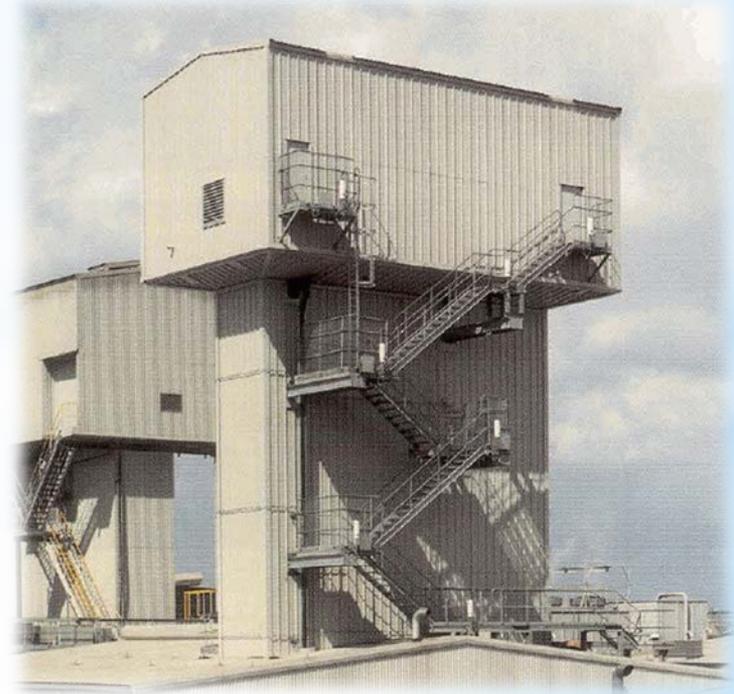


Verification of temperature distribution in crateless and hydrostatic retorts



Photo from <http://www.maloinc.com/>



Presented by Mr. Thanath Ketsarin
National Food Institute (NFI)

* Why we do temperature distribution test?

- ✓ Establishment/verification of Venting procedure
- ✓ Come-up Time
- ✓ Cold Zone/Slowest Heating zone
- ✓ Accuracy of filled system thermometer, Recording device, Pressure gauge and RTD display.
- ✓ Documentation for food safety system

* When we do the temperature distribution test?

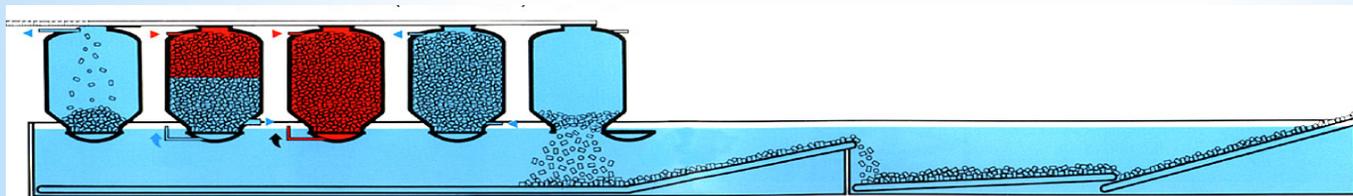
- ✓ New retort installation
- ✓ Retort structure changed
ex. steam inlet, steam spreader, vent
- ✓ Change container orientation pattern or container size, type
- ✓ Change critical factors ex. IT, Main steam pressure
- ✓ HACCP plan

* Crateless Retort

- Steam retort
- Single can conveyor
- Batch processing
- No crate or basket
- Jumble loading

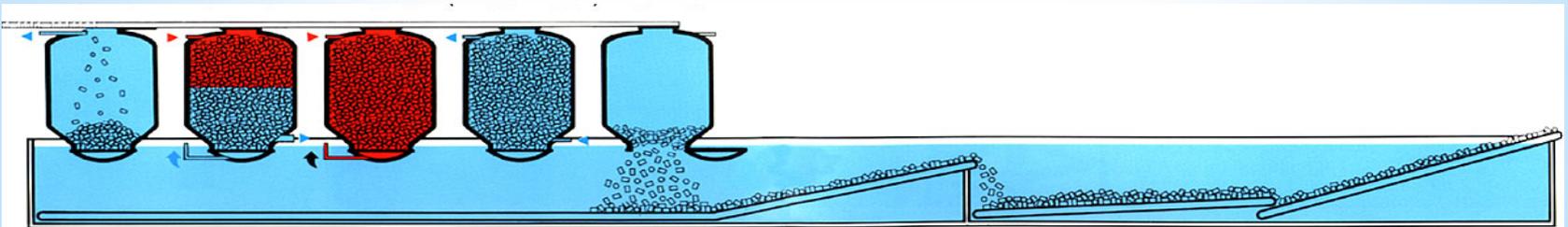


Source: Kiat Fah Foods Co., Ltd.



