6

Treatment Manual

Certifying Facilities

Certification of Forced Hot Air and Vapor Heat Treatment Facilities

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Introduction

Forced hot air (FHA) and vapor heat (VH) treatment facilities must be certified by a qualified APHIS inspector. For brevity, "certification" and "re-certification" will both be referred to as "certification" in this chapter.

Prior to the first certification at a facility, the facility plan and process description must be approved by the Treatment Quality Assurance Unit (TQAU) (TQAU contact information can be found at the end of the chapter). Certification tests must be carried out prior to treatment at the beginning of the shipping season or whenever APHIS determines that a malfunction or alteration in the system warrants a certification test.

Certification will be granted on the basis of the ability of the chamber to meet treatment requirements, extent and condition of phytosanitary safeguards, sanitary (human health) conditions, and safety conditions. Facilities must be certified for each species (in some cases each variety or subspecies) of fruit, each chamber load configuration (half full, quarter full, etc.…), and, for some species, each size class of fruit treated.

Facilities should be aware that certification may not be the only condition under which they may treat fruit for shipment to or within the US. In addition to certification, there are other requirements such

as agreeing to an operational workplan, signing compliance agreements, and obtaining import permits that must be satisfied prior to treatment. Treatment facility managers outside the US should contact APHIS International Services (IS) and managers of facilities in the US or its territories should contact their local PPQ office for a complete list of requirements.

Plan and Process Approval

Prior to the start of facility construction, a detailed plan of the facility's physical characteristics and a written, step by step, description of the all the processes related to treatment must be approved by TQAU (all plans and supporting materials must be submitted in Standard English). Plans and process descriptions for facilities within the US and its territories must be submitted through the local PPQ office, facilities outside the US should consult APHIS IS for the appropriate plan submission procedure.

At a minimum, plans must include the following information as diagrams and/or written descriptions:

1. Physical location of facility.
2. Areas designated for fruit arrival.
3. Areas for storage of untreated fruit.
4. Pre-treatment sorting and grading areas.
5. Crates, lugs, bins, etc.... that will be used to hold fruit during treatment, including total volume and projected fruit capacity.
6. Delineations of area(s) for storage of treated and untreated fruit.
7. Treatment chamber including heating system, crate arrangement within the chamber, and air flow.
8. Post-treatment cooling system.
9. Post-treatment packing.
10. Areas designated for loading of treated fruit.
11. Systems designed to ensure phytosanitary security of the treated fruit.
12. Systems designed to ensure water which comes into contact with fruit is free of microbial or any other contaminants that may adversely affect human health.
13. Description of all processes related to treatment of fruit. These descriptions should reference diagrams with numbers where appropriate.

The process of reviewing the plans and process descriptions may take as long as sixty days and subsequent requests for additional information may further extend this time. Facilities should take this time constraint into account when developing a project timeline. Facilities will receive a letter granting plan approval or describing plan deficiencies. Plan approvals expire one year from the approval date if the facility has not been certified.

Preliminary Performance Testing

Following plan approval, the facility should be built according to the plans. If deviations from the plans are necessary, TQAU must approve these changes (changes should be submitted in a manner similar to that described in "Plan and Process Approval"). After construction is completed, the facility must be tested to be sure it can meet all treatment requirements. These trials should test the ability of the treatment chambers to heat a full (maximum) load of fruit to according the treatment guidelines. Any problems or deficiencies found in the facility must be corrected and the preliminary tests must be re-run until all treatment requirements are met. After the facility representative is satisfied that the treatment system is running properly and can fully meet treatment requirements, they must submit results of the test to TQAU for review.

General requirements for test result submission are in the list below, facilities will be provided with specific requirements as part of the plan approval letter.

1. Amount, type, and size of fruit in load and in each crate.
2. A diagram of chamber that shows location of each permanent sensor.
3. Time and temperature data from the test run(s).

