Nitrogen application guide

Coffee packaging

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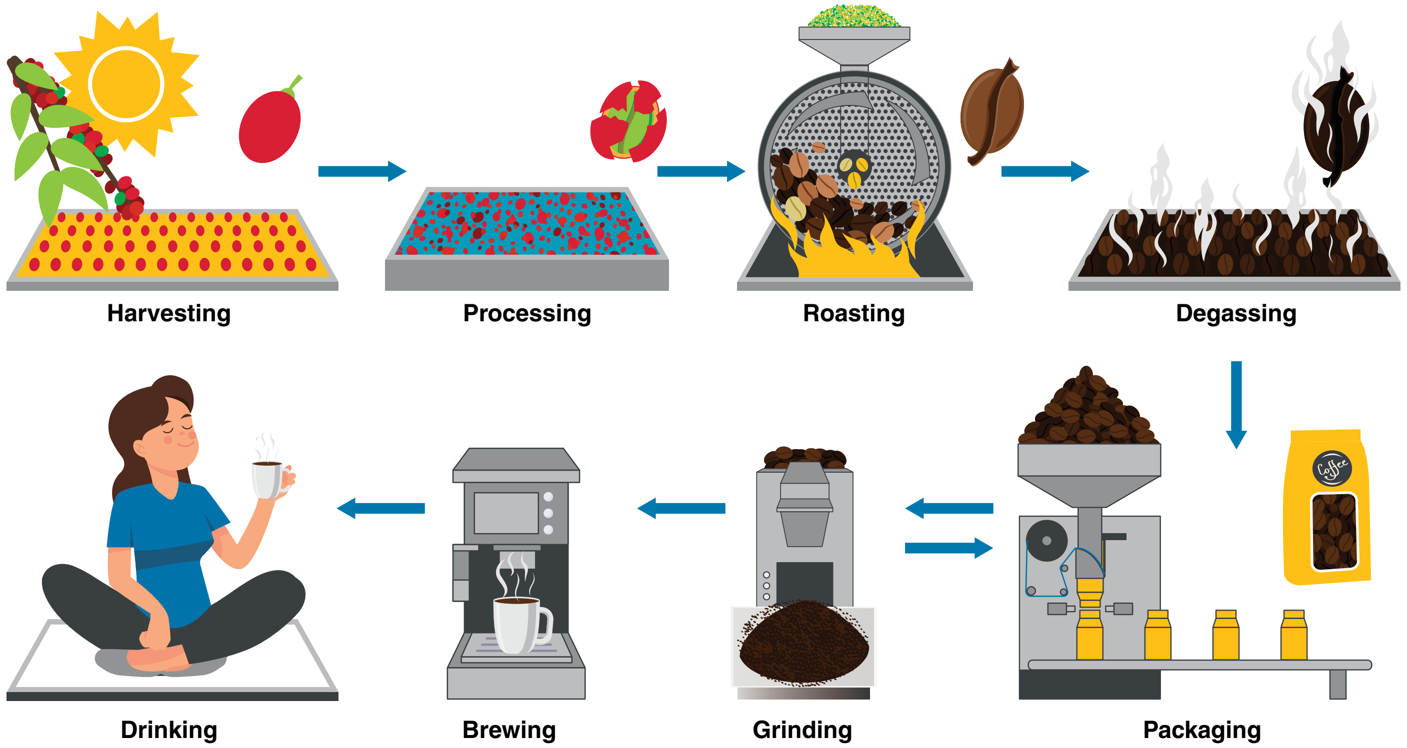
The application

What is coffee packaging?

When coffee arrives in our cups, it has reached the end of a very long journey. Typically, coffee beans grow in very specific climates that can be found in countries like Brazil, Colombia and Ethiopia. However, to ensure its freshness, the coffee is often roasted, ground and packaged in the country where it is consumed.

The reason is that, once the beans have been roasted and ground, their flavor can change quickly and the coffee can go stale. That is why the steps between roasting and consumption – especially packaging – are crucial to preserving the coffee's taste.

Just as there are several different ways of packaging coffee, for example in pods, tins or bags, there are also different types of packaging machines to get the job done. These include vertical form fill seal (VFFS) machines, capsule packing and tin filling machines.



