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

Thermal Processing for Meat and Poultry Products Training

USDA

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)

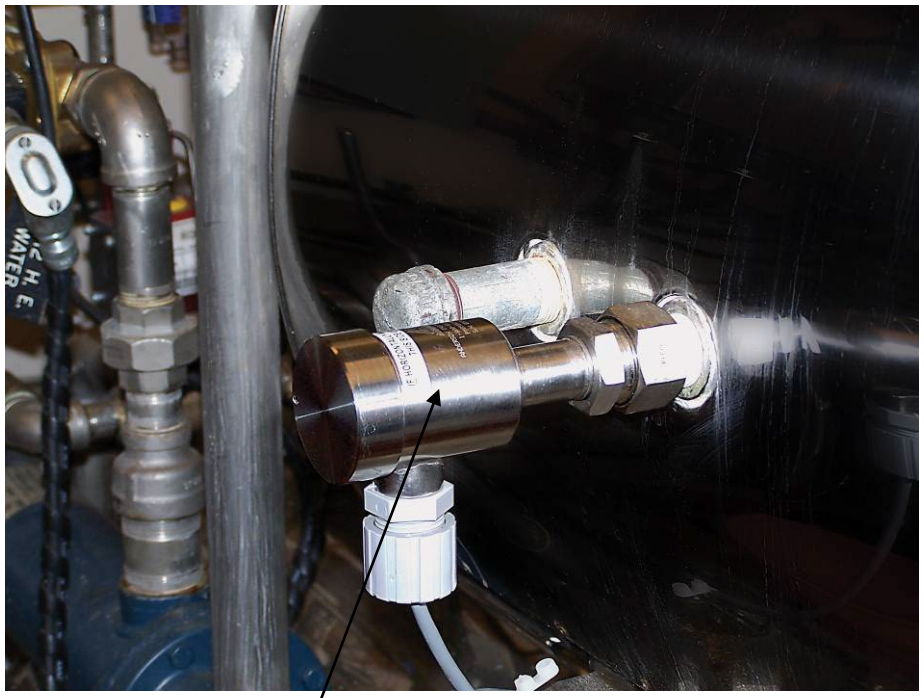
Mercury-In-Glass/Equivalent Thermometer

- 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

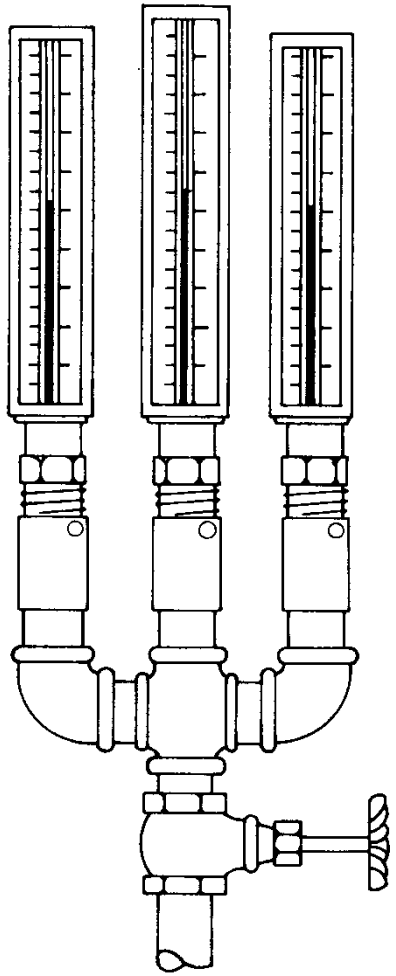
Temperature Indicating Devices- Acidified Low Acid Canned Foods

- No specific regulation regarding temperature indicating devices
- Calibration is necessary

Checking the Accuracy of Thermometers

- 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



Temperature Indicating Devices

- 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

Temperature Indicating Devices

- 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)

