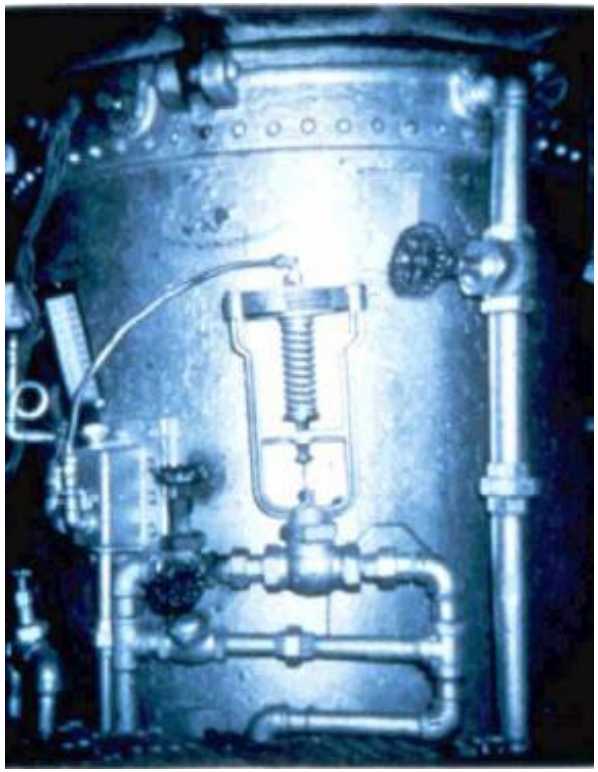
Module 8. Steam, Batch, Still Retorts

Thermal Processing for Meat and Poultry Products Training

USDA

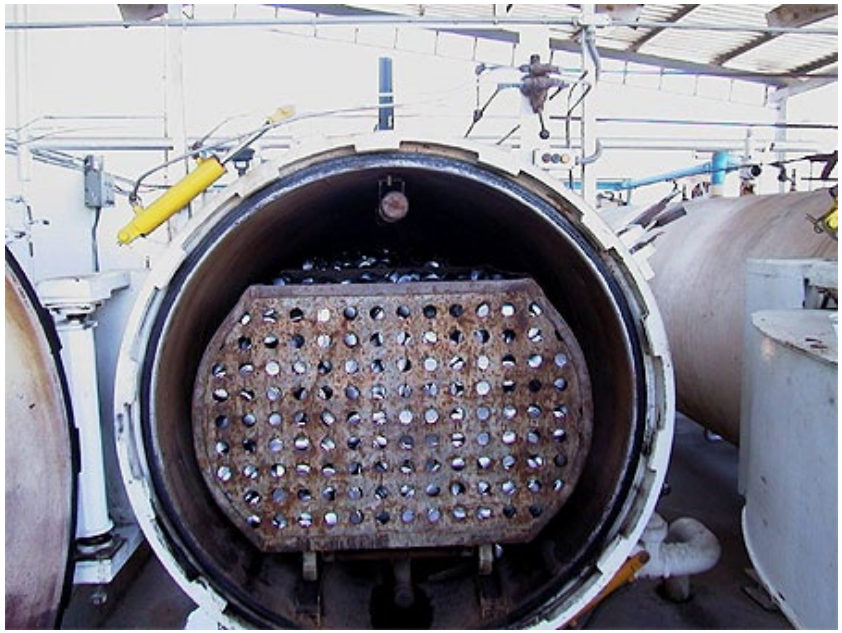
Advantages of Steam

- Excellent Medium for Heat Transfer
- Temperature Easily Regulated
- Pressure Can Counter-balance Internal Can Pressure
- Easy to Produce and Stored for Instant Use



Description of the Retort

- Pressure Vessel
- Batch-type
- Non-agitating
- Vertical or horizontal
- With or without crates



Construction

- Boiler plate
- Riveted or welded
- Doors or lids
- Lugs or locks

Installation and Operation

- Adequate steam supply
- Adequate water supply
- Proper venting

Vertical Retort

THERMAL PROCESSING TRAINING

RETORT HOOK-UP AND SPECIFIC OPERATING INSTRUCTIONS

VERTICAL RETORTS — Simple Process Without Pressure Cooling

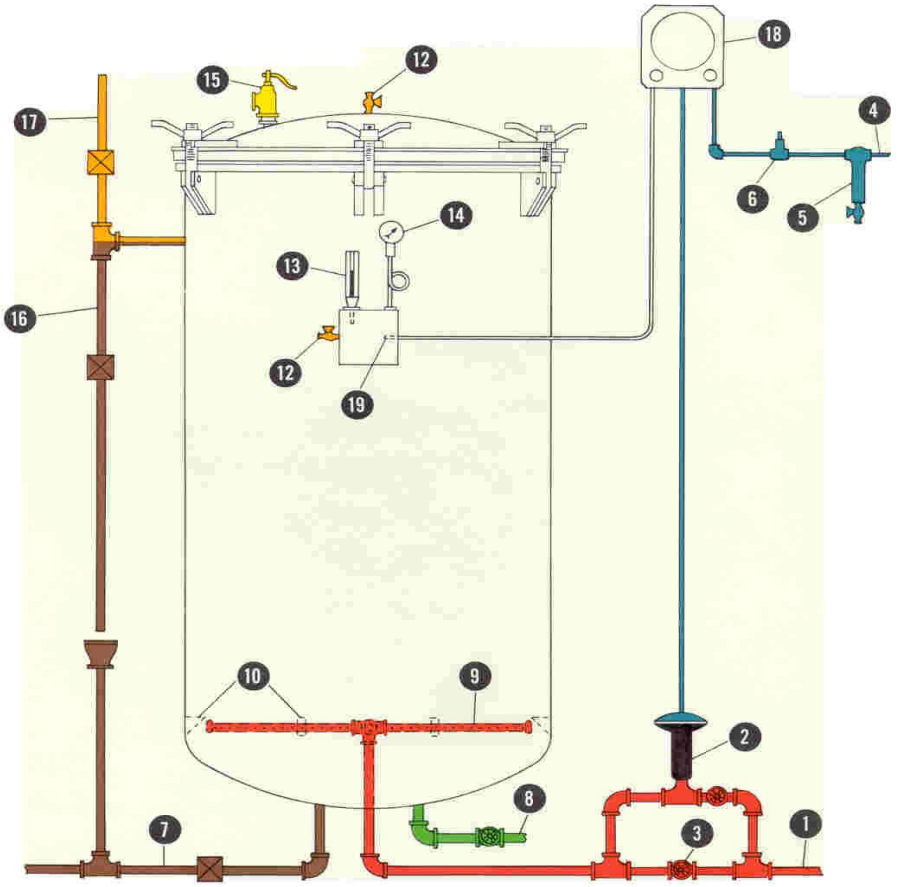


FIGURE 1

COLOR LEGEND

- Steam
- Water
- Drain, Overflow
- Vents, Bleeders
- Air
- Safety Valves, Pressure Relief Valves

