

PROCESSING OF READY TO EAT PRODUCTS



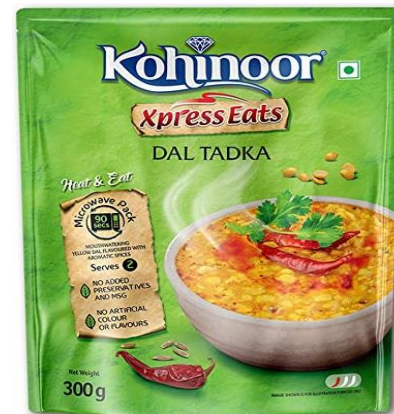
AATMANIRBHAR BHARAT

PM Formalisation of Micro Food Processing
Enterprises Scheme (PM FME Scheme)

WHAT ARE READY TO EAT FOODS?

- Any plant/animal derived food which is offered in fresh/processed form like frozen/shelf stable form.
- Can be Ready to cook/Ready to heat/Ready to mix/Ready to drink/Ready to eat.
- Ranges from snack bites to meal kits.
- Eg:Fried/baked snacks, Beverages, Instant meal kits, Ready to heat meal kits, Bakery products ,Gravies, sauces, Premixes.
- India's ready-to-eat food market stood at \$261 million in 2017 and is projected to rise to \$647 million by 2023 at a CAGR of over 16 percent during 2018-2023.

RTE EXAMPLES



KEY GROWTH FACTORS OF RTE

SCOPE

- Growing urbanization, increasing rate of earning working class and per capita spending.
- Fast-evolving urban lifestyle
- Increasing disposable income for the middle-class population
- Demand for fast food, ready to cook/mix/eat products
- Saves time and labour
- Products offering extended shelf life.

