Module 7. Thermal Processing System Components, Instrumentation, and Equipment, and Process Room Operation

Thermal Processing for Meat and Poultry Products Training
Temperature Indicating Devices

- Mercury-in-glass (MIG) thermometer serves as the reference instrument for LACF
- Alternative devices such as thermocouples or resistance temperature devices (RTD) or digital temperature gauges (DTG) may be used
- Each retort is required to have at least one MIG thermometer, DTG, RTD or equivalent thermometer or electronic device (PLC)
Mercury-In-Glass/Equivalent Thermometer

- Easily readable to 1°F
- MIG range not to exceed 17°F/inch graduation
-Installed where easily read
-Installation location varies depending on retort type
Temperature Indicating Devices

- Tested for accuracy when installed and annually
- Defective devices **must** be repaired or replaced
Example of Alternative Device (RTD)

Sensor of RTD installed on Retort and the Display
No specific regulation regarding temperature indicating devices

Calibration is necessary
Need an accurate reference device, e.g., a instrument of known accuracy.

Need a testing device that provides consistent temperature
Calibration Tree for MIG Thermometers
The accurate reference device must be traceable to a national or international standard.

In the U.S., traceability is provided by the National Institute of Standards and Technology (NIST).

Records of the accuracy checks must be maintained.
- Records must specify the following information:
  - Identification of the device (MIG/DTG/RTD)
  - Manufacturer of the device
  - Identification of the reference device
  - Equipment and procedures used for check
  - Date and test results
  - Name of person or facility performing test
  - Date of next test (optional)
Temperature Indicating Devices

- Each device must have a tag, seal, or other means to identify it and correlate it with the accuracy check record.
- A record is necessary for documenting the accuracy of the reference device.
- For acidified foods, no specific requirements on the type of device – should still test for accuracy.
Low-acid foods:

- Required for each retort
- Can be combined with the steam controller to be a recorder controller
- Provides a permanent record of temperature and time for the thermal process
Temperature/Time Recording Devices

- The temperature/time recorder should agree as close as possible with MIG/RTD but never higher
- Accuracy to 1°F
- Pen arc adjusted properly
- Time of day set properly
- Prevent unauthorized changes with a lock or notice
Chart-Type Recorders

- Use appropriate chart paper
- Graduations not to exceed 2°F within a range of ±10°F of the process temperature
- Scale not to exceed 55°F/inch within ± 20°F of the process temperature
Temperature/Time Recording Devices

- Continuous line or multipoint plotter
- Installation location of recorder bulb or sensor will vary based on the type of thermal processing system
- Pasteurizers must be equipped with a temperature/time recording device.
- Must be operated to ensure uniform heat distribution throughout the processing system.
- Heat distribution data must be kept on file.
Each retort **must** have an automatic steam controller

- Air operated, electrically operated or self-activated
- Controller may be combined with recorder to form recorder-controller
Pneumatic Control System

PV - Pilot Valve
D - Diaphragm
F - Flapper Valve
N - Nozzle
R - Reducing Tube
S - Valve Seats for Pilot Valve Plunger

Temperature Bulb
Thermal Tube
Pen Arm
Bourdon Tube
Air Inlet
Air to Controller Valve
Pneumatic Control Valve

AIR IN
DIAPHRAGM

SPRING

VALVE
Electronic Automated Control Systems

- Can be programmed to control entire process
- Consult with processing authority
- Regulatory review may be necessary

Momentum by FMC

ICON by Stock
Instrument Air Supply Requires:

- Adequate filter system
- Clean, dry air at the proper pressure
- Independent air supply system
Air Supply

Recording Controller

Reducing Valve Set for 20 psi

1/2” Minimum Main Air Supply 75-100 lb per sq in

Aftercooler

Water in

Water out

Drain

Intake filter

Filter

Drain

Air Filter

Use 1/4” O.D. Copper Tubing For Instrument Air Supply Line
Pressure Gauges

- Scale should not exceed 2 PSI
- Useful when processing with overpressure, pressure cooling and as safety device
Wristwatches are not permitted
Use analog or digital clock
Located where easily and accurately read
Instrument and plumbing maintenance is essential to proper operation.

The regulations require that each thermal processing system be examined at least once a year.
Steam Supply:

- Steam is the most common heating medium
- Supply of steam to thermal processing area must be adequate to bring the retort up to process temperature
Globe valve - better sealing
Gate valve - full flow
Valve Types and Uses

- Gate or Ball: Used on vents for rapid discharge and are full flow
- Air and water lines connected to the retort must be equipped with a globe valve or other suitable valve to prevent leaking into the retort
- Double block and bleed configurations or three-way valves are often installed on water or air lines used for cooling
Set-up to protect against leaking
Bleeders

Small openings on retorts used for:

- Circulation of steam
- Air removal that comes in with the steam
- Condensate removal

Required on external wells when the MIG/DTG and recorder probes are installed in an external well.
Spreadsers

- Continuation of steam or water lines inside retort
- Perforated pipe to provide uniform distribution of steam or water in the retort
Mufflers

- Used on vents and bleeders to reduce noise
- **Must** not reduce air removal or interfere with heat distribution
- Cartridges must be inspected and replaced as needed
Pasteurizers for Acidified Low Acid Canned Products

- Use steam or water at atmospheric pressure
- Generally heater/cooler combination
- Continuous container handling
- Need temperature distribution studies to show how uniform heat is maintained
Operating processes and procedures **must** be posted in conspicuous place or be readily available to the operator and CSI.
Prevention of Retort Bypass

- A system for product traffic control must be established to prevent containers from bypassing the retort.
- Each crate or at least one container in each crate must be marked with a heat sensitive indicator.
Heat-Sensitive Indicators

- Paint, tags, tape, or ink
- Color change merely indicates heating medium contacted the container
- Visual check must be performed
Other Precautions

- Close retort door only when ready to start the thermal process
- Cans of doubtful status **must** be destroyed
Coding of Containers

- Each container **must** be coded
- Codes are embossed or imprinted
- May be legibly marked on a securely affixed container label
Coding of Containers

Code Requirements:

- Product unless printed on the container
- Year packed
- Day packed
Importance of Coding:

- Provides way to isolate and/or retrieve questionable product
- Frequent code changes minimize amount of questionable product
Initial Temperature (IT)

- Temperature of the coldest component in the product when thermal process begins
- **Must** be determined for coldest container in retort
The Initial Temperature is a critical parameter and is as important to adequacy of the heat process as retort temperature and process time.
FSIS requirements:

- Temperature indicating device
- Means of circulating the air inside the incubator
- Time/temperature recorder
- 1 container per retort load or 1 per 1,000 containers
- Samples held at 95°F ± 5°F for 10 days (240 hours)
- Product held until incubation completed
- May propose alternate plans
Questions?