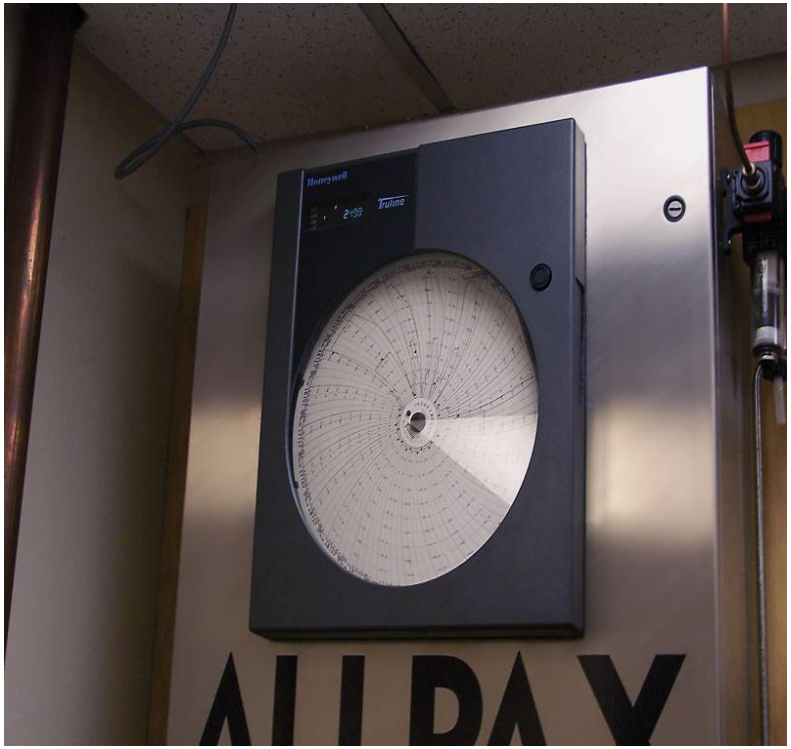
Temperature Indicating Devices

- 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

Temperature/Time Recording Devices

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

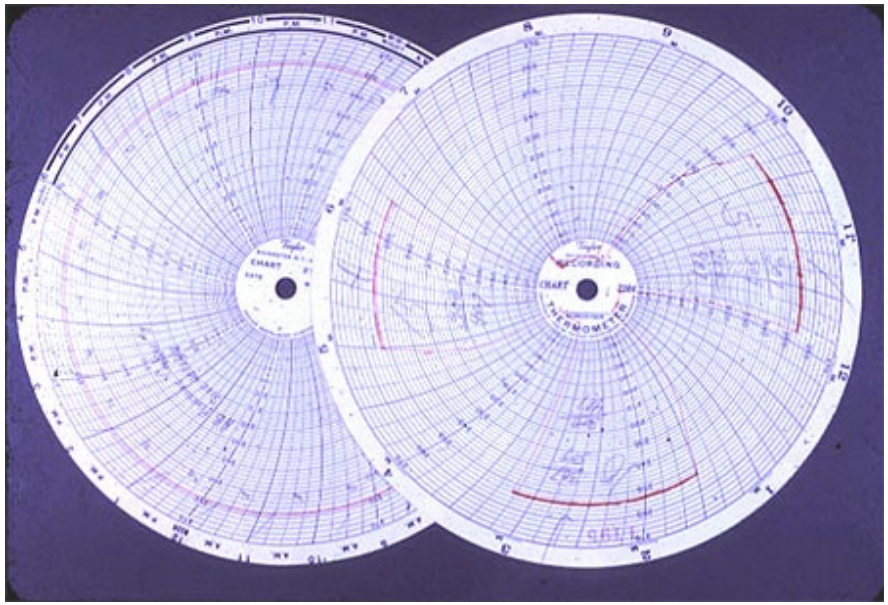


Temperature/Time Recording Devices

- 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

Temperature/Time Recording Devices Acidified Low Acid Canned Foods

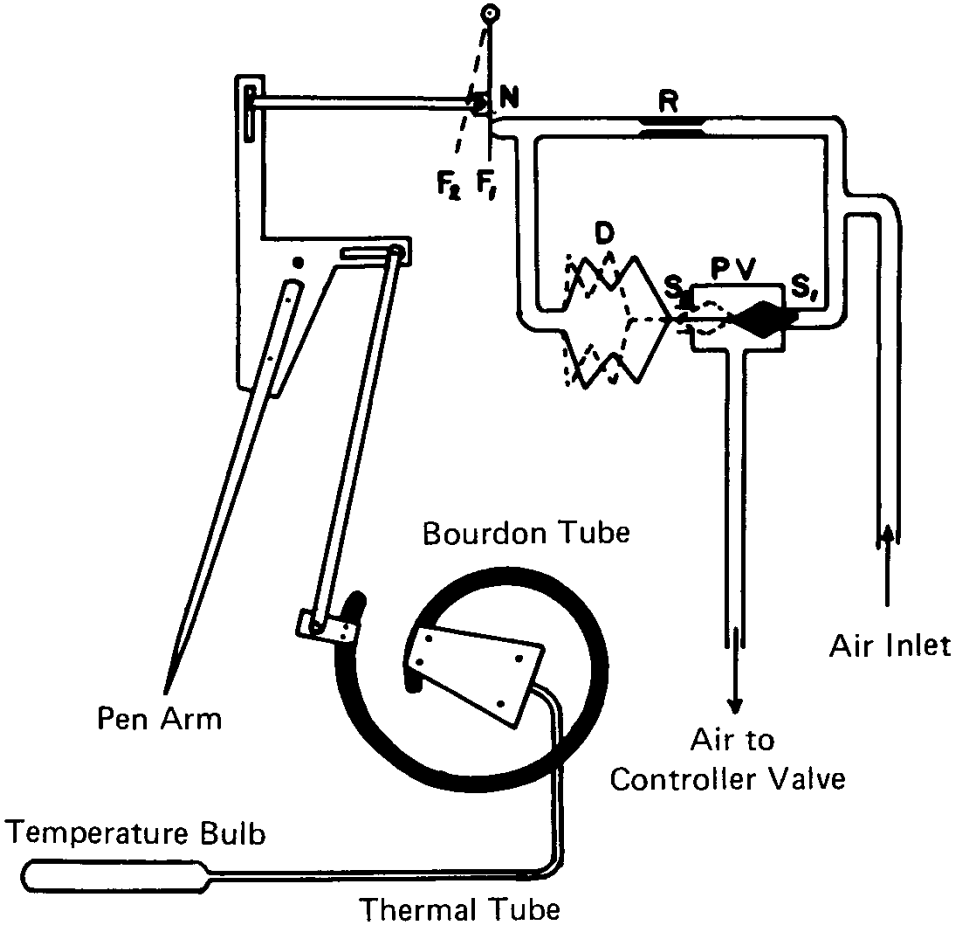