The process of reviewing results from preliminary performance tests may take as long as 30 days. After TQAU reviews the results from the preliminary performance test, they will issue a letter either approving or rejecting the results. If approval is granted, the facility representative can then schedule an official certification test.

Official Certification Testing

The official certification test has four main components: (i) calibrating the portable and permanent sensors, (ii) permanent sensor heat up test (iii) thermal mapping (cold spot mapping), and (iv) conducting an actual test treatment. These steps are discussed below in detail. A

certification test must be completed for each combination of fruit species, chamber load configuration, and, in some cases, fruit size class.

Calibrating the Portable Temperature Sensors

If the facility is outside the US, it is the responsibility of the exporter to provide portable temperature sensors for the certification procedure.

NOTICE

Only portable sensors approved by **TQAU** may be used. Contact **TQAU** for a list of approved temperature sensors.

Permanent sensors may not be substituted for portable sensors.

Portable temperature sensors must be calibrated in a swirling hot water bath with a factory calibrated certified glass mercury thermometer with 0.1°C (0.2°F) graduations as a standard. The temperature of the swirling hot water bath must consistently read the treatment temperature on the certified thermometer. Portable temperature sensors must be inserted into the hot water bath and must remain until the certified thermometer reads the treatment temperature for ten consecutive minutes. After the 10 minute calibration period, the portable sensors may be removed and their data read. Any sensor that deviates by more than +/- 0.3°C (0.5°F) from the treatment temperature may not be used. The greatest deviation for each portable sensor should be recorded as the correction factor for that portable sensor.

Important

Prior to each use, carefully inspect the calibrated certified glass mercury thermometers for bubbles in the mercury or other defects.

Calibrating the Permanent Temperature Sensors

The permanent temperature recording system should be calibrated in the same manner described for portable sensors described in "Calibrating the Portable Temperature Sensors".

However, it should be noted that this calibration is not just for the sensor portion of the temperature recording system, but applies to the sensors, the wires that attach the sensors to the recording instruments, the recording instruments, and any other devices used to measure, transmit, or record the temperature. Failure of the permanent temperature recording system to read within +/- 0.3°C (0.5°F) of the treatment temperature may indicate that a portion of or the entire permanent temperature recording system needs to be

repaired or replaced. If any part or portion of the permanent temperature recording system is repaired or replaced, the entire permanent temperature recording system must be recalibrated.

NOTICE

Calibration of permanent and portable temperature sensors must be completed before the permanent sensor heat-up test, thermal mapping, and or test treatment is performed.

Permanent Sensor Heat-up Test

The permanent temperature sensor system must be tested against the portable temperature sensors to verify that the permanent temperature sensors correctly respond to changes in temperature within the chamber.

This test is performed by arranging permanent temperature sensors and portable temperature sensors in close proximity within the treatment chamber. A maximum ratio of 2 permanent sensors to one portable sensor is allowed for this test. Sensors should be placed in locations within the chamber that are expected to have relatively uniform heating patters. After all sensors are secured within the chamber, conduct the treatment as usual. When the test is complete, review the data. All data collected from the permanent temperature sensors must be within +/- 0.3°C (0.5°F) of the corresponding portable temperature sensor.

Thermal Mapping

Thermal mapping determines the placement of permanent temperature sensors in the chamber. Because the permanent temperature sensors will be placed in the coldest areas of the chamber, this process is also referred to as cold spot mapping or cold spot testing. The process of thermal mapping is relatively simple, portable temperature sensors are placed throughout the chamber and the treatment is conducted. The sensors that took the longest time to record treatment temperature represent colder areas of the chamber. Thermal mapping can be time consuming and resource intensive. The procedure is as follows:

1. Based on basic thermodynamics and data from the preliminary performance test, develop hypotheses about which regions of the chamber are most likely to have cold spots. This will be based primarily on the direction of the air flow in the chamber. Chambers in which air flows in a single vertical direction will generally have cold regions in portions of the load that come into contact with the heated air last. For example, if the chamber delivers hot air from the bottom, the top of the load is likely to take longer to heat up because the fruit at the bottom absorbs heat first. In chambers where the air flow changes direction or the air delivery is horizontal, it may be more difficult to form these types of hypotheses.

