolution of 0.1°C.
- All temperature sensors used in the process must be properly identified at both ends of their cables.

2.2 Treatment Procedure

- The execution of in-transit cold treatment must be communicated in advance to MAPA, in accordance with SDA Ordinance No. 385/2021.
- The fruits intended for cold treatment during transit must be pre-cooled in a storage chamber until they reach the specified treatment temperature.
- The temperature recorder must be activated at least 30 minutes before calibration begins and must continuously record temperatures until data extraction at the final destination.
- The identification labels and the connection integrity of each temperature sensor used must be verified prior to the start of the treatment.
- The temperature sensors must undergo a calibration process in which they are submerged in a container containing 20% water and 80% ice.
- During calibration, each sensor must show a variation of no more than 0.1°C between two readings taken at intervals of more than one and less than five minutes.
- Sensors that indicate temperatures above 0.3°C or below -0.3°C must be replaced.
- The results and times of both readings must be recorded in the application form (ANNEX I), signed by the facility's Responsible Technician.
- Once calibration is completed, the recorder must be set to reflect the correct temperature reading (0°C).
- The pulp temperature of the fruits to be treated must be measured immediately prior to shipment by the Responsible Technician of the registered or accredited facility.
- Shipment shall only be authorized if the difference between the pulp temperature and the specified treatment temperature is less than 0.28°C.
- The pulp temperature observed in each pallet within the shipment must be recorded in the application form.
- At least three pulp temperature sensors must be installed, positioned as follows:
    - At the top of the load, at the rear of the container, near the cold air return inlet;
    - At mid-height, slightly toward the rear, near the midpoint of the container;
    - At mid-height, in the pallet closest to the container doors.
- The sensor installation locations must be marked with adhesive labels.
- To determine the treatment duration, the temperature–time table defined for each species must be consulted (refer to section 2.3).

- Once the process is completed, the registered or accredited facility must issue a Phytosanitary Treatment Certificate for Quarantine Purposes, in accordance with SDA Ordinance No. 385/2021, stating that the cold treatment will be finalized during transit.
- All in-transit cold treatments performed must be reported to MAPA by the tenth business day of the following month, as established in the same ordinance.

2.3 Treatment Time and Temperature

The treatment duration and the pulp temperature of fruits subjected to in-transit cold treatment must comply with the parameters defined for each species in the table below:

Grape (*Vitis vinifera***): for** *Ceratitis capitata* **and** *Anastrepha fraterculus*

Temperature (°C)	**Treatment Duration (days)**
1.11 or lower	15
1.67 or lower	17

3. Cold Treatment in Refrigerated Chambers Applied to Fresh Fruits

3.1 Equipment and Authorization

- The facility responsible for applying cold treatment in refrigerated chambers must be registered or accredited by the Ministry of Agriculture and Livestock (MAPA), in accordance with the provisions of SDA Ordinance No. 385/2021.
- The refrigerated chamber designated for cold treatment must be equipped with a temperature recording system capable of logging the date, time, and temperature throughout the entire treatment process, at intervals not exceeding one hour.
- The temperature logging system must be password-protected and tamper-proof. It must operate within a temperature range of −3°C to 3°C, with a minimum resolution of 0.1°C.
- The system must also allow real-time visualization of the temperatures recorded by the sensors, for purposes of treatment monitoring and calibration.
- All temperature sensors must be identified at both ends of their cables.
- The number of sensors required will vary according to the cubic capacity of the chamber and the specific fruit species being treated.
- The precise placement of sensors shall be determined during the inspection process for registration or accreditation of the chamber.
- The use of pulp temperature sensors will only be required when the phytosanitary requirements of the importing country specify internal temperature thresholds for the fruit.
- Refrigerated chambers may still be authorized for cold treatment without pulp sensors, provided that there is no intention to certify shipments to countries that impose such internal temperature parameters. In such cases, the limitation must be explicitly stated in the facility's registration or accreditation file (SEI process).

3.2 Annual Performance Test

- At the beginning of each export season, the cold treatment system must be calibrated by the facility's Responsible Technician.
- The identification labels and physical connections of all temperature sensors used in the process must be verified in advance.
- The sensors must then be calibrated by submersion in a solution of 20% water and 80% ice.
- During calibration, each sensor must demonstrate a variation of no more than 0.1°C between two readings taken more than one and less than five minutes apart.
- Any sensor indicating a temperature above 0.3°C or below -0.3°C must be replaced.
- The results and timestamps of both readings must be documented and signed by the Responsible Technician, as per ANNEX II.
- After calibration, the recorder must be adjusted to indicate the correct temperature (0°C).