Coffee has gone a long way before it finally arrives in your cup.

Many kinds of packaging exist. Pods & capsules have gained a lot of popularity lately.

1. Flexible packing
2. Flexible packing with degassing valve
3. Canned packing
4. Vacuum packing
5. Pods
6. Capsules

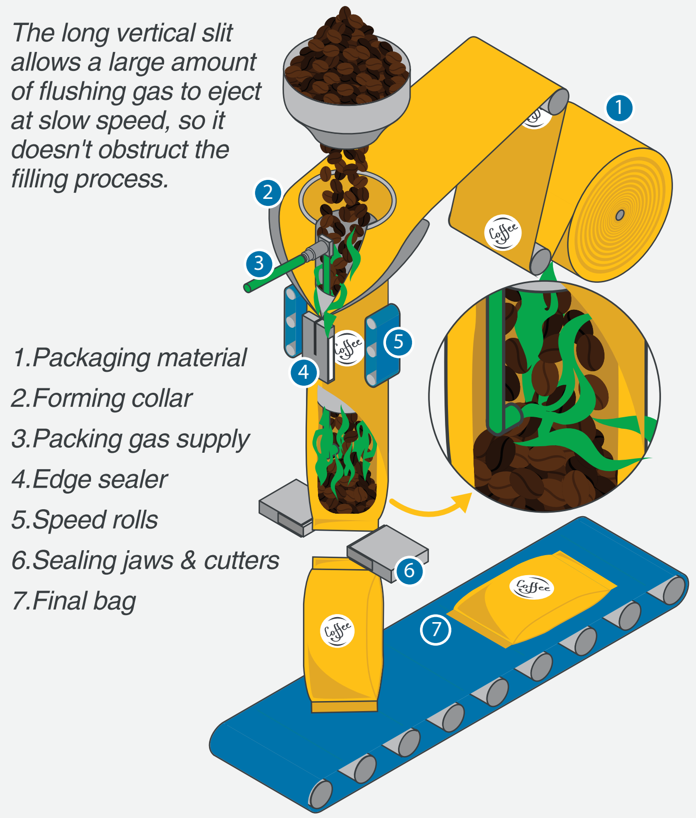
Where is nitrogen used in coffee packing and why?`

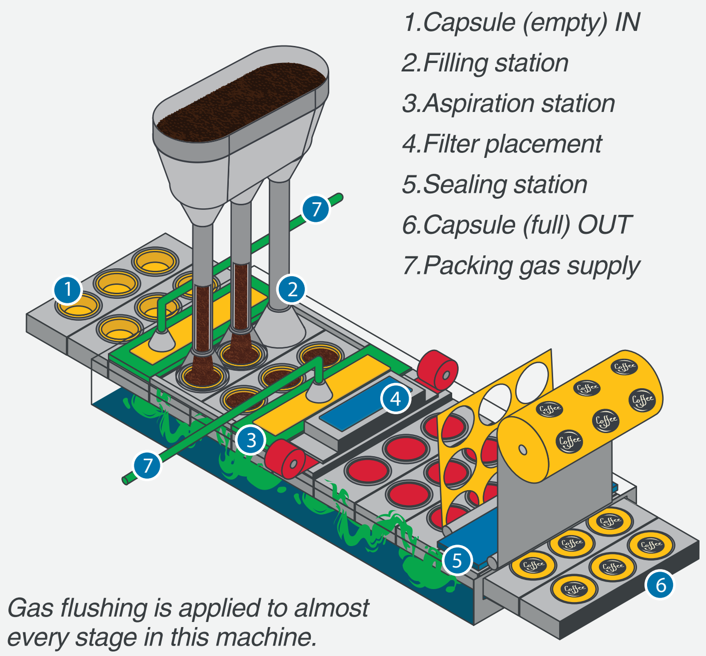
Nitrogen is inserted in the packaging of coffee to maintain its freshness and to extend its shelf life. Here's how nitrogen is used in the most common types of packaging:

VFFS is a packaging method that works by dosing the coffee beans or powder vertically into a plastic tube. Then it gets sealed into a **bag.** The amount of coffee is managed by weighing the dose that is dropped. During this process, the bag is constantly flushed with nitrogen to ensure an inert atmosphere.

