

Process Analytics in Breweries



HAMILTON 

Welcome to the Heart of Analytics!



Sensor manufacturing in Bonaduz, CH



Headquarter in Reno, USA

How it all began

Back in 1947 the chemical engineer Clark Hamilton developed the first microliter syringe for chromatography and founded Hamilton Inc. in Whittier, California. In the early fifties the company moved to Reno, Nevada, its headquarters since then. Later in 1966, in response to the increasing demand for syringes in Europe, Asia and Africa, he founded the European headquarters in Bonaduz, Switzerland.

In product development, the first syringes were followed by diluters, robotics systems, and GC and HPLC chromatography columns- all with the ability to be customized for customer specific and OEM solutions. In 1989, Hamilton started its sensor business with the release of new pH sensors, and has since developed a portfolio of analytical process sensors with unique innovations. Today, more than 65 years later, the name Hamilton is associated with uncompromising quality in precision fluid measuring and products for laboratory and process analytics.

Hamilton is certified according to ISO 9001 and 13485 standards. Since 2010 Hamilton has implemented Lean Manufacturing principles.



Key Innovations for Process Analytics

Intelligent Sensors – Wisdom from Within

TRANSMITTER INSIDE!



With the transmitter integrated in the head and using open industry standards, Arc sensors offer fully compensated, backwards compatible measurement signals that integrate directly into new or existing process control systems. Multiple connectivity and cutting-edge technology guarantee a robust signal transmission in every use case.



Hamilton Arc System

Hamilton pH glasses: V,F, H, PHI, HF, HB



Measurement stability and sensor lifetime in various environments requires different pH glasses. PHI and HB withstand frequent steam sterilization, autoclaving and CIP cleaning using hot caustic. HF ensures the longest possible lifetime in processes containing hydrofluoric acid and at low temperatures. The H glass performs best in low conductivity media.

Single Pore for pH sensors



A Single Pore is an open liquid junction and an alternative to diaphragms. This non-clogging concept requires a polymeric reference electrolyte: Polysolve Plus covers the full pH range, a wide temperature range and withstands reference poisoning for a long time. It's stable against most organic solvents and free of toxic acrylamide. Both concepts combined lead to the outstanding Polilyte Plus.

Optical oxygen measurement



The world's first optical dissolved oxygen (DO) process sensor for demanding applications in the Pharma, Biotech and Beverage industries. Precise measurement, even in static fluids. No polarization time and no replacement of cathode and electrolyte needed.

DuraCal pH Buffer Solutions



A complete range of long shelf-life stable pH buffer solutions with closed-loop traceability. Certified from an accredited laboratory and compared against primary reference solutions from NIST (USA) or PTB (Germany).