- Pasteurizers must be equipped with a temperature/time recording device
- Must be operated to ensure uniform heat distribution throughout the processing system
- Heat distribution data must be kept on file

Temperature Control System

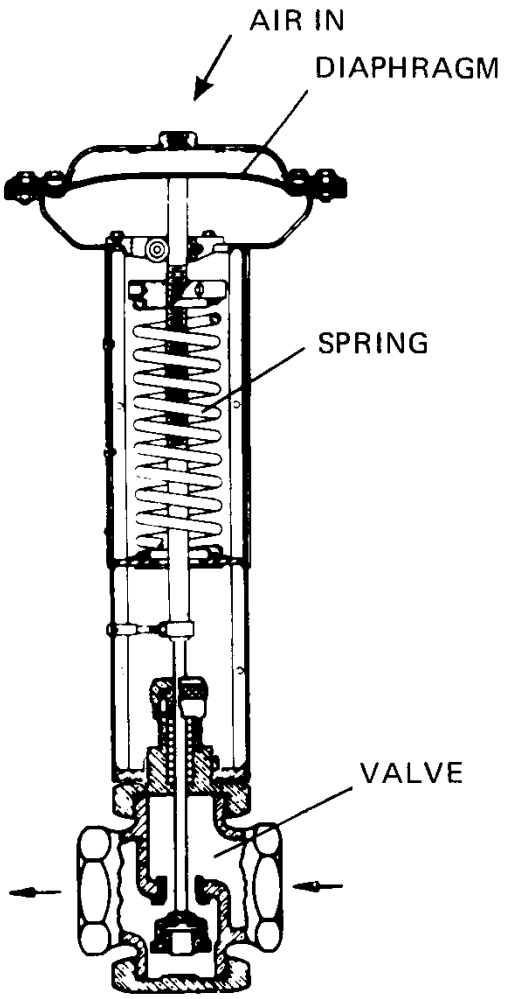
- Each retort **must** have an automatic steam controller
- Air operated, electrically operated or self-activated
- Controller may be combined with recorder to form recorder-controller

