Circulation System Components and Related Materials for Swimming Pools Spas, and Hot Tubs

8 Recessed automatic surface skimmers

This section contains requirements for recessed automatic surface skimmers used for public and residential pools and spas/hot tubs. The requirements apply to the basic components of a surface skimmer, including the skimmer housing; strainer basket; weir; cover and mounting ring; equalizer valve or air lock protector; trimmer valve and flow balancing valves for multiple skimmer installation; and vacuum cleaner connections. Recommended procedures for the installation and operation of skimmers on public and residential pools and spas/hot tubs are provided in annex J.

8.1 Housing

8.1.1 Skimmer housings whose inlets may be closed during part of operating cycle shall not sustain damage or permanent deformation when exposed to a negative pressure of 85 kPa (25 in Hg).

8.1.2 The housing design shall allow for a smooth flow over the effective weir length.

8.1.3 On swimming pool skimmers, the housing opening at the entrance throat shall be at least 190 mm (7.5 in) wide. On spa/hot tub skimmers, the housing opening at the entrance throat shall be at least 102 mm (4 in) wide. If a circular weir is used, there shall be a clearance of at least 51 mm (2 in) between the weir lip and the side of the skimmer housing.

8.2 Weir

8.2.1 A skimmer shall have a weir that operates freely with continuous action and adjusts automatically to variations in water level over a minimum range of 102 mm (4 in), or 76 mm (3 in.) if an auto-fill pool water level control device is used when operated at the maximum design flow rate (see annex E, section E.2).

8.2.2 Flap-type weirs on swimming pool skimmers shall have a minimum unobstructed width of 184 mm (7.25 in) over the full operating range. Flap-type weirs on spa/hot tub skimmers shall have a minimum unobstructed width of 95 mm (3.75 in) over the full operating range. Flap-type weirs shall be buoyant and designed to develop an even flow over their full width. The clearance between the weir and the housing side shall not exceed 3 mm (0.125 in) at any point. Hinge construction shall preclude leakage. The weir shall be firmly attached to the housing and shall be accessible for cleaning and replacement in the field.

8.2.3 Circular weirs shall have a minimum diameter of 102 mm (4 in). They shall be buoyant and designed to develop an even flow on the water surface around the circumference. The radial clearance between the weir float and the weir housing shall not exceed 2 mm (0.079 in). The float or basket housing shall have devices to eliminate binding. The weir shall be accessible for cleaning and replacement in the field.

8.3 Strainer basket

8.3.1 A skimmer shall have a strainer basket to trap suspended and floating material in the overflow water passing through the skimmer. Spa/hot tub skimmers that have self-contained filters are exempt...
from this requirement.

8.3.2 Strainer baskets shall be readily removable and easily cleanable.

8.3.3 The area of each opening in the strainer basket shall not exceed 0.3 cm$^2$ (0.05 in$^2$).

8.3.4 For swimming pool skimmers, the total open area in the strainer basket shall be 194 cm$^2$ (30 in$^2$) or greater. For spa/hot tub skimmers, the total open area in the strainer basket shall be 71 cm$^2$ (11 in$^2$) or greater.

8.3.5 For swimming pool skimmers, the internal volume of the strainer basket shall be 2620 cm$^3$ (160 in$^3$) or greater. For spa/hot tub skimmers, the internal volume in the strainer basket shall be 720 cm$^3$ (44 in$^3$) or greater.

8.4 Equalizer line (public pools)

8.4.1 A skimmer intended for public pool applications shall have an equalizer line that prevents air from becoming entrained in the suction line.

8.4.2 When the skimmer is operating at the maximum design flow rate and the water level drops is lowered to 51 mm (2 in) below the lowest overflow level of the weir (see annex E, section E 2.4.e), the flow rate through the equalizer line shall be within ± 5% of the maximum design flow rate (see annex E, section E.4).