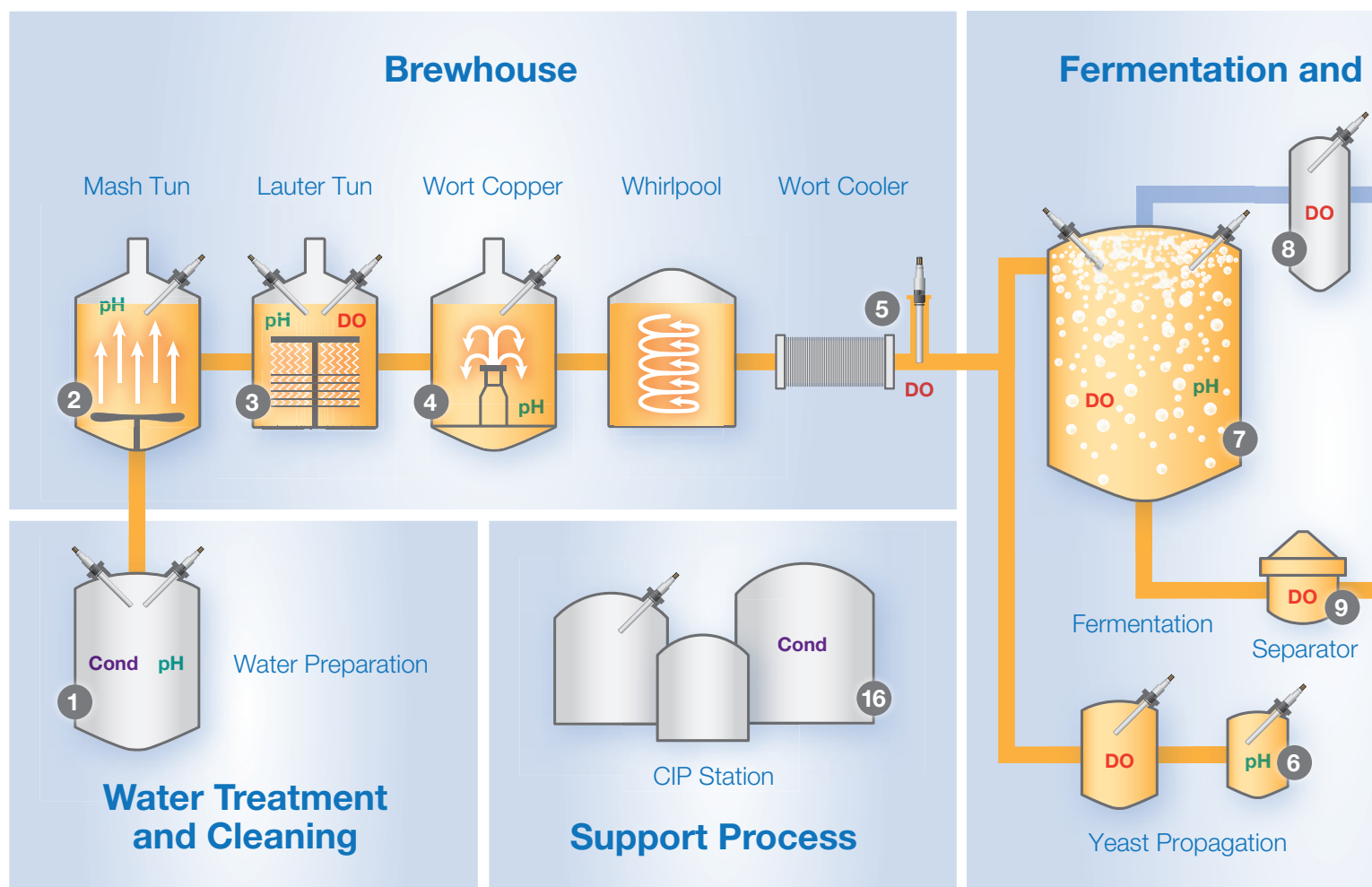
Low Conductivity Standards



First manufacturer worldwide of long shelf-life stable conductivity standards at 1.3 and 5 $\mu\text{S}/\text{cm}$ fulfilling USP 645 requirements and being certified by the PTB.

Your Process – Our Solutions

The basic raw materials for beer are water, barley, hops and yeast. Making beer is a multi-step process, and each step has to be monitored and controlled in order to produce high quality and tasty beer. In-line measurement and control of analytical parameters such as pH, conductivity and dissolved oxygen are essential to the brewing process.