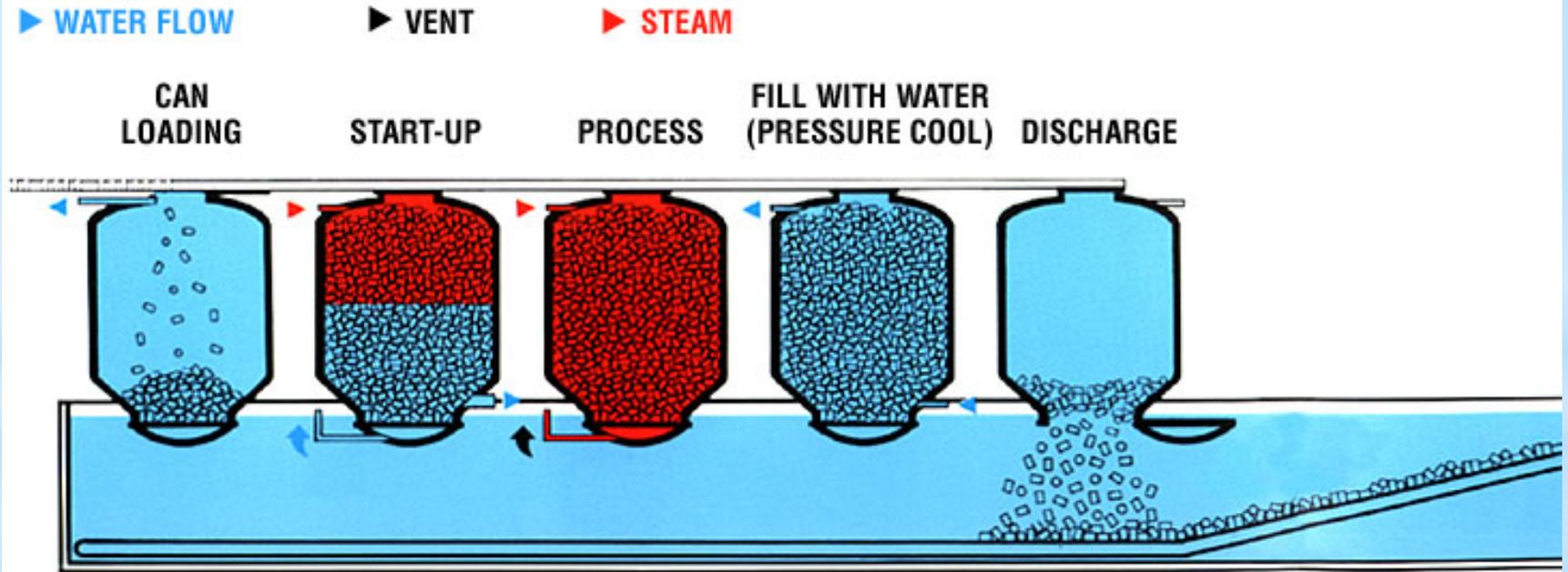
* Crateless Retort

Advantage	Disadvantage
Energy (steam) saving	Can damage during loading.
Labor saving	Can denting (unloading)
Flexibility of process and container size	Scramble load (nested cans)



* Cratless retort operation

TYPICAL PROCESSING SEQUENCE



Water filling

Steam on
& Venting

Cooking

Pressure
cooling

Discharge

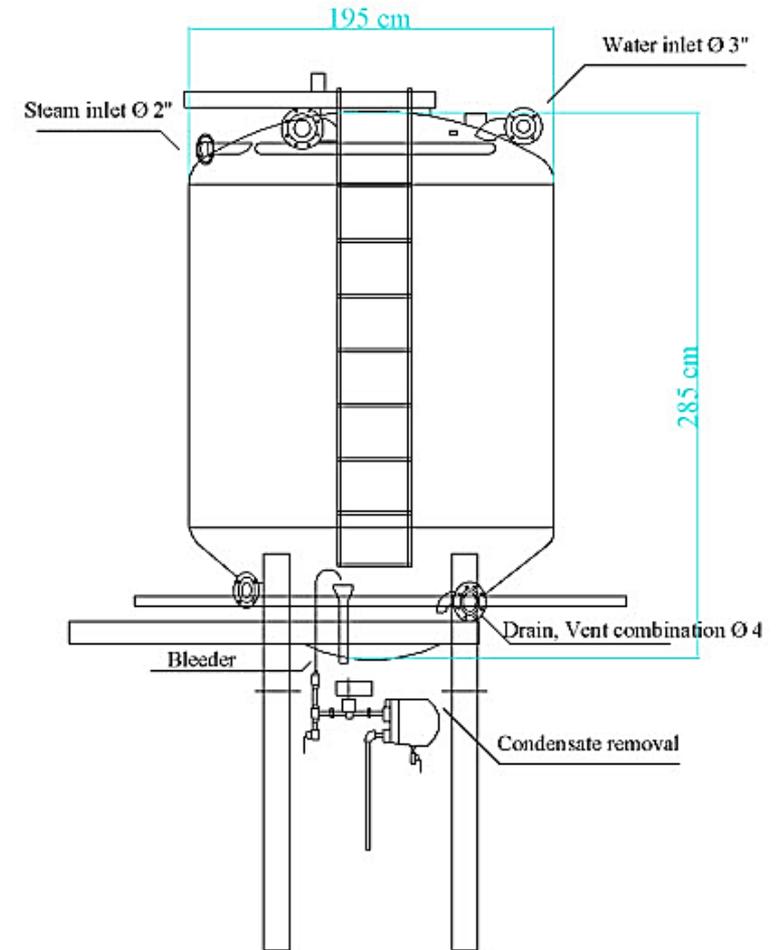
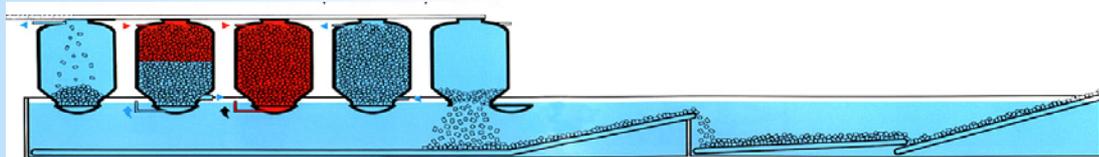
Cooling in canal