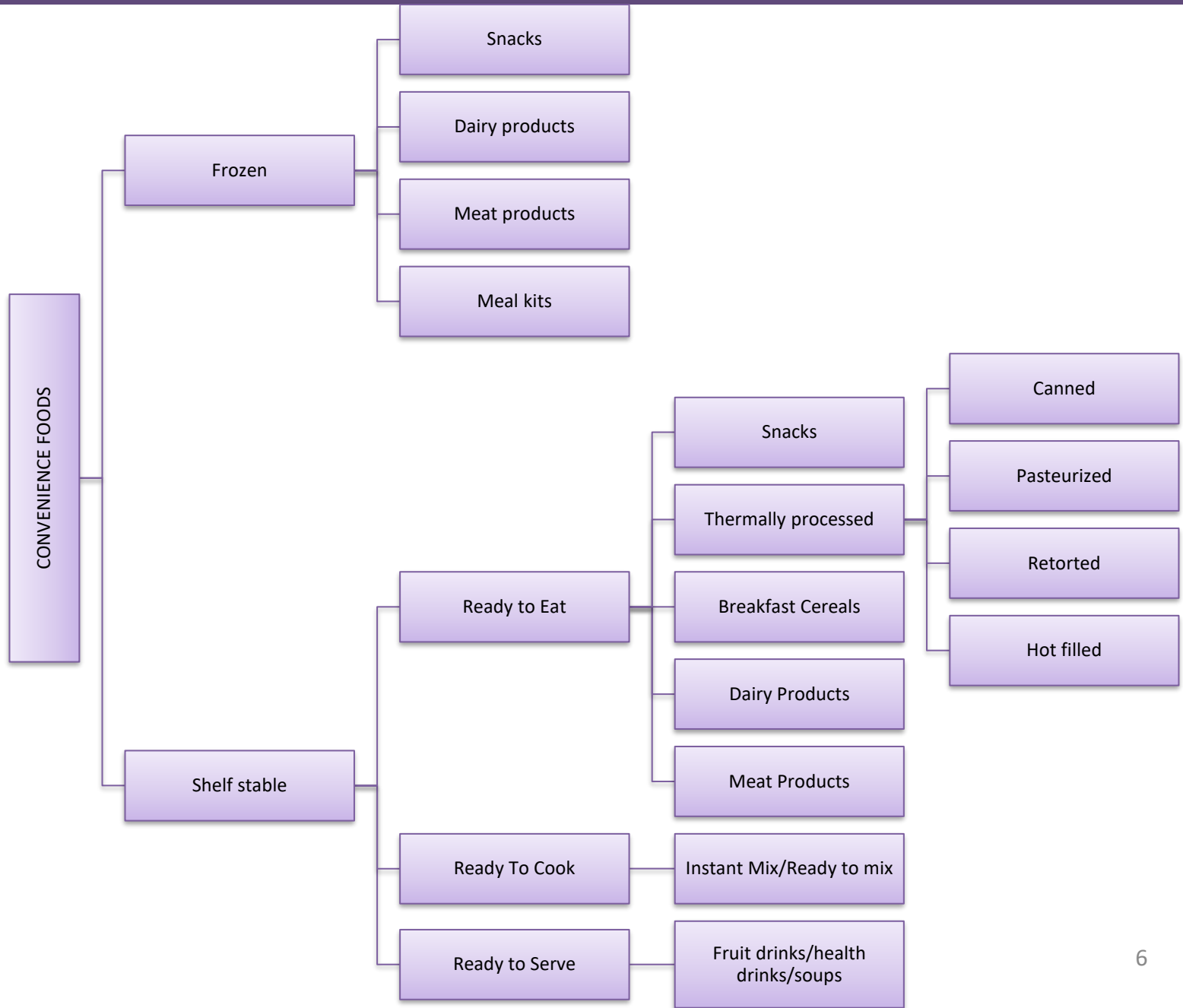
THREATS

- Lack of efficient commodity distribution system
- Mindset and negative view of the nutritional value of packaged RTE items.

MARKET PLAYERS

- **Snacks (Extruded snacks, Chips, Namkeen):** PepsiCo, ITC Foods Ltd, Pratap Snacks, Balaji Wafers, DFM Foods, Bikanervala, Haldirams.
- **Frozen foods:** Apex Frozen Foods Ltd, Godrej Agrovat Ltd, ITC Ltd, Venky's (India) Ltd, HyFun Frozen Foods Pvt. Ltd, Innovative Foods Ltd, Mother Dairy Fruit and Vegetable Pvt. Ltd, McCain Foods (India) Pvt. Ltd,
- **Thermally processed Foods:** ITC Foods Ltd, Gits Food Products Pvt. Ltd, MTR Foods, Haldirams
- **Instant foods/Ready to Cook:** MTR Foods, Haldirams, Nestle.