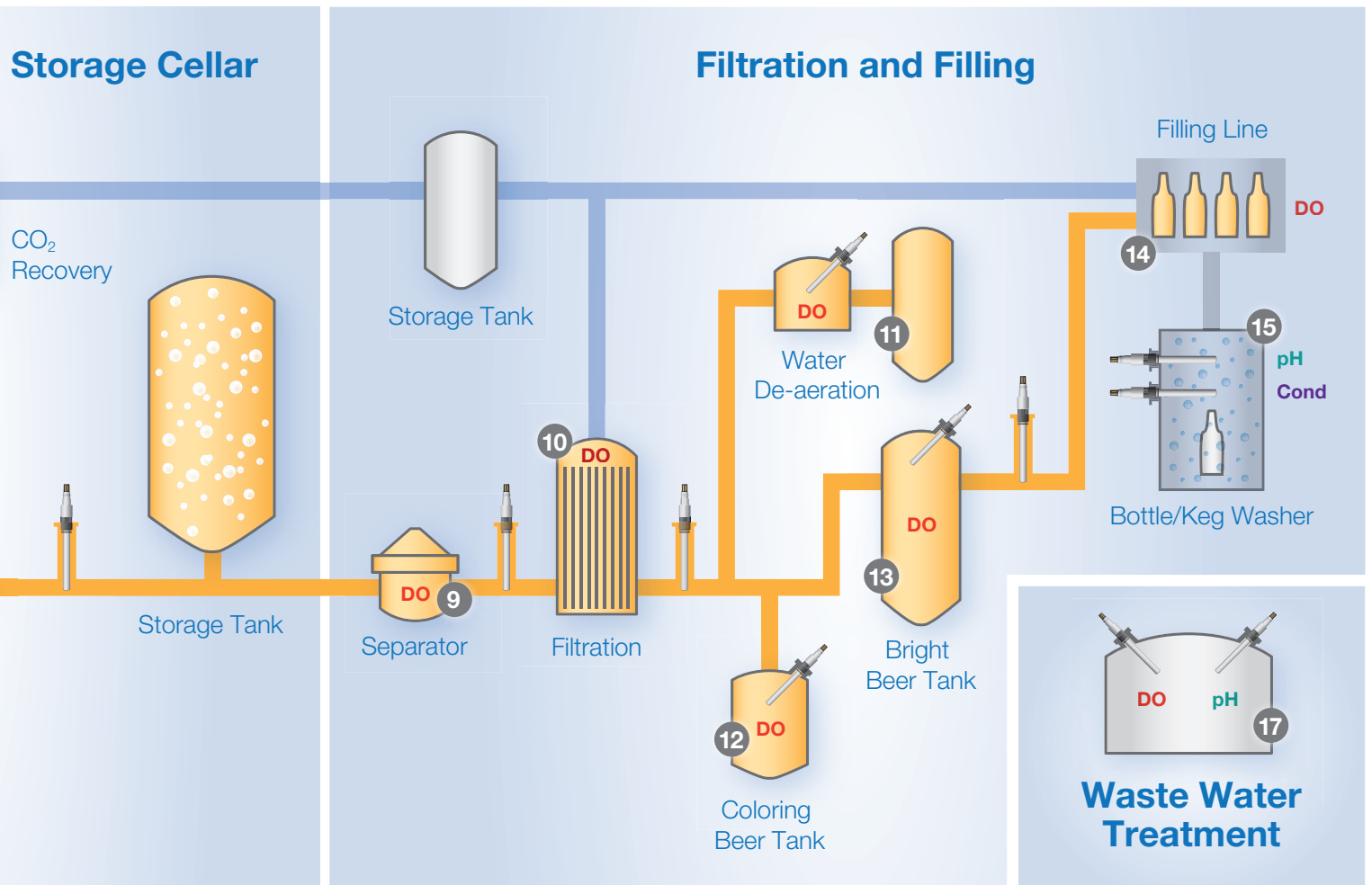
- ① **pH:** Polilyte Plus / **Cond:** Conducell 4USF
- ② **pH:** EasyFerm Bio
- ③ **pH:** EasyFerm Bio / **DO:** VisiFerm DO
- ④ **pH:** EasyFerm Bio

- ⑤ **DO:** VisiFerm DO
- ⑥ **pH:** EasyFerm Bio / **DO:** VisiFerm DO
- ⑦ **pH:** EasyFerm Bio / **DO:** VisiTrace DO
- ⑧ **DO:** VisiTrace DO





All Hamilton sensors are user friendly and easy to integrate into existing process control systems. Sensors, housings and buffers are compliant with the existing regulations.



9 DO: VisiTrace DO
10 DO: VisiTrace DO
11 DO: VisiTrace DO

12 DO: VisiTrace DO
13 DO: VisiTrace DO
14 DO: VisiTrace DO

15 pH: Polilyte Plus / Cond: Conducell 4USF
16 Cond: Conducell 4USF
17 pH: Polilyte Plus / DO: VisiFerm DO

Our Sensors – Your Benefits

EasyFerm Bio

The EasyFerm Bio family of pH electrodes is ideal for food & beverage applications like fermentations, where cleaning in place (CIP), steam sterilization (SIP) and autoclavation procedures occur frequently. Precise measurement and long sensor durability can be achieved due to the high performance coatramic diaphragm and the CIP-resistant HB pH glass. The certified reference electrolyte “Foodlyte” has passed biocompatibility tests successfully. Available with the innovative Arc technology.



