SECTION 01 / 06

Carbonated Soft Drink Production Process PDF: Syrup, Carbonation & Filling

Process map & product definition

The carbonated soft drink production process combines consistent formulation with controlled gas dissolution and pressure filling. A typical line prepares syrup, blends it with treated water, adds carbon dioxide under controlled conditions, fills a pressure-rated container and closes it promptly. This PDF guide follows those interfaces and provides an equipment checklist, commissioning questions and a simple capacity example.

Specify the drink and package together. Sugar content, sweetener system, acidity, foaming behavior, carbonation target and storage conditions influence the process. Bottle pressure resistance, closure performance and can seam design also affect the result. Carbonation is not a substitute for a validated preservation strategy; the microbiological design must match the product and intended shelf life.

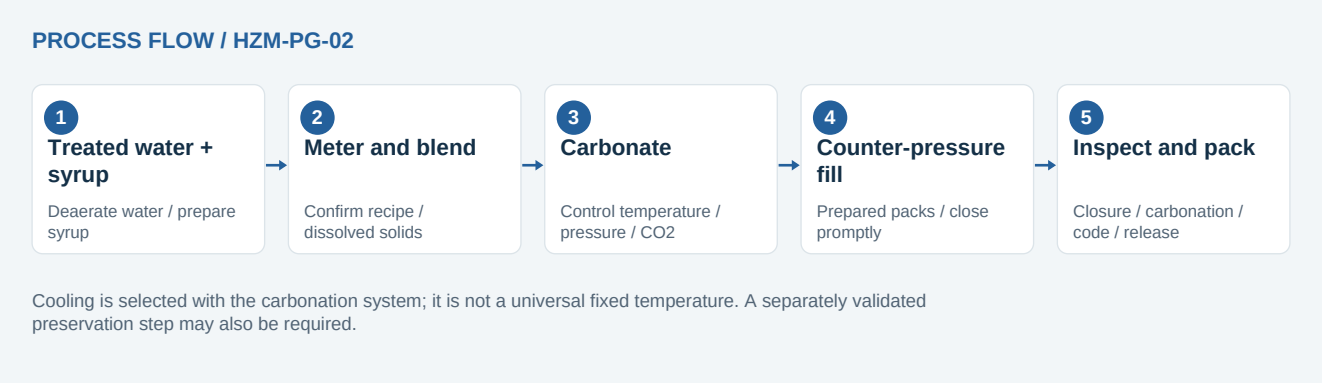

Figure 1. Original process schematic. Alternative routes require product-specific assessment.

Scope of this flow chart

The diagram shows a typical post-mix CSD line. It does not claim that all soft drinks require identical syrup treatment, cooling, preservatives or pasteurization. Define those requirements with the formulation and process specialists.

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Syrup preparation, blending & gas dissolution

01 / Receive water, ingredients and carbon dioxide

Set incoming specifications for the source water and all ingredients. Include approved food-grade CO2 supply and traceable delivery records. Keep concentrated flavors and minor ingredients identifiable: a small weighing error can affect a large finished batch. Treatment of water should be based on its measured quality and the finished-drink specification.

02 / Prepare simple syrup and finished syrup

Dissolve sugar when required, check the solution and combine ingredients in the documented order. Liquid sweetener feeds may use a different preparation route. Include suitable filtration or screening where the recipe permits it. Record actual additions and the final syrup release result instead of relying only on an operator-entered batch name.

03 / Deaerate and proportion

Removal of dissolved air can support controlled carbonation. Meter the water and syrup to the approved ratio, using calibrated flow or mass measurements. Brix is useful for many sugar-containing recipes but must be interpreted with temperature and formulation in mind; it is not a direct sugar reading for every multi-ingredient or sugar-free beverage [1].

04 / Carbonate at stable operating conditions

A carbonator dissolves CO2 in the beverage under controlled pressure and temperature. Keep the transfer path to the filler stable so that unnecessary pressure drops do not release gas. Product temperature, gas supply, mixing performance and flow all belong in the commissioning record. Do not copy a pressure setting from another machine or drink [1].

05 / Fill under pressure and close

Counter-pressure filling brings the container and filling system into the appropriate pressure relationship before liquid transfer. Controlled pressure release helps manage foaming before the closure is applied [2]. Match valve operation and closure handling to the package and recipe. Include empty-container inspection and the hygiene treatment required by the validated process.

SECTION 03 / 06

Equipment & packaging requirements

Figure 2. PET-bottle CSD filling equipment from the HZM equipment library. The external view does not show the upstream syrup room or carbonator.

Section	Typical equipment	Purchase specification
Syrup room	Dissolver, ingredient dosing, mixing tanks	Recipe range; usable batch volume; mixing time
Water / blending	Treatment, deaeration, proportioning	Water quality; dosing accuracy; turndown
Carbonation	Carbonator, gas controls, cooling as selected	Target CO2; flow range; temperature envelope
Filling / closing	Pressure filler, capper or seamer	Bottle or can drawings; foam behavior; closure tests
Dry end	Inspection, coding, labeler, packer	Condensation handling; label adhesion; pack strength

PET bottles, glass bottles and cans require different handling and closure systems. A machine advertised for carbonated drinks should still be assessed with the intended package samples and recipe. For cans, request a seam inspection plan; for screw caps, agree torque and leakage checks. Include appropriate pressure-rated components and safe operating procedures in the supplied documentation.

