NSF International
Recreational Water Program

Component Certification Specification for Manual and Automated Pool Cleaners (CCS-15965)

The Public Health and Safety Company.™

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Component Certification Specification for
Manual and Automated Pool Cleaners CCS-15965

Scope:

This establishes evaluation and testing criteria for manual and automated pool cleaners. The criteria include requirements for the materials, design and construction, marking, installation and use instructions, and performance of the equipment to pick up certain contaminants in the pool water. Automated pool cleaners shall also be evaluated for the pattern of floor/wall coverage.

1.0 Pool cleaner systems and related equipment for public use

Pool cleaners and related equipment intended for public use shall be evaluated for conformance to the requirements of this standard. This standard does not purport to address all of the safety concerns. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

1.1 Limitations

NSF, in performing its functions in accordance with its objectives, does not assume or undertake to discharge any responsibility of the manufacturer or any other party. NSF shall not be responsible to anyone for the use of or reliance upon this standard by anyone. NSF shall not incur any obligation or liability for damages, including consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon this standard.

2.0 Definitions

Automated Pool Cleaner: a pool cleaner intended to collect debris and sediment from the swimming pool without direct human control

Manual Pool Cleaner: a pool cleaner intended to collect debris and sediment from the swimming pool that requires manual control to perform the intended function

Cleaning Path: The width of the automatic or manual cleaning device measured from the inside of the outermost wheels, track, or other drive device. In the absence of wheels, a track or other drive device, the cleaning path shall be defined as the width measured from the outside edge of the outermost brushes or cleaning appurtenances

Integral: Part of the device that cannot be removed without compromising the device function or physical integrity of the system.

Readily accessible: fabricated to be exposed for cleaning and inspection without using tools

Sealed: Fabricated without openings to prevent entry of liquid.

3.0 Materials

3.1 General

All pool cleaner materials contacting water shall meet the health safety review and corrosion resistance requirements of Section 3 and Annex A of NSF/ANSI Standard 50.

3.2 Alternate materials

If other specific materials or components are utilized, those components and materials must be evaluated as satisfactory from the standpoint of public health and performance for the intended end-use.

4.0 General Requirements

4.1 Debris and sediment collected by the pool cleaner shall be readily removable.

4.2 Automated pool cleaners utilizing a container to collect the debris and sediment shall possess a mechanism for alerting the user when the filter has been filled

5.0 Performance

5.1 Contaminant Removal

Manual or automated pool cleaners shall be tested for quantitative removal of contaminants from underwater surfaces.

5.1.1 Test Area

The device under test shall be operated in one continuous single pass over a test area defined as follows:

- The length of the test area considered for contaminant removal shall be 3.0±0.5 feet, and preceded by a length of uncontaminated surface equal to the length of the device under test or a minimum of 2.0 feet , whichever is greater, and followed by a length of uncontaminated surface equal to the length of the device under test or a minimum of 1.5 feet, whichever is greater
- The width of the test area considered for contaminant removal shall be 1.0±0.5 inches less than the full width of the cleaning path of the device under test
- The test surface shall be submerged in water having a depth that is a minimum 28”
- Test water shall have a temperature of 75±10°F, and shall have a turbidity of ≤ 2.0 NTU

5.1.2 Test Surfaces

Testing shall be performed on each of the following test surfaces:

- Grouted ceramic, porcelain, or glass tile having a smooth and uniform surface, or a prefabricated tile-like surface that possesses similar surface features (i.e. the depressions in the grout lines around tiles, etc.)

- Vinyl pool liner, finely textured

- Concrete
    - Cast in place concrete, cement board, or gunite shall be acceptable
    - The surface shall be troweled smooth, or equivalent

- No plaster, epoxy or paint shall be applied over the concrete
- Joints shall be permitted in the test area provided they are filled with an appropriate patching compound to a level even with the surrounding concrete

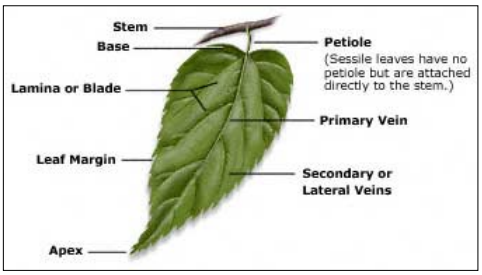
5.1.3 Contaminants

Separate tests shall be performed with each of the following contaminants on each of the test surfaces:

- Sand
  - Sand shall be washed #20 silica sand conforming to 12.2.2.1 of NSF 50
  - The concentration shall be 8 ml of dry sand per square foot of contaminated test area

- Elastic hair ties
  - Hair ties shall have an un-stretched overall diameter of 2.0±0.5 inches and a cross-sectional diameter of 0.125±0.063 inches
  - Hair ties shall have no metal fasteners incorporated in their design
  - The concentration shall be 2 hair ties per square foot of contaminated test area

- Leaves
  - Whole leaves shall be used
  - Green (still live) leaves shall not be used
  - Two size groups of leaves will be used during testing:
    - Group 1:
      - Shall have lobed or incised margins (for example, oak leaves)
      - The length of the leaves shall be 6.0±1.0 inches from apex to base
      - The greatest width of the leaf blade shall be 4.5±1.0 inches
      - A petiole shall be present on 50±10% of the leaves used for testing, and shall be ≥1.0 inches in length



Group 2:

- Shall have an oval or similar shape, and have whole or dentate margins (for example, elm or various polar leaves)
- The length of the leaves shall be 3.5±1.0 inches from apex to base
- The greatest width of the leaf blade shall be 2.0±1.0 inches
- A petiole shall be present on 50±10% of the leaves used for testing, and shall be ≤1.0 inches in length

- The number of leaves from each size group used during testing shall be equal
- A petiole of a leaf shall not be considered when measuring length
- Leaf stems shall not be present
- The concentration shall be 2 leaves per square foot of contaminated test area

5.1.4 Method

1. Install and condition the device under test in accordance with the manufacturer's instructions
2. Device settings:
    a. When applicable, the device under test shall have a clean, unused filtration element
        i. If the manufacturer provides filtration elements specific to the contaminant being tested, the appropriate filtration element shall be used
    b. Devices that utilize the pool circulation system filter to capture vacuumed contaminants:
        i. Install a filter or appropriate device to capture all of the contamination removed by the device under test prior to returning water to the test tank OR
        ii. Install a system or device on the test tank that does not return vacuumed water to the tank during the test, and maintains the required level of water Note: this option will require contamination quantification after testing in accordance with 8.a.ii.1 (amount of contaminant remaining in test area)
    c. If the device under test allows the user to adjust operational settings according to the type of surface being cleaned, the device shall be set to the applicable surface setting for the test being performed
    d. If the device allows the user to adjust the linear speed of travel, the device shall be set to the standard/median speed
    e. If the device allows the user to adjust the suction or cleaning intensity, the device shall be set to the standard/median level
3. Prior to testing, quantify the amount of contaminant being used
    a. When testing with sand as the contaminant:
        i. Obtain a dry weight of the volume of sand required in section 1.5.2.3, and record as w_1
        ii. If the device under test utilizes an onboard filtration element, obtain a dry weight of the filtration element of the device under test and record as w_2
            1. Place the element in an oven set at 140±5°F for a minimum of 6 hours
            2. Weigh the elements immediately after removal from the drying oven
                a. Note: a containment vessel or pan with known tare weight shall be permitted for ease of handling provided it is dried along with the filtration element
    b. When testing with hair ties or leaves, record the number of individual hair ties or leaves used
4. Evenly distribute the contaminant over the applicable test area
    a. Prior to distributing leaves or hair ties, they shall be conditioned by submerging in water until negatively buoyant, but at a minimum 24 hours

5. Operate the device under test, allowing a single pass over the contaminated test area
    a. Unless otherwise specified by the manufacturer, manual vacuums shall be held at an angle of 45°
    b. Manual pool cleaners shall maintain contact with the cleaning surface at a consistent speed, and travel in a straight path
    c. Initiate the device at the beginning of the test surface that precedes the test surface being considered for contamination removal
    d. The device under test shall pass over the contaminated test area and not deviate from a straight path
    e. Unless otherwise specified by the manufacturer, manual vacuums shall be operated at a speed of 1.25±0.25 feet per second
    f. The device under test shall continue to operate to the end of the test surface that follows the test area considered for contamination removal
6. After the device under test reaches the end of the test area, stop and turn off the device under test
    a. Any contamination that falls out of the device under test after turning off but prior to removing the device under test from the test water shall be considered not to have been captured
7. Follow the manufacturer's instructions for removing the device from the pool
8. Quantify the contaminant removal of the device under test
    a. When testing with sand as the contaminant:
        i. For devices utilizing an onboard filtration element(s):
            1. Remove and dry the filtration element(s) of the device under test, taking care not to dislodge any entrapped contaminants
            2. Contamination that is dislodged during removal of filtration element(s) shall still be considered to have been captured
            3. Obtain a dry weight of the soiled filtration element(s) of the device under test and record as w_3
                a. Place the element in an oven set at 140±5°F for a minimum of 6 hours
                b. Weigh the elements immediately after removal from the drying oven
                    i. Note: a containment vessel or pan with known tare weight shall be permitted for ease of handling provided it is dried along with the filtration element
            4. The percent of sand removed shall be calculated by:

$$\% \, Captured = \left[\frac{w_3 - w_2}{w_1}\right] \times 100\%$$

        ii. For devices that utilize the pool circulation system filter:
            1. Quantify the amount of sand remaining on the test surface by manually removing and obtaining a dry weight

            OR

            2. If an inline filter or appropriate device was installed in step 2, quantify the contaminant removal using the same method as for devices using an onboard filtration element (step 8.a.i, above)
    b. When testing with hair ties as the contaminant:
        i. Count the number of hair ties remaining on the test area or remove the filtration element of the device and count the number of hair ties captured
    c. When testing with leaves as the contaminant:
        i. Count the number of leaves remaining on the test area or remove the filtration element of the device and count the number of leaves captured

ii. Should leaf fragments remain in the test area, the fraction of the leaf remaining (by area) shall be estimated upwards to the nearest ¼

5.1.5 Acceptance Criteria

A manual or automated pool cleaner may be rated for the removal of sand, small debris, leaves, or any combination thereof.

- A device rated for the removal of sand shall remove ≥ 85% of sand from each test surface
- A device rated for the removal of small debris shall remove ≥ 75% of the total number of hair ties used from each test surface
- A device rated for the removal of leaves shall remove ≥ 75% of the total number of leaves used from each test surface

5.2 Pool Coverage

Automated pool cleaners shall be tested to assess the ability to completely pass over all areas of a standard shaped pool during a standard cleaning cycle

5.2.1 Test Pool

The device under test shall be operated in a standard shaped pool measuring a minimum of 16 feet by a minimum of 32 feet. The depth of the pool shall be at a minimum 36 inches. No obstructions or obstacles shall be located in or around the perimeter of the test pool.

5.2.2 Test Surfaces

The surface of the test pool shall be permitted to be any one of the surfaces described in section 5.1.2.

5.2.3 Procedure

Either method below may be used, provided an accurate measurement of coverage area is obtained.

5.2.3.1 Method I

1. Install and condition the device under test in accordance with the manufacturer's instructions
    a. When applicable, the device under test shall have a clean, unused filtration element
        i. If the manufacturer provides filtration elements specific to the contaminant being tested, the appropriate filtration element shall be used
    b. Devices that utilize the pool circulation system filter to capture vacuumed contaminants:
        i. Install a filter or appropriate device to capture all of the contamination removed by the device under test prior to returning water to the test tank
    c. If the device under test allows the user to adjust operational settings according to the type of surface being cleaned, the device shall be set to the applicable surface setting for the test being performed
    d. If the device allows the user to adjust the linear speed of travel or suction/cleaning intensity, the device shall be set to standard/median levels
    e. If the device allows the user to adjust the type of cleaning cycle performed (light/quick, regular, heavy duty, etc.), the device shall be set to the standard/median level
2. Prior to testing, quantify the amount of contaminant being used
    a. Contaminants may be:

i. #20 flint gravel, 1/8" x 1/16" stone, washed
1. The concentration shall not exceed 4 ml of dry gravel per square foot of pool area

OR

ii. Elastic hair ties
1. Hair ties shall have an un-stretched overall diameter of 2.0±0.5 inches and a cross-sectional diameter of 0.125±0.063 inches
2. Hair ties shall have no metal fasteners incorporated in their design
3. The concentration shall not exceed 2 hair ties per square foot of pool area

b. For devices containing onboard filtration elements, the volume of contaminant used shall not exceed 90% capacity of the onboard filtration element
c. When testing with gravel as the contaminant, obtain a dry weight of the volume of gravel and record as w_1
i. Place the element in an oven set at 140±5°F for a minimum of 6 hours
ii. Weigh the elements immediately after removal from the drying oven
1. Note: a containment vessel or pan with known tare weight shall be permitted for ease of handling provided it is dried along with the filtration element
d. When testing with hair ties, determine the number of individual hair ties used and record as n_1