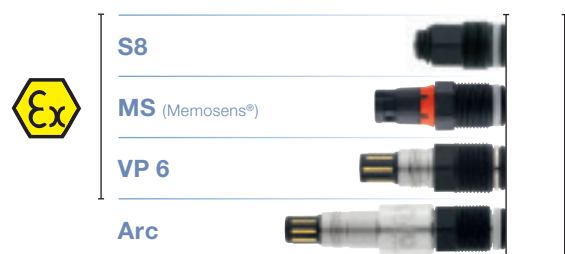
Benefits

- ▶ Fast recovery and stable measurement signals after several CIP, SIP and autoclavation procedures
- ▶ Pre-pressurized for accurate measurement and reduced maintenance
- ▶ Enhanced hygienic barrier due to coatramic diaphragm
- ▶ Biocompatibility tested according to EN ISO 10993-5



Polilyte Plus

The Polilyte Plus family of pH and ORP electrodes is designed for harsh chemical environments like in the bottle / keg washer, for process water preparation and wastewater treatment. The great performance in these applications can be achieved due to the Single Pore technology and the Polysolve Plus electrolyte. Available with the innovative Arc technology.



Benefits

- ▶ Highly reproducible and stable measurements in bottle & keg washers thanks to the Polysolve Plus electrolyte
- ▶ No clogging in wastewater due to the Single Pore technology ensures long lifetime
- ▶ Polysolve Plus reference electrolyte covers a wide temperature range and withstands reference poisoning
- ▶ Available as ORP sensor



VisiFerm DO

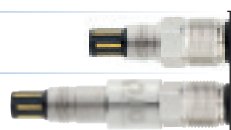
The VisiFerm DO is designed to measure in high dissolved oxygen ranges in the brewing process, like during the wort aeration. It has all the advantages of Hamilton's optical DO sensors: fast response time and easy maintenance. It's designed for frequent CIP, SIP and autoclaving procedures. This is powerful during measurements in breweries, which may not allow for calibration after every CIP. Analog (classical nA, 4-20 mA) and digital (Modbus) signal outputs are possible. Available with the innovative Arc technology.

Benefits

- ▶ Fast response time of the optical technology enables fast detection of changes of the DO content
- ▶ Easy and very little maintenance, no electrolyte to replace & refill
- ▶ Insensitive to CO₂, pressure hammers and independent from flow – ideal for wort aeration
- ▶ Suitable for CIP, SIP and autoclaving due to rugged sensor construction

VP 8

Arc



USP
Class VI



VisiTrace DO

The VisiTrace DO is designed to measure dissolved oxygen in the low ppb ranges in brewing applications, notably after filtration and before the filling. In addition, the special designed ODO Cap L0 for breweries is stabilized against standard disinfectant solution with active chlorine and chlorine dioxide. This is powerful during measurements in breweries, which may not allow for calibration after every CIP. Available with integrated Bluetooth 4.0 technology may be used for monitoring, configuration and calibration with Smartphones. The VisiTrace DO offers all the advantages of Hamilton's optical dissolved oxygen sensors.

Benefits

- ▶ Trace level measurement from 0 - 2000 ppb
- ▶ Stable against chlorine and chlorine dioxide
- ▶ Robust design enabling simplified maintenance
- ▶ 2 wire 4-20 mA connection
- ▶ Wireless communication to Bluetooth 4.0 Smartphones
- ▶ Built-in micro-transmitter

M 12



USP
Class VI





Conducell 4USF

The Conducell 4USF family of 4-pole conductivity sensors is suitable to measure a broad range of conductivities with excellent linearity. A typical application is the water preparation and monitoring of the CIP station. Available with the innovative Arc technology. Various process connections are available: PG 13.5, Tuchenhausen Varivent®, BioConnect® and Triclamp. The right pole material for every environment: stainless steel DIN 1.4435, DIN 2.4602 and Titanium.

