

# Instrument Guidance for Beer Quality Labs

by Melissa Antone, Quality & Sensory Specialist

Initiating a beer quality program can be daunting. Effectively utilizing a limited budget to achieve the most impactful result at the brewery requires a knowledge of potential pitfalls and pinch points based on the business model.

It is recommended that breweries join trade organizations such as the Brewers Association and the American Society of Brewing Chemists (ASBC) for access to important resources and methods related to the topic of brewing quality. The table below categorizes various instruments and their relevance to beer production. The subsequent table provides Example Lab Setups at Basic, Intermediate, and Comprehensive levels of QA/QC, but it is important to keep in mind that each business has unique circumstances, and these examples are likely to require adjustments in the contexts of the brewery's specific needs and priorities.

For instance, a brew pub may be planning to exclusively sell beer on draught from their taproom. They do not plan to package and distribute, but perhaps they are hoping to re-pitch yeast for their flagship styles. This brewery should focus their sights on instruments and methods that support *Yeast and Fermentation*, such as a microscope or automatic yeast cell counter for measuring yeast cell concentration and viability. While controlling contamination is always important, an issue can be caught immediately since the beer will never travel far from the taproom. The threat of a reputation shattering recall is minimal. Establishing a cadence for routine sensory analysis can be most impactful for identifying defects or contamination.

A boutique brewery and blendery who produces both clean styles and mixed culture beers for release in cans or bottles should invest in *Sanitation and Contamination* efforts to ensure proper cleaning protocols to prevent equipment contamination. The purchase of an ATP luminometer would have the greatest impact for this brewery, as it provides instant results with minimal time and training.. With additional time and resources, the use of differential media and the accompanying supplies can provide more specific answers about contamination identification. For the speediest results, PCR (Polymerase Chain Reaction) Instrumentation is recommended, though this convenience comes with a higher price tag. All Sanitation & Contamination Quality efforts require a comprehensive understanding of Aseptic (Sterile) Technique.

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A regional sized brewery planning large scale distribution should consider the aforementioned investments plus a focus on packaging quality to ensure that a well made beer stays fresher longer. At times the demand of production, warehouse, and delivery schedules are more restrictive, so investing in more advanced and automated equipment can provide quicker turnaround times on results. It is encouraged that a brewery of this size set aside the budget for an Automatic Yeast Cell Counter, an ATP meter, PCR Instruments, and an Optical CO<sub>2</sub> & Dissolved Oxygen Meter.

Every type of brewery benefits from a sensory program, but even sensory analysis can be catered to the specific brewery's needs. Every sensory program should start with basic training and by defining the desired sensory attributes of flagship beers. Then, analyze every batch for those attributes, and determine whether the beer meets its benchmark. A simple "Pass or Fail" system is often most effective. Training is required to ensure accurate results, and as the brewery grows, additional analyses can be introduced.

Lastly, a quality program is only as good as its data. If the brewery is committed to robust quality programs, investment in data analysis software (such as DraughtLab Pro and Grist Analytics) will streamline data with built in statistical tools. Serious consideration should be put into data analysis and the systems for corrective action that will inevitably be warranted. Without a clear plan in this regard, all efforts and investments risk being a moot cause.

(Instrument Guidance Charts and Example Lab Sets below.)

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Lab Instrument Guide for New and Growing Breweries			
Category	Instrument	Method(s)	Additional Materials & Notes
Raw Materials	Sieve Set	Grist Analysis	
	Sensory Panel	Malt, Hop, and Brewing Water Sensory Analysis	Training is strongly encouraged for reliable sensory analysis.
Category	Instrument	Method(s)	Additional Materials & Notes
Hot Side (Brew House) QC	Hydrometer	Specific Gravity	Test Cylinder
	Digital Density Meter	Specific Gravity	
	Digital pH Meter	pH	
	Temperature Probe	Temperature	
	Spectrophotometer	Wort Bitterness (IBU), Wort Free Amino Nitrogen (FAN), Wort Color (SRM)	
	Sensory Panel	Wort Analysis	Training is strongly encouraged for reliable sensory analysis.
Category	Instrument	Method(s)	Additional Materials & Notes
Yeast &	Hydrometer	Specific Gravity	