Can loading

* Temperature Distribution Test

➤ Retort Survey

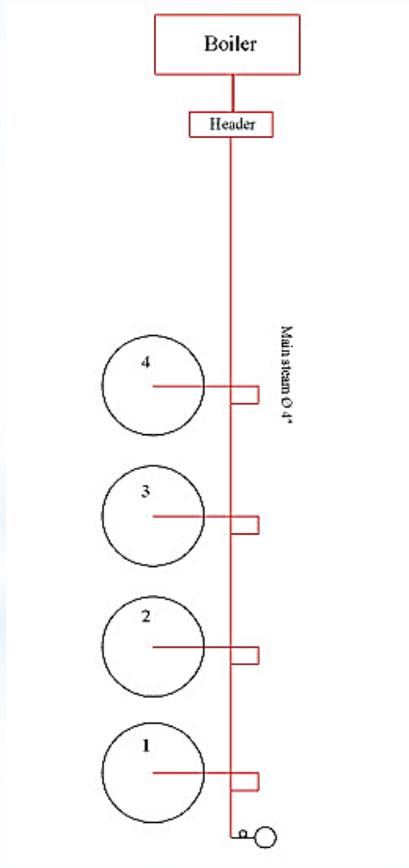
- Retort room
- Retort arrangement
- Retort structure and equipment
- No. retort start up at the same time



* Temperature Distribution Test

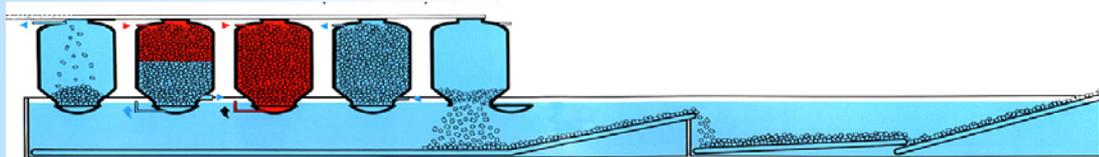


Photo from Royal Food Vietnam



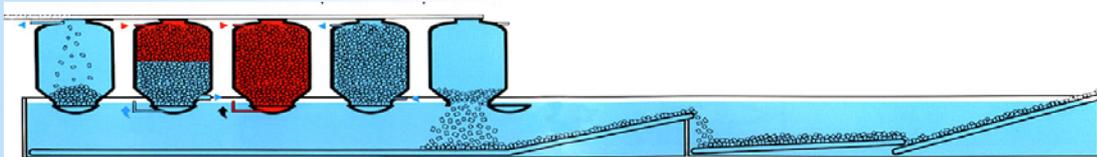
Selection of
representative
retort

The farthest from
steam supply



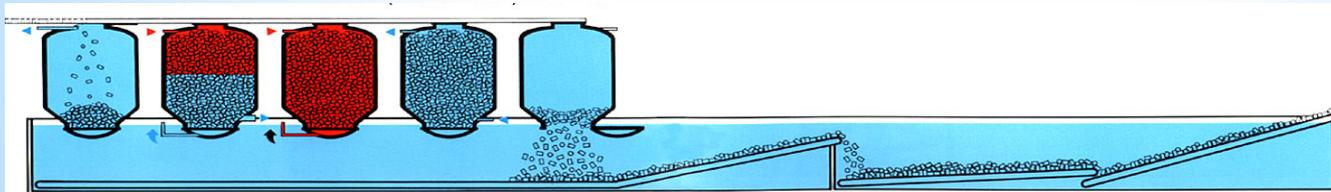
* Controlled Parameter

Container size	Smallest size
Approximately number of cans per retort	
Container orientation	Jumble loading style
Minimum initial product temperature	
Minimum cushion water temperature	
Maximum retort venting simultaneously	
Minimum main steam line pressure (Before starting vent procedure)	



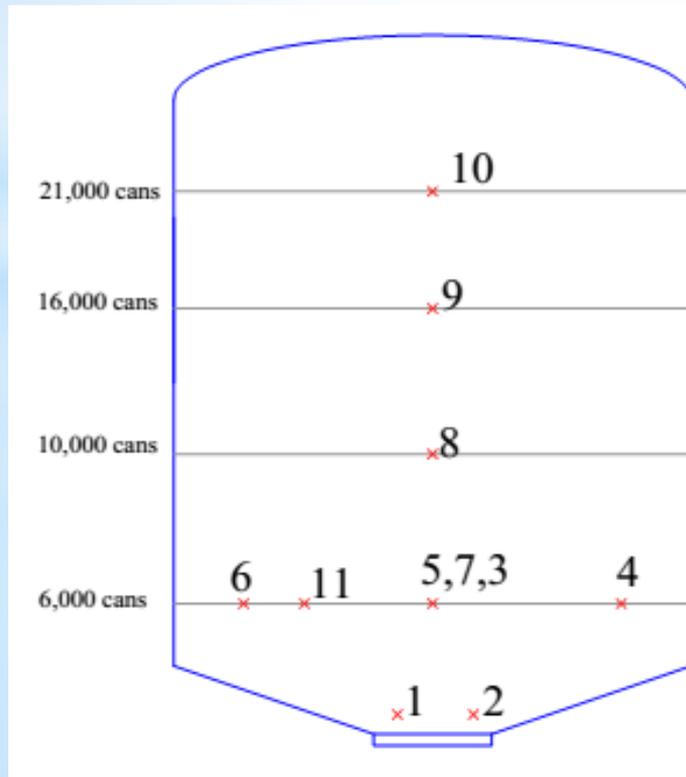
* Testing Equipment

- Wireless Data logger
- Computer and Software



* TD Test Procedure

- ✓ Place thermocouple in the retort load and measuring heating medium
 - Minimum 5TCs
 - One at MIG and RTD sensor
- ✓ Minimum 2 replication



