

Processing Method	Treatment Method		Description	Temp/Time Range	Common Beverage Types	Common Package Types
	(Beverage)	(Package)				
Hot-Fill	HTST (High Temp/ Short Time)	Hot-Fill	The combination of HTST and filling bottles with hot product in order to treat the package is commonly referred to as a Hot-Fill process. Beverages must be high-acid (pH < 4.6) in order for this method to be viable.	175 -205 °F 15 - 30 sec	Sports Drinks, Juices, Enhanced Waters	PET Bottles, Glass Bottles
ESL (Extended Shelf-Life)	HTST or UHT (Ultra High Temp)	None	ESL products must be refrigerated throughout their shelf-life. The beverage is HTST or UHT processed but the package is filled cold and not treated.	185 - 300 °F 2 - 90 sec	Milk, Juices	Milk Jugs, Cartons, PET Bottles
Low-Acid Aseptic	UHT/Direct Steam UHT/Indirect Heating	Aseptic	Low-Acid (pH > 4.6) beverages require higher temperatures to reduce risk of pathogen growth. Heating is achieved by injecting steam directly into the liquid (Direct Steam) or via traditional heat exchangers (Indirect Heating). In Aseptic filling the package is sterilized separately via chemical treatment, then filled with commercially sterile beverage in a sterile environment.	280- 300 °F 2 - 6 sec	Milk, Non-Dairy Milks, Protein Shakes	HDPE Bottles, Tetra Pak Cartons
High-Acid Aseptic	HTST or UHT	Aseptic	Shelf-stable, High-Acid (pH < 4.6) products can be aseptically filled if the thermal abuse and packaging restrictions (high cost & design limitations) of Hot-Fill processing are undesired.	220 - 270 °F 2 - 9 sec	Juices	HDPE Bottles, Tetra Pak Cartons
Tunnel Pasteurization	Filled Package is heated, treating beverage & package simultaneously		High-Acid (pH < 4.6) beverages are filled at cold temperatures, sealed and then heated by a water spray while continuously moving through a tunnel.	160 - 175 °F 7 - 15 min	Carbonated Soft Drinks, Beer	Cans, Glass Bottles
Retort	Filled Package is heated, treating beverage & package simultaneously		Retort processing can be used for Low-Acid (pH > 4.6) products when more intense thermal processing is needed. The filled & sealed package is heated and held at a high temperature via steam and/or water.	230 - 275 °F 2 - 60 min	Coffee, Dairy Products	Cans, Glass Bottles
Cold-Fill/Cold-Fill Preserved	Beverage formula inhibits microbial growth		Cold-Fill processing can be used only if the beverage itself inhibits microbial growth. This can be achieved through the addition of chemical preservatives (benzoate).	N/A	Carbonated Soft Drinks, Waters	PET Bottles, Cans