MANUAL VALVES

- Globe
- Gate

1. Steam Inlet
2. Steam Control Valve
3. By-pass
4. Air, Instrument
5. Filter
6. Pressure Regulator
7. Drain
8. Water Inlet
9. Steam Spreader
10. Basket Supports
12. Bleeders
13. Thermometer
14. Pressure Gauge
15. Safety Valve
16. Overflow
17. Vent
18. Control, Steam
19. Control Element

Horizontal Retort

THERMAL PROCESSING TRAINING

RETORT HOOK-UP AND SPECIFIC OPERATING INSTRUCTIONS

COLOR LEGEND

- Steam
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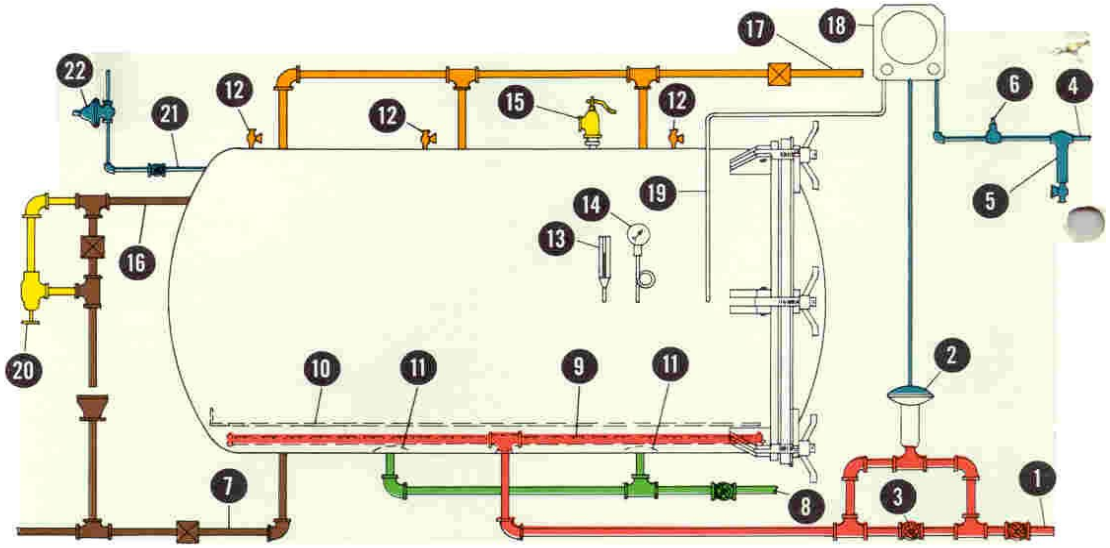
- Drain, Overflow
- Vents, Bleeders
- Air
- Safety Valves, Pressure Relief Valves

MANUAL VALVES

- Globe
- Gate

HORIZONTAL RETORTS Pressure Cooling Under Air Pressure—Venting Through Outside Manifold



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2. Steam Control Valve
3. By-pass
4. Air, Instrument
5. Filter
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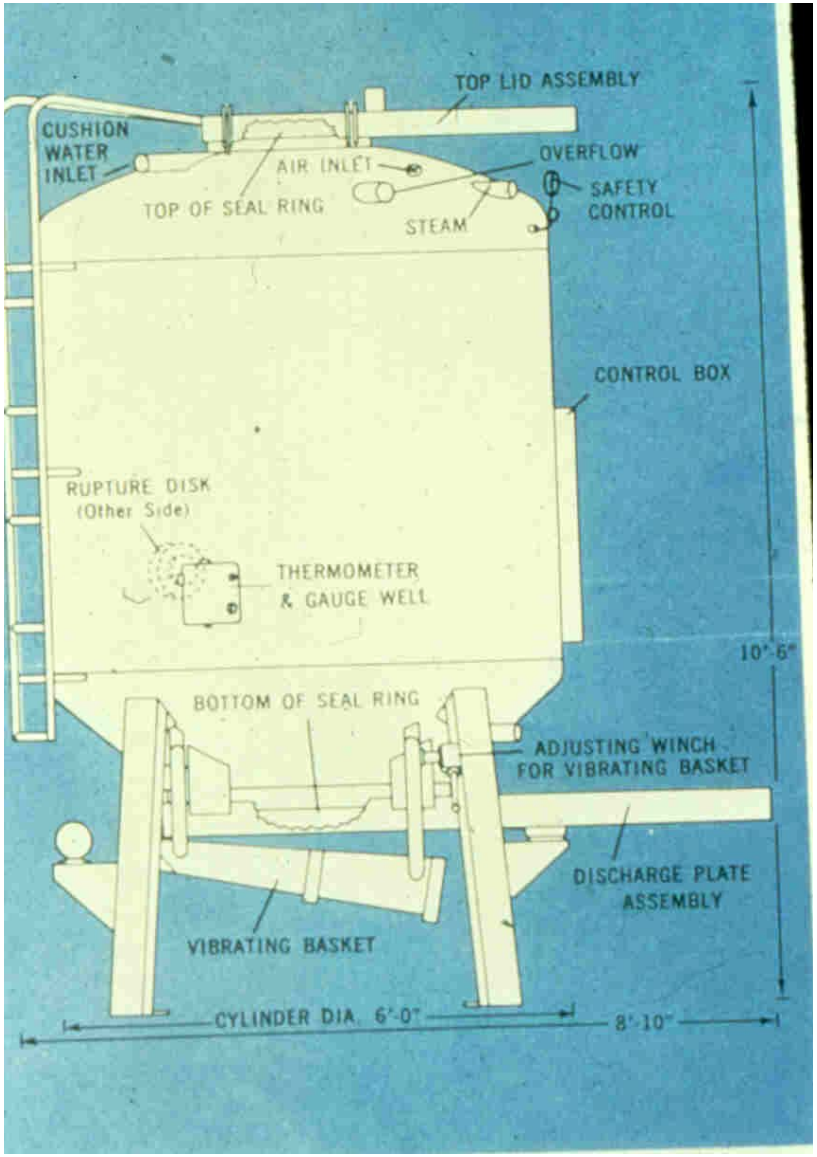
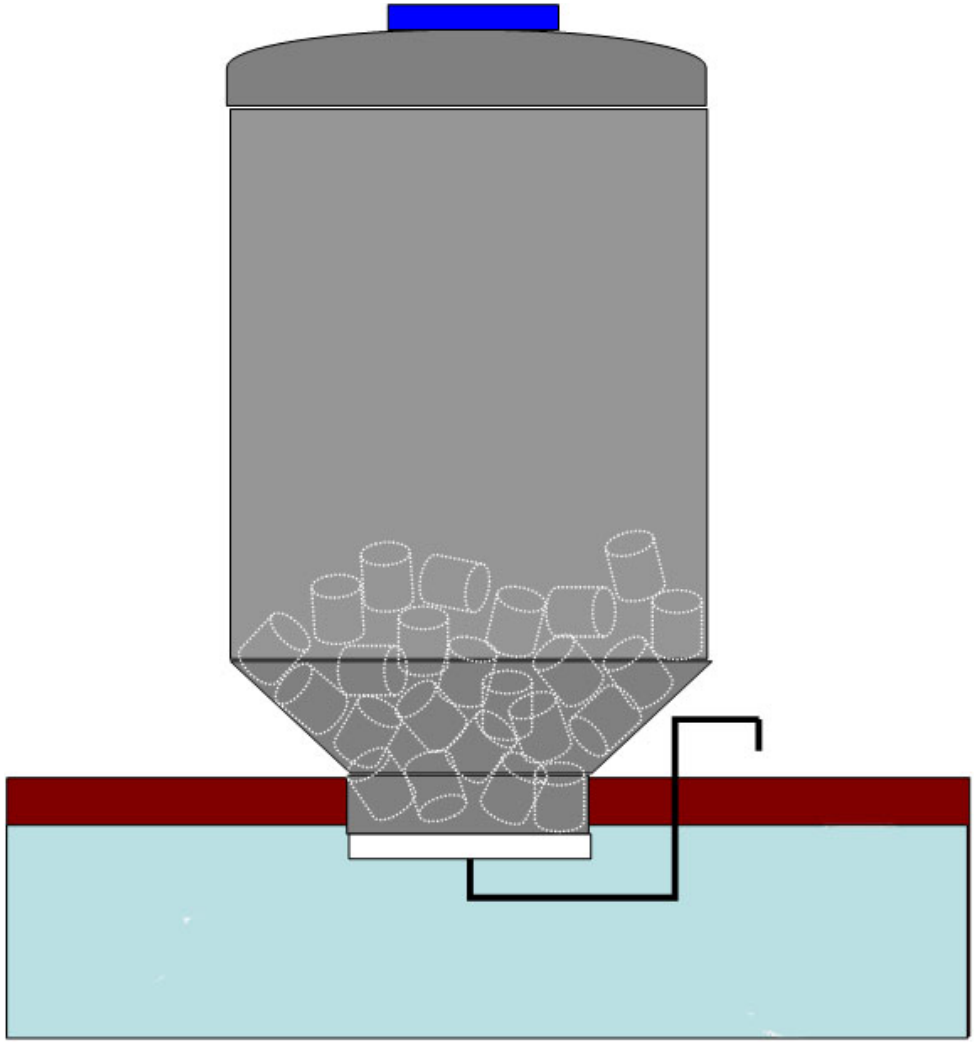
9. Steam Spreader
10. Basket Supports
11. Water Baffle
12. Bleeders
13. Thermometer
14. Pressure Gauge
15. Safety Valve
16. Overflow
17. Vent
18. Control, Steam
19. Control Element
20. Pressure Relief Valve
21. Air Inlet
22. Pressure Regulator, Air