Protect wireless temperature probes

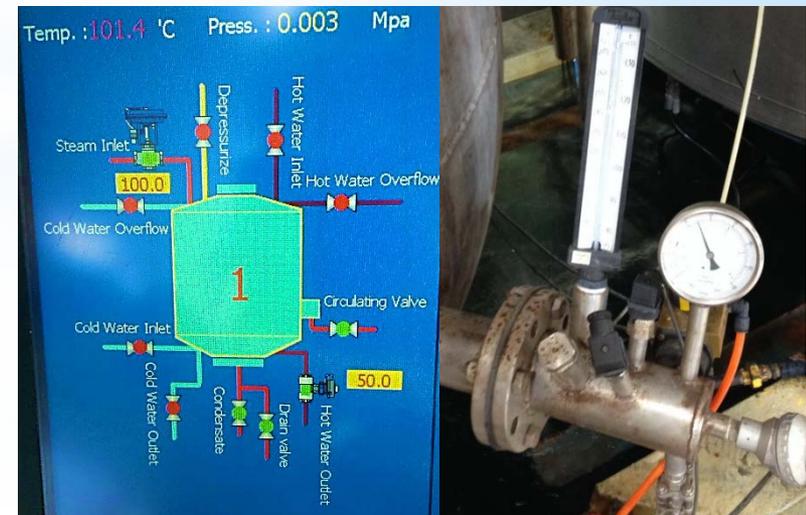
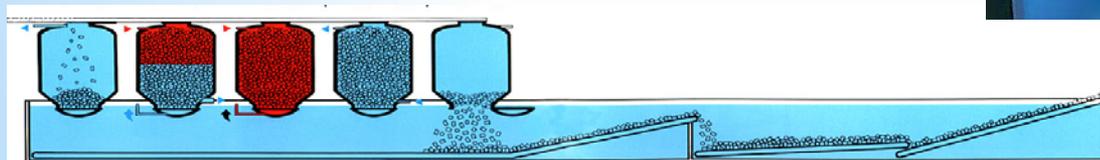


* Recorded data

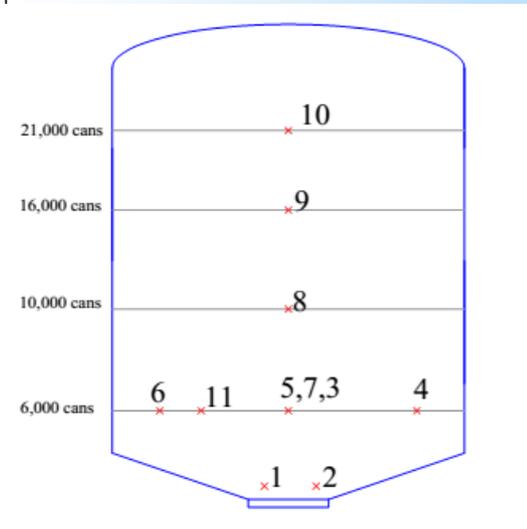
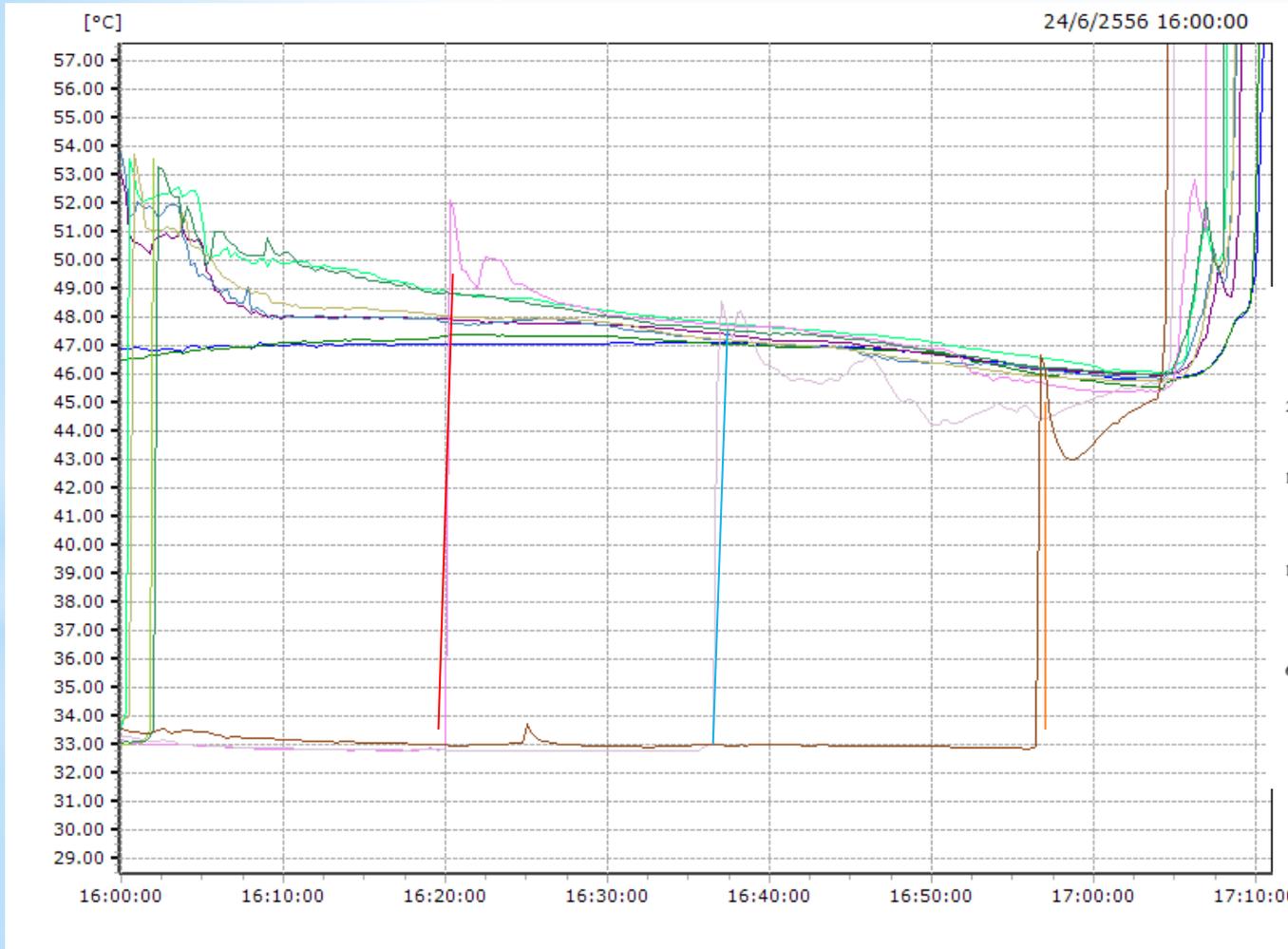
- Main steam pressure and retort pressure during testing
- Initial temperature
- Operation steps and time at steam on
- Temperature at MIG thermometer, recording device and temperature controller
- Time at vent closed and retort up

