

6

Treatment Manual

Certifying Facilities

Certification of Hot Water Immersion Facilities

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Introduction

Quarantine treatment by immersion in hot water is used primarily for fruits that are hosts of tropical fruit flies. Exposing the fruit to a temperature of at least 115 °F (46.1 °C) for specific periods of time (depending upon the specific pest, type of fruit, and size of fruit) constitutes a quarantine treatment. The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS) incorporates this principle of insect control into its regulations to facilitate the importation or interstate movement of certain fruits from areas where tropical fruit flies are the significant pests of concern.

Commercial facilities using hot water immersion treatment are subject to USDA-APHIS, certification on an annual basis. More frequent tests may be required at the option of APHIS. APHIS certification is given solely in conjunction with quarantine treatment requirements.



The certifying official shall check with the manager of the facility to be sure that he is aware of the requirement for using potable water. Whenever water comes into contact with fresh produce, the water's quality dictates the potential for pathogen contamination. To reduce the risk of food-borne illnesses, the water used for washing, treatments, and cooling must be fortified with sodium hypochlorite (household bleach), and constantly maintained at a chlorine level not to exceed 200 ppm.

Preliminary Performance Testing

If the facility has **not** been previously certified by APHIS, the operators should conduct preliminary, informal performance tests on their own (together with an engineer, if needed), to assure themselves that their equipment is in good working order.

By trial and error, the manager of the facility should decide on a tentative temperature set point for their tanks. This should be done by immersing one or more full baskets of fruit into each tank, to be certain that the water temperature (nearest the fruit) reaches at least 115.0 °F (46.1 °C) within 5 minutes. A thermostatic set point for each tank is typically in the range of 115.8 °F to 116.9 °F (46.6 °C to 47.2 °C).

As an option, some hot water immersion systems use an initial higher set point for the first several minutes, then automatically drop to a lower set point for the remainder of the treatment. (If this programming option is used, the change to the second set point must be done automatically, **not** manually.)

Data from the preliminary tests need **not** be recorded on official forms. These data, however, must be presented to APHIS, as evidence that the facility is ready for the official performance test.

Once the facility has been officially certified, APHIS does **not** require the facility to present preliminary performance test data in subsequent years, except when there have been major engineering changes to the equipment.

New Procedures for Hot Water Facility Certification and Commercial Testing

These guidelines have been issued to provide a more accurate reflection of the tank's coldest temperatures. They are **not** intended to replace existing procedures, but to be used in conjunction with the current operational framework. These guidelines are only needed for facilities **not** capturing interior probe temperatures with actual sensors and are **only** in place until each facility begins capturing interior temperatures with actual sensors. Furthermore, these guidelines will be in effect until each facility develops a procedure for placing probes in the coldest locations of the tank. Facilities already using temporary probes as a routine part of commercial testing can disregard the procedures outlined below. All new equipment and procedures must be approved by the Treatment Quality Assurance Unit (**TQAU**) before implementation.

Refer to **Figure 6-1-1** for information regarding adjusted temperatures and set points:

| 1 | 2 | 3 | 4 | 5 | 6 |
|--------------------------|------------------------------|---|---------------|------------------------------|----------------------|
| Tank Sensor (Lowest) (F) | Portable Sensor (Lowest) (F) | Adjusted Tank Sensor Temperature ¹ (F) | Set Point (F) | Treatment Interval (minutes) | Pulp Temperature (F) |
| 116.0 | 115.9 | 115.1 | 117.0 | 5 | 78 |
| 115.5 | 115.4 | 115.1 | 116.0 | 6 - 30 | 78 |
| 115.3 | 115.2 | 115.1 | 115.5 | 31 - 60 | 78 |
| 115.1 | 115.0 | 115.1 | 115.3 | 61 - 75 | 78 |
| 115.0 | 115.0 | 115.0 | 115.0 | 76 - 90 | 78 |

FIGURE 6-1-1 Hypothetical Certification Results: Treatment Tank with Multiple Set Points

1 Adjusted Tank Sensor Temperature Equation:

Take the amount of temperature exceeding 115.0 from Portable Sensor (Lowest) in column 2, and subtract it from Tank Sensor (Lowest) in column 1 ($116.0 - 0.9 = 115.1$).

1. Average minimum pulp temperatures must be taken from a minimum of 5 fruit extracted from the coldest fruit before treatment. On certification day, this average pulp temperature becomes the minimum commercial treatment pulp temperature permitted. All fruit must be at or above 70 °F to be hot water treated.
2. The "adjusted tank sensor temperature" is determined by taking the amount of temperature exceeding 115.0 from Portable Sensor (Lowest) in column 2, and subtract it from Tank Sensor (Lowest) in column 1.
3. During certification, establish the set point with its lowest corresponding charted temperature. Document these values on the PPQ Form 482, Certificate of Approval and an attachment in the format of **Figure 6-1-1**.
4. The **Figure 6-1-1** attachment and PPQ Form 482 must be displayed in a prominent location at the facility.
5. During commercial treatments, the "Adjusted Tank Sensor Temperature" is used as the lowest treatment temperature. The commercial treatment fails if the tank temperature is below the "Adjusted Tank Sensor Temperature"

Mango temperatures prior to treatment

During certification, determine and record an average pulp temperature (prior to treatment). Calculate this averaged pulp temperature by averaging pulp temperatures from the 5 "coldest" mangoes before treatment (mangoes extracted from the coldest

locations). This temperature becomes the minimum pretreatment pulp temperature allowable for commercial treatments. Therefore, during subsequent commercial treatments, mangoes must be at or above this minimum temperature before beginning treatment. (Any fruit below 70 °F cannot be treated per manual requirements).