Pneumatic Control System

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



Pneumatic Control Valve



Electronic Automated Control Systems

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

ICON by Stock

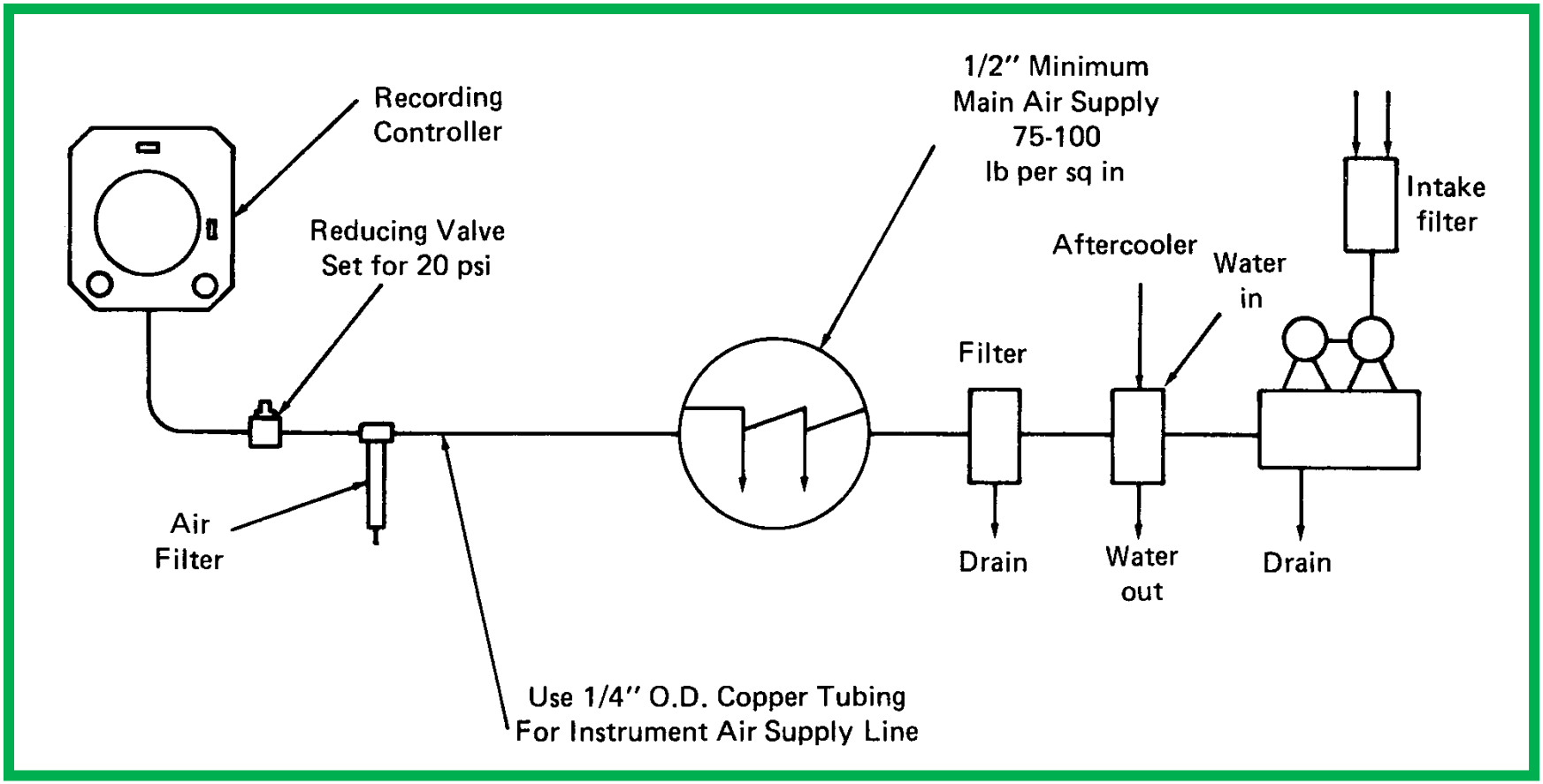
Momentum by FMC

Instrument Air Supply

Instrument Air Supply Requires:

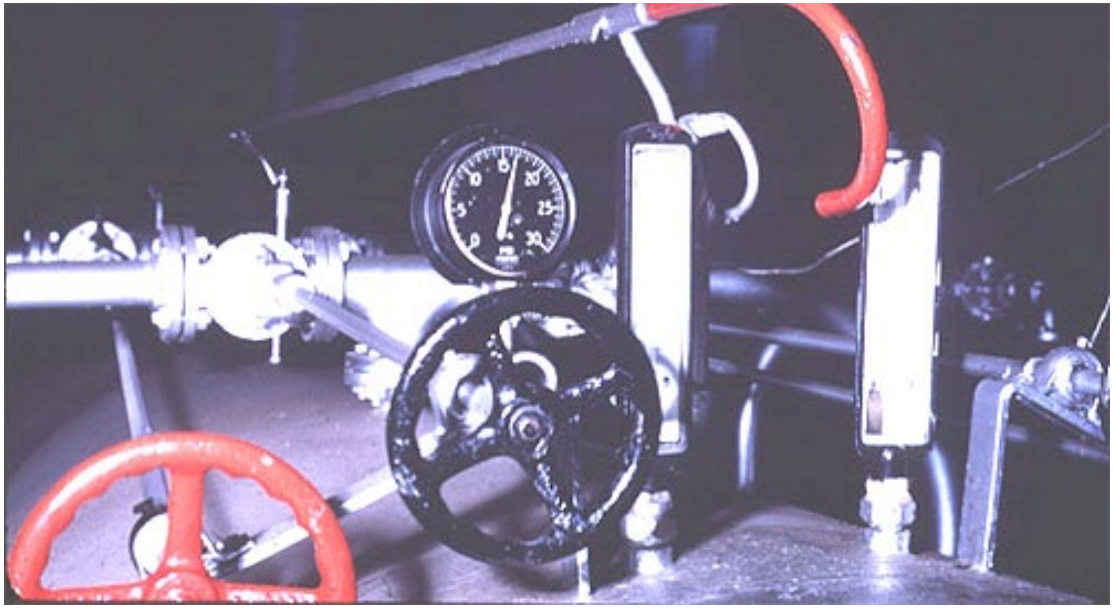
- Adequate filter system
- Clean, dry air at the proper pressure
- Independent air supply system