8.4.3 When the skimmer is operating normally at the maximum design flow rate and up to 75% of the open area in the strainer basket is blocked, the flow rate (leakage) past the equalizer line shall not exceed 10% of the total flow rate through the skimmer (see annex E, section E.3).

8.5 Cover and mounting ring

8.5.1 A skimmer shall have a removable cover with a mounting ring. The cover and ring shall be free of sharp edges. The exposed surface of the cover shall be free of and projections and have a permanent skid-resistant finish. A means of securing the cover in place shall be provided so that the cover cannot be dislodged, unintentionally removed, or otherwise become unstable during use.

8.5.2 Each type and model of polymer skimmer cover shall meet the UV exposure and structural integrity requirements in 8.5.2.1 and 8.5.2.2. Type and model differences that require separate testing include shape, structure, material, color, plating, and finish.

8.5.2.1 The cover shall be exposed to ultraviolet light and water spray in accordance with ASTM G 154, using the common exposure condition, Cycle 3 found in table X2.1 of ASTM G 154 for a period of 750 hours (see annex E, section E.5.2). The sample shall experience no crazing, cracking or geometrical deformation.

8.5.2.2 Skimmer covers that pass the UV exposure test shall be tested for structural integrity in accordance with E.5.3. A skimmer cover shall not deflect more than 9.0 mm (0.35 in), permanently deform, crack, or lose material exclusive of plating or finish when subjected to a point load of 136 kg ±2.2 kg (300 lb ± 5 lb).

8.6 Trimmer valves
Trimmer valves shall not interfere with the performance of the skimmer.

8.7 Vacuum cleaner connections
Vacuum cleaner connections shall be in a convenient location for use and shall not interfere with normal operation of the skimmer.
8.8  Operation and installation instructions

8.8.1  The manufacturer shall provide written operation and installation instructions with each unit. The instructions shall include drawings, charts, and parts lists necessary for the proper installation, operation, and maintenance of the skimmer.

8.8.2  A skimmer equipped with an equalizer shall have, in its operation and installation instructions, a warning that the skimmer is to be installed with an equalizer wall or drain fitting conforming to ANSI/ASME A112.19.8 to prevent hair or body entrapment at the skimmer equalizer. The manufacturer may or may not supply the fitting with the skimmer.

8.8.3  A skimmer's maximum flow rating (LPM, GPM) shall be specified based on the nominal pipe size intended to plumb the suction line (and, or equalizer line). The maximum velocity for any nominal pipe size shall not exceed 1.83 MPS (6 FPS).

8.9  Data plates(s)

A skimmer shall have a data plate(s) that is permanent, easy to read, and securely attached, cast, or stamped onto the cover or skimmer housing at a location readily accessible after installation. The data plate(s) shall contain the following information:

– manufacturer's name and address;
– skimmer model number;
– minimum design flow rate in liters/minute (gallons/minute); and
– maximum design flow rate in liters/minute (gallons/minute).

The data plate(s) shall indicate whether the skimmer is designed for swimming pool applications or spa/hot tub applications. A skimmer designed for both applications is exempt from this requirement. If a skimmer is intended for residential use only (see 8.4), the data plate(s) shall so indicate.

•
•
•
Annex E
(normative)

Test methods for the evaluation of recessed automatic skimmers

NOTE – The test conditions specified in this annex are not intended to represent recommended field use conditions.

E.1 Negative pressure test

E.1.1 Purpose

To verify the structural integrity of a recessed automatic skimmer housing if the skimmer is closed during part of the operating cycle.

E.1.2 Apparatus

– vacuum source capable of producing a vacuum of 85 kPa (25 in Hg); and
– vacuum gauge accurate to ± 1% and scaled to yield the measurement within 25% to 75% of scale.

