H.T.S.T. EQUIPMENT TEST PROCEDURES

Field Reference

Sequence of Testing

Equipment testing should be conducted in the following sequence to minimize equipment run times.

Pasteurizer Not Operating – 3, 1, 4, 2, 7, 10, 8, 5B, 5E, 5C (dual stem), 9

Pasteurizer Operating – 5A, 5C (single stem), 5G, 11, 5D, 5F

Test 01  **Indicating Thermometer - Temperature Accuracy**  
(Tolerance - .5 °F indicator, 1 °F airspace)

Prepare a water bath at a temperature within (over) 3 °F of the appropriate pasteurization temperature. Remove the heat source and agitate. Insert check thermometer and indicating thermometer and compare readings. Repeat.

Test 02  **Recording Thermometer - Temperature Accuracy**  
(Tolerance – 1 °F)

Prepare 3 water baths (boiling, ice water and pasteurization range). Immerse the recorder in boiling water for 5 minutes. Remove the recorder from the boiling water and immerse in water at pasteurization temperature and compare with the indicator after a 5 minute stabilization period. Repeat with ice water bath.

Test 03  **Recording Thermometer - Time Accuracy**  
(Tolerance – Recorded time of pasteurization not to exceed the true elapsed time)

Compare the recorded time over a period of 30 minutes with an accurate watch. Enter on chart and initial.

Test 04  **Recording Thermometer Check Against Indicating Thermometer**  
(Tolerance – Recording thermometer shall not read higher than indicator)

Compare the indicator temperature with the recorder temperature at a stabilized pasteurization temperature.

Test 05  **Flow Diversion Device - Proper Assembly and Function**

A.  **Leakage Past Valve Seat**

On initial H.T.S.T. start-up with steam to heater off and system operating with FDD in diverted flow position, disconnect the forward flow piping from the FDD. Observe the valve seat for leakage.
B. **Operation of Valve Stem**

Place recorder in water bath above cut-in temperature. Place device in forward and divert flow several times and observe ease of stem movement.

C. **Device Assembly**

**Dual Stem** – With FDD in divert flow, remove one actuator clamp. Move device to forward flow and disconnect stem from actuator. Move device to divert flow and turn on metering pump. Pump should not run when FDD is improperly assembled.

Reassemble the FDD by moving it to forward flow and reconnecting the stem to the actuator. Repeat for the other actuator.

**Single Stem** – With H.T.S.T. system operating as in test 5A above, unscrew by one-half turns the 13 H hex nut which holds the top of the valve to the valve body. The metering pump should de-energize. Tighten the FDD hex nut and reconnect the forward flow piping. Start the metering pump. When divert flow is attained, remove the connecting key located at the base of the valve stem. The metering pump should de-energize.

D. **Manual Diversion**

1. With the H.T.S.T. system operating at maximum operating pressure and with FDD in forward flow, press the manual divert button. This should cause:
   
   1. FDD to assume divert position
   2. De-energization of booster pump with pressure differential between raw and pasteurized maintained at 1 p.s.i. minimum.

2. With the H.T.S.T. system in forward flow, press the manual divert button until the raw pressure reaches 0 p.s.i. Release the manual divert button and observe that the pressure differential between raw and pasteurized indicators is maintained at 1 p.s.i. minimum.

E. **Response Time**

(Tolerance – 1 sec.)

With recorder immersed in a bath slightly above pasteurization temperature, allow to cool gradually. At the moment of cut-out, time the stem movement through the fully divert position.
F. **Time Delay Interlock with Metering Pump (Dual Stem Devices)**
(Metering pump must run down before FDD assumes forward flow after manual diversion)

With system operating in forward flow move control switch to “inspect” position. The following must occur in sequence:

1. FDD moves to divert flow and metering pump is turned off.
2. FDD remains in divert while metering pump runs down.
3. After metering pump stops, FDD assumes forward flow position.

Repeat with C.I.P. mode.

G. **Flush Delay (Dual Stem Devices)**
(Tolerance – 2 sec. delay)

With the H.T.S.T. system operating in divert flow, slowly raise temperature to forward flow cut-in. At the moment of cut-in, the forward flow actuator should move to the forward flow position. A cam timer will delay actuation of the leak detect valve to flush unpasteurized product from the area between the valves. With a stopwatch, time the delay from the moment the forward flow valve assumes fully forward position to the moment the leak detect valve begins actuation. It may be possible to perform this test with hot water bath if the cam timer is not de-energized through the metering pump.