Air Supply


Recording
Controller
Reducing Valve
Set for 20 psi
Air
Filter
1/2" Minimum
Main Air Supply
75-100
lb per sq in
Filter
Drain
Aftercooler
Water
in
Water
out
Intake
filter
Drain
Use 1/4" O.D. Copper Tubing
For Instrument Air Supply Line

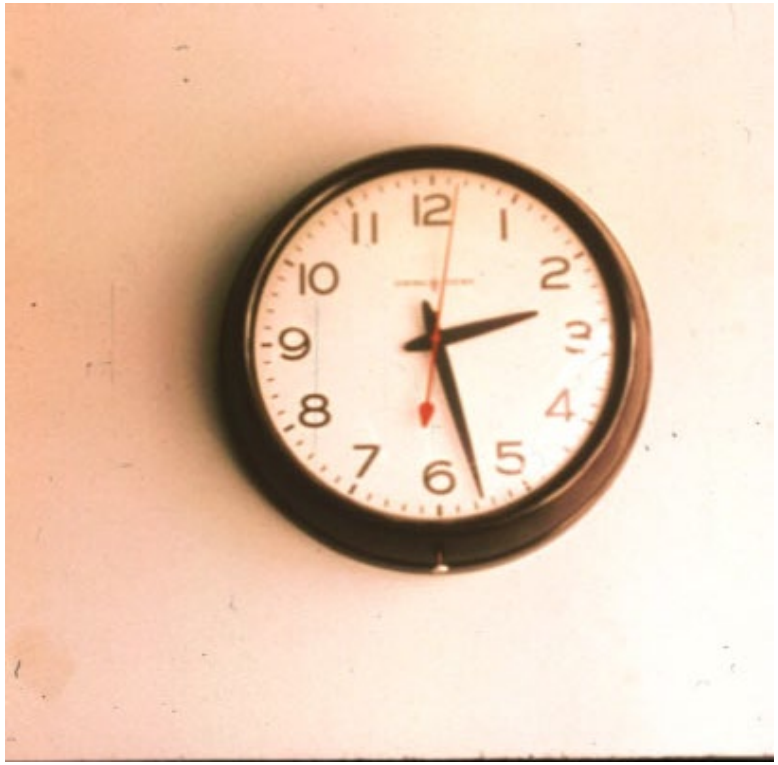
Pressure Gauges

- Scale should not exceed 2 PSI
- Useful when processing with overpressure, pressure cooling and as safety device



Timing Devices

- Wristwatches are **not** permitted
- Use analog or digital clock
- Located where easily and accurately read



Maintenance

Instrument and plumbing maintenance is essential to proper operation

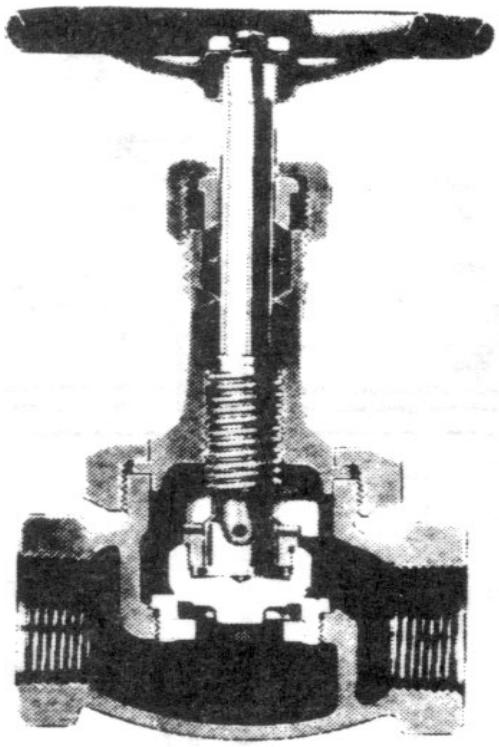
The regulations require that each thermal processing system be examined at least **once a year**