E.1.3 Negative pressure test method

a) Assemble skimmer in accordance with the manufacturer's instructions.

b) Close the skimmer equalizer inlet. Attach the vacuum source to the skimmer outlet and apply an internal vacuum of 85 ± 3.4 kPa (25 ± 1 in Hg). Hold the vacuum for at least 5 min.

c) Slowly release the vacuum and examine the skimmer housing for evidence of structural failure or other permanent deformation.

E.1.4 Acceptance criteria

There shall be no evidence of structural failure or permanent deformation of the skimmer housing.

E.2 Weir opening

E.2.1 Purpose

To verify that a weir will automatically adjust to changes in the water level when operating at the maximum design flow rate.

E.2.2 Apparatus

– turbidimeter scaled in nephelometric turbidity units (NTU) accurate to ± 2 NTU;
– temperature indicating device accurate to ± 1 °C (± 2 °F);
– adequate size tank and pump to deliver required flow; and
– flow measuring device accurate to ± 3%.
### E.2.3 Test water

<table>
<thead>
<tr>
<th></th>
<th>swimming pools</th>
<th>hot tubs/ spas</th>
</tr>
</thead>
<tbody>
<tr>
<td>water temperature</td>
<td>$24 \pm 6 , ^\circ\text{C} (75 \pm 10 , ^\circ\text{F})$</td>
<td>$39 \pm 3 , ^\circ\text{C} (102 \pm 5 , ^\circ\text{F})$</td>
</tr>
<tr>
<td>turbidity</td>
<td>$\leq 15 \text{ NTU}$</td>
<td>$\leq 15 \text{ NTU}$</td>
</tr>
</tbody>
</table>

### E.2.4 Weir opening test method

a) Install the skimmer to the test tank in accordance with the manufacturer's instructions.

b) Connect a flow meter to the skimmer's outlet port.

c) Fill the tank to the skimmer's normal operating level and set the flow at the maximum design flow rate.

d) Slowly raise the water level in the tank until it reaches the maximum level at which the weir will operate. Record this level.

e) Slowly lower the water level in the tank while observing the water flow over the weir. When the velocity of water traveling over the weir is no longer sufficient to sustain a normal operating level (i.e. lowest overflow level of the weir) in the skimmer throat (and no entrained air observed in suction line), shut off close the drain valve and record the water level in the tank.

### E.2.5 Acceptance criteria

The difference between the maximum water level and the minimum water level at which the skimmer functions shall be at least 102 mm (4 in), or 76 mm (3 in) if an auto-fill pool water level control device is used.

### E.3 Equalizer leakage test

#### E.3.1 Purpose

To verify that the leakage of water through the equalizer does not exceed 10% of the total flow through the skimmer under normal operating conditions.

#### E.3.2 Apparatus

- turbidimeter scaled in NTU accurate to ± 2 NTU;
- temperature indicating device accurate to ± 1 °C (± 2 °F);
- adequate size tank and pump to deliver required flow; and
- flow measuring device accurate to ± 1.5% or ± 4 L/min (± 1 gal/min), whichever is greater.

#### E.3.3 Test water

<table>
<thead>
<tr>
<th></th>
<th>swimming pools</th>
<th>hot tubs/spas</th>
</tr>
</thead>
<tbody>
<tr>
<td>water temperature</td>
<td>$24 \pm 6 , ^\circ\text{C} (75 \pm 10 , ^\circ\text{F})$</td>
<td>$39 \pm 3 , ^\circ\text{C} (102 \pm 5 , ^\circ\text{F})$</td>
</tr>
<tr>
<td>turbidity</td>
<td>$\leq 15 \text{ NTU}$</td>
<td>$\leq 15 \text{ NTU}$</td>
</tr>
</tbody>
</table>
E.3.4 Equalizer leakage test method

   a) Install the skimmer to the test tank in accordance with the manufacturer's instructions.
   b) Connect a flow meter to the skimmer's equalizer inlet port and one to the skimmer outlet port.
   c) Fill the tank to the skimmer's normal operating level and set the flow at the maximum design flow rate.
   d) Measure the flow rate through the equalizer pipe and the total flow rate through the skimmer. Calculate the percentage of the total flow rate through the skimmer that is admitted through the equalizer pipe.
   e) If the skimmer has an equalizer valve, block 75% of the strainer basket's open area and repeat the steps in annex E, sections E.3.4 c) and d).