3.3 Cold Treatment Procedure

- The cold treatment process must be communicated in advance to MAPA, in accordance with SDA Ordinance No. 385/2021.
- The goods must be arranged inside the chamber in a way that facilitates proper airflow.
- An ambient sensor must be positioned near the cold air return inlet.
- If a second ambient sensor is necessary, it should be placed near the cold air outlet.

- Pulp sensors must be installed in the warmest zones of the refrigerated chamber, or in areas where airflow may be compromised, as identified during the facility's inspection for registration or accreditation.
- The chamber must be sealed before the start of the cold treatment and remain sealed until the process is complete.
- The official treatment start date and time shall be considered as the moment when all sensors reach the temperature established by the importing country's phytosanitary requirements and the chamber is properly sealed.
- Upon conclusion of the treatment, the registered or accredited facility must issue a Phytosanitary Treatment Certificate for Quarantine Purposes, as established by SDA Ordinance No. 385/2021.
- All cold treatments conducted must be reported to MAPA by the tenth business day of the following month.

3.4 Number of Sensors

- The number of ambient and pulp sensors required for authorization of a refrigerated chamber for cold treatment must follow the parameters established in the table defined for each species. Exceptions are detailed in section 3.1.

Grapes (*Vitis vinifera*)

Chamber Capacity (m^3)	Number of Pallets	Ambient Sensors	Pulp Sensors
0 – 283	1 – 100	1	2
284 – 566	101 – 200	1	3
567 – 849	201 – 300	1	4
850 – 1132	301 – 400	1	5
1133 – 1415	401 – 500	1	6
1416 – 1698	501 – 600	1	7
1699 – 1981	601 – 700	1	8
1982 – 2264	701 – 800	1	9
2265 – 2547	801 – 900	1	10
2548 – 2830	901 – 1000	1	11

Apple (*Malus domestica*)

Chamber Capacity (m^3)	Number of Pallets	Ambient Sensors	Pulp Sensors
Any	Any	2	4

ANNEX I – Loading and Calibration Certificate for In-Transit Cold Treatment in Refrigerated Container

LPCO: _____ Cód. do Estabelecimento: BR-_____
Exportador/ Exporter: _____
Porto de Saída / Port of Lading: _____
Porto de Entrada / Destination: _____
Nome do Navio / Name of Carrier: _____
Data Estimada da Chegada / Eta: _____/_____/_____
Identificação Container / Container ID: _____
Nº de Caixas / Nº of Boxes: _____. Peso Líquido:_____
Nº Aprox. De Cachos/Caixa / Approx. Nº of Bunches/Carton: _____
Tipo do Registrador / Recording Instrument Type: _____
Nº de Série / Serial Number: _____

CALIBRAÇÃO DOS SENSORES A 0 ºC / SENSOR CALIBRATION AT 32 ºF

Sensor	Temperatura / Temperature			Hora / Time
	01 min	02 min	03 min	
1 -				
2 -				
3 -				

Temperatura Pré-Carregamento / Pre-Loanding Temperature
(The minimum and maximum temperatures must be measured after assessing all pallets inside the cold storage chamber.)
MIN: _____ ºC MAX: _____ºC

Início e Fim do Carregamento / Start and End Loading
(The time at which loading operations begin and end must be documented
Start: _____:_____ End:_____:_____

Temperatura dos Sensores de Polpa / Pulp Temperature Sensors
1- _____ ºC 2- _____ ºC 3- _____ ºC

Signature of the Responsible Technician Date:

_____ _____/_____/_____

ANNEX II – Calibration Certificate for Temperature Sensors in Refrigerated Chamber for Cold Treatment

Facility: _____
Facility Code: BR-_____
Chamber ID: _____

SENSOR CALIBRATION AT 0 ºC

Sensor	Pulp/ Chamber	Temp (01 min)	Temp (05 min)	Deviation	Approved/ Rejected
1 -					
2 -					
3 -					
4 -					
5 -					
6 -					
7 -					
8 -					
9 -					
10 -					
11 -					
12 -					

Signature of the Responsible Technician Date:

_____ _____/_____/_____