2. Inspect fruit to be used in test to be sure it is similar in size, ripeness, and variety to the fruit that will be routinely treated. Fruit should be sorted and a subset totaling the number of portable temperature sensors plus 20% should be selected. The difference between the heaviest and lightest fruit must not be more than 5% of the heaviest fruit's weight.
3. Each sensor must be placed in one of the fruit in the subset collected in #2 above. The most sensitive portion of the temperature sensor must be placed in the area of the fruit pulp most resistant to temperature change, usually the center of the fruit or close to the pit.
4. Based on the hypotheses formed in #1 above, place the majority of the portable temperature sensors in the areas thought to be cold regions. In order to verify the hypothesis, place a portion of the portable temperature sensors in the areas thought to be warmer. If no hypotheses were formed in #1 above, portable temperature sensors must be placed in a systematic pattern that can provide a complete thermal map of the entire load. If necessary, contact TQAU for assistance developing a thermal mapping sampling scheme.

NOTICE

Each chamber may require a different number of portable sensors depending on factors such as the chamber size, chamber dimensions, air flow patterns, and size and species of the fruit. Typically, a chamber approximately the size of a standard 40 ft. shipping container will require about 60 sensors. Contact **TQAU** for help in determining the number of sensors required.

5. Create a map of the chamber that shows the relative horizontal and vertical location of each portable temperature sensor.
6. Conduct the treatment.
7. Remove the portable temperature sensors and read their data.
8. Determine the amount of time each portable temperature sensor took to reach treatment temperature. The portable temperature sensors which required the longest time to reach treatment temperature indicate cold spots.

NOTICE

All portable temperature sensors must reach treatment temperature.

9. Create a map of the cold spots based on the map created in step #5 and the analysis completed in step #8.
10. Repeat this process at least twice for each load / volume configuration to ensure that correct and consistent cold spots are found.

11. Based on the thermal maps created in step #9, create a map showing the location of each permanent temperature sensor for each load/ volume configuration.

If thermal mapping shows that difference in the time required to reach treatment temperature between any two sensors is greater than 2 hours, the chamber will not be certified.

Conducting a Test Treatment

A test treatment must be performed to verify that the chamber is capable of meeting treatment requirements. Test treatments are only required for the maximum load/volume configuration that the facility will be certified for and may be done in conjunction with the thermal mapping described above. The procedure for conducting a test treatment is as follows:

1. Place permanent temperature sensors in areas of the load that are thought to be cold spots (based on thermal mapping data).
2. Conduct the treatment.
3. During treatment, inspect the outside of the chamber to be sure it is free of leaks, is operating smoothly, and generally is in good working order.
4. After treatment is completed, review the temperature logs from the permanent temperature sensors. All permanent temperature sensors must have reached the treatment temperature.

Frequency of Certification

A certification test is required once a year, usually at the beginning of the shipping season, and whenever the system has a malfunction, breakdown, or other failure (excluding malfunction of temperature sensors) that require modifications that alter the manner in which the system functions.

Frequency of Permanent Temperature Sensor Calibration

Permanent temperature sensors must be calibrated using the process described in "Calibrating the Permanent Temperature Sensors" on page-6-6-4. Calibration of permanent temperature sensors must be performed every 14 days. However, calibration can also occur whenever any part of the permanent temperature recording system fails or is replaced, or at the discretion of the APHIS inspector.

Documentation

All tests performed during certification must be documented by the APHIS official. A copy of the signed APHIS Form 482, copies of all thermal maps, description of load size limitations, description of any other special limitations placed on the treatment, and any other pertinent addenda or appendices, must be sent to TQAU for final approval.

Contact Information

TQAU

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