Retort recipe

Step *	Setting temperature* (°C)	Set time* (Minute)	Set pressure* (psi)	Action
0	-	-	-	Filling water
1	-	-	5	Blow down
2	-	2	-	Vent
3	121	-	-	Come up
4	121	Process time	-	Process
5	-	-	-	Cooling
6	-	-	-	Discharge

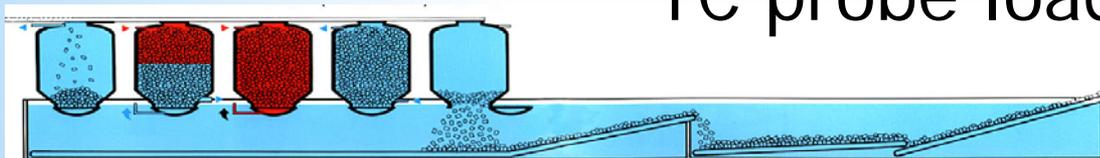


* Data acquisition

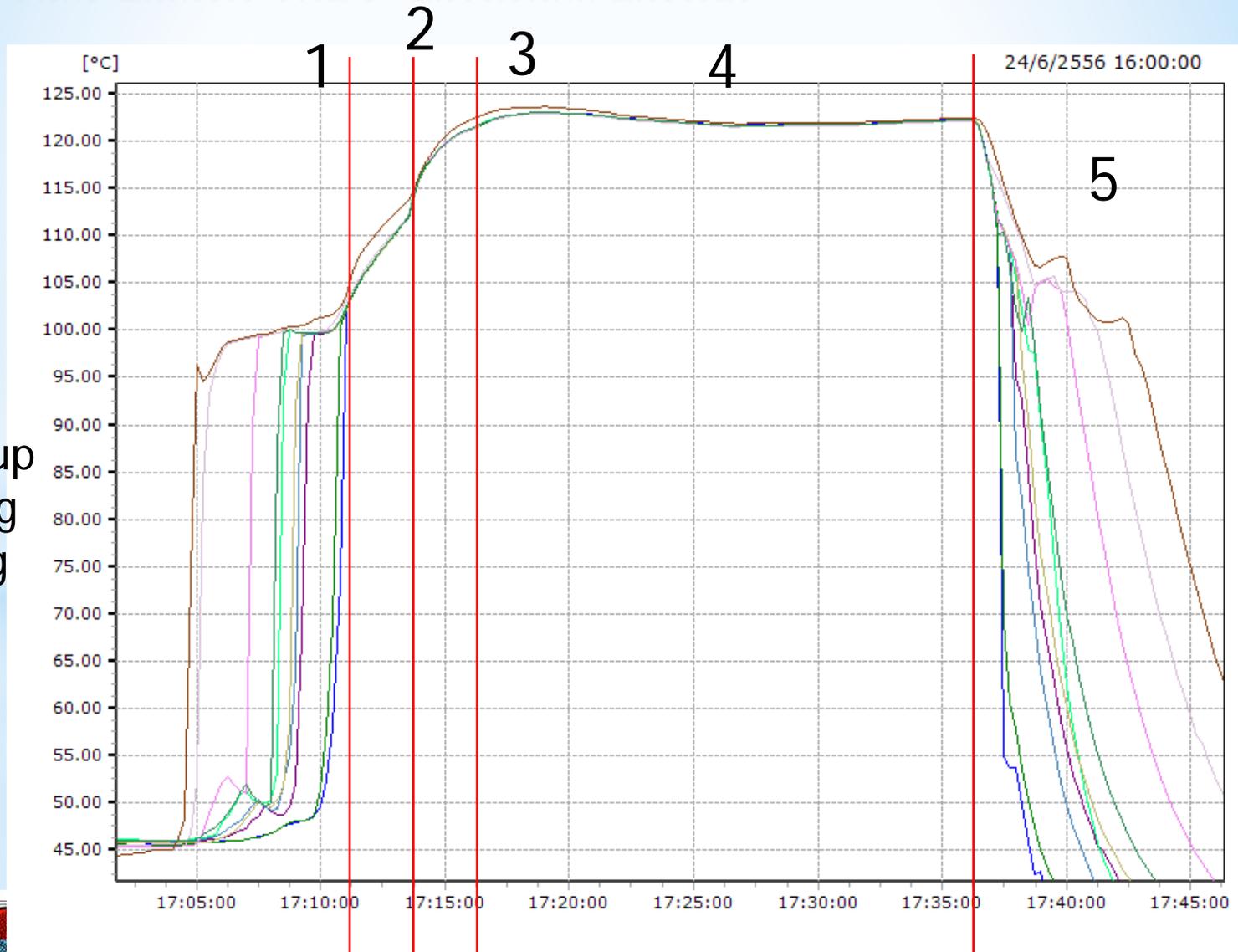


TC location

TC probe loading



* TD test result for Crateless retort

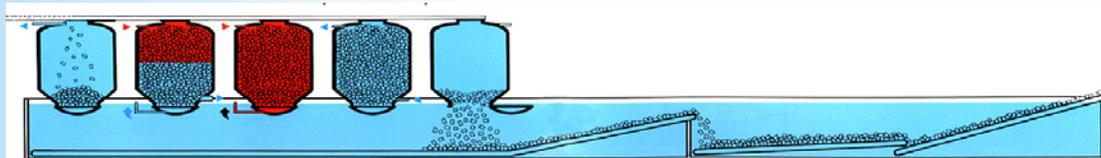


1. Drain
2. Vent
3. Come up
4. Cooking
5. Cooling



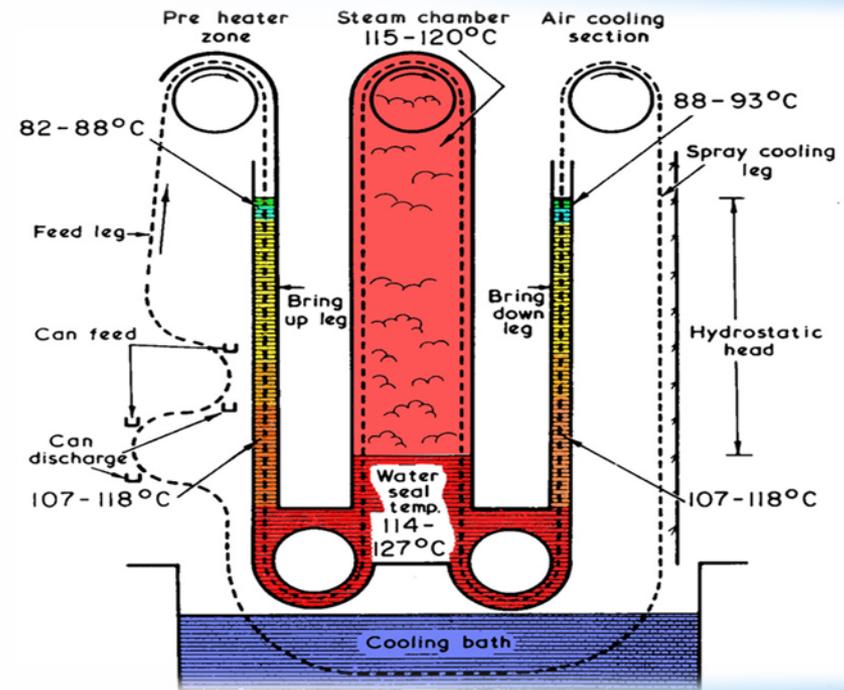
* TD for Crateless retort

- Verification of existed venting procedure
- Verification temperature distribution during cook period.
- No temperature drop during cooking (complete venting)



* Hydrostatic Retort

- Hydrostatic retorts use water columns to counterbalance the pressure in the steam dome called “hydrostatic pressure”