Fermentation	Digital Density Meter	Specific Gravity	
	Digital pH Meter	pH	Burette, NaOH, Hot/Stir Plate
	Temperature Probe	Fermentation Temperature	
	Compound Microscope	Yeast Cell Concentration and Viability	Haemocytometer, Pipette(s), Methylene Blue Dye
	Automatic Cell Counter	Yeast Cell Concentration & Viability	Pipette(s), Dye (corresponding to the model used)
	Hot/Stir Plate	Forced Fermentation	Airlock, Magnetic Stir Bar
	Water Bath or Sous Vide	Forced Diacetyl Test	Clean Jars, Trained Sensory Panel
	Spectrophotometer	VDK (Diacetyl), Bitterness (IBU), Color (SRM)	Chemical Reagents, Fume Hood, Fire Proof Chemical Cabinet, Quartz Cuvettes, Wrist Action Shaker & Centrifuge (ASBC 23)
	Sensory Panel	Production Release (Pass/Fail)	
<b>Category</b>	<b>Instrument</b>	<b>Method(s)</b>	<b>Additional Materials &amp; Notes</b>
Sanitation & Contamination	Aseptic Sampling Kit	Sterile Sampling	
	Compound Microscope	Gram Staining	Gram Stain Kit, Microscope Slides
	Hot/Stir Plate	Media Preparation	Aseptic Sampling Supplies, Selective or differential media of choice, Sterile Tubes or Petri Dishes
	Autoclave & Incubator	Detection & Identification of Microorganisms	Aseptic Sampling Supplies, Selective or differential media of choice, Sterile Tubes or Petri Dishes

	Anaerobic Chamber	Detection & Identification of [Anaerobic] Microorganisms	Aseptic Sampling Supplies, Selective or differential media of choice, Sterile Tubes or Petri Dishes
	Selective & Differential Media (ie: Fast Orange, HLP, WLM, LCSM, LWYM, etc.)	Detection & Identification of Microorganisms	Laminar Flow Hood, Aseptic Sampling Supplies, Sterile Jars or Whirlpak® Sterile Bags, Sterile Pipette(s), Sterile Tubes or Petri Dishes
	Membrane Filtration Kit	Detection & Identification of Microorganisms	Laminar Flow Hood, Aseptic Sampling Supplies, Sterile Jars or Whirlpak® Sterile Bags, Sterile Pipette(s), Selective or differential media of choice, Sterile Tubes or Petri Dishes
	ATP Luminometer	Testing Equipment Cleanliness	Proprietary Swabs or Wands
	PCR Instrumentation	Detection & Identification of Microorganisms	Aseptic Sampling Kit
<b>Category</b>	<b>Instrument</b>	<b>Method(s)</b>	<b>Additional Materials &amp; Notes</b>
Packaging Quality	Zahm & Nagel Air Tester	Measuring CO2 in Brite Tanks, Measuring CO2 & Headspace Air in Package	20% solution NaOH or KOH
	Optical CO2 & Dissolved Oxygen Meter	Measuring CO2 & O2 in Bright Tanks & Package	
	Bottle Crimp Gauge	Bottle Crimp Analysis	
	Can Seam Micrometer	Can Seam Analysis	
	Can Seam Monitor	Advanced Can Seam Analysis	

(Example Lab Sets below.)

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Example Lab Sets for Breweries		
Basic Setup	Intermediate Setup	Comprehensive Setup
<ul style="list-style-type: none"> <li>Hydrometer</li> <li>pH meter</li> <li>Temperature Probe</li> <li>Microscope + Haemocytometer</li> <li>Hot/Stir Plate</li> <li>Water Bath</li> <li>Fast Orange Media</li> <li>ATP Luminometer + wands</li> <li>Bottle Crump Gauge &amp; Can Seam Micrometer - if packaging</li> <li>Sensory Panel</li> </ul> <p>\$3,000 USD (approx.) + additional/consumable materials</p>	<ul style="list-style-type: none"> <li><i>Basic Setup</i> +</li> <li>Digital Density Meter</li> <li>Automated Cell Counter (Oculyze)</li> <li>Autoclave (or Pressure Cooker)</li> <li>Incubator</li> <li>Anaerobic Chamber (make your own)</li> <li>HLP Media</li> <li>Zahm &amp; Nagel Air Tester - if packaging</li> <li>Quality and Sensory Data Management Software (ex. Grist Analytics &amp; Draughtlab Pro)</li> </ul> <p>\$7,000 USD (approx.) + additional/consumable materials &amp; subscriptions</p>	<ul style="list-style-type: none"> <li><i>Intermediate Setup</i> +</li> <li>Spectrophotometer</li> <li>Centrifuge</li> <li>Mechanical Shaker</li> <li>Membrane Filtration Kit</li> <li>Other Differential &amp; Selective Media</li> <li>PCR Instrumentation</li> <li>Optical CO2 &amp; Dissolved Oxygen Meter - if packaging</li> <li>Can Seam Monitor - if canning</li> </ul> <p>\$35,000 (approx) + additional/consumable materials &amp; subscriptions</p>



Contributing Author  
**Melissa Antone**

**Quality & Sensory Specialist, Melissa Antone LLC**

*Mel has worn many hats in the beer world, but her specialty is brewing QA/QC and Sensory Analysis. Her prior roles include Sensory Manager for Avery Brewing Co, Business Development for AROXA Certified Flavor Standards, and Quality Trainer for the Brewers Association. She is a Beer Educator, Contributor to Zymurgy Magazine and MBAA Tech Quarterly, International Beer Judge, and Beverage Director for The Rayback Collective in Boulder, CO..*