

Fig. 1 Horizontal and Vertical Retorts

Why Use a C1960?

The C1960 ensures high quality retorting and productivity. Features making it ideal for retorts include:

- ▶ Automatic temperature control for increased production and operational efficiency.
- ▶ Up to ten set point profiles, including guaranteed ramp and soak with individual hysteresis for precise temperature profiles and improved product quality.
- ▶ Dedicated front panel for Ramp/Soak profile applications.
- ▶ Three displays showing target set point, time remaining in segment and current segment running.
- ▶ Fast startup with self-seeking set point.
- ▶ Direct-connected RTD and/or thermocouple inputs reduce installation costs.
- ▶ Easy-clean NEMA4X/IP66 front face.

Features and Benefits

Precise Set-Point Profiles Improve Quality, Consistency and Yield

- ▶ The C1960 features a Ramp/Soak set point profile generator with configurable hysteresis. It can be programmed with up to 10 temperature profiles and has a maximum of 99 segments that can be distributed throughout the programs.
- ▶ Configurable hysteresis provides the flexibility to set the upper and lower limits of both ramp and soak segments to achieve a particular process requirement.
- ▶ A guaranteed process ramp is provided as part of the C1960 profile. This feature is useful in situations where steam fluctuations may occur. For example, when ramping the process to the desired temperature set point, the guaranteed process ramp tries to ensure that the process keeps pace with the rising set point. If it cannot, the set point ramp is delayed until the process is within the specified hysteresis band.
- ▶ The guaranteed soak ensures that the temperature and duration of the soak are held to the configured set points.

Comprehensive Displays for Improved Operation

- ▶ The large, dedicated ramp/soak front panel display of the C1960 allows the operator to see displayed information from a distance. This information includes the target set point, time remaining in main soak segment and the segment running.
- ▶ The controller also includes status indicators to show if the profile is in a ramp or soak segment. Dedicated keys allow simple control of the profile. The keys are:
 - Run
 - Hold
 - Stop
 - Increase Time/Temperature
 - Decrease Time/Temperature

Direct Connecting I/O Reduces Installation Costs

- ▶ With the C1960, RTD or thermocouple inputs are connected directly to the instrument. Linearization and ranging are automatic. This not only simplifies installation but also reduces installation costs by eliminating the need for special termination panels or conversion equipment.

The Application

Much of the food consumed each year is preserved by packaging it in hermetically-sealed containers in a process known as *canning*.