Benefits

- ▶ High accuracy and linearity over a broad measuring range
- ▶ Hygienic design with FDA-compliant materials and EHEDG certificate with Hamilton's hygienic socket for its excellent cleanability
- ▶ Suitable for CIP, steam sterilization and autoclavation



VP 6

Arc

USP
Class VI

OxyGold B

The OxyGold family of classical amperometric oxygen sensors (Clark cells) is designed for applications with trace levels of oxygen, i.e. de-aerated water and the gaseous phase of the CO₂ recovery. The acidic electrolyte in the OxyGold B shows no cross-sensitivity to carbon dioxide which is important in breweries. Available with the innovative Arc technology.

Benefits

- ▶ Accurate trace measurement
- ▶ Acidic electrolyte insensitive to CO₂
- ▶ Suitable for high temperatures and high pressures during sterilization and CIP
- ▶ Only very little flow required
- ▶ Easy replacement of the cathode



VP 6

Arc

USP
Class VI

Beverly – Born to Brew

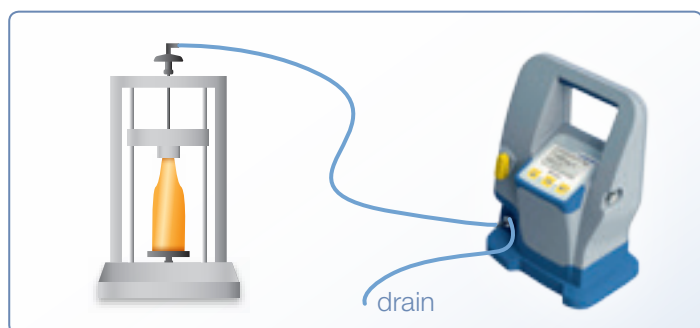
Beverly is designed for at-line and laboratory use to provide excellent reliability in a rugged design, and purpose built to handle the environmental extremes encountered in everyday brewing operations. Superior performance at an affordable price is achieved using Hamilton's best in class optical sensor VisiFerm DO with built-in intelligence, making Beverly the brewer's best friend.

Benefits

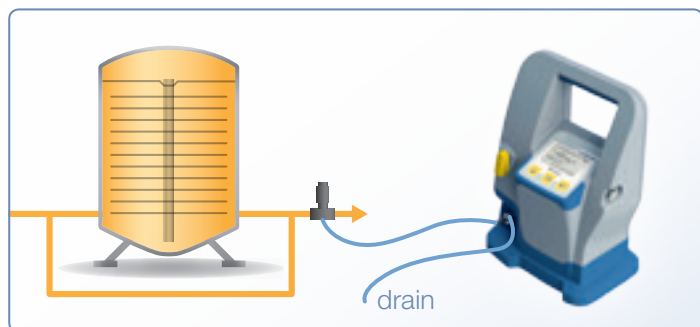
- ▶ Efficiency and serviceability bred from VisiFerm DO optical sensors
- ▶ Built to endure IP 67 watertight standards
- ▶ Stamina for 50 hours of continuous operation
- ▶ Fast response time down to ppb level
- ▶ Calibration without removing the sensor



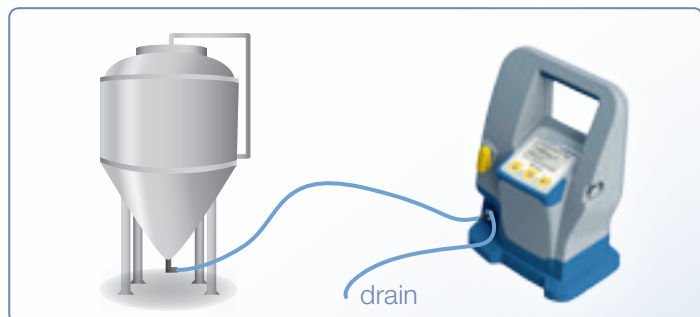
Measure DO in the bottle or can



Measure DO during or after filtration



Check DO of bright tank prior to bottling



Hygienic Housings

Hamilton has developed hygienic housings for Pharma, Biotech and the Food & Beverage industry. They are compliant with all relevant existing regulations including FDA. Hamilton's housings fulfill all cleanability and sterilization requirements and the medium affected materials are FDA approved. Various process connections are available, like Tuchenhausen Varivent®, 25 mm standard port and Triclamp.