E.3.5 Acceptance criteria

The flow rate through the equalizer pipe shall not exceed 10% of the total flow rate through the skimmer.

E.4 Flow to pump test – equalizer performance

E.4.1 Purpose

To verify that a skimmer's equalizer device will prevent air from entering the suction line of the circulation system and will maintain the proper flow rate in the suction line when the water level drops below the lowest overflow level of the skimmer weir.

E.4.2 Apparatus

– turbidimeter scaled in NTU accurate to ± 2 NTU;
– temperature indicating device accurate to ± 1 °C (± 2 °F);
– adequate size tank and pump to deliver required flow; and
– flow measuring device accurate to ± 3%.

E.4.3 Test water

<table>
<thead>
<tr>
<th></th>
<th>swimming pools</th>
<th>hot tubs/ spas</th>
</tr>
</thead>
<tbody>
<tr>
<td>water temperature</td>
<td>24 ± 6 °C (75 ± 10 °F)</td>
<td>39 ± 3 °C (102 ± 5 °F)</td>
</tr>
<tr>
<td>turbidity</td>
<td>≤ 15 NTU</td>
<td>≤ 15 NTU</td>
</tr>
</tbody>
</table>

E.4.4 Flow to pump - equalizer performance test method

   a) Install the skimmer to the test tank in accordance with the manufacturer's instructions.
   b) Connect a flow meter to the skimmer's outlet port.
   c) Fill the tank to the skimmer's normal operating level and set the flow at the maximum design flow rate. Observe the return line to the test tank for any signs of air being admitted into the tank. If any air is noted, check the suction line for leaks.
d) Lower the water level in the tank to 51 ± 6.4 mm (2 ± 0.25 in) below the lowest overflow level of the weir. Observe the return flow of water to the tank for entrained air for 30 s after lowering the water level. There shall be no entrained air observed in the suction line after 30 s from the time the water level drops below the lowest overflow level of the weir. Measure and record the flow rate in the suction line.

E.4.5 Acceptance criteria

There shall be no entrained air observed in the suction line after 30 s from the time the water level drops below the lowest overflow level of the weir. The flow rate in the suction line shall not deviate from the maximum design flow rate by more than ± 5% from the maximum design flow rate when the water level drops below the lowest overflow level of the weir.

E.5 Skimmer covers UV exposure (polymer covers only) and structural integrity.

E.5.1 Purpose

To verify the skimmer cover material and design exhibits acceptable weather resistance and structural strength.

E.5.2 Ultraviolet light exposure test (polymer covers only)

Six (6) new covers (of each material, color, plating or finish) shall be exposed to ultraviolet light and water spray in accordance with ASTM G 154, using the common exposure condition, Cycle 3 found in Table X2.1 of ASTM G 154 for a period of 750 hours. Detachable logo labels or plates shall be removed for this test.

E.5.2.2 Test method

Specimens shall be mounted inside the test apparatus, with the normally exposed surface of the specimens facing the UV lamps and positioned so they receive exposure approximating an installed cover. After exposure, the skimmer covers shall be kept at ambient temperature and atmospheric pressure for at least 16 hours and not more than 96 hours. The skimmer covers shall then be visually examined for deterioration.

E.5.2.3 Acceptance criteria

No specimen shall exhibit crazing or cracking. Discoloration shall not be considered unacceptable deterioration. Skimmer covers passing the UV exposure test shall be tested for structural integrity in accordance with E.5.3.

E.5.3 Structural integrity

Six (6) covers which have passed the ultraviolet light exposure test shall be subjected to a Point load and deformation test. Detachable logo labels or plates shall be removed for this test.