3. Evenly distribute the contaminant over the applicable test area
a. If used, hair ties shall be conditioned by submerging in water until negatively buoyant, but at a minimum 24 hours
b. If the device under test is designed to clean vertical pool surfaces, provisions shall be made to include wall areas in the evaluation of the percentage of the pool surface area cleaned
4. Operate the device under test for one complete standard cleaning cycle, and stop and turn off the device under test
5. Quantify the contaminant removal of the device under test
a. When testing with gravel as the contaminant:
i. If the device utilizes an onboard filtration element, remove the filtration element(s) and collect all gravel captured by the device under test. If the device utilizes the pool circulation system filter, quantify the contaminant removal by collecting the gravel in the inline filter or appropriate device that was installed in step 1b
ii. Obtain a dry weight of gravel captured by the device under test and record as w_2
iii. The percent pool area covered shall be calculated by:

$$\%\ Coverage = \left[\frac{w_2}{w_1}\right] \times 100\%$$

b. When testing with hair ties as the contaminant:
i. Count the number of hair ties captured and record as n_2
ii. The percent pool area covered shall be calculated by:

$$\%\ Coverage = \left[\frac{n_2}{n_1}\right] \times 100\%$$

5.2.3.1 Method II (preferred)

Utilize photographic/video tracking and computational techniques to obtain a visual representation of the test pool areas covered by the device under test over one complete standard cleaning cycle. If the device under test is designed to clean vertical pool surfaces, provisions shall be made to include wall areas in the calculation of the percentage of the pool surface area cleaned.

5.2.4 Acceptance Criteria

A device may be rated to clean the following surfaces of the pool:

- Floor Only
- Wall and Floor
- Wall Only

During one complete standard cleaning cycle, the device under test shall provide >95% coverage of the pool surface area(s) for which it is rated.

5.3 Hydrostatic Pressure or Vacuum

Devices that are operated via circulation or booster pump pressure or vacuum shall be subjected to a pressure or vacuum test. Systems that incorporate a pressure or vacuum regulating valve shall be exempt from this test.

5.3.1 Pressure powered systems

Pressurize components of the device that are subject to pressure to 1.5 times the manufacturer's maximum rated pressure within a period of 60-70 seconds and maintain that pressure for 5 minutes

5.3.2 Vacuum powered system

Apply a vacuum to components of the device that are subject to vacuum to 1.5 times the manufacturer's maximum rated vacuum (up to a maximum of 25"Hg) within 60-70 seconds and maintain that vacuum for 5 minutes

5.3.3 Acceptance Criteria

The device shall not sustain permanent damage or deformation. Leakage shall not constitute a failure.

6.0 Data plate

Data plate(s) shall be permanently attached and readily accessible. The data plate(s) shall have the following information:

- Manufacturer's name and contact information (address, phone number, website, or prime supplier);
- Model number;
- Serial number or date of manufacturer;
- electrical requirements - volts, amps and Hertz
- The contaminants that the device rated to remove (i.e. sand, small debris, and/or leaves)
- The surfaces that the device is rated to clean (floor only, wall only, wall and floor)
    - Automated cleaners shall include a warning regarding entrapment and entanglement (unit with a cord) risks
- Part number for onboard filtration element(s) (if applicable)
- Maximum rated pressure or vacuum (circulation or booster pump pressure/vacuum powered systems)
- The NSF Certification mark (<Relevant Standard> replaced with **CCS-14xxx**)

7.0 Owner's manual

A manual shall be provided with each pool cleaning system, and shall address the following:

7.1 Safety Instructions

- Automated cleaners shall warn against entrapment and entanglement (unit with a cord) risks
- Avoidance of other risks as appropriate

7.2 Installation instructions

- Site preparation
- Assembly of system
- Electrical requirements and precautions
- Pump pressure/vacuum and flow requirements (pressure or vacuum powered units)

7.3 Operation and maintenance instructions

- Floor/wall rating
- Sand/debris/leaf rating
- Surface limitations
- Steps of operation
- Regular maintenance requirements and instructions
- Storage and winterization instructions
- Filtration system maintenance, including filter cartridge removal, cleaning, and installation
- Cleaning instructions for system, including required cleaning frequency

7.4 Service information

- Warranty
- Troubleshooting guide
- Parts list and diagram
- Customer service contact information