FlexiFit

The FlexiFit, a non-retractable housing can be used in many applications in the brewery, beverage and the pharmaceutical industry. It is suitable for cleanings in place (CIP) and in-line steam sterilizations (SIP). All kinds of Hamilton sensors can be inserted.

Retractex

If sensors have to be replaced, rinsed or recalibrated while in operation retractable housings are the method of choice. Hamilton offers manual and pneumatical housings for this purpose. The pneumatical Retractex HyCIP version can easily be integrated in process control systems. Different process connections ensure their compatibility to existing pipings and vessels. The hygienic design of the rinsing chamber makes the Retractex HyCIP an outstanding and unique product.



HAMILTON
CUSTOMIZED
PRODUCT

Need a custom housing or sensor? The Hamilton Customized Product team is happy to help design products for your specific application. Give us a call to learn more.



Traceable Buffers & Standards

Hamilton offers a wide range of calibration buffers for pH and ORP as well as conductivity standards, suitable for the use under GMP, GLP, ISO 9001 and EN 45000 regulations. Traceability is ensured through an unbroken chain of comparison to reference material of the highest metrological quality from NIST (National Institute of Standards and Technology, USA) and PTB (Physikalisch Technische Bundesanstalt, Germany).

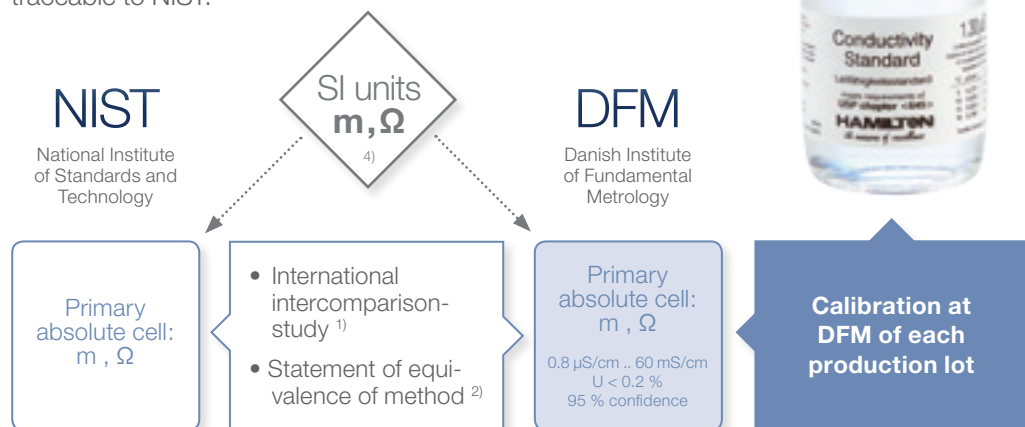
pH Buffers

A complete range of buffer solutions from pH 1.09 to 12.0 provides never before achieved pH stability. Hamilton guarantees that Duracal pH buffers will be stable for 5 years after the date of manufacturing. The plastic bottles with their built-in compartment allow very convenient calibrations. Primary and secondary standards are used for the calibration of the devices and the manufacturing of the buffers. All buffer solutions are certified by the accredited external laboratory DAKK (Deutsche Akkreditierungsstelle) and traceable to NIST.



Conductivity Standards

Hamilton is the first manufacturer to offer conductivity standards in 1.3 and 5 $\mu\text{S}/\text{cm}$ with a certified accuracy of $\pm 1\%$, and a lifetime of 1 and 3 years respectively. The entire range from 1.3 to 12880 $\mu\text{S}/\text{cm}$ is certified by the Danish Institute of Fundamental Metrology (DFM) and traceable to NIST.



1) International intercomparison of electrolytic conductivity between NIST, DFM and OMH (Hungarian Office of Metrology); published in Metrologia, vol. 38, no. 6, 549-554 (2001)

2) The accuracy level of the DFM measurement is secured through a cooperation with NIST with whom there has been made an agreement on mutual recognition of calibration results.

3) DFM is accredited by DANAK (Danish accreditation authority) under reg. no. 255.

DANAK is one of the signatories to the EA Multilateral Agreement for the mutual recognition of calibration certificates.

4) International System of Units: 7 base units are m, kg, s, A, K, mol, cd



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