CATEGORIES OF RTE



RETORTING

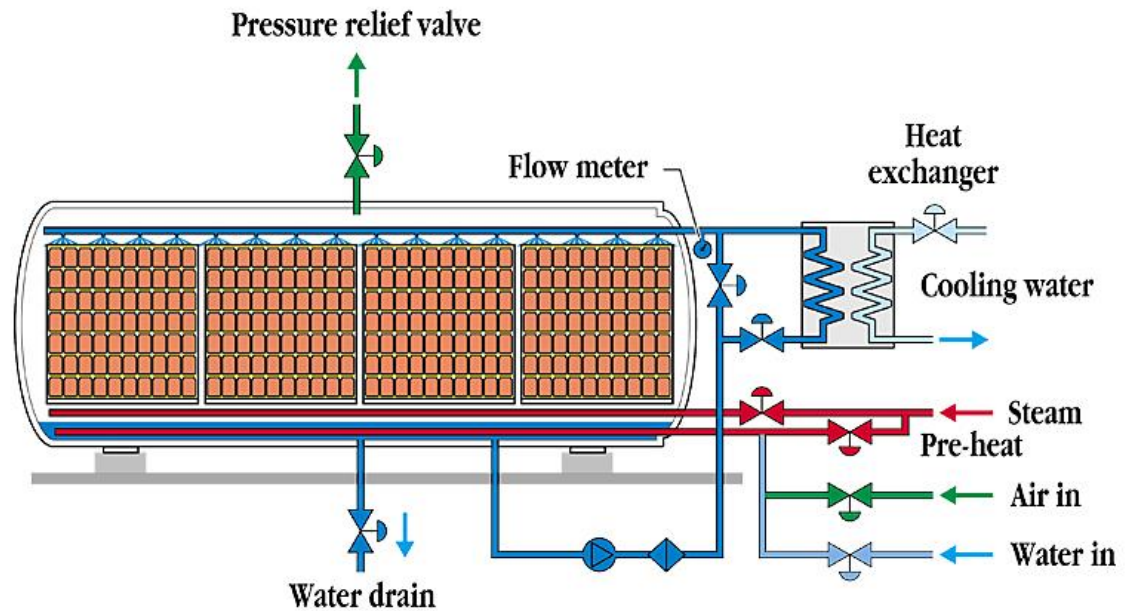
- Known as **autoclave/sterilizer**, is a retort is a pressure vessel used to “**commercially sterilize**” food.
- **Retorting** is thermal processing of low acid foods prone to microbial spoilage in hermetically sealed containers to extend their shelf life.
- The goal is to obtain commercial sterilization by application of heat and pressure.
- Low acid foods (i.e.: defined as products with a finished equilibrium pH greater than 4.6 and a water activity greater than 0.85).
- Process done at temperatures at or above **250°F or 121°C**.
- Batch retorts are widely used.

RETORT



Retort

Schematic diagram of steam water spray retort



COMMERCIAL STERILITY

- Food safety & commercial sterility is measured by the inactivation of target organism.
- General heat resistant organisms taken into consideration are ***Clostridium botulinum*** and ***Clostridium sporanges*** .
- ***Clostridium botulinum*** is the target organism for all general thermal processing systems.
- Exposure time and temperature is determined by certain calculation parameters such as **D Value**, **Z value** and **F₀ value** .
- “F₀” is defined as the number of equivalent minutes of sterilization at **250°F (121°C)** delivered to a load (product).
- A **F₀ value of 3(12D)** is required for achieving complete sterilization .
- Ensuring double safety, **F₀ of 6** is considered.

PROCESS PARAMETERS

Processing Parameters taken into consideration:

- Processing Time, Temperature and Pressure
- F_0 value or lethality rate.
- Heat penetration studies.

Factors affecting the rate of heat transfer

- Type of process and parameter
- Equipment design
- Size ,shape and type of the package
- Product characteristic such as solid content, viscosity, particulates.
- Headspace

MACHINERY & UTILITIES USED

Machineries

- Kettles, unloading vessels
- Filling machine(leepack,Toyo)
- Weigh checker
- Retort, loading trays.(Retort-KM Grand,Lagarde,JBTC,Allpax.
- X-Ray/Metal detector(JBTC,Ishida)
- Drying conveyors
- Cartoning

