MONITORING THE MONITORS

A look at the function of automatic controllers and water quality testing devices and how they are evaluated and tested under NSF/ANSI Standard 50

Water quality is key to an enjoyable waterpark, pool, or spa experience. NSF International has addressed the need for increased safety of swimmers and recreational water users since 1959 through research, standards development, product testing, manufacturing facility inspections, and product certification. NSF's most recent research and development of testing and evaluation criteria yielded requirements for evaluation and testing of two product types:

- Automatic Controllers (AC)
- Water Quality Test Devices (WQTD)

The requirements were developed through NSF's Joint Committee on Recreational Water Facilities. This committee is the oversight body that reviews and revises NSF/ANSI Standard 50 requirements. It is comprised of equal voting membership of three stakeholder groups:

1. Public health officials (CDC-Center for Disease Control and Prevention, state, and county public health officials),
2. Product manufacturers (makers of automatic controllers, chemical feeders, chemical generators, pumps, water quality test devices, etc), and
3. Product users (engineering and design firms, aquatic facility managers, service company staff, trade association members, etc)

ACs and WQTDs are critical to water quality maintenance and health safety. NSF Certification of AC and WQTD products to NSF/ANSI Standard 50 assures that the products meet the most stringent criteria in the industry and will perform well for the intended application, (ie pool or spa conditions).

An AC is a device that senses one or more pool/spa related water parameters. If tdetects a level outside a given range, the controller sends a signal to engage other equipment to respond to and correct the situation to return the water to the desired set-point range. Most automatic controllers are systems comprised of the following components:

1. A flow cell is the "test site", which is typically a transparent vessel with ports for installation of one or more chemical probes and inlet/outlet ports to enable a consistent flow of water through the vessel for on going sampling and monitoring.
2. A chemical probe or sensor is "the detective" used to monitor a given control parameter, such as pH, oxidation reduction potential (ORP), temperature, free chlorine, etc.
3. A controller is the "the brain" that receives the signals and data from the chemical probes or sensors, then compares the latest readings to set points, and sends output signals to activate one or more types of equipment.

Other AC components include, chemical storage tanks, chemical generators, and mechanical chemical feeding pumps. The AC system enables an action or response to help maintain water within specific ranges. The AC is commonly used to monitor and maintain temperature, pH, disinfectant level, ORP or other values.

For example, if a pH or ORP value is sensed too low compared to the preset limit, the controller can then activate equipment to add specific chemicals to the water to raise the water chemistry parameter to help the sanitizer in the water be most effective and protective of public health.

NSF's evaluation and testing of ACs includes the following:

 REPRINTED WITH PERMISSION © 2011 AQUATICS INTERNATIONAL

1 Chemical resistance testing, which includes a 100-day exposure of the product to chemical challenge solutions, after the product is tested for performance.
2 Monitor display, which shows operation status and other details via a digital or analogue display, if so equipped. Display tests are performed after the chemical resistance tests.
3 Life testing, which involves operating 3 separate controller systems being tested for 110,000 actuation cycles at the manufacturers maximum rated load (ie 2 amp, etc.).
4 Performance operating conditions are assessed to determine if the controller can respond with output signals that accurately correspond with the varying input signal when tested at four increments between 0% and 100% of the operating ranges.
a ORP 650 mV to 850 mV with +/-20 mV accuracy.
b pH 6.8 to 8.2 with +/-0.2 accuracy.
c Free Chlorine (Cl)/Bromine (Br) 0-10 parts per million (ppm) as Cl2 or 0-20 ppm as Br2 with +/-10% accuracy.
d Total Cl/Br 0-10 ppm as Cl2 or 0-20 ppm as Br2 with +/-10% accuracy.
5 The controller shall meet the requirements above before and after the chemical resistance test.
6 Failure sensing and signaling devices:
a The controller shall possess a default mechanism or process capable of detecting and delivering a distinct visible signal to notify the user when the controller is not maintaining a parameter within the acceptable range for the swimming pool or spa/hot tub water as set by the user.
7 Operational protection:
a The AC shall have an automatic mechanism for preventing operation of any chemical feeder by the controller whenever water circulation at the chemical injection points is interrupted, or the manufacturer shall provide printed materials warning the user of the potential for elevated chemical concentrations and/or hazardous gas introduction into the pool or spa resulting from conditions of no flow in the recirculation system.
8 Operation and installation instructions:
a Proper installation, operation, and maintenance instructions
b Diagrams and parts list to help with identification and part orders
c Replacement probe model number or senor output signal requirements
d Maximum external load rated in volts and amps
e Caution statement warning user about public access to system
f Applicable operating ranges (such as pH, ORP min/max)
9 Data plates will be affixed to the controller and contain information such as NSF/ANSI 50 marking, equipment name, manufacturers name and address, model number, electrical requirements (volts, amps, hertz), maximum external load, serial number and date of manufacture, caution statements, replacement sensor model numbers or sensor output signal requirements

The following section provides insight into the different types of water quality testing devices (WQTD) and how they are tested and certified by NSF to NSF/ANSI Standard 50.

- Products are either electronic (probes and meters) or non-electronic (reagent strips and titration kits)
- Visual color comparators or digital display devices
- Liquid reagent kits (may be visual or electronic)
- Test strips (typically visual)
- Probes and meters (almost exclusively electronic)

NSF's evaluation and testing of WQTDs includes the following:

1 Testing of WQTD performance for pH, free chlorine, total chlorine, hardness, total alkalinity, or cyanuric acid concentration.
a Using gravimetric methods and standard methods to create challenge waters.
b Evaluation for accuracy within operating range in standard and as claimed by manufacturer

b Testing in triplicate and averaging results.
c Evaluation for repeatability by testing two products from a production lot
c Evaluation for reproducibility by testing product from two production lots
2 Testing for shelf life:
a Compare performance of a WQTD after storage against a WQTD that was not stored.

Follow duration, temperature recommendations of the manufacturer, the product is tested to verify conformity with the performance of product that has not been stored.

3 Operation and use instructions supplied by the manufacturer to product user:
a NSF testing of products is in accordance with the manufacturer's instructions. This is a critical aspect of product testing. Failure to follow instructions and good laboratory practices will invalidate testing results.
b Manufacturers must specify the WQTD components and conditioning.
c Manufacturers must specify the sample size, reagents required and volume/mass of reagents, mixing procedures, wait times, as well as method of determining test result, including any calculations and conversion factors.
d Manufacturers must specify maintenance of WQTD product/components.
e Manufacturers must specify proper storage conditions.
4 Product Marking:
a The WQTD shall have identification or marking that is permanent, easy to read, and securely attached to the product.

The identification shall contain:

- Manufacturer's name and address
- Model number or part number of the unit
- Parts list to facilitate the identification and ordering of replacement parts
- WQTD classification level (L1, L2, L3) for each parameter in accordance with NSF Testing to show lowest number or best achieved performance
- Production date of the WQTD and its components for use date, as well as shelf life once the product is opened, energized or used.

As evidenced by the detailed assessment criteria above, NSF evaluation, testing, inspection, and certification ensures the products are reble to help you manage your residential or commercial recreational water facilities. ■