Filling a tin is a similar process. A pre-weighed dose (this is often ground coffee) is dropped from a hopper into a tin while the tin is flushed with nitrogen.

When **filling capsules,** pre-dosed ground coffee (the amount of coffee is very specific) is dropped into capsules or pods that are then sealed with positive pressure using nitrogen.





Large scale coffee bag filling is used for the bulk bags that are sent to coffee shops. At the roastery, the bags, already inerted with nitrogen, are filled using a hopper. That means the coffee enters an atmosphere that is already inert. In some cases, the inerting is done post-filling.

The requirements

What is the flow and purity required for nitrogen in coffee packaging?

1. FLOW

As with many food packing applications, the recommended flow is often based on the size of the package multiplied by 2-3 to allow the package to be properly flushed. However, for each of the packaging technologies, the flow can vary slightly. This also applies to different roasteries (depending on how they set up their gas flushing). The pressure is typically quite low, just above atmospheric.

1.1 VFFS

The nitrogen is flushed through a nozzle into the bags. Therefore, the flow depends on the pressure and nozzle size. The rule of thumb (2-3 times the size of the package) can help determine the flow rate. However, more efficient setups may use less and others more. The corresponding value can then be multiplied by the number of bags moving through the process.

1.2 Tin filling

For tins, slightly less nitrogen can be used than the rule of thumb. That is because when the tin is filled, the coffee already displaces the air it contains. Nitrogen is then used to top off the tin at the end via a nozzle. Again, the pressure, nozzle size, number of nozzles, as well as the number of tins determine the flow.

1.3 Bulk bags

The flow is determined based on the flow through the lance at the pressure it flushes the bag. If it is an empty bag not filled with air, it is possible that one flush will be sufficient. If it is a filled bag, the flow will purely be determined on the amount of time over which the flushing takes place.

1.4 Capsules

In this case the flow can vary depending on the type of machine, but the same principles as above can roughly be applied.

2. PURITY

In many cases, the perfect nitrogen purity for coffee packaging is 99.5%. A higher purity often yields no benefits. A residual oxygen percentage of between 0.5-2% in the package is needed to increase the coffee's shelf life.

In addition, check local regulations for nitrogen use in direct food contact applications. European Union regulations (231/2012) for example, have defined nitrogen as a food ingredient labeled E941 that requires a 99% purity.

Key questions to ask and sizing calculations

Existing coffee roastery: Real data

- Pressure can be found at the point of use
- Invoices for deliveries can help determine costs and consumption, and calculate ROI
- Running hours can be used to determine the average flow rate
- Maximum usage over 1 day/week

- If the nitrogen comes in bottles, this is easier to determine
- If it is in liquid form, it may be possible to use invoices. However, the most accurate method in all cases is flow metering

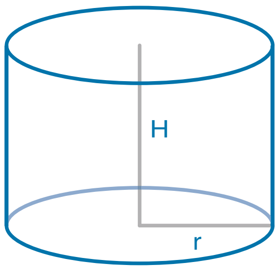
New coffee roastery: Estimates & calculations

- What is the packaging type?
- How many packaging lines?
- What are the running hours of the packaging lines?
- How big are the coffee packages and how many are processed per hour?
- What pressure is needed for gas flushing?
- How big are the gas flushing nozzles?
- Does the manufacturer of the packaging machine have data?
- Will the bag purity be tested? If so, what is the spec?

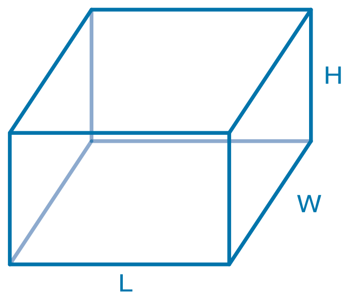
Calculating package volume:

Depending on the shape, a tin can simply be calculated as a cylinder. A bag can be calculated as a cuboid or cylinder:

Cylinder volume (tin) = $V = \pi \times r^2 \times H$



Cuboid volume (bag) = $V = L \times W \times H$



Flow = (volume of bag/tin) x (2-3 flushes of gas) x (number of packages per hour)

Example = 0.0003 Nm^3 bag x 3 flushes x 10,000 bags per hour = 9 Nm^3/h

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