FIGURE 6

Crateless Retort



Crateless Retort

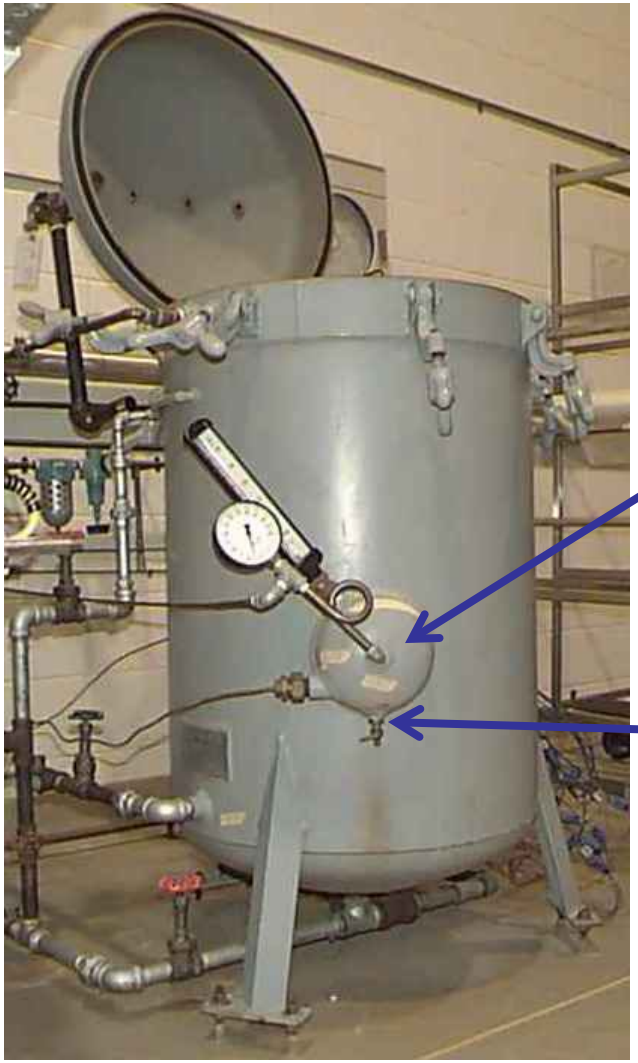


Instrumentation

- Temperature indicating device (Mercury-in-Glass - MIG) or equivalent device (e.g., Resistance Temperature Device – RTD or Digital Temperature Gauge-DTG)
- Temperature/time recording device
- Installed in retort shell or external well

External Well

- Must be connected through at least a 3/4” opening
- Must have at least a 1/16” bleeder opening



Steam Inlet

- Must be large enough for proper operation
- Must facilitate air removal
- Must be located opposite the vent

Steam Spreaders – Vertical Retorts

- Not required for vertical retorts
- If used, usually in form of a cross
- Perforations along the top or side

