POOL WATER TREATMENT
ADVISORY GROUP

TECHNICAL NOTE

39 – Residual control

September 2018
TYPES OF CHLORINE SENSORS AND CALIBRATION

This technical notes reviews the two traditional styles of chlorine monitoring – redox and amperometric – and a system that can accurately deal with these and other pool water parameters.

Redox

Commonly referred to as ORP/HRR (oxidising redox potential/high resolution redox), an ORP probe is a sensor that responds to the oxidising potential in the pool water. It does not specifically measure chlorine, but will respond to any oxidiser in the water. Not all oxidisers disinfect.

Chlorine is an oxidiser as well as a disinfectant, so the redox probe will respond to its presence in the pool water. The redox probe is pH sensitive and so will provide different readings (mV outputs) as pH levels change in the pool water being sampled.

A redox probe signal output is not linear, and cannot determine an accurate difference between, say, 0.5mg/l and 5mg/l of chlorine within the sample water. So scheduled calibration between the controller and ORP sensor is necessary, with the use of pool water tests kits or buffer solutions. This should be part of the supplier's maintenance schedule. It is always wise to start sensor and controller calibration by testing the pH sensor.

There are some controllers which use redox probes to indicate a free chlorine residual on the controller, however this is purely inferential, electronically generated within the controller, and does not accurately indicate the precise free chlorine residual within the sample water.

Amperometric

This has been the mainstay for measuring free chlorine for many years. Its probes comprise two electrodes – normally copper/platinum but sometimes gold. Today there are two main types of amperometric sensors.

- An older design circulates pool water around the electrodes with either grit or glass beads to keep the electrodes clean. It may also require a buffer solution injection to help stabilise the sample water pH. The copper electrode is sacrificial and is changed every year or two. The water supply needs to be set at a constant rate, as this type of cell is sensitive to flow and pressure variations.
- The second, more commonly used sensor is more robust and employs membrane technology to overcome the issues of the older design and so requires no support from bead cleaning or buffer

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correction. Current measured in µA is generated by the sensor in the presence of chlorine and will provide a linear output to the controller with measurement values up to 100mg/l. The normal parameters of the pool water will not adversely affect the free chlorine residual readings. The chlorine level is set using DPD1 tablets and it is important that the zero is calibrated first with no flow passing through the sensor holder cell.

Potentiostatic measurement cell

This is a probe system providing the best measurement of free chlorine, and is very accurate and reliable in clean water applications like swimming pools. Probes normally last two years before needing to be replaced. There is no zero drift like amperometric cells and normally calibration is done with DPD1 tablets in the same way as the amperometric sensor.

Some free chlorine probes need regular addition of electrolyte. Flow through the sensor cell is regulated by a flow control valve – not only to maintain a constant flow, but if supplied with flow switching, to prevent the over-injection of chemical if the circulation pumps fail. With most sensors and controllers, temperature compensation is selected within the control function to increase the sensor's accuracy when there are changes in sample water temperatures.

With probe technology, it is now possible to measure and control many of the pool parameters including free chlorine, total chlorine, redox potential, pH, and TDS all within the same measuring cell and displayed on a single pool controller. These measurements can be used to regulate circulation pump speeds, in theory reducing energy demand.