Utilities

- Air compressor
- Boiler
- Exhaust and ventilation unit
- Cooling towers

MACHINERY & UTILITIES USED



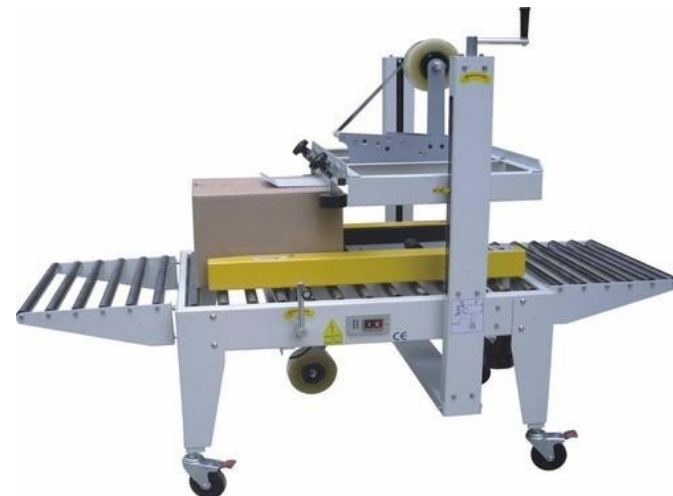
Retort trays and loader



Pouch filling machine



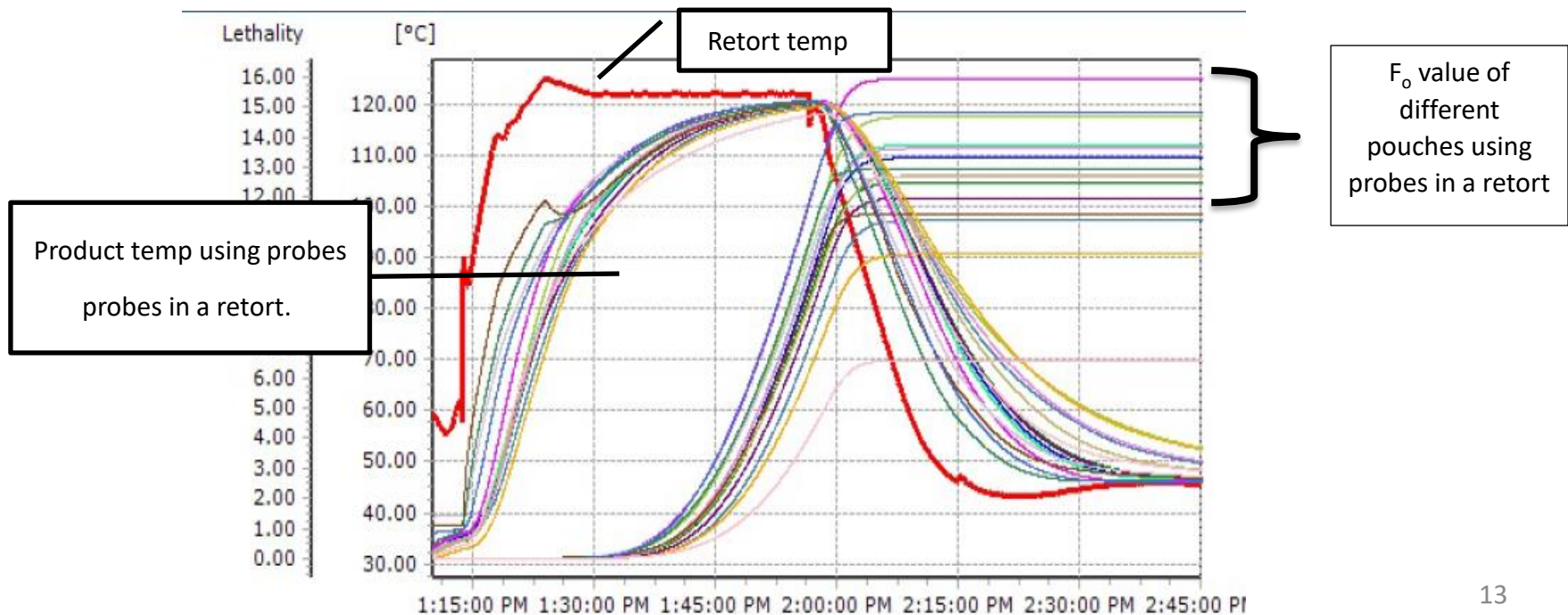
X-Ray/Metal detector



Cartoning Machine

HEAT PENETRATION

- Used to determine the rate of heating & cooling of the product, to ensure safe a thermal process.
- Validation of the process design can be done including F_0 values, temp, time, pressure, cooling time etc.
- Thermocouples are used to collect data of the rate of heat transfer, used to identify cold point.