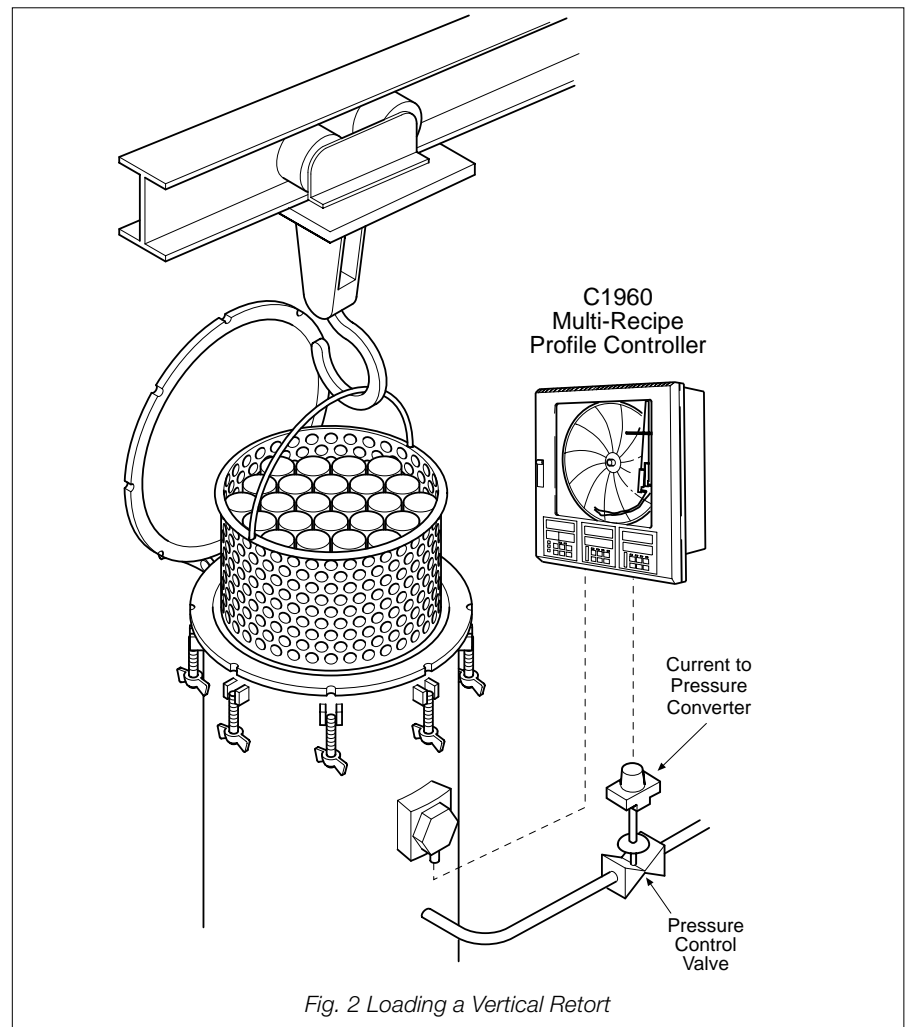
One of the most important steps in the canning of foods is 'thermal processing', more commonly referred to as the *retorting* operation. In this operation, strict specifications concerning both time and temperature must be adhered to and repeated batch after batch to obtain sterile product and uniform quality.

Processing is done in batches using a cylindrical, pressurized vessel called a *retort*. Retorts are classified as either vertical or horizontal, depending on the position of its long axis. A vertical retort is loaded from the top whereas a horizontal retort is loaded from one end.

In either retort type, the canned product is cooked by one of two processes:

- ▶ Steam cooking for product stored in metal containers
- ▶ Water cooking for product stored in glass jars

Steam cooking is done in a steam atmosphere devoid of air, and water cooking is done in steam heated water.



The Retorting Process – Steam Cooking

The cooking sequence is similar in both vertical and horizontal retorts:

- Load retort with canned product
- Lock cover or door
- Vent the retort
- Raise to cooking temperature
- Cook product for a predetermined period of time
- Either cool with water under pressure. (normally used for large cans) or pressure relieve (Normally used for small cans)
- Water cool at atmospheric pressure
- Unload retort