Steam Spreaders

Number of Spreader Perforations

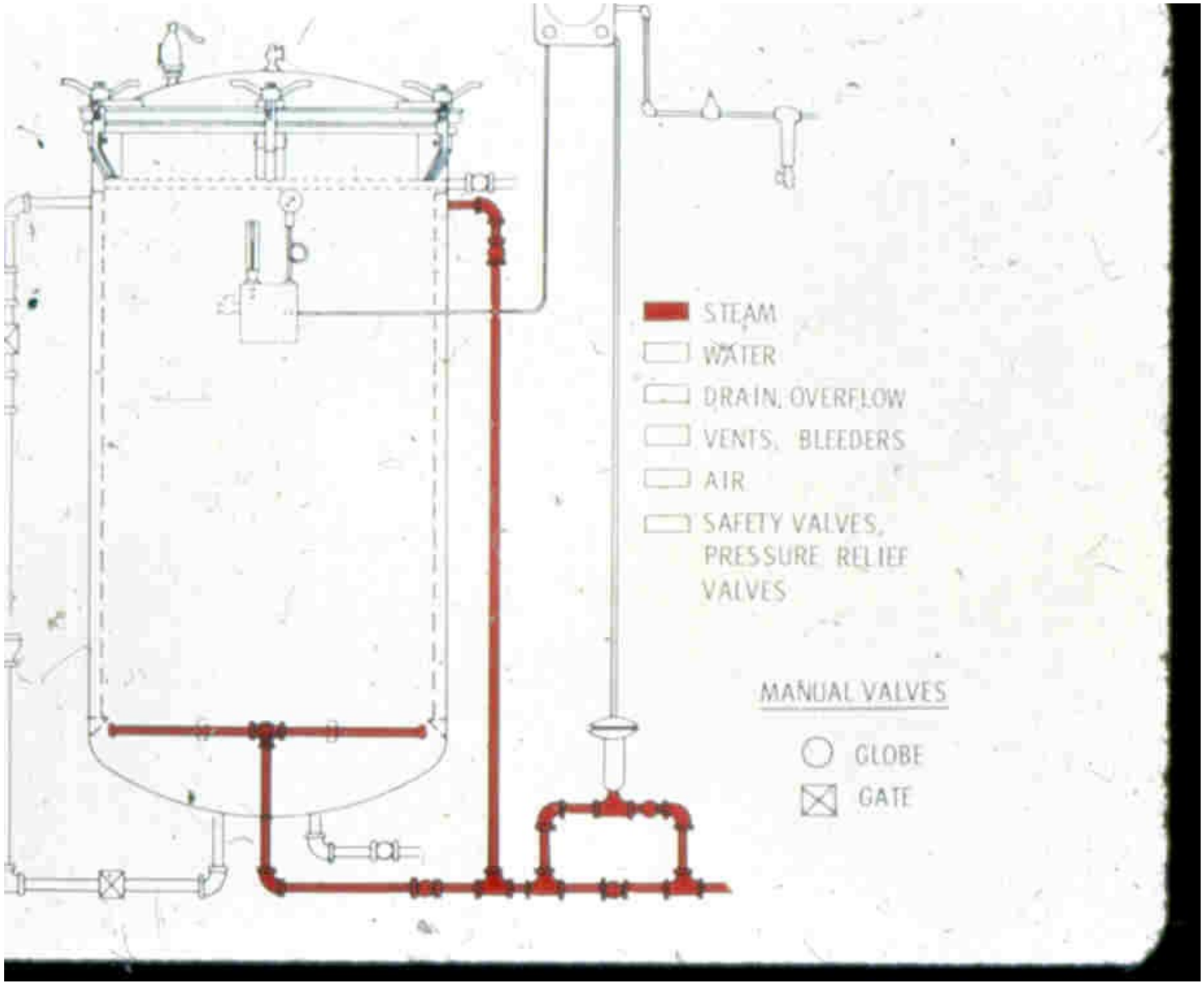
Total cross-sectional area should be equal to 1.5 to 2 times the cross-sectional area of the smallest part of the steam inlet line.

Steam Spreaders

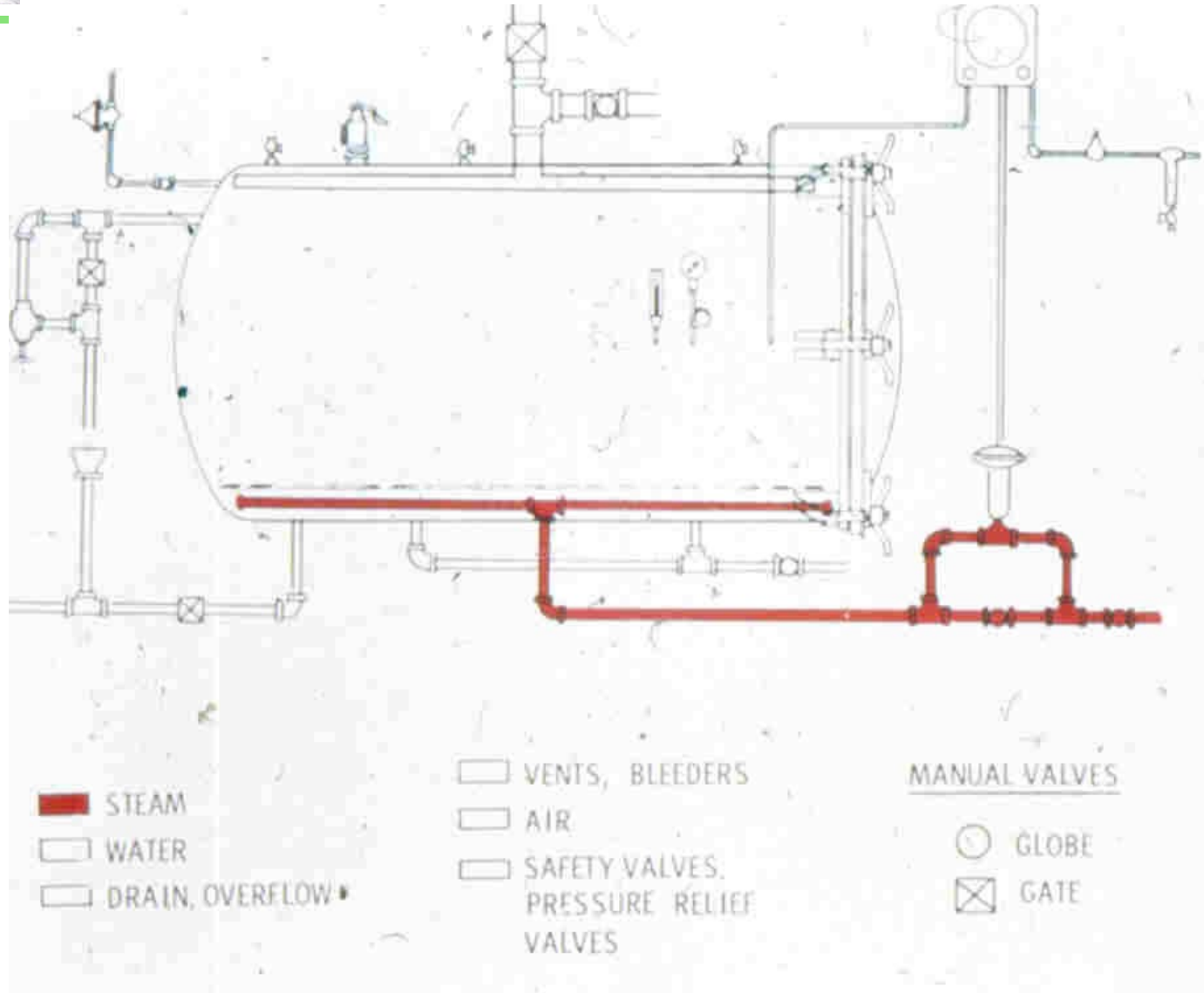
Number of Holes in Steam Spreaders for Steam Inlet Pipe Sizes