FACTORS EFFECTING HP

Factors effecting HP studies are :

Product : Weight, formulation, preparation process, fill weight, solid to liquid ratio, consistency, physico-chemical parameters.

Packaging type: material that the container or pouch is made of, orientation, thickness, headspace, size and dimension,

Method of fill: Fill temp, Fill and net weight, Heat space

Sealing: Proper sealing, De aeration, vacuum.

Retort: Type of retort and operation method, come up time, tray racking systems

STAGES IN RETORTING

- **Water fill-** This differs and is an optional step depending upon the type of retort.
- **Come up-** This is the first step of the process, directed to achieve the target cook temp within the set time.
- **Cook time-** Sterilising the product at the designed time-temp combination with other set conditions.
- **Cool-** Gradual cooling is provided post the cook step, to bring the product to the ambient temperature.
- **Drain-**Water is drained by the end of the process as to the set level in the process design
- * *Sub steps within the steps are designed as per process requirement.*

TYPES OF RETORT

There are batch and continuous type retort. Among which the widely used are the batch retorts.

Different types of batch retorts are as below:

- ❖ Saturated Steam Retort Process-Direct steam Heating
- ❖ Water Immersion Retort (Static & Rotary)
- ❖ Water Spray Retort (Static & Rotary)
- ❖ Steam Air Retort (Static & Rotary)

SATURATED STEAM RETORT -DIRECT STEAM HEATING

- Oldest steam retort type with simple design and operation

Pros

Low Capital investment, particularly with carbon steel retorts

Easy to operate manually

Can process most canned product

Cons

Venting uses a lot of steam and is not an economical step. Uses a lot of energy.

Inflexible – typically limited to processing heavy sidewall containers, such as cans.

Cannot process most fragile containers, such as pouches, plastic bottles and plastic jar

WATER IMMERSION RETORT (STATIC & ROTARY)

- Like saturated steam process ,the product is completely separated from any cooling air .
- Product is completely immersed in water.
- Air is introduced on top of water to provide overpressure.
- Sometimes air is introduced to the steam which then heats the air.

Pros

Flexible and can process virtually all types of containers

Can provide for a partial immersion process with a rotary configuration.

Best application for rotary processes more than 10 RPM's.

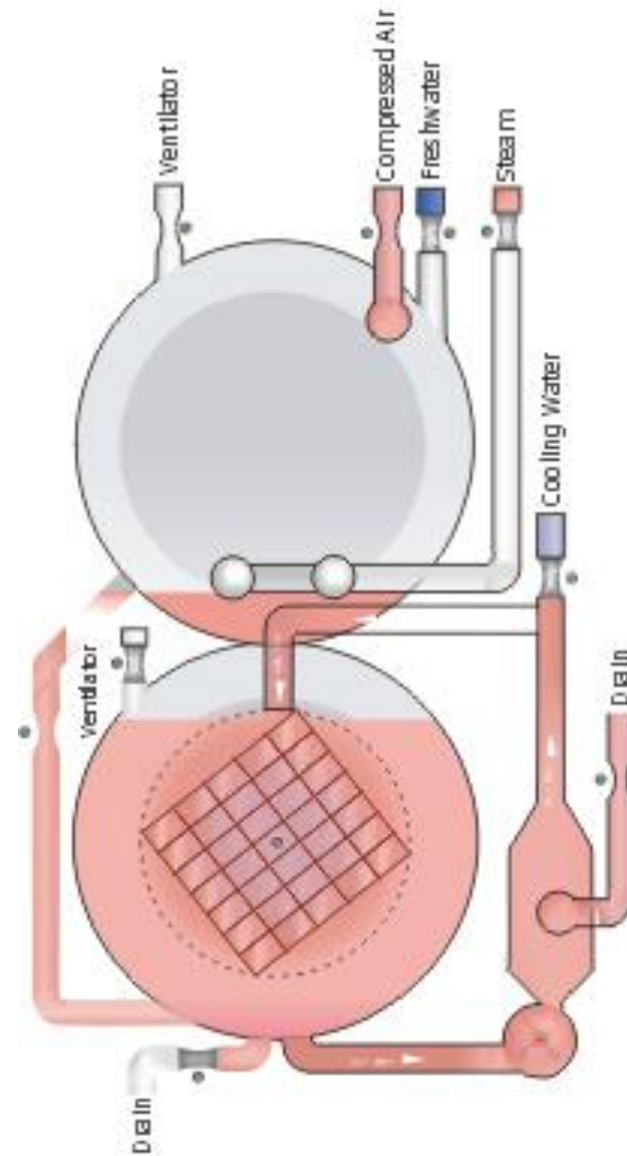
Cons

Virtually impossible to operate manually, given the complexity of piping.

Machines with rotary processes require significantly more maintenance time and money.

Higher Capital Investment – if a double (piggy-back style configuration) tank system is used.

WATER IMMERSION RETORT (STATIC & ROTARY)



WATER SPRAY RETORT (STATIC & ROTARY)

- Uses overpressure (by introducing air during sterilization)

Pros

Flexible and lower capital investment compared to the other types of overpressure retorts.

Cons

Is generally not a good option for rotary processes, particularly for those that exceed 10 RPM's

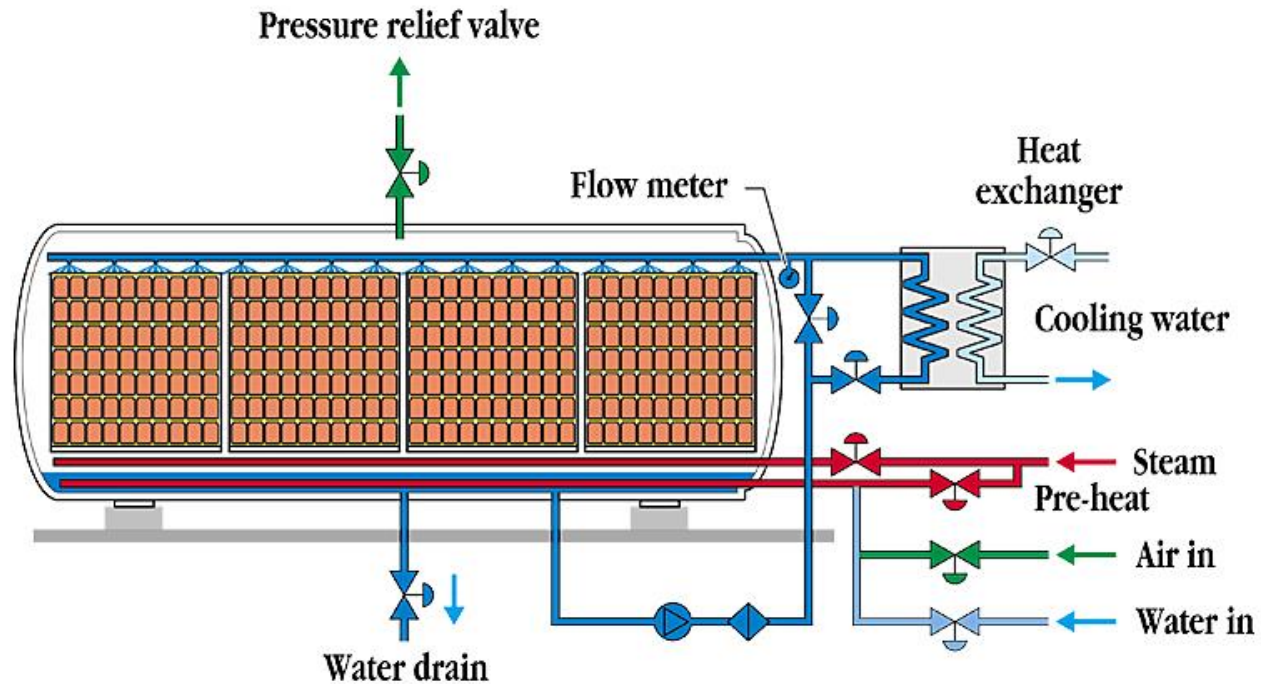
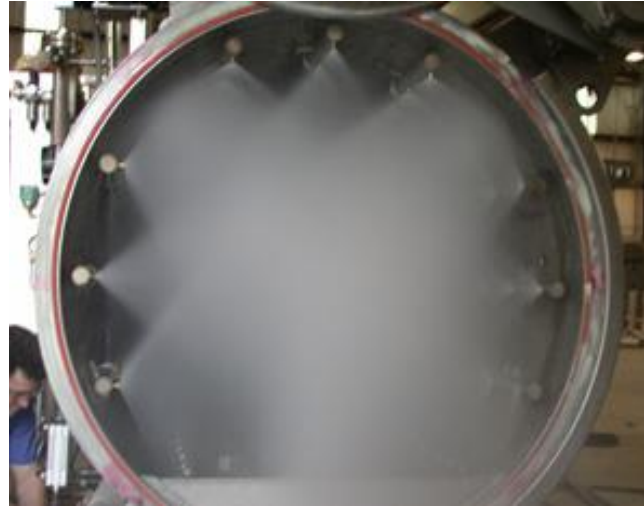
Energy efficient .Utilizes a heat exchanger and pump to recirculate both sterilizing water and cooling water.

Machines with rotary processes require significantly more maintenance time and money.

Sterilizing / cooling water can be reused without chemical treatment for the next process.

Extended cooling times due to indirect cooling (via heat exchanger) and due to water spraying.

WATER SPRAY RETORT (STATIC & ROTARY)



STEAM AIR RETORT (STATIC & ROTARY)

- Uses overpressure process, except that the product is exposed to the effect of air overpressure.
- Fan is used as a driving force to balance the steam with the air to avoid cold spots

Pros

Cons

Flexible and moderate capital investment compared to Water Immersion retorts

Is generally not a good option for high-RPM rotary processes, particularly for those that exceed 15 RPM's

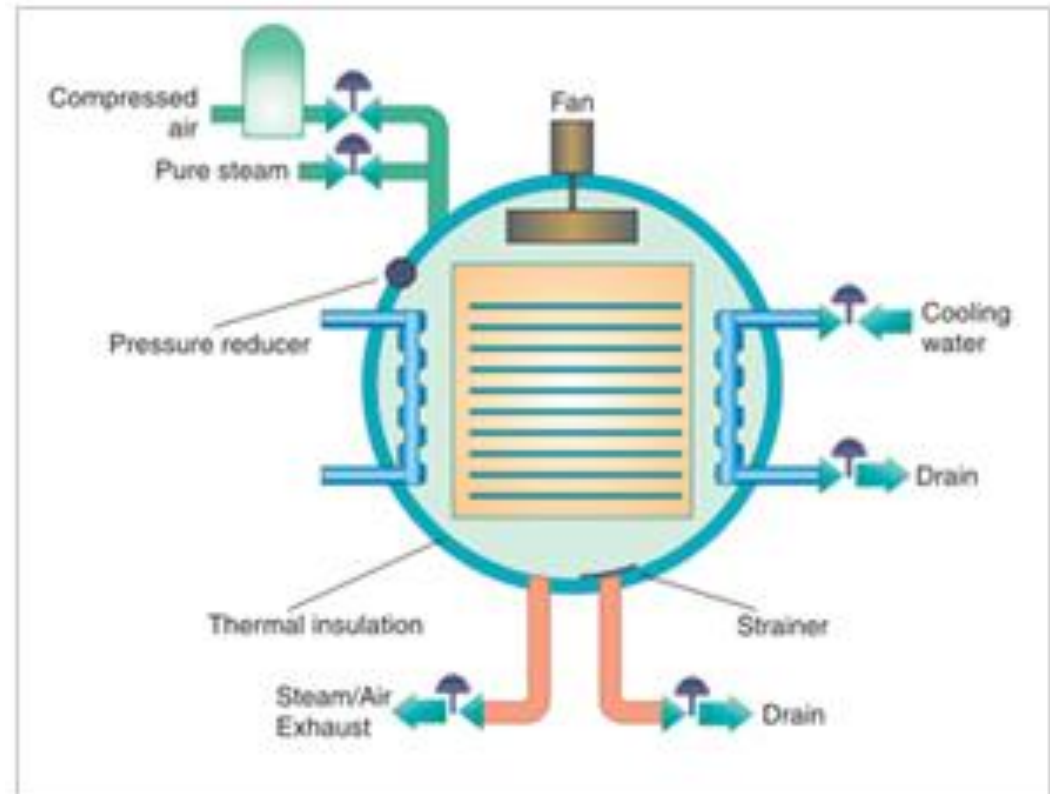
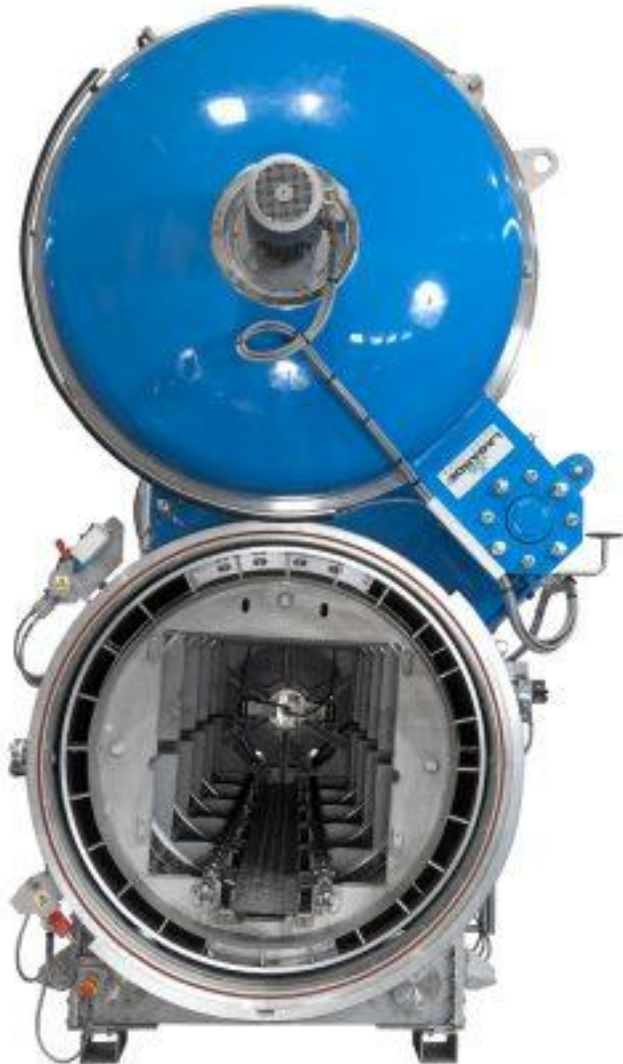
Energy efficient, utilizes a fan for forced convection.

Machines with rotary processes require significantly more maintenance time and money.

Other than the addition of the fan, the machine is a generally simple design and an easy process to administer.

The Fan is a moving part that adds to the complexity / maintenance of the retort that is unique to the Steam-Air process.

STEAM AIR RETORT (STATIC & ROTARY)



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