E.5.3.1 Test equipment

A point load machine capable of recording a minimum reading of 2.2 Kg (5 lb) and suitably motorized to apply loads at a rate of 5.08 to 6.35 mm/min (0.20 to 0.25 in/min). Load application accessories include a 2 in. diameter steel Tup with a 2 in. ± 0.5 in spherical nose radius. And a 50mm (2 in) diameter x 12mm (0.25 in) thick Buna-N pad of Shore A Durometer 60 ± 5 hardness shall be used between the Tup and cover when applying the point load.

E.5.3.2 Specimen conditioning
All specimens shall be submerged in water at a temperature of 23°C ± 2°C (73.4°F ± 3°F) for at least 2 hours before testing. Testing shall proceed immediately upon removing specimens from water.

**E.5.3.3 Test fixture**

The covers shall be installed in a rigid fixture capable of supporting the cover in a manner similar to the actual installation. The cover attaching screws shall not be installed.

**E.5.3.4 Test method**

Subject the center of cover to a load of 136 Kg ± 2.2 Kg (300 lb ± 5 lb). Test all six (6) specimens.

**E.5.3.5 Acceptance criteria**

A skimmer cover shall not deflect more than 9.0 mm (0.35 in). A skimmer cover shall not crack, lose material exclusive of plating or finish, or be permanently deformed (such as geometrical or dimensional deformation).
Annex J

Recessed automatic surface skimmers
recommendations for installation and operation

This is not a basic part of the Standard nor the responsibility of the manufacturer. However, to obtain satisfactory performance and proper results, the following limitations should be considered in the overall hydraulic design of the pool, spa, or hot tub. The method of installation and operation should be in conformance with the manufacturer's recommendations and the applicable state and local laws and regulations.

Skimmers may be installed in public swimming pools on the basis of 46.5 m² (500 ft²) of water surface area per unit, or fraction thereof; for residential swimming pools, on the basis of 74.4 m² (800 ft²) of water surface area per unit or fraction thereof; or for spas or hot tubs, on the basis of 9.3 m² (100 ft²) of surface area or fraction thereof. Where unusual shapes of pools are encountered, special considerations must be given the number of skimmers used. The required skimmers should be distributed to insure effective skimming of the entire surface. Their location should also take into consideration the pool, spa, or hot tub shape, prevailing winds, and circulation patterns in the pool, spa, or hot tub. Return inlets should be sized to provide inlet velocity of at least 3 m (10 ft) per second for good mixing and proper dispersal of return water. Return inlet should provide circulation patterns toward skimmers to improve surface drift.

Skimmers should be built into the pool, spa, or hot tub walls with no protrusions beyond the face (except for the faceplate) or above the deck. The throat of flap type weir should not be narrower than the skimming weir. Skimmers should be accurately positioned to assure that the average operating water level occurs at the midpoint of weir operating range.

Piping for skimmers should have a minimum capacity of 80% for public and 50% for residential pools, spas, or hot tubs of the required filter flow, and it should not be less that 75.6 Lpm (20 gpm) per skimmer. In pools, spas, or hot tubs having capacities of less than 60,480 L (16,000 gal), and surface areas of less than 46.5 m² (500 ft²), flow rates should not be reduced even if total turnover period of the pool, spa, or hot tub is shortened. In multiple installations, each skimmer should not be individually adjustable for flow. Single skimmers without integral trimmer valve should be installed to facilitate the balancing of flow between skimmer and main outlet.

Strainer baskets, when provided, should be cleaned regularly for proper performance. Clogged baskets impair the flow and free action of the weir resulting in nonperformance.

Skimmer weirs should be checked out routinely for attachment to housing and proper action.

Direct addition of acids, alum, chlorine solution or powders, and other chemicals will seriously corrode a valve, tank, screen, and other metal parts of skimmers and related circulations components and should not be performed.