



DISSOLVED OXYGEN

A BELL'S BREWERY QUALITY LAB REFERENCE SHEET

What is D.O.?

- *Dissolved Oxygen.* The dissolved portion means the gas has entered a liquid, like beer. Oxygen makes up 21% of the air we breathe and is the primary contaminant that we encounter in the brewery.
- Oxygen is a very reactive chemical that can damage beer flavor when dissolved in any liquid that touches our beer.
- Essentially, oxygen makes our beer taste old faster.



How we measure D.O.

We measure oxygen in many areas of the brewery:

- Testing trace gas phase oxygen in bulk food-grade CO₂.
- In tank after any transfers, centrifuging, ingredient additions, filtration, carbonating.
- On the way to each filler (keg, bottle, can).
- Post package TPO (Total Package Oxygen, measuring both headspace O₂ and liquid O₂ separately).

Why it's important

- We need oxygen to help the yeast grow and make beer.
- After fermentation, we want as little oxygen to touch our beer as possible. The lower the oxygen, the better our beer is going to taste!
- Oxygen speeds up the reactions that make our beer taste old.
- We want to maintain hop and positive yeast character as long as possible and reduce negative flavors like paper, dried fruit and sweetness.

What sets us apart from other breweries

- We have (intentionally, sadly) destroyed more beer due to excessive DO than most breweries produce in an entire year, for the sake of quality and fresh tasting beer!
- We utilize both inline and portable sensors to measure oxygen comprehensively throughout the brewery.
- Oxygen is so reactive we measure it immediately, or we may get false low readings!
- We can see oxygen ingress from a loose clamp with our instrumentation.
- We have spent a great deal of time optimizing packaging startups to ensure it's a very low oxygen environment and continuously monitor all of our packaging runs.
- We can measure the different levels of oxygen in the headspace and the liquid of a package which is essential in trouble shooting package oxygen issues.
- We routinely audit all of our fill valves and do maintenance on them to ensure they are working properly!
- TPO (total package oxygen)! Our brewing team can do everything right, but the beer can become stale with careless packaging. We test our bottles, cans, and kegs at the start and end of every packaging run. Bottles and cans are tested every hour to ensure there is no DO pickup during the packaging process. This ensures the freshest tasting beer!

What D.O. does to our beer

- Changes the flavor!
- Reduces hop flavor
- Increases sweetness
- Can increase color
- Reduces pleasant fruit esters
- Staling
- Increases dried fruit flavors
- Increases astringency
- Changes bitterness character
- Increase paper/wet cardboard flavor

How to sell to others

- Measuring oxygen is a critical step we take very serious to ensure our customers experience the freshest tasting beer.
- We have specifications for allowable amounts of DO. These were developed from a long series of sensory panel studies.
- We audit our capabilities.
- Package oxygen measurements are reported on a weekly basis.
- We do a lot of work to ensure all of our oxygen sensing instruments are working properly and routinely conduct calibrations on our instruments.