Equipment

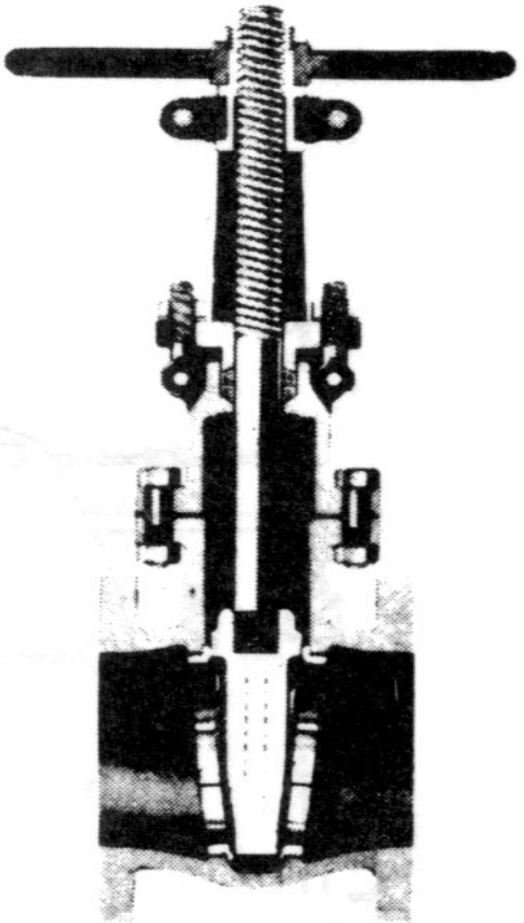
Steam Supply:

- 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

Valve Types and Uses



Globe



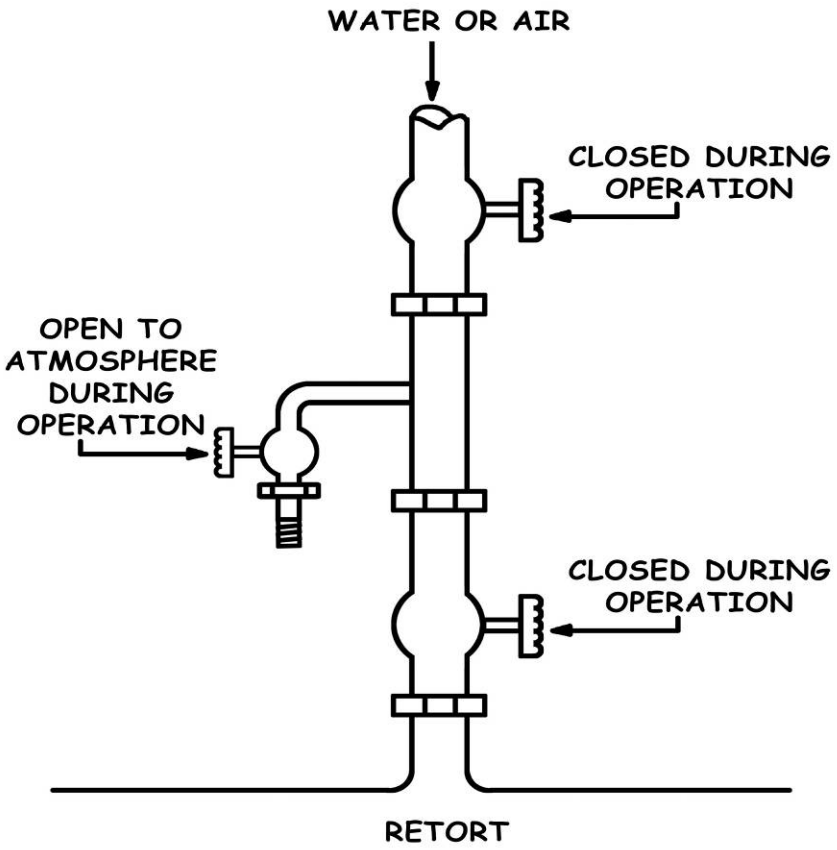
Gate (Rising stem)