Permanent probe temperatures

During certification, record from the printout/chart each set point with its lowest corresponding charted (permanent probe) temperature. A treatment tank may have one set point or multiple set points. If the tank has multiple set points, these set points are for a fixed length of treatment time. Refer to **Figure 6-1-1** for a detailed explanation. This "adjusted tank temperature sensor" (always above 115.0 °F) becomes the lowest temperature permitted for that set point, or the "standard" at that set point. Commercial temperatures (permanent probe temperatures from the chart/printout) must be equal to or greater than the set point standard for each length of time. Document each "adjusted tank sensor temperature" determined during certification, on the PPQ Form 482, Certificate of Approval and on the attachment to the Certificate.

Procedures for Conducting the Annual APHIS Performance Test

To approve the facility, the APHIS officer (or designated representative) shall take the following steps:

- 1.** If the facility has **not** been previously certified, or if modifications have been made since the last performance test, compare the plans and drawings with the actual installation.

Clearly show dimensions, water circulation, temperature sensing and recording systems, and safeguarding precautions in the plans and specifications.

- 2.** Conduct a performance test (at least annually), during an actual treatment (as described below), to determine (or verify) a temperature "set point" for the system, and to determine the minimum duration of time required between the immersion of successive baskets of fruit within the same tank.
- 3.** Inspect the heating, water circulation, and alarm systems, and check to see that all necessary safeguards (including screens, fans, locks, and air curtains) are secure and operational.
- 4.** Calibrate the portable sensors, recording the results on APHIS form 205 (or a plain sheet of paper).

- A.** Using a factory-calibrated, mercury, non-mercury or digital thermometer as the standard, compare the reading of each portable sensor to the standard, and record any deviation.
 - B.** To facilitate this process, a specially designed, portable temperature calibrator may be used, which uses either hot air or a swirling hot water bath, set at approximately the temperature at which treatments will take place; a treatment tank can also be used for this purpose, provided that the water is kept in motion.
- 5.** Examine the calibration of the tank's permanent RTD sensors, and record the results on APHIS form 206.
- 6.** Tape the cords of three or four portable "water temperature sensors" to the skins of three or four selected fruits in each basket. (Do **not** cover the end of the sensor with tape.)
- 7.** Insert a portable "pulp temperature sensor" approximately one centimeter into the flesh of one or more fruits in the tank.
 - A.** Hold the sensor in place with tape.
 - B.** It is **not** necessary to have a pulp temperature sensor in each basket.
- 8.** Set the fruit at ambient temperature (70 °F or above) immediately prior to the performance test.

If the fruit is pre-warmed by artificial means, note this routine as a condition of approval that should be followed for each commercial treatment.

- 9.** On the location diagram (APHIS form 207), show the relative position of each portable sensor used in the test, and indicate whether it is a "water" or a "pulp" sensor. Number each sensor.
- 10.** While the fruit are immersed in water, use an electronic thermometer to monitor the temperatures of each portable sensor at various times throughout the test. (record this information on APHIS form 208 for each tank.)

As a second option, a portable, automatic recording instrument can be used; it must, however, operate independently from the temperature recording system installed at the facility.

- 11.** During the performance test, lower the baskets of fruit into the hot water immersion tank.
 - A.** Closely monitor the "water temperature sensors" during the first five minutes of treatment.

APHIS requires that the temperatures of all “water temperature sensors” must reach at least 115 °F (46.1 °C) within 5 minutes; if **not**, in order to achieve the 5-minute temperature recovery requirement, repeat the test using other fruit, using a slightly higher water temperature set point, and/or a slightly longer time interval between subsequent basket immersions.

- B.** Run the test for the full duration (up to 90 minutes, depending upon fruit size).

During that time, all “water temperature sensors” must read at least 115 °F (46.1 °C) at the 5 minute point and beyond; in addition, the “pulp temperature sensor” (or sensors) must read at least 113 °F (45 °C) *by the end of the test*.



It should be noted that APHIS standards for passing the official performance test are higher than the standards accepted for commercial treatments. This is intentional. *During commercial treatments* of mangoes, the water in the tank is allowed up to 5 minutes to reach the minimum treatment temperature of 115 °F after the fruit have been submerged.



The mango hot water schedules also have a built-in tolerance for subnormal temperatures in the range of 113.7 °F to 114.9 °F for up to 10 minutes (in the case of 65 or 75-minute treatments), or 15 minutes (in the case of 90-minute treatments). This tolerance was designed to “save” an ongoing treatment during an emergency situation such as an electrical power outage. However, *for purposes of the official performance test*, all water temperature sensors are required to read at least 115.0 °F within the first 5 minutes, and to maintain temperatures at or above that threshold during the remainder of the treatment.

- 12.** For issuance of a Certificate of Approval (PPQ form 482), submit all supporting documents to the APHIS-Regional Office (or to another APHIS office delegated by the Region).
- 13.** APHIS will certify the facility only when all requirements are met, including *two* successful hot water immersion treatments in each tank, using standard fruit loads.

For annual recertification, however, only *one* successful performance test is required per tank, unless the Work Plan requires additional tests. Submit a copy of PPQ Form 482, the corresponding attachment (**Figure 6-1-1**), all forms used in the certification or recertification and printouts from the temperature recorder to **TQAU**.

Protocols for Foreign Treatment Facilities

This section has been moved to the [Commodity Preclearance Program Management Guidelines](#).

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