Size Holes (inches)	1 inch pipe	1¼ inch pipe	1½ inch pipe	2 inch pipe	2½ inch pipe
3/16	47–63	82–109	111–148	183–244	261–347
1/4	27–36	46–61	63–83	103–137	147–196
3/8	—	21–28	28–37	46–61	66–87
1/2	—	12–16	16–21	26–35	37–49

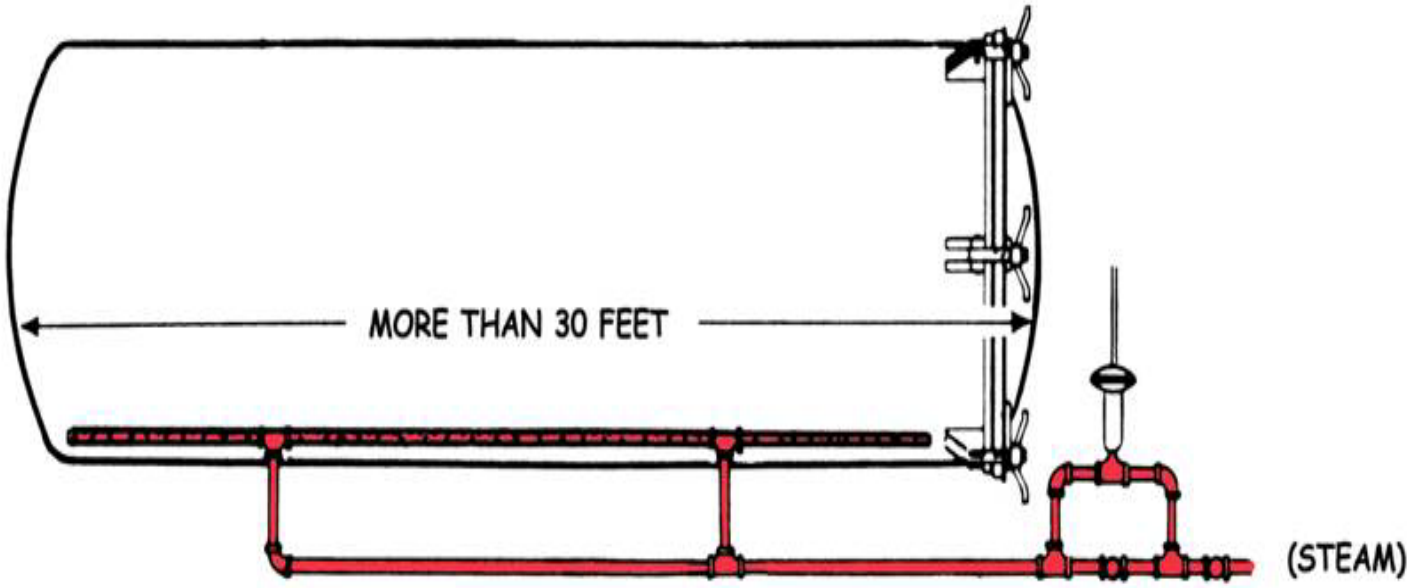
Steam Entry Into Vertical Retort



Steam Entry Into Horizontal Retort



Steam Spreaders



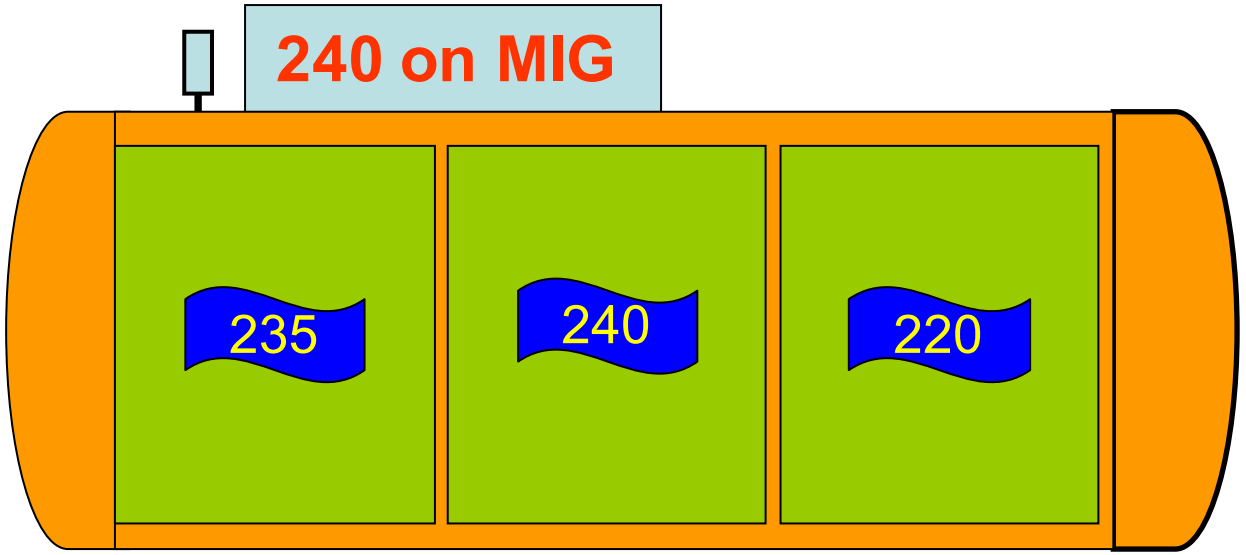
A RETORT OVER 30 FEET NEEDS TWO STEAM SPREADER INLETS.