- 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

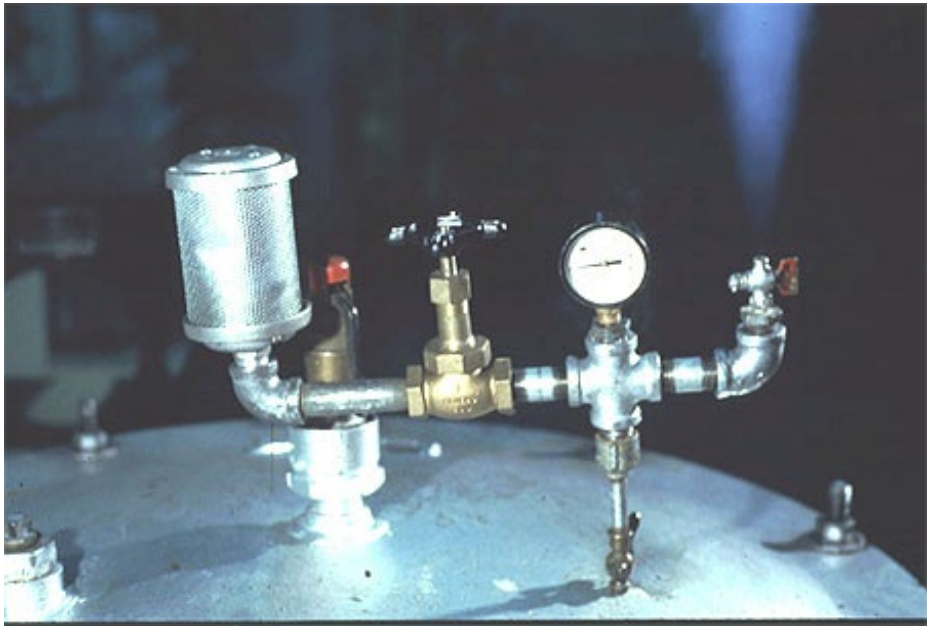
Required on external wells when the MIG/DTG and recorder probes are installed in an external well