- “Water leg and steam dome
- no door or valves sealing
(water seal)
- Steam heating medium
- Constants temperature and
Container loaded rate



* Hydrostatic Retort



Advantage

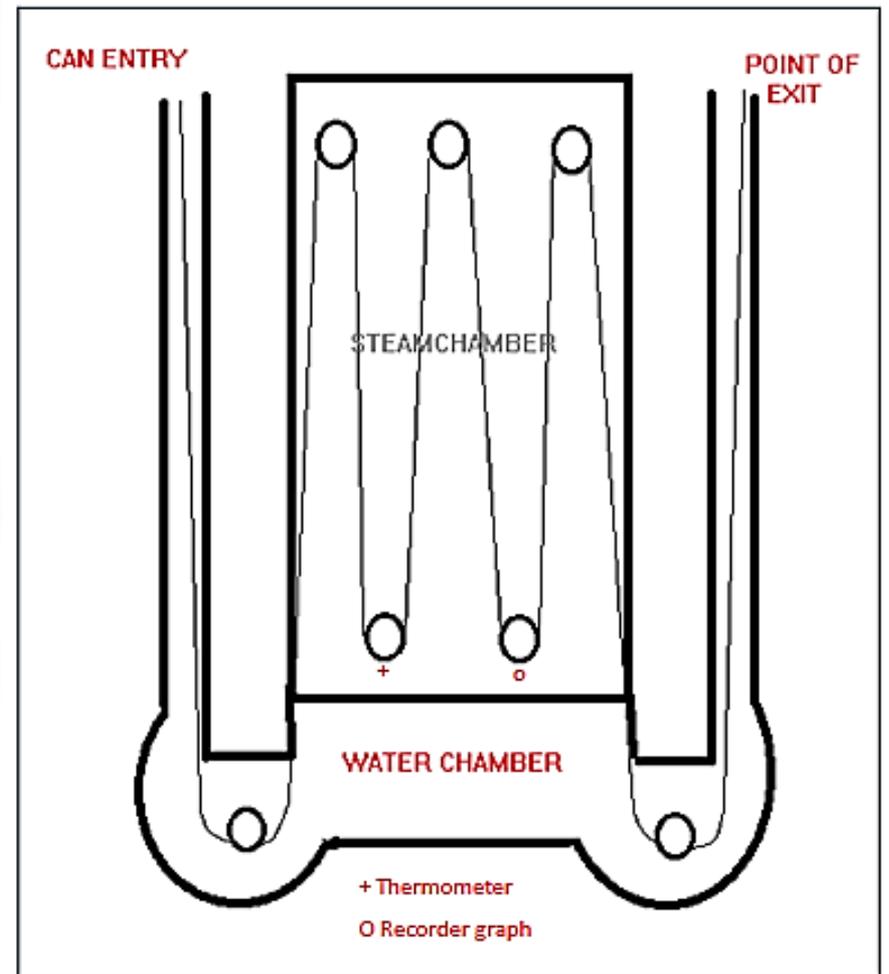
Savings in floor space.	The container is subjected to minimum thermal shock.
Reduction steam and water costs (energy saving)	Hydrostats use less cooling water
High capacity operation.	Constant temperature operation
Capability of processing all sizes of cans, glass containers, and retort pouches.	The containers are handled gently because of the low chain speed (1-6 FPM).
Low labor requirements	

Disadvantage

- Large capital investment

* Hydrostatic operation

- Filling water into the machine
- Preheating step (include venting).
- Pressurizing step.
- Entering to the sterilizing program.