End-of-line planning matters when cold packages enter a warm, humid room. Evaluate condensation and surface drying before labeling and coding. A warmer or other conditioning stage is a project choice, not a compulsory step in every line. Confirm actual plant temperature and humidity rather than selecting equipment from a generic process sketch.

SECTION 04 / 06

Control points & troubleshooting

Observation	Checks to prioritize	Avoid this shortcut
Excess foam at discharge	Product temperature, pressure stability, filling and vent sequence	Raising pressure without reviewing package limits
Low packaged CO2	Sampling method, inlet CO2, leaks, transfer and closure losses	Assuming the carbonator display equals package CO2
Variable flavor or solids	Syrup release, flow calibration, batch identity	Correcting by taste alone
Inconsistent fill	Foam, valve condition, container dimensions	Changing every valve setting at once
Wet labels or weak adhesion	Dew point, package conditioning, surface drying	Blaming label stock before checking condensation

Take baseline samples under steady conditions and record the associated line settings. When investigating a problem, change one relevant variable at a time and preserve the before-and-after data. Use the approved measurement method for dissolved CO2; sample handling, temperature and loss of pressure can distort a result. Separate quality checks from the site-specific food-safety controls.

Cleaning and recipe changes

Identify syrup, flavor, sweetener and color residues that may carry into the next drink. Plan the production sequence and cleaning verification accordingly. Confirm complete cleaning of both the mixer and filler product circuits, then check first-off product before release. Rinsing until the liquid appears clear is not, by itself, evidence of a validated cleaning cycle.

Start-up and stops

Specify how the mixer, carbonator and filler respond to low flow, interrupted CO2, loss of cooling and an extended stop. Track startup product separately until recipe and carbonation results are acceptable. Define restart checks before normal packaging resumes.

SECTION 05 / 06

Capacity, CO2 balance & acceptance tests

Worked example - illustrative design basis

A line running 12,000 bottles/h at 0.5 L requires 6,000 L/h of finished drink before losses. At an assumed product target of 6 g CO2/L, dissolved CO2 in that flow is 36 kg/h. This is product uptake only; total supplied gas is higher when purge, vent, startup and other losses apply.

The example is arithmetic, not a recommended carbonation level or a utility guarantee. Use the actual recipe target and have the supplier state gas consumption at the specified package, temperature, speed and operating pattern. A useful test report distinguishes steady-running gas use from an entire shift with starts, stops and changeovers.

Check syrup supply against filler demand

For an illustrative volumetric water-to-syrup ratio of 5:1, a 6,000 L/h finished stream requires 1,000 L/h of syrup and 5,000 L/h of water, assuming additive volumes. Real recipe dosing may be defined by mass and requires density correction. Confirm the basis before setting flow ratios or sizing syrup tanks.

- Test the intended beverage at minimum and maximum guaranteed speed.
- Measure recipe conformity and packaged CO2 with agreed sampling methods.
- Assess foaming, fill accuracy, leakage and closure integrity after stable operation.
- Demonstrate recovery after a controlled stop and document startup rejects.
- Run a format change and verify the first acceptable packs afterward.
- Measure cooling, compressed-air and gas consumption on an agreed basis.

Define acceptance in saleable containers rather than gross machine counts. Agree how microstops, rejected packs and startup losses enter the calculation. For a multi-format line, list which recipe and container combinations are covered by the guarantee and which need further trials.

SECTION 06 / 06

Questions to resolve before ordering

Does every carbonated drink need the same filling temperature?

No. The operating window depends on CO2 content, product behavior, package pressure limits and filler design. Request a guaranteed temperature-and-speed envelope for the actual drink rather than assuming one temperature works for all CSD lines.

Can an ordinary water filler handle carbonated drinks?

Do not assume so. Gas retention and foam control require an appropriate filling system, pressure-rated product path and compatible containers. Obtain written confirmation of the machine configuration and test conditions.

Should the syrup be pasteurized?

That decision belongs to the product preservation design. Ingredient quality, formulation, microbial hazards, storage and other control measures affect whether and where thermal treatment is needed. The simplified flow chart does not make that decision for a specific product.

How much CO2 should be budgeted?

Start with liquid flow multiplied by the target dissolved CO2, then add documented consumption for purging, venting and operating losses. Ask for actual-use measurements and the assumptions behind a vendor estimate.

What information makes a quotation comparable?

Provide recipe characteristics, target CO2, package samples, hourly output, source-water results, product temperature, storage conditions and the available utilities. Ask every bidder to use the same acceptance criteria and boundary of supply.

Technical references

General technology references accessed September 21, 2026. Diagrams and worksheets are original planning material; examples are not equipment guarantees or process settings.

1. Krones: Contiflow mixing and carbonation

2. Krones: Modulfill VFS filling principles

3. Krones: Process technology for soft drinks and juices

Find equipment and further planning articles at www.hzmmachine.com. For a project review, provide your recipe characteristics, package specification, required output and site utilities.