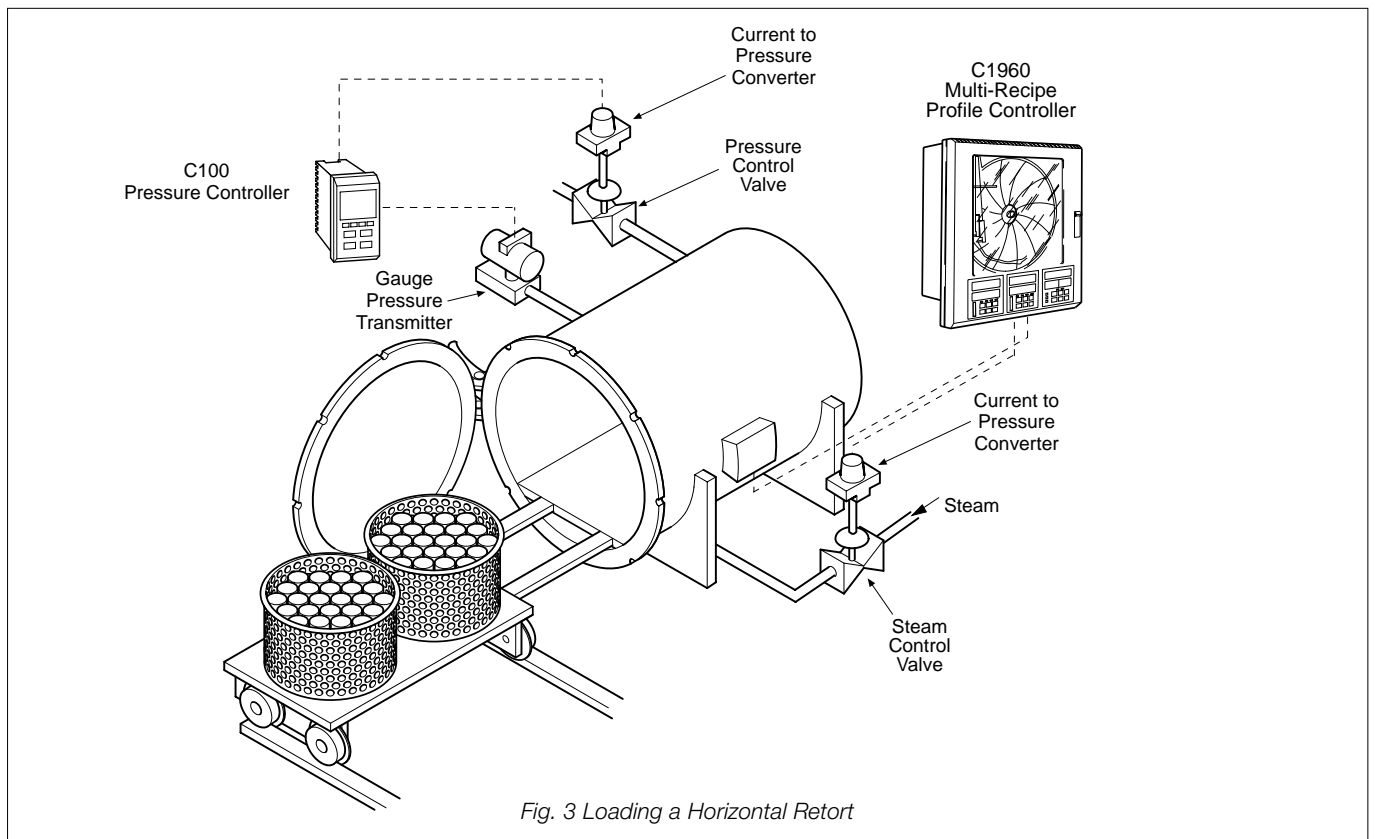
Loading, locking the cover or door and unloading are strictly manual functions.

► Venting Period

Venting the retort is the first step in the cooking cycle and takes place after the door, or cover, is screwed down tightly on the loaded retort. Its purpose is to eliminate the air in the retort. Steam is used to purge the air from the retort in order to obtain a steam-only atmosphere. It is important to get the air out of the retort before the cooking period starts because air, due to poor heat conductivity, acts as an insulator preventing the canned product from being adequately cooked. *Proper venting is achieved by purging for a preset time period and to a desired temperature - there are no shortcuts.*

► Raise-to-Cook Temperature Period

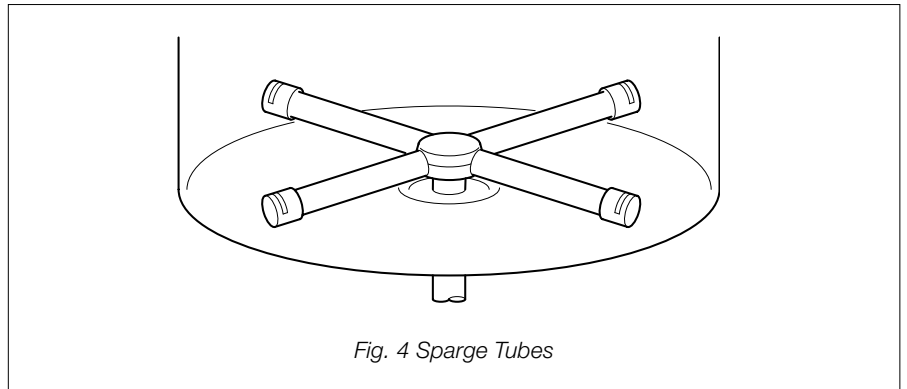
This period occurs after the completed vent period and is the interim period from the vent temperature to cook temperature.