* Controlled Parameters



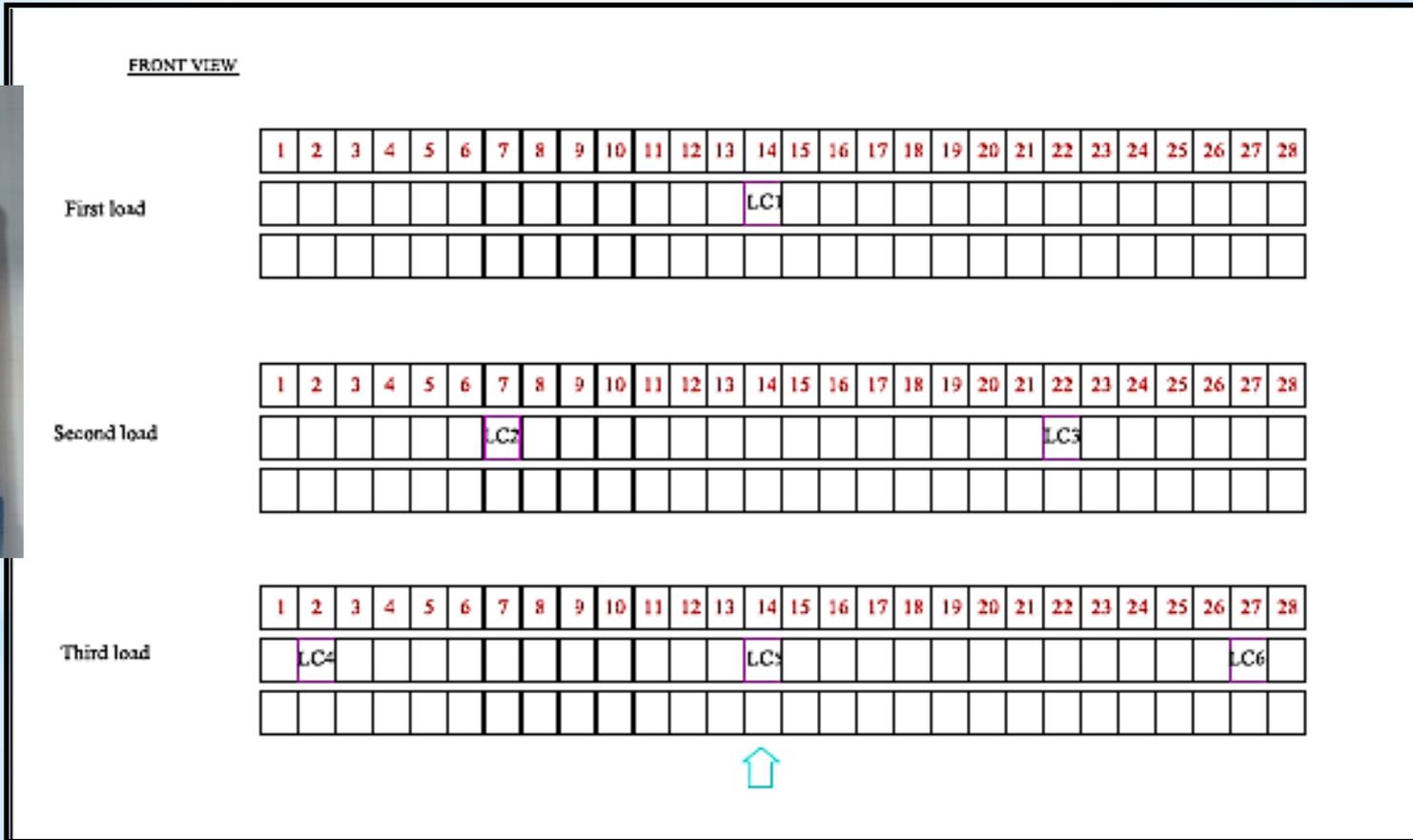
- Container size
- Maximum number of container per carrier bar
- Number of carrier bar in heating chamber
- Container orientation
- Maximum carrier chain speed
- Minimum initial temperature
- Minimum water temperature in feed leg
- Maximum retort come up simultaneously
(At starting temperature distribution procedure)

* TD Test Procedure



- ✓ **Check the facilities as water, air, steam supply**
- ✓ **Place the thermocouple in each part of retort, feed leg, steam dome, discharge leg, then stop the chain for venting verification.**
- ✓ **Place the thermocouple at desired period of loading depends on chain speed (TD verification after venting).**
- ✓ **Minimum 2 Replication**