Vents

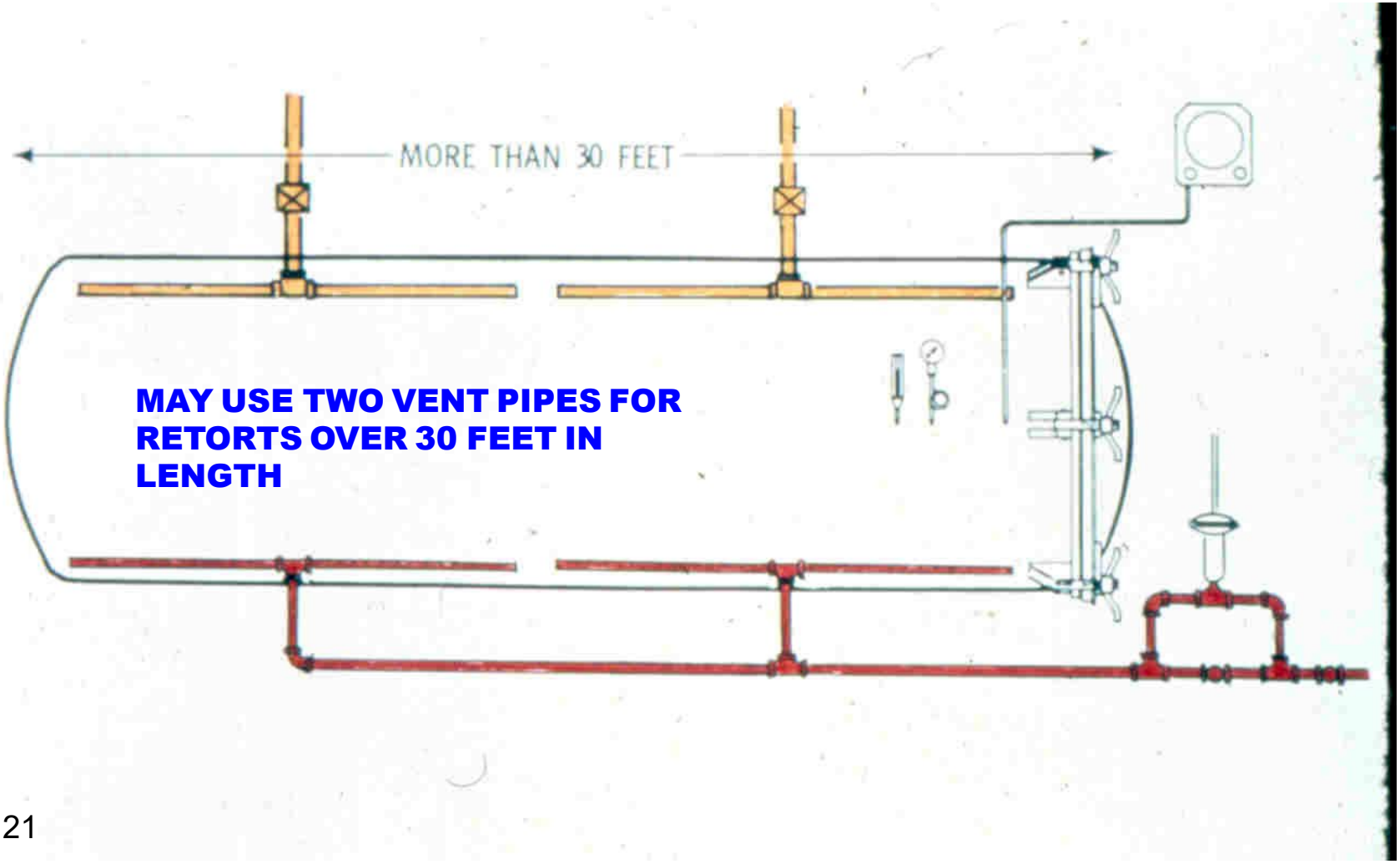
- Large valve-controlled openings to remove air from the retort
- Located opposite steam inlet
- Controlled by a full flow valve or equivalent
- Atmospheric break between vent and closed drain required

Inadequate Removal of Air is Serious

- Less efficient as a heating medium
- Insulates containers
- Air and moisture may cause rusting of cans



Vents


MORE THAN 30 FEET
MAY USE TWO VENT PIPES FOR RETORTS OVER 30 FEET IN LENGTH

Vents

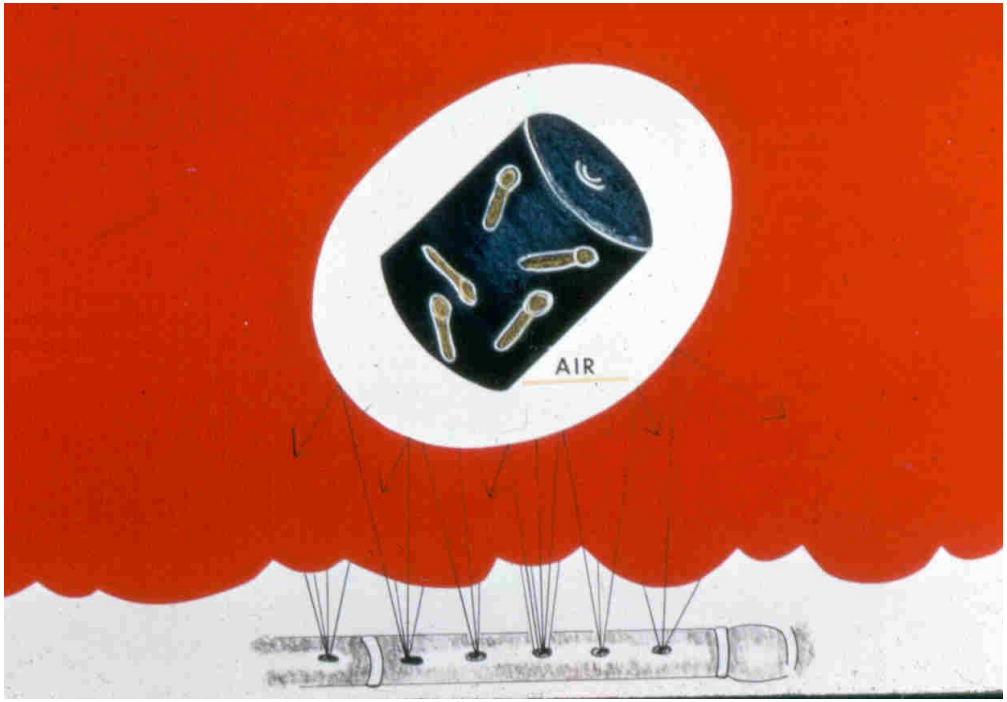
Vent Manifold:

- Connects several vent pipes from same retort
- Cross-sectional area of manifold pipe must be larger than cross-sectional area of all connecting vents

Venting and Come Up Time

Come Up Time (CUT) = Vent time + the time it takes to bring the retort to processing temperature

- Venting removes air from the retort
- Air transfers heat less efficiently than steam



Venting and Come Up Time

- Established by process authority
- May require both a set time and temperature
- Can be established on the basis of reaching a certain temperature
- Venting schedule must be met to assure adequate air removal
- Retorts with unusual piping, loading or operating procedures must be tested for proper heat distribution