**Test 06  Leak Protection Valve**

Test not applicable to H.T.S.T. system.

**Test 07  Indicating Thermometer on Pipelines - Thermometric Response**
(Tolerance – 4 sec. over 12 °F temperature range)

Establish a water bath slightly above maximum pasteurization temperature for the thermometer for the thermometer being tested. Immerse indicator in cool water bath. Insert indicator in hot water bath and start stopwatch at 19 °F below bath temperature and stop stopwatch at 7 °F below bath temperature.

**Test 08  Recorder / Controller - Thermometric Response**
(Tolerance – 5 sec. over 12 °F temperature range)

Establish a water bath at 7 °F above cut-in temperature using indicator. Immerse recorder in bath and start stopwatch at 12 °F below cut-in temperature and stop stopwatch when controller cuts-in.
Test 09  Setting of Control Switches - Regenerator Pressure

Pressure Gauge Accuracy
(Tolerance – 1 p.s.i.)

1. Remove both differential pressure controller sensors from their process locations and attach to the tee of the pneumatic testing device.

2. Both needle indicators should be within .5 p.s.i. of 0. If not, adjust them to read 0.

3. Pressurize the pneumatic tube to the normal operating pressure of the pasteurized side of the regenerator and observe the position of the needle indicators. The indicators must be within 1 p.s.i. of each other.

4. Quickly exhaust the air from the pneumatic tube while observing the indicators as they drop to 0 or their static position. The indicators should not deviate greater than ± 1 scale unit during the drop.

Pressure Switches Used to Control Operation of the Booster Pump

1. After completion of accuracy testing, move the sensors to separate fittings in order that pressure to each fitting may be controlled by a separate regulator.

2. Apply air pressure to the white needle indicator sensor (raw) to attain the normal operating pressure of the booster pump.

3. Press the test button while slowly applying pressure to the orange needle indicator sensor (pasteurized) until the test light turns on (or you hear the microswitch activate). Record cut-in differential.

4. Slowly decrease pressure to move the orange needle indicator down scale until the test light turns off. Record cut-out differential.

The test light should not turn on until the orange needle indicator is at least 2 p.s.i. higher than the white needle indicator, and the test light should turn off when the orange needle indicator is no less than 2 p.s.i. higher than the white needle indicator.

5. When the test is complete, the pressure sensors must be reinstalled in their normal process locations and, with connections loose to drain any accumulated water, readjust both indicators to read 0 p.s.i.
Test 10  **Milk Flow Controls - Cut-in, Cut-out Temperature**

**Cut-in**

Establish a water bath slightly below pasteurization temperature and immerse recorder and indicator in bath. Increase heat gradually (1 °F per 30 sec.). Read indicator when controller cuts in. Record on chart.

**Cut-out**

With recorder and indicator in bath above cut-in temperature, slowly cool bath (1 °F per 30 sec.). Read the indicator when controller cuts out. Record on chart.

Check to see if the frequency pen is synchronized with the recording pen on the same arc.

Test 11  **Continuous Flow Holders - Holding Time**

(Tolerance – All 6 tests in both forward and divert flow within .5 sec. of each other. If consistent readings cannot be obtained, use the fastest time as the holding time. Holding time must meet or exceed legal pasteurization time and temperature requirements for the product being pasteurized.)

1. Using water, operate the H.T.S.T. with all flow promoting devices at maximum flow capacity. Conduct holding tube time test with salt injection equipment in both forward and divert flow (6 tests in each position).

2. Conduct a can fill test using both water and milk in order to determine the actual holding time for milk. Use one of the following methods for determining the holding time for milk:

   a. **Equal Volume Method**

   \[
   \text{Holding time milk} = \frac{T \times M_v}{W_v}
   \]

   Where  
   
   \(T = \text{Hold time with water}\)  
   \(M_v = \text{Time to deliver measured volume of milk}\)  
   \(W_v = \text{Time to deliver measured volume of water}\)

   b. **Equal Weights Method**

   \[
   \text{Holding time milk} = \frac{T \times M_v x 1.032}{W_v}
   \]

   Where  
   
   \(T = \text{Hold time with water}\)  
   \(M_v = \text{Time to deliver a weighted quantity of milk}\)  
   \(W_v = \text{Time to deliver an equal weight of water}\)  
   \(1.032 = \text{Specific gravity of milk}\)