* TC placement



Temperature probe placement diagram

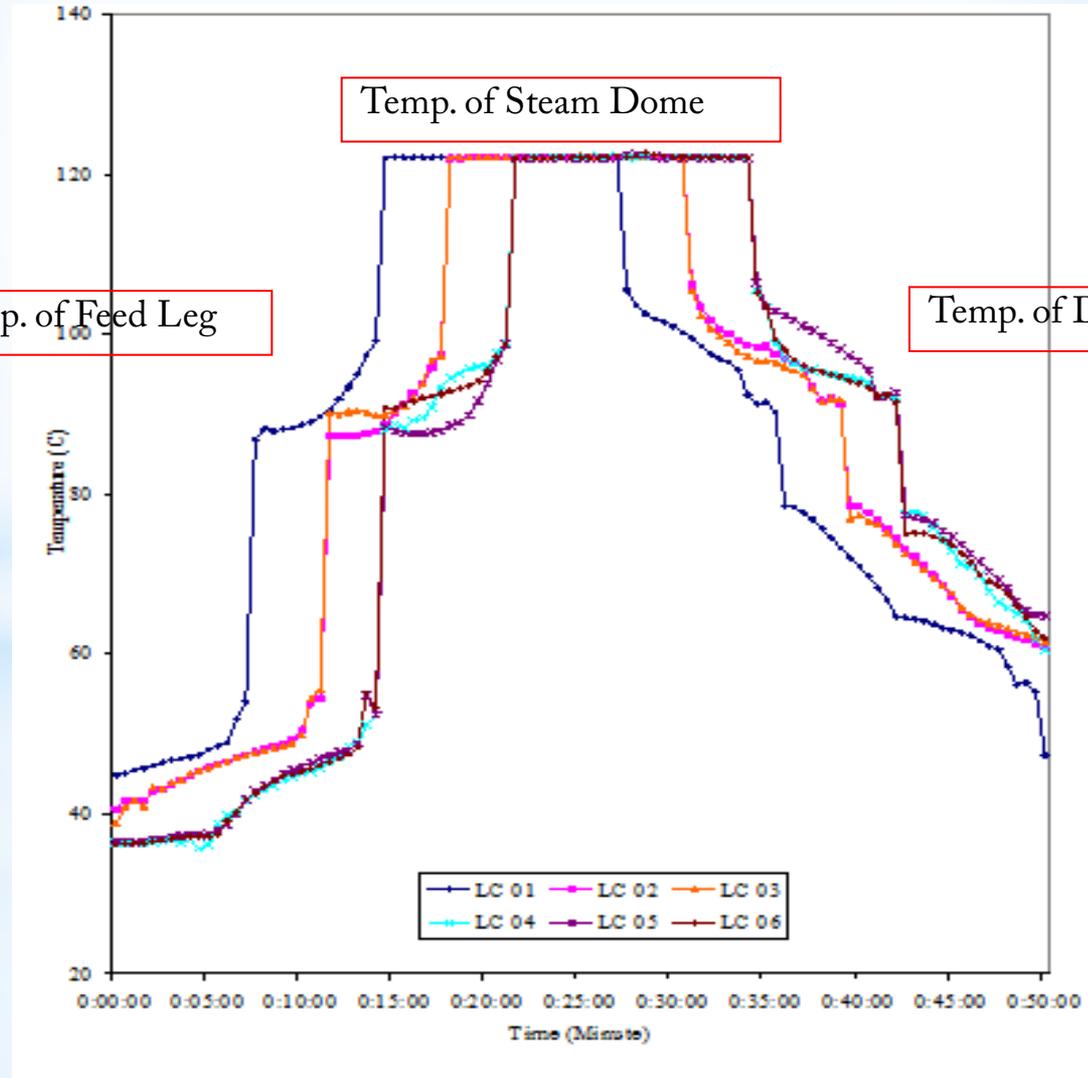


* Recorded data

- Initial Temperature
- Time steam on;
- Time and temperature vent(s) closed;
- Time first containers enter retort;
- Time last containers exit retorts;
- Temperature in water legs (if applicable);
- Container carrier chain speed; and/or
- Chain speed (for retorts providing agitation).



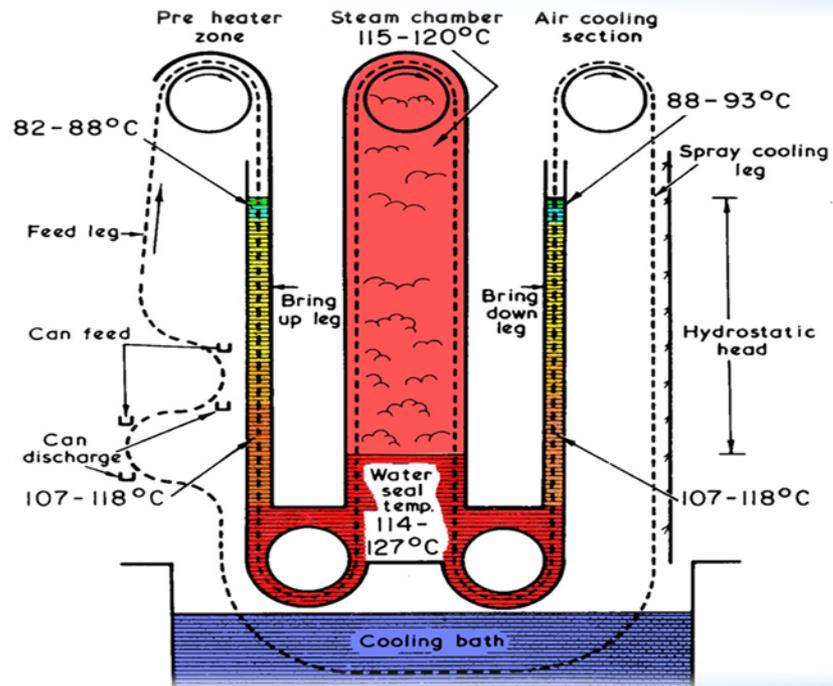
* Testing Result



A minimum-maximum temperature vs. time plot run A (empty loaded retort)

* Note

- How to place the probes into the retort
- Interval time of probe loading in the retort
- Verification of TD after venting



* Conclusion

- Steam operation needs to verify the venting procedure and TD.
- Retort structure must be considered before testing.
- No fluctuation and drop of temperature during cook period.
- Temperature and time of vent closed must be noted.



Thank you for attention.

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