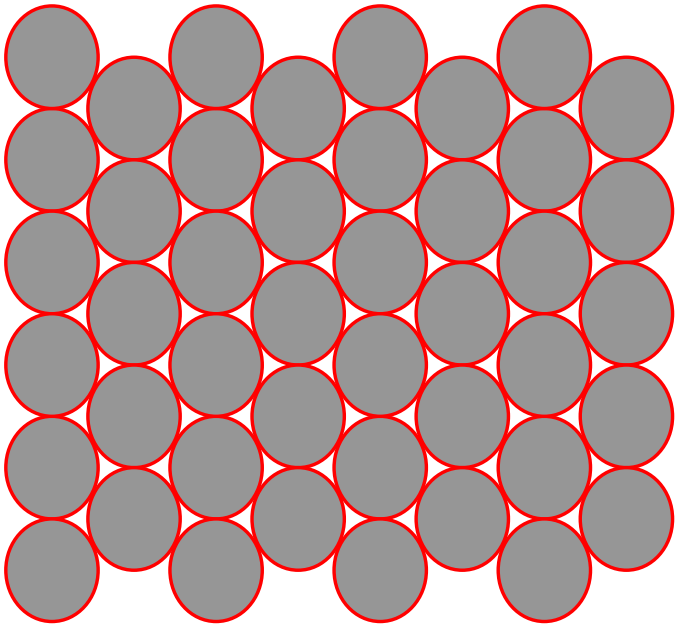
Construction of Crates, Carts and Divider Plates

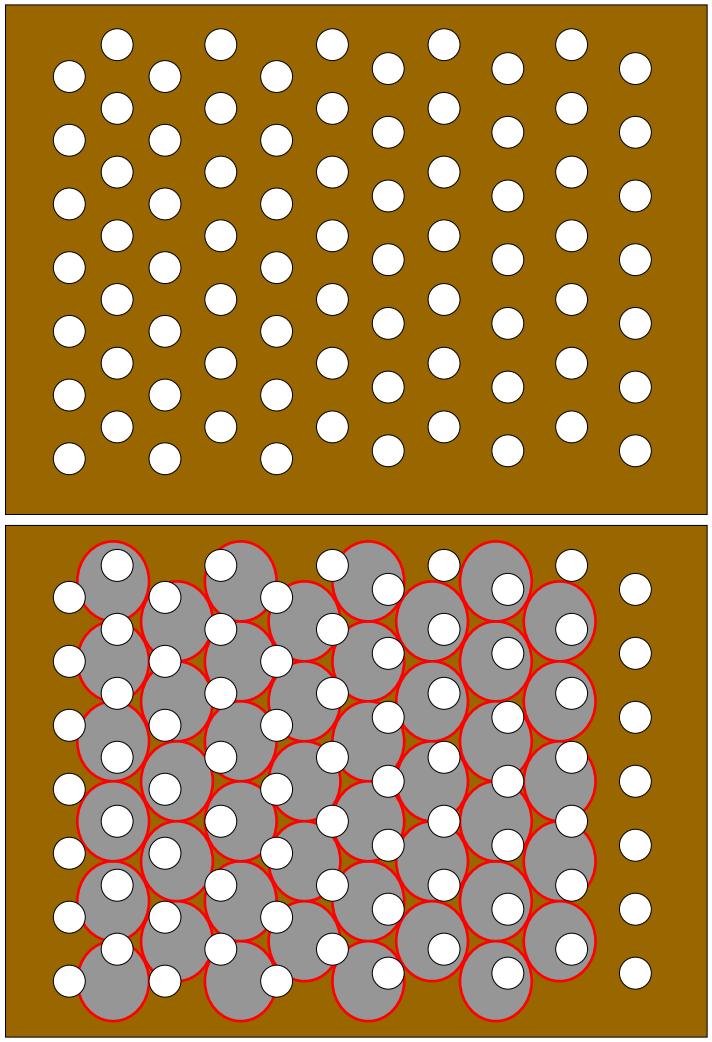
- Constructed of suitable materials
- Perforations shall be 1” holes on 2” centers or equivalent (27% open area)

Effects of Divider Plates on Venting and CUT

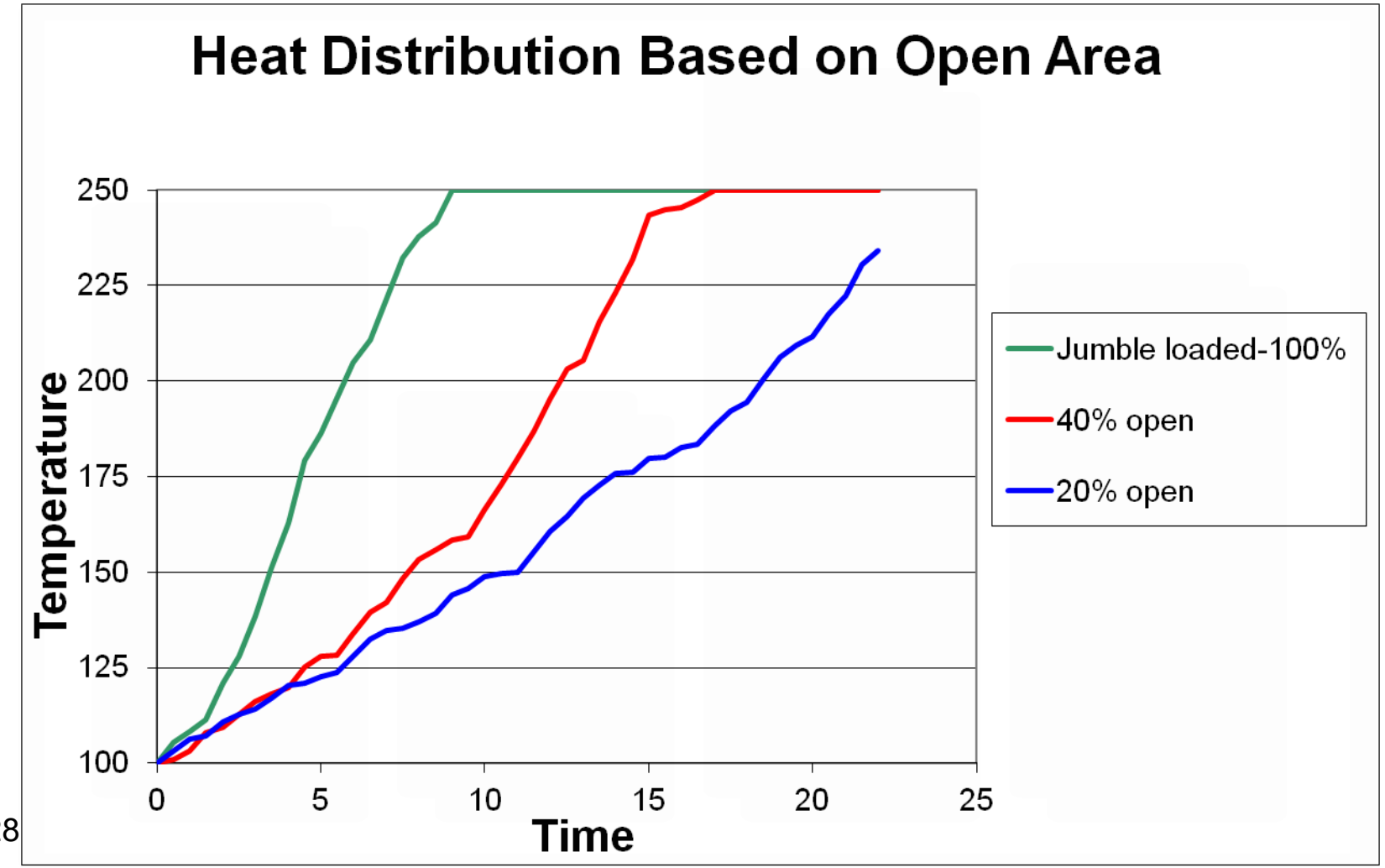
- May require longer venting time
- May inhibit steam flow among containers
- Venting adequacy documented by heat distribution data