Spreaders

- 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

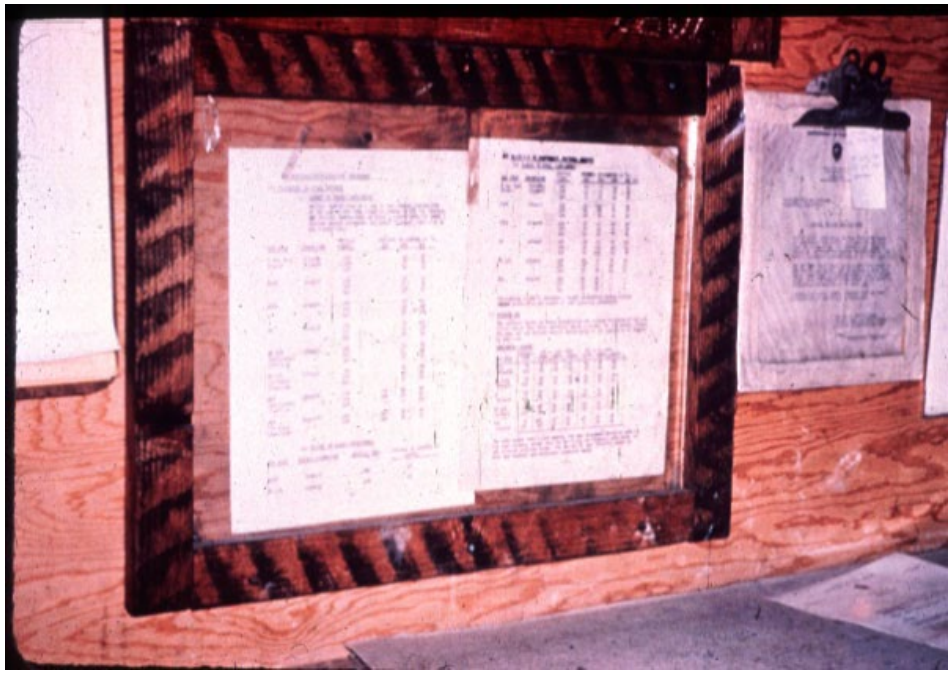


Pasteurizers for Acidified Low Acid Canned Products

- 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

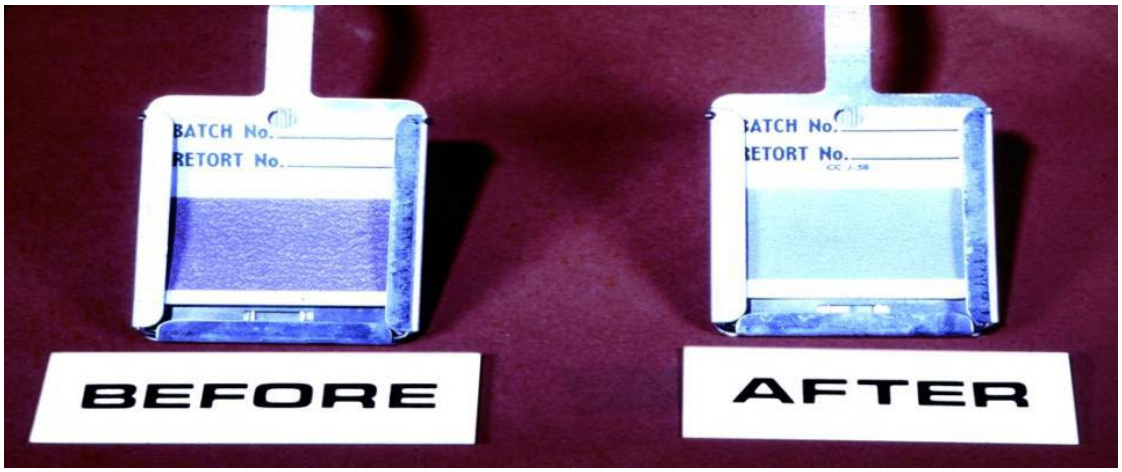
Posting of Thermal Processes

Operating processes and procedures **must** be posted in conspicuous place or be readily available to the operator and CSI



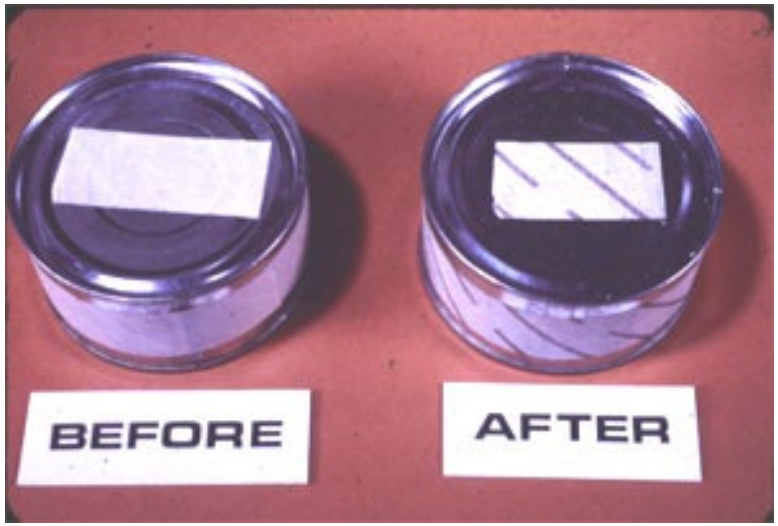
Prevention of Retort Bypass

- 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



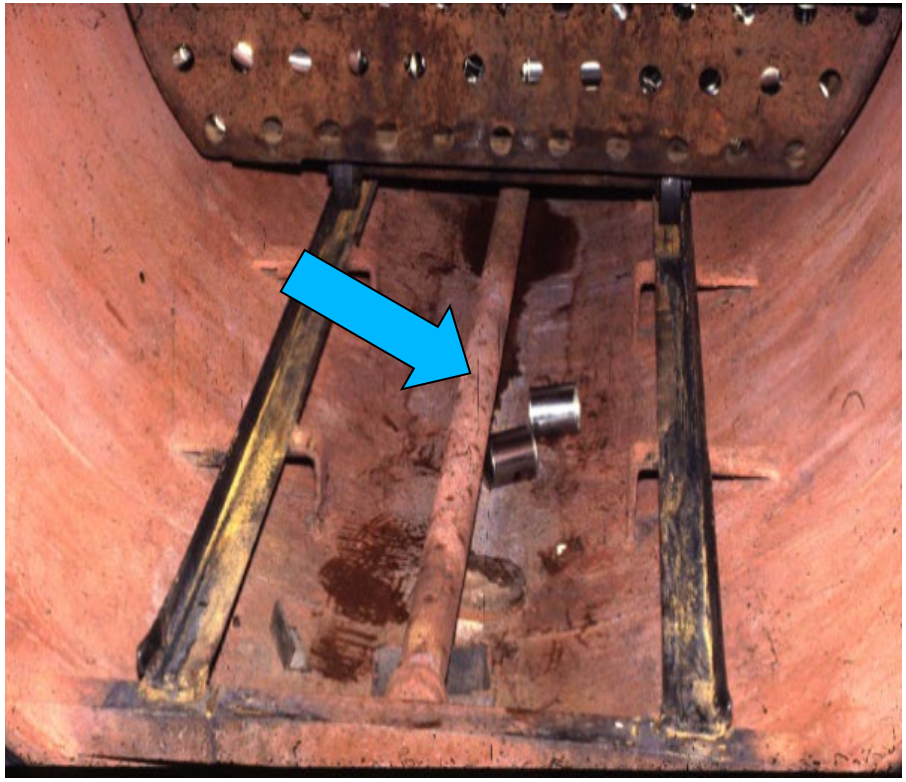
Heat-Sensitive Indicators

- 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

Coding of Containers

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

Initial Temperature

The Initial Temperature is a critical parameter and is as important to adequacy of the heat process as retort temperature and process time

Product Incubation

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

Questions?