▶ The Cook Period

This period is essential in order to properly cook the product, thereby destroying any organisms that could later spoil it. These organisms, called spores, are able to withstand several hours of atmospheric boiling water temperature, but are destroyed in a short time at a temperature of 116 to 121°C (240 to 250°F).

The correct temperature and the duration of the cook period are equally important in achieving the desired objectives. Overcooking not only increases costs, it also causes loss of taste or appearance of the finished product.



▶ Pressure Relief Period

The retort pressure, attained as a result of cooking at high temperature in a closed vessel, must be relieved before the product can be safely removed. If the retort has been filled with small cans, the pressure can be reduced to atmospheric immediately in a process known as *blowdown*.

However, if the retort contains large cans, it is necessary to lower their internal pressure before blowdown takes place to prevent them from exploding or distorting. The reduction of internal can pressure is obtained by circulating cooling water through the retort whilst maintaining retort pressure at the value attained during cooking by introducing pressurizing air. When can internal pressure has dropped to a safe value, indicated by the temperature of the cooling water leaving the retort dropping to a desired value, blowdown can take place without the threat of can damage.

▶ Water Cooling Period

In order to increase retort production, small cans are removed from the retort immediately after blowdown and immersed in a cooling canal prior to labeling. Larger cans, after cooling in the retort, may require further cooling in the same manner. The determining factor is the temperature of the product at the time it is packed in cases. This temperature is critical because cans that are too cool may rust externally, while those that are too warm prior to being cased and closely stacked in storage will cool too slowly and will be damaged by “stack burn”, or spoiled by creating conditions that encourage the growth of thermophile bacteria.

The cooling canal is a rectangular-shaped, cold-water filled channel near the retort through which the can-filled baskets are pulled after they are unloaded from the retort. The length of the canal, the temperature of the water, and the speed of the conveyor determines the final can temperature. When a cooling canal is used instead of the retort for final cooling, the reduced retort-time cycle increases production.

The Retort Process – Water Cooking

Product in glass jars is processed in a water-filled retort that is heated with steam. The topmost jars must be covered by 4 to 6 inches of water throughout the cycle and the water must be agitated to provide uniform cooking. Good agitation of the heated water is attained by introducing air into the steam supply line to create a bubbling action.

To ensure that the jar lids remain tightly sealed, the retort pressure is maintained slightly higher than internal jar pressure. Pressurizing the retort also means that cooking temperatures in excess of 100°C (212°F) can be achieved.

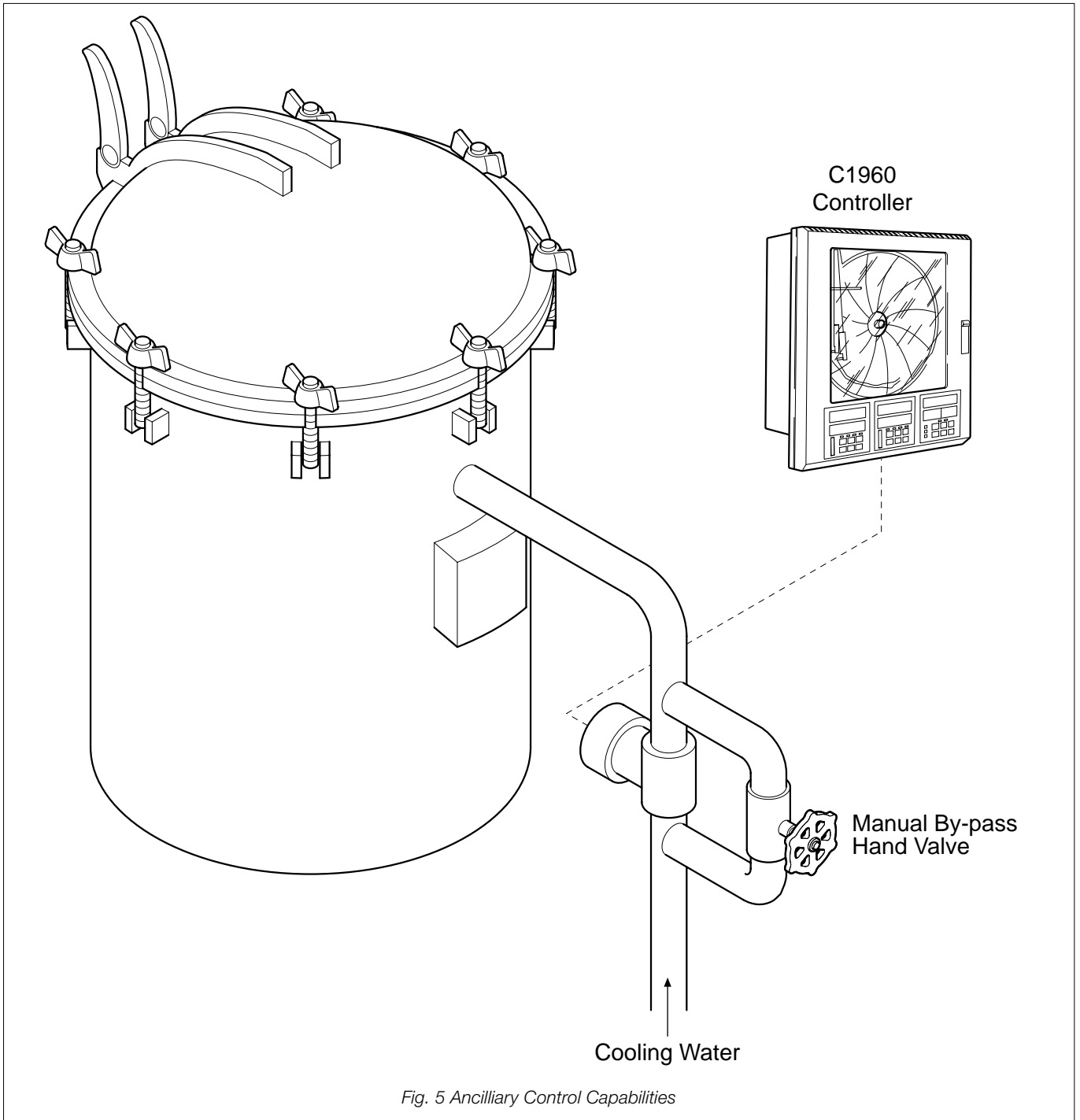


Fig. 5 Ancillary Control Capabilities

▶ **Preheat Period**

During the first stage, the vertical retort is filled with water prior to loading the jars. On subsequent stages, the water used to cool down the last batch remains in the retort.

The temperature of this water is too low for the next batch of hot-product filled jars (glass cannot withstand a thermal shock of more than 50°F) and must therefore be heated with steam to a predetermined temperature before the jars are immersed. This operation is called preheat. The preheat water temperature must not be more than 15°F above product temperature to avoid raising the internal jar pressure which would cause the jar lids to open and to prevent premature cooking of the product.

Preheating in a horizontal retort is not possible because the jars must be loaded and the door closed before water can be added. The water used to fill the retort must be preheated externally.

▶ **Raise to Cook Temperature Period**

The period in which the water is heated from initial temperature to cook temperature is referred to as the “raise to cook” period and should be kept to a minimum to prevent overcooking.

▶ **The Cook Period**

Both temperature and time are critical for the same reasons as outlined in steam cook.

▶ **The Pressure Cool Period**

The internal jar pressure must be lowered sufficiently to prevent it from forcing the jar lids open after cooking. To do this, retort pressure is maintained above jar internal pressure as cooling water is circulated through the retort to cool the product and reduce the pressure in the jar. Temperature reduction is done quickly to stop the cooking of the product.

▶ **Pressure Relief Period**

After the jars have been cooled sufficiently, the retort pressure may be reduced to atmospheric (blown down) without danger to the containers.

▶ **Atmospheric Cooling Period**

After blowdown, and with the retort cover or door open, cooling water can be circulated through the retort in order to continue the product cooling process. Alternatively, the jars can be removed and submerged in a cooling canal before labeling.

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Printed in UK (12.03)

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