Effects of Divider Plates on Venting and CUT





Effects of Divider Plates on Venting and CUT



Bleeders

- Remove air to provide circulation of steam
- Must be opposite steam entry
- Wide open during entire process
- Arranged to observe functioning
- Condensate bleeder requirement when steam entry is above the containers

Bleeders

- Small openings, normally 1/16 to 1/8 inch in diameter used to remove air from steam retorts and circulate the steam while they are in operation
- Open during come up and processing
- Bleeders must be within 1 foot of outermost containers and no more than 8 feet apart along the top of the horizontal retort.

Bleeders

Retort Bleeder with Valve

Mufflers

- Used on bleeders and vents to decrease noise
- Must not impede normal operation

Air Supply

- For air-operated automatic steam controllers
- For pressure cooling to prevent can buckling
- Equip with a suitable valve to prevent leakage

Water Supply

- For cooling containers in retort
- Equip with suitable valve to prevent leakage
- Cool carefully to avoid condensing steam

Temperature and Timing

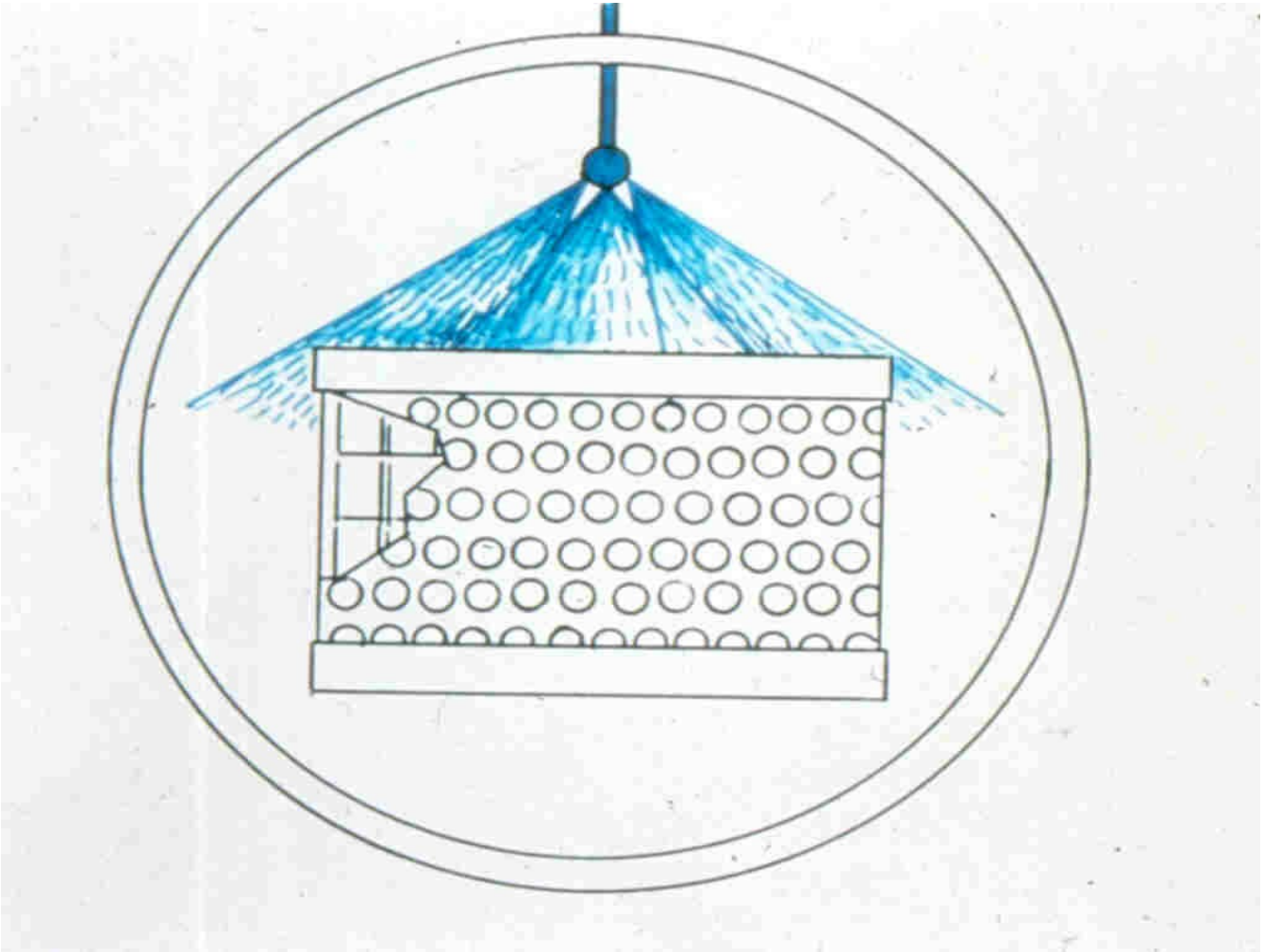
Initial Temperature — Must be determined for the coldest container

Process Timing — Must not start until the venting schedule is completed and the process schedule retort temperature is achieved

Container Cooling

- May need pressure cooling
- Cool to at least 104°F
- Suggest complete flooding of retort

Container Cooling



Container cooling is done first by overhead sprays and then by flooding.

Container Cooling

Valves must be tight fitting and maintained on water pipes to prevent leaking water into retort during thermal processing.

Cooling Water Treatment

Container cooling water shall be chlorinated or otherwise sanitized for cooling canals and re-circulated water supplies.

Recordkeeping Requirements

- Critical factors must be measured and recorded in accordance with the method and frequency in the written procedure
- Suggest